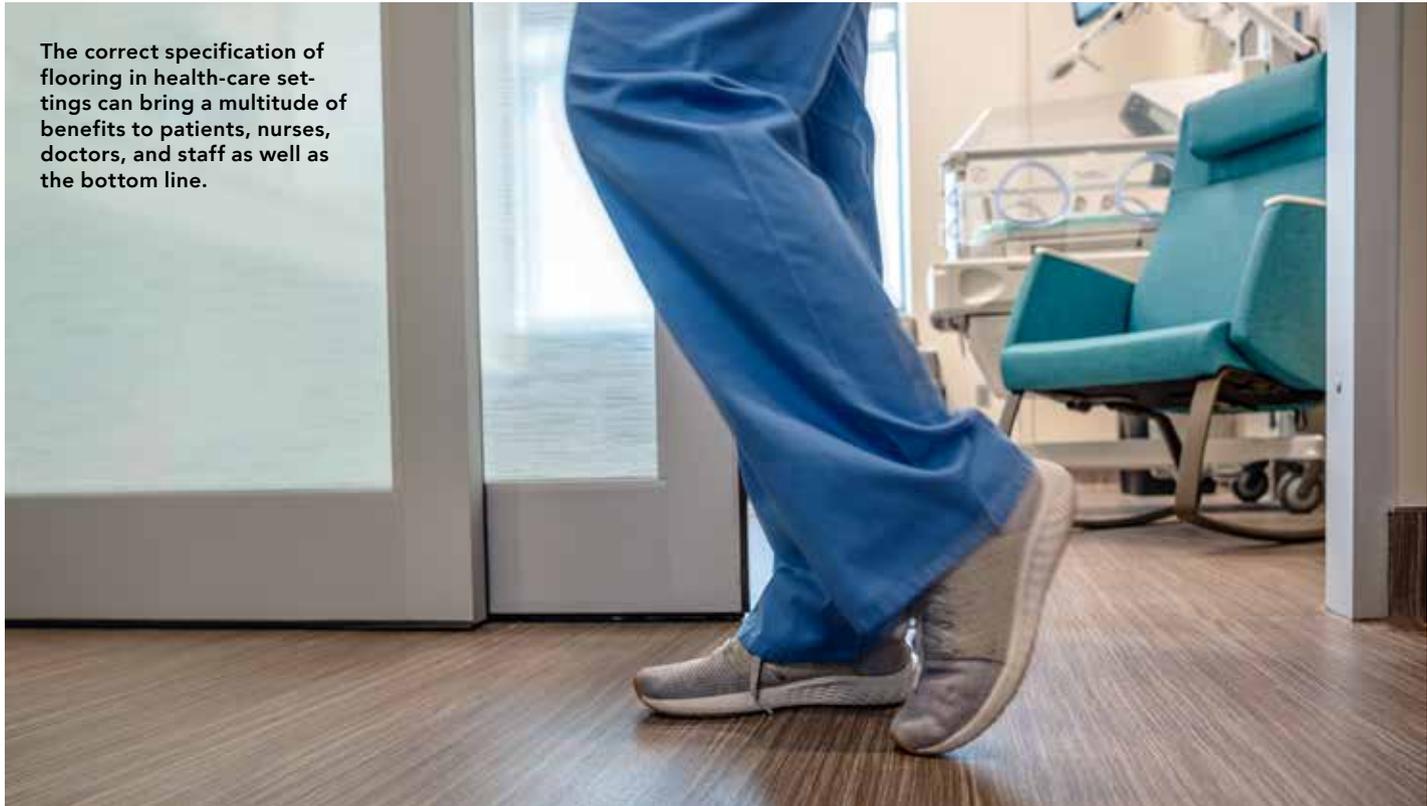


All images courtesy of Ecore



The correct specification of flooring in health-care settings can bring a multitude of benefits to patients, nurses, doctors, and staff as well as the bottom line.

