Managing Noise in the Healthcare Space through Flooring Specification

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"Noise has long been recognized as an environmental stressor that causes physiological, psychological, and behavioral changes in healthy subjects. Environmental noise and its potential effects on healing and recovery are of special concern to nurses in hospital settings, where increased levels of noise and the effect of noise on patient sleep and cognitive function have been well documented in the literature." *(Shades of Florence Nightingale: Potential Impact of Noise Stress on Wound Healing, D.O. McCarthy, M.E. Ouimet, J.M. Daun, Holistic Nurse Pract 1991)*

Perhaps one of the most significant examples left behind by the founder of modern nursing, Florence Nightingale, was her commitment to patient care. She understood the importance of producing a state of mind and body conducive to healing. When it comes to designing the built environment in a way that promotes healing, the old adage "out of sight, out of mind" rings true, as acoustics are too-often neglected. Yet, according to the 2015 Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS) scores, noise remains at the top of the list of patient complaints.[i]

The World Health Organization (WHO) guidelines call for continuous background noise in hospital patient rooms to remain at or below 35 dB(A) during the day and 30 dB(A) at night, with nighttime peaks no higher than 40 dB(A)[ii]. A 2005 study examining U.S. hospital noise levels over the previous 45 years found no facility complied with these guidelines. In fact, hospital background noise levels have been increasing since the 1960s, up from 57 dB(A) in 1960 to 72 dB(A) in 2007 during the daytime, and 42 dB(A) in 1960 to 60 dB(A) during the night.[iii]

To better improve the healing environment for patients and providers, healthcare designers and specifiers are now seeking products that feature specific acoustic benefits. While "noise" is a subjective term and can be traced to a variety of sources (hallway conversations, footsteps, rolling carts and alarms to name a few), hospitals and healthcare facilities are working to implement sound control and mitigate sound transmission, as both play a key role in creating a healing space.

Impact of Noise on Patients and Staff

A comfortable acoustic environment is vital to supporting the safety, health, healing and well-being of patients and providers. Patients' physiological health can be negatively affected by poor acoustics, inhibiting the healing process and increasing their chances for readmission. High noise levels can lead to patient annoyance, sleep disruption, elevated blood pressure and decreased healing rates.[iv] In terms of mental and emotional health, acoustics can impact how comfortable and secure a patient and their family members feel in the healthcare setting. Loud noises that startle patients or disrupt sleep can have long-term effects, while softer sound transmission can present a lack of privacy and also cause discomfort.[v]

Likewise, patient care teams also feel the impact of poor acoustics. When completing tasks in a space with a high level of noise, providers may have to exert more energy to listen or be heard, which can cause fatigue and burnout.[vi] Speech intelligibility is imperative in a healthcare environment, and extraneous sounds can impede providers' abilities to understand and quickly respond to a variety of auditory signals – such as conversations, alarms and other equipment – which directly affect patient care and human error.

Furthermore, HIPAA standards require individual patient information communicated orally, written or digitally must remain private.[vii] When the healthcare environment is finished with materials that reflect sound or designed without acoustics in mind, discussions among patients and providers can easily carry into other areas and be overheard by an unintended listener. Poor acoustic design increases the risk of noncompliance with federal privacy regulations.

Different design strategies and technologies can be used to quiet the healing environment and minimize the transmission of sound from adjacent spaces. Products such as acoustical ceiling tiles and acoustical wall panels aim to protect patients and providers from extraneous noise by absorbing sounds from a variety of sources rather than reflecting them back into the environment. Another often overlooked component is flooring surface technology that offers noise reducing qualities without sacrificing cleanliness or ergonomic comfort.

Beyond Carpet and Tile

In the healthcare environment, flooring that is hygienic and easy-to-clean is a top priority – prompting most designers to select hard surface materials for durability and cleanliness. Constant foot traffic and the movement of carts and other equipment along these surfaces, however, often create loud noises that increase sound levels throughout the facility and impact patient satisfaction. Opting for a carpet or other fibrous material that absorbs sound, on the other hand, can raise concerns of cleanliness as well as increase risks of tripping and catching when rolling carts. Recent breakthrough technology has resulted in a third option – resilient flooring – that garners the hygienic benefits of a hard surface with the acoustic and ergonomic attributes associated with carpets or other textile surfaces. These innovative materials offer high levels of sound absorption and reduce surface noise while providing supportive cushioning underfoot to drive safety and comfort. Adding a new dimension in healthcare finishes, these resilient flooring options are helping to create more comfortable and effective healing environments for patients and providers.

