Acoustics and the Patient Experience

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Hospitals are unique and complex acoustic environments filled with numerous noise sources, limited by strict hygienic requirements, and populated with critically sensitive occupants. Healthy acoustic conditions are paramount to the missions of hospitals: patients need to sleep and heal without environmental stressors; staff, patients, and family need to communicate accurately but privately; staff need to be able to localize alarms and calls for help. Noise in hospitals has been shown to increase patient risk for cardiovascular response, pain, intensive care delirium, fragmented sleep, and reduced recuperation. Results show that effective hospital soundscapes require a complex choreography of architectural layout, acoustic design, medical equipment and alarms, and administrative processes that is only beginning to be fully understood.

In the past few years, there are new influences that seek to improve the acoustical conditions within healthcare environments and achieve better patient outcomes. To explain this new influence, one must understand that the healthcare system in the United States serves the public through a combination of private insurance companies and public health insurance programs. Recently, to foster transparency and compare the performance of hospitals both regionally and nationally, the Department of Health and Human Services (HHS) developed a survey call the Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS). These surveys are the first national, standardized, publicly reported survey of patients' perspectives of hospital care. This survey is part of the Value-Based Purchasing program in the United States, which links a portion of the public health insurance payments to the performance of that hospital with respect to quality of care, patient outcomes (not contracting additional diseases during stay, or returning due to complications), and patient experience of care. For the past 6 years this survey has asked patients to convey their hospital stay experience by answering 32 multiple choice questions, one question asks about the patient's experience with noise; "how often was the area around your room quiet at night?" Ongoing analyses of these surveys responses have proven that noise is predominantly the lowest score on the survey. The analysis also showed strong correlations between noise and the general patient experience; specifically, the survey results show a trend where every 1 point increase in the responses with respect to noise yields an additional 0.75 points on the other questions for that institution. While these survey responses are currently used by proactive facilities for improvement guidance, they also determine financial reimbursement by the government. By 2017, if hospitals do not meet performance standards, including the perception of noise, then these institutions could be fined up to 2% of the total bill for services. Conversely, the high performing facilities will be rewarded with up to a 2% bonus on the payment for services. Based on this new financial incentive model, the difference in responses by patients could result in budgetary benefits or penalties of millions of dollars each year for many large hospitals throughout the United States.

The challenge for researchers and engineers evaluating healthcare noise challenges is effectively defining “quiet” for patients, which is in the realm of psycho-acoustics, the perception of sound. Some researchers have approached this problem by evaluating the types of sounds that awaken patients, which is believed to be the most common reason patients state the area around their room was not quiet. This interdisciplinary group of doctors and engineers performed a sleep study with recorded audio examples at controlled sound levels to measure the sleep arousal thresholds for 14 different sound sources, and found that phones, alarms, and staff conversations were highly alerting. Designing to control or reduce noise from phones and alarms is a condition of the devices and their use, but reducing noise from staff conversations is a complex condition of building acoustics and staff behavior.

Another multidisciplinary research team, the Healthcare Acoustics Research Team (HART), explored medical noise impacts from the perspective of acoustical engineering, medical care, and architecture. Their research into building acoustics found that the perception of noise by staff within different hospital floor plans was not related to the average or maximum sound levels, but the incidence of instantaneous peak sound levels over 90 dB(A). Their research into staff responses to noise confirmed concerns that noise increases auditory fatigue, mental fatigue, and stress, which reduces their effectiveness at listening for auditory cues from patients in distress. Studies by this group and other independent engineers have investigated the effectiveness of intervention studies, evaluations of initial conditions and the improvements from acoustic mitigation measures, to find that staff and patients respond positively to increased sound absorption and reduced sound levels from alarms and conversations outside patient rooms. The next phases of research into noise and acoustics in healthcare environments will try to connect the findings of better acoustic environments with improved patient outcomes and staff performance. This includes addressing questions about what portions of the complex acoustical performance of the building layout and systems provide the most benefit for the building occupants, and developing a more accurate metric to evaluate the perception of “quiet” within the facility. Patient outcomes and staff satisfaction cannot be measured in a vacuum, which forces the research and engineering community to develop unique strategies to evaluate noise control solutions within healthcare environments.

Ultimately, the goal is to improve patient outcomes in healthcare environments. The research shows that improvements with respect to noise can improve the overall outcomes of patients. It is these advances that acoustical engineers, facility and equipment designers, medical administration and staff are all working toward.