Health-Care Flooring for the New Normal

Savvy specification helps patients, staff, and the bottom line in challenging times

Sponsored by Ecore | *By Kathy Price-Robinson*

According to the Lucian Leape Institute's National Patient Safety Foundation, "Workplace safety is inextricably linked to patient safety. Unless caregivers are given the protection, respect, and support they need, they are more likely to make errors, fail to follow safe practices, and not work well in teams."¹

As a result of the COVID-19 pandemic, 2020 could be seen as a year of awakening. We are now collectively awakening to and more aware of the state of public health, as well as the state of our health-care system. And this will surely lead into an era of change.

Changes are likely to occur in three main areas: 1) how we view public health with attention to increasing wellness; 2) how we

deliver health-care services when people get sick; 3) how we value nurses, doctors, and other health-care providers and invest in their well-being. For architects and designers who specify products for health-care settings, the years and decades ahead will be informed by what we have lived through.

PUBLIC HEALTH AND WELLNESS

When the pandemic hit, Americans woke up not only to the shaky foundations of our health-care system, but also to the general lack of health and wellness of our citizens as a whole, which put even more strain on our system. As the earliest fatalities caused by the novel coronavirus were reported, the term "comorbidity" became inextricably

CONTINUING EDUCATION

AIA
Continuing
Education
Provider 1 AIA LU/HSW

Learning Objectives

After reading this article, you should be able to:

1. Discuss the state of wellness and illness in the United States, including what the COVID-19 pandemic revealed about our current health-care system, and possible outcomes and impacts to population health moving forward.
2. Identify the challenges that exist within a health-care setting.
3. Explain how flooring can help solve problems related to noise, staff fatigue, slips and falls, and infectious surfaces.
4. Describe how to specify the right product for a specific health-care application.
5. Review case studies that illustrate the challenges faced by health-care providers, and explain how savvy flooring specification can help meet these challenges.

To receive AIA credit, you are required to read the entire article and pass the test. Go to ce.architecturalrecord.com for complete text and to take the test for free.

AIA COURSE #K2101B



linked to the statistics. It quickly became clear that those with such existing challenges as obesity, diabetes, and asthma had a harder time surviving the virus than did citizens without those conditions and illnesses. The prevalence of obesity in the United States is more than 42 percent, up from 30 percent in 2000.² According to the U.S. Centers for Disease Control and Prevention, “Obesity-related conditions include heart disease, stroke, type 2 diabetes, and certain types of cancer that are some of the leading causes of preventable, premature death.” Even before the pandemic, the medical cost for people who have obesity was \$1,429 higher than those of normal weight. This totaled \$147 billion in 2008. Never in recent memory has the cost of poor public health been so starkly observed.

But improving public health is not an easy task. While a doctor might suggest more exercise to a patient, how possible is that? Are there sidewalks in the area? Are there bike lanes? Is it safe to walk at night? What if the patient lives in a highly polluted area where breathing outside is not healthy, as is the situation with many low income and people of color? What if the rental housing is in ill repair and contains mold spores that contribute to respiratory problems?

And while a doctor might suggest that a patient eat more fruits and vegetables, are there markets with these foods in the neighborhood? Or does the patient live in a fresh food desert with only junk food and sodas available at the local store? Are there community gardens where one could grow some fresh food?

Yet despite the challenges, a healthy population will be a key component in future battles with viruses. It is likely that wellness efforts will rise to the forefront of population health strategy. Exercise, nutrition, and emotional and mental balance contribute to the wellness initiative.

When the tally has been done to calculate the cost of ill public health on both individuals and society, it is likely that the impetus toward creating a healthier citizenry will move to the forefront.

Delivery of Health-Care Services

While a healthier population will certainly ease strain on the health-care system, the system itself is poised to undergo massive changes too. Fundamental shifts are already happening, as witnessed by a tremendous—and some would say long overdue—surge in telemedicine, using video conferencing for patients to consult with health-care

providers. In this scenario, the doctor, nurse, practitioner, or specialist can interperse video conferencing with live visits for patients that need in-person evaluation. With video, patients are spared the time and expense of traveling to the location, and they are not in danger of contracting viruses from other patients in the waiting room. The downside is for patients who do not have or cannot navigate a computer, Internet access, or both.

