**Questions Log – AAH1803 webinar “Understanding Noise in Healthcare Environments”**

Q: There was no discussion regarding sound mitigation systems/white noise systems. Has there been any study regarding the effectiveness of these?

A: White noise – or “sound masking” systems introduce noise so that relatively low level sounds don’t stand out from the ambient so greatly. They are used routinely in open plan offices so that the speech of any person is not necessarily heard by everyone in the room. A potential limitation of these systems in the hospital setting is that the ambient levels are often already so high that a masking system would potentially further increase noise levels. As it is, in other words, people tend to speak with a raised voice in hospitals because the background noise level is typically very high. Adding white noise able to mask the hospital sounds in many units would therefore require making the patient rooms even louder. In healthcare settings where the ambient noise level is low it is possible that carefully designed sound masking systems could be feasible, provided this topic is studied in more detail and trained professionals carefully design the systems. I have seen one study that suggested use of sound masking is possible and might even improve the situation for patients, but the potential downside is that it would potentially require greater effort in speech communication to overcome the masking and would make the ambient level louder for everyone. Therefore, this topic needs further research.

Q: Can you speak about the application of sound absorption versus sound barriers?

A: We generally categorize noise control by where a given approach operates: at the source, along the path from source to receiver/observer, at the observer. Most noise control approaches try to lessen sound as it travels from the location of generation to a place where it is received. Both sound absorption and sound barriers count as along-the-path noise control. Absorption turns sound energy into heat. In architectural situations, absorption is normally applied to walls and ceilings so that sound striking a wall or ceiling is mostly absorbed. By contrast, a sound barrier is an object that is intended to prevent sound from directly traveling from one side of the object to the other. A wall or a closed door, for instance, will operate as a barrier for sound going from the hallway to a patient room. For the most part, barriers reflect sound rather than allowing it to go through to the other side. Both barriers and absorption are useful in hospital situations. Good walls and doors can greatly reduce the noise that goes from one room to another or from the hallway to a room. Once that sound gets into a room, though, absorption on the ceiling and walls can reduce its impact through absorption.

Q: Where are the layout analyses? Are they published?

A: Example references are:

S. Okcu, E. Shpuza, E. Ryherd, and C. Zimring (2013) “Linking acoustics and floor-plate shape qualities of healthcare settings,” Architectural Science Review 56(4), 315-332.

L. MacAllister, C. Zimring, and E. Ryherd (2016) “Environmental variables that influence patient satisfaction: A review of the literature,” Health Environments Research and Design J. 10(1), 155-169.

L. MacAllister, C. Zimring, E. Ryherd (2018) “Exploring the relationships between patient room layout and patient satisfaction,” accepted to Health Environments Research and Design J.

Q: Have you done any studies on "nurse stations" - (e.g. density of people) - solutions that allow for collaboration yet also keep things quiet?

A: We are currently collaborating on a study with HDR to look at the impact of nurse station design on acoustics at two hospitals. We have collected acoustic data and staff surveys and expect to have results ready soon, so stay tuned.

Q: Does FGI provide 'correct' and enough acoustical minimum for patient walls and ceiling at patient room, exam room, etc.?

A: The FGI was carefully assembled by acknowledged experts in the field. They reflect a desire to provide a practical solution that balances the desire for a quiet space with a reasonable cost to achieve. So, in response to your question, we could always do better but adhering to FGI mean that at least an acceptable standard is maintained.

Q: Is integrating an angled wall in a hard sterile medical environment vs having a square room helpful to reduce noise in lieu of ICRA ban of absorptive materials?

A: Sound is a lot like light. It moves in a straight path until it hits an object and then it tends to reflect mostly specularly (like a tennis ball against a wall). Generally, rectangular rooms have a reasonable mixing of sound and even without special sound absorbing materials, some sound is absorbed every time it gets to a wall (5% or more of the energy on each reflection). In some quirky situations, sound tends to bounce between two parallel walls, producing what sounds like an echo. We call that flutter echo. For this situation, nonparallel walls will help. However, outside of the flutter echo issue, nonparallel walls aren’t likely to improve the sound in the room compared to parallel walls.