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Mr. James Cobb
Georgia Regional Medical Program
938 Peachtree St., N.E.
Atlanta, Georgia 30309

Assigned to: Health Systems Research Center

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A Comprehensive Plan and Systems Design for . . .

An Improved Emergency Medical System for Metropolitan Atlanta

Developed by the Health Systems Research Center
John W. Coyle (Project Manager),
Mark S. Blum, and Oren L. Reinbolt

Under contract with the Georgia Regional Medical Program

Health Systems Research Center
Georgia Institute of Technology
Atlanta March 1973
SELECTED HSRC REPORTS

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Program in Hospital and Medical Systems Final Report and Evaluation, USPHS Grant No. DO2 AH 01056, February 1973, 238 pp. (Hospital Abstract #10050 MN).

Fiscal Controls for Hospital Departments, Program Bulletin No. 7, USPHS Grant No. DO2 AH 01056-05, October 1972, 203 pp. (Hospital Abstract #09499 AC).

- Volume I: Summary, 20 pp. (Hospital Abstract #RLO-7441)
- Volume II: A Methodology for Evaluating the Radiographic Facilities Location-Allocation Problem, 223 pp. (Hospital Abstract #RLO-7442)
- Volume IV, Part 1: A Short-Range Forecasting Model for Radiological Services, 60 pp. (Hospital Abstract #RLO-7444)
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- Volume I: Project Summary, 58 pp. (Hospital Abstract #MRO-7741)
- Volume II: State of the Art Review, 135 pp. (Hospital Abstract #MRO-7742)
- Volume III: Methods Manual, 325 pp. (Hospital Abstract #MRO-7743)

The Planning of Clinical Facilities for Medical Education: A Systems Approach, Program Bulletin No. 6, USPHS Grant No. 2 DO2 AH 01056-04, August 1970, 349 pp. (Hospital Abstract #MD2-5900)


Disposable Versus Reprocessed Hospital Supplies, Final Report, USPHS Research Grant No. CN 5968, June 1964, 77 pp. (Hospital Abstract #45).
AN IMPROVED
EMERGENCY MEDICAL SYSTEM
FOR METROPOLITAN ATLANTA

John W. Coyle, M.S., Project Manager
Mark S. Blum, BIE
Oren L. Reinbolt, M.S.

A Comprehensive Plan and Systems Design
developed by the
Health Systems Research Center

Under contract with the
Georgia Regional Medical Program

Health Systems Research Center
Georgia Institute of Technology
Atlanta March 1973
PREFACE

The present document contains a systems design and a comprehensive plan for an improved emergency medical services (EMS) system for metropolitan Atlanta. The plan was developed in the period July 1, 1972 through February 28, 1973 by the Health Systems Research Center of the Georgia Institute of Technology at the request of the Georgia Regional Medical Program (GRMP).

At the present time, a coordinated system for efficiently and effectively providing emergency medical services does not exist in metropolitan Atlanta. The objectives of the project described herein were to examine the present means of delivering EMS in metropolitan Atlanta, to analyze in detail the subsystems considered to be essential to the effective performance of modern EMS systems, and to culminate with the development of a comprehensive plan for improving the EMS system in metropolitan Atlanta to reflect the state of the art. Special attention was devoted to the hospital emergency facilities, vehicles and equipment, ambulance attendant training, dispatch and control, and communications. In addition, the EMS plan addresses the areas of public education, disaster planning, and evaluation and financing of the EMS system. The plan includes a recommendation for an organization to coordinate the metropolitan EMS resources in an effective and efficient manner.

Chapter 1 of this document is a summary of the project and outlines the development of the plan, from the initial involvement of HSRC with the Metropolitan Atlanta Council for Health some four years ago to the present comprehensive EMS plan. Chapter 2 presents a summary of recommendations by HSRC for improving the metropolitan Atlanta EMS, based upon the detailed analyses presented in Chapter 3 through Chapter 14. The final two chapters of this plan, Chapter 15 and Chapter 16, present a cost estimate and suggested implementation schedule for the improved EMS system for metropolitan Atlanta.

The successful development of the plan was due to the efforts of various individuals, institutions, and groups to whom credit is gratefully extended. To attempt to list the literally dozens of people, in Georgia and around the nation, who provided valuable information to the project is to risk omitting the names of some individuals. Nevertheless, members of the following agencies and organizations in the Atlanta Area are deserving of special credit,
and specific individuals are cited throughout the present document in those chapters to which the individuals provided input.

Atlanta Area Physicians
Atlanta Area Police and Fire Chiefs
Atlanta Area Hospital Administrators
Communications Manufacturers
Civil Defense
DeKalb Area Technical School
Emergency Health Unit of the Department of Human Resources
Division of Physical Health
EMS Task Force of the Atlanta Regional Commission
Georgia Heart Association
Georgia Hospital Association
Grady Memorial Hospital
Metro Ambulance Service
Military Personnel at Fort McPherson and Dobbins AFB
Southern Bell Telephone Company

Important contributions were made to the project by the following on behalf of the Health Systems Research Center: Mark S. Blum, Eve Carroll, Iris Mitchell, Russell G. Overton, Oren L. Reinbolt, and Nelson F. Sayford.

Our special thanks are given to Eve Carroll, who single-handedly typed this document under pressure of time at considerable inconvenience to herself.

In particular, our sincere appreciation is extended to Dr. J. Gordon Barrow and the Staff of the Georgia Regional Medical Program. The citizens of metropolitan Atlanta and those interested in improving emergency medical services owe their gratitude to the Georgia Regional Medical Program for its foresight in supporting the development of the plan presented herein for an improved EMS system.

John W. Coyle
EMS Projects Manager

Harold E. Smalley
Director

Health Systems Research Center
Atlanta
March 30, 1973
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CHAPTER 1

SUMMARY OF THE EMERGENCY MEDICAL SERVICES
SYSTEM PLANNING PROJECT

INTRODUCTION

The present document contains a comprehensive plan and a systems design for an improved emergency medical services (EMS) system for metropolitan Atlanta. The plan and design, developed by the Health Systems Research Center at the request of the Georgia Regional Medical Program (GRMP), are the culmination of an intensive project, which began on July 1, 1972, and which included an examination of the present EMS system in the seven-county Atlanta area and detailed analyses of the several EMS subsystems which are considered to be essential to the effective performance of a modern EMS system.

In this chapter, the developments which led to the metropolitan Atlanta EMS planning project are described briefly as well as the analytical process employed in the project; the characteristics of the EMS system are set forth; and steps to be taken by the seven metropolitan counties with the assistance of GRMP, the Atlanta Regional Commission (ARC), the Health Systems Research Center (HSRC) and other agencies concerned with EMS are delineated.

EMS PROJECT BACKGROUND

Throughout the nation, government officials at all levels, physicians, and community leaders have become concerned in the last several years with the effectiveness of emergency medical services systems. Locally, concern over the effectiveness of the system for delivery of emergency medical care caused the community leaders and physicians to create commissions or task forces to study the quality of and make recommendations for improving the metropolitan Atlanta EMS system. Also, the Georgia Regional Medical Program has devoted some of its resources and energies to the problems of EMS in metropolitan Atlanta as well as in other communities in
Georgia. In the following paragraphs, some of the important background to the EMS plan developed by HSRC is presented.

EMS Task Force

The Metropolitan Atlanta Council for Health (MACHealth) established the Task Force on Emergency Health Services in 1969. At that time, MACHealth was the 314(b) comprehensive health planning agency for metropolitan Atlanta; on January 1, 1972, MACHealth became the Department of Health and Social Services Planning of the Atlanta Regional Commission, which was established by the Georgia State Legislature to coordinate land-use, transportation, criminal justice, transportation, and other comprehensive regional planning activities in metropolitan Atlanta.

The MACHealth Task Force was charged with the responsibility to identify problems associated with the provision of emergency medical services in the metropolitan Atlanta area. Members of the Task Force included physicians, hospital administrators, members of State and county government agencies and public services, ambulance service operators, members of the professional community, and members of the academic community including faculty of the Health Systems Research Center of Georgia Tech. MACHealth personnel provided staff assistance to the Task Force.

The MACHealth Task Force focused its energies on two major activities. First, a preliminary survey was conducted of emergency facilities in metropolitan Atlanta. The results of the survey included average monthly emergency loads in the hospital emergency departments in the Atlanta area; estimates of the percentage of emergencies which were surgical, medical, pediatric, and OB-Gyn at each emergency facility; estimates of emergency occurrences according to time of day for weekdays and weekends; estimates of the emergency visits at each emergency facility which were truly urgent, at the convenience of the patient, or at the convenience of the patient's physician; and the types of treatment available at each emergency facility. The survey report also listed tentative suggestions for improving the metropolitan Atlanta EMS system.

The second major activity was to provide counsel to the Health Systems Research Center as HSRC developed grant applications for
projects to perform the necessary planning, development, and design for an improved emergency medical services system for metropolitan Atlanta.

When MACHealth became the Department of Health and Social Services Planning of the ARC, the MACHealth Task Force was reconstituted as the ARC Task Force on Emergency Medical Services. The EMS Task Force of the ARC was expanded to include members representing over 50 agencies in the seven-county Atlanta area. The EMS Task Force members were assigned to subcommittees which were set up to define the community's position in the following EMS areas: Public Information and Education, Manpower and Training, Communications, Dispatch and Control Procedures, Transportation and Equipment, Emergency Facilities, and Disaster Planning. A Steering Committee for the EMS Task Force was also established.

Concurrent with the development by HSRC of the EMS plan for metropolitan Atlanta, the various subcommittees of the Task Force through frequent meetings and discussions evolved positions on the various aspects of EMS. Staff of the Health Systems Research Center served actively as consultants to each of the subcommittees. In turn, the subcommittees provided counsel to the HSRC staff in the Center's effort to develop the plan for improving the EMS system in metropolitan Atlanta.

The subcommittee positions have been documented in a two volume report dated February 1973 entitled *Emergency Medical Services in the Metropolitan Atlanta Region*, which report has been presented to the Atlanta Regional Commission.

**Governor's Study Commission on Emergency Medical Services**

Among the recommendations made by the Study Commission in the Fall of 1971 were (1) the need of legislation for licensing ambulance operators and for establishing standards of ambulance service performance; (2) the appropriation of State funds to match Federal funds available for improving ambulance service through the Federal Highway Safety Program; and (3) the administration of the EMS standard of the Federal Highway Safety Program by the Georgia Department of Human Resources in coordination with the Georgia Office of the Coordinator of Highway Safety.
Another important recommendation of the Study Commission was to increase the annual licensing fee for motor vehicles by two dollars. The additional two dollars per license would provide $5,600,000 which would be used to upgrade ambulance services throughout the State.

**Ambulance Legislation**

The Georgia State Legislature in its 1972 session passed legislation directed toward improving ambulance service throughout the State. The legislation, H.B. 370, was enacted as Chapter 88-31 of the "Georgia Health Code" and charged the Division of Physical Health (formerly the Department of Public Health) of the Georgia Department of Human Resources with the responsibility for licensing ambulance services and establishing standards for ambulance attendants, drivers, and operators. The legislation enabled reasonable regulations and standards applicable to ambulance services to be developed for the first time in the State of Georgia.

The specific regulations which have been developed from the legislation were considered by the EMS Task Force to be inadequate, however, to the emergency medical care needs of metropolitan Atlanta. The inadequacies were documented in a resolution adopted by the EMS Task Force on October 17, 1972, which resolution also recommended that standards for ambulance services be specifically developed for metropolitan Atlanta and that local ordinances be established to enable enforcement of the standards.

**National Developments**

In his "Message on Health Care System" of March 2, 1972, President Nixon specifically mentioned emergency medical services as an area of health care which would receive Federal attention and support. The Federal government allocated $8,000,000 in fiscal year 1972 to develop model EMS systems throughout the nation and established a Special Project Office (SPO) within the Health Services and Mental Health Administration (HSMHA) of the U. S. Public Health Service to administer the new Federal thrust to improve EMS systems.

The bulk of the fiscal 1972 funds were given to five areas to develop five model EMS system projects. The five areas selected to
receive support were Illinois, Arkansas, eight counties in Florida, seven counties in Ohio, and San Diego and two neighboring counties in California.

The five projects focus primarily on improving existing methods of delivering emergency care including transportation and communications techniques, manpower programs, and hospital emergency department equipment. As the projects are intended to be demonstration sites for advanced and innovative approaches, stress is placed on evaluating the impact on the EMS system effectiveness of changes made in the EMS system.

Some $15,000,000 has been allocated to the Federal EMS activity for the present (1973) fiscal year. Legislation is currently under consideration by the U. S. Senate Subcommittee on Health to authorize $300,000,000 over the next three years for EMS project grants, and the funds would be provided on a matching basis (up to 75 per cent) for the development or expansion of comprehensive areawide EMS systems.

The director of the SPO has been advised by the Georgia Regional Medical Program of the EMS planning activity in metropolitan Atlanta and has expressed tentative interest in the resultant EMS plan. Generally, awards for EMS projects through the EMS Special Project Office require that the project site be coextensive with an areawide comprehensive health planning 314(b) agency. In general, then, within the metropolitan Atlanta area, individual governmental units are not able to receive individual EMS project grants but rather must present a plan for a coordinated effort to improve EMS throughout the 314(b) planning area in order to be eligible for grant awards through the SPO.

**GRMP Involvement in EMS**

The Georgia Regional Medical Program has for several years concentrated considerable resources on efforts to improve emergency medical services systems in several areas of Georgia. With the assistance of the State Office of Comprehensive Health Planning, 314(a) agency for Georgia, GRMP developed a detailed program to deliver more effectively and economically emergency medical care to the citizens of Georgia.

GRMP has provided support for the implementation of improvements to the EMS systems in Valdosta, Georgia and surrounding counties, in
Savannah and Columbus, Georgia, and in DeKalb County, which is one of the seven counties in the metropolitan Atlanta area. An important feature of these implementations has been the integrated support provided, when appropriate, by the Office of the Coordinator of Highway Safety, the Emergency Health Unit of the Georgia Department of Human Resources Division of Physical Health, and the Georgia Department of Education along with the support provided by GRMP.

The integrated assistance to these communities has been achieved in the following manner. Through the Highway Safety Program, the Office of the Coordinator of Highway Safety has provided Federal funds which have been matched with State funds administered by the Department of Human Resources to purchase ambulances and ambulance communications hardware. GRMP has provided funds to purchase additional communications equipment and otherwise upgrade the equipment on ambulances. GRMP has also provided guarantees for physician salaries to enable twenty-four hour physician coverage in the hospital emergency facilities. The Department of Education has initiated programs to train ambulance attendants at area vocational-technical schools, and GRMP has augmented the funds necessary to enable training of ambulance attendants in the use of special intensive care equipment.

In addition to the implementation support provided to EMS systems in the mentioned communities, GRMP requested, in January 1972, that the Health Systems Research Center undertake the responsibility of developing a comprehensive emergency medical services plan for metropolitan Atlanta. The request by GRMP arose from recognition of the complexities of EMS problems in metropolitan Atlanta and of the complexities of the seven-county area served by the EMS system. As a consequence, GRMP realized that an intensive effort would be required to develop a coordinated EMS plan before an integrated, economical, and effective EMS system could be implemented in metropolitan Atlanta. HSRC then received from GRMP the overture which led directly to the present document.

DeKalb County EMS Project

The cessation of service by several private ambulance operators caused the DeKalb County government to seek new means of providing ambulance
service for the citizenry of the county. DeKalb County staff planners undertook a study of the situation and used the occasion to develop not only mechanisms for replacing the prior ambulance services but also to upgrade considerably the county's emergency medical services system, and the county government with the support of the community and physicians assumed responsibility for EMS. Although the county committed itself to improving EMS through its own efforts and without external funding, the county did apply for and receive some Federal funds through the Georgia Regional Medical Program.

The improved EMS system is presently being installed in DeKalb County and includes improved communications capabilities, emergency medical training provided through the DeKalb Area Technical School, a rapid emergency medical response capability provided by prepositioned ambulances augmented by Fire Department fire combat vehicles, and coordinated dispatch and control of emergency medical resources. The EMS system has been designed to allow both private ambulance services and the DeKalb Fire Department to share the responsibility for providing emergency transport and treatment at the scene. The new EMS system is scheduled to begin operation in the Spring of 1973.

**HSRC INVOLVEMENT WITH EMS**

As already noted, the metropolitan Atlanta 314(b) comprehensive health planning agency, which is now a component of the Atlanta Regional Commission, has had both a Task Force on Emergency Health Services (EHS) and, subsequently, a Task Force on Emergency Medical Services. The Task Forces were established to provide for coordinated EMS decisions in metropolitan Atlanta. Faculty members of the Health Systems Research Center have been active participants on both the EHS Task Force and the EMS Task Force.

One member of the HSRC faculty had been chairman of the EHS Task Force Subcommittee on Research and Planning and has been a member of the Steering Committee of the EMS Task Force. Other HSRC staff have served as members of the EHS Task Force, and two members of the HSRC staff have served as consultants to all seven subcommittees of the EMS Task Force.
In addition, one HSRC staff member, who has participated in the planning of the metropolitan Atlanta EMS system, has been an ambulance attendant with the Baltimore (Md.) County Fire Department. This staff member is a registered emergency medical technician in the State of Maryland and is an instructor in cardiopulmonary resuscitation certified by the Georgia Heart Association.

Several EMS related projects have been conducted by students at Georgia Tech under the supervision of HSRC faculty in the last several years. Two of the studies dealt with ambulance service, another study was concerned with the treatment available in hospital emergency departments, and two other studies, including one master's thesis, have reported conclusions and recommendations on the use of helicopters as emergency medical vehicles. In addition, five other student projects have examined the internal systems and procedures within hospital emergency departments, and in 1970, one student conducted a comprehensive review and analysis of the metropolitan Atlanta EMS system.

In addition to the EMS planning project conducted at the request of the Georgia Regional Medical Program and reported in the present document, the Health Systems Research Center is also engaged in EMS research which is supported by a grant from the National Center for Health Services Research and Development of the U. S. Public Health Service. This research project is concerned with the development of computer simulation models which can be used in planning EMS systems. The models are to be developed for use in evaluating the effects on EMS systems of changes in the various features of an EMS system and are to measure the effects of the changes in terms of appropriate criteria such as the time required to respond to a medical emergency and to bring the victims to an appropriate emergency facility, emergency victims mortality rates, and the percentage utilization of emergency vehicles, facilities, equipment, and personnel. Also, the incidence of long delays before the arrival of an emergency vehicle is to be incorporated in the models as a measure of effectiveness. The EMS planning models to be developed in this research project may be used by health planners who must determine how best to change an emergency medical services system to respond to community needs for emergency service.
EMS PLANNING PROJECT APPROACH

A coordinated system for efficiently and effectively providing emergency medical services essentially has not existed heretofore in metropolitan Atlanta. Many ambulances in metropolitan Atlanta have been staffed with attendants who had no training or inadequate training, as measured against modern standards developed by the American Medical Association and the U. S. Department of Transportation for the training of emergency medical technicians. Furthermore, throughout the seven-county Atlanta area which has a population of approximately 1,500,000 people, ambulance service has been provided in too many cases by funeral homes whose ambulances carried little or no equipment and rarely had two-way radio communications capability. Also, the ambulances have not been dispersed in a manner which would tend to provide an adequate response time for medical emergencies.

Generally, hospitals and ambulance services have been unable to communicate with each other via radio. Consequently, hospital emergency departments have rarely had advance notification of the impending arrival of an emergency patient. Furthermore, citizens have had a multiplicity of oftentimes confusing or misleading choices from which to select a means of seeking aid in emergency medical situations. Through 1972, the provision of emergency medical care has been fragmented among a number of agencies with essentially no operational or quality control enforced.

In order to rectify the EMS situation in metropolitan Atlanta, the Health Systems Research Center initiated an intensive, eight-month project in July 1972 to develop a plan for an improved emergency medical services system for the seven-county Atlanta area. The approach employed by the HSRC staff in the course of the project is outlined in the following paragraphs.

Literature Review

During the last several years, HSRC assembled a collection of more than 250 EMS related journal articles, books, reports, and other items. These reference materials, covering the full range of EMS topics,
included information on the EMS system in metropolitan Atlanta and the experiences of EMS planners and researchers in other communities in the U.S. and other nations. This literature was particularly useful in the analyses conducted of training for emergency medical technicians, telemetry, the 911 telephone number, EMS radio communications, EMS demand, and ambulance positioning.

**Site-visits to Other EMS Systems**

In order to acquire first-hand knowledge of the operational characteristics of other EMS systems, HSRC staff visited New York City; Jacksonville, Florida; and Columbus, Ohio. Personnel responsible for the direction and planning of the EMS systems in these cities were most generous in providing information and documentation to the HSRC staff. The information acquired through these visits was generally useful in developing the EMS plan for metropolitan Atlanta and was particularly pertinent to the analyses of dispatch and control, the 911 telephone number, telemetry, and EMS system cost.

**Correspondence with Other EMS Planners and Researchers**

Throughout the project, HSRC staff corresponded with EMS planners and researchers in Oregon; Seattle, Washington; South Carolina; Jacksonville and Miami, Florida; Columbus, Ohio; Houston, Texas; and Pittsburgh, Pennsylvania. Information was shared between the EMS planners and researchers in other communities and the HSRC staff. Particularly important information and expert opinion were obtained on training of emergency medical technicians, telemetry, and desirable ambulance response times.

**Attendance at EMS Conferences**

HSRC staff attended three conferences, two of which were devoted wholly to EMS and one of which was a meeting of the American Heart Association. At the EMS Conference held in Atlanta on November 27-29, 1972, EMS authorities from around the nation conducted workshops on EMS planning and presented information on EMS systems in Illinois; Jacksonville, Florida; and Columbus, Ohio.
On January 4, 1973, a member of the HSRC staff presented a talk on EMS planning in metropolitan Atlanta to an EMS conference sponsored by the National Center for Health Services Research and Development in Washington, D.C. and heard presentations on EMS developments in Pittsburgh and Philadelphia, Pennsylvania. The conference, attended by high level EMS administrators in the U.S. Public Health Service also included presentations on future EMS support from the Federal government.

At the American Heart Association meeting held in Atlanta on February 2, 1973, an HSRC staff member had the opportunity to obtain direct personal inputs from some of the nation's leading physicians involved in advanced EMS systems.

Coordination with the EMS Task Force and the ARC

During the period of April 1972 through February 1973, HSRC staff made presentations to the EMS Task Force of the ARC in order to keep the Task Force apprised of the progress of the planning project. Also, HSRC staff attended nearly all Task Force subcommittee meetings and contributed their technical inputs to the subcommittees. In turn, HSRC staff was given counsel by the various subcommittees during this period.

Results of a survey, which was conducted by HSRC, of metropolitan Atlanta hospital emergency departments were presented to the EMS Task Force Subcommittee on Emergency Facilities, and various working papers prepared by HSRC were presented to the appropriate subcommittee for review and comment. In developing an ambulance service survey, HSRC received suggestions from ARC staff, and the survey form was subsequently mailed out to metropolitan Atlanta ambulance services with an ARC cover letter. A follow-up telephone survey of ambulance services was conducted by the ARC staff, and the results of this survey were provided to HSRC.

HSRC staff generated numerous technical and information memoranda during the EMS planning project. Copies of these memoranda were given to ARC. In turn, HSRC received, from the various Task Force subcommittees, memoranda which described the positions taken by the subcommittees.
Inputs from Other EMS Related Agencies in Metropolitan Atlanta

Throughout the EMS planning project, various organizations and agencies generously provided inputs to the HSRC staff. HSRC had conversations and meetings with metropolitan Atlanta fire and police chiefs; staff of the Emergency Health Unit of the Department of Human Resources Division of Physical Health; staff of the Georgia Hospital Association; metropolitan Atlanta hospital administrators; personnel of the Southern Bell Telephone Company, various communications manufacturers, emergency medical equipment manufacturers, and ambulance services; military personnel at Fort McPherson and Dobbins Air Force Base; staff of the DeKalb Area Technical School; and Civil Defense personnel. In addition, important inputs were solicited from physicians in metropolitan Atlanta particularly on training of emergency medical technicians.

Documentation and Analysis of the Present Metropolitan Atlanta EMS System

In order to describe the present EMS system in metropolitan Atlanta, memoranda and several working papers were prepared by HSRC staff. The memoranda were routinely prepared as a result of meetings and conversations with various persons. Substantial documentation and analyses were prepared as working papers which were submitted to the appropriate EMS Task Force subcommittee and other persons for review and comment. Working papers were prepared on EMS communications, location of ambulances, training of emergency medical technicians, telemetry, dispatch and control, and EMS entry design concepts.

In addition, as already mentioned, surveys of emergency facilities and ambulance services were conducted to document the information relevant to these aspects of metropolitan Atlanta's EMS system. Information on the capabilities and resources of the emergency facilities in the Atlanta area was collected via an indepth survey which was personally conducted in each of the hospitals with full time emergency departments. Data on ambulance services was collected via a mailed questionnaire and over the telephone.
Synthesis of the EMS Plan and Systems Design

The working papers, in addition to documenting the EMS system and presenting analyses, included tentative EMS system design recommendations which were based on technical and functional analyses, and the working papers served as the basic materials for preparation of the present document. As part of the EMS system plan for metropolitan Atlanta, a pattern for positioning ambulances in strategic locations about the Atlanta area was developed based on predictions of the demand for ambulance service and on knowledge of other demographic features of the region. The ambulance positioning pattern was designed such that ambulance availability would be at least 90 per cent and the average ambulance response time would be approximately six minutes.

Recommendations for training of emergency medical technicians were derived from the experiences of other EMS systems and a functional requirements analysis. Specifications for ambulances were developed principally through the efforts of the EMS Task Force Subcommittee on Transportation and Equipment and largely in accord with nationally recognized standards while incorporating a few modifications to suit the local situation. Detailed procedures for performing the dispatch and operational control functions were derived to facilitate the operation of all components of the EMS system in a coordinated manner, and detailed design specifications for an areawide communications subsystem were developed. Lastly, a scheme for financing the operation of the improved EMS system was recommended.

The details of the EMS planning process are described in the following chapters of the present document.

OVERVIEW OF THE EMS PLAN

Detailed specifications of the EMS plan for metropolitan Atlanta are given in the following chapters and are not repeated here. Basically the plan specifies the means whereby existing deficiencies in the EMS system in the seven-county Atlanta area may be eliminated.
The principal provisions of the EMS plan are as follows and include:

1) A single emergency medical service telephone number which is well publicized and posted on all phones and which connects the caller directly to a regional dispatch and control center.

2) A regional dispatch and control center which is responsible for the dispatch of the closest, appropriate emergency medical vehicles to the emergency scene and which is responsible for monitoring and maintaining information on the status of emergency facilities, emergency medical vehicles, and emergency medical situations.

3) An emergency transportation subsystem which includes appropriately equipped and staffed ambulances, medical aid vehicles, and mobile intensive care units positioned about the metropolitan Atlanta area such that the average time for an ambulance to respond to an emergency following the dispatch notification is six minutes, such that ambulance availability for immediate dispatch is 90 per cent, and such that a medical aid vehicle is dispatched in emergency medical situations requiring the fastest possible response.

4) A range of emergency treatment skills to be possessed by the personnel on ambulances, medical aid vehicles, and mobile intensive care units; the emergency treatment skills are such that the emergency victim's condition can be stabilized at the emergency scene through the application of emergency treatment techniques tested in Atlanta and other communities; the range of emergency treatment skills and requisite training are such that an upward career path for emergency medical technicians has been created.

5) A comprehensive set of dispatch and control procedures which enable the closest, appropriate emergency facility to be prepared for the patient's arrival and which generally enable the efficient and effective management and coordination of the EMS system resources.
6) A communications subsystem which provides for both radio and telephone communication between the various EMS system resources as appropriate.

7) A program of public education directed toward educating the citizenry in basic first aid skills, on the use of the single EMS telephone number, and on the utility and proper use of first aid skills and the EMS system.

8) The means of marshalling the resources of the EMS system in disaster situations.

9) The means of financing the EMS system through the assumption by the seven metropolitan counties of the fiscal responsibility for supporting the emergency transportation, communications, and dispatch subsystems and for supporting the agency which has been selected by the seven counties to coordinate the EMS functions which are regional in nature.

10) The designation by the seven counties of an agency to which the seven counties have assigned the performance (on behalf of the counties) of EMS functions which are regional and coordinative in nature.

Specific major recommendations for the metropolitan Atlanta EMS system are listed in Chapter 2, and other recommendations are presented throughout the other chapters of the present document.

**STEPS TO BE TAKEN IN THE NEAR TERM**

A schedule of steps necessary for implementing the improved EMS system is given in Chapter 16, and the estimated cost of operating the EMS system is given in Chapter 15. The first step to be taken by the seven counties is to select an organization to serve on the counties' behalf as the EMS Coordinating Agency (ECA). Taking this basic first step is essential to the implementation of the majority of steps given in Chapter 16. Implicit in the first step is the assumption by the seven counties of at least certain financial responsibilities, namely support of the EMS Coordinating Agency and the dispatch and control center operated by the ECA.
Also, the implementation will more easily be accomplished if the counties also assume responsibility for financing the transportation and communications subsystems of the EMS system. If the counties do assume the indicated financial responsibilities and select an organization to serve as the EMS Coordinating Agency at an early date (sometime in the Spring of 1973), the basic features of the improved EMS system for metropolitan Atlanta can be operational by January 1, 1974.
CHAPTER 2
SUMMARY OF RECOMMENDATIONS
FOR THE METROPOLITAN ATLANTA EMS SYSTEM

INTRODUCTION

This chapter presents a brief summary of the principal recommenda-
tions which are described in detail in the following chapters of the
present plan. The analyses and rationale supporting these principal
recommendations are presented in appropriately designated sections of the
following chapters and are not repeated below. This summary of recommenda-
tions does not include all of the recommendations presented in the present
plan, but is limited to those recommendations that significantly influence
the character of the EMS system.

RECOMMENDATIONS

EMS System Organization - Chapter 3

1. It is recommended that the EMS system be responsible to
the county governments. Coordination of the metropolitan Atlanta EMS
system and performance of EMS functions which are areawide in nature is to
be achieved on behalf of the counties through an EMS Coordinating Agency
to be developed by or selected by the county commissions. The EMS
Coordinating Agency is to be governed by a Board of Directors consisting
of one county commissioner from each county in metropolitan Atlanta and
an equal number of citizens plus perhaps a staff member of the Atlanta
Regional Commission. Coordinative and areawide functions of the EMS
Coordinating Agency are to consist of the following: coordination of
education for EMS personnel, receipt and disbursement of federal funds
for EMS operations, arranging for transfer of funds for intercounty EMS
activity, dispatch and resource status control, establishment and adoption
of standards and regulations, operational coordination, planning, coordi-
nation of public education, quality control and evaluation, and reporting.
2. It is recommended that the EMS Coordinating Agency is to maintain communication at the Board level, with citizens, medical authorities, and hospitals through established Advisory Councils.

Emergency Facilities - Chapter 4

3. It is recommended that the EMS Coordinating Agency periodically update information describing hospital emergency services, and related supportive services in the metropolitan Atlanta area.

4. It is recommended that current facility capability and bed and emergency department capacity data are to be provided to the EMS Coordinating Agency dispatch and control center (DCC), to insure that patients are transported to available and medically appropriate, facility resources.

5. It is recommended that the categorization of emergency hospital facilities, presented in Chapter 4, be officially adopted by metropolitan Atlanta.

Emergency Transportation and Vehicles - Chapter 5

6. It is recommended that functional requirements for emergency medical care in metropolitan Atlanta require three distinct levels of responding equipment and treatment capability, as follows: medical aid vehicles to apply resuscitative and first aid skills, in appropriate circumstances, to the victim of a medical emergency as quickly as possible after the emergency is reported; emergency ambulances to provide definitive care and stabilizing treatment to the victim within an average of six minutes after dispatch; mobile intensive care units to provide concentrated experience for ambulance attendant training programs, to provide advanced paramedical skills and intensive care to patients as appropriate, and to provide appropriate manpower and supplies to multi-casualty incidents.

7. It is recommended that the medical aid vehicle concept proposed for the EMS system utilize existing police and fire department vehicle and manpower resources in metropolitan Atlanta.
8. It is recommended that the EMS system utilize 34 geographically distributed emergency ambulances throughout metropolitan Atlanta and three mobile intensive care units, one to be located at Grady Memorial Hospital, DeKalb General Hospital, and Kennestone Hospital.

9. It is recommended that emergency ambulances are to carry supplies and equipment required for definitive care of coronary emergencies and shock, in addition to minimum supplies specified by the U. S. Department of Transportation.

10. It is recommended that hospitals and emergency vehicles of the EMS system utilize, as appropriate, interchangeable equipment and supplies to minimize delay and patient movement subsequent to stabilization.

11. It is recommended that four distinct levels of training be established to provide a manageable system for acquisition and distribution of skills and to provide a career incentive to system emergency medical technicians (EMT's).

12. It is recommended that all EMT's be trained to treat victims of medical emergencies with intravenous fluid therapy, as appropriate, according to specific standing medical orders.

13. It is recommended that carefully selected EMT's (to be designated EMT-A2's) be trained to defibrillate patients, as appropriate, according to specific standing medical orders, and to administer cardiac drugs under radio supervision from a physician, utilizing telemetry of electrocardiograms as a training aid. These EMT's should receive instruction in Advanced EMT skills, as defined by the U. S. Department of Transportation, including arrhythmia recognition and endotracheal intubation while working under the direct supervision of a registered nurse on a hospital based mobile intensive care unit.

14. It is recommended that graduates of the Advanced EMT training program recommended in recommendation 13, above, be designated EMT-A3's and assigned to an emergency ambulance, to perform advanced procedures under radio supervision of a physician.
15. It is recommended that the EMT-A3's, having demonstrated proficiency in arrhythmia recognition, should not be dependent upon physician interpretation of electrocardiogram via telemetry. The EMT-A3 should perform the advanced procedures only under radio supervision of a physician, as stated in recommendation 14.

16. It is recommended that a two year associate arts degree training program in emergency medical care be provided through hospitals and universities, as required, for EMT's desirous of a career in emergency medical care. Graduates of this program, to be designated EMT-A4's ultimately will command the mobile intensive care units of the EMS system and possess the most comprehensive level of emergency treatment skills among EMT's in the system.

17. It is recommended that the need for emergency department technicians and special emergency care training for emergency department nurses should be evaluated to identify system inadequacies and propose solutions.

18. It is recommended that one seven digit telephone number be established as a rapid entry mechanism to the EMS system to be utilized throughout the seven county metropolitan Atlanta area. The telephone data is to be received and triaged by the EMS Coordinating Agency dispatch and control center.

19. It is recommended that one central dispatch facility, to be operated by the EMS Coordinating Agency, be established to dispatch and coordinate all emergency vehicles in the Atlanta metropolitan area. The dispatch and control center should maintain current status information regarding hospital capacities and ambulance location and status.

20. It is recommended that all requests for an emergency ambulance are to receive an emergency response. In order to prevent abuse of the system, if, upon arrival at the scene, the ambulance personnel determine that the person does not require transportation in an emergency vehicle, the person is not to be transported. If the person requires some
minor medical treatment, the patient should be treated as appropriate by the EMTs and referred to a clinic or family physician. If there is any doubt as to the need for transportation in an emergency vehicle, the patient will be transported. The data relevant to this procedure will be reviewed periodically by physicians through the Medical Advisory Council.

Communications - Chapter 8

21. It is recommended that each emergency ambulance is to be equipped with a four channel VHF radio to include: a dispatch frequency common to all ambulances, a hospital to ambulance frequency, the Georgia Hospital Association (GHA) hospital frequency of 155.340 MHz, and the GHA hospital frequency of 155.280 MHz or a VHF frequency chosen by the ambulance service.

22. It is recommended that category 1, 2, and 3 hospitals, as defined in Chapter 4, are to be connected to the dispatch and control center (DCC) via direct telephone line; major fire and police departments are to have direct telephone communication with the DCC, and ambulance quarters are also to have direct telephone communications with the DCC.

Data Requirements for Evaluation and Management - Chapter 9

23. It is recommended that the EMS Coordinating Agency is to maintain an ongoing analysis of the EMS system utilizing data provided by various organizations including existing agencies and government organizations, ambulance services, emergency departments; and the dispatch and control center. Deficiencies identified through analysis may be corrected through actions of the EMS Coordinating Agency and the Board of Directors of the EMS Coordinating Agency.

Financing the EMS System - Chapter 10

24. It is recommended the Emergency Medical Services system is not to present the patient or the patient's family with a charge for ambulance service and that the cost of emergency ambulance service be paid by the counties.
25. It is recommended that funds to support the cost of indigent care in hospitals and costs associated with emergency ambulance service within a county are to be obtained from the counties participating in the EMS system and are to be paid directly to the provider of service.

26. It is recommended that external funding, such as federal grant awards, related to operational aspects of the EMS system are to be requested through and distributed by the EMS Coordinating Agency to various counties and EMS components as appropriate.

27. It is recommended that payment of fixed costs associated with intercounty emergency ambulance service be arranged by the EMS Coordinating Agency, since the EMS Coordinating Agency is to maintain records on intercounty emergency ambulance utilization.

Disaster Planning - Chapter 11

28. It is recommended that the proposed Medical Annex of the Civil Defense Natural Disaster Plan, and other recommendations of the Disaster Planning Subcommittee of the EMS Task Force, be adopted to upgrade existing disaster plans and create plans for meeting the needs of disaster victims of airplane crashes, explosions, and so forth.

29. It is recommended that the mobile intensive care units and dispatch and control center, as well as the other resources of the EMS system, be incorporated into the metropolitan Atlanta disaster plan to allow for coordinated use of EMS resources by disaster authorities.

Public Education Related to the EMS - Chapter 12

30. It is recommended that all available news media be utilized to inform the citizens of metropolitan Atlanta of the need for first aid skills, symptoms of dangerous disease, and proper use of the EMS system. Public education programs are to be coordinated by the EMS Coordinating Agency.

31. It is recommended that Basic First Aid (American Red Cross) and cardiopulmonary resuscitation technique be taught in all public schools to students of appropriate age groups recommended by American Red Cross and American Heart Association authorities.
32. It is recommended that the telephone number designated as the number to call to obtain emergency medical services be attached to each telephone in metropolitan Atlanta by representatives of Southern Bell, if Southern Bell policy is in accordance with the recommendation.
INTRODUCTION

As proposed and explained in Chapter 10 of the present document, the emergency medical services provided by the metropolitan Atlanta EMS system are to be rendered to the citizens at no charge. As with other public services particularly those of an emergency nature such as fire and police services, emergency medical services are proposed to be supported from local taxes except for hospital and physician provided emergency medical care.

The exceptions derive from the historical pattern of billing patients (who have the ability to pay) for hospital and physician provided emergency medical care. No such historical norm can be said to apply, however, to emergency ambulance service; in fact, in many large communities, such as metropolitan Atlanta, ambulance service is already provided at no charge to the citizens.

In addition to support of emergency ambulance service from tax dollars, the communications subsystem, which links the various metropolitan EMS resources, the dispatch and control subsystem, which enables the coordinated operation of the metropolitan EMS resources, and the EMS Coordinating Agency, which performs, on behalf of the counties, functions which are regional and coordinative in nature, are proposed to be also supported from tax dollars.

When local taxes are expended to provide medical services at the local level, the collection and disbursement of such taxes has been generally a county responsibility. Consequently, the role of the counties looms large in implementing the improved EMS system proposed herein. The full scope of county involvement and responsibility in implementing the proposed EMS system is described in succeeding sections of the present chapter.
RATIONALE FOR NO-CHARGE AMBULANCE SERVICES

A basic concept in the development of modern emergency medical service systems is to encourage the emergency victim or his family, friends, and associates to call upon the resources of the EMS system without hesitation when needed, particularly in cardiac emergencies. Modern EMS systems are designed to bring sophisticated emergency care promptly to the emergency victim.

However, as in the Jacksonville EMS system, in most emergency situations, the patient is brought to an emergency facility via private automobile thereby bypassing the emergency treatment skills which are incorporated in advanced EMS transportation subsystems and sometimes resulting in the patient being brought to an emergency facility which is not able to provide the needed emergency care. Exacerbating this situation is the fact that in certain types of medical emergencies, particularly cardiac emergencies, the patient delays in seeking the needed assistance for a variety of reasons.

It therefore follows that, if citizens are to be encouraged to call upon the EMS system promptly when needed, no deterrent to the timely utilization of the EMS system should be established which would cause the citizens to hesitate in calling for an emergency ambulance. To charge for ambulance service is to establish a deterrent to the efficacious utilization of the EMS transportation subsystem by the citizenry. In order to reduce the likelihood of abusing such a no-charge ambulance service, the policies and procedures described in Chapter 7 should be adopted.

THE ROLE OF COUNTY GOVERNMENT

The organizational interrelationships of the proposed EMS system are shown in Figure 3.1. The organizational interrelationships are essentially the same as in the present metropolitan Atlanta EMS system except that a major new organizational entity, designated in the present document as the EMS Coordinating Agency (ECA) is included in the proposed emergency medical services system.*

* The EMS Coordinating Agency is also referred to as the EMS Agency or the Agency throughout the present document.
FIGURE 3.1 EMS System Interrelationships.
The ECA is functionally and structurally described in a subsequent section of the present chapter. Basically, however, the ECA is proposed to be established by the seven metropolitan Atlanta counties to perform certain regional, coordinative functions on behalf of the counties and within policies established by the seven county governments. The ECA serves as the organizational entity responsible to the county governments for implementing regional EMS policies.

The county governments are responsible to the citizens of the county for assuring that the resources necessary for effectively and economically providing emergency medical services are available within the county. The counties are responsible for the quality of the EMS within the county, although the counties would delegate the actual quality monitoring function to the ECA and the Medical Advisory Council of the ECA.

**Ambulance Services**

The counties should develop contractual arrangements to provide emergency transportation and emergency medical care outside of the hospital. Contracts would be negotiated with private ambulance companies or with public service agencies of the county such as the county fire department or police department or a county operated hospital.

The details of the negotiated contracts are left to the individual counties. Presumably, however, the counties would solicit competitive bids from private ambulance services which would propose to provide ambulances, dedicated to emergency service, at one or more of the ambulance locations within the county as specified in Chapter 5. The ambulances of course would be required to satisfy the vehicular, equipment, and personnel standards set forth in Chapters 5, 6, and 8, and the ambulance service would agree to operate the emergency vehicle according to the coordinated dispatch and control needs of the metropolitan EMS system as set forth in Chapter 7.

If private ambulance services are not able to satisfy the county's or regional requirements, the county would assign responsibility for providing emergency ambulance service to a county public service agency such as the county fire department or police department or a county operated...
hospital. Alternatively, a county could elect to arrange for a public service agency of a local municipality or neighboring county to provide ambulance service.

**Medical Aid Vehicles**

In order to provide for the fastest possible emergency medical response, when such a response is needed, each county will arrange for county fire and police departments to provide medical aid vehicles according to the specifications in Chapters 5, 6, and 7. The counties can alternatively elect to arrange for medical aid vehicles to be provided by a local municipality.

**Emergency Facilities**

Each county should assure monies for the emergency treatment of indigent residents. The regional nature of EMS resources will require contractual arrangements among many emergency facilities in all counties. Occasionally, citizens of one county will require treatment in another county, possibly due to the nature of an illness or injury. Payment for emergency treatment must be provided. The need for such arrangements is substantiated in the information collected in the emergency department survey conducted by HSRC and is well expressed by the EMS Task Force Subcommittee on Emergency Facilities.

**TRANSPORTATION SUBSYSTEM**

The transportation subsystem of the metropolitan Atlanta EMS system is organizationally depicted in Figure 3.1 and fully described in Chapter 5. This subsystem includes all resources required to bring emergency medical care to the sick and injured and to deliver care on the scene and en route to an emergency facility. The ambulances, mobile intensive care units (MICUs), medical aid vehicles, and associated personnel are the primary components of the transportation subsystem of the EMS system. As already mentioned, the counties are responsible for providing adequate emergency ambulance service and medical aid vehicles. The counties are also responsible for
providing the funds for the MICUs. The MICUs, however, are to be used principally in a training role and in disaster situations. As coordination of training activities is a function of the ECA and since the mobilization of the metropolitan Atlanta EMS resources is to be performed by the dispatch and control center (DCC) of the ECA, the MICUs should be assigned by the counties as a responsibility of the ECA.

EMERGENCY FACILITIES SUBSYSTEM

The emergency facilities subsystem of the metropolitan Atlanta EMS system is also depicted in Figure 3.1 and is discussed in depth in Chapter 4. The emergency facilities include all hospital emergency departments and back-up services necessary for the provision of emergency medical care to the sick and injured. The emergency facilities report significant changes in emergency capacity to the DCC of the EMS Agency in order to provide for coordinated operation of the metropolitan Atlanta EMS system.

PROVISION OF TRAINING

The training of EMS system personnel is to be a major function during the first few years following the initial implementation of the proposed EMS system. Of course, training will be a continuing function due to the need for continuing education and refresher courses and to replace emergency medical technicians who leave the EMS system.

Coordination of training in the metropolitan Atlanta EMS system is to be a function of the EMS Agency. The mechanisms for providing training are discussed in Chapter 6.

EMS COORDINATING AGENCY

The seven counties should select or create an EMS Coordinating Agency to perform essential functions, which are regional and coordinative in nature, for the EMS system. The EMS Coordinating Agency is to administer the dispatch and control procedures and perform the dispatching function for the EMS system. The quality control, evaluation, and planning functions of the EMS system are also to be performed by the Agency on behalf of the counties. The Agency is to create and adopt standards and regulations as
appropriate to the efficient and effective operation of the EMS system and is to be responsible for the operational control of EMS resources. The EMS Agency is to also be responsible for coordinating public education programs, which are described in Chapter 12 of the present plan. Management reports, describing the operating characteristics of the EMS system, achievement of performance objectives, and so forth are to be prepared by the staff of the EMS Coordinating Agency and are to be distributed to the citizens and medical societies of metropolitan Atlanta through the participating county governments.

The EMS Agency is to coordinate certain financial distribution functions for the EMS system. Federal grants for upgrading EMS are to be coordinated through the EMS Agency, which will distribute the funds to other EMS subsystems such as emergency facilities and transportation. The Agency is also to be responsible for the coordination of all EMS training to assure equivalency of skills in the metropolitan Atlanta area.

Organization of the EMS Coordinating Agency

A configuration for the EMS Agency is illustrated in Figure 3.2. The organization structure is configured to establish an agency which is responsive to the requirements of the county governments and to facilitate the performance of the functions delegated to the EMS Agency. The organization incorporates features intended to accommodate the needs of the entire EMS system as recommended throughout the present EMS plan. Implementation of the EMS system is facilitated by the distribution of responsibility and authority inherent in the proposed organization.

Board of Directors

The EMS Coordinating Agency is ultimately responsible to the citizens of metropolitan Atlanta through the county commissioners who provide policy direction to the Agency and who serve on the Board of Directors. As seen in Figure 3.2, the Board of Directors is provisionally shown to include one county commissioner and one citizen from each of the seven counties. In order to provide for an odd number of
One county commissioner and one citizen from each county to serve as a member of the EMS Coordinating Agency Board of Directors

- COORDINATOR
- ASSISTANT COORDINATOR FOR MEDICAL AFFAIRS
- STAFF

COORDINATIVE AND REGIONAL FUNCTIONS:

- Dispatch and Control
- Quality Control
- Evaluation
- Planning
- Reporting
- Receipt and Distribution of Federal Funds
- Standards and Regulations
- Operational Coordination
- Public Education
- EMS Training

FIGURE 3.2 Organizational Structure of the Emergency Medical Services Coordinating Agency.
Board members, perhaps a member of the Atlanta Regional Commission staff could serve as a fifteenth member.

The Board would be initially responsible for creating the charter and establishing the bylaws of the Agency; selecting the Coordinator and Assistant Coordinator for Medical Affairs; assigning, to the Coordinator, the functional responsibilities necessary for implementation of policy established by the Board; and policy level liaison activities associated with the Advisory Councils illustrated in Figure 3.2.

**Hospital Advisory Council**

The Hospital Advisory Council serves to advise the Board of Directors of the needs of the emergency facilities subsystem of the EMS system. The Council should be composed of one hospital administrator from each hospital participating in the metropolitan Atlanta area EMS system.

**Medical Advisory Council**

The EMS system is a medical care delivery system and, as such, requires inputs and advice at the Board of Director level from medical authorities. The Medical Advisory Council should have representation from all medical societies within the EMS system service area. Representatives from the major medical, nursing, and allied health educational institutions in the area should also be included.

**Citizen Advisory Council**

The philosophy in support of the Citizen Advisory Council differs from the basic philosophy involved in appointment of citizens to the Board of Directors. The Citizen Advisory Council provides the communities of metropolitan Atlanta with a greatly expanded opportunity to effect two-way communication between the EMS system and the citizens. The Council should include representation from every community having identifiable and unique needs to be communicated to the Agency.
Coordinator

The Coordinator of the EMS Coordinating Agency is selected by, and responsible to the Board of Directors. The Coordinator is responsible for implementing policies established by the Board and for the performance of all of the EMS Agency functions previously mentioned and subsequently described in detail. The Coordinator is responsible for all aspects of the day to day operation of the Agency.

Assistant Coordinator for Medical Affairs

The EMS system is to provide emergency medical services to the citizenry of metropolitan Atlanta. The medical care aspect of the EMS system is the major factor influencing the patient care provided by the system. The Assistant Coordinator for Medical Affairs is responsible to the Coordinator for the medical conduct of the system. A primary function of the position of Assistant Coordinator for Medical Affairs is the communication, with respect to medical affairs, between system components and the medical community in metropolitan Atlanta. The Assistant Coordinator should be a physician.

Staff Positions of the EMS Coordinating Agency

The staff reporting to the Coordinator, with the exception of the Assistant Coordinator for Medical Affairs, consists of dispatch and clerical personnel, and a management analyst, as shown in Figure 3.3. The dispatch activities performed by the dispatchers, receiving operator, and triage officer are fully described in Chapter 7.

The management analyst is responsible for the preparation of information, quality control, and statistical reports of EMS system performance. The management analyst also assists the Coordinator with the activities involved in the planning function of the Agency.
Functions of the EMS Coordinating Agency

The EMS system basically consists of four functional subsystems, each of which serves various functional responsibilities, plus the supportive communications subsystem. The four functional subsystems are:

- Coordination
- Emergency Facilities
- Emergency Transportation
- Training
The interrelationships among these subsystems in essence define the EMS system organization. The EMS system organization is derived then from the need for the subsystems to interrelate with each other. In terms of the EMS system providing emergency medical care, the effective interrelations between the transportation, facilities, and training subsystems are achieved through the coordination subsystem and enabled by the communications subsystem.

The transportation, facilities, training, and communications subsystems are discussed in detail in succeeding chapters. The following paragraphs focus on the coordination subsystem and describe the coordinative functions performed by the EMS Agency.

**Dispatch and Control**

The dispatch and control function is performed by the dispatch and control center (DCC) of the EMS Agency and includes receipt of information describing an emergency, analysis of the information to determine the proper resources to be dispatched, the radio dispatch and control of resources, and maintenance of intelligence on system status. The dispatch and control center is also responsible for medical triage of requests for emergency service and the dissemination of selected first aid information to callers. The DCC causes the coordinated operation of the EMS system through the application of documented procedure and receives and processes management information from hospitals. The activities performed within the DCC are thoroughly described in Chapter 7.

**Quality Control**

The EMS Agency in conjunction with the Medical Advisory Council performs the quality control function for the EMS system through testing and inspection. Testing activities provide a continuous monitor of the proficiency of EMS medical personnel. The tests are administered according to an established schedule to be developed jointly by the providers of training and the EMS Agency acting on behalf of the county governments.
The EMS Agency coordinates the performance of periodic quality control inspection surveys of emergency facility and transportation resources. The inspections, to be conducted by the Medical Advisory Council and the Hospital Advisory Council, protect the patient as well as the ambulance services and hospitals by noting deficiencies and, internally (within the system), reporting the deficiencies such that the ambulance service or hospital emergency facility can take corrective action.

**Evaluation**

Evaluation of the EMS system is concerned with measuring the effectiveness of the EMS system. The term evaluation is used in the sense of measuring EMS system performance in terms of criteria such as response time, utilization, and cost, whereas quality control refers specifically to the quality of the medical care available to the emergency patient. Evaluation activities include analysis and review of data obtained at the dispatch and control center, from ambulance reports, and from emergency department records. The evaluation will identify, for example, the need for more or fewer ambulances, for a change in the scope of service provided in emergency departments, or for redistribution of ambulances to correct unacceptable average response times. Evaluation is further described in Chapter 9.

**Planning**

The planning activities of the Agency include planning for changes in the EMS system in order to accommodate changing community requirements for emergency medical services. Planning activities can develop because of the results of evaluation and quality control studies or because of the availability of new technology.

**Reporting**

The reporting function of the EMS Agency includes activities to summarize and distribute data to appropriate recipients. Quality control and evaluation reporting will, for the most part, remain
within the EMS system. Financial reports and reports describing EMS system performance will be directed upwards in the organization and to the citizens of metropolitan Atlanta.

Receipt and Distribution of Federal Funds

Funds may be available for the operation or improvement of the EMS system through grants from Federal sources. Generally, the opportunity to receive Federal EMS operation and improvement grants is enhanced if there is a single, identifiable agency, such as the EMS Agency, which is responsible for coordinating the overall management of the EMS system resources and which can serve as the recipient of the funds. The EMS Agency would then distribute the funds to the various EMS system components according to a schedule which would have been prepared beforehand for inclusion in the application for the grant.

Presumably, any funds to be made available by the State of Georgia for EMS operations, and specifically for activities which are coordinative and regional in nature, could be handled in a similar manner.

Standards and Regulations

The Agency, on behalf of the county governments creates or adopts rules and regulations appropriate for the operational and quality control of the EMS system participants. The justification for the rules and regulations, and the use of rules and regulations is included in the discussion of Dispatch and Control Procedures in Chapter 7.

Operational Coordination

Operational coordination is achieved at the dispatch and control center. The EMS system operations are monitored at the DCC, and inappropriate or improper performance can be noted and information forwarded to the proper EMS component such that corrective action can be taken. This function is particularly concerned with monitoring the performance of the transportation subsystem and the manner in which the communications subsystem is used.
Public Education and EMS Training Coordination

Public education and EMS training are described in Chapters 12 and 6, respectively. The Agency receives data relevant to training and public education and responds to observed needs for coordination. Public education programs are released and implemented in a controlled manner to insure maximum effectiveness. Training programs for EMS medical personnel are coordinated through the Agency to insure equivalency of skills and recognition of distinct levels of skill throughout the metropolitan Atlanta area.

INTERACTION BETWEEN COMMUNITY AGENCIES AND THE EMS AGENCY

Community agencies such as ARC, GRMP, HSRC, Economic Opportunity Atlanta, and hospitals with emergency departments and others will have significant information and experience to share with the EMS Agency, particularly in the area of health, economics, and social characteristics of the metropolitan Atlanta area. Advice and guidance from medical societies and other medical resources will be essential to the EMS system. For example, the interaction between the EMS Agency and community medical resources is a significant activity to be performed by the Assistant Coordinator for Medical Affairs.

The Georgia Department of Human Resources, Georgia Department of Education, and Office of the Coordinator of Highway Safety can provide significant assistance to the EMS Agency. Legislation and education of relevance to the EMS system should be developed with the involvement of these State agencies in many instances.

The Health Systems Research Center can assist the EMS Coordinating Agency in future analysis and system design support. The 314(b) agency in Atlanta can contribute very valuable assistance to the EMS Agency in planning changes in the EMS system. The Department of Health and Social Services Planning of ARC has been actively coordinating community involvement in emergency medical services system design in metropolitan Atlanta for several years through the metropolitan Atlanta EMS Task Force.
FINANCING THE EMS SYSTEM

The operating costs associated with the EMS system are both fixed and variable. The greatest costs, by far, are those fixed costs associated with maintaining resources in a constant state of readiness. Variable costs are dependent upon factors such as mileage and number of patients. The flow of funds within the EMS system organization is discussed below.

Income

The recommended EMS system will not charge a fee for the transportation and on-the-scene medical care provided to citizens as already noted and as further described in Chapter 10. The collection of monies necessary for care provided to indigent patients within emergency facilities and for emergency transportation generally is basically a county responsibility. Hopefully, Federal and State funds will augment the county support of the EMS system. Also, tax dollars to support the ECA and its dispatch and control center and the MICUs are required.

Disbursements

Disbursements of funds to support fixed costs of the transportation component of the EMS system should be made directly to the ambulance services by the county governments. Similarly, each county will make disbursements directly to hospitals for indigent care. Furthermore, counties should make arrangements to provide payment for the treatment of their indigent residents in hospitals located in another county.

Variable costs associated with intercounty emergency transportation, that is, transportation from one county to another, perhaps should be distributed by the EMS Coordinating Agency. The Agency has access to all official records necessary for accurate appropriation of monies associated with these variable costs.

SELECTION OF THE EMS AGENCY

Although HSRC has outlined the suggested basic character of the EMS Coordinating Agency, HSRC leaves the designation or creation of the ECA
to the counties, which can be assisted in the process by the ARC and GRMP. Possible alternative organizations which could be selected as the EMS Agency are:

- Civil Defense
- DeKalb County Fire Department or the City of Atlanta Fire Department
- Grady Memorial Hospital and the Fulton-DeKalb Hospital Authority
- Metropolitan Atlanta Foundation for Medical Care, Inc. of the Medical Association of Atlanta
- Metropolitan Atlanta Health District
  (if and when this organization becomes viable)

In addition to the above organizational possibilities, a new, independent, non-profit organization could be created specifically to serve as the EMS Coordinating Agency. Also, the Atlanta Regional Commission might be a possible organization, and the Georgia Regional Medical Program is yet another possibility. The Health Systems Research Center would be pleased to accept the responsibility if selected.

While HSRC has not specified the organization, some criteria for selection of an appropriate organization can be given. The decision regarding which of the organizational possibilities would best meet the needs of the EMS system and metropolitan Atlanta should be based partially on the present resources, capabilities and role of the candidate organization.

For example, experiences in dispatch and control, mobilizing resources for emergency situations, and in operating public service systems are desirable characteristics of the selected organization. Presently established radio and telephone communications links and space available to house the ECA and its dispatch and control center should be considered in the selection process.
In some large disaster situations, the metropolitan Atlanta EMS system will have to interface with regional EMS systems in other parts of Georgia and possibly in other states. Consequently, the organization selected to serve as the EMS Agency will desirably have already established operational arrangements for communicating with other EMS systems throughout Georgia. While probably obvious, it should be noted that the ECA dispatch and control center is designed to serve metropolitan Atlanta in both normal emergency medical situations and disasters which result in medical casualties.

Also, probably obvious, but worthy of explicit statement, are the facts that the EMS system is an emergency medical system designed to provide rapid response to victims of medical emergencies and that the majority of these emergency patients ultimately are admitted to a hospital emergency department.

None of the above criteria is suggested to be overriding, and, in fact, other criteria may also surface during the actual selection process. It is recommended that the suggested criteria be considered in the selection of the organization to serve as the EMS Coordinating Agency.
CHAPTER 4

EMERGENCY FACILITIES

INTRODUCTION

One of the basic subsystems of an emergency medical services (EMS) system is the emergency facilities subsystem. The term "emergency facilities" is used to designate hospitals with emergency departments (EDs), which are responsible for providing definitive treatment to arriving emergency patients. This chapter outlines the emergency facilities available in metropolitan Atlanta, in terms of equipment, personnel, and procedures. A survey of 19 area hospitals with EDs is described and the results are presented in tabular form. Recommendations based upon the survey results are made to upgrade certain facilities in order to provide services where none presently exist. The hospitals are categorized according to emergency service capabilities, and the potential use of the categorization is presented. Finally, recommendations are made for future analyses of the emergency facilities subsystem to be performed when the EMS system becomes operational.

LOCATIONS AND FUNCTIONS OF METROPOLITAN ATLANTA EMERGENCY FACILITIES

There are 52 hospitals and other acute care health facilities in the metropolitan Atlanta area as shown in Appendix A. For two reasons, however, EMS facilities planning and analyses concentrate primarily on the acute care, short term, general hospitals with emergency departments. First, acute care hospitals with EDs are oriented toward emergency care, and truly emergent patients, by definition, are suffering from acute diseases or injuries. Secondly, short term, general hospitals with EDs provide services which are wide enough in scope to handle the majority of patient conditions. Specialty hospitals with EDs may only be able to treat a small fraction of all emergency patient conditions. The greatest impact upon the metropolitan Atlanta EMS system, therefore, can be expected to come from acute care, short term, general hospitals with EDs.
Of the 52 acute care health facilities in metropolitan Atlanta, 20 are short term, general hospitals with 24 hour emergency departments. Four other general hospitals under construction are scheduled to open 24 hour emergency departments in 1973. Table 4.1 lists the 20 metropolitan Atlanta acute care, short term, general hospitals with 24 hour emergency departments and Figure 4.1 shows their locations as well as the locations of the four new hospitals under construction.

From Figure 4.1, it is readily apparent that hospital EDs are well distributed throughout the metropolitan Atlanta area and, for the most part, are easily accessible to the population. Grady Memorial Hospital, which provides by far the most extensive emergency service in the area, and perhaps in the Southeast, is located almost exactly in the center of the metropolitan Atlanta area. Although Grady Memorial Hospital receives the majority of ED patients, large numbers of ED visits occur at the decentralized locations of Kennestone Hospital, Clayton General Hospital, South Fulton Hospital, DeKalb General Hospital, and other hospitals as shown in Figure 4.2.

Although general hospital EDs provide most emergency patient treatment, the specialty hospitals may be occasionally called upon to offer specialized service or consultation. The specialty hospitals located in metropolitan Atlanta are listed in Table 4.2.
TABLE 4.1  Acute Care, Short Term, General Hospitals with Emergency Departments in Metropolitan Atlanta.

<table>
<thead>
<tr>
<th>OPERATING, JANUARY 1, 1973</th>
<th>EMS CATEGORY</th>
<th>BEDS*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Buford General Hospital</td>
<td>IV</td>
<td>39</td>
</tr>
<tr>
<td>Button Gwinnettt Hospital</td>
<td>IV</td>
<td>74</td>
</tr>
<tr>
<td>Clayton General Hospital</td>
<td>III</td>
<td>170</td>
</tr>
<tr>
<td>Cobb General Hospital</td>
<td>II</td>
<td>164</td>
</tr>
<tr>
<td>Crawford W. Long Memorial Hospital of Emory University</td>
<td>IV</td>
<td>382</td>
</tr>
<tr>
<td>DeKalb General Hospital</td>
<td>II</td>
<td>368</td>
</tr>
<tr>
<td>Doctors Hospital</td>
<td>III</td>
<td>114</td>
</tr>
<tr>
<td>Douglas County Memorial Hospital</td>
<td>IV</td>
<td>51</td>
</tr>
<tr>
<td>Georgia Baptist Hospital</td>
<td>II</td>
<td>475</td>
</tr>
<tr>
<td>Grady Memorial Hospital</td>
<td>I</td>
<td>1039</td>
</tr>
<tr>
<td>Holy Family Hospital</td>
<td>III</td>
<td>129</td>
</tr>
<tr>
<td>Joan Glancy Memorial Hospital</td>
<td>IV</td>
<td>100</td>
</tr>
<tr>
<td>Kennestone Hospital</td>
<td>II</td>
<td>368</td>
</tr>
<tr>
<td>Northside Hospital</td>
<td>II</td>
<td>247</td>
</tr>
<tr>
<td>Piedmont Hospital</td>
<td>II</td>
<td>314</td>
</tr>
<tr>
<td>Rockdale County Hospital</td>
<td>IV</td>
<td>23</td>
</tr>
<tr>
<td>Shallowford Community Hospital</td>
<td>III</td>
<td>-</td>
</tr>
<tr>
<td>South Fulton Hospital</td>
<td>II</td>
<td>292</td>
</tr>
<tr>
<td>St. Joseph's Infirmary</td>
<td>IV</td>
<td>300</td>
</tr>
<tr>
<td>West Paces Ferry Hospital</td>
<td>III</td>
<td>-</td>
</tr>
</tbody>
</table>

UNDER CONSTRUCTION, JANUARY 1, 1973

Atlanta West Hospital
Bolton Road Medical Center
Smyrna Hospital
Urban Medical Services Community Hospital

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* 1972 Guide Issue, AHA.
KEY

- Existing, January 1, 1973
- Under Construction

FIGURE 4.1 Locations of Acute Care, Short Term, General Hospitals With Emergency Departments in Metropolitan Atlanta.
FIGURE 4.2 Yearly Volume of Visits to Metropolitan Atlanta Acute Care, Short Term, General Hospital Emergency Departments (1971).
TABLE 4.2 Specialty Hospitals in Metropolitan Atlanta.

<table>
<thead>
<tr>
<th>HOSPITAL</th>
<th>SPECIALTY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Atlanta Hospital</td>
<td>Eye, Ear, Nose, and Throat</td>
</tr>
<tr>
<td>Brawner Hospital</td>
<td>Psychiatric</td>
</tr>
<tr>
<td>Georgia Mental Health Institute</td>
<td>Psychiatric</td>
</tr>
<tr>
<td>Georgia Regional Hospital at Atlanta</td>
<td>Psychiatric</td>
</tr>
<tr>
<td>Henrietta Egleston Hospital for Children</td>
<td>General for Children</td>
</tr>
<tr>
<td>Metropolitan Eye Hospital</td>
<td>Ophthalmalogy</td>
</tr>
<tr>
<td>Metropolitan Psychiatric Center, Inc.</td>
<td>Psychiatric</td>
</tr>
<tr>
<td>Parkwood Hospital, Inc.</td>
<td>Psychiatric</td>
</tr>
<tr>
<td>Peachtree Hospital, Inc.</td>
<td>Psychiatric</td>
</tr>
<tr>
<td>Ponce de Leon Infirmary</td>
<td>Eye, Ear, Nose, and Throat</td>
</tr>
<tr>
<td>White Cross Hospital</td>
<td>Alcoholism</td>
</tr>
</tbody>
</table>

SURVEY OF FACILITIES

Purpose

In the past two years, information concerning metropolitan Atlanta acute care, short term, general hospitals with emergency departments has been obtained by several organizations.* Unfortunately, the data gathered were usually concerned with the hospital in general rather than emergency treatment capability specifically. The information on hospital ED communications, equipment, procedures, funding, and staffing was essentially nonexistent. Specific ED information that did exist was either outdated or lacked credibility. The need was apparent for a precise, updated picture of the hospital EDs as they exist now.

* Surveying organizations in the past three years included the Georgia Department of Human Resources, Emergency Health Unit; Georgia Department of Public Health, Health Facilities Service - Planning Section; the Joint Commission on Accreditation of Hospitals; American Hospital Association; and others.
Instruments Used

It was decided that the most effective way of accurately determining each hospital ED profile would be to make on-site visits to each of the acute care, short term, general hospitals to interview an administrator and an ED nurse or physician when possible, at each ED. An eleven page questionnaire* was constructed, fashioned after previous questionnaires which were mailed by the Georgia Department of Human Resources, and guidelines from the U. S. Department of Health, Education, and Welfare. A trial run was made at Kennestone Hospital, and slight modifications were made at the suggestion of Mr. John Bowling, Kennestone Hospital's assistant administrator and Dr. Mark Lindsey, ED physician at Kennestone Hospital. The revised questionnaire was then submitted to the EMS Task Force Emergency Facilities Subcommittee for review and comment. Additional revisions were made and the final version of the questionnaire was deemed adequate to gather ED data.**

Since conducting the ED survey and constructing the resulting profile were projected to be time-consuming tasks, every effort was made to gather reliable data, and the following steps were taken to reduce the possibility of misinterpretation:

1) The same HSRC staff member gathered data at all hospitals.
2) The HSRC staff member read each question aloud and explained the intent of each question.
3) The HSRC staff member completed a copy of the questionnaire at the same time the person being interviewed completed a copy.
4) At the end of the interview, the copies were checked against each other, and any inconsistencies resolved.
5) A final copy of the completed questionnaire was mailed to each hospital with the request to review and comment on the accuracy of the information contained within.

* The complete questionnaire is presented in Appendix B.
** Membership of the subcommittee is given in Appendix D.
**Application**

The ED questionnaire was administered in August and September of 1972. Supplemental data were gathered by telephone to clarify certain answers to questions. All information was essentially complete by October 1, 1972, except for Shallowford Community Hospital which opened after the survey period and therefore was not surveyed.

**SURVEY RESULTS**

Tables 4.3 through 4.8 of this chapter give summary data for the following questionnaire categories: procedures performed, facilities available, equipment available, communications capabilities, staffing of EDs, and medical specialties available at the hospitals. The tables are labeled to correspond closely to the survey questions dealing with each subject, although in some cases, the wording has been slightly modified to reflect the intent of the question, but in a briefer form.

**Procedures Performed in EDs**

Table 4.3 lists 15 procedures that should be available in every hospital emergency department when required (4, p.210). The check marks (✓) in each column indicate an affirmative answer to the question appearing on the survey form. For all 20 hospitals, a perfect score would be 300 check marks. The metropolitan Atlanta hospitals had 293 or 97.7 per cent of the procedures available among all hospitals. Although few deficiencies are seen to exist, the following areas are worthy of consideration.

1) Drug treatment capability in Gwinnett County probably needs upgrading.

2) Joan Glancy Memorial Hospital may need to upgrade capability for managing cardiac arrhythmias.

3) Rockdale County Hospital may need to upgrade capability for treating major hemorrhage.

Besides the areas listed above, the hospital EDs appear to be capable of providing treatment for most emergency medical problems, although as is seen in Tables 4.5 and 4.7, the apparent capability is sometimes clouded by the absence of trained personnel or equipment.
# Table 4.3: Emergency Medical Procedures Regularly Performed by Metropolitan Atlanta Hospital Emergency Departments

<table>
<thead>
<tr>
<th>Hospital</th>
<th>Control of Major Hemorrhage</th>
<th>Primary Care of Wounds</th>
<th>Closures of IV Fluids, Drugs, Blood Loss</th>
<th>Immobilization of Fractures</th>
<th>Cardiopulmonary Resuscitation</th>
<th>Management of Life-Threatening Arrhythmias</th>
<th>Endotracheal Intubation and Ventilation</th>
<th>Tracheotomy</th>
<th>Aspiration - Joint</th>
<th>Aspiration - Abdomen</th>
<th>Decompression of Pleural Space</th>
<th>Decompression of Parietal Space</th>
<th>Treatment of Poisonings Including Gastric Lavage</th>
<th>Treatment of Drug Overdose/Abuse</th>
</tr>
</thead>
<tbody>
<tr>
<td>BUFORD GENERAL</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
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<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>BUTTON GWINNETT</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
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<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>CLAYTON GENERAL</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
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<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>COBB GENERAL</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
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<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>CRAWFORD W. LONG</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
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* Information collected subsequent to the opening of Shallowford Community Hospital indicates that all 15 procedures are performed.
Facilities Located In or Near the ED

Data gathered concerning facilities located in or near the ED are confusing due to the fact that many ED facilities do not fall into neat, well-defined categories. Therefore, Table 4.4 should be interpreted with some caution, lest the reader reach inappropriate conclusions. For example, the large number of combined beds which serve several functions within the ED as shown in the first five columns are precise only to the point that specific bed facilities are represented in some fashion. The figures do give, however, a general picture of the ED functional layout for each of the 20 hospitals. The large number of highly flexible facilities at Grady Memorial Hospital requires the use of a symbol (L) to designate a large undefined quantity in several of the columns, since, at Grady Memorial Hospital, beds are not allocated specifically to specialty care units, but rather are shared as needed between a variety of different units. A similar flexibility is found in other hospitals (as well as Grady Memorial Hospital) where emergency psychiatric beds in the ED are combined with an inpatient mental health ward.

Some information in Table 4.4 is more well-defined and may be used with some certainty. For example, the number of beds in each hospital's ICU and CCU is given, and combined ICU/CCU beds are noted in another column of the table.* All hospitals except Douglas County Hospital have operating suites, and each operating suite is staffed with in-house or on-call staff 24 hours per day. Furthermore, four of the hospitals have operational OR suites 24 hours per day.

Although a burn unit is not shown in any of the hospitals, the fact is that Grady Memorial Hospital has extensive burn treatment facilities which are available almost immediately when required. The burn unit at Grady Memorial Hospital is used for other purposes when no burn unit is required, and therefore Table 4.4 shows no full-time burn unit available in metropolitan Atlanta.

* Appendix C presents locations of ICU, CCU, and OR facilities in metropolitan Atlanta.
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<tr>
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<th>EXAMINATION AND TREATMENT BDD</th>
<th>RESUSCITATION AND MINOR SURGERY BDDS</th>
<th>FRACTURE OR PLASTER BEDS</th>
<th>HOLING AND OBSERVATION BDDS</th>
<th>EMERGENCY PSYCHOLOGICAL CARE BEDS</th>
<th>OR PORTABLE X-RAY</th>
<th>CORONARY CARE</th>
<th>BEDS IN ED</th>
<th>RECEPTION AREA FOR PUBLIC</th>
<th>ACTIVE SUPPLY AREA</th>
<th>BEDS IN COMBINED ICU/CCU FACILITY</th>
<th>B ED S IN CCU</th>
<th>BEDS IN ICU</th>
<th>BEDS IN PCU</th>
<th>IS THERE A BURN UNIT?</th>
<th>IS THERE AN INPATIENT MENTAL HEALTH WARD?</th>
<th>DOES ED HAVE PRIORITY USE OF OR FACILITIES?</th>
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**KEY:**
- **Y:** YES
- **N:** NO
- **0:** ZERO

* **COMBINED, MULTIPURPOSE FACILITY**
* **WEEKDAYS ONLY**
* **LARGE, NOT EASILY QUANTIFIED**

*0: Beds used principally for another purpose.
Equipment in the ED

Each hospital ED was checked for the standard emergency equipment shown in Table 4.5. The availability of equipment was placed into one of four categories as shown in the key:

1) A check mark (✓) implies that equipment is physically located or stored in the ED.
2) A five (5) implies that equipment is located close to the ED and may be obtained within five minutes.
3) An "A" implies that equipment is available to the ED, but probably requires more than five minutes to obtain.
4) A zero (0) implies that equipment is never available to the ED.

Normally, an "A" was assigned to equipment within the hospital but not located adjacent to the ED. In the case of whole blood, however, hospitals without a blood bank (Buford General, Button Gwinnett, Doctors, Douglas County, Joan Glancy Memorial, and Rockdale County Hospitals) indicated arrangements with police or American Red Cross to obtain blood quickly. Most hospital personnel interviewed expressed the belief that whole blood need not be located within the ED since a cross match (and the resultant delay) is always needed for the emergency patient's blood, anyway. Grady Memorial Hospital is the only hospital having whole blood stored in the ED.

A comparison of all hospital EDs, and the equipment located within each, will show any striking deviations from the average quite easily. For example, Button Gwinnett Hospital lacks a mechanical ventilator, central venous catheterization tray, and pleural and pericardial drainage equipment. Holy Family Hospital has no cardiac pacemaker available to the ED. Rockdale County Hospital has no cardiac pacemaker, no central venous catheterization tray, and no bronchoscope available to the ED. Table 4.5 shows that every other hospital has the equipment listed above available to the ED.

Other equipment deficiencies are not quite so clear cut. It is the feeling of the American Heart Association, however, that all hospital
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Table 4.5: Equipment and Supplies Available to Hospital Emergency Departments in Metropolitan Atlanta.

Key:
- ✓: Available to emergency department within five minutes
- ✓: Available to emergency department, but not within five minutes
- □: Not available to the emergency department

Legend:
- O: Available in emergency department
- V: Available within five minutes
- A: Available, but not within five minutes
- 0: Not available to the emergency department

Sources:
- Buford General
- St. Joseph's
- South Fulton
- Rockdale County
- Piedmont
- Northside
- Kennestone
- Grady Memorial
- Georgian Baptist
- Crawford W. Long
- Cobb General
- Clay General
EDs should have external cardiac defibrillators and a cardiac monitoring device available instantly. Hospitals without this equipment instantly available are Buford General Hospital, Crawford W. Long Hospital, Holy Family Hospital, and Rockdale County Hospital. Perhaps sterile tracheostomy equipment should be available in the ED, in which case DeKalb General Hospital should add this equipment to their already capable ED.

Although no other glaring deficiencies exist, those persons in control of metropolitan Atlanta's EDs may benefit from viewing Table 4.5 and noting the comparison of equipment presented. In relation to the overall expense of the EMS system, the cost of individual items of equipment presented in the table is low indeed.

Hospital Communications Facilities

Communications facilities are needed within the hospital for both inter-hospital and intra-hospital coordination of efforts as described in Chapter 8 of this report. Table 4.6 exhibits present communications hardware as of the date of the ED survey. The telephone communication system, in general, looks adequate, since most hospitals have telephones which bypass the switchboard and also have pay telephones near the ED. In effect, this allows three alternative telephone routes for getting information to or from the ED in disaster situations.

Radio communications in the hospitals, however, are seen to be severely restricted with only four of the 20 hospitals having two way radios and only two of these hospitals on the Georgia Statewide Emergency Radio Network frequency.* However, most hospitals listed a desire to implement additional communications hardware and two way radios are a high priority item. With the additional radio equipment, hospitals may easily add paging systems to their communications systems if desired.

Telemetry is available to some degree in seven of the hospitals. At present the telemetry systems are experimental and in evaluative stages of development. Several hospitals are receiving telemetered electrocardiograms (ECGs) from private physicians or small hospitals in outlying towns.

* See Chapter 8 for complete details of the Georgia Hospital Association radio network.
TABLE 4.6 Communications Equipment in Hospitals with Emergency Departments in Metropolitan Atlanta.

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* Subscribes to a professional radio paging service.
Other hospitals, including Kennestone Hospital, receive telemetry directly from ambulances. Another sophisticated communications system presently in use is a closed circuit television network connecting four hospitals with the Center for Disease Control.

Table 4.6 shows the confused state of hospital communications at this time. The reader should be aware that half of the hospitals plan to expand communications in the future. A plan for a fully integrated EMS communication system is presented in Chapter 8.

**Staffing of EDs**

Table 4.7 shows the staffing pattern of the hospital EDs. All of the EDs are open 24 hours per day and each is always staffed by an ED nurse. Generally, the smaller hospitals have ED physicians on call, and only the larger hospitals have 24 hour physician coverage in the ED. Other hospital-based physician's shifts are shown for hospitals without 24 hour physician ED coverage, and in two hospitals not having 24 hour ED physician coverage hospital-based physicians are available in the hospital, outside of the ED, 24 hours per day. Fourteen of the 20 hospitals are staffed by at least one physician at all times.

Staffing of supportive services is more difficult to define. Often at night in smaller hospitals the supportive services are locked and unstaffed, but available for use by the ED nurse. In most instances this procedure works quite well and radiology, pharmacy, laboratory, and inhalation therapy are all available to the attending physician on call for the ED. It seems possible, therefore, for a workable solution to be devised to provide 24 hour access to inhalation therapy at Button Gwinnett Hospital and pharmacy at Douglas County Hospital. Currently, neither hospital provides access to full supportive services after normal working hours.

**Specialty Physician Coverage**

The presence of medical specialty coverage on the active staff of a hospital determines to some extent the capability of that hospital's
TABLE 4.7 Staffing and Availability of Hospital Emergency Departments in Metropolitan Atlanta.

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</table>

* Information acquired after the opening of Shallowford Community Hospital indicates that the entries presented here are accurate.
emergency department.* The ED survey ascertained the specialty back-up by classifying possible coverage of each specialty according to the following key:

(1) Designates a hospital-based physician staff position which is staffed at all times.

(2) Designates a hospital-based physician single shift position where the physician may be recalled at any time.

(3) Designates a position for a physician with medical staff privileges who could arrive at the ED within 30 minutes after notification.

(4) Designates a specialty position not usually available at the hospital.

The surveyor ascertained the classification best representing the coverage for each specialty listed in Table 4.8 and entered the results in the questionnaire. The last five columns of the table were specialties added by the hospital personnel as "other" specialties represented in the hospital, and therefore were not directly asked of the initial hospitals interviewed, although these specialties were added to the questionnaire as they were mentioned for the first time.

Classification three in Table 4.8 is ambiguous due to the fact that many specialists have medical staff privileges with more than one hospital. In such a case, each hospital may count the same specialist and somewhat invalidate the results. Likewise, specialties may be represented sporadically or on not precisely defined schedules. Classification four may be a judgment of an individual administrator rather than precise fact in any given hospital.

Grady Memorial Hospital is obviously the leader in specialty back-up coverage. However, it is worthwhile to note that full time

* Special emphasis has been placed upon the specialty back-up by the Emergency Facilities Subcommittee of the EMS Task Force in developing the categorization methodology presented later in this chapter.
TABLE 4.8 Availability of Specialty Coverage in Hospital Emergency Departments in Metropolitan Atlanta.

<table>
<thead>
<tr>
<th>SPECIALTY</th>
<th>ANESTHESIOLOGIST</th>
<th>GENERAL SURGEON</th>
<th>INTERNIST</th>
<th>NEUROSURGEON</th>
<th>OBSTETRICIAN</th>
<th>GYNECOLOGIST</th>
<th>ORAL SURGEON</th>
<th>ORTHOPEDIC SURGEON</th>
<th>OTOLARYNGOLOGIST</th>
<th>PEDIATRICIAN</th>
<th>PLASTIC SURGEON</th>
<th>PSYCHIATRIST</th>
<th>THORACIC SURGEON</th>
<th>UROLOGIST</th>
<th>GENERAL PRACTITIONER</th>
<th>PATHOLOGIST</th>
<th>ANESTHETIST</th>
<th>SURGICAL RESIDENTS</th>
<th>PODIATRIST</th>
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</table>

KEY: 1: Hospital based physician within hospital at all times  
      2: Hospital based physician who works one shift and may be recalled during other shifts  
      3: Physician with medical staff privileges who could be in the ED within 30 minutes  
      4: Specialist never available for in-hospital service  
      -: Information not available.
specialty coverage exists in other hospitals as well, as shown in Table 4.9 below:

<table>
<thead>
<tr>
<th>Hospital</th>
<th>24 Hour Specialty Coverage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crawford W. Long Memorial Hospital</td>
<td>General Surgeon, Internist, Obstetrician-Gynecologist, Pediatrician</td>
</tr>
<tr>
<td>Georgia Baptist Hospital</td>
<td>Anesthetist, Anesthesiologist</td>
</tr>
<tr>
<td>Northside Hospital</td>
<td>Anesthesiologist</td>
</tr>
<tr>
<td>St. Joseph's Infirmary</td>
<td>Surgical Residents</td>
</tr>
</tbody>
</table>

FUTURE USE OF SURVEY RESULTS

Reference Value

The survey presents detailed information about each of the 20 hospital emergency departments in metropolitan Atlanta. As such, the survey data represent a collection of reference information for anyone concerned with operating the EMS system. Although the data collected in the ED survey age very quickly, especially in the dynamic health care system found in metropolitan Atlanta, the survey data provide the best existing profile of emergency facilities in the EMS system. Beyond that, the survey data represent a base line from which future evaluations of the facilities subsystem improvements may be determined. Naturally, in time, new EDs will open and existing facilities may expand or reduce services. To measure the effectiveness of changes in the system it is necessary to monitor the status of each element in the system. For this reason, the survey has reference value and should be conducted on a regular schedule by the EMS agency.
Suggest Changes

Several obvious problems have been pointed out throughout this chapter. These problems suggest changes to be made at the discretion of the hospital administrators with the collaboration of the EMS Agency, hopefully to upgrade all facilities in a coordinated manner to be more effective EMS treatment resources. Regardless, administrators should know the techniques and capabilities of other hospital EDs both as a basis from which to measure performance and as a guide for referring serious cases to other facilities.

Operational Control

The information gathered in the emergency department survey represents a first step toward developing a complete set of decision parameters for the most effective use of facilities, both by the general public and by the EMS system dispatch and control center (DCC). The general public will probably be aware only of the fact that all metropolitan Atlanta hospitals with EDs have a categorization of EMS capability as developed later in this chapter. Information may be compiled, however, to develop a more thorough document (or pamphlet) for public distribution exhibiting the capabilities and locations of all hospital EDs in the metropolitan Atlanta area. The source of information would most likely be the present ED survey form, or an updated version, perhaps compiled every year. Given the proper information, the general public might make better decisions and more accurately utilize the nearest, best facility for each individual set of circumstances, rather than rely on the fragmented and occasionally incorrect information which is available now. It should be clearly noted, however, that the EMS system described in the present document is designed to bring the appropriate emergency medical care to the emergency patient rather than to have the emergency patient bring himself to the emergency department. A publication or public education campaign which would tend to reverse this process must be avoided at all costs.

The EMS system DCC stands to profit even more from the ED survey information since the DCC is able to operationally control a large
percentage of the total flow of truly emergent patients. Presumably, well organized and carefully thought out decisions as to which hospitals receive which patients will result in better patient care and in more efficient utilization of resources. By knowing the capacity and capability of each hospital ED, the DCC may reduce the presently pressing problem of patients arriving at hospitals with over utilized ED service, lack of specialty physician back-up, or limited general treatment capability. Current status of CCU, ICU, and other specialty units may be matched with maximum capacities to revise decision rules as the EMS system changes with respect to volume or type of patients requiring emergency care. Maintaining such cognizance of EMS system resources is particularly valuable in disaster situations.

As a first step, the DCC may utilize the information from the ED survey to develop guidelines and simple decision rules governing patient flow. The decision rules may be expected to be much more discriminating than the simple categorization of facilities developed for the general public, since a relatively small number of trained professional dispatchers require the information, and consideration may be given to more detailed concepts. For example, the hospitals may be ranked according to their ability to treat severe heart attacks, yet a completely different ranking may result when the ability of the hospital to treat severe psychiatric emergencies is considered. The DCC may find a need to separately rank, categorize, or summarize each hospital's ability to treat burn, poisoning, cardiovascular, obstetrical, drug-related, severe trauma, and other types of emergencies. Moreover, the DCC may conceivably discover a marked difference in the abilities (and consequently the categorization) of hospitals to treat special emergencies as a function of the time of day, due to the staffing patterns of ED physicians, nurses and specialty physicians. The ED survey provides the foundation data for such a task, but the DCC should determine any necessary additional data requirements and attempt to effect the necessary data collection through the EMS Coordinating Agency.

CATEGORIZATION OF HOSPITAL EDS

The basic purpose of categorization is to identify the readiness and capabilities of the hospital and its entire staff to receive and treat,
correctly and expeditiously, emergency patients. Ambulance personnel not coordinated by the DCC, law enforcement officers, and other citizens of the area, having advanced knowledge of the designated EMS categories of the various hospitals may then select the proper facility to which emergent patients should be taken (3, p.1)

Some concern is commonly expressed with respect to the status accompanying a high categorization, both from the public and from hospital personnel. The public should be made aware that a categorization does not directly affect the quality of care rendered to the patient unless the patient has an emergency which directly requires a certain category of hospital ED. For example, patients with minor lacerations may and probably will, receive better care at category 3 and category 4 hospitals than at the more sophisticated EDs, since oftentimes triaging may cause a pre-empting of care at category 1 and category 2 hospitals to serve more serious patients. The great majority, statistically speaking, of the patients at the 20 emergency service facilities probably receive satisfactory treatment, regardless of which emergency facility the patients visit.* Just as important for the patient to recognize, however, is the need for sophisticated emergency treatment and to understand which hospital facility is nearest and best equipped to handle the emergency. Hospital personnel should realize that a high categorization is not a status symbol, but rather an index of general emergency care capability. It may be more justifiable for a hospital to downgrade emergency service capability, or even completely discontinue emergency services rather than offer an unnecessary and expensive service. The true status for the hospital is derived from recognition for providing the needed level of emergency medical care.

Categorization Schemes

There are many proposed methods of categorizing the 20 emergency medical facilities in the metropolitan Atlanta area, including guidelines from the AMA, American College of Surgeons, American Academy of

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* Opinion of the members of the Task Force on EMS Emergency Facilities Subcommittee.
Orthopaedic Surgeons, American Hospital Association, and the Georgia Department of Human Resources. HSRC follows guidelines recommended by the Atlanta Regional Commission EMS Task Force, Emergency Facilities Subcommittee, since this group is both knowledgeable and directly involved with hospitals in the metropolitan Atlanta area. Therefore, categorization will be made according to the criteria below:

**Category 1** - Emergency department service available 24 hours per day: emergency physicians on duty in the emergency department 24 hours per day; full medical specialty coverage on the active hospital staff; radio communications equipment; affiliation with a medical school residency training program; a hospital based ambulance service.

**Category 2** - Emergency department service available 24 hours per day; emergency physician on duty in the emergency department 24 hours per day; full medical specialty coverage from the active hospital staff; radio communications equipment.

**Category 3** - Emergency department service available 24 hours per day; emergency physician on duty in the emergency department 24 hours per day; some medical specialty coverage available from the active hospital staff; radio communications equipment.

**Category 4** - Emergency department service available 24 hours per day; physicians on call, available within 30 minutes; radio communications equipment.

**Category 5** - Emergency department services available.
Categorization of Metropolitan Atlanta Hospitals

Based upon the HSRC Emergency Department Questionnaire, the ARC Task Force on EMS, the AHA Guide Issue, and the GHA Guide Issue, the 20 hospitals with EDs have been assigned to the categories as shown in Table 4.10.

FUTURE ANALYSES

Objective

Future analyses of metropolitan Atlanta's emergency medical facilities should be designed to aid in the accomplishment of two goals:

1) To insure that the proper number of emergency medical facilities are available to the EMS system, but not more than are cost-effective.

2) To determine which patient conditions are to be handled at which hospitals.

The specific objective of future analyses should be to gather and analyze data concerned with patient needs, patient volume, ED service time, patient origin, and quality of patient care for each hospital ED in the EMS system. Chapter 9 shows how these data requirements may be satisfied.

Once routine data collection is performed in the integrated EMS system, adjustments can be made concerning EMS facilities. The Research Staff of HSRC had hoped to make recommendations for opening or closing EMS facilities, and for upgrading or downgrading existing facilities, but found data to be inconclusive at present and difficult to gather. The primary cause of the difficulty in obtaining EMS system data is the absence of a coordinated system from which to gather the data. At present, the fragmented subsystems composing metropolitan Atlanta's EMS make the task of gathering complete and non-overlapping data nearly impossible except with considerable expenditure of resources. Coordination, inherent in the proposed EMS system will rectify this problem.
TABLE 4.10  Acute Care, Short Term, General Hospitals With Emergency Departments in Metropolitan Atlanta, by EMS Category.

<table>
<thead>
<tr>
<th>HOSPITAL</th>
<th>EMS CATEGORY</th>
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<tbody>
<tr>
<td>*Grady Memorial Hospital</td>
<td>I</td>
</tr>
<tr>
<td>*Cobb General Hospital</td>
<td>II</td>
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<td>II</td>
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<td>*Kennestone Hospital</td>
<td>II</td>
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<td>*Northside Hospital</td>
<td>II</td>
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<td>*Piedmont Hospital</td>
<td>II</td>
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<td>*South Fulton Hospital</td>
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<tr>
<td>Button Gwinnett Hospital</td>
<td>IV</td>
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<tr>
<td>*Crawford W. Long Memorial Hospital of Emory University</td>
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<tr>
<td>Douglas County Hospital</td>
<td>IV</td>
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<tr>
<td>Joan Glancy Memorial Hospital</td>
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<tr>
<td>Rockdale County Hospital</td>
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<tr>
<td>*St. Joseph's Infirmary</td>
<td>IV</td>
</tr>
</tbody>
</table>

* Accredited Hospitals (1).
REFERENCES


CHAPTER 5

EMERGENCY TRANSPORTATION AND VEHICLES

INTRODUCTION

Historically, an emergency medical services (EMS) system deals primarily with ambulances and other vehicles used for the evacuation and transportation of emergency victims. This present document emphasizes the importance of other elements of the EMS system to the overall effectiveness of medical service rendered to emergency patients. However, emphasis must remain on the emergency vehicle component of the system due to the significance of transportation as the interface between the occurrence of an emergency medical situation and the patient's receipt of hospital care. This chapter presents the functional requirements of the transportation and vehicle component of the EMS system. A survey of the present purveyors of ambulance service is described, and the overall EMS transportation capabilities currently in metropolitan Atlanta are presented. The expected demand for emergency transportation is calculated and resulting recommendations for the numbers and locations of medical aid vehicles (MAVs), emergency ambulances, and mobile intensive care units (MICUs) are formulated. Specifications are presented for both vehicles and equipment to be carried by vehicles, which specifications have been principally developed through the intimate involvement of the Atlanta Regional Commission (ARC) EMS Task Force Subcommittee on Transportation and Equipment.* Estimates for the cost of the transportation subsystem of the EMS system are developed, based upon recommendations made in the first sections of this chapter. The potential use of helicopters is examined, both for detection of automobile accidents and transportation of emergency patients. Finally, recommendations for future analyses are presented for consideration by the EMS Coordinating Agency.

* Membership of this subcommittee is given in Appendix D.
SURVEY OF AMBULANCE PURVEYORS

In order to determine the capabilities of present ambulance service purveyors in metropolitan Atlanta, the Research Staff of HSRC designed an ambulance survey form to be completed by representatives of each ambulance service.* The form was presented to ARC for review and comment and altered accordingly. Due to the large number of ambulance providers in the area, the decision was made not to personally interview each provider of ambulance service. Therefore, only the two largest providers of emergency ambulance service, Grady Ambulance Service and Metro Ambulance Service, were personally interviewed, and the other providers received the forms by mail with a cover letter from the ARC.

Response to the 62 mailed forms was unacceptable, with only five completed forms being returned. Ambulance purveyors reported that the form was received too close to the deadline date to be completed or, in some cases, after the form was supposed to have been returned. Consequently, very limited data were obtained from the original ambulance survey, and ARC conducted a telephone survey in December, 1972 and January, 1973 to collect missing data concerning ambulance purveyors.** The results of this telephone survey are summarized in Table 5.1.

It can be seen from Table 5.1 that seven ambulance services perform nearly 85 per cent of all emergency ambulance trips in metropolitan Atlanta. However, over 50 other companies compete for the remaining 15 per cent of the emergency ambulance calls.***

* See Appendix E for a complete copy of the ambulance survey form.

** See Appendix F for the complete results of the ARC telephone survey of ambulance purveyors.

*** See Appendix G for a complete listing of all ambulance service providers in the metropolitan Atlanta area.
TABLE 5.1  Largest Emergency Ambulance Purveyors in Metropolitan Atlanta, Calls Per Month, Number of EMTs, Number of Van-Type Vehicles as of January 1, 1973.

<table>
<thead>
<tr>
<th>Emergency Calls Per Month</th>
<th>% of Total Emergency Calls in EMS System</th>
<th>Number* of EMTs in Organization</th>
<th>% of Total EMTs</th>
<th>Number of Vans**</th>
<th>% of Total Number of Vans in EMS System</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grady Ambulance Service</td>
<td>3725</td>
<td>61.1</td>
<td>11</td>
<td>13.9</td>
<td>12</td>
</tr>
<tr>
<td>Metro Ambulance Service</td>
<td>583</td>
<td>9.6</td>
<td>25</td>
<td>31.6</td>
<td>13</td>
</tr>
<tr>
<td>Hines Funeral Home</td>
<td>200</td>
<td>3.3</td>
<td>0</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Colonial Chapel Ambulance Service</td>
<td>196</td>
<td>3.2</td>
<td>1</td>
<td>1.3</td>
<td>2</td>
</tr>
<tr>
<td>Sanders Funeral Home</td>
<td>175</td>
<td>2.9</td>
<td>0</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Professional Ambulance Service</td>
<td>167</td>
<td>2.7</td>
<td>3</td>
<td>3.8</td>
<td>0</td>
</tr>
<tr>
<td>Suburban Ambulance Service</td>
<td>125</td>
<td>2.1</td>
<td>4</td>
<td>5.1</td>
<td>2</td>
</tr>
<tr>
<td>TOTAL</td>
<td>5171</td>
<td>84.9</td>
<td>44</td>
<td>55.7</td>
<td>33</td>
</tr>
<tr>
<td>ALL OTHERS</td>
<td>923</td>
<td>15.1</td>
<td>35</td>
<td>44.3</td>
<td>14</td>
</tr>
<tr>
<td>GRAND TOTAL</td>
<td>6094</td>
<td>100</td>
<td>79</td>
<td>100</td>
<td>47</td>
</tr>
</tbody>
</table>

* Only registered EMTs as of January 1, 1973 are counted, although certain ambulance services have EMTs in training and also non-registered EMTs.

** Vans are assumed to be close to meeting ambulance specifications, although use of the term here does not imply 54 inch headroom.
PRESENT EMERGENCY TRANSPORTATION SUBSYSTEM

Funeral Homes

Ambulances and invalid vehicles are provided in metropolitan Atlanta by 59 different organizations, of which the vast majority are funeral homes.* Although the funeral homes are regarded as generally providing a quality of emergency transportation and patient care lower than acceptable by current standards, it must be realized that many funeral homes provide emergency transportation because it is expected of them, or for promoting public relations. Although arguments have been presented in support of the economics of dual-purpose ambulance-hearse vehicles, the trend toward providing emergency medical treatment at the emergency scene and en route to a hospital makes this dual role much more difficult (3, p.67).** The headroom required for an EMT to effectively administer emergency treatments such as cardiopulmonary resuscitation (CPR), added to the space required to store equipment and supplies necessary for effective emergency treatments, almost demands a van or larger vehicle. Funeral homes in metropolitan Atlanta, who once were the main source of acceptable vehicles for quickly transporting emergency litter patients (and consequently received public pressure to do so) are not necessarily a source of vehicles designed for effective patient care. Consequently, funeral homes have ceased to provide emergency ambulance service as soon as other sources of effective vehicles have appeared, and only 40 organizations now provide emergency ambulance service.

Due to the primary function of funeral home vehicles, almost without exception the emergency ambulances provided by funeral homes in metropolitan Atlanta are below standards set later in this chapter. Therefore, it is safe to say that the majority of emergency ambulances in metropolitan Atlanta do not meet the recommended standards. Fortunately, the majority of emergency ambulance runs are made by the relatively few organizations shown in Table 5.1, and therefore the average emergency ambulance

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* A complete listing of ambulance service purveyors is presented in Appendix G.

** Numbers in paranthesis refer to references at the end of this chapter.
patient in metropolitan Atlanta is currently treated and transported in an acceptable vehicle.* Only in the lower population density areas do funeral homes perform the majority of ambulance runs.

Private Ambulance Services

Metro Ambulance Service

The most sophisticated emergency vehicles and equipment in use in metropolitan Atlanta today are found under the control of private ambulance services specializing in emergency ambulance service only. The largest of the private ambulance services is Metro Ambulance Service, operating principally in the City of Atlanta and in Cobb County. Metro Ambulance Service has 13 vehicles which meet all specifications presented in this chapter, although only nine vehicles are available for emergency service at any one time. Seven of the vehicles are 1972 Chevrolet vans with 60 inches of headroom, one is a 1973 Dodge van with 64 inches of headroom, and the latest vehicle is a 1973 Ford modular ambulance with 60 inches of headroom.** Metro Ambulance Service primarily provides emergency ambulance service to all of Cobb County, the north section of the City of Atlanta, Sandy Springs, and the northwestern section of DeKalb County.

Metro Ambulance Service is the only ambulance service in metropolitan Atlanta with radio telemetry (of ECGs) capability at present. Metro personnel are trained and equipped to defibrillate and administer certain cardiac drugs, as well as to start I.V.'s for treatment of shock.

Other Private Ambulance Services

Approximately ten other private ambulance services operate in metropolitan Atlanta. The majority of the companies operate

* Not to imply that training and skill of attendants is acceptable for the majority of ambulance runs.

** Modular ambulances are composed of an ambulance body (or module) mounted on a truck frame (chassis).
two or three emergency ambulances and normally meet most standards for vehicles and equipment recommended in this document. The trend for these smaller companies is to upgrade equipment and training as quickly as possible in order to remain within standards set by the Georgia State Law (8).*

A feature common to most private ambulance services is the use of the vehicles for non-emergency invalid transportation as well as emergency ambulance use. This practice is economically appealing to the private operators, since most invalid trips have a higher collection probability, whereas emergency trips often result in uncollectable charges for the ambulance operator. Unfortunately, the multiple use of vehicles for both emergency and non-emergency transportation results in an unsteady emergency system with the number of emergency vehicles available depending upon the number of invalid calls being made.

Public Ambulance Services

Grady Ambulance Service

Grady Memorial Hospital provides the largest public emergency ambulance service in metropolitan Atlanta, and also represents the only hospital based ambulance service. The entire fleet of 12 ambulances operated by Grady Ambulance Service are vans, but only five of the vehicles meet the minimum headroom requirement of 54 inches.** Two of these five vehicles are step vans used primarily for transporting groups of wheel chair patients to or from the hospital, and therefore only three of the vehicles which meet the headroom specification are available for routine emergency service. Of the total of 12 vehicles, a maximum of eight are regularly scheduled for emergency service and carry acceptable equipment according to present norms. Normally the vehicles are located at Grady Memorial Hospital, but occasionally vehicles may be decentralized to South Fulton Hospital, DeKalb Police Headquarters in Decatur, and

* Presented in Appendix P.

** As of December, 1972. Vehicles are being upgraded when replaced according to regular maintenance schedules.
Atlanta Fire Station #16 on Simpson Road, Atlanta. Grady Memorial Hospital provides ambulance service to all of Fulton County and DeKalb County as provided in the Fulton-DeKalb Hospital Charter.

**DeKalb County Fire Department**

The proposed EMS system to be operated in DeKalb County by the DeKalb County Fire Department will offer the second largest public ambulance service in metropolitan Atlanta. The three DeKalb County Fire Department vehicles are to be truck-mounted modular ambulances and will be located at DeKalb County Fire Stations. In addition to these three vehicles, an ambulance from Grady Ambulance Service and from at least two private ambulance services will be dispatched by the DeKalb County EMS system. All vehicles and supplies in the DeKalb County EMS system are to meet certain standards established by DeKalb County, which in turn are equivalent to standards set forth later in this chapter.

**Gwinnett County Fire Department**

The Gwinnett County Fire Department currently operates two vans as emergency ambulances. One more van is ordered, and firemen are undergoing training to staff these new vehicles to serve the western section of Gwinnett County. The new vehicles will probably be located at decentralized fire stations to provide coverage to the population of Gwinnett County.

**Other Public Ambulance Services**

In the true sense of the term, no public ambulance services exist other than those cited in the preceding paragraphs. However, various rescue services are provided throughout metropolitan Atlanta by police and fire departments. For example, the Clayton County Fire Department operates two rescue vans which, although geared toward light extrication, carry first-aid equipment and occasionally transport patients. Several other of the many fire departments in metropolitan Atlanta offer such vehicles, and most fire department vehicles carry some first-aid equipment.
The Atlanta Police Department operates two roving rescue units which have the responsibility for providing initial emergency treatment, primarily to highway accident victims and victims of crime-related medical emergencies until the arrival of an ambulance. Although the rescue units do not normally transport patients, the response of the vehicles is quick and the aid given to the emergency patient was observed to be of a high quality.*

PROPOSED FUNCTIONAL TYPES, NUMBERS, AND LOCATIONS OF EMS SYSTEM VEHICLES IN METROPOLITAN ATLANTA

The complex interaction of factors in an EMS system is easily exemplified by considering the relationship between functions of emergency vehicles, types of emergency vehicles, numbers of emergency vehicles, and locations of emergency vehicles. Any change in one of these four factors results in a direct effect on the other three. Likewise, when designing the system, functions, types, numbers, or locations are equally likely candidates for the starting point or foundation of the transportation subsystem design. This chapter presumes that functional requirements of vehicles should be the key to the overall transportation subsystem design.

Functional Types of EMS System Vehicles

The functional requirements of the EMS system vehicles are composed of three basic considerations as shown below:

1) Certain situations require extremely quick response by vehicles. For example, the effective treatment of certain cardiac problems, choking, drowning, and electrocution are dependent primarily upon time.

2) Other situations are not quite so dependent upon time but require emergency medical equipment and capabilities for transporting patients.

3) EMS vehicles are the best environment for advanced training of emergency medical technicians and should be used as such.

* By the HSRC Research Staff on January 19, 1973.
Naturally, two or even all three of the functional requirements outlined above could be performed by the same vehicle. However, functional requirement number one requires many vehicles in the service area while functional requirement number two and three demand fewer vehicles but expensive outlays of equipment. Another concern is the large number of personnel required to satisfy the first functional requirement and the very high level of training of personnel required to perform the third functional requirement. It is safe to say that to perform all of the functional requirements with one vehicle type would not be economically feasible.

Medical Aid Vehicles (MAVs)

Due to the large number of vehicles required to provide quick response to an area as large as metropolitan Atlanta and the corresponding large number of personnel required to man the vehicles, it is recommended that police and fire vehicles be employed to act in a dual capacity and thereby to provide medical aid vehicles (MAVs) for the metropolitan Atlanta EMS system. The MAV should carry the personnel, training, and supplies necessary to arrest shock-producing injury and sustain respiration.

MAVs will satisfy three critical needs of the EMS, which are:

1) Extremely quick response to acutely time dependent emergency situations.
2) Additional manpower required for cardiopulmonary resuscitation (CPR) and patient movement.
3) Response independent of delays or unavailability of other vehicles in the EMS system.

There is no need for the MAV to transport patients, however. It is important to note that the MAV concept provides for utilization of existing manpower and vehicles, and, as such, does not require a large expenditure of funds.
Emergency Ambulances

The majority of calls for emergency medical service will not be acutely time dependent*, yet will require rapid response by well equipped emergency vehicles to provide the capability for treatment and transport of emergency litter patients. Emergency ambulances must always be dispatched with MAVs to provide transportation and treatment capability, and also to provide initial response to acutely time dependent emergencies when found to be closer to the scene than an MAV. Full details of the interaction of emergency ambulances and MAVs are given in Chapter 7.

Mobile Intensive Care Units (MICU)

To perform the function of training emergency medical technicians to the advanced levels specified in Chapter 6, special units known as mobile intensive care units (MICUs) staffed by highly trained personnel are required. In addition, the MICU is intended to act as a direct extension of the CCU and ICU of the acute care general hospital. By answering all severe trauma and critical emergency calls in the MICU service area, the personnel staffing the MICU utilize skills which emergency ambulance personnel are only rarely required to use. Naturally, the high exposure to critical emergency situations enhances the appeal of the MICU as a training vehicle, both for initial training of advanced EMTs and for periodic refresher training of all ambulance personnel. The MICUs are more expensive than ambulances in terms of equipment and manpower requirements, and consequently few of the vehicles can be supported by the EMS system. The dispatch and control procedures for MICUs are given in Chapter 7, and the use of MICUs for training personnel are presented in Chapter 6.

Recommended Numbers and Locations of Emergency Vehicles

Medical Aid Vehicles

If medical aid does not reach non-breathing patients within four to six minutes after the occurrence of cardiopulmonary arrest, 

* Based upon data collected in Jacksonville, Florida and Columbus, Ohio.
resuscitation will rarely be effective (4, p.1). Moreover, every minute delayed in receiving help reduces the patient's chances of being resuscitated as shown in Table 5.2 below, and resuscitation after six minutes have elapsed may produce a patient with irreversible brain damage (4).

<table>
<thead>
<tr>
<th>DELAY</th>
<th>CHANCE OF RESUSCITATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 minute</td>
<td>98 out of 100</td>
</tr>
<tr>
<td>2 minutes</td>
<td>92 out of 100</td>
</tr>
<tr>
<td>3 minutes</td>
<td>72 out of 100</td>
</tr>
<tr>
<td>4 minutes</td>
<td>50 out of 100</td>
</tr>
<tr>
<td>5 minutes</td>
<td>25 out of 100</td>
</tr>
<tr>
<td>6 minutes</td>
<td>11 out of 100</td>
</tr>
<tr>
<td>7 minutes</td>
<td>8 out of 100</td>
</tr>
<tr>
<td>8 minutes</td>
<td>5 out of 100</td>
</tr>
<tr>
<td>9 minutes</td>
<td>2 out of 100</td>
</tr>
<tr>
<td>10 minutes</td>
<td>1 out of 100</td>
</tr>
<tr>
<td>11 minutes</td>
<td>1 out of 1,000</td>
</tr>
<tr>
<td>12 minutes</td>
<td>1 out of 10,000</td>
</tr>
</tbody>
</table>

NOTE: Irreversible brain damage occurs in most persons within four to six minutes after the oxygen supply to the brain is cut off. Data appearing above the dashed line were extracted from a film entitled "Pulse of Life," produced by Archer S. Gordon, M.D., Ph.D., and available from the American Heart Association. Data appearing below the dashed line were prepared by the Seattle Chapter of the American Red Cross from standard oxygen deficiency tables.*

* Telephone interview between Mark S. Blum, HSRC, and Jerry Montgomery, Coordinator of EMS, Seattle King County Department of Public Health, on March 20, 1973. (See Reference 10).
During the time between the occurrence of a cardiopulmonary arrest and the application of CPR by paramedical personnel, several events must occur. Table 5.3 below lists time estimates of the expected sequence of events following the cardiac arrest, which show that an ambulance six minutes (travel time) from the scene of the arrest is only 5 per cent effective in resuscitating the patients and moreover, after six minutes, the patient may have irreversible brain damage.

**TABLE 5.3** Listing and Hypothesized Time Estimates of Events That Might Occur Between the Onset of a Cardiac Arrest, and the Arrival of Trained Personnel.

<table>
<thead>
<tr>
<th>EVENTS</th>
<th>TIME REQUIRED (Seconds)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recognition of the need for trained personnel</td>
<td>10</td>
</tr>
<tr>
<td>Travel to a telephone</td>
<td>6</td>
</tr>
<tr>
<td>Dialing a seven digit telephone number</td>
<td>8</td>
</tr>
<tr>
<td>Waiting for an answer</td>
<td>2</td>
</tr>
<tr>
<td>Describing complaint</td>
<td>9</td>
</tr>
<tr>
<td>Describing and verifying the location</td>
<td>20</td>
</tr>
<tr>
<td>Identifying appropriate vehicle to send</td>
<td>5</td>
</tr>
<tr>
<td>Radio dispatch and verification</td>
<td>15</td>
</tr>
<tr>
<td>Ambulance crew enters vehicle</td>
<td>10</td>
</tr>
<tr>
<td>Ambulance travel (assume 6 minutes)</td>
<td>360</td>
</tr>
<tr>
<td>Stopping ambulance and obtaining equipment</td>
<td>15</td>
</tr>
<tr>
<td>Travel, on foot, from ambulance to patient</td>
<td>10</td>
</tr>
<tr>
<td>Verification of cardiac arrest, by vital signs, and beginning CPR</td>
<td>10</td>
</tr>
</tbody>
</table>

Total Time (Seconds) 480

Total Time (Minutes) 8

Chance of Resuscitation 5 out of 100

82
Since the minimum time elapsed during the sequence of events in Table 5.3 other than travel time is two minutes, the assumed six minute travel time reduces the patient's chance of resuscitation to 5 per cent. If the brief analysis presented here is at all indicative of real world situations, the need for MAVs (who may actually reach the patient within four minutes of the onset of symptoms) in abundance is indisputable.

The number of MAVs should, therefore, be as large as possible and economically feasible. Since fire departments and police departments are to be asked to assume the responsibility for using existing vehicles to supply MAVs, the economics are easily justified. Therefore, it is recommended that every fire station in metropolitan Atlanta supply a medical aid vehicle, which is manned by firemen and located at the fire station. In addition to the fire department MAVs, every police vehicle should carry MAV equipment and at least one properly trained man, thereby qualifying the police vehicle as an MAV. The locations of the police vehicles will be non-fixed since the vehicles commonly rove.

Captain Waters, Director of the Jacksonville EMS system feels that the MAV concept is sound and has directly resulted in the saving of lives by Jacksonville firemen. In addition, Captain Waters sees no reduction of the effectiveness of the fire department in fighting fires while supplying MAV support concurrently.* MAVs are also used in Los Angeles, California and Columbus, Ohio and are scheduled to be implemented in the EMS system for DeKalb County.

Emergency Ambulances

Measures of Effectiveness

For purposes of determining the proper number and location of ambulances for the metropolitan Atlanta EMS system, two measures have been used to determine the effectiveness of the EMS system to respond

* Personal interview between Oren L. Reinbolt, HSRC, and Captain John Waters, Director of Public Safety, Jacksonville, Florida, on December 7, 1972.
to demands for emergency medical service. These measures are "immediate availability" and "average response time", and although the measures are not independent, they represent quite different physical phenomena. Immediate availability is defined as the expected per cent of the time that a demand for emergency service can result in the immediate dispatch of an ambulance. An accepted standard for immediate availability is 90 per cent or above (3, p.55; 11, p.62).* Using this standard, fewer than 10 per cent of the demands for emergency service are expected to wait for a currently busy ambulance to become available.

Response time is defined as the elapsed time between a call being received by the EMS system receiving operator and the arrival of an ambulance at the scene of the emergency. Target response times for EMS systems in other cities range from four to ten minutes for urban areas and from ten to 20 minutes for rural areas. In Jacksonville, Florida, the current average response time of 7.4 minutes is deemed adequate by the city's Director of Public Safety, Captain John Waters.** Captain L. O. Martin of the Houston Fire Department EMS system states that the 5.8 minute average response time in Houston is acceptable.*** It is interesting to note that the Houston EMS system does not incorporate the MAV concept whereas the Jacksonville EMS system does. An acceptable ambulance response time may be higher in systems using MAVs than in systems using ambulances as the first mode of response.

The sequence of events that consume the time associated with response are related as shown in Figure 5.1. A call for emergency service must first wait for an ambulance to become available. In a properly designed system, this delay is negligible for a large proportion of the calls. However, a small percentage of calls may be expected to experience positive time delays due to all ambulances being busy. Once an ambulance is available, a certain time is required for the dispatcher to

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* Personal interview between HSRC Staff and Thomas Hulfish, President of Paramed, Inc. on August 30, 1972.

** Personal correspondence to Oren L. Reinbolt, HSRC, from Captain John Waters, September 27, 1972.

*** Personal correspondence to Oren L. Reinbolt, HSRC, from Chief L. O. Martin on September 29, 1972.
transmit information about the waiting call to the ambulance driver. After information is transferred, the ambulance departs and travels to the proper location. The time between the receipt of the call for an ambulance and the arrival of the ambulance at the scene is the response time. Average response time can be expected to increase as immediate availability decreases, and longer waiting times are incurred before ambulances are dispatched. The public sees this result in the form of randomly selected emergency victims waiting excessive lengths of time for ambulances.