Valuing and Caring for Nurses, Doctors, and Health-Care Providers

Of all the images the COVID-19 pandemic created, perhaps most striking was the sight of exhausted and overwhelmed nurses, doctors, orderlies, and others in the COVID-19 wards. TV and newspaper images showing these truly essential workers serving long hours day after day, often without sufficient personal protective equipment (PPE), captured the country’s attention. Without their dedication, many more deaths from the virus would likely have happened.

Nurses were especially stressed by the pandemic, as they not only cared for an onslaught of critically ill and contagious patients, but they were also tasked with comforting the dying when family members were

barred from rooms due to the virus. These stresses on nurses as witnessed by the country were gut wrenching. As a result, many changes to the nursing profession are expected.

Some new awareness of nurses as a result of the pandemic include:

- Nurses have been working with fewer resources because of budget cuts and staffing shortages.
- There has been increased retirement due to concerns of catching COVID-19 in the workplace.
- Nurses have seen an increase in compassion fatigue.
- There has been a decrease in self-care.³

Changes likely to occur in the nursing profession are:

- There will be a growing public awareness of lack of nurse safety.
- There will be a focus on wellness and well-being for nurses, both in the hospital or clinic setting and outside of work.
- Nurses could be taking on more responsibilities once relegated only to doctors.
- There will be more opportunities for nurses to deliver some care and consultation via telemedicine, perhaps saving them from being on their feet for 12 hours at a time.⁴

Even as the pandemic unfolded, nurses started adapting on their own to prevent infections and deliver compassionate care.

One example is nurses moving IV drips and other machines toward the doorways of patient rooms so that the nurses did not have to always walk in and out of patient areas. This simple technique helped prevent the spread of the virus.

In another example, as it quickly became apparent that the use of PPE covering nurses faces except for the eyes made it hard for them to convey the compassionate care they want to deliver, some nurses taped smiling photos of themselves onto the front of their gowns so that a patient would feel the all-important human connection.

While no one knows for certain how the future will unfold in public health policy and the health-care industry, there is certainly heightened awareness about these issues. For the architect and designer, creating health-care settings that promote the health and well-being of both patients and caregivers, and an improved bottom line, will certainly be a priority. In the next section, we look at the challenges in a health-care setting that savvy specifications can help alleviate. We will use flooring as an example of products that can make the situation better.

PROVIDING SOLUTIONS IN HEALTH-CARE SETTINGS

The patient experience and outcomes must come first in a health-care setting. This is particularly relevant as Medicare and Medicaid reimbursements are tied to patient satisfaction as determined by the Hospital Consumer Assessment of Health-Care Providers and Systems (HCAPHS). This patient satisfaction survey is required by the Centers for Medicare and Medicaid Services (CMS) for all hospitals in the United States. The survey is for adult inpatients, excluding psychiatric patients. The ACA reimbursement policy is based on a “pay for performance,” outcome-based perspective as opposed to the previous “fees for services” model.

The challenges in a health-care setting must be overcome to achieve a high level of patient satisfaction. If nurses are tired and stressed, if the noise levels in the hospital are too high, if the hospital is not kept hygienic, the patient suffers, as does the bottom line.

We will look at some of the most pressing challenges in health-care settings and examine how the specification of the right flooring product can diminish these problems. But first, let’s establish the scientific basis for the correct specification.

Health-Care Design based on Data, Not Anecdote

When using design to solve problems, the seriousness of today’s health-care needs dictates that design decisions are made based on data and not anecdotes, hype, or heresy. Two of the most respected sources for data-based design are the Center for Health Design (CHD) and the recommendation from the Facilities Guidelines Institute (FGI).

