America’s Hospitals Are Falling Short

Hospitals are stressful places to work, stressful to visit, dangerous for patients and expensive to run. According to the National Academies’ Institute of Medicine, hospital stays are a leading cause of death in the US:

• As many as 98,000 Americans die each year during hospitalization due to preventable, medical errors.

• Up to 2 million U.S. hospital patients, 1 in 20 of all those admitted, contract dangerous infections every year during their stays.

• In 1995, hospital-acquired infections cost $4.5 billion and contributed to more than 88,000 deaths. Hospital infections are a leading cause of death in the United States.

But hospitals need not be this way. Researchers in the PhD Program at Georgia Tech, are exploring evidence-based approaches on how to improve healthcare facility design and are collaborating with MCG Healthcare, Emory Health Sciences Center and SSM Healthcare in studying their current facilities and in planning new ones. Research Scientist Dr Mahbub Rashid and Dr Craig Zimring are conducting a Healthy Environments class where they are focusing on how information technology for computerized medical records can be incorporated into the architectural design of Emory’s Hospitals to increase teamwork, improve patient-centeredness and reduce error.

PhD faculty member Dr Ruchi Choudhary has conducted an indepth study of strategic decision-making for technical and mechanical systems in hospitals. She has developed a methodology that allows hospitals to make tradeoffs during renovation and construction among systems and requirements, such as lighting, HVAC, energy control and infection control.

A recent review of the research literature—the most thorough of its kind—conducted by Dr Zimring, PhD student Anjali Joseph and Dr Choudhary, working with Dr Roger Ulrich and Xiaobo Quan from Texas A&M, carefully analyzed over 700 scientific studies, and concluded that the interior design of hospital environments contribute to the hospital illnesses previously listed, and can be a cost-effective tool for improvement. Through improved design, and particularly design of patient-care areas, hospitals can increase patient safety, reduce patient and family stress, increase staff effectiveness and improve overall system efficiency, effectiveness and financial performance. For example:

• There is compelling evidence that providing single patient rooms, as opposed to semi-private rooms or wards, reduces infection rates, patient falls and medical errors, and increases participation by family. While larger variable-acuity rooms and other amenities might increase the initial cost of construction by 5%, evidence suggests that the payback period is approximately one year.

• Controlled, randomized studies show that increased natural lighting and a reduction in noise can diminish drug use, decrease pain for patients and minimize hospital stays and lower stress levels for staff.

• Implementing improved filtering systems for air quality during construction, can reduce hospital-acquired infection.

• Using methods for analyzing networks of corridors and pathways in hospital layouts, like Space Syntax, can reduce poor wayfinding, which is a major source of stress for outpatients and visitors, and is costly in staff time.

The full text of the literature review, complete with all references, can be downloaded without charge at: http://www.healthdesign.org/research/reports/ .
Studies in design formulation and critical interpretation of architectural work

A theme issue of the Journal of Architecture to be published this spring will feature four essays describing recent work at Georgia Tech at the interface of architectural morphology, critical interpretation, and cognitive studies of design. The lead essay by Dr. John Peponis outlines an emerging theory of design formulation; papers by Dr. Arati Kanazac (PhD, 2000, Assistant Professor, University of Cincinnati) and Weiling He (PhD, 2005) offer interpretive accounts of architectural works which draw their program from works in other media such as painting and poetry, and a paper by Dr. Sonit Bafna extends the argument by drawing methodological conclusions related to historical understanding of buildings.

These essays are a part of a research program at Georgia Tech aimed at developing a structural theory of architectural design. The point of departure for the work is the observation that architectural works are able to engender meaning that may not be a part of the initial intention of the designer, and that such meaning is neither circumstantial, nor external to the design, but rather inherent to the design itself. The goal of the work is to develop a structural description of the manner in which such meaning is produced and to examine its consequences for morphological theories of the generation of designs, and for interpretive studies of architectural works. The work so far has progressed on several fronts. A series of graduate seminars on "The Spatial Construction of Meaning" led by Dr. Peponis and Dr. Ken Knoespel (Chair, Department of Literature, Culture, and Cognition in the Ivan Allen College) have explored this issue through exercises in which the grammatical content of works in different media, such as poetry and painting, is translated into an architectural program. The point of these exercises is to develop cases through which specific structural characteristics of the meaningful architectural form can be explored. This work has been presented in several forums, including a special issue of the journal Philosophica (no. 70), guest edited by Dr. Ken Knoespel.