**Figure 5.1** Relationship of Time Sequence of Events Following an Emergency.

**Key:**
- **A:** Time spent waiting for ambulance to become available. Immediate availability is the per cent of the time that A equals zero.
- **B:** Detection delay and entry delay combined.
- **C:** Dispatch delay.
- **D:** Time that ambulance spends en route (travel delay)
Number of Ambulances Required to Provide Criterion Immediate Availability

To determine the number of ambulances required to guarantee an immediate availability of some criterion level, the mathematical theory of waiting lines (queues) is used. Empirical evidence suggests that calls for emergency medical service arrive randomly, totally independent of each other.*

Cases arise where calls are not generated at random, such as fires, floods, and multiple victim accidents, but these occurrences occur infrequently and are therefore treated as disaster situations.

A general mathematical theory of the performance of waiting lines is available and may be applied using the following assumptions.

1) Calls for emergency service arrive randomly with a known average number per hour, which may vary with the time of day or day of week.
2) All ambulances are identical in capability and a total of N ambulances exist. No back-up service exists.
3) The average service time for emergency ambulance calls is known.
4) Calls received when all N ambulances are busy will form a waiting line and be served on a first-come, first-served basis.
5) Ambulances can not desert one call for another.

The assumptions become less binding as the number (N) of ambulances in the system increases. To guarantee a high percentage of immediate availability, N must be chosen large enough for a waiting line to form only rarely, and

* The same mathematical theory describes the arrival rate of telephone calls to a telephone operator at a switchboard, from which early waiting line theory was developed. This parallel may appeal to the intuition of the reader.
a good approximation is to let N approach infinity. As N grows large, an ambulance is never required to desert one call for another call, since a second ambulance is dispatched instead. No back-up service is ever utilized, therefore no back-up service needs to exist. The order in which waiting calls are served (queueing discipline) is not important to the solution process since calls are assumed to never wait for service, that is, an ambulance is always available. Thus, it can be seen that the assumptions become increasingly valid as the immediate availability (or the total number) of ambulances in the system increases.

Therefore, if the arrival rate of calls for EMS and the service times for ambulance runs are specified, the probability of any arbitrary number of ambulances being busy is easily read from probability tables as shown in Appendix H.

The arrival rate of calls for emergency service depends on diverse characteristics of the population being served but has been found to grossly increase proportionately with the size of the population. Naturally, call frequency can best be determined from past records of ambulance services, but the records are often incomplete, difficult to access, very time consuming to review, and often contain grouped data which can cause misleading statistics. For example, few ambulance services separate emergency runs from non-emergency transfers in the ambulance records.

An estimate of 35 emergency calls per 1000 population per year in the ambulance service area is therefore used as an estimate of average demand to be placed upon the EMS system.* To determine the peak load placed on the EMS system by daily cycles of demand, the estimate is made that peak demand is 150 per cent of average demand. Data from Grady Ambulance Service and from the EMS system in Cambridge, Massachusetts support this estimate (2; 11, p.50).

The time required per ambulance run is also based upon estimates, rather than records. Once again, the records of the ambulance services did not contain the information necessary to generate
reliable statistics. Most ambulance operators questioned on the ambulance survey responded that average service time falls between 30 minutes and one hour. A conservative estimate for average service time can therefore be taken as one hour.

**Results of Calculations for 90 Per Cent Immediate Availability**

Keeping the previous discussions in mind, the number of ambulances required to guarantee 90 per cent immediate availability in the metropolitan Atlanta EMS system can be calculated. Clayton County is taken as an example:

1) Clayton County Population = 98,043*

2) \[ \frac{98043 \text{ persons}}{1} \times \frac{35 \text{ emergency calls}}{1000 \text{ pop/yr}} = 3431 \text{ calls/year} \]

3) \[ \frac{3431 \text{ calls}}{\text{year}} \times \frac{1 \text{ year}}{365 \text{ days}} \times \frac{1 \text{ day}}{24 \text{ hours}} = 0.392 \text{ calls/hour} \]

Clayton County is expected, therefore, to generate 0.392 calls for EMS per hour on the average. Since peak demand is 150 per cent of average demand:

4) \[ 0.392 \times 1.50 = 0.587 \text{ calls/hour} = \text{peak demand} \]

The following table can be constructed using waiting line theory from the previous assumptions regarding emergency call arrival rate and ambulance service times in Clayton County.**

---

* All population figures in this chapter are based upon the 1970 census.

** As shown in Appendix H.
TABLE 5.4  Per Cent of Time that Various Numbers of Ambulances in Clayton County are Occupied at any Given Instant.

<table>
<thead>
<tr>
<th>NUMBER OF BUSY AMBULANCES</th>
<th>EXPECTED PER CENT OF TIME</th>
<th>CUMULATIVE (PER CENT)*</th>
</tr>
</thead>
<tbody>
<tr>
<td>no busy ambulances</td>
<td>54.7</td>
<td>54.7</td>
</tr>
<tr>
<td>exactly one busy ambulance</td>
<td>32.9</td>
<td>87.6</td>
</tr>
<tr>
<td>exactly two busy ambulances</td>
<td>9.9</td>
<td>97.5</td>
</tr>
<tr>
<td>exactly three busy ambulances</td>
<td>2.0</td>
<td>99.5</td>
</tr>
<tr>
<td>exactly four busy ambulances</td>
<td>0.3</td>
<td>99.8</td>
</tr>
<tr>
<td>exactly five busy ambulances</td>
<td>0.1</td>
<td>99.9</td>
</tr>
</tbody>
</table>

From Table 5.4, it can be seen that two or less ambulances are expected to be busy 97.5 per cent of the time. Therefore, if Clayton County has three ambulances, the chances (or probability) of one ambulance being available when called is 97.5 per cent. Similar calculations for the other counties in metropolitan Atlanta result in required numbers of ambulances as shown in Table 5.5. The numbers of ambulances specified in Table 5.5 guarantee an average per cent immediate availability greater than 90 per cent for every county except Rockdale County. If Rockdale County had two ambulances, the per cent immediate availability would be nearly 1.0, which is far better immediate availability than can normally be supported by a rural community, and therefore one ambulance is assumed to be a reasonable number of emergency ambulances for Rockdale County.

* Figures presented in this column represent a running sum of the percentages in the middle column.
TABLE 5.5 Required Number of Ambulances to Insure a Given Level of Immediate Availability

<table>
<thead>
<tr>
<th>COUNTY</th>
<th>POPULATION</th>
<th>CALLS PER HOUR</th>
<th>REQUIRED # OF AMBULANCES</th>
<th>PER CENT IMMEDIATE AVAILABILITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clayton</td>
<td>98,043</td>
<td>0.587</td>
<td>3</td>
<td>97.5</td>
</tr>
<tr>
<td>Cobb</td>
<td>196,793</td>
<td>1.179</td>
<td>4</td>
<td>96.6</td>
</tr>
<tr>
<td>DeKalb</td>
<td>415,387</td>
<td>2.488</td>
<td>6</td>
<td>95.7</td>
</tr>
<tr>
<td>Douglas</td>
<td>28,659</td>
<td>0.170</td>
<td>2</td>
<td>98.2</td>
</tr>
<tr>
<td>Fulton</td>
<td>607,592</td>
<td>3.641</td>
<td>7</td>
<td>92.7</td>
</tr>
<tr>
<td>Gwinnett</td>
<td>72,349</td>
<td>0.433</td>
<td>2</td>
<td>98.9</td>
</tr>
<tr>
<td>Rockdale</td>
<td>18,152</td>
<td>0.109</td>
<td>1</td>
<td>89.1</td>
</tr>
<tr>
<td>TOTALS</td>
<td>1,436,975</td>
<td>8.607</td>
<td>25</td>
<td>99.9</td>
</tr>
</tbody>
</table>

Number of Ambulances Required to Provide Criterion Response Time

No mention has been made thus far regarding the number of ambulances necessary to meet response time requirements. Obviously, response time is longer for a single central ambulance location for all ambulances than for the same number of ambulances when dispersed throughout a region. However, the immediate response capability remains the same, regardless of how ambulances are located, if the number of ambulances remains the same. The previous analysis to determine the number of ambulances required to give a 90 per cent immediate availability can only be used as a lower bound on the true number of ambulances required to meet immediate availability and response time criterion. An expected result is that more ambulances are needed to provide acceptable response times than are needed to guarantee immediate availability of 90 per cent.

Each alternative set of locations of ambulances and corresponding service areas within a county may be expected to generate a distinct average response time. The optimal allocation of ambulances to service areas can only be achieved by enumeration of all possible...
alternatives, which is well beyond the scope of this present report. Computer simulation is perhaps the best method of determining the best allocation possible. However, the following section illustrates the methodology for predicting response time for any alternative location of ambulances independent of the method used to choose the locations.

Service Areas for Each Ambulance

If an ambulance is assigned a service area roughly circular in shape, it is possible to determine:* 

a) The radius of the ambulance service area, given the criterion average distance the ambulance travels to the scene per run, or

b) The average distance the ambulance is expected to travel to the scene per run, given the criterion radius of the service area.

In either case, the radius (R) of the service area and the average trip distance (DR) of the ambulance to the scene are not equal. The average distance traveled (trip length) to the scene is exactly two-thirds of the radius of the service area for the ambulance. If the expected speed of the ambulance running with lights and siren is known, and the conversion factor (a) of air to road miles is known, enough information is available to construct ambulance service areas which guarantee a target response time for each ambulance.

For example, using Clayton County once more for illustration, the following steps illustrate the calculation for the ambulance service areas which guarantee a six minute response.

1) Assume the speed (S) of an ambulance is 45 MPH; S=45
2) Assume 1.2 road miles equals 1.0 air miles; a=1.2
3) Desired response time (RT) is six minutes; RT=6

* Proven in Appendix J.
4) Let \( R \) = radius of the service area in air miles;
\( DR \) = ambulance trip length, in road miles;
\( DA \) = ambulance trip length in air miles.

5) \( R = \frac{3}{2} \times DA \)

6) But \( DR = 6 \text{ minutes} \times \frac{45 \text{ miles}}{60 \text{ minutes}} = 4.5 \text{ road miles} \)

7) \( DA = 4.5 \text{ road miles} \times \frac{1 \text{ AIR mile}}{1.2 \text{ road miles}} = 3.75 \text{ air miles} \)

Therefore:

8) \( R = \frac{3}{2} \times 3.75 \text{ air miles} = 5.625 \text{ air miles} \)

Thus, a circle with a 5.625 mile radius designates a response area in which the average ambulance travel time at a speed of 45 MPH is exactly six minutes. Naturally some trips will take longer than six minutes, but these trips are offset by shorter trips to give the six minute average.

As a first approximation to calculating the optimal number of ambulances for each county, a graphic technique can be used. A large scale map of the seven county area showing population density is covered with circles representing six minute response areas. If the circles do not overlap excessively, yet cover a substantial proportion of the population, the number of circles used represents an estimate of the number of ambulance bases needed to guarantee an average six minute travel time (See Figure 5.2). The centers of the circles are located at fire stations or hospitals in the recommended EMS system but the technique is applicable for any locational considerations. The different size circles in Figure 5.2 result from the different attainable speeds possible in each county in the metropolitan Atlanta area.

Once the initial approximation has been made, a calculation is necessary to determine the response time of the proposed number and location of ambulances which constitute the transportation subsystem. The number of ambulances may be modified to raise or lower the
ASSUMED SPEEDS (MPH):

Clayton  45  
Cobb      40  
DeKalb    35  
Douglas   50  
Fulton    30 (urban areas) 
           50 (rural areas) 
Gwinnett  50  
Rockdale  55  

NOTE: This figure is Step 2 of the methodology for determining number and locations of ambulances, which is presented later.

FIGURE 5.2  A Graphical Estimate of the Number of Ambulance Service Areas Required to Guarantee an Average Six Minute Response Time, With Differing Ambulance Speeds in Each County.
response times in each county to reflect the results of the response time calculation.

Calculating the Response Time

For any given number and location of ambulances within a county, a distinct expected average response time results. To calculate this response time, several assumptions must be made:

1) The entire population of each census tract may be considered to be located at the mathematical centroid of the tract.
2) The number of emergency calls generated per service area is directly proportional to the number of persons residing in the service area.
3) Air miles are directly proportional to actual road miles.
4) When an ambulance is called and is not available, another ambulance is dispatched and must travel twice the distance that the original ambulance would travel.

If the above assumptions are valid, the expected response time may be easily calculated. First, the service areas, initially approximated as circles, are revised to conform to census tract boundaries. Although this procedure may introduce some error, on the average the effect is small since the tracts may be chosen so that errors cancel each other. If this procedure results in a gross distortion of the service area in certain cases, the census tracts may be divided and assigned correspondingly fewer inhabitants. Next, the centroid of each census tract within the service area is approximated visually. The population of the tract is assumed to be located at the centroid of the tract. Since the number of emergencies generated by the population of the tract can be inferred, and the location of the ambulance quarters is known, the total number of trips made by the ambulance to each census tract centroid is easily calculated and weighted by the distance.
When this calculation is performed for all census tracts within an ambulance's service area, an average response distance can be calculated. This distance is directly proportional to time, based upon average speed of the ambulance. A slight problem does exist when an ambulance is not immediately available for dispatch. However assumption number four above provides a close approximation to an otherwise unsolvable calculation.

**Recommended Number and Location of Ambulances in Clayton County**

Clayton County is taken as an example county to illustrate how the final recommended number of ambulances is determined. The recommended number and location is a result of a step by step process.

**STEP 1:** From calculations in Table 5.4, the minimum number of ambulances required to provide 90 per cent or greater immediate availability for Clayton County is determined to be three ambulances.

**STEP 2:** From Figure 5.2, a graphic estimate of the number of ambulances required to provide a six minute response time in Clayton County is two ambulances.

**STEP 3:** Choosing the larger number of ambulances from Step 1 and Step 2, three ambulances are stationed at hospitals or fire stations, depending on population density and highway accessibility.*

**STEP 4:** Calculate the expected response time as outlined above and add or subtract ambulances to adjust the response time to be longer or shorter. In the case of Clayton County, the three ambulances

* Normally fire departments are more carefully concerned with response time when choosing station sights than are hospitals. Therefore, more fire stations are properly located to house ambulances.
from Step 3 guarantee a six minute response time (In the case of Gwinnett County, Step 1 requires two ambulances, Step 2 requires four ambulances, but Step 4 requires three ambulances to generate the target response time of six minutes).

Table 5.6 gives the numerical calculation for the expected distance traveled by ambulances stationed at the three recommended locations in Clayton County.* From the expected distance, the expected response time can be calculated, depending only upon the speed at which the ambulance travels. Column one of Table 5.6 contains the census tracts grouped by each ambulance's primary service area. Column two shows the population of each tract. Column three shows the ambulance location within the service area. By measuring the distance in air miles from the ambulance location in column three to the centroids of the tracts in column one, the entries in column four are determined. Column five represents the product of column two and column four and may be used to determine the average distance traveled to each tract weighted by the population of the tract. When all the census tracts served by an ambulance are listed, a row is created, titled "TOTAL" and which presents the total population of the service area in column two and presents the total of column five. Column six is equal to column five divided by column two and represents the distance that the average person in the service area lives from the ambulance base. Column seven gives the per cent immediate availability of each ambulance for the primary service area based on the population of the service area and the assumptions listed previously. Since N is not infinite in this case, the probabilities are estimates, rather than exact calculations. Column eight gives the distance that a secondary ambulance must travel if the primary ambulance is not available. Normally, this distance is assumed to be twice the distance calculated in column six. The average ambulance trip to the scene is calculated as:

\[
= (\text{column six}) \times (\text{column seven}) + (\text{column eight}) \times (1 - \text{column seven})
\]

* Tables for the other six counties are shown in Appendix K.
<table>
<thead>
<tr>
<th>Census Tract</th>
<th>Pop.</th>
<th>Nearest Ambulance Base</th>
<th>Distance to Ambulance Base (miles)</th>
<th>Distance X Population</th>
<th>Average Miles Per Person (Primary)</th>
<th>% Immediate Availability of Ambulance</th>
<th>Average Miles Per Person (secondary)</th>
<th>Average Ambulance Trip (miles)</th>
</tr>
</thead>
<tbody>
<tr>
<td>401</td>
<td>2,571</td>
<td>Clayton</td>
<td>5.0</td>
<td>12,855</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>402</td>
<td>5,872</td>
<td>General</td>
<td>3.75</td>
<td>22,020</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>404.04</td>
<td>12,678</td>
<td>Hospital</td>
<td>2.5</td>
<td>31,695</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>405.01</td>
<td>11,761</td>
<td>#26</td>
<td>2.0</td>
<td>23,522</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>404.03</td>
<td>4,313</td>
<td></td>
<td>5.0</td>
<td>21,565</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOTAL</td>
<td>37,195</td>
<td></td>
<td></td>
<td>111,567</td>
<td>3.002</td>
<td>77.8</td>
<td>6.004</td>
<td>3.668</td>
</tr>
<tr>
<td>403.01</td>
<td>2,684</td>
<td>Forest</td>
<td>2.0</td>
<td>5,368</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>403.02</td>
<td>6,956</td>
<td>Park Fire</td>
<td>1.25</td>
<td>8,692</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>403.03</td>
<td>6,963</td>
<td>Dept.</td>
<td>1.25</td>
<td>8,703</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>403.04</td>
<td>5,508</td>
<td>(Linda Way)</td>
<td>0.5</td>
<td>2,754</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>403.05</td>
<td>6,141</td>
<td></td>
<td>1.75</td>
<td>10,746</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>404.01</td>
<td>6,969</td>
<td></td>
<td>2.60</td>
<td>18,119</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>404.02</td>
<td>7,385</td>
<td></td>
<td>3.25</td>
<td>24,001</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOTAL</td>
<td>42,606</td>
<td></td>
<td></td>
<td>78,385</td>
<td>1.84</td>
<td>74.5</td>
<td>3.68</td>
<td>2.309</td>
</tr>
<tr>
<td>405.02</td>
<td>3,350</td>
<td>Jonesboro</td>
<td>2.75</td>
<td>9,212</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>406.01</td>
<td>11,821</td>
<td>Fire Dept.</td>
<td>2.25</td>
<td>26,597</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>406.02</td>
<td>3,071</td>
<td></td>
<td>4.5</td>
<td>13,819</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOTAL</td>
<td>18,242</td>
<td></td>
<td></td>
<td>49,629</td>
<td>2.721</td>
<td>89.0</td>
<td>5.44</td>
<td>3.021</td>
</tr>
<tr>
<td>TOTAL</td>
<td>98,043</td>
<td></td>
<td></td>
<td>209,328</td>
<td>2.135</td>
<td></td>
<td></td>
<td>2.957</td>
</tr>
</tbody>
</table>

TABLE 5.6 Expected Ambulance Trip Length, Clavton County.
and is presented in column nine. The total average ambulance trip length for all ambulances in the entire county is shown in the lower right-hand corner of the table. Although the immediate availability of each individual ambulance is less than 90 per cent as shown in column seven, it should be realized that the three ambulances are available to the county residents, in which case the immediate availability for Clayton County is 97.5 per cent as shown earlier in Table 5.5.

Ambulance Requirements for Other than Peak Periods

The numbers and locations of ambulances presented in Table 5.7 are the recommendations for the peak demand hours, which are normally considered to be between 6 P.M. and 2 A.M.* Naturally, to assume that certain hours are peak demand periods is to assume that other periods will not require the 34 ambulances recommended. Moreover, during the slack periods, immediate availability may increase, even as the total number of ambulances in the system decreases. Response times may be better, since attainable average response speeds may increase as traffic is reduced on the highways. It can be said with certainty that the locations presently containing two ambulances will not need to staff both ambulances at all times. The same response time can be achieved with certainty in the system during slack periods utilizing only 29 ambulances, and probably fewer. Data requirements are outlined in Chapter 9 for determining the number of ambulances needed to maintain criterion levels of performance at all times.

* Based upon the staffing pattern of Grady Ambulance Service.
<table>
<thead>
<tr>
<th>County</th>
<th>Number of Ambulances</th>
<th>Ambulance Number</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clayton</td>
<td>1</td>
<td>1</td>
<td>Clayton General Hospital</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>2</td>
<td>Jonesboro Fire Department Headquarters</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>3</td>
<td>Forest Park Fire Department (Linda Way)</td>
</tr>
<tr>
<td>Cobb</td>
<td>2</td>
<td>4,5</td>
<td>Metro Ambulance Service Headquarters, Marietta</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>6</td>
<td>Cobb County Fire Department, station #8</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>7</td>
<td>Cobb County Fire Department, station #10</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>8</td>
<td>Cobb County Fire Department, station #1</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>9</td>
<td>Smyrna Fire Department Headquarters</td>
</tr>
<tr>
<td>DeKalb</td>
<td>1</td>
<td>10</td>
<td>DeKalb County Fire Department, station #6</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>11</td>
<td>DeKalb County Fire Department, station #11</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>12</td>
<td>DeKalb County Fire Department, station #16</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>13</td>
<td>Colonial Chapel Ambulance Service</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>14</td>
<td>Interstate 285 and Memorial Drive (Grady Ambulance)</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>15</td>
<td>Suburban Ambulance Service</td>
</tr>
<tr>
<td>Douglas</td>
<td>1</td>
<td>16</td>
<td>Douglas County Hospital</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>17</td>
<td>Southwest region (to be decided)</td>
</tr>
<tr>
<td>Fulton</td>
<td>2</td>
<td>18,19</td>
<td>Grady Memorial Hospital</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>20,21</td>
<td>Atlanta Fire Department, station #30</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>22,23</td>
<td>Atlanta Fire Department, station #21</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>24,25</td>
<td>Atlanta Fire Department, station #22</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>26</td>
<td>Holy Family Hospital</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>27</td>
<td>East Point Fire Department, station #5</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>28</td>
<td>Atlanta Fire Department, station #33</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>29</td>
<td>Fairburn Fire Department Headquarters</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>30</td>
<td>Alpharetta Fire Department Headquarters</td>
</tr>
<tr>
<td>Gwinnett</td>
<td>1</td>
<td>31</td>
<td>Button Gwinnett Hospital</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>32</td>
<td>Norcross Fire Department Headquarters</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>33</td>
<td>Suwanee Fire Department Headquarters</td>
</tr>
<tr>
<td>Rockdale</td>
<td>1</td>
<td>34</td>
<td>Rockdale County Hospital</td>
</tr>
</tbody>
</table>

* As determined by the four steps mentioned earlier in this chapter.
KEY:

○ MOBILE INTENSIVE CARE UNITS
● AMBULANCES

FIGURE 5.3 Proposed Ambulance and Mobile Intensive Care Unit Locations for the Metropolitan Atlanta EMS System.
Ambulance Requirements for Maintenance

Extra ambulances are needed for back-up purposes primarily due to maintenance requirements, as exemplified by the City of Jacksonville which reserves four additional ambulances as back-up vehicles for the ten ambulances normally in service.* Based upon this ratio, it is tempting to say that a proven ambulance system has shown the need for back-up vehicles on the order of 40 per cent of normally operating vehicles, and therefore metropolitan Atlanta needs 14 additional vehicles. However, several other factors must be taken into account. The number of ambulances provided by private ambulance services, the economy of scale inherent in back-up systems of this type, and the varying number of ambulances as a function of cyclic demand patterns will each affect the actual required number of back-up vehicles. One statement can be made with certainty. If all municipal ambulances are maintained as a unified system, rather than as individual, separate components, the number of ambulances used as back-up vehicles can be shared and will thereby be minimized.

Mobile Intensive Care Units (MICUs)

Location

The use of the mobile intensive care unit primarily as a mechanism for providing a high level of training for EMTs is discussed in Chapter 6. To provide the necessary training, the MICU's must be located in hospitals with comprehensive ED capabilities, and it is recommended that only Category I or Category II hospitals be considered as potential sites for supporting MICUs.** Due to the heavy emergency load and the extensive facilities at Grady Memorial Hospital, it is recommended that one MICU be stationed there, along with the two ambulances previously mentioned. Eight other hospitals could potentially support MICUs in the metropolitan Atlanta area.


** Hospital ED categories are explained in Chapter 4.
Utilization of the MICUs must be high compared to other emergency medical vehicles for two reasons. First, the vehicle is more expensive to operate than ambulances due in part to the additional equipment and also due to a higher personnel cost, since MICUs are staffed by three EMTs. Secondly, the utilization must be high in order to make the vehicle an effective training device. A common problem with training ambulance personnel to high levels of skill on conventional ambulances is that truly emergent patients are rarely seen by regular operating ambulance personnel due to the high per cent of time the ambulance spends waiting for a call (6, p.65).* A high level of training requires practice, and therefore a high utilization of the training vehicle.

High utilization of the MICUs can be achieved in two ways. The total number of MICUs should be kept low, and the locations of the vehicles must be geographically dispersed. In addition, the MICUs should be located in high population density areas to minimize the response time of the vehicle.

A proposed system of MICUs for metropolitan Atlanta which meets all of the above considerations is:

1) One MICU at Grady Memorial Hospital
2) One MICU at Kennestone Hospital
3) One MICU at DeKalb General Hospital

The location of MICUs are shown in Figure 5.3 with the ambulance locations.

VEHICLE SPECIFICATIONS

Specifications for Medical Aid Vehicles (MAVs)

An MAV is incorporated in the EMS system to provide a quick response to acutely time dependent emergency situations, and to supply additional manpower and vehicles when needed. The equipment carried by

* Personal interview between Oren L. Reinbolt, HSRC, and Chief Donald E. Werner, Columbus Fire Department, Columbus, Ohio, on September 5, 1972.
the vehicle is minimal and patients are not transported by the vehicle. Therefore, an adequate MAV is any vehicle which can transport at least one person to an emergency scene, and police cruisers, private automobiles, and fire vehicles of all types, are suitable as MAVs.

**Specifications for Emergency Ambulances***

Specifications for emergency ambulances are dependent upon the objectives of an ambulance, which are:

1) Provide a safe and smooth ride for the patient and, when necessary, a fast mode of transportation, especially to the scene of a medical emergency.

2) Provide ample working space to allow ambulance attendants to deliver effective emergency treatment to the patient.

3) Provide room for the patient and for the supplies necessary for the attendant to render emergency care.

In order to achieve these objectives, the following minimum ambulance specifications should be required of all ambulances used as emergency medical transportation vehicles in the metropolitan Atlanta EMS system.**

I. PATIENT COMPARTMENT

A) Rear doors shall be no less than 38 inches high and 40 inches wide.

B) Rear doors shall be of the type that will securely fasten when opened to prevent wind from closing.

C) Must have at least one side door in the patient compartment suitable for adequate emergency evacuation of any patient.

* Specifications for emergency ambulances were developed largely through the workings of the Atlanta Regional Commission's EMS Task Force Subcommittee on Transportation and Equipment chaired by Mr. Ed Pounds, with additional comment by the Research Staff of HSRC.

** The specifications presented herein meet standards set by the Georgia Public Law 88-31 as shown in Appendix P.
D) The patient compartment shall be separated from the driver compartment by a full length and width bulkhead with sliding glass windows.

E) The patient compartment shall have an internal height (floor to ceiling) of no less than 54 inches (60 inches is preferable), and shall be of such internal length as to provide no less than 15 inches (25 inches is preferable) clearance between the end of the stretcher, in locked position, and the completely closed rear doors. It shall be desirable to have no less than 15 inches (25 inches is preferable) clearance between the head of the stretcher and the compartment bulkhead.

F) A good bench shall be provided parallel to the stretcher (in its locked position) and securely positioned and long enough for the attendant to be able to administer to the patient from one end of the stretcher to the other.

G) Illumination must be adequate throughout the patient compartment and provide an intensity of 40 foot-candles at the patient's level for both adequate observation of vital signs and medical care during transit.

H) The patient compartment shall provide cabinets with room for named supplies and shall be covered in smooth nonporous material. The floor shall be covered with vinyl or plastic type material.

I) There shall be adequate facilities for securing ambulance cot and other equipment during transport.

J) IV hanger hook(s) shall be provided and properly mounted.
II. SIREN, EXTERNAL LIGHTS, AND INSIGNIA

A) There shall be at least one rotating warning light on the roof.

B) There shall be at least four flashing roof lights (4" sealed beam or equivalent), one located on each upper corner of the body, so that two are facing the front and two are facing the rear.

C) Rear loading light is required.

D) Ambulance shall be equipped with either a conventional "free-rolling" siren or a 100 watt output electronic siren. Either shall be mounted, facing forward, on the outside of the ambulance.

E) The vehicle shall be clearly marked with ambulance insignia on both sides.

III. OTHER REQUIREMENTS

A) The ambulance must be equipped with front doors on both sides of the driver's compartment.

B) The brakes shall be extra heavy-duty with vacuum power assistance.

C) Heavy-duty shocks and springs with front stabilizer bar are required.

D) A heavy-duty cooling system is required.

E) A heavy-duty battery, rated at no less than 72 ampere-hours, is required.

F) An alternator with a peak output rating of 100 amps is required.

G) The ambulance should be marked with the EMS number of the vehicle on all four sides and on the roof.

The specifications above are general enough to allow for many different ambulance manufacturers to bid on the vehicles yet specific enough
to demand functional ambulances. If the specifications are met, the objectives of a good ambulance will be met.

Specifications for MICUs

The role of the MICU is to provide a training ground for advanced EMTs. Additionally, the MICU is to have treatment capability for medical emergencies which is the most sophisticated to be found in the metropolitan Atlanta EMS. Therefore, the need for a high quality vehicle is easily justified. The MICUs should be of the very best quality available to the EMS system.

Recommended specifications for the MICUs are:

1) Must meet all specifications for emergency ambulances presented in the preceding section.
2) Additionally, must have at least 60 inches of headroom and have an internal length to provide no less than 25 inches clearance between the end of the stretcher, in locked position, and the completely closed rear doors. Also must have 25 inches or more clearance between the head of the stretcher and the compartment bulkhead.
3) Vehicle shall be marked with the words "Mobile Intensive Care Unit" on both sides, and "MICU" on the roof.

EQUIPMENT SPECIFICATIONS

Equipment Carried by Medical Aid Vehicles

Medical Aid Vehicles supply manpower, quickness of response, and limited emergency medical treatment to the patient. The MAV should carry personnel with the training recommended in Chapter 6 and the supplies necessary to arrest shock-producing injury and sustain respiration. Equipment should be packaged in a convenient manner so as to aid in the transporting of equipment by a variety of smaller vehicles. Essential equipment for the medical aid vehicles consists of:
two - ROLLS OF ADHESIVE TAPE, one roll one inch wide and one roll two inches wide.
two - UNIVERSAL DRESSINGS, approximately ten inches by 30 inches.
four - STERILE GAUZE PADS, four inches by four inches.
two - BANDAGES, soft roller, self-adhering type, four inches by five yards.
two - MOUTH TO MOUTH ARTIFICIAL VENTILATION AIRWAYS for adult and child.
one - WOOLEN BLANKET.

Equipment and Supplies Carried by Ambulances*

The following equipment and supplies are in accord with nationally recognized standards but incorporate improvements to accommodate local situations.** It is recommended that in order for an ambulance attendant to provide necessary life-sustaining care to emergency victims, an ambulance must contain the following:

<table>
<thead>
<tr>
<th>Quantity</th>
<th>Equipment and Supplies</th>
</tr>
</thead>
<tbody>
<tr>
<td>One</td>
<td>PORTABLE SUCTION APPARATUS, with wide bore tubing and rigid pharyngeal suction tip;</td>
</tr>
<tr>
<td>One</td>
<td>BAG-MASK VENTILATION UNIT, with adult, child, and infant size masks. Valves must operate in cold weather, and unit must be capable of use with oxygen supply;</td>
</tr>
<tr>
<td>Three</td>
<td>OROPHARYNGEAL AIRWAYS, with adult, child and infant sizes;</td>
</tr>
<tr>
<td>Two</td>
<td>MOUTH-TO-MOUTH ARTIFICIAL VENTILATION AIRWAYS, for adult and child;</td>
</tr>
<tr>
<td>One</td>
<td>PORTABLE OXYGEN APPARATUS, with two E cylinders, regulator with liter gauage, adequate tubing and semi-open, valveless, transparent masks in adult, child and infant sizes;</td>
</tr>
<tr>
<td>Two</td>
<td>CERVICAL COLLARS, one adult and one child;</td>
</tr>
</tbody>
</table>

* Developed by the ARC Task Force on EMS Subcommittee on Transportation and Equipment.

** These equipment specifications also surpass the equipment standards in the Georgia Public Law 88-31 as shown in Appendix P.
One - TRACTION SPLINT, hinged half-ring with commercial limb support slings, padded ankle hitch, and traction strap (Optional - Hare telescoping traction splint);

Four - PADDED WOODEN SPLINTS, 15 inches by three inches;

Two - PADDED WOODEN SPLINTS, 36 inches by three inches;

Two - PADDED WOODEN SPLINTS, 54 inches by three inches;

One Set - INFLATED SPLINTS, uncomplicated with zipper closures;

One - SPINE BOARD, short with accessories;

One - SPINE BOARD, long with accessories;

One - ORTHOPEDIC TYPE SCOOP STRETCHER;

Two - SHEARS, for bandages;

One - BLOOD PRESSURE MANOMETER, CUFF, AND STETHOSCOPE:

Two - SAND BAGS, about four inches in width, two inches in thickness, and 12 inches in length;

Two - LEATHER RESTRAINTS, cuff type with straps;

One - PILLOW, with vinyl cover;

One - EMESIS BASIN and/or EMESIS BAG;

Two - TOURNIQUETS, minimum width of one inch;

One - COT, AMBULANCE, all level type with appropriate linens and blankets;

One - STAIR CHAIR, collapsible with wheels;

One - PEN LIGHT;

Two - PROTECTIVE PLASTIC SHEETS, for use as a stretcher or weather-proof cover;

Two - MOUTH GAGS, either commercial or made of three tongue blades taped together and padded;

Four - UNIVERSAL DRESSINGS, approximately ten inches by 30 inches, compactly folded and packaged in convenient size;

Twelve - STERILE GAUZE PADS, four inches by four inches;

Eight - BANDAGES, soft roller, selfadhering type, four inches by 5 yards;

One - ALUMINUM FOIL, roll, 18 inches by 25 feet, sterilized and wrapped;

Two - ROLLS OF ADHESIVE TAPE, one roll one inch wide and one roll two inches wide;

One - SNAKE BITE KIT;
Two  - BURN SHEETS, sterile and wrapped;
Six  - TRIANGULAR BANDAGES;
Ten  - SAFETY PINS;
One  - OBSTETRICAL KIT, sterile;
One  - POISON KIT;
Six  - CHEMICAL ICE PACKS;
Four - VASELINE GAUZE PADS;
Ten  - COTTON SWABS, sterile;
Twelve - ALCOHOL SPONGES, individually wrapped;
Four  - STERILE INTRAVENOUS AGENTS, preferably in plastic bags, with administration kits;
Four  - SUGAR CUBES, individually wrapped (for Insulin shock);
Two  - ENDOTRACHEAL INTUBATION KITS, disposable;
One  - EXTERNAL DIRECT CURRENT DEFIBRILLATOR;
One  - OSCILLOSCOPE and STRIP CHART RECORDER;
One  - CARDIAC DRUG KIT, prefilled dosages, to be determined by physicians.

The equipment recommended above exceeds by a considerable margin the specifications listed in the Airlie Conference on EMS yet represents a small cost as a percentage of the overall ambulance operating expenses (6, p.52). It would be poor economy to render ineffective emergency patient care as a result of not having the relatively inexpensive recommended equipment available. It is strongly urged, therefore, that the recommended equipment list be taken as minimal standards and no exceptions to the standards allowed.

The Letterman exchange system utilized by the armed forces for nearly 100 years would be of value in the metropolitan Atlanta EMS system. Basically, the system requires hospital emergency departments to stock selected emergency implements and appliances. When a hospital ED receives a patient with a selected item in use, the hospital ED provides a stocked replacement unit to the ambulance attendant. An example of the Letterman system's advantages occur when a patient is delivered to the ED on a spine board. Rather than wait for the spine board to be released by the physician, or move the patient unnecessarily to release the board, the
ambulance attendant is given a hospital spine board in exchange for the board attached to the patient. The ambulance is back in service quickly yet fully equipped (6, p.55). Moreover, coordination and cooperation between the ED and ambulance personnel is enhanced. The Letterman concept can be extended to disposable supplies as well. For example, the hospital can replace drugs used by the ambulance attendants and add the charge to the patient's hospital bill.

A second concept, similar to the Letterman system is also recommended for the metropolitan Atlanta EMS system. The need for clean linens after each ambulance trip to a hospital suggests that the hospitals be the source of linen for the ambulances. Each hospital has extensive laundry service already operating and the additional ambulance linen is not expected to add a noticeable burden. If the linen supply is handled in the manner prescribed here, an ambulance can be inservice as soon as the ambulance departs from the hospital. Otherwise, the ambulance may need to remain out of service until the linen supply is replenished from another source.

Equipment to be Carried by MICUs

The equipment to be carried by MICUs must be adequate to allow EMT-A4 level ambulance attendants to perform to the full capacity of their training as recommended in Chapter 6. Personnel from the individual hospital housing the MICU should make agreements with the EMS Coordinating Agency as to the exact equipment and supplies to be carried by the MICU. Undoubtedly, the MICU must contain all equipment carried by the standard ambulances. However, physicians have personal preferences for the type and quantity of drugs used in treating patients and, to a certain extent, prefer alternative procedures to be performed. Since the ED physician-MICU interface must be close knit, specific equipment should be specified at the ED physician-MICU level. However, guidelines are presented in Appendix L which shows the equipment carried by the Seattle, Washington MICU known as "Medic One." It is felt that the MICUs in the metropolitan Atlanta EMS system should be similar to Medic One or similar to the High Trauma Units in the Columbus, Ohio, EMS system.
The MICUs are the only vehicles in the system which are required to have telemetry capability to transmit ECGs over a radio frequency. In addition, the MICU must carry strip chart recorders to produce electrocardiograms which may be given to the ED physician whenever cardiac patients are delivered to the ED or CCU by an MICU.

HELIICOPTERS

In the metropolitan Atlanta area, seven organizations operate helicopters as shown in Table 5.8.*

<table>
<thead>
<tr>
<th>Organization</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Executive Helicopters, Inc.</td>
<td>3</td>
</tr>
<tr>
<td>C &amp; S Bank</td>
<td>3</td>
</tr>
<tr>
<td>Vertol, Inc.</td>
<td>1</td>
</tr>
<tr>
<td>Mobley Aviation</td>
<td>1</td>
</tr>
<tr>
<td>Atlanta Police Department</td>
<td>2</td>
</tr>
<tr>
<td>DeKalb County Police Department</td>
<td>1</td>
</tr>
<tr>
<td>U. S. Army Reserve</td>
<td>9</td>
</tr>
<tr>
<td>First National Bank</td>
<td>2</td>
</tr>
</tbody>
</table>

**TOTAL** 22

Since the helicopters have far greater visibility during congested traffic hours, it is recommended that the EMS Coordinating Agency make every effort to insure the existence of an easy mechanism of reporting highway accidents from the helicopters in the air. The concept is not an unfamiliar one since helicopters are presently used for spotting traffic patterns. Transportation of patients by private helicopters is not recommended in the metropolitan Atlanta area as a general rule, since

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* Telephone conversation between Oren L. Reinbolt, HSRC, and Mr. Doug Moore, General Aviation District Office, Atlanta, on November 9, 1972.
private helicopters generally do not have room for both a litter patient and an EMT to accompany the patient.

**Helicopters as Routine Ambulances**

Although the cost-effectiveness and overall desirability of using helicopters routinely as emergency medical vehicles is an unanswered question throughout the nation (13), certain instances conceivably may arise in which helicopters may be forced to function as ambulances in the metropolitan Atlanta area. Presently heliports exist at Northside Hospital and Grady Memorial Hospital. However, the heliport at Northside Hospital is surrounded by light poles (and the accompanying wires) which are used to light the parking lot, and the heliport is impossible to use if needed. It is recommended that the heliport at Northside Hospital be closed, and that the heliport at Grady Memorial Hospital be more fully developed. The functional development of a heliport at Grady Memorial Hospital will make the metropolitan Atlanta EMS resources much more accessible to the outlying areas of Georgia.

**Military Aid**

**Military Aid to Safety and Traffic (MAST)**

The MAST program was designed to provide military helicopters and personnel to assist civilian communities in the evacuation of accident victims and, when necessary, to transfer civilian patients from small hospitals in remote areas to larger, full-facility hospitals (9). At present, only Army Aero-medical and Air Force Aerospace Rescue and Recovery Units are involved. Although MAST programs may be implemented soon in Columbus, Georgia, Savannah, Georgia, and Columbia, South Carolina, no unit of the Army or Air Force which qualifies as a potential MAST site is located within 100 miles of the City of Atlanta.* It seems reasonable to assume, therefore, that MAST is not to be available to metropolitan Atlanta, at the present time. Furthermore, based on various communications with DOD officials and other persons, additional MAST programs may not be implemented

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*Personal conversation between Oren L. Reinbolt, HSRC, and Major Ellingson, 3rd Army Surgeons Office, Atlanta, Georgia on July 10, 1972.*
at previously selected sites, although the exact reasons for this are not clear at this time.

Other Military Aid

Although no formal agreement exists, the EMS system may potentially receive assistance, as has happened in the past, from Detachment 145 of the U. S. Army Reserve located at Dobbins Air Force Base.* Although the detachment is under the control of the 3rd Army Headquarters at Ft. McPherson, a total of eight Huie and one U3A helicopters are located at Dobbins. Six of the aircraft are equipped as MEDIVAC units, each of which can carry up to six litter patients plus four crew members. Alternative configurations of litters in the helicopters are available such that two litter patients may be effectively treated by attendants simultaneously. Thirty pilots are qualified to fly the MEDIVAC helicopters, most of whom flew similar vehicles in tight quarters in Viet Nam. The mission of the detachment is a training mission only, but the unit provides active air ambulance service for a yearly two week summer camp in Tennessee. Generally, the personnel involved seem willing to work out a volunteer arrangement to provide air ambulance service to metropolitan Atlanta, although perhaps on week-ends only. A similar system is currently operational in Columbus, Ohio using Air National Guard personnel.**

COST OF MANPOWER, VEHICLES, AND EQUIPMENT FOR THE TRANSPORTATION SUBSYSTEM (1,5,7,12)***

Medical Aid Vehicles

Medical aid vehicles are provided by the police and fire departments in the seven counties, and are therefore assumed to be free of

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* Personal interview between Oren L. Reinbolt, HSRC, and Mr. Allen Pope, who is in an administrative position for the detachment, on November 9, 1972.

** Personal interview between Oren L. Reinbolt, HSRC, and Chief Donald E. Werner, Columbus Fire Department, Columbus, Ohio, on September 5, 1972.

*** Numbers in parenthesis refer to references at the end of this chapter.
charge. Equipment carried by the MAVs, although limited, has a definable cost and is estimated to be $40.00 per MAV.

**Ambulances**

Although ambulances and ambulance equipment are two distinct expenses, most bids by ambulance manufacturers include equipment as part of the bid price. The price can be determined separately, however, and may be estimated as:

1) Vehicle $12,500
   Specified equipment 4,000
   **SUBTOTAL** $16,500

   Defibrillator 2,500
   **TOTAL INVESTMENT** $19,000

Various defibrillator prices range from $900 to $3,500, but the estimate presented here represents a standard item.

**Mobile Intensive Care Units**

The mobile intensive care units must contain all equipment carried by standard ambulances, more specialized equipment, and telemetry. The price may be expected to be:

   Fully equipped ambulance $19,000
   Special equipment 2,500
   Telemetry transmitter 2,500
   **TOTAL INVESTMENT** $24,000

**Manpower Cost**

Based on computations shown in Table 6.5, the manpower required to staff 34 ambulances for two shifts, 29 ambulances for one shift, and three MICUs for three shifts is as shown in Table 5.9.

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* Recent bids for comparably equipped ambulances in a fleet of ten for Jacksonville, Florida, ranged from $15,000 to $19,500.

** Less mobile radios which are included in Chapter 8.
TABLE 5.9 Annual Cost of Manpower Required to Staff EMS Vehicles.

<table>
<thead>
<tr>
<th>POSITION</th>
<th>NO. PERSONNEL REQUIRED</th>
<th>SALARY/YR</th>
<th>COST</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>AMBULANCE PERSONNEL</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EMT-A1</td>
<td>153</td>
<td>$7,500</td>
<td>$1,147,500</td>
</tr>
<tr>
<td>EMT-A3</td>
<td>153</td>
<td>$9,000</td>
<td>1,377,000</td>
</tr>
<tr>
<td><strong>TOTAL, AMBULANCE PERSONNEL</strong></td>
<td></td>
<td></td>
<td>$2,524,500</td>
</tr>
<tr>
<td><strong>MICU PERSONNEL</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EMT-A2</td>
<td>28</td>
<td>$8,000</td>
<td>$224,000</td>
</tr>
<tr>
<td>EMT-A4</td>
<td>14</td>
<td>$10,000</td>
<td>140,000</td>
</tr>
<tr>
<td><strong>TOTAL, MICU PERSONNEL</strong></td>
<td></td>
<td></td>
<td>$364,000</td>
</tr>
<tr>
<td><strong>TOTAL, ALL PERSONNEL</strong></td>
<td></td>
<td></td>
<td>$2,888,500</td>
</tr>
</tbody>
</table>

**Total Vehicle and Equipment Cost**

Based upon the preceding sections, the total operating cost for manpower, vehicles, and equipment may be estimated. The figures are presented with the following assumptions:

1) Thirty-four ambulances are in operation, 16 hours per day.
2) Twenty-nine ambulances are in operation, eight hours per day.
3) Three MICUs are in operation, 24 hours per day.
4) All EMS ambulance and MICU personnel work 40 hours per week.
5) EMTs receive an equivalent of 29 days each in fringe benefits.
6) All operating ambulances are staffed by two men at all times.
7) All MICUs are staffed by three men at all times.
8) Vehicle maintenance, gas, and oil, averages $3,000 per vehicle per year.
9) Eight vehicles are required as back-up for the transportation subsystem.
10) Ambulances have a three year life, equipment has a four year life.
<table>
<thead>
<tr>
<th>TABLE 5.10</th>
<th>Total Manpower, Vehicle, and Equipment Cost of the Metropolitan Atlanta EMS Transportation Subsystem, Not Including MAVs.</th>
</tr>
</thead>
<tbody>
<tr>
<td>I. Capital Investment</td>
<td></td>
</tr>
<tr>
<td>A. Ambulance, complete</td>
<td>42 @ $ 19,000</td>
</tr>
<tr>
<td>B. MICU, complete</td>
<td>3 @  $ 24,000</td>
</tr>
<tr>
<td>TOTAL</td>
<td></td>
</tr>
</tbody>
</table>

| II. Annual Operating Costs |                                                                                                                  |
| A. Ambulance              |                                                                                                                  |
| 1) Depreciation           | 42 @  $ 5,667 | $ 238,014 |
| 2) Personnel Salaries     |                                                                                                                  |
| 3) Gas, Oil, Maintenance  | 42 @  $ 3,000  | 126,000    |
| TOTAL ANNUAL OPERATING COST FOR AMBULANCES |                                                                                                                  |

| B. MICU                   |                                                                                                                  |
| 1) Depreciation           | 3 @  $ 7,000 | $ 21,000 |
| 2) Personnel Salaries     |                                                                                                                  |
| 3) Gas, Oil, Maintenance  | 3 @  $ 3,000  | 9,000     |
| TOTAL ANNUAL OPERATING COST FOR MICUs |                                                                                                                  |
| TOTAL ANNUAL OPERATING COST FOR THE TRANSPORTATION SUBSYSTEM OF THE EMS SYSTEM | $3,282,514 |

The preceding table must be considered with caution; the amounts presented are reasonable but are estimates based upon the assumptions given. Of course, metropolitan Atlanta presently contains more ambulances than are needed for emergency service. The exact number of these vehicles which satisfy the recommended standards is not known nor is it known how many of the ambulance services will wish to operate within a coordinated EMS system as described in the present document. The possibility exists that no new ambulances will need to be purchased and
certainly not 34. Then the capital investment amounts in Table 5.10 may not represent immediately needed cash outlay. Nevertheless, the depreciation charges for existing vehicles of ambulance services which participate in the EMS system are proper elements of system cost just as depreciation charges for new ambulances would be.

The number of vehicles supplied by private contractors has a direct influence upon the actual values in the table. Although the personnel are needed as shown in Table 5.9, the required personnel, will not be completely available until 1976 as shown in Table 6.6. Tables 5.9 and 5.10, however, do provide insight into the overall system cost. From Table 5.10, the cost of ambulance service per operating vehicle may be estimated, which may be useful in determining private contract rates or dividing costs between counties. The ambulance cost per operating vehicle is:

\[
\begin{align*}
\text{Annual Operating Cost Per Ambulance (34)} &= \$84,956 \\
\text{Annual Operating Cost Per MICU (3)} &= \$131,333
\end{align*}
\]

**FUTURE ANALYSES**

As mentioned previously in this chapter, recommendations for numbers of vehicles, locations of vehicles, types of equipment and other aspects of the transportation and equipment subsystem of the EMS system are the best judgment of the HSRC Research Staff based upon the analyses presented within this chapter and best available data. As implementation occurs, and additional data are gathered concerning the special problems and considerations unique to metropolitan Atlanta, adjustments can be made to the recommendations presented herein in order to achieve better EMS system performance. Chapter 9 deals with evaluation of the EMS system and presents specific details of the procedures for collecting and analyzing the data. Specific attention should be paid to actual response times of each vehicle, utilization of each vehicle, demand for emergency service, and the number of emergency transfers performed. The EMS Coordinating Agency must assume the responsibility for coordinating needed adjustments to the system so that the performance criteria are met.
In addition, as more data are gathered concerning EMS in metropolitan Atlanta, consideration should be given to the feasibility and cost/benefit of incorporating disaster vans and helicopters into the EMS system. It is expected that more detailed analyses of both disaster vans and helicopters will be available in the future from sources currently operating pilot and demonstration projects.

REFERENCES


12. Thompson, Kenneth, *Emergency Medical Services DeKalb County/Atlanta Metropolitan Region* (for GRMP), Atlanta, Georgia, 1972.

CHAPTER 6
TRAINING OF EMS SYSTEM PERSONNEL

INTRODUCTION

"The most important step yet to be accomplished in the drive to upgrade emergency medical services is the formation of a standard program of education of the highest quality for ambulance attendants (emergency medical technicians) (8, p.20). This chapter presents a discussion of emergency medical services (EMS) system training which includes a state of the art review and a description of present training in the metropolitan Atlanta area. An analysis to identify present EMS training inadequacies and recommendations for a comprehensive program of education for EMS personnel are included.

The text of this chapter contains terminology that has been recently introduced to the health care environment and, even more recently, to the lay public. Unfamiliar and potentially confusing terminology is thoroughly defined, when necessary, throughout the chapter. Legislation throughout the United States, which has significantly influenced the education of EMS personnel, is discussed prior to the presentation of descriptive or analytical data.

SUMMARY OF TRAINING RECOMMENDATIONS

Description of Recommendations

The recommendations of this chapter bring training of EMS personnel to the state of the art and provide for the development of mechanisms which provide for perpetual review of the quality of emergency medical care skills in the metropolitan Atlanta area. Included in the recommendations are:

1. Recommendations for the development of four levels of training for ambulance personnel.
2. A schedule for training development and procurement.
4. Suggested training objectives for dispatch, fire, police, and emergency department personnel.
5. Comments regarding career and financial incentives.
6. A discussion of the responsibility for providing training.

**Scope of Recommendations**

Emergency medical care may be provided either by members of the medical profession or by the first lay person to discover a need for the provision of care. Training of the general public and the need for physician and nurse specialists in emergency care is beyond the scope of this chapter. Emphasis is placed on the transportation component of the system due to the significance of ambulances as an interface between the occurrence of an emergency medical situation and receipt of hospital care. Training for dispatch personnel, police, fire, and emergency room personnel is included to the extent that personnel of these auxiliary systems interact with the personnel of the transportation subsystem.

**Support for Recommendations**

The training recommendations in this chapter, by necessity, depart radically from the present training in the metropolitan Atlanta area. Reasonable concern regarding the legality of a few recommendations warrants a discussion of the support available to allow for implementation of the recommendations. The Manpower and Training Subcommittee of the EMS Task Force of the Atlanta Regional Commission (see Appendix D) has kindly reviewed the recommendations and provided valuable comment throughout the training analysis.

Prominent physicians and providers of emergency medical service in the metropolitan Atlanta area, the State of Georgia, and throughout the United States have been consulted, have provided assistance, and documented their support of the training recommended in this chapter.
(see Appendix 0). The staff of the Emergency Health Unit of the Division of Physical Health of the Georgia Department of Human Resources has documented an opinion which states that the skills of defibrillation and drug administration, including intravenous fluids, performed by emergency medical technicians (as defined and recommended in this chapter), "...are essential to the success of this program."

TRAINING STANDARDS AND REGULATIONS

National Standards and Regulations

Federal regulations requiring training for EMS ambulance personnel do not exist. However, the U. S. Senate Subcommittee on Health is actively concerned over the absence of regulatory legislation, and attempts are being made towards assisting State governments to create EMS legislation.** Federal standards, however, are available. Highway Safety Program Standards require state highway safety programs to provide, as a minimum, training, licensing, and related requirements (12, p.21).

The American Medical Association, American Hospital Association, American Heart Association, American Red Cross, and other national organizations have demonstrated an interest in EMS personnel training. At the national level, the most significant contribution to emergency medical care has been the development of a training text and a registry for ambulance personnel who have demonstrated proficiency in certain skills. The text and registry are discussed in a separate section, entitled "Emergency Medical Technician Training", of the present chapter.

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* Memorandum to E. S. Osborne, Jr., M. D., Acting Director, Division of Physical Health, from W. A. Fountain, Chief, Emergency Health Unit, Georgia Department of Human Resources, dated December 21, 1972.

** Personal interview between Mark S. Blum, HSRC, and Mr. Neil Chayet, Attorney at Law, consultant to the U. S. Senate Subcommittee on Health, on February 2, 1973.
State Standards and Regulations

Regulatory state legislation, where it exists, usually requires first aid training at the Standard or Advanced level of the American Red Cross training. Some states, as of November 1971, require emergency medical technician (EMT) training as set forth in standards promulgated by the U. S. Department of Transportation (DOT). This EMT-DOT training is included in the requirements of Chapter 88-31 of the "Georgia Health Code," effective as of January 1, 1973 (9). EMT training is thoroughly described in the following section of the present chapter.

Chapter 88-31 of the "Georgia Health Code" is known as the Ambulance Service Act of 1970. This law requires that ambulance services be licensed, and further, that ambulance attendants must complete a standard American Red Cross Advanced First Aid course or equivalent prior to employment. In addition, ambulance attendants must complete the basic Department of Transportation course, mentioned above, or an equivalent. The Ambulance Service Act is clearly a benefit to the citizens of Georgia.

The Ambulance Service Act is not enforceable as of February 1973 and will not be enforceable until the regulations, derived from the Act, have been adopted. The regulations (see appendix P) should be adopted before July 1973. This delay and other delays built into the Act represent the most significant weaknesses of the Act, with respect to the metropolitan Atlanta area. The weaknesses are outlined below*:

a) Ambulance attendants, employed prior to January 1, 1973, are not required to have any training, of any kind, until September 1, 1973.

b) Minimal training standards promulgated by national authorities on Emergency Medical Services will not be required for these ambulance attendants until September 1, 1975.

* Weaknesses are presented as they appeared in "A Resolution" adopted by the EMS Task Force at the October 17, 1972 EMS Task Force Meeting.
c) Although there is a requirement that "not less than two persons" man an ambulance during transport of an emergency patient, only one of these is required to be an "ambulance attendant". No qualifications whatsoever have been imposed on the second person - not even ambulance driver training.

d) The ambulance attendant is not required to be in the patient compartment during transport of an emergency patient.

e) Most of the ambulance apparatus (supplies and equipment) which "shall be on each vehicle being used as an ambulance" can not be used properly by untrained persons. On some items, ambulance attendants are not required to have such training until as late as September 1, 1975.

f) Provisional licenses, to be issued on a conditional basis, have the effect of allowing the Department to waive part or all of the requirements for ambulance apparatus for up to one year, and to waive part or all of the training requirements for ambulance attendants for up to two years.

g) There are no specific provisions for regulating the size, shape and configuration of vehicles used to transport emergency patients.

EMERGENCY MEDICAL TECHNICIAN TRAINING

The term emergency medical technician, frequently abbreviated EMT, is used throughout this chapter, as a synonym for ambulance attendant. An EMT has responsibility for patient care, whereas a "driver" does not.

The term EMT is often used as an abbreviated version of the title "Emergency Medical Technician - Ambulance (EMT-A)," but the two titles, EMT and EMT-A, should not be used synonymously. The concepts and recommendations associated with EMT-A training were documented by the Department of Transportation in 1971 as a result of growing national concern (15).
The reference textbook for EMT-A training programs was published by the American Academy of Orthopaedic Surgeons in 1971 (2).

EMT-A Training

The EMT-A training, often referred to as the DOT EMT program or training (as in Chapter 88-31 of the "Georgia Health Code"), has as its objectives:

a) To teach students the overall role and responsibilities of the emergency medical technician in performing emergency care and operational aspects of his job.

b) To develop student skill in diagnosis and all emergency treatment procedures short of those rendered by physicians or by paramedical personnel under the direct supervision of a physician.

c) To develop student skill in the use of and care for all equipment required to accomplish his job (16, p.2).

The basic DOT program requires 71 hours of didactic and practical skill training, ten hours of in-hospital observation, and final written testing and practical evaluation of skills. Lessons include life threatening emergencies, injuries, common medical emergencies, childbirth and problems of child patients, lifting and moving patients, environmental emergencies, extrication from automobiles, and operational aspects of the EMT's job (16, p.2).

In the metropolitan Atlanta area, an expanded version of the DOT EMT course is offered at DeKalb Area Technical School.* The course requires 110 hours to complete and includes ten hours of clinical experience, defensive driving (not emergency vehicle driving), and the examination for the national Registry of Emergency Medical Technicians - Ambulance, in addition to DOT recommendations.** The course outline for the DeKalb Tech EMT training program is provided in Appendix Q.

* DeKalb Area Technical School hereinafter referred to as DeKalb Tech.

** The Defensive Driving Course was developed as a part of the National Safety Council Driver Improvement Program.
Registry of Emergency Medical Technicians - Ambulance

National Registry

The formation of a registry for ambulance attendants was initiated by the Committee on Acute Medicine of the American Society of Anesthesiologists in May, 1968 (8, p.78). The Registry of Emergency Medical Technicians - Ambulance was established on June 4, 1970 at the American Medical Association headquarters in Chicago, Illinois. A registered EMT-A must have a prescribed minimum of experience, must be at least 18 years of age, and must have successfully completed a DOT EMT program or equivalent.

In addition to the Registry of Emergency Medical Technicians - Ambulance, which is located in Ohio, a second national registry exists in Sarasota, Florida. The Florida registry is sponsored by the American Ambulance and Rescue Association (AARA). The AARA registry is totally independent of the Columbus registry and does not require an evaluation of an applicant's practical skills. There is a possibility that one of the two registries will discontinue operation and direct effort and support to the remaining organization.*

State Registry

Many states are registering or certifying the competence of their EMT's. Not all require the DOT training program, and certification by a state agency does not automatically qualify an EMT for the National Registry for EMT-A's. On the other hand, most states will certify an EMT if the EMT holds a national certificate including the State of Georgia. The Georgia Department of Human Resources is responsible for the State Registry of Emergency Medical Technicians. General and special requirements for the registry in Georgia are listed on the following page:**


** Information contained in a letter from Richard M. Harden, Commissioner, Georgia Department of Human Resources, to Dan E. Sweat, Jr., Executive Director, Atlanta Regional Commission, dated January 11, 1973.

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General Requirements

1. Applicants must be at least eighteen years of age.

2. Applicants must submit a fully prepared, signed application.

3. Applicants must be able to give and receive written and verbal directions and instructions satisfactorily.

4. Applicants must be physically and mentally capable of performing the duties of an Emergency Medical Technician.

5. Applicants must possess a currently valid Georgia driver's license.

Special Requirements

1. Applicants must either satisfactorily complete a course of instruction approved by the Georgia Department of Human Resources or complete the examination for the National Registry with a passing grade on both the academic and practical sections.

2. Applicants must attend a defensive driving course offered or approved by the Georgia Safety Council if they are to drive ambulances in addition to their technician duties.

3. Applicants must attend a refresher training course every two years in order to remain on the registry.

STATE OF THE ART FOR AMBULANCE PERSONNEL TRAINING

The level of available EMS training and skill in the United States varies from no training to the procurement of Doctor of Medicine education and even beyond to cardiology and traumatology specialties. In terms of formal education programs, at a minimum level of training, the American Red Cross provides basic first aid instruction. There are various intermediate training levels including Advanced Red Cross First Aid, cardiopulmonary
resuscitation, Emergency Medical Technician (EMT) programs, and special more advanced programs designed by physicians and hospitals. According to the Ambulance Service Act the EMT in Georgia will be required to complete an EMT-A training program.

Definitions

Many of the more sophisticated EMT training programs place emphasis on the treatment of heart problems. The heart produces electrical potential that varies as the heart beats. An electrocardiograph or ECG machine is attached to the patient through wires to measure this electric potential. The machine will display the rhythm of the heart onto an electric screen (cardioscope) or onto a paper tape or strip (electrocardiogram or rhythm strip). Telemetry transmits the electrocardiogram (ECG) to a remote point, such as a hospital.

An arrhythmia is an abnormal rhythm of the heart and the presence of arrhythmia can be observed on an ECG or an electrocardioscope. A cardiac arrest means the heart has arrested or stopped any effective pumping action. A common arrhythmia associated with cardiac arrest is known as ventricular fibrillation, and a defibrillation machine may be used in an attempt to correct this arrhythmia. Defibrillation is a technique which consists of applying an electric shock to the heart from a defibrillator.

The definitions presented thus far are designed for the reader with little knowledge of medical terminology and emergency medical care technique. The definitions are adequate for the purposes of this chapter. The definitions are far too general to be referred to as accurate with respect to an understanding of medical concept or electrical function and measurement of heart activity.

Intravenous Therapy for Shock

The DOT EMT-A training does not provide for the development of skill in the administration of intravenous fluid for the treatment of shock. The course provides an understanding of the principle of this
treatment, however, which suggests that application of the skill would be a logical expansion of the EMT-A training (2, p.76). This has proven to be the case in some municipal ambulance systems in the United States and is implied in the EMT-A job description published by the Department of Transportation, which states: "Administers drugs, including intravenous fluids, as directed by a physician" (13). It appears that most training of the venipuncture technique (puncture of a vein) is provided through hospitals, with courses including from eight to forty hours of clinical and didactic exposure.

**Coronary Care**

There are several experimental systems throughout the country in which ambulance personnel are trained to defibrillate and administer medication according to radioed instructions from a physician. The training programs associated with these systems deal primarily with the teaching of skills such as intramuscular, hypodermic, and intravenous injection; use of electrocardiographic equipment; and use of telemetry devices. The training required for EMT's in these systems does not necessarily include comprehensive instruction in arrhythmia recognition and decision making, since the physician retains diagnostic responsibility and performs the diagnostic function with the aid of telemetry (6).

Representative of a more sophisticated level of training is an EMS system in Oregon. Trained in electrocardiography and defibrillation, the ambulance crews perform on their own, without specific direction from a physician (14). In Columbus, Ohio, ambulance personnel are trained to defibrillate, and also to administer drugs under standing orders, without direct or indirect (radio telemetry) physician supervision*. The training for both of these systems was provided through hospital and academic resources in special programs designed by physicians.

* Personal interview between Oren L. Reinbolt, HSRC, and Chief Donald E. Werner, Columbus Fire Department, Columbus, Ohio, on September 5, 1972.
Advanced Programs for EMT Training

The most advanced programs for ambulance personnel (based on length and subject matter content) are described by the American Medical Association and the Department of Health, Education, and Welfare (HEW). The HEW program guidelines describe the advanced course as being medically oriented and designed to "... center on management of symptom complexes, rather than diagnosis of specific conditions." The course places emphasis on developing a greater proficiency of skills, especially life-saving care, through advanced study in the basic sciences and management of life-threatening problems (4).

The program designed by the American Medical Association (AMA) extends training to include an understanding of the principles of emergency care. This program is designed as a college curriculum with a recommended two years of study (5). Clinical experience in a hospital environment is included at a rate of eight hours per week. Both the HEW and AMA programs are designed for those seeking a career in ambulance services.

The most publicized training programs for ambulance personnel have been presented in the preceding text. A sample of the subject matter included in each type of program is presented in Table 6.1 on the following page.
TABLE 6.1 Training Program Description and Comparison of Selected EMT Curricula

NOTE: The technique and didactic/clinical description represents a sample of content, and is not an all inclusive list of subject matter presented in each program.

<table>
<thead>
<tr>
<th>Course Length (hours)</th>
<th>vital signs</th>
<th>technique/equipment</th>
<th>didactic/clinical</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Physician Participation</td>
<td>Blood Pressure</td>
<td>ECG</td>
</tr>
<tr>
<td>American Red Cross - Advanced First Aid</td>
<td>16</td>
<td>x x x x</td>
<td>x</td>
</tr>
<tr>
<td>Emergency Medical Technician-Ambulance</td>
<td>81</td>
<td>x x x x x</td>
<td>x x x x</td>
</tr>
<tr>
<td>Reference: Emergency Care and Transportation of the Sick and Injured, American Association of Orthopedic Surgeons, 1971</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Emergency Medical System, Jacksonville, Florida - Training Program (Telemetry)</td>
<td>210</td>
<td>x x x x x x x x x x x x x</td>
<td>x x x x x x x x x x x x x x x</td>
</tr>
<tr>
<td>Emergency Medical System, Portland, Oregon</td>
<td>156</td>
<td>x x x x x x x x x x x x x x</td>
<td>x x x x x x x x x x x x x</td>
</tr>
<tr>
<td>Emergency Medical Service Technician</td>
<td>*</td>
<td>x x x x x x x x x x x x x x</td>
<td>x x x x x x x x x x x x x x</td>
</tr>
</tbody>
</table>

* This recommended college program includes four semesters of study (65 semester hours).
An accurate assessment of the need to modify existing training programs for the proposed EMS system in the metropolitan Atlanta area is dependent upon identification of relevant training available in the existing system. Through several discussions with various emergency medical service providers in the area, a wide variety of training programs and resources have been identified. The basic characteristics of metropolitan Atlanta area training programs for ambulance personnel are expressed through a summary of four local training programs. The programs to be presented have been specifically designed for:

Grady Memorial Hospital
Metro Ambulance Service
DeKalb County Fire Department
Clayton County Fire Department

**Grady Memorial Hospital**

The training for ambulance personnel at Grady Memorial Hospital includes the EMT-A course offered at DeKalb Tech and special inservice training. Applicants for the ambulance service are required to have a high school education and to possess current certification in American Red Cross Standard First Aid.

The inservice training begins with a four hour orientation to Grady Memorial Hospital followed immediately by a four hour orientation to the ambulance, during which the trainee accompanies ambulance personnel as they perform routine duties. The following day, the trainee is assigned as an observer to one ambulance for an eight hour shift.

The second phase of inservice training includes five, eight hour training sessions within the hospital. The training and training objectives are outlined in Table 6.2.
TABLE 6.2  Grady Memorial Hospital Inservice Training Program for Ambulance Attendants.

<table>
<thead>
<tr>
<th>TRAINING</th>
<th>OBJECTIVE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Venipuncture</td>
<td>To develop skill in obtaining blood specimens from a vein, through observation and participation.</td>
</tr>
<tr>
<td>Childbirth</td>
<td>To observe and participate in normal childbirth; to develop skill in the technique.</td>
</tr>
<tr>
<td>Inhalation Therapy Techniques</td>
<td>To learn the techniques of airway management and ventilation, through applied technique in the operating room.</td>
</tr>
<tr>
<td>Surgical Emergency Clinic Exposure</td>
<td>To become familiar with, and psychologically adapt to the sight of, severe trauma. To learn bandaging and hemorrhage control technique.</td>
</tr>
<tr>
<td>Medical Emergency Clinic Exposure</td>
<td>To learn to recognize and develop skill in obtaining diagnostic information from vital signs.</td>
</tr>
</tbody>
</table>

Following the 40 hour program outlined above, the trainee is again assigned to the ambulance as an observer. After observing for one week (five, eight hour shifts), the trainee is evaluated by the supervisor and, subject to approval, is assigned full responsibility as an attendant.

Successful completion of the EMT-A training is not a mandatory prerequisite to the inservice program but is considered desirable. If the trainee has not completed the EMT-A training prior to the end of inservice training, full attendant responsibility may still be assigned. Attendants employed under these circumstances are required to complete the next available EMT-A training course offered in the metropolitan Atlanta area.
Metro Ambulance Service

Applicants for the position of ambulance attendant at Metro Ambulance Service (Metro) must have successfully completed the American Red Cross Standard and Advanced First Aid training or be enrolled in a Red Cross program to achieve these objectives. Immediately upon hire, trainees are instructed in cardiopulmonary resuscitation technique (CPR) by a staff instructor approved by the Georgia Heart Association. Cardiopulmonary (heart-lung) resuscitation provides the patient with air, through mouth to mouth artificial respiration, and blood circulation, via the application of closed chest heart massage or chest compression.

After receiving CPR training, the trainee may be sent to a three day program in emergency care presented by the American Academy of Orthopaedic Surgeons (AAOS). The AAOS program is by-passed if it is not available within a reasonable time and distance.

Metro trainees are then required to complete the EMT-A training offered at DeKalb Tech. In addition, trainees receive approximately 40 hours of instruction in acute coronary care presented through the Department of Continuing Education at Kennestone Hospital. The training includes:

- didactic instruction: 12 hours
- clinical instruction: 5 hours
- inservice review: 20 hours (approximately)
- testing: 3 hours (approximately)

**TOTAL: 40 hours**

The course provides training in the use of defibrillators, arrhythmia recognition, and use of the following drugs: Atropine, Lidocaine, Sodium Bicarbonate, and Talwin (for pain). Drugs are administered from pre-filled syringes obtained at Kennestone Hospital.

Metro ambulance personnel may, upon discovering a patient in cardiac arrest, defibrillate and administer Sodium Bicarbonate, without telemetry of ECG to a physician, if evidence indicates that
cardiac arrest has occurred very recently (within a few minutes)*.

**DeKalb County Fire Department**

The training program which has been designed for the fire service in DeKalb County includes the EMT-A course at DeKalb Technical School, and 40 hours of inservice instruction in medical terminology.

A unique feature of this fire department system is the proposed screening of EMT's to determine the need for refresher or additional training. The screening process would be periodically conducted by physicians from the county medical society.

**Clayton County Fire Department**

Fire department personnel in Clayton County receive emergency medical care training through a program provided by the Clayton General Hospital. The program prepares trainees to work in the hospital emergency department after they receive 80 hours of instruction in both medical and administrative procedures. The work performed in the emergency department provides the trainee with 100 hours of clinical experience and develops skill in the following areas:

- cardiopulmonary resuscitation
- care of spinal, head, and chest injuries
- emergency childbirth
- use of airways
- care of medical emergencies
- care for poisoning
- special care of: alcoholic, drug, and pediatric emergencies
- use of cardioscope and ECG techniques
- defibrillation (in the emergency department only, at this time)
- burn care
- use of intravenous fluid

* Telephone conversation between Mark S. Blum, HSRC, and Mr. Ed Pounds, President, Metro Ambulance Service, on January 24, 1973.
In addition to the skills mentioned above, medical terminology, the legal aspects of care, and emergency driving subjects are taught to the trainee.

Each man under this program is a member of the American Ambulance and Rescue Association, which has a national accreditation system, whereby members apply for the professional certificate in Emergency Medical Science. Upon attaining this certificate, a member is officially listed as a Registered Emergency Medical Technician.* The program is directed by the National Registry Commission for Emergency Medical Standards. This Clayton County program represents the only local source of EMT training which leads to registration outside of the DeKalb Area Technical School program.

Summary of Present Training in Metropolitan Atlanta

The four training programs presented above describe the present training available in metropolitan Atlanta, of a caliber at least equal to the EMT-A training. The availability of these skills to the citizen of the metropolitan Atlanta area is far less than would be expected. The DeKalb County Fire Department EMS system is not operational as of February 1973 but is due to be operational prior to July 1973, and the Clayton County Fire Department operates rescue vehicles, but does not provide ambulance service.

In a telephone survey of 24 hour emergency ambulance services, conducted by the Atlanta Regional Commission, it was found that only one service employed persons trained in the skill of defibrillation. Only 14 of the 40 ambulance services operating 24 hours per day employed EMT-A's, and of the 14 services employing EMT-A's, nine of the services employed less than five EMT-A's. At least 13 of the 24 hour emergency ambulance services did not have employees trained in CPR, and seven of the services did not have employees trained in Advanced Red Cross First Aid.

In the metropolitan Atlanta area today, there are at least two, 24 hour emergency ambulance services, who do not employ any persons

* Registration of EMT's in this program refers to the Florida registry as described previously in the present chapter.
with any formal training at all, and neither has plans to discontinue emergency service.* The Ambulance Service Act will not require these companies to obtain employees with any training until September 1, 1973.

Future Plans for Ambulance Personnel Training

The training program at Grady Memorial Hospital is presently being expanded to include instruction in defibrillation, and it is anticipated that training in the use of intravenous medication will be included in the near future. Medical opinion at the hospital has not been finalized with respect to the administration of cardiac drugs by ambulance personnel. The DeKalb County Fire Department, in conjunction with the DeKalb County Medical Society, is conducting a training program to teach advanced coronary care skills to firemen. The program includes defibrillation, arrhythmia recognition, and drug therapy.

Availability of Trained Ambulance Personnel in Metropolitan Atlanta

The data collected from the ARC telephone survey and HSRC Ambulance Survey Form (see Appendix F) indicate that 223 full-time and 137 part-time ambulance attendants are employed by the 40 ambulance services operating 24 hours per day. In addition, data obtained from the Georgia Department of Human Resources**, through the ARC, indicate that four EMT instructors and 95 EMT's reside within the metropolitan Atlanta area, and 32 EMT's reside in a county immediately adjacent to metropolitan Atlanta. Table 6.3 describes the availability of trained EMS personnel in metropolitan Atlanta. Only employed ambulance personnel are included.

The DeKalb County Fire Department employes 25 EMT's as of February 1973 and is planning to begin ambulance service before July, 1972.

* Data obtained from an ARC telephone survey of ambulance services, and HSRC Form No. 3. Results are summarized in Appendix F.

** Data obtained from Emergency Medical Services in the Metropolitan Atlanta Region, Volume II, February 1973, EMS Task Force, Appendix 6, page 2.
DeKalb Tech plans to graduate an additional 340 EMT-A's before July 1, 1973.*

**TABLE 6.3** Availability of Trained Ambulance Personnel in Metropolitan Atlanta.

<table>
<thead>
<tr>
<th>TRAINING CATEGORIES</th>
<th>NUMBER OF AMBULANCE PERSONNEL</th>
<th>PER CENT OF AMBULANCE PERSONNEL</th>
</tr>
</thead>
<tbody>
<tr>
<td>No formal training</td>
<td>91</td>
<td>25</td>
</tr>
<tr>
<td>Basic Red Cross First Aid</td>
<td>279</td>
<td>78</td>
</tr>
<tr>
<td>Standard Red Cross First Aid</td>
<td>257</td>
<td>71</td>
</tr>
<tr>
<td>Advanced Red Cross First Aid</td>
<td>201</td>
<td>56</td>
</tr>
<tr>
<td>Cardiopulmonary Resuscitation</td>
<td>161</td>
<td>45</td>
</tr>
<tr>
<td>Registered EMT</td>
<td>88</td>
<td>23</td>
</tr>
<tr>
<td>Intravenous Therapy</td>
<td>46</td>
<td>13</td>
</tr>
<tr>
<td>Defibrillation and Cardiac Drugs</td>
<td>34</td>
<td>9</td>
</tr>
<tr>
<td>Total Surveyed</td>
<td>360</td>
<td>-</td>
</tr>
</tbody>
</table>

**ANALYSIS AND RECOMMENDATIONS**

Comprehension of proposed training is facilitated by an explanation of the process through which recommendations are developed, and the manner in which the recommendations are presented. Training programs are recommended to provide the personnel of the EMS system with specific skills and knowledge. The first major analysis determines the skill required by the EMT in order to meet the needs of the victim of an injury or illness. A secondary analysis is performed to identify the skills required by the auxiliary personnel. Auxiliary personnel require skills to serve the citizens directly in metropolitan Atlanta and to interact effectively with...

* Telephone conversation between Mark S. Blum, HSRC, and Mr. Phil Petty, Coordinator, EMT Training, Georgia Department of Vocational Education, on February 22, 1973.
ambulance personnel. A summary of training recommendations is presented immediately following the analysis of required skills.

The second major analysis identifies the management needs of the EMS training subsystem including financial and advancement incentives and structural and organizational needs. The analysis includes auxiliary as well as EMT training needs and is followed by a summary of recommendations to achieve management and organizational goals.

A discussion of training recommendation implementation needs is presented separately. Necessary prerequisites to a successful implementation include a definition of responsibility for training, testing and certification requirements, preparation of course material, legal evaluation and appropriate action, and an assessment of the number of personnel to be trained. The final set of training recommendations are presented after the discussion of implementation needs. The recommendations include a schedule for implementation of training recommendations and a discussion of the responsibility for implementation.

ANALYSIS OF EMS SYSTEM TRAINING NEEDS

Ambulance Personnel Training Needs

The analysis, to determine required EMT skill, investigates the need for a particular medical skill and the training required to provide the skill to trainees. The analysis is limited to skills not required by the Ambulance Service Act of 1970.

Emergency Vehicle Driving

Although several training programs include a review of defensive driving or the principles of emergency driving, there are no training programs for emergency vehicle driving available to EMS personnel. The ambulance is an emergency vehicle, and the operator of an emergency vehicle should be adequately trained.

Intravenous Therapy

The lesson objectives for the EMT-A (DOT) training program require that the student develop a basic understanding of intravenous
therapy (16, p.5). This objective, included in the lesson pertaining to shock, implies that a need exists for development of intravenous (I.V.) therapy as an EMT skill. The text for the EMT-A (DOT) course, produced by the American Academy of Orthopaedic Surgeons (AAOS), establishes a need for proper treatment of shock. The AAOS text presents several noteworthy statements concerning shock, which are summarized below:

1. Shock may accompany many different emergency situations.
2. If the conditions causing shock are not arrested, death follows.
3. Any patient who exhibits any of the signs and symptoms of shock should be vigorously treated for shock as soon as the EMT arrives.
4. Begin intravenous infusion at once (for hemorrhagic shock).
5. Intravenous infusion is a common resuscitation measure that can easily be performed by an EMT.

Another reference which has served as a textbook for EMT-A (DOT) training programs, states that the treatment of shock takes priority over all other emergency care measures except for the correction of breathing problems, the re-establishment of circulation, and the control of profuse bleeding (10, p.114).

One of the first procedures required for definitive therapy in cardiac arrest, and a preventative measure for suspected heart attack victims, is the establishment of an intravenous route. The availability of a pathway to the bloodstream can save critical time for the physician who will need to administer life-saving drugs rapidly.

The information presented thus far establishes hemorrhagic shock as a medical problem for which I.V. therapy is clearly indicated as a necessary skill. The technique of venipuncture, the puncture of a vein, has been successfully taught to ambulance personnel in metropolitan Atlanta within eight hours.* A ten class-hour expansion of the EMT-A

* Grady Memorial Hospital ambulance training program, as described previously in the present chapter.
The training program at DeKalb Tech has been recommended as adequate by an EMT staff instructor at the school.*

In summary, the need for I.V. therapy as a treatment procedure for shock has been clearly established. The training should develop a thorough understanding of the venipuncture technique and a knowledge of the I.V. solutions applicable in common situations. Training should be comprehensive enough to allow use of I.V. therapy for shock in common situations without specific direction from physicians. EMT's should fully understand the limits of their responsibility and, in uncommon or uncertain situations, recognize the need for guidance from a physician as to which medication should be administered, if any.

Cardiac Defibrillation and Cardiac Drugs

The need for cardiac defibrillation and the use of cardiac drugs is established in Appendix DD. In summary, the discussion in Appendix DD describes the usual mechanism of sudden death in myocardial infarction as ventricular fibrillation. Cardiopulmonary resuscitation (CPR) may provide effective circulation and respiration to the victim en route to the hospital. However, as described in Appendix DD, the risks from CPR are greater than risks associated with defibrillation, successful defibrillation is not as likely after CPR, and the chance of recovery diminishes with delay in the provision of definitive therapy.

The American Heart Association states that early use of some cardiac drugs can not be overemphasized. Appendix DD also quotes one source which states: "AV block may be corrected by Atropine. The early administration of this drug to patients in their own homes may avert the need for more hazardous procedures later." The need for the skills of defibrillation and drug administration to be applied as soon as possible for appropriately diagnosed arrhythmia control or correction is clearly established in Appendix DD.

In a project sponsored by the Oregon State Board of Health, the feasibility of incorporating defibrillation without telemetry into an EMS system was demonstrated (14). The project has produced a suggested training program for ambulance attendants which contains:

- Didactic instruction: 16 hours
- Observation and tutoring in coronary care unit: 40 hours
- Animal Laboratory: 8 hours
- Observation and instruction by anesthesiologist: 4 hours
- Weekly two-hour drill, quizzes, examination: 16 hours

**TOTAL**: 84 hours

The Oregon program of instruction is designed to teach ambulance personnel to defibrillate patients based upon observation of loss of consciousness, respiratory arrest, absence of pulse, and signs of ventricular fibrillation on an oscilloscope.

The Oregon program was developed in 1969. Today, in 1973, programs have been proposed to provide advanced cardiac care skills to EMT's in less than 80 hours. One such advanced course, provided in Appendix R, includes instruction in defibrillation; the use of drugs including atropine, lidocaine, and narcotic analgesics; intravenous cannulation; and initiating intravenous fluids. This program requires 69 hours of instruction.* It must be noted that the program has not been officially endorsed by the National Academy of Sciences Subcommittee on Cardiac Emergencies at this time.

The exact syllabus of appropriate coronary care training programs for EMT's in metropolitan Atlanta remains an unknown. Various programs and program ideas are presented in Appendices R through T. Forty hour programs designed to teach skills to be used with telemetry, but providing standing orders for defibrillation and intravenous infusion of sodium bicarbonate for cardiac arrest, have been successful in the metropolitan Atlanta area.

* Correspondence from Don M. Benson, M. D., to Mark S. Blum, HSRC, dated November 17, 1972.
In Columbus, Ohio, a 64 hour training program teaches personnel of the "High Trauma Unit" to use drugs such as Lidocaine, Sodium Bicarbonate, Epinephrine, Atropine, Nitroglycerine, Isuprel, and Ringers Lactate. The system includes defibrillation and does not utilize telemetry.* In the Jacksonville, Florida EMS system, training for the use of cardiac drugs relies heavily upon continuing inservice education.

Advanced EMT Training

In 1970, a publication of the Department of Health, Education, and Welfare (HEW) described the ambulance attendant of the future as having the capability to carry out, independently or through voice communication with physicians, procedures such as "... the giving of medication by hypodermic or intravenous routes, transfusion, tracheotomy or cricothyreotomy, defibrillation, mechanical external cardiac compression, and control of hemorrhage" (3). In a second HEW publication, reprinted in March 1972, a comprehensive advanced training program for the EMT-A was presented with a 480 hour syllabus based upon information gathered from established pilot programs (4). Ambulance personnel in the Jacksonville, Florida EMS have enrolled in the evening division of Florida Junior College in a 60 semester hour Associate Arts degree program in Emergency Medical Technology, which is described in Appendix U.

All of the statements describing advanced EMT programs imply a need for advanced skills. Justification for advanced programs, which produce personnel described as the "new health professional" by the American Medical Association, can be discovered through a careful analysis of the community emergency health needs and skills presently provided by EMT training (5). Table 6.4 compares two of the skills mentioned in the 1970 HEW publication to the skills acquired by EMT's in present training.

* Personal interview between Oren L. Reinbolt, HSRC, and Chief Donald E. Werner, Columbus Fire Department, Columbus, Ohio, on September 5, 1972. The Columbus training program is presented in Appendix T.
### TABLE 6.4 Present vs. Proposed Skills for EMT's

<table>
<thead>
<tr>
<th>MEDICAL PROBLEM</th>
<th>RESULT</th>
<th>PRESENT SKILL</th>
<th>PROPOSED SKILL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tension Pneumothorax</td>
<td>death</td>
<td>prompt transporta-</td>
<td>decompression of tension pneumothorax (inserting a</td>
</tr>
<tr>
<td></td>
<td>rapidly</td>
<td>tion to hospital</td>
<td>hollow needle through the chest wall)</td>
</tr>
<tr>
<td>Airway Obstruction</td>
<td>death</td>
<td>transport as rapidly as possible; continue</td>
<td>tracheotomy or cricothyreotomy</td>
</tr>
<tr>
<td></td>
<td>rapidly</td>
<td>unremittingly in attempts to get air past the</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>foreign body or to dislodge it</td>
<td></td>
</tr>
</tbody>
</table>

Both of the emergency medical problems cited above can cause death within minutes. In the rural areas to be serviced by the Atlanta EMS, death resulting from these emergencies will probably occur, since hospitals are not quickly accessible. Tension pneumothorax results from trauma and consequently becomes a potential medical problem in automobile accidents. Fatal accidents in the metropolitan Atlanta area occur more frequently in rural areas. In 1970, 58% of the automobile fatalities which occurred in the metropolitan area occurred outside of Fulton County.*

Discussions which suggest that surgical procedures be performed by trained ambulance personnel are often viewed with a great deal of skepticism. For this reason it may be worthwhile to include a brief description of one such procedure. In response to the need for a skill

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* Included are Fulton, DeKalb, Cobb, Clayton, Gwinnett, and Douglas Counties. Figures were obtained from the Accident Reporting Section of the Georgia State Patrol. Automobile fatality figures were not obtained for Rockdale County.
to deal with airway obstruction, a cricothyrotomy has been suggested. The procedure, also referred to as a cricothyroidotomy, is discussed in *Emergency Medicine*, Vol. 2, February, 1970, pages 50-51 (7). Some noteworthy statements which provide valuable insight to the procedure are presented below:

1) Cricothyroidotomy is a quick, easy technique because there are no major blood vessels in the area, and the distance between the skin and the trachea is only four or five millimeters.

2) The procedure requires an incision approximately one and one-half centimeters long. The incision is made over a notch between the thyroid and cricoid cartilage, which is located by feeling the neck.

3) The entire operation usually takes less than a minute, and a person not familiar with surgery or surgical techniques can be trained to do a cricothyroidotomy.

Medical opinion regarding the propriety of ambulance attendants performing cricothyroidotomies and relieving tension pneumothorax is mixed. Some physicians support the concept and others do not. No alternatives have been suggested for the procedure to relieve tension pneumothorax, and it remains as an EMT responsibility recommended by the U. S. Department of Health, Education, and Welfare (HEW) as of March 1972 (4).

Endotracheal intubation, as an alternative to cricothyroidotomy, is recommended in the HEW Advanced Training Program for Emergency Medical Technicians - Ambulance. The procedure involves the insertion of a tube to the lungs through either the nose or mouth. Physicians associated with the Miami, Florida and Jacksonville, Florida EMS systems support the endotracheal procedure and emphasize that it will provide adequate ventilation in all but a few cases.* The fact remains, however,

* Personal interview between Mark S. Blum, HSRC, and Roy Baker, M. D., Chief Fire Surgeon, Jacksonville, Florida, and Eugene Nagel, M. D., Associate Professor, Department of Anesthesiology, University of Miami, on February 2, 1973.
that severe, unresolvable airway obstructions may require establishment of an airway below the obstruction. Insertion of a large bore needle, sometimes referred to as a needle tracheostomy, may be required as a last effort, directed by a physician, and the only alternative to brain damage or death.

Training Needs for Medical Aid Vehicle Personnel

The Medical Aid Vehicle (MAV) delivers manpower to the scene of an emergency to arrest shock-producing injury, prevent further injury, and provide resuscitative skills to the victim. Therefore, MAV personnel must be trained in the technique of hemorrhage control, first aid for shock, cardiopulmonary resuscitation, and diagnostic skills as appropriate. The MAV personnel must be trained to understand what they must not do to the patient, as well as what they may do. For example, extrication of a patient with a fractured spinal column, in order to elevate the legs as a first aid precaution against shock, would defeat the purpose of the MAV.

The need for additional medical skill for MAV personnel is not readily justifiable. Measurement of pulse, respiration, and blood pressure by MAV personnel could provide valuable information to ambulance personnel and further reduce the time spent by the ambulance on the scene. The ambulance is expected to arrive at the emergency scene less than five minutes after the MAV, however, and the MAV personnel may therefore not have time to apply additional technique to the patient.

Training Needs for Emergency Department Personnel

All emergency department (ED) personnel who normally interact with ambulance or dispatch and control center (DCC) personnel will require a knowledge of the procedures that have been created to control EMS system operation. In addition to the training needs outlined below, ED personnel will require an understanding of the tools used by the EMT. Successful interaction between ED and ambulance personnel may depend upon a mutual understanding of the responsibilities and skills possessed by both EMT's and ED personnel.
Professional Nursing

Emergency Department (ED) training for nursing personnel is not normally included in nursing school curriculum. The lack of ED training programs for nurses is presently a concern of the National Emergency Department Nurses Association. In metropolitan Atlanta, the need for ED nursing training has not been formally evaluated, and an evaluation of that need appears to be appropriate.

Emergency Department Technician

The emergency department technician (EDT) can be a valuable and economical resource to the ED. Emergency patients are often medically unstable. The availability of skilled personnel to monitor patients, obtain vital signs, and perform minor ED procedures appears worthy of further evaluation.

Dispatch and Control Center Personnel Training

Receiving Operators

The receiving operators (RO) at the dispatch and control center do not require a knowledge of medicine or medical technique, since all requests for service will receive an emergency response, and the triage officer will assist when medical knowledge is required. However, the RO is required to relay information to the dispatcher without error, and unfamiliar terms such as disease and drug nomenclature represent a potential source of delay. Training in medical terminology is required to minimize the delay associated with unfamiliar terms.

Knowledge of at least the numbers 1 through 10, in various foreign languages may be required by the RO. There are persons living within metropolitan Atlanta who do not speak English. DCC personnel must be prepared to obtain a telephone number, as minimum data for location identification processes, from citizens who cannot speak English.
Radio Dispatch Personnel Training Needs

The radio dispatch positions at the DCC receive information from the RO and require appropriate medical terminology training as described previously. In addition, dispatchers are required to converse with EMT's. Dispatchers may be requested to relay information regarding medical procedures and equipment to a hospital. Accurate relay of information is essential and substantiates the need to provide a knowledge of the nomenclature used by EMT's to the dispatchers. The procedures by which dispatchers coordinate resources will be learned during a period of on-the-job training.

TRAINING RECOMMENDATIONS

The analysis to determine the skills and knowledge required by various EMS system personnel produces several recommendations for training program objectives. The objectives are summarized in the following text.

EMT Training Recommendations

Emergency Vehicle Driving

Every EMT-A must receive training in the proper operation of an emergency vehicle. The training program should include practical experience. If appropriate programs do not exist in the metropolitan Atlanta area, emergency driving courses should be brought to metropolitan Atlanta.

Intravenous Therapy

Intravenous (I.V.) therapy has been established as an important procedure for the treatment of shock and other medical problems. Therefore, the technique of venipuncture should be included in the training of all EMT-A's. The speed with which hemorrhagic shock progresses suggests that the EMT-A should be instructed in the proper application of select intravenous fluids and further that the EMT-A should not be required to obtain physician supervision prior to the use of select I.V. fluids. The EMT-A should work under standing orders, possibly similar to the example
provided in Figure 6.1, and only if a physician is available for consultation should the need arise.

In any instance of shock due to external hemorrhage or trauma with suspected internal bleeding requiring immediate volume replacement:

1. Employ necessary immediate first aid measures; e.g., to control hemorrhage
2. Begin two intravenous routes with large bore catheters
3. Begin two liters Ringers in Lactate or two units Plasmonate
4. Contact HMC physician or transport patient immediately to appropriate medical facility

FIGURE 6.1 Routine Orders for the Use of I.V. by Paramedic Interns of the Seattle Fire Department.

Defibrillation

Available literature relevant to coronary care by ambulance personnel consistently emphasizes the need for highly motivated health personnel. In the Houston, Texas program of ambulance coronary care, the selection of personnel is described as one of the most important elements of the program (1). The first recommendation for coronary care training, if metropolitan Atlanta is to benefit from the experience of existing systems, is that candidates for training in the advanced skills must be carefully selected from the existing resource of EMT's.

A training program designed to provide selected EMT-A's with the knowledge and skill required to utilize the techniques of defibrillation should be developed. Data from previous experiments and existing EMS systems have established telemetry of ECG prior to
defibrillation to be an unnecessary delay, and telemetry should not be required as a prerequisite to defibrillation. The EMT-A, when trained to defibrillate, should do so under standing orders. Defibrillation should be performed with appropriate I.V. therapy, if deemed necessary. The EMT-A must have immediate access to a physician, via radio, should the need for consultation arise. Attempts to contact a physician should occur as soon as the EMT-A assisting with the procedure is free to do so.

Cardiac Drugs

The telemetry analysis in Appendix DD describes the desirability and occasional necessity for the use of cardiac drugs, in addition to defibrillation, for cardiac resuscitation. Appendix DD also describes the distinct advantages associated with acute drug therapy as a preventative coronary care measure. It is, therefore, recommended that selected EMT-A's be trained to assist a remotely located physician in the administration of cardiac drugs. The training program should provide the EMT-A with a knowledge of arrhythmia recognition and the appropriate use of common cardiac drugs. The experience of leading EMS systems suggests that EMT-A's may not safely assume responsibility for arrhythmia recognition without extensive practice. The responsibility for arrhythmia recognition and decision making must remain with a physician until appropriate expertise is acquired by the EMT-A. Consequently, telemetry is recommended as a training tool through which a physician may interpret the ECG and instruct the EMT-A.

Advanced Training

An advanced training program for drug therapy should be developed to provide EMT-A's with the knowledge and skill required to administer cardiac drugs without the use of telemetry, but under the radio supervision of a physician, as deemed necessary. The experience and design of other successful EMS system training programs suggests that the advanced program should rely heavily upon experience gained from coronary emergencies and from working under the radio supervision of a physician. Advanced skills, such as endotracheal intubation, as described in the Advanced
Training Program for Emergency Medical Technicians - Ambulance, published by the U. S. Department of Health, Education, and Welfare, should be included.* The guidelines included in the HEW Advanced Training Program are consistent with the objectives set forth in the preceding analysis.

Auxiliary Personnel Training Recommendations

MAV Personnel

Medical aid vehicle (MAV) personnel should be trained to identify and control hemorrhage and shock. In addition, MAV personnel must be trained to perform cardiopulmonary resuscitation and to assist ambulance personnel with suction, oxygen, and mechanical breathing apparatus and artificial airways. Lessons in moving and lifting patients, and for diagnostic evaluation of the patient to identify spinal or neck fractures should also be included.

Emergency Department Personnel

ED nurses should receive a thorough orientation to the ambulance and the equipment carried on ambulances. ED nurses also should be acquainted with the skills of the EMT-A. Emergency department technicians (EDT's) should be trained according to the needs of the hospital ED. The need for a regional EDT training program should be investigated.

Dispatch and Control Center Personnel

All dispatch and control center (DCC) personnel should receive training in medical terminology. Dispatchers at the DCC should receive training in terminology used by EMT's. Foreign language orientation ideally should be included as a part of DCC personnel training. The orientation to foreign language should be brief, but adequate to allow DCC personnel to use prepared phonetic aids, unassisted. Training in DCC procedure should be provided on the job, prior to the beginning of DCC operations.

* See Appendix FF.
TRAINING SYSTEM MANAGEMENT ANALYSIS

One noted authority on management indicates that opportunity for advancement is a key factor in "extreme" employee satisfaction, and that a lack of opportunity is a factor in "extreme" employee dissatisfaction (11). Ambulance personnel refine skills through routine work experience. The highly motivated and educated EMT's will be forced to seek advancement outside of the system unless advancement opportunity is present. Personnel leaving the system will take with them the highest level of experience, knowledge, and refined skill, and the most valuable resource in the EMS system will be lost.

Several prominent authorities, both locally and nationally, emphasize the need for appropriate salaries for EMT's charged with the responsibility of saving lives. The Task Force on Personnel and Education, at the Airlie Conference in 1969, concluded that, "Specialty training is essential for improving care and should provide advancement in stature and income" (8, p.22). The need for advancement opportunity and reasonable financial incentive is well documented in the Basic Training Program for Emergency Medical Technician - Ambulance Concepts and Recommendations, from which the following excerpt was taken:

"Needless to say, the low pay scale for ambulance personnel is a major factor contributing to today's problem. While training alone will not necessarily guarantee increased pay, it seems reasonable to assume that a career ladder developed around an effective training program will enhance emergency medical care and the professional status of ambulance personnel, thereby justifying increased pay scales and facilitating the recruitment and retention of qualified personnel" (15, p.4).

Management of the training program will be hampered unless the curriculum for the course is standardized. Trainees must receive recognition for training previously completed if the system is to minimize wasted time and effort. Police and fire personnel, and rescue personnel in particular,
may have a need to complete the EMT-A program, or even advanced training. Utilization of the basic training provided to auxiliary personnel, such as training for MAV service, will be most effective if the training is an identifiable segment of the EMT training program.

**RECOMMENDATIONS FOR A SYSTEM OF TRAINING**

The recommendations presented thus far are assembled into a training program which is summarized below.

**EMT Training Program**

The need for a career structure for EMT's, and the need to manage the EMT as an EMS system resource establishes a requirement for a structured system of training. The varying EMT skills produce three distinct levels of EMT training, and the requirement for a professional career position establishes a fourth level of training. Financial incentives for the EMT must be appropriate for each level of training as described below.

**EMT-A1**

Training for the EMT-A1 includes the EMT-A curriculum and didactic, practical, and clinical training required for I.V. therapy as recommended previously. The EMT-A1 represents the minimum required skill on the ambulance. It is recommended that proficiency in I.V. therapy be developed routinely as part of the EMT-A training program conducted at DeKalb Area Technical School.

**EMT-A2**

The EMT-A2 receives training in the technique of defibrillation and the administration of cardiac drugs. The EMT-A2 should be chosen from the EMT-A1 personnel in the system. Upon successfully completing the EMT-A2 program, the EMT should be capable of defibrillating without telemetry of ECG to a physician. The EMT-A2 must also be a competent assistant to the physician, capable of administering cardiac drugs on a telemetry-equipped vehicle or under professional supervision. The
increased responsibility of the EMT-A2 should be rewarded financially and by a change of stature or rank. EMT-A2 training should be an identifiable segment of the EMT-A3 program.

**EMT-A3**

The EMT-A3 should be trained beyond the level of EMT-A2 to administer cardiac drugs and perform advanced techniques such as endotracheal intubation under the radio supervision of a physician. The responsibility for ECG interpretation should rest with the EMT-A3, and telemetry of ECG should not be required for the treatment of a patient under the care of an EMT-A3. The EMT-A3 should receive financial compensation for increased responsibility, as well as a promotion in status. The EMT-A3 curriculum should be an identifiable segment of the EMT-A4 program.

**EMT-A4**

The EMT-A4 is the highest level of EMT professional in the EMS system. Carefully selected EMT-A1, EMT-A2, or EMT-A3 personnel should be provided with a mechanism for achieving an education in emergency medical technology, consistent with the guidelines established by the American Medical Association (5). Justification for a local program to provide an Associate Arts degree for EMT's is a function of the volume of EMT-A personnel seeking degree training. The program may be justifiable within the State of Georgia by the combined demand for degree level training from EMS systems throughout the State.

**Training Program for Auxiliary Personnel**

Training programs for auxiliary personnel in police and fire services and Emergency Department personnel should consist of identifiable segments of the EMT training program. Dispatch and Control Center (DCC) personnel will require special instruction which should be created from EMT training materials. Training for DCC personnel should be standardized to facilitate repetition of the course as required.
IMPLEMENTATION NEEDS

Successful implementation of the training programs recommended in this chapter depends upon the following:

1. The content of recommended training programs must be developed and responsibility for the development and administration of training programs must be assigned.
2. A mechanism for providing training and experience must be developed.
3. Procedures for uniform testing, certification of proficiency, and recertification must be developed.
4. Legal restrictions must be identified and eliminated if necessary.
5. The number of trained personnel required by the EMS system must be established, and appropriate training capacity must be made available.

Responsibility for Training Program Development

The responsibility for the development and administration of training programs for EMT's is presently divided among the Georgia Department of Human Resources, the Georgia Department of Education, the Office of Highway Safety, and, in metropolitan Atlanta, the DeKalb Area Technical School, and various State and county medical societies and associations.

Implementation of advanced training programs will require continued support from the Georgia Department of Human Resources, the Department of Education, and Area Vocational - Technical Schools. The development of the advanced training will require close coordination among area medical societies and the EMS Coordinating Agency. The medical societies must participate and provide guidance in the establishment of advanced training.

Responsibility for Training Program Administration

The administration of training programs will require a team approach, involving the agencies, departments, and societies mentioned above, and also, the hospitals of the metropolitan Atlanta area. The
recommended training requires significant clinical experience in coronary and intensive care, autopsy, and other areas of the hospital. The advanced training of allied health personnel may require participation of the University System, as well, for degree granting programs.

Training Mechanisms

EMT-A1 personnel should continue to receive training at DeKalb Tech. The EMT-A program at DeKalb Tech should be expanded to provide required instruction in intravenous therapy. The EMT-A1 must demonstrate competence prior to acceptance into an EMT-A2 program. Testing to evaluate EMT-A2 candidates should be conducted by appropriate authorities and recorded by the EMS Coordinating Agency. Collection of test results by the EMS Coordinating Agency will provide a central source of information which can be used to schedule recertification testing for EMT's.

EMT-A2 trainees must be stationed at a hospital based ambulance, so that clinical experience may be provided. A special purpose vehicle known as a mobile intensive care unit (MICU) will provide field experience. The MICU is discussed separately, following the EMT-A4 discussion. EMT-A3 training will require hospital and MICU experience as well.

The EMT-A4 trainee will require hospital experience and didactic instruction lasting approximately two years (5). A program at a local university is required if the citizens of metropolitan Atlanta are to utilize the skills of the EMT-A4 trainee.

The Mobile Intensive Care Unit

The mobile intensive care unit (MICU) exists primarily as a training resource, but stands ready to deliver professional emergency care skills to citizens of the metropolitan Atlanta area, twenty-four hours a day, seven days a week. The vehicle is completely described in Chapter 5, as a telemetry equipped ambulance containing supplies for on-the-scene intensive care.

The MICU is under the command of a highly qualified, professional, and experienced registered nurse or an EMT-A4. Two EMT-A2
trainees, upon successful completion of EMT-A2 training, are promoted to the level of EMT-A2 and remain on the MICU to complete advanced training. The MICU, with a staff of three EMT's (or 2 EMT's and a nurse), responds to all multi-casualty and cardiac or pulmonary emergencies, unless advanced skills are available on the scene (See Chapter 7). The citizens of metropolitan Atlanta receive comprehensive care from the MICU, and the MICU EMT-A2 receives the concentrated experience required to become an EMT-A3.

The EMT-A2 is, in fact, an EMT-A3 trainee. Instruction in the principles of advanced care is provided to the EMT-A2 during the assignment to a hospital based MICU. The EMT-A2, upon successful completion of this EMT-A3 training, is promoted and transferred to an ambulance. An EMT-A2 trainee replaces the graduate, and the cycle repeats. The advancement of EMT-A personnel is illustrated diagramatically in Figure 6.2. Eventually, EMT-A3 personnel may be reassigned to the MICU for refresher training.

Testing and Certification

Testing and certification of EMT-A's is described as a prerequisite to successful implementation of training recommendations, because personnel can not be allowed to advance or to treat the sick and injured until they have demonstrated an ability to do so. Testing materials should be developed by educators and physicians, and may be administered by the State or counties, and recorded by the EMS Coordinating Agency. Three testing programs are required: aptitude testing, proficiency testing, and testing to insure continuing proficiency on a periodic basis as a prerequisite to recertification. The recertification procedure is essential to quality control.
FIGURE 6.2 Illustration of EMT-A Advancement and Training Mechanisms.
Legal Restrictions

In Georgia, not all of the questions regarding advanced EMT-A skills have been answered. Physicians and attorneys have expressed widely differing opinions as to the liability associated with advanced EMT skills. The need for resolution of the question of legal ramifications associated with advanced EMT skills is emphasized herein. Enabling legislation, if necessary, must be developed prior to implementation of the plan. The successful resolution of these questions in other states, however, can serve as a guide in Georgia and in the metropolitan Atlanta area. One example of enabling legislation, a law that has been modified to protect EMT's, is presented in Appendix CC. The Georgia Good Samaritan Law does not protect EMT's who receive a fee for service and additional legislation may be required.*

Manpower Requirements

Two trained EMT's are required, per shift, for each ambulance. Although one EMT will be required to drive the vehicle, the patient must be stabilized prior to transportation, if possible, and two EMT's are required for nearly all emergency care procedures. Effective cardiopulmonary resuscitation during transportation requires one driver and two EMT's. The third EMT is available in the MICU, which, as described in Chapter 7, will respond if necessary.

The relationship between delay and death requires the advanced skills of an EMT-A3 on every vehicle in addition to an EMT-A1. One EMT-A4 and two EMT-A2's are required on each MICU. The total staff should vary throughout the day, according to demand, to minimize cost. Thirty-four ambulances and three MICU's are planned for two eight hour shifts, and 29 ambulances and three MICU's are scheduled for one eight hour shift (See Chapter 5). The required staff is described in Table 6.5. The size of the staff varies from 9.45 per ambulance to approximately 6.6 per ambulance if EMT's work a 40 hour week or a 56 hour week respectively. Allowances are approximate and may vary considerably among ambulance service providers.

* The Georgia Good Samaritan Law is presented in Appendix Y.
TABLE 6.5 Required Staff for EMS Transportation Subsystem Based Upon 40 Hour Per Week Employment.*

<table>
<thead>
<tr>
<th>SKILL LEVEL</th>
<th>SHIFT</th>
<th>TOTAL BY SKILL LEVEL</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>DAY</td>
<td>EVENING</td>
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<tr>
<td>EMT-A1</td>
<td>47.6</td>
<td>47.6</td>
</tr>
<tr>
<td>EMT-A2 (MICU)</td>
<td>8.4</td>
<td>8.4</td>
</tr>
<tr>
<td>EMT-A3</td>
<td>47.6</td>
<td>47.6</td>
</tr>
<tr>
<td>EMT-A4 (MICU)**</td>
<td>4.2</td>
<td>4.2</td>
</tr>
<tr>
<td>TOTAL BY SHIFT</td>
<td>107.8</td>
<td>107.8</td>
</tr>
</tbody>
</table>

SICK ALLOWANCE AT 12 DAYS/FTE/YEAR 16.1
VACATION ALLOWANCE AT 10 DAYS/FTE/YEAR 13.4
HOLIDAY ALLOWANCE AT 7 DAYS/FTE/YEAR 9.4
GRAND TOTAL 348.3

IMPLEMENTATION SCHEDULE

The implementation schedule presented below is valuable as a methodology for establishing an accurate schedule, once training programs have been established. The implementation schedule presented is an estimate and is based upon several assumptions which are listed below:

1) Training is available five days per week.
2) I.V. therapy lessons are provided to 79 presently employed EMT-A's at the rate of 25 EMT's per week, beginning on May 1, 1973.
3) The remaining 221 EMT-A's (EMT-A4 not included) required by the system will be trained in I.V. therapy and EMT (DOT) skills by July 1, 1973.

* Staff figures are expressed in Full Time Equivalent (FTE) personnel.

** Initially EMT-A4's will be replaced by highly qualified Registered Nurses.
4) EMT-A2 training will require 40 hours and is provided to 28 EMT-A1's at a time (approximately nine students per MICU).

5) EMT-A3 training will require 25 weeks and is provided to 28 EMT-A2's at a time (approximately nine students per MICU).

6) RN's are available for MICU supervision immediately, and may be replaced as EMT-A4's become available.


The training schedule is presented in tabular form in Table 6.6. Although training for the system will not be complete until July, 1976, the availability of the MICU will provide the citizens of the metropolitan Atlanta area with comprehensive skills immediately.

**TABLE 6.6 EMT-A Training Schedule for EMS System.**

<table>
<thead>
<tr>
<th>SKILL</th>
<th>AS OF DATE</th>
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<td>LEVEL</td>
<td>5/1/73</td>
</tr>
<tr>
<td>-------</td>
<td>------------</td>
</tr>
<tr>
<td>EMT-A1</td>
<td>0</td>
</tr>
<tr>
<td>EMT-A2</td>
<td>34</td>
</tr>
<tr>
<td>EMT-A3</td>
<td>0</td>
</tr>
</tbody>
</table>

**TOTAL PERSONNEL TRAINED, BY SKILL**
REFERENCES

CHAPTER 6

1. Ambulance Division, Houston Fire Department, Houston, Texas, February 1972.


INTRODUCTION

Dispatch and control of emergency medical services (EMS) resources is a complex management process which determines exactly how the EMS system will behave in a given set of circumstances. In this chapter, the mechanisms and resources responsible for the dispatch and control function of the EMS system for metropolitan Atlanta are defined. The operating characteristics of existing dispatch and control subsystems in metropolitan Atlanta are presented briefly and evaluated. Details of the dispatch and control subsystem in the proposed EMS system are presented and serve to describe the operating characteristics of the entire system.

THE DISPATCH AND CONTROL FUNCTION

The dispatch and control function of the EMS system consists of four basic activities: receipt of information, analysis of information, synthesis of management command, and control of resources and information. The control of resources and information is an ongoing activity, whereas receipt and analysis of information and synthesis of management command are sequentially dependent upon each other as illustrated in Figure 7.1.

![Diagram of Dispatch and Control Activities]

FIGURE 7.1 Dispatch and Control Activities.

The component of the dispatch and control subsystem responsible for the receipt of information is referred to as the entry component. A report
of a medical emergency would be relayed to the analysis activity through the entry component. Analysis of information and synthesis of management command represent two additional activities that would, for example, determine the most appropriate resources to respond to an emergency and subsequently direct the response to begin via a communications system.

The fourth activity of dispatch and control coordinates resources for the entire EMS system, through the use of pre-established procedures. Analogous to the memory in a living system, these procedures, coupled with entry component data, provide the information from which management commands are synthesized. The control procedures describe exactly how the EMS system will react to information received via the entry component.

EXISTING METROPOLITAN ATLANTA AREA EMS DISPATCH AND CONTROL SYSTEM

General Overview

At the present time, the EMS system in the metropolitan Atlanta area is composed of several smaller, relatively independent EMS systems, each having a dispatch and control subsystem of its own. In addition to many functionally complete EMS systems, several independent EMS components are found in the metropolitan Atlanta area. Telephone company operators, physicians, hospitals, and fire and police services often perform the EMS entry activity by receiving and relaying information. Occasionally, these components will analyze and command as well by determining which EMS resource will respond. A symbolic and simplified illustration of the existing dispatch and control system in the metropolitan Atlanta area is provided in Figure 7.2.
Specific System Examples

A discussion of each EMS dispatch and control subsystem or component in the metropolitan Atlanta area would be neither practical nor useful due to the large number of systems existing today. The existing subsystems and components which are presently involved in dispatch and control are listed in Table 7.1 with a number indicating the approximate quantity of each.

The dispatch and control (D/C) subsystem examples to be discussed have been chosen to describe the variations in dispatch and control in the metropolitan Atlanta area. Although police and fire departments play a major role in the receipt and distribution of incoming EMS data and provide rescue and first aid assistance in some cases, these municipal services are not discussed. Police and fire departments do not routinely control the patient transportation or advanced medical care EMS resources and therefore do not perform all of the dispatch and control activities necessary to an EMS system.
Grady Memorial Hospital

Grady Memorial Hospital receives the majority of requests for emergency medical care in the metropolitan Atlanta area. The analysis activity of dispatch and control is not complex and consists primarily of five basic determinations:

1) Is the location of the emergency beyond the service capability of the Grady Ambulance Service?
2) Is a Grady Ambulance available?
3) Is the response to be an emergency (use of warning devices on vehicle)?
4) Is a Grady Ambulance available in the field as opposed to an available Grady Ambulance located at Grady Memorial Hospital?

* Data obtained from the Emergency Medical Services Task Force of the Atlanta Regional Commission.
5) If a Grady Ambulance is available in the field, is it closer to the location of the emergency than a Grady Ambulance located at Grady Memorial Hospital?

The analysis of incoming data at the Grady Ambulance Service may become more complex at times but usually results in the synthesis of a command to dispatch a Grady Ambulance from the hospital. The ambulances are completely controlled by the dispatch and control sub-system, and the status of the manpower, vehicles, and emergency department (ED) resources at Grady Memorial Hospital is maintained.

Metro Ambulance Service

Metro Ambulance Service (Metro) is the second largest provider of emergency ambulance service in the metropolitan Atlanta area and consequently, maintains the second busiest dispatch and control subsystem. The entry component of the dispatch and control subsystem of Metro differs from the Grady Memorial Hospital subsystem, in that two entry points (telephone numbers) exist, one telephone number serving Cobb County and one telephone number serving Fulton County. The calling party presumably enters the Metro system in the region that is closest to the emergency scene.

The analysis activity of Metro's dispatch and control subsystem is slightly more complex than that of the Grady Ambulance Service due to varying resource capabilities. Decision making with respect to resource assignment is dependent upon location, as at Grady, but any available medical data and the mechanism of injury also influence the synthesis of dispatch command.

The control activity of the Metro D/C subsystem includes manpower, vehicle, and hospital status information as in the Grady Ambulance Service D/C subsystem. Medical resources, such as physicians and nurses available in hospitals to interpret telemetered electrocardiograms (ECG's) and radio traffic including telemetered ECG waveforms on telemetry radio frequencies, are also coordinated. These medical resources
and telemetry communication elements represent an additional dimension of the dispatch and control process.

