

Quiet on the Hall

Researchers search for ways to reduce noise and improve sleep in nursing homes.

At the nurses' station, the repeated rings from a patient's call button pierce the typical nighttime hum, then bounce off a high stucco ceiling and echo down the corridors of the nursing home.

Residents awaken and call out in the darkness for familiar faces. Nurses exchange information across the hallways. Someone reaches into the janitor's closet for a mop, and a creaky hinge grates on nerves like fingernails scraping a chalkboard. Sleep eludes the residents, and frustrated nurses dread tomorrow.

Noise disturbs sleep. Your mother knew it when she tiptoed down the hall from the baby's room, and research proves it's equally true for seniors in nursing homes. Now, acoustical engineers and geriatrics researchers want to know if they can improve nursing home residents' sleep – and ultimately their health and quality of life – by implementing a few noise-reducing, environmental interventions. The interventions have appeal because they create no additional burden on the staff, which is already stretched thin because

by JANE M. SANDERS

Sound-absorbing panels hung on nursing home hallway walls have reduced noise by a factor of 16 in experiments conducted by Georgia Tech Research Institute researchers. That reduction is equivalent to the difference in noise between music booming from 16 speakers versus just one speaker.

PHOTO BY GARY MEER

of a nursing shortage, researchers say.

Even modest noise increases above the background level — not just the spike from a metal object banging a tile floor — disturb the sleep of nursing home residents, according to researchers from the Georgia Institute of Technology, Emory University and the Atlanta Veterans Administration Medical Center. Their data shows that noise increases measured at six or more decibels were a factor in 18 percent of almost 4,000 awakenings among 92 nursing home residents studied for almost 500 person-nights. The findings are from an ongoing, five-year study funded by the National Institute of Aging.

“The nursing home population has a great deal of sleep disturbance,” says Bettye Rose Connell, a health research scientist at the Department of Veterans Affairs Medical Center in Atlanta and an assistant professor of medicine at Emory. “Not all awakenings are related to noise. Health problems affect residents’ sleep. But sleep disruption related to noise is enough of a problem that we want to find ways to relieve it.”

Researchers have determined that nursing home noises usually fall into one of three broad categories: people talking, including staff; mechanical noises, including alarms, elevators,

computers and cleaning equipment; and people doing things, such as pushing carts down the hall and closing file drawers.

With these findings in mind, acoustical engineers at the Georgia Tech Research Institute (GTRI) created several low-cost, noise-reducing environmental interventions, which they have tested with noise measurement equipment in five metro Atlanta nursing homes. The results are promising, they say. One of the interventions — sound-absorbing panels hung on hallway walls — has reduced noise by a factor of 16. That is equivalent to the difference in noise between music booming from 16 speakers versus just one speaker, researchers explain.

“These interventions reduce echoes and reverberations in hallways and rooms,” says Krishan Ahuja, a Regents researcher at GTRI and a professor of aerospace engineering at Georgia Tech. “We have the noise-absorbing panels, ways to reduce banging doors, special hooks for curtains, and we even wrap the ice machines in material to reduce noise.”

Researchers have also tested an environmental intervention to reduce television noise. They have moved the speakers from the TV set to the headboards of nursing home beds, allowing residents to

hear the TV just as well without having to turn up the volume too high. They are also experimenting with tiny speakers embedded in bed pillows.

Feedback from the Field

Though researchers have not systematically collected user feedback as part of the study, residents and staff have volunteered their opinions on the interventions.



PHOTOS BY GARY MEEK

At Ross Memorial Healthcare Center in Kennesaw, Ga., assistant administrator Jimmy Ross noted “a tremendous reduction” in noise after researchers temporarily installed sound-absorbing panels on his facility’s hallways. “You don’t even hear yourself walking down the hall,” he explains. “And you can actually hear the P.A. system with the music on since you have the dampening of other background noises.”

Alice Cook, who has lived at Ross Memorial for more than two years, agrees with Ross’ assessment. “It’s much quieter here, especially in the evening,” she says. “... There really has been quite a bit of difference. When I’m watching TV in the evening, it’s definitely quieter. I don’t hear all the interference from the hall.”

Residents and nursing home staff members have also expressed their feelings directly to researchers. “The residents say they can hear sounds better now,” Ahuja says. “The background noise has gone down, and for older people, that’s very important. ... Nurses tell me the reduction in noise is very calming. That may improve the productivity of the nursing staff. And we hope people are sleeping better.”

Quantifying the Results

Having examined the extent to which noise increases are associated with awakenings among nursing home residents, researchers are eager to quantify the effects of their noise-reducing interventions on diminishing nighttime sleep disturbances, Ahuja says.