On another front, the program of research has involved interpretive analysis of historical works. In a series of recent papers and conference presentations, Dr. Bafna has been exploring design sketches and personal recollection of designs by prominent architects in order to analyze strategic moments at which the design falls into place, or at which crucial design decisions are taken. The premise here is that understanding the differences between successful and unsuccessful versions of designs gives important clues to structural understanding of designs. This work has the potential to offer contributions to the methodology of historical interpretation and a methodical approach that puts the focus in interpretive studies back on the architectural object itself. Ongoing doctoral dissertations by Hazem Ziada on the Palace of the Soviets competition of 1926 and by Saleem Mokbel Dahabreh on Richard Meier's recent projects both continue this analytically descriptive approach to understanding architectural work.

Predicting and managing the risk of mold growth in buildings

Microbial growth is a major cause of Indoor Air Quality (IAQ) problems. In a study of 695 buildings, microbial growth accounted for 35% of the IAQ problems encountered. The implications of mold growth range from unacceptable musty smells and defacement of interior finishes, to structural damage and health effects, not to mention lengthy litigation processes. Mold is likely to occur when a favorable combination of humidity, temperature, and substrate nutrient concentrations exist. The set of relevant building parameters includes physical properties of building components, aspects of building usage, certain materials, and critical interpretation of buildings. Dr. Allen College) have explored this issue through exercises in which the grammatical content of works in different media, such as poetry and painting, is translated into an architectural program. The point of these exercises is to develop cases through which specific structural characteristics of the meaningful architectural form can be explored. This work has been presented in several forums, including a special issue of the journal Philosophica (no. 70), guest edited by Dr. Ken Knoespel.

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Despite decades of intensive research efforts to prevent mold, modern buildings and residences continue to suffer from mold infestation. The main reason is that current prescriptive regulations focus on the control of relative humidity only. However, recent research has shown that mold occurrences are influenced by a multitude of parameters with complex physical interactions. The set of relevant building parameters includes physical properties of building components, aspects of building usage, certain materials,

Research shows that regular stair use can help in weight loss and improve health. COA researchers are exploring how stair design and placement can encourage people to use stairs rather than elevators.
Physical Activity by Design

The US is facing an epidemic of diseases related to obesity and physical activity. According to the National Centers for Disease Control and Prevention, over 200,000 Americans die each year because we do not achieve at least 30 minutes of moderate exercise most days of the week. Faculty and students in the PhD Program have recently initiated several research programs exploring how the design of building sites, buildings and building elements can encourage physical activity. All of these are funded by the Robert Wood Johnson Foundation (RWJF).

Craig Zimring and PhD students Anjali Joseph, Gayle Nicoll and Sharon Tsepas co-authored a paper in a February 2005 supplement to the American Journal of Preventive Medicine entitled “Influences of Building Design and Site Design on Physical Activity: Research and Intervention Opportunities.” The authors found that most active living research has focused on how city and urban design impacts physical activity; relatively little has focused on how the design of buildings and sites impact physical activity. This is an important area for future research. Craig Zimring and PhD student Sharon Tsepas have recently completed a white paper for RWJF exploring how public buildings can increase physical activity, and are proposing further research and policy intervention. Zimring and Tsepas reviewed the literature and concluded that public agencies can impact physical activity, by such measures as choosing walkable sites and providing comfortable and useable stairs within buildings.

Zimring and Tsepas surveyed several high-level state and federal officials, and found considerable interest in active living and a desire for case studies and best practice examples.

The importance of encouraging physical activity through design has also resulted in four additional research projects to the PhD Program from RWJF. Ruth Dakon (now a faculty member at the University College London), Craig Zimring, and Anjali Joseph completed a research project in spring 2005, focusing on the role of design and layout in encouraging physical activity for older adults. Working with Lauren Harris-Kojetin and Kristen Kieler of the American Association of Housing and Services for the Aged’s Institute for the Future of Aging Services, the researchers surveyed some 800 continuing care retirement communities in 42 states in the US. They have found that having covered sidewalks and providing attractive walking destination, can help encourage older residents to be active. Joseph is following up on this work with a RWJF dissertation grant where she will conduct case studies of retirement communities.

Stairs in buildings provide a good opportunity for everyday physical activity. Gayle Nicoll is conducting her own RWJF dissertation grant where she is exploring what design features of stairs, and features of building design and layout, affect users’ willingness to use stairs voluntarily. Craig Zimring and PhD student Keith Jundanian are working with CDC epidemiologist Dr Bill Kohl, and California building planner and programmer Cheryl Fuller, to conduct a case study of an innovative state office building in Los Angeles. The building, designed by noted architect Thom Mayne of Morphosis, is the first major office building in the US to use “skip stop” elevators where the main elevator only stop at floors 1, 4, 8 and 12. Able-bodied users are expected to walk up or down to their offices, on an innovative stair that allows views into the building and encounters with others. The research team will do Post Occupancy Evaluations (POEs) on use of the stairs, as well as how this new, and innovative design of stairs, is received by staff and management.