Small Service Dispatch and Control Subsystems

The majority of remaining ambulance service providers in the metropolitan Atlanta area utilize a very simple dispatch and control subsystem. The entry usually occurs through a telephone and, occasionally, information describing an emergency is obtained through a radio receiver tuned to a local police department. The analysis activity consists of the decision to respond or not to respond. Control of resource status through a radio or telephone device is usually limited to "available" or "unavailable" information.

The DeKalb County Fire Department System

Although the EMS system of the DeKalb County Fire Department is not operational as of February 1973, the concepts and basic procedures for operation of the system have been defined. The dispatch and control subsystem of the proposed DeKalb County EMS system represents the most complex D/C subsystem discussed thus far. The entry component of the DeKalb County EMS system will be designed to receive all DeKalb County EMS system data. Analysis of incoming data will include location, mechanism of injury, and medical data decision rules as in the Metro system. However, the dispatch and control function will control more than one fixed ambulance location thereby expanding the analysis process.

The control activity of the DeKalb County EMS system will be similar in scope to the Metro system differing only in magnitude of use. The control and use of fire combat resources to provide emergency medical assistance to the ambulance resources, if implemented, will add another dimension to the DeKalb County Fire Department EMS system D/C function.

DISPATCH AND CONTROL PERFORMANCE OBJECTIVES

The proposed EMS dispatch and control subsystem must satisfy certain performance objectives if the EMS system is to perform in an acceptable
manner. The present D/C subsystems may be evaluated against these same objectives to determine how they should be changed if any changes are necessary. The performance objectives are established by analyzing the citizen's EMS needs as they relate to the dispatch and control function.

**Entry Activity Objectives**

The D/C entry activity has three primary objectives related to the receipt of information. The entry component must be rapid, accurate, and thorough. An entry component can not be confusing to those who use it nor can it be difficult to access (locate, or reach). These necessary attributes of the EMS entry activity are expressed as objectives which state that the EMS entry component must:

1) Receive information and relay information to the dispatch and control analysis as rapidly as is necessary.
2) Transfer information from the citizen to the analysis activity without error.
3) Obtain all of the information required by the analysis activity.
4) Be designed so that citizens can not become confused when attempting to enter the EMS system.
5) Be accessible to the citizen (easy to locate and close at hand).

The preceding objectives are determined through brief analysis. Further analysis of the entry activity yields additional objectives with life-saving potential. These objectives are presented below stating that the D/C entry component must also:

6) Minimize delay between detection and reporting of an emergency.
7) Minimize citizen error potential.
8) Provide first aid instruction to the citizen.

The last three entry objectives are subtle in nature but provide significant benefit to the EMS system if the objectives can be
achieved. The delay between detection and reporting of an emergency can be minimized by utilizing a telephone number that may be easily memorized. The delay may be reduced by posting emergency telephone numbers onto the telephone device to eliminate search and retrieval processes or the need to dial the operator.

The citizen's potential for error can be reduced if all emergency services have the ability to transfer data among each other. If the citizen reaches an inappropriate emergency service, the data can be transferred to the appropriate service. If the dispatch personnel in an EMS system question the citizen to be sure that the citizen has not inadvertently reached an inappropriate emergency service, the potential for failing to discover the citizen's error is minimized.

First aid instruction may be provided to the citizen reporting a medical emergency. The instruction may include suggestions for treatment such as direct pressure technique to control hemorrhage or preventative advice such as warning the citizen against cutting the umbilical cord of a newborn. This entry activity and others are discussed further in Appendix M.

Analysis Function and Management Command Function Objectives

Synthesis of management commands (the dispatch directive to resources) is achieved directly from analysis of information and application of control procedures. The synthesis of management commands is an activity which directly follows from the analysis activity and does not require a separate set of performance objectives. However, analysis of information obtained through the D/C entry component is a dispatch and control activity that is subject to evaluation and requires a set of performance objectives.

The analysis activity of dispatch and control must be rapid, accurate, and complete; that is, analysis must include all data relevant to the citizen's need and all resources at the disposal of the EMS system. The analysis activity can be accurate and thorough only if it proceeds in an orderly fashion. Finally, the analysis activity must result in management commands which utilize resources in a manner that provides acceptable
service with minimum resource utilization. Conversely, the EMS system must be managed such that available resources are maximized in preparation for the unpredictable EMS demand. In summary, the analysis activity of the dispatch and control subsystem must:

1) Be accomplished as rapidly as necessary (and possible).
2) Be performed without error.
3) Include an analysis of all EMS resources and input data obtained through the entry system, as appropriate.
4) Proceed in an orderly fashion.
5) Create management commands that minimize resource utilization while maintaining an acceptable level of service.

Control Procedure Objectives

The control procedures will influence entry, analysis, and command synthesis activities and, therefore, must be thorough with respect to the internal dispatch and control process. The procedures must thoroughly provide for the coordination needs of all EMS resources, including auxiliary police and fire services, hospitals, physicians, and so forth. The control procedures must be applicable to the routine and special demands of the environment and, therefore, must interface with disaster procedures of other systems, such as police, fire, and Civil Defense, if necessary. The mechanisms through which the procedures are used must be designed for rapid access in addition to accurate access.

It is important that common procedure related problems are avoided. Specifically, the procedures must be disseminated to all EMS components in a format that is easily understood. Finally, the procedures must be revised as necessary by the EMS Coordinating Agency and disseminated to all EMS resources without delay.

In summary, objectives relevant to control procedures state that the procedures must:

1) Be complete with respect to internal dispatch and control requirements.
2) Provide for interface with all EMS resources and auxiliary resources.

3) Provide for disaster situations as well as routine operations.

4) Utilize mechanisms conducive to rapid and accurate access of procedures.

5) Provide adequate dissemination of easily understood procedures to all affected EMS components.

6) Provide a mechanism for revision of control procedures as required.

PRESENT SYSTEM EVALUATION

The present EMS dispatch and control subsystem in the metropolitan Atlanta area is evaluated against the performance objectives in Table 7.2. It is important to emphasize that each of the individual dispatch and control subsystems of the numerous EMS systems are not evaluated. The existing dispatch and control subsystem of the total EMS system, which consists of many smaller EMS systems is evaluated in an aggregate manner.

The figures in Table 7.2 describe a subsystem that never or rarely achieves 69 per cent of the objectives. Four of the five objectives usually achieved relate to speed, after the consumer has entered the system, and accuracy. These objectives are usually achieved, because the EMS component is usually a simple service system as described previously.
TABLE 7.2 Evaluation of Present Dispatch and Control Subsystem.

<table>
<thead>
<tr>
<th>Performance Objectives:</th>
<th>Acceptable</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Dispatch and Control Systems</td>
<td>No</td>
<td>Rarely</td>
</tr>
<tr>
<td><strong>Entry System:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Receives and relays information rapidly</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Transfers information accurately</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Obtains adequate information</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reduces citizen confusion</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Easily accessible</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Minimizes delay from detection to report</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Minimizes citizen error potential</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Provides first aid instruction</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Analysis and Synthesis of Command</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rapid</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Accurate analysis</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Includes all EMS resources</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Proceeds in an orderly fashion</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Minimizes resource utilization</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Control System</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Complete for internal use</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Includes all EMS resources</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Provides for disaster</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Utilizes rapid/accurate mechanisms</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adequately disseminated</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Provides for adequate revision</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Per cent NO</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Per cent RARELY acceptable</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Per cent USUALLY acceptable</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Per cent YES</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
PROPOSED DISPATCH AND CONTROL SUBSYSTEM

The proposed D/C subsystem was developed through an analysis of the concepts inherent in resource management. The concept, utility, and inherent weaknesses of each subsystem design alternative are subjected to analysis. Hardware design specifications and associated costs are ignored to the extent possible. An elaboration of the entry component design analysis is presented in Appendix M in its entirety and serves to illustrate the detail of the analytical process.

Entry Activity

Entry Concept Definitions

There are two basic concepts of entry component design defined in this analysis, although modifications of these concepts produce many design alternatives. The basic concepts include single entry and multiple entry systems, which are illustrated in Figure 7.3.

![Figure 7.3 Single and Multiple Entry Design Alternatives.](image-url)
Single entry designs have a single point of entry, and multiple entry designs have more than one entry point. The entry point, in a telephone system, would consist of a telephone number. Emphasis is given to the fact that the entry component is an entity and, as illustrated in Figure 7.3 and for purposes of the immediate discussion, does not influence the dispatch analysis and control design except for the interface of the entry component with other components of the D/C subsystem.

**Entry Concept Analysis**

The first objective of this analysis is to determine whether single or multiple entry will best meet the needs of the citizen in the metropolitan Atlanta area. Single and multiple entry designs achieve, or have potential for achieving, several of the entry component performance objectives including:

- Receipt and relay of information.
- Transfer of information.
- Accessibility.
- First aid instruction.

In special situations, multiple entry can obtain adequate information where single entry may not. The situation occurs when a citizen gives an incomplete address. The multiple entry design permits extrapolation of the text of the citizen's conversation, and the fact that the citizen has attempted to reach a specific EMS system organization in order to accurately determine the location of the emergency. Extrapolation of multiple entry data usually occurs at the small community or county level EMS system. A control procedure requiring an immediate interrogation of the citizen to determine the community in which the emergency has occurred, will allow the single entry design to obtain adequate information and achieve this performance objective. Electronic solutions to the location identification problem are not available for EMS application at this time in metropolitan Atlanta (See Appendix M).

Multiple entry designs, by definition, create potential confusion for the citizen by allowing him to face a decision, at times of stress, regarding which of the multiple entry points he should use.
Confusion would be eliminated if the appropriate telephone number (entry point) was placed on every telephone in the metropolitan Atlanta area. Extensive campaigns to achieve this objective have not been successful elsewhere, however, apparently due to community apathy.* Furthermore, telephone company national advertising materials do not illustrate telephone numbers, and local telephone companies may not be able to assume responsibility for posting emergency numbers on local telephones.

Multiple entry designs are less desirable than single entry designs with respect to minimizing the delay between detection of an emergency and reporting the emergency. The delay usually results from:

1) Search for a telephone directory.
2) Retrieval of a telephone directory.
3) Search for the appropriate telephone number.
4) Interaction with a telephone company operator.
5) Any combination of items 1 through 4, above.

Memorization of the emergency telephone number is an effective solution to the delay problem. Single entry designs may not promote memorization of an emergency telephone number but do not inhibit memorization of a number. In multiple entry designs, the citizen may memorize the emergency telephone applicable to his residence, but the probability that a citizen will memorize several EMS entry numbers is low. Nearly 250,000 citizens in the metropolitan Atlanta area are employed outside of their county of residence, and would have incomplete protection with knowledge only of their home EMS telephone number (3). An effective method for posting an emergency telephone number onto all telephones would solve this multiple entry problem.

Analysis of the single and multiple entry potential for minimizing citizen error clearly indicates the advantages of single entry. The citizen frequently reports emergency medical problems to his physician or relative, relying on these intermediaries for advice. There exists some probability that intermediary persons will report the emergency

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* Personal interview between Oren L. Reinbolt, HSRC, and Captain John Waters, Director of Public Safety, Jacksonville, Florida, on December 7, 1972.
to the EMS resources serving the intermediary's region, and these EMS resources may not be appropriately located with respect to the scene of the emergency. The potential for this kind of consumer error is minimized with single entry.

The single entry design is superior to the multiple entry design for application in the metropolitan Atlanta area, since only the single entry design effectively achieves each of the performance objectives.

Single Entry Design Decisions

Single entry designs with more than one telephone number are often used to facilitate changes from multiple to single entry. Retention and rerouting of existing emergency numbers to the single entry point ensures service to citizens who inadvertently dial an obsolete number. In the metropolitan Atlanta area, however, the routine telephone traffic of various fire and police departments, approximately 55 funeral homes and ambulance services, and the switchboard traffic for Grady Memorial Hospital would prohibit practical implementation of this design.

The 911 telephone number is advertised nationally as the number to call for a police, fire, or medical emergency. Therefore, agreement should be reached among the 82 fire and police departments in the metropolitan Atlanta area prior to a 911 implementation for EMS. The delay incurred by citizens inadvertently dialing 911 for emergency fire or police services could result in serious consequences if 911 exists only as an EMS related device. The 911 concept is discussed in Appendix EE.

The use of telephone numbers posted onto telephones can eliminate telephone number retrieval processes that consume critical minutes. Utility companies, particularly Southern Bell, can reach most metropolitan Atlanta area residents with a monthly bill for services, and may provide a mechanism for delivering the emergency telephone sticker.

The accessibility of the entry system to the citizen on the street or the citizen traveling limited access highways remains to be evaluated. Regardless of the outcome of this future analysis,
it is recommended that one seven digit telephone number be the entry mechanism to the metropolitan Atlanta EMS system.

Analysis and Dispatch Command Activities

Analysis and Command Concept Definitions

The analysis and command concepts to be analyzed for EMS include centralized and decentralized design alternatives. The analysis and dispatch command activities of the D/C function deal with the analysis of information acquired by the D/C entry component and synthesis of dispatch directives. The analysis and dispatch command activities can be performed in a centralized or decentralized manner as illustrated in Figure 7.4.

FIGURE 7.4 Centralized and Decentralized Dispatch Alternatives
Centralized Versus Decentralized System Analysis

There are several published documents that deal with the relative advantages and disadvantages of centralized versus decentralized management. Notable sources have described central dispatching as being of paramount importance with respect to communication, coordination, and resource management in an EMS system (4). A central dispatching function for the entire State of Georgia, however, probably would not be accepted as an optimum solution to the EMS needs of the metropolitan Atlanta area without careful analysis. A concepts analysis, utilizing the performance objectives set forth previously, is therefore a necessary prerequisite to a recommendation for the design of the analysis and dispatch command components of the D/C subsystem in the metropolitan Atlanta area EMS system.

Centralized and decentralized dispatch analysis and command designs have similar capacities for accuracy and orderly analysis of information. Centralized and decentralized dispatch analysis may be equally as rapid with the exception of situations in which resources from one region must be utilized by another. Decentralized designs experience delay in this situation. The delay is a function of resource monitoring capabilities and dispatch communications capabilities, and the nature of the delay is analyzed separately in following paragraphs. The need for interaction among regions in the metropolitan Atlanta area is examined at the county level.

There is a distinct probability that an ambulance assigned to a particular service area will be occupied and that the closest available ambulance will be located in an adjoining district. Table 7.3 describes, by county, the probability that the closest available ambulance will be in an adjoining district which may or may not be located in a different county. Approximately 200,000 persons live within one mile of a county boundary in the Atlanta, Georgia SMSA and are therefore subject to a significant probability that their EMS needs may have to be met by an ambulance responding from another county on occasion.*

* Standard Metropolitan Statistical Area (SMSA), as defined by the Bureau of Census, including Fulton, DeKalb, Gwinnett, Clayton, and Cobb County.
TABLE 7.3  Probability of Ambulance Response from an Adjoining District.

<table>
<thead>
<tr>
<th>County</th>
<th>Probability Range (per cent)*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fulton</td>
<td>7.5 - 30.1</td>
</tr>
<tr>
<td>DeKalb</td>
<td>14.0 - 49.0</td>
</tr>
<tr>
<td>Cobb</td>
<td>7.5 - 18.0</td>
</tr>
<tr>
<td>Gwinnett</td>
<td>9.5 - 17.0</td>
</tr>
<tr>
<td>Rockdale</td>
<td>10.9</td>
</tr>
<tr>
<td>Clayton</td>
<td>11.0 - 22.1</td>
</tr>
<tr>
<td>Douglas</td>
<td>1.8 - 15.0</td>
</tr>
</tbody>
</table>

NOTE: Data is obtained from Appendix K.

The delay incurred when a decentralized dispatch analysis component of one dispatching center requires resources assigned to another dispatching center may be reduced through effective resource status monitoring and communication. The delay can not be avoided completely. Several tasks must be performed after dispatch analysis has determined that the appropriate resource is controlled by another dispatching center. These tasks may include:

1) Determine procedure for communication.
2) Attempt communication.
3) Relay location information.
4) Determine availability of resource(s).
5) Relay medical information.
6) Relay route information.
7) Receive confirmation.
8) Wait for approval from other EMS dispatching center.

Decentralized dispatch analysis is severely hampered with respect to an accurate analysis of all EMS resources. The most effective response to a request for emergency service can only be determined with certainty after all resources have been considered. Several ambulances
or other vehicles capable of rendering medical aid may be traveling throughout the metropolitan Atlanta area either returning from a call or performing a low priority task. Failure to consider these resources, in addition to resources assigned to a particular dispatching center, may significantly reduce the effectiveness of the EMS system.

Dispatch analysis must include radio and hospital resource management. Hospitals with restricted emergency department (ED) or ICU and CCU capability must relay this information to each dispatching center. Conceivably, a hospital reporting one remaining ED bed could receive two patients in the decentralized system. That is, two different dispatching centers might each dispatch one patient to the hospital unaware of the decision made by the other dispatching center.

All emergency vehicles and hospitals must have one radio frequency in common to allow for disaster use and vehicle to hospital communication. Priorities for the use of this frequency can not be easily established in a decentralized system. Speed is critical when medical advice must be radioed to an ambulance. Communication among dispatch centers for the purpose of regulating the use of radio resources would not be in the best interest of the patient since delay is impossible to avoid in such circumstances. The alternative possibility of a multiplicity of radio frequencies for vehicle to hospital communications is clearly not an appropriate solution.

Thus far, the discussion has dealt with certain performance parameters of the dispatch analysis activity. Centralized dispatch analysis has no significant disadvantages with respect to the parameters, whereas decentralized dispatch analysis appears to have severe shortcomings. There are several additional criteria that remain to be discussed briefly.

Centralized and Decentralized System Analysis

In support of centralized dispatch, the following additional points are suggested as applicable:

1) An ambulance from region A, traveling in region B, should be controlled by the region B Dispatcher.
The region B Dispatcher does not have the control authority, may not have appropriate radio hardware, and may not be aware of the presence of the ambulance from region A, in a decentralized dispatch environment.

2) Connecting hardware that would be required to convey all of the resource information to each dispatch center, in a decentralized system, would be expensive.

3) Each hospital would be required to maintain communication with each dispatch center, a duplication of effort and equipment.

4) Personnel in one organization, including dispatchers and ambulance crew members, may resent having to control or having to be controlled by personnel of another organization, on a routine basis, as would be the case with decentralized dispatching.

The points mentioned above to support the centralized dispatch subsystem are not conclusive. In number 1, above, the region B dispatch could be given authority to dispatch ambulances from region A through formal agreements between the regions. Similarly, multifrequency radio hardware can be utilized in a decentralized dispatch system to allow each dispatch center to communicate with each ambulance. A telephone, radio, or teletype link could be used to advise the region B dispatch center of the presence or imminent presence of an ambulance from region A.

Communications links would be required among decentralized dispatching centers to retain the control ability inherent in one central dispatching facility. However, arguments stating that the cost of interconnecting communications links would be prohibitive may not be valid. The cost of hardware required for effective communications between a central dispatching center and ambulances traveling in distant areas of a large service area may offset the costs associated with interconnecting communications or reduce the difference in cost to a point where the argument is not significant.
The third point mentioned to support centralized dispatch states that hospitals would be required to communicate with many dispatch centers in a decentralized D/C subsystem. However, hospitals could communicate with one dispatch center which, in turn, would relay the message to the other dispatch centers. This solution is not necessarily the best solution to this communications problem but is a solution nevertheless.

The problems associated with decentralized dispatching have been cited to support centralized dispatching. These problems are shown to have solutions in the preceding paragraphs but, as mentioned in the fourth point above, the solutions may create inter-organizational and personnel problems, which can develop when personnel from one organization are passed to the control of another organization recurrently for short periods of time. These human factors may be significant but can be minimized, however, through the leadership of the affected organizations.

In support of decentralized dispatching, the following points are suggested as applicable:

1) Utilization of existing dispatch centers and personnel is good economy.
2) Dispatch authority may be stronger in existing organizations.
3) Implementation would occur sooner if existing dispatch resources were used.
4) Dispatch personnel responsible for a particular area can dispatch quickly and may be able to synthesize complete location information from incomplete information due to their familiarity with an area.
5) In a decentralized system, different radio frequencies are used, and radio congestion and delay are minimized.
The points cited above to support decentralized dispatching are not conclusive. The first and third point may be used to support centralized dispatching as well as decentralized dispatching. A centralized dispatching facility can be located at an existing fire, police or other dispatching center, and as mentioned in the first point, utilization of existing dispatch centers would appear to be good economy. Although an existing dispatch center would require modification to allow for dispatching of ambulances in the entire seven county metropolitan Atlanta area, modifications to each dispatching center would be required to allow for integrated resource control in a decentralized D/C design.

In number 2 above, the argument that dispatch authority is stronger in existing agencies may be factual but assumes that existing agencies would not be involved in a central dispatching center. Dispatch authority may be delegated to a central dispatching center and a central dispatching or coordinating agency may include representation from all organizations to be coordinated or dispatched. This principle of representation is inherent in the design of the EMS Coordinating Agency described in Chapter 3.

The fourth point cites the speed advantages associated with the familiarity of a dispatcher with a particular area. Appropriate location identification aids, such as detailed maps, street listings, and even computers may provide a central dispatching center with similar speed advantages.* The advantages of decentralized location identification activity may be worthwhile, however, and can be included in a central dispatching center. These advantages can be achieved by having more than one person, within the centralized dispatching center, responsible for location analysis and by then assigning, to each of these individuals, primary responsibility for location analysis in a given sub-area of the metropolitan Atlanta area.

The final point cited in support of decentralized dispatching refers to the advantages of multifrequency communication.

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* Computerized dispatching has been used in New York City's EMS system but has been abandoned.
On the other hand, the present EMS communications subsystem in metropolitan Atlanta utilizes a multiplicity of frequencies and is seriously hampered due to the absence of a common frequency among the many EMS resources.* There are advantages inherent in the use of more than one frequency for radio communication, particularly as a solution to high utilization or congestion. However, multiple frequency communications can exist in a centralized D/C subsystem or a decentralized D/C subsystem and this point cannot, in fact, be cited to support either.

**CONCLUSIONS**

The advantages of both centralized and decentralized dispatch systems may be realized with a centralized dispatch analysis function, if:

1) The coordination of resources and synthesis of management command is centralized.

2) Primary responsibility for location identification in the sub-areas of metropolitan Atlanta is delegated among more than one location analyst, such that each of the location analysts has principal responsibility for (and therefore, it can be assumed, intimate familiarity with) his specific sub-area.

The resulting D/C subsystem would incorporate the advantages of a decentralized location identification activity into a centralized dispatch function. The recommended D/C subsystem utilizes personnel and supportive hardware which are collocated. Furthermore, cost is minimized through shared use of hardware, maximum interaction among dispatch personnel is achieved, and delays are minimized.

**SPECIFIC DISPATCH AND CONTROL PROCEDURES**

The dispatch and control procedures for the metropolitan Atlanta area EMS system constitute an important subset of the operational decision rules of the system. The procedures incorporate basic philosophy and concept, reducing these fundamentals to a document that can be used to

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* The present and recommended communications subsystems of the EMS system are described in Chapter 8.
regulate the activity of the system. If the emergency medical services system is to be effective, the system resources must be managed in a manner which insures accurate mobilization of appropriate resources within an acceptable period of time. This objective represents a goal which all dispatch and control procedures are designed to achieve.

Documentation of the dispatch and control procedure (DCP) analysis includes final conclusions, that is, the list of specific procedures, and a discussion of topics having special significance. The DCPs are presented in a sequence that corresponds closely to the manner in which they should be used.

**Discussion of Procedures of Special Significance**

Within the DCP listing are a few, previously undocumented, operating characteristics of the EMS system. These system characteristics are discussed briefly below in the order in which they appear in the DCPs. These topics are highlighted in the list of DCPs with a check mark (√).

The DCPs are designed to satisfy the management needs of a system of geographically dispersed ambulances as described in Chapter 5. Each ambulance is assigned to service a district defined by predetermined boundaries and is designated as the primary ambulance for that district. The ambulance assignments and district configurations are engineered to achieve a six minute average ambulance response time, that is, the elapsed time between dispatch of the ambulance and its arrival at the scene. It should be noted that two or more ambulances may be assigned to a district if the district's expected demand for service exceeds the service capacity of one ambulance.

If a primary ambulance is unable to respond to a request for service within its district, the closest available ambulance is dispatched usually from an adjoining district. For the purpose of this discussion, an ambulance that is dispatched to an emergency outside of its district is referred to as a secondary ambulance.

**Questionable Emergencies**

Every situation to which an EMS vehicle is directed to respond must be an emergency if the system is to effectively satisfy the
emergency medical needs of the community. Therefore, definition of an emergency is of paramount importance to the system. Emergencies have been defined in the DCPs, which in summary state that for doubtful situations a request for service will receive an emergency response.

The decision to assume that an emergency need exists in doubtful situations is consistent with the objectives of the EMS, since this procedure alone may save lives or reduce injury. Apparently minor injuries such as fractures or lacerations may be accompanied by shock, which can not be effectively diagnosed by the dispatcher. Failure to splint a simple fracture, which could be construed as a non-emergency, can result in permanent nerve and muscle damage. The experience of other emergency medical systems has shown that upon arriving to treat what has been reported to be a non-emergency, ambulance crews have discovered critical emergencies, such as pulmonary or cardiopulmonary arrest.

While emergency medical systems in cities such as Jacksonville and Seattle have substantiated the fact that a majority of calls are not emergencies, it is generally agreed that failure to assume that an emergency exists may cost a life. An emergency response to a non-emergency will consume little more than six minutes, on the average, since emergency vehicles will be available for a call immediately upon determining that emergency treatment is unnecessary.

Triage Officer

The triage officer is a medically skilled employee stationed at the receiving operator post in the dispatch center. The triage officer determines which requests for emergency service deserve priority and has proven to be an effective tool for reducing the number of unnecessary ambulance calls (2). The triage officer also provides first aid advice to citizens while trained personnel are responding to the scene. This advice may be simple but lifesaving, such as: instructing heart attack victims to remain seated; suggesting direct pressure technique for severe hemorrhage control to lay persons assisting victims of stabbings, accidents, and so forth; and advising lay persons not to cut the umbilical cord of a newborn infant.
The triage function is performed by Registered Nurses at the Communications Bureau of the New York City Emergency Medical Service. The need to utilize RN's as opposed to a lesser skill may require investigation if the most cost-effective design is to be implemented. However, legal ramifications associated with the use of a non-professional triage officer may warrant permanent use of RN's.

Medical Aid Vehicles

A medical aid vehicle (MAV) is defined in Chapter 5 as a police or fire vehicle that can respond to the scene of a medical emergency. The MAV should carry personnel having completed the training requirements recommended in Chapter 6 and the supplies necessary to arrest shock-producing injury and sustain respiration, as described in Chapter 5. MAVs will satisfy three critical needs of the EMS system which are:

1) The quickest possible system response to a medical emergency upon receipt of notification at the D/C subsystem.

2) Additional manpower required for cardiopulmonary resuscitation and patient movement.

3) Rapid response independent of ambulance delay or temporary ambulance unavailability.

If medical aid does not reach non-breathing patients within four to six minutes after pulmonary arrest occurs, resuscitation will rarely be effective (1). Since the average ambulance response time is six minutes and dispatch functions require additional time, ambulances will not (on the average) reach non-breathers quickly enough to prevent biological death. Police and fire vehicles, which are both numerous and geographically dispersed, can increase the probability that resuscitative aid will reach the non-breathing patient quickly enough to be effective.
Cardiopulmonary resuscitation (CPR) provides the patient with sixty heart compressions per minute approaching a normal pulse rate. Respiration is provided at a rate of eight breaths per minute with one rescuer, or twelve breaths per minute (a normal rate) with two rescuers applying CPR. Since a team of two people is required to move a patient on a stretcher, a team of four is desirable for moving patients receiving CPR, and no less than three people are required. Use of manpower from an MAV, as opposed to a second ambulance, enables the system to provide adequate care without further reducing the availability of EMS manpower and ambulances.

The third function of a medical aid vehicle involves stabilization of patients and control of shock-producing injuries such as severe hemorrhage. Although ambulances will also perform this function, they may become delayed due to uncontrollable factors such as traffic, or they may be responding from some distance due to the occasional unavailability of the closest, or primary, ambulance.

It is important to note that the MAV concept provides for utilization of existing manpower and vehicles and as such does not require a large expenditure of funds. Final implementation of the MAV concept may include both police and fire resources. Police and fire dispatchers should observe a specific radio procedure when announcing and assigning medical aid vehicle calls.

Mobile Intensive Care Unit

The mobile intensive care unit (MICU) is a vehicle that provides comprehensive skill and equipment to the victim of a critical emergency. The MICU control procedures are designed so that the MICU will not respond unless a high level of skill is required, and not available on a standard emergency ambulance at the scene of an emergency. Also, the training function of the MICU is enhanced by the relationship of MICU utilization to the need for highly trained personnel.

Available Ambulance in Quarters

The dispatch order for an ambulance in quarters is communicated twice for each assignment, first by radio and the second
dispatch over telephone lines. The radio dispatch is actually a query of all vehicles available out of quarters. Should one of these vehicles be close to the reported emergency, the crew will advise the dispatcher. The dispatcher may elect to dispatch the moving vehicle to the scene, in lieu of the original choice.

The telephone dispatch, as it is used in systems such as Baltimore and Jacksonville, allows more freedom of speech between the ambulance crew and the dispatcher. Detailed information about the patient, or the location, may be exchanged without utilizing radio transmission.

Radio installations would not be required at ambulance quarters in this system design. In case of disaster or loss of telephone lines, mobile radios could be utilized as communication back-up devices.

Ambulance Radio Codes

The ambulance radio codes are designed to reduce the time consumed by radio transmission and to facilitate rapid communication of information. Of primary importance is the utility of the radio codes with respect to rapid and accurate management of resource status information within the dispatch subsystem.

An informal survey of fire, police, and ambulance services in the Atlanta area indicates that "ten-codes" are popular among these services (Ten-codes are listed in Appendix N). Ten-codes, however, do not satisfy the status reporting needs of the EMS system, and the introduction of a modified version of these codes could produce significant confusion. The status reporting information needs of the EMS system ambulances are listed in Table 7.4, which also describes the most appropriate ten-code, the availability of the ambulance, and the radio code suggested for use in metropolitan Atlanta. The proposed codes are adaptable to hardware systems that facilitate rapid decision making.
TABLE 7.4 Ambulance Status Radio Codes.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>In Quarters</td>
<td>X</td>
<td></td>
<td>None</td>
<td>K1</td>
</tr>
<tr>
<td>Responding to Scene</td>
<td>X</td>
<td></td>
<td>None</td>
<td>K2</td>
</tr>
<tr>
<td>Arrived at the Scene</td>
<td>X</td>
<td>10-97</td>
<td>K3</td>
<td></td>
</tr>
<tr>
<td>Available at Scene</td>
<td>X</td>
<td></td>
<td>None</td>
<td>K30</td>
</tr>
<tr>
<td>Responding to Hospital</td>
<td>X</td>
<td></td>
<td>None</td>
<td>K4</td>
</tr>
<tr>
<td>Arrived at the Hospital</td>
<td>X</td>
<td></td>
<td>None</td>
<td>K5</td>
</tr>
<tr>
<td>Available at Hospital</td>
<td>X</td>
<td></td>
<td>None</td>
<td>K50</td>
</tr>
<tr>
<td>Returning to Quarters, Out of Home District</td>
<td>X</td>
<td></td>
<td>None</td>
<td>K6</td>
</tr>
<tr>
<td>Returning in Home District</td>
<td>X</td>
<td>10-98</td>
<td>K7</td>
<td></td>
</tr>
<tr>
<td>Returning Unavailable</td>
<td>X</td>
<td></td>
<td>None</td>
<td>K8</td>
</tr>
<tr>
<td>Out of Service</td>
<td>X</td>
<td>10-7</td>
<td>K9</td>
<td></td>
</tr>
<tr>
<td>In Service</td>
<td>X</td>
<td>10-8</td>
<td>K-Zero</td>
<td></td>
</tr>
</tbody>
</table>

All address data should be repeated to verify accuracy of radio reception. It is strongly recommended that the dispatcher end each transmission by stating the time, and that the time be used by the dispatcher in place of "10-4" as an indication of acknowledgement.** The use of time is illustrated in the following example:

Ambulance: "Squad Six, K4, Piedmont."
Dispatcher: "Squad Six, fourteen fifty-two."

* Ten-codes such as 10-7 (out of service) or 10-8 (in service) convey availability information to the dispatcher but status information is not available in coded form.

** Time should be expressed in twenty-four hour sequence, for example, 1:00 p.m. expressed as 1300 hours.
The use of time will facilitate accurate reporting by ambulances. Time should be recorded as the ambulance changes its status, so response, treatment, and other related service times can be measured and evaluated as described in Chapter 9.

Identification of an ambulance (three syllables) as a "Squad" (one syllable) is suggested, to further reduce transmission time.* The dispatcher (three syllables) should be referred to by a title with fewer syllables also. Although the word "base" has been commonly used to identify a stationary dispatcher in many systems, the existence of "base" hospital radios may give rise to some confusion. The titles "Control", and "Dispatch" represent two possible alternatives.

Disposition of Non-emergencies at the Scene

The DCP for resource control at the scene states: "If, upon examination, it is determined that a patient does not require transportation in an emergency vehicle, the patient will be treated at the scene but will not be transported. The Squad will report to the Dispatcher that it is available for call at the scene."

The primary objective of this procedure is to reduce the time that the EMS system devotes to non-emergency service. A second objective of the procedure is to discourage abuse of the EMS system. Requesters who dishonestly describe an emergency for the purpose of obtaining transportation to a hospital will find, that although an ambulance does respond, their request will be denied. The experience of the Jacksonville EMS system suggests that approximately one-half of all patients will not be transported. Although this procedure produced public criticism of the Jacksonville system, an audit conducted by the Jacksonville Board of Fire Surgeons concluded that the ambulance crews were correct, in their decisions not to transport, 96.5% of the time.

* The term "Squad" is used in the DCP listing, rather than the word "Ambulance."
Hospital Routing

Procedures for determining which hospital is to receive an ambulance patient, often place all of the responsibility for this decision with either the ambulance or the dispatcher. Both of these methods fail to utilize all of the information available for this decision making process and may create a demand for hospital transfers. The recommended hospital routing DCP for the Atlanta area EMS provides for a shared responsibility between the ambulance and the dispatcher.

The hospital routing DCP requires the ambulance personnel, when possible and appropriate, to obtain information such as patient or physician preferences, medical record location, and so forth, in addition to diagnostic data. The ambulance notifies the dispatcher of the decision, allowing the dispatcher to redirect the patient if the chosen hospital is inadequate, without available beds, or operating at full capacity in the Emergency Department and, when relevant, CCU, ICU, and operating suite.

DISPATCH AND CONTROL PROCEDURE LISTING*

I. Receiving a Request for Service
   A. Emergency Requests
      1. Public Telephone
         a. Receiving Operator will answer the telephone, "Emergency Service for what county?"
         b. Receiving Operator will obtain the following information:
            Nature of emergency
            Whether patient is conscious
            Location of emergency, including address, closest intersection, community, and county
            Need for ancillary equipment

* A draft of these procedures was reviewed at a meeting of the Dispatch and Control Subcommittee of the Emergency Medical Services Task Force of the Atlanta Regional Commission.
B. Other Requests

1. Requests for Transportation (Non-emergency)
   a. Receiving Operator will explain that service is restricted to emergencies.
   b. Persistent callers, or reporters of false alarms will be referred for appropriate action.
   c. Caller may be referred to appropriate pages of a telephone directory, for non-emergency ambulance service.

2. Questionable Emergencies
   a. All requests for an immediate response for an acute medical problem will receive an emergency response.
   b. If a telephone number has not been obtained, and the nature of the emergency is unknown, the response will be handled as an emergency.
c. Reporters of questionable emergencies may, at the discretion of the receiving operator, be referred to the Triage Officer.

d. The Triage Officer will discuss the medical problem with the caller, applying medical knowledge to ascertain the urgency of the call.

e. The Triage Officer may not refuse a request for emergency service.

C. First Aid Instruction

1. First aid instruction will be provided over the telephone, by the Triage Officer only, at the discretion of the Receiving Operator and the Triage Officer.

2. Instruction will be provided for:
   a. Childbirth (variable)
   b. Hemorrhage (direct pressure)
   c. Unusually high fever (ice)
   d. Impaled objects (not to be removed)
   e. Chemical burns of the eye (wash)
   f. Insulin shock (sugar)
   g. Poisoning (Poison Control will be contacted)
   h. Chest pain (Instruct to sit down)
   i. Difficulty breathing (variable)

D. Difficulty Obtaining Location*

1. Unknown County
   a. Receiving Operator will obtain a community name or a telephone number applicable to the patient location, if possible.
   b. Southern Bell will be asked to determine the exchange area if the emergency has been reported from a telephone located at the emergency scene, and the telephone number can not be relayed by the caller.

* Dispatchers interviewed in New York City state that citizens in need of medical assistance tend to give too much data rather than insufficient data concerning location descriptions. Procedures to insure that a technique for obtaining location data is available in difficult situations are included as a precaution.
c. Landmark questions, from a prepared list, will be used to obtain generalized location information, if necessary.

2. Unknown Street or Street Number
   a. Receiving Operator will obtain a telephone number applicable to the patient location, if possible, and determine the address from cross reference files.
   b. If telephone number information is not available, the caller will be questioned to determine the identity of neighbors, relatives, or other persons who might assist with the location process.
   c. Receiving Operator may request a Dispatcher to assist with location identification.

3. Unusual delay, due to location identification problems, will require a Medical Aid Vehicle response. The MAV will proceed to an area close to the emergency scene to await complete instruction.

E. Dissemination of Information to Dispatchers
   1. Minimum Response Calls
      a. Dispatcher will be advised of emergencies requiring minimum response as soon as the address and nature of the call have been ascertained.
      b. The Receiving Operator will obtain remaining data after the dispatcher has adequate information for analysis.
   2. Data obtained for a routine emergency are to be routed to the appropriate Dispatcher after the telephone interview is complete.
   3. First aid instruction must not delay dispatch of resources, but may continue after dispatch data have been routed to the appropriate Dispatcher.
II. Determining Appropriate Resources for Response

A. Squad

1. At least one Squad will be dispatched for all emergency medical calls.

2. Only one Squad will be dispatched initially unless additional vehicles are specifically requested by a reliable source.

3. Reliable sources shall include:
   a. Personnel affiliated with the EMS
   b. Police personnel
   c. Fire personnel
   d. Physicians
   e. Persons identifying themselves as members of professions related to those mentioned above.
   f. Persons reporting mass casualty or disaster situations

B. Medical Aid Vehicle (MAV)*

1. An MAV will be dispatched to insure an acceptable response time if:
   a. The Squad is expected to be delayed more than two minutes from dispatch time to beginning of travel.
   b. A secondary Squad is responding.

2. An MAV will be dispatched at the same time or prior to assigned Squads to insure minimum response time and provide additional manpower if any of the following medical problems are reported:
   a. Heart attack, chest pain, or cardiac arrest
   b. Pulmonary arrest, or severe dyspnea
   c. Unconsciousness
   d. Electrocution or drowning
   e. Shock, other than psychogenic (including anaphylaxis)

3. An MAV will be dispatched if requested by a Squad affiliated with the EMS.

* The MAV is requested from the appropriate police or fire department, via telephone line.
C. Mobile Intensive Care Unit (MICU)

1. An MICU will not respond unless a Squad has been dispatched.

2. An MICU will be dispatched if requested by a reliable source as defined in Section II, Part A.

3. An MICU will respond to all multiple casualty incidents reported by a reliable source as defined in Section II, Part A.

4. An MICU will respond to reports of cardiac emergency, in addition to the assigned Squad, if the Squad:
   a. carries a crew of two EMT-Al personnel, or
   b. carries an EMT-A2, without radio telemetry (as determined by communications check each shift).

D. Police Assistance

1. Police vehicles will be requested from the appropriate municipality in all cases of suspected crime, including:
   a. Suicide or attempted suicide
   b. Automobile related injury
   c. Drug related injury or symptoms

2. Police vehicles will be requested in any of the following situations:
   a. Emergency is reported by a suspected juvenile (to be determined by the EMS Receiving Operator).
   b. False alarm is suspected.
   c. Requester fails to provide telephone number and name.
   d. Emergency occurs in a previously designated high-risk area.

3. If requested by a Squad affiliated with the EMS system, police assistance will be obtained from the appropriate municipality.

E. Fire Department Assistance

1. Fire Department vehicles will be requested in all cases of suspected fire or explosion including reports of:

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* EMT-Al and EMT-A2 personnel are emergency medical technicians who have been trained to the first and second skill level as described in Chapter 6.
a. Burns by fire
b. Smoke inhalation

2. Fire Department will be notified in the following situations:
   a. Report of overturned vehicles
   b. Gasoline in the street
   c. Suicide or attempted suicide by natural gas asphyxiation

3. If requested by a Squad affiliated with the EMS system, the appropriate Fire Department will be notified.

F. Rescue Vehicles

1. Rescue vehicles will be requested from the appropriate municipal resources in cases of entrapment or other rescue situations.

2. Requests for rescue vehicles are not dependent upon a report from a reliable source as defined in Section II, Part A.*

III. Dispatch Procedures - Squad (or MICU)

✓ A. Squad Available in Quarters

1. The Dispatcher will preface the radio alert with a one second tone.

2. The Dispatcher will transmit the Squad number, location of the emergency, and the time at which the transmission takes place.

3. The Dispatcher will contact the Squad quarters via direct telephone line and provide details, to include:
   a. Specific location of emergency
   b. Description of emergency
   c. Number of patients
   d. Status of responding ancillary equipment, including MAV and MICU

* A request for rescue vehicles is not dependent upon a report from a reliable source due to the time-consuming nature of rescue operations, and the relative ease with which the need for rescue is ascertained by lay persons.
4. Squad personnel will record the address and time that the alert was received, and repeat the address back to the Dispatcher for verification.

5. Immediately upon beginning the response, the Squad personnel will notify the Dispatcher, who will reply by transmitting the time.

B. Available Squad out of Quarters

1. The Dispatcher will transmit to the Squad directly, giving the Squad number, preceded by a one second tone.

2. Squad personnel will transmit acknowledgement.

3. Upon receipt of acknowledgement, the Dispatcher will transmit the following information:
   a. Squad number
   b. Specific location of emergency
   c. Description of emergency
   d. Number of patients
   e. Status of responding ancillary equipment, including MAV and MICU.
   f. Exact time
   g. Report numbers*

4. Squad personnel will record the address and time, and transmit the address back to the Dispatcher.

5. If the address has been received correctly, the Dispatcher will transmit the time.

6. Immediately upon beginning the response, the Squad personnel will notify the Dispatcher, who will reply by transmitting the time.

C. Unsatisfactory Response Time

1. Failure to Acknowledge Alert
   a. If a Squad does not acknowledge the Dispatcher within one minute, a Medical Aid Vehicle will be requested, unless, due to the nature of the call, an MAV is already responding.

* A dispatch report number is assigned to each emergency call to facilitate collation of Dispatcher and Squad reports.
b. If the Squad does not acknowledge within a second period of one minute, a secondary Squad will be dispatched.

c. If the primary Squad acknowledges within the next two minutes, the secondary Squad will be canceled, and the primary Squad will be allowed to respond.

2. Failure to Reach Responding Status
   a. If a Squad, having acknowledged an alert, fails to report that it is responding within one minute of its last communication, an MAV will be requested, unless it has been previously dispatched.
   b. If the Squad does not report that it is responding within a second period of one minute, a secondary Squad will be dispatched.
   c. If the primary Squad reports that it is responding, within the next two minutes, the secondary Squad will be canceled, and the primary Squad will be allowed to respond.

D. Cancellations
   1. Calls may be canceled in any one of the following situations:
      a. Requester* may cancel a call at any time, unless crime is suspected.
      b. Squad personnel on the scene may cancel any additional equipment en route.
      c. Incidents involving unsatisfactory response time.
   2. The dispatcher will transmit notification that the call has been canceled along with the exact time to vehicles enroute to the scene.
   3. If a call is canceled before the Squad has begun its response, the dispatcher will notify the Squad when it reports its responding status.

* The identity of the requester must be verified to the satisfaction of the EMS Dispatcher.
IV. Resource Status Reporting

A. Squad (or MICU)
   1. Squads will report their status to the Dispatcher using the designated code.
   2. Squad status changes will be reported as they occur, and may include the following:

   STATUS
   a. In quarters
   b. Responding to the scene
   c. Arrived at the scene
   d. Available at scene
   e. Responding to hospital (specify which)
   f. Arrived at the hospital (specify which)
   g. Available at hospital (specify which)
   h. Returning to quarters, out of home district
   i. Returning in home district
   j. Returning unavailable
   k. Out of service (specify reason)
   l. In service

B. Ancillary Equipment
   1. Status reporting of MAV, fire, police, and rescue equipment will remain as a responsibility of the appropriate ancillary system.
   2. Special situations which will effect the use of ancillary resources by the EMS system should be reported to the EMS Dispatcher by the appropriate ancillary system dispatcher.

C. Hospitals
   1. Emergency Department Status
      a. Area emergency departments will notify the EMS Dispatcher if and when their ability to service patients becomes restricted.
      b. The Dispatcher will be advised as these restrictions occur, and will ask for the expected duration of the situation.
c. The Dispatcher will verify these situations at forty (40) minute intervals until the emergency department capacity is reported to be normal.

d. Significant emergency department status information will be reported to all Squad personnel, by the Dispatcher.

2. Inpatient Occupancy

a. Area admitting departments will advise the EMS Dispatcher if and when their ability to admit patients to the general hospital, CCU, ICU, or other specialty unit becomes restricted.*

b. The Dispatcher will be advised as these restrictions occur, and should be informed as bed availability varies, until restrictions are lifted.

c. The Dispatcher will verify admitting restrictions every four hours, until restrictions are lifted.

V. Resource Control

A. Squad Control

1. Initial Dispatch

a. The closest available Squad (to be predetermined for vehicles in quarters in a defined area) will be dispatched to an emergency.

b. Prior to dispatching an available Squad out of quarters, the Dispatcher will ascertain the vehicle's estimated time of arrival at the scene, to determine if the response time will be acceptable.

c. Dispatch of Squads to unfamiliar areas will be made at the discretion of the Dispatcher, after consultation with the Squad personnel, if necessary.

2. Response to the Scene

a. Warning devices will be used when responding, unless the situation indicates otherwise.

b. When more than one vehicle is responding, the Squad

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* Specialty units may include Pediatrics, Labor and Delivery Suite, Burn units, Detoxification units, and so forth.
shall control the scene, with the following exceptions:

MICU vehicles have control if they are present.
Rescue vehicles have control in rescue situations.
Fire vehicles have control if fire is involved.
Police vehicles have control if crime is involved.
c. Police escorts will not be requested unless escorting is restricted to cross street traffic control, or special traffic hazard situations, to be determined by the Squad personnel.

3. At the Scene
a. As quickly as possible, the Squad crew will evaluate the need for additional equipment and either request or cancel same.
b. Emergency patients who require Squad transportation to a hospital will be stabilized prior to removal.
c. If, upon examination, it is determined that a patient does not require transportation in an emergency vehicle, the patient will be treated at the scene, but will not be transported. The Squad will report to the Dispatcher that it is available for call at the scene. Reasons for not transporting will be recorded.

4. Hospital Routing
a. The Squad personnel will determine which hospital is to receive the patient, subject to approval from the Dispatcher.
b. The decision to transport to a specific hospital will be based upon:
   Diagnosis of the patient's injury or illness.
   Severity of symptoms
   Traffic conditions
   Patient medical record location
   Physician preference, if known
   Emergency department capacities
   Bed availability in hospitals
c. The Dispatcher will redirect the Squad if:
   The emergency department has reached capacity.
   Beds are unavailable.
   Diagnosis requires treatment at a different hospital.

d. The Dispatcher may request that a Squad re-route to a specific hospital, for reasons of traffic and resource control. Squad personnel may override requests of this type, if the patient's care is not compromised by the decision.

B. MICU Control
   1. Initial dispatch procedure for MICU is identical to Squad procedure.
   2. Response to the scene procedure for MICU is identical to Squad procedure.
   3. At the scene
      a. If treatment of the patient does not require an MICU, the MICU will advise the Dispatcher that it is available for call.
      b. If the patient requires the services of an MICU, the Squad on the scene will be released at the discretion of the MICU EMT-A4 or RN.
      c. If the MICU arrives prior to the Squad, the patient will be stabilized, and transferred to the Squad, when it arrives, unless:
         the patient requires the services of an MICU, or
         the patient may be jeopardized by the delay.
   4. The MICU EMT-A4 or RN will determine to which hospital an MICU patient is to be taken, subject to Dispatcher approval.

C. Communication Resources
   1. Requests for hospital-Squad communication will be made as follows:
      a. The Squad personnel will hail the Dispatcher.
      b. Upon acknowledgement, the Squad personnel will inform the Dispatcher of the diagnosis, and request
hospital communication, specifying the hospital.
c. The Dispatcher will advise the Squad to monitor the
ambulance-hospital frequency.
d. The Dispatcher will call the hospital, inform them
of the diagnosis, and the hospital will call the
Squad on the proper frequency.

2. When reporting en route to a hospital, Squad personnel
will request hospital notification if any of the
following conditions apply:
a. Transporting more than one patient.
b. En route under emergency conditions (warning
devices in use).
c. Patient appears to require admission as an inpatient.
d. Patient is six years of age, or less.
e. Patient is combative.
f. Patient is unconscious.

3. Hospitals will be notified via direct telephone line by
the Dispatcher, subject to the conditions set forth in
number 2, above, who will obtain the following informa-
tion from the Squad:
a. Reason for notification
b. Estimated time of arrival (ETA)
c. Provisional diagnosis
d. Patient's sex and approximate age
e. State of consciousness

D. Ancillary Services
Requests for ancillary services, such as police, fire, etc.
are controlled according to the procedures set forth
previously.

VI. Hospital Transfers
A. Upon receipt of a request to transfer a patient from one
hospital to another, the dispatcher will determine if an
emergency response to the hospital is necessary.
B. Prior to removal of the patient from the hospital, the Squad
personnel will obtain a written document describing the
treatment that the patient has received, and the reason for
the transfer.
C. The name of the hospital representative responsible for the transfer request will be entered on the Squad report.

D. If hospital personnel accompany the patient during the transfer, they will be returned to their point of origin by the EMS system vehicle, unless other means of transportation are available.

PROPOSED SYSTEM EVALUATION

The D/C subsystem of the present EMS system in metropolitan Atlanta is evaluated in Table 7.2. The proposed D/C subsystem is evaluated in Table 7.5. The proposed D/C subsystem achieves all performance objectives nearly all of the time. Failure to collect adequate location identification information is rare and technological developments in the near future should enable the D/C subsystem to achieve all performance objectives consistently.
TABLE 7.5 Evaluation of Proposed Dispatch and Control System.

<table>
<thead>
<tr>
<th>Performance Objectives:</th>
<th>Acceptable</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dispatch and Control Systems</td>
<td>No</td>
</tr>
<tr>
<td>Entry System:</td>
<td></td>
</tr>
<tr>
<td>Receives and relays information rapidly</td>
<td></td>
</tr>
<tr>
<td>Transfers information accurately</td>
<td></td>
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<tr>
<td>Obtains adequate information</td>
<td></td>
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<tr>
<td>Reduces consumer confusion</td>
<td></td>
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<tr>
<td>Easily accessible</td>
<td></td>
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<tr>
<td>Minimizes delay from detection to report</td>
<td></td>
</tr>
<tr>
<td>Minimizes consumer error potential</td>
<td></td>
</tr>
<tr>
<td>Provides first aid instruction</td>
<td></td>
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<tr>
<td>Analysis and Synthesis of Command</td>
<td></td>
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<tr>
<td>Rapid</td>
<td></td>
</tr>
<tr>
<td>Accurate analysis</td>
<td></td>
</tr>
<tr>
<td>Includes all EMS resources</td>
<td></td>
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<tr>
<td>Proceeds in an orderly fashion</td>
<td></td>
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<tr>
<td>Minimizes resource utilization</td>
<td></td>
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<tr>
<td>Control System</td>
<td></td>
</tr>
<tr>
<td>Complete for internal use</td>
<td></td>
</tr>
<tr>
<td>Includes all EMS resources</td>
<td></td>
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<tr>
<td>Provides for disaster</td>
<td></td>
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<tr>
<td>Utilizes rapid/accurate mechanisms</td>
<td></td>
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<tr>
<td>Adequately disseminated</td>
<td></td>
</tr>
<tr>
<td>Provides for adequate revision</td>
<td></td>
</tr>
<tr>
<td>Per cent NO</td>
<td></td>
</tr>
<tr>
<td>Per cent RARELY acceptable</td>
<td></td>
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<tr>
<td>Per cent USUALLY acceptable</td>
<td></td>
</tr>
<tr>
<td>Per cent YES</td>
<td></td>
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</tbody>
</table>

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OPERATIONAL CHARACTERISTICS OF THE DISPATCH AND CONTROL CENTER

The detail associated with the actual operation of the Dispatch and Control Center (DCC) can be accurately described only after the DCC becomes operational. However, based upon the procedures and analyses presented thus far, major operating characteristics of the DCC can be postulated.

The DCC staff consists of four persons. The entry data is received by the receiving operator (RO) or the triage officer (TO) if the RO is occupied. The need for triage or first aid instruction is satisfied by the TO as location identification data are routed, on the dispatch form, to one of two dispatchers.

Each dispatcher is responsible for performing the dispatch analysis for emergencies occurring within the geographical area to which he has been assigned. However, both dispatchers are equally capable of using the maps, street listings, and other prepared materials at the DCC regardless of the location in which an emergency occurs. The assignment of a dispatcher to a predetermined area facilitates memorization of street names and a dispatcher's familiarity with an area.

The dispatchers share communication responsibilities. If, for example, dispatcher A is occupied, dispatcher B will receive and process data. The routine initial dispatch of resources utilizes radio and telephone as described earlier in this chapter. If both dispatchers are idle, one may perform the radio dispatch, while the other dispatcher uses the telephone. Similarly, if auxiliary resources are required, one dispatcher may alert the Squad, as the other dispatcher notifies police, fire, or MAV resources. Operational characteristics of the DCC are illustrated in Figure 7.5.
Location Identification Tasks

Location identification (LI) tasks are performed to support analysis activity in the D/C subsystem. It should be noted that:

1. LI represents one of the most time consuming D/C subsystem processes.
2. The responsibility for LI is shared between the D/C subsystem and the ambulance personnel of the system; this fact is often overlooked by designers when planning a dispatch and control center.

The LI task is the first task to be performed in the dispatch analysis activity and consists of a search procedure to determine the identity of the district in which an emergency has occurred. Political subdivision and street name data provided by a citizen reporting an emergency can be used to identify the emergency district from an alphabetical cross file of street names and district, which are segregated according to major political subdivision.* Once the district corresponding to the emergency location has been identified, subsequent analysis tasks may be performed.

* Separate files should exist for each political subdivision to identify different streets with the same name.
Essential resource assignment information for dispatch may be included on a card similar to the card illustrated in Figure 7.6. The card describes the closest resources and map for each district. The map may be a numbered, 35 mm colored slide containing an enlarged street map of the area in which the emergency has occurred.

The LI responsibility associated with dispatchers includes district identification. In addition, dispatchers must be prepared to assist the ambulance personnel upon request. Ambulance personnel are assigned to a primary district and are responsible for learning the location of every street in their district and major streets in adjacent districts at least. The EMT performs in the field and is expected to be knowledgeable about his environment. This task is quite reasonable in view of the fact that considerable time is expected to be available for study between emergency calls.

Computers have been used to assist with the LI task in the past but the success of computer assisted dispatching has not been overwhelming. The Emergency Medical Service of New York City utilized a computer to assist with the D/C function, but has abandoned the computer due to information maintenance requirements and down time.* The cost-effectiveness of computer assisted dispatching compared to the cost-effectiveness of a manual system has not been adequately identified in existing D/C subsystems. Computerized dispatch is recommended as a topic worthy of further evaluation by qualified, objective analysts.

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**FIGURE 7.6** Dispatch Resource Assignment Card.
DCC Layout

Although several alternative layout designs exist, the DCC layout should be planned to support the functions described in the present chapter. The layout should also be consistent with sound engineering workstation design and workflow principles. One possible design is illustrated in Figure 7.7 below.

**FIGURE 7.7** Illustration of One Dispatch Center Layout Alternative.
REFERENCES


CHAPTER 8

COMMUNICATIONS

INTRODUCTION

A coordinated communications subsystem is necessary for the effective operation of an emergency medical services (EMS) system, particularly a comprehensive care, fully integrated, regional system as proposed herein for the metropolitan Atlanta area. Due to the size of the geographical area in consideration and the necessity for dispersal of vehicles to maintain an adequate response capability, the communications subsystem must coordinate efforts across 2143 square miles of land populated by 1.5 million persons. As described in Chapter 7, hospitals, ambulances, dispatchers, police, and other service organizations must have the capability to communicate among themselves and with each other. Additionally, the citizen must have a method of quickly and easily notifying the EMS system of a need for emergency medical service.

This chapter first describes the EMS communications capabilities found in metropolitan Atlanta today. Next, the Georgia Statewide Emergency Radio Network is described in terms of concept and hardware required. The present status of the metropolitan Atlanta EMS radio network is shown. Based upon the operational considerations in Chapter 7, the specific recommendations for a communications subsystem for the metropolitan Atlanta EMS system are presented. Citizen entry, hospital communications, ambulance communications, and the dispatch and control center (DCC) are each presented in terms of hardware requirements. Finally, cost estimates are presented for the recommended EMS communications subsystem.
PRESENT EMS COMMUNICATIONS CAPABILITIES IN METROPOLITAN ATLANTA

Citizen Entry*

At present, in the majority of cases, the citizen enters the EMS system by standard telephone. The telephone equipment is reliable and, for the most part, convenient. A problem does exist for the person at a coin-operated telephone if the person has no coin, since coin-operated telephones in metropolitan Atlanta will not operate without a coin first being inserted. However, the most serious problem of present citizen entry is the fact that more than 2,199 telephone numbers are listed in the telephone directory as numbers to dial for emergency medical help.** The citizen's problem is mainly a software problem rather than a hardware problem. All ambulance purveyors have telephones, although the telephone is often answered by an answering service or dual purpose party in times other than peak service hours. Likewise, all hospital emergency departments (EDs) have telephones, although the caller must normally first reach the switchboard then wait to be transferred to the ED. The Southern Bell operator is available to assist the caller who dials "0", and the operator keeps a list of ambulance services. However, the operator is faced with the similar problem of deciding which of the ambulance service telephone numbers to dial for help.

The 911 emergency telephone number is not available to citizens of the metropolitan Atlanta toll free service area.*** In many cities which do not have 911, the caller is transferred directly to information or a special operator; however, a caller in metropolitan Atlanta who mistakenly dials 911 hears, "I'm sorry. We are unable to complete your call as dialed. Please check the number and dial again or ask your operator for assistance. This is a recording."

* Operational problems associated with citizen entry are further developed in Appendix M.

** See Table 7.1.

*** A toll free service area is the area in which telephone callers may dial each other and converse, with no additional charge for service. Metropolitan Atlanta is the largest toll free service area in the world.
In the City of Atlanta, an alternative to telephone entry into the EMS system exists in the form of Atlanta Fire Department call boxes. New, two-way voice communication boxes are replacing the 555 presently existing pull-alarm boxes. Both types transmit the exact location of the box via land lines and allow the caller to precisely describe a fire or other emergency to the fire department. One hundred and ninety two-way voice boxes are currently installed. Although the use of pull type alarms to report medical emergencies is discouraged, the new type of voice alarm can be of great service to the consumer reporting an emergency in the City of Atlanta. Current plans are for all 555 alarm boxes to be replaced with the voice type alarms.*

**Hospital Communications**

**Telephone**

As mentioned in Chapter 4, the 20 metropolitan Atlanta hospitals with EDs are basically equipped for telephone communications. Nearly all of the hospitals have switchboard extensions, direct lines bypassing the switchboard, and pay telephones in the ED, thus providing a three phase back-up telephone system.

**Radio**

Radio communications other than paging are present in only four of the hospitals, and of the four only South Fulton Hospital and Grady Memorial Hospital are equipped to communicate on the same frequency. Kennestone Hospital and Buford General Hospital have two other frequencies, each designed to allow radio communication with a private ambulance company. Therefore, in a disaster situation in which telephone systems are disabled, only four hospitals and three ambulance services would have the capability to coordinate the efforts of ambulances and hospitals by radio.


** Information on metropolitan Atlanta hospital ED communications capabilities was collected via the HSRC hospital emergency room survey, the results of which have been presented in Table 4.4.
Television

Three of the 20 hospitals with EDs are connected by a closed circuit television system which also includes the Center for Disease Control (CDC) and Emory University Hospital. Although the television network is of potential value for EMS communications, the principle function of the television network is to serve as a teaching device, and the television system is not configured in a way which would readily enable its use for emergency communications.

Telemetry

Several of the hospitals, notably Kennestone Hospital, have made arrangements to receive ECGs by radio telemetry from ambulances in the field. Radio equipment at Kennestone Hospital can transmit and receive audible voice communications as well as receive audible tone modulated signals from Metro Ambulance Service. The tone modulated radio signals may be demodulated at Kennestone Hospital to reconstruct a remotely located patient's ECG.

Crawford W. Long Memorial Hospital, St. Joseph's Infirmary, and Georgia Baptist Hospital have equipment to demodulate telemetry signals that arrive by telephone lines. Crawford W. Long Memorial Hospital uses this equipment to reconstruct ECGs originating at the three Gwinnett County hospitals and also at Metro Ambulance Service Headquarters. St. Joseph's Infirmary demodulates signals from Metro Ambulance Headquarters, but not routinely. Georgia Baptist Hospital receives telemetered signals by telephone lines from small rural towns in North Georgia.

Ambulance Purveyors

Of the 59 metropolitan Atlanta ambulance purveyors listed in Appendix G, 40 offer emergency ambulance service. Of the 40 emergency ambulance services, 28 have radio communications capabilities; that is, 70 per cent of the emergency ambulance services are radio equipped. Although the percentage is high, the frequencies are such that most of
these ambulances are able to communicate with only the ambulance head-
quartes from which the ambulance is controlled. In a majority of cases, the only method of communicating with a hospital physician is by relaying messages received from the ambulance via radio at the ambulance head-
quartes to the hospital or physician via telephone. A few exceptions exist in that some of the headquarters (Metro Ambulance Service for one) have telephone patching devices which allow radio transmissions from the ambulance to be retransmitted through standard telephone lines to the hospitals. On the other hand, some ambulances in the field have no means whatsoever of communicating with a hospital physician.

In terms of direct ambulance to hospital radio communications, only three of the 40 emergency ambulance services have this capability. The Grady Ambulances are equipped with radios operating on the 155.340 MHz frequency allowing communications with South Fulton Hospital or the Grady Ambulance Service dispatcher. Metro Ambulance Service has a radio communications link with Kennestone Hospital, and Tapp Funeral Home has a radio communications link with Buford General Hospital.

Other Elements of the Present Communications Subsystem

Grady Memorial Hospital is connected with the Atlanta Police and Fire Departments by direct, ring-down telephone lines to allow a quick and accurate flow of information concerning emergencies occurring in the City of Atlanta. A similar telephone link connects South Fulton Hospital with the East Point Fire Department.

Eight of the 20 hospitals with EDs currently are using radio paging systems or "beepers" to contact key hospital administrative and medical staff when necessary. The radio pager carried by the person in the field remains quiet until a tone coded signal activates the unit to selectively produce a tone in the pager. The person in the field then returns a call by public telephone to the paging headquarters.

Conclusion

The above discussion leads to the conclusion that the present metropolitan Atlanta EMS communications capabilities are rudimentary. In general the few existing radio communications capabilities are incompatible
and are operated independent of each other, and therefore the coordination objective of the EMS communications subsystem in metropolitan Atlanta is not realized.

THE GEORGIA STATEWIDE EMERGENCY RADIO NETWORK*

Purpose

The Georgia Hospital Association's Board of Trustees adopted specifications in 1970 for a standard radio unit to be followed by all member institutions when purchasing radio equipment.** The intent of the specifications was "to provide one system throughout the State of Georgia whereby hospitals and emergency vehicles could communicate with each other in emergency situations. It was also thought that the network would help to facilitate the dispatching of emergency vehicles" and to provide control in directing the flow of ambulances (4). The specifications describe a radio subsystem which is compatible with radio subsystems developed in other states and which is referred to as HEAR by Motorola and EACOM by General Electric.***

Frequencies Used

The Georgia Statewide Emergency Radio Network design utilizes the frequency modulation (FM) mode of transmission on two frequencies in the VHF range as shown below:

155.340 MHz - Has been reserved for hospital use only by the FCC. Can be used for routine communications between hospitals, and also for emergency communications

* See Appendix V for complete specifications of the Georgia Statewide Emergency Radio Network.

** Personal interview between Oren L. Reinbolt, HSRC, and Robert Jones, Assistant Director, GHA, on July 13, 1972.

*** HEAR is an acronym for Hospital Emergency Administrative Radio and EACOM is an acronym for Emergency and Administrative Communications for Hospitals.
between hospitals, or between hospitals and ambulances. Hospital based ambulances may be dispatched and controlled on this frequency. License is held by the individual hospital.

155.280 MHz - Has been reserved for base to base communications between hospitals designated as "regional" by GHA. No ambulance communication or paging is to be performed on this frequency. License is held by the Emergency Health Unit of the Department of Human Resources.

Organization

The GHA system is designed so that hospitals in an area may carry on day to day communications via radio on the frequency 155.340 MHz. In addition, the physicians in hospitals may give medical advice to ambulance attendants utilizing this frequency, and hospital based ambulances may be dispatched on this frequency. If all hospitals and all ambulances in an area have the 155.340 MHz frequency, then any unit may communicate with any other unit. Additionally, the advantage of simultaneous communication with more than one other unit gives speed not found in telephone communications.

Realizing that the radio communications between regional hospitals are probably needed principally during disaster situations, which is exactly the time that the 155.340 MHz frequency would become particularly crowded with hospital and ambulance traffic, GHA specified a second frequency for use by regional hospitals, that is, 155.280 MHz. Thus, area hospitals and ambulances may communicate effectively on 155.340 MHz to combat a local disaster while a regional hospital in the area coordinates aid from other regions on the 155.280 MHz frequency. Since regional hospitals also need to coordinate with area hospitals, the regional hospitals also have the 155.340 MHz frequency.
Operating Features

Since untrained radio operators are normally responsible for radio communication within a hospital, the GHA equipment specifications are designed for ease of operation. The radio is designed to operate as closely as possible to the common telephone including a handset and telephone type dial squelch encoder.

A second feature of the GHA specifications is the "private line" operation of the radio in the hospital. Tone coded squelch protects the hospital from hearing conversations directed to other hospitals or ambulances. The hospital only receives calls which are specifically directed to the hospital when dialed by an encoder from a radio somewhere else in the system. An exception is the case of an "ALL CALL", where any radio in the system can dial all other radios simultaneously.

RECOMMENDED EMS COMMUNICATIONS SUBSYSTEM

Use of the Georgia Statewide Emergency Radio Network for Metropolitan Atlanta

Although the Georgia Statewide Emergency Radio Network is a proven, workable system, the GHA system was neither designed nor intended to meet the routine operational requirements of a regional EMS system for a population the size of metropolitan Atlanta. The need for simple entry, resource monitoring, and centralized dispatch and control, added to the crowding that would result from 52 hospitals and 34 ambulances located in close proximity, make the exact duplication of the GHA Statewide Radio Network unworkable.* The GHA radio network, however, is extremely valuable as a basic starting point for a comprehensive metropolitan Atlanta EMS communications subsystem design, and therefore every effort is made in the recommended EMS system communications subsystem to build upon the GHA radio network and to expand upon the basic principles of the system when necessary to meet metropolitan Atlanta's specific needs.

* Hospitals and ambulance locations are presented in Chapter 4 and Chapter 5.
Entry Hardware Analysis

Address Identification

Appendix W shows the current state of development of some of the many potential telephone equipment breakthroughs which may increase the efficiency and accuracy of the telephone entry and address location functions of the communications subsystem. At the present time, automatic address identification of the calling party is not possible in metropolitan Atlanta, either by automatically determining a complete telephone number (ANI) or the telephone exchange (AEI) from which the call originates. Even if the number or the exchange could be determined automatically, a computerized cross index of telephone numbers and related addresses does not exist. Breakthroughs in both areas mentioned above are potential within the next five years and should be utilized by the DCC when available.*

Free Access Coin Telephones

Free access coin telephones are a desirable feature of the entry system but must be supported with caution. The cost of field modification to existing coin telephones is approximately $450 per telephone. In addition to the field charge, modifications to wire centers are necessary at an additional expense. The total cost of changing from the present coin-operated telephones to a complete system of free access coin telephones is estimated to be over three million dollars.** Therefore, it is recommended that coin telephones connected to common control wire centers be replaced by free access coin telephone systems, but only when routine maintenance requirements warrant replacement. In this manner, the free access coin telephone service becomes available to the public at a slower rate but also much less expensively.


The 911 telephone concept, although much publicized, is of questionable value to the EMS system in metropolitan Atlanta and is not recommended at this time. The 911 concept is discussed briefly in Chapter 7 and Appendix M, and is presented in a separate analysis devoted entirely to 911 in Appendix EE. References 2, 3, 5, 6, 7, 8, 9, and 10 served in part as the basis for this conclusion.

Analysis of the 911 emergency telephone concept indicates that an application of the concept would not be appropriate for the metropolitan Atlanta area at the present time, for two reasons, as described below:

1) The 911 telephone number is advertised nationally as the number to call for police, fire, or medical emergency. The delay incurred by citizens dialing 911 for emergency fire or police services could result in serious consequences if 911 exists only as an EMS related device.

2) The cost of 911 is significant and cost-effectiveness of 911 would be poor unless fire and police departments participated in a 911 application.

Radio System Analysis

The GHA Statewide Emergency Radio Network is based upon reliable equipment and sound logic, and should therefore form the backbone of the hospital communications network. Only Grady Memorial Hospital, DeKalb General Hospital, and Kennestone Hospital are recommended to be directly involved with MICUs. The remaining hospitals could meet GHA
recommendations with a simple, one channel radio. Due to the high concentration of hospitals in the metropolitan Atlanta area, the GHA recommended frequencies (155.280 MHz and 155.340 MHz) should remain free from paging, non-hospital use, and ambulance communication.* It is assumed that routine ambulance dispatching on the 155.340 MHz frequency might result in a near standstill of ambulance dispatching during disaster situations when hospitals might crowd the frequency with hospital to hospital communications requirements.

Primary dispatching of ambulances may be conducted on one VHF channel, due to the concise nature of most required transmissions and the use of radio codes, if a secondary radio channel is available for extended conversations between ambulances and hospital physicians or nurses.** The advantages of dispatching on one frequency are manifold including greater unity of the system, a need for fewer dispatchers, and more effective dispatching. A second channel other than the dispatching frequency is therefore necessary to insure the capability of ambulance to hospital communications.*** Hospitals may install the 155.XX2 MHz channel in their basic radio along with the existing 155.340 MHz channel while still adhering to GHA recommended equipment specifications.

Other Communications Analyses

The dispatch and control center (DCC) has functional requirements as outlined in Chapter 7 which demand immediate telephone communications with each of the 29 ambulance bases. In addition, the category I, II, and III hospital EDs need to be in direct telephone contact with the DCC. To meet these requirements, direct ring-down telephone lines to each ambulance base and to each major hospital ED are recommended.

*A complete listing of metropolitan Atlanta hospitals is shown in Appendix A.

**Based upon performance of operating EMS systems in Columbus, Ohio and Jacksonville, Florida. Appendix X gives a listing of available frequencies.

***Henceforth, the dispatch frequency is referred to as 155.XX1 MHz and the secondary frequency is referred to as 155.XX2 MHz. Neither may be one of the GHA recommended frequencies, 155.280 MHz and 155.340 MHz.
As a back-up device to insure radio communication between ambulances and hospitals, it is recommended that the DCC have telephone patching equipment available.

SPECIFIC EQUIPMENT RECOMMENDATIONS

Hospitals

To meet the functional requirements for hospital radio communications, each hospital should have a two-channel radio that satisfies the GHA radio specifications.* The radio would thus be an exact duplicate of the two-channel radios specified by GHA for use in "Regional" hospitals, that is, one radio with two-frequency transmit and two-frequency receive capability, with two separate receivers to enable simultaneous reception of both frequencies. The radio should operate on the following two frequencies:

1) 155.340 MHz - Licensed to the hospital for routine hospital to hospital communications.

2) 155.XX2 MHz - Licensed to the EMS Coordinating Agency for ambulance to hospital medical consultation.

It should be noted that although the radio hardware in the hospitals satisfies GHA specifications, only one of the frequencies specified above are on the Georgia Statewide Emergency Radio Network. The second frequency (155.XX2 MHz) is needed to minimize crowding of the 155.340 MHz frequency found in large metropolitan areas such as Atlanta.

The regional hospitals, Grady Memorial Hospital, DeKalb General Hospital, and Kennestone Hospital, must have an additional radio frequency (155.280 MHz) to effectively coordinate in disaster situations. A three-channel radio is not recommended for these hospitals, since MICU related communications could completely disable the hospitals' communications.

* GHA specifications for hospital base radios are presented in Appendix V.
capabilities if a three-channel radio were utilized. The recommended radio hardware for each regional hospital is therefore to include two radios, both meeting GHA specifications. A two-channel radio of the type specified above for area hospitals should utilize the Georgia Statewide Emergency Radio Network frequencies (155.340 MHz and 155.280 MHz). Additionally, a one-channel radio meeting GHA specifications should be utilized, operating on the ambulance to hospital frequency (155.XX2 MHz).

The 155.340 MHz frequency should be monitored by all hospitals at all times in anticipation of hospital to hospital communication. The "private line" feature of the equipment should insure that the radio is not bothersome to the hospital staff, and only calls intended for the hospital are heard in the hospital. Whenever an ambulance needs to talk to a hospital, the DCC will arrange the communication by notifying the hospital by ring-down telephone line or a radio call on the 155.340 MHz channel.

Telephone communications capabilities in the hospital EDs should include the following:

1) A coin-operated telephone located in or near the ED.
2) A standard telephone in or near the ED which bypasses the switchboard.
3) A direct, ring-down telephone to the EMS dispatch and control center. (Category I, II, and III hospitals only).

Ambulances and MICUs

Each ambulance and MICU should utilize a 4 channel, VHF, 80-110 watt transceiver utilizing the following frequencies:

1) 155.XX1 MHz – Licensed to the EMS Coordinating Agency for dispatch and control of emergency ambulances and MICUs.
2) 155.XX2 MHz – Licensed to the EMS Coordinating Agency for ambulance to hospital medical consultation.

3) 155.340 MHz – Licensed to selected hospitals by agreement to provide additional ambulance to hospital medical consultation when necessary.

4) 155.280 MHz – For MICUs only, to effectively coordinate with regional hospitals in disaster situations. Licensed to the Georgia Department of Human Resources.

4) 155.XXX MHz – For ambulances only, on the dispatch frequency of the organization which provides the ambulance service. Used if the ambulance is scheduled as a non-emergency vehicle to provide invalid transportation.

Normally, the ambulances and MICUs monitor the dispatch and control channel, 155.XX1 MHz. Radios must have tone coded squelch to protect against "skip" from extraneous sources. However, no selective (dial type) digital encoder is necessary for the mobile radios.

Detailed Specification – Mobile Unit Design

I. Overall Characteristics

A. Style of Equipment

The mobile transceiver should be designed as a single unit housed in a heavy gage metal case and suitable for trunk-mounting in a motor vehicle. Mobile transmitter/receiver design should be total solid state except for transmitter driver and final amplifier stages. Each mobile unit should be furnished complete with the following listed accessories:
1) Control Head  
2) Loud Speaker and Cable  
3) Intercabling and Power Cables  
4) Roof-top Antenna and Cable  
5) Complete kit of installation accessories

B. Operating Voltage  
Mobile transmitter/receiver units should be designed for operation from 12 volt, negative ground automotive electrical system.

II. Detailed Specifications - Mobile Receiver

A. Number of Channels  
Mobile unit design should provide operation on four receive channels; however, units may be ordered with frequency determining elements for three channels only.

B. Modulation Acceptance  
Should be +7 KHz.

C. Sensitivity  
Receiver quieting should be 20 dB at no greater than 0.5 microvolt.

D. Frequency Stability  
Frequency stability should be maintained within ±0.0005% over the temperature range of -30º to +60º C.

E. Selectivity  
EIA SINAD selectivity should be more than 90 dB down at +30 KHz.

F. Spurious Responses  
All spurious and image responses should be at least 90 dB down at any frequency outside the normal received channel.

G. Audio Output  
Should be at least 5 watts at less than 5% distortion.

H. Audio Response  
Should be within +1, -8 dB of 6 dB/octave de-emphasis characteristic from 300 to 3000KHz.

I. Squelch Circuit  
Receiver should have subaudible squelch (not selective for each radio) to protect against skip from other radio systems.
III. Detailed Specifications - Mobile Transmitter

A. Number of Channels
   Mobile unit design should provide operation on four transmitting channels; however, units may be ordered with frequency determining elements for three channel only.

B. RF Power Output
   Should be a minimum of 65 watts 50 ohms RF impedance.

C. Frequency Stability
   Should be within ±0.0005% of assigned frequency over the temperature range of -30°C to +60°C.

D. Spurious Emissions
   All spurious and harmonic emissions should be down at least 70 dB below carrier.

E. Modulation
   Should be 16F3, +5 KHz for 100% at 1000 Hz.

F. Audio Response
   Should be within +1, -3 dB of 6dB/octave pre-emphasis characteristic from 300 to 3000 Hz.

IV. Qualifying Mobile Radios
   The specifications are written such that at least the following radios may qualify:
   A. General Electric, MASTR II, models MC76, MC66
   B. Motorola, MOCOM 70, model T53BBN
   C. Motorola, Georgia Law Enforcement, model T63BBN-GA71

Telemetry Specifications for MICUs

Telemetry is recommended in this report to be required equipment only for the MICUs. Naturally, the use of telemetry on ambulances is not to be discouraged, especially if telemetry is used as an aid, rather than as a restrictive requirement, to the EMT providing emergency treatment.*

* An analysis of the need for telemetry in metropolitan Atlanta is presented in Appendix DD.
Telemetry equipment is currently designed to provide either continuous or intermittent signal (tone-modulated ECG) propagation, but not both. Although the American College of Cardiologists endorses the concept of continuous (five minutes or more) telemetry of ECGs, the leading telemetry equipment on the market today utilizes intermittent (non-continuous) telemetry systems (1).* In fact, the Research Staff of HSRC knows of no currently operating telemetry systems which provide continuous monitoring as recommended by the American College of Cardiologists.

Telemetry equipment specifications must be based on manufacturers' guarantees of reliability, as well as desired operational characteristics as determined by physicians and MICU personnel. Therefore, detailed specifications for telemetry equipment are left to the judgment of the EMS Coordinating Agency.

Certain recommendations can be made at this time, however, and these recommendations are as follows:

1) Grady Memorial Hospital, Kennestone Hospital, and DeKalb General Hospital should each have the capability of demodulating telemetry signals originating at MICUs.

2) The telemetry equipment should be designed so as to utilize as many of the UHF telemetry frequencies as possible, as designated by the FCC, and the license for telemetry frequencies utilized by MICUs should be held by the EMS Coordinating Agency.

Dispatch and Control Center (DCC)

The dispatch and control center is the communications hub for the entire EMS system. Communications equipment at the DCC should include:

* Intermittent telemetry systems are in use in Los Angeles, California; Miami, Florida; Columbus, Ohio; Nassau County, New York; Jacksonville, Florida; and Houston, Texas.
I. Telephone Equipment

A. Direct ring-down telephone lines (14 lines) to category I, II, and III hospital emergency departments, plus one extra ring-down telephone line to Grady Memorial Hospital.*

B. Direct ring-down telephone lines to all ambulance bases. (29 lines)

C. Quick dialing capability and radio patching capability to all fire and police departments in the seven counties. (82 total)

D. Direct ring-down telephone lines (8 lines) to the following:
   1) Atlanta Fire Department
   2) Atlanta Police Department
   3) DeKalb County Communications Center
   4) Cobb County Fire Department
   5) Cobb County Police Department
   6) Clayton County Fire Department
   7) Clayton County Police Department
   8) East Point Fire Department

E. Automatic Call Distributor (ACD-60) or an equivalent type of telephone switchboard to receive incoming calls, transfer calls when necessary, and give a recorded message to hold if all DCC personnel are busy.

F. Ten incoming lines to the telephone switchboard.

G. Four terminal points for direct lines.

H. Eight extra terminals to answer calls from the telephone switchboard (not normally used but provided for use in disaster situations).

* Grady Memorial Hospital is to have ring-down telephone lines to both the surgical emergency clinic and the medical emergency clinic.
II. Radio Equipment

A. Base station equipped with two-channel transmitter and two separate receivers, operating on the GHA Statewide Emergency Radio Network frequencies.

B. Base station equipped with two-channel transmitter and two separate receivers operating on the dispatch frequency (155.XX1 MHz) and the ambulance-hospital frequency (155.XX2 MHz).

C. Dial encoders for three channels (tone coded squelch).

D. Decoders for three channels.

E. Subaudible tone coded squelch generator (automatic on dispatch frequency, non-specific).

F. Four antenna towers, for satellite receivers, possibly located at Kennestone Hospital, Clayton General Hospital, Douglas County Hospital, and Joan Glancy Memorial Hospital.

G. Four satellite receiver systems, four receivers per cabinet, tone signaling and multi-coupler.

H. Receiver voting comparator (four) one for each radio channel.

I. Dedicated telephone lines to each antenna tower.

III. Special Equipment

A. Status Board as described in Chapter 7.
   1) Map of area.
   2) Visual display of status.

B. Telephone patching equipment.

C. Selected additional equipment.
COST OF THE COMMUNICATIONS SUBSYSTEM

The cost savings achievable by purchasing radio equipment under existing or obtainable state or group contracts is significant. However, cost estimates which follow are full retail prices and therefore represent the upper bound for the specified equipment costs. All electronic equipment is assumed to have a five year service life.

I. Each hospital is to have the following radio equipment:

A. Base station $1,490  
B. Digital encoder 255  
C. Digital decoder 250  
D. GHA specified control 700  
E. Antenna 185  
F. Tower (if needed) 428  
G. Transmission line 265  
H. Radio installation 250  
I. Tower installation 400  

TOTAL CAPITAL INVESTMENT PER HOSPITAL $4,223

II. Each ambulance is to have the following equipment:

A. Four-channel mobile radio $1,375  
B. External loudspeaker, PA 75  
C. Installation 50  

TOTAL CAPITAL INVESTMENT PER AMBULANCE $1,500

III. Telemetry equipment:

A. Telemetry transmitters $2,500  
B. Two-channel telemetry demodulator 3,000  

TOTAL CAPITAL INVESTMENT PER TELEMETRY UNIT $5,500

IV. Dispatch and Control Center:

A. Telephone equipment installation $2,150  
B. Radio equipment purchase 24,000  
C. Status equipment purchase 20,000  

TOTAL CAPITAL EXPENSE FOR DCC $46,150
V. Total communications subsystems capital investment:

<table>
<thead>
<tr>
<th>Description</th>
<th>Quantity</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hospital radios (2 channel)</td>
<td>20</td>
<td>$84,460</td>
</tr>
<tr>
<td>Second hospital radio (1 channel)</td>
<td>3</td>
<td>$7,200</td>
</tr>
<tr>
<td>Mobile radios (4 channel)</td>
<td>45</td>
<td>$67,500</td>
</tr>
<tr>
<td>Telemetry equipment</td>
<td>3</td>
<td>$16,500</td>
</tr>
<tr>
<td>Dispatch and Control Center</td>
<td></td>
<td>$46,150</td>
</tr>
</tbody>
</table>

TOTAL CAPITAL INVESTMENT FOR COMMUNICATIONS SUBSYSTEM OF EMS SYSTEM $221,810

Annual Operating Cost of the Communications Subsystem

Based upon the assumption that electronic equipment has a five year service life, the following estimated operating cost of the communication subsystem is presented:

<table>
<thead>
<tr>
<th>Description</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Depreciation of radio and electronic equipment</td>
<td>$44,362</td>
</tr>
<tr>
<td>Annual telephone bill</td>
<td></td>
</tr>
<tr>
<td></td>
<td>18,960</td>
</tr>
</tbody>
</table>

TOTAL ANNUAL OPERATING COST OF THE COMMUNICATION SUBSYSTEM $63,322
REFERENCES


7. Emergency Telephone Communications Workshop (Summary of Proceedings), National Service to Regional Councils, Washington, D. C., Held in Omaha, Nebraska on December 16-17, 1970.


CHAPTER 9
DATA REQUIREMENTS FOR THE MANAGEMENT AND EVALUATION
OF THE METROPOLITAN ATLANTA EMS SYSTEM

INTRODUCTION

One of the most difficult tasks in designing, redesigning and measuring the performance of EMS systems at present is the collection of valid data from which accurate analyses can be made. Certainly, ambulance, hospital ED, and dispatcher records are deficient in the EMS system in metropolitan Atlanta at present, both in terms of missing data and consistency in recording the data. These deficiencies have been also noted in other chapters of the present document.

This chapter outlines the need for accurate and consistent data, both as a tool for management decision making and as an evaluative device for creating publicity, measuring the effect of system modifications, and as a necessity for obtaining Federal funds. Performance measures are presented and categorized as to their managerial or evaluative function. Finally, a list of sources of data are presented, and where necessary, new data sources are specified.

GENERAL DATA REQUIREMENTS

Data for Management

Effective management of the proposed EMS system is dependent upon the measurement of the resultant performance of the EMS system as alternative strategies for performing necessary functions are implemented. For example, the reassignment of an ambulance service area may change the average response time of the ambulance, as well as the per cent immediate availability and per cent of response times longer than maximum acceptable levels.* Without accurate data, the management of the EMS system must

* Statistical performance measures are described in Chapter 5.
operate by intuition, which can be costly both in terms of economic efficiency and number of unnecessary deaths and injuries.

As a general rule, the data required for management purposes are short term and precisely measurable. The effect of various policy decisions upon the performance of the overall EMS system may be measured only as accurately as the data gathered in the operating EMS system. It is possible with the use of valid data to correct, in the short term, management decisions that would lead to increased loss of life in the long term.

Data for Evaluation of the EMS System

Evaluation of the EMS system requires a comparison of long term overall performance measures of the EMS system with a baseline developed at the onset of implementation and recalculated periodically thereafter. Long term policy decisions, as well as experimental programs require more comprehensive data than do normal management decisions, since an evaluation of the effect of the entire EMS system on the health of the population is desirable. The performance measures for evaluations of this type include qualitative as well as quantitative measures, which are presented later in this chapter.

A second reason for an evaluation of the EMS system, and therefore another demand for comprehensive data, is the requirement by most Federal funding agencies for an evaluation to be conducted of Federally funded EMS demonstration projects. Therefore, applications for Federal funds to support EMS system implementations must include an evaluation scheme in the proposal. If an EMS project includes an accurate and detailed evaluation, the funding agency is able to assess the benefit derived from the Federal support and acquires information which can be disseminated to EMS planners throughout the nation.

An evaluation of the metropolitan Atlanta EMS should have significant publicity value and may be used as an argument for justifying fiscal support on the local level. As mentioned in Chapter 12, there is a need for increased public interest in and concern for EMS, and favorable
publicity may be expected to help fulfill the need. EMS is an emotional issue and thus may be expected to be supported to a large degree depending on the favorable publicity received as has occurred in Jacksonville, Florida.

PERFORMANCE MEASURES

Although the performance of an EMS system is difficult to measure quantitatively in terms of ultimate measures such as changes in mortality and morbidity rates which can be directly attributed to the specific presence or absence of a feature in the EMS system, the following quantitative and qualitative measures are commonly suggested (2,3).

Managerial Performance Measures of the EMS System

To aid in the management of the EMS system, the performance measures listed in Table 9.1 are recommended.

TABLE 9.1 Managerial Performance Measures of an EMS System.

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Runs per vehicle per injury type.</td>
</tr>
<tr>
<td>2.</td>
<td>Per cent of runs with at least one registered EMT-A.</td>
</tr>
<tr>
<td>3.</td>
<td>Runs per 1000 population, by county and by dispatcher.</td>
</tr>
<tr>
<td>4.</td>
<td>Minutes of daily use for each ambulance and MICU.</td>
</tr>
<tr>
<td>5.</td>
<td>Number of ambulance and MICU runs to each hospital.</td>
</tr>
<tr>
<td>6.</td>
<td>Average response time, and number of runs over the target maximum response time, by type of vehicle (ambulance or MICU).</td>
</tr>
<tr>
<td>7.</td>
<td>Number of patients found dead on the arrival of the vehicle at the emergency scene.</td>
</tr>
<tr>
<td>8.</td>
<td>Waiting time of emergency patients at each hospital ED as a function of time of day and day of week.</td>
</tr>
<tr>
<td>9.</td>
<td>Per cent of patients needing ambulance care who actually received ambulance care.</td>
</tr>
<tr>
<td>10.</td>
<td>Per cent of patients getting ambulance care who actually needed ambulance care.</td>
</tr>
</tbody>
</table>
TABLE 9.1 (cont.) Managerial Performance Measures of an EMS System.

<table>
<thead>
<tr>
<th></th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>11</td>
<td>Method of arrival of patient to hospital ED, by type and severity of disease.</td>
</tr>
<tr>
<td>12</td>
<td>Patient characteristics; that is, age, sex, and so forth.</td>
</tr>
<tr>
<td>13</td>
<td>Per cent of runs where ambulance communicated directly with the hospital ED by radio.</td>
</tr>
<tr>
<td>14</td>
<td>Per cent of false alarms.</td>
</tr>
<tr>
<td>15</td>
<td>Number of redirected runs, including medical transfers within three hours of patient's arrival at a hospital.</td>
</tr>
<tr>
<td>16</td>
<td>Number of MAV dispatches per 100 ambulance calls.</td>
</tr>
<tr>
<td>17</td>
<td>Per cent of ambulances dispatched to secondary service areas.</td>
</tr>
<tr>
<td>18</td>
<td>Entry delays experienced by citizens, with times, if possible.</td>
</tr>
<tr>
<td>19</td>
<td>Frequency of first aid procedures performed at the scene of the emergency and en route to the hospital.</td>
</tr>
<tr>
<td>20</td>
<td>Per cent of dry runs, where a patient existed, but was diagnosed as a non-emergency.</td>
</tr>
<tr>
<td>21</td>
<td>Per cent of patients transported who died en route to the hospital.</td>
</tr>
<tr>
<td>22</td>
<td>Per cent of patients delivered viable to hospital, but dying in the ED, by disease.</td>
</tr>
<tr>
<td>23</td>
<td>Time between arrival of patients at the ED and their first encounter with a physician.</td>
</tr>
<tr>
<td>24</td>
<td>Average length of stay for ED admissions.</td>
</tr>
<tr>
<td>25</td>
<td>Per cent of ambulance trips resulting in ED admission.</td>
</tr>
<tr>
<td>26</td>
<td>Evaluation by medical staff as to appropriateness of first aid and life support rendered by EMT-A's.</td>
</tr>
<tr>
<td>27</td>
<td>Actual training of ambulance attendants compared with training required to do the job.</td>
</tr>
</tbody>
</table>

It should be noted that many of the performance measures in Table 9.1 are specific and may be calculated at periodic intervals, perhaps once per month. Furthermore, data need not be routinely collected for all of the performance measures in Table 9.1, but rather can be collected on a periodic sampling schedule.
Evaluative Performance Measures of the EMS System

Table 9.2 presents evaluative performance measures, for which data may be collected less frequently. These evaluative performance measures are broader in scope than the managerial performance measures, and many of the measures listed in Table 9.2 are general enough to be easily understood by the lay public, which thereby enhances the publicity value of the evaluation.

TABLE 9.2 Evaluative Performance Measures of an EMS System.

28. Mortality rate by type of disease.
29. Morbidity rate by type of disease.
30. Automobile-related deaths per 1000 population.
31. Automobile-related deaths per mile of road.
32. Automobile-related deaths per 1000 accidents.
33. Automobile-related deaths per automobile-related injury.
34. Patient load at each hospital ED by type and severity of problem.
35. Capability of hospitals to treat emergency patients (categorization).
36. Communications capabilities of hospitals with other hospitals, and with ambulances.
37. Training level of EMS personnel, average and distribution.
38. Per cent of ambulances in compliance with the American College of Surgeons minimum equipment recommendations.
39. Per cent of ambulances staffed by each level of registered EMT-As, and the total number of each level of EMT-As in the metropolitan Atlanta area.
40. Per cent of short term, acute care, general hospitals with full time ED physicians.
41. Statistical breakdown of common, citizen oriented problems, such as, too many telephone numbers to call to gain entry into the EMS.
Performance Measures Common to Management and Evaluation

Table 9.3 describes the manner in which the performance measures sometimes overlap. Management is further broken down into planning, operational control, and quality control, and the performance measures are more precisely assigned to their related functions. Naturally, specific instances occur where a measure is used to calculate the performance of a function not normally assigned as shown in Table 9.3.


<table>
<thead>
<tr>
<th>FUNCTION</th>
<th>PERFORMANCE MEASURE*</th>
</tr>
</thead>
<tbody>
<tr>
<td>I. Management</td>
<td></td>
</tr>
<tr>
<td>A. Planning</td>
<td>8, 11, 12, 17, 34, 41</td>
</tr>
<tr>
<td>B. Operational Control</td>
<td>1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 13, 14, 15, 16, 17, 18</td>
</tr>
<tr>
<td>C. Quality Control</td>
<td>19, 20, 21, 22, 23, 24, 25, 26, 27, 35, 37, 38, 39, 40</td>
</tr>
<tr>
<td>II. Evaluation</td>
<td>28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41</td>
</tr>
</tbody>
</table>

SOURCES OF DATA

To insure the reliability of data gathered to generate the performance measures above, sources of data should be kept to a minimum. Unfortunately, all data requirements cannot be met by one source, and therefore multiple sources must be used to collect or disseminate data as described below.

* Numbers refer to performance measures listed in Table 9.1 and Table 9.2. Numbers which are underlined appear more than once in the table.
A. Readily Available Information

Various government agencies and private organizations routinely keep statistical data which may be of use to the EMS Coordinating Agency, especially in the areas of broad based information required for evaluative purposes. Examples are: highway mortality figures from the Georgia State Patrol, Accident Reporting Section; heart related statistics from the Georgia Heart Association; listing of hospitals with emergency departments from the Georgia Department of Human Resources, and many others.

B. Dispatch Center Report Form

The dispatch and control center (DCC) is in a position to collect specific data available to no other subsystem of the EMS system. Examples are the arrival times of calls for emergency service, per cent of calls which cannot be immediately answered, and the number of MAVs dispatched. To collect information which would otherwise be lost, a DCC report form must be utilized.*

C. Ambulance Report Form

The ambulance or MICU personnel are in close contact with the emergency patient and often represent the initial contact of the patient with trained medical personnel. The initial condition of the patient, as well as the time sequence of events in the emergency run are available only to the ambulance personnel and therefore must be recorded on the ambulance report form along with the particulars of each case.**

D. Emergency Department Records

Although hospital EDs currently keep records of emergency patients as part of the routine medical records system in each hospital, the ED records are of limited value in their present state of development since the data recorded in the ED records are not consistent by type of

* A DCC report form must be devised.

** An example ambulance report form is presented in Appendix Z.
data from one hospital to another. Also, the forms used for recording ED patient data are different for almost all hospitals thereby making retrospective data analysis that much more difficult.

To be of subsequent value in providing data for analysis, the ED records should be expanded and redesigned to more clearly, concisely, and consistently capture information on treatment, severity, and disposition of emergency patients, as well as the patients' mode of arrival. Furthermore, it would be highly desirable to have the ED form keyed by incident number to the ambulance report form and the DCC report form such that the data on all three forms associated with a specific emergency for a particular patient could readily be related.

E. Emergency Department Survey

In order to follow the development of emergency facilities in the metropolitan Atlanta area, the EMS Coordinating Agency should, as a regional service, routinely survey the hospital emergency departments in the seven counties.* In particular, the survey should collect information concerning the capacities and capabilities of each hospital ED, which information is useful in both the day by day management of the EMS system and in planning of EMS system modifications.

F. Georgia State Licensure Offices

Recent laws specify that all ambulance operators providing emergency service must be regularly licensed by the State of Georgia (1). Similarly, an EMT registry exists. Both of these sources provide current information regarding ambulance service resources available in metropolitan Atlanta.

G. New Data Sources

Special data collections are expected to be necessary, at times. An example of such a campaign would be to determine citizen oriented problems such as entry delays faced in reporting emergencies.

* An example hospital ED survey form is shown in Appendix B.
Sources of Data for Performance Measures

Table 9.4 shows the primary source of data for each of the 41 performance measures listed in Table 9.1 and Table 9.2. Some measures are listed more than once, since data from more than one source are required to compute the measure. In certain instances, one source of data may be substituted for another source. In these instances, the most easily acquired data, from an operational point of view are used.

TABLE 9.4 Sources of Data for EMS Performance Measures.

<table>
<thead>
<tr>
<th>Source of Data</th>
<th>Performance Measure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Readily Available (A)*</td>
<td>28, 29, 30, 31, 32, 33</td>
</tr>
<tr>
<td>Dispatch and Control Form (B)</td>
<td>3, 6, 8, 13, 14, 15, 16, 17, 23</td>
</tr>
<tr>
<td>Ambulance Report Form (C)</td>
<td>1, 2, 4, 5, 7, 12, 19, 20, 21, 22, 25, 27</td>
</tr>
<tr>
<td>Hospital ED Records (D)</td>
<td>8, 11, 12, 22, 23, 25, 34</td>
</tr>
<tr>
<td>Hospital ED Survey (E)</td>
<td>35, 36, 40</td>
</tr>
<tr>
<td>State Licesure Offices (F)</td>
<td>37, 38, 39</td>
</tr>
<tr>
<td>New Data Source (G)</td>
<td>9, 10, 18, 26, 27, 41</td>
</tr>
</tbody>
</table>

* Letters in paranthesis refer to paragraphs describing the data sources.
REFERENCES

CHAPTER 9


CHAPTER 10
FINANCING THE EMS SYSTEM

INTRODUCTION

This chapter discusses the responsibility, philosophy, and alternative sources available for funding the EMS system. Financing must be concerned with the initial investment in system hardware and training program development, although the investments should be seen as being amortized as an operating expense. Financing must also be provided for operating costs including personnel costs and maintenance costs for equipment and ongoing programs as appropriate.

The basic philosophy upon which this chapter is developed identifies local funds as the strength and foundation of EMS system financial support. Federal grant monies can not be guaranteed and are considered to be essentially extraneous to the present discussion. That is, improving the metropolitan Atlanta EMS system is now basically in the hands of the seven counties. However, since some funds may be available from Federal or State sources, these external sources of funding are described in this Chapter.

Possible sources of funding are briefly described in the following pages, and include: county taxes; Office of the Coordinator of Highway Safety; Georgia Department of Education; Georgia Regional Medical Program; and the EMS Special Project Office within the Health Services and Mental Health Administration of the U.S. Public Health Service.

ROLE OF THE EMS COORDINATING AGENCY

As discussed in Chapter 3, grant applications for Federal funding of EMS system installation or operating costs are to be made through the EMS Coordinating Agency (ECA). If Federal funds are awarded to metropolitan Atlanta for EMS, the EMS Agency is then to distribute the funds to the various EMS system components according to a schedule which would have been prepared and agreed to beforehand and would have been included in the grant application.
Also requests for State funds or Federal funds administered by State agencies can be most expeditiously requested through the ECA when the requested funds are to be applied to EMS system activities which are coordinative or regional in nature. Any such requests for funds are not made independently by the ECA, since the Agency serves on behalf of the seven counties and acts in order to implement decisions made by the Agency's Board of Directors, which in turn receives input from the three Advisory Councils.*

In addition to the ECA having a role in requesting, receiving, and distributing Federal and State funds, the Agency is also to assist in arranging and enabling the payment of the fixed costs associated with intercounty emergency ambulance service. The Agency is to play this role, because the agency, through the dispatch and control center is to routinely collect information on the operation of the metropolitan Atlanta EMS system including utilization of ambulances for intercounty emergency service.

**SUBSYSTEM REVENUE REQUIREMENTS**

In the following paragraphs, the revenue requirements of the four basic functional subsystems of the EMS system are discussed. The four subsystems are transportation, facilities, training, and the EMS Coordinating Agency. The communications subsystem, which is a supportive subsystem, is not located separately but rather is included in the discussion of the functional subsystems.

**Emergency Transportation**

The proposed EMS system is not to charge the patient or his family, directly, for emergency ambulance service provided to the patient. Financial support of the transportation subsystem, which includes vehicles, medical equipment and supplies, communications equipment, and personnel, is to be provided by the counties from county taxes. Medical aid vehicles are to be provided through use of existing resources of fire and police

* See the section entitled "EMS Coordinating Agency" in Chapter 3 for a discussion of the Board of Directors and the Advisory Councils.
departments; the three mobile intensive care units (MICUs) are to be paid for by the seven counties, and the EMS Agency is to be assigned operational responsibility for the MICUs. Ambulance financial matters are discussed indepth in following paragraphs.

Alternative Ambulance Service Charging Policies

Although a policy of not charging the patient directly for emergency ambulance service has already been established and explained in Chapter 3, further discussion of this recommendation is warranted. Various EMS systems in the U. S. have differing policies for charging the patient for ambulance service and no one policy has been established as correct for all communities. Arguments can be presented for any one of three different charging policy alternatives which include:

(1) No charge.
(2) Full cost charge.
(3) Supplemental charge, a form of co-insurance.

Some EMS systems do not charge the patient or his family for transportation services rendered. In such cases, funds to support the EMS transportation subsystem are obtained from tax dollars or contributions and special grants. The policy requiring that the full cost of emergency transport services rendered be paid by the patient or his family is common among private ambulance service purveyors. In some systems, a portion of the cost for transportation and on the scene care is charged. In those EMS systems in which only a part of the cost for service is charged, transportation revenue supplements the basic subsidization of the EMS system by county or city tax dollars.

All three of the cited charging alternatives are presently employed in various cities, but in several large cities (for example, New York City, Baltimore, Maryland, and Columbus, Ohio), no charge is made for emergency medical transportation. In those cities where a fee is charged for emergency ambulance service, problems associated with collection of fees are often cited as a significant factor contributing to the demise of private ambulance services.
Analysis Supporting the Recommendation

The decision not to charge the patient or his family for transportation related emergency medical service is based upon the EMS system goal to encourage use of the system. The experience of many EMS systems is that, when a charge is made for emergency ambulance service, such charges inhibit the citizens' use of the EMS transportation subsystem thereby voiding, to a degree, the medical care benefits designed into modern EMS systems.

Basic concepts in the development of modern EMS systems are to bring appropriate medical care to the emergency patient at the emergency scene, to stabilize the patient's condition at the scene, and then to transport the patient safely and under the care of trained personnel to the most appropriate emergency facility. As noted in Chapter 5, the improved EMS system for metropolitan Atlanta is designed to bring emergency medical care to the emergency victim in an average of six minutes. Additionally, in emergency medical situations which require the quickest possible response, a medical aid vehicle is to be dispatched to arrive at the scene of the emergency in an average time much less than six minutes.

If the community is to benefit from such modern emergency medical concepts and design characteristics, then any factor which tends to cause the citizens not to use the system for legitimate emergency medical situations can only be considered a negative factor. The assumption that a citizen will drive to a hospital rather than pay a fee for transportation appears to be valid. The experience of the Jacksonville, Florida EMS, which charges $22.50 for transportation, has shown that most heart attack victims do, in fact, drive to a hospital despite the availability of a relatively low cost, high quality EMS transportation subsystem.*

Consequently, the presently proposed EMS plan recommends that counties assume the fiscal responsibility for providing these vital emergency medical services just as the counties presently

* See Chapter 12.
assume responsibility for providing other vital emergency services such as fire and police protection. To adopt a policy other than the policy outlined above is to nullify, partially but perhaps to a significant degree, the high level of EMS system performance which can be achieved through implementation of the herein proposed EMS system plan for metropolitan Atlanta.

The policy not to charge citizens directly for ambulance service should be closely monitored and re-evaluated as appropriate. Abuses of the system should be noted and checked, as described in Chapter 7. If necessary, the EMS system charging policy can be changed to one of the other alternatives mentioned above.

**Fiscal Arrangements for Ambulance Service**

The costs of emergency transportation and emergency treatment provided to the patient, both at the scene and enroute to the hospital, consist of fixed and variable cost elements. For purposes of the immediate discussion, fixed costs are defined as the cost to the county of having its segment of the transportation subsystem established and in place per the specifications in Chapter 5. Variable costs are defined as the costs which are dependent upon factors such as mileage and number of patients transported and miles traveled in providing emergency transport. The amount of variable costs incurred in any time period is known only after the fact; however, the variable cost amount for a given time period can probably be predicted with a relatively good degree of accuracy once the proposed EMS system accumulates a record of operational experience.

Each county government is to arrange for the establishment of the county's segment of the EMS transportation subsystem through negotiation of contracts with private ambulance companies or, when necessary, by delegating to some public service agency the responsibility for emergency transportation. The term, private ambulance company, is used in a general sense and is meant to include any private organization which can provide emergency ambulance service per the specifications in the present document particularly in Chapter 5. Also, if a county is
unable to arrange for private organizations to provide emergency ambulance service and county public service agencies are unable to assume the responsibility, the county can arrange to have public service agencies of a local municipality or a neighboring county to provide the service.

Conceivably, a county could arrange to have emergency ambulance service provided by one or more private companies and one or more public service agencies simultaneously in order to achieve the county's EMS transportation subsystem requirements. The contracts with the private companies would be negotiated such that the private companies would provide ambulances dedicated to emergency service at a fixed price, and the contracts would include a provision whereby the companies would bill the county each month for the amount of the variable costs of providing emergency transport.

The fixed price portion of the contracts between private companies and the counties would include all fixed costs associated with the emergency ambulance plus whatever fee the company could negotiate with the county. Contracts could be awarded to private ambulance companies on a competitive basis. The selection of a company from among the offering competitors should not be based solely on the price in the bid but should include other factors such as the experience and history of quality of service provided by the companies.

Situations can occur in which an emergency patient is transported in an emergency vehicle which is from a county other than the patient's county of residence. Such situations are referred to as intercounty emergency ambulance service, and the guiding fiscal principle in such situations is suggested to be that the patient's county of residence is responsible for reimbursing the county, which provided the ambulance, for the fixed cost associated with the ambulance. Reimbursements between counties can be made quarterly, annually, or according to any schedule established by the Board of Directors of the EMS Coordinating Agency.

Information needed to establish the amounts of the intercounty reimbursements can be readily obtained from data to be routinely
collected by the ECA dispatch and control center. After the EMS system has been implemented and a record of operating experience accumulated, the record may show that the net sum of the reimbursements between counties is essentially zero, in which case the Board of Directors may decide to dispense with the reimbursement procedure.

Finally, the variable costs associated with intercounty emergency ambulance service are to be billed by the ambulance operator directly to the patient's county of residence.

Emergency Facilities

Recognizing the historical development of the medical care charging practices in effect in this county, the proposed EMS system plan for metropolitan Atlanta does not in any way suggest a change in the accepted pattern of billing and paying for hospital and physician provided emergency medical care. Of course, an accepted part of the present billing and payment pattern is that counties, along with whatever Federal and State assistance which might be available, assume the burden of paying all or part of the emergency care provided to indigent patients depending on the patients' ability to pay.

In regard to emergency medical care provided to indigent patients, the EMS plan presented herein does call for the creation of additional hospital-county contracts such that indigent patients can receive the necessary emergency care in the most suitable hospital emergency department. The contracts should provide for provision of emergency care to indigent patients regardless of county of residence and should assure that the hospitals and physicians receive fair payment for services rendered to the indigent patients. The need for such contractual arrangements was frequently mentioned by hospital administrators who provided information in the course of the hospital emergency facility survey conducted by HSRC during the summer of 1972.

The contracts then should provide for emergency treatment of indigent non-resident patients of the county. Reimbursements for emergency care provided to indigent patients would be handled directly by the hospitals and counties.
Also, EMS system communications components in hospital emergency facilities are to be financed by the counties.

Training of EMS Personnel

The cost of training consists of two principal components: the cost associated with providing training, such as instructor salary, training materials, and so forth; and the cost associated with the receipt of training, including salary support for the trainees. The cost associated with provision of training may be supported by Federal, State, and county funds. However, it should be noted that training for EMS personnel might not, and perhaps should not be, provided in every county. The ECA Board of Directors, through the ECA and in conjunction with the Georgia Department of Education, area vocational-technical schools, hospitals, and the medical societies, should arrange for necessary training sites. Each of the counties should provide its proportionate share of the cost of the training provided at the sites.

The MICUs, including the supplies, equipment, and personnel instructor on the MICU, represent costs associated with the provision of training. These costs include fixed and variable components similar to the costs associated with emergency ambulance service, and the costs should be proportionately supported by county funds as described in the previous paragraph. Fixed and variable cost payments associated with the operation of the MICUs should be paid to the EMS Coordinating Agency, since the ECA is to be assigned the responsibility of MICU operation.

Although the MICUs are based at hospitals and utilize some hospital personnel and supplies, the EMS Agency, not the hospital, should be responsible for performing the administrative and managerial tasks required for MICU support. The MICUs serve the entire region rather than a county or a hospital, both as training devices and medical care vehicles and are therefore most appropriately supported by county funds provided to the EMS Coordinating Agency.

Salary support for a trainee should be provided by the trainee's employer, according to arrangements between the employer and
Employee. The trainee, during all periods of training, retains his identification and affiliation with his ambulance service organization. Salary for EMT's in training should be treated as a fixed cost, and therefore, the cost should be provided for in the negotiated contracts between counties and ambulance service providers.

EMC Coordinating Agency

The EMC Coordinating Agency performs its assigned functions on behalf of each county in the EMC system. The utilization of EMC Coordinating Agency resources in serving the counties varies according to the demand for EMS in each county. County funds to support the activities of the EMC Coordinating Agency should, therefore, be paid to the Agency in amounts proportional to EMS demand. The EMS demand or load in each county is recorded routinely at the dispatch and control center for data analysis purposes. Therefore, projections of EMS demand may be established for future periods of operation, and annual expected costs can be computed to facilitate county budgeting processes. All costs associated with the operation of the ECA, including the dispatch and control center, are to be paid by the metropolitan counties.

FINANCING SOURCES

The various sources for EMS funds are presented and discussed below. The need to depend upon county support is re-emphasized, since Federal funds may or may not be available.

County Taxes

Emergency medical care has been presented herein as a county responsibility, and it is proposed that each county should be responsible for the EMS costs required to protect the health of the county's citizens. The need of funds for transportation and transportation care, emergency facility treatment of indigents, training, and the EMC Coordinating Agency has been presented in the present document, and the counties participating
in the EMS system should be prepared to finance the fixed and variable operating costs.*

**Georgia Coordinator of Highway Safety**

Financial assistance may be available for the purchase of ambulance and ambulance service related communication equipment from Federal funds administered by the Coordinator of Highway Safety for Georgia. The funds are provided through the Federal Highway Safety Program which includes provision, under section 402 of the Highway Safety Act of 1966, for grant-in-aid programs to be established to assist states and political subdivisions in implementing EMS transportation sub-systems. Matching local funds are required in order to obtain grant funds through the Coordinator of Highway Safety.

**Georgia Department of Education**

The Georgia Department of Education is presently administering the EMT training program at DeKalb Area Technical School with assistance of grant funds used to establish the instructional program.** Funds for developing additional emergency medical training programs may be available if needed in the future through the Manpower Development Training Act.

**Georgia Regional Medical Program**

The Georgia Regional Medical Program (GRMP) can provide funds to assist in the development of emergency medical service systems. GRMP support may be used to supplement the EMS system financial assistance provided by the sources mentioned above. GRMP funds may be provided through a program of temporary assistance, which can cover a period of time not to exceed three years.

* Actual EMS costs are presented and discussed in Chapter 15.

** EMT training is fully described in Chapter 6.
Special Project Office for EMS of the Health Services and Mental Health Administration

The EMS Special Project Office (SPO) of the Health Services and Mental Health Administration (HSMHA) has been directed, by the Department of Health, Education, and Welfare, to administer new Federal grant programs for EMS. The Emergency Medical Services Systems Development Act of 1973 (S.504) would authorize $300,000,000 over the next three years for project grants on a matching basis, up to 75 per cent, for the development or expansion of comprehensive area EMS systems. The SPO has been advised of EMS developments in the metropolitan Atlanta area through personal conversations with HSRC and GRMP Staff.

Georgia Vehicular Licensure Fees

The Governor's Study Commission on Emergency Medical Services in Georgia has recommended that the annual fee for licensing motor vehicles be increased by two dollars and that the annual revenue (approximately $5,600,000) collected through the fee increase be used to provide long-range State aid for emergency ambulance operations.
CHAPTER 11
DISASTER PLANNING

INTRODUCTION
The analysis, present situation, and recommendations for planning to meet the medical demands of a disaster have, to a great extent, been developed by the EMS Task Force Subcommittee on Disaster Planning. The EMS Task Force report is reproduced in Appendix AA. The resources of the EMS system, as presented in this present EMS plan, will become an integral part of the medical team for disaster control when a disaster occurs.

This chapter presents a brief discussion of the role of the EMS system in a disaster situation. The discussion relies heavily upon the functions described in Appendix AA, and describes the use of EMS system transportation resources, communication resources, and the dispatch and control center in disaster situations.

MOBILE INTENSIVE CARE UNIT
The mobile intensive care unit (MICU), although not equipped to handle a disaster without assistance, carries supplies and medical personnel that are valuable to the On Site Medical Director. MICU's are able to assist in performing initial triage (separation of the injured according to severity and treatment needs) and life-sustaining resuscitation. The supplies carried by the MICU, as described in Appendix L, are crucial in critical medical emergencies and probably will be the only supplies on the disaster scene when the Medical Aid Team first arrives.