“In the next phase, we will apply these interventions in facilities for a longer period of time and actually compare the noise at bedside with data from volunteer residents who are wearing equipment to detect whether they are sleeping and how many times they wake up during the night,” explains Robert Funk, a GTRI research engineer, who is leading the field research for Ahuja.

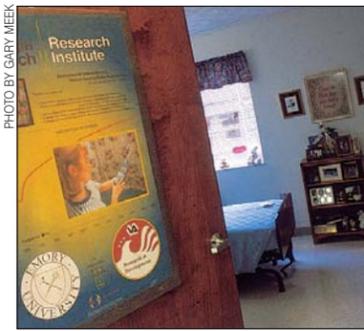
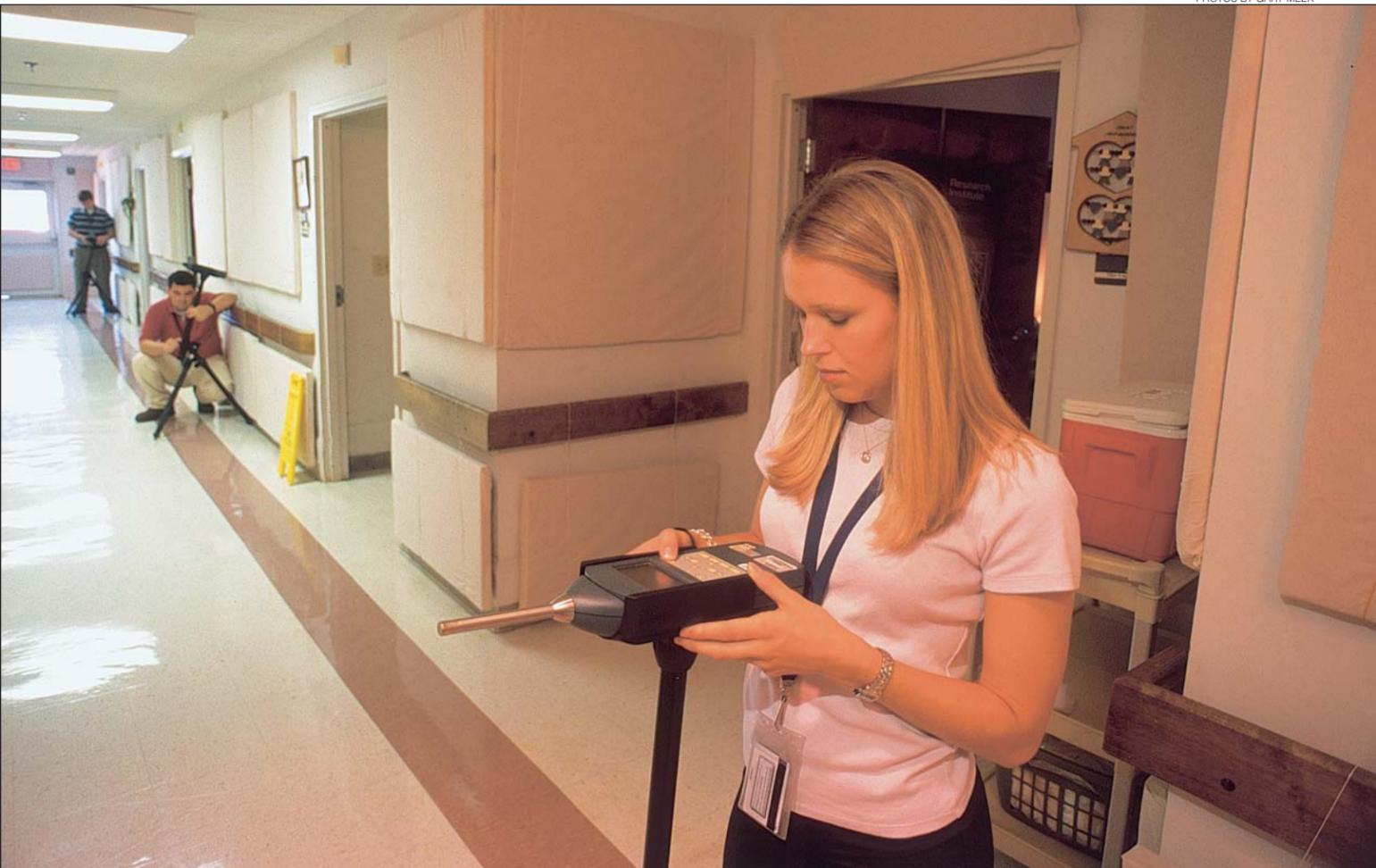
Researchers are studying sleep using wrist actigraphy, in which residents wear a device that looks like a large sports watch. The device records the normal arm movements a person makes when he or she awakes. Researchers chose wrist actigraphy over polysomnography — which involves the attachment of wires to a person’s head to record brain waves — because the latter is not feasible to use with many nursing home residents, Connell explains. Wrist actigraphy is a “less fine-grained” technique, but it has been validated against polysomnography and proven reliable, she adds.