According to CHD, “The Center for Health Design advances best practices and empowers health-care leaders with quality research that demonstrates the value of design to improve health outcomes, patient experience of care, and provider/staff satisfaction and performance. Through design research, education, and advocacy, we are leading the way in transforming hospitals, clinics, wellness centers, doctor’s offices, and residential care facilities for a safer, healthier tomorrow.”

The organization’s Pebble Project, Research Coalition, and Advisory Services programs connect industry leaders with resources that help them identify the impact that investing in facility design can make.

According to FGI, its mission is to “establish and promote consensus-based guidelines



Nurses and other health-care workers spend many hours a day on their feet. The proper specification of flooring has proven positive impacts on their health and well-being.

and publications, advised by research, to advance quality health care.”

Both of these organizations are dedicated to evidence-based design and should be consulted when specifying to solve the problems in today’s health-care settings. Among the most pressing issues is staff fatigue.

Staff Fatigue and Aging Nurses

Long before COVID-19’s impact on society, overworked and overstressed nurses were already a problem looking for a solution. Nurses are on their feet for many hours per shift, with 12-hour shifts being typical. While sore feet might be the obvious outcome, many more ailments are associated with long periods of standing and walking. According to an article in a nursing publication titled “Moving violations: negative impacts of standing and walking in nurses’ health”:

“Long periods of walking and standing are associated with plantar fasciitis, tendonitis, cumulative muscle fatigue, and varicose veins. Chronic venous disease, including primary/idiopathic abnormalities of the venous system and secondary sequelae after deep venous thrombosis, have also been associated with women who work in standing positions. In general, long periods of walking and standing without adequate rest periods is bad for your health.”⁵

These conditions lead to missed work and workers compensation claims many times greater than in other professions, as seen in the graph below.⁶

Also, the workforce in hospitals is getting older. While the valuable experience and wisdom of older workers is much needed, the risks of injury and illness are greater.

The case study on the next page illustrates both the problem of nurse fatigue and a solution in flooring specification.

NOISE

When discussing the challenges of noise in a health-care setting and solutions to this problem, it makes sense to consider this quote from a report on perhaps the most influential nurse of all time:

“Florence Nightingale proposed that nursing’s major role in patient care is to produce a state of mind and body conducive to healing. She stressed nursing’s responsibility for managing the patient’s environment, assuring that the patient



The Center for Health Design is a trusted source for data-based specifications.



The Facilities Guidelines Institute provides guidance for designers and specifiers.

received adequate comfort, hygiene, nutrition, and rest.”⁷

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 noise levels and effect of noise on patient sleep and cognitive function have been well documented.

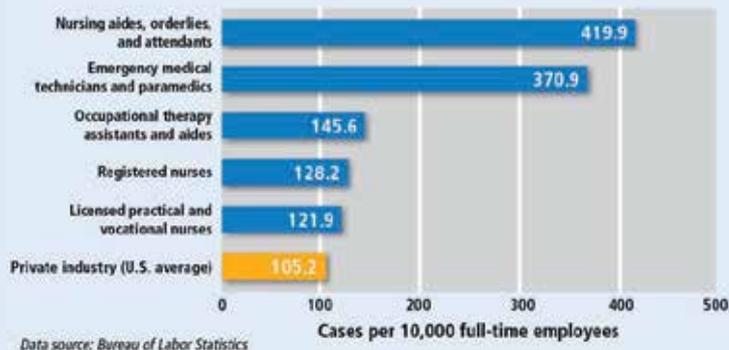
Perhaps one of the most significant examples left behind by the founder of modern nursing, Florence Nightingale,

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 HCAHPS scores, noise remains at the top of the list of patient complaints.⁸

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).⁹ A 2005 study examining U.S. hospital noise levels over the previous 45 years found that 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.¹⁰

To better improve the healing environment for patients and providers, health-care 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 health-care facilities are working to implement sound control and mitigate sound transmission, as both play a key role in creating a healing space.