The MICU may serve as a control center at the Medical Aid Station. In addition to supplies and manpower, the MICU has radio communication on the EMS dispatch frequency, medical consultation frequency, hospital-wide frequency (155.340 MHz), and regional hospital frequency (155.280 MHz), as described in Chapter 8.
EMS DISPATCH AND CONTROL CENTER

The dispatch and control center (DCC) of the EMS Coordinating Agency would be able to provide assistance in controlling and coordinating all hospital and transportation resources in a disaster. The DCC, as a matter of daily routine, maintains current information on the availability of emergency department beds, CCU beds and inpatient beds, for all Category I, II, and III hospitals in metropolitan Atlanta.*

The DCC maintains current information regarding services available at each emergency hospital, also as a matter of routine. The DCC can communicate with each hospital via radio, controls all radio traffic among hospitals, ambulances, and MICU's, and can reach any major police or fire department in metropolitan Atlanta via direct line.

The resources and expertise of the DCC can be invaluable to the Disaster Coordinator and the Disaster Medical Director when a disaster occurs. The role of the DCC must be carefully defined and documented. The interaction between the DCC and Civil Defense must be fully understood and rehearsed in disaster drills to guarantee effective operations.

COMMUNICATIONS

The communication subsystem of the EMS system is designed to include radio frequencies that may be used throughout the State of Georgia in a disaster situation, specifically 155.340 MHz and 155.280 MHz. The interaction between Civil Defense (CD) and the DCC will require the presence of a CD official at the DCC or radio or telephone communication links between CD and the DCC (unless CD becomes the EMS Coordinating Agency in which case the DCC would be logically located at a CD installation). City of Atlanta Civil Defense Headquarters does not presently have radio frequencies compatible with hospitals and most fire departments. Civil Defense also does not presently have direct telephone communication lines with metropolitan Atlanta hospitals, or most police and fire departments.**

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* DCC communications are described in Chapter 8.

** Telephone interview between Oren L. Reinbolt, HSRC, and Bob Chaney of Atlanta Civil Defense on February 27, 1973.
Civil Defense should not duplicate the communication resources of the EMS Agency including radio and telephone communication devices. Regional hospitals (Grady Memorial Hospital, Kennestone Hospital) and MICU's or ambulances are capable of replacing the DCC radio control, if the DCC becomes disabled by some disaster force.
CHAPTER 12
PUBLIC EDUCATION RELATED TO THE EMS

INTRODUCTION

A system of emergency medical service is analogues to a link chain and public education represents a link in that chain. Without public education the EMS system will not succeed in achieving all of the goals, and the degree of success will diminish. The citizen who attempts to reach a physician after discovering a non-breathing victim of a medical emergency may easily cost the victim his life. The public must know what to do if the complex of men and equipment recommended in the present EMS system plan is to be effective.

OBJECTIVES OF PUBLIC EDUCATION

Public education has several objectives, all of which are directed toward saving lives and reducing disability. The objectives are grouped as follows:

1) Public education is to minimize the delay between detection of an emergency and reporting of an emergency.
2) Public education must encourage the citizens of metropolitan Atlanta to learn and use life-saving techniques.

Specific objectives are presented as recommendations following a discussion of the present EMS public education efforts in metropolitan Atlanta.

EMS RELATED PUBLIC EDUCATION IN THE UNITED STATES

In 1969, public awareness was listed as the first element of planning for an EMS system at the Airlie Conference (1, p.32). Joseph K. Owen, Ph.D., presented a paper at the Airlie Conference stating, "Ideally, citizens should be trained in first aid and know how to render necessary emergency care to themselves and those around them. As a practical matter, they must
at least know how to obtain professional assistance".* The Airlie Conference recommended that standard first aid training by the American Red Cross, or equivalent training, be required for licensure to operate any vehicle on land, sea, or in the air (1, p.17).

Publicity materials from the Seattle Medic Two program are included in Appendix BB. The Medic Two program has as its primary objective instruction of all eligible Seattle residents in the technique of cardiopulmonary resuscitation. The Northeast Florida Heart Association is attempting to train the entire Jacksonville community in mouth-to-mouth resuscitation technique and closed-chest massage. Special classes are held for relatives of known "cardiacs" and demonstrations are conducted in busy public places (2, p.11). First aid instruction is provided in public schools throughout the United States, and recently, cardiopulmonary resuscitation classes have been taught to high school students.**

Several cities attempt to publicize emergency telephone numbers to be used for obtaining emergency medical assistance. Police and fire vehicles often display the appropriate emergency telephone number for police and fire department assistance and, occasionally, medical aid. Systems utilizing "911" frequently advertise the emergency number on pay telephones. In communities with progressive EMS systems, such as Jacksonville, Florida, attempts have been made to publicize the symptoms of serious illnesses, especially heart attack. The Jacksonville Fire Department has mailed the emergency medical aid telephone number to all residents and requested that the number be affixed to the telephone. The telephone sticker is illustrated in Figure 12.1.

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** Personal interview between Mark S. Blum, HSRC, and Peter Safar, M.D., Department of Anesthesiology, University of Pittsburgh, February 2, 1973.
First Aid and Resuscitative Skills

Despite the availability of cardiopulmonary resuscitation (CPR) training, the short length of the course, and the absence of any charge for the training, less than one per cent of the population of Georgia is registered as having completed the CPR course. In metropolitan Atlanta 4500 citizens (or 0.3 per cent of the citizens) are registered as having completed the CPR Training during the 12 month period ending January 21, 1973.* Registration expires after 12 months and all persons must take a refresher course in order to maintain their CPR certification.

The Atlanta Chapter of the American Red Cross has recorded 16,512 persons in the metropolitan Atlanta area as holding current first aid cards (assuming all holders of advanced cards have also completed standard training level courses) as of June 1972. This figure accounts for

* Data obtained from the Georgia Heart Association.
approximately one per cent of the population. In addition, of approximately 300 schools in metropolitan Atlanta, only five or six teach first aid even though the basic course is designed for the fifth grade.*

The Occupational Safety and Health Act (OSHA), effective April 28, 1971, has had a significant impact on the availability of first aid skill in the community.** OSHA requires employers of one or more persons (except domestic) to demonstrate the availability of medical assistance within 15 minutes after a need has been ascertained or to make first aid equipment and a basic first aid (Red Cross) certificate holder available to the employees at all times.

**Public Education to Minimize Delay**

Public Education to minimize the delay between detection of a medical emergency and report of the emergency is essentially nonexistent in the metropolitan Atlanta area. The metropolitan Atlanta telephone directory lists the telephone number of Grady Ambulance on the inside front cover. However, nearly 1,316,500 citizens live beyond the acceptable six minute response area of Grady Memorial Hospital (See Appendix K).

February, 1973, is known as "heart month". Publicity efforts associated with heart disease increase during February, and newspaper articles have been published to acquaint the citizens of metropolitan Atlanta with the first symptoms of heart attack and advise the victim to call his physician if the symptoms occur.

**ANALYSIS AND RECOMMENDATIONS**

An approach for implementing a public information and education program in metropolitan Atlanta has been recommended by the EMS Public Information Subcommittee of the EMS Task Force (See Appendix D).

* Personal interview between Mark S. Blum, HSRC, and Mr. Tommy C. Ishee, Atlanta Chapter, American Red Cross, on October 17, 1972.

The EMS Task Force recommendations are presented below:*  

RECOMMENDATIONS: Realizing that the public's awareness of the necessity and performance quality of an adequate EMS system is, in large part, dependent on the cooperation of the region's media resources, it is recommended that a consumer awareness program be developed, stressing the fact that an adequate EMS system is a community responsibility, and that such a program be implemented through the cooperation of such resources as soon as possible. And, recognizing that the quality of EMS now available to the residents of this region is — on the average — below acceptable standards, it is recommended that appropriate Public Information and Education programs be developed to increase consumer acceptance for improved EMS delivery and that such programs be presented with the support of media resources as a part of implementing an adequate EMS system in the Metropolitan Atlanta Region.  

Finally, to further stress the fact that the delivery of emergency medical care is a community responsibility, it is recommended that those officials selected for the implementation of such a system be required to make available for public scrutiny all information relating to the performance of the system so far as it doesn't violate the privacy of emergency victims.  

First Aid and Resuscitative Skills  

The EMS system is designed to effectively meet the needs of every victim of a medical emergency that is alive at the time the emergency is reported. Clinically dead victims may be revivable if resuscitation begins within six minutes, according to the probability distribution shown in Table 12.1.

TABLE 12.1 Chance of Resuscitation from Cardiac Arrest, as a Function of Delay Between Onset and the Application of Cardiopulmonary Resuscitation.

<table>
<thead>
<tr>
<th>DELAY</th>
<th>CHANCE OF RESUSCITATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 minute</td>
<td>98 out of 100</td>
</tr>
<tr>
<td>2 minutes</td>
<td>92 out of 100</td>
</tr>
<tr>
<td>3 minutes</td>
<td>72 out of 100</td>
</tr>
<tr>
<td>4 minutes</td>
<td>50 out of 100</td>
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<tr>
<td>5 minutes</td>
<td>25 out of 100</td>
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<tr>
<td>6 minutes</td>
<td>11 out of 100</td>
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<tr>
<td>7 minutes</td>
<td>8 out of 100</td>
</tr>
<tr>
<td>8 minutes</td>
<td>5 out of 100</td>
</tr>
<tr>
<td>9 minutes</td>
<td>2 out of 100</td>
</tr>
<tr>
<td>10 minutes</td>
<td>1 out of 100</td>
</tr>
<tr>
<td>11 minutes</td>
<td>1 out of 1,000</td>
</tr>
<tr>
<td>12 minutes</td>
<td>1 out of 10,000</td>
</tr>
</tbody>
</table>

NOTE: Irreversible brain damage occurs in most persons within four to six minutes after the oxygen supply to the brain is cut off. Data appearing above the dashed line were extracted from a film entitled "Pulse of Life," produced by Archer S. Gordon, M.D., Ph.D., and available from the American Heart Association. Data appearing below the dashed line were prepared by the Seattle Chapter of the American Red Cross from standard oxygen deficiency tables.*

Cardiac arrest is not always the result of cardiovascular disease. Several accidental injuries, such as injuries resulting from

* Telephone interview between Mark S. Blum, HSRC, and Jerry Montgomery, Coordinator of EMS, Seattle King County Department of Public Health, on March 20, 1973. (See Reference (3).
automobile accidents, may render the victim unconscious and unable to breathe due to the position of the victim's head. Inability to breathe will lead to cardiac arrest and a mere repositioning of the head to establish an airway can save a life.

The closest medical aid to the emergency scene should be the closest passerby or a family member or neighbor. Hence, the citizens of metropolitan Atlanta should be made aware of the need for a well trained public. Cardiopulmonary resuscitation (CPR) and basic first aid, as an absolute minimum, should be taught in all public schools. The news media, including radio, television, and the press, should educate the citizens, informing all metropolitan Atlanta residents of the following:

1) The importance of First Aid and CPR.
2) The length of training courses.
3) The availability of training courses.
4) The fact that training is absolutely free.
5) The importance of the first four minutes in serious emergencies.
6) The legal immunity of trained first aid rescuers at the scene of an emergency.

The State of Georgia should evaluate the feasibility of requiring a current standard first aid certificate (American Red Cross or equivalent) as a prerequisite for initial and subsequent licensing of all motor vehicle operators in the State. The Multimedia First Aid training program developed by the American Red Cross provides adequate training, with the exception of CPR, in eight hours.

Public Education to Minimize Delay

The importance of the first four minutes to the critically ill or injured person has been established. The citizen in metropolitan Atlanta must minimize the time between detection and report of an emergency. The news media must accept its responsibility for community service and teach the citizen of metropolitan Atlanta the technique for minimizing the delay. Specifically, the public must learn:
1) The first symptoms of heart disease and other major causes of sudden death.

2) That the EMS system dispatcher should be contacted first, before anyone else, including the physician.*

3) The emergency medical telephone number and how the system reacts to a call for help with emphasis on the fact that the EMS system does not charge a fee.

4) To place emergency telephone numbers onto the telephone in clear view.

A heart attack is often accompanied by distinct warning symptoms. If the victim of a heart attack recognizes the symptoms, action may be taken. The radio, television, and press media should coordinate programs to educate the public to know the symptoms by utilizing spot advertisement during peak viewing or listening hours as appropriate.

Despite extensive publicity programs in Jacksonville, Florida, most (67 per cent) persons admitted to the hospital with a heart attack do not arrive via the available EMS transportation.** The citizen of metropolitan Atlanta must be educated to understand that most (over 60 per cent) deaths from heart attack occur within the first hour and that most victims of death within the first hour do not reach the hospital.*** The citizens of metropolitan Atlanta must not only be exposed to the facts but also instructed to remember the facts. The citizen must realize that most family physicians are not equipped to respond to cardiac arrest within the first four minutes. The citizens of metropolitan Atlanta must realize that effective medical aid will arrive quickly only if the EMS dispatch center is notified as soon as symptoms are present.

* Unless a physician has specifically instructed a patient to do otherwise.

** Personal interview between Oren L. Reinbolt, HSRC, and Captain John Waters, Director of Public Safety, Jacksonville, Florida, on December 7, 1972.

*** Data obtained from Appendix BB.
The telephone number to be implemented for public access to the EMS system must be publicized frequently on radio, television, and in the press. The number should become a part of the orientation process for all new residents in the metropolitan Atlanta area, should be publicized through public schools, colleges, and universities, and should be included in the information provided by welcoming committees and services.

In Jacksonville, Florida, almost 25 per cent of all emergency medical calls are reported to the police in spite of intensive campaigns requesting citizens to place the emergency medical telephone number onto telephones. The need for continued advertisement of the EMS system telephone number via the public media appears to be warranted. Many citizens do not place emergency telephone numbers onto the telephone for various reasons. The General Sales Manager of Southern Bell is presently investigating the possibility of having Southern Bell telephone installers place the number onto each new and serviced telephone.* Nothing can be done to prevent the citizen from removing the number, however, and publicity efforts should continue.

REFERENCES


* Personal comment made by W. Frank Blount, General Sales Manager, Southern Bell, at EMS Task Force meeting, on January 22, 1973.
CHAPTER 13

ADMINISTRATION AND MANAGEMENT OF THE EMS COORDINATING AGENCY

INTRODUCTION

In Chapter 3, the functional responsibilities of the EMS Coordinating Agency are described. In addition to the functions described in Chapter 3, which are operationally oriented, certain administrative and managerial activities must be routinely performed. These internal activities of the EMS Agency are concerned with personnel, work system logistics, and cash flow management and management control. Each subject is addressed in the following paragraphs.

ADMINISTRATIVE AND MANAGERIAL ACTIVITIES

Personnel Administration and Management

Personnel administration includes development and administration of the personnel management goals and policies which are internal to the EMS Coordinating Agency. Personnel management activities include administration of established policies, work schedule design and management, design of employee benefit schedules, development and administration of wage and salary standards, employee evaluation, and related activities.

Also, when the ECA is established initially, personnel are to be recruited and trained, as necessary, to fill the positions in the ECA dispatch and control center and on the mobile intensive care units. The specific training and skills requirements for the personnel in the dispatch and control center need to be further examined. Certain training and skills requirements have been identified in Chapter 6, and the job analysis studies mentioned in the paragraph below entitled "Work System Management" can provide additional inputs into the identification of the specifics of the training and skills requirements.
Work System Management

Although in Chapter 6 a fairly detailed description of the work activities of the DCC personnel is presented within the specified dispatch and control procedures, the precise methods of performing these work activities have to be formulated. After the work methods have been designed and job specifications written, job analysis studies are to be conducted in order to determine the optimal combinations of DCC employee activities, tasks, and duties. Subsequently, job evaluation studies are to be conducted in order to determine precisely the relative worth of the jobs.

The results of the job analysis and job evaluation studies can then be used to establish properly related wage levels for DCC personnel and an appropriate hierarchy of positions within the DCC such that an equitable and efficacious line of authority and supervision within the DCC are established.

The results of the job analysis and evaluation studies directly contribute to the development and administration of the personnel management policies previously mentioned. And as already noted, the studies' results are important to the correct specification of the DCC training and skills requirements.

For purposes of estimating the personnel costs for the EMS Coordinating Agency and its dispatch and control center, assumed wage levels for ECA personnel are used in Chapter 15. The wage levels connote a hierarchical organization within the dispatch and control center which may not be indicated upon completing the job analysis and evaluation studies.

Logistic and Support Management

Internal logistics support for the ECA needs to be specified in addition to the secretarial support identified in Chapter 3. Some of these additional logistics management details include activities related to janitorial services, supply control and acquisition, office supply procurement and contractual services, insurance, parking arrangements for
employees and visitors, and so forth. Also, provisions must be made for maintenance and rental of equipment.

**Cash Flow Management**

The functional relationships among the EMS system components, and the associated cash flow, are described in Chapters 3 and 10. As stated in Chapter 3, the EMS Coordinating Agency is to receive a pro rata portion of funds, from each county, to cover the cost of ECA operation. Then needs develop for record keeping, banking, and related cash flow administration and management tasks to be performed by the EMS Agency.

Also, the Agency is to arrange, on behalf of the counties, for distribution of Federal and State grant monies if such funds become available. Activities in support of the fiscal management of grant funds are to include the preparation of internal and EMS system budgets and financial statements and reports.

Finally, the internal cash flow needs of the Agency must be addressed. Rent, telephone, utilities, supplies, payroll, and other cost-incurring elements of Agency logistics require that mechanisms be established to assure that cash on hand is adequate to these needs.

**Management Control**

Management control procedures need to be established for all EMS Coordinating Agency functions. Internal supervision procedures within the DCC need to be established and aligned with the ECA organizational structure, which in Figure 3.3 in Chapter 3 is shown as an essentially horizontal organization. Figure 3.3, however, is probably not a representation of the final ECA organizational structure, since the need for internal supervisory responsibility in the DCC during all three operating shifts is expected to require that one of the persons in the DCC be responsible for the orderly operation of the DCC.

Consequently, some form of organizational hierarchy needs to be developed within the DCC. Furthermore, once developed, an organizational hierarchy normally implies a possible path of career progression.
through the related job classifications in the organization. For example, a receiving operator in the DCC might aspire to become a dispatcher assuming, of course, that the dispatcher position is a higher level position than the receiving operator position.

Management control within the EMS Coordinating Agency and monitoring the performance of the EMS system implies the need for information to be collected and reported to the ECA coordinator. Compilation, analysis, and dissemination of data on finance, volume of dispatches, descriptive summaries of emergency ambulance calls, emergency medical service response times, ambulance availability and the other performance measures given in Chapter 9 must be routinely performed.

**SUMMARY**

The EMS Coordinating Agency is to be established to facilitate, on behalf of the seven metropolitan county governments, the effective and efficient performance of the metropolitan Atlanta emergency medical services system. In order to perform the facilitating role, the county governments assign to the EMS Agency the various operational functional responsibilities described in Chapter 3. In turn, in order to satisfactorily perform the assigned role, the need develops for the Agency to perform the administrative and managerial activities described in the present chapter.

The intent of this chapter then is to emphasize the need for, and scope of, internal EMS agency administration and management considerations. The material in this chapter is not all inclusive, but is designed to illustrate the nature of some of the internal activities of the Agency.
CHAPTER 14

FUTURE EMS ANALYSES AND ADDITIONAL RECOMMENDATIONS

INTRODUCTION

As part of the ongoing operation of the EMS system, continued planning and analyses are to be conducted (as with any other organization) in order to provide for continuing improvement of the EMS system and to adjust to the changing needs of metropolitan Atlanta. These analyses have been indicated in several of the preceding chapters, and some of the associated data collection requirements are presented in Chapter 9. The analyses are discussed and, to some extent, repeated herein in order to present a consolidated discussion of future analyses for easy reference.

This chapter presents recommendations for future analyses to be performed by the EMS Coordinating Agency (ECA) in the areas of facilities, transportation and vehicles, training, dispatch and control, and communications. In addition, other considerations and recommendations are suggested for examination by the EMS Coordinating Agency. Most of these other considerations and recommendations have not been examined in detail by the HSRC staff but are thought to be worthy of analysis by the ECA and other organizations concerned with EMS in metropolitan Atlanta.

FUTURE FACILITIES ANALYSES

Number and Scope

As presented in Chapter 4, future analyses of the facilities subsystem of the EMS system should be directed toward the accomplishment of two goals:

1) Insure that the number and location of emergency facilities throughout metropolitan Atlanta are such that the facilities are readily accessible to the public and provide adequate emergency treatment capability and capacity, but not to the extent that
the EMS system is oversupplied with emergency facilities thereby failing to maintain cost-effectiveness. In addition, however, cost-effectiveness considerations must be included, along with consideration of accessibility and adequacy in the ultimate determination of the proper number and location of emergency facilities.

2) Determine precisely what scope of emergency treatment capability (in terms of services and hours of operation) is to be available at each of the facilities in the EMS system based upon the number and locations of facilities in the system.

Based upon the routine data collections described in Chapter 9, the EMS Coordinating Agency should have available the data necessary to make valid recommendations as to the scope of emergency service capabilities required at each hospital ED to fulfill patient needs. A recommended approach is as follows:

1) Determine if enough emergency patient treatment capabilities exist in metropolitan Atlanta to adequately fulfill patient requirements for emergency services. As a first step, determine if the total emergency treatment capabilities of the facilities exceed the total demand for emergency treatment.

2) If the aggregate treatment capability in the metropolitan Atlanta area is in excess of the total demand for emergency services, then criteria must be developed for determining the proper relative proximity of emergency facilities to the location of patients needing the services. For example, if all emergency facilities were located downtown in the City of Atlanta, the facilities would be too distant to be effective in treating severe trauma in outlying areas.
3) Based upon the origin of emergency patients over a period of time, the facilities subsystem can be evaluated as to whether or not the proximity criteria mentioned above, are being met.

4) Facilities may be upgraded or downgraded as necessary so as to provide the necessary emergency treatment capabilities at sites meeting the proximity criteria to patients in need of service.

Although the above approach requires considerable data, the data collections presented in Chapter 9 insure that the necessary data is routinely collected for this and other purposes. It should be noted that the above approach must be expanded into a specific method (that is, set of steps). Furthermore, it should be understood quite clearly that the above described analytical problem is very complex and has not been solved as yet in other communities.

FUTURE VEHICLE AND TRANSPORTATION ANALYSES

Number and Location of Vehicles

The proposed number and locations of vehicles presented in Chapter 5 are based upon the analyses presented in that chapter and the best available data. However, once the EMS system becomes operational, data collected from the ambulance run reports and the dispatch and control center (DCC) form can be substituted for the presently used estimates of the service demand placed on emergency medical vehicles. It is to be expected that certain deviations from the estimated data will be found over time, due largely to the urban dynamics of metropolitan Atlanta (as with any large metropolitan area). The EMS Coordinating Agency should be prepared to analyze the specific data collected which directly relates to vehicle response times, each vehicle's utilization, number of responses by vehicles into secondary service areas, and other performance measures, and to make adjustments in the locations of vehicles where such adjustments
are indicated. Similarly, vehicles may be added to or subtracted from the total number of vehicles in the EMS system, although great care should be used to avoid adding vehicles as a substitute for locating vehicles properly.

Routinely collected data should also be analyzed to determine the number and locations of vehicles which are affected by the time of day. Although the recommended number of vehicles is based upon the peak daily demand for EMS, and to some extent may be interpreted as an analysis of a static system, the EMS Coordinating Agency should realize that demand for EMS is dynamic and varies to some extent as a function of the time of day and the day of the week. Analysis of the functioning EMS system may show a need to concentrate ambulances in the urban areas during normal working hours, and shift ambulances to the suburban areas at other times. The total number of emergency vehicles required in the EMS system should be less during the early morning hours, due in part to reduced demand and also to increased emergency vehicle speeds which are attainable when highway traffic is light.

**Utility of Special Vehicles**

Both helicopters and disaster vans have been used in emergency medical service systems in certain cities in the United States, although detailed evaluations of the real utility of either type of vehicle have not been produced. As more data become available from currently operating pilot projects using helicopters or disaster vans, the estimated utility of such vehicles may be calculated based upon comparable data from the metropolitan Atlanta EMS system. The EMS Coordinating Agency should recognize the potential value of each of these types of vehicles, and carefully consider the feasibility and cost-effectiveness of incorporating the vehicles into the EMS system.
FUTURE TRAINING ANALYSES

Professional Nursing

Special training in the ED is not normally included in nursing school curriculum, and the lack of ED training for nurses is presently a concern of the National Emergency Department Nurses Association. In metropolitan Atlanta, the need for ED nursing training has not been formally evaluated, and an evaluation of the need should be conducted by the relevant nursing organizations, metropolitan Atlanta ED nurses and physicians, and the ECA. The potential value of rotating ED nurses through special training on an MICU is also worthy of consideration.

Emergency Department Technician

Dependent upon the outlook of the hospital personnel, the EMT-A's quartered at hospitals are capable of offering valuable assistance to the ED staff. The actual working relationship, other than formal training, of EMT-A's and hospital employees is an evolutionary process and should be developed to the greatest possible extent. However, after the initial development of good working relationships between ambulance and hospital staffs is complete, emphasis should be placed upon analyzing the need for, and cost-effectiveness of emergency department technicians, the ED counterpart of the EMT-A.

FUTURE DISPATCH AND CONTROL ANALYSES

Computer-aided dispatch of vehicles is, at first glance, a desirable feature of a dispatch center. However, a deeper analysis of the advantages and disadvantages of computer-aided dispatch systems reveals that such systems may in fact reduce the efficiency of the dispatch function.* Problems inherently faced when a computer is introduced into the dispatch function include:

* Based on an indepth examination of the EMS dispatch subsystem in New York City.
1) A dispatch system which relies primarily upon computer analysis of locations usually also has a manual back-up. Unfortunately, the manual back-up gets little use and can sometimes be inefficient when called upon.

2) The information which must be accessible to the computer is constantly changing and therefore must be updated regularly. The need for continual data update requires considerable effort for data preparation and entry; although the precise level of effort required for the preparation and entry of data is unknown at this time, this required effort is an important consideration.

3) A certain time delay results from the necessity to follow specific encoding requirements of the computer. In improperly designed computer systems, this time delay is unacceptable.

4) The cost of sophisticated computer assistance can be prohibitive in some cases, and the money spent to install such a system may be more effectively spent to upgrade other elements of the dispatch system. That is, the cost benefit of computer-aided dispatch must be determined vis-a-vis the cost-benefit which could possibly derive from other uses of the funds.

5) The maintenance of the hardware and software of real-time, computer-aided dispatch systems can consume considerable sums of money.

To emphasize the disadvantages listed above, it should be remembered that the New York City EMS system implemented a computer-assisted dispatch subsystem, but, upon evaluation, returned to manual dispatching. The experience of local police agencies with the National Crime Information Center System should be closely examined to gain insight into the advantages and disadvantages of computer-based, public service, real-time information systems.
There are also certain advantages to a properly designed computer-assisted dispatch subsystem, including high reliability and increased accuracy, both of which are essentially independent of operator fatigue, stress, and other human factors which can affect the performance of manual dispatch subsystems. Methods of time-sharing of computer services may be possible between the EMS dispatch and control center and the Atlanta Police Department, in which case the cost of the computer assistance may be considerably reduced.

Certain other automation features are also worthy of analysis as an alternative to completely manual or sophisticated computer-aided dispatch systems, for example, the RADRU* system currently in use by the Atlanta Fire Department. The unit consists of a console and a back-lit screen for projecting slides accessed by pressing three keys on the keyboard. Over 20,000 pages of data can be scanned in a matter of seconds, as a function of the first three letters of a street name, or a fire alarm box number. Similar systems are currently being installed in Los Angeles and are being considered by the Fire Department of New York (1, p.4).

To determine which level of automation should be included in the EMS dispatch and control center, the DCC should be operated manually so as to produce a data base without the expense of computer equipment. The dispatch function should be analyzed at a later time to determine the cost-effectiveness of changing to a more automated dispatch subsystem, and the appropriate equipment (or no equipment) should then be installed.

FUTURE COMMUNICATIONS ANALYSES

The 911 Telephone Number

The 911 telephone number is mentioned in several sections of this EMS plan, including Chapter 7, Chapter 8, and Appendix W. Based upon an analysis of present capabilities of the Southern Bell Telephone System

* RADRU is an acronym for Rapid Access Data Retrieval Unit, developed by Lockheed at the Marietta computer center.
and the presently large number of police, fire, and other emergency service organizations in metropolitan Atlanta, the 911 telephone number has not been recommended. However, as mentioned in Appendix W, the capabilities of the telephone system in metropolitan Atlanta are expected to increase in the next five years. In addition, governmental reorganizations are always a possibility, and such reorganizations may either increase or decrease the desirability of the 911 telephone number.

Evaluations of the 911 system's utility have been scarce, but are expected to be available in the future. The EMS Coordinating Agency should stay abreast of the changing telephone and governmental situations and, at the same time, continue gathering evaluations of other existing 911 entry systems so as to be able to intelligently analyze (and recommend, when and if appropriate) the 911 telephone number for metropolitan Atlanta.

Telemetry of ECGs

The recommendations of this present plan are for telemetry to be required only on MICUs but to be allowed on any ambulance if desired. Documentation for this recommendation is found in Chapter 7 and is based primarily upon information from operating EMS systems in the nation which have, but may or may not utilize, telemetry equipment. At the present time, the majority of users of telemetry systems claim that telemetry is a sometimes useful tool, but, in some instances, telemetry can actually result in reduced effectiveness in resuscitating the victim of cardiac arrest.*

Detailed analytical evaluations of telemetry systems are not presently available, especially as relating to the trade-off between telemetry capability and the alternative of higher training for EMT-A's to accomplish the same treatment capability for handling cardiac emergencies. As these evaluations become available and the operating telemetry systems in metropolitan Atlanta are themselves evaluated, the addition or reduction of telemetry capability should be re-examined.

* Further developed in Appendix DD.
OTHER CONSIDERATIONS AND RECOMMENDATIONS

Certain features of the recommended EMS system do not fit neatly within the chapters of this plan. This section is devoted to recommendations of the plan and also to other aspects of the EMS system which although possibly not requiring extensive analyses, are deserving of consideration nonetheless.

Direct Admissions to Hospital CCUs

In cases of known serious cardiac dysrhythmias, hospital emergency departments should be able to arrange for the patient to be admitted directly to the hospital CCU thereby avoiding the unnecessary delay of examination in the ED.

Ambulance Supplies from Hospitals

The Letterman System of replacing ambulance supplies at hospitals requires a standardization of long and short spine boards, as well as other exchangeable items.* Perhaps laundry supplies may also be standardized and exchanged at the hospital ED. Since the hospitals operate laundry facilities in either case, the overall cost would probably be less if laundry was exchanged also. It should be recalled from Table 5.1 and from the discussion in Chapter 5 of the number of emergency vehicle service runs estimated for metropolitan Atlanta per day, that the average expected daily number of emergency patients transported in emergency vehicles is expected to be less than 200 patients per day. Since these 200 patients would be distributed across the 20 hospitals with EDs, any one hospital would experience only a small increase in laundry load.

Vehicle Color

Due to the high visibility of the yellow-green color, it is suggested that ambulances should, whenever possible, be painted yellow-green.

* Explained in Chapter 5.
Vehicle Right of Way

To increase safety and reduce response times of vehicles, formal agreements should be made to enforce traffic laws pertaining to emergency vehicle right of way. Equally important is the need to instill in the public an understanding of the critical necessity of yielding the right of way to emergency vehicles.

Walkie-Talkies

Many EMS systems include walkie-talkies in the ambulances. The idea has some merit and should be investigated when possible, although walkie-talkies are not included in the recommended EMS communications subsystem presented in Chapter 8.

CPR in Every Apartment Complex

The concept of requiring every apartment complex resident manager to learn, or designate someone else to learn, CPR has received some support. Basically, the concept is a good one, but may be difficult to realize.

EMT Identification

EMT's must be identifiable when at the scene of an emergency. Standardization of uniforms, badges, patches, and ID cards with a picture of the EMT are possible methods of identifying EMTs from various organizations.

Physicians on Call

Organizations of physicians who provide after hours services have received recent attention in medical journals. In Atlanta, such an organization, known as Physicians on Call, exists and provides 24 hour clinic or referral service.* The EMS Coordinating Agency should closely examine the possibility of including this, and other such organizations, into the overall EMS system.

* Located at 4346 Roswell Road, N. E., Atlanta, Georgia, telephone 266-0046.

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Atlanta Police Department Rescue Vehicles

The use of Atlanta Police Department rescue vehicles as roving MAVs should be encouraged, especially in light of the excellent performance of the two existing APD rescue vehicles. A cost-effectiveness study should be conducted to evaluate the feasibility of expanding from two units to four units so as to reduce response time, reduce travel speed, and increase the availability of the units.

Management of DOAs

Explicit guidelines should be developed by the EMS Coordinating Agency to insure that EMS patients who die before being admitted to a hospital are delivered to the proper destination, such as county morgues or other designated places. The management of DOAs by the private ambulance services and funeral homes, which are expected to continue service independent from the EMS system, should also be examined to insure that survivors of the DOA in actuality determine to which funeral home the DOA is delivered.

REFERENCE

1. RADRU IS HERE, Atlanta Fire Department Newsletter, Volume 1, Number 4, 1972.
CHAPTER 15
COST OF THE METROPOLITAN ATLANTA EMS SYSTEM

INTRODUCTION

Several of the previous chapters in this present report contain capital investment and annual operating cost estimates of the various subsystems of the recommended EMS system. These investment and operating cost estimates are repeated, and somewhat expanded upon in this chapter, to provide the reader with a consolidated presentation of the estimates and to clarify the relative financial requirements of various EMS components. Capital investment and operating cost estimates are presented for the vehicles and equipment, manpower, dispatch and control center, and communications of the EMS system, and although no cost estimates are needed for training of EMS personnel, considerations of training costs are presented.

CAPITAL INVESTMENT AND ANNUAL OPERATING COST OF THE EMERGENCY VEHICLES AND EQUIPMENT

The transportation subsystem accounts for the largest capital investment of any subsystem in the EMS system. Ambulances, MICUs, and MAVs require equipment, and of course the vehicles must be purchased and maintained for the EMS system. The estimates for the transportation subsystem capital investment and annual operating (that is, depreciation, maintenance, and running) costs are based upon a vehicle life of three years, a medical equipment life of four years, and an electronic equipment life of five years.

Table 15.1 shows the estimated transportation subsystem capital investment and annual operating costs based upon the assumption that eight vehicles can provide the necessary back-up for maintenance of the 34 required ambulances. These back-up vehicles need to be equipped as standard ambulances, including the installation of a four channel radio, but do not require extra defibrillators, MICU equipment, or telemetry equipment, since this equipment is portable and may be carried from one
### TABLE 15.1 Estimated Transportation Subsystem Capital Investment and Annual Operating Cost

#### I. CAPITAL INVESTMENT

<table>
<thead>
<tr>
<th>Item</th>
<th>Quantity</th>
<th>Cost per Item</th>
<th>Total Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Ambulances</td>
<td>42</td>
<td>$12,500</td>
<td>$525,000</td>
</tr>
<tr>
<td>B. MICUs</td>
<td>3</td>
<td>$12,500</td>
<td>37,500</td>
</tr>
<tr>
<td>C. Ambulance equipment</td>
<td>45</td>
<td>$4,000</td>
<td>180,000</td>
</tr>
<tr>
<td>D. MICU equipment</td>
<td>3</td>
<td>$2,500</td>
<td>7,500</td>
</tr>
<tr>
<td>E. Defibrillators</td>
<td>37</td>
<td>$2,500</td>
<td>92,500</td>
</tr>
<tr>
<td>F. MAV equipment</td>
<td>250</td>
<td>$40</td>
<td>10,000</td>
</tr>
</tbody>
</table>

**TOTAL CAPITAL INVESTMENT FOR TRANSPORTATION SUBSYSTEM** $852,500

#### II. ANNUAL FIXED OPERATING EXPENSES

<table>
<thead>
<tr>
<th>Item</th>
<th>Quantity</th>
<th>Cost per Item</th>
<th>Total Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Ambulance depreciation</td>
<td>42</td>
<td>$4,167</td>
<td>$175,014</td>
</tr>
<tr>
<td>B. MICU depreciation</td>
<td>3</td>
<td>$4,167</td>
<td>12,501</td>
</tr>
<tr>
<td>C. Ambulance equipment</td>
<td>45</td>
<td>$1,000</td>
<td>45,000</td>
</tr>
<tr>
<td>D. MICU equipment</td>
<td>3</td>
<td>$625</td>
<td>1,875</td>
</tr>
<tr>
<td>E. MAV equipment</td>
<td>250</td>
<td>$10</td>
<td>2,500</td>
</tr>
<tr>
<td>F. Defibrillators</td>
<td>37</td>
<td>$500</td>
<td>18,500</td>
</tr>
</tbody>
</table>

**TOTAL ANNUAL FIXED OPERATING EXPENSES** $255,390

#### III. ANNUAL VARIABLE OPERATING COSTS

<table>
<thead>
<tr>
<th>Item</th>
<th>Quantity</th>
<th>Cost per Item</th>
<th>Total Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>G. Replacement of supplies</td>
<td>37</td>
<td>$400</td>
<td>$14,800</td>
</tr>
<tr>
<td>H. Gas and oil</td>
<td>37</td>
<td>$2,000</td>
<td>74,000</td>
</tr>
<tr>
<td>I. Maintenance, all vehicles</td>
<td>45</td>
<td>$1,000</td>
<td>45,000</td>
</tr>
</tbody>
</table>

**TOTAL ANNUAL VARIABLE OPERATING COST** $133,800

**TOTAL ANNUAL OPERATING COST** $389,190
vehicle to another as necessary. Estimates for gas, oil, and maintenance
costs are based upon cost analyses from other operational EMS systems
(1,2). The 250 medical aid vehicle supply boxes represent an initial
estimate that may be adjusted in the future.

MANPOWER COST ESTIMATES

Throughout the present document, estimates of manpower costs
consider only two subsystems of the EMS system: the EMS Coordinating
Agency (ECA) and the transportation subsystem. Furthermore, only the
ambulance and MICU personnel assigned to the emergency vehicles are
included in the EMS transportation subsystem manpower cost estimates;
that is, management personnel of the ambulance service organizations,
both private and public agencies, are not included in the estimates.

Also, the MAV personnel are excluded from the EMS transportation
subsystem manpower cost estimates, since implementation of the MAV concept
is assumed to require no additional personnel. That is, the present
personnel of metropolitan police and fire departments are assumed to be
adequate in numbers to provide MAV service. The assumption appears to
be valid, since in many instances in metropolitan Atlanta, police are
already responding to automobile accidents resulting in injuries. The
additional number of emergency medical situations requiring MAV response
is not known at the present time but is presumed to be within the existing
capabilities of the police and fire departments in metropolitan Atlanta.

All positions presented in Table 15.2 require 40 hour work weeks
and eight hour shifts and include benefits as shown in Table 6.5. The
EMS Coordinating Agency positions are further described in Chapter 3 and
Chapter 7, and the ambulance and MICU personnel are described in Chapter 6.
<table>
<thead>
<tr>
<th>TABLE 15.2 Estimated Annual Manpower Cost for the EMS System.*</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>I. EMS Coordinating Agency Personnel</strong></td>
</tr>
<tr>
<td>A. Coordinator for EMS Agency 1 @ $ 25,000 $ 25,000</td>
</tr>
<tr>
<td>B. Assistant Coordinator for Medical Affairs 1/2 time @ $ 50,000 25,000</td>
</tr>
<tr>
<td>C. Secretary 1 @ $ 7,000 7,000</td>
</tr>
<tr>
<td>D. Management analyst 1 @ $ 12,000 12,000</td>
</tr>
<tr>
<td>E. Nurses (telephone triage) 5 @ $ 10,500 52,500</td>
</tr>
<tr>
<td>F. Dispatchers 10 @ $ 8,000 80,000</td>
</tr>
<tr>
<td>G. Receiving Operators 5 @ $ 7,000 35,000</td>
</tr>
<tr>
<td><strong>TOTAL ANNUAL ECA MANPOWER COST</strong> $ 236,500</td>
</tr>
<tr>
<td><strong>II. Ambulance Personnel</strong></td>
</tr>
<tr>
<td>A. EMT-A1 153 @ $ 7,500 $ 1,147,500</td>
</tr>
<tr>
<td>B. EMT-A3 153 @ $ 9,000 1,377,000</td>
</tr>
<tr>
<td><strong>TOTAL ANNUAL AMBULANCE MANPOWER COST</strong> $ 2,524,500</td>
</tr>
<tr>
<td><strong>III. MICU Personnel</strong></td>
</tr>
<tr>
<td>A. EMT-A2 28 @ $ 8,000 $ 224,000</td>
</tr>
<tr>
<td>B. EMT-A4 14 @ $ 10,000 140,000</td>
</tr>
<tr>
<td><strong>TOTAL ANNUAL MICU MANPOWER COST</strong> $ 364,000</td>
</tr>
<tr>
<td><strong>TOTAL ANNUAL EMS SYSTEM MANPOWER COST</strong> $ 3,125,000</td>
</tr>
</tbody>
</table>

**RENTAL AND OFFICE COSTS**

Due to the 8 hour work shift schedule of the emergency ambulance personnel, these personnel should not require sleeping quarters while on duty. Rather, the spare time is designed to be filled by education and practice sessions, both academic and operational, such as memorizing all

* Including adjusted manpower requirements to reflect sick leave and vacation benefits.
street locations in the ambulance service area and practicing first aid skills, such as bandaging, splinting, and so forth.

MICU personnel will perform paramedical functions in the emergency departments, ICU's, or CCU's in the hospital at which the MICU is based. In addition, didactic instruction will be provided to MICU personnel during the time available between emergency calls.

While emergency ambulances and MICUs are to be located at existing operational hospitals, fire departments, and private ambulance services, quarters for EMS vehicular personnel are not necessary, and no charge then is estimated for such accommodations.

An exception to the free accommodations may be experienced by the EMS Coordinating Agency which may be required to lease the floor space required to house the ECA and its dispatch and control center as shown in Table 15.3. The feasibility of locating the ECA at an existing facility with the necessary space, such as Civil Defense or the DeKalb County Emergency Operations Center, should be investigated, but costs associated with renting space for the ECA must be assumed at the present time.

| Coordinator's Office                  | 180 square feet |
| Assistant Coordinator for Medical Affairs' Office | 180 square feet |
| Management Analyst's Office           | 120 square feet |
| Dispatch and Analysis Area            | 1,000 square feet |
| Conference Area                       | 400 square feet |
| Secretary - Reception Area            | 300 square feet |

2,180 square feet

ANNUAL COST OF FLOOR SPACE FOR ECA, ESTIMATED AT EIGHT DOLLARS PER SQUARE FOOT PER YEAR = $17,440
CAPITAL INVESTMENT AND ANNUAL OPERATING COST OF THE COMMUNICATIONS SUBSYSTEM

Table 15.4 presents the capital investment for communications equipment which was derived in Chapter 8. From the capital investment, the annual operating costs of the communications subsystem have been derived based upon a five year service life for radio equipment.

**TABLE 15.4** Estimated Communications Subsystem Capital Investment and Annual Operating Cost.

<table>
<thead>
<tr>
<th>I. CAPITAL INVESTMENT</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Hospital Radios (2 channels)</td>
<td>20 @ $ 4,223</td>
<td>$ 84,460</td>
<td></td>
</tr>
<tr>
<td>B. Second Hospital Radios (1 channel)</td>
<td>3 @ $ 2,400</td>
<td>7,200</td>
<td></td>
</tr>
<tr>
<td>C. Ambulance Radios</td>
<td>45 @ $ 1,500</td>
<td>67,500</td>
<td></td>
</tr>
<tr>
<td>D. Telemetry Equipment</td>
<td>4 @ $ 5,500</td>
<td>22,000</td>
<td></td>
</tr>
<tr>
<td>E. DCC</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1) Telephone installation</td>
<td>3,000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2) Radio system, complete</td>
<td>25,000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3) Status board and other resource monitoring equipment</td>
<td>20,000</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>TOTAL COMMUNICATIONS SUBSYSTEM CAPITAL INVESTMENT</strong></td>
<td><strong>$229,160</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>II. ANNUAL OPERATING COSTS</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Hospital radio depreciation</td>
<td>20 @ $ 845</td>
<td>$ 16,900</td>
<td></td>
</tr>
<tr>
<td>B. Second hospital radio depreciation</td>
<td>3 @ $ 480</td>
<td>1,440</td>
<td></td>
</tr>
<tr>
<td>C. Ambulance radio depreciation</td>
<td>45 @ $ 300</td>
<td>13,500</td>
<td></td>
</tr>
<tr>
<td>D. Telemetry system depreciation</td>
<td>4 @ $ 1,100</td>
<td>4,400</td>
<td></td>
</tr>
<tr>
<td>E. Telephone yearly charge</td>
<td>18,960</td>
<td></td>
<td></td>
</tr>
<tr>
<td>F. DCC radio system depreciation</td>
<td>5,000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>G. Status board depreciation</td>
<td>4,000</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>TOTAL COMMUNICATIONS SUBSYSTEM ANNUAL OPERATING COST</strong></td>
<td><strong>$ 64,200</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
TRAINING COSTS

The expense associated with training of metropolitan Atlanta's EMS system personnel are explained in Chapter 10. Salary support for persons enrolled in EMT training is to be provided by the ambulance service organization for which the trainee works except in the case of EMS system personnel who choose to enroll in an associate degree program, which might require to enroll in school full time for two years. Since much of the training can be provided as on the job training, the major portion of the cost of salary support for trainees is actually already accounted for within the cost of EMS transportation subsystem personnel.

For the purposes of this chapter, the entire cost of developing the details of the training programs for the EMS system is assumed to be borne by the Georgia Department of Education as more extensive training programs are developed to meet the needs of metropolitan Atlanta. Since the nature of additionally needed EMS training programs has only been sketched in Chapter 6, the cost of the training program development can not be estimated at this time. Furthermore, the cost of development when known, possibly should not be fully charged to the metropolitan Atlanta EMS system. In any case, the cost of training program development represents only a small fraction of the total EMS system cost.

SUMMARY

Table 15.5 summarizes the estimated costs and capital investments presented in Tables 15.1 through 15.4. It is interesting to note that the annual operating cost for metropolitan Atlanta's EMS system is less than $2.50 per resident.* The City of Jacksonville's Safety Director, Captain John Waters reports that the EMS system in Jacksonville operates at a cost of $1.68 per resident; Captain Waters is quick to point out that the per capita cost of police and fire services are $35.00 and $24.00 respectively in Jacksonville (3, p.9). The average EMS system cost per

* Based upon 1970 census showing the population of metropolitan Atlanta to be 1,436,975 persons.
resident per year is about 50 per cent higher in Atlanta than in Jacksonville; the higher cost in Atlanta is attributable to differences in the demographic and EMS system operating characteristics of Atlanta as compared to Jacksonville.

**TABLE 15.5** Total Capital Investment and Annual Operating Cost of the EMS System.

<table>
<thead>
<tr>
<th>I. Capital Investment</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Transportation Subsystem</td>
<td>$ 852,500</td>
</tr>
<tr>
<td>B. Manpower</td>
<td>0</td>
</tr>
<tr>
<td>C. EMS Coordinating Agency Office Space</td>
<td>0</td>
</tr>
<tr>
<td>D. Communications Subsystem</td>
<td>229,160</td>
</tr>
<tr>
<td>E. Training</td>
<td>0</td>
</tr>
</tbody>
</table>

**TOTAL CAPITAL INVESTMENT FOR EMS SYSTEM** $1,081,660

<table>
<thead>
<tr>
<th>II. Annual Operating Costs</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Transportation Subsystem</td>
<td>$ 389,190</td>
</tr>
<tr>
<td>B. Manpower</td>
<td>3,125,000</td>
</tr>
<tr>
<td>C. EMS Coordinating Agency Office Space</td>
<td>17,440</td>
</tr>
<tr>
<td>D. Communications Subsystem</td>
<td>64,200</td>
</tr>
<tr>
<td>E. Training</td>
<td>0</td>
</tr>
</tbody>
</table>

**TOTAL ANNUAL OPERATING COST FOR EMS SYSTEM** $3,595,830

Table 15.6 presents the estimated EMS cost per resident by county, based upon the number of ambulances and hospitals in each county and the population of each county, assuming the EMS system is operational.
TABLE 15.6 EMS System Annual Operating Cost Per Resident in Each County.

<table>
<thead>
<tr>
<th>COUNTY</th>
<th>POPULATION</th>
<th>ANNUAL OPERATING COST</th>
<th>ANNUAL COST PER RESIDENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clayton</td>
<td>98,043</td>
<td>$303,236</td>
<td>$3.09</td>
</tr>
<tr>
<td>Cobb</td>
<td>196,793</td>
<td>606,809</td>
<td>3.08</td>
</tr>
<tr>
<td>DeKalb</td>
<td>415,387</td>
<td>709,417</td>
<td>1.71</td>
</tr>
<tr>
<td>Douglas</td>
<td>28,659</td>
<td>185,346</td>
<td>6.47</td>
</tr>
<tr>
<td>Fulton</td>
<td>607,592</td>
<td>1,403,063</td>
<td>2.31</td>
</tr>
<tr>
<td>Gwinnet</td>
<td>72,349</td>
<td>292,957</td>
<td>4.05</td>
</tr>
<tr>
<td>Rockdale</td>
<td>18,152</td>
<td>94,868</td>
<td>5.23</td>
</tr>
<tr>
<td>TOTAL</td>
<td>1,436,975</td>
<td>$3,595,830</td>
<td>$2.50</td>
</tr>
</tbody>
</table>

NOTE: Population statistics are from the 1970 census.

The differences among the annual cost per resident for EMS in the seven counties derives from the differing demographic characteristics of the seven counties.

REFERENCES


CHAPTER 16

IMPLEMENTATION SCHEDULE FOR
THE IMPROVED EMS SYSTEM

The following major steps must be taken if the proposed EMS system is to be installed in metropolitan Atlanta. The time schedule consists of judicious estimates, which have been checked with equipment vendors or have been extracted from the experiences of EMS systems in other cities. The improved EMS system can begin basic operation by January 1, 1974 if the first and crucial step can be taken by the governments of the seven counties.

<table>
<thead>
<tr>
<th>IMPLEMENTATION ACTIVITY OR EVENT</th>
<th>DATES OF PERFORMANCE OR COMPLETION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. The counties agree to implement an improved and coordinated EMS system, to accept responsibility for financially supporting the EMS system, and to enact local ordinances governing the provision of EMS.</td>
<td>Sometime in the Spring of 1973; by July 1, 1973.</td>
</tr>
<tr>
<td>2. Based on discussions which are to occur in the Spring of 1973, the counties establish a Board of Directors which creates the charter, the bylaws, and develops basic EMS policies for establishing the EMS Coordinating Agency.</td>
<td>By July 1, 1973.</td>
</tr>
<tr>
<td>3. The Board of Directors, with the assistance of ARC and GRMP designates the organization to serve as the EMS Coordinating Agency, and</td>
<td>By July 1, 1973.</td>
</tr>
</tbody>
</table>
if appropriate hires a Coordinator for the ECA and an Assistant Coordinator for Medical Affairs for the ECA.


5. ECA hires a management analyst, registered nurse (who is to later serve as the triage officer in the DCC), and a secretary, who can provide assistance to the Coordinator and Assistant Coordinator with performing many of the remaining steps in the implementation schedule. July 1 - July 31, 1973.


15. MICU vendors' quotes reviewed by ECA.

16. MICU vendor selected and order placed by ECA.

17. Counties, with assistance of the ECA, negotiate with hospitals on providing indigent patient emergency care and on the exchange and provision of equipment and supplies with ambulances.

18. RFQ on provision of ambulance service prepared for counties by the ECA.


20. Ambulance service companies quotes reviewed by counties.

21. Each county selects ambulance service companies to provide emergency ambulance service in the county.

22. Counties sign contracts with ambulance service companies.

23. If necessary, following the receipt by the counties of 301
the ambulance service companies' quotes, each county designates a county agency or agencies to provide ambulance service in service areas which were not filled by private ambulance service companies. (Alternatively, a county can arrange to have such gaps in ambulance service provided under contract with public agencies of neighboring counties or local municipalities.)

24. RFQ for purchase of needed ambulances prepared by ECA on behalf of county agencies which are to be providing emergency ambulance service. Sept. 1 - Sept. 28, 1973.


28. Direct telephone lines installed between DCC and all category I, II, & III hospitals, designated fire stations and other ambulance locations such as designated police and fire headquarters. Oct. 16 - Nov. 15, 1973.


33. Assistant Coordinator for Medical Affairs of the ECA with representatives of medical societies, hospitals, and other relevant agencies and institutions investigates the need for a regional training program for emergency department technicians. Jan. 1 - June 30, 1974.

34. MICU's received from vendor. Nov. 30, 1973.


39. EMT-A3 training initiated for EMT-A2's. Jan. 2, 1974 -

40. Assistant Coordinator for Medical Affairs of the ECA with representatives of medical societies and other relevant agencies and allied health educators arranges for an EMT-A4 training program to be established. Jan. 2, 1974 -


42. Southern Bell begins to place the emergency telephone number labels on telephones as the telephones are installed or serviced; also a mass mailing of the labels by telephone bills is to be conducted beginning Jan. 2, 1974. Jan. 2, 1974 -

43. Public education campaign on the use of the single emergency telephone number is initiated using the public media. Jan. 2, 1974 -


45. MAV concept in operation. Jan. 2, 1974 -
46. DCC in operation. Jan. 2, 1974 -

47. Ambulances ordered in November, Jan. 2, 1974 -
    1973 begin to arrive and are
    dispersed.

    grant application to EMS
    Special Project Office of the
    Health Services and Mental
    Health Administration, U. S.
    Public Health Service; since
    the number of additional
    ambulances for the metropolitan
    Atlanta EMS system is not to be
    known precisely until September 28,
    1973, the proposal can include a
    variable request for funds for
    ambulances; other EMS system
    needs are however known at the
    time that the grant application
    is submitted.
<table>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>Counties agree to implement improved EMS system</td>
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<td></td>
<td></td>
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</tr>
<tr>
<td>2</td>
<td>EMS Agency charter established</td>
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<td></td>
<td></td>
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</tr>
<tr>
<td>3</td>
<td>Selection of EMS Agency and Coordinator hired</td>
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<td></td>
<td></td>
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</tr>
<tr>
<td>4</td>
<td>Advisory Councils formed</td>
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<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>5</td>
<td>EMS Agency personnel hired</td>
<td></td>
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</tbody>
</table>

FIGURE 16.1 Implementation Schedule for the Improved EMS System for Metropolitan Atlanta.
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</thead>
<tbody>
<tr>
<td>6</td>
<td>EMS Agency occupies quarters</td>
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</tr>
<tr>
<td>7</td>
<td>Communications RFQ prepared</td>
<td></td>
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<td></td>
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</tr>
<tr>
<td>8</td>
<td>Communications RFQ advertised</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Communications quotes reviewed</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>10</td>
<td>Communications vendor selected</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Radio license applications to FCC</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>M A V personnel training</td>
<td></td>
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<td></td>
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<td></td>
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</tr>
</tbody>
</table>

**FIGURE 16.1 (cont.)** Implementation Schedule for the Improved EMS System for Metropolitan Atlanta.
FIGURE 16.1 (cont.) Implementation Schedule for the Improved EMS System for Metropolitan Atlanta.
<table>
<thead>
<tr>
<th>Month</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>July 20</td>
<td>Ambulance service quotes reviewed</td>
</tr>
<tr>
<td>Aug. 21</td>
<td>Ambulance services selected by counties</td>
</tr>
<tr>
<td>Sept. 22</td>
<td>Counties sign contracts with ambulance services</td>
</tr>
<tr>
<td>Oct. 23</td>
<td>Public agencies designated to provide ambulance service in unfilled areas</td>
</tr>
</tbody>
</table>

FIGURE 16.1 (cont.) Implementation Schedule for the Improved EMS System for Metropolitan Atlanta.
<table>
<thead>
<tr>
<th>Date</th>
<th>Event Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>July 24</td>
<td>Ambulance purchase RFQ prepared</td>
</tr>
<tr>
<td>Aug. 25</td>
<td>Ambulance purchase RFQ advertised</td>
</tr>
<tr>
<td>Sept. 26</td>
<td>Ambulance purchase quotes reviewed</td>
</tr>
<tr>
<td>Oct. 27</td>
<td>Ambulance manufacturer selected</td>
</tr>
<tr>
<td>Nov. 28</td>
<td>Direct telephone lines installed</td>
</tr>
<tr>
<td>Dec. 29</td>
<td>DCC incoming telephone lines installed</td>
</tr>
</tbody>
</table>

**FIGURE 16.1 (cont.)** Implementation Schedule for the Improved EMS System for Metropolitan Atlanta.
FIGURE 16.1 (cont.) Implementation Schedule for the Improved EMS System for Metropolitan Atlanta.
<table>
<thead>
<tr>
<th>Number</th>
<th>Event Description</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>37</td>
<td>MICU's begin operation</td>
<td>July</td>
</tr>
<tr>
<td>38</td>
<td>EMT-A2 training initiated</td>
<td>August</td>
</tr>
<tr>
<td>39</td>
<td>EMT-A3 training initiated</td>
<td>September</td>
</tr>
<tr>
<td>40</td>
<td>EMT-A4 training program developed</td>
<td>October</td>
</tr>
<tr>
<td>41</td>
<td>ECA arranges with Southern Bell to put labels on phones</td>
<td>December</td>
</tr>
<tr>
<td>42</td>
<td>Southern Bell puts labels on telephones</td>
<td>June</td>
</tr>
</tbody>
</table>

**FIGURE 16.1 (cont.)** Implementation Schedule for the Improved EMS System for Metropolitan Atlanta.
FIGURE 16.1 (cont.) Implementation Schedule for the Improved EMS System for Metropolitan Atlanta.
<table>
<thead>
<tr>
<th>APPENDIX</th>
<th>PAGE</th>
</tr>
</thead>
<tbody>
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</tr>
<tr>
<td>B</td>
<td>METROPOLITAN ATLANTA EMERGENCY ROOM QUESTIONNAIRE</td>
</tr>
<tr>
<td>C</td>
<td>SPECIALTY UNITS AND CAPABILITIES IN THE METROPOLITAN ATLANTA AREA HOSPITALS</td>
</tr>
<tr>
<td>D</td>
<td>MEMBERS AND SPECIAL CONSULTANTS OF THE ATLANTA REGIONAL COMMISSION'S TASK FORCE ON EMERGENCY MEDICAL SERVICES</td>
</tr>
<tr>
<td>E</td>
<td>HSRC AMBULANCE SURVEY FORM</td>
</tr>
<tr>
<td>F</td>
<td>ATLANTA REGIONAL COMMISSION TELEPHONE SURVEY OF AMBULANCE SERVICES</td>
</tr>
<tr>
<td>G</td>
<td>AMBULANCE PURVEYORS IN THE METROPOLITAN ATLANTA AREA</td>
</tr>
<tr>
<td>H</td>
<td>A QUEUING FORMULA TO DETERMINE PERCENTAGE OF IMMEDIATE AVAILABILITY OF AMBULANCES, GIVEN TOTAL NUMBER OF AMBULANCES IN THE SYSTEM</td>
</tr>
<tr>
<td>I</td>
<td>EXPECTED DEMAND TO BE PLACED UPON THE METROPOLITAN ATLANTA EMERGENCY MEDICAL SYSTEM</td>
</tr>
<tr>
<td>J</td>
<td>CALCULATION OF RADIUS (R) GUARANTEEING AN AVERAGE RESPONSE DISTANCE OF r MILES</td>
</tr>
<tr>
<td>K</td>
<td>CALCULATION TABLES TO DETERMINE THE EXPECTED RESPONSE TIME FOR THE RECOMMENDED AMBULANCE LOCATIONS IN EACH COUNTY OF METROPOLITAN ATLANTA</td>
</tr>
<tr>
<td>L</td>
<td>SEATTLE MOBILE INTENSIVE/CORONARY CARE UNIT INVENTORY OF SUPPLIES AND EQUIPMENT</td>
</tr>
<tr>
<td>M</td>
<td>ENTRY SYSTEM DESIGN</td>
</tr>
<tr>
<td>N</td>
<td>TEN CODE SIGNALS</td>
</tr>
<tr>
<td>O</td>
<td>PERSONS CONTACTED FOR COMMENT CONCERNING TRAINING RECOMMENDATIONS</td>
</tr>
<tr>
<td>P</td>
<td>GEORGIA AMBULANCE LAW AND REGULATIONS</td>
</tr>
<tr>
<td>Q</td>
<td>COURSE OUTLINE FOR EMT TRAINING AT DEKALB AREA TECHNICAL SCHOOL</td>
</tr>
</tbody>
</table>
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APPENDIX A

HOSPITALS AND OTHER ACUTE HEALTH CARE FACILITIES
IN THE METROPOLITAN ATLANTA AREA

The following four pages list the names and addresses of the acute health care facilities in the seven counties of metropolitan Atlanta. This listing was developed from the AHA Guide Issue, the GHA Guide Issue, the Yellow Pages, and the Atlanta Regional Commission's "Listing of Hospitals and Student Infirmaries".
## Presently Operating

<table>
<thead>
<tr>
<th>Hospital</th>
<th>Address</th>
</tr>
</thead>
<tbody>
<tr>
<td>ATLANTA HOSPITAL</td>
<td>705 Juniper Street, N. E. Atlanta, Georgia 30308</td>
</tr>
<tr>
<td>AUSTELL HOSPITAL</td>
<td>5990 Love Street Austell, Georgia 30001</td>
</tr>
<tr>
<td>BRAUNER HOSPITAL, INC.</td>
<td>3180 Atlanta Street Smyrna, Georgia 30080</td>
</tr>
<tr>
<td>BUFORD GENERAL HOSPITAL</td>
<td>55 Morningside Drive Buford, Georgia 30516</td>
</tr>
<tr>
<td>BUTTON GWINNETT HOSPITAL</td>
<td>255 Scenic Highway Lawrenceville, Georgia 30245</td>
</tr>
<tr>
<td>CLAYTON GENERAL HOSPITAL</td>
<td>11 S. W. Upper Riverdale Road Riverdale, Georgia 30274</td>
</tr>
<tr>
<td>COBB GENERAL HOSPITAL</td>
<td>3950 Austell Road, S. W. Austell, Georgia 30001</td>
</tr>
<tr>
<td>CRAWFORD W. LONG MEMORIAL HOSPITAL OF EMORY UNIVERSITY</td>
<td>35 Linden Avenue, N. E. Atlanta, Georgia 30308</td>
</tr>
<tr>
<td>DEKALB GENERAL HOSPITAL</td>
<td>2701 N. Decatur Road Decatur, Georgia 30033</td>
</tr>
<tr>
<td>DOCTORS HOSPITAL</td>
<td>2160 Idlewood Road Tucker, Georgia 30084</td>
</tr>
<tr>
<td>DOCTORS MEMORIAL HOSPITAL, INC.</td>
<td>20 Linden Avenue, N. E. Atlanta, Georgia 30308</td>
</tr>
<tr>
<td>DOUGLAS COUNTY MEMORIAL HOSPITAL</td>
<td>P. O. Box 1117 Douglasville, Georgia 30134</td>
</tr>
<tr>
<td>ELKS AIDMORE HOSPITAL</td>
<td>2040 Ridgewood Drive, N. E. Atlanta, Georgia 30333</td>
</tr>
<tr>
<td>EMORY UNIVERSITY HOSPITAL</td>
<td>1364 Clifton Road, N. E. Atlanta, Georgia 30322</td>
</tr>
<tr>
<td>EMORY UNIVERSITY STUDENT INFIRMARY</td>
<td>1364 Clifton Road, N. E. Atlanta, Georgia 30322</td>
</tr>
</tbody>
</table>
FRANCES WINSHIP WALTERS STUDENT INFIRMARY

GEORGIA BAPTIST HOSPITAL

GEORGIA MENTAL HEALTH INSTITUTE

GEORGIA REGIONAL HOSPITAL AT ATLANTA

GEORGIA RETARDATION CENTER HOSPITAL UNIT

GRADY MEMORIAL HOSPITAL

HENRIETTA EGGLESTON HOSPITAL FOR CHILDREN

HOLY FAMILY HOSPITAL

HUGHES SPALDING PAVILLION OF GRADY MEMORIAL HOSPITAL

JESSE PARKER WILLIAMS HOSPITAL

JOAN GLANCY MEMORIAL HOSPITAL

JOSEPH B. WHITEHEAD MEMORIAL INFIRMARY

KENNESTONE HOSPITAL

MCLENDON HOSPITAL, INC.

METROPOLITAN EYE HOSPITAL

METROPOLITAN PSYCHIATRIC CENTER, INC.
NORTHSIDE HOSPITAL

PARKWOOD HOSPITAL, INC.

PEACHTREE HOSPITAL, INC.

PIEDMONT HOSPITAL, INC.

PONCE DE LEON INFIRMARY

POWDER SPRINGS HOSPITAL

ROCKDALE COUNTY HOSPITAL

RUTLAND INFIRMARY

SHALLOWFORD COMMUNITY HOSPITAL

SOUTH FULTON HOSPITAL

ST. JOSEPH'S INFIRMARY

U. S. ARMY HOSPITAL

U. S. PENITENTIARY HOSPITAL

VETERANS ADMINISTRATION HOSPITAL
   ATLANTA

WEST PACES FERRY HOSPITAL

WHITE CROSS HOSPITAL

1000 Johnson Ferry Road, N. E.
Atlanta, Georgia 30342

1999 Cliff Valley Way
Atlanta, Georgia 30329

1999 Cliff Valley Way
Atlanta, Georgia 30329

1968 Peachtree Road, N. W.
Atlanta, Georgia 30309

144 Ponce de Leon Avenue, N. E.
Atlanta, Georgia 30308

4294 Atlanta Street
Powder Springs, Georgia

1412 Loganville Road, N. E.
Conyers, Georgia 30207

Woodward Academy
P. O. Box 87190
College Park, Georgia 30337

4575 N. Shallowford Road
Chamblee, Georgia 30341

1170 Cleveland Avenue
East Point, Georgia 30344

265 Ivy Street, N. E.
Atlanta, Georgia 30303

Fort McPherson, Georgia

601 McDonough Boulevard
Atlanta, Georgia 30315

1670 Clairmont Road
Decatur, Georgia 30033

3200 Howell Mill, N. W.
Atlanta, Georgia 30327

1290 Dixie Highway
Jonesboro, Georgia
Projected To Open in 1973

ATLANTA WEST HOSPITAL
Box 43566
Atlanta, Georgia 30336

BOLTON ROAD MEDICAL CENTER
2601 Bolton Road
Atlanta, Georgia 30331

DECATOR HOSPITAL
North Professional Building
Decatur, Georgia 30033

SMYRNA HOSPITAL
3949 South Cobb Drive
Smyrna, Georgia 30080

URBAN MEDICAL SERVICES COMMUNITY HOSPITAL
I-75 and Windy Hill Road
Smyrna, Georgia 30080
APPENDIX B

METROPOLITAN ATLANTA EMERGENCY ROOM QUESTIONNAIRE

The Emergency Room Questionnaire presented here is fashioned after earlier questionnaires from the Georgia Department of Human Resources and guidelines from the U. S. Department of Health, Education, and Welfare. As described in Chapter 4, the questionnaires were each completed by a hospital administrator or ED personnel in direct response to questions from a personal interviewer. The questionnaires were completed in August and September of 1972 and represent the source of most specific data presented in this report.
METRO-ATLANTA EMERGENCY ROOM QUESTIONNAIRE

HOSPITAL ________________________________________________________________

ADMINISTRATOR _________________________________________________________

PHONE NUMBER _________________________________________________________

DATA COLLECTED BY _____________________________________________________

DATA PROVIDED BY:  

I ________________________________________________________________

II ________________________________________________________________

III ________________________________________________________________

IV ________________________________________________________________

V ________________________________________________________________

VI ________________________________________________________________

DATE ______________________________

I. GENERAL

EMERGENCIES:  

Yes  No

A. Does Emergency Room operate 24 hours per day, seven days a week?  

   If No, list the hours of operation using military hours (e.g. 0700-1530 shift):

   ________________________________________________________________

B. Does the payment system request cash for all E.R. charges?  

C. Is the patient billed for the total or remaining balance via regular hospital billing?  

D. Does the bill contain an E.R. physician's fee?  

E. Does the hospital collect for ambulance services?  

F. Does E.R. treat medically indigent emergency patients other than Medicaid?  

G. If Medicaid or Medicare benefits are not sufficient to cover E.R. charges and if the patient cannot pay the balance, who then bears this cost?  

______________________________________________________________
H. Do you have to refer emergency patients to other emergency facilities?

   If Yes, why? ____________________________________________________________

I. What problems arise when you have to transfer an emergency patient to another emergency facility?

   ________________________________________________________________
   ________________________________________________________________
   ________________________________________________________________
   ________________________________________________________________

J. What problems do you encounter when an emergency patient is transferred from another emergency facility to your emergency room?

   ________________________________________________________________
   ________________________________________________________________
   ________________________________________________________________
   ________________________________________________________________

K. Are E.R. charges for cross-county transfer welfare or charity patients (who have been transferred to your facility from another county) paid for from your county's tax base?

   ________________________________________________________________
   ________________________________________________________________
   ________________________________________________________________
   ________________________________________________________________

   Do other metro Atlanta counties (from which cross-county transfer patients originate) pay the E.R. charges for services provided to their welfare or charity citizens in your E.R.?

   If Yes, which counties (enumerate)?

   ________________________________________________________________
   ________________________________________________________________

   Are E.R. charges for cross-county transfer welfare or charity patients covered from the hospital surplus when tax dollars will not fully pay the E.R. charges?

   ________________________________________________________________
   ________________________________________________________________

L. Does your hospital/county ever pay for ambulance services?

   If Yes, under what circumstances?
M. For emergency services for which payment is not received, how does the hospital propose that these costs be recovered?

N. Should Emergency Room Services be supported from the county's general tax base? (similar to police and fire services)

O. What percentage of E.R. billing is uncollectable?

II. STAFFING

A. PROFESSIONAL AND SUPPORTIVE STAFFING

1. How many E.R. Physicians are there and what specialties do they represent?

2. What is the professional staffing coverage in emergency department?

<table>
<thead>
<tr>
<th>Number of shifts per week</th>
<th>Day</th>
<th>Evening</th>
<th>Night</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) On duty in emergency department</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(2) On duty within hospital</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(3) On call outside hospital</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(4) Neither on duty nor on call</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of shifts per week</td>
<td>(Entries should total &quot;7&quot; in each column for each category)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>---------------------------</td>
<td>--------------------------------------------------------</td>
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**c. Licensed practical nurse coverage**

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<th>Day</th>
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<tbody>
<tr>
<td>(1) On duty in emergency department</td>
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<tr>
<td>(2) On duty within hospital</td>
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<tr>
<td>(3) On call outside hospital</td>
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<tr>
<td>(4) Neither on duty nor on call</td>
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**d. Ancillary personnel coverage**

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<td>(1) On duty in emergency department</td>
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<td>(2) On duty within hospital</td>
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<td>(3) On call outside hospital</td>
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<td>(4) Neither on duty nor on call</td>
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**e. Paramedical personnel coverage**

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<tbody>
<tr>
<td>(1) On duty in emergency department</td>
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<td>(2) On duty within hospital</td>
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<td>(3) On call outside hospital</td>
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<tr>
<td>(4) Neither on duty nor on call</td>
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</table>

**f. Supportive services**

<table>
<thead>
<tr>
<th></th>
<th>Hours During Which Services Are Available</th>
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<tbody>
<tr>
<td>(1) Radiology</td>
<td></td>
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<tr>
<td>(2) Laboratory</td>
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<tr>
<td>(3) Pharmacy</td>
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<tr>
<td>(4) Inhalation Therapy</td>
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</tbody>
</table>
3. What is the availability of specialty coverage?

<table>
<thead>
<tr>
<th></th>
<th>Hospital Based Physician within hospital 24 hours per day</th>
<th>Hospital Based Physician who works a shift and may be recalled during other shifts</th>
<th>Physician with medical staff privileges who could be at the E.R. within 30 minutes</th>
<th>Never available for inhospital service</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Anesthesiologist</td>
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<tr>
<td>b. General Surgeon</td>
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<tr>
<td>c. Internist</td>
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<tr>
<td>d. Internist-Cardiologist</td>
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<tr>
<td>e. Neurosurgeon</td>
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<tr>
<td>f. Obstetrician-Gynecologist</td>
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<tr>
<td>g. Ophthalmologist</td>
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<tr>
<td>h. Oral Surgeon</td>
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<tr>
<td>i. Orthopedic Surgeon</td>
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<tr>
<td>j. Otolaryngologist</td>
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<tr>
<td>k. Pediatrician</td>
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<tr>
<td>l. Plastic Surgeon</td>
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<tr>
<td>m. Psychiatrist</td>
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<tr>
<td>n. Radiologist</td>
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<tr>
<td>o. Thoracic Surgeon</td>
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<td>p. Urologist</td>
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<tr>
<td>q. General Practitioner</td>
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<tr>
<td>r. Other (Specify)</td>
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</table>
III. COMMUNICATIONS

A. Are there direct telephone lines to police?
   fire?
   ambulance service(s)?
   others?

   Describe each one.

B. What private telephone numbers exist which bypass the
   switchboard?

C. Are there outside two-way radio communications?

   1. With whom?
   2. Frequencies?

D. Is there a radio paging system?

   1. For whom?
   2. What frequencies?
   3. Brand name?
   4. No. of units?

E. Is there an intercom system between the E.R. and
   other units?

   Which ones?

F. Any future plans for acquiring new communications
   equipment?

   Explain.

G. Any future plans for telemetry systems?

   Explain.

   (Ambulance to E.R.; ambulance to CCU)

H. Are there pay telephones conveniently located to the
   E.R. in the hospital?
IV. FACILITIES

A. What facilities are located in, or immediately adjacent to, the emergency department? (Mutually exclusive categories)

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<td>1. Examination and treatment rooms?</td>
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<td>If Yes, give number of beds.</td>
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<td>2. Resuscitation and minor surgery rooms?</td>
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<td>3. Fracture or plaster rooms?</td>
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<td>4. Holding and observation beds?</td>
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<td>5. Emergency psychiatric care beds?</td>
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<td>If Yes, give number of beds.</td>
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<td>6. X-ray room?</td>
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<td>7. Coronary room?</td>
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<td>If Yes, give number of beds.</td>
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<td>8. Reception area for ambulatory patients, friends, and family?</td>
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<td>9. Active supply area?</td>
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B. Is the operating room for major surgery available on a priority basis to the emergency department?

C. How many major operating rooms are in the O.R. suite?

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<tr>
<td>1. Are O.R. Personnel on duty within hospital 24 hours per day?</td>
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<tr>
<td>2. Are O.R. Personnel available, on call, 24 hours per day?</td>
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D. Are support service facilities available to the emergency department on a priority basis?

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<tr>
<td>1. X-ray?</td>
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<td>2. Laboratory?</td>
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<td>3. Pharmacy?</td>
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<td>4. Inhalation therapy?</td>
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</table>

E. Is there an outside E.R. entrance which is easily accessible and clearly marked?

F. Is there an inpatient mental health ward?
G. Specialty Units

<table>
<thead>
<tr>
<th>Question</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Is there an ICU/CCU? If Yes, give number of beds.</td>
<td></td>
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<tr>
<td>Is there a CCU? If Yes, give number of beds.</td>
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<tr>
<td>If there an ICU? If Yes, give number of beds.</td>
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<tr>
<td>Is there a PCU? If Yes, give number of beds.</td>
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<tr>
<td>Is there a Burn unit? If Yes, give number of beds.</td>
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</table>

V. EMERGENCY SERVICES AND PROCEDURES

A. Does the hospital have the staff, facilities, and supplies to regularly provide the following services to an emergency outpatient in the E.R.?

<table>
<thead>
<tr>
<th>Service</th>
<th>Yes</th>
<th>No</th>
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<tbody>
<tr>
<td>Control of major external hemorrhage?</td>
<td></td>
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<tr>
<td>Primary care and closure of wounds?</td>
<td></td>
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<tr>
<td>Administration of intravenous drugs, fluids, and blood?</td>
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<tr>
<td>Immobilization of fractures?</td>
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<tr>
<td>Cardiopulmonary resuscitation?</td>
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<tr>
<td>Management of life-threatening cardiac dysrhythmias?</td>
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<tr>
<td>Endotracheal intubation and ventilation?</td>
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<td>Tracheostomy?</td>
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<td>Aspiration - joint?</td>
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<td>Aspiration - abdomen?</td>
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<td>Aspiration - chest?</td>
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<tr>
<td>Decompression of pleural space?</td>
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<tr>
<td>Decompression of pericardial space?</td>
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<tr>
<td>Treatment of poisonings, including gastric lavage?</td>
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<tr>
<td>Drug overdose/abuse?</td>
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</tbody>
</table>
B. Has the staff in the emergency department been instructed to look for an emergency medical identification symbol or card carried by the patient?  

<table>
<thead>
<tr>
<th></th>
<th>Yes</th>
<th>No</th>
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C. Do you use a classification system to determine priority of treatment?

If Yes, describe the classification system.

________________________________________________________________________

________________________________________________________________________

D. Could the E.R. be readied for mass major trauma?

How many patients could be accommodated?

E. Does a disaster plan exist?

F. Date of last drill.

VI. EQUIPMENT AND SUPPLIES

A. What types of supplies and equipment are available?

<table>
<thead>
<tr>
<th></th>
<th>In emergency department</th>
<th>Available within 5 minutes</th>
<th>Available longer than 5 minutes</th>
<th>Not available</th>
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<tbody>
<tr>
<td>1. Oxygen supply?</td>
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<td>2. Ventilation equipment with bag-valve-mask unit?</td>
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<td>3. Mechanical ventilator?</td>
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<td>4. Suction with pharyngeal and tracheal catheters?</td>
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<td>5. Tracheal intubation equipment?</td>
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<td>6. Cardioscope and/or electrocardiograph?</td>
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<td>7. External cardiac defibrillator?</td>
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<td>8. Cardiac pacemaker?</td>
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<td>9. Drugs for cardio-pulmonary emergencies?</td>
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<td>10. Resuscitative intravenous fluids?</td>
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<td></td>
<td>In emergency department</td>
<td>Available within 5 minutes</td>
<td>Available longer than 5 minutes</td>
<td>Not available</td>
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<td>11.</td>
<td>Whole blood?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12.</td>
<td>Venous infusion and injection equipment?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13.</td>
<td>Nerve block tray?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14.</td>
<td>Venous cut-down tray?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15.</td>
<td>Central venous catheterization tray?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16.</td>
<td>Sterile tracheostomy equipment?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>17.</td>
<td>Bronchoscope?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18.</td>
<td>Thoracotomy equipment?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>19.</td>
<td>Laryngoscopy equipment?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20.</td>
<td>Pleural and pericardial draining equipment?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>21.</td>
<td>Gastric lavage equipment?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>22.</td>
<td>Poison antidotes?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>23.</td>
<td>Electroencephalograph?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>24.</td>
<td>Anaphylactic tray?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>25.</td>
<td>Narcotics?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>26.</td>
<td>Crutchfield tong tray?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>27.</td>
<td>Orthopedic equipment?</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
VII. Describe future plans for E.R. expansion, relocation, remodeling, etc.

VIII. Have any studies of the E.R. been completed in your hospital by consultants, in-house administrative or engineering staff, or university students? Yes ____ No ____

If yes, may we have a copy of the study reports?
APPENDIX C

SPECIALTY UNITS AND CAPABILITIES IN THE METROPOLITAN ATLANTA AREA HOSPITALS

The following maps are designed to show the number and location of specialty facilities in metropolitan Atlanta. Data presented were gathered from the Emergency Room Questionnaire presented in Appendix B.
A - Buford General Hospital
B - Button Gwinnett Hospital
C - Clayton General Hospital
D - Cobb General Hospital
E - Crawford W. Long Memorial Hospital
F - DeKalb General Hospital
G - Doctors Hospital
H - Douglas County Memorial Hospital
I - Georgia Baptist Hospital
J - Grady Memorial Hospital
K - Holy Family Hospital
L - Joan Glancy Memorial Hospital
M - Kennestone Hospital
N - Northside Hospital
O - Piedmont Hospital
P - Rockdale County Hospital
Q - Shallowford Community Hospital
R - South Fulton Hospital
S - St. Joseph's Infirmary
T - West Paces Ferry Hospital
U - Atlanta West Hospital
V - Bolton Road Medical Center
W - Smyrna Hospital
X - Urban Medical Services Community Hospital

- Existing Hospital
○ Under Construction

FIGURE C.1 Metropolitan Atlanta Hospitals With EDs by EMS Category.*

* As defined in Chapter 4.
A - Buford General Hospital
B - Button Gwinnett Hospital
C - Clayton General Hospital
D - Cobb General Hospital
E - Crawford W. Long Memorial Hospital
F - DeKalb General Hospital
G - Doctors Hospital
H - Douglas County Memorial Hospital
I - Georgia Baptist Hospital
J - Grady Memorial Hospital
K - Holy Family Hospital
L - Joan Glancy Memorial Hospital
M - Kennestone Hospital
N - Northside Hospital
O - Piedmont Hospital
P - Rockdale County Hospital
Q - Shallowford Community Hospital
R - South Fulton Hospital
S - St. Joseph's Infirmary
T - West Paces Ferry Hospital
U - Atlanta West Hospital
V - Bolton Road Medical Center
W - Smyrna Hospital
X - Urban Medical Services Community Hospital

* Existing Hospital
○ Under Construction

**FIGURE C.2** Number and Location of CCU Beds in the Metropolitan Atlanta Area.
FIGURE C.3  Number and Location of ICU Beds in Metropolitan Atlanta.
A - Buford General Hospital
B - Button Gwinnett Hospital
C - Clayton General Hospital
D - Cobb General Hospital
E - Crawford W. Long Memorial Hospital
F - DeKalb General Hospital
G - Doctors Hospital
H - Douglas County Memorial Hospital
I - Georgia Baptist Hospital
J - Grady Memorial Hospital
K - Holy Family Hospital
L - Joan Glancy Memorial Hospital
M - Kennestone Hospital
N - Northside Hospital
O - Piedmont Hospital
P - Rockdale County Hospital
Q - Shallowford Community Hospital
R - South Fulton Hospital
S - St. Joseph's Infirmary
T - West Paces Ferry Hospital
U - Atlanta West Hospital
V - Bolton Road Medical Center
W - Smyrna Hospital
X - Urban Medical Services Community Hospital

* A check (√) indicates 24 hour ED physician coverage.

FIGURE C.4 Hospitals With 24 Hour ED Physicians in Metropolitan Atlanta.*
FIGURE C.5 Metropolitan Atlanta Hospitals With 24 Hour Operating Room Staff.*

* A check (✓) indicates 24 hour OR staff.
APPENDIX D

MEMBERS AND SPECIAL CONSULTANTS OF THE ATLANTA REGIONAL COMMISSION'S TASK FORCE ON EMERGENCY MEDICAL SERVICES

The ARC Task Force on EMS was divided into seven subcommittees consisting of the members shown on the following pages. It should be noted that the chairman of each of the seven special subcommittees was a member of the steering committee. The final report of the Task Force on EMS is entitled "Emergency Medical Services in the Metropolitan Atlanta Region."
APPENDIX D

ATLANTA REGIONAL COMMISSION'S TASK FORCE
ON EMERGENCY MEDICAL SERVICES

Steering Committee:

J. Norman Berry, M. D.            Mark M. Lindsey, M. D.
Luther M. Vinton, Jr., M.D.        Douglas B. Kendrick, M. D.
Bill Jamieson, Jr.                 Lyndon Beall
Arthur M. Kaplan                   John W. Coyle
F. Ray Pinkerton                   James S. Garvin, Jr.
Lt. R. W. Deariso                   Algie L. Jordan
Edgar H. Pounds                    Kenneth R. Thompson

Public Information and Education Subcommittee:

Bill Jamieson, Jr., Chairman       Allen May
John F. Kiser                      Jacklyn Petchenik
Patton Lindsley

Manpower and Training Subcommittee:

Arthur M. Kaplan, Chairman         Tommy C. Ishee, Jr.
Lyndon Beall                       Steven R. K. Sylvester
Linwood Beck                       George Wren, Ph.D.
Mark S. Blum                       W. A. (Bill) Fountain
David Hilton

Communications Subcommittee:

F. Ray Pinkerton, Chairman         Bill Guice
Ray H. Billings                    Bob Jones
W. Frank Blount                    George Marshall
Aubrey M. Bush, Ph.D.              Edgar H. Pounds
Tom H. Cobb                        Oren L. Reinbolt
John W. Crunkleton                 Wendell Wood

Dispatch and Control Procedures Subcommittee:

Robert W. Deariso, Chairman        Tom H. Cobb
Ray H. Billings                    J. W. Crunkleton
Mark S. Blum                       Ray Mattison
Bob Jones                          H. V. Gunter
J. K. Pfohl, Jr.                   O. L. Keheley
Jerry Turner                       Gilbert Martinez
Transportation and Equipment Subcommittee:
Edgar H. Pounds, Chairman  J. I. Gibson
Lyndon Beall  David Hilton
Mark S. Blum  Gilbert Martinez
Robert Cundiff  Edward L. Steinhauer

Emergency Facilities Subcommittee:
Mark M. Lindsey, M. D., Chairman  Kenneth Lowery
John F. Bowling  Sam Pangburn
A. M. Brock  Robert Parrish
Fred R. Crawford, Ph.D.  Oren L. Reinbolt
John R. Gerlach  John Stone, M. D.
J. Fred Gunter  Marilyn Stone, D.D.S.
Glen Hogan

Disaster Planning Subcommittee:
Douglas B. Kendrick, M. D., Chairman  J. Fred Gunter
H. L. Baccus  Albert L. Martin, Jr.
Charles E. Batthis, Jr.  David Moody
Fred R. Crawford, Ph.D.  Oren L. Reinbolt
Gerald J. Fico  J. G. Rosser, Jr.
APPENDIX E

HSRC AMBULANCE SURVEY FORM

The Ambulance Survey Form presented here was designed by the HSRC Research Staff and modeled after surveys recommended by the U. S. Department of Health, Education, and Welfare, and similar efforts by the Department of Preventive Medicine at the Ohio State University. In addition, past surveys by the Georgia Department of Human Resources were examined. The HSRC Ambulance Survey was slightly modified, and mailed by the ARC in November, 1972. Results of the questionnaire are presented in Chapter 5.
APPENDIX E

HSRC AMBULANCE SURVEY FORM

Introduction:

The questions on the following pages are designed to collect statistical information, and rely heavily upon various numbers and figures you may keep in your records.

Your answers to these questions are quite important to the survey of emergency ambulance service, and we ask that you answer them, even if you do not keep very detailed records. If you need to estimate a number, please be as accurate as you can. Indicate if your answer is an estimate, rather than a computed number based upon detailed records, in the space provided.

Should you have any questions, please call Jim Garvin, Atlanta Regional Commission, at 522-7577. Thank you for your help.

(Name of Organization)

(Name of Person Filling Out Form)

(Title)
A. GENERAL INFORMATION

1. Who may we contact if we have questions? ____________________________
   Title ____________________ Telephone ____________________

2. Give complete address for your organization:
   Name ____________________
   Street ____________________
   City, Zip Code ______________
   County ____________________

3. Type of Organization (check one):
   ____ Commercial Ambulance Company (ambulance service only)
   ____ County Police Department
   ____ City Police Department
   ____ County Fire Department
   ____ City Fire Department
   ____ Hospital
   ____ Other (specify) ______________

4. Which of the following best describes your emergency ambulance operation
   (check one)?
   ____ stationed at one location; please provide the address: ____________
   ____ stationed at more than one location; please provide the addresses
       (street, city, county)
       Location 1 ______________________________
       Location 2 ______________________________
       Location 3 ______________________________
       Location 4 ______________________________
   ____ roving vehicle(s) (Do not receive calls while waiting at a fixed
     location)

5. Does your organization belong to any ambulance associations? __ Yes
   __ No  If yes, which associations? ________________________________

6. When did your organization first provide non-emergency patient transpor-
   tation services? Date ______________
   Emergency Service? Date ______________
   Why did you begin providing emergency service? ________________________________

7. Do you have any plans to discontinue emergency service in the future?
   ____ Yes  ____ No  If yes, when? Date ______________
   Why? ________________________________

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B. SERVICE AREA AND TYPE OF SERVICE

Definitions:

| Emergency Conditions - Ambulance uses warning signals such as lights and siren, traveling at maximum safe speed. |
| Non-emergency Conditions - Vehicle does not use warning signals such as lights and siren, and travels within posted speed limits. |

| Emergency Call - A call in which a patient is picked up outside of a hospital and transported to a hospital under emergency conditions. |
| Emergency Hospital Transfer - A call in which a patient is picked up at a hospital and transported to another hospital under emergency conditions. |

| Non-emergency Call - A call to which a vehicle is sent to move a patient either to or from a hospital, clinic, etc., but NOT from one hospital to another hospital, under non-emergency conditions. |
| Non-emergency Hospital Transfer - A call in which a vehicle moves a patient from one hospital to another hospital, under non-emergency conditions. |

1. Please indicate with a check mark in the appropriate box (above) which types of calls you routinely perform.

2. Outline the geographical area you service, on the map on page 4.

3. Outline the geographical area in which you handle emergency calls (TYPE I), on the map on page 5. If this area is the same as the one described in question two, place a check here: ___
SERVICE AREA FOR EMERGENCY CALLS ONLY
C. STATISTICS

Note: The answers in this section should correspond to the questionnaire definitions (presented previously). In each question, specific numbers are requested. If you can not answer the question from detailed records, please attempt to estimate an answer, and indicate that your answer is an estimate, in the space provided.


1. a. Definitions:

   False Alarm - An emergency call for which the ambulance was not needed, did not provide treatment, and did not transport a patient.

   D.O.A. (Dead on Arrival) - An emergency call where the patient is dead when the ambulance arrives, and not transported to a hospital under emergency conditions.

b. Please complete the chart on page seven.
### ANNUAL STATISTICS

November, 1971 - October, 1972

<table>
<thead>
<tr>
<th>Grand Total of All Calls</th>
<th>1. Emergency Calls (Do not include items 2, 5, or 6) TYPE I</th>
<th>2. Emergency Hospital Transfers (Do not include items 5 or 6) TYPE II</th>
<th>3. Non-Emergency Calls (Do not include items 1, 2, 4, 5, 6, or 7) TYPE III</th>
<th>4. Non-Emergency Hospital Transfers (Do not include items 1, 2, 5, 6, or 7) TYPE IV</th>
<th>5. False Alarms</th>
<th>6. DOA (Dead on Arrival)</th>
<th>7. Emergencies (Items 1, 2, 5, and 6)</th>
<th>8. Non-Emergencies (Items 3 and 4) (Do not include items 5 or 6)</th>
</tr>
</thead>
</table>

**NOTE:**

1. If you have one location or operate a roving vehicle, place all figures in the "All Ambulance Locations" column.
2. If your records consist of only emergency and non-emergency figures, please enter those figures below, in addition to completing the chart above. Indicate which group contains DOA and false alarm calls.
   - Emergencies _____
   - Non-Emergencies _____
   - Estimate? _____Yes _____No.
3. If you need more space, use the back of this page. Be sure to identify each number, and note which numbers are estimates.
2. Do you provide a back-up service* to other ambulance organizations? ___ Yes ___ No If yes, how many calls in the most recent twelve (12) months (include October, 1972) were back-up calls? _______ (Number of back-up calls) Is this figure an estimate? ___ Yes ___ No

If possible, please attach a copy of your back-up service contract or agreement (if you provide back-up service), and list the ambulance organizations involved.

3. Please indicate which hospitals you service, by noting the approximate percent of your total calls which are delivered to each (indicate less than 1% with a check mark):

Fulton:  
[ ] Grady  
[ ] Georgia Baptist  
[ ] Northside  
[ ] Piedmont  
[ ] South Fulton  
[ ] Crawford Long  
[ ] Holy Family  
[ ] St. Joseph's Infirmary  
[ ] West Paces Ferry

DeKalb:  
[ ] DeKalb General  
[ ] Doctors (Tucker)  
[ ] Kennestone  
[ ] Cobb General  
[ ] Rockdale County

Clayton:  
[ ] Clayton General  
[ ] Douglas County  
[ ] Button Gwinnett  
[ ] Buford General  
[ ] Joan Glancy

Are these figures estimated? ___ Yes ___ No

4. Please describe the information you record for each ambulance call. If possible, attach a blank or duplicate copy of your ambulance run report.

*Back-up service is defined as a service you provide to another ambulance organization, whereby, according to some predetermined arrangement, they refer to you emergency calls which they cannot properly answer.
5. What is the average duration of your emergency calls, from dispatch until the ambulance is again available for call? _____ minutes
   Is this a computed statistic? _____ Estimate? _____

6. What is the average speed traveled for an emergency call? _____ MPH
   Is this a computed statistic? _____ Estimate? _____

7. What percent of your calls are:
   _____ heart attack or related
   _____ automobile accidents
   _____ home injury
   _____ injury out of the home
   _____ medical problems at home
   _____ medical problems occurring out of the home

   Is your answer to this question: _____ a computed statistic _____ an estimate?

D. STAFFING AND TRAINING

1. On emergency calls, are your vehicles usually manned by (check):
   _____ driver only; _____ driver and one attendant; _____ driver and more than one attendant.

2. In the chart below, please indicate the number of ambulance personnel available at the ambulance location for emergency calls (drivers and attendants only).

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Day Shift</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Evening Shift</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Night Shift</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

3. a. DEFINITIONS which apply to this question are provided below.

   Hours worked per week - Total hours per week that the employee is usually paid for, or is regularly scheduled to be available on the premises for ambulance calls.

   Hours devoted to ambulance service - If the employee does not devote 100% of his time to the ambulance service, please estimate the number of hours per week that are devoted to the ambulance service. Include time spent on ambulance calls, training, routine maintenance of vehicles (including linen and supply restocking), stand by hours, etc.

   Stand by hours - Time spent waiting for an ambulance call at the ambulance station. Time spent performing tasks related to the ambulance business may be included. When defining ambulance related work be sure you do not include time for tasks which could be performed if you did not have ambulances.

   On the job training - Training received through work experience.

   Basic First Aid - As defined and certified by the American Red Cross, or equivalent.
Standard First Aid - As defined and certified by the American Red Cross, or equivalent.

Multimedia First Aid - An eight hour program that satisfies requirements for certification at the Standard First Aid level, presented by the American Red Cross.

Advanced First Aid - As defined and certified by the American Red Cross.

Emergency Medical Technician-Ambulance (EMT-A) - Course designed to meet the specifications set forth by the U. S. Department of Transportation, or an equivalent leading to certification as an EMT-A, approved by the state of Georgia.

Certified in cardiopulmonary resuscitation - Program sponsored by the Georgia Heart Association, or equivalent.

Formal instruction - A training program designed or conducted by a hospital, physician, or nurse.

Formal instruction in I.V. therapy - Formal instruction in the venipuncture technique and administration of fluids through intravenous infusion.

Formal instruction in defibrillation - Formal instruction in the use of a defibrillator to correct certain cardiac arrhythmias.

Formal instruction in drug administration - Formal instruction in the techniques of hypodermic and intramuscular injection and the use of drugs such as pain killers, cardiovascular drugs, etc.

b. INSTRUCTIONS: Please list each employee who performs ambulance related work by describing his or her skill or title, and complete the requested information. Two pages have been provided for your use, in addition to a sample page which has been filled in. One entry should be made for each employee on your staff who spends time performing ambulance related work. If you employ people whose positions are not described on the data collection form, please answer the following questions.

c. How many of the employees not described on the data collection form are full time (40 hours or more per week)? ______

d. How many of the employees not described on the data collection form are part-time (less than 40 hours per week)? ______
<table>
<thead>
<tr>
<th>TRAINING</th>
<th>(Check)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Form No. 3</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Hours Worked Per Week</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hours Devoted to Ambulance Service</td>
</tr>
<tr>
<td>On the Job</td>
</tr>
<tr>
<td>Basic First Aid</td>
</tr>
<tr>
<td>Standard First Aid</td>
</tr>
<tr>
<td>Multimedia First Aid</td>
</tr>
<tr>
<td>Advanced First Aid</td>
</tr>
<tr>
<td>Emergency Medical Technician</td>
</tr>
<tr>
<td>Cardiopulmonary Resuscitation</td>
</tr>
<tr>
<td>IV Therapy</td>
</tr>
<tr>
<td>Defibrillation</td>
</tr>
<tr>
<td>Drug Administration</td>
</tr>
<tr>
<td>Other (specify)</td>
</tr>
</tbody>
</table>
E. COMMUNICATIONS

1. List the frequencies used to: Transmit  Receive
   ______ MHZ       ______ MHZ
   ______ MHZ       ______ MHZ
   ______ MHZ       ______ MHZ

   If you use only one frequency, can your equipment be expanded to multichannel
   capability with only minor changes?  __Yes  __No  If yes, indicate the
   number of channel positions your equipment can be expanded to include.  _____

2. Do you utilize telemetry?  __Yes  __No  If yes, which hospitals are
   involved? _____________________________________________

   What frequencies do you use for telemetry? ______________________________

3. Do your emergency ambulances communicate from the patient location to hospitals:
   ______ directly
   ______ indirectly, through dispatcher
   ______ as a matter of routine
   ______ in special cases (explain) _________________________________________
   ______ do not communicate with hospitals

   If you communicate with hospitals, which hospitals are involved? ______

F. DISPATCH AND CONTROL

1. Briefly describe your method of dispatching emergency ambulances.

2. Which of the following do you use in your radio procedure?  (Check)
   ______ the "10" code system (10-4, 10-8, etc.)
   ______ military time
   ______ standard time
   ______ other radio procedure or codes (explain) ____________________________

   Note: If you utilize a code system (other than the "10" codes) attach a copy
   of the codes and their meanings.
3. From what sources (be specific) do you receive your requests for emergency ambulance service? What percent of the requests come from each source? Are these figures computed statistics? ___ Estimates? ___

<table>
<thead>
<tr>
<th>Source</th>
<th>Percent</th>
<th>Other Sources</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Police Dept. (which?)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fire Dept. (which?)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ambulance Service (which?)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

4. Do ambulances from other organizations respond to emergency calls that you have been requested to answer? ___ Yes ___ No If yes, does this occur (check one):

- ___ less than once per month
- ___ between 1 and 5 times per month
- ___ between 5 and 10 times per month
- ___ over 10 times per month; approximately how many times? ______

Note: Do not include incidents where a second ambulance has been specifically requested.

G. VEHICLES AND EQUIPMENT

1. Describe your ambulance vehicles below:

<table>
<thead>
<tr>
<th>Make</th>
<th>Year</th>
<th>Check Appropriate Type</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Horse</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Van</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mobile</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Stretcher</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Other 54&quot; head-room</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Other 54&quot; head-room at least</td>
</tr>
</tbody>
</table>

360
2. Indicate how many vehicles are regularly scheduled as emergency ambulances at the exact hours listed below.

<table>
<thead>
<tr>
<th>Time</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>12 p.m. midnight</td>
<td>1</td>
</tr>
<tr>
<td>2 a.m.</td>
<td>1</td>
</tr>
<tr>
<td>4 a.m.</td>
<td>1</td>
</tr>
<tr>
<td>6 a.m.</td>
<td>1</td>
</tr>
<tr>
<td>8 a.m.</td>
<td>1</td>
</tr>
<tr>
<td>10 a.m.</td>
<td>1</td>
</tr>
<tr>
<td>12 noon</td>
<td>1</td>
</tr>
<tr>
<td>2 p.m.</td>
<td>1</td>
</tr>
<tr>
<td>4 p.m.</td>
<td>1</td>
</tr>
<tr>
<td>6 p.m.</td>
<td>1</td>
</tr>
<tr>
<td>8 p.m.</td>
<td>1</td>
</tr>
<tr>
<td>10 p.m.</td>
<td>1</td>
</tr>
</tbody>
</table>

3. Does the answer to question two above vary with the day of the week? ___ Yes ___ No
   If yes, please elaborate.

4. Indicate below with a check mark those items carried on all of your emergency ambulances. If the item is carried on some, but not all of your emergency ambulances, indicate the number that do carry the item, by writing the number in the space provided.

   ____ Air Splints
   ____ Mechanical Splints
   ____ Restraints
   ____ Spine Board (long)
   ____ Spine Board (short)
   ____ Suction Apparatus
   ____ Suction Apparatus, portable
   ____ Oxygen and Related Masks
   ____ Oxygen, portable, with Masks
   ____ Stethoscope
   ____ Sphygmomanometer
   ____ Obstetrical Kit (Sterile)
   ____ Poison Antidote
   ____ Oropharyngeal Airways
   ____ Sterile Dressings
   ____ Drugs (list) ________________
   ____ EKG (Strip Chart Recorder)
   ____ Defibrillator
   ____ Scoop Stretcher
   ____ Sterile Gloves
   ____ Walkie Talkie (hand held) Two-Way Radio
   ____ Rescue Tools (list) ________________
   ____
Privileged Communication

H. FINANCE

1. Do you receive payment for indigent calls from any source? ___ Yes ___ No
   If yes, from whom do you receive payment (be specific and include city, county, state departments, etc.)?

   If you receive payment for indigent calls, how are you paid (check one)?
   ____ payment of one sum, regardless of the volume of calls
   ____ payment dependent upon the volume of calls handled
   ____ other (describe)

2. Does a hospital ever pay for your ambulance service? ___ Yes ___ No
   If yes, describe.

3. Please attach a list of your fees for ambulance transportation and related services (optional). Include separate charges for oxygen, first aid, mileage, drugs, etc. (if applicable).
APPENDIX F

ATLANTA REGIONAL COMMISSION TELEPHONE SURVEY
OF AMBULANCE SERVICES

Due to the poor response to the large questionnaire (Appendix F) designed by HSRC and mailed by ARC, the following telephone survey form was designed. Staff members of ARC conducted the telephone survey in December, 1972, and January, 1973, and included all emergency ambulance purveyors in metropolitan Atlanta who did not respond to the longer, mailed survey form. Results of the survey are presented in Table F.1 which follows the sample telephone survey form.
AMBULANCE SURVEY
PHONE QUESTIONNAIRE

FIRM NAME _______________________________ PHONE __________________

ADDRESS ___________________________________ OWNER __________________

PERSON'S NAME GIVING DATA ________________________ POSITION ________________

Did you receive survey forms? Yes No Don't know

Reason for not answering _______________________________________________________

Do you provide 24 hr./7 day/wk. emergency transport? Yes No When started ________

How many emergency calls average/month __________________ (e.g. November)

% from police, fire, civil defense: _______ % from hospitals: _______

% from general public: _______ % from other (specify) _______

What % of your total ambulance runs are emergency runs: _______

Plan to discontinue? Yes No Maybe When _______ Why ________________________

Transport to which hospitals ________________________

How many and what type vehicles used: Combination ______________ Van ______________

Modular ___________ Other ___________ (indicate no. under 54" by circling no.)

Total no. of transport vehicles _______ with red light & sirens ______________

Do you have two-way radio communications between vehicle and Base __________ (frequency)

Hospital ____________________ Other ___________ Who __________________

No. of men full time: _______________ Part time _______________

Level of training BFA ___ SFA ___ AFA ___ CPR ___AAOS ___ EMT-A ___

IV ___ DEFIB ___ DRUGS ___ OTHER ___ WHAT ________________________

GENERAL COMMENTS: ______________________________________________________

Data taken by ______________________________ Date ______________________

AM/hnw 364 December 27, 1972
### TABLE F.1
Results of 1973 ARC Telephone Survey of Emergency Ambulance Purveyors in Metropolitan Atlanta.

<table>
<thead>
<tr>
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<th>1</th>
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<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
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**TABLE F.1 (cont.)** Results of 1973 ARC Telephone Survey of Emergency Ambulance Purveyors in Metropolitan Atlanta.

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<td>YES</td>
<td>YES</td>
<td>YES</td>
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<tr>
<td>WHAT PER CENT COME FROM THE PUBLIC?</td>
<td>10 92 90 40 50 95 70 90 55 50</td>
<td>50</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>WHAT PER CENT COME FROM HOSPITALS?</td>
<td>0 0 0 0 0 0 0 0 0</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>WHAT PER CENT COME FROM OTHER SOURCES?</td>
<td>0 0 0 0 0 0 0 0 0 0</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>WHAT PER CENT OF ALL RUNS ARE EMERGENCIES?</td>
<td>25 25 15 33 30 30 95 90 55 50</td>
<td>50</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DO YOU PLAN TO STOP EMERGENCY SERVICE?</td>
<td>NO NO NO NO NO MAY YES YES NO NO</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOTAL NUMBER OF VEHICLES</td>
<td>2 2 2 5 1 1 4 3 1 2</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOTAL VEHICLES WHICH ARE VANS</td>
<td>1 1 0 0 1 1 0 0 0 0</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOTAL NUMBER OF EMPLOYEES</td>
<td>7 5 9 25 4 5 15 10 11 7</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOTAL TRAINED IN BASIC AND STANDARD FIRST AID.</td>
<td>6 4 ? 12 1 4 15 10 7 7</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOTAL TRAINED IN ADVANCED FIRST AID</td>
<td>? 0 ? 12 1 0 0 0 7 5</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOTAL TRAINED IN CPR</td>
<td>? 0 ? 12 0 0 0 0 8 5</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOTAL COMPLETING AAOS, BUT NOT EMT-A</td>
<td>0 0 0 0 0 0 0 0 0 0</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOTAL REGISTERED EMT-As</td>
<td>1 0 1 12 0 0 0 0 0 5</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOTAL TRAINED TO DEFRIBRILLATE</td>
<td>0 0 0 0 0 0 0 0 0 0</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IS THE AMBULANCE RADIO EQUIPPED</td>
<td>YES YES YES NO NO YES YES YES YES YES</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
TABLE F.2  Summary of Results of ARC Telephone Survey of Emergency Ambulance Purveyors in Metropolitan Atlanta.

<table>
<thead>
<tr>
<th>SURVEY ITEM</th>
<th>DATA SUMMARY</th>
</tr>
</thead>
<tbody>
<tr>
<td>TOTAL WITH NO PLANS TO DISCONTINUE</td>
<td>34</td>
</tr>
<tr>
<td>TOTAL VEHICLES</td>
<td>115</td>
</tr>
<tr>
<td>TOTAL VANS</td>
<td>45</td>
</tr>
<tr>
<td>TOTAL EMPLOYMENT</td>
<td>482</td>
</tr>
<tr>
<td>TOTAL TRAINED IN BASIC AND STANDARD FIRST AID</td>
<td>307</td>
</tr>
<tr>
<td>TOTAL TRAINED IN ADVANCED FIRST AID</td>
<td>231</td>
</tr>
<tr>
<td>TOTAL TRAINED IN CPR</td>
<td>202</td>
</tr>
<tr>
<td>TOTAL AAOS, BUT NOT EMT-A</td>
<td>8</td>
</tr>
<tr>
<td>TOTAL EMT-A</td>
<td>76</td>
</tr>
<tr>
<td>TOTAL TRAINED TO DEFIBRILLATE</td>
<td>23</td>
</tr>
<tr>
<td>TOTAL COMPANIES WITH RADIO EQUIPMENT</td>
<td>28</td>
</tr>
<tr>
<td>TOTAL EMERGENCY AMBULANCE PURVEYORS</td>
<td>40</td>
</tr>
<tr>
<td>TOTAL MONTHLY EMERGENCY DEMAND (AMBULANCE CALLS)</td>
<td>6190</td>
</tr>
</tbody>
</table>
APPENDIX G

AMBULANCE PURVEYORS IN THE METROPOLITAN ATLANTA AREA

The following pages present the names and addresses of the 59 ambulance purveyors operating in the seven counties of metropolitan Atlanta. Of the 59 purveyors, the 40 purveyors operating emergency ambulance services as of January 1, 1973 are illustrated in Appendix F. The listing of ambulance purveyors presented here was compiled from the Yellow Pages, Georgia Department of Human Resources, Southern Bell Information Operator, and the ARC. Ambulance purveyors not offering emergency service are designated as such.
APPENDIX G

AMBULANCE PURVEYORS IN THE METROPOLITAN ATLANTA AREA

1. Abercrombie-Patterson Funeral Home
   1054 Main Street, Forest Park, Georgia

2. Blakes Funeral Home (no emergency service)
   2166 Bankhead Highway, N. E., Atlanta, Georgia

3. Byron's Ambulance Service
   530 Main Street, Forest Park, Georgia

4. Castellaw Funeral Home
   866 Church Street, Smyrna, Georgia

5. Colonial Chapel Ambulance Service
   5315 Buford Highway, Doraville, Georgia

6. Couch & Mason Forest Hill Chapel
   Scenic Highway, Lawrenceville, Georgia

7. Couch-Mundy Funeral Home
   1040 Main Street, Stone Mountain, Georgia

8. Cox Bros. Funeral Directors
   380 Auburn Avenue, N. E., Atlanta, Georgia

9. Davis, Gene Funeral Home
   1115 Clay Road, S. W., Mableton, Georgia

10. Davis, Roy Funeral Home
    5925 Mullberry Street, Austell, Georgia

11. Dawson, Alfonso Mortuary (no emergency service)
    3000 Gordon Road, S. W., Atlanta, Georgia

    467 Stonewall, Atlanta, Georgia

13. DeKalb County Fire Department
    DeKalb County, Georgia

14. Dickson Pope & Son Funeral Home (no emergency service)
    168 McDonough, Jonesboro, Georgia

15. Dillon J. Austin Co. (no emergency service)
    502 Pryor Street, S. W., Atlanta, Georgia

    1806 Ellington, Decatur, Georgia

372
17. Eppinger Bradley & Sons (no emergency service)
   130 Holiday, N. W., Marietta, Georgia

18. Grady Memorial Hospital
   80 Butler Street, S. E., Atlanta, Georgia

19. Gwinnet County Fire Department
   57 College Street, Lawrenceville, Georgia

20. Hanley Ashby Street Funeral Home (no emergency service)
   103 Ashby, S. W., Atlanta, Georgia

21. Hanley's Bell Street Funeral Home (no emergency service)
   21 Bell, N. E., Atlanta, Georgia

22. Hanley Co. Funeral Directors (no emergency service)
   449 Washington Avenue, N. E., Atlanta, Georgia

23. Haugabrooks Funeral Home
   364 Auburn Avenue, N. E., Atlanta, Georgia

24. Hines Funeral Home
   1258 Bankhead Avenue, N. W., Atlanta, Georgia

25. Houston, T. E. Funeral Home
   2480 Bankhead Highway, Atlanta, Georgia

26. Ivey Bros. Inc. (no emergency service)
   492 Larkin, S. W., Atlanta, Georgia

27. Jones, Louie E. Funeral Home Inc.
   55 N. Main Street, Alpharetta, Georgia

28. Kennesaw Chapel Ambulance Service
   2676 Summer Street, N. W., Kennesaw, Georgia

29. Lemon Funeral Home
   300 Griffin, McDonough, Georgia

30. McCray Brothers Funeral Home (no emergency service)
   843 Hollywood Road, N. W., Atlanta, Georgia

31. Medford Norman Funeral Home & Ambulance Service
   1699 Canton Highway, Marietta, Georgia

32. Metro Ambulance Service
   398 - 14th Street, N. W., Atlanta, Georgia

33. Metro Ambulance Service
   P. O. Box 195, Marietta, Georgia

373
34. Milsap and Son Funeral Home (no emergency service)  
   1062 Loyd Street, Conyers, Georgia
35. Mitchell Ambulance Service  
   1087 N. Main, Conyers, Georgia
36. Mobley-McLane Funeral Home  
   4320 Cowan Road, Tucker, Georgia
37. Murdaugh Brothers (no emergency service)  
   367 Parkway Drive, N. E., Atlanta, Georgia
38. Nash Funeral Home  
   345 Irwindale Road, Duluth, Georgia
39. Oak Lawn Chapel  
   315 Jackson, S. E., Lawrenceville, Georgia
40. Patterson, R. T. Funeral Home (no emergency service)  
   1001 N. Buford Highway, Norcross, Georgia
41. Pollard Funeral Home (no emergency service)  
   827 Washington Street, S. W., Atlanta, Georgia
42. Professional Ambulance Service  
   989 Cleveland Avenue, East Point, Georgia
43. Roswell Funeral Home  
   590 Mimosa Boulevard, Roswell, Georgia
44. Sanders Funeral Home & Ambulance Service  
   2950 King Street, S. E., Smyrna, Georgia
45. Sandy Springs Chapel  
   136 Mt. Vernon Highway, N. E., Sandy Springs, Georgia
46. Simpson, J. D. Funeral Home (no emergency service)  
   6787 East Forest Avenue, Atlanta, Georgia
47. South Fulton Ambulance Service  
   3362 Stewart Avenue, Hapeville, Georgia
48. Suburban Ambulance Service  
   P. O. Box 117, Avondale Estates, Georgia
49. Superior Ambulance Service  
   6644 Church Street, Riverdale, Georgia
50. Tapp Funeral Home  
   201 Morningside Drive, Buford, Georgia
51. Thornton Mortuary (no emergency service)  
   3346 Gordon Road, Atlanta, Georgia
52. Turk's Memory Chapel  
   4405 Marietta Street, Powder Springs, Georgia

53. Turner, A. S.  
   2773 North Decatur Road, Decatur, Georgia

54. Tyler Funeral Home  
   511 W. Trinity Place, Decatur, Georgia

55. Ward, Horis A. Inc.  
   2321 Candler Road, Decatur, Georgia

56. White, Harry L. Funeral Home (no emergency service)  
   1299 Milstead Avenue, Conyers, Georgia

57. J. Cowan Whitley Company  
   W. Broad Street, Douglasville, Georgia

58. Wink-McCurdy  
   2279 Benson Poole Road, Smyrna, Georgia

59. Wright Ambulance Service  
   168 Broad Street, Fairburn, Georgia
APPENDIX H

A QUEUING FORMULA TO DETERMINE PERCENTAGE OF IMMEDIATE AVAILABILITY OF AMBULANCES, GIVEN TOTAL NUMBER OF AMBULANCES IN THE SYSTEM

The following appendix gives a mathematical model based upon the theory of queues (waiting lines) to determine the probability of a patient who needs an ambulance, finding that all ambulances are busy, given the number of ambulances in the system. The analysis shows that the probability of any given number of ambulances being busy at any given instant in time is dependent upon the arrival rate of calls (μ) and closely approximates the common Poisson probability distribution with mean (λ/μ). From the probability of various numbers of ambulances being occupied at a given instant in time, the probability of finding that all ambulances are busy can be inferred, given the total number of ambulances. Chapter 5 uses the formula presented in this Appendix to determine ambulance requirements for each of the seven counties in metropolitan Atlanta. (See Table 5.4)
APPENDIX H

A QUEUEING FORMULA TO DETERMINE PERCENTAGE OF IMMEDIATE AVAILABILITY OF AMBULANCES, GIVEN TOTAL NUMBER OF AMBULANCES IN THE SYSTEM

Let: 
- $s$ = total number of ambulances in the system
- $n$ = number of busy ambulances at any given time
- $\lambda_n$ = arrival rate of calls for service, given $n$ busy ambulances
- $\mu_n$ = service rate by $n$ ambulances working together
- $P_n$ = probability of $n$ ambulances being busy at one time

Assume: 
1) Poisson Arrival of demand for ambulance service
2) Exponential Service Times for ambulance calls
3) $\lambda_n = \lambda$ for all $n > 0$
4) $\mu_n = n \mu$ for $0 \leq n \leq s$

The single-server, steady-state solution for exponential service and Poisson arrivals is well known and cited in most operations research texts to be:

$$P_n = \frac{\prod_{i=1}^{n-1} \lambda_i}{\prod_{i=1}^{n} \mu_i} \cdot P_0, \text{ for } n \geq 1$$

$$\sum_{n=0}^{\infty} P_n = 1 \Rightarrow P_0 + \frac{\lambda_0}{\mu_1} P_0 + \frac{\lambda_0 \lambda_1}{\mu_1 \mu_2} P_0 + \ldots = 1$$

or,

$$P_0 \left[ 1 + \sum_{n=0}^{\infty} \frac{\prod_{i=1}^{n-1} \lambda_i}{\prod_{i=1}^{n} \mu_i} \right] = 1$$

thus,

$$P_0 = \frac{1}{1 + \sum_{n=0}^{\infty} \frac{\prod_{i=0}^{n-1} \lambda_i}{\prod_{i=1}^{n} \mu_i}}$$
Extending this result to the multiple server case:

\[
\begin{align*}
P_n &= \frac{\prod_{l=1}^{s-1} \lambda l}{\prod_{l} \mu l} \cdot P_0, \\
\text{as before, but } \lambda l &= \lambda \text{ for all } l \\
\text{and } \mu n &= n\mu \text{ for } 0 \leq \mu \leq s
\end{align*}
\]

thus,

\[
P_n = \frac{\lambda^n}{\mu \cdot 2 \mu \cdot 3 \mu \cdot ...} \cdot P_0 = \left(\frac{\lambda}{\mu}\right)^n \cdot \frac{P_0}{n!} \text{ for } n \leq s
\]

making the approximation that \( s \) is large, \( n \) is expected to always be less than \( s \), and the above term for \( P_n \) is accurate.