To gather noise data, researchers use standard sound-level meters, which plot curves showing the noise spectrum — noise amplitude versus frequency. The equipment also measures overall loudness expressed in decibels weighted to reflect the human ear’s response, Funk explains.

After researchers quantify the effects of environmental interventions on nursing home residents’ sleep, they plan to study the combination of these interventions with behavioral interventions being investigated in a parallel study led by physician Joseph Ouslander, a professor of medicine and nursing and director of the Emory Center for Health in Aging. Ouslander’s study is testing six interventions, including increased daytime activity, light exposure, consistent bedtime routine and a noise abatement policy for staff. To date, he has found that these interventions reduce the amount of daytime sleep among nursing home residents. Analysis of sleep data is ongoing.

“The implications of our data so far are that it will probably take a combination of behavioral and environmental interventions to improve sleep in nursing home residents,” Ouslander says. “This is what we plan to test in the fifth year of the grant. Our long-term goal is to provide nursing homes with feasible interventions that will improve the

Below and near right: GTRI researchers take sound-level measurements during experiments at Ross Memorial Healthcare Center, a nursing home in Kennesaw, Ga. They are testing the effectiveness of environmental interventions in reducing sleep disturbances in nursing home residents.



Sound-absorbing panels can be placed on nursing home residents’ doors to reduce noise. Residents can decorate them as they wish.

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GTRI Regents Researcher Krishan Ahuja, left, is collaborating with health scientist Bettye Rose Connell of the Atlanta V.A. Medical Center and Emory University in a study of nursing home noise.

Below: Ahuja, right, and Jimmie Ross, assistant administrator of Ross Memorial Healthcare Center, discuss noise-reduction strategies for nursing homes.

sleep, behavior, mood and overall quality of life for frail nursing home residents.”

Real-World Applications

Assistant nursing home administrator Ross is hopeful that he and others in his profession will gain a better understanding of noise and sleep disturbance problems from the Georgia Tech and Emory studies. “We’re looking forward to the data from the study so we can make better decisions about dealing with noise,” Ross says.

For nursing homes, which operate under tight budgets, the cost of the interventions will have to be weighed against the benefits, researchers and administrators say. The cost of implementing noise-reducing interventions is unknown for now. But Ahuja estimates the cost of sound-absorbing panels at \$1.50 to \$2 per square foot. Custom-designed panels featuring artwork or printed fabrics would, of course, cost more.

Ross believes taking at least small steps to improve conditions will benefit the facility. “In the long run, the benefits will be more than the costs to implement these things,” he says. “.... The residents will have a better quality of life. They can focus on other things to improve their existence here, and noise won’t be one of the issues they raise.”

Implementing the researchers’ noise-reducing interventions is problematic for now, though.

“Some of the interventions are not commercially available yet, but they are made from commercially available materials,” Funk explains. The panels, for example, are made from standard sound-absorbing, fiberglass or foam material, Ahuja adds.

Bringing the materials together to create a

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product available on the market may take some time. The researchers’ immediate focus is on delivering insights into how existing nursing homes can be retrofitted and new ones can be designed to mitigate noise.

“We’re coming up with design rules for architects so that not only can they make the design good for movement, but also for noise,” Funk says. “They can consider things like the locations of doors and what treatments on the ceilings and walls will reduce ambient noise.”

These design rules and the interventions researchers have devised could be applied in “any place where there are hard surfaces, you have echoes and you can’t hear things properly,” Ahuja adds. “These places could include hospitals, churches, mosques, offices, dental offices and in homes in some cases. We’re even putting these panels in some of the auditoriums at Georgia Tech.”

Though the applications of the research are potentially broad, the focus of the study remains on nursing homes, where the noise problems are most critical to people’s health and quality of life.

“Sleep disturbance is a very common problem among nursing home residents,” Connell says.

“They sleep during the day because they don’t sleep at night. Some don’t sleep at night because they sleep during the day. It can be a vicious circle. Also, diseases contribute to sleep disturbances. We can’t do anything about that, but we can potentially impact sleep problems caused by noise.... Though we probably can’t help residents sleep through the night, we hope we can reduce the number of times they wake up.”

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