Rates of Injuries Resulting in Days Away from Work for Selected Health-Care Occupations, 2011



This figure shows health-care-related occupations with the highest rates of injuries resulting in days away from work in 2011. Rates are expressed per 10,000 FTEs. This graph is not restricted to hospitals, due to limitations of the underlying data.

Rates of injuries resulting in days away from work are far higher for some health-care workers than for the average of the private industry labor force.

CASE STUDY: METHODIST MANSFIELD MEDICAL CENTER NICU



The designers of the maternity center at Methodist Mansfield Medical Center located in Mansfield, Texas, specified flooring for its acoustical and ergonomic benefits.

Methodist Mansfield Medical Center in Mansfield, Texas, has a full-service maternity center, including a licensed Level II Neonatal Center, featuring some of the latest family-centric design, amenities, and technology. In 2018, the hospital started a \$8.7-million expansion and renovation of its existing 8-bed Neonatal Intensive Care Unit (NICU), adding eight additional private rooms, family amenities, a state-of-the-art infant security system, and dedicated respiratory and lactation support spaces. The phased expansion and renovation project will enhance Methodist Mansfield's commitment to superior clinical care for obstetric services, including high-risk mothers and premature babies.

Whitney Hendrickson, RN, CHID, EDAC, LEED AP ID+C, Interior Designer III, associate with Perkins & Will, knew exactly what type of flooring she wanted to specify for this project. After going on a tour of Pennsylvania Presbyterian Hospital in Philadelphia in 2017, Hendrickson fell in love with a collection of rubber-backed vinyl flooring that is ergonomically designed especially for health-care settings.

"Since I toured that facility, I have been waiting to use the flooring for the right project," Hendrickson says. "As soon as we walked into that unit (an ICU), it was so eerie because it was unexpectedly quiet. My eyes and ears did not match up. I thought they must not have had many patients...but they did! You could see staff moving around, carts being pushed down the corridors, but I did not hear what I normally hear in an ICU. It did not feel "clinical" at all—in a good way." This is because Hendrickson was experiencing the acoustic benefits of the specialty surfacing.

The Challenge: In addition to its acoustic benefits, Hendrickson also wanted a surface that would support staff. Prior to becoming a certified interior designer and serving as a board member for the Nursing Institute of Health-Care Design (NIHD), Hendrickson's first career was as a pediatric nurse for bone-marrow transplants. "Being a nurse is physically labor-intensive, and exhausting and hard on your body," she says. "I was too young to have plantar fasciitis and throbbing knee pain. Clinicians are wired to put the patient first, so on long shifts, the opportunities for respite are few and far between. I will never forget my roots and what a physical toll your body takes when working at the bedside."

That experience led Hendrickson to serve on the NIHD Board, an organization whose mission is to

engage and integrate clinical expertise into the planning and design of health-care environments. With advocacy at her core, Hendrickson wanted to look at the environment holistically and select materials that could provide ergonomic benefits to staff too.

The Solution: Hendrickson worked with Thais Pimentel, LEED AP ID+C, Interior Designer II, of Perkins and Will to specify two engineered resilient surfaces with patented technology, whereby a heterogenous vinyl sheet is fusion bonded to a 5-millimeter VCR backing. As a result of the VCR in both new products, the new surfacing significantly reduces surface-generated noise, and provides a force reduction of 11.5 percent and energy restitution of 72 percent. This enhanced ergonomic performance also reduces the force of impact related to falls. Additionally, Pimentel specified the flooring in a subtle curved pattern to assist with wayfinding and help delineate staff and family areas.

The Results: "If they only get 15 minutes to sit down, I want to give these users a floor that is going to let their body perform like an athlete's would," Hendrickson says. "These staff members are standing up 13 hours each day; so if I cannot change the workload, I want to at least help them take better care of themselves—even if they do not know it!"