To find \( P_0 \), use the fact that \( \sum_{n=0}^{s} P_n = 1 \)

letting \( \rho = \frac{\lambda}{\mu} \), \( P_0 \left[1 + \frac{\rho}{1!} + \frac{\rho^2}{2!} + \frac{\rho^3}{3!} + ... + \frac{\rho^s}{s!}\right] = 1 \)

\[
= P_0 \left[\sum_{k=0}^{s} \frac{\rho^k}{k!}\right] = 1, \text{ for } \rho < 1
\]

therefore,

\[
P_0 = \frac{1}{\sum_{k=0}^{s} \frac{\rho^k}{k!}}
\]

and,

\[
P_n = \rho^n \left(\frac{P_0}{n!}\right) \Rightarrow P_n = \frac{1}{\sum_{k=0}^{s} \frac{\rho^k}{k!}} \cdot \rho^n
\]

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or,

\[ P_n = \frac{(\lambda/\mu)^n}{n!} \sum_{k=0}^{s} \frac{(\lambda/\mu)^k}{k!} \]

The values for \( P_n \) calculated above closely approximate the Poisson probability function as long as \( s \) is large relative to \((\lambda/\mu)\). In effect, when the percent of immediate availability of ambulances is large, the number of busy ambulances in the system closely approximates a Poisson distribution with mean \((\lambda/\mu)\).

A numerical example follows in Table H.1:

if \( s = 5 \) ambulances  
\( \lambda = 1 \) call/hour  
\( \mu = 1 \) call/hour  
then \( \lambda/\mu = 1/1 = 1 \)

<table>
<thead>
<tr>
<th>( n )</th>
<th>((\lambda/\mu)^n)</th>
<th>((\lambda/\mu)^n/n!)</th>
<th>( P_n )</th>
<th>( \sum P_i )</th>
<th>Poisson Cumulative Probability ([\lambda=1])</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1</td>
<td>1</td>
<td>.3681</td>
<td>.368</td>
<td>.368</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>1</td>
<td>.3681</td>
<td>.736</td>
<td>.736</td>
</tr>
<tr>
<td>2</td>
<td>1</td>
<td>2</td>
<td>.1840</td>
<td>.920</td>
<td>.920</td>
</tr>
<tr>
<td>3</td>
<td>1</td>
<td>6</td>
<td>.0614</td>
<td>.982</td>
<td>.981</td>
</tr>
<tr>
<td>4</td>
<td>1</td>
<td>24</td>
<td>.0153</td>
<td>.997</td>
<td>.996</td>
</tr>
<tr>
<td>5</td>
<td>1</td>
<td>120</td>
<td>.0031</td>
<td>1.000</td>
<td>.999</td>
</tr>
</tbody>
</table>

The example shows the last two columns nearly identical, illustrating the fact that the Poisson probability function describes the number of busy ambulances in the system.

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APPENDIX I

EXPECTED DEMAND TO BE PLACED UPON THE
METROPOLITAN ATLANTA EMERGENCY MEDICAL SYSTEM

The number of requests for emergency medical service to be expected in an operating EMS system directly affects the design of the system in terms of number and location of vehicles, size of the dispatch center, and many other elements of the system. Due to the inadequacy of present ambulance records, a good methodology for determining the number of calls expected to be generated for EMS simply does not exist. Therefore, the estimates of demand for EMS must be based upon known factors, in this case population. Several formulas have been devised in other reports to predict demand for EMS as a function of population. These formulas are analyzed and compared to estimates and rough data to determine which formula best suits the individual case of metropolitan Atlanta.
APPENDIX I

EXPECTED DEMAND TO BE PLACED UPON THE METROPOLITAN ATLANTA EMERGENCY MEDICAL SYSTEM

The Dunlap Report, "Economics of Highway Emergency Ambulance Services," (1) includes a graph of the annual number of emergency calls generated from populations of service areas. The purpose of the graph is to allow an analyst to predict demand placed upon an EMS system as a function of population only, keeping in mind the fact that population figures are generally easily obtainable whereas ambulance records are not. Based upon the responses of 80 ambulance purveyors to the question "Approximate number of emergency ambulance calls per year?", the report concluded that a good estimate of the number of emergency ambulance calls generated may be calculated by the formula:

\[ Y = 10.06X + 70 \]

where \( Y \) is the number of emergency calls/yr.

\( X \) is the population of the service area divided by 1000

For the city of Houston, Texas, then, the formula would predict:

\[ Y = (10.06) \cdot (1233) + 70 = 12,473 \text{ emergencies/yr}. \]

However, records of emergency runs in Houston show that the ambulances were called upon to answer 47,100 emergency runs last year. Table I.1 shows the actual and predicted demand for emergency service for two large southern cities and a northern city comparable in size to Atlanta. In each case, the Dunlap prediction falls short of the actual demand by at least 300%.
### Table I.1 Actual and Predicted Demand for EMS in Three Cities

<table>
<thead>
<tr>
<th>CITY</th>
<th>POPULATION</th>
<th>CALLS ACTUALLY RECEIVED</th>
<th>PREDICTED BY DUNLAP FORMULA</th>
<th>PREDICTED BY &quot;35 PER YEAR PER 1000 POPULATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jacksonville</td>
<td>529,000</td>
<td>19,300*</td>
<td>5,391</td>
<td>18,515</td>
</tr>
<tr>
<td>Houston</td>
<td>1,233,000</td>
<td>47,100**</td>
<td>12,473</td>
<td>43,155</td>
</tr>
<tr>
<td>Columbus, Ohio</td>
<td>600,000</td>
<td>25,226***</td>
<td>6,106</td>
<td>21,000</td>
</tr>
</tbody>
</table>

Captain Waters of Jacksonville, Florida, has stated that demand upon an EMS system is generated at the rate of one call per day per 10,000 population or 36.5 patients per 1000 population per year. Other cities with operating EMS systems have been analyzed (2) and found to generate calls on the average of 35 patients per 1000 population per year. (The Stevenson Estimate)

In support of the Stevenson Estimate's validity for metropolitan Atlanta EMS demand, two surveys may be presented. The first was designed by the State of Georgia in 1970 and sent to all ambulance purveyors in the state. Although the information contained in the questionnaires is sometimes vague and subject to interpretation, the total of all metropolitan Atlanta ambulance purveyors' estimates of emergency traffic is 76,000 emergency calls per year. Secondly, a recent telephone survey by the Atlanta Regional Commission in 1973**** provided an estimate of 73,128 emergency calls per year. Table I.2 shows that the Stevenson Estimate is much closer than the Dunlap Estimate to both of the survey results.

---

* Personal interview with Captain John Waters on December 8, 1972.
** Personal correspondence with Captain Martin on September 29, 1972
*** Personal interview with Chief Werner on September 5, 1972
****Appendix F presents the complete results of the ARC survey.
TABLE I.2 Estimated Number of Emergency Ambulance Calls for Metropolitan Atlanta.

<table>
<thead>
<tr>
<th>CITY</th>
<th>POPULATION</th>
<th>PREDICTED BY DUNLAP FORMULA</th>
<th>STEVENSON ESTIMATE</th>
<th>GEORGIA AMBULANCE SURVEY - 1970</th>
<th>ARC SURVEY 1973</th>
</tr>
</thead>
<tbody>
<tr>
<td>Atlanta</td>
<td>1,484,000</td>
<td>14,910</td>
<td>51,940</td>
<td>76,000</td>
<td>73,000</td>
</tr>
</tbody>
</table>

Both survey results are seen to be significantly higher than the average of cities in the Stevenson Estimate. Most likely, the higher figures are a result of Grady Ambulance Service's tendency to report invalid transportation calls as emergency ambulance calls.

Due to the seemingly more accurate results achieved with the Stevenson Estimate, the figure of 35 emergency calls per 1,000 population per year will be used throughout this document.
BIBLIOGRAPHY

APPENDIX I


APPENDIX J

CALCULATION OF RADIUS (R)
GUARANTEEING AN AVERAGE RESPONSE DISTANCE OF r MILES

This appendix is developed to enable an analyst to determine the average response time of an ambulance with a circular service area concentric with the ambulance headquarters, based strictly upon expected ambulance travel speed. Since response time is directly proportional to road distance, which in turn is directly proportional to air distance, the size of a circle (air distance) may be calculated for any given criterion response time. The size of the criterion response time circle is important in the technique of graphically approximating the number and location of ambulances required to guarantee criterion response time in a service area.
APPENDIX J

CALCULATION OF RADIUS (R)
GUARANTEING AN AVERAGE RESPONSE DISTANCE OF r MILES

Rectangular coordinate system:

\[ \text{area} = \pi (\text{radius})^2 \]

substituting, \( x = \pi(y)^2 \implies y = \left(\frac{x}{\pi}\right)^{\frac{1}{2}} \)

Area \( x \)

Assuming: 1) population density is uniform within the circle prescribed by the radius to be calculated and \( p = \frac{\text{people}}{\text{unit area}} \)

2) road distance (\( r_r \)) is directly proportional to air distance (\( r \)) by a factor (\( a \)) such that \( r_r = ar \)

3) ambulance is located at origin of circle, will travel a maximum air distance of \( R \)

average air distance per person is given by:

\[ \sum_{\text{all people}} \left( \text{person} \times \text{(air distance from ambulance)} \right) / \text{total people} = r_{\text{ave}} \]

symbolically:

\[ r_{\text{ave}} = \frac{\int_0^A p \left( \frac{x}{\pi} \right)^{\frac{1}{2}} \, dx}{p \cdot \pi R^2} \]

where \( A = \text{total area} = \pi R^2 \)
Integrating over the total area,

\[
\bar{r} = \frac{P \pi^{\frac{1}{2}} \int_{0}^{R} x^{\frac{1}{2}} \, dx}{P \pi R^2} = \frac{P (\pi)^{\frac{1}{2}} \cdot \frac{2}{3} (\pi)^{\frac{3}{2}} R^3}{P \pi R^2} = \frac{P \pi R^2 \cdot \frac{2}{3} R}{P \pi R^2} = \frac{2 R}{3}
\]

\[
\Rightarrow \bar{r}_{ave} = \frac{2}{3} R
\]

\[
\Rightarrow r_{ave} = \frac{2 R \alpha}{3}
\]

Thus, the average air distance travelled by the ambulance (\(\bar{r}_{ave}\)) is seen to equal two-thirds of the maximum air distance travelled. The average road distance (\(r_{ave}\)) equals the average air distance multiplied by the factor \(\alpha\) (to give \(\frac{2}{3} R \alpha\)).
APPENDIX K

CALCULATION TABLES TO DETERMINE THE EXPECTED RESPONSE TIME
FOR THE RECOMMENDED AMBULANCE LOCATIONS IN
EACH COUNTY OF METROPOLITAN ATLANTA

The Tables presented in this appendix represent actual figures generated in the calculations of the expected response times of ambulances in each county. The technique is described in detail in Chapter 5, where a similar table is developed for Clayton County. There is no table for Douglas County, due to the unknown location of the second ambulance and uncertainty for the need for the second ambulance. In other figures however, an estimate is presented for the response time in Douglas County.
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TABLE K.2 (cont.) Expected Ambulance Trip Length, DeKalb County.

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### TABLE K.3 (cont.) Expected Ambulance Trip Length, Fulton County.

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1 4,604 Atlanta Fire Department Station #21 (two ambulances) 3.0 13,812
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90 3,783                                     2.75 10,403
91 7,311                                      2.4 17,546
92 3,613                                      2.0 7,226
93 5,386                                      1.25 6,732
94 5,356                                      1.5 8,034
95 5,882                                      1.25 7,352
96 8,332                                      0.5 4,166
97 3,228                                      4.0 12,912
TABLE K.3 (cont.) Expected Ambulance Trip Length, Fulton County.

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<th>Distance to Ambulance Base (miles)</th>
<th>Distance X Population</th>
<th>Average Miles Per Person (Primary)</th>
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### TABLE K.3 (cont.) Expected Ambulance Trip Length, Fulton County.

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For all tracts
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<th>Pop.</th>
<th>Nearest Ambulance Base</th>
<th>Distance to Ambulance Base (miles)</th>
<th>Distance X Population</th>
<th>Average Miles Per Person (Primary)</th>
<th>% Immediate Availability of Ambulance</th>
<th>Average Miles Per Person (Secondary)</th>
<th>Average Ambulance Trip (miles)</th>
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<td>Census Tract</td>
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<td>Nearest Ambulance Base</td>
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<td>Distance X Population</td>
<td>Average Miles Per Person (Primary)</td>
<td>% Immediate Availability of Ambulance</td>
<td>Average Miles Per Person (secondary)</td>
<td>Average Ambulance Trip (miles)</td>
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<td>----------------------</td>
<td>------</td>
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<td>----------------------</td>
<td>----------------------------------</td>
<td>--------------------------------------</td>
<td>------------------------------------</td>
<td>-----------------------------</td>
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<td>North Rockdale</td>
<td>2,900</td>
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<td>17,400</td>
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<td>37,200</td>
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<td><strong>TOTAL</strong></td>
<td>18,300</td>
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<td></td>
<td>72,600</td>
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<td>.891</td>
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<td>4.625</td>
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<td></td>
<td></td>
<td>72,600</td>
<td>3.967</td>
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The following pages contain a detailed inventory of the Seattle ambulance (MICU) known as "Medic 1", under the operation of the Seattle Fire Department. The information was obtained from Chief Philbin of the Seattle Fire Department by personal correspondence on December 7, 1972 and contains details of:

Ventilating Kit
Doctor Bag
Drug List
Trauma Kit
Apparatus Stock
Equipment: Portable Equipment in Vehicle
Equipment: Physician's Station and Medic I Office

Alphabetical list of supplies indicating manufacturer or vendor, model or stock number, price per unit.
APPENDIX L

SEATTLE MOBILE INTENSIVE/CORONARY CARE UNIT

INVENTORY OF SUPPLIES AND EQUIPMENT

VENTILATING KIT
DOCTOR BAG
DRUG LIST
TRAUMA KIT
APPARATUS STOCK

EQUIPMENT: Portable Equipment in Vehicle

EQUIPMENT: Physician's Station and Medic I Office

Alphabetical list of supplies indicating manufacturer or vendor, model or stock number, price per unit.
VENTILATING KIT

1 laryngoscope handle (Foregger) with 2 "C" batteries

1 130 mm blade, #3 (MacIntosh), curved
1 108 mm blade, #2 (MacIntosh), curved
1 87 mm blade, #1 (MacIntosh), curved
1 108 mm blade, #3 (Miller), straight
1 87 mm blade, #2 (Miller), straight

2 lamps, spare for #3 blade
2 lamps, spare for #1 and #2 blades

1 60 mm airway, disposable
1 80 mm airway, disposable
1 90 mm airway, disposable
1 100 mm airway, disposable

1 "Shew" aspirator with Shrader Venturi connector, supply tubing and suction catheter

1 #9 endotrach tube with adapters
1 #8.5 endotrach tube with adapters
1 #8 endotrach tube with adapters
1 #7 endotrach tube with adapters
1 #6 endotrach tube with adapters
1 #5 endotrach tube with adapters

1 suction catheter, 22", 10f
1 suction catheter, 22", 18f
1 suction catheter, Yankauer Tip

1 syringe, irrigation, 50 cc
1 syringe, 12 cc without needle

1 hemostat (6" forceps), straight
1 Magill forceps, curved
6 sterile tongue depressors
1 tracheal stylet (copper guide)
4 nasal prongs (cannulas)
1 oxygen connection hose assembly
1 IV administration set, extra long tubing
1 IV solution microdrip set
2 arm boards, disposable
1 Kling bandage, 3"
1 nasal gastric tube
2 "C" batteries, spare for handle
4 gauze pads, 4x4" sterile
1 500 cc sodium bicarbonate 5%
1 lantern, portable
1 flashlight, penlight size
1 Laerdal Mark II Resusci Folding Bag with adult and child face pieces (with Laerdal non-rebreathing valve oxygen reservoir, oxygen supply tubing, and Schrader fitting)
1 5" corrugated extension tube for Laerdal Bag
1 90 degree endotracheal tube adapter, 15 mm, to Laerdal valve (in plastic box)

**DOCTOR BAG** (see also Drug List)

**LOWER RIGHT:**
- 1 sphygmomanometer; cuff
- 1 stethoscope
- 1 scissors, utility
- 2 rolls adhesive tape, 1"
- 4 plastic garbage bags
- 1 roll ECG paper, Cardiorite
- 1 razor, disposable with blade
- 4 pkg gauze pads, sterile 3x4" (2/pkg)
- 3 towels, disposable

**LOWER LEFT:**
**Syringes:**
- 2 3cc without needle
- 4 12 cc without needle
- 2 50 cc without needle
- 2 3 cc with 21x1-1/2 needle
- 4 12 cc with 20x1-1/2 needle

**MIDDLE:**
- 10 bandaids
- 1 IV solution administration set
**Needles:**
- 3 Longdwell, 18g
- 3 Longdwell, 16g
- 3 Longdwell, 14g
- 3 Butterfly, 21g (scalp vein)
- 2 Butterfly, 19g (scalp vein)
- 2 Butterfly, 16g (scalp vein)
- 2 intracath, medium, #17
- 2 intracath, large, #14
- 4 Penrose tubing 1x18"

**WING:**
- 1 forceps, small
- 2 scalpels, disposable, with blade
- 1 scissors, dressing
- 12 alcohol sponges
- 4 cardiac needles, 20x3-1/2
- 1 thermometer
TOP DRUG TRAY:
4 syringes, 3 cc without needle

DRUG TRAY:
Needles, disposable:
5 19g 1-1/2"
5 20g 1-1/2"
5 25g 5/8"
<table>
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<th>DRUG</th>
<th>CONCENTRATION</th>
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<th>BAG</th>
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<td>Aramine (metaraminol)</td>
<td>10 mg/ml</td>
<td>10 ml vial</td>
<td>2 vials</td>
<td>12 vials</td>
<td>12/box</td>
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<tr>
<td>atropine</td>
<td>0.4 mg/ml</td>
<td>20 ml vial</td>
<td>1 vial</td>
<td>12 vials</td>
<td>25/box</td>
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<tr>
<td>digoxin (Lanoxin)</td>
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<td>2 ml amp</td>
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<td>100/box</td>
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<td>epinephrine (adrenaline chloride)</td>
<td>1:1000</td>
<td>1 ml vial</td>
<td>3 vials</td>
<td>2 vials</td>
<td>each</td>
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<tr>
<td>Isuprel (isoproterenol)</td>
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<td>5 ml amp</td>
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<td>20 vials</td>
<td>10/box</td>
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<tr>
<td>Lasix (furosemide)</td>
<td>20 mg/2 ml</td>
<td>2 ml amp</td>
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<td>10 vials</td>
<td>5/box</td>
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<tr>
<td>Levophed (norepinephrine)</td>
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<td>4 ml amp</td>
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<td>10/box</td>
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<td>Luminol</td>
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<td>(2 grains)</td>
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<td>2 vials</td>
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<td>tab</td>
<td>btl 50</td>
<td>btl 50</td>
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<tr>
<td>phenobarbital</td>
<td>130 mg/ml</td>
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<td>1 amp</td>
<td>10 vials</td>
<td>100/box</td>
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<tr>
<td>Pitocin</td>
<td>100 mg/ml</td>
<td>10 mg vials</td>
<td>1 vial</td>
<td>10 vials</td>
<td>1/box</td>
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<tr>
<td>procainamide (Pronestyl)</td>
<td>100 mg/ml</td>
<td>10 mg vials</td>
<td>1 vial</td>
<td>10 vials</td>
<td>1/box</td>
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<tr>
<td>Valium (diazepam)</td>
<td>10 mg/2 ml</td>
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<td>2 vials</td>
<td>2 vials</td>
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<td>Mycitracin ointment</td>
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<td>1 tube</td>
<td>10 tubes</td>
<td>10 tubes</td>
<td>10/box</td>
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<td>aminophyllin</td>
<td>250 mg syringe</td>
<td>pre-pak</td>
<td>2 amps</td>
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<td>10/box</td>
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<td>2 vials</td>
<td>1 vial</td>
<td>each</td>
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<td>atropine</td>
<td>0.1 mg/cc</td>
<td>10cc pre-pak</td>
<td>3 vials</td>
<td>7 vials</td>
<td>10/box</td>
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<tr>
<td>calcium chloride</td>
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<td>1 ml pre-pak</td>
<td>3 vials</td>
<td>10 vials</td>
<td>10/box</td>
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<td>1 kit</td>
<td>1 kit</td>
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<td>5% dextrose in water</td>
<td>500 cc Viaflex plastic bags</td>
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<td>50% dextrose in water</td>
<td>50% sol'n</td>
<td>50 cc vial</td>
<td>1 vial</td>
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<td>25/box</td>
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<tr>
<td>epinephrine</td>
<td>1:10,000, with cardiac needle</td>
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<td>10 vials</td>
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<td>lidocaine (Xylocaine)</td>
<td>10 ml syringe, 1%, pre-pack</td>
<td>4 amps</td>
<td>10 vials</td>
<td>10/box</td>
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<td>lidocaine (for microdrip)</td>
<td>2 gm/50 ml, pre-pack (in Vent Kit: 2 amps)</td>
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<tr>
<td>Medihaler-Iso</td>
<td>22.5 ml</td>
<td>1 kit</td>
<td>1 kit</td>
<td>1 kit</td>
<td>each</td>
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<td>Ophthame (proparacaine HCl)</td>
<td>0.5%</td>
<td>15cc btl</td>
<td>2 btls</td>
<td>1 btls</td>
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</table>
TRAUMA KIT

6 lavender top tubes (contains anticoagulant)
6 red top tubes
6 needles for vacutainers (tubes)
3 plastic tube holders

5 scalp vein needles
3 elastic bandages, 3" (Ace)
3 elastic bandages, 6"
6 Kerlix bandages, 4-1/2" (Kling)
1 box gauze pads, 4x4 (sterile)
1 pair ring cutters
3 eye shields
6 eye patches
1 role nitrazine paper

2 intracaths, 14ga x 24"
2 Foley catheters, 14 ga
2 Foley catheters, 16 ga
2 Foley catheters, 18 ga

2 Foley catheterization kits, disposable
4 Levine tubes, 18 ga
1 stainless steel basin
3 emesis basins (disposable)
10 Virac swabs

3 Tracheotomy Tray
1 #3 scalpel with #15 blade attached
1 6 cc disposable syringe
1 Kelly forceps - straight
1 Kelly forceps - curved
10 gauze pads, 4x4
1 Portex tracheostomy tube #33FG on outside of sealed tray

Obstetric Kit
1 large straight scissors
1 large straight Kelly forceps
1 large curved Kelly forceps
2 umbilical cord clamps
18" umbilical cord tape
10 4x4" sponges - gauze
2 diapers
4 safety pins
2 baby blankets
2 "Peri" pads (sanitary napkins)
2 towels
1 ear syringe

3 Burn Kit
4 sterile large sheets - individually wrapped
<table>
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<td>I.V. solution administration set, extra long</td>
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<tr>
<td>I.V. solution microdrip set</td>
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<td>I.V. Solutions:</td>
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<tr>
<td>5% D/W, 500cc</td>
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</tr>
<tr>
<td>Sodium bicarbonate, 500cc</td>
<td>8</td>
<td></td>
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<tr>
<td>Ringers lactate, 500cc</td>
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<td></td>
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<tr>
<td>Nasal oxygen, size 10</td>
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<tr>
<td>Nasal oxygen, size 14</td>
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<td>Venti-masks, 24%</td>
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<tr>
<td>Venti-masks, 28%</td>
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<tr>
<td>Venti-masks, 35%</td>
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<tr>
<td>Arm boards, disposable</td>
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<td>Gauze pads, 4x4</td>
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<tr>
<td>Bandages, Kling, 4&quot;</td>
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<td></td>
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<tr>
<td>Surgical gloves, size 8</td>
<td>4 pr</td>
<td></td>
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<tr>
<td>Patient electrodes</td>
<td>12 sets</td>
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<td>Electrode paste</td>
<td>2 tubes</td>
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<td>Patient cables</td>
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<td>Bed pan</td>
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<td>Sheets</td>
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<tr>
<td>Urinals</td>
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<td>Emesis basin</td>
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<tr>
<td>Wrist restraints</td>
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</table>
EQUIPMENT: Portable Equipment in Vehicle

1 Portable radio, Motorola
5 page boy receiver units, Motorola HO4BNC-1106AQ
5 Battery Charger Units, NLN6432
1 modulator, portable, Johnnie Walker "Pok-E-Tel"
1 extension speaker cable, 25'

1 Portable Electrocardiogram, Cardiorite 909
1 patient cable
4 limb electrode straps, 15'
4 limb electrodes
1 Welsh vacuum cup, 15 mm diameter
1 tube electrode paste

1 Portable pacemaker, Electrodyne, TR-3
2 electrodes, transthoracic bipolar pacemaker
2 electrodes, floating bipolar pacemaker
1 electric connector cable
1 external pacing electrode and cable assembly
2 pt gloves, surgical, size 8

1 stretcher, Ferno-Washington, Model 26
1 stretcher, Robinson orthopedic
1 stretcher, chair-bed, Ferno-Washington Model 41 (mattress/frame assembly of Ferno-Washington stretcher, Model 26)

1 Monitoring oscilloscope-defibrillator, Physio-Control "Life Pak 33"
3 sets patient electrodes
2 sets patient cables
1 tube electrode paste

1 Elder valve
1 adult face piece
1 child face piece
1 Hudson regulator and flow meter, OT 306B, plain oxygen connector
1 Hudson regulator and flow meter, Schrader oxygen connector
4 tanks oxygen, size "E"

1 set (3 sizes) splints, deflatable
1 set (5 sizes) splints, inflatable
1 cervical collar
1 Thompson frame

1 tape recorded (cassette-type), Craig
1 cassette (in recorder)
EQUIPMENT: Physician's Station and Medic I Office

1 demodulator (ECG receiver), Johnnie Walker "Min-F-Tel"
1 Signal source control box (to receive radio and/or telephone communication from Medic I team - "gray box")
1 tape recorder, Uher 800
1 7" reel of tape
1 7" take-up reel

Additional items stored in Medic I office:

1 tire gauge
1 battery hydrometer
1 flashlight
Pads, gauze, 4x4
  gauze, sterile 3x4
  Eye 1.00 box/50

Pads, gauze, 4x4
  gauze, sterile 3x4
  Eye 1.00 box/50

Paper, Nitrazine (VanWaters & Rogers 15387-006)
  EKG (for Cardiorite - CGR Medical Corp. #3545) 1.45 roll
  EKG (for Hewlett-Packard) Permapaper 7.00 box/3
  9.30 6 rolls

Paste, electrode 5.30 box/2

Razors, Disposable (American Hospital #29800) 24.00 case/100

Scalpel, disposable with #11 blade (Will Ross 8911)
  #15 blade (Will Ross 8915) 2.30 box/10

Shields, eye (American Hospital #23520) 2.00 dz

Scissors, utility, 8"
  dressing

Sphygmomanometer

Sponges, pre-op scrub 18.00 case

Stethoscope, Bowles

Stylet, tracheal (copper guide)

Syringes:
  Disposable, no needle, 3cc 15.00 case/250
  6cc
  12 cc
  irrigation, 50 cc 30.00 case/100

  Disposable, with needle, 3cc, 21 x 1-1/2 20.00 case/250
  6cc, 22 x 1
  12cc, 20 x 1-1/2

Syringe, ear, 3 oz .60 each

Tape, adhesive, 1"
  Umbilical cord, 18" 2.50 roll

  Recording, cassette, Sony C-90 (Closed Circuit T.V. Div.) 2.20 each
  7" Reel, Scotch 190, 1-4" x 1800 (Treck
  photographic) 4.96 each

Thermometer, rectal 4.35 dozen

Tubes, vacutainer, red top (3200)
  lavender top (3206X) 2.60 can/40
  2.60 can/50
Tubing:

- Nasal gastric, Levine 14 ga (Davol 2961B) .65 each
- Levine 18 ga .20 each
- Penrose, 1" x 1 yard, Amber latex

Tracheostomy, Portex #33 FG

- Towels, disposable (Western Paper Co. #3477), Terri-towels 25.00 case
- Virac swabs (American Hospital 23370-30)

Venti-Mask, 24%
- 28%
- 35%

Electrodes, disposable EKG (Hayes Tech., Electro-Disc Type-A) 25.00 bag/100
- Floating bipolar pacemaker (Elecath #561; 4f, 100 cm) 19.80 each
- Transthoracic bipolar pacemaker: Elecath parts, as follows:
  - curved pacing stylet, #552 (.038, 38 cm) 24.00 each
  - transthoracic needle, #NNT-6 (18 ga, 6") 5.80 each
  - connecting adapter, #CA-275 (75 cm) 8.00 each

Forceps, straight, 6" Kelly (Aloe TR 2445)
- curved, 6" Kelly 5.65 each
- curved (large, Magill)

Gloves, surgical, size 7-1/2 16.00 box/50
- size 8

Handle, scalpel, #3 Pard Parker 1.55 each

Hemostat (see Forceps)

Holders, vacutainer (plastic tube)

Intra-caths, size 14 55.00 case/50
- size 17

I.V. Sets:

- Phlebotomy (500 cc bottle + I.V. tubing) 35.50 case
- Transfusion set, Plexitron (Travenol 2C2027)
- Administration, extra long (Travenol 2C0011) 28.00 case
- Administration, Microdrip (Travenol 2C0002) 21.25 case

I.V. Solutions:

- Ringers lactate, 500 cc (Travenol 2A2323) 5.00 case
- 1000 cc (Travenol 2A2074)
- 5% D/W, 500 cc bottle (Travenol 2A0163) 5.00 case
- 5% D/W, 500 cc plastic container (Travenol 2B0063) 20.00 case
- Sodium bicarbonate, 500 ml bottle (Travenol 2A1833) 12.70 case

Levine Tubes (see Tubing, Nasal gastric)
### Needles:

- **Longdwell catheter**, 14f (Will Ross #6763)  
  16f (Will Ross #6758)  
  18f (Will Ross #6743)

- **Spinal**, 20 x 3-1/2 (cardiac)
- **Disposable**, 19 x 1-1/2  
  20 x 1-1/2  
  25 x 5/8
- **Vacutainer**, 21 x 1-1/2

- **Butterfly (scalp vein)**, size 19 (Abbott Labs 4716)  
  size 21

- **Adapters**, endotrach tube, 90°, 15mm (Haves Technical #50 14 01)

- **Airways**, disposable, Berman:  
  60 mm (American Hospital 32070-015)  
  80 mm (32070-020)  
  90 mm (32070-040)

- **Alcohol wipes** (Aloe)

- **Arm boards**, disposable, 17-1/2" (Aloe 6161)

- **Band aids**, Regular, 3/4 x 3  
  **Bandage**, Kling, 3"  
  **Bandage**, Kling, 4"  
  elastic, 3" (Ace)  
  elastic, 4" (Ace)

- **Bags**, plastic garbage

- **Basins**, emesis, plastic, Zylon  
  stainless steel, 7 quart, Vollrath #8734

- **Batteries**, AA (penlight), Mallory #MN 1500 (915AA)  
  C (for laryngoscope) (935C)  
  D (for flashlight) (950C)  
  Mercury, VS 146X, 8.4 volt (for modulator)  
  Burgess (for lantern)

- **Blades**, laryngoscope, curved, Macintosh  
  laryngoscope, straight, Miller (Anes.Equip.Supply & Serv.)  
  Scalpel, #15

- **Cables**, patient monitor, 3 electrodes (Amer.Hospital #65375-932)

- **Cannulas (nasal prongs)**

<table>
<thead>
<tr>
<th>Item Description</th>
<th>Price/kg/1000</th>
<th>Price/cs/1000</th>
<th>Price/each</th>
</tr>
</thead>
<tbody>
<tr>
<td>Longdwell catheter, 14f</td>
<td>.50 each</td>
<td>12.00 box/25</td>
<td>3.00 box/100</td>
</tr>
<tr>
<td>Disposable, 19 x 1-1/2</td>
<td>.70 case</td>
<td>16.00 pkg/1000</td>
<td></td>
</tr>
<tr>
<td>Spinal, 20 x 3-1/2 (cardiac)</td>
<td>3.00 box/100</td>
<td>1.50 box/100</td>
<td></td>
</tr>
<tr>
<td>Vacuum, 21 x 1-1/2</td>
<td>1.30 dz</td>
<td>75.00 cs/50</td>
<td></td>
</tr>
</tbody>
</table>
Catheters:
  Regu-Vac, size 10 20.00 cs/50
  size 14
  Nasal oxygen, size 10 10.00 cs/50
  size 14
  Foley, 1 way, 30 cc, 16 ga 2.15 each
  18 ga
  Yankauer Tip (Aloe #MAR 5015 TS) 65.00 cs/50

Clamps, umbilical cord

Cuffs, blood pressure

Cutter, ring (American Hospital #41550-015)

Depressors, tongue, sterile

Endotracheal tubes with connectors, Magill disposable 2.00 each
  (Anesthesia Equip. & Supply #101905-C)
APPENDIX M

ENTRY SYSTEM DESIGN

INTRODUCTION

The mechanism through which the emergency medical services (EMS) system becomes aware of a demand for service, i.e., the entry component of the communication subsystem, will influence many facets of the total EMS design including performance factors such as system response time. The present appendix defines and analyzes the concept, utility, and inherent weaknesses of entry communication subsystem design alternatives. To the extent possible, hardware design specifications and their associated costs are ignored.
DEFINITIONS

The EMS entry subsystem is defined as the set of procedures and devices through which a need for immediate medical aid is reported to the EMS system. A single entry communication subsystem provides one (single) point of entry to the EMS. Multiple entry subsystems have more than one (multiple) entry point. Entry subsystem alternatives are illustrated in Figure M.1.

FIGURE M.1 Multiple and Single Entry Design Alternatives.
PRESENT SYSTEM

The present EMS consists of several, unintegrated components, which, for the purposes of illustration, are limited to ambulance services in the metropolitan Atlanta. There are 59 ambulance services in the metropolitan Atlanta area at the present time, each with its own entry system, as illustrated in Figure M.2.

![Diagram of the present EMS system in Metropolitan Atlanta]

**FIGURE M.2** Entry System of the Present EMS System in Metropolitan Atlanta.

In the illustration presented above, the present metropolitan Atlanta area EMS is depicted as many independent components. The magnitude of the multiple entry subsystem is readily discernible.*

* Two-way radio, police, fire, and other similar entry points may also exist, but have not been illustrated due to their complexity.
ANALYSIS OF ENTRY SYSTEM ALTERNATIVES

Conceptually, there are significant differences between single and multiple entry designs. The major shortcomings and advantages of each entry system are described below.

Single Entry Systems

A significant advantage of single entry communication is the control ability it can provide, by allowing one intelligence to monitor 100 per cent of all incoming EMS data. Emergency medical situations that occur in a public place are often reported more than once. An effectively monitored single entry point can eliminate the unnecessary dispatch of more than one ambulance to one emergency scene.

Single entry designs with more than one telephone number are often used to facilitate changes from multiple to single entry systems. Re-routing of pre-existing emergency numbers to the single entry point insures service to consumers who inadvertently dial an obsolete number. Unfortunately, the large number of entry points in the Atlanta area would prohibit rapid or efficient use of this system.

Single entry systems are not without weaknesses. To be completely effective, single entry systems must either service a geographical area of limited size, or receive support from sophisticated electronic equipment. The need to restrict the size of single entry system service areas can be illustrated by creating a hypothetical situation, and analyzing the system response to that situation.

Scenario One:

While mowing his lawn, a man grasps his chest, and falls to the ground, unconscious. His neighbor, witnessing the incident, runs to the victim's side, notes that the victim is unconscious, and returns to his home to summon an ambulance. The neighbor obtains the telephone number of the ambulance service from a sticker on his telephone, and dials the number. When the ambulance service answers the telephone, the neighbor, who by now is extremely excited, says, "I think my neighbor has had a heart attack. Come quick. He lives at Ten Main Street." Realizing that the lawn mower is still running, and that the victim may need artificial respiration, the neighbor hangs up the telephone and runs back to the victim.
If the ambulance service mentioned in Scenario 1 received calls from only one small town, with one "Main Street," the ambulance would be dispatched. If the ambulance service received communications from an entire county, one ambulance would be needed to respond to every "Main Street" in the county. An EMS single entry subsystem serving the entire, seven county metropolitan Atlanta area could not effectively meet the needs of the victim in Scenario 1. There are approximately thirty-one* "Main" or "Maine" streets in the metropolitan Atlanta area, and an investigation of each would disable the EMS, since all but three ambulances would become unavailable.

Scenario 1 provides an illustration of a popular argument against single entry. It is important to emphasize that the great majority of residents in the metropolitan Atlanta area do not live at an address that is duplicated elsewhere within the system boundaries. In New York City, EMS operators ask each caller for his borough, which is analogous to a county, over 600,000 times per year. Obtaining borough information is not considered to be a major problem.**

The problem of many locations with the same name is common to streets, churches, post offices, apartment complexes, commercial business, and others. The problem can be partially solved by consumer education, and nearly eliminated by dispatch procedures that are designed to obtain community identification information before the street address and other data concerning the emergency are requested. This technique is used by telephone company long distance information operations, when they answer "Information for what city," at the beginning of each conversation.

In the future, absolute resolution of location identification problems that arise from single entry systems may be achieved electronically, through telephone systems known as Automatic Exchange Identification (AEI)

* Based upon a telephone survey of Planning and Engineering Departments in the metropolitan Atlanta area.

** Personal interview conducted by Mark S. Blum, HSRC, with dispatchers, dispatch supervisors, and Mr. W. Zein, Administrative Associate, at the Emergency Medical Service of New York City Health & Hospitals Corporation headquarters on January 11, 1973.
and Automatic Number Identification (ANI). With an ANI support system, the telephone number of the neighbor in Scenario 1 would have been displayed to the EMS operator. A computer could produce the exact location of the telephone, thereby providing sufficient information to the dispatch function of the EMS.

AEI support to a single entry system will identify the exchange area from which the telephone request for service originated. This data, along with the data supplied by the neighbor in Scenario 1, would be adequate for the EMS dispatch function, since the appropriate "Main Street" could be identified with less difficulty.

ANI capability will not include 100 per cent of the Atlanta metropolitan area until approximately 1978. It must be emphasized, that ANI, as it now exists, is an integral part of the telephone system billing function. ANI can not be extended beyond the telephone system billing function at the present time, although, in conjunction with 911 experiments to design an EMS application of ANI have been proposed.*

AEI, like ANI, is not available for use by the EMS at the present time. Although the equipment required for an AEI system does exist, implementation in the Atlanta area would involve significant cost, and a delay until approximately 1977.**

Single entry systems can be utilized in conjunction with any number of dispatchers. It should be noted, however, that the transfer of information from the receiving station to the appropriate dispatch center in a multi-dispatch EMS, can not be accomplished without human intervention.** The delay is not significant, however, amounting to only a few seconds.

** Single Entry - Single Telephone Number Systems

The use of an easily memorized telephone number can significantly reduce the time required to obtain medical aid in an emergency, as

* Telephone interview between Mark S. Blum, HSRC, and W. Frank Blount, General Sales Manager, Southern Bell, on December 8, 1972.

shown in Figure M.3, by eliminating the need to: (1) contact a telephone company operator; (2) locate and retrieve a telephone directory; or (3) locate the EMS number in a telephone directory.

A regional EMS system that utilizes one easily memorized telephone number throughout its entire service area eliminates the potential confusion that can occur as a result of a different number for each major political subdivision. In the metropolitan Atlanta area, many residents live outside of the City of Atlanta, but travel to the city daily for employment, shopping, and other reasons. If these transient residents should desire to access the EMS system while they are in Atlanta, knowledge of their "home" EMS telephone number will be of no value. The absence of a regional telephone number would require the caller to memorize several telephone numbers, which is unlikely, or to contact a telephone company operator, or to locate a telephone directory and then the number applicable to the location of the emergency. Table M.1, provides some indication of the mobility of residents in the Atlanta, Georgia SMSA.

An EMS that utilizes one telephone number is only compatible with a single entry communication subsystem due to technological restrictions. Therefore the aforementioned disadvantages of single entry are necessarily inherent in the use of an EMS system with one telephone number.
<table>
<thead>
<tr>
<th>SMSA AREAS</th>
<th>WORKING IN AREA OF RESIDENCE</th>
<th>WORKING OUT OF AREA OF RESIDENCE</th>
<th>WORKING OUT OF SMSA</th>
<th>NOT KNOWN</th>
<th>TOTAL WORKING</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clayton County</td>
<td>11,566</td>
<td>24,891</td>
<td>1,745</td>
<td>2,171</td>
<td>40,373</td>
</tr>
<tr>
<td>Cobb County</td>
<td>44,639</td>
<td>31,905</td>
<td>1,751</td>
<td>4,360</td>
<td>82,655</td>
</tr>
<tr>
<td>DeKalb County (excluding Atl.)</td>
<td>59,993</td>
<td>85,427</td>
<td>4,168</td>
<td>8,575</td>
<td>158,163</td>
</tr>
<tr>
<td>City of Atlanta (all)</td>
<td>141,212</td>
<td>37,715</td>
<td>2,923</td>
<td>23,254</td>
<td>205,104</td>
</tr>
<tr>
<td>Fulton County (excluding Atl.)</td>
<td>22,283</td>
<td>37,893</td>
<td>1,680</td>
<td>3,821</td>
<td>65,677</td>
</tr>
<tr>
<td>South Fulton (incl. E. Pt.)</td>
<td>17,199</td>
<td>25,096</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>North Fulton</td>
<td>5,084</td>
<td>12,797</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Gwinnett County</td>
<td>9,400</td>
<td>16,755</td>
<td>1,083</td>
<td>1,750</td>
<td>28,988</td>
</tr>
<tr>
<td>Totals</td>
<td>289,093</td>
<td>234,586</td>
<td>13,350</td>
<td>43,931</td>
<td>580,960</td>
</tr>
</tbody>
</table>

*Data from "Social characteristics of the Population" Table P-2, Census Tracts PHC (1)-14, April 1970, Dept. of Commerce, Bureau of Census. Atlanta Standard Metropolitan Statistical Area (SMSA), as defined by the Bureau of Census, including Fulton, DeKalb, Gwinnett, Clayton, and Cobb County.*
In the first alternative in Figure M.4, each of the telephone numbers might be assigned to a subregion. The EMS receiving operator can determine the region from which the emergency is reported, by noting the telephone over which the call was received. Conceptually, the configuration is similar to an Automatic Exchange Identification design. Retention of the ability to determine which point of entry the consumer has used distinguishes this alternative from a similar, single entry design.

This alternative has single entry control advantages, and also provides a reasonably effective method for reducing the size of the geographical area to be managed, as described above.

The second alternative in Figure M.4 involves one dispatcher for each entry point. If, as in alternative one, each telephone number is assigned to a subregion, the dispatcher can assume that the call originated in the area corresponding to the dialed telephone number. Response to a report of a medical emergency on "Main Street," as described in Scenario One, would become manageable, if the subregion in which that street is located, is known. The principle advantage of a multiple entry design is its compatibility with a multi-dispatch center system. If more than one dispatch center is to be used in the system, multiple entry allows the consumer to contact the appropriate dispatcher directly, without the equipment, personnel, or delay that would be required to route the call in a single entry system.

Both of these multiple entry alternatives require the use of more than one telephone number, and consequently, are subject to the disadvantages of a multi-telephone number system. The disadvantages associated with the use of a different telephone number for subregions within the metropolitan Atlanta region have been described, and are repeated below:

1) Many persons travel from county to county, and, therefore, receive only partial security from learning their "home" EMS telephone number.
2) There is a very low probability that the average consumer will memorize several numbers.
3) In a multi-telephone number system, there exists some probability that consumers will become confused when attempting to remember more than one EMS telephone number.
There are two additional observations which support arguments against a multi-telephone number system. If, for example, the consumer attempts to enter a county based system, but does not know what county he is in, he can not enter the system properly. The alternative is to dial the "Operator," who may be equally unable to decide which county EMS is appropriate. Entry into the system via regional telephone number can provide the consumer with a resource capable of assisting with the location identification function, and time could be saved.

The second observation in support of arguments against multiple entry, is based upon the indications that an ill or injured person frequently will not telephone the EMS system directly. The elderly often contact their children, if possible. Wives may telephone their husbands in emergencies, and many people contact a physician. The consumer who reports a medical emergency to a regional EMS system receiving operator, will receive service more rapidly than if he had reported the emergency to the wrong EMS operator, a real possibility if indirect reporting occurs. Scenario 2 illustrates the problem of indirect reporting.

Scenario Two:

Mr. Jones sits at home watching football and experiences severe chest pain. He telephones his physician to report the problem. The physician advises Mr. Jones to relax, and asks for his address. Mr. Jones says, "17 York Road". The physician dials the EMS number, which he obtains from a sticker on his telephone.

Regional Receiving Operator

The telephone is answered, "Emergency Medical Service for what county, please?" The physician realizes that he can not answer the question. He states that he does not know, and that he will find out.

Subregional Receiving Operator

The telephone is answered "Emergency Medical Service - Bob County." The physician describes the problem, giving the address as "17 York Road." The EMS operator advises that an ambulance will be sent. Unfortunately, the patient lives on 17 York Road in adjoining Jim County, and the error consumes vitally important time.
Posted Emergency Telephone Numbers

With knowledge of the EMS telephone number the consumer is able to enter the system without delay, since the processes required to determine the appropriate EMS telephone number may be bypassed. The use of one easily memorized telephone number would, therefore, appear to be the most rapid entry system discussed thus far. It should be noted, however, that there is no guarantee that the consumer will memorize the telephone number, or successfully recall the number while under stress.

An emergency telephone number, if it is permanently affixed or posted onto a telephone device, can not be forgotten, and provides insurance against potential consumer apathy towards memorization of a telephone number which, hopefully, will never be used. The speed advantages of a posted telephone number are not influenced by the number of dispatchers, or the number of telephone numbers used to enter the EMS system.

The posted telephone number does not represent a solution to all entry problems. If a multiple entry system is used, physicians, and others who receive reports of medical emergencies, may relay the information to the wrong dispatcher by dialing the posted number, as described in Scenario Two. The experience of other systems, such as the Jacksonville EMS, indicates that people are reluctant to place stickers onto their telephones. In the Atlanta area, several thousand telephones are either removed, installed, or moved each month, and emergency numbers would need to be updated. Approximately 70,000 such telephone transactions occurred in December, 1972. This figure indicates that Southern Bell representatives have access to many telephones, and suggests that Southern Bell representatives might place EMS system telephone number stickers onto the instruments during installation. However, it should be noted that Southern Bell may not be permitted to place stickers or other materials onto the telephones at this time. To do so could be in conflict with national advertising policy, since telephones are not pictured with attached emergency numbers in advertisement literature.

CONCLUSIONS

The best entry system for the Atlanta metropolitan area emergency medical system must have several qualities. The performance objectives
used in this system analysis are listed and defined below:

1) The system must provide for rapid dispatch, after notification has been received.
2) The system must minimize the consumer's potential for error.
3) The system must convey accurate and sufficient information to the dispatch function.
4) The system must minimize delay between detection and report of the emergency.
5) The system must be available for implementation immediately or within a reasonable period of time.
6) The system must allow for complete management of incoming data to optimize resource utilization and response time.
7) The system must be accessible to the consumer.

The analysis to determine the entry system that will best meet the needs of the majority of residents in the metropolitan Atlanta area has been performed on the previous pages.

Implementation of one seven digit telephone number, to be the entry mechanism to an emergency medical service system serving the metropolitan Atlanta area is recommended.

The shortcomings of single entry should be overcome by appropriate procedures, and technical assistance to the location identification function should be made available to the EMS system as soon as it becomes practical. The posting of the EMS telephone number onto every telephone in the region is strongly recommended. Telephone installers should carry emergency telephone number stickers, and make them available to all new customers.
APPENDIX N

TEN CODE SIGNALS

The use of approximately 75 radio code signals, known as Ten Code Signals, is widespread in emergency services dispatching throughout the United States. The Ten Code Signals from "10-1" to "10-99" are described in this appendix. As described in Chapter 7, Ten Code Signals are not recommended for use by the EMS system.
APPENDIX N

TEN CODE SIGNALS

<table>
<thead>
<tr>
<th>CODE</th>
<th>INTERPRETATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>10-1</td>
<td>Receiving poorly (move to better location).</td>
</tr>
<tr>
<td>10-2</td>
<td>Receiving well.</td>
</tr>
<tr>
<td>10-3</td>
<td>Stop transmitting</td>
</tr>
<tr>
<td>10-4</td>
<td>Acknowledgement.</td>
</tr>
<tr>
<td>10-5</td>
<td>Relay.</td>
</tr>
<tr>
<td>10-6</td>
<td>Busy</td>
</tr>
<tr>
<td>10-7</td>
<td>Out of Service.</td>
</tr>
<tr>
<td>10-8</td>
<td>In Service.</td>
</tr>
<tr>
<td>10-9</td>
<td>Repeat, conditions bad.</td>
</tr>
<tr>
<td>10-10</td>
<td>Out of service - subject to call.</td>
</tr>
<tr>
<td>10-11</td>
<td>Dispatching too rapidly.</td>
</tr>
<tr>
<td>10-12</td>
<td>Officials or visitors present.</td>
</tr>
<tr>
<td>10-13</td>
<td>Advise weather and road conditions.</td>
</tr>
<tr>
<td>10-14</td>
<td>Convoy or escort</td>
</tr>
<tr>
<td>10-15</td>
<td>We have prisoner in custody.</td>
</tr>
<tr>
<td>10-16</td>
<td>Pick up prisoner at _______________.</td>
</tr>
<tr>
<td>10-17</td>
<td>Conduct investigation.</td>
</tr>
<tr>
<td>10-18</td>
<td>Complete assignment quickly as possible.</td>
</tr>
<tr>
<td>10-19</td>
<td>Return to your Station.</td>
</tr>
<tr>
<td>10-20</td>
<td>What is your location?</td>
</tr>
<tr>
<td>10-21</td>
<td>Call this station by telephone.</td>
</tr>
<tr>
<td>10-22</td>
<td>Take no further action last information.</td>
</tr>
<tr>
<td>10-23</td>
<td>Stand by.</td>
</tr>
<tr>
<td>10-24</td>
<td>Trouble at station - unwelcome visitors - all units in vicinity report at once.</td>
</tr>
<tr>
<td>10-25</td>
<td>Do you have contact with _____________?</td>
</tr>
<tr>
<td>10-26</td>
<td>Can you obtain automobile registration information from _____________?</td>
</tr>
</tbody>
</table>
10-27  Any answer our number ________________?

10-28  Check full registration information (license, motor, name, stolen, etc.).

10-29  Check for wanted.

10-30  Does not conform to rules and regulations.

10-31  Is lie detector available?

10-32  Is drunkometer available?

10-33  Emergency traffic.

10-34  Clear for local dispatch.

10-35  Confidential information.

10-36  Correct time?

10-37  Operator on duty?

10-38  Station report - satisfactory.

10-39  Your number __________ delivered to address.

10-40  Advise if Officer ________ is available for radio call.

10-41  Tune to _______ kcs for test with mobile unit or emergency service.

10-42  Officer __________ now at his home.

10-50  Involved in danger, need immediate assistance. (If possible advise location and brief message of situation).

10-60  What is next item (message) number?

10-61  Stand by for CW traffic on _______ kcs.

10-62  Unable to copy phone, use CW.

10-63  Net directed.

10-64  Net free.

10-65  Clear for item (message) assignment.

10-66  Clear for cancellation.

10-67  Stations __________ carry this item (message).

10-68  Repeat dispatch.

10-69  Have you dispatched ________________?
10-70 Net message (state not traffic).
10-71 Proceed with traffic in sequence (busy here).
10-80 Tower lights at station burned out.
10-81 Officer number _____ will be at your station ________.
10-82 Reserve room with bath at hotel for officer number __________.
10-83 Have officer number _______ call this station by phone.
10-84 Advise telephone number ________ your city ________, number ________ will not return this date.
10-85 Officer number ________ left this station for ________.
10-86 Officer number ________ left this station for ________ at ________.
10-87 Officer number ________ will be in ________ if officer number ________ will be in.
10-88 What phone number shall we call to make station to station call to officer number ________?
10-89 Request that radio serviceman be sent to this station.
10-90 Radio serviceman will be at your station ________.
10-91 Prepare for inspection (date, time).
10-92 Our quality poor, transmitter apparently out of adjustment.
10-93 Frequencies to be checked this date.
10-94 Test-no modulation—for frequency check.
10-95 Test intermittently with normal modulation for ________.
10-96 Test continuously with tone modulation for ________.
<table>
<thead>
<tr>
<th>CODE</th>
<th>INTERPRETATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>10-97</td>
<td>Arrived at Scene.</td>
</tr>
<tr>
<td>10-98</td>
<td>Finished with last Assignment.</td>
</tr>
<tr>
<td>10-99</td>
<td>Unable to Receive Your Signal.</td>
</tr>
</tbody>
</table>
Several prominent physicians and others associated with emergency medical services, have been provided with a summary or detailed discussion of training recommendations, or have been contacted personally for advice. This appendix lists the names of physicians and others who have been contacted for comment and provided assistance.
APPENDIX O

PERSONS CONTACTED FOR COMMENT
CONCERNING TRAINING RECOMMENDATIONS

<table>
<thead>
<tr>
<th>Name</th>
<th>Occupation and Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>*Roy Baker, M. D.</td>
<td>Chief Fire Surgeon, Jacksonville, Florida</td>
</tr>
<tr>
<td>*Lyndon Beall</td>
<td>Program Management Officer, Georgia Department of Human Resources</td>
</tr>
<tr>
<td>Donald M. Benson, M.D.</td>
<td>Presbyterian-University Hospital, Pittsburgh, Pennsylvania</td>
</tr>
<tr>
<td>*J. Norman Berry, M.D.</td>
<td>Chairman, EMS Task Force</td>
</tr>
<tr>
<td>Richard E. Dollinger</td>
<td>Director, Engineering and Related Technology, Florida Junior College at Jacksonville, Florida</td>
</tr>
<tr>
<td>*W. A. Fountain</td>
<td>Chief, Emergency Health Unit, Georgia Department of Human Resources</td>
</tr>
<tr>
<td>Douglas B. Kendrick, M.D.</td>
<td>Georgia Regional Medical Program</td>
</tr>
<tr>
<td>Costas T. Lambrew, M.D.</td>
<td>Chief, Division of Cardiology, Nassau County Medical Center, New York</td>
</tr>
<tr>
<td>William J. McIntyre</td>
<td>Director, Emergency Medical Services, Oregon State Department of Human Resources</td>
</tr>
<tr>
<td>*Eugene Nagel, M.D.</td>
<td>Associate Professor, Department of Anesthesiology, University of Miami</td>
</tr>
<tr>
<td>Robert Parrish</td>
<td>Administrative Assistant, Out-Patient Services, Grady Memorial Hospital</td>
</tr>
<tr>
<td>John E. Philbin</td>
<td>Assistant Chief, Seattle Fire Department</td>
</tr>
<tr>
<td>Edward Press, M.D.</td>
<td>Deputy Administrator and Public Health Officer, Oregon State Department of Human Resources</td>
</tr>
<tr>
<td>Peter Safar, M.D.</td>
<td>Department of Anesthesiology, University of Pittsburgh, Pennsylvania</td>
</tr>
<tr>
<td>Mark E. Silverman, M.D.</td>
<td>Emory-Piedmont Professor of Medicine</td>
</tr>
<tr>
<td>M. Freeman Simmons, M.D.</td>
<td>DeKalb General Hospital</td>
</tr>
<tr>
<td>*John M. Waters</td>
<td>Director of Public Safety, Jacksonville, Florida</td>
</tr>
<tr>
<td>Marian Wildeboer, R.N.</td>
<td>Instructor, DeKalb Area Technical School</td>
</tr>
<tr>
<td>Asa G. Yancey, M.D.</td>
<td>Medical Director, Grady Memorial Hospital, Associate Dean, Emory University, Atlanta</td>
</tr>
</tbody>
</table>

* Personal Interview
All training recommendations as presented in EMS Working Paper Number 3, were presented to the EMS Task Force Subcommittee on Manpower and Training, for review and comment.
APPENDIX P

GEORGIA AMBULANCE LAW AND REGULATIONS

The Ambulance Service Act of 1970, Chapter 88-31 of the Georgia Health Code, is presented in this appendix. A draft of the proposed regulations for ambulance service in the State of Georgia, is also included. The proposed regulations have not been adopted as of February 28, 1973.
APPENDIX P

GEORGIA AMBULANCE LAW AND REGULATIONS

A BILL TO BE ENTITLED

AN ACT

To amend Code Title 88, known as the "Georgia Health Code", as amended, so as to provide for licensing ambulance services; to provide that an ambulance service shall not be operated in this State without a valid license as provided herein; to define certain terms; to provide for an application for the license; to provide for issuing the license upon a finding that the applicant meets certain standards; to provide standards for ambulances; to provide for renewing the license; to provide for a revocation of the license; to provide for filing certain reports; to provide for the operation of the ambulance as an emergency vehicle; to provide that it shall be unlawful for the operators of certain motor vehicles to pass ambulances under certain conditions; to provide for the enforcement of the provisions of this Act; to authorize the Department of Public Health to make certain inspections; to provide exemptions; to provide for penalties; to provide the standard of liability for licensed ambulance services; to provide that this Act does not prohibit any license fee assessed by a municipality; to provide an effective date; to repeal conflicting laws; and for other purposes.

BE IT ENACTED BY THE GENERAL ASSEMBLY OF GEORGIA:

Section 1. Code Title 88, known as the "Georgia Health Code", as amended, is hereby amended by adding a new Chapter to be designated as Chapter 88-31, to read as follows:

"CHAPTER 88-31

AMBULANCE SERVICE

440
Section 88-3101. Definitions. Unless a different meaning is required by the context, the following terms as used in this Chapter shall have the meaning hereinafter respectively ascribed to them:

(a) 'Ambulance' means a motor vehicle that is specially constructed and equipped and is intended to be used for the emergency transportation of patients, including dual purpose police patrol cars and funeral coaches or hearses which otherwise comply with the provisions of this Chapter.

(b) 'Person' means any individual, firm, partnership, association, corporation, company, group of individuals acting together for a common purpose or organization of any kind, including any governmental agency other than the United States.

(c) 'Ambulance service' means the providing of emergency care and transportation on the public streets and highways of this State for a wounded, injured, sick, invalid or incapacitated human being to or from a place where medical or hospital care is furnished.

(d) 'License' when issued to an ambulance service signifies that its facilities and operations comply with the provisions of this Chapter and the rules and regulations issued by the Department pursuant to the provisions of this Chapter.

(e) 'Provisional license' when issued to an ambulance service means a license issued on a conditional basis for one of the following reasons:

(1) To allow a newly established ambulance service a period of 30 days to demonstrate that its facilities and operations comply with the provisions of this Chapter and rules and regulations issued by the Department pursuant to the provisions of this Chapter.

(2) To allow existing ambulance services a period of 12 months to comply with the provisions of this Chapter, and rules and regulations issued by the Department pursuant to the provisions of this Chapter, provided the ambulance service shall present a plan acceptable to the Department defining how all vehicles will be equipped with all the necessary apparatus to fulfill the provisions of this Chapter, and how all attendants shall be trained to meet the standards of Code Section 88-3112 of this Chapter within two years.
(f) 'License Officer' means the Director of the Department or his designee.

(g) 'Patient' means an individual who is sick, injured, wounded, or otherwise incapacitated or helpless.

(h) 'Ambulance attendant' means a person responsible for the care of patients being transported in an ambulance.

(i) 'Department' means the Georgia Department of Public Health.

(j) 'Invalid car' means a motor vehicle not used for emergency purposes but used only to transport persons who are convalescent, sick or otherwise nonambulatory.

Section 88-3102. License required. No person shall operate an ambulance service in this State without having a valid license or provisional license issued by the License Officer pursuant to this Chapter authorizing such service to be operated.

Section 88-3103. Application for license. An application for a license or provisional license shall be made to the License Officer. The application shall be accompanied by a fee of $25.00, except applications from governmental agencies. The application shall be made upon forms prescribed by the License Officer and shall contain the following:

(a) The name and address of the owner of the ambulance service or proposed ambulance service.

(b) The name under which the applicant is doing business or proposes to do business.

(c) The training and experience of the applicant in the transportation and care of patients.

(d) A description of each ambulance, including the make, model, year of manufacture, motor and chassis number; and the color scheme, insignia, name, monogram or other distinguishing characteristics to be used to designate applicant's ambulance.
(e) The location and description of the place or places from which the ambulance service is intended to operate.

Section 88-3104. Duties of the License Officer.

(a) The License Officer shall, within 10 days after receipt of an application for a license or provisional license as provided for herein, cause such investigation as he deems necessary to be made to determine that the standards prescribed by this Chapter have been met.

(b) The License Officer shall issue a license hereunder for a period of two years, unless earlier suspended, revoked or terminated, when he finds:

(1) That all the requirements of this Chapter have been met.

(c) The License Officer shall issue provisional licenses for one year under the circumstances provided in Section 88-3101 (3) (2).

(d) Before issuing a license to a government or governmental agency for a new ambulance service, the License Officer shall establish that, due to inadequate private service, the public's convenience and necessity require the proposed ambulance service.

Section 88-3105. Standards for ambulances. Ambulances operated by persons engaged in providing ambulance service shall:

(a) Be suitable for the transportation of patients from the standpoint of health, sanitation and safety, and be maintained on suitable premises;

(b) Have supplies and equipment readily available for dressing wounds, splinting fractures, controlling hemorrhaging and providing oxygen;

(c) Be equipped with approved safety belts for the driver and for a passenger in the front seat if such seat is provided; and

(d) Have insurance coverage issued by an insurance company licensed to do business in Georgia providing for the payment of damages:

(1) For injury to or death of individuals in accidents resulting from any cause for which the owner of the ambulance would
be liable on account of liability imposed on him by law, regardless of whether the ambulance was being driven by the owner or his agent, and

(2) For the loss or damage to the property of another, including personal property, under like circumstances, in such sums and under such terms as may be required in regulations promulgated by the Department. A certificate of insurance shall be submitted to the License Officer for approval prior to the issuance of each ambulance license. Satisfactory evidence that such insurance is at all times in force and effect shall be furnished to the License Officer, in such form as he may specify, by all licensees required to provide such insurance under the provisions of this Chapter.

Section 88-3106. Renewal of license. Change of ownership of ambulance service.

(a) Renewal of any license issued under the provisions of this Chapter shall require conformance with all the requirements of this Chapter as upon original licensing.

(b) Change of ownership of an ambulance service shall require a new application and a new license issued in conformance with the requirements of this Chapter as upon original licensing.

Section 88-3107. Revocation of license.

(a) Any license issued hereunder may be suspended or revoked for a failure of a licensee to comply and to maintain compliance with the applicable provisions of this Chapter or rules and regulations issued pursuant to the provisions of this Chapter, but only after opportunity for hearing as provided in Code Chapter 88-3 and the Georgia Administrative Procedure Act.

(b) Any person who has exhausted all administrative remedies available within the Department and who is substantially aggrieved by a final order or final action of the License Officer, is entitled to judicial review, in the manner provided by Code Chapter 88-3 and the Georgia Administrative Procedure Act.
Section 88-3108. Reports. Records of each ambulance trip shall be made by the ambulance service in a manner and on such forms as may be prescribed by the Department through regulations. Such records shall be available for inspection by the Department at any time, and a summary of ambulance service activities shall be prepared on specific cases and furnished to the Department if requested.

Section 88-3109. Obedience to traffic laws, ordinances, and regulations.

(a) The driver of an ambulance, when responding to an emergency call or while transporting a patient, is authorized to operate the ambulance as an emergency vehicle pursuant to the provisions of the Uniform Act Regulating Traffic on Highways, approved, January 11, 1954 (Ga. Laws 1953, Nov.-Dec. Sess., p. 556), as amended.

(b) It shall be unlawful for any person operating a motor vehicle to pass an ambulance being operated on a highway at the maximum speed limit if the flashing lights on such ambulance are in operation. Any person violating the provisions of this subsection shall be guilty of a misdemeanor, and upon conviction thereof, shall be punished as for a misdemeanor.

Section 88-3110. Enforcement; inspections. The Department and its duly authorized agents are hereby authorized to enforce compliance with the provisions of this Chapter and rules and regulations promulgated hereunder as provided in Code Chapter 88-3; and in connection therewith, to enter upon and inspect in a reasonable manner the premises of persons providing ambulance service, during the reasonable business hours of the day.

Section 88-3111. Exemptions. The provisions of this Chapter shall not apply to the following:

(a) An ambulance or ambulance service operated by an agency of the United States Government;
(b) A vehicle that is operated by a person who is not licensed to furnish ambulance service which is rendering assistance temporarily in the case of a major catastrophe or emergency with which the licensed ambulance services of Georgia are insufficient or unable to cope with such catastrophe or emergency;

(c) An ambulance, which is operated from a location outside of Georgia, in order to transport patients who are picked up beyond the limits of Georgia, to locations within Georgia.

(d) An invalid car or the operator thereof.

Section 88-3112. Rules and regulations. The Department is hereby authorized to promulgate rules and regulations for the protection of the public health by:

(a) prescribing reasonable health, sanitation and safety standards for transporting patients in ambulances; and

(b) prescribing reasonable conditions under which ambulance attendants are required; and

(c) establishing certain criteria for the training of ambulance attendants and prescribing further;

1. Such ambulance attendant must have successfully completed the standard American Red Cross advanced first aid course or equivalent.

2. Such ambulance attendant, if he be employed as such, must successfully complete within twenty-four additional months following the completion of requirement (1) above, the basic Department of Transportation course or an equivalent course prescribed by the Medical Association of Georgia. New employed attendants, after the effective date of this Chapter, must have completed the standard American Red Cross advanced first aid course of equivalent before employment and must pass the emergency medical technician test within nine (9) months of employment, except in hardship cases approved by the Department.
(d) the emergency medical technician course is to be offered at area hospitals and/or area technical vocational schools in conjunction with their emergency patient care and personnel training programs.

Provided, however, that nothing herein shall authorize the Department to promulgate rules or regulations which shall prevent the continued use of dual purpose funeral coaches or hearses currently being used as ambulances if the vehicles otherwise conform to the requirements of Section 88-3105 of this Chapter, except for their size and shape.

Section 88-3113. Penalties. Any person violating the provisions of of Section 88-3102 shall be guilty of a misdemeanor and, upon conviction thereof, shall be punished as for a misdemeanor.

Section 88-3114. Liability. Any person, including agents and employees, who is licensed to furnish ambulance service and who in good faith renders emergency care to a person who is a victim of an accident or emergency shall not be liable for any civil damages to such victim as a result of any act or omission by such person in rendering such emergency care to such victim."

Section 2. No provision of this Act shall be construed as prohibiting or preventing a municipality from fixing, charging, assessing or collecting any license fee or registration fee on any business or profession covered by this Act, or upon any related profession or anyone engaged in any related profession governed by the provisions of this Act, or from establishing additional regulations regarding ambulance service.

Section 3. This Act shall become effective January 1, 1973.

Section 4. All laws and parts of laws in conflict with this Act are hereby repealed.
*PROPOSED REGULATIONS
FOR
AMBULANCE SERVICE

270-0-0-.01 DEFINITIONS. — Unless a different meaning is required by the context, the following terms as used in this Chapter shall have the meaning hereinafter respectively ascribed to them:

(1) "Ambulance" means a motor vehicle that is specially constructed and equipped and is intended to be used for emergency transportation of patients, including dual purpose police patrol cars and funeral coaches or hearses which otherwise comply with the provisions of this Chapter.

(2) "Ambulance Attendant" means a person responsible for the care of patients being transported in an ambulance.

(3) "Ambulance Service" means the providing of emergency care and transportation on the public streets and highways of this State for a wounded, injured, sick, invalid or incapacitated human to or from a place where medical or hospital care is furnished.

(4) "Approved" means acceptable to the Department based on its determination as to conformance with appropriate standards and good public health practice.

(5) "Department" means the Georgia Department of Human Resources.

(6) "Driver" means every person who drives or who is in actual physical control of a vehicle [Ga. Code Annotated 68-1503 (2) (c)].

(7) "Emergency" means any circumstance calling for immediate action in which medical attention is indicated.

(8) "Employed" means 'used as such' or 'acting as such'.

(9) "Invalid Car" means a motor vehicle not used for emergency purposes but used only to transport persons who are convalescent or otherwise non-ambulatory.

(10) "License" means written authorization granted to a person by the Department to operate an ambulance service and signifies satisfactory compliance with this Chapter.

(11) "License Officer" means the Commissioner of the Department or his designee.

(12) "Patient" means an individual who is sick, injured, wounded, or otherwise incapacitated or helpless.

(13) "Person" means any individual, firm, partnership, association, corporation, company, group of individuals acting together for a common purpose or organization of any kind, including any governmental agency other than of the United States.

(14) "Provisional License" means a license issued on a conditional basis for one of the following reasons:

(a) to allow a newly established ambulance service a period of 30 days to demonstrate that its facilities and operations comply with the provisions of this Chapter.

(b) to allow existing ambulance services a period of 12 months to comply with the provisions of this Chapter, provided the ambulance service shall present a plan acceptable to the Department defining how all vehicles will be equipped with all the necessary apparatus to fulfill the provisions of this Chapter within one year, and how all attendants shall be trained to meet the standards of Section 270-0-0-.08 within two years.

270-0-0-.02 GENERAL PROVISIONS. --

(1) No person shall operate an ambulance service in this State without being in compliance with the provisions of this Chapter, except this Chapter shall not apply to the following:

(a) an ambulance or ambulance service operated by an agency of the United States Government;
(b) a vehicle, rendering assistance temporarily in the case of a major catastrophe or emergency with which the licensed ambulance services of Georgia are insufficient or unable to cope;

(c) an ambulance operated from a location outside of Georgia and transports patients, picked up beyond the limits of Georgia, to locations within Georgia;

(d) an invalid car or the operator thereof.

(2) Records of each ambulance trip shall be made by the ambulance service in a manner, frequency and on such forms as may be prescribed by the Department. Such records shall be available for inspection by the Department at any time, and a summary of ambulance service activities shall be prepared on specific cases and furnished to the Department if requested.

(3) The driver of an ambulance, when responding to an emergency call or while transporting a patient, is authorized to operate the ambulance as an emergency vehicle pursuant to the provisions of the Uniform Act Regulating Traffic on Highways, approved January 11, 1954 [Ga. Laws 1953, Nov.-Dec. Sess., p. 556], as amended.

(4) Any person, including agents and employees, who is licensed to furnish ambulance service and who in good faith renders emergency care to a person who is a victim of an accident or emergency shall not be liable for any civil damages to such victim as a result of any act or omission by such person in rendering such emergency care to such victim.

(5) No provision of this Chapter shall be construed as prohibiting or preventing a municipality from fixing, charging, assessing or collecting any license fee or registration fee on any business or profession covered by this Chapter, or upon any related profession or anyone engaged in any related profession governed by the provisions of this Chapter, or from establishing additional regulations regarding ambulance service.

270-0-0-.03 LICENSE. --

(1) After the effective date, no person shall operate an ambulance service in this State without having a valid license or provisional license issued by the License Officer pursuant to provisions of this Chapter.
Ambulance service shall be provided on a twenty-four hour basis.

Licenses are not transferable in respect to person or location.

270-0-0-.04 APPLICATION FOR LICENSE. -- An application for a license or provisional license shall be made to the License Officer. The application shall be accompanied by a fee of $25, except applications from governmental agencies. The application shall be made upon forms prescribed by the License Officer and shall contain as a minimum, but not limited to, the following:

1. The name and address of the owner of the ambulance service or proposed ambulance service.

2. The name under which the applicant is doing business or proposes to do business.

3. The training and experience of the applicant in the transportation and care of patients.

4. A description of each ambulance, including the make, model, year of manufacture, motor and chassis number, and the color scheme, insignia, name, monogram or other distinguishing characteristics to be used to designate applicant's ambulance.

5. The location and description of the place or places from which the ambulance service is intended to operate.

6. Insurance coverage.

270-0-0-.05 DUTIES OF THE LICENSE OFFICER. --

1. The License Officer shall, within ten days after receipt of an application for a license or provisional license as provided for herein, cause such investigation as he deems necessary to be made to determine compliance with the provisions of this Chapter.

2. The License Officer shall issue a license hereunder for a period of two years when he finds that all the requirements of this Chapter have been met.

3. The License Officer shall issue provisional licenses under the circumstances provided in Section 270-0-0-.01(14).
(4) Before issuing a license to a government or governmental agency for a new ambulance service, the License Officer shall establish that, due to inadequate private service, the public's convenience and necessity require the proposed ambulance service.

270-0-0-.06 RENEWAL OF LICENSE. -- Renewal of any license issued under the provisions of this Chapter shall require conformance with all the requirements of this Chapter as upon original licensing.

270-0-0-.07 REVOCATION OF LICENSE. --

(1) Any license issued hereunder may be suspended or revoked for failure of a licensee to comply and to maintain compliance with the applicable provisions of this Chapter, but only after opportunity for hearing as provided in Code Chapter 88-3 and the Georgia Administrative Procedure Act.

(2) Any person, who has exhausted all administrative remedies available within the Department and who is substantially aggrieved by a final action of the License Officer, is entitled to judicial review in the manner provided by Code Chapter 88-3 and the Georgia Administrative Procedure Act.

270-0-0-.08 STANDARDS FOR AMBULANCE ATTENDANTS. --

(1) Ambulance attendants shall in the performance of their duties exhibit professionalism that contributes to the general well-being of their patients.

(2) Training:

(a) ambulance attendants employed prior to January 1, 1973;

1. must have completed the standard American Red Cross Advanced First Aid Course or equivalent by September 1, 1973; and

2. must successfully complete by September 1, 1975 the Department of Transportation "Basic Ambulance Training Program for Emergency Medical Technician-Ambulance" or equivalent.
(b) ambulance attendants employed after January 1, 1973;

1. must have completed the standard American Red Cross Advanced First Aid Course or equivalent before employment; and

2. must complete the Department of Transportation "Basic Training Program for Emergency Medical Technician-Ambulance" or equivalent within nine months of employment, except in hardship cases approved by the Department.

(c) individuals who complete courses which are equivalent to or exceed the above, as determined by the Department in conjunction with the Medical Association of Georgia, and successfully pass required examinations may be employed as ambulance attendants.

(d) refresher and/or advanced training may be required of ambulance attendants based on the need as determined by the Department.

270-0-0-.09 STANDARDS FOR AMBULANCES. --

(1) General:

(a) ambulances must be maintained on suitable premises, be of an approved design, properly equipped, maintained and operated so as to contribute to the general well-being of patients. However, dual purpose funeral coaches or hearses of the type currently being used as ambulances may continue to be used as ambulances provided they conform to the provisions of this Chapter, except for size and shape.

(b) each ambulance while transporting an emergency patient shall be manned by not less than two persons, one of whom must be an ambulance attendant.

(c) ambulances acquired during the license period shall be reported to the License Officer within ten days of the date of acquisition.

(2) Equipment - The following quantities and items of supplies and equipment shall be on each vehicle being used as an ambulance:

<table>
<thead>
<tr>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>One - PORTABLE SUCTION APPARATUS, with wide bore tubing and rigid pharyngeal suction tip;</td>
</tr>
</tbody>
</table>
One - BAG-MASK VENTILATION UNIT, with adult, child, and infant size masks. Valves must operate in cold weather, and unit must be capable of use with oxygen supply;

Three - OROPHARYNGEAL AIRWAYS, with adult, child and infant sizes;

Two - MOUTH-TO-MOUTH ARTIFICIAL VENTILATION AIRWAYS, for adult and child;

One - PORTABLE OXYGEN APPARATUS, with adequate tubing and semi-open, valveless, transparent masks in adult, child and infant sizes;

Two - MOUTH GAGS, either commercial or made of three tongue blades taped together and padded;

Four - UNIVERSAL DRESSINGS, approximately 10 inches by 30 inches, compactly folded and packaged in convenient size;

Twelve - STERILE GAUSE PADS, 4 inches by 4 inches;

Eight - BANDAGES, soft roller, self-adhering-type, 4 inches by 5 yards;

One - ALUMINUM FOIL, roll, 18 inches by 25 feet, sterilized and wrapped;

Two - ROLLS OF ADHESIVE TAPE, one roll one inch wide and one roll two inches wide;

Two - BURN SHEETS, sterile and wrapped;

Two - CERVICAL COLLARS, one adult and one child;

One - TRACTION SPLINT - lower extremity, hinged half-ring with commercial limb support slings, padded ankle hitch, and traction strap (Optional - Hare telescoping traction splint);

Four - PADDED BOARDS, two 4-1/2 ft. long by 3 inches wide and two 3 ft. long by 3 inches wide;

Two - PADDED WOODEN SPLINTS, 15 inches by 3 inches;

One set - INFLATED SPLINTS, uncomplicated and closed with zippers;

One - SPINE BOARD, short with accessories;
One - SPINE BOARD, long with accessories (Optional-Folding orthopedic type scoop stretcher);

Six - TRIANGULAR BANDAGES;

Ten - SAFETY PINS;

Two - SHEARS, for bandages;

One - OBSTETRICAL KIT, sterile;

One - POISON KIT;

One - BLOOD PRESSURE MANOMETER, CUFF, AND STETHOSCOPE;

Two - BAGS, sand and/or saw dust;

Two - LEATHER RESTRAINTS, cuff type with straps

One - PILLOW, with vinyl cover;

One - EMESIS BASIN and/or EMESIS BAG;

Four - VASELINE GAUZE PADS;

Two - TOURNIQUETS, minimum width of one inch;

Ten - COTTON SWABS, sterile;

(3) Safety:

(a) ambulances must be equipped with approved safety belts for the driver and for a passenger in the front seat if such seat is provided;

(b) ambulances must display a current safety inspection decal.

(4) Insurance:

(a) the ambulance service must have insurance coverage for each ambulance in amounts not less than minimum required by State Law. Such insurance shall be issued by an insurance company licensed to do business in Georgia and provide for the payment of damages;

1. for injury to or death of individuals in accidents resulting from any cause for which the owner of the ambulance would be liable on account of liability imposed on him by law, regardless of whether the ambulance was being driven by the owner or his agent; and
2. for the loss of or damage to the property of another, including personal property, under like circumstances.

(b) a certificate of insurance shall be submitted to the License Officer for approval prior to issuance of each license. Satisfactory evidence that such insurance is at all times in force and effect shall be furnished to the License Officer in such form as he may specify by all licensees required to provide such insurance. The person providing the ambulance service shall notify the License Officer of any cancellation of insurance or failure to renew such insurance that would constitute a violation of this section.

(5) Communication:

(a) each ambulance shall be equipped with a short wave two-way radio approved by the Department, provided that radios shall not be required when:

1. the ambulance normally serves only hospitals without an approved communication system, or

2. the ambulance normally serves only Category IV hospitals as classified by the Department.

(b) the ambulance radio shall operate on frequency 155.340 MHz or have a capability approved by the Department to allow ambulance-to-hospital communications.

(6) Sanitation:

(a) the ambulance shall be maintained in a clean condition with the interior being thoroughly cleaned after each use;

(b) linens shall be clean and changed after each use;

(c) equipment:

1. all equipment except disposable items, shall be so designed, constructed, and of such materials that under normal conditions and operations it shall be durable and capable of withstanding repeated cleaning procedures approved by the Department.
2. equipment intended and generally recognized as for one usage only, then to be discarded, shall not be re-used.

3. equipment shall be maintained in a state of good repair.

4. equipment shall be cleaned after each use.

5. sanitizing and/or sterilization of equipment requiring such treatment shall be accomplished in a manner approved by the Department.

6. equipment shall be stored and handled in an approved manner so as to offer the desired protection and shall be readily accessible upon need.

(7) Unwanted or discarded waste material shall be stored and disposed of by an approved method.

270-0-0-.10 INSPECTION. --

(1) The Department and its duly authorized agents are hereby authorized to enter upon and inspect in a reasonable manner the premises of persons providing ambulance service during the reasonable business hours of the day.

(2) When the health authority makes an inspection of an ambulance service, the findings shall be recorded on an inspection report form provided for this purpose. The management or its representative shall sign the inspection form acknowledging the inspection, but it shall not necessarily indicate agreement with the findings thereon. A copy of the inspection report shall be furnished to the license holder.

270-0-0-.11 ENFORCEMENT. -- The Department and its duly authorized agents are hereby authorized to enforce compliance with the provisions of this Chapter as provided in Code Chapter 88-3, Enforcement and Administrative Procedure, the Georgia Health Code, Acts 1964.
APPENDIX Q

COURSE OUTLINE FOR EMT TRAINING AT
DEKALB AREA TECHNICAL SCHOOL

The EMT-A training program presented through the DeKalb Area Technical School represents the primary source of EMT manpower to metropolitan Atlanta. The course is an expanded version of the DOT EMT training program, as described in Chapter 6. The Course Outline of the DeKalb Tech EMT training program is presented on the following pages.
APPENDIX Q

COURSE OUTLINE FOR EMT TRAINING AT
DEKALB AREA TECHNICAL SCHOOL

Text: Emergency Care and Transportation
of the Sick and Injured

Class 1 Orientation to course and ethics
Class 2 Patient assessment
    Monitoring vital signs
Class 3 Bleeding and shock
Class 4 Lab - Monitoring vital signs
Class 5 Cardio-pulmonary resuscitation
Class 6 CPR continued
Class 7 CPR - written test and practical test
Class 8 Airway maintenance and emergencies (Anesthesiologist)
Class 9 Wounds
    Lab - Bandaging and sterile technique
TEST I
Class 10 Upper and lower extremity fractures (Orthopedist)
Class 11 Spinal injuries (Orthopedist)
Class 12 Lab - Splinting, lifting and moving (Orthopedist)
Class 13 TEST II
    Chest injuries (Thoracic Surgeon)
Class 14 Head injuries (Neuro Surgeon)
    Facial, eye, and ear injuries (Plastic Surgeon)
Class 15 Injuries to the abdomen, pelvis, and genitalia (General Surgeon)
    Lab - Injury care--patient situations
Class 16 Drug abuse
    Poisoning (Pediatrician)
Class 17  Extrication (To be held off campus)
Class 18  Familiarization with ambulance equipment (Off campus)
Class 19  Environmental injuries
Class 20  TEST III
            Ambulance calls and procedures
Class 21  Medical emergencies - part 1 (Internist)
Class 22  Medical emergencies - part 2 (Internist)
Class 23  Defensive driving (Not currently available)
Class 24  Defensive driving (Not currently available)
Class 25  Emergency childbirth (Obstetrician)
Class 26  Emergency childbirth practice
            Working with children
Class 27  Legal aspects (Attorney)
            Lab - Oxygen equipment
Class 28  TEST IV
            Course skill review
Class 29  Course review
Class 30  National Registry Exam Class
The course outline of an advanced course for paramedical personnel is provided in this appendix. The course outline is a draft, and was created by Don M. Benson, M.D., to serve as a guide to be used for discussion. The proposed training has neither been proven nor endorsed, and is described, by the author, as a "STRAW MAN" draft.
APPENDIX R

DRAFT OF A PROPOSED ADVANCED COURSE FOR
TRAINING PARAMEDICAL PERSONNEL

STRAW MAN

May 18, 1972

The course proposed here consists of 20 class sessions, 3 hours in
length and three in-hospital observation sessions—each 3 hours in length.
The course could be taught by physicians, nurse specialists and experienced
advanced emergency medical technicians.

The proposed subjects to be included are listed below:

Class 1  Introduction; pre-test; define the problem—motivate students.
Class 2  Review cardiopulmonary resuscitation; review use of oxygen-
ation and ventilation equipment; practice both.
Class 3  Observing vital signs (including patient complaint, general
patient condition, level of consciousness, skin color and
perfusion, approximate age, sex, race, blood pressure, pulse,
respiratory rate, etc.); practice determining and communica-
ting vital signs.
Class 4  Test on observation and communication skills; introduction
to acute myocardial infarction; acute myocardial infarction—
rhythm disturbances (ventricular fibrillation, empirical
defibrillation).
Class 5  Safe use of defibrillator, practice use of defibrillator.
Class 6  Acute myocardial infarction—initial care of patient, report-
ing to medical command officer; practice.
Class 7  Intravenous cannulation and initiating intravenous fluids;
practice.
Class 8  Anti-arrhythmics, atropine; practice on simulated patient
problems.
Class 9  Anti-arrhythmics, lidocaine; practice on simulated patient
problems.
Class 10  Acute myocardial infarction--practice patient problems demanding all knowledge and skills learned to this point.

Class 11  Same as Class 10.

Class 12  Written and practical test.

Class 13  Acute myocardial infarction with respiratory distress, initial care, definitive care and practice.

Class 14  Acute myocardial infarction with shock, initial care.

Class 15  Acute myocardial infarction use of narcotic analgesics and practice.

Class 16  Acute myocardial infarction with hypertension; practice.

Class 17  EKG monitoring--basic; practice.

Class 18  Equipment problems and maintenance; practice.

Class 19  Written and practical test.

Class 20  Review test results and final discussion.

In addition to the above, students should have some period (at least 9 hours) of in-hospital observation in critical and coronary care units.
APPENDIX S

SELECTED MATERIALS FROM
SEATTLE PARAMEDIC TRAINING PROGRAM

The materials presented in this appendix are provided as an illustration of the degree of complexity inherent in an advanced EMT training program. The standing medical orders that apply to Seattle Paramedics are also included.
APPENDIX S

SELECTED MATERIALS FROM
SEATTLE PARAMEDIC TRAINING PROGRAM

Harborview Hall Auditorium
7:00-10:00 p.m. 2/28/72

EMERGENCY PARAMEDIC TRAINING COURSE (III)
LECTURE SCHEDULE

Tu. March 21 Normal and Pathologic Anatomy and Physiology of the Cardiovascular System
Dr. Hernan Alvarez
Th. 23 Anatomy and Physiology of the Pulmonary System; Medical Emergencies
Bennett Aud.
Dr. Robert Fisher
Tu. 28 Physical Diagnosis (cardiopulmonary)
Dr. Alvarez
Th. 30 Acute Myocardial Infarction and Sudden Death
Dr. Robert Miller
Mon. April 3 Cardiac Dysrhythmias: Recognition and Types
Dr. Miller
Tu. 4 Cardiac Dysrhythmias: Treatment of Ventricular Tachycardia and Fibrillation, and Acidosis; Other Drug Therapy
Dr. Alvarez
Th. 6 CPR
Dr. Alvarez
Dr. Miller
Tu. 11 Techniques
Th. 13 Techniques
Mon. 17 Shock and Fluid Therapy
Dr. Timothy Fleming
Tu. 18 Summary and Test on Cardiopulmonary Section
Th. 20 Review of Test
Tu. 25 Trauma to the Pulmonary System
Dr. Fisher
Th. 27 Neurology
Dr. Michael Copass
Tu. May 2 Neurology
Dr. Copass
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<td>Th.</td>
<td>4</td>
<td>Care of Injuries or Emergencies Involving the Musculo-Skeletal System; Soft Tissue</td>
<td>Dr. Robert Watkins, Dr. S. T. Hansen</td>
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<td>Care of Injuries or Emergencies Involving the Musculo-Skeletal System; Fractures</td>
<td>Dr. Watkins, Dr. Hansen</td>
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<td>Tu.</td>
<td>9</td>
<td>Orthopedic Techniques</td>
<td>Dr. Watkins, Dr. Hansen</td>
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<td>Th. May</td>
<td>11</td>
<td>Abdomen and Genito-Urinary Tract</td>
<td>Dr. Raoul St. Pierre</td>
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<tr>
<td>Tu.</td>
<td>16</td>
<td>Abdomen and Genito-Urinary Tract</td>
<td>Dr. St. Pierre</td>
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<tr>
<td>Th.</td>
<td>18</td>
<td>Obstetrics and Gynecology</td>
<td>Dr. David Eschenbach</td>
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<tr>
<td>Tu.</td>
<td>23</td>
<td>Obstetrics and Gynecology</td>
<td>Dr. Eschenbach</td>
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<tr>
<td>Th.</td>
<td>25</td>
<td>Emergencies in Pediatrics</td>
<td>Dr. Steven Dassell</td>
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<tr>
<td>Mon.</td>
<td>29</td>
<td>Management of Accidental and Purposeful Ingestions</td>
<td>Dr. St. Pierre</td>
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<td>Tu.</td>
<td>30</td>
<td>Facial Fractures and the Emergency Therapy</td>
<td>Dr. David Slepyan</td>
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<td>Th. June</td>
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<td>Trauma to the Eye and Ocular Adnexa</td>
<td>Dr. John Chandler</td>
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<td>Tu.</td>
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<td>Emergency Psychiatry</td>
<td>Dr. Lindsay</td>
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<td>Th.</td>
<td>8</td>
<td>Triage and Disaster Management</td>
<td>Dr. Duane Bietz</td>
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<tr>
<td>Tu.</td>
<td>13</td>
<td>Communications (Telemetry)</td>
<td>Mr. Howard Fordice</td>
</tr>
<tr>
<td>Th.</td>
<td>15</td>
<td>Rescue and Extrication</td>
<td>Capt. Roger Maloney</td>
</tr>
<tr>
<td>Fri.</td>
<td>16</td>
<td>Legal Considerations</td>
<td>Mr. James Wilson</td>
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<tr>
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<td>Review</td>
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<td>Th.</td>
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</tr>
<tr>
<td>Tu.</td>
<td>27</td>
<td>Review of Final Examination</td>
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</tr>
</tbody>
</table>
STANDING ORDERS*

The following principles and procedures are to be adopted when a physician is not in immediate attendance on an aid unit (Aid 10, Medic I).

I. A physician at Harborview will always be available for instructions and consultation by radio or phone. A page boy alerting method will be used.

II. Medical procedures, beyond the scope of current aid car operations, will be carried out only upon written order from the responsible physician (usually the project director) or upon radio or telephone directions from a physician for a specific problem. Except when treating cardio-pulmonary arrest or shock requiring intravenous fluid resuscitation; medications and intravenous solutions will be administered only after orders have been received from a physician.

III. Medic I and Aid 10 orders

PLAN A-1: In instances of recent circulatory arrest, resuscitative efforts should be carried out as follows:

1. Verification of circulatory arrest by absence of consciousness, arterial pulse, and respiration, and by history from witnesses.

2. Initiation of effective cardiopulmonary resuscitation. This will be the responsibility of the first unit arriving on the scene (usually the aid car crew).

3. Determination of the cardiac mechanism, usually with the Life Pak "quick look" paddles.

4. If ventricular fibrillation is present, a 400-watt second pre-cordial shock should be delivered and its effect on cardiac rhythm assessed.

* From a memorandum to Paramedic Interns, from James R. Cantrell, M.D. dated January 17, 1972
5. Use of an endotracheal tube is often a useful adjunct, and its use is encouraged if it can be passed within 15 seconds. Ventilation is to be carried out with 100% oxygen in patients with circulatory arrest.

6. An intravenous infusion of 5% sodium bicarbonate should be instituted. A 500 cc flask contains a total of 300 mEq of sodium bicarbonate or approximately 60 mEq of sodium bicarbonate per each 100 cc of solution.

The usual dose of sodium bicarbonate is 100-300 cc of the 5% solution (60-180 mEq). No more than one bottle should ever be infused. After successful treatment of circulatory arrest, the sodium bicarbonate solution should be removed and a flask containing 5% dextrose in water slowly infused at 10-15 drops per minute.

7. If ventricular fibrillation persists or recurs, repeat shocks (400 watt-seconds) are indicated after infusing the initial 50-100 cc of sodium bicarbonate.

8. Lidocaine, 100 mg., should be given intravenously as a single push when
   a. ventricular fibrillation is refractory to two shocks, or if
   b. ventricular fibrillation recurs, or
   c. when ventricular fibrillation has been successfully treated.

9. The following drugs may also be given if resuscitation has not proven effective:
   a. additional 100 mg. lidocaine intravenously
   b. 0.5 mg. epinephrine (5 cc, 1:10,000) intracardiac or intravenously
c. 10 cc of 10% calcium gluconate directly into the intravenous needle, not into the IV tubing if sodium bicarbonate infusion is running

PLAN A-2: In any instance of shock due to external hemorrhage or trauma with suspected internal bleeding requiring immediate volume replacement:

1. Employ necessary immediate first-aid measures; e.g., to control hemorrhage
2. Begin two intravenous routes with large bore catheters
3. Begin two liters Ringers in Lactate or two units Plasmonate
4. Contact HMC physician or transport patient immediately to appropriate medical facility

PLAN B: Applies to all patients not defined under plans A-1 and A-2 above.

1. Physician is to be contacted after briefly obtaining history and performing critical physician examination prior to administering any therapy which exceeds routine first aid procedures.
APPENDIX T

COURSE IN EMERGENCY CARDIOPULMONARY CARE, AND PROTOCOL FOR COLUMBUS, OHIO MEDIC UNITS

The training program presented in this appendix is worthy of special attention. The program is used in Columbus, Ohio, to provide diagnostic skill and skill in the use of "lidocaine, NaHCO₃, isuprel, epinephrine, atropine, O₂" therapy for coronary care to EMT's. Defibrillation and endotracheal intubation are also included in the course. The protocol by which Columbus Medic Units operate, does not include telemetry, and consultation with a physician is not required.
APPENDIX T

COURSE IN EMERGENCY CARDIOPULMONARY CARE
AND PROTOCOL FOR COLUMBUS, OHIO MEDIC UNITS*

TRAINING

Course Outline

1) Normal physiology of the cardiopulmonary system (Physiologist) 2 hrs
2) Pathophysiology of shock, congestive heart failure, acute pulmonary edema, respiratory failure (Lecture and audiovisual aids) (Doctor) 7 hrs
3) Clinical manifestations and pathophysiology of coronary artery disease (Doctor) 2 hrs
4) Diagnosis and treatment of severe allergic reactions (Nurse) 1 hr
5) Emergency treatment of severe trauma (Doctor) 2 hrs
6) Anatomy and pathology of the heart (incl. demonstration) (Pathologist) 2 hrs
7) Electrophysiology, electrocardiography, diagnosis of arrhythmias, myocardial ischemia and conduction defects (lectures, audiovisual aids, problems, dog lab) (Physiologist, Nurse) 20 hrs
8) Drugs (lidocaine, NaHCO₃, isuprel, epinephrine, atropine, O₂) (Nurse) 4 hrs
9) Endotracheal intubation (Anesthesia) 2 hrs
10) CPR Review (Nurse) 1 hr
11) Monitors, defibrillators, telemetry (basic understanding of electronics and operation) (lectures and dog lab) (Med. Electronic Specialist) 4 hrs

* Sponsored by the Department of Medicine, the Ohio State University College of Medicine and the Central Ohio Chapter of the Ohio Heart Association.
12) Pacemakers (Nurse) 2 hrs

13) Nursing skills (IV therapy, injections, venipuncture, blood pressure, rotating tourniquets, sterile techniques, defibrillation) 15 hrs

There is a 2-hour examination at the end of this 64 hour course. A grade of 70 or higher must be achieved to obtain certification.

Continuing education is provided in three ways:

1) Monthly 2-hour meetings for review of problems and introduction of new concepts.

2) Frequent direct observation of squad activities by Mrs. Kathryn Sampson.

3) Participation in arrhythmia courses for CCU nurses at various Columbus hospitals.

PROTOCOL FOR COLUMBUS MEDIC UNITS

I ROUTINE FOR ALL PATIENTS WITH SUSPECTED ACUTE CARDIOPULMONARY DISEASE

1. Vital signs (BP, HR, Resp)
2. 12-lead ECG
3. Start IV with 5% D\textsubscript{5}W
4. O\textsubscript{2} at 5 L/min (2L/min for pts with lung disease)

II SUSPECTED MYOCARDIAL INFARCTION

1. PVC's if
   a) frequent (greater than 4/min)
   b) multifocal
   c) R on T pattern

Give 100 mg lidocaine IV over 2-3"
May repeat q 5" as needed

475
2. Supraventricular tachycardia
   No specific Rx

3. Bradycardia (Less than 50/min)
   a) sinus, nodal, 2° or 3° block - give atropine 0.6 - 1.0 mg IM or IV. If no response in 5" start isuprel infusion (no more than 1 gm/min)
   b) Give atropine first if patient with PVC's has a slow heart rate

III SHOCK

1. Airway (endotracheal intubation if unconscious)
2. Feet up
3. Isuprel infusion if cardiac etiology (not to exceed 1 gm/min)
4. Antiarrhythmic therapy if indicated

IV CARDIOPULMONARY ARREST

1. Ventricular tachycardia
   a) Lidocaine 100 mg IV if conscious
   b) Chest thump if unconscious. If unsuccessful, defibrillation

2. Ventricular fibrillation
   a) Chest thump
   b) Defibrillation (if unsuccessful, give 100 mg lidocaine and repeat)
   c) Airway (endotracheal intubation)
   d) NaHCO₃ (1 amp for each 5" of inadequate circulation)
e) Antiarrhythmic treatment as indicated after
defibrillation

3. Idoventricular rhythm
   a) Isuprel infusion
   b) NaHCO₃
   c) Airway (endotracheal intubation)

4. Asystole
   a) Chest thump
   b) If rhythm appears treat as 1, 2, or 3.
      If no rhythm appears, begin CPR, airway,
      NaHCO₃, isuprel.
      If no response by ten minutes, discontinue.

V SYNCOPE OR UNCONSCIOUSNESS

1. Obtain ECG if heart attack suspected or arrhythmia noted.
   Transport if arrhythmia present.

2. If unconscious and no obvious etiology, obtain 5cc blood
   (red top tube) and administer 25 ml of 25% glucose.

3. If CVA or seizure suspected, transport, maintain airway.

4. If patient having seizure, do not try to insert airway.

VI TRAUMA

1. If shock or hypotension (less than 70 mmHg systolic)
   start infusion of Ringer's lactate. If patient does not
   respond, start 2nd infusion and use BP cuff over Ringer's.

2. Endotracheal intubation if indicated.
VII ALLERGIC REACTIONS (Insect, Drug)

1. Observe for edema of face or respiratory distress or edema remote from injury site.
   a) If none of the above, treat symptomatically.
   b) If above are present, give epinephrine SC (0.3–0.5 mg for adults, 0.2–0.3 mg for children under 100 pounds)
   c) Maintain airway and assist respirations as needed and transport.
APPENDIX U

ASSOCIATE DEGREE PROGRAM IN ADVANCED
EMERGENCY MEDICAL TECHNICIAN

This appendix includes a description of the advanced EMT training program offered at the Florida Junior College at Jacksonville. The course has been taught to EMT personnel of the Jacksonville Fire Department.

The 81 hour EMT-A (DOT) training program may be accepted as six credits in the Associate Degree program. The Associate Degree program will receive students aspiring to become Emergency Paramedics, and Physicians Assistants to be employed by private physicians and clinics.
APPENDIX U

ASSOCIATE DEGREE PROGRAM IN ADVANCED
EMERGENCY MEDICAL TECHNICIAN

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<td>BY 211</td>
<td>Anatomy and Physiology I</td>
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<td>Fundamentals of Medical Care</td>
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|                       | TERM II | | |
| EH 102               | English Composition | 3 | |
| MS 101               | College Math | 3 | |
| BY 212               | Anatomy and Physiology II | 3 | |
| SC 101               | Life in its Biological Environment | 3 | 15 |
| SLS 102              | Origins of American Society | 3 | |

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|                     | TERM IV | | |
| PAM 202 *          | Practicum in Emergency Medicine II | 4 | |
| PAM 204 *          | Physical - Mental Illness II | 5 | |
| PAM 205 *          | Patient Psychology | 3 | 17 |
|                     | TOTAL CREDITS | 64 | |
SLS 102 - ORIGINS OF AMERICAN SOCIETY

A continuation of SLS 101 with emphasis on American political institutions, American economic institutions, and America's leadership in the world. A study of the United States Constitution is included in this course. Three class periods.

PSY 105 - GENERAL PSYCHOLOGY

An analysis of human behavior by the study of the adaptation of the individual to his physical and social environment. Three class periods.

BY 209 - MICROBIOLOGY

A study of the protista, viruses, rickettsias, and schizomycetes of medical and economic importance. Laboratory exercises introduce bacteriologic techniques and aseptic procedures using nonpathogenic organisms. Three class periods and three laboratory hours.

BY 211 - ANATOMY AND PHYSIOLOGY

A study of the gross morphology and physiology of the human. The course includes sections concerned with cells, tissues, musculo-skeletal system, circulation, the lymphatic system, the excretory system and fluids and electrolyte balance. Two hours lecture and one two-hour lab.

BY 212 - ANATOMY AND PHYSIOLOGY

Prerequisite: BY 211. A continuation of BY 211. Topics considered are the endocrine system, reproductive system, nervous system, special senses; respiratory system, digestive system and the integument. Two hour lecture, one two-hour lab.

PAM 203 - PHYSICAL - MENTAL ILLNESS I

Study of the physical and psychological needs of patients in all age groups. Content includes instruction and concurrent laboratory practice in the medical care of patients with medical or surgical conditions, care of the sick child and the mental and emotional illnesses of functional origin. Three class periods of four laboratory hours.
PAM 204 - PHYSICAL - MENTAL ILLNESS II
Continued study of the major health problems in the community and nation with guided laboratory experience in the care of patients with acute and long term illnesses including mental disorders of organic origin. Five class periods.

SC 101 - LIFE IN ITS BIOLOGICAL ENVIRONMENT
An introduction to biological structures, function, processes, principles and concepts. This course is designed to fulfill the general education requirement. Three class periods.

EH 101 - ENGLISH COMPOSITION
A comprehensive course which embodies the fundamentals of effective expression, with emphasis on expository writing, logical and imaginative thinking, and reading for understanding and appreciation. Three class periods.

EH 102 - ENGLISH COMPOSITION
Prerequisite: EH 101. A continuation of EH 101, this course includes study and practice in research writing. Three class periods.

MS 101 - COLLEGE MATH
Prerequisite: Two years of high school mathematics, GS 99, or equivalent. This course is designed for the General Education Mathematics requirement. Emphasis is on concepts with manipulation as a tool to reinforce these concepts. The topics include mathematical logic, set symbolism and terminology, number bases, modular arithmetic, introduction to algebra and probability, and a thorough development of the real number system. Three class periods.

HS 201 - HUMANITIES
Prerequisites: EH 101 or consent of instructor. A study of human expression, problems and values through the study of Western man's achievements in art, music, literature, and philosophy. The course provides an introduction to appreciation of the arts, letters, and critical thought through study of the ancient, medieval, and renaissance periods. Three contact hours.
SOCIOLOGY SY 201 - INTRODUCTORY SOCIOLOGY

A study of sociological concepts, theories, and methods; social groups, processes, and change. Three class periods.

PRACTICUM IN EMERGENCY MEDICAL CARE I - PAM 201

Basic anatomy, physiology, pharmacology and bacteriology with emphasis on patho-physiologic changes and their correction. Training is through classroom demonstration, laboratory experience and actual patient care. Three class periods - Two lab periods.

PRACTICUM IN EMERGENCY MEDICAL CARE II - PAM 202

A continuation of basic course with in depth study to qualify the student. To carry out procedures now applied by allied health assistants under physician supervision in hospitals and military medical corpsmen in combat areas. Three class periods. Two lab periods.

PATIENT PSYCHOLOGY - PAM 205

An extension of PSY 105 emphasizing emergency psychology in cases of hysteria, death in a family, and child-parent communication in tragedy situations.

MA 101 - MEDICAL TERMINOLOGY

Development of a medical vocabulary commonly used in physicians' offices. Emphasis given to the physiologic and anatomic terms referring to human tissues and organic systems and use of medical dictionaries, manuals, and pharmaceutical references. Two class periods.

PAM 101 - FUNDAMENTALS OF MEDICAL CARE

A study of the concepts, principles, and techniques that form the foundation for all subsequent medical care courses. Emphasis is placed on the essential knowledge, understandings, and skills which are basic in the medical care of patients in all age groups. Content includes instruction in the problem-solving process, inter-personal relationships, medical history, mental health concepts, asepsis, nutrition, body mechanics, hygienic practices, drug administration, and community health needs and resources. Three class periods and six laboratory hours.
APPENDIX V

EQUIPMENT SPECIFICATIONS FOR THE GEORGIA STATEWIDE EMERGENCY RADIO NETWORK, AS RECOMMENDED BY THE GEORGIA HOSPITAL ASSOCIATION AND THE GEORGIA DEPARTMENT OF HUMAN RESOURCES

The following pages contain complete specifications for both hospital and ambulance radio equipment as recommended by the Georgia Hospital Association. It should be noted that the HSRC recommended EMS system duplicates the GHA specifications for hospital radios, but does not recommend the mobile radios presented in this appendix. A complete description of the Statewide Radio Network is presented in Chapter 8.
1.0 GENERAL REQUIREMENTS

1.1 Intent

The Georgia Hospital Association is a voluntary membership association serving hospitals in the State of Georgia. It is the intent of these specifications to describe the VHF/FM radio communications system to be utilized by as many of the Hospital Association membership as feasible and having the capability of expanding communications to other states.

Since continuity of communications is of major importance, it is desired that equipment offered by bidders comply with the specifications set forth herein. A qualified bidder wishing to submit a proposal for equipment which may differ with one or more of the specifications outlined should provide appropriate description of the differences in its bid.

1.2 System Design

Hospital Emergency radio system shall be designed to function both on a normal day to day basis by providing a hospital and associated vehicles and personnel with basic radio communications, and on an emergency basis by providing basic radio communications between hospitals in a region and between a base station hospital in one region and a base station hospital in another region.

The system shall be simple to operate, employing standard procedures that are self-evident to non-skilled personnel. Equipment design must be such that all controls and operation procedures are straight forward and suitable for operation by relatively non-technical employees, such as telephone operators and administrative staff personnel.

Radio system design shall include design features to provide 2-way radio communication between a hospital and its emergency vehicles, 2-way communication by hand-held radio for hospital personnel on foot, and 2-way radio communication between hospitals within the system.

Base station and mobile radio system design shall include provisions for a method of selective signaling between base station and mobile, and between base stations by means of digital dialing, encoding, and decoding equipment capable of expansion to handle additional radio units as required.

1.3 Frequency Band

Radio System transmitting and receiving equipment shall be designed for operation within the 150-160 MHz band. Exact operating frequencies designated for Hospital System use and for Special Emergency
use will be specified when equipment orders are placed.

### 1.4 Number of Channels

Base station radio equipment shall be provided in either of two designs; one-frequency radio transmit and one-frequency receive with seven (7) digital decoder; or two-frequency transmit and two-frequency receive with two (2) separate receivers each with seven digital decoder.

Single frequency units shall be designed for expansion to include two-frequency transmit and two-frequency receive by adding a second separate receiver with seven digital decoder.

### 1.5 Installation

Suppliers shall include, as a separate item, cost of installation of each base station system and each mobile radio unit supplied.

Each installation shall be complete in every respect and shall be in accordance with good engineering practices, as well as in compliance with local electrical codes and Federal Communications Commission Rules and Regulations.

### 1.6 Equipment Maintenance

Suppliers shall include, as a separate item, monthly service rates, per unit, for each major equipment item supplied, i.e., each base station, remote console, mobile unit, etc.

Each Supplier shall include, as a part of his quotation, a list of maintenance facilities that will be responsible for the maintenance of equipment supplied. List shall include names of Maintenance Company and address.

Since hospitals must operate on a 24 hour a day basis, suppliers shall specify the hours of the day that equipment maintenance is available and additional charge, if any, for "off hour" maintenance service.

### 1.7 FCC Type Acceptance

All equipment covered by this specification shall conform to the latest Federal Communications Commission standards applicable as of the date of bid. All equipment must be listed as type accepted by the Federal Communications Commission.

### 1.8 Contractor Responsibility

It shall be the responsibility of the contractor to verify the suitability of equipment items to meet the specifications. It shall also be the responsibility of the contractor to provide a complete operating system, satisfactory to the user. The contractor shall provide complete service with respect to the licensing of all equipment supplied and shall establish and maintain, for use of the Georgia Hospital Association, a complete record of all radio frequencies, signaling frequencies, and coded squelch frequencies in use on the system.
2.0 DETAILED SPECIFICATIONS - BASE STATION DESIGN

2.1 Style of Equipment

Base Station transmitter/receiver units shall be housed in painted, heavy gage metal cabinet, suitable for indoor installation and designed for remote control operation.

2.2 Two-Channel Capability

Base design of base station unit shall provide for expansion of single frequency model by simple field modification to add second transmit channel and second independent receiver chassis.

2.3 Operating Voltage

Base station equipment shall be designed for operation from 117 volt AC source.

2.4 Circuit Design

Base station design including exciter, power supply and receiver shall be total solid state; however, limited use of vacuum tubes in the final transmitter stages will be acceptable.

3.0 DETAILED SPECIFICATIONS - BASE STATION RECEIVER

3.1 Channel Spacing

Shall be 30 KH Z (Split Channel)

3.2 Modulation Acceptance

Shall be ± 6 KH Z

3.3 Sensitivity

Shall be less than 0.5 microvolt for 20 dB quieting.

3.4 Frequency Stability

Shall be maintained within ± 0.0005% over the temperature range of -30°C to +60°C.

3.5 Selectivity

Selectivity characteristic shall provide at least 85 dB attenuation at ± 30 KH Z from assigned operating frequency.

3.6 Spurious Response

All image and spurious responses shall be at least 100 dB down at any frequency outside the normal received channel.

3.7 Audio Output

Audio Output shall be at least 3 watts to a 3 ohm (nominal) load with less than 10% distortion at 1000 Hz.
1.8 Audio Response

Shall be +1, -8 dB of 6 dB/octave de-emphasis characteristic from 300 to 3000 Hz.

3.9 Squelch Design

Receiver shall be equipped with dual squelch, i.e., carrier operated and tone coded. Squelch threshold shall be .25 microvolt or less carrier operated; .25 microvolt or less tone coded.

Receiver design shall include special provision to unlock coded squelch upon receipt of pulse code from digital dialing system.

4.0 DETAILED SPECIFICATION - BASE STATION TRANSMITTER

4.1 Number of Frequency Channels

Base station transmitter shall be designed for two-frequency operation; however, base station may be ordered equipped with one frequency determining element only.

4.2 Power Output

Shall be a minimum of 80 watts, 50 ohms RF impedance.

4.3 Frequency Stability

Shall be maintained within \( \pm .0005\% \) over the temperature range of \(-300^\circ C\) to \(+60^\circ C\).

4.4 Spurious Emissions

All spurious and harmonic emissions shall be down at least 85 dB.

4.5 Modulation

Shall be 16F3, \( \pm 5\) KHz for 100\% at 1000 Hz.

4.6 Audio Response

Shall be within +1, -3 dB/octave pre-emphasis characteristic from 300 to 3000 Hz.

4.7 Audio Distortion

Shall be less than 3\% at 1000 Hz; 2/3 maximum deviation.

4.8 Remote Control Chassis

Each base station shall be furnished complete with remote control panel to facilitate remote control operation. Remote control chassis design shall include circuits for two-channel operation as well as tone coded squelch disabling.

5.0 DETAILED SPECIFICATION - REMOTE CONTROL CONSOLE
5.1 Basic Design

Remote control console shall be housed in an attractive cabinet suitable for desk-top use. Digital encoder dial shall be included in the front panel design and a convenient handset and hang-up cradle shall be provided on the side of the console housing.

Circuit design shall be total solid state - no tubes shall be included in the design of the remote control console.

Console shall be completely self-contained and shall include all essential equipment required to operate and control the remotely located base station. Each console shall include all necessary controls and circuitry to operate the two-frequency base station described in Section 3.0 of these specifications.