The GA Tech team has therefore opted for a radically different approach, based on the assessment of the uncertainties of all parameters and their propagation through a dynamic mold assessment model. This approach generates a mold risk distribution that reveals the probability of mold occurrence in selected trouble spots in a building. The approach has been tested on the highly contested Hawaii Hilton case, an office building in Miami, the MLK office building in downtown Atlanta and a student dorm at the campus. The figures below show examples of the results using the developed mold risk indicator (MRI) in the case studies. In all cases the new approach was able to show the circumstances under which mold risk could indeed occur, leading to a set of clear specifications for remediation and, for new designs, to A/E procurement methods that will significantly reduce the mold risk. An example of the results of the mold risk indicator: Cumulative density functions of the office case and the dormitory case with normalized mold growth risky days
The Building Futures Council’s First Conference on The Future of the AEC Industry: Engaging the New Generation of Doctoral Students in U.S. Universities

Academic researchers too often attend conferences that only involve other academics. There is a important need to link researchers with people who understand the context of the problems they are working on. On March 16-17, 2005, such a conference was initiated in Las Vegas, Nevada, by the Building Futures Council.

Its purpose was to connect industry with doctoral education in the built environment. Its aim was to explore new ideas, opportunities, directions, and innovations that will impact the practices and technology used by those designing, constructing and managing the built environment. A goal was to create an intellectual pipeline addressing the future of the Architecture, Engineering and Construction (AEC) industry with researchers addressing its problems. The conference was organized by Dean Thomas Galloway, and chaired by Chuck Eastman, Roozbeh Kangar and Linda Thomas-Mobely of the College of Architecture. The Conference Coordinators were Ghang Lee, Research Scientist, and Tarang Taunk, PhD. student and Amy Fields, AGC staff person. The Call for Papers generated fifty-five abstracts from universities in the US. Through the blind peer review process, thirty-three abstracts were invited to submit full papers. Twenty-two full papers were received that were reviewed again through the blind peer review process with sixteen selected for presentation.

Two thirds of the reviewers were from the academia and one third were domain experts from industry with many years of experience. Among the papers accepted were four papers by Georgia Tech Ph.D. students, Hans Verheij, Shariar Makarechi, Elf Yagmur and Debajyoti Pati.

Travel expenses for students with accepted papers were paid by the conference. The conference lasted two half days, with a conference dinner and lots of discussion time. In addition, eight of the presented papers were selected for publication in the special issue of the Journal Automation in Construction. During the conference, three of the presented papers were selected for the Best Paper awards; one was awarded to Hans Verheij, for his paper, “Collaborative Project Planning in Owner-Architect Partnerships”. The goal of this event was to facilitate the interaction between the authors and the BFC/AGC members, and eventually between academia and industry. BFC members served as mentors, providing insightful comments or possible sources for data or funding. This was the first for what is hoped to become an annual affair.

PhD News

Publications

Books


Chapters of Book


Journal Papers


Journal Papers


Proceedings


Honors and Awards


Fernandez-Solis JL, Awarded the Presentation in the 5th International Postgraduate Research Conference of the University of Salford, Salford, UK, April 2005.


Other News

Eduardo Lyon, work was published in "Go Direct to Fabrication and Cut-out the Middleman" in Architecture Magazine, December 2004: 101. Eduardo Lyon’s research is focused on design for manufacturing (DFM) in architecture.

Eric Sundquist, has been appointed to the Planning Commission in the City of Decatur. In February, he began a three-year term as one of seven members on the commission. The Planning Commission reviews projects that require variances of the city’s zoning and design regulations. This year, it is also supervising the revision of Decatur’s comprehensive plan.

Sugie Lee, got a tenure-track assistant faculty position at the Maxine Goodman Levin College of Urban Affairs at Cleveland State University in August 2005.

Weiling He, got a tenure-track assistant faculty position at the College of Architecture, Texas A&M University in August 2005.

Ermal Shpuza, got a tenure-track assistant faculty position at the College of Architecture, Texas A&M University in August 2005.


Horsfall K, got a tenure-track assistant faculty position at the College of Architecture, Texas A&M University in August 2005.

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