Hendrickson and Pimentel are thrilled with the surfacing at the NICU at Methodist Mansfield Medical Center and look forward to seeing the second phase of the NICU open soon. "I would love to see the flooring collection grow even more in the future," Hendrickson adds. "This product is the right solution for a lot of environments."



To create an environment conducive to healing, the designer should specify flooring with proven acoustical benefits.

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.¹¹ In terms of mental and emotional health, acoustics can impact how comfortable and secure a patient and their family members feel in the health-care 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.¹²

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. Speech intelligibility is imperative in a health-care 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 affect patient care and human error.

Furthermore, HIPAA standards require that individual patient information communicated orally, written, or digitally remain private.¹³ When the health-care environment is finished with materials that

reflect sound or is 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.

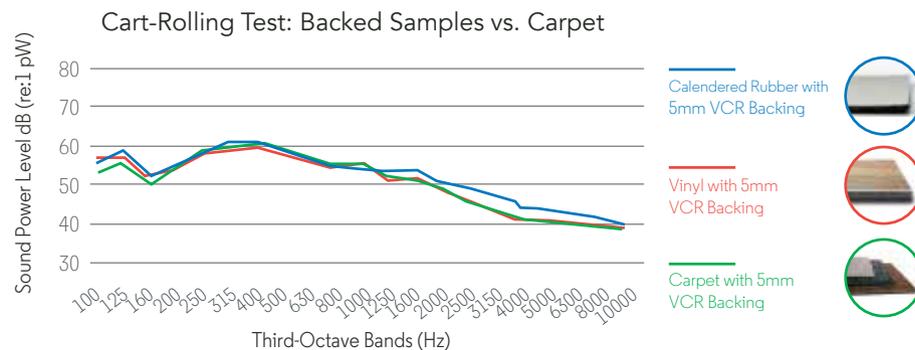
Different design strategies and technologies can be used to quiet the healing environment and minimize the transmission of sound from adjacent spaces. Products such as acoustical ceiling tiles and acoustical wall panels aim to protect patients and providers from extraneous noise by absorbing sounds from 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.

In the health-care 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—engineered resilient flooring with a 5-millimeter vulcanized composition rubber backing—that garners the hygienic benefits of a hard surface with the acoustic and ergonomic attributes associated with carpets and other textile surfaces. These innovative materials mitigate the energy of sound, making the space seem quieter, while providing supportive cushioning underfoot to drive safety and comfort. Adding a new dimension in health-care finishes, engineered resilient flooring options are helping to create more comfortable and effective healing environments for patients and providers.

Measuring the Impact of Flooring on Sound

To compare the effect of different flooring materials on surface-generated sound in health care, the University of Hartford Acoustics program in 2014 conducted an independent research study titled "Contribution of Floor Treatment Characteristics to Noise



Cart-rolling test results for sheet vinyl fusion bonded to vulcanized composition rubber (VCR) (5mm backing), calendered rubber fusion bonded to VCR (5mm backing), and commercial-grade carpet fusion bonded to VCR (5mm backing). Source: University of Hartford Acoustics

A rolling cart test at the University of Hartford Acoustics program demonstrated that when a vulcanized composition rubber backing was fusion bonded with a vinyl surfacing, it was as quiet as commercial carpet.

CASE STUDY: PENNSYLVANIA PRESBYTERIAN MEDICAL CENTER

The Pennsylvania Presbyterian Medical Center (PPMC) of the University of Pennsylvania Health System (UPHS) is one of the premier medical centers on the East Coast. Penn Medicine's Trauma Program alone treats more than 2,200 patients annually who have life-threatening injuries.

In an effort to support PPMC's commitment to patients, staff, and multiple missions of clinical care, the medical center spent three years creating a new trauma center. Beginning in 2012, PPMC began designing the Pavilion for Advanced Care (PAC).

With a diversity of involved stakeholders, the many needs of the staff and the patient required a flooring product that could effectively deliver safety for the patients, enhanced ergonomic benefits for the staff, and superior acoustic properties to assure a quiet healing environment.