All digital encoders and decoders, whether base station or mobile, shall be designed to provide seven (7) digital decoding and encoding according to the following sequence:

1st digit - sets equipment
2nd & 3rd digits - indicates region
4th & 5th digits - indicates hospital
6th & 7th digits - indicates unit

5.2 Operating Voltage

Remote control console shall be designed for operation from 117 volt AC power source.

5.3 Handset and Hang-up Cradle

Console design shall include provision for automatic channel monitoring and automatic digital decoder reset function. Lifting handset shall automatically disable coded squelch and transfer audio from console speaker to handset.

5.4 Tone Disable

Digital encoder design shall include provision to eliminate annoyance of dialing tones being heard by mobiles and portables. Only the unit whose digital code has been dialed shall be alerted.

5.5 Clock

Each remote console shall be furnished complete with front panel clock. (Note: Optional on the part of the purchaser.)

5.6 Voice Meter

Each remote console shall be furnished complete with front panel VU Meter. (Note: optional on part of the purchaser.)

6.0 DETAILED SPECIFICATION - MOBILE UNIT DESIGN

6.1 Style of Equipment

Mobile transmitter/receiver unit shall be designed as a single unit housed in heavy gage metal case and suitable for trunk-
mounting in a motor vehicle. Mobile transmitter/receiver design shall be total solid state except for transmitter driver and final amplifier stages. Each mobile unit shall be furnished complete with the following listed accessories:

a. Control Head  
b. Loud Speaker and Cable  
c. Intercabling and Power Cables  
d. Roof-top Antenna and Cable  
e. Complete kit of installation accessories

6.2 Operating Voltage

Mobile transmitter/receiver units shall be designed for operation from 12 volt, negative ground automotive electrical system.

7.0 DETAILED SPECIFICATIONS - MOBILE RECEIVER

7.1 Number of Channels

Mobile unit design shall provide operation on two receive channels; however, units may be ordered with frequency determining elements for one channel only.

7.2 Modulation Acceptance

Shall be ± 6 KHz.

7.3 Sensitivity

Receiver quieting shall be 20 dB at no greater than 0.5 microvolt.

7.4 Frequency Stability

Frequency stability shall be maintained within ± 0.0005% over the temperature range of -30° to +60° C.

7.5 Selectivity

Overall selectivity characteristic shall provide at least 85 dB attenuation at ± 30 KHz from assigned operating frequency.

7.6 Spurious Responses

All spurious and image responses shall be at least 100 dB down at any frequency outside the normal received channel.

7.7 Audio Output

Shall be at least 5 watts at less than 5% distortion.

7.8 Audio Response

Shall be within +1, -8 dB of 6 dB/octave de-emphasis characteristic from 300 to 3000 KHz.

7.9 Squelch Circuit

Receiver shall be designed with dual squelch capability i.e.,
carrier operated and tone coded. Squelch threshold sensitivity (nominal) shall be .25 microvolt carrier operated squelch; .25 microvolt tone coded squelch.

8.0 DETAILED SPECIFICATIONS - MOBILE TRANSMITTER

8.1 Number of Channels

Mobile unit design shall provide operation on two transmitting channels; however, units may be ordered with frequency determining elements for one channel only.

8.2 RE Power Output

Shall be a minimum of 80 watts 50 ohms RF impedance.

8.3 Frequency Stability

Shall be within + .0005% of assigned frequency over the temperature range of -30° C. to +60° C.

8.4 Spurious Emissions

All spurious and harmonic emissions shall be down at least 85 dB below carrier.

8.5 Modulation

Shall be 16F3, + 5 KHz for 100% at 1000 Hz.

8.6 Audio Response

Shall be within +1, -3 dB of 6dB/octave pre-emphasis characteristic from 300 to 3000 Hz.

9.0 DETAILED SPECIFICATION - MOBILE DIGITAL DECODER UNIT

9.1 Decoder Design

Mobile decoder unit shall be enclosed in the mobile unit or in a compact housing suitable for under-dash mounting.

9.2 Number of Functions

Digital decoder shall be capable of providing two function operation with provision for field modification to provide up to five function operation.

9.3 Code Selection

Decoder design shall allow coding to be changed by merely rearranging pin-tip connectors or screws without need for soldering.

9.4 Indicator Lamp and Reset

Decoder unit panel shall include call indicator light and decoder reset button.
10.0 **Mobile Digital Encoder**

Mobile digital encoder shall perform same function as base station unit described in Section 5.0 and shall be furnished complete with dial.

11.0 **Instruction Manuals**

One instruction manual containing complete comprehensive information with respect to schematic diagrams, servicing procedures and parts lists shall be furnished with each base station, remote console, and mobile unit supplied.

12.0 **Base Station Antenna and Transmission Line**

Each base station supplied shall be furnished complete with one (1) base station, omni directional, 5.8 dB gain antenna with mounting hardware and adequate length of an adequate sized foam filled, metal jacketed transmission line complete with necessary connectors and fittings. Antenna support structure shall be adequate to provide the required communications coverage of the individual hospital and shall be of good engineering design and shall meet the wind loading specifications of the Electronic Industries Association (standard RS-222-A).

In order to determine the individual needs of participating hospitals, an actual on site survey will be required, and range map supplied.

13.0 **Warranty and Delivery**

a. All equipment supplied shall be warranted for a period of one year from date of installation.

b. Workmanship on all equipment supplied shall conform to the latest applicable standards of the I.E.E.E., the Electronics Industries Association, and state and local electrical codes.

c. Supplier shall indicate delivery schedule at time quotation is submitted.
### EQUIPMENT

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
</table>
| **ITEM E-1** | Transmitter/Receiver Base Station  
Complete with Antenna and Transmission  
Line: Two frequency transmit, two one  
frequency receivers with tone coded  
squelch and two digital decoders.  

Each |
| **ITEM E-2** | Transmitter/Receiver Base Station  
Complete with Antenna and Transmission  
Line: One frequency transmit, one  
frequency receiver with tone coded  
squelch and digital decoder.  

Each |
| **ITEM E-3** | Receiver, Digital Decoder and Frequency  
determining devices to modify Base  
Station Item E-2 to Base Station  
Item E-1.  

Each |
| **ITEM E-4** | Remote Control Console to operate  
Base Station Item E-1.  

Each |
| **ITEM E-5** | Remote Control Console to operate  
Base Station Item E-2.  

Each |
| **ITEM E-6** | Components to modify Remote  
Control Console Item E-5 to  
operate as Remote Control Console  
Item E-4.  

Each |
| **ITEM E-7** | Transmitter/Receiver Mobile:  
Two frequency transmit two  
frequency receive with tone  
coded squelch.  

Each |
| **ITEM E-8** | Transmitter/Receiver Mobile:  
One frequency transmit one  
frequency receive with tone  
coded squelch.  

Each |
| **ITEM E-9** | Mobile Multifunction digital  
decoder with call indicator light.  

Each |
REQUEST FOR QUOTATION

Items and Description

EQUIPMENT (Continued)

ITEM E-10 Mobile Digital Encoder with illuminated
dial.

Each

INSTALLATION

ITEM I-1 Transmitter/Receiver Base Station
Complete with Antenna and Transmission line as described in
Equipment Items E-1 and E-2.

Each

ITEM I-2 Receiver, Digital Decoder and
frequency determining devices to be
field installed in Equipment Item E-2.

Each

ITEM I-3 Remote Control Console as
described in Equipment Items
E-4 and E-5.

Each

ITEM I-4 Components to modify Remote
Control Console equipment Item
E-5 to operate Base Station
equipment Item E-1.

Each

ITEM I-5 Transmitter/Receiver Mobile:
Complete with Decoder and
Encoder. Equipment Items
E-7 and E-8.

Each

MAINTENANCE

ITEM M-1 Transmitter/Receiver Base Station

24 hour day Each Mo.
40 hour week Each Mo.

ITEM M-2 Remote Control Console

24 hour day Each Mo.
40 hour week Each Mo.

ITEM M-3 Transmitter/Receiver Mobile
with Decoder/Encoder

24 hour day Each Mo.
40 hour week Each Mo.

without Decoder/Encoder

24 hour day Each Mo.
40 hour week Each Mo.
APPENDIX W

TELEPHONE HARDWARE RELEVANT TO EMS COMMUNICATIONS

The significance of telephone hardware to the location identification, status reporting, and entry component communication subsystems in the EMS system prompted a meeting between HSRC Research Staff and W. L. Nickles, Plant Operations Supervisor at Southern Bell. The results of the meeting were documented in an internal memorandum and reviewed for accuracy by W. L. Nickles. The memorandum, dated January 12, 1973, is presented in this appendix. The following topics are presented:

Automatic Number Identification (ANI)
Automatic Exchange Identification (AEI)
Free Access Coin Phones
Locating Addresses, Given Only the Telephone Number 911
Automatic Call Distributor
Transfer of Status Information
Southern Bell's Role
MEMORANDUM

TO: EMS Personnel
FROM: O. Reinbolt
SUBJECT: January 5 Meeting of M. Blum, O. Reinbolt, and W. L. Nickles, Plant Operations Supervisor at Southern Bell

I. Automatic Number Identification (ANI) and Automatic Exchange Identification (AEI)

Neither ANI nor AEI is completely dependent upon electronic switching. Common control switching is necessary, but may be done utilizing electromechanical circuits. Common control switching acts upon the seven digit number as an entity rather than breaking the number into parts and switching step-by-step. Atlanta is scheduled to have all common control switching 1982. ANI and AEI at present are only available to callers arriving at an operator station by trunks. Thus, while it is fairly easy for an operator to get ANI (she receives all calls on trunks), it would be impossible for any other telephone number to get ANI since many calls coming to this number would arrive by standard telephone lines. Current experimentation by Bell Laboratories may result in ANI being made available for standard telephone lines, but actual development will be final by 1977 or 1978 at the earliest. It is safe to say that the metropolitan Atlanta EMS cannot utilize ANI or AEI within the next five years.

II. Free Access Coin Phones

Commonly called "dial tone first" phones because dial tone first is necessary before free calls may be made, this concept is supported in principle by AT&T. The pay phones could be changed to "dial tone first" in the field, then the wire centers could be programmed to accept any number of selected emergency telephone numbers, free, without requiring a dime to be deposited by the calling party. Field modification of pay phones would require about $450 per phone and modifications to the wire centers would be substantial. The overall cost could easily approach that of 911, and implementation could not be completed before 1976.
III. Locating Addresses, Given Only the Telephone Number

Presently, this capability exists, but only by manual methods. Each wire center keeps records for the numbers serviced by that wire center only. Numbers are given in the telephone directory front pages telling the customer where to call to find information about his telephone. The Telephone Company target is: given a telephone number, if the proper wire center has been contacted, the secretary can retrieve the caller's record within 90 seconds of hearing the telephone number. In December, 1972 the Telephone Company installed 40,000 telephones in Atlanta and disconnected 30,000 phones, resulting in a net change of 70,000 numbers. However, the service does stay current with a one-or-two day lag in updating numbers and corresponding addresses.

IV. 911

The 911 number must be installed as a separate exchange and, therefore, needs to connect to all other wire centers by trunk lines. The resulting expense is enormous for Atlanta, but may be reduced as more common control equipment is installed at the wire centers. The New York and Chicago configurations are contrasted with the Atlanta telephone configurations as shown below:

Since fewer wire centers exist in Chicago or New York, fewer new trunks must be installed to connect with the 911 exchange when implemented in these cities. In Chicago, since the wire centers must be coded for "message unit"
billing, the wire center is identifiable to the police station by merely running a trunk from each of the several wire centers to the police station. The present configuration of trunk lines and the status of common control switching in Atlanta indicate that a 911 system for this city is not feasible at present and probably will not be feasible before 1976.

V. Automatic Call Distributor (ACD)

This is a type of switchboard that automatically distributes incoming calls to two or more dispatchers in order to equalize workload. Instead of receiving a busy signal, callers hear a recorded message until the call can be answered. A transfer capability provides for quick transfer of calls from one dispatcher to another dispatcher in the event that the wrong dispatcher was initially called. The system is presently in use in Atlanta by MARTA.

VI. Transfer of Status Information Via Phone Lines

Direct telephone lines between dispatchers could be used to transfer ambulance status and other similar information without the need for voice initiation or voice response. The method would probably include a key type tone encoder which would feed into a mini-computer which would transfer or route messages. Display boards with relay decoders could be activated to display information at each center. Features might include automatic sequencing, interrupt, priority, and override capability.

VII. Southern Bell's Role

Given the proper design parameters, Southern Bell can design alternative systems for review by HSRC. The time lag for design is two to three weeks.
APPENDIX X

RADIO FREQUENCIES ALLOCATED BY THE FCC
TO EMERGENCY SERVICE ORGANIZATIONS

This appendix lists the 13 radio frequencies on which the VHF communications specified in Chapter 8 may be conducted.
APPENDIX X

RADIO FREQUENCIES ALLOCATED BY THE FCC TO EMERGENCY SERVICE ORGANIZATIONS

FCC regulations, section 89.525 entitled "Frequencies Available to the Special Emergency Radio Service", allocate a total of 13 frequencies in the VHF range for command and control, and dispatching of vehicles by emergency service organizations, including ambulance services.

Of the 13 frequencies, the five frequencies below are for use by hospitals only for hospital radio communications:

155.325 MHZ
*155.340 MHZ
155.355 MHZ
155.385 MHZ
155.400 MHZ

The remaining Special Emergency Radio Service Frequencies are:

155.160 MHZ
155.175 MHZ
155.205 MHZ
155.220 MHZ
155.235 MHZ
155.265 MHZ
*155.280 MHZ
155.295 MHZ

* Indicates a frequency of the GHA Specified, Georgia Statewide Emergency Radio Network.
APPENDIX Y

THE GEORGIA GOOD SAMARITAN LAW

The Georgia Good Samaritan Law does not protect EMT's performing duties for which monetary compensation is received. This law has significant value to public education programs. The law clearly describes the relief from civil liability for all persons rendering emergency care.
Relief from civil liability of practitioners rendering emergency care. Any person, including those licensed to practice medicine and surgery pursuant to the provisions of this Chapter, and including any person licensed to render service ancillary thereto, who in good faith renders emergency care at the scene of an accident or emergency to the victim or victims thereof without making any charge thereof, shall not be liable for any civil damages as a result of any act or omission by such person in rendering the emergency care or as a result of any act or failure to act to provide or arrange for further medical treatment or care for the injured person (Acts 1962, P. 534).
The ambulance run report presented herein was designed by the HSRC Research Staff as a prototype for the actual report to be used by ambulance personnel in the metropolitan Atlanta EMS system. The report is designed to allow diagnostic and treatment messages to be handwritten, so as to permit explicit information to accompany the patient to the physician in the ED. At a later, less critical time, the complaint and aid codes may be completed on the first carbon of the form. The HSRC recommendation is for the form to be in triplicate, one copy for the ED, one copy for the ambulance quarters, and one copy for the EMS Coordinating Agency.

If the ambulance run report is completed in full, the data requirements to be fulfilled by the ambulance report as designated in Table 9.3 will be met. The report is modeled after similar report forms in Jacksonville, Florida, Columbus, Ohio, and New York City, New York.
<table>
<thead>
<tr>
<th>AMBULANCE REPORT</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>LOCATION OF PATIENT</strong></td>
</tr>
<tr>
<td><strong>STREET (APT)</strong></td>
</tr>
<tr>
<td><strong>NEAREST INTERSECTION</strong></td>
</tr>
<tr>
<td>TIME CALL RECEIVED</td>
</tr>
<tr>
<td>VEHICLE EN ROUTE</td>
</tr>
<tr>
<td>VEHICLE AVAILABLE</td>
</tr>
<tr>
<td>ARRIVE QUARTERS</td>
</tr>
<tr>
<td>NOTIFIED BY</td>
</tr>
<tr>
<td>CONTROL</td>
</tr>
<tr>
<td>PUBLIC</td>
</tr>
<tr>
<td>OTHER</td>
</tr>
<tr>
<td>VEHICLE LOCATION WHEN DISPATCHED</td>
</tr>
<tr>
<td>QUARTERS</td>
</tr>
<tr>
<td>OTHER</td>
</tr>
<tr>
<td>OD READING (DISPATCH)</td>
</tr>
<tr>
<td>OD READING (AT SCENE)</td>
</tr>
<tr>
<td>OD READING (HOSPITAL)</td>
</tr>
<tr>
<td>TRANSFER</td>
</tr>
<tr>
<td>CANCELED</td>
</tr>
<tr>
<td>UNABLE TO LOCATE</td>
</tr>
<tr>
<td>DRY RUN (CODE)</td>
</tr>
<tr>
<td><strong>PATIENT'S NAME</strong></td>
</tr>
<tr>
<td>LAST</td>
</tr>
<tr>
<td>FIRST M.I.</td>
</tr>
<tr>
<td><strong>HOME ADDRESS</strong></td>
</tr>
<tr>
<td>STREET</td>
</tr>
<tr>
<td>CITY</td>
</tr>
<tr>
<td>COUNTY</td>
</tr>
<tr>
<td>ZIP CODE</td>
</tr>
<tr>
<td>AGE</td>
</tr>
<tr>
<td>MALE</td>
</tr>
<tr>
<td>BIRTHDAY</td>
</tr>
<tr>
<td>FEMALE</td>
</tr>
<tr>
<td><strong>AID GIVEN BEFORE ARRIVAL OF AMBO</strong></td>
</tr>
<tr>
<td>BY WHOM?</td>
</tr>
<tr>
<td><strong>AID GIVEN BY AMBULANCE CREW</strong></td>
</tr>
<tr>
<td><strong>COMPLAINT</strong></td>
</tr>
<tr>
<td><strong>OD READING</strong></td>
</tr>
<tr>
<td><strong>PULSE RESP B/P</strong></td>
</tr>
<tr>
<td><strong>TIME</strong></td>
</tr>
<tr>
<td><strong>MAJOR COMPLAINT CODES</strong></td>
</tr>
<tr>
<td><strong>CODES FOR AID GIVEN BY CREW</strong></td>
</tr>
<tr>
<td>CPR</td>
</tr>
<tr>
<td>IV</td>
</tr>
<tr>
<td>DEFIBRILLATE</td>
</tr>
<tr>
<td>OXYGEN</td>
</tr>
<tr>
<td>DRUGS</td>
</tr>
<tr>
<td><strong>CODE FOR HOSPITAL TO WHICH PATIENT TRANSPORTED</strong></td>
</tr>
<tr>
<td><strong>COMMENTS FOR DRY RUNS</strong></td>
</tr>
</tbody>
</table>
### Complaint Codes

**Complaint Code Consists of a Letter Specifying Site of Complaint Followed by a Number Specifying Type of Complaint.**

<table>
<thead>
<tr>
<th>Complaint Site Code</th>
<th>Complaint Type Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>A...Abdomen</td>
<td>01...Abrasion</td>
</tr>
<tr>
<td>B...Back</td>
<td>02...Amputation</td>
</tr>
<tr>
<td>C...Buttocks-Perineum</td>
<td>03...Asphyxiation</td>
</tr>
<tr>
<td>D...Chest</td>
<td>04...Avulsion</td>
</tr>
<tr>
<td>E...Eye</td>
<td>05...Burn</td>
</tr>
<tr>
<td>F...Face</td>
<td>06...Concussion</td>
</tr>
<tr>
<td>G...Fingers</td>
<td>07...Contusion-Bruise</td>
</tr>
<tr>
<td>H...Foot-Ankle</td>
<td>08...Crushing</td>
</tr>
<tr>
<td>I...Hand-Wrist</td>
<td>09...Dislocation</td>
</tr>
<tr>
<td>J...Head</td>
<td>10...Drowning</td>
</tr>
<tr>
<td>K...Internal</td>
<td>11...Electrocution</td>
</tr>
<tr>
<td>L...Lower Arm-Elbow</td>
<td>12...Fracture</td>
</tr>
<tr>
<td>M...Lower Leg-Knee</td>
<td>13...Internal</td>
</tr>
<tr>
<td>N...Multiple</td>
<td>14...Laceration-Cut</td>
</tr>
<tr>
<td>O...Neck</td>
<td>15...Puncture</td>
</tr>
<tr>
<td>P...Non-Specific</td>
<td>16...Sprain-Strain</td>
</tr>
<tr>
<td>Q...Pelvis</td>
<td>17...Abdominal Pain</td>
</tr>
<tr>
<td>R...Toes</td>
<td>18...Abortion-Miscarriage</td>
</tr>
<tr>
<td>S...Upper Arm-Shoulder</td>
<td>19...Asthma</td>
</tr>
<tr>
<td>T...Upper Leg-Hip</td>
<td>20...Burn</td>
</tr>
<tr>
<td>U...Other (Show As Diagnosis)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>AID Given by Ambulance Crew</th>
</tr>
</thead>
<tbody>
<tr>
<td>01...Airway Suctioned</td>
</tr>
<tr>
<td>02...Airway Tube</td>
</tr>
<tr>
<td>03...Artificial Respiration</td>
</tr>
<tr>
<td>04...Bandaging</td>
</tr>
<tr>
<td>05...Cold Application</td>
</tr>
<tr>
<td>06...Controlled Bleeding</td>
</tr>
<tr>
<td>07...Controlled Shock</td>
</tr>
<tr>
<td>08...EKG</td>
</tr>
<tr>
<td>09...Endotracheal Tube</td>
</tr>
<tr>
<td>10...Limb Splints</td>
</tr>
<tr>
<td>11...Obstetrical Assist</td>
</tr>
<tr>
<td>12...Obstetrical Delivery</td>
</tr>
<tr>
<td>13...Pain Relief</td>
</tr>
<tr>
<td>14...Patient Restraints</td>
</tr>
<tr>
<td>15...Psychological First Aid</td>
</tr>
<tr>
<td>16...Spinal Immobilization</td>
</tr>
<tr>
<td>17...Telemetry</td>
</tr>
<tr>
<td>18...Traction Applied</td>
</tr>
<tr>
<td>19...Transportation Only</td>
</tr>
<tr>
<td>20...None</td>
</tr>
<tr>
<td>21...Other (Comment)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Hospital Codes</th>
</tr>
</thead>
<tbody>
<tr>
<td>01...Grady</td>
</tr>
<tr>
<td>02...Kennestone</td>
</tr>
<tr>
<td>03...CA. Baptist</td>
</tr>
<tr>
<td>04...Northside</td>
</tr>
<tr>
<td>05...Piedmont</td>
</tr>
<tr>
<td>06...S. Fulton</td>
</tr>
<tr>
<td>07...Cobb General</td>
</tr>
<tr>
<td>08...C. W. Long</td>
</tr>
<tr>
<td>09...DeKalb General</td>
</tr>
<tr>
<td>10...Holy Family</td>
</tr>
<tr>
<td>11...St. Joseph</td>
</tr>
<tr>
<td>12...Clayton General</td>
</tr>
<tr>
<td>13...Doctors</td>
</tr>
<tr>
<td>14...Douglas</td>
</tr>
<tr>
<td>15...Button-Gwinnett</td>
</tr>
<tr>
<td>16...Buford General</td>
</tr>
<tr>
<td>17...Joan Glancy</td>
</tr>
<tr>
<td>18...Rockdale</td>
</tr>
<tr>
<td>19...Shallowford</td>
</tr>
<tr>
<td>20...W. Paces</td>
</tr>
<tr>
<td>21...Other</td>
</tr>
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</table>

### Hospital Codes

<table>
<thead>
<tr>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>1...Cardiac Arrest</td>
</tr>
<tr>
<td>2...Chills</td>
</tr>
<tr>
<td>3...Communicable Disease</td>
</tr>
<tr>
<td>4...Convulsions (Describe on Form)</td>
</tr>
<tr>
<td>5...Diabetic Coma</td>
</tr>
<tr>
<td>6...Difficulty in Breathing - Shortness of Breath</td>
</tr>
<tr>
<td>7...Dizziness-Fainting-Weakness</td>
</tr>
<tr>
<td>8...Empysema</td>
</tr>
<tr>
<td>9...Fever</td>
</tr>
<tr>
<td>10...Genitourinary Problems</td>
</tr>
<tr>
<td>11...Heart Attack</td>
</tr>
<tr>
<td>12...Heart Failure</td>
</tr>
<tr>
<td>13...Heat Exhaustion</td>
</tr>
<tr>
<td>14...Heat Stroke (Sunstroke)</td>
</tr>
<tr>
<td>15...Hemorrhaging (Nasal)</td>
</tr>
<tr>
<td>16...Hemorrhaging (Vaginal)</td>
</tr>
<tr>
<td>17...Hemorrhaging (Other - Describe on Form)</td>
</tr>
<tr>
<td>18...Impairment Similar to That Caused by Alcohol</td>
</tr>
<tr>
<td>19...Insulin Shock</td>
</tr>
<tr>
<td>20...Mental Disorder(s)</td>
</tr>
<tr>
<td>21...Nausea</td>
</tr>
<tr>
<td>22...Paralysis (Describe on Form)</td>
</tr>
<tr>
<td>23...Poison (Drugs - Includes Drug Overdose-State Type, Amount)</td>
</tr>
<tr>
<td>24...Poison (Other-State Type, Amount and Route Taken on Form)</td>
</tr>
<tr>
<td>25...Shock</td>
</tr>
<tr>
<td>26...Stomach Problems</td>
</tr>
<tr>
<td>27...Stroke</td>
</tr>
<tr>
<td>28...Vomiting</td>
</tr>
<tr>
<td>29...Unknown</td>
</tr>
<tr>
<td>30...Other (Show As Diagnosis)</td>
</tr>
</tbody>
</table>

### Dry Run Codes (Patient Not Transported)

<table>
<thead>
<tr>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>01...Patient Diagnosed As Non-Emergency (Comments)</td>
</tr>
<tr>
<td>02...Patient Needed, But Refused Care (Signature of Patient)</td>
</tr>
<tr>
<td>03...Patient Transferred By Other Means (Comments)</td>
</tr>
<tr>
<td>04...Patient Not Moved Because Doa</td>
</tr>
</tbody>
</table>
A thorough discussion of disaster planning for metropolitan Atlanta has been prepared by the EMS Task Force Subcommittee on Disaster Planning and is presented in this appendix. The discussion includes recommendations for action that are in accord with the EMS system described in this present document. Chapter 11 of the present plan discusses the use of EMS system resources in a disaster situation.
INTRODUCTION

When multi-casualty disaster occurs, it is the rare community that can cope with the situation without outside help - large numbers of casualties require large numbers of rescue men, emergency medical technicians, ambulances, hospital facilities and medical personnel. In order to mobilize these resources from within and from without a community and in order to most effectively utilize these resources, a workable plan must have been developed and tested in advance. The first thirty minutes will be when lives will be saved and injuries or disabilities reduced by prompt and correct application of modern emergency care techniques.

This report presents listings of the basic objectives of a disaster plan, the situation in Metropolitan Atlanta Region today, major deficiencies in this area and finally the sub-committee recommendations.

BASIC OBJECTIVES

1. Develop a coordinated Medical Plan for mass casualty care of victims of a natural disaster, such as a flood, tornado or civil disturbance in the seven county Metropolitan Atlanta Region.

2. Designate a hospital to provide a Disaster Medical Director charged with the responsibility of implementing the Medical Plan.

3. Designate a representative of the local government charged with overall responsibility of coordinating emergency operations at the disaster site.

4. Develop a list of hospitals and the medical support they agree to provide.
5. Develop a list of the ambulance service providers and the trained manpower and equipped vehicles available.

6. Provide for a communications system (radio and telephone) between hospitals, between hospitals and their ambulances, and between hospitals and their medical teams and representatives at the disaster site.

7. Require a well marked vehicle, tent or building at or close to the disaster site designated as a Command Post or Coordination Center and equipped with adequate communications for use by representatives of the emergency forces operating in the area.

SITUATION TODAY

1. There is a Disaster Medical Care Plan for the municipal and rural areas in Fulton, DeKalb and Cobb Counties. It was prepared in 1968 to provide medical services for casualties resulting from Civil disturbances and is a part of the Atlanta and Fulton County Civil Defense Plan dealing with civil disturbances.

2. Grady Memorial Hospital is the Central Control for the Plan and its Medical Director is the Chief Coordinator of the Plan.

3. The local Civil Defense Director is the overall Disaster Coordinator for his local government.

4. Existing arrangements provide for the Chief Coordinator at Grady Hospital to inform other hospitals (in these 3 counties) of disaster situations, and, as necessary, to ask for medical support.

5. Ambulance service is available as listed in the current telephone directory. (Ref. Appendix 2 for a current listing and Appendix 8 for training and equipment status).*

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* Appendices 2 and 8 of Emergency Medical Services in the Metropolitan Atlanta Region, Volume II, February, 1973, by the EMS Task Force.
6. Commercial telephone is the communications link between hospitals. Three hospitals have radio communication with three different ambulance companies. (Ref. Appendix 9 for Georgia Hospital Association Communications Plan).

7. Local governmental agencies may or may not establish a well marked and equipped Command Post or Coordination Center at the disaster site.

8. The seven counties do not have a joint Disaster Committee.

9. There is no pretested mass casualty plan for aircraft accidents at Hartsfield International Airport or in surrounding communities.

MAJOR DEFICIENCIES

1. There is no coordinated Medical Plan for mass casualty care in the event of a natural disaster in the seven county area.

2. There is no list of hospitals who have agreed to participate and provide predeterminable medical support.

3. There is no list of ambulance companies nor are there established minimum standards to which they conform.

4. There is no radio communication between the major hospitals in the 7 county area. Only 3 hospitals utilize two-way radio communications with ambulances.

5. There is no written agreement or requirement for some governmental agency to establish a well marked Command Post or Coordination Center at the Disaster site.

6. There is no committee for Disaster Planning to coordinate and implement the 7 county disaster plan.

7. The community is ill prepared to cope with a major airplane disaster.

RECOMMENDATIONS

1. That the Medical Annex as given in the following paragraphs be adopted as a set of guidelines to provide a Medical Plan
for mass casualty care in the event of a natural disaster, such as a flood, tornado or civil disturbance in the seven county Metropolitan Atlanta Region.

2. That the Medical Annex be forwarded for concurrence to the following:
   a. Selected hospitals.
   b. Medical Societies.
   c. The Metropolitan Atlanta Hospital District of the Georgia Hospital Association.
   d. County Commissioners.
   e. Governmental officials of the urban areas in the counties.
   f. Civil Defense Directors of the Counties and Urban areas, and Area 7.

3. A committee on Disaster Planning with professional and administrative representatives from each of the seven counties should be established. The Disaster Coordinator at Grady should be the chairman. Purpose: To have responsibility for implementing critiqueing and revitalizing this plan at least semi-annually.

4. That a special mass casualty medical plan be developed for Hartsfield International Airport and surrounding area for dealing with large aircraft crashes.

PROPOSED MEDICAL ANNEX OF THE CIVIL DEFENSE NATURAL DISASTER PLAN

Introduction

Purpose

To provide a coordinated Medical Plan for mass casualty care in the seven county Metropolitan Atlanta Region; i.e., Fulton, DeKalb, Cobb, Clayton, Gwinnett, Douglas and Rockdale. The plan is designed to provide medical services in support of local governments in the event of a natural disaster, such as a flood, tornado, civil disturbance or any other
mass casualty producing emergency, except a nuclear attack or other enemy action against the United States.

**Authority**

This plan shall be in accord with and have the support of the County Commissioners of Fulton, DeKalb, Cobb, Clayton, Gwinnet, Douglas and Rockdale; the Medical Societies of the affected counties; the proper government officials of the urban areas in these counties; the Atlanta Hospital district of the Georgia Hospital Association; the Hospital Authorities; all participating hospitals in the region, and the Atlanta Regional Commission. This plan has been coordinated with and is in consonance with existing plans of the State, Area 7 and local Civil Defense authorities, the military command involved, the American Red Cross and the Salvation Army.

**Declaration**

The declaration of a condition of emergency resulting from a natural disaster in a given governmental subdivision is a function of the duly elected governmental head of the local jurisdiction or municipality.

**Implementation**

Upon declaration of a disaster situation existing in a political subdivision, the head of the local government or his designated representative may call Grady Memorial Hospital (659-1212) and request that this Medical Plan, as agreed upon by all parties, be implemented. He should also notify his Civil Defense Director if he had not already done so.

This plan encourages all participating hospitals to implement their own disaster plans upon recognition of a mass casualty situation and be prepared to assist other hospitals as indicated.
The Medical Plan

Participants

Hospitals which have agreed to participate in this plan and their capabilities to provide medical support at the disaster site and to receive casualties are to be determined by the EMS Coordinating Agency.

Definitions

Terms used in this plan are defined as follows:

Disaster Coordinator

The local Civil Defense Director has already been designated the Disaster Coordinator and assigned overall responsibility for Disaster Planning and Operations, for his local government.

Disaster Medical Director

A physician on the staff of Grady Memorial Hospital charged with the responsibility of implementing this Medical Plan.

Command Post

A well marked vehicle, tent or building at or close to the disaster site and equipped with radio and/or telephone communications. It will be established by the local Disaster Coordinator (Civil Defense Director) to serve as one well identified "Coordination Center" for use by representatives of emergency forces operating in the disaster area.

On Site Medical Director

A surgeon on the staff of Grady Memorial Hospital who will represent the Disaster Medical Director at the Command Post. He will implement the medical aspects of this plan at the site under the supervision of the Disaster Coordinator.
Medical Aid Station

A medical aid station located in a school or some other suitable building or temporary shelter near the disaster site for the emergency treatment of casualties.

Medical Aid Team

A team of at least two nurses, two surgeons and one internist, an administrative assistant, and a clerk provided by one of the participating hospitals to man the Medical Aid Station.

Information Team

A team consisting of an administrator and one other member of the staff of Grady or a participating hospital who reconnoiters the disaster site and reports their estimate of the casualty situation to the Disaster Medical Director at Grady.

Plans

Each participating hospital will have a disaster plan and will conduct drills or disaster exercises to establish proficiency in managing multiple casualties. These plans should provide for adequate coverage in the hospital as well as the medical support capability.

Actions

When the local governing official declares a disaster situation and calls Grady Memorial Hospital (659-1212) and requests implementation of this Medical Plan, emergency medical actions will be executed and coordinated as follows:

1. Grady switchboard operator will notify the Medical Director of Grady who is the Disaster Medical Director for this plan.
2. The Disaster Medical Director, assisted by members of his staff will immediately and simultaneously initiate the following actions:
a. Dispatch the "Information Team" with a mobile radio to the site. This team will contact rescue teams already on the scene and reconnoiter the disaster area to obtain all information possible as to the extent of the damage, number of people involved, estimated number and type of casualties and any other pertinent information that would be helpful in planning for complete coverage. The team will report by radio its estimate of the situation to the Disaster Medical Director at Grady. The team chief will then proceed to the Command Post, report his estimate to the officials present, and inform them that he will coordinate medical activities at the site until the On Site Medical Director arrives from Grady.

b. Call all other participating hospitals or selected ones, depending on the estimate of casualties, inform them of the disaster situation, and ask them to implement their disaster plans.

c. Dispatch the On Site Medical Director with mobile radio from the staff at Grady to report to the Command Post and implement medical aspects of this plan at the site. He will select a location for the Aid Station and advise all concerned of its location. He will be in charge of the Medical Aid Team at the Medical Aid Station. He will make job assignments of the professional personnel and will place volunteer medical workers where they can be best utilized. He will keep the Command Post and the Disaster Medical Director informed of the progress of the medical teams and the projected requirements for facilities and supplies.
d. Dispatch its Medical Aid Team with mobile radio to the site to man the Medical Aid Station. The team will report to the On Site Medical Director for location of their Aid Station and the team will function under the On Site Medical Director. The team will carry supplies and equipment to perform triage or sorting resuscitation, and will direct disposition and evacuation of patients to specific hospitals as directed by the Disaster Medical Director through the On Site Medical Director.

e. Update the report of hospital census; bed status; availability of staff and breakdown by specialties; operating room status, including sterilized goods; blood; and solutions. With this information the Disaster Medical Director will keep the On Site Medical Director at the site and the triage teams informed as to where patients should be sent for hospitalization. When the Disaster Medical Director calls a hospital for a status report, he will appraise the Hospital Administrator of the type of disaster and what may be expected.

f. Request ambulances, or other appropriate vehicles be sent to the Aid Station in sufficient numbers to evacuate casualties. If the Medical Aid Station is not operational, ambulance drivers will be directed to report to the Command Post for instructions on evacuation of patients.

g. Maintain current information on availability of supplies, order them when needed and keep the medical aid team, or teams adequately supplied on request.

h. Call the Director of Area 7 Civil Defense (627-2471) and inform him of the disaster situation.

i. Make arrangements with other hospitals to provide relief for the Medical Aid Team if it appears that the team will be working more than 6 hours.
3. Participating hospitals which have activated their disaster plans will keep the Disaster Medical Director at Grady informed of their work load, their level of resources, its needs, and any change in their capability to receive patients. Each hospital will in turn be kept appraised of impending work loads by the Disaster Medical Director or a member of his staff.

4. The American Red Cross will send a representative to the Command Post and will make the services of a coordinator of volunteer medical services available to the On Site Medical Director for assignment at the disaster site.

5. Blood is a precious commodity and must be retained in the donor until required. The Disaster Medical Director will have full responsibility for making public announcements to obtain blood donors and he will also be responsible for distribution of blood supplies.

**Communications**

Adequate communications systems are essential for the effective execution of this Medical Plan.

Telephone and radio communications between hospitals is desirable with Grady Memorial Hospital being the base station for the inter-hospital radio net.

Each participating hospital having the capability to send a team or teams to the disaster site needs another radio net, i.e., a base station and one or more mobile units for the Information Team and the Medical Aid Team.

A sketch of a possible communications system is shown in Figure

**Supporting Services**

The local Civil Defense Natural Disaster Plan to which this Medical Annex is attached describes the availability and coordination of
other supporting services responding to the disaster, such as:

The local Civil Defense Director will establish an Information Center near the Command Post where representatives of the news media can obtain factual information.

The American Red Cross will extend emergency services and relief in addition to the medical professionals already made available to the On Site Medical Director.

The Salvation Army will provide canteen and other services within capabilities.

Health and Welfare Departments provide appropriate services to victims of the disaster.

Public School Systems establish and operate emergency shelters at schools as requested.

The extent of these and other emergency services vary from County to County, but additional resources can be obtained by request through Civil Defense channels.
FIGURE AA.1  Communications Sketch for the Disaster Medical Plan.

NOTE: Sketched above is a sample of a Communications System. Actual systems will have to be developed by those who can provide the personnel and equipment to operate the system. Details of this system to be established by the EMS Coordinating Agency. In this sketch Hospital X sends out Information Team and Grady sends out the On Site Medical Director and Medical Aid Team.
Sample Check List of Actions

To facilitate rapid response to a disaster situation by responsible officials, their actions are summarized in this section which may be detached and carried by a person responding to a natural disaster.

Local Police - (*) Security, traffic control and evaluation of personnel.

Fire Department - (*) Fire suppression and control, rescue of personnel and determination of area to be evacuated.

Head of Government - (*) The duly elected head of the local government, or his designated representative may:

1. Declare emergency
2. Call Grady Hospital (659-1212) and request implementation of this Medical Plan.
3. Instruct his Civil Defense Director to implement the provisions of the local Natural Disaster Plan.

Grady Hospital - (659-1212) The Executive Director will direct implementation of the Medical Plan and designate the Medical Director of Grady as the Disaster Medical Director to implement the Medical Plan.

Civil Defense - (*) The local Civil Defense Director will implement the Natural Disaster Plan to include:

1. Establishment of a Command Post at the site.
2. Establishment of an Information Center at the site.
3. Requests for assistance from Area 7 Coordinator (627-2471, Ext. 211) if additional resources are needed.

Disaster Medical Director - (659-1212) The Medical Director of Grady Hospital, assisted by his staff will:

* Insert Local Agency Number.
1. Dispatch the "Information Team", with a mobile radio, to the site.

2. Dispatch an On Site Medical Director with mobile radio from the staff at Grady to the Command Post at the disaster site.

3. Call all other participating hospitals, or selected ones depending on the estimate of casualties, inform them of the situation and ask them to implement their disaster plans.

4. Dispatch its Medical Aid Team with mobile radio to the site to man the Medical Aid Station.

5. Call Area 7 Civil Defense (627-2471) and inform the Director or his representative of the disaster situation.

6. Direct the evacuation of patients to specific hospitals by instructions to the Medical Aid Team through the On Site Medical Director.

7. Request additional ambulances, or other appropriate vehicles, be dispatched to the Medical Aid Station in sufficient numbers to evacuate casualties.

8. Update the report of census from participating hospitals.

9. Maintain a current inventory of supplies, order them when needed, and keep the Medical Aid Team adequately supplied on request.

Information Team - This team will contact rescue teams already on the scene and reconnoiter the disaster area to obtain all information possible that would be helpful in planning for complete medical coverage. It will report by radio its estimate of the situation to the Disaster Medical Director at Grady. The team chief will then proceed to the Command Post, report his estimate to the officials present, and inform them that he will direct medical activities at the site until the On Site Medical Director arrives from Grady Hospital.
On Site Medical Director - He serves on the staff of the Disaster Coordinator at the Command Post to implement the medical aspects of the Plan at the site. He will:

1. Select a site for the Medical Aid Station.
2. Be in charge of the Medical Aid Team.
3. Pass on instructions from the Disaster Medical Director to the Medical Aid Team for the Evacuation of patients to specific hospitals.
4. Make job assignments of professional personnel and place volunteer medical workers where they can be best utilized.
5. Keep the Command Post and the Disaster Medical Coordinator informed of the progress of the Medical teams and the projected requirements for facilities and supplies.

Medical Aid Team - The team operates under the On Site Medical Director. It will:

1. Establish and operate a Medical Aid Station at a place designated by the On Site Medical Director.
2. Perform triage or sorting, resuscitation, disposition and evacuation of patients to specific hospitals as directed by the On Site Medical Director.
3. Keep the On Site Medical Director informed of progress on treatment and disposition of patients, and the need for additional supplies and equipment.
4. Give the On Site Medical Director an estimated time that the team should be relieved by another Medical Aid Team.

Hospitals - Participating hospitals will:

1. Provide the emergency support listed in Appendix 1 when requested by the Disaster Medical Director.
2. Keep the Disaster Medical Director informed of the capability to receive and treat patients.
3. Be prepared to relieve the Medical Aid Team upon request of the Disaster Medical Director.

Red Cross - Agrees to:
1. Send a representative to the Command Post.
2. Provide a coordinator of volunteer medical services to the On Site Medical Director.
3. Supplement efforts of civil authorities in extending emergency services and relief (food, clothing, shelter, first aid and nursing and medical care).

Salvation Army - (873-2631) Agrees to:
1. Have a representative report to the Command Post.
2. Provide mobile canteen and other services within capabilities.

Public School Systems - (*) Establish and operate emergency shelter at school site(s) on request of the Disaster Coordinator.

Economic Opportunity Atlanta, Inc. (EOA) (688-1012) - Implements emergency neighborhood service center plans upon request of the Disaster Coordinator.

Utility Companies - Render area safe for emergency workers.
Georgia Power Company, 522-6121; Atlanta Gas Light Company, 522-1150; and Southern Bell Telephone Company, 226-0433.

* Insert Local Agency Number.
APPENDIX BB

PUBLIC EDUCATION MATERIAL FOR CARDIOPULMONARY RESUSCITATION

The materials presented in this appendix include an "Information Sheet" and an illustrative description of cardiopulmonary resuscitation technique. The program title, MEDIC II, was chosen to emphasize the fact that MEDIC I, a Mobile Intensive Care Unit of the Seattle Fire Department, can not combat sudden death effectively without the active participation of Seattle's citizens.
What is "Medic Two"?

Medic Two is a three-year project, sponsored jointly by the Seattle Rotary Club #4 and the Seattle Fire Department, and endorsed by the King County Medical Society and endorsed and financially assisted by the Washington State Heart Association. It is aimed at teaching Cardiopulmonary Resuscitation (CPR) to Seattle residents.

What is CPR and what type of training will be given?

CPR is the manual chest compression and lung ventilation necessary to sustain life in the event of a heart stoppage. The training will include instruction on the three steps necessary to sustain life if a victim is discovered unconscious: How to establish a positive airway if the victim is simply unconscious, how to administer mouth-to-mouth ventilation if the person is not breathing, and how to administer manual chest compression if the pulse is absent.

Why is the training desirable?

Statistically, someone dies of coronary disease every minute of every day, year after year--some 500,000 citizens a year. Most deaths (upwards of 60%) occur within the first hour, and the majority of these victims never reach a hospital.

According to American Red Cross figures, if CPR is started for a heart attack victim within one minute of the attack, the chance of recovery is 98%. If this same treatment is delayed just four minutes, the chance of recovery is reduced to 50%, and if there is a seven minute delay, the victim has only an 8% chance.

The average response time for Seattle Fire Department emergency equipment (Aid Cars) is around four minutes and while their service
is as outstanding as any in the nation, a citizen with CPR knowledge can do much to help save lives in this community in those extremely crucial moments before the Aid Car Arrives.

Who can enroll in this course?
Medic Two is open to all citizens, at least 12 years of age. Groups of 30 as well as individuals may enroll. The groups may come from business organizations, schools, fraternal and social clubs, friends and neighbors, etc.

How is the training conducted?
All classes are under the supervision of Seattle Fire Department Medic One personnel. The course is three hours in length and uses a film and various training aids (manikins, so designed as to allow the individual to practice administering CPR). The Instructors work directly with each trainee as he practices and masters the CPR technique.

Are training sites available or must the group secure one?
Either method is acceptable. If you do not have a site, one will be selected. However, it is preferred to have the group select its own location. It may be a place of business, a church, a community club-house, and in some instances, even a private residence. The only requirements are that the area be large enough to accommodate the class of 30 and still have room left to practice CPR on the training aids and view the film. Two six foot tables should also be provided.

What are the starting times for the classes?
As a general rule, the starting times for the classes will be 9:00 a.m., 1:00 p.m., 2:00 p.m. and 7 o'clock in the evening, Monday through Saturday.

Who do you contact to arrange a class?
This can be accomplished by calling 583-6577, the "Medic Two Booking Office".
Will you please review the major points one last time?

1. Open to all Seattle residents, aged 12 and above.
2. One three-hour class, using film and various training aids.
3. Classes limited to groups of 30.
4. Starting times: 9:00 a.m., 1:00 p.m., 2:00 p.m. and 7 o'clock in the evening, Monday through Saturday.
5. Class arrangements may be made by phone.

THE HEART THAT IS SAVED

MAY BE YOURS

OR A MEMBER OF YOUR FAMILY

ANOTHER SEATTLE FIRST

PLEASE HELP US
CARDIOPULMONARY RESUSCITATION (CPR)  
MEDIC II

IRWAY

CHECK
LOOK — Blocked air passage.
Skin color - pale to blue.
LISTEN — No breath sounds.
FEEL — Chest does not rise. Ear at nose, no air movement.

ACT
1. Clean out the mouth.
2. Tilt head back.

REATHING

CHECK
LOOK — Skin color - pale to blue.
Opening in neck.
LISTEN — No breath sounds.
FEEL — Chest does not rise. Ear at nose, no air movement.

ACT
1. Make airtight seal to mouth.
2. Blow until chest expands well.
3. Repeat 12–15 times per minute.

CHECK
LOOK — Dilated pupils.
Skin color - blue.
Chest does not rise.
LISTEN — Ear on chest, no heartbeat.
Ear at nose, no air movement.
FEEL — At neck, no pulse.

ACT
1. Put the heel of one hand on the breastplate at the proper point in the center of the chest.
2. Put the other hand on top of the first, do not allow the fingers to touch the chest wall.
3. Depress breastplate 1½” to 2’ at rate of 60–80 times per minute.

FOR HELP IN SEATTLE CALL 9-1-1

Conducted by Seattle Fire Department

Sponsored by Seattle Rotary Club #4
APPENDIX CC

AN EXAMPLE OF LEGISLATION DESIGNED TO ENABLE EMT'S TO PERFORM ADVANCED PROCEDURES

The sample of enabling legislation presented in this appendix was created to protect advanced EMT's, known as Mobile Intensive Care Paramedics, in the State of Oregon. The document is a proposed amendment to the Medical Practice Act.*

* Correspondence from William J. McIntyre, Director, EMS, Oregon Department of Human Resources, to Mark S. Blum, HSRC, dated December 7, 1972.
Relating to the performance of certain actions by persons who render emergency medical assistance; amending ORS 677.

Be It Enacted by the People of the State of Oregon:

Section 1. ORS 677.010 is amended to read:

677.010. (1) As used in this section:

(a) "Division" means the Oregon State Health Division

(b) "Mobile Intensive Care Paramedic" means a person who:

(1) is 18 years of age or older

(2) has successfully completed a "Mobile Intensive Care Paramedic Course", as defined in the following subsection,

(3) has been examined and certified as a Mobile Intensive Care Paramedic by the Division.

(c) "Mobile Intensive Care Paramedic Course" consists of instructions by a licensed physician including but not limited to the following:

(1) artificial respiration including oxygen administration and endotracheal intubation

(2) closed chest cardiopulmonary resuscitation

(3) intravenous infusion with saline and glucose solutions

(4) gastric and pulmonary suction

(5) to record and interpret electrocardiograms

(6) cardiac defibrillation
oral and parenteral administration of the following classes of drugs:

(a) antiarrhythmics
(b) vagolytics
(c) chronotropics
(d) analgesics
(e) alkalinizing agents
(f) vasopressors
(g) vadodilators

Section 2. The Division is authorized to prescribe fees for certification and recertification and such fee shall be based on the cost of administering the provisions of this Act.

Section 3. Mobile Intensive Care Paramedics shall be authorized to perform such acts under written or oral authorization of a licensed physician as shall be established by the rules and regulations of the Division, including, but not limited to, administration of oral and intravenous solutions and medications, cardiac defibrillation, and endotracheal intubation.

Section 4. The Division is authorized and directed to establish appropriate rules and regulations concerning the administration of this Act. Such rules may deal with, but are not limited to, such matters as criteria for training programs, determination of acts which may be performed by Mobile Intensive Care Paramedics, fees for certification and recertification at specified intervals and other necessary and proper matters.

Section 5. No Mobile Intensive Care Paramedic, or physician or hospital licensed in this state shall be subject to civil liability, based solely upon failure to obtain consent in rendering emergency medical, surgical, hospital or health services to any individual regardless of age where the patient is unable to give his consent for any reason and there is no other person reasonably available who is legally authorized to consent to
the providing of such care; provided, however, that such paramedic, physician, or hospital has acted in good faith and without knowledge of facts negating consent.

Section 6. The Division has the discretionary authority to waive the requirements of Section 1(b)(2) of any applicant who has completed training in another state or territory of the United States or District of Columbia equivalent to the Mobile Intensive Care Paramedic course as defined in Section 1(c) of this Act.

Section 7. (1) The Division shall admit to examination any candidate who pays the fee provided for in the rules and regulations and submits evidence verified by oath, satisfactory to the Division, that such applicant:

(a) is 18 or older

(b) is free from habitual use of dangerous drugs and narcotics; free from alcoholism; free from any illness or injury which would reasonable prohibit him from performing the tasks outlined in this Chapter.

Section 8. (1)(a) Certification may be denied, suspended or revoked in accordance with the provisions of ORS Chapter 183 for failure to have successfully completed an approved course or to meet or continue to meet the physical and mental qualifications required to be certified under Section 4 and 7 of this Act or the rules promulgated thereunder.
APPENDIX DD

AN EVALUATION OF THE NEED FOR TELEMETRY IN THE METROPOLITAN ATLANTA EMERGENCY MEDICAL SERVICES SYSTEM

Although telemetry is a popular concept for EMS systems, the widespread implementation of telemetry equipment has not been recommended for metropolitan Atlanta. The present appendix suggests that telemetry be used as a tool in the treatment of cardiac emergencies, rather than as a requirement.
APPENDIX DD

AN EVALUATION OF THE NEED FOR TELEMETRY IN THE METROPOLITAN ATLANTA EMERGENCY MEDICAL SERVICES SYSTEM

INTRODUCTION

A well designed emergency medical services (EMS) system must address not only trauma, but cardiovascular problems as well. The importance of cardiovascular emergencies is illustrated in Table DD.1 below, which shows mortality statistics for metropolitan Atlanta in 1970.*

<table>
<thead>
<tr>
<th>METROPOLITAN ATLANTA COUNTY</th>
<th>CARDIOVASCULAR DEATHS IN 1970</th>
<th>CARDIOVASCULAR DEATHS PER 100,000</th>
<th>HIGHWAY ACCIDENT DEATHS IN 1970</th>
<th>HIGHWAY DEATHS PER 100,000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clayton</td>
<td>239</td>
<td>244</td>
<td>29</td>
<td>30</td>
</tr>
<tr>
<td>Cobb</td>
<td>491</td>
<td>249</td>
<td>55</td>
<td>28</td>
</tr>
<tr>
<td>DeKalb</td>
<td>1222</td>
<td>294</td>
<td>62</td>
<td>15</td>
</tr>
<tr>
<td>Douglas</td>
<td>103</td>
<td>359</td>
<td>17</td>
<td>59</td>
</tr>
<tr>
<td>Fulton</td>
<td>2905</td>
<td>478</td>
<td>143</td>
<td>23</td>
</tr>
<tr>
<td>Gwinnett</td>
<td>254</td>
<td>351</td>
<td>33</td>
<td>46</td>
</tr>
<tr>
<td>Rockdale</td>
<td>63</td>
<td>346</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>COMBINED COUNTIES</td>
<td>5277</td>
<td>367</td>
<td>339</td>
<td>24</td>
</tr>
</tbody>
</table>

It can be seen from the table that for every person dying on metropolitan Atlanta's highways, 15 persons die due to cardiovascular disease. Not all

* Georgia Heart Association statistics.
cardiovascular deaths may be prevented, even with the most sophisticated emergency medical services. Effective response to rheumatic, hypertensive, arteriosclerotic, and other chronic forms of heart disease are beyond the scope of modern emergency medical service systems. However, in the period from 1965 to 1970, 60 per cent of the cardiovascular fatalities in the United States were due to ischemic heart disease, which commonly results in an acute myocardial infarction (AMI) and is known to the lay population as a heart attack (12, p.20).* It can be inferred from the preceding table that at least 3200 persons in metropolitan Atlanta died from AMI's in 1970.

TREATMENT OF CARDIAC EMERGENCIES IN HOSPITALS

The advent of the hospital coronary care unit (CCU) in recent years has shown that mortality from AMI can be reduced by about 10 per cent in most well-equipped hospitals. For example, the introduction of a CCU at St. Vincent's Hospital in New York City resulted in a decline from 32 per cent of AMI's resulting in deaths in 1964 to 17 per cent of AMI's proving fatal in 1967 (6, p.363). The problem is that the majority of deaths from AMI occur within the first hour of the infarct and consequently nearly two-thirds of the patients die before they may be admitted to the hospital (10, p.666). A study by McNeilly and Pemberton found that among 901 individuals who had had a fatal AMI in a one year period in 1956, only 414 reached the hospital; of these, 109 were dead on arrival. Figure DD.1 shows the per cent of the total of 901 deaths as a function of the elapsed time after onset of the infarct.

* Ischemic heart disease is defined as local anemia in the heart due to mechanical obstruction (mainly arterial narrowing) to the blood supply (11, p.649).
From Figure DD.1, it is seen that 40 per cent of the AMI deaths in this study were within one hour of the infarct. The benefits of the hospital coronary care unit were never available to the majority of these victims.

Emergency medical services analysts have proposed and operated at least seven alternative systems to cope with cardiac emergencies as listed in Table DD.2 which follows.

**TABLE DD.2** Levels of Capability for Treatment of Cardiac Emergencies, in Order of Increasing Cost.

<table>
<thead>
<tr>
<th>Level</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>a.</td>
<td>Using a standard ambulance or hearse, with one or more attendants, give the AMI patient oxygen and rush to a hospital ED.</td>
</tr>
<tr>
<td>b.</td>
<td>Two trained attendants in a standard ambulance apply cardiopulmonary resuscitation (CPR) and rush patient to a hospital ED.</td>
</tr>
<tr>
<td>c.</td>
<td>Two trained attendants in a standard ambulance use CPR, intravenous fluid (IV) therapy, and a defibrillator; try to stabilize patient before moving patient to hospital ED.</td>
</tr>
</tbody>
</table>
TABLE DD.2 (cont.) Levels of Capability for Treatment of Cardiac Emergencies, in Order of Increasing Cost.

d. Two or three attendants in mobile intensive care unit (MICU) with CPR, IVs, defibrillator, and drugs stabilize patient before moving patient to hospital ED.

e. Two or three attendants in MICU with CPR, IVs, defibrillator, drugs, and telemetry stabilize patient and proceed slowly to hospital CCU.

f. Physician or nurse with attendants in MICU with CPR, IVs, defibrillator, drugs, and all necessary equipment to treat cardiac problems of most types offer definitive therapy at the scene.

The decision when designing an EMS capable of effectively handling acute myocardial infarctions is not just whether to add telemetry to ambulances, but rather to determine which of the levels in Table DD.2 is best suited to accomplish the goal, based upon the medical characteristics of the acute myocardial infarction.

MEDICAL CHARACTERISTICS OF THE AMI

During a four year period, Pantridge reports encountering 193 patients with cardiac arrest outside the hospital. In the absence of efficient resuscitation within four minutes, the majority had asystole (cardiac standstill), while among those receiving efficient resuscitation within four minutes, the majority had ventricular fibrillation (quivering, non-pumping heart). This evidence suggests that the usual mechanism of sudden death in myocardial infarctions is first ventricular fibrillation and then asystole. Rhythm disturbances are common in all patients in the first two hours after myocardial infarction (9, p.232).

Ventricular fibrillation is commonly handled outside the hospital in two ways, through cardiopulmonary resuscitation or external direct current countershock (defibrillation). Captain Waters of Jacksonville, Florida, states that "while they [EMTs] can carry out CPR, and have done so in a
number of cases, this method over a period of time usually results in progressive hypoxia and acidosis, and the chance of salvage declines steadily with delay in definitive treatment" (4, p.45). The same viewpoint is shared by Gearty, who states, "The risks from CPR are greater than those from defibrillation, and in primary ventricular fibrillation the chance of a successful outcome after massage is less. Because of the efficiency and safety of defibrillation in trained hands it is essential that all people coming into frequent contact with cases of cardiac arrest should be trained to recognize ventricular fibrillation and to perform external defibrillation. The ideal [best available] treatment for ventricular fibrillation is immediate external countershock" (5, p.34). In further support of defibrillation by EMTs is the fact that prolonged CPR is difficult to administer, and becomes even more difficult in a moving vehicle.

It has been shown that a high percentage of AMI patients may suffer atrioventricular (AV) block within one hour after the onset of symptoms (6, p.363). Pantridge states that "AV block may be corrected by atropine. The early administration of this drug to patients in their own homes may avert the need for more hazardous procedures later" (1, p.1097). The American Heart Association states, "The early use of positive inotropic (strengthening muscle contractility) or vasoactive drugs cannot be over-emphasized since the restoration of normal function in some instances is impossible without these agents.* Also required is the prompt administration of sodium bicarbonate to combat profound metabolic acidosis" (2). Lown and his associates have pointed out that arrhythmia deaths are usually preceded by easily recognized ECG patterns and therefore may be prevented in some cases by preventing the arrhythmia. The usual mechanism is the administration of the least amount of the most effective drug, and has been proven effective in 131 consecutive cases of AMI (7, p.162). The use of drugs is seen to be extremely important in the effective handling of cardiac emergencies.

* Vasoactive drugs influence the tone or caliber of blood vessels (11). Examples of vasoactive drugs are Epinephrine, Levarterenol (constricts), and Isoproterenol (dilates).
To fully complement medical opinion regarding emergency treatment of the AMI, the designer of an EMS must choose between levels (d), (e), or (f) in Table DD.2, since only these levels offer a defibrillator and drugs immediately to the patient. Of the three levels, level (f) which includes a physician as part of the ambulance crew is the oldest concept. Initially, a mobile coronary care unit (MCCU) was placed in operation in Belfast, Ireland, by Pantridge to evaluate the utility of such a unit. During the period from 1966 to 1969, the mortality rate of patients admitted to the hospital CCU through use of the MICU was 12.3 per cent whereas the mortality rate of patients admitted to the hospital CCU in the normal manner averaged 22.6 per cent (4). The mobile unit recorded no deaths during transport throughout this three year period. Statistics for a similar system operating in Newcastle upon Tyne, Great Britain are presented in Table DD.3 below (3, p.228).

<table>
<thead>
<tr>
<th>CATEGORY</th>
<th>NUMBER</th>
<th>PER CENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lives definitely saved</td>
<td>3</td>
<td>2.2%</td>
</tr>
<tr>
<td>Patients substantially improved by treatment</td>
<td>16</td>
<td>11.9%</td>
</tr>
<tr>
<td>Patients appreciably improved by treatment</td>
<td>20</td>
<td>14.8%</td>
</tr>
<tr>
<td>Patients already dead when MCCU arrived</td>
<td>12</td>
<td>8.9%</td>
</tr>
<tr>
<td>Patients who died at home despite treatment</td>
<td>9</td>
<td>6.7%</td>
</tr>
<tr>
<td>Patients whose prognosis was uninfluenced by MCCU</td>
<td>75</td>
<td>55.6%</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td>135</td>
<td>100.0%</td>
</tr>
</tbody>
</table>

Although a mobile coronary care unit staffed by a physician seems effective, it must be kept in mind that physicians are a scarce resource and might be more cost-effectively employed elsewhere in the health care delivery system. Mobile units similar to the Belfast, Ireland unit were later incorporated
into the EMS system in Columbus, Ohio, where it was later determined to drop the physician from the unit. Due to the increased response time of the MCCU, which needed to wait two or three minutes for a physician, the MCCU without the physician was determined to be more effective in saving lives.*

TELEMETRY

Most mobile cardiac units in use in the United States today are of level (e) which offers the same level of service as level (f) substituting radio telemetry for the actual presence of a physician.** Radio telemetry allows the transmission of diagnostic signs (usually ECGs) from the patient in or near the ambulance to the physician at another location. During the first year of operation, the level (e) system in Seattle, Washington performed as shown in Table DD.4 below (8).

TABLE DD.4  Performance of an MICU (Medic 1) in Seattle, Washington During the First Year of Operation.

<table>
<thead>
<tr>
<th>OUTCOME OF RUN</th>
<th>NUMBER</th>
<th>% OF TOTAL</th>
<th>% OF CARDIACS</th>
<th>% OF VFib</th>
</tr>
</thead>
<tbody>
<tr>
<td>I. No Cardiac Problem</td>
<td>1106</td>
<td>61</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>II. Cardiac Problem Found</td>
<td>707</td>
<td>39</td>
<td>100</td>
<td>0</td>
</tr>
<tr>
<td>A. No Ventricular Fibrillation</td>
<td>482</td>
<td>27</td>
<td>68</td>
<td>0</td>
</tr>
<tr>
<td>B. Ventricular Fibrillation Present</td>
<td>225</td>
<td>12</td>
<td>32</td>
<td>100</td>
</tr>
<tr>
<td>(1) Not Resuscitated</td>
<td>149</td>
<td>8</td>
<td>21</td>
<td>66</td>
</tr>
<tr>
<td>(2) Resuscitated</td>
<td>76</td>
<td>4</td>
<td>11</td>
<td>34</td>
</tr>
<tr>
<td>(a) Died Later</td>
<td>45</td>
<td>2</td>
<td>6</td>
<td>20</td>
</tr>
<tr>
<td>(b) Lived, Discharged</td>
<td>31</td>
<td>2</td>
<td>4</td>
<td>14</td>
</tr>
<tr>
<td>TOTAL RUNS</td>
<td>1813</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
</tbody>
</table>

* Personal interview between Oren L. Reinbolt, HSRC, and Robert Chase, Ohio State University, Department of Preventive Medicine, in Columbus, Ohio, on September 5, 1972.

** Examples include the EMS systems in such cities as Miami; Jacksonville; Houston; San Francisco; Seattle; Chicago; Pittsburgh; Hartford, Kansas City; and Grand Rapids.
Similar results have been reported by other cities offering level (e) service.

ALTERNATIVE TO TELEMETRY

Although the use of telemetry is popular and has reduced emergency fatalities, no clear argument exists as to why EMTs cannot perform the same functions without the use of telemetry described herein as level (d). Dr. Richard Lewis of Columbus, Ohio says, "The time required in transmission, finding a doctor to interpret the cardiogram, and returning instructions for therapy was too long for proper treatment of patients with cardiac arrest. We therefore have not made telemetry a requirement before initiating therapy. At the present, we use our telemeter system as a back-up for judgment cases ... I am convinced ... that paramedical personnel can be trained to treat cardiovascular emergencies as effectively as physicians."* It appears that in some cases, a telemetry system may do more harm than good for the cardiac emergency patient.

EVALUATION

The best solution seems to be to equip MICUs with telemetry equipment, but not depend upon telemetry when EMTs can perform routine procedures on their own. The majority of myocardial infarction patients exhibit strikingly similar symptoms and react predictably to common treatment procedures. There is no apparent reason, therefore, why trained EMTs can not administer common drugs, defibrillate, and stabilize the majority of AMI patients without the delays inherent in the use of telemetry. The use of a strip recorder (for ECGs) can insure the physician a record of actions taken by the EMT for further use. If the EMT needs consultation with a physician, the telemetry should be available for use as a tool, not a requirement.

* Personal correspondence from Dr. Richard Lewis, Director, Division of Cardiology, the Ohio State University, to Oren L. Reinbolt, HSRC, on August 14, 1972.
REFERENCES


APPENDIX EE

ANALYSIS OF 911

The 911 emergency telephone number, although much publicized, is of questionable value to the EMS system in metropolitan Atlanta and is not recommended at this time. This present appendix discusses the 911 concept emphasizing the deficiencies inherent in a 911 application to the recommended EMS system.
APPENDIX EE

ANALYSIS OF 911

The 911 telephone concept, although much publicized, is of questionable value to the EMS system in metropolitan Atlanta. Basically, the implementation of 911 should occur in any community only if the 911 telephone number is to serve fire, police, and emergency medical services. The need for a 911 implementation to serve all three emergency services derives from two facts:

1) A partial implementation, for example, to serve only EMS could result in citizens mistakenly calling 911 when in need of police or fire service, because of the widespread publicity which has been given 911 as the universal emergency number.

2) In some communities, including metropolitan Atlanta, because of the characteristics of installed telephone system hardware, a 911 implementation requires considerable modification to, or replacement of, telephone system hardware and is therefore quite expensive; if 911 is implemented to serve all three emergency services, then the cost of implementation is conceptually spread over the three services; this is not to say that the implementation of 911 for three services is less expensive but rather that more than one service would be benefiting from the implementation of 911, and at the same cost.

The above two facts are relevant to the installation of 911 in any metropolitan area. Several facts particular to a discussion of implementing 911 in metropolitan Atlanta need to be cited.

Metropolitan Atlanta consists of seven counties which contain a total of more than 50 municipalities. Serving the counties and municipalities are some 35 separate police departments (See Table 7.1).
Each of these 82 public service agencies at the present time has its own telephone number and receives calls at the agency's headquarters from citizens in need of police or fire assistance. The various agencies cooperate closely, although each agency does essentially maintain control over its resources and basically exists to serve the citizens of its own community.

The dispatch and control of the agencies' resources can be described as a decentralized process. That is, an agency, on receiving a call for emergency service from a citizen in the agency's own community, identifies the most appropriate set of resources to make the necessary response and then dispatches the resources to the emergency scene. If additional resources, beyond the agency's own capabilities, are required for the response, the agency requests assistance from a second agency in a nearby community. The second agency, on receiving the request to provide assistance, assesses its ability to assist, and if able, the second agency dispatches the resources needed to provide the requested assistance.

The above described mutual aid process is used by the fire and police services in metropolitan Atlanta. On the other hand, the system for delivering emergency medical services, as described in the presently proposed EMS plan for metropolitan Atlanta, is to employ a centralized dispatch and control process in order (1) to take advantage of equipment and personnel economies inherent in a centralized dispatch and control center versus a multitude of dispatch and control centers, (2) to minimize the delay between the receipt of a request for emergency medical service and the dispatch of appropriate resources, and (3) to facilitate the effective coordination of all emergency medical resources in the metropolitan Atlanta area. A detailed discussion of the rationale supporting the recommendation for centralized dispatch and control of emergency medical resources is presented in Chapter 7 of the present document.

Given that the EMS system is to include a centralized dispatch and control concept, the 911 telephone number could be implemented to serve the EMS system. However, given that other emergency
services dispatch and control their resources in a coordinated but decentralized manner, 911 can not, at the present time, be implemented to serve the various fire and police agencies unless one of two situations develops.

First, if fire and police service requests are routed to a central reception point and then rerouted to the appropriate county or municipal fire or police agency, 911 could be implemented. At the present time, such rerouting of emergency calls requires a manual intervention link in the call routing process in order to route the call to the appropriate agency. For several reasons, such an operational mode is generally unacceptable to the various agencies which would be affected, including the fact that each organization would experience added time delays in receiving calls.

The second situation, that would enable implementation of 911 for fire and police services in the seven county Atlanta area, requires either that all Atlanta area fire departments consolidate and that all Atlanta area police departments consolidate or that the fire and police departments at least agree to centralize the dispatch and control function for fire and police services. Since neither event is expected to occur, then 911 can not, at the present time, be implemented for fire and police services in metropolitan Atlanta.

The reader might be tempted to apply exactly the rationale for centralized EMS dispatch and control to the question of centralized versus decentralized dispatch and control of fire and police services. However, to translate directly the EMS rationale to fire and police services is to neglect a number of factors, discussion of which are beyond the scope of this present document.

Before concluding the present discussion of 911, comments on automatic call routing, cost of implementing 911, and the effectiveness of 911 are in order. A system of automatic call routing has been suggested as a possible technical solution to eliminate the previously mentioned manual intervention required to reroute emergency service requests made via 911. Such a system would enable the automatic (that is, without manual intervention) routing of 911 calls to the
appropriate county or municipality from which the call originates. However, the automatic call routing capability cannot be implemented throughout the metropolitan Atlanta area for several years, and ironically, the automatic routing system would prohibit the use of 911 for EMS while enabling the use of 911 for fire and police services.* This dilemma derives from the fact that, as already mentioned, municipal and county fire and police services operate in a decentralized manner while the EMS system proposed herein is designed to be coordinated through a regional (centralized) dispatch and control center (DCC) operated by the EMS Coordinating Agency described in Chapter 3. The automatic call routine capability, in enabling the automatic routing of 911 calls to the appropriate county or municipality, would then preclude the standard routing of 911 calls to the single location of the emergency medical services system DCC.

With regard to the cost of implementing 911 in metropolitan Atlanta, due to the fact that 51 telephone exchanges serve the seven counties and because of the configuration of the metropolitan telephone system, the cost of installing 911 throughout the Atlanta area would be quite high, even if the benefits of the implementation could be shared by EMS and fire and police services. An estimate of the cost to the community of installing 911 can be obtained from the Southern Bell Telephone Company. In any event, given the foregoing discussion, implementation of 911 for metropolitan Atlanta is not worthy of further discussion, regardless of cost considerations.

In conclusion, the installation of 911, given the above described circumstances, is not recommended for metropolitan Atlanta by the HSRC research staff. In all fairness, while the 911 concept has been accorded considerable celebrity and although the advantages of 911 appear to be self-evident, a limited search of the literature (1,2,3,4,5, 6,7,8) conducted by HSRC staff has not uncovered evidence to indicate that 911 as a mechanism for consumer entry into an EMS system is superior.

in effectiveness to other, more conventional mechanisms such as a well publicized, easy to remember standard telephone number, which is present and visible on all telephones.* Furthermore, Captain Waters, Director of the Jacksonville EMS system, has considered the implementation of 911 for Jacksonville and has, for the present at least, dismissed the idea.** It should be noted that Jacksonville and Duval County have a consolidated government, and police, fire, and emergency medical services are all under Captain Waters' direction; that is, the installation of 911 in Jacksonville was not prohibited by some of the problems which are particular to metropolitan Atlanta. Naturally, future developments of 911 should be monitored, and opportunities for a cost-justifiable implementation of 911 should be studied.

Based on the foregoing discussion and the analysis of EMS consumer entry concepts in Chapter 7 and Appendix M, a single, easy to remember, seven digit telephone number is recommended as the mechanism through which consumers can access the metropolitan Atlanta EMS system. Furthermore, the prominent posting of the EMS telephone number onto every telephone in the region is strongly recommended. The Southern Bell Telephone Company is urged to adopt a policy of having telephone installers place telephone number stickers onto each new and serviced telephone.

* Numbers in parentheses refer to references at the end of this appendix.

** Personal interview between Oren L. Reinbolt, HSRC, and Captain John M. Waters, Director of Public Safety, Jacksonville, Florida, on December 7, 1972.
REFERENCES


5. Emergency Telephone Communications Workshop (Summary of Proceedings), National Service to Regional Councils, Washington, D. C., Held in Omaha, Nebraska on December 16-17, 1970.


APPENDIX FF

ADVANCED TRAINING PROGRAM FOR
EMERGENCY MEDICAL TECHNICIANS--AMBULANCE

The recommended advanced training described in Chapter 6 specifies that EMT-A3's be trained to perform techniques recommended by the Department of Health, Education, and Welfare (HEW). The HEW publication referred to in Chapter 6 is reproduced in the present appendix.
ADVANCED TRAINING PROGRAM
FOR EMERGENCY
MEDICAL TECHNICIANS--
AMBULANCE

Guidelines and Recommendations prepared by the
Committee on Emergency Medical Services
and the
Subcommittee on Ambulance Services
Division of Medical Sciences
National Academy of Sciences
National Research Council

Joint financial support by the

U.S. DEPARTMENT OF TRANSPORTATION
National Highway Traffic Safety Administration

and the

U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
Public Health Service
Health Services and Mental Health Administration
Division of Emergency Health Services
5600 Fishers Lane, Rockville, Maryland  20852

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Committee on Emergency Medical Services

John M. Howard, M.D., Professor of Surgery, Hahnemann Medical College, Philadelphia, Pennsylvania, Chairman
William F. Bouzarth, M.D., Clinical Associate Professor of Neurosurgery, Temple University, Philadelphia, Pennsylvania
Walter W. Carroll, M.D., Associate Director, Joint Commission on Accreditation of Hospitals, Chicago, Illinois
Edwin L. Crosby, M.D., Director and Executive Vice President, American Hospital Association, Chicago, Illinois
Joseph D. Farrington, M.D., Orthopaedic Surgeon, Lakeland Medical Associates, Ltd., Woodruff, Wisconsin
William J. Grace, M.D., Professor of Clinical Medicine, New York University School of Medicine, New York City
William Haddon, Jr., M.D., President, Insurance Institute for Highway Safety, Washington, D.C.
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Peter Safar, M.D., Professor and Chairman, Department of Anesthesiology, University of Pittsburgh School of Medicine, Pittsburgh, Pennsylvania
John M. Waters, Jr., Chief Operating Officer and Executive Assistant to the Mayor, Jacksonville, Florida

Subcommittee on Ambulance Services

Joseph D. Farrington, M.D., Orthopaedic Surgeon, Lakeland Medical Associates, Ltd., Woodruff, Wisconsin, Chairman
Don M. Benson, M.D. (Capt. USAF, MC), USAF Hospital Carswell, Fort Worth, Texas
Richard C. Gaard, M.D., Head, Department of Anesthesia, North Memorial Hospital, Minneapolis, Minnesota
J. G. Fred Hiss, M.D., Clinical Professor of Medicine, Emeritus, State University of New York, Upstate Medical Center at Syracuse, Syracuse, New York
Kenneth F. Kimball, M.D., Assistant Professor of Surgery, University of Nebraska Medical Center, Kearney, Nebraska
Jack R. Liberator, R.N., Director, Administrative Services, Children's Hospital, Columbus, Ohio
Norman D. Logan, M.D., Instructor in Orthopaedic Surgery, University of Oregon Medical School, Portland, Oregon
Rocco V. Morando, State Consultant, Emergency & Rescue Squad Training; Vocational-Technical Education, The Ohio State University, Columbus, Ohio
J. Walter Schaefer, President, Schaefer's Ambulance Service, Los Angeles, California
Kenneth R. Thompson, Jr., President, Ambulance Association of America, Fort Worth, Texas
John M. Waters, Jr., Chief Operating Officer and Executive Assistant to the Mayor, Jacksonville, Florida

Staff

Sam F. Seeley, M.D., Division of Medical Sciences, National Research Council, Washington, D.C.
Clarence G. Johnson, Division of Emergency Health Services, Health Services and Mental Health Administration, Department of Health, Education, and Welfare, Bethesda, Maryland
INTRODUCTION

In 1968 the Committee on Emergency Medical Services of the National Academy of Sciences-National Research Council published recommendations and guidelines on the training of ambulance personnel. That report detailed the fundamentals of basic-level training and stressed the need for advanced training to qualify ambulance emergency medical technicians to carry out measures now applied by lay assistants in emergency departments or by medical corpsmen in combat areas.

NAS-NRC recommendations have been the basis on which the National Highway Traffic Safety Administration and the American College of Surgeons have formalized basic-level training courses for ambulance emergency medical technicians, both of which provide for 70-72 hr of didactic, classroom, practice, and demonstration sessions plus 10 hr of in-hospital observation and instruction. The basic-level training courses of many other organizations have been expanded to be in consonance with the above two courses, thus ensuring nationally uniform criteria on which to examine and certify proficiency for purposes of licensure.

A number of medical centers have independently established advanced-level training programs of several weeks or months. Some of these pilot programs have developed to the stage where graduates telemeter electrocardiographs and are authorized by physicians, through voice communication, to carry out defibrillation in selected cases. The curricula and the experience gained in the limited number of pilot courses have been reviewed by the NAS-NRC Committee on Emergency Medical Services and its Subcommittee on Ambulance Services, which now consider it timely to recommend nationally uniform guidelines for the advanced training of ambulance emergency medical technicians.

Certification of proficiency, as determined by examination on successful completion of the basic-level training program or its equivalent, is prerequisite to admission to the advanced course of training. Candidates for this course would include many experienced ambulance personnel and former military medical corpsmen as well as those graduating from the basic-level program and seeking a career in ambulance services.

Since trainees will have been indoctrinated and introduced to emergency medical care in the basic training program or its equiva-
lent, emphasis should be on developing greater proficiency in skills, especially life-saving emergency care, through advanced study in the basic sciences and management of life-threatening problems.

The training must be carried out in a medical facility capable of conducting this advanced emergency medical technician training program. If it is conducted in collaboration with a community or junior college or vocational school, the school must be closely affiliated, both geographically and organizationally, with the medical facility.

The program must be medically oriented and physician controlled. Allied health and lay instructors are necessary in many aspects of the program, and they should be particularly active in the demonstration and practice sessions.

There must be an academic atmosphere. Trainees must be in uniforms with a standard means of identification when engaged in patient care and clinical portions of the program.

Ideally there should be a full-time 3-month program. However, if a part-time course is necessary, it should be completed within a calendar year.

The program outlined below consists of a minimum of 480 hr of didactic, laboratory, clinical, and field instruction. Because stressful tasks are best performed instinctively, the program emphasizes repetitive trainee participation in real and simulated patient care and operational problems. Training aids, such as ambulance mockups, communication and dispatching facilities, animal laboratories, and mannequins are required. Reliance on written materials is reduced through maximal use of audiovisual aids. Major laboratory and field demonstrations may be recorded on film or video tape for later study.

Emergency care instruction should center on management of symptom complexes, rather than diagnosis of specific conditions. A procedure manual describing courses of action to be followed in caring for common conditions should be available.

The success of a learning experience depends to a great extent on the enthusiasm generated in trainees by their instructors. Therefore, instructors should be chosen with extreme care, and only those who radiate enthusiasm and confidence should be employed.

For each group of students rotating in clinical areas, one person should be specifically assigned and responsible for the bulk of instruction, grading, attendance recording, and disciplinary control.

Students must be indoctrinated in the need to solve future problems and constantly improve their performance by utilizing the resources of the community and those of allied professions, e.g.,
firefighting, law-enforcement, rescue, utilities, civil defense, and library personnel. The techniques for locating materials in books and periodicals must be learned.

Specific study outlines, assignments, and check lists of tasks completed should be provided for each student.

The nature of the program requires that applicants be carefully screened. Supervisors may wish to use traditional psychologic screening devices to help select candidates.

Mastery of the principles of emergency care, extrication, patient handling, use of equipment, and communication is the goal during the first portion of training. This training in classrooms and laboratories can be conducted in part in community or junior colleges or vocational schools. The daily study plan should call for initial presentation of material in a seminar, followed by a drill-practice period during which the students, working under the guidance of instructors, are required to carry out maneuvers and solve operational and patient care problems.

The role and limitations of the emergency medical technician in the delivery of emergency care should be discussed. The importance of acceptable appearance, deportment and a professional and reassuring attitude toward every patient must be emphasized. Frequent review, question, and evaluation sessions must be part of the program to ensure understanding and retention of material.

Experience has shown that open communication channels between each student and a staff member enhances the vitality of programs. The final session each day should be a "class meeting," during which criticism and comments are received and discussed, reassurance is offered, and assignments are made. The relevance of the previous material to the total program and its goals may have to be discussed.

The second portion of the program is spent during the periods of greatest activity in emergency and critical care areas of a hospital, including the emergency department; intensive care, coronary care, anesthetic, surgical, obstetric, and pediatric areas; recovery rooms; and the morgue. Autopsy experience is essential.

The program is concluded with a one-week period of review, field exercises, and examinations.

Each program should include a means of evaluating the proficiency of its graduates with a view to modifying the curriculum as may be necessary. The effect of advanced training on overall health care should be evaluated in terms of reduction of morbidity and mortality.
RECOMMENDED COURSE CONTENT

The advanced emergency medical technician—ambulance (EMT—A) candidate already has the educational foundation provided by basic EMT—A training. Much of his additional training will be repetition of basic anatomy, physiology, pharmacology, and bacteriology covered during the basic course, but with emphasis now directed to pathophysiologic changes and their correction, rather than symptom treatment. Practice in basic emergency care must be carried out until response is not only correct but instinctive.

Training is through classroom demonstration, laboratory experience, and actual patient care in the various areas of the hospital. Emphasis is on the anatomic and pathophysiologic basis of a disease process, reasons for the type of treatment rendered, how this treatment alters the disease process, and autopsy findings in instances where the patient does not survive.

In addition to the procedures that the student is authorized or directed by a physician to perform, he will observe and become familiar with many procedures now performed only by physicians. Life-saving procedures must be thoroughly learned by all students, whether or not local regulations would currently allow them to carry out such acts independently; men trained in one jurisdiction may well function in jurisdictions where laws regulating their activity are not so limiting. As more emergency medical technicians—ambulance are trained, as their capabilities are recognized, and as good ambulance-to-hospital communication develops, greater use of their skills under the direction of the physician will evolve.

The curriculum should include in-depth study of such caliber and extent as to qualify the emergency medical technician to carry out procedures now applied by allied health assistants under physician supervision in hospitals and by military medical corpsmen in combat areas.

Subjects of the curriculum are as follows:

1. Animal laboratory experience
   A. Signs, symptoms, correction of:
      1. Airway obstruction, asphyxia, hypoventilation, hypoxia
      2. Ventricular fibrillation, premature ventricular contractions, ventricular standstill
3. Pneumothorax
   a. Tension
   b. Open
   c. Simple (hazard of converting to tension pneumothorax by administering positive pressure ventilation)
4. Hemothorax
5. Cardiac tamponade

B. Expertise in:
   1. Endotracheal intubation
   2. Endotracheal suction
   3. Assisted and controlled ventilation
   4. Venipuncture

II. Classroom and laboratory
A. Anatomy—didactic, anatomy laboratory, morgue
B. Advanced physiology
   1. Normal
   2. Abnormal
      a. Hypoxia, asphyxia, hypoventilation, complications of oxygen inhalation, decompensated chronic obstructive lung disease
      b. Hypovolemia
      c. Shock
      d. Cranial injuries
      e. Drug overdose
      f. Burns
      g. Coronary occlusion or insufficiency
      h. Stroke
      i. Diabetes
      j. Drowning
      k. Electrocution
      l. Masked organ damage
C. Bacteriology—principles of infection, asepsis, decontamination
D. Pharmacology
   1. Acid base concepts
   2. Common resuscitative drugs, vasoactive agents, antiarrhythmics, alkalinizing agents, balanced electrolyte solutions, blood volume expanders
   3. Actions of and reactions to common drugs
   4. Contraindications for some drugs
E. Fluid volume—relationship to blood pressure, pulse rate, urine output

F. Use and interpretation of cardiac monitor—lead placement, use of lead pad, common artifacts

G. Defibrillation—associated equipment dangers

H. Hypodermic injections—as different from intravenous

I. Intravenous injections—syringe, tubing, needle sizes, dynamics of flow, site selection, volume indications and restrictions

J. Pacemakers

K. Sterile techniques

L. Isolation techniques

M. Use and maintenance of approved mechanical equipment

N. Common problems and pitfalls associated with the use of equipment (understanding of tank color coding, pin indexing, reducing yoke installation)

O. Unacceptable equipment and why—respirators, airways, etc.

P. Personnel management

Q. Logistics management

R. Concepts of coordinated disaster response

S. Protection—from noxious liquids and gases, radiation, mechanical and electric hazards

T. Communication techniques—radio, telephone, verbal and written reports, telemetry of physiologic data

U. Teaching techniques and methods—lecture, audiovisual, examinations

V. Principles of extrication and patient handling

III. Hospital departments—experience to be gained in:

A. Anesthesiology

1. Vital and diagnostic signs—recognition and significance

2. Airway control techniques in apneic and breathing patients, tracheal intubation, suctioning

3. Positive pressure ventilation devices—manual and mechanical

4. Injections—intravenous, intramuscular, subcutaneous

5. Intravenous fluids
6. Electrocardiogram and electroencephalogram patterns
7. Loss of protective reflexes
8. Management of unconscious patient

B. Recovery room
1. Management of unconscious patient
2. Respiratory care, including airway control, oxygenation, ventilation, airway humidification techniques
3. Vital and diagnostic signs
4. Central venous pressure monitoring concepts
5. Drainage systems—gastric, bladder, pleural
6. Nursing skills, such as transfer of patients with dressings and drains

C. Intensive care and coronary care
1. Monitors—cardioscope, others
2. Defibrillation
3. Pacemakers
4. Intravenous fluids and medications
5. Long-term ventilation problems, intermittent positive pressure breathing (IPPB), care and maintenance of equipment
6. Vital and diagnostic signs
7. Use of drugs
8. Electrocardiogram—basic patterns
9. Cardiopulmonary resuscitation
10. Equipment hazards
11. Electroencephalograph—brain death, possible organ donor
12. Fluid intake, output

D. Surgery
1. Sterile techniques
2. Anatomy and physiology
3. Wound care
4. Dressings

E. Orthopedics
1. Immobilization techniques
2. Wound care

F. Neurosurgery
1. Unconsciousness
2. Paralysis
3. Wound care
G. Obstetrics, nursery and pediatrics
1. Delivery and postdelivery care
   a. Placenta
   b. Hemorrhage
   c. Perineal damage
   d. Monitoring of fetal heart tones
2. Care of newborn
   a. Handling of the infant—head support, etc.
   b. Airway ventilation and oxygenation problems
   c. Umbilical cord
   d. Temperature control
   e. Cardiopulmonary resuscitation

H. Emergency department
1. Application of principles of emergency care
2. Critique for evaluation of good and poor emergency care at the scene with follow-up in hospital

IV. Morgue—Observation of autopsies for:
   A. Basic topographic anatomy
   B. Conditioning to open wounds, trauma
   C. Anatomic basis of endotracheal intubation
   D. Cause of death from trauma
   E. Complications of cardiac compression
   F. Fractures and associated injuries—emphasis on nerve and vessel damage

V. Practice in simulated and real emergencies
   A. Extrication—light, heavy
   B. Triage (sorting)
   C. Disaster exercises
   D. Group Management
   E. Stop-action demonstrations
   F. Ambulance design adaptation and future needs
   G. Ambulance maintenance—repair of equipment, use of common tools
   H. Transport over difficult terrain
I. Helicopter transportation
J. Water transportation
K. Review of patient care situations
L. Driving review—emergency driving, defensive driving
Program in Hospital and Medical Systems
Final Report and Evaluation

by
Harold E. Smalley (Program Director),
John W. Coyle, and Russell G. Overton

Developmental Training Grant D02 AH 01056
Bureau of Health Manpower Education
National Institutes of Health

Health Systems Research Center
Georgia Institute of Technology
Atlanta February 1973
SELECTED HSRC REPORTS

The present report and other publications of the Health Systems Research Center are available in either hard copy or microfilm from University Microfilms, 300 North Zeeb Road, Ann Arbor, Michigan 48106. When ordering a publication from the list below, refer to the appropriate Hospital Abstract number.

Program in Hospital and Medical Systems -- Final Report and Evaluation, USPHS Grant No. DO2 AH 01056, February 1973, 238 pp. (Hospital Abstract #10050 MN).

Fiscal Controls for Hospital Departments, Program Bulletin No. 7, USPHS Grant No. DO2 AH 01056-05, October 1972, 203 pp. (Hospital Abstract #09499 AC).

Volume I: Summary, 20 pp. (Hospital Abstract #RLO-7441)
Volume II: A Methodology for Evaluating the Radiographic Facilities Location-Allocation Problem, 223 pp. (Hospital Abstract #RLO-7442)
Volume IV, Part 1: A Short-Range Forecasting Model for Radiological Services, 60 pp. (Hospital Abstract #RLO-7444)
Volume IV, Part 2: Computer Simulation of Radiographic Operations, 71 pp. (Hospital Abstract #RLO-7445)
Volume IV, Part 3: A Procedure for Identifying Radiology Performance Goals and Criteria, 40 pp. (Hospital Abstract #RLO-7446)
Volume IV, Part 4: An Approach to Selecting a Preferred Alternative, 43 pp. (Hospital Abstract #RLO-7447)

Volume I: Project Summary, 58 pp. (Hospital Abstract #MRO-7741)
Volume II: State of the Art Review, 135 pp. (Hospital Abstract #MRO-7742)
Volume III: Methods Manual, 325 pp. (Hospital Abstract #MRO-7743)

The Planning of Clinical Facilities for Medical Education: A Systems Approach, Program Bulletin No. 6, USPHS Grant No. 2 DO2 AH 01056-04, August 1970, 349 pp. (Hospital Abstract #MD2-5900)


Disposable Versus Reprocessed Hospital Supplies, Final Report, USPHS Research Grant No. GN 5968, June 1964, 77 pp. (Hospital Abstract #45).
PROGRAM IN HOSPITAL AND MEDICAL SYSTEMS

FINAL REPORT AND EVALUATION

by

Harold E. Smalley, Ph.D. (Program Director)
John W. Coyle, M.S.
Russell G. Overton, B.I.E.

A Developmental Training Project
directed by the
Health Systems Research Center
in cooperation with the
School of Industrial and Systems Engineering
and the
Medical College of Georgia

This project was supported by training grants
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Education, National Institutes of Health.

Health Systems Research Center
Georgia Institute of Technology

Atlanta        February 1973
The present report contains the final report and evaluation of the Program in Hospital and Medical Systems (PHMS) which is a jointly administered training program of the Georgia Institute of Technology and the Medical College of Georgia. This innovative educational program has been supported by developmental training grants from the Bureau of Health Manpower Education of the National Institutes of Health. The original Developmental Training Grant AHP 7-15 was awarded for the period July 1, 1967 through June 30, 1970, and a renewal Developmental Training Grant D02 AH 01056 was awarded for the period July 1, 1970 through June 30, 1972.

Section I of this report is a SUMMARY OF THE PROGRAM IN HOSPITAL AND MEDICAL SYSTEMS during the period July 1, 1967 through June 30, 1972; Section II of this report contains the EVALUATION OF PHMS TRAINING; and Section III of this report is a SUMMARY OF PHMS ACTIVITIES AND DEVELOPMENT during the period January 1, 1971 through June 30, 1972. PHMS activities and developments during the period July 1, 1967 through December 31, 1970 have been reported in progress reports submitted previously to the Bureau of Health Manpower Education.

The general objective of the training project was to develop a unique educational program consisting of a new curriculum for the training of industrial engineers who were being prepared to enter the health field as a permanent career environment. Emphasis in this developmental program was primarily upon graduate education in health systems at the master's level, but attention was also given to health systems training at both the undergraduate and doctoral levels. The program also provided educational opportunities in interdisciplinary areas for students in other branches of engineering, physical science, management, computer science, architecture, and the health professions.

A direct outgrowth of health related education begun at Georgia Tech in 1958, the Program in Hospital and Medical Systems was formally initiated
in July, 1967 as a cooperative educational program of Georgia Tech and the Medical College. While the training grants have been concluded, the Program in Hospital and Medical Systems is to continue as a program of instruction at the Georgia Institute of Technology. PHMS sits as the senior, established component of an expanding set of health related curricula offered at Georgia Tech.

The successful development of this new educational program was due to the efforts of various individuals, institutions, and groups to whom credit is gratefully extended. To attempt to list the many people who made substantial contributions to PHMS is to risk omitting the names of some individuals. Nevertheless, important contributions were made to the project by the following persons on behalf of Georgia Tech and the Medical College.

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Jack R. Walker
John R. Watt
M. Linda Weatherly

Dr. Bloom has served as Associate Vice President for Academic Affairs at Georgia Tech, and his advice and counsel have been most valuable. Dr. Lehrer has served as Director of the School of Industrial and Systems Engineering at Georgia Tech, in which the majority of PHMS trainees were enrolled. Dr. Mathews served as Assistant Program Director of PHMS and had operational responsibility for PHMS activities at the Medical College. Dr. O'Rear, presently the Vice Chancellor for Health Affairs of the University System of the State of Georgia, was President of the Medical College of Georgia during the conception and development of PHMS, and in large measure, his support of the program made the cooperative relationship between Georgia Tech and the Medical College possible.
My sincere thanks are given to Mary Tarver and Lynn Weatherly for doing an outstanding job of typing this report under pressure of time and at considerable inconvenience to themselves and to Edward French and Nelson Sayford who also assisted in the preparation of the report.

Appreciation is extended to the administrators and staffs of the many hospitals and health organizations which provided sites for the fieldwork projects and work experiences in which PHMS students were involved. Our gratitude is also owed to the many seminar speakers, guest lecturers, and consultants who contributed their knowledge to PHMS.

In particular, our sincere appreciation is extended to the Allied Health Professions Branch, Division of Allied Health Manpower, Bureau of Health Manpower Education of the National Institutes of Health for its support of the development of PHMS and its faith in the concept of the new allied health resource, the health systems professional.

Harold E. Smalley, Program Director
Health Systems Research Center
Atlanta
February 28, 1973
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SECTION I

SUMMARY OF THE

PROGRAM IN HOSPITAL AND MEDICAL SYSTEMS

1 July 1967 through 30 June 1972
INTRODUCTION

The Program in Hospital and Medical Systems (PHMS) is a jointly administered training program of the Georgia Institute of Technology and the Medical College of Georgia. The purpose of the program is to provide educational opportunities in the new allied health professions field referred to as hospital and medical systems or, more simply, as health systems. Health systems is that field of study and practice aimed toward improving the delivery of health care services principally through the application of systems science, including industrial and systems engineering, operations research, and management science. Emphasis is upon systematic planning, engineering design, and scientific management in respect to health care facilities, manpower, and methods. Because of the complexity of health systems, the approach is typically interdisciplinary, often involving other branches of engineering, the physical and behavioral sciences, industrial management, information science, computer technology, architecture, and the various health sciences and professions.

PHMS was designed to meet educational needs within this new interdisciplinary field. The program principally emphasized expanding the scope of the functions traditionally performed by industrial engineers thereby creating a new health technologist who was trained to analyze, improve, and design systems for the delivery of health services to the public. Graduate education at the master's level was the principal focus of PHMS, although educational opportunities were also provided to students at the undergraduate and doctoral levels.

A direct outgrowth of health related education begun at Georgia Tech in 1958, the Program in Hospital and Medical Systems was formally initiated in July, 1967 as a cooperative educational program of Georgia Tech and the Medical College. This innovative, allied health educational program was supported by developmental training grants from the Bureau of Health Manpower Education, formerly the Bureau of Health Manpower, of the National Institutes of Health. The original Developmental Training Grant AHP 7-15 was awarded
for the period July 1, 1967 through June 30, 1970, and a renewal Developmental Training Grant D02 AH 01056 was awarded for the period July 1, 1970 through June 30, 1972. The renewal grant period was subsequently extended to December 31, 1972 to facilitate an evaluation of the training offered through PHMS. The evaluation and its results and conclusions are presented in Section II of the present report.

The PHMS educational objectives were achieved through a set of courses which are more fully described in following paragraphs. Basically, the courses included an orientation to the health system and health care delivery problems, instruction in the techniques of solving health care delivery problems, presentation of case studies which demonstrated the application of the techniques, and problem solution experiences. Additionally, the educational opportunities were enhanced by involving selected students in research and service projects of the Health Systems Research Center at Georgia Tech and of the Division of Health Systems Engineering (now the Division of Systems and Computer Services) at the Medical College.

While the training grants have been concluded, the Program in Hospital and Medical Systems is to continue as a program of instruction at the Georgia Institute of Technology. PHMS sits as the senior, established component of an expanding set of health related curricula offered at Georgia Tech. These curricula include the recently instituted, and PHMS spawned, B.S. degree program in health systems offered by the Health Systems Research Center (HSRC). A new M.S. degree program in health systems is presently being developed and is also to be offered by HSRC. A health facility design track, developed jointly by HSRC and Georgia Tech's School of Architecture, is to be offered as an option within the M.S. curriculum in architecture beginning in the Fall of 1973. And the School of Information and Computer Science implemented new M.S. and Ph.D. degree programs in biomedical information and computer science during 1972.

The following pages of Section I of the present report contain a summary of the objectives, principal activities, and features of the Program in Hospital and Medical Systems during the period July 1, 1967 through June 30, 1972. A detailed description of PHMS activities and accomplishments in the
period January 1, 1971 through June 30, 1972 is contained in Section III of the present report. PHMS activities during the period July 1, 1967 through December 31, 1970 have been reported in progress reports submitted previously to the Bureau of Health Manpower Education.
OBJECTIVES OF PHMS

The general objective of the training project was to develop a unique educational program consisting of a new curriculum for the training of industrial engineers who were being prepared to enter the health field as a permanent career environment. Emphasis in this developmental project was primarily upon graduate education in health systems at the master's level, but attention was also given to health systems training at both the undergraduate and doctoral levels. The project also provided educational opportunities in interdisciplinary areas for students in other branches of engineering, physical science, management, computer science, architecture, and the health professions.

Specific objectives of PHMS were originally stated as:

1. To generate and cultivate a source of industrial engineers who are both technically competent and health services oriented as an effective means of solving problems associated with the delivery of health services to the public, and to develop means of orienting industrial engineers to the hospital and medical environment.

2. To develop means of acquainting members of the health team with the philosophy, principles, approaches, and techniques of modern industrial engineering.

3. To promote the cause of allied health manpower by developing an educational program which interfaces engineering and management sciences with the health professions in interdisciplinary areas of study and practice.

During the course of developing PHMS, the above-listed specific objectives were expanded and refined to define more precisely the specific objectives and in recognition of increased emphasis to be given certain aspects of the program. A set of sub-objectives evolved and were first stated in the application for the renewal training grant submitted to the National Institutes of Health in 1970. These sub-objectives were:
1a. To consolidate the subject matter and to restructure the format of health related coursework, including the recent emphasis upon health service delivery problems.

1b. To accelerate thesis and dissertation work related to innovative health care delivery modes and community-wide health services in metropolitan Atlanta.

2a. To conduct seminars, workshops, short courses, conferences, and other educational programs which will acquaint physicians, dentists, nurses, hospital administrators, and allied health personnel (faculty, student, practitioner) with the systems approach to health service delivery.

2b. To further develop communications with the health professions (faculty, student, practitioner) through adjunct faculty arrangements, joint faculty appointments, guest lecture invitations, and collaboration in projects of mutual interest.

3a. To broaden the disciplinary mix of allied health manpower training by increasing the educational involvement of "non-health" fields such as architecture, information science, industrial management, psychology, and various branches of engineering and physical science.

3b. To develop cooperative arrangements and affiliations with other units of the University System of Georgia, with academic and health institutions in metropolitan Atlanta, and with health agencies throughout the State.
MAJOR EVENTS RELATED TO PHMS

Certain events which were of major significance in relation to the conception, implementation and overall development of PHMS, or which developed in substantial part from this health systems training program, occurred prior to and during the period of July 1, 1967 through June 30, 1972. These events are described in the following paragraphs.

August 1966 - The Hospital Management Systems Analyst Training Program (HMSATP) was concluded at the Georgia Institute of Technology. An experimental program for training selected hospital personnel to become management systems analysts, HMSATP was funded by a grant from the W. K. Kellogg Foundation and was conducted by the Hospital Systems Research Group (HSRG) of the School of Industrial Engineering at Georgia Tech in cooperation with the Georgia Hospital Association and the Metropolitan Atlanta Hospital Council.

The general objective of HMSATP was the establishment of a useful body of knowledge in respect to the analyst approach to management systems improvement. The program was concerned with methodologies for training analysts and for developing permanent analyst programs in hospitals. The approach employed in HMSATP included selection of a trainee from each of the participating hospitals, intensive academic instruction of the trainee in the basic principles of industrial engineering followed by an on-the-job preceptorship, and assistance to each hospital in establishing a permanent management systems function.

The experiences of the HSRG faculty and staff in HMSATP were instrumental in the identification of a need for further innovative experiments in training analysts who would be both technically competent and health services oriented. The HMSATP experiences, combined with other health related instructional experiences of the HSRG faculty at Georgia Tech since 1958, led directly to the development of PHMS.
July 1967 - On July 1, 1967, the Program in Hospital and Medical Systems was established at the Georgia Institute of Technology and the Medical College of Georgia with the assistance of a three year developmental training grant awarded by the Bureau of Health Manpower of the National Institutes of Health (Grant AHP 7-15). Cooperative arrangements were established at both educational institutions such that the organizational PHMS was administered through the School of Industrial Engineering (subsequently renamed School of Industrial and Systems Engineering) at Georgia Tech and through the office of the president at the Medical College. The original training grant was continued over a three year period (Grant No.'s AHP 7-15A-67, AHP 7-15B-68, and AHP 7-15C-69) and expired June 30, 1970.

July 1968 - The Medical College component of PHMS was given departmental status within the Medical College on July 1, 1968. The Assistant Director of PHMS was appointed to the academic rank of assistant professor and two other Augusta based PHMS staff members were given faculty status at the Medical College. In addition to the continuing performance of the PHMS educational activities in Augusta, the new department was given responsibility for all systems projects on the Medical College campus. Also, in July 1968, a two year Traineeship Grant EH 69-660 was awarded by the Bureau of Health Manpower of the National Institutes of Health to provide stipends, dependency allowances, tuition, and fees for four PHMS trainees at the master's level. Appendix J of the present report contains a more detailed description of the traineeship grant and the students and their activities which were supported by the grant funds.

September 1969 - The Health Systems Research Center (HSRC) was established as an independent division of Georgia Tech by the Regents of the University System of Georgia on September 1, 1969, thereby separating the organizational PHMS from the School of Industrial and Systems Engineering. HSRC was created as an interdisciplinary and interinstitutional program of health related research, education, and service and was an outgrowth of PHMS. Functioning as an independent division of Georgia Tech, HSRC provided campus-wide leadership for the growth and development of interdepartmental health systems education, research, and service programs; and through
cooperative relationships and joint faculty appointments with the various schools of instruction, HSRC engaged in educational programs which offered its trainees opportunities to pursue academic work leading to both undergraduate and graduate degrees in various branches of engineering, sciences, and management.

July 1970 - Continued support for PHMS during the period July 1, 1970 through June 30, 1972 was provided by the Bureau of Health Manpower Education (formerly the Bureau of Health Manpower) of the National Institutes of Health through a two year renewal Developmental Training Grant D02 AH 01056 awarded on July 1, 1970.

September 1970 - On September 1, 1970, the Medical College component of PHMS was designated as the Division of Health Systems Engineering (DHSE) reporting organizationally to the President of the Medical College. DHSE, as an affiliated component of the Health Systems Research Center, continued PHMS educational activities and developed new programs of health systems education for orienting medical professionals and students in the medical professions to the philosophy, principles, approaches, and techniques of industrial engineering. Also, the new division continued to provide systems engineering services to the School of Dentistry, the School of Medicine, the Eugene Talmadge Memorial Hospital, and other units of the Medical College.

April 1972 - Beginning on April 1, 1972, the Health Systems Research Center in cooperation with the Georgia Hospital Association (GHA) has implemented a new service program to provide systems improvement services to the member institutions of GHA. The purposes of this community outreach program included establishing an additional mechanism for complementing and augmenting the HSRC programs of health systems education including PHMS.

This service program, referred to as Project SIS, provides new opportunities for student involvement in health systems projects. Also, Project SIS promotes cooperative arrangements for developing sites for student practicums and externships whereby health systems majors are to receive on-the-job training under the direction of an HSRC faculty member or a preceptor in a cooperating institution.
As a means of acquainting members of the health team with the philosophy and practice of modern industrial engineering, courses are offered through Project SIS to the staffs of participating hospitals. These courses include an orientation to hospital systems improvement and training in the application of management and systems engineering to the solution of hospital systems problems.

On April 25, 1972, HSRC received notification of a five year Special Project Grant awarded by the Bureau of Health Manpower Education of the National Institutes of Health to plan, establish, and develop new health systems credit education curricula to prepare Georgia Tech students for careers as health systems practitioners. The first of these curricula is a basic curriculum for training health systems analysts as practitioners in hospitals and in other health service organizations and leads to the Bachelor of Science degree. The second is a sequence of courses plus field training that will comprise a health systems option for undergraduate students in various engineering, science, and management curricula at Georgia Tech. And, the third curriculum is for advanced training, retraining, and continuing education to prepare system-type graduates as practitioners in the more complex health care environments or as supervisors of analysts, or to prepare graduates with diverse backgrounds as health planners, and this curriculum leads to the Master of Science degree. This new health systems education program, referred to as the Program in Health Systems, is a direct derivative of PHMS, and the features of this new program are based on the lessons learned by the HSRC faculty in PHMS.
FEATURES OF PHMS

The Program in Hospital and Medical Systems was primarily concerned with the training of industrial engineers at the master's level for careers in the health field through a program of formal coursework for academic credit. The coursework included classroom or lecture-type courses and fieldwork or project-type courses including thesis research. The formal coursework was augmented through professionally supervised, health service experiences at the Health Systems Research Center (HSRC) of Georgia Tech in Atlanta and at the Division of Health Systems Engineering (DHSE) at the Medical College in Augusta. As a further means of augmenting the training of PHMS students and of enriching the overall program, an active seminar series was instituted on both the Atlanta and the Augusta campuses.

In addition to the training of master's level industrial engineering students, PHMS was expanded to include students both working toward the bachelor's and doctoral degrees. Particularly, in recognition of the need for future teachers and researchers in this new allied health field, some of the master's graduates were encouraged to continue their graduate studies and pursue the Ph.D. degree. Such doctoral students, while adhering to all requirements for the Ph.D. degree, took the health oriented courses and did doctoral research on a health service problem. Also, doctoral students in PHMS were expected to gain some teaching experience and to engage in some professional practice in a health service institution.

As PHMS evolved, students in disciplines other than industrial engineering were encouraged to participate in PHMS in order to encourage the interdisciplinary development of this new allied health manpower which is often confronted with problems requiring the skills of more than one discipline. Students in business, computer science, architecture, industrial management, and other areas of study were brought into PHMS in increasing numbers as the program developed.
The more significant features of PHMS are described in the following paragraphs.

PHMS TRAINEES

The designation PHMS trainee was used to refer to a matriculated student who was pursuing a degree (undergraduate, master’s, or doctoral) in one of the several cooperating schools of instruction at Georgia Tech or other academic institutions and who affiliated with HSRC in order to emphasize health systems in his program of study. PHMS trainees took a number of the PHMS courses in a coordinated program of study and/or were substantially involved in health related work experiences through participation in research and service projects. The following were types of PHMS trainees.

_Undergraduate_ -- Majors in industrial and systems engineering (or other professional curricula at Georgia Tech) who wished to emphasize health systems in their electives.

_Master's_ -- Graduate students who worked toward either the undesignated or designated master’s degree at Georgia Tech, with a major in health systems.

_Doctoral_ -- Advanced graduate students who worked toward the Ph.D. degree in industrial and systems engineering, operations research, management science, or a similar technical field at Georgia Tech, with a major in health systems.

_Special_ -- Students in any of the previous categories who were enrolled at an institution other than Georgia Tech but who were actively involved in HSRC programs.

Some PHMS trainees provided their own financial support; some were supported by HSRC and DHSE through student assistantships, graduate research or teaching assistantships, or part-time staff positions; others were supported by scholarships from cooperating hospitals, associations, foundations, or private firms; and still others were supported by fellowships or traineeships provided by NIH, NCHSRD, NASA, NSF, or NDEA.
TRAINEESHIPS AND FELLOWSHIPS

On July 1, 1968, the Bureau of Health Manpower of the National Institutes of Health awarded Traineeship Grant EH 69-660 for a one year period to provide stipends, dependency allowances, tuition, and fees for qualifying PHMS trainees at the master's level. A second year award, Traineeship Grant 5 A10 AH 00660, was made by the same agency to continue the support during the period July 1, 1969 through June 30, 1970. In addition, two trainees were awarded fellowships as individuals through Direct Fellowship Awards 69-171 and 5 P01 HS45475 from the United States Public Health Service. Five PHMS trainees received financial support under Traineeship Grant EH 69-660, and four trainees received financial support through Traineeship Grant 5 A10 AH 00660.

A list of the PHMS trainees, who received traineeships and fellowships, and the trainees' academic accomplishments through February 1971 is contained in Appendix J of the present report.

PHMS COURSEWORK

The principal mechanism for didactic instruction in PHMS has been a three course sequence of core courses in hospital and medical systems:

ISyE 418, Industrial Engineering in Hospitals.
ISyE 665, Case Studies in Hospital Management Systems.
ISyE 765, Projects in Hospital Management Systems.

The main purposes of this sequence have been to provide a health service orientation to industrial engineering and other students and to develop their knowledge and skills in applying systems techniques to health service problems. Catalog descriptions of these courses are given in Appendix A of the present report.

The first course in this sequence, ISyE 418, has been offered as an undergraduate elective since 1965 and has been approved for graduate credit. The course syllabus originally was limited to a study of hospital management systems and the means by which such systems may be improved through the application of industrial engineering principles and techniques, based upon material in the first ten chapters of the text, "Hospital Industrial Engineering," by Smalley.
and Freeman. The syllabus has been broadened to include consideration of the total health field and the various areas within that field where health oriented industrial engineers may make significant contributions. New topic areas include health insurance, relevant federal legislation, the role of regulatory agencies, community health planning, urban problems, and cooperative multi-hospital systems programs.

The second course in the sequence, ISyE 665, has been offered to graduate students since 1967. Building upon an appreciation of industrial engineering in hospitals, this course is concerned with a variety of problems facing hospital management and with industrial engineering techniques useful in increasing systems productivity and improving managerial decisions. The major purpose is to demonstrate approaches, methods, and attainable results in actual hospital situations. Through the medium of case studies, a broad range of industrial engineering topics is covered, cases coming from Chapters 11-26 of the course text, "Hospital Industrial Engineering," from other publications, and from the reports of practicing hospital industrial engineers.

The third course in the sequence, ISyE 765, is available to PHMS graduate students in each of the four quarters of the school year. Research, education, and operational projects are carried out by individual students under faculty supervision in actual hospital situations, both in Atlanta and in Augusta. Emphasis is placed upon unusual applications of the principles and approaches of industrial engineering to the study of complex hospital management systems, and results are reported formally in written form.

PHMS has also utilized undergraduate and graduate special problems courses (ISyE 491,2,3 - Special Problems and ISyE 704,5,6 - Special Problems in Industrial Engineering) for health systems training. PHMS doctoral trainees and thesis-option master's trainees were required to select a health related thesis or dissertation topic and were aided by PHMS faculty who served in advisory capacities. (PHMS thesis and dissertation work was normally completed under ISyE 700 - Master's Thesis and ISyE 800 - Doctor's Thesis.)

PHMS SEMINAR AND GUEST LECTURE PROGRAMS

One of the more significant of the PHMS non-credit educational activities has been the PHMS seminar program. The seminars have offered PHMS students
and faculty the opportunity to learn about recent health field activities and developments from various health field professionals. Another benefit of the seminar program has been to acquaint members of the health team (physicians, nurses, hospital administrators, and so forth) with health oriented applications of industrial engineering.

The interdisciplinary cooperation and collaborative philosophy which served as the basis for the seminar program was also evident in the program of guest lectures whereby PHMS faculty members presented lectures to classes of other programs such as the Program in Health Administration at Georgia State University. Additionally, faculty from the other programs presented guest lectures to PHMS classes. A listing of seminars and guest lectures presented during the period January 1, 1971 through June 30, 1972 is in Section III of the present report, and a complete listing of the seminars and guest lectures presented from July 1, 1967 to June 30, 1972 is given in Appendix I.

**TRAIENEES' INVOLVEMENT IN SERVICE PROJECTS**

Consistent with the purposes and objectives of PHMS, trainees have been involved in health related work experiences through participation in service projects of HSRC at Georgia Tech and of DHSE at the Medical College. Under the supervision of professional health systems practitioners, PHMS trainees have been engaged in a wide variety of service projects in several Atlanta area hospitals with whom PHMS has developed cooperative relationships and in service projects conducted by DHSE for the several schools within MCG and for the Eugene Talmadge Memorial Hospital, clinical teaching unit of the Medical College.

Over the years, students based in Atlanta have participated in service projects conducted principally at South Fulton Hospital, Holy Family Hospital, and Crawford W. Long Memorial Hospital. Additionally, some students have been engaged in service activities at Central State Hospital in Milledgeville, Georgia. With the advent of the new state-wide, HSRC service program, Project SIS, a broad range of service project opportunities has been made available to provide health related work experiences for PHMS students.
Since the inception of PHMS, trainees have had the opportunity to participate in systems engineering and planning projects conducted by DHSE at the Medical College. DHSE projects have included studies of the drug distribution system and the charge and billing procedures at Talmadge Hospital; the support systems of the School of Medicine at MCG; dental manpower requirements for the State of Georgia conducted for the School of Dentistry at MCG. Trainees at DHSE have also been involved in the planning and designing of new clinical facilities for the Medical College.