Measuring Flooring's Impact on Sound: In-Room Sound

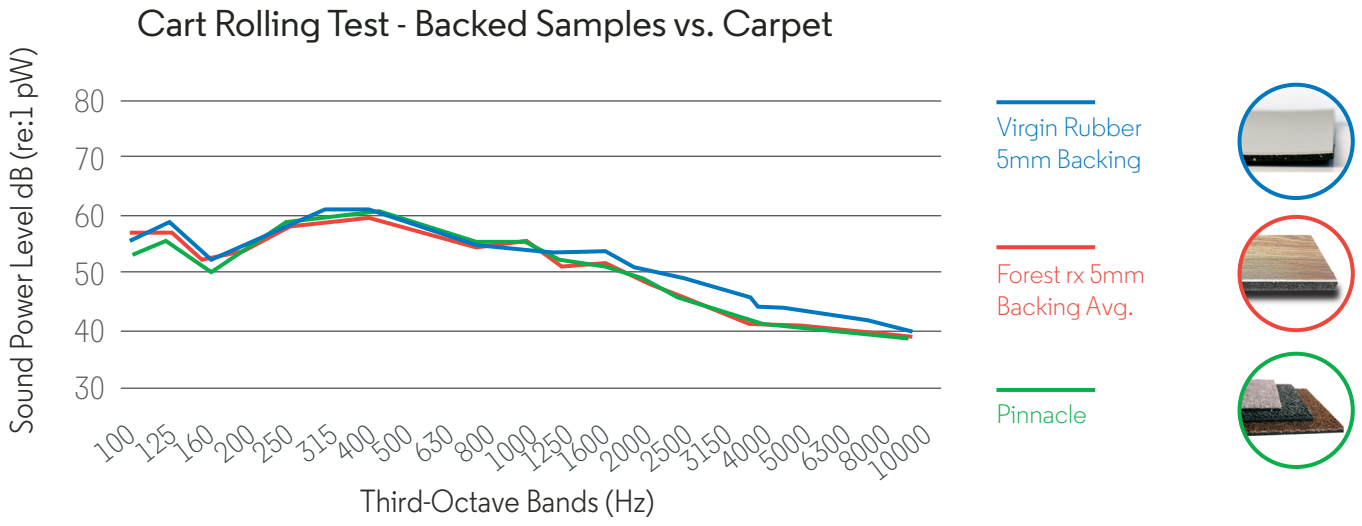
All exposed finishes within a room – including flooring – can affect the speed and efficiency with which sound travels in it. Surface generated sound measures the level of sound within the same room produced by an impact on the surface. For example, the surface generated sound of a medical cart rolling across a porcelain tile floor is very different and generally louder than the same cart moving on a rubber mat. By selecting the right surfacing, a floor can help to contain the sound and vibration to more comfortable levels.

To compare the effect of different flooring materials on surface generated sound in healthcare, the University of Hartford Acoustics program in 2014 conducted an independent research study titled "Contribution of Floor Treatment Characteristics to Noise Levels in Health Care Facilities."[viii] Two senior acoustical engineering students chose to undertake this topic for a semester-long research project. It aimed to quantify the influence different flooring materials can have on hospital corridor noise.

While there are many noise sources within a hospital, one potentially significant source can come from the hallways and corridors where regular traffic can include both footfall from staff and visitors and rolling noises from medical carts and gurneys. The University of Hartford recognized that addressing these noise sources could positively affect the acoustic environment in patient rooms.

The students conducted three different tests on each surface material: an absorption test (ASTM C423), a tapping machine test and a rolling cart test. The materials tested included carpet tiles with a rubber backing, sheet vinyl, sheet vinyl with a rubber-backing, virgin rubber sheet and virgin rubber sheet with a rubber backing. Three of these featured Ecore technology, whereby a wear layer is fusion-bonded to a recycled rubber backing. The goal was to determine how effective this technology is in reducing noise when added to vinyl and rubber surfaces, and comparing these results to standard commercial floors, such as carpet and other traditional resilient sheet products – the third option mentioned above.

The study found when Ecore's rubber backing was combined with vinyl surfacing, *it was as quiet as commercial carpet* when rolling a medical cart across a room or with standard footfall, yet more conducive to meeting the sanitary maintenance requirements of the healing environment with a hard, resilient surface.[vii]



Cart rolling test results for Ecore Forest rx sheet vinyl (5mm backing), Ecore virgin rubber (5mm backing), and Pinnacle 5mm rubber backed commercial grade carpet.
Source: University of Hartford Acoustics [viii]

Measuring Flooring's Impact on Sound: Sound-Transmission

In addition to affecting the speed and efficiency of sound being reflected within a room, flooring also contributes to the efficiency of sound transmission between vertically adjacent rooms. Common industry standards used to determine the severity of noise generated from a source room to a room below are Impact Insulation Class (IIC) ratings and Delta IIC ratings. These standards also play a key role in determining the effectiveness of acoustic solutions, such as floor underlayments.

IIC is a rating of how well a floor-ceiling assembly attenuates impact sounds, such as footsteps or dropped items, and can be significantly improved with more absorbent floor covering and underlayment. IIC is dominated by material properties and installation methods. The more effective a floor-ceiling assembly is at isolating vibrations and absorbing impact sound, the higher the IIC rating.

Delta IIC ratings measure how much impact sound isolation a product adds to a 6" slab floor assembly with no ceiling below. As a basic example, if a bare 6" slab has an original IIC rating of 28 and then flooring and underlayment result in an IIC rating increase to 50, the Delta IIC rating would be 22. Delta IIC ratings are helpful when comparing impact sound performance of different materials or products.

Conclusion

Studies reveal loud sound levels can have a negative impact on patient wellness, provider efficiency and overall quality of care. To reduce sound levels and improve patient experience and outcomes, many healthcare facilities are looking to update their site designs and the materials used – including flooring selection. When evaluating healthcare flooring options, it is important to consider the need to reduce noise levels while maintaining high standards of cleanliness, while providing safety and comfort to patients and providers underfoot. Studies show resilient flooring surfaces backed with recycled rubber underlayment solve acoustical issues without creating a hygienic risk. These single, fusion-bonded products contribute to a quieter environment more conducive to healing while supporting providers in their delivery of quality care.

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