**TRAINEES' INVOLVEMENT IN RESEARCH PROJECTS**

During the period July 1, 1967 through June 30, 1972, PHMS trainees have had numerous opportunities to participate in several sponsored projects. These projects have been:

"Analysis of Optimal Radiographic Location Networks," supported by Grant No. HS 00179 from the National Center for Health Services Research and Development, 1969-1971.


"Design of Stephens County Health Maintenance Facility," supported by a contract from the Georgia Regional Medical Program, 1971.

"The Efficacy of Various Beverages as Athletes' Replacement Fluid," supported by a grant from Coca Cola USA, 1970-1971.

"Quantitative Methods for Evaluating Hospital Designs," supported by a Grant No. HM 00529 from the National Center for Health Services Research and Development, 1967-1969.

PHMS trainees have been deeply involved in each of the above listed projects.

**COOPERATIVE RELATIONSHIPS**

An objective of PHMS which was of importance to the overall development of the training program was developing and fostering cooperative relationships with other academic and health institutions. During the first five years of PHMS and particularly after HSRC was established, many of these relationships were developed and strengthened. These successful relationships were indicative of the academic and health communities' recognition and acceptance of PHMS and the health systems manpower resource.
Among those institutions and agencies with which intensive cooperative relationships were established were the Georgia Hospital Association, the Medical Association of Georgia, several county medical societies, numerous hospitals in Atlanta and Georgia, the Georgia Regional Medical Program, the metropolitan Atlanta 314(b) health planning agency, the Program in Health Administration and the School of Allied Health Sciences of Georgia State University and various academic units at Georgia Tech, particularly the School of Industrial and Systems Engineering, the School of Architecture, and those units which have recently established health related educational programs of their own. Most significantly, PHMS served as the unifying link between Georgia Tech and the Medical College.

Important, growing collaborative arrangements have also been established between HSRC and several offices of the Division of Physical Health and the Division of Mental Health of the Georgia Department of Human Resources, the Region IV office of the USPHS, Emory University School of Medicine, the University of Georgia, Atlanta University Center, several county health departments, the local chapter of the American Red Cross, and the Georgia Heart Association.

These relationships have germinated principally from the participation of HSRC faculty on various committees and ad hoc bodies of the above listed agencies and through joint faculty appointments for several HSRC faculty members with other academic units of Georgia Tech and the other institutions of the University System of the State of Georgia.

STUDENTS IN PHMS

As indicated by the objectives of the training program, PHMS was conceived and implemented as a graduate education program involving only students of the School of Industrial and Systems Engineering of Georgia Tech. However, as the program developed, and especially in the latter years, PHMS experienced an increasing demand from students of various other disciplines and undergraduates for health related educational experiences. Thus, by the end of the project period, PHMS had involved undergraduate students from eight other disciplines at Georgia Tech (Architecture, Biology, Chemistry, Chemical Engineering, Electrical
Engineering, Industrial Management, Mechanical Engineering, and Psychology), graduate students from two other disciplines at Georgia Tech (the College of Industrial Management and the School of Information and Computer Science), and also students from other institutions such as the Medical College of Georgia, Georgia State University, Augusta College, and Clemson University.

More than 300 students were exposed to health related educational experiences through the Program in Hospital and Medical Systems. Most of the students were involved in PHMS by taking only one course or through some form of relatively incidental involvement in the range of research and service project experiences. Some of these more than 300 students, however, took advantage of the educational experiences available through PHMS to a substantial degree, and these students were designated PHMS trainees. In fact, 65 of the students involved in PHMS were finally so designated as of June 30, 1972.

In Tables 10, 11, and 12 in Section III of the present report, summary academic information on the 65 PHMS trainees is presented. Thirty-two master's trainees are listed in Table 10, 13 doctoral trainees are listed in Table 11, and 26 undergraduate trainees are listed in Table 12 for a total of 71 trainees. Seventy-one trainees have been listed in the three tables, but two of these students have withdrawn from the program and four of the students have been both undergraduate and master's trainees. Hence, a net total of 65 individuals are referred to as being PHMS trainees. The vast majority (52) of the trainees were students in the School of Industrial and Systems Engineering at Georgia Tech as shown in Tables 10, 11, and 12. Four trainees each were enrolled in industrial management and business administration curricula; three trainees were students in the School of Information and Computer Science. One trainee was enrolled in a chemical engineering degree program, and one trainee was a student in the School of Architecture.

Although undergraduate trainees were not originally intended to be an official part of the program, undergraduates were utilized productively on a variety of health related projects and became recognized as a significant source of health systems manpower. For instance, four of these students subsequently entered the PHMS master's program and several others were employed in health systems positions following graduation.
As noted previously, more than 300 students were exposed to health related educational experiences through PHMS; the majority of these students were undergraduates who completed only the introductory course, ISyE 418, of the basic three course health systems sequence. Particularly noteworthy among this group of 300 plus students were undergraduates in the Georgia Tech School of Architecture. These architecture students were interested in possible careers in the design of hospitals and other types of health facilities, and many of these students subsequently were involved in health facility designs in architectural design courses, which were directed by a member of the Architecture faculty with a particular interest in the design of health facilities. Faculty of HSRC have frequently contributed guidance to the students in the course of their design projects and normally sat on the review panels and juries which critiqued the designs. One member of the HSRC faculty has had a joint appointment with the School of Architecture, and a promising new direction for health systems education at Georgia Tech is a health facility design track being developed jointly by HSRC and School of Architecture faculty and to be offered as an option within the M.S. curriculum in architecture.
LESSONS FROM PHMS

The development of PHMS during the first five years of the program proceeded, for the most part, according to plan. However, the HSRC faculty itself learned a number of lessons principally based on the faculty's perception of apparent student needs, the students' expressions of their own desires, and the manpower needs of the health field. These lessons derived from several developments which were largely unpredicted and which had a significant effect on the overall process of developing PHMS.

The two individual developments which contributed most to the lessons learned by the HSRC faculty were the increasing undergraduate interest in health related educational experiences and the interdisciplinary nature of the demand for PHMS coursework. Complementing the unexpected high level of undergraduate interest in the program was the seeming need of health service institutions for health systems manpower with bachelor's level training.

Additionally, through contact with the PHMS students, particularly the trainees, the faculty has perceived the existence of a relationship between a student's commitment to the health field during his education and the quality of the student's subsequent contributions as a health systems practitioner. Although the existence of such a relationship is well known in many, if not all, fields and while having no formula for testing a student's commitment, the HSRC faculty feels compelled to point out explicitly the existence of the phenomenon so other faculties, which may be planning to establish health systems education programs, may at least consider the relationship in developing their own programs.

The correctness of these lessons are largely verified by the conclusions drawn from the recently completed evaluation of PHMS training, which evaluation is included as Section II of the present report. Further discussion of these lessons and the manner in which the lessons have contributed to the present and planned programs of health systems education at Georgia Tech are discussed in the paragraphs which follow.

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REDESIGN AND RESTRUCTURE OF PHMS

Since PHMS was conceived and implemented as a graduate industrial engineering program, undergraduate and interdisciplinary influences were not directly compatible with the original philosophy upon which the training program was based. Rather than ignore these factors, however, PHMS was restructured and courses were redesigned in order to accommodate the new demands. Industrial and systems engineering remained as the academic core of the program, and ISyE students continued to comprise the majority of the PHMS trainees.

Generally, the content of the PHMS core courses was broadened in scope, and PHMS practical experiences, acquired by students through their involvement in research and service projects, became interdisciplinary in nature and approach. Particularly, the character of ISyE 418, in which so many students from other disciplines enrolled, was changed over the years to accommodate to some degree the interests and needs of these other students. Originally, ISyE 418 was intended to be an introduction for industrial engineering students to the hospital and the application of industrial engineering techniques to the solution of health field problems, principally those problems existing in the hospital. When the demand for health systems education by students from other disciplines became evident, ISyE 418 was reoriented to include some basic instruction in industrial engineering techniques. Also, the topical coverage of the health field in ISyE 418 was broadened to include more non-hospital aspects of the health field.

Undergraduate interest in ISyE 418 was found to be representative of an increasing undergraduate interest in the health care field. Many of these students expressed a desire for more undergraduate health related coursework and training experiences. As previously mentioned, PHMS eventually did allow undergraduates to become trainees and provided field training for many of these students.

COMMITMENT OF PHMS STUDENTS

Dr. Allan Blackman of the Department of Health Services, University of Washington, in recently commenting on the evaluation of graduate programs in
comprehensive health planning has stated:

One measure of success of a graduate program is the quality and commitment of the students it recruits. The character of recruits probably plays a more important role in their future effectiveness and success than does the content of their graduate training.*

Dr. Blackman's statement applies to the PHMS experience. Those trainees who themselves did the most to further the development of the training program are also those individuals who have displayed the strongest commitment to the health systems field as a career environment and are also the individuals who have subsequently attained a high degree of success as systems professionals within the health field.

The trainees who entered the program, especially in the initial years, with a strong health field commitment, and with a full understanding of the newness of the health systems field and the developmental nature of the program, were individuals of exceptional character. These trainees were, in part, mavericks and were determined in their efforts to obtain the most from the PHMS educational experiences and to help develop the training project via their suggestions and continuing interest even after graduation. The contributions to the improvement of health care delivery that have already been made by these former trainees exemplify the quality and commitment of these individuals.

* Blackman, Allan, "The Evaluation of Graduate Programs in Comprehensive Health Planning: Some Suggestions," Program Notes, Association of University Programs in Hospital Administration, December 1972, No. 5, p. 34.
LEGACY OF PHMS

The Program in Hospital and Medical Systems has been a rich experience for the Georgia Institute of Technology, for the Medical College of Georgia, and indeed for health systems education programs throughout the nation. PHMS continues as an established program of health systems education principally designed for graduate students in the School of Industrial and Systems Engineering. Additionally, several new health systems programs are being established at Georgia Tech including three new curricula being offered by HSRC.

The School of Information and Computer Science, in cooperation with the Emory University School of Medicine has implemented new M.S. and Ph.D. degree programs in biomedical information and computer science during 1972. Faculty and student interest in the health field has been stimulated in several other academic units of Georgia Tech. Students in the College of Industrial Management, the several engineering schools of the Institute, and the School of Architecture now routinely elect to work on various health field projects in their project-type courses and frequently call upon the resources of the Health Systems Research Center for assistance. The faculty of the Institute demonstrates continually growing interest in the health field as a research environment. At the Medical College of Georgia, the faculty of the Division of Health Systems Engineering is actively teaching an expanding set of health systems courses to health professions students in the various schools in addition to providing work experiences and thesis guidance to PHMS trainees.

Some former PHMS trainees have taken faculty positions at other universities and have initiated new programs of health systems education, research, and service at these institutions. In at least one instance, a former trainee has taken the philosophies and approaches developed at Georgia Tech abroad and has developed a burgeoning health systems program within an industrial engineering curriculum in Mexico. Other trainees have carried health systems concepts to established programs in hospital or health administration thereby enriching those programs by providing a new dimension to the hospital and health administration curricula.
To at least some degree, health systems education at Georgia Tech, particularly PHMS, has served as the stimulus for creating new programs in health systems education at universities around the nation. Judging from the volume of inquiries received from other institutions seeking advice on establishing such programs, PHMS has been accorded considerable notice as an innovative, precursor mechanism for producing the new allied health resource which is necessary if the system for delivering health care is to be improved.

FUTURE PLANS FOR PHMS

PHMS is to be continued as a program of primarily graduate instruction at the Georgia Institute of Technology. In cooperation with the School of Industrial and Systems Engineering, the faculty of the Health Systems Research Center is to continue to play the major role in providing instruction to PHMS students in the application of industrial engineering to health service delivery problems. The vehicles of instruction are to continue primarily to be ISyE 418, 665, and 765 combined with work experiences provided to the students in research and service projects conducted by HSRC. In addition, various special problem and project courses, principally ISyE 491, 2, 3 and ISyE 704, 5, 6, plus master's thesis and doctoral dissertation courses also are to continue to be utilized as mechanisms for providing health related industrial engineering education.

Certain modifications to the PHMS core courses are scheduled to be made in 1973. ISyE 418, which has principally included an orientation to the health system and instruction in the techniques of solving health system problems, is to be redesigned to include essentially the case study material which has been presented in ISyE 665. New, advanced case study material, drawn from the literature and also from HSRC staff experiences in recent research and service projects, are to be incorporated in ISyE 665.

The impetus for these modifications to the PHMS courses derives from the wealth of newly reported health systems applications reported in the literature combined with the establishment at Georgia Tech of the new Program in Health Systems curricula which include a set of courses giving comprehensive coverage of the many facets of the health field and presenting instruction in the full range of health systems techniques.
ESTABLISHMENT OF THE PROGRAM IN HEALTH SYSTEMS

The overall success of the PHMS, the increasing student interest in and broadly based demand for health related educational experiences, the professional accomplishments and recognition of PHMS graduates, and the realization that the needs for health systems manpower exceed the capability of PHMS and similar graduate level programs eventually caused the Health Systems Research Center to begin structuring plans in the latter part of 1971 for both an undergraduate health systems curriculum and a new graduate health systems curriculum. The plans also included the development of several new health systems tracks to be offered as options within other curricula at Georgia Tech for students adapting their degree plans to health field needs. Based upon the PHMS experience, the plans included greatly expanded programs of health systems coursework for bachelor's and master's students.

The new B.S. degree program in health systems has been developed and initiated by HSRC at Georgia Tech, and initial student response to the course offerings, based on actual student registrations for the Winter Quarter 1973 and preregistration of students for the Spring Quarter 1973, has exceeded faculty estimates by a factor of two. Furthermore, in the first two months of the new B.S. curriculum, 12 students have enrolled as health systems majors thereby auguring that the originally projected first year enrollment of 25 health systems majors may be exceeded. A unique feature of the new B.S. curriculum is the senior year practicum or externship whereby health systems majors will receive on-the-job training in a local hospital or with a cooperating institution such as the Medical College of Georgia.

As previously mentioned, the Georgia Tech School of Architecture and HSRC are presently cooperating on the development of a new health facility design track for the M.S. degree in architecture. This degree option in architecture is the second such health systems track developed at Georgia Tech, PHMS itself being the first. Discussions with one other academic unit of the Institute are presently concerned with yet another new health systems option for an established degree program. Also, HSRC is working with the Southern Technical Institute, a unit of the Georgia Tech College of Engineering offering two and four year engineering technology programs, on the development of several possibilities for health systems options within the Southern Tech curricula.
The new Program in Health Systems is also to include a new M.S. curriculum which is presently under development. The M.S. degree program is to offer graduate level education to prepare health systems and related students for the more complex kinds of health systems work, including community health planning.

The Program in Health Systems is being developed and implemented with the assistance of Special Project Grant 1D12 AM00242 awarded by the Bureau of Health Manpower Education of the National Institutes of Health for a five year period.
CONCLUSION

The Program in Hospital and Medical Systems can be assessed as having been a successful program. An evaluation of the PHMS training is presented in Section II of the present report. In a specific sense, the training per se has been judged by the trainees of the program to have provided the proper preparation to perform as practicing health systems practitioners. That is, the training content and methods developed in PHMS seem to have been an important first step in creating an educational program for providing the health field with a new type of allied health manpower.

In a more general sense, PHMS is largely viewed by the trainees, and certainly the HSRC faculty, as having been an outstanding success. In addition to having accomplished the specific training objectives, the existence of PHMS has contributed to significant progress in various other areas. As shown in Figure 1, cooperative relationships have been established with health agencies, health professionals, and other institutions. PHMS has provided the foundation of organization, facilities, and experience upon which the Health Systems Research Center and its various programs of education, research, and service were founded.

The PHMS experience has contributed significantly to the spawning of a set of health systems education programs at Georgia Tech. To some extent, PHMS has served to facilitate the active research program of HSRC which in turn has provided to the students an opportunity to be involved in the research projects.

HSRC, in cooperation with the Georgia Hospital Association, has established a new community outreach service program called "Systems Improvement Services for Georgia Hospitals" (Project SIS). The Georgia Hospital Association and its member hospitals knew about HSRC because some of the hospitals had been involved with training of students through PHMS student projects. Consequently, when the hospital association decided to explore the feasibility of a multi-hospital systems improvement program, the association
SEMINARS &
GUEST LECTURES

OTHER
PROFESSIONALS

PHMS

HEALTH ORIENTATION

TECHNIQUES
FOR
SOLVING HEALTH CARE DELIVERY PROBLEMS

EXPOSURE TO
HEALTH CARE PROFESSIONALS

CASE STUDIES

PROBLEM/SOLUTION EXPERIENCE

RESEARCH AND SERVICE PROJECT EXPERIENCES

CONSIDERATION
OF
PHMS

ADDITIONAL RESULTS OF PHMS

ORGANIZATION STAFF
FACILITIES
EXPERIENCE RECOGNITION

DIVISION OF SYSTEMS AND
COMPUTER SERVICES (AUGUSTA)

PROJECT S.I.S. (SERVICE)

PROGRAM IN HEALTH SYSTEMS (EDUCATION)

HEALTH SYSTEMS RESEARCH

HEALTH SERVICES ORIENTED INDUSTRIAL ENGINEERS

HEALTH SERVICES ORIENTED PRACTITIONERS FROM OTHER DISCIPLINES

ISyE STUDENTS

STUDENTS OF OTHER DISCIPLINES

ADJUNCT FACULTY

OTHER INSTITUTIONS

FIGURE 1. Conceptualization of PHMS Experiences, Developments, and Derivatives
approached HSRC. In turn, Project SIS provides PHMS trainees and students in the new health systems curricula with opportunities for obtaining work experiences in participating hospitals.

In retrospect, the contributions and successes of PHMS were manifold. Many students benefited substantially from the PHMS experience as did various institutions, professionals, agencies, and other programs. Additionally, due largely to the PHMS training project, "health systems" has become a bona fide allied health field of study and practice and is listed as such by the Department of Health, Education, and Welfare, and Georgia Tech has been admitted to institutional membership in the Association of Schools of Allied Health Professions.

Although the PHMS training grant officially expired on June 30, 1972, the coursework that was established by PHMS continues to provide students with health related educational experiences. Also, the other programs involving health systems research, service, and education at Georgia Tech and the Medical College of Georgia, developed largely through PHMS, continue to develop, apply, and disseminate new knowledge with respect to the design, experimentation, evaluation, implementation, and demonstration of new and improved systems for the delivery of health services to the public.
SECTION II

EVALUATION

OF

PHMS TRAINING
SUMMARY OF PHMS EVALUATION

The Program in Hospital and Medical Systems (PHMS) has been an educational program jointly offered by the Georgia Institute of Technology and the Medical College of Georgia since July 1, 1967. PHMS has received support during its development from the Bureau of Health Manpower Education of the National Institutes of Health. A continuing educational program of Georgia Tech and the Medical College, PHMS has provided health related education to students, primarily in Tech's School of Industrial and Systems Engineering, in a supplementary manner so as to complement each student's formal industrial engineering training. In addition, the program has also provided educational opportunities in interdisciplinary areas to students in other branches of engineering, physical science, management, computer science, architecture, and the health professions.

The principal objective of PHMS has been to generate and cultivate a source of industrial engineers who would be both technically competent and health services oriented as an effective means of solving problems in the delivery of health care services. Other objectives of PHMS have been to develop means of acquainting members of the health team with the philosophy, principles, approaches, and techniques of modern industrial engineering and to promote the cause of allied health manpower by developing an educational program which interfaces engineering and management sciences with the health professions in interdisciplinary areas of study and practice.

Educational experiences have been provided to students in PHMS through formal coursework and, for selected students, through on-the-job training in research and service projects of the Health Systems Research Center at Georgia Tech or the Division of Health Systems Engineering at the Medical College. The intent of PHMS has been to provide each student with the necessary degree of orientation and exposure to the health field so the student could readily adapt to and work effectively within the health services environment.

To ascertain the degree to which PHMS achieved its principal objective, the evaluation described in this section of the present report was conducted.
The evaluation attempted to assess whether or not PHMS had been successful in providing the health field with an industrial engineering resource. The evaluation instruments included two questionnaires which were used to obtain evaluative input from students who had been involved in PHMS. Also a structured interview was conducted with several individuals who had supervised former PHMS trainees in their initial health field employment.

The principal conclusion derived from the evaluation was that, as an innovative and developmental program, PHMS had been generally successful in providing the health field with technically competent and health services oriented manpower capable of solving health service delivery problems. Other important conclusions were that health systems training programs, such as PHMS, should: include a diversified and in-depth orientation to the health field and that this orientation should include significant input from physicians, nurses, hospital administrators and other health professionals and should also include coverage of the organizational, human, and interpersonal characteristics particular to the health field; stress the basic systems techniques of analysis and design with only eclectic coverage given to operations research techniques; and include a substantial amount of real life, health related work experiences provided through student involvement in actual health field service and research projects.

And finally, the health systems field has come of age and has been recognized as a new, bona fide, and vital allied health field of professional practice for the person who is both health services oriented and trained in appropriate systems techniques. The requirements of this new field are such that new curricula, which are specifically designed for educating health systems practitioners and which lead to degrees in health systems, are needed.
INTRODUCTION

More than 300 students were exposed to health related educational experiences through the Program in Hospital and Medical Systems (PHMS). These educational experiences consisted of lecture-type and project-type health related coursework which has been described in Section I of this present report and has also been described in following paragraphs of the present Section. In addition, health related training was also provided to selected students through involvement in research and service projects of the Health Systems Research Center at Georgia Tech or the Division of Health Systems Engineering at the Medical College.

Most of the more than 300 students were involved in PHMS by taking only one course or through some form of relatively incidental involvement in the range of research and service project experiences. Some of these more than 300 students, however, took advantage of the educational experiences available through PHMS to a substantial degree. These students were designated PHMS trainees. In fact, 65 of the students involved in PHMS were so designated.

The designation PHMS trainee was used to refer to a matriculated student who was pursuing a degree (undergraduate, master's, or doctoral) in one of the several cooperating schools of instruction at Georgia Tech or other academic institutions and who affiliated with HSRC in order to emphasize health systems in his program of study. PHMS trainees took a number of the PHMS courses in a coordinated program of study and/or were substantially involved in health related work experiences through participation in research and service projects.

The coursework offered through PHMS consisted of a basic three-course sequence of core courses in health systems (ISyE 418 - Industrial Engineering in Hospitals; ISyE 665 - Case Studies in Hospital Management Systems; and ISyE 765 - Projects in Hospital Management Systems), undergraduate and graduate project courses (ISyE 491,2,3 - Special Problems and ISyE 704,5,6 - Special Problems in Industrial Engineering), and master's thesis and doctoral dissertation courses (ISyE 700 - Master's Thesis and ISyE 800 - Doctor's Thesis).
In this section of the present report, an evaluation of the health-related training provided through PHMS to PHMS trainees and other students is presented. The purpose, specific objectives, and method of the evaluation are described in the following paragraphs.

PURPOSE

The principal objective of the Program in Hospital and Medical Systems was to generate and cultivate a source of industrial engineers who would be both technically competent and health services oriented as an effective means of solving problems associated with the delivery of health services to the public. Secondary and tertiary objectives were to develop means of acquainting members of the health team with the philosophy, principles, approaches, and techniques of modern industrial engineering and to promote the cause of allied health manpower by developing an educational program which interfaces engineering and management sciences with the health professions in interdisciplinary areas of study and practice.*

The purpose of this evaluation then was to ascertain the degree to which the principal objective, and to some extent the secondary and tertiary objectives, of PHMS were accomplished. Specifically, the evaluation assessed PHMS as a means of providing the health field with an industrial engineering manpower resource which was properly prepared to perform within the health services environment.

OBJECTIVES

In order to accomplish the purpose of the evaluation, the following specific objectives were established. The specific objectives were to ascertain:

1. The extent to which PHMS was a beneficial training experience for the trainees, primarily, and also for the other students involved in PHMS.

* A detailed presentation of all PHMS objectives may be found in Section I of the present report.
2. The relative value of and the correctness of emphasis among the individual features of PHMS.

3. Trainee receptiveness to the individual components of PHMS coursework and work experience.

4. The extent to which those trainees and other PHMS students who became employed in the health field had been properly health field oriented by PHMS.

5. The degree to which those trainees who became employed in the health field were better prepared to perform their jobs relative to other new employees in similar positions and having comparable education but no previous health field involvement.

The evaluation was also structured to obtain the following information:

6. Suggestions for possible program additions or improvement.

7. Suggestions for future educational programs for health systems analysts, hospital industrial engineers, and hospital management systems engineers.

SCOPE

The objectives of the Program in Hospital and Medical Systems included areas of involvement which were not directly related to the training of industrial engineers for health careers. All endeavors of PHMS have been considered by the evaluation, but primary attention was devoted to the proper assessment of PHMS as a training program. Although the overall success of training programs such as PHMS is to some extent a function of the talents of the individual student participants, no attempt has been made to evaluate individual performance. Additionally, the evaluation did not include an assessment of the industrial engineering portions of the program since the assumption was made that the industrial engineering training was adequate as determined by the standard requirements of the Georgia Institute of Technology for granting the M.S. and Ph.D. degrees in industrial engineering.
Evaluative inputs of PHMS principally were obtained from PHMS trainees. In addition, the evaluation included inputs from selected initial employers of those trainees who took positions in the health field and inputs from the many other students who took health related training offered through PHMS but who did not become involved in the program to the extent that these students were designated trainees.

The evaluation of PHMS did not include an assessment of the training program by professionally practicing hospital engineers or health systems engineers and analysts other than those practicing engineers who have been affiliated with PHMS in some way either as students or as employers of students who had been involved in PHMS. Also, faculties involved in other university health systems programs were not asked to contribute to the evaluation.

Inputs from these other potential evaluators would have been valuable, but a decision was made to limit the scope of the present evaluation to include assessments only from those persons who have had a substantive degree of contact with PHMS. The faculty of the Health Systems Research Center, however, does intend to conduct a more broadly based assessment of health systems education at Georgia Tech in the future, at which time evaluative inputs from practicing hospital industrial engineers, health systems engineers and analysts, and faculties of other health systems training programs are to be solicited.

Also, the evaluation was not intended to include a comparison of the character, form, and success of health systems education at Georgia Tech with health systems education offered at other institutions. Such a comparison would have been of interest to the faculty of the Health Systems Research Center and assuredly to other faculties as well but was determined to be beyond the scope of the present evaluation.

No attempt was made to include in the present evaluation a comparative assessment of PHMS as appropriate training for the many different types of health systems positions, although such a comparison would have provided information on the possible need for different types of training programs for the different types of positions. And, lastly, the evalua-
tion did not include an assessment of whether or not the commitment of students to the health field, when the students enter a program such as PHMS, significantly affects the students' academic success nor their eventual placement in health systems positions.
METHOD OF PROCEDURE

To accomplish the objectives of the evaluation, questionnaires and structured interviews were used as instruments for data collection. Specifically, separate instruments were designed for each of three different groups: former PHMS trainees, initial health field employers of PHMS trainees, and former ISyE 418 students.

PHMS TRAINEE QUESTIONNAIRE

In attempting to assess the overall effectiveness of PHMS as a training program, opinions and information were solicited from those students who participated directly in the training program, that is, the PHMS trainees. To obtain these opinions and information, a questionnaire was designed in which the PHMS trainees were asked to provide assessments of the PHMS coursework and/or work experience at Georgia Tech or the Medical College. In addition to detailed questions concerning the various components of PHMS educational experiences, the questionnaire also requested suggestions for improvements, changes, and additions to PHMS. Trainees were also asked to assess the overall training program with respect to its primary objectives. A copy of the trainee questionnaire is contained in Appendix C.

The trainee questionnaire was sent to the 65 PHMS trainees in the Fall of 1972.* In order to facilitate a high rate of response from the PHMS trainees, a stamped, self-addressed envelope was sent along to be used to return the completed PHMS questionnaire. Also a cover letter explaining the intent and importance of the PHMS questionnaire was mailed to the trainees. A cut-off date thirty days after the day on which the questionnaires were mailed to the trainees was established; completed questionnaires received after the cut-off date were not to be included in the evaluation.

* A complete list of the 65 trainees to whom the PHMS trainee questionnaire was sent is in Appendix B.
EMPLOYERS INTERVIEW

In order to determine whether or not PHMS trainees were better prepared to perform in the health field relative to other new employees with comparable education but no previous health involvement, a structured interview was designed and conducted with initial health field employers (immediate supervisors) of former PHMS trainees. The interview consisted of questions in which the supervisors were asked to give their assessments concerning (1) the value of the trainees' health field training, (2) specific areas of knowledge demonstrated by the trainee which were beneficial, and (3) whether preference would be shown to hiring additional PHMS trainees compared to graduates of comparable, but not health related, educational programs.

In the PHMS trainee questionnaire, trainees, who were initially employed in the health field, were asked to list the names and addresses of their initial immediate supervisors. The interview with the immediate supervisors was conducted via telephone. Seven supervisors were interviewed; all supervisors were interviewed in the same day.

A transcript of the questions asked in the interview is contained in Appendix C, and the names and addresses of the immediate supervisors are in Appendix E.

ISyE 418 STUDENT QUESTIONNAIRE

A primary objective of ISyE 418, Industrial Engineering in Hospitals, was to orient students of industrial engineering and various other disciplines to the health field and applications of industrial engineering to hospitals. Since this course involved more students by far than any other course of the PHMS curriculum, opinions held by these students were considered to be an important source of information with which to evaluate the orientation objective of the training project.

A questionnaire was designed in which the ISyE 418 students were asked questions regarding (1) the degree to which ISyE 418 increased the students' interest in the health systems field, (2) the students' willingness to have taken additional health related courses had the courses
been available, (3) the degree to which ISyE 418 influenced the students' career choice, and (4) the students' present interest in employment in the health field. A copy of the ISyE 418 questionnaire is contained in Appendix C.

The questionnaire was sent to 224 out of the 255 former ISyE 418 students who had completed the course as of the Winter Quarter of 1972; the questionnaire was not sent to the 31 other former ISyE 418 students because the students' addresses could not be located.* In order to facilitate a high rate of response from the former ISyE 418 students, the questions were typed on a stamped, self-addressed post card to be used in responding to the questions. Also a cover letter explaining the intent and importance of the questionnaire was mailed to the students. A cut-off date thirty days after the day on which the questionnaires were mailed to the former ISyE 418 students was established; completed questionnaires received after the cut-off date were not to be included in the evaluation.

* A complete list of the 224 students to whom the ISyE 418 questionnaire was sent is available from the Health Systems Research Center.
RESULTS

The information collected from each of the three types of instruments which were described in the Method of Procedure is presented in the following paragraphs and the Appendices.

PHMS TRAINEE QUESTIONNAIRE RESULTS

Twenty-eight completed questionnaires were received before the analysis of the data was begun as shown in Table 1. Therefore, the information collected by the trainee questionnaire represents evaluative input from approximately 43 percent of all former PHMS trainees.

<table>
<thead>
<tr>
<th>NUMBER</th>
<th>PERCENTAGES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Completed Questionnaires Returned</td>
<td>28</td>
</tr>
<tr>
<td>&quot;Wrong Addresses&quot; Returned</td>
<td>3</td>
</tr>
<tr>
<td>Questionnaires Outstanding*</td>
<td>34</td>
</tr>
<tr>
<td>Total Mailed</td>
<td>65</td>
</tr>
</tbody>
</table>

TABLE 1 Response to PHMS Trainee Questionnaire

Each former trainee was asked to answer 17 questions which covered five general areas: PHMS coursework, PHMS work experience, the overall program, PHMS training and subsequent trainee health field involvement, and suggestions for future programs. These questions and the responses to each question are presented on the following pages and in the Appendices.

* Seven additional completed questionnaires were received after the results were calculated.
In question 1, various orientation and technique application areas were listed and the trainees were asked which of these areas were given either excessive, proper, or insufficient emphasis by PHMS educational experiences.* These areas and the response percentages for each area are presented in Table 2.

Generally, the PHMS trainees believed that, in the health field orientation portion of the coursework, the coverage of the history of health care, the problems facing the health care industry, and hospital departments received the proper level of treatment and emphasis. Also, a majority of the trainees thought that the interfaces and interrelationships among hospital departments and the types and functions of professional and auxiliary health manpower had been properly covered although, in both categories, significant minorities (43 percent and 40 percent respectively) were of the opinion that these two orientation areas had been treated insufficiently in the PHMS coursework.

On the other hand, three out of five PHMS trainees thought that the health field orientation portion of the coursework had not dealt sufficiently with non-hospital, institutional components of health care nor with Federal government agencies. Furthermore, three out of four trainees replied, as part of their response to question 1, that state and county government agencies had been given insufficient coverage in the PHMS coursework; in fact, the treatment given to state and county government agencies was judged relatively by the trainees to be the least sufficient of all areas in the orientation portion of PHMS coursework.

The data in Table 2 also indicate that the portion of PHMS coursework concerned with the applications of various engineering techniques were judged to have been properly emphasized on the whole. The treatment of work simplification, work measurement and work system design, engineering

* Precise statements of the questions in the PHMS questionnaire are given in Appendix C.
Question 1: Considering the educational experiences provided to you through PHMS, which of the following areas do you feel were given either excessive, proper, or insufficient emphasis?

<table>
<thead>
<tr>
<th>AREAS</th>
<th>RESPONSE PERCENTAGES</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Level of Emphasis</td>
</tr>
<tr>
<td></td>
<td>Excessive</td>
</tr>
<tr>
<td><strong>I. ORIENTATION</strong></td>
<td></td>
</tr>
<tr>
<td>A. History of Health Care</td>
<td>86%</td>
</tr>
<tr>
<td>B. Problems Facing the Health Care Industry</td>
<td>86%</td>
</tr>
<tr>
<td>C. Hospital Departments</td>
<td>3%</td>
</tr>
<tr>
<td>D. Interfaces and inter-relationships Among Hospital Departments</td>
<td>54%</td>
</tr>
<tr>
<td>E. Non-hospital, Institutional Components of Health Care Such as Clinics, Nursing Homes, Group Practices, etc.</td>
<td>36%</td>
</tr>
<tr>
<td>F. State and County Government Agencies</td>
<td>22%</td>
</tr>
<tr>
<td>G. Federal Government Agencies</td>
<td>36%</td>
</tr>
<tr>
<td>H. Types and Functions of Professional and Auxiliary Health Manpower</td>
<td>57%</td>
</tr>
<tr>
<td><strong>II. APPLICATION OF SYSTEMS/MANAGEMENT ENGINEERING TECHNIQUES AS PRESENTED IN PHMS COURSEWORK (LECTURES, CASE STUDIES, PROJECTS)</strong></td>
<td></td>
</tr>
<tr>
<td>A. Queueing Theory</td>
<td>50%</td>
</tr>
<tr>
<td>B. Inventory Models</td>
<td>50%</td>
</tr>
<tr>
<td>C. Work Simplification Techniques</td>
<td>86%</td>
</tr>
<tr>
<td>D. Work Measurement/Work System Design</td>
<td>11%</td>
</tr>
<tr>
<td>E. Engineering Economy</td>
<td>61%</td>
</tr>
<tr>
<td>F. Simulation Techniques</td>
<td>11%</td>
</tr>
<tr>
<td>G. Applications of the Research Method to the Health Field</td>
<td>11%</td>
</tr>
<tr>
<td>H. Other Areas Listed by the Trainees:</td>
<td>3%</td>
</tr>
<tr>
<td>1. Statistics and Probability</td>
<td>3%</td>
</tr>
<tr>
<td>2. Management Information Systems</td>
<td>3%</td>
</tr>
</tbody>
</table>

**TABLE 2** PHMS Trainees' Responses to Question 1 in the PHMS Trainee Questionnaire.
economy, and the application of the research method were given the proper level of emphasis in the opinions of majorities of the trainees.

The trainees were of equally mixed mind regarding the coverage of queueing theory and inventory models; 50 percent of the trainees considered the emphasis given these two application areas to have been proper and 50 percent considered the emphasis given to have been insufficient. Regarding the application of simulation techniques, 43 percent, 46 percent, and 11 percent respectively considered the treatment of this technique to have been proper, insufficient, and excessive.

Only one student chose to offer, as part of his reply to question 1, other technical areas (statistics and probability; management information systems) as techniques which were included in the applications portion of PHMS coursework. This one trainee, who represented three percent of the total of 28 responding trainees, judged the coverage of these two technical areas as sufficient.

In the second question, each trainee was asked (1) if the PHMS coursework had been of subsequent value thereby enabling better performance in his health field employment than if the trainee had chosen a curriculum without health involvement and (2) if the student had been involved in the health field subsequent to his involvement with PHMS. As illustrated in Table 3, all of the trainees who have been subsequently involved with the health field (and who gave a reply to this question) thought that their PHMS training had been of significant value.

The health systems educational experiences offered to students through PHMS have been extensively described in Section I and Section III of the present report and have been also precisely defined in the introductory paragraphs to the PHMS trainee questionnaire in Appendix C of this report. However, basically the educational experiences consisted of formal coursework, both lecture-recitation courses referred to as classroom experiences and project-type courses referred to as fieldwork experiences, plus work experiences offered to students through participation in research and service projects at the Health Systems Research Center of Georgia Tech and the Division of Health Systems Engineering at the Medical College.
Question 2. Have you found that the health related coursework which you completed as a PHMS trainee has been of significant value; i.e., in your opinion, were you better prepared to perform in the health field than you would have been if you had instead opted for a curriculum without health involvement?  
YES  UNCERTAIN  NO  I HAVE HAD NO INVOLVEMENT WITH THE HEALTH FIELD SUBSEQUENT TO PHMS.  

<table>
<thead>
<tr>
<th>Answers to Question 2</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>61%</td>
</tr>
<tr>
<td>Uncertain</td>
<td>0%</td>
</tr>
<tr>
<td>No</td>
<td>0%</td>
</tr>
<tr>
<td>No Subsequent Involvement in Health Field</td>
<td>32%</td>
</tr>
<tr>
<td>No Reply</td>
<td>7%</td>
</tr>
</tbody>
</table>

Question 3. Would you attribute the "useful knowledge gained" from your PHMS coursework to classroom experience (lectures), fieldwork experience (projects, papers, proposals, etc.), or both?  
CLASSROOM  FIELDWORK  BOTH  

<table>
<thead>
<tr>
<th>Answers to Question 3</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Classroom</td>
<td>11%</td>
</tr>
<tr>
<td>Fieldwork</td>
<td>18%</td>
</tr>
<tr>
<td>Both</td>
<td>71%</td>
</tr>
</tbody>
</table>

Question 4. Considering the classroom experience (lectures) and fieldwork experience (projects, papers, etc.) associated with your PHMS coursework, and the subsequent value of each, was the blend of these two experiences proportionately correct?  
YES  NO  

<table>
<thead>
<tr>
<th>Answers to Question 4</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>78%</td>
</tr>
<tr>
<td>No</td>
<td>15%</td>
</tr>
<tr>
<td>No Reply</td>
<td>7%</td>
</tr>
</tbody>
</table>

TABLE 3  PHMS Trainees' Responses to Questions 2, 3, and 4 in the PHMS Trainee Questionnaire.
Questions 3 and 4 of the trainee questionnaire focused on the PHMS coursework, both the lecture-recitation type and the fieldwork or project type. In question 3, the trainees were asked if the "useful knowledge gained" from the PHMS coursework could be attributed to classroom experiences, fieldwork experiences, or both. In question 4, the trainees were asked if the blend of these two experiences had been proportionately correct. As illustrated in Table 3, 71 percent of the trainees replied that the "useful knowledge gained" was attributable to both the classroom and fieldwork experiences, and 78 percent of the trainees considered the blend of these two types of coursework to have been proportionately correct.

Trainees who stated that the proportions of classroom experiences and fieldwork experiences within the coursework had been incorrect, were asked to clarify their answers with comments. These comments are contained in the question 4 section of Appendix D. Generally, the trainees who offered comments favored additional fieldwork experiences, that is, project-type courses.

In an attempt to identify where PHMS might have been lacking in its coverage of appropriate bodies of knowledge, the trainees were asked in question 5 to suggest any areas, topics, or bodies of knowledge which, in their opinion, would have been of subsequent value to the trainees in their professional practice and which should have been included in their coursework. Suggestions offered by the trainees are listed in Table 4 along with the number of times each suggestion was made. Interpersonal relations and the total health system were suggested most often (five citations each), and computers and information systems were cited as topics needing additional coverage. A complete listing of the trainees' suggestions is in the section of Appendix D which describes the responses to question 5.

PHMS Work Experiences

Questions 6 through 8 were directly related to trainee work experiences at the Health Systems Research Center at Georgia Tech and the Division of Health Systems Engineering at the Medical College. In question 6, the trainees who had been involved in PHMS work experiences were asked if these
Question 5: Please list any areas, topics, bodies of knowledge, etc., which would have been of subsequent value to you had they been included in your coursework (not just health related).

<table>
<thead>
<tr>
<th>Replies to Question 5</th>
<th>Number of Times Mentioned</th>
</tr>
</thead>
<tbody>
<tr>
<td>Computers and Information Systems</td>
<td>4</td>
</tr>
<tr>
<td>Interpersonal Relations</td>
<td>5</td>
</tr>
<tr>
<td>Accounting</td>
<td>2</td>
</tr>
<tr>
<td>Management</td>
<td>3</td>
</tr>
<tr>
<td>Classical Industrial Engineering</td>
<td>3</td>
</tr>
<tr>
<td>Operations Research</td>
<td>1</td>
</tr>
<tr>
<td>Statistics</td>
<td>1</td>
</tr>
<tr>
<td>Report Writing</td>
<td>1</td>
</tr>
<tr>
<td>Total Health System</td>
<td>5</td>
</tr>
<tr>
<td>Hospital Administration and Medical Terms</td>
<td>3</td>
</tr>
<tr>
<td>Third Party Finance</td>
<td>2</td>
</tr>
<tr>
<td>Legislation</td>
<td>1</td>
</tr>
<tr>
<td>Relationship of Health System Changes to Costs</td>
<td>1</td>
</tr>
</tbody>
</table>

Note: The above list is an attempt to aggregate the trainees' responses to question 5. Precise statements of the trainees' responses are contained in Appendix D of the present report.

TABLE 4 PHMS Trainees' Responses to Question 5 in the PHMS Trainee Questionnaire.
work experiences had been of value as preparation for the trainees' subsequent involvement with the health field or other field. As shown in Table 5, 82 percent of the trainees replied in the affirmative.

In question 7, the trainees were asked in what ways the work experiences had proven to be beneficial, and in question 8, suggestions for changes and improvements in the work experiences were solicited. Twenty trainees offered comments in response to question 7; the trainees' comments were difficult to condense into a general, aggregate statement, but their comments left little room to question the value of the insights acquired through their practical work experiences. The trainees' comments touched on a range of topics: (1) operational constraints in the health care system, (2) dealings with and understanding of hospital management and medical staff, (3) the accelerated learning which derives from being thrust into a problem solution oriented environment, (4) working with other people, and (5) understanding the quality of care issue. Perhaps the comments offered by the trainees in response to question 7 can best be characterized as an endorsement of the concept that actual practical experiences can constitute an invaluable part of the educational process and impart a type knowledge which cannot normally be transmitted via the mechanisms commonly considered to be the sum and substance of a student's education. All of the comments given by the students in response to question 7 are in Appendix D of the present report.

In suggesting changes and improvements in the PHMS work experiences, 17 trainees offered comments tending to cite the need for expanded practical experiences, greater variety of experiences, and additional responsibilities for the students. While one trainee suggested more involvement in research, a number of the trainees called for a lessened research orientation in the work experiences; that is, the general tone of the comments was in support of involvement in practical problem solving. All suggestions for changes in the PHMS work experiences are in the question 8 section of Appendix D of the present report.
Question 6: If you worked for the HSRG, HSRC, PHMS, or DHSE while pursuing your degree(s), was this work experience of any value in your subsequent involvement in the health field per se or any other field in which you have been or are employed?  
YES (HEALTH FIELD) ____
YES (OTHER FIELD) ____
NO ____

Answers to Question 6

<table>
<thead>
<tr>
<th>Response</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes (Health Field)</td>
<td>50%</td>
</tr>
<tr>
<td>Yes (Other Field)</td>
<td>32%</td>
</tr>
<tr>
<td>No</td>
<td>3%</td>
</tr>
<tr>
<td>No Reply</td>
<td>15%</td>
</tr>
</tbody>
</table>

Question 12: Based upon your experiences with PHMS, was the hospital or health field environment as you expected to find it when you began your initial employment in the health care field?  
YES ____  NO ____

If not, could the "difference" have been eliminated by a better PHMS orientation through coursework/work experience?  
YES ____  NO ____

Answers to First Part of Question 12

<table>
<thead>
<tr>
<th>Response</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>71%</td>
</tr>
<tr>
<td>No</td>
<td>29%</td>
</tr>
</tbody>
</table>

Answers to Second Part of Question 12

<table>
<thead>
<tr>
<th>Response</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>50%</td>
</tr>
<tr>
<td>No</td>
<td>50%</td>
</tr>
</tbody>
</table>

Note: Trainees were asked to elaborate with comments on their Yes or No answers to question 12. A complete list of these comments is given in Appendix D of the present report.

TABLE 5 PHMS Trainees' Responses to Question 6 and 12 in the PHMS Trainee Questionnaire.
The Overall Program

Question 9 asked the trainees to list those features of PHMS which were of significant value and question 10 asked the trainees to list other features which should have been included in PHMS. The responses to these questions highlighted the value of the PHMS project-type courses and work experiences and emphasized a need for an expanded program of additional coursework and greater exposure to the health field. Complete lists of these comments are contained in the sections of Appendix D which describe questions 9 and 10 and the responses to these questions.

Twenty-seven trainees provided comments in response to question 9. In commenting on the features of PHMS which had been of significant value, the students touched on a wide range of program features including (1) the course material, (2) the practical problem solving experiences, (3) the combination of classroom or lecture-type coursework with fieldwork or project-type coursework, (4) the seminar program, (5) the opportunity to associate with experienced health systems practitioners and researchers, and (6) the work experiences provided to trainees through involvement in research and service projects at the Health Systems Research Center of Georgia Tech and the Division of Health Systems Engineering at the Medical College.

In replying to question 10, sixteen trainees offered suggestions of features which should have been included in PHMS. While stressing the need for expanded course offerings and greater involvement of hospital administration and medical professionals in health systems education, the trainees also expressed a desire for additional practical problem solving experiences. Specific topical needs mentioned by the trainees for inclusion in expanded course offerings were (1) labor, interpersonal, and communications considerations of the health system, (2) government agencies and the financing of health care, (3) private agencies and the financing of health care, (4) area wide planning, (5) viewpoints of hospital administration, medicine, and public health, and (6) trends in the health system.

In question 11, each trainee was asked to consider his involvement with PHMS and then to summarize his overall assessment of the training program.
particularly with regard to the program's principal objective which was to
generate and cultivate a source of industrial engineers who are both tech-
nically competent and health services oriented as an effective means of
solving problems associated with the delivery of health services to the
public and to develop means of orienting industrial engineers to the hos-
pital and medical environment. Twenty-seven trainees elected to provide
such an assessment. The trainees' comments are included in the question
11 section of Appendix D of the present report.

The general opinion of the trainees was that PHMS was a successful
and valuable program. Many of the trainees' comments were quite lengthy,
but three trainees held their replies to one word each: "successful",
"good", and "excellent". The following quotes were excerpted from some
of the trainees' comments: "the objectives were fully achieved"; "rela-
tively good program"; "program was well planned and well managed"
"objectives have been achieved"; "accomplished your goal"; "very effective"
"the objectives above were met satisfactorily"; "innovative, challenging,
and truly worthwhile".

Some of the trainees tempered their remarks by noting that, as a
source of health services oriented industrial engineers, PHMS output might
be judged fair while also noting that its greatest impact may come later.
A few trainees pointed out that the PHMS experience could have been im-
proved by including more coursework giving greater coverage to non-hospital
aspects of the health system and by including additional inputs from health
professionals.

PHMS Training and Subsequent Trainee Health Field Involvement

Questions 12 through 16 were directed primarily toward those trainees
who have been or are presently involved in the health field. These ques-
tions were concerned with whether or not the trainees had been properly
oriented to the health field environment and had been prepared to identify
and solve health systems problems, with identifying the presently and
seemingly unsolvable health systems problems, and with the effectiveness
of health systems practitioners in improving the methods of delivering
health care.
In question 12, the trainees were asked if the hospital and health field environment had been as the trainees had expected on beginning employment in the health field, and if not as expected, could the "difference" have been eliminated through a better PHMS orientation. As illustrated in Table 5, seventy-one percent of the trainees who responded to question 12 found the hospital and health field environment to be as the trainees had expected based on their PHMS experiences. Half of the students who had found the health field environment to be different from their expectations replied, in the second part of question 12, that this difference could not have been eliminated. One student commented (see Appendix D): "We were told the health care field is slow to change--it is."

Each trainee was asked in question 13 if PHMS had provided the necessary insight to solve the technical and organizational problems which the trainee had encountered in his employment in the health field. Fifty-eight percent of the trainees had been provided the necessary insight, while another 16 percent of the trainees qualified their answers by stating that PHMS had provided the insight to solve the technical problems but not the organizational problems. These results are shown in Table 6.

Several trainees additionally offered comments in reply to question 13. The comments reinforced trainees' responses given to other questions in that the comments tended to emphasize the need for increased treatment of organizational and interpersonal considerations in training health systems practitioners. The trainees' comments are presented in Appendix D of the present report.

In question 14, the trainees were asked if PHMS had prepared the trainees to identify health related problems and structure the solution of the problems. As illustrated in Table 6, eighty-nine percent of the trainees who responded to this question replied in the affirmative. Several trainees, in their comments related to this question, suggested that the apparent success of PHMS in preparing students to identify and structure the solution of health systems problems could have been further enhanced by increased emphasis on the "systems" aspects of health care delivery. These comments are included in Appendix D of this report.
Question 13: Did PHMS, generally, provide you with the insight necessary to solve the technical and/or organizational (interpersonal, human) problems which you have encountered in your professional employment?

YES ____  NO ____

Answers to Question 13

<table>
<thead>
<tr>
<th>Response</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>58%</td>
</tr>
<tr>
<td>No</td>
<td>26%</td>
</tr>
<tr>
<td>Technical-Yes/Organizational-No</td>
<td>16%</td>
</tr>
</tbody>
</table>

Question 14: Did PHMS, generally, prepare you to identify health related problems and structure their solutions (as opposed to solving an already structured "textbook" problem)?

YES ____  NO ____

Answers to Question 14

<table>
<thead>
<tr>
<th>Response</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>89%</td>
</tr>
<tr>
<td>No</td>
<td>11%</td>
</tr>
</tbody>
</table>

Question 16: Do you believe that health systems analysts, hospital industrial engineers, hospital management/systems engineers, etc., can be effective in improving the methods of delivering health care, planning the future structure of the health system, and reducing the cost of health care?

YES ____  NO ____

Answers to Question 16

<table>
<thead>
<tr>
<th>Response</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>100%</td>
</tr>
<tr>
<td>No</td>
<td>0%</td>
</tr>
</tbody>
</table>

Note: Trainees were invited to elaborate with comments on their Yes or No answers to questions 13, 14, and 16. A complete list of these comments is given in Appendix D of the present report.

TABLE 6  PHMS Trainees' Responses to Questions 13, 14, and 16 in the PHMS Trainee Questionnaire.
Each trainee was asked in question 15 to list the principal hospital management problems which, at the present time, seem to defy solution through the application of the methods and techniques of systems analysis, industrial engineering, and management engineering. Fourteen trainees replied to this question. Interpersonal and organizational problems which inhibit implementation of recommendations were frequently noted by the trainees in response to this question. Also, the quality of care issue and problems associated with third party reimbursement programs were mentioned by a couple of trainees. The complete list of comments given in response to question 15 is included in Appendix D.

Former PHMS trainees were asked in question 16 if the trainees believed that health systems analysts, hospital industrial engineers, hospital management/systems engineers (all of these terms have been used in referring to graduates of PHMS as well as of other health systems training programs) could be effective in improving the methods of delivering health care, planning the future structure of the health system, and reducing the cost of health care. All trainees who answered this question replied in the affirmative. Several of the trainees gave comments (listed in Appendix D) in support of their answers, and some trainees qualified their answers. One trainee cautioned that the hospital component of the health system cannot be emphasized in programs such as PHMS to the exclusion of other components of the health system if the impact of health systems practitioners is to be other than very small. Another trainee noted that such practitioners must adopt a team approach to solving health care delivery problems, and yet another trainee suggested that attempted improvements have the best chance for success when pressed by an organization or activity that has "influence" upon major systems and a willingness to effect change.

Suggestions for Future Programs

In question 17, the trainees were asked what should be included in future educational programs for health systems analysts, hospital industrial engineers, and hospital management/systems engineers which would help these health systems practitioners to perform more effectively in the health field. Table 7 contains nine areas of study which were proposed by question 17 and
the yes-no response percentages for each. Also listed in Table 7 are other areas of study which were suggested by the trainees. Comments made by trainees in reply to this question are contained in the question 17 section of Appendix D.

A large majority of the trainees in the case of each of the nine proposed areas of study recommended that the area of study be included in future health systems training programs. In fact, the trainees unanimously supported the inclusion of courses in classical industrial engineering, statistics, computer programming, interpersonal/human relations, and information systems design. Courses in operations research techniques were recommended by 76 percent of the trainees, but this response was the lowest level of support recorded by any of the nine areas of study.

Twenty-four other areas of study were also suggested by the trainees for inclusion in future health systems training. These suggested areas covered a wide range of topics. Actually some of the suggested areas were related to each other and, in fact, to some of the areas included in the statement of the question itself, but all trainee suggestions were listed in order to provide complete information on the trainees' thoughts regarding the character of future health systems training programs.

EMPLOYERS' INTERVIEW RESULTS

In order to ascertain the degree to which the former PHMS trainee employed in the health field was initially better prepared to perform his job relative to other new employees with comparable education but having no previous health field involvement, the initial immediate supervisors of seven PHMS trainees were contacted and asked four questions. Precise statements of the four questions are in Appendix C of the present report.

The supervisors were asked in the first question if the employed trainee had been better prepared to perform his job due to his health field orientation than other new employees with comparable education but no health field training. All seven supervisors answered in the affirmative and some offered brief elaborative comments (listed in Appendix F).
Question 17: In your opinion, what should be included in future educational programs (such as HSRC's new curriculum in health systems) for health systems analysts, hospital I.E.'s and hospital management/systems engineers which would help them to perform more effectively in the health field?

<table>
<thead>
<tr>
<th>AREAS OF STUDY</th>
<th>RESPONSE</th>
<th>PERCENTAGES</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Classical I.E.</td>
<td>100%</td>
<td>-</td>
</tr>
<tr>
<td>B. Statistics</td>
<td>100%</td>
<td>-</td>
</tr>
<tr>
<td>C. Operations Research Techniques</td>
<td>76%</td>
<td>24%</td>
</tr>
<tr>
<td>D. Computer Programming</td>
<td>100%</td>
<td>-</td>
</tr>
<tr>
<td>E. General Management Courses</td>
<td>95%</td>
<td>5%</td>
</tr>
<tr>
<td>F. Accounting and Finance Courses</td>
<td>86%</td>
<td>14%</td>
</tr>
<tr>
<td>G. Interpersonal/Human Relations Courses</td>
<td>100%</td>
<td>-</td>
</tr>
<tr>
<td>H. Facilities Planning</td>
<td>95%</td>
<td>5%</td>
</tr>
<tr>
<td>I. Information Systems Design</td>
<td>100%</td>
<td>-</td>
</tr>
<tr>
<td>J. Other Areas Suggested by the Trainees:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Psychology</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Data Collection Systems</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Cost Evaluation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Legal Aspects and Health Legislation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Labor Relations</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. In Depth ISyE 418 Type Course</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Report Writing (suggested by two trainees)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. Planning, Programming, and Budgeting Systems</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. Cost Effectiveness Ratio Analysis</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10. Organization Theory</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11. Problem Definition</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12. Simulation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13. Medical Terminology</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14. Field Experience (suggested by two trainees)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15. Medical Science</td>
<td></td>
<td></td>
</tr>
<tr>
<td>16. Health Planning</td>
<td></td>
<td></td>
</tr>
<tr>
<td>17. Health Politics</td>
<td></td>
<td></td>
</tr>
<tr>
<td>18. The Consumer and Health Care</td>
<td></td>
<td></td>
</tr>
<tr>
<td>19. Design</td>
<td></td>
<td></td>
</tr>
<tr>
<td>20. Health Care Organization and Structure</td>
<td></td>
<td></td>
</tr>
<tr>
<td>21. Clinical Processes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>22. Planning</td>
<td></td>
<td></td>
</tr>
<tr>
<td>23. Health Systems Terminology</td>
<td></td>
<td></td>
</tr>
<tr>
<td>24. Cases in Health Services</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: Some of the above listed areas could clearly have been combined such as Medical Science and Clinical Processes, Planning and Health Planning, and Medical Terminology and Health Systems Terminology as well as other possible combinations. All of the suggested areas were suggested once except in the two noted cases.

TABLE 7 PHMS Trainees' Opinions of Which Areas of Study Should Be Included in Future Educational Programs for Health Systems Analysts Practitioners. (Trainees' Responses to Question 17.)
In question 2, the supervisors were asked to list the specific health related areas of knowledge or experience which the trainee had demonstrated through the performance of his job and which were considered to have been significantly beneficial. Among those areas mentioned by the supervisors were general health and hospital orientation and familiarity with medical terminology. A complete list of these responses is contained in Appendix F.

Each supervisor was asked in question 3 to list the health related experiences or knowledge that he would like future employees to have received from their formal educational programs. A knowledge of accounting, health care financing, clinical processes, medical terminology, and basic techniques of data collection were suggested by the supervisors for inclusion in health systems training programs. The supervisors also cited a need for such programs to include exposure to the problems encountered in implementing study results, orientation to the government controlled hospital compared to the private hospital, and more participation by health professionals in the instructional process. All of the suggestions made by these employers in response to this question are listed in Appendix F.

In the last question the employers were asked if additional PHMS trainees would be given preference over graduates of non-health curricula when hiring for other entry-level positions. All employers said that PHMS trainees would be given preference if all other things were equal. One supervisor also said that the PHMS orientation to the health field should be further strengthened. Additional comments are listed in Appendix F of the present report.

ISyE 418 STUDENT QUESTIONNAIRE RESULTS

The ISyE 418 student questionnaire was mailed to 224 students who had completed the course as of the Winter Quarter of 1972. The responses to 147 completed questionnaires were used for the analysis as shown in Table 8; thus, the information collected via the ISyE 418 questionnaire represented evaluative input from approximately 58 percent of all former ISyE 418 students who had been sent the questionnaire.
<table>
<thead>
<tr>
<th>Completed Questionnaires Returned</th>
<th>147</th>
<th>65%</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;Wrong Addresses&quot; Returned</td>
<td>3</td>
<td>1%</td>
</tr>
<tr>
<td>Questionnaires Outstanding*</td>
<td>74</td>
<td>33%</td>
</tr>
<tr>
<td>Total Mailed</td>
<td>224</td>
<td>100%</td>
</tr>
</tbody>
</table>

**TABLE 8** Response to ISyE 418 Student Questionnaire

In question 1 of the post care questionnaire, each former ISyE 418 student was asked if the course increased his interest in the health field and health systems engineering. Approximately 94 percent of those students responding to this question answered either "VERY MUCH" or "MODERATELY" while the remaining 6 percent answered either "VERY LITTLE" or "NOT AT ALL." These response percentages are illustrated in Table 9.

The second question inquired as to whether or not additional courses in health related industrial engineering would have been taken by the former students if such courses had been available. Seventy-one percent of the respondents answered "YES" and the response percentages for the "NOT SURE" and "NO" answers were 23 percent and 6 percent respectively. Table 9 also displays the response percentages for this question.

* Eight additional completed questionnaires were received after the cut-off date for inclusion of received questionnaires in the evaluation.
Question 1: "Did ISyE 418, "Industrial Engineering in Hospitals," increase your interest in the health field and in health systems engineering?"

<table>
<thead>
<tr>
<th>ANSWER</th>
<th>PERCENTAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very Much</td>
<td>58%</td>
</tr>
<tr>
<td>Moderately</td>
<td>36%</td>
</tr>
<tr>
<td>Very Little</td>
<td>4%</td>
</tr>
<tr>
<td>Not at All</td>
<td>2%</td>
</tr>
</tbody>
</table>

Question 2: "Would you have taken any additional courses in health-related IE if such courses had been available?"

<table>
<thead>
<tr>
<th>ANSWER</th>
<th>PERCENTAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>71%</td>
</tr>
<tr>
<td>Not Sure</td>
<td>23%</td>
</tr>
<tr>
<td>No</td>
<td>6%</td>
</tr>
</tbody>
</table>

Question 3: "Did ISyE 418 influence your career choice?"

<table>
<thead>
<tr>
<th>ANSWER</th>
<th>PERCENTAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very Much</td>
<td>14%</td>
</tr>
<tr>
<td>Moderately</td>
<td>24%</td>
</tr>
<tr>
<td>Very Little</td>
<td>29%</td>
</tr>
<tr>
<td>Not at All</td>
<td>27%</td>
</tr>
<tr>
<td>(No Answer Given)</td>
<td>(6%)</td>
</tr>
</tbody>
</table>

Question 4: "If engineering and management positions within the health field were available to you at a competitive salary, would you seriously consider them?"

<table>
<thead>
<tr>
<th>ANSWER</th>
<th>PERCENTAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>75%</td>
</tr>
<tr>
<td>Not Sure</td>
<td>14%</td>
</tr>
<tr>
<td>No</td>
<td>10%</td>
</tr>
<tr>
<td>(No Answer Given)</td>
<td>(1%)</td>
</tr>
</tbody>
</table>

TABLE 9  ISyE 418 Students' Responses to the Questions in the ISyE 418 Student Questionnaire.
Question 3 asked if ISyE 418 influenced the career choice of these former students. The responses to this question were rather evenly distributed among the four possible answers. The smallest percentage of fourteen percent of the students answered "VERY MUCH", 25 percent responded "MODERATELY", 29 percent answered "VERY LITTLE", and 27 percent replied "NOT AT ALL". These data are shown in Table 9.

The students were asked via the fourth question if engineering and management positions within the health field would be seriously considered by the students if such positions were made available at competitive salaries. Seventy-five percent of the students replied that such positions would be given serious consideration, whereas 14 percent were uncertain, and 10 percent said "NO". Table 9 illustrates these responses.
DISCUSSION

The Program in Hospital and Medical Systems (PHMS) provided health related educational experiences to students, primarily of the School of Industrial and Systems Engineering of Georgia Tech, in a supplementary manner so as to complement each student's formal industrial engineering training. The intent of PHMS was to provide each student with the necessary degree of health field orientation and exposure so that the student could easily adapt to and work effectively within the health services environment. Health related coursework and work experience were the two principal training methods by which PHMS prepared students for health field employment. Therefore, the evaluation of the effectiveness of PHMS as a training program centered upon the PHMS coursework and work experience and was concerned with the resulting degree of overall preparedness of the PHMS trainees. The following discussion concentrates on the aforementioned methods of training and is primarily based upon the information received from former trainees, other former students, and initial employers of trainees.

PHMS COURSEWORK

As described in the Introduction to Section II and elsewhere throughout the present report, PHMS coursework consisted of a basic three course sequence in hospital and medical systems (ISyE 418, 665, and 765), undergraduate and graduate project courses (ISyE 491, 2, 3 and 704, 5, 6), and master's thesis and doctoral dissertation courses (ISyE 700 and 800). To achieve the orientation objective of the training project, most trainees were required to take the basic three course sequence which covered the areas of health field introduction (ISyE 418), case studies in the application of industrial engineering to health field problems (ISyE 665), and health related project work (ISyE 765). The degree to which these courses achieved the orientation objective of PHMS, that is, provided a sufficient
level of health field familiarity, was ascertained from the former PHMS students' responses to the various questions of the evaluation instruments.

With respect to introducing students to the health field and giving them a broad overview of industrial engineering applied in the health services environment, ISyE 418 was apparently successful. As indicated by the data (Table 9), the majority of former ISyE 418 students agreed that this course increased their interest in the health systems field. Also, the majority of these former students agreed that they would have taken additional health related courses had the courses been available. This desire, in retrospect, was not surprising since the only other PHMS courses offered at the undergraduate level were special problem courses (ISyE 491, 2,3). However, satisfying the demand for more health related didactic experiences by undergraduate students was actually beyond the scope of the training project since PHMS was conceived and implemented as a graduate education program. The increasing undergraduate interest in the health field was, nonetheless, considered to be encouraging and worthy of future study.

Additional evidence of the actual success of the overall PHMS health field orientation effort was gained from the individual trainees who responded to the trainee questionnaire and who were initially employed in the health field subsequent to PHMS (Tables 3 and 5). The majority of these trainees (approximately three out of four) reported that they had been properly oriented to the health field; that is, the trainees found the health services environment to be generally as the students had expected. An additional endorsement of the orientation portion of PHMS was received from the initial employers of these trainees. Those employers who were contacted during the evaluation stated without exception that the employed trainees had received a proper health field orientation from PHMS and were better able to perform their jobs relative to other new employees having graduated from non-health curricula.

Whereas sufficient evidence of the value of the overall orientation which trainees received through PHMS seemed to exist, evidence of individual topic deficiencies within the orientation coursework also was apparent.
Some trainees reported that certain areas of the PHMS orientation were given insufficient emphasis (Table 2). Although these reported areas of deficient coverage were to some extent a function of each individual trainee's particular type of subsequent health field involvement, in the aggregate, these reports were considered to be noteworthy constructive criticisms. Specifically, the majority of former trainees stated that the areas of orientation which received insufficient emphasis by PHMS were: (1) non-hospital, institutional components of health care, and (2) county, state, and Federal government agencies.

In retrospect, PHMS possibly did emphasize coverage of the hospital relative to other components of the health system. This contention is at least partially indicated by the titles of the three PHMS core courses: ISyE 418 - Industrial Engineering in Hospitals; ISyE 665 - Case Studies in Hospital Management Systems; ISyE 765 - Projects in Hospital Management Systems. The coverage of non-hospital aspects of the health system has been increased over the years during the development of PHMS, and the point made by the trainees has been well taken. Future health oriented industrial engineering programs should include additional coverage of non-hospital components of the health system compared to the coverage provided by PHMS, but as the trainees also indicated in their responses, such increased coverage should probably result from additional coursework rather than through a decrease in the absolute level of coverage given to the hospital.

A substantial minority (43 percent) of the trainee respondents also considered the following areas to have received insufficient emphasis in PHMS: (1) interfaces and inter-relationships among hospital departments, and (2) types and functions of professional and auxiliary health manpower (Table 2).

As previously mentioned, PHMS course offerings included special problem and project courses (ISyE 491,2,3; ISyE 704,5,6; and ISyE 765) and a course which presented case studies in the application of industrial engineering techniques to the health field (ISyE 665). These courses typically attempted to demonstrate to the student, through case studies or project fieldwork, how industrial engineering skills may be effectively applied to problem areas.
within the health services environment. In general, the former trainees stated that, for the most part, applications of individual industrial engineering techniques were adequately presented by PHMS coursework. A significant number of these former students did suggest, however, that the techniques and applications related to queueing theory, inventory theory, and simulation should have received more emphasis (Table 2).

The applications courses of the PHMS coursework, particularly ISyE 665, were designed to present representative examples of the value of hospital and health field industrial engineering, and were in no way intended to be exhaustive in the coverage of the potential uses of I.E. in the health field. Considering both the intended purpose of the applications coursework and the variety of health field activities in which former trainees have been engaged, the trainees' desire to have received more specific applications experience was considered to be a natural response. For example, a trainee who has been heavily involved in inventory control systems work may wish to have received more inventory theory and inventory control techniques experience, whereas a trainee who has been working with outpatient clinic scheduling problems may wish to have received more applications experience with queueing theory.

The desire for more applications emphasis within the PHMS coursework was actually indicative of a more general feeling among former trainees. The consensus of this feeling was that, in retrospect and based upon individual health field experiences encountered subsequent to PHMS, the trainees wished PHMS could have provided a broader selection of health field coursework. Evidence of trainee sentiment concerning PHMS coursework was obtained from the trainees' responses to question 10 of the trainee questionnaire which asked what additional features should have been included in PHMS. Frequently mentioned among the responses to this question was the desire for an expanded offering of health related courses. Additionally, when the trainees were given a list of nine general areas of study and were asked which of these areas should be included in future educational programs such as PHMS, the trainees not only approved the nine areas, but also listed twenty-four other areas which, in their opinion, should be included (Table 7). These twenty-four suggested areas ranged from health field areas such as (1) the consumer and health care, (2) labor relations, and (3) health care organization and
structure to methodological topics such as (1) simulation, (2) cost effectiveness ratio analysis, and (3) data collection techniques.

When suggesting areas to be included in future educational programs such as PHMS, several trainees also commented that, based upon their experiences in the health field subsequent to graduation, health related coursework should stress the basic techniques of analysis and synthesis. These trainees, who have been employed within the health field, have apparently discovered that basic techniques and approaches to problem solving are required more often than the sophisticated approaches such as operations research techniques.

While the latter point seemed to be in conflict with the trainees' suggestion that simulation and its applications should receive more intensive coverage, the trainees' responses were interpreted to mean that coverage of operations research techniques should be eclectic. Apparently, simulation was found to be a useful technique, while other operations research techniques were found to be of lesser value. Perhaps worthy of note again at this point was the substantial support for increased emphasis of queueing theory, which support was obtained in responses given by trainees to question 1 of the trainee questionnaire.

Throughout the trainees' responses to the questions which attempted to get at the trainees' opinions on which health field topics and which methodological topics should be included in health systems curricula, the trainees cited the need for essentially five areas to be included in health systems programs such as PHMS. These five areas were (1) the health system, to be covered broadly and in depth, (2) basic systems techniques of analysis and synthesis, (3) interpersonal relations and organization theory, (4) management and accounting, and (5) information processing.

While the evaluation instruments were not designed to provide detailed answers to questions regarding what specific systems techniques should be included in future health systems curricula (the Health Systems Research Center intends to make such determinations in future evaluations), the trainees' responses did provide insights into the trainees' opinions on the
relative value of the various specific techniques. These insights were derived from the trainees' narrative responses and comments, some of which were made parenthetically or as marginal notes on the questionnaire. Generally, the techniques of inventory control, scheduling, forecasting, engineering economy determinations, work measurement, work systems and production systems design, simulation, queueing theory, and PERT/CPR received support from the trainees. On the other hand, while the trainees were not specific, the general tone of the trainees' responses did not seem to include considerable support for what are sometimes referred to as the sophisticated techniques of operations research; that is, nonlinear and integer programming, game theory, network theory, and dynamic programming, and perhaps linear programming as well. While the evaluators discerned this lack of support for the mentioned areas of study, the comments have been only offered with caution and merely to apprise other health systems educators of these insights.

Although questionnaire responses indicated a strong desire among former trainees and other students for additional types of health related coursework, the responses also indicated that the coursework offered by PHMS and taken by the students had gained an overwhelming endorsement from the students. Also, the majority of former trainees stated that both the classroom experience (lectures) and the fieldwork experience (projects, papers) associated with PHMS coursework had been of considerable value in subsequent professional endeavors.

PHMS WORK EXPERIENCE

Many trainees were given the opportunity through PHMS to augment their health related coursework training with actual work experience provided at either the Health Systems Research Center of the Georgia Institute of Technology or the Division of Health Systems Engineering of the Medical College of Georgia. Some students were provided with financial assistantships and given tasks to perform which were associated with either health related research, science, or education. Also, other students were simply volunteers and worked on health related projects for which they received no financial
support. The intended purposes of the PHMS work experience were to give trainees some practical experience in solving and contending with real life, health related problems and situations.

The value of the PHMS work experiences, which were supervised by professional health systems practitioners, was indicated by the responses and comments of the trainees who responded to the trainee questionnaire. As was cited in the data, almost without exception the trainees who had received work experience through PHMS stated that the experience had been of value in subsequent employment. The trainees' comments regarding the ways in which the PHMS work experiences had been of value often reflected the benefit of having received practical health field experience and exposure.* Many trainees commented that the PHMS work experiences allowed them to gain greater insight into the workings of the health care industry and to achieve a better understanding of the overall health care system.

In addition to obtaining an opportunity to test their technical skills, apparently of particular benefit to the trainees was the exposure to the complex medical and sociological factors of the health system, the complexities and interlinking of the several hierarchical structures within the health care field, and the interrelationships between and interests of the frequently conflicting domains of health care; that is, government, consumers, hospital administration, medicine, and health planning. As noted in the paragraphs in which PHMS coursework was discussed, health systems education programs should include a broad and in-depth coverage of the many aspects of the health system. As also mentioned previously, PHMS should have included additional coverage of the health field in the coursework, and apparently, the work experiences compensated to some extent for the insufficient classroom coverage.

The HSRC faculty's long standing position has been that work experiences serve as a valuable component of a student's overall preparation for profes-

* Appendix D contains a complete listing of the trainees' narrative responses and comments.
sional practice in the health care field. Clearly, the PHMS trainees support this position.

The value of clinical training has long been recognized in medicine, and in recent years, the inclusion of hands-on experience for students of the information processing disciplines has become commonly accepted as a de rigueur requirement in the data processing field. Also, an honored element of curricula in the sciences and engineering for many years has been a considerable amount of laboratory work, which despite misconceptions in the minds of some people is not merely intended to familiarize the student with laboratory apparatus. Laboratory experiences and clinical training are valuable because these educational mechanisms genuinely contribute to the extension of the student's understanding of the material presented via the lecture-recitation mechanism.

In health systems education, as in other curricula concerned with systems technology applied to social systems, clinical experiences and laboratory practice cannot normally be transferred to the campus, and fieldwork projects, done by students normally in the relatively short span of a ten week academic quarter, only enable the student to scratch the surface of the complexities of the health system. Consequently, PHMS trainees were given numerous opportunities to obtain work experiences, which in the trainees' opinions contributed substantially to their development prior to entering professional practice.

How much clinical training, via actual work experiences, should be included in health systems education has yet to be determined. The faculty of the Health Systems Research Center hopes to begin to determine the correct absolute amount through future investigations.

Although most trainees were very strongly in favor of the PHMS work experiences, many of these students pointed out that the work experiences could have been even better. A greater variety of relevant health related work experiences was suggested by some of the trainees and a greater degree of student involvement in project work and with health professionals was desired by others. A suggestion which was frequently offered was that student assistants should have been given more responsibility. Additionally,
some students advocated a cooperative option whereby students could alternate on a quarterly basis between going to school and working in the health field.

Perhaps at this point, notice should be given to the fact that of the 28 trainees, whose questionnaires were received in time to be included in the evaluation of PHMS, 85 percent of the trainees were graduate students at the time of their involvement in PHMS.

In conclusion, the consensus regarding the PHMS work experience was, as indicated by trainee responses and comments, similar in meaning to the consensus regarding the PHMS coursework; that is, the trainees benefited substantially from the work experience but also wished that the exposure could have been greater.

OVERALL TRAINEE PREPAREDNESS

After having participated as a trainee in PHMS, and having completed all other requirements for the degree being pursued, each trainee was assumed to have been prepared for employment within the health field. The degree to which trainees were actually prepared was obviously a function of the extent to which each trainee had participated in the program and also a function of each trainee's propensity to learn. The individual responses and comments from those trainees who had been employed within the health field and also the comments from the initial health field employers did, however, offer a general indication of the merits and shortcomings of trainee preparedness.

As mentioned earlier, almost all of the trainees who were employed within the health field had found the health services environment to be as expected. Employers of these trainees were impressed with the level of hospital and health care orientation and familiarity that trainees possessed. Additionally, some of the employers singled out certain desirable areas of knowledge, such as medical terminology and hospital organization, that were demonstrated by trainees. In general, trainees appeared to have been properly prepared to adapt to the health field work environment.

From the information obtained via the trainees' questionnaire, an overwhelming majority of the health field employed trainees stated that
PHMS had generally provided the skills necessary to identify health related problems and structure the solutions to the problems. Some of the comments made by trainees in this regard attributed the problem identification/solution orientation acquired by students to the fieldwork experiences associated with PHMS project-type coursework and to the PHMS work experiences. A majority of the trainees stated that PHMS had provided the insight necessary to solve technical and organizational problems, although several trainees commented that PHMS training had been adequate to solve the technical problems but not the organizational, interpersonal, human behavior problems which have generally been a source of frustration for many trainees.

When asked specifically to list the principal hospital management problems which seemed to defy solution, many trainees commented that the interpersonal and organizational problems had presented the greatest difficulties. Specifically, a number of trainees stated that the physician-administrator power struggle had been difficult to deal with; others said that gaining acceptance of the new systems resource had been constrained by interpersonal problems with and among medical professionals and hospital management. Several trainees retrospectively wished that PHMS could have provided trainees with greater acquaintance with these types of problems through coursework or fieldwork experiences and through more exposure to hospital administrators and medical professionals. Additionally, all trainees who responded to the trainee questionnaire stated that interpersonal and human relations courses should be included in future health systems educational programs such as PHMS.

Although only a small sample of trainee employers were interviewed as part of the evaluation, perhaps the strongest endorsement of PHMS trainee preparedness was obtained from the initial health field employers who stated without exception that based upon the performance of the employed trainees, preference would be given to hiring other PHMS trainees over graduates of non-health curricula. This statement did not imply, however, that the employers were completely satisfied with each trainee's degree of preparation; in fact, several employers suggested certain ways in which the PHMS training could have been improved.
Employers suggested a need for a more dynamic program of practical experience and a need for more independence and responsibility for the trainees in project work. Although suggesting that PHMS training could have been improved in various ways, the employers unanimously stated that the PHMS trainees were better prepared to perform within the health field than other new engineering graduates of non-health curricula principally because of the trainees' knowledge of the health field and its particular characteristics and problems.

A SUMMARY ASSESSMENT OF PHMS

The trainee questionnaire gave each trainee the opportunity to, first, consider his involvement with PHMS coursework and/or PHMS work experiences and his resulting degree of health field preparedness, and then, secondly, to discuss whether or not the principal objectives of PHMS had been achieved. The individual assessments of the overall training project which were received from the trainee respondents seemed to represent a considerable amount of serious and honest reflection. For different reasons but without exception, each trainee stated that PHMS had been a successful training program and had achieved the objective of providing the health field with a technically competent and health services oriented industrial engineering resource.

Although the trainees as a whole considered PHMS to have been successful, several trainees also stated that the degree of success could have been even greater. These statements were in consonance with similar statements made by trainees in regard to the PHMS coursework, PHMS work experiences, and trainee preparedness as previously discussed. For instance, a few trainees stated once again that PHMS should have provided additional health care courses and should have involved more health care professionals in the training process.

Regarding the production of health systems manpower, 65 students were involved in PHMS as trainees during the period July 1, 1967 through June 30, 1972. Also, more than 250 other students received health related industrial engineering education through the PHMS course offerings. Former trainees generally regarded this performance as fair and a good start in an essentially virgin field, which has come to be recognized as a new and vital allied health field largely because of PHMS.
Several of the PHMS graduates have taken faculty positions at various universities, and these graduates have initiated health systems education at their institutions. In addition, PHMS has inspired yet other universities throughout the nation to institute health systems programs.

The trainee respondents unanimously acknowledged the success of PHMS and endorsed the overall PHMS concept, although many trainees offered suggestions for improving PHMS. This overwhelming endorsement appeared to have been, in part, based upon the fact that the trainees, again unanimously, believed that health systems practitioners could be utilized very effectively within the health field. Having this belief in the need for an industrial engineering type resource for the health field, the trainees stated in their individual assessments that PHMS particularly when considered as a developmental program, was an important step in the right direction toward providing the health field with the needed industrial engineering resource.

Typical of the responses from former trainees who had been employed in the health field is the statement of one such individual who said that through coursework and field experience, PHMS provided "a unique and effective means to gain an appreciation and understanding of the health care delivery system." Another trainee offered this endorsement: "No program in the country has made as great an impact on the field."

PHMS seems to have been a successful program for health systems education although several improvements can be made in the various features of the program. Most of the improvements, if implemented, require a substantial expansion of the PHMS coursework. This fact coupled with the numerous areas of study, which the trainees suggested for inclusion in future health systems education programs, points to the need for curricula specifically designed for the new allied health field of health systems. In such curricula, students would receive substantial amounts of instruction in the phenomena of health system processes along with instruction in the appropriate methodological areas. Appealing analogies with several established curricula for other disciplines can be constructed.
For example, a chemical engineer receives considerable instruction in chemical processes plus instruction in the techniques of solving problems encountered in the chemical industry. Similarly, the health systems professional should be imbued with health system processes and should be provided with the technical skills needed for solution of problems encountered in the health services industry. Just as the systems needs of the chemical industry are best served by the professional who has received a degree in chemical engineering, the systems needs of the health services industry will be best served by professionals who have been trained in and received their degrees in the new allied health field known as health systems.
CONCLUSIONS

This evaluation was concerned with the degree to which the principal objective, and to some extent the secondary and tertiary objectives, of PHMS were accomplished. Specifically, the evaluation assessed PHMS as a means of providing the health field with an industrial engineering manpower resource which was properly prepared to perform within the health services environment. Based on the evaluation results, the following conclusions were developed.

1. The Program in Hospital and Medical Systems was a beneficial training experience for the PHMS trainees and for other students who also received some health systems training through PHMS. The orientation to the characteristics and problems of the health field was clearly valuable, although the orientation should have been expanded. The instruction and work experiences provided relative to the application of systems techniques to the solution of health services problems was determined to be appropriate, particularly since PHMS coursework was conceived as including those core courses and since PHMS was a developmental program in an essentially brand new field.

2. Given the limited number of PHMS courses and the developmental nature of the program, the individual features of PHMS, which consisted of lecture-type and project-type courses combined with health related work experiences, were correctly balanced. An expanded set of health related courses and additional health related work experiences for future health systems education programs were recommended as being highly desirable.

The PHMS training emphasized health services problems in the hospital relative to the problems encountered in other components of the health system. Several suggestions for rectifying this situation were offered.

3. Generally, the training offered by PHMS was solidly endorsed. Both the coursework and work experiences were of value in providing the
preparation necessary for professional systems practice in the health services environment. The work experiences provided to PHMS trainees were of substantial value in the trainees' education, and the results of the evaluation pointed toward the need for such clinical training to be incorporated in health systems education programs.

4. PHMS trainees possessed a degree of health field familiarity such that the trainees readily adapted to working effectively within the health services environment. The orientation should be improved further to increase the students' knowledge of non-hospital components of the health system and to prepare the students better for the particular organizational, human, and interpersonal characteristics of the health field.

5. PHMS trainees employed in the health field were better prepared to function successfully in their initial health field positions than other new employees in similar positions with comparable educations but with no previous health field involvement.

6. Specific improvements suggested for PHMS included the need for:

   a) A greater variety and selection of PHMS coursework, including increased coverage of non-hospital components of the health system, increased inputs from health field professionals such as physicians and hospital administrators, courses in organizational, human, and interpersonal behavior with emphasis on the health field, and increased emphasis on information transfer and processing.

   b) Continued emphasis on the basic systems techniques of analysis and synthesis with eclectic coverage of operations research techniques.

   c) A greater variety of health related clinical experiences through both fieldwork courses and work experiences including involvement of students in substantive roles and increased student responsibilities in the projects.

7. PHMS served successfully as a model for future health systems education programs, but such future programs should incorporate the above-cited improvements.
8. Health systems is a vital, new allied health field of professional practice for the person who is both health services oriented and trained in appropriate systems techniques, and the requirements of this new field are such that new curricula, which are specifically designed for educating health systems practitioners and which lead to degrees in health systems, are needed.
RECOMMENDATIONS

Based on the results of this evaluation, the following recommendations are offered for PHMS and other health systems education programs.

1. The health field orientation portion of health systems education programs should include a broad and in-depth coverage of the various aspects of the health field including material on the organizational, human, and interpersonal characteristics particular to the health field.

2. Health systems education programs should include substantial input from health field professionals such as physicians, hospital administrators, nurses, and government officials from health related agencies.

3. The methodology or techniques portion of health systems education programs should stress the basic systems techniques of analysis and synthesis with eclectic coverage given to operations research techniques.

4. Health systems education programs should include a substantial amount of clinical training to be provided through fieldwork courses and real life work experiences.

5. Health systems, as a bona fide, new, and vital allied health field of professional practice, should have new, degree-granting curricula developed, which curricula should include instruction in health system processes and appropriate techniques for solving health system problems, plus courses in information transfer and processing, management, accounting, and organization theory.

In addition to the above recommendations for health systems education programs, the following recommendations are offered for future evaluations of the content and character of health systems education both at Georgia Tech and at other universities.

6. Future evaluations should be made which include inputs from a larger number of practicing health systems professionals including graduates from other universities' health systems education programs. Also,
faculties of other health system programs should be asked to contribute in-
puts to future evaluations.

7. An attempt should be made to more precisely determine the proper
absolute amounts and relative proportions of coursework, both lecture-type
and project-type, and work experiences which should be included in health
systems education programs.

8. Also, the specific systems techniques, which should be included
in health systems training, should be more precisely determined.

9. Future evaluations should attempt to assess what differences, if
any, should exist between the curricula for different types of health
systems positions and whether these differences can be accommodated via
a variety of options within a basic health systems curriculum or whether
disparate curricula are necessary.

10. Also of interest would be a comparison of the character, content,
and success of health systems education at Georgia Tech with health systems
education at other universities.
SECTION III

SUMMARY OF PHMS ACTIVITIES AND DEVELOPMENT

1 January 1971 through 30 June 1972
INTRODUCTION

This section of the present report describes progress made in developing the Program in Hospital and Medical Systems during the last eighteen months of the five-year developmental training project supported by the Bureau of Health Manpower Education of the U. S. Public Health Service. Thus, this section covers the last six months of USPHS Grant No. 2 DO2 AH 01056-04 and the full twelve months of USPHS Grant No. 2 DO2 AH 01056-05.

As stated in Section I of this report, specific objectives of PHMS were as follows:

1. To generate and cultivate a source of industrial engineers who are both technically competent and health services oriented as an effective means of solving problems associated with the delivery of health services to various groups within the community.

2. To develop means of orienting industrial engineers to the hospital and medical environment and of acquainting members of the health team with the philosophy, principles, approaches, and techniques of modern industrial engineering.

3. To promote the cause of allied health manpower by developing an educational program which interfaces engineering sciences with health sciences in interdisciplinary areas of study and practice.

The general objective of the training project was to develop a unique educational program consisting of a new curriculum for the training of industrial engineers who were being prepared to enter the health field as a permanent career environment. Although emphasis in this developmental project was upon graduate education in hospital management systems at the master's level, some attention was also given to health systems training at the doctoral and undergraduate levels. Interdisciplinary health related educational opportunities were also provided to various students in both engineering and the health professions.
The degree to which the general objective and the specific objectives of PHMS were achieved is the principal topic of Section II of the present report. Section III generally describes the activities and development of PHMS during the period January 1, 1971 through June 30, 1972.

**GRANT NUMBERS AND TITLE**

2 DO2 AH 01056-04
2 DO2 AH 01056-05 (Expired June 30, 1972)
"Program in Hospital and Medical Systems"

**NAME OF GRANTEE INSTITUTION**

Georgia Institute of Technology
Atlanta, Georgia

**NAME OF PROGRAM DIRECTOR**

Harold E. Smalley, Ph.D.
Regents' Professor and Director
Director, Health Systems Research Center

**PERIOD COVERED BY REPORT**

January 1, 1971 through June 30, 1972

**DATE OF PREPARATION**

February 28, 1973
# STAFFING

## PROFESSIONAL PERSONNEL

<table>
<thead>
<tr>
<th>Name and Title</th>
<th>Period of Involvement</th>
<th>PHMS Project Activity</th>
</tr>
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<tbody>
<tr>
<td>Harold E. Smalley, Ph.D.</td>
<td>1/1/71-12/31/71</td>
<td>25%*</td>
</tr>
<tr>
<td>Regents' Professor and Director</td>
<td>1/1/72-6/30/72</td>
<td>33%*</td>
</tr>
</tbody>
</table>

Responsibilities: Overall direction of the training project on the Georgia Tech campus, at HSRC in the Piedmont Hospital Complex, at Georgia State University, and at the Medical College of Georgia; thesis and dissertation direction; taught ISyE 665 in the Spring Quarter of 1972; general program development.

| A. D. Joseph Emerzian, Ph.D.          | 1/1/71-12/31/71       | 10%                   |
| Visiting Professor                    | 1/1/72-6/30/72        | 15%                   |

Responsibilities: Consulted on development of training program and on project evaluation; assisted with preparations for ISyE 665 in the Spring Quarter of 1972.

| John R. Watt, Ph.D.                   | 5/1/71-6/30/71        | 100%                  |
| Visiting Associate Professor          | 7/1/71-12/31/71       | 50%*                  |
|                                      | 1/1/72-5/31/72        | 50%*                  |

Responsibilities: Taught ISyE 418 in the Summer and Fall Quarters of 1971 and in the Winter and Spring Quarters of 1972; directed student projects in hospitals; developed teaching-learning materials.

| John W. Coyle, M.S.                  | 1/1/71-12/31/71       | 25%*                  |
| Assistant Professor                   | 1/1/72-6/30/72        | 33%*                  |

Responsibilities: Advised trainees on computer needs and uses; administered IBM Hospital Management Game in ISyE 665 in the Spring Quarter of 1972; developed new course material; planned and coordinated trainee involvement in health systems projects; planned for evaluation of PHMS and for producing the final PHMS report for the National Institutes of Health; directed various special problem courses; coordinated educational interfaces with the School of Architecture.

* Remainder of time devoted to academic administration and to education and research closely related to the training project; thus, virtually 100% time was devoted to hospital and medical systems.
Gerald L. Delon, Ph.D.  
Assistant Professor  
1/1/71-4/30/71  10%*

Responsibilities: Advised trainees involved in the USPHS sponsored research project, "Systems Analysis of Medical Records in Georgia."

James B. Mathews, Ph.D.  
Assistant Professor  
1/1/71-12/31/71  20%*  (and Associate Director, DHSE)

1/1/72-6/30/72  20%*

Responsibilities: Directed master's theses of trainees; coordinated PHMS activities at the Medical College; assisted with plans for evaluation of PHMS.

James F. Smith, MSE  
Assistant Professor  
1/1/71-12/31/71  25%*  
1/1/72-6/30/72  25%*

Responsibilities: Coordinated new teaching-learning materials; coordinated employment and placement service; coordinated trainee involvement in HSRC's community service program, Hospital Systems Improvement Services (Project SIS), which functions in cooperation with the Georgia Hospital Association.

William G. Sullivan, Ph.D.  
Assistant Professor (DHSE)  
1/1/71-6/30/71  10%*  
7/1/71-10/16/71  5%*

Responsibilities: Coordinated trainee involvement in the USPHS sponsored research project, "Analysis of Optimal Radiographic Location Networks," at the Medical College of Georgia.

Edwin M. Sheats, MBA  
Instructor  
1/1/71-12/31/71  25%*  
1/1/72-6/30/72  25%*

Responsibilities: Supervised academic records, alumni records, and other trainee data; coordinated audiovisual development, including CCTV; supervised trainee projects in hospitals; assisted with teaching of ISyE 418 in the Winter Quarter of 1972.

Joseph H. McNinch, M.D.  
Staff Consultant  
9/1/71-12/31/71  10%  
1/1/72-6/30/72  5%

Responsibilities: Advised faculty, staff, and trainees on medical practice, hospital administration, medical records, national organizations, and other matters related to health systems.

* Remainder of time devoted to academic administration and to education and research closely related to the training project; thus, virtually 100% time was devoted to hospital and medical systems.
Joseph A. Harrison, Ph.D.  
1/1/71-6/15/71  
25% 
Assistant Professor 
Responsibilities: Advised trainees on statistics and similar technical matters; directed various trainee projects; served on thesis committees.

Richard M. Bramblett, MSIE  
1/1/71-6/30/71  
10%* 
Assistant Professor (DHSE)  
7/1/71-12/31/71  
5%* 
1/1/72-6/30/72  
10%* 
Responsibilities: Directed field training of all PHMS trainees at the Medical College of Georgia.

Jan R. Gustafson, B.A.  
2/1/71-12/31/71  
50%* 
Administrative Specialist  
1/1/72-6/30/72  
25%* 
Responsibilities: Coordinated internal management and support services for PHMS.

A. David Luckey, M.S.  
11/1/71-12/31/71  
5%* 
Research Associate (DHSE)  
1/1/72-6/30/72  
5%* 
Responsibilities: Directed student projects at the Medical College of Georgia.

ADJUNCT FACULTY

During the five-year project period, PHMS adjunct faculty members effectively contributed to the training process in many ways. These individuals served on thesis and dissertation committees, participated in seminars, were involved in health related research and service projects, and often furnished advice to trainees. The following is a list of those individuals who served at various times as members of the PHMS adjunct faculty during the period January 1, 1971 through June 30, 1972:

Philip Adler, Jr., Ph.D., Professor of Technology Management, Georgia Institute of Technology. 
J. Norman Berry, M.D., Associate Clinical Professor of Medicine, Emory University. 
Walter L. Bloom, M.D., Professor of Biology and Associate Vice President for Academic Affairs, Georgia Institute of Technology.

* Remainder of time devoted to academic administration and to education and research closely related to the training project; thus, virtually 100% time was devoted to hospital and medical systems.
Mark D. Brown, M.D., Professor and Chairman of Radiology, Medical College of Georgia.
J. Rhodes Haverty, M.D., Professor and Dean of Allied Health Sciences, Georgia State University.
Raphael B. Levine, Ph.D., Director, Department of Health and Social Services Planning, Atlanta Regional Commission.
F. Levering Neely, M.D., Clinical Associate Professor of Medicine, Emory University.
Vladimir Slamecka, DLS, Professor and Director of Information and Computer Science, Georgia Institute of Technology.
Robert E. Stiemke, M.S., Professor of Civil Engineering, Georgia Institute of Technology.
W. Loren Williams, Ph.D., Research Professor of Psychology and Director of the Division of Education R & D, Medical College of Georgia.
Richard Wilson, A.A.Dipl., Professor of Architecture, Georgia Institute of Technology.
George R. Wren, Ph.D., Professor and Director of Health Administration, Georgia State University.
Thomas J. Zwemer, DDS, Professor of Orthodontics and Associate Dean of Dentistry, Medical College of Georgia.

REPRESENTATIVES OF COOPERATING INSTITUTIONS

During the period January 1, 1971 through June 30, 1972, relationships with other academic institutions, Georgia Tech subdivisions, health delivery institutions, health related associations, government agencies, and private firms were strengthened. The following listing contains the names of representatives of cooperating institutions with which PHMS shared cooperative relationships during the eighteen-month period:

J. Gordon Barrow, M.D., Director, Georgia Regional Medical Program.
A. Evan Boddy, M.D., Medical Director, Cherokee Atomedic Hospital.
Richard E. Gillock, MBA, Administrator, Eugene Talmadge Memorial Hospital, Medical College of Georgia.
J. Fred Gunter, MHA, Administrator, South Fulton Hospital.
Glen M. Hogan, LLB, Executive Director, Georgia Hospital Association.
Douglas B. Kendrick, M.D., Medical Director, Grady Memorial Hospital.
Hulett D. Sumlin, B.S., Administrator, Piedmont Hospital.

JOINT FACULTY APPOINTMENTS

As a means of facilitating the PHMS training process, several members of the PHMS faculty held joint faculty appointments at various times during the period January 1, 1971 through June 30, 1972. Those faculty members who held joint appointments were:
GUEST LECTURES AND SEMINARS

The following individuals either gave guest presentations or conducted seminars during the period January 1, 1971 through June 30, 1972:


John Ferguson, Executive Director, Hall County Hospital in Gainesville, Georgia, "Hospital Management System Problems," Atlanta, August 1971.

John R. Fuller, Systems Engineer, Division of Health Systems Engineering, Medical College of Georgia, "The Unit Dose Medication System," Augusta, March 1971.

Ted Grazman, Research Associate, Program in Health Administration, Georgia State University, "Long-Range Planning for Hospitals," Atlanta, September 1971.

Max G. Holland, Ph.D., Associate Professor of Management, Georgia State University, "Health Planning in Rural Areas," Atlanta, February 1972.

Donald Kemper, HSRC, "Quality Control and Staffing Utilization Programs for Nursing Service Departments," Atlanta, August 1971.


Frederic Kennedy, Associate Director, Department of Health and Social Services, Atlanta Regional Commission, "Assessment of the Availability of Hospital Beds within the Atlanta Metropolitan Planning Region," Atlanta, May 1972.

Roland J. Knobel, Ph.D., Associate Professor, Program in Health Administration, Georgia State University, "Program in Health Administration, Georgia State University," Atlanta, February 1971.

Ben W. Latimer, Director, Carolinas Hospital Improvement Program, "Carolinas Hospital Improvement Program," Atlanta, February 1972.

M. E. McNabb, Food Service Administrator, Central State Hospital, Milledgeville, Georgia, "Food Management Improvements as a Result of Utilizing Computer-Assisted Menu Planning (CAMP)," Augusta, July 1971.

Robert M. Mason, Research Scientist, Engineering Experiment Station, Georgia Institute of Technology, "Organizational Health and Strategic Planning," Atlanta, August 1971.

James B. Mathews, Ph.D., Director, Division of Systems and Computer Services, Medical College of Georgia, "Health Systems Engineering at Medical College of Georgia," March 1972.

Ole Olsen, Ph.D., Associate Professor of Industrial Management, Georgia Institute of Technology, "The Potential Impact of Computers on Managerial Aspects of Health Care Delivery," Atlanta, June 1971.


David R. Shaw, Director, Systems Development Department, University of Alabama Hospital and Clinics, "Systems Engineering Services at the University of Alabama Hospital and Clinics," Atlanta, December 1971.

Vladimir Slamecka, DLS, Professor and Director of the School of Information and Computer Science, Georgia Institute of Technology, "The Biomedical Information Systems and Biomedical Computer Systems Option at Georgia Tech," Atlanta, May 1972.
Elfr. Stubler, Ph.D., Director, Labor Sciences, the German Federal Research Institute for Home Economics, "Work Methods Education for Nurses," Atlanta, April 1971.

Curtis J. Tompkins, Ph.D., Assistant Professor, Graduate School of Business Administration, University of Virginia, "Medical Terminology," Atlanta, February 1972.

George R. Wren, Ph.D., Professor and Director of Health Administration, Georgia State University, "The Health Care Crisis," Atlanta, February 1972.

George R. Wren, Ph.D., Professor and Director of Health Administration, Georgia State University, "Comprehensive Health Planning in Bacon County, Georgia," Atlanta, May 1972.

CONSULTANTS

The following individuals served at various times as consultants to the training project during the period January 1, 1971 through June 30, 1972:

John R. Freeman, Ph.D., Director of Management Services, The Medicus Corporation, Dallas, Texas.
Glenn M. Hogan, Executive Director, Georgia Hospital Association, Atlanta.
Frank R. Mark, M.D., Federal Health Activities Coordinator, Health Services and Mental Health Administration, U.S. Public Health Service, Rockville, Maryland.

APPROVED PROGRAM POSITIONS

All approved program positions were filled during the period January 1, 1971 through June 30, 1972 with the following exception. Dr. Emerzian was not able to accept an appointment due to unresolved commitments at the University of Connecticut. Dr. Emerzian was able to participate in program activities by visiting the Health Systems Research Center on several occasions. Major duties planned for Dr. Emerzian were reallocated among other faculty and professional staff during this period.

CHANGES IN STAFFING

Joseph H. McNinch, M.D., became a staff consultant with PHMS on September 1, 1971. With Dr. McNinch's participation and the increased involvement of
Mr. Coyle and Mr. Bramblett, position vacancies resulting from the resignations of Dr. Delon and Dr. Harrison in 1971 did not result in any loss in program continuity. Dr. Sullivan also resigned in 1971, and Mr. Bramblett was promoted to fill this vacancy; A. David Luckey was promoted to fill the vacancy created by Mr. Bramblett's promotion.
TRAINING ACTIVITIES

FORMAL COURSEWORK

During the period January 1, 1971 through June 30, 1972, the basic three course sequence in hospital and medical systems (ISyE 418, 665, 765) was further developed and broadened, and new uses were made of both undergraduate and graduate project courses (ISyE 491,2,3 and 704,5,6) for health related instruction. The following health related courses were taught by PHMS faculty members and were available to PHMS trainees:

- ISyE 418 Industrial Engineering in Hospitals
- ISyE 491,2,3 Special Problems
- ISyE 665 Case Studies in Hospital Management Systems
- ISyE 700 Master's Thesis
- ISyE 704,5,6 Special Problems in Industrial Engineering
- ISyE 765 Projects in Hospital Management Systems
- ISyE 800 Doctoral Thesis

ISyE 418 was an approved elective for both undergraduate and graduate students and was a required course for all PHMS trainees; ISyE 491,2,3 (formerly IE 451,2,3) was an undergraduate elective. In addition to ISyE 418, PHMS graduate trainees normally were required to take ISyE 665 and either ISyE 704,5,6 or ISyE 765. Additionally, master's trainees had to take ISyE 700 and doctoral trainees had to take ISyE 800. Comparable project courses or thesis courses were required of PHMS trainees enrolled in other schools associated with the training project.

Enrollment in health related formal coursework (excluding thesis and dissertation courses) at Georgia Tech may be summarized as follows:

<table>
<thead>
<tr>
<th>Course</th>
<th>Total during 6/67-12/70</th>
<th>Enrollment during 1/1/71 through 6/30/72</th>
<th>Total through 6/30/72</th>
</tr>
</thead>
<tbody>
<tr>
<td>ISyE 418</td>
<td>157</td>
<td>Winter 22</td>
<td>Spring 22</td>
</tr>
<tr>
<td>ISyE 4XX</td>
<td>20</td>
<td>Winter 1</td>
<td>Spring -</td>
</tr>
<tr>
<td>(Projects)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ISyE 665</td>
<td>16</td>
<td>Winter 1</td>
<td>Spring -</td>
</tr>
<tr>
<td>ISyE 704,5,6</td>
<td>35</td>
<td>Winter 1</td>
<td>Spring -</td>
</tr>
<tr>
<td>ISyE 765</td>
<td>7</td>
<td>Winter -</td>
<td>Spring -</td>
</tr>
<tr>
<td>Totals</td>
<td>235</td>
<td>Winter 24</td>
<td>Spring 22</td>
</tr>
</tbody>
</table>
A further broadening of the disciplinary mix of students involved in the training project was achieved during the period January 1, 1971 through June 30, 1972. The following disciplines were represented in formal coursework, some for the first time:

- Architecture
- Biology
- Chemistry
- Chemical Engineering
- Electrical Engineering
- Industrial Management
- Industrial and Systems Engineering
- Mechanical Engineering
- Psychology

The following term-project reports were prepared and submitted by students enrolled in health related academic courses during the period January 1, 1971 through June 30, 1972:


"Suggestions for Improvement of Certain Aspects of Piedmont Hospital's Housing Department," Jones, Rolin C., and Edwin B. Lane, August 1971.
"An Initial Study of Emory University Hospital's PT and OT Departments' Financial Situation," Might, Thomas O., August 1971.
"Grady Hospital General Admissions Clinic," Reilman, Susan, and Arturo Casasa, August 1971.
"An Analysis of the Cost of Treatments in the Departments of Physical and Occupational Therapy at Emory University Hospital," Ayoubi, Joan, August 1971.


NEW EDUCATIONAL DEVELOPMENT AND INSTRUCTION

During the period January 1, 1971 through June 30, 1972, there were many new developments in credit educational activities at the Medical College of Georgia and Georgia Tech. The following courses were developed and taught by Dr. Mathews and Mr. Bramblett at the Medical College:

An introduction to management science offered by the School of Graduate Studies.

An introductory management course for Medical Records Science students.
MRS 319. Management.
An additional management course for Medical Records Science students.

A health systems course for medical technology students and dental hygiene students.

Dr. Mathews and Mr. Bramblett also provided numerous guest lectures for courses taught by many of the schools at the Medical College. In addition, they prepared descriptions of six new Health Systems course offerings which were offered by the Division of Health Systems Engineering "on demand" to Medical College students. Dr. Mathews also continued to serve on the master's thesis advisory committees of several PHMS trainees who were completing requirements for ISyE 700.

In Atlanta, the Health Systems Research Center faculty taught PHMS courses, appeared as guest lecturers in classes of other disciplines, served on design juries in the School of Architecture, and developed numerous teaching-learning materials for subsequent inclusion in formal coursework. A large share of the total teaching responsibility was assumed by Dr. John R. Watt, Visiting Associate Professor, University of Texas. Dr. Watt founded the Hospital Systems and Research Program at the University of Texas and taught courses in hospital systems analysis and improvement. Over 120 students were enrolled in Dr. Watt's health related courses over a three and one-half year period at the University of Texas.

One of the primary advantages gained in developing relationships that promoted visiting professorships was that teaching material and experiences could be shared by different programs for the benefit of all associated students. For example, Dr. Watt introduced numerous new educational materials and audiovisual aids in ISyE 418 as a result of his experiences at the University of Texas. He also developed many new instructional "packages" for use in subsequent sessions of ISyE 418 and other health related courses at Georgia Tech and at the Medical College of Georgia.

Of special significance was the PHMS faculty's development of proposed B.S. and M.S. curricula for training health systems analysts through formal
degree granting mechanisms at Georgia Tech. A formal proposal was submitted to the Bureau of Health Manpower Education, NIH, in the Fall of 1971 and was approved for funding in April 1972. The new training grant, designated "Program in Health Systems," was officially approved by the Curriculum Committee of Georgia Tech in October 1972, and the first health systems course was offered during the Winter Quarter of 1973.

NON-CREDIT PROGRAMS

In addition to formal coursework for academic credit, several kinds of non-credit educational activities were further developed during the period January 1, 1971 through June 30, 1972. Notable among these activities were the following:

(a) The Medical College seminar program in Augusta.

(b) The HSRC seminar program in Atlanta.

(c) A short course in work simplification for Medical College faculty and students and for hospital personnel in Augusta.

(d) Monthly interdisciplinary sessions of the faculty and students involved in the USPHS-sponsored research project, "Analysis of Optimal Radiographic Location Networks," alternating between Atlanta and Augusta.

(e) A graduate seminar in the School of Industrial and Systems Engineering at Georgia Tech conducted by Dr. Mathews.

(f) Two seminars for Medical College staff members concerning "Computer-Based Systems: Fundamentals of Planning and Design" conducted by Mr. Luckey.

(g) A number of interdisciplinary sessions with cooperating groups such as Georgia Tech's Bioengineering Center and Environmental Resources Center, College of Industrial Management, and Schools of Architecture, Psychology, and Information and Computer Science; Georgia State's School of Allied Health Sciences; Emory's Regional Rehabilitation Research and Training Center;

* A complete list of seminars held and guest lectures presented during the period July 1, 1967 through June 30, 1972 is contained in Appendix I.
a considerable number of schools, departments, and divisions at the Medical College; and a wide variety of health institutions and agencies in metropolitan Atlanta.

CLINICAL TRAINING

During the period January 1, 1971 through June 30, 1972, PHMS trainees completed the following reports as a result of projects conducted in or related to hospitals in metropolitan Atlanta and throughout Georgia:


Various PHMS trainees received additional health related training by participating in extramurally and intramurally funded research projects at the Health Systems Research Center, Georgia Tech, or at the Division of
Health Systems Engineering, Medical College of Georgia. During the period January 1, 1971 through June 30, 1972, there were four sponsored research projects which involved trainee participation. These research projects were:

"Analysis of Optimal Radiographic Location Networks," sponsored by the National Center for Health Services Research, USPHS.

"Systems Analysis of Medical Records in Georgia," sponsored by the Regional Medical Programs Service, USPHS.

"The Efficiency of Various Beverages as Athletes' Replacement Fluid," sponsored by the Coca Cola Company, U.S.A., and through the Georgia Tech Foundation.

"Design of Stephens County Health Maintenance Facility," sponsored by the Georgia Regional Medical Program.

Several PHMS trainees received health related practical experience by participating in HSRC's new shared services program for Georgia hospitals, Hospital System Development Services (Project SIS). Project SIS, initiated in April of 1972, is a jointly administered program of Georgia Tech (HSRC) and the Georgia Hospital Association and provides systems engineering services to participating Georgia hospitals.

THESES AND DISSERTATIONS

PHMS trainees who pursued either the designated MSIE degree or the undesignated MS degree in the School of Industrial and Systems Engineering were expected to follow a program of study which included the master's thesis. Trainees enrolled in other cooperating schools adhered to policies of those schools, some of which provided for a non-thesis option. The following master's theses were successfully completed by PHMS trainees during the period January 1, 1971 through June 30, 1972:


A total of four master's thesis were in progress on 30 June 1972 as follows:

"Forecasting Demands for Radiographic Service," (Approved Topic), Donald B. Russell.

"An Industrial Dynamics Simulation Model for Long-range Planning at a State Mental Health Institution," (Approved Topic), J. Michael Jones.


"Manpower and Facility Mixes in a Private Dental Practice: A Simulation Analysis," (Approved Topic), William D. Carswell, III.

The doctoral program was intended for highly gifted individuals whose past accomplishments indicated a high potential for successful completion of program requirements and a subsequent creative contribution to the health field, usually either as a teacher or an investigator but often as a practitioner or a consultant. For majors in hospital and medical systems, the dissertation and one area of the comprehensive examination were health oriented. Two doctoral dissertations were completed by PHMS trainees during the period January 1, 1971 through June 30, 1972:


Doctoral dissertations in progress at the end of the Spring Quarter 1972 were as follows:

"Fiscal Controls for Hospital Departments," (Approved Topic), Tee H. Hiett.**


"Strategic Planning and Organizational Health: A Systems Approach," (Approved Topic), Robert M. Mason.

* Gerald B. Widegren had completed all requirements for and received the MSIE degree at the time of the writing of this report.

** Tee H. Hiett had completed all requirements for and received the Ph.D. degree at the time of the writing of this report.
OTHER PHMS ACTIVITIES

Credit and non-credit training programs received significant benefits from the new closed circuit television studio and associated equipment made possible by the PHMS grant. Arrangements were completed in the early fall of 1971 and, subsequently, several members of the HSRC faculty and staff developed expertise in program development and equipment operation. Several regular class sessions of ISyE 418, taught during the Fall Quarter of 1971, were taped in the classroom in the School of Industrial and Systems Engineering and numerous sessions were taped during 1972. This communications medium allowed regular instruction sessions and guest lectures to be saved for subsequent presentations to future students.

Staff members participating in the development of audiovisual materials also conducted extensive experiments with lighting, camera angles, and special effects. Additionally, HSRC developed a photo copying capability, making possible the creation of new audiovisual aids for classroom instruction. The many slides and 16 mm movies that had been acquired in previous years were catalogued for easy access and use by the faculty.

Continuing efforts were made to promote cooperation and information exchange with various groups throughout this country and abroad. Faculty and staff members of PHMS participated actively in relevant societies, associations, and government agencies, and maintained continuing contacts with other university centers, multi-hospital programs, and similar groups interested in manpower for the scientific treatment of hospital and medical systems. Several PHMS staff members served as officers and committee members of the Hospital Management Systems Society of the American Hospital Association, and of the Hospital and Health Services Division of the American Institute of Industrial Engineers; and PHMS was well represented at the national annual meetings of these two societies.

Program Bulletins

The following program bulletins and manuscripts for publication were prepared by PHMS faculty and staff members during the period January 1, 1971 through June 30, 1972:
"Analysis of Optimal Radiographic Location Networks," Final Report, USPHS Grant No. HS 00179, October 1971:

"Systems Analysis of Medical Records in Georgia," Final Report, USPHS Contract No. HSM 110-70-349, September 1971:

Publications
The following articles were written by PHMS faculty and staff members and either published or submitted for publication during the period January 1, 1971 through June 30, 1972:


Fuller, J. R., "Nursing and Pharmacy Direct Labor in the Floor Stock and Unit Dose Drug Distribution Systems," American Journal of Hospital Pharmacy, (submitted for publication).


Presentations

The following presentations were made during the period January 1, 1971 through June 30, 1972 by members of the PHMS staff and faculty:


"Our Fractionated Health-Care Non-System," Watt, John R., presented at the Regional and City Planning Seminar, University of Texas, Austin, Texas, February 1971.


"Health Services Research at the Georgia Institute of Technology," Coyle, John W., presented at the National Center for Disease Control, Atlanta, Georgia, April 1971.

"What's Right and What's Wrong with U.S. Medical Care Today," Watt, John R., presented to the North Austin Lion's Club, Austin, Texas, April 1971.


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"Health Systems Research Center and Pharmacy-Related Projects," Smalley, Harold E., presented at the 14th Annual Seminar of the Georgia Society of Hospital Pharmacists, University of Georgia, Athens, Georgia, October 1971.


"A New Service Program for Georgia Hospitals," Smalley, Harold E., and James F. Smith, presented to the Membership Assembly of Georgia Hospital Association, Atlanta, Georgia, January 1972.


"Hospital Industrial Engineering in Latin America," Smalley, Harold E., presented at a special meeting of the Mexico Chapter, American Institute of Industrial Engineers, Mexico City, D.F., June 1972.

"Planning an Emergency Medical System for Atlanta," Coyle, John W., presented to the EMS Task Force of the Atlanta Regional Commission, Atlanta, Georgia, June 1972.


SUMMARY OF METHODS OF PROVIDING PHMS EDUCATIONAL EXPERIENCES

The following list contains an overall summary of the methods by which students were provided with health related educational experiences during the period January 1, 1971 through June 30, 1972:

1. Lectures, recitations, textbook readings, library research, and discussions in health oriented courses.

2. Guest lectures and demonstrations (some with slides, transparencies, and other visuals) in both the credit courses and the seminars.

3. PHMS faculty and staff lectures and presentations to faculty and students in other programs at Georgia Tech and in other universities.

4. Individual project courses (ISyE 491,2,3; ISyE 704,5,6; and ISyE 765) in which a trainee completed an academically oriented, faculty supervised, real world project in hospital and medical systems.

5. Health oriented term projects completed in either non-PHMS courses or health oriented courses by groups of students (including all PHMS trainees).

6. Involvement of trainees in ongoing research and service projects as a means of providing health service orientation and promoting knowledge and skill in creative and independent work. Such involvement also provided the students with a mechanism for gathering data for theses and dissertations.
7. Participation by trainees and other students in the computerized IBM hospital management game.

8. Continuation of the experimental use of closed circuit television and pre-recorded videotapes in providing students with the benefit of previous guest lectures, special programs, and feedback concerning the delivery of oral reports.

9. The teaching of credit courses for the allied health sciences at Georgia Tech, Georgia State, the Medical College of Georgia, and Augusta College.

10. Seminars, short courses, and various other interdisciplinary sessions.

STATUS OF TRAINEES

At the beginning of calendar year 1971, there were a total of nineteen active PHMS trainees. This total included eleven master's trainees, seven doctoral trainees, and one undergraduate trainee. During the period January 1, 1971 through June 30, 1972, nine trainees graduated (seven master's, one doctoral, and one undergraduate), one trainee transferred from PHMS to another program of the School of Industrial and Systems Engineering, and one trainee withdrew from PHMS. During this same period, seven new trainees joined the program (four master's and three undergraduate). Thus, as of June 30, 1972, there were fifteen active PHMS trainees comprised of eight master's, four doctoral, and three undergraduate students. Trainee statistics for the five year period July 1, 1967 through June 30, 1972 are contained in Tables 10 through 14 of the present report.

EQUIPMENT PURCHASED

During the period January 1, 1971 through June 30, 1972 grant funds in the amount of $2,500 were matched with an equivalent state allocation to purchase audiovisual and closed circuit television equipment for PHMS. In addition, an overhead projector and a calculator were also purchased in support of the training program.

CHANGES IN PROGRAM

There were no changes in either the general objective or the specific objectives of the training project, as given in the 1970 grant renewal application and restated in Section I of the present report. All approved program activities were developed and administered as described throughout the present report.
<table>
<thead>
<tr>
<th>Trainee Code</th>
<th>Academic Discipline</th>
<th>Date Entered</th>
<th>Quarters Completed Under PHMS</th>
<th>Credit Hours Completed Under PHMS</th>
<th>Quality Point Average*</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>101</td>
<td>Industrial and Systems Engg.</td>
<td>7-67</td>
<td>5</td>
<td>27 17</td>
<td>3.8</td>
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<td>26 16</td>
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<td>MSIE 6-70</td>
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<td>0 4</td>
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<td>Degree requirements completed 6-71</td>
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<td>3.2</td>
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*A=4.0, B=3.0, C=2.0, D=1.0, F=0.0, S=Satisfactory Progress.

**Summer of 1967 in COSTEP Program.


##PHS Traineeship Award 69-171.
<table>
<thead>
<tr>
<th>Trainee Code</th>
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<th>Credit Hours Completed Under PHMS</th>
<th>Quality Point Average</th>
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#NSF Fellowship superseded by PHS Predoctoral Intermediate Fellowship 1-F1-CH-30, 873.
##PHS Predoctoral Research Fellowship Award 5 F01 HS 45475.
+These three doctoral students transferred from PHMS to other programs of the School of Industrial and Systems Engineering but continued their interests in health systems.
<table>
<thead>
<tr>
<th>Trainee Code</th>
<th>Academic Discipline</th>
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<th>Quarters Completed Under PHMS</th>
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**TABLE 12** Summary of Undergraduate Trainees' Academic Performance under PHMS.
<table>
<thead>
<tr>
<th></th>
<th>Master's Trainees</th>
<th>Doctoral Trainees</th>
<th>Totals For All Graduate Trainees</th>
<th>Undergraduate Trainees</th>
<th>Totals, All Trainees</th>
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<td>Students prior to PHMS (7/67)</td>
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<td>14</td>
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<td>Subtotals</td>
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<td>9</td>
<td>23</td>
<td>9</td>
<td>32</td>
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<tr>
<td>Less: leaving 7/67-6/68)*</td>
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<td>Active beginning 2nd year</td>
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<td>18</td>
<td>2</td>
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<td>2</td>
<td>9</td>
<td>8</td>
<td>17</td>
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<tr>
<td>Subtotals</td>
<td>17</td>
<td>10</td>
<td>27</td>
<td>10</td>
<td>37</td>
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<tr>
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<td>1</td>
<td>10</td>
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<tr>
<td>Active beginning 3rd year</td>
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<td>9</td>
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<td>2</td>
<td>4</td>
<td>3</td>
<td>7</td>
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<td>11</td>
<td>21</td>
<td>11</td>
<td>32</td>
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<tr>
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<td>3</td>
<td>5</td>
<td>9</td>
<td>14</td>
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<td>Active beginning 4th year</td>
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<td>16</td>
<td>2</td>
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<td>5</td>
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<tr>
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<td>8</td>
<td>21</td>
<td>5</td>
<td>26</td>
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<tr>
<td>Less: leaving (7/70-12/70)*</td>
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<td>4</td>
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<td>7</td>
<td>22</td>
<td>4</td>
<td>26</td>
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<td>Less: leaving (1/71-6/72)*</td>
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<td>Active as of 6/30/72</td>
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<td>Total enrollment since 7/67</td>
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<td>22</td>
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</table>

* Via graduation, interruption by selective service, or withdrawal.

TABLE 13 Manpower Production Summary.
<table>
<thead>
<tr>
<th></th>
<th>Master's Trainees</th>
<th>Doctoral Trainees</th>
<th>All Graduate Trainees</th>
<th>Undergraduate Trainees</th>
<th>Total, Trainees</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Students</td>
<td>32</td>
<td>13</td>
<td>45</td>
<td>26</td>
<td>71</td>
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<tr>
<td>Total Man-Quarters</td>
<td>188</td>
<td>145</td>
<td>333</td>
<td>90</td>
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<td>Average Man-Quarters*</td>
<td>5.8</td>
<td>11.2</td>
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<tr>
<td>Equivalent Full Time**</td>
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<td>Quarter-Hours Per Man-Quarter</td>
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<td>6</td>
<td>25</td>
<td>22</td>
<td>47</td>
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</table>

*Total man-quarters divided by number of students.
**Total man-quarters divided by total quarters elapsed during the reporting period 7/1/67-6/30/72=20 quarters.

TABLE 14  Statistical Summary of All PHMS Trainees' Academic Performance.
## APPENDICES

<table>
<thead>
<tr>
<th>Appendix</th>
<th>Title</th>
<th>Page</th>
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<tbody>
<tr>
<td>A</td>
<td>DESCRIPTIONS OF THE PHMS CORE COURSES</td>
<td>125</td>
</tr>
<tr>
<td>B</td>
<td>NAMES OF PHMS TRAINEES AND THEIR PRESENT POSITIONS</td>
<td>129</td>
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<td>C</td>
<td>EVALUATION INSTRUMENTS USED IN THE EVALUATION OF THE PROGRAM IN HOSPITAL AND MEDICAL SYSTEMS</td>
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<td>D</td>
<td>NARRATIVE COMMENTS AND RESPONSES GIVEN BY PHMS TRAINEES IN ANSWERING THE QUESTIONS OF THE PHMS TRAINEE QUESTIONNAIRE</td>
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<td>E</td>
<td>NAMES AND ADDRESSES OF PHMS TRAINEES' IMMEDIATE SUPERVISORS WITH WHOM THE INITIAL HEALTH FIELD EMPLOYER STRUCTURED INTERVIEW WAS CONDUCTED</td>
<td>181</td>
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<td>F</td>
<td>RESPONSES AND COMMENTS GIVEN BY PHMS TRAINEES' IMMEDIATE SUPERVISORS WITH WHOM THE INITIAL HEALTH FIELD EMPLOYER STRUCTURED INTERVIEW WAS CONDUCTED</td>
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<td>G</td>
<td>THESES AND DISSERTATIONS COMPLETED BY PHMS TRAINEES</td>
<td>191</td>
</tr>
<tr>
<td>H</td>
<td>PROJECT REPORTS COMPLETED BY PHMS STUDENTS</td>
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<td>I</td>
<td>SEMINARS AND GUEST LECTURES PRESENTED UNDER THE AUSPICES OF PHMS</td>
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<tr>
<td>J</td>
<td>TRAINEESHIPS IN HOSPITAL AND MEDICAL SYSTEMS FINAL REPORT</td>
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</table>
APPENDIX A

DESCRIPTIONS

OF THE

PHMS CORE COURSES
Descriptions of the core courses in the Program in Hospital and Medical Systems are presented below.

ISyE 418. Industrial Engineering in Hospitals
3-0-3. Prerequisite: Senior standing or consent of instructor.

Study of hospital management systems and the means by which such systems may be improved through the application of industrial engineering principles and techniques. The hospital as a managerial environment, characteristics of the management systems utilized in striving toward hospital goals, and the philosophies and approaches involved in improving hospital management systems. An introduction to health systems and a survey of medical terminology.

ISyE 665. Case Studies in Hospital Management Systems
3-0-3. Prerequisite: ISyE 418 or consent of instructor.

Building upon an appreciation of industrial engineering in hospitals, this course is concerned with a variety of problems facing management in the health industry and with industrial engineering techniques useful in increasing systems productivity and improving managerial decisions. The major purpose is to demonstrate approaches, methods, and attainable results in actual health-service situations. Through the medium of case studies, a broad range of industrial engineering topics is covered, along with analyses of the total system of health-care delivery.

ISyE 765. Projects in Hospital Management Systems
Credit to be arranged. Prerequisite: ISyE 665 or consent of instructor.

Research, education, and operational projects at the graduate level carried out in actual hospital situations under faculty supervision. Emphasis is upon unusual applications of the principles and approaches of industrial engineering to the study of complex hospital management systems.
APPENDIX B

NAMES OF PHMS TRAINEES

AND

THEIR PRESENT POSITIONS
PHMS TRAINEES

The designation PHMS trainee was used to refer to a matriculated student who was pursuing a degree (undergraduate, master's, or doctoral) in one of the several cooperating schools of instruction at Georgia Tech or other academic institutions and who affiliated with HSRC in order to emphasize health systems in his program of study. PHMS trainees took a number of the PHMS courses in a coordinated program of study and/or were substantially involved in health related work experiences through participation in research and service projects.

The following is a list of 65 former students who participated in the PHMS training program and were designated as PHMS trainees.

<table>
<thead>
<tr>
<th>NAME</th>
<th>POSITION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Master's Students:</td>
<td></td>
</tr>
<tr>
<td>Felipe Alonso</td>
<td>Consultant in Puerto Rico</td>
</tr>
<tr>
<td>William D. Carswell</td>
<td>Systems Engineer II, Division of Systems and Computer Services, Medical College of Georgia</td>
</tr>
<tr>
<td>Arturo Casasa</td>
<td>I.E. Professor, Instituto Tecnologico de cd. Madero</td>
</tr>
<tr>
<td>Frank A. Collins</td>
<td>Commissioned officer in USPHS, Environmental Protection Service (re-entered Georgia Tech 10/70)</td>
</tr>
<tr>
<td>John H. Duchman</td>
<td>Present position unknown</td>
</tr>
<tr>
<td>Joseph T. Dyer</td>
<td>Program Administrator, Insurance Systems of America</td>
</tr>
<tr>
<td>Robert F. Ellis</td>
<td>Assistant D. P. Manager/Systems Analyst, Lloyd Noland Hospital</td>
</tr>
<tr>
<td>Howard E. Fagin</td>
<td>Director of Health Services, Health Resources Corporation</td>
</tr>
<tr>
<td>Jasper H. Hardison</td>
<td>Present position unknown</td>
</tr>
<tr>
<td>Byron E. Hodnett</td>
<td>Consultant, Booz, Allen, and Associates</td>
</tr>
<tr>
<td>Joan S. Horwitz</td>
<td>Instructor, Department of Epidemiology and Biostatistics, Tulane University</td>
</tr>
<tr>
<td>NAME</td>
<td>POSITION</td>
</tr>
<tr>
<td>-----------------------------</td>
<td>--------------------------------------------------------------------------</td>
</tr>
<tr>
<td>J. Michael Jones*</td>
<td>President, Health Resources Corporation</td>
</tr>
<tr>
<td>Donald W. Kemper</td>
<td>Director, Health Systems Development, Health Systems, Inc.</td>
</tr>
<tr>
<td>James G. Knight</td>
<td>Full-time student at Medical College of Georgia</td>
</tr>
<tr>
<td>David P. Mason, Jr.*</td>
<td>Lieutenant, U. S. Army (Operations Research and Systems Engineering)</td>
</tr>
<tr>
<td>Anita Montelione</td>
<td>Full-time master's student, GIT</td>
</tr>
<tr>
<td>Humberto J. Ortega</td>
<td>Computer Analyst, Humble Oil and Refining Company</td>
</tr>
<tr>
<td>Russell G. Overton*</td>
<td>Systems Engineer, Medical College of Georgia; then</td>
</tr>
<tr>
<td></td>
<td>Graduate Research Assistant, HSRC</td>
</tr>
<tr>
<td>Julio J. Pascual</td>
<td>Senior Consultant in Puerto Rico</td>
</tr>
<tr>
<td>Paul A. Robertson</td>
<td>Full-time student at Tulane University Medical School</td>
</tr>
<tr>
<td>Donald B. Russell</td>
<td>Health Facilities Officer, U. S. Air Force</td>
</tr>
<tr>
<td>Nelson Sayford</td>
<td>Graduate Research Assistant, HSRC</td>
</tr>
<tr>
<td>Dwight R. Sedgwick</td>
<td>Consultant, Summerour and Associates</td>
</tr>
<tr>
<td>Richard N. Sendler</td>
<td>I.E. Functions, Eastern Airlines</td>
</tr>
<tr>
<td>David R. Shaw</td>
<td>Director, Systems Development Department, and</td>
</tr>
<tr>
<td></td>
<td>Lecturer in Hospital Administration, University of Alabama Hospitals and</td>
</tr>
<tr>
<td></td>
<td>Clinics</td>
</tr>
<tr>
<td>Edwin M. Sheats*</td>
<td>Formerly Systems Analyst, Medical College of Georgia; presently</td>
</tr>
<tr>
<td></td>
<td>Instructor, Audiovisual Coordinator, Health Systems Specialist (Project S.I.S.), HSRC</td>
</tr>
<tr>
<td>James H. Skipper</td>
<td>Industrial Engineer, Central State Hospital (Georgia)</td>
</tr>
<tr>
<td>P. Donald Stubbs</td>
<td>Representative, Mid-Continent Life Insurance Company</td>
</tr>
<tr>
<td>Andrew T. Sumner</td>
<td>Chief, Health Evaluation Center, Health Service Research Branch, Federal</td>
</tr>
<tr>
<td></td>
<td>Health Program Service, USPHS</td>
</tr>
<tr>
<td>Felix Ulloa</td>
<td>Technical Assistant, BID-Comersan (Council of Markets of San Salvador)</td>
</tr>
<tr>
<td>Gerald B. Widegren</td>
<td>Project Manager, MEDICUS Corporation</td>
</tr>
<tr>
<td>Raymond D. Wilmot</td>
<td>Chief, Systems Engineering Branch, U. S. Air Force</td>
</tr>
</tbody>
</table>

* Also participated in PHMS as an undergraduate trainee.
NAME | POSITION
---|---
**Doctoral Students:**
Richard M. Bramblett | Assistant Director and Assistant Professor, Division of Systems and Computer Services, Medical College of Georgia
William I. Crichton | President, Bill Crichton and Associates, Inc.
John R. Freeman | Director of Management Services, MEDICUS Corporation
Richard H. Gould | Associate Professor, Industrial Arts and Technology, Middle Tennessee State University (withdrew from PHMS)
Tee H. Hiett | Associate Professor, Program in Hospital and Health Administration, University of Alabama
Max G. Holland | Associate Professor of Management, and Allied Faculty Member of Program in Health Administration, Georgia State University
Joseph D. Marsh | Full-time student and NCHSR&D Fellow, GIT
Robert M. Mason | Research Scientist, Engineering Experiment Station, GIT
James B. Mathews | Director, Division of Systems and Computer Services, Medical College of Georgia
Gonzalo Mitre-Salazar | Professor and Head, Department of Industrial Engineering, Instituto Tecnológico y de Estudios de Monterrey, Mexico
William G. Sullivan | Assistant Professor, Department of Industrial Engineering, University of Tennessee
Curtis J. Tompkins | Associate Professor, Graduate School of Business Administration, University of Virginia

**Undergraduate Students:**
Benny J. Dyer | Self-employed, Investment Management
Thomas A. Eschenbrenner | Formerly in the Graduate School of Business Administration, University of Texas; Consultant, Ernst and Ernst
Jim B. Grant | Formerly U. S. Army; Federal Highway Department; presently seeking suitable position in the health field
Steven J. Halmos | Vice President, Safecard Services
William R. Hutson | Systems Engineer, USPHS Hospital, New Orleans
<table>
<thead>
<tr>
<th>NAME</th>
<th>POSITION</th>
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<tbody>
<tr>
<td>Johnny N. Johnson</td>
<td>Instructor, School of Dentistry, Medical College of Georgia</td>
</tr>
<tr>
<td>R. Michael Jones</td>
<td>Process Engineer, ITT Rayonier, Inc.</td>
</tr>
<tr>
<td>Robert A. Jordan</td>
<td>Formerly commissioned officer in USPHS; present position unknown</td>
</tr>
<tr>
<td>John A. McGill</td>
<td>Project Engineer, Fiber Industries, Inc.</td>
</tr>
<tr>
<td>John C. McLean</td>
<td>Lieutenant, U. S. Air Force</td>
</tr>
<tr>
<td>David W. Magruder</td>
<td>Management/Engineer--Systems Design/Improvement, First National Bank of Atlanta</td>
</tr>
<tr>
<td>Dihlard C. Marshall</td>
<td>Assistant Grants Coordinator, Medical College of Georgia</td>
</tr>
<tr>
<td>C. Phillip Meyer</td>
<td>Project Assistant, HSRC</td>
</tr>
<tr>
<td>James L. Oakes, Jr.</td>
<td>Systems Engineer, Medical College of Georgia; then Hospital Administrator, U. S. Air Force</td>
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<tr>
<td>Terrance M. Patrick</td>
<td>Architect</td>
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<tr>
<td>J. Vaughn Pearson</td>
<td>Director of Industrial Engineering, Central State Hospital, Georgia</td>
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<tr>
<td>Frederick G. Schiesser</td>
<td>Present position unknown</td>
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<tr>
<td>Marshall T. Schreeder</td>
<td>Full-time student at Tulane University Medical School</td>
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<tr>
<td>Gary M. Stone</td>
<td>Engineer, Southern Bell Telephone and Telegraph Company</td>
</tr>
<tr>
<td>John S. Wilkinson</td>
<td>Administrative Assistant for Industrial Engineering, Holy Family Hospital</td>
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<tr>
<td>E. Duncan Wood</td>
<td>Full-time master's student, GIT</td>
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APPENDIX C

EVALUATION INSTRUMENTS

USED IN THE

EVALUATION OF THE

PROGRAM IN HOSPITAL AND MEDICAL SYSTEMS
DEAR FORMER PHMS TRAINEE:

As you may recall, the Program in Hospital and Medical Systems originated as the title of a federally supported training project initiated in July 1967 under the joint administration of Georgia Tech and the Medical College of Georgia. Concurrently, PHMS became an organizational designation within the School of Industrial Engineering (later renamed the School of Industrial and Systems Engineering) and also an organizational designation for an affiliated component of the training project at the Medical College in Augusta.

In September 1969, the organizational PHMS was separated from the School of ISyE and became the Health Systems Research Center (HSRC) and in September 1970 the affiliated organizational unit at the Medical College changed its name from PHMS to the Division of Health Systems Engineering (DHSE).

This federal training grant expired 30 June 1972 and we are now gathering information with which to evaluate our efforts in attracting persons to the health field; training them for professional practice, research careers, or educational faculty; and helping to place them in productive positions within the health industry. To accomplish this evaluation we need relevant input from our former trainees. Your answers to the enclosed questionnaire will greatly facilitate our evaluative study of PHMS and will also serve as valuable input to our new degree program in health systems which was given final institutional approval on 31 October 1972 (see enclosure).

Your response to previous questionnaires has always been greatly appreciated and we encourage your continued support and interest.

Thank you.

Sincerely,

Harold E. Smalley
Director

Enclosures
This questionnaire is directed toward former students who, at one time or another, were involved in the PHMS training program and were classified officially as "trainees." Trainees of PHMS received their training through formal coursework such as courses (ISyE 418, 665, 765) taught by PHMS faculty; project oriented courses (ISyE 451-2-3, 461-2, 472, 482, 491-2-3, etc.) for which health related topics were selected for study, and direction or coordination of the projects was accomplished through PHMS; and thesis and dissertation work (ISyE 700 and 800) for which health related topics were selected and PHMS faculty served in advisory capacities.

Additionally, some trainees received training through work experience made available by PHMS at either Georgia Tech (HSRG, PHMS, or HSRC) or the Medical College of Georgia (PHMS or DHSE). These trainees were usually designated as either project assistants, graduate research assistants, graduate teaching assistants, or systems engineering assistants; and received financial remuneration for their work. Also, some students performed project work in cooperation with PHMS for which they received no financial assistance. These trainees were designated volunteers.

In order to assure that the evaluation of PHMS will consider each of the educational experiences described above, questions related to both PHMS coursework and work experience have been included in the questionnaire. Additionally, there are several questions directed primarily toward those trainees who have been or are now presently employed in the health field.

1. Considering the educational experiences provided to you through PHMS, which of the following areas do you feel were given either excessive, proper, or insufficient emphasis?

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<thead>
<tr>
<th>Excessive</th>
<th>Proper</th>
<th>Insufficient</th>
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<tr>
<td>I. ORIENTATION</td>
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<td>A. History of Health Care</td>
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<td>B. Problems Facing the Health Care Industry</td>
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<td>C. Hospital Departments</td>
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<td>D. Interfaces and Inter-relationships Among Hospital Departments</td>
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<td>E. Non-hospital, Institutional Components of Health Care Such As Clinics, Nursing Homes, Group Practices, etc.</td>
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<td>F. State and County Government Agencies</td>
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<td>G. Federal Government Agencies</td>
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<td>H. Types and Functions of Professional and Auxiliary Health Manpower</td>
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</table>

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II. APPLICATION OF SYSTEMS/MANAGEMENT ENGINEERING TECHNIQUES AS PRESENTED IN PHMS COURSEWORK (LECTURES, CASE STUDIES, PROJECTS)

A. Queueing Theory
B. Inventory Models
C. Work Simplification Techniques
D. Work Measurement/Work System Design
E. Engineering Economy
F. Simulation Techniques
G. Applications of the Research Method to the Health Field
H. Others

2. Have you found that the health related coursework which you completed as a PHMS trainee has been of significant value; i.e., in your opinion, were you better prepared to perform in the health field than you would have been if you had instead opted for a curriculum without health involvement?
YES _____ UNCERTAIN _____ NO _____ I HAVE HAD NO INVOLVEMENT WITH THE HEALTH FIELD SUBSEQUENT TO PHMS _____

3. Would you attribute the "useful knowledge gained" from your PHMS coursework to classroom experience (lectures), fieldwork experience (projects, papers, proposals, etc.), or both?
CLASSROOM _____ FIELDWORK _____ BOTH _____

4. Considering the classroom experience (lectures) and fieldwork experience (projects, papers, etc.) associated with your PHMS coursework, and the subsequent value of each, was the blend of these two experiences proportionately correct?
YES _____ NO _____

If not, how should the proportion have been changed?

5. Please list any areas, topics, bodies of knowledge, etc., which would have been of subsequent value to you had they been included in your coursework (not just health related).
6. If you worked for the HSRG, HSRC, PHMS, or DHSE while pursuing your degree(s), was this work experience of any value in your subsequent involvement in the health field per se or any other field in which you have been or are employed?
YES (HEALTH FIELD) _____
YES (OTHER FIELD) _____
NO _____

7. If you answered "YES" to question number six, please describe in what way(s) this work experience proved to be beneficial.

8. What additions, changes, improvements, etc., would you have favored with respect to your work experience with the HSRG, HSRC, PHMS, or DHSE?

9. What features of PHMS do you consider to have been of the most significant value?

10. What features do you think should have been included in PHMS which may not have been included?
11. According to the 1970 PHMS grant renewal application, specific objectives of PHMS were:

"To generate and cultivate a source of industrial engineers who are both technically competent and health-services oriented as an effective means of solving problems associated with the delivery of health services to the public and to develop means of orienting industrial engineers to the hospital and medical environment."

With respect to these objectives and based upon your involvement (course-work and/or work experience), please summarize your overall assessment of the Program in Hospital and Medical Systems.
12. Based upon your experiences with PHMS, was the hospital or health field environment as you expected to find it when you began your initial employment in the health care field? 
YES ___ NO ___ 
COMMENTS: 

If not, could the "difference" have been eliminated by a better PHMS orientation through coursework/work experience? 
YES ___ NO ___ 
COMMENTS: 

13. Did PHMS, generally, provide you with the insight necessary to solve the technical and/or organizational (interpersonal, human) problems which you have encountered in your professional employment? 
YES ___ NO ___ 
COMMENTS: 

14. Did PHMS, generally, prepare you to identify health related problems and structure their solutions (as opposed to solving an already structured "textbook" problem)? YES ___ NO ___ 
COMMENTS: 

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15. Based on your professional experiences, what are the principal hospital management problems which seem to defy solution at the present time through the methods and techniques of systems analysis, industrial engineering, and management engineering?

16. Do you believe that health systems analysts, hospital industrial engineers, hospital management/systems engineers, etc. can be effective in improving the methods of delivering health care, planning the future structure of the health system, and reducing the cost of health care?  
YES ______  NO ______  
COMMENTS:

17. In your opinion, what should be included in future educational programs (such as HSRC's new curriculum in health systems) for health systems analysts, hospital I.E.'s, and hospital management/systems engineers which would help them to perform more effectively in the health field?

A. Classical I.E.  
B. Statistics  
C. Operations Research Techniques  
D. Computer Programming  
E. General Management Courses  
F. Accounting and Finance Courses  
G. Interpersonal/Human Relations Courses  
H. Facilities Planning  
I. Information Systems Design  
J. Others (please specify)  

YES  NO

COMMENTS:
GENERAL INFORMATION (All Trainees):

18. For each position that you have held since leaving PHMS, please list your employer, inclusive dates of employment, and the functions that you performed.

<table>
<thead>
<tr>
<th>EMPLOYER</th>
<th>INCLUSIVE DATES</th>
<th>FUNCTIONS</th>
</tr>
</thead>
</table>

19. There is a possibility that we may wish to contact initial employers of PHMS trainees in order to ask their opinion regarding the degree to which the employed trainee was prepared by PHMS to perform in the health field. If you were employed within the health field after leaving PHMS, please list your immediate supervisor's name, address, and phone number (if possible).

<table>
<thead>
<tr>
<th>SUPERVISOR</th>
<th>ADDRESS</th>
<th>PHONE NUMBER</th>
</tr>
</thead>
</table>

Your Name (please print)
Dear Former Student:

Since 1958 HSRC has provided various kinds of health-related training and experiences for students through the School of Industrial and Systems Engineering and other schools at Georgia Tech. Since July 1967, HSRC has been supported by a federal training grant to demonstrate how the level of health systems manpower can be increased. As a result of this grant, I.E. 418, "Industrial Engineering in Hospitals," was developed and has been offered since the winter quarter of 1965. We are now nearing the end of the grant period and must gather information with which to evaluate our efforts in attracting persons to this field; training them for professional practice, research careers, or educational faculty; and helping to place them in productive positions within the health industry. In conjunction with this evaluation we need relevant information from our former I.E. 418 students.

We are asking that you complete the enclosed post card questionnaire and return it to us. The information supplied to us by you and other former I.E. 418 students will provide positive feedback concerning the value of such health-related courses. Additionally, if you would like to occasionally receive health-related material from HSRC, indicate "yes" to question 6, and we will place your name on our mailing list.

We will greatly appreciate your prompt reply.

Sincerely,

Harold E. Smalley, Ph.D.
Regents' Professor and
Director

Enclosure
ISyE 418 STUDENT QUESTIONNAIRE

NAME ___________________________ OCCUPATION ___________________________

1. Did ISyE 418, "Industrial Engineering in Hospitals," increase your interest in the health field and in health systems engineering?
   Very much ___ Moderately ___ Very little ___ Not at all ___

2. Would you have taken any additional courses in health-related IE if such courses had been available?
   Yes ___ Not sure ___ No ___

3. Did ISyE 418 influence your career choice?
   Very much ___ Moderately ___ Very little ___ Not at all ___

4. If engineering and management positions within the health field were available to you at a competitive salary, would you seriously consider them?
   Yes ___ Not sure ___ No ___

5. If you are employed in the health field, please list your title, organization, and address. ________________________________


6. Mailing list? Yes ___ No ___
INITIAL HEALTH FIELD EMPLOYERS

OF PHMS TRAINEES

STRUCTURED INTERVIEW

A transcript of the structured interview conducted with the initial health field employers (immediate supervisors) of several PHMS trainees is presented on the following page.
INITIAL HEALTH FIELD EMPLOYER STRUCTURED INTERVIEW

OBJECTIVE: To ascertain the degree to which the former PHMS trainee employed in the health field was initially better prepared to perform his job relative to other new employees with comparable education but having no previous health field involvement.

QUESTIONS

The following questions should be answered by comparing the performance of (Trainee's Name) to that of other new employees with similar positions and relatively equal education but having no previous health experience or involvement.

1. In your opinion was (Trainee's Name) better prepared to perform his job in your organization due to his health field exposure? Yes ______ No ______
   If he was, could you briefly explain in what way(s)?

2. Please list any specific health related areas of knowledge or experience which (Trainee's Name) may have demonstrated to you through the performance of his job and which you feel were significantly beneficial.

3. Specifically, how could (Trainee's Name) have been better prepared for a job in the Health field (such as in your organization) by training programs such as PHMS, i.e., what health related experiences or knowledge would you like for future employees to have received from their formal education programs?

4. Would you show a decided preference to hiring other PHMS trainees over graduates of non-health curricula for other entry-level positions? Yes _____ No _____

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APPENDIX D

NARRATIVE COMMENTS AND RESPONSES

GIVEN BY PHMS TRAINEES IN ANSWERING

THE QUESTIONS OF THE PHMS TRAINEE QUESTIONNAIRE

Not all trainees chose to respond to every question of the questionnaire and questions 1, 2, 3, and 6 did not solicit narrative replies.
QUESTION 1: Considering the educational experiences provided to you through PHMS, which of the following areas do you feel were given either excessive, proper, or insufficient emphasis? (NOTE: As shown on the questionnaire in Appendix C, several health orientation areas and industrial engineering techniques were listed as part of question 1. The trainees' responses are presented in Table 2 in Section II of the present report.)

QUESTION 2: Have you found that the health related coursework which you completed as a PHMS trainee has been of significant value; i.e., in your opinion, were you better prepared to perform in the health field than you would have been if you had instead opted for a curriculum without health involvement? YES _____ UNCERTAIN _____ NO _____ I HAVE HAD NO INVOLVEMENT WITH THE HEALTH FIELD SUBSEQUENT TO PHMS. _____ (NOTE: The trainees' responses to question 2 are presented in Table 3 in Section II of the present report.)

QUESTION 3: Would you attribute the "useful knowledge gained" from your PHMS coursework to classroom experience (lectures), fieldwork experience (projects, papers, proposals, etc.), or both? CLASSROOM _____ FIELDWORK _____ BOTH _____ (NOTE: The trainees' responses to question 3 are presented in Table 3 in Section II of the present report.)

THE PRESENT APPENDIX CONTAINS THE NARRATIVE COMMENTS AND RESPONSES OF THE PHMS TRAINEES TO QUESTIONS IN WHICH NARRATIVE REPLIES WERE REQUESTED. QUESTIONS 1, 2, AND 3 DID NOT ASK FOR NARRATIVE COMMENTS AND RESPONSES.
QUESTION 4: Considering the classroom experience (lectures) and fieldwork experience (projects, papers, etc.) associated with your PHMS coursework, and the subsequent value of each, was the blend of these two experiences proportionately correct? If not, how should the proportion have been changed?

The following comments were made by trainees in response to question 4:

<table>
<thead>
<tr>
<th>TRAINEE CODE</th>
<th>DESIGNATION</th>
<th>COMMENTS FROM TRAINEES</th>
</tr>
</thead>
<tbody>
<tr>
<td>110</td>
<td></td>
<td>More time should be devoted to classwork and short term field projects which would expose student to greater variety of problems and techniques.</td>
</tr>
<tr>
<td>116</td>
<td></td>
<td>More varied fieldwork would be appropriate.</td>
</tr>
<tr>
<td>126</td>
<td></td>
<td>An increase in the amount of fieldwork in actual problem environment so as to provide an exercise in problem determination.</td>
</tr>
<tr>
<td>133</td>
<td></td>
<td>Projects not too valuable.</td>
</tr>
<tr>
<td>314</td>
<td></td>
<td>Greater emphasis on student involvement via outside projects; however, not at the expense of class lectures.</td>
</tr>
</tbody>
</table>
QUESTION 5: Please list any areas, topics, bodies of knowledge, etc., which would have been of subsequent value to you had they been included in your coursework (not just health related).

The following areas of study were offered by trainees in response to question 5:

<table>
<thead>
<tr>
<th>TRAINEE CODE</th>
<th>RESPONSES FROM TRAINEES</th>
</tr>
</thead>
<tbody>
<tr>
<td>105</td>
<td>Third Party Finance</td>
</tr>
<tr>
<td>105</td>
<td>Relationship of Cost/Changes</td>
</tr>
<tr>
<td>105</td>
<td>Labor Relations</td>
</tr>
<tr>
<td>106</td>
<td>Hospital Administration (organization, structure and economics of health care systems, federal health care system)</td>
</tr>
<tr>
<td>106</td>
<td>Medicare (personal health services, health manpower, emergency health services, HMOs, CHP, RMP, population dynamics)</td>
</tr>
<tr>
<td>106</td>
<td>Health Information Systems (analysis, hardware, software)</td>
</tr>
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<td>110</td>
<td>Business Letters and Report Writing</td>
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<td>110</td>
<td>Industrial/Personal Relations</td>
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<td>Cost Accounting</td>
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<td>111</td>
<td>Computer Programming</td>
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<td>114</td>
<td>Accounting, Management, Other Business Courses</td>
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<td>117</td>
<td>Government Legislation and Effects</td>
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<td>119</td>
<td>Classical I.E.</td>
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<td>General Management</td>
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<td>Accounting</td>
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<td>Systems Engineering</td>
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</tr>
<tr>
<td>314</td>
<td></td>
</tr>
</tbody>
</table>
QUESTION 6: If you worked for the HSRG, HSRC, PHMS, or DHSE while pursuing your degree(s), was this work experience of any value in your subsequent involvement in the health field per se or any other field in which you have been or are employed?
YES (HEALTH FIELD) ____
YES (OTHER FIELD) ____
NO ____

(NOTE: The trainees' responses to question 6 are presented in Table 5 in Section II of the present report.)
QUESTION 7: If you answered "YES" to question number six, please describe in what way(s) this work experience proved to be beneficial.

The following responses were made by trainees regarding question 7:

<table>
<thead>
<tr>
<th>TRAINEE CODE</th>
<th>RESPONSES FROM TRAINEES</th>
</tr>
</thead>
<tbody>
<tr>
<td>103</td>
<td>My work at South Fulton Hospital was about the only opportunity I've ever had to work as an I.E.</td>
</tr>
<tr>
<td>104</td>
<td>Working with people and approaching problem areas wherein a solution satisfactory to all was necessary.</td>
</tr>
<tr>
<td>105</td>
<td>Interaction with hospital personnel and &quot;real world&quot; problems permitted a better understanding of the real and imagined constraints (i.e., costs, attitudes, philosophies, etc.) under which hospital management and others operate.</td>
</tr>
<tr>
<td>106</td>
<td>The work experience allowed me to utilize O.R. techniques which was personally gratifying; work experience provided a better understanding of the health care system and resulted in increased professionalism.</td>
</tr>
<tr>
<td>107</td>
<td>Working in Augusta gave me a better understanding and appreciation of management of industrial engineering studies; this, I think, is proving beneficial on my current job.</td>
</tr>
<tr>
<td>111</td>
<td>Doing my I.E. work in some hospital; doing my I.E. work in the marketing system for children care.</td>
</tr>
<tr>
<td>114</td>
<td>I was able to see first hand computer usage in hospitals and clinics thus gaining experience; I was able to hear reasons for not using computers in certain hospital applications.</td>
</tr>
<tr>
<td>116</td>
<td>Gained insight into workings of the health industry.</td>
</tr>
<tr>
<td>117</td>
<td>A practical understanding of the &quot;quality&quot; issue; a start at how to exert your opinions and professional judgment to members of the medical staff.</td>
</tr>
<tr>
<td>TRAINEE CODE</td>
<td>DESIGNATION</td>
</tr>
<tr>
<td>-------------</td>
<td>-------------</td>
</tr>
<tr>
<td>120</td>
<td></td>
</tr>
<tr>
<td>126</td>
<td></td>
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<tr>
<td>128</td>
<td></td>
</tr>
<tr>
<td>129</td>
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<td>202</td>
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<td>204</td>
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<tr>
<td>205</td>
<td></td>
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<tr>
<td>211</td>
<td></td>
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<tr>
<td>212</td>
<td></td>
</tr>
<tr>
<td>301</td>
<td></td>
</tr>
<tr>
<td>314</td>
<td></td>
</tr>
</tbody>
</table>
QUESTION 8: What additions, changes, improvements, etc., would you have favored with respect to your work experience with the HSRG, HSRC, PHMS, or DHSE?

The following suggestions were made by trainees in response to question 8:

<table>
<thead>
<tr>
<th>TRAINEE CODE</th>
<th>DESIGNATION</th>
<th>RESPONSES FROM TRAINEES</th>
</tr>
</thead>
<tbody>
<tr>
<td>103</td>
<td></td>
<td>No changes.</td>
</tr>
<tr>
<td>105</td>
<td></td>
<td>Variety of work experiences; use of relevant case studies and simulation exercises.</td>
</tr>
<tr>
<td>106</td>
<td></td>
<td>Some work experience should not be dictated by thesis or project requirements.</td>
</tr>
<tr>
<td>107</td>
<td></td>
<td>I think it would be helpful to students if they could undertake short-term projects with ample time allowed for writing up the project. Also, my work experience would have been more useful for me if I had been given more background training in working with hospital personnel before I started my work at the hospital.</td>
</tr>
<tr>
<td>114</td>
<td></td>
<td>More direct supervision by the participating hospital personnel would help -- than interviews and subsequent term papers; this closer relationship was evident in some of the other students' projects but should be an element in each one.</td>
</tr>
<tr>
<td>116</td>
<td></td>
<td>Less of a research orientation; less of a hospital orientation.</td>
</tr>
<tr>
<td>120</td>
<td></td>
<td>Closer guidance from faculty members.</td>
</tr>
<tr>
<td>122</td>
<td></td>
<td>Supervision is too close; supervisors end up doing the project work due to &quot;student syndrome.&quot;</td>
</tr>
<tr>
<td>126</td>
<td></td>
<td>More unstructured, consulting projects.</td>
</tr>
<tr>
<td>129</td>
<td></td>
<td>More diversification of work involvement (HSRC).</td>
</tr>
<tr>
<td>131</td>
<td></td>
<td>Additional contact with persons, problems, etc., out in the field.</td>
</tr>
<tr>
<td>TRAINEE CODE</td>
<td>RESPONSES FROM TRAINEES</td>
<td></td>
</tr>
<tr>
<td>-------------</td>
<td>------------------------</td>
<td></td>
</tr>
<tr>
<td>202</td>
<td>More actual down-to-earth systems work in hospital with less &quot;research&quot; oriented experience aimed toward publications.</td>
<td></td>
</tr>
<tr>
<td>205</td>
<td>More involvement in research.</td>
<td></td>
</tr>
<tr>
<td>210</td>
<td>Should be more experience -- longer duration.</td>
<td></td>
</tr>
<tr>
<td>211</td>
<td>Broader exposure to various health problems.</td>
<td></td>
</tr>
<tr>
<td>212</td>
<td>Additional responsibilities.</td>
<td></td>
</tr>
<tr>
<td>311</td>
<td>More project responsibilities for undergraduate assistants.</td>
<td></td>
</tr>
</tbody>
</table>
QUESTION 9: What features of PHMS do you consider to have been of the most significant value?

The following responses were made by trainees regarding question 9:

<table>
<thead>
<tr>
<th>TRAINEE CODE</th>
<th>RESPONSES FROM TRAINEES</th>
</tr>
</thead>
<tbody>
<tr>
<td>103</td>
<td>I welcomed the opportunity to gain both I.E. and health experience while going through school.</td>
</tr>
<tr>
<td>104</td>
<td>The work experience.</td>
</tr>
<tr>
<td>105</td>
<td>Interaction and orientation of I.E. faculty and students to problems and solutions of health care delivery system; increased emphasis of interdisciplinary projects and studies; and opportunities to combine classroom and field-work experiences.</td>
</tr>
<tr>
<td>106</td>
<td>Work experience and salary; relationship to other PHMS members.</td>
</tr>
<tr>
<td>107</td>
<td>Project management awareness; emphasis on improving my communication ability.</td>
</tr>
<tr>
<td>110</td>
<td>Attracted a number of qualified individuals into a field which they probably would not otherwise have given any consideration.</td>
</tr>
<tr>
<td>111</td>
<td>Plant facilities, engineering economy, methods engineering, operations research, and management.</td>
</tr>
<tr>
<td>114</td>
<td>The field experience, the seminars with visiting lecturers, and course material.</td>
</tr>
<tr>
<td>116</td>
<td>Technical competence.</td>
</tr>
<tr>
<td>117</td>
<td>Departmental studies; operational knowledge is essential to understanding the &quot;quality&quot; ramifications.</td>
</tr>
<tr>
<td>119</td>
<td>Projects and work experiences; also, guidance of experts in the health and hospital industrial engineering field (i.e., faculty members of PHMS).</td>
</tr>
<tr>
<td>120</td>
<td>Work experience after class-type orientation.</td>
</tr>
<tr>
<td>TRAINEE CODE</td>
<td>RESPONSES FROM TRAINEES</td>
</tr>
<tr>
<td>-------------</td>
<td>------------------------</td>
</tr>
<tr>
<td>126</td>
<td>Exposure to problems and solutions.</td>
</tr>
<tr>
<td>128</td>
<td>Work experience.</td>
</tr>
<tr>
<td>129</td>
<td>The work experience gained in the field while attending school.</td>
</tr>
<tr>
<td>131</td>
<td>Work experience (assistantship): experience in service, education, and research within the health field.</td>
</tr>
<tr>
<td>132</td>
<td>The project and work experiences.</td>
</tr>
<tr>
<td>133</td>
<td>Class lectures.</td>
</tr>
<tr>
<td>202</td>
<td>Establishment of important contacts.</td>
</tr>
<tr>
<td>204</td>
<td>Experience on projects.</td>
</tr>
<tr>
<td>205</td>
<td>Introduction to a new field; practical orientation.</td>
</tr>
<tr>
<td>210</td>
<td>Weekly seminars were excellent.</td>
</tr>
<tr>
<td>211</td>
<td>Contact and exposure to health care delivery systems.</td>
</tr>
<tr>
<td>212</td>
<td>Creation of broadly based level of awareness of health system components, relationships; and potential and limitations for improvement in health care industry.</td>
</tr>
<tr>
<td>301</td>
<td>Working in the hospital setting.</td>
</tr>
<tr>
<td>311</td>
<td>It provided a focal point for the most advanced ideas in this field and launched a number of persons into promising careers in health systems.</td>
</tr>
<tr>
<td>314</td>
<td>An excellent introduction to the health industry, both on an academic and real-life basis; theory and practicality of dealing with health were present; ability to work with and become associated with qualified professionals in health and related disciplines.</td>
</tr>
</tbody>
</table>
QUESTION 10: What features do you think should have been included in PHMS which may not have been included?

The following suggestions were offered by trainees in response to question 10:

<table>
<thead>
<tr>
<th>TRAINEE CODE</th>
<th>RESPONSES FROM TRAINEES</th>
</tr>
</thead>
<tbody>
<tr>
<td>103</td>
<td>Additional applications of I.E. techniques (O.R., computers, etc.) to health problems by a broader faculty.</td>
</tr>
<tr>
<td>105</td>
<td>Coursework or seminars with (1) appropriate governmental and private agencies regarding the financing and trends of health care (BCBS, Medicare, HMOs, etc.), (2) area-wide planning groups, (3) planning groups, agencies or individuals involved in the design and construction of health care facilities, and (4) labor relations (organized labor in hospitals and other health institutions).</td>
</tr>
<tr>
<td>106</td>
<td>More courses in the health-care system taught from the hospital administration, medical, and public health viewpoint; HSRC should be more operational (service) involved in health care system.</td>
</tr>
<tr>
<td>107</td>
<td>More emphasis on understanding medical aspects of hospital industrial engineering. Often there seems to be a communication gap between myself and doctors, nurses, and other hospital personnel.</td>
</tr>
<tr>
<td>110</td>
<td>More exposure to the hospital environment; conversely, inviting hospital management to attend classes or seminars to make them aware of the potential benefits of an industrial engineering function within their ranks.</td>
</tr>
<tr>
<td>114</td>
<td>Improvements in dealing with hospital administration -- at times the values of administration and engineering do not come together -- this is where a business outlook of pure cost justification is sometimes lacking in the engineer.</td>
</tr>
<tr>
<td>116</td>
<td>Politics of health systems; priorities and direction in improving health systems.</td>
</tr>
<tr>
<td>120</td>
<td>Expanded course offerings.</td>
</tr>
<tr>
<td>TRAINEE CODE</td>
<td>RESPONSES FROM TRAINEES</td>
</tr>
<tr>
<td>-------------</td>
<td>------------------------</td>
</tr>
<tr>
<td>122</td>
<td>The PHMS program was organized through the academic lines with, apparently, little discussion with &quot;business officers&quot;; attempts to improve &quot;departmental&quot; or divisional areas was met with some resistance.</td>
</tr>
<tr>
<td>126</td>
<td>More input from medical professionals (MDs, RNs, etc.).</td>
</tr>
<tr>
<td>129</td>
<td>Professors who have recently been involved in health systems applications including O.R./M.S. techniques; more practical experience via externships, practicums, etc.</td>
</tr>
<tr>
<td>131</td>
<td>Health field cooperative type option similar to externship feature of the new program in health systems.</td>
</tr>
<tr>
<td>132</td>
<td>A cooperative-type program.</td>
</tr>
<tr>
<td>205</td>
<td>A better management of students' programs relative to their objectives; a much closer relationship with actual health care institutions.</td>
</tr>
<tr>
<td>210</td>
<td>Exposure of individuals to other trainees' work areas.</td>
</tr>
<tr>
<td>314</td>
<td>Greater exposure to non-engineering students on Georgia Tech campus.</td>
</tr>
</tbody>
</table>
QUESTION 11: According to the 1970 PHMS grant renewal application, specific objectives of PHMS were: "To generate and cultivate a source of industrial engineers who are both technically competent and health-services oriented as an effective means of solving problems associated with the delivery of health services to the public and to develop means of orienting industrial engineers to the hospital and medical environment." With respect to these objectives and based upon your involvement (coursework and/or work experience), please summarize your overall assessment of the Program in Hospital and Medical Systems.

The following assessments of PHMS were made by trainees in response to question 11:

<table>
<thead>
<tr>
<th>TRAINEE CODE</th>
<th>RESPONSES FROM TRAINEES</th>
</tr>
</thead>
<tbody>
<tr>
<td>103</td>
<td>I would say the objectives were fully achieved. I was certainly oriented to the hospital and medical environment. Although I ended up not choosing an assignment in the area, I am aware of the problems. I feel that the technical competence of the graduates goes without saying.</td>
</tr>
<tr>
<td>105</td>
<td>As one of the earlier participants in PHMS, the initial coursework and field experience was more of a superficial nature when compared to current PHMS efforts. However, in my opinion, the PHMS, both then and now, provides a unique and effective means to gain an appreciation and understanding of the health care delivery system and the potential involvement of I.E. and other disciplines. PHMS has also created a very valuable &quot;recruitment pool&quot; for those institutions and programs seeking &quot;experienced&quot; engineers or health systems people. While there is a continuing need to keep the program up-to-date and relevant to trends in I.E. (and other related disciplines) and the health care delivery system, the objectives of PHMS have been effectively achieved.</td>
</tr>
<tr>
<td>106</td>
<td>Objectives met; relatively good program; potentially, the program could be improved by addition of health care courses and health professionals. Also, service programs should be strengthened.</td>
</tr>
<tr>
<td>107</td>
<td>I think my involvement was always oriented toward fulfilling these objectives. In general, I think PHMS is achieving its objectives.</td>
</tr>
<tr>
<td>110</td>
<td>Successful.</td>
</tr>
<tr>
<td>TRAINEE CODE</td>
<td>DESIGNATION</td>
</tr>
<tr>
<td>--------------</td>
<td>-------------</td>
</tr>
<tr>
<td>111</td>
<td>At this time, I think that one of the most important areas to be covered by the IE people is the health field because (I'm talking about my country) it is abandoned without any efficiency or productivity accomplishment.</td>
</tr>
<tr>
<td>114</td>
<td>The overall program was well planned and well managed. The improvements since I was involved have proven that the management of the project is constantly striving for improvement as well. The materials taught were relevant to the entire health field. The results provided me with a broad outlook on problems of health care.</td>
</tr>
<tr>
<td>116</td>
<td>In my own experience, the &quot;approach&quot; to health systems analysis advocated through PHMS has been in conflict with the program's orientation to the hospital. Looking to the objectives of health systems, I have been forced to form my solution sphere outside of the hospital. More basic health system questions appear to be in the accessibility or primary care and the impact of health care on health.</td>
</tr>
<tr>
<td>117</td>
<td>In retrospect, considering all factors, I think PHMS did a good job in pursuing its goals.</td>
</tr>
<tr>
<td>119</td>
<td>Good.</td>
</tr>
<tr>
<td>120</td>
<td>These objectives have been achieved, as the summary of this survey will show. The quality of the products could, however, have been greatly increased with the provision of faculty members who exhibited an interest in students as the essence of the program. Although effort must be devoted to promoting and perpetuating any organization, general student opinion was that a disproportionate level of effort was devoted to the mechanics of the program, rather than to the students.</td>
</tr>
<tr>
<td>122</td>
<td>With respect to these objectives, I think you have accomplished your goal. A better assessment would be to ascertain where all the graduates are now working.</td>
</tr>
<tr>
<td>126</td>
<td>The charge seems to be relevant to problems which exist and are worth solving.</td>
</tr>
<tr>
<td>128</td>
<td>Most of the people with whom I was associated seemed highly competent, and many were health-services oriented. However, some seemed to be interested purely in their own gain, and if, incidentally, the public benefited, that was acceptable.</td>
</tr>
</tbody>
</table>
I believe the objectives have been fulfilled. However, when I came to DHSE after graduation in 1970, I had no health system course or experience background. The knowledge I gained there (DHSE) in a short work experience was of greater value as a learning experience than a year at Tech in a master's program concurrent with an HSRC assistant-ship. I would have to say that a background of coursework in health systems is not essential if a good source of OJT is available as in my case (DHSE).

I would assess PHMS as having been a worthwhile training program, i.e. it accomplished its principal objectives. However, in terms of numbers of students directly affected, PHMS's impact is questionable. The program, in general, seems to have been an important step in the right direction.

I have enjoyed the program. Since I am still in school, and still in the program, I do not as yet have the ability to look back on the program and evaluate it.

Course and field work have served these goals fairly well.

My own involvement was highly satisfactory. Without it, my career would certainly not have taken the positive courses which have occurred over the past six or so years. However, I am somewhat disappointed at the general output of PHMS and the relative impact of "official" trainees. I refer not only to numbers of graduates now involved in significant health care activities, but to percentages of graduates staying with health care, and to relative quality of those graduates.

It is my belief that PHMS has produced a "group" of engineers which have become disciples of health systems engineering. No program in the country has made as great an impact on the field.

I think it was pretty good as a start, but could have been better developed throughout its period, and definitely would be outdated as a model for future programs; cost/benefit -- unknown.

Excellent.

The PHMS has been very effective in meeting these objectives.
<table>
<thead>
<tr>
<th>TRAINEE CODE</th>
<th>RESPONSES FROM TRAINEES</th>
</tr>
</thead>
<tbody>
<tr>
<td>212</td>
<td>Orienting IEs to hospital and medical environment -- excellent; source of IEs as effective means of solving problems -- fair (to date, greatest impact may come later).</td>
</tr>
<tr>
<td>301</td>
<td>From my very limited perspective, I can only offer one suggestion. Much of the work, which hospitals desperately need along Industrial Engineering lines, involves the more basic I.E. techniques learned during undergraduate study. I.E. 418 was an adequate introductory course. The offering of another undergraduate course or two could provide candidates a broader background in hospitals at the undergraduate level. Frequently, although with decreasing frequency as hospitals become more sophisticated, an organized system for collecting relevant data is lacking. We have had to cope with such a situation in which data for making &quot;repair or replace&quot; decisions were lacking.</td>
</tr>
<tr>
<td>311</td>
<td>Although I chose another field for my career, I do believe that the PHMS made opportunities available and provided training that would have given me a successful start into a health related profession. I feel that the objectives above were met satisfactorily.</td>
</tr>
<tr>
<td>314</td>
<td>Based on my limited involvement, the program (PHMS) seemed innovative, challenging and truly worthwhile. My only reservation about the program is the rather small number of students involved in the program. The strength of such a program lies in its ability to produce qualified graduates, rather than to merely enhance the reputations of existing professionals. PHMS was small in relation to other programs and this probably resulted in the production of a smaller number of highly qualified graduates. In general, I think the program was successful and this success is directly related to the Director of the program.</td>
</tr>
</tbody>
</table>
QUESTION 12: Based upon your experiences with PHMS, was the hospital or health field environment as you expected to find it when you began your initial employment in the health care field? If not, could the "difference" have been eliminated by a better PHMS orientation through coursework/work experience?

The following comments were offered by trainees in response to question 12:

<table>
<thead>
<tr>
<th>TRAINEE CODE</th>
<th>COMMENTS FROM TRAINEES</th>
</tr>
</thead>
<tbody>
<tr>
<td>114</td>
<td>We were told that the health care field was slow to change -- it is.</td>
</tr>
<tr>
<td>204</td>
<td>I found many things unlike I expected, but, I found more things as I had expected.</td>
</tr>
<tr>
<td>205</td>
<td>Emphases and needs were somewhat different from my previous concept of them.</td>
</tr>
</tbody>
</table>
QUESTION 13: Did PHMS, generally, provide you with the insight necessary to solve the technical and/or organizational (interpersonal, human) problems which you have encountered in your professional employment?

The following comments were made by trainees regarding question 13:

<table>
<thead>
<tr>
<th>TRAINEE CODE</th>
<th>DESIGNATION</th>
<th>COMMENTS FROM TRAINEES</th>
</tr>
</thead>
<tbody>
<tr>
<td>103</td>
<td></td>
<td>Any work experience, such as the one at PHMS, has to make you better prepared for what comes next.</td>
</tr>
<tr>
<td>105</td>
<td></td>
<td>Technical solutions yes, but organizational problems were handled in more of a superficial manner.</td>
</tr>
<tr>
<td>106</td>
<td></td>
<td>Work experience and more health courses needed.</td>
</tr>
<tr>
<td>114</td>
<td></td>
<td>Some of the organizational problems were not evident in the coursework.</td>
</tr>
<tr>
<td>116</td>
<td></td>
<td>Technical but not organizational/political.</td>
</tr>
<tr>
<td>120</td>
<td></td>
<td>Technical problems -- yes; organizational -- no. Insight into interpersonal relationships between the disciplines within the field could have been provided by members of the &quot;adjunct&quot; faculty that were seldom, if ever, seen by the students.</td>
</tr>
<tr>
<td>131</td>
<td></td>
<td>I do not believe that my PHMS directly provided me with this &quot;insight.&quot;</td>
</tr>
<tr>
<td>205</td>
<td></td>
<td>Could have been better.</td>
</tr>
<tr>
<td>301</td>
<td></td>
<td>I.E. 418 really did not address itself to this and the scholastic point of view really sheltered me rather than exposed me to the hospital setting.</td>
</tr>
</tbody>
</table>
QUESTION 14: Did PHMS, generally, prepare you to identify health related problems and structure their solutions (as opposed to solving an already structured "textbook" problem)?

The following comments were offered by trainees in response to question 14:

<table>
<thead>
<tr>
<th>TRAINEE CODE</th>
<th>DESIGNATION</th>
<th>COMMENTS FROM TRAINEES</th>
</tr>
</thead>
<tbody>
<tr>
<td>105</td>
<td></td>
<td>I did feel, however, that additional or equal stress should be placed on the &quot;systems&quot; aspect of health care organizations rather than individual problems within one component of an organization.</td>
</tr>
<tr>
<td>106</td>
<td></td>
<td>Yes, but the solutions would be improved through a better understanding of the health care system.</td>
</tr>
<tr>
<td>114</td>
<td></td>
<td>Some of the fieldwork assignments required that we solve problems never before referenced in &quot;textbook&quot; form.</td>
</tr>
<tr>
<td>116</td>
<td></td>
<td>Problem orientation often led to suboptimization.</td>
</tr>
<tr>
<td>117</td>
<td></td>
<td>Both educational and work experience were helpful here.</td>
</tr>
<tr>
<td>129</td>
<td></td>
<td>Certain people had some influence in this; however, after my course involvement I doubt that it has greatly improved problem structuring.</td>
</tr>
<tr>
<td>205</td>
<td></td>
<td>Emphasized &quot;support&quot; functions more than &quot;health related.&quot;</td>
</tr>
<tr>
<td>314</td>
<td></td>
<td>Not enough real life problems encountered in classroom.</td>
</tr>
</tbody>
</table>
QUESTION 15: Based on your professional experiences, what are the principal hospital management problems which seem to defy solution at the present time through the methods and techniques of systems analysis, industrial engineering, and management engineering?

The following responses were made by trainees with respect to question 15:

<table>
<thead>
<tr>
<th>TRAINEE CODE</th>
<th>RESPONSES FROM TRAINEES</th>
</tr>
</thead>
<tbody>
<tr>
<td>105</td>
<td>Adequate financing from third party payers; area-wide planning (duplication of service and beds within a community which frequently results in underutilization within specific hospitals).</td>
</tr>
<tr>
<td>106</td>
<td>Management of operations -- I.E. generally doesn't help in firefighting and insure that day to day problems will be alleviated; evaluation of health care programs -- biostatistics, epidemiology would be of valuable assistance in solving this problem; with the increasing emphasis in outpatient care and health care organization, I would hope the HSRC students will be trained to investigate these &quot;broader&quot; problems.</td>
</tr>
<tr>
<td>114</td>
<td>Management of a large number of employees to get maximum production; solution of the total hospital communication problem for a reasonable cost.</td>
</tr>
<tr>
<td>116</td>
<td>Reversing the incentive system to health maintenance rather than crisis intervention.</td>
</tr>
<tr>
<td>117</td>
<td>In general, quantifying the &quot;quality&quot; issue and determining how it influences the consumption of resources. Actually, I don't think any problem &quot;defies solution&quot; if medical professionals are cooperative and if there is sufficient time to complete a detailed study. If either of these two ingredients are not present, any problem can be insolvable.</td>
</tr>
<tr>
<td>119</td>
<td>The organizational structure of a hospital to some extent; the unwillingness of management, at times, to implement significant recommendations (this may be improved to some extent by &quot;better selling&quot; by the industrial engineer); lack of sophistication of management.</td>
</tr>
<tr>
<td>TRAINEE CODE</td>
<td>RESPONSES FROM TRAINEES</td>
</tr>
<tr>
<td>--------------</td>
<td>-------------------------</td>
</tr>
<tr>
<td>120</td>
<td>Dealing with the various federal and private insurance programs.</td>
</tr>
<tr>
<td>129</td>
<td>The physician-administrator power struggle.</td>
</tr>
<tr>
<td>131</td>
<td>Interpersonal problems which seem to prevent acceptance/implementation with respect to systems engineering resources; especially in dealing with medical personnel.</td>
</tr>
<tr>
<td>202</td>
<td>Quality measurement and monitoring in a meaningful way.</td>
</tr>
<tr>
<td>204</td>
<td>The sociology of health care -- the human problems which are inherent in a complex system made up of various professional groups.</td>
</tr>
<tr>
<td>205</td>
<td>Personnel management; planning and implementing; and relations with physicians.</td>
</tr>
<tr>
<td>211</td>
<td>Providing service geared to the social mores of the community the hospital serves, e.g., most physicians work during the day while much of the demand is for services after normal working hours.</td>
</tr>
<tr>
<td>301</td>
<td>The fact that if the administrator does not recognize an area of study as a problem, he will make no move to improve that area in the face of conclusive recommendations.</td>
</tr>
</tbody>
</table>
QUESTION 16: Do you believe that health systems analysts, hospital industrial engineers, hospital management/systems engineers, etc., can be effective in improving the methods of delivering health care, planning the future structure of the health system, and reducing the cost of health care?

The following comments were made by trainees in response to question 16:

<table>
<thead>
<tr>
<th>TRAINEE CODE</th>
<th>DESIGNATION</th>
<th>COMMENTS FROM TRAINEES</th>
</tr>
</thead>
<tbody>
<tr>
<td>114</td>
<td></td>
<td>Improvements to the above problems can be made if not totally solved.</td>
</tr>
<tr>
<td>116</td>
<td></td>
<td>However, such impact will be very small if the hospital is viewed as the total system. Larger system solutions can benefit from the I.E.'s logic if not from his more technical planning tools.</td>
</tr>
<tr>
<td>117</td>
<td></td>
<td>No question about it. Actually, too often they are the only people in the health environment (outside of government and architects) that usually are charged with these responsibilities.</td>
</tr>
<tr>
<td>119</td>
<td></td>
<td>The &quot;total systems view,&quot; offered by industrial engineers, appears to be most beneficial in providing managers with analyses and information for decision making.</td>
</tr>
<tr>
<td>202</td>
<td></td>
<td>If they attempt improvement through an organization or activity that has influence upon major systems and willingness to effect change.</td>
</tr>
<tr>
<td>204</td>
<td></td>
<td>There is no doubt that the system for delivering health care will (and should) change; the professionals listed above can play a major role in effecting changes.</td>
</tr>
<tr>
<td>314</td>
<td></td>
<td>Yes, provided that &quot;health analysts&quot; adopt a team approach and agree to compromise solutions with other often-neglected professionals.</td>
</tr>
</tbody>
</table>
QUESTION 17: In your opinion, what should be included in future educational programs (such as HSRC's new curriculum in health systems) for health systems analysts, hospital I.E.s, and hospital management/systems engineers which would help them to perform more effectively in the health field?

The following comments were offered by trainees in response to question 17:

<table>
<thead>
<tr>
<th>TRAINEE CODE</th>
<th>DESIGNATION</th>
<th>COMMENTS FROM TRAINEES</th>
</tr>
</thead>
<tbody>
<tr>
<td>117</td>
<td></td>
<td>The government is taking a much more visible role in health delivery and I feel understanding the government's historical, current, and possible future influence is extremely helpful.</td>
</tr>
<tr>
<td>119</td>
<td></td>
<td>More emphasis should be placed on problem definition and selection of relevant data than manipulation of given data.</td>
</tr>
<tr>
<td>301</td>
<td></td>
<td>How to work with hospital personnel and gain their active cooperation is an essential requisite to success in hospitals in my opinion.</td>
</tr>
<tr>
<td>314</td>
<td></td>
<td>Unfortunately, PHMS (and other I.E. related programs) have become too enamored with the seemingly omnipotent characteristics of operations research; a return to the basics is needed.</td>
</tr>
</tbody>
</table>
APPENDIX E

NAMES AND ADDRESSES

OF PHMS TRAINEES' IMMEDIATE SUPERVISORS

WITH WHOM

THE INITIAL HEALTH FIELD EMPLOYER

STRUCTURED INTERVIEW WAS CONDUCTED
The employers structured interview was completed by contacting the following persons:

<table>
<thead>
<tr>
<th>NAME</th>
<th>POSITION AND ADDRESS</th>
</tr>
</thead>
<tbody>
<tr>
<td>William R. Anderson</td>
<td>Assistant Administrator and Controller Emory University Hospital 1364 Clifton Rd., N. E. Atlanta, Georgia 30322</td>
</tr>
<tr>
<td>Howard E. Fagin</td>
<td>Director of Health Services Health Resources Corporation 375 Pharr Rd., N. E., Suite 215 Atlanta, Georgia 30305</td>
</tr>
<tr>
<td>Dr. Richard K. C. Hsieh</td>
<td>Chief, Health Services Research Division of Hospitals USPHS Wyman Park Drive and 31st Street Baltimore, Maryland 21211</td>
</tr>
<tr>
<td>Fred Madden</td>
<td>Director, Manpower Division Central State Hospital P. O. Box 325 Milledgeville, Georgia 31062</td>
</tr>
<tr>
<td>Sheldon A. Miller</td>
<td>Director Office of Equipment Consultation Health Facilities Planning and Construction Services USPHS Parklawn Building, Room 9-35 Rockville, Maryland 20852</td>
</tr>
<tr>
<td>J. Vaughn Pearson</td>
<td>Director Industrial Engineering Central State Hospital P. O. Box 325 Milledgeville, Georgia 31062</td>
</tr>
<tr>
<td>Cosmo D. Zang</td>
<td>Chief, Data Management Branch Federal Health Programs Service Health Services and Mental Health Administration USPHS Parklawn Building, Room 14A-40 Rockville, Maryland 20852</td>
</tr>
</tbody>
</table>
APPENDIX F

RESPONSES AND COMMENTS GIVEN BY
PHMS TRAINEES' IMMEDIATE SUPERVISORS
WITH WHOM THE INITIAL HEALTH FIELD
EMPLOYER STRUCTURED INTERVIEW WAS CONDUCTED

The responses and comments given by health field employers of PHMS trainees were acquired by conducting the structured interview on the telephone. The responses and comments thereby obtained and given in this Appendix are not verbatim transcriptions but rather represent an attempt to characterize objectively the supervisors' comments from hand-written notes.
QUESTION 1: In your opinion was (Name of Trainee) better prepared to perform his job in your organization due to his health field exposure? If he was, could you briefly explain in what way(s)?

The following comments were made by the immediate supervisors in response to question 1:

<table>
<thead>
<tr>
<th>TRAINEE CODE</th>
<th>RESPONSES FROM SUPERVISORS</th>
</tr>
</thead>
<tbody>
<tr>
<td>106</td>
<td>YES: (1) Knowledgeable of the hospital and its organization; (2) Possessed economic understanding of and practical experience in the health field; and (3) Personality was conducive to functioning in health environment.</td>
</tr>
<tr>
<td>108</td>
<td>YES: Not sure if PHMS was responsible since the trainee had varied health experience prior to PHMS.</td>
</tr>
<tr>
<td>114</td>
<td>YES: Generally.</td>
</tr>
<tr>
<td>116</td>
<td>YES: Very practical in applications and approach.</td>
</tr>
<tr>
<td>117</td>
<td>YES: Generally oriented and prepared.</td>
</tr>
<tr>
<td>119</td>
<td>YES: He was oriented to the hospital's work area and environment through his work experience as a trainee at this hospital.</td>
</tr>
<tr>
<td>301</td>
<td>YES: Orientation to hospital, terminology, and problems.</td>
</tr>
</tbody>
</table>
QUESTION 2: Please list any specific health related areas of knowledge or experience which (Name of Trainee) may have demonstrated to you through the performance of his job and which you feel were significantly beneficial.

The following areas of knowledge or experience were offered in response to question 2:

<table>
<thead>
<tr>
<th>TRAINEE CODE</th>
<th>DESIGNATION</th>
<th>RESPONSES FROM SUPERVISORS</th>
</tr>
</thead>
<tbody>
<tr>
<td>106</td>
<td>Terminology and familiarity with areas related to patient care.</td>
<td></td>
</tr>
<tr>
<td>116</td>
<td>(1) General health orientation; (2) Interpersonal relations; and (3) Hospital organization and politics.</td>
<td></td>
</tr>
<tr>
<td>117</td>
<td>(1) Layout; (2) Computer information systems design; (3) Engineering economy; and (4) Equipment evaluation.</td>
<td></td>
</tr>
<tr>
<td>119</td>
<td>General orientation.</td>
<td></td>
</tr>
<tr>
<td>301</td>
<td>Technical abilities were excellent; he adapted to the hospital and its problems quickly.</td>
<td></td>
</tr>
</tbody>
</table>
QUESTION 3: Specifically, how could (Name of Trainee) have been better prepared for a job in the health field (such as in your organization) by training programs such as PHMS, i.e., what health related experiences or knowledge would you like for future employees to have received from their formal education programs?

The following comments were made in response to question 3:

<table>
<thead>
<tr>
<th>TRAINEE CODE</th>
<th>RESPONSES FROM SUPERVISORS</th>
</tr>
</thead>
<tbody>
<tr>
<td>108</td>
<td>(1) Need a different kind of practical experience; (2) Need to have more health professionals participate in instruction; and (3) The Georgia Institute of Technology has to be more active and participate in the Association of University Programs in Health Administration.</td>
</tr>
<tr>
<td>114</td>
<td>(1) Accounting, and (2) Financing of health care.</td>
</tr>
<tr>
<td>116</td>
<td>(1) Medical Terminology, and (2) Clinical processes.</td>
</tr>
<tr>
<td>117</td>
<td>More responsibility and independence in project work.</td>
</tr>
<tr>
<td>119</td>
<td>(1) Basic techniques of data collection, and (2) Orientation concerning the dependence of project implementation upon management's whims.</td>
</tr>
<tr>
<td>301</td>
<td>Orientation to the governmentally controlled hospital and its environment vis-a'-vis the private hospital.</td>
</tr>
</tbody>
</table>

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QUESTION 4: Would you show a decided preference to hiring other PHMS trainees over graduates of non-health curricula for other entry-level positions?

The following comments were offered in response to question 4:

<table>
<thead>
<tr>
<th>TRAINEE CODE</th>
<th>RESPONSES FROM SUPERVISORS</th>
</tr>
</thead>
<tbody>
<tr>
<td>106</td>
<td>YES: However, preference would be shown to any person with the necessary technical training and who had received some health field exposure or work experience.</td>
</tr>
<tr>
<td>108</td>
<td>YES: If a person with industrial engineering skills was needed; PHMS trainees are oriented to health field but not enough.</td>
</tr>
<tr>
<td>117</td>
<td>YES: All other things being equal.</td>
</tr>
<tr>
<td>301</td>
<td>YES: All other things being equal.</td>
</tr>
</tbody>
</table>
APPENDIX G

THESES AND DISSERTATIONS

completed by PHMS trainees
The titles of theses and dissertations completed by PHMS trainees during the period July 1, 1967 through June 30, 1972 are presented in this Appendix. Titles of PHMS trainees' theses and dissertations which were in process on June 30, 1972 are given in Section III of the present report.

**MASTER'S TESSES**


"An Application of Managerial Accounting to Cost Data in a Hospital Service Department," Felipe Alonso, August 1968, 45 pp.


APPENDIX H

PROJECT REPORTS

COMPLETED BY PHMS STUDENTS
The titles of project reports completed by PHMS students during the period July 1, 1967 through June 30, 1972 are presented in this Appendix. The titles of theses and dissertations completed by PHMS trainees are excluded from this Appendix and are listed in Appendix G.

ISyE 418


"Housekeeping Maintenance Costs at Grady Memorial Hospital," Foster, John R., December 1967.


"Layout of Duplicating and Mail Rooms - Veterans Administration Hospital," Thomas, J. K., December 1967.


"Computerized and Automated Hospital Systems," Lankford, R., Fall 1968.


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"Humanizing the Hospital through Planning," Black, R., December 1968.


"Factors Influencing Rising Hospital Cost," Crannell, D. J., December 1968.


"Legal Implications of the Physician Practicing in the Hospital," Harvey, R. T., December 1968.


"Electronic Data Processing Applications to Medical Diagnosis," Schreeder, M. T., December 1968.


"The Medical Records System at Grady Hospital," Horwitz, Joni S., December 1969.


"Analysis of the Inventory System at South Fulton Hospital," Hall, Herschel E., June 1970.


"The Role of the Industrial Engineer in a Supplies Application Situation at Holy Family Hospital with Special Emphasis on Disposables and Re-usables," Hughey, Terry L., and Machtolff, John, June 1970.


"A Comparative Study Between a Semi-Automated System and the Present System of the Hematology Laboratory at the University Hospital, Augusta, Georgia," Brown, Ohma H., Clark, James T., Queen, Ellery E., and Wood, Jerry W., December 1970.


"Study of Procedures and Utilization of the Laboratory Services Unit, National Center for Disease Control," Boothe, Stephen; Crouch, Louis; Moore, William W., Jr.; and LaCour, Joseph A., December 1970.


"Improvement of Patient Flow Using Analysis of Medical Service Capabilities, Clinic Combinations, and Pharmacy Operation in the Pediatric Outpatient Clinics," Acker, Robert; Cofer, Joseph; Grasso, Bruce; and Porter, Thomas, May 1971.


"An Analysis of the Cost of Treatments in the Departments of Physical and Occupational Therapy at Emory University Hospital," Ayoubi, Joan, August 1971.


"An Initial Study of Emory University Hospital's PT and OT Departments' Financial Situation," Might, Thomas O., August 1971.


"Hospital Field Project for Crawford W. Long Hospital," King, K., Lyles, W., Perdue, D., (Study of Emergency Room), February 1972.


ISyE 451


ISyE 451,2,3


ISyE 460


ISyE 482


ISyE 491,2


ISyE 603


ISyE 665


ISyE 680


ISyE 690


"A Description of Supportive Service Departments of Eugene Talmadge Memorial Hospital," Kemper, Donald W., September 1968.


"Industrial Engineering Applications in New Health Service Fields," Kemper, Donald W., December 1968.


"Bio-Engineering at Georgia Tech," Knight, J. G., Fall 1969.


"Patient and Medical Record Flow to and from the General Surgery Clinic at Grady Hospital," Duchman, Anita M., October 1970.

"A Study of the Medical Outpatient Clinic at Grady Memorial Hospital," Duchman, John H., October 1970.


"Facilities Planning in the Health Field," Kemper, Donald W., March 1969.


"Projected Faculty Requirements for Piedmont Hospital School of Nursing," Duchman, Anita M., December 1970.
"A Look at the Medical Significance of Date of Birth," Horwitz, Joan S., June 1970.


"Examining-Room Requirements at ETMH," Sumner, Andrew T., April 1968.


"A Descriptive Analysis of the Fourth Year Elective Process of the School of Medicine," Kemper, Donald W., September 1968.


1967

"A Methodology for Analysis of the Phase III Elective Process, School of Medicine, Medical College of Georgia," Bramblett, R. M., November 1967. (Hospital Systems Portion of the Ph.D. Comprehensive Examination, School of I.E.)


1968

"Hospital Information System for South Fulton Hospital," Fagin, H. E., March 1968. (Interim Project Report - PHMS)


"A Qualitative Approach to the Design of Nursing Units," Pascual, Julio J., June 1968. (Special Project)

"Information System Analysis (South Fulton Hospital)," Tompkins, C. J., July 1968. (PHMS Report)


1969


1970


"Forecasting the Need for Medical Services at Grady Memorial Hospital," Dyer, Joseph T., September 1970.


1971


1972


No Date

"Pert Diagram of Stapes Surgery," Hill, W. W., Thompson, R.

"Computerized Patient Monitoring: The State of the Art," Knight, J. G.

"A Design Program for John Calvin Nursing Home," Pettefer, S. E., Pope, B. L.


"Productivity Model - Report No. 2," Tellez, G. J.

"A Method to Improve Operating Room Charges," Villalobos, M.
APPENDIX I

SEMINARS AND GUEST LECTURES

PRESENTED UNDER

THE AUSPICES OF PHMS
The titles of PHMS seminars conducted and guest lectures presented during the period July 1, 1967 through June 30, 1972 are presented in this Appendix.

SEMINARS AND GUEST LECTURES


Hofmann, "Planning and Designing Health Facilities to Achieve Lower Operating Costs," October 1967.


Conort, Frank E., MHA, Assistant Administrator, South Fulton Hospital, Atlanta, "Cost Finding in Hospitals," November 1967.

Diggs, Walter W., MHA, Administrator, Eugene Talmadge Memorial Hospital, Medical College of Georgia, Augusta, "Outpatient Service Fundamentals," November 1967.

Fagin, Howard E., M.S. in PH, Graduate Teaching Assistant and Project Engineer, South Fulton Hospital, Atlanta, "Equipment Planning Program of the PHS," November 1967.

Ortego, Humberto J., MSIE, Graduate Teaching Assistant and Project Engineer, South Fulton Hospital, Atlanta, "A Stochastic Model for Interdepartmental Hospital Traffic," November 1967.

Spence, Joseph T., Area Representative, Hospital Administrative Services, American Hospital Association, "The Hospital Administrative Services Program of AHA," November 1967.

Chester, Theodore E., Chairman, Department of Social Administration, University of Manchester (England), "The British Experience with Hospital Systems Improvement," December 1967.

Clark, Eva Louise, R.N., MBA, Director of Nursing Service, Eugene Talmadge Memorial Hospital, Medical College of Georgia, Augusta, "Planning with an Architect," December 1967.

Hiett, Tee H., M.S., Lecturer in Industrial and Systems Engineering Georgia Institute of Technology, "Fiscal Controls for Hospital Departments," December 1967.

Davis, J. Gordon, Ph.D., Assistant Professor of Industrial and Systems Engineering, Georgia Institute of Technology, "Hospital Applications of Critical Path Methods," January 1968.

Holland, Max G., MBA, Assistant Professor of Management, Georgia State University, Atlanta, "Patient Input System at Eugene Talmadge Memorial Hospital," January 1968.

Walker, Jack R., Ph.D., Associate Professor of Industrial and Systems Engineering, Georgia Institute of Technology, "Management and Motivation," February 1968.

Birdsong, Jackson H., Lecturer in Industrial and Systems Engineering, Georgia Institute of Technology, "Industrial Engineering Techniques in Medicine," March 1968.

Buchanan, J. Russell, MSIE, Assistant Professor of Industrial Engineering, University of Tennessee, Knoxville, "Critical Path Control of the Transfer of Key Hospital Departments," March 1968.

Chyatte, Samuel B., M.D., Chief, Department of Physical Medicine, Emory University Hospital, Atlanta, "Industrial Engineering Techniques in Medicine," March 1968.

Latimer, Ben W., MSIE, Director, Management Systems, Methodist Hospital, Memphis, "A Unit Dose Drug Distribution System," March 1968.

Spradlin, Bobby C., Ph.D., Assistant Professor of Industrial and Systems Engineering, Georgia Institute of Technology, "Complex Systems Design and Analysis," March 1968.

Delon, Gerald L., Ph.D., Assistant Professor, Industrial and Systems Engineering, Georgia Institute of Technology, "The Pathology Laboratory: A Total Systems Approach," April 1968.

Dumas, Frank M., Ph.D., Chairman, Department of Psychology, Augusta, College, "Frontier Concepts in Theoretical Management," April 1968.

Miller, Sheldon A., MHA, Chief, Equipment Branch, Division of Hospital and Medical Facilities, PHS, "Government Commitment to Health Care," April 1968.


Gustafson, David H., Ph.D., Assistant Professor, Industrial Engineering, University of Wisconsin, Madison, "Subjective Likelihood Estimation in Medical Decision Making," May 1968.

Hogan, Glenn M., LL.B., Executive Director, Georgia Hospital Association, "Functions of a State Hospital Association," May 1968.

Smith, Leo A., MSIE, Instructor, School of Industrial Engineering, Purdue University, Lafayette, Indiana, "Human Factors in Inspection Processes," May 1968.


Alonso, Felipe, MSIE, Graduate Assistant, PHMS, "An Application of Managerial Accounting to Cost Date in a Hospital Service Department," August 1968.

Barker, W. Daniel, MHA, Assistant Director, Crawford W. Long Memorial Hospital, Atlanta, "Hospital Administration and Industrial Engineers," October 1968.

Gunter, J. Fred, MHA, Administrator, South Fulton Hospital, Atlanta, "Industrial Engineering at South Fulton Hospital," October 1968.

Johnson, James B., University of South Florida, "Scheduling the Operating Room," October 1968.


Shaw, David R., MSIE, Director, Systems Development Department, University of Alabama, Birmingham Medical Center, "Factors to Evaluate in Establishing Hospital Charges," October 1968.

Spence, Joseph T., Area Representative, Hospital Administrative Services, American Hospital Association, "Productivity Measurement in Hospitals," October 1968.

Bloom, Walter L., M.D., Associate Vice President for Academic Affairs, Georgia Institute of Technology, "Group Practice and Other Trends in Medical Systems," November 1968.

Walter, J.R., Ph.D., Deputy Director, Health Sciences Functional Planning Unit, University of Toronto (Canada), "Computer Simulation in Planning Within Medical Schools," November 1968.

Wren, George R., Ph.D., Director, Program in Hospital Administration, Georgia State University, "Hospital Administration," November 1968.

Robinson, Robert E., M.D., Bowman-Gray School of Medicine, Wake Forest University, "Patient Care and the Computer," December 1968.


Collins, Frank A., BIE, National Air Pollution Control Administration, PHS, "The Industrial Engineer and Environmental Health Service," February 1969.


Nichols, Lee F., A.B., Administrator, Holy Family Hospital (in collaboration with Ernest Borders and James Walker), "Hospital Industrial Engineering at Holy Family Hospital," February 1969.


Daly, William J., Administrative Resident, Eugene Talmadge Memorial Hospital, Medical College of Georgia, Augusta, "Role Conflicts Between 19th and 20th Century Managers," April 1969.


Ramsden, Mrs. Betty, RRL, Director, School of Medical Records Administration, Emory University Hospital, "The Medical Records Department," April 1969.

Sullivan, William G., Senior Systems Engineer, Eugene Talmadge Memorial Hospital, Medical College of Georgia, "The Systems Planning Project at the Medical College of Georgia," April 1969.

Young, Mrs. Faye G., Chief, Dietetic Service, V. A. Hospital, Atlanta, "Central Kitchen Operations," April 1969.

Grim, Charles E., Assistant Administrator, V. A. Hospital, Atlanta, "The V. A. Analyst Program," May 1969.

Miller, Sheldon A., MHA, Chief, Equipment Branch, Division of Hospital and Medical Facilities, USPHS, "Hospital Equipment," May 1969.


Pecora, Mrs. Florence, Director, Central Supply, Holy Family Hospital, Atlanta, "Central Supply Department," May 1969.

Sumner, Andrew T., Systems Engineer, PHS Hospital, Baltimore, "Project Planning for a Multiphasic Health Screening Clinic," May 1969.

Aliaga, Rene, Grady Memorial Hospital, Atlanta, "Socialized Medicine in Bolivia and Other Latin American Countries," June 1969.

Linney, George, Assistant Administrator, University Hospital, Augusta, "Operational Features of the New University Hospital," September 1969.


Delon, Gerald L., Ph.D., Assistant Professor, Industrial Engineering, Georgia Institute of Technology and J. M. Jones, "Simulation Models for Long-Range Planning at a Mental Health Institution," October 1969.


Longest, Beaufort, Instructor, Program in Hospital Administration, Georgia State University, "Objectives of the Hospital," October 1969.

Wren, George R., Ph.D., Director, Program in Health Administration, Georgia State University, "Systems for the Delivery of Health Delivery," October 1969.

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Wren, George R., Ph.D., Director, Program in Health Administration, Georgia State University, "Organization of Hospital and Medical Staff," October 1969.

Wren, George R., Ph.D., Director, Program in Health Administration, Georgia State University, "The Role of the Hospital Administrator," October 1969.

Kennedy, Frederick, Research Triangle Institute, "The Development of a Simulation Model of a Community Health Service Team," December 1969.


Slamecka, Vladimir, DLS, Professor and Director, School of Information and Computer Science, Georgia Institute of Technology, "The Audiographic Learning System," Augusta, January 1970.


Fey, Willard R., S.M., Associate Professor of Industrial and Systems Engineering, Georgia Institute of Technology, "Feedback Dynamics," Atlanta, February 1970.


Bennett, Cecil, Management Services Division, Medical College of Georgia, "The Use of Hospital Administrative Services (HAS) as a Managerial Tool by the ETMH," Augusta, March 1970.


Kennedy, Frederic D., MBA, Head, Health Services Section, Research Triangle Institute, "Regional Alcoholism Systems," Atlanta, April 1970.

Mitre-Salazar, Gonzalo, Ph.D., Department of Industrial Engineering, Instituto Tecnologico y de Estudios Superiores de Monterrey, Mexico, "Hospital Industrial Engineering in Mexico," Atlanta, June 1970.


Griffioen, H., M.D., Chief Medical Officer, Caltex Pacific Indonesia, "Geography, Politics, and Economics of the Oil Industry in Indonesia and their Effects upon Health Services for Employees," Atlanta, October 1970.


Neely, F. Levering, M.D., Clinical Associate Professor of Medicine, Emory University, "The Testing of Beverages as Athletes' Replacement Fluids," Atlanta, October 1970.

Adler, Philip, Jr., Ph.D., Associate Professor of Technology Management, Georgia Institute of Technology, "Health Systems Activities at Emory University," Atlanta, November 1970.


Davenport, Richard K., Ph.D., Associate Professor of Psychology, Georgia Institute of Technology, "The Psychological Effects of Architectural Designs in Health Care Facilities," Atlanta, November 1970.


Wren, George R., Ph.D., Professor and Director, Program in Health Administration, Georgia State University, "The Hospital Administrator, his Background and his Responsibilities," April 1970; "Hospital and Health Administration," Atlanta, November 1970.

Watt, John R., Ph.D., Director, Hospital Systems and Research Program, Associate Professor of Mechanical Engineering, University of Texas, "The Texas Health Systems Program," Atlanta, December 1970.
Knobel, Roland J., Ph.D., Associate Professor, Program in Health Administration, Georgia State University, "Program in Health Administration, Georgia State University," Atlanta, February 1971.

Fuller, John R., Systems Engineer, Division of Health Systems Engineering, Medical College of Georgia, "The Unit Dose Medication System," Augusta, March 1971.

Stubler, Elfr., Ph.D., Director, Labor Sciences, the German Federal Research Institute for Home Economics, "Work Methods Education for Nurses," Atlanta, April 1971.

Kennedy, Fredric, Associate Director, Department of Health and Social Services, Atlanta Regional Commission, "Assessment of the Availability of Hospital Beds Within the Atlanta Metropolitan Planning Region," Atlanta, May 1972.


Olsen, Ole, Ph.D., Associate Professor of Industrial Management, Georgia Institute of Technology, "The Potential Impact of Computers on Managerial Aspects of Health Care Delivery," Atlanta, June 1971.


McNabb, M. E., Food Service Administrator, Central State Hospital, Milledgeville, Georgia, "Food Management Improvements as a Result of Utilizing Computer-Assisted Menu Planning (CAMP)," Augusta, July 1971.

Ferguson, John, Executive Director, Hall County Hospital in Gainesville, Georgia, "Hospital Management System Problems," Atlanta, August 1971.


Kemper, Donald, HSRC, "Quality Control and Staffing Utilization Programs for Nursing Service Department," Atlanta, August 1971.

Mason, Robert M., Research Scientist, Engineering Experiment Station, Georgia Institute of Technology, "Organizational Health and Strategic Planning," Atlanta, August 1971.

Grazman, Ted, Research Associate, Program in Health Administration, Georgia State University, "Long-Range Planning for Hospitals," Atlanta, September 1971.


Shaw, David R., Director, Systems Development Department, University of Alabama Hospital and Clinics, "Systems Engineering Services at the University of Alabama Hospital and Clinics," Atlanta, December 1971.

Holland, Max G., Ph.D., Associate Professor of Management, Georgia State University, "Health Planning in Rural Areas," Atlanta, February 1972.

Tompkins, Curtis J., Ph.D., Assistant Professor, Graduate School of Business Administration, University of Virginia, "Medical Terminology," Atlanta, February 1972.

Wren, George R., Ph.D., Professor and Director of Health Administration, Georgia State University, "The Health Care Crisis," Atlanta, February 1972.

Latimer, Ben W., Director, Carolinas Hospital Improvement Program, "Carolinas Hospital Improvement Program," Atlanta, February 1972.


Mathews, James B., Ph.D., Director, Division of Systems and Computer Services, Medical College of Georgia, "Health Systems Engineering at Medical College of Georgia," March 1972.


Slamecka, Vladimir, DLS, Professor and Director of the School of Information and Computer Science, Georgia Institute of Technology, "The Biomedical Information Systems and Biomedical Computer Systems Option at Georgia Tech," Atlanta, May 1972.

Wren, George R., Ph.D., Professor and Director of Health Administration, Georgia State University, "Comprehensive Health Planning in Bacon County, Georgia," Atlanta, May 1972.
APPENDIX J

TRAINEESHIPS IN

HOSPITAL AND MEDICAL SYSTEMS

FINAL REPORT
TRAINEEHIPS IN
HOSPITAL AND MEDICAL SYSTEMS

Final Report

Direct Fellowship Award #1-F1-CH-30,873
Direct Fellowship Award #69-171
Traineeship Grant #EH-69-660-A
Traineeship Grant #5 AlO AH 00660-02
Direct Fellowship Award #5 F01 HS45475

Submitted to

Health Manpower Educational Services
Bureau of Health Manpower Education
National Institutes of Health
U.S. Public Health Service

By

Harold E. Smalley, Ph.D.
Regents' Professor and Program Director

Georgia Institute of Technology
Atlanta, Georgia

March 1971
TRAINEE SHIPS IN
HOSPITAL AND MEDICAL SYSTEMS

Introduction

This final report covers five Public Health Service awards and grants for the support of twelve trainees in the "Program in Hospital and Medical Systems" (PHMS) at the Georgia Institute of Technology during the period from September 1965 through February 1971.

PHMS is a jointly administered training program of the Georgia Institute of Technology and the Medical College of Georgia and is designed to meet educational needs within that interdisciplinary field concerned with improvements in the management of health services through industrial and systems engineering, operations research, and management science. Graduate students are trained at Georgia Tech in the scientific treatment of hospital and medical systems and undertake project work and thesis research either in one of several cooperating institutions in Metropolitan Atlanta or at the Eugene Talmadge Memorial Hospital, clinical teaching unit of the Medical College in Augusta. In addition, students in dentistry, health administration, medicine, nursing, and other health professions are offered appreciation courses in modern industrial engineering techniques and are encouraged to participate in various interdisciplinary projects.

The general objective of the training project is to develop a unique educational program consisting of a new curriculum for the training of industrial engineers who are being prepared to enter the health field as a permanent career environment. Emphasis in this developmental project has been upon graduate education in health systems at the master's level, but attention has also been given to complementary curricula at the doctoral level and experiments with undergraduate health-systems training. The project continues to provide educational opportunities in interdisciplinary areas for students in engineering, physical science, management, and the health professions. The PHMS training project, supported by PHS Grant #2 D02 AH 01056, is
described more fully in the March 1971 annual Progress Report to the Public Health Service, a copy of which is attached as Exhibit A.

Prior to July 1967, the sponsoring department was known as the "Hospital Systems Research Group" of the School of Industrial Engineering; since July 1967, PHMS has been jointly administered by the Georgia Institute of Technology and the Medical College of Georgia; and since September 1969, PHMS has been a major project of the Health Systems Research Center (HSRC), in cooperation with the School of Industrial and Systems Engineering, and with the continuing affiliation of the Medical College of Georgia. The 1971-72 General Catalog description of HSRC is attached as Exhibit B.

PHMS Trainee Policy

PHMS Trainee Defined

The designation, "PHMS Trainee," refers to a matriculated student who is pursuing a degree (undergraduate, master's, or doctoral) in one of the several cooperating schools of instruction at Georgia Tech or other academic institutions and who affiliates with HSRC in order to emphasize Hospital and Medical Systems in his program of study. Since the PHMS training project is directed and conducted by the Health Systems Research Center, such affiliated students are sometimes referred to as "HSRC Trainees." The following are types of PHMS trainees:

Undergraduate--Majors in industrial and systems engineering (or other professional curricula at Georgia Tech) who wish to emphasize health systems in their electives.

Master's--Graduate students working toward either the undesignated or designated master's degree at Georgia Tech, with a major in health systems.

Doctoral--Advanced graduate students working toward the Ph.D. degree in industrial and systems engineering, operations research, management science, or a similar technical field at Georgia Tech, with a major in health systems.

Special--Students in any of the previous categories who are enrolled at an institution other than Georgia Tech but who are actively involved in HSRC programs.

Entrance into PHMS

A student wishing to enter PHMS may do so by obtaining approval of the school of instruction in which he is enrolled and making application to HSRC. Such PHMS trainees follow regular curricula or core programs of their
"home schools," include a sequence of health-related courses as electives, and engage in project work or student research on health-systems problems.

Originally, PHMS was open only to students in the School of Industrial and Systems Engineering, but in recent years it has included students from various other schools on the Georgia Tech campus (Industrial Management, Information and Computer Science, Architecture, and Chemical Engineering) and from other institutions such as the Medical College, Georgia State, Augusta College, Clemson University, and Tulane Medical School. Such an expanded program is intended to provide a health-systems orientation to academic work within a given discipline, as well as opportunities to employ interdisciplinary approaches to health-systems problems.

Every PHMS trainee is expected to possess an uncommon interest in applying industrial and systems engineering, operations research, management science, or some other quantitatively oriented scientific body of knowledge to the solution of health-systems problems, and to participate in the non-credit seminars conducted by HSRC.

Health-Related Courses

The following health-related courses are taught by PHMS faculty members and are available to PHMS trainees:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>IE 418</td>
<td>Industrial Engineering in Hospitals</td>
<td>3-0-3</td>
</tr>
<tr>
<td>IE 451,2,3</td>
<td>Special Problems</td>
<td>0-3-1</td>
</tr>
<tr>
<td>IE 665</td>
<td>Case Studies in Hospital Management Systems</td>
<td>3-0-3</td>
</tr>
<tr>
<td>IE 700</td>
<td>Master's Thesis</td>
<td>*</td>
</tr>
<tr>
<td>IE 704,5,6</td>
<td>Special Problems</td>
<td>*</td>
</tr>
<tr>
<td>IE 765</td>
<td>Projects in Hospital Management Systems</td>
<td>*</td>
</tr>
<tr>
<td>IE 800</td>
<td>Doctor's Thesis</td>
<td>*</td>
</tr>
</tbody>
</table>

*Credit arranged on individual basis

Undergraduate Trainees

Undergraduate trainees are required to include IE 418 as an elective and to engage in health-related project work as "clinical training" under professional supervision. In addition to the term project in IE 418, these trainees either undertake health-oriented special problems under IE 451,2,3 or serve as student assistants on HSRC research, education, or community-outreach projects.

Master's Trainees

Master's trainees must take IE 418 (unless it was included in the undergraduate program), IE 665, and at least three quarter-hours of health-
related project-type coursework, either IE 704,5,6 or IE 765. Each master's trainee enrolled in the School of Industrial and Systems Engineering must complete an approved health-related thesis with credit for at least seventeen quarter-hours of IE 700, and a PHMS faculty member must be a member of the trainee's Thesis Advisory Committee. Master's trainees enrolled in other cooperating schools adhere to policies of those schools, some of which provide for a non-thesis option.

Doctoral Trainees

Doctoral trainees are expected to build upon the PHMS master's program and to include in the doctoral program of study any omissions or deficiencies. Such trainees are expected to gain some experience in classroom teaching. One area of the Ph.D. Comprehensive Examination and the doctoral dissertation must be health oriented, and a PHMS faculty member must be on the Thesis Advisory Committee.

Fellowships and Traineeships

Some PHMS trainees provide their own support; some are supported by HSRC through student assistantships, graduate research or teaching assistantships, or part-time staff positions; others are supported by scholarships from cooperating hospitals, associations, foundations, or private firms; and still others are supported by individual fellowships or traineeships provided by NIH, NCHSRD, NASA, NSF, or NDEA. Listings of trainees enrolled since PHMS was initiated in July 1967 are given on Pages 31-33 of Exhibit A. However, the present report is limited to those PHMS trainees supported by the Public Health Service through individual awards and grants from the Bureau of Health Manpower Education and the National Center for Health Services Research and Development.

A total of twelve graduate students majoring in hospital and medical systems were supported under five PHS awards or grants for fellowships or traineeships, as follows:
<table>
<thead>
<tr>
<th>Name</th>
<th>Grant Number</th>
<th>Support Period</th>
</tr>
</thead>
<tbody>
<tr>
<td>James B. Mathews</td>
<td>1-F1-CH-30,873</td>
<td>9/65 - 1/67</td>
</tr>
<tr>
<td>Howard E. Fagin</td>
<td>69-171</td>
<td>9/67 - 6/69</td>
</tr>
<tr>
<td>Donald W. Kemper</td>
<td>EH-69-660-A</td>
<td>9/68 - 3/69</td>
</tr>
<tr>
<td>David P. Mason, Jr.</td>
<td>EH-69-660-A</td>
<td>9/68 - 3/70</td>
</tr>
<tr>
<td>Joan S. Horwitz</td>
<td>5 A10 AH 00660-02</td>
<td>9/69 - 9/70</td>
</tr>
<tr>
<td>James G. Knight</td>
<td>5 A10 AH 00660-02</td>
<td>9/69 - 9/70</td>
</tr>
<tr>
<td>Anita M. Duchman</td>
<td>5 A10 AH 00660-02</td>
<td>6/70 - 2/71</td>
</tr>
<tr>
<td>John H. Duchman</td>
<td>5 A10 AH 00660-02</td>
<td>6/70 - 10/70</td>
</tr>
<tr>
<td>Joseph D. Marsh, Jr.</td>
<td>5 F01 HS45475</td>
<td>9/69 - *</td>
</tr>
</tbody>
</table>

**Direct Fellowship Award #1-F1-CH-30,873**

**James B. Mathews**

This trainee received the BIE degree from the Georgia Institute of Technology in June 1961 under the Cooperative Plan, and after a short experience as an industrial engineer with E. I. DuPont de Nemours and Company, he went on active duty and served three years as a Procurement/Production Officer with the U.S. Air Force. Upon his release from active duty in September 1964, he was admitted to the graduate program of the School of Industrial Engineering at Georgia Tech and was awarded a National Science Foundation Fellowship.

During 1964-65, he became involved with programs of the Hospital Systems Research Group and was given a direct award of a Predoctoral Intermediate Fellowship by PHS which became effective in September 1965. From the Fall Quarter 1965 through the Winter Quarter 1967, this trainee completed forty-one quarter-hours of coursework, audited fourteen quarter-hours, and completed twenty-four quarter-hours of thesis, for a total of seventy-nine quarter-hours. His master's research paper was "The Use of ANOVA and Regression Techniques in the Investigation of Decision Determinants in Hospitals." He was awarded the MSIE degree with a major in

* This Fellowship from the NCHSRD is presently active and has been approved to September 1971; a continuation application is anticipated.
hospital and medical systems in June 1966 and continued his interest in
the health field as a doctoral student.

In February 1967, he was appointed Project Engineer and was transferred to the campus of the Medical College of Georgia in Augusta to lead a team of resident planners on a major project concerned with new systems and facilities for medical education and research at MCG -- a project which provided highly relevant experiences and data sources for his doctoral dissertation. This new status required that he resign from his PHS Fellowship, but his educational objectives and program of study remained unchanged. All degree requirements were completed, and the Ph.D. was awarded in September 1970. The approved dissertation was:


Having served as Assistant Director, Program in Hospital and Medical Systems, at the Medical College since 1968, Dr. Mathews was promoted to Associate Director, Division of Health Systems Engineering, MCG, in October 1970. In this capacity he is in administrative charge of an organizational unit of some fifteen full-time persons engaged in health systems services, research, and education. Dr. Mathews also holds a joint appointment as Assistant Professor of Industrial and Systems Engineering at Georgia Tech, in which capacity he provides instruction and directs theses for Georgia Tech students majoring in hospital and medical systems.

Direct Fellowship Award #69-171

Howard E. Fagin

This trainee received both the BSIE degree in June 1965 and the MSPH degree in August 1966 from the University of Oklahoma where he was supported by a PHS Traineeship awarded to him by that institution. He was admitted to the graduate program of the School of Industrial Engineering at Georgia Tech in September 1966, whereupon he affiliated with the Hospital Systems Research Group and served as a Graduate Teaching and Research Assistant in 1966-67.

During the Spring of 1967, he was awarded a commission by the Public Health Service and went on active duty in the COSTEP program during the summer of 1967. He returned to Georgia Tech in the Fall of 1967 and
was given a direct award of a Predoctoral Fellowship by PHS to continue his graduate studies with the Program in Hospital and Medical Systems.

At the end of 1967-68, permission was obtained from the PHS to use a portion of the funds from Traineeship Grant #EH-69-660-A as a direct award to Mr. Fagin for an additional academic year of graduate work which included coursework toward a doctorate. During the seven quarters from Fall 1967 through Spring 1969, this trainee completed twenty-five quarter-hours of coursework, audited twelve hours, and was credited with fifty hours of research and project work, for a total of eighty-seven hours. Projects completed were as follows:

"Alternative Approaches to the Management of Hospital Construction"
"Automated Systems and other Unique Features of the Atomedic Hospital"
"Equipment Planning Program of the PHS"
"Evaluation of IE Health Course Sequence"
"Future Means of Delivering Health Care and Improving Hospital Management Decisions"
"Outpatient and Emergency Services"

During the period of his appointment, this trainee also prepared three research proposals and co-authored a manuscript which was published:

"Hospital Planning for Communicable Disease Patients" (Research Proposal)
"Planning Community Health Services" (Research Proposal)
"Quantification of Decision Criteria to evaluate Alternate Plans for Hospital Support Services" (Research Proposal)

He was awarded the MSIE degree with a major in hospital and medical systems in June 1969, at which time he returned to active duty with the Public Health Service in its Division of Hospital and Medical Facilities; Architectural, Engineering, and Equipment Branch.

At present, Mr. Fagin is Health Facilities Equipment Advisor with the Public Health Service in Silver Spring, Maryland, and is concurrently pursuing a doctoral program in absentia with the University of Oklahoma, building upon his graduate work in hospital and medical systems at Georgia
Tech. His approved dissertation topic is:
"Procedures and Cost Analysis of a University Hospital Blood Bank."

Traineeship Grant #EH-69-660-A

Robert F. Ellis

This trainee, a graduate of the School of Chemistry at Georgia Tech, enrolled as a graduate student in Georgia Tech's School of Information Science in 1968 and shortly thereafter became interested in health-care applications of computer technology. He was awarded a PHS Master's Traineeship in the Fall of 1968 and thus became the first PHMS trainee outside the School of Industrial Engineering. During two academic quarters of traineeship support, he completed twenty quarter-hours of coursework and audited five hours. His projects were as follows:

"Centralized Medical Laboratories" (Co-authored with David P. Mason, Jr.)
"Information System for a Community Health Center"
"PHMS Reference Room: Purpose and Organization"
"Survey of Computer Facilities in Atlanta Hospitals"

In March 1969, he withdrew as a graduate student from Georgia Tech and resigned his PHS Traineeship in order to pursue a career in health systems, with emphasis upon data processing and information systems. At present, Mr. Ellis is a Systems Analyst with the Computer Systems Department of Emory University Hospital in Atlanta.

Donald W. Kemper

This trainee became interested in the health field as an undergraduate student at the University of Texas where he received the BES degree (with honors) in June 1968. He was admitted to graduate study in the School of Industrial and Systems Engineering at Georgia Tech in June 1968 and spent the Summer of 1968 as a Staff Assistant in the Program in Hospital and Medical Systems at the Medical College in Augusta, where he began his master's program. His PHS Traineeship began in the Fall 1968 when he came to the Georgia Tech campus to pursue coursework with PHMS in Atlanta. During two academic quarters of traineeship support, he completed twenty-five quarter-hours of coursework (with all A's) and audited four hours. His special-problem projects were:

"A Description of Supportive Service Departments of Eugene Talmadge Memorial Hospital"
"A Descriptive Analysis of the Fourth Year Elective Process of the School of Medicine"
"Development of an Organization Chart of the Medical College of Georgia"
"Facilities Planning in the Health Field"
"Industrial Engineering Applications in New Health Service Fields"
"Shared Services in Radiology" (Co-authored with William I. Crichton, Jr.)

This program of study was interrupted in March 1969 when the trainee accepted a commission with the Public Health Service and went on active duty as an Assistant Sanitary Engineer with the Federal Health Program Service. Expecting to be released by PHS in March 1971, Mr. Kemper obtained readmission to Georgia Tech and expects to resume his master's program with PHMS in the Spring Quarter 1971. His proposed thesis topic is:

"Hospital Information Systems: Methodology for Design and Evaluation"

David P. Mason, Jr.

This trainee became interested in the health field as a Georgia Tech undergraduate when he served as a PHMS Student Assistant and was assigned project work in local cooperating hospitals (Code 307) during the Winter and Spring of 1968. Upon receiving the BIE degree in June 1968, he was admitted to the graduate program of the School of Industrial and Systems Engineering and continued his affiliation with PHMS.

His PHS Traineeship was awarded in the Fall 1968 and continued for six consecutive quarters. During this period, he completed thirty-three quarter-hours of coursework, audited five hours, and was credited with thirty-nine quarter-hours of IE 700 "Master's Thesis," for a total of seventy-seven hours. His special-problem projects were as follows:

"A Book Review: A Review of the Manuscript of Hospital Administration Design"
"Centralized Medical Laboratories" (Co-authored with Robert F. Ellis)
"A Computerized Diagnostic Radiology Simulator"
"Development of a Hospital Management Game involving Industrial Dynamics"
"Hospital Problems Analysis"
"Industrial Engineering Staff Work in a General Hospital"
"Management Educational Analysis Activities"
"Medical Systems Analysis in the OEO Clinic Environment"
"Special Research Center Problems Analysis"

The traineeship was terminated in March 1970, anticipating his entry upon active duty with the U.S. Army. Mr. Mason continued work on his thesis
in absentia, completing all degree requirements for the MSIE with a major in hospital and medical systems in December 1970. The approved thesis was:

"A Comprehensive Clinical Health Team Composition and Facility Evaluation."

Presently he is an officer with the U.S. Army Medical Service in Germany.

Gerald B. Widegren

This trainee, a graduate of the School of Mechanical Engineering at Georgia Tech in June 1968, was admitted to the graduate program of the School of Industrial and Systems Engineering at that time, affiliating with PHMS. He served as a Graduate Research Assistant during the Summer of 1968 and transferred to Augusta as an Engineering Assistant with the Program in Hospital and Medical Systems in September.

In January 1969, he returned to Georgia Tech as a Graduate Research Assistant and was awarded a PHS Traineeship in the Spring of 1969. After spending the Summer in Europe, he returned to Georgia Tech in the Fall of 1969 to continue his coursework and his Traineeship. He completed sixteen quarter-hours of coursework credit and five hours of thesis credit for a total of twenty-one hours, including special-problem projects as follows:

"Analysis of Piedmont Hospital Drug Losses"
"Evaluation of the Health Systems Research Center"
"Methodologies for Central Supply Tray Costing at Eugene Talmadge Memorial Hospital"
"A Methodology for Evaluating the Shared Pharmacy" (Co-authored with G. J. Gilbart)

After completing the coursework in his master's program, he transferred again to the Medical College campus to undertake his master's research. During the Winter, Spring, and Summer of 1970, he served as Engineering Assistant in the Division of Health Systems Engineering and was involved actively in the PHS-sponsored research project, "Analysis of Optimal Radiographic Location Networks," which served as a vehicle for his thesis. He was transferred back to Atlanta in the Fall 1970 where he has been serving as a Research Assistant with the Health Systems Research Center and assigned to the PHS-sponsored research project, "A Systems Analysis of Medical Records Within Georgia."

Mr. Widegren is presently completing his thesis, entitled:

"Simulating Operating Characteristics of Selected Radiographic Facilities Arrangement."
He expects to receive the master's degree with a major in hospital and medical systems in the Spring of 1971.

Donald B. Russell

This trainee came to Georgia Tech from Virginia Polytechnic Institute where he had received the BSIE degree in December 1968. He affiliated with PHMS in January 1969 as a Graduate Research Assistant and was awarded a PHS Traineeship beginning in the Spring Quarter 1969. During three academic quarters of Traineeship support he completed twenty quarter-hours of coursework and seventeen hours of thesis work, for a total of thirty-seven hours. He completed the following special-problem project work:

"Analysis of an Extended Care Facility Information System"  
(Co-authored with Steven J. Halmos and Ben J. Dyer)  
"The Objectives of a Typical Diagnostic Radiology Department"  
"Preliminary Design for Extended Care Facilities"  
"Shared Food Services in Hospitals"

The project in Radiology cited above (conducted in the Winter 1970) was undertaken at the Medical College in Augusta where he was involved in the PHS-sponsored research project, "Analysis of Optimal Radiographic Location Networks," which served as a data source for his thesis.

His traineeship was terminated when he went on active duty with the U.S. Air Force in March 1970, but he has continued to work, in absentia, on his thesis which is entitled:

"Forecasting Demands for Radiographic Service"

Mr. Russell has been transferred to Atlanta by the U.S. Air Force and is presently serving as a Health Facilities Officer. He expects to receive the master's degree with a major in hospital and medical systems in June 1971.

Traineeship Grant #5 A10 AH 00660-02

Joan S. Horwitz

This trainee received the B.S. degree in mathematics from the University of Miami in June 1969 and was admitted to PHMS and the School of Industrial and Systems Engineering in September 1969. Mrs. Horwitz was the first female trainee in PHMS, with her PHS Traineeship beginning in September 1969.

During the four academic quarters of Traineeship support, she completed thirty-six quarter-hours of coursework, audited three hours, and
took seventeen quarter-hours of thesis work, for a total of fifty hours. Her special-problem projects were as follows:

"A Look at the Medical Significance of Date of Birth"
"A Mathematical Model of a Recurrent Epidemic--Rubella"
"Medical Records System at Grady Hospital"
"A Statistical Analysis: The Effect of Pre-Natal Care"

The traineeship terminated in September 1970, and she is working, in absentia, on the final phase of her thesis which is entitled:

"A Mathematical Model of an Epidemic Process"

Presently Mrs. Horwitz is an Operation Research Analyst with Touro Infirmary in New Orleans.

James G. Knight

This trainee, a March 1969 graduate of Georgia Tech's School of Mechanical Engineering, entered the School of Industrial and Systems Engineering in the Spring 1969. He joined PHMS with a PHS Traineeship effective in September 1969. During four academic quarters of Traineeship support, he completed forty-five quarter-hours of graduate coursework (plus certain undergraduate courses), audited six hours, and was credited with seventeen quarter-hours of thesis work. His special-problem projects were as follows:

"Bioengineering at Georgia Tech"
"Studies in Human Behavior"
"A Survey of Automated Patient Monitoring Systems"

Even though this Traineeship was terminated in September 1970, he continues work on his approved thesis topic:

"An Evaluation of Replacement Fluids and Muscle Performance following Strenuous Exertion."

Presently Mr. Knight is serving as Project Assistant to F. Levering Neely, M.D., on the research project "The Efficacy of Various Beverages as Athletes' Replacement Fluid," supported by a grant from Coca Cola U.S.A. and the Georgia Tech Foundation. He expects to complete all requirements for the master's degree with a major in Hospital and Medical Systems in June 1971 and to enter medical school in September 1971.

Anita M. Duchman

This trainee received the B.A. degree in economics, with a minor in mathematics, from Vanderbilt University in June 1969. During 1969-70, she did some graduate work at the University of Tennessee at Chattanooga and was admitted to the graduate program of the School of Industrial and Systems
Engineering at Georgia Tech in June 1970. She affiliated at that time with PHMS on a PHS Traineeship. During the period from June 1970 through February 1971, she completed thirty-three quarter-hours of coursework and completed the following projects:

"Applications of an Electronic Data Processing System to Hospital Operations"
"Medical Records Staffing at St. Joseph's Infirmary"  
( Co-authored with John M. Faucett, James V. McGettrick, and John H. Messmer)
"Patient and Medical Record Flow to and from the General Surgery Clinic at Grady Hospital"
"Projected Faculty Requirements for Piedmont Hospital School of Nursing"

Mrs. Duchman resigned her Traineeship at the end of February 1971 in order to concentrate upon the field of industrial dynamics, but she still has hopes of a career in the health field.

John H. Duchman

This trainee (husband of Trainee 124) received the B.S. degree in economics from the New York University School of Commerce in June 1965. He pursued pre-doctoral work in economics at Vanderbilt University and subsequently mathematics work at the University of Tennessee at Chattanooga.

He was admitted to the graduate program of the School of Industrial and Systems Engineering in June 1970 and affiliated with PHMS. Mr. and Mrs. Duchman were the first husband and wife to be affiliated with PHMS. His PHS Traineeship was awarded in the Summer 1970. During the Summer and Fall, he completed twenty-one quarter-hours of coursework, including the following special-problem projects:

"Efficiency in Community and Regional Health Service Facility Utilization"
"A Study of the Medical Outpatient Clinic at Grady Memorial Hospital"

Mr. Duchman resigned his Traineeship at the end of October 1970 in order to concentrate upon the field of operations research methodology and systems theory, but he intends to pursue a career in the health field.
This trainee received the BIE degree (with honors) in December 1967 and the MSE degree in June 1969, both in industrial and systems engineering at the University of Florida. While at Florida he was actively involved in programs of the Health Systems Research Division of the J. Hillis Miller Health Center, working under the tutorage of Dr. John R. Freeman. His approved master's thesis was:


He was admitted to the doctoral program of the School of Industrial and Systems Engineering in June 1969 and immediately affiliated with PHMS. During the Summer of 1969, he served as a Graduate Research Assistant and, in September, was awarded a PHS Predoctoral Research Fellowship by the National Center for Health Services Research and Development. This Fellowship was continued for a second year in September 1970.

During the period of his Fellowship, he has completed fifty-one quarter-hours of coursework and audited twelve hours, for a total of sixty-three hours. He has passed the Ph.D. Qualifying Examination and the French Examination and has completed all but three courses in his approved program of study. He has been recommended for admission to the Ph.D. Comprehensive Examination for the Spring Quarter 1971 and expects to begin his doctoral research in June 1971. His proposed dissertation is:

"An Optimal Sequential Program for Patient Scheduling."

A continuation application for the Fellowship is expected to be made in September 1971, anticipating completion of all degree requirements by June 1972.