Project designer Colleen Harrington with Ewing Cole, the architectural firm involved with this project, was tasked with specifying a product based on four primary considerations: "Noise was a critical concern from the user, and really focused on noise generated by footfall and corridor activity," she says. "Joint relief for the staff and ergonomics was a definite concern/objective. A wood-look aesthetic and designing a warm, comforting space that was not institutional was also important." And last but not least, memory with respect to vertical deformation. "Indentation recovery from the weight of the beds" was important.

The hospital selected 5,000 square yards of an engineered resilient surface comprised of heterogenous vinyl fusion bonded to a 5-millimeter vulcanized composition rubber backing for the patient bays, treatment areas, corridors, and nurses' stations. This ergonomically designed flooring reduces the risk of injury associated with falls.

"Force-reduction tests have shown that the fall impact is reduced 16.9 percent (in accordance with DIN 18032) when this flooring is installed," says Mark Huxta, director of sales, health and wellness, Ecore. "Because of the rubber backing, this high-tech flooring offers an ergonomic solution compared to other resilient floors."



This ergonomically designed flooring—an engineered resilient surface comprised of heterogenous vinyl fusion bonded to a 5-millimeter vulcanized composition rubber backing—reduces the risk of injury associated with falls.

When selecting the building materials for PAC, the hospital chose high-contrast resources and pops of bright colors to help decrease patient and visitor anxiety. Color and material transitions were also utilized to distinguish between staff, patient, and family zones within the ICU patient rooms.

With regard to its acoustic benefits when using IIC tests (in accordance with ASTM E492 and E2179), the specified flooring allows the most basic assemblies to exceed the strict IIC 50 building code requirements, reducing impact sound more than 20 decibels with no ceiling below. As mentioned, the undergraduate research study conducted by the University of Hartford's Acoustic Program in 2014 concluded that the specially designed flooring is indeed as quiet as carpet. In fact, the new ASTM E-3133 standard for Floor Impact Sound addresses this very issue and came about as a result of the research study.

Levels in Health-Care Facilities."¹⁴ 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 vulcanized composition rubber backing, sheet vinyl, sheet vinyl with a vulcanized composition rubber backing, virgin rubber sheet, and virgin rubber sheet with a vulcanized composition rubber backing. Three of these products featured a patented technology, whereby

a wear layer was fusion-bonded to a vulcanized composition rubber backing. The goal was to determine how effective this technology is in reducing noise when added to vinyl and rubber surfaces, and compare these results to standard commercial floors, such as carpet and other traditional resilient sheet products—the third option mentioned above.

The study found when a vulcanized composition rubber backing was fusion bonded with a vinyl surfacing, it was as quiet as commercial carpet when rolling a medical cart across a room or with standard footfall.

CASE STUDY: UNIVERSITY OF WISCONSIN HEALTH'S UNIVERSITY HOSPITAL



The designer's main focus in choosing flooring at a newly renovated Neuroscience Intensive Care Unit at a hospital in Wisconsin was slip resistance, footfall noise, and comfort underfoot.

The University of Wisconsin (UW) Health's University Hospital in Madison, Wisconsin, sought to reduce noise and improve the patient and staff experience in its newly renovated, 18-bed Neuroscience Intensive Care Unit (Neuro ICU). An ergonomic health-care surface provided the solution.

University Hospital features a Level I adult and pediatric Trauma Center, an American College of Surgeons-verified Burn Center, Organ Transplant programs, one of the nation's first certified comprehensive Stroke Centers, and the UW Carbone Cancer Center. UW Health is an integrated health system at the University of Wisconsin-Madison serving more than 600,000 patients each year.

According to Ardis Hutchins, AIA, IIDA, CHID, EDAC, a licensed architect and registered interior designer with UW Health, noise reduction to improve HCAHP scores was a high priority.

"We are a teaching research hospital, so we have many groups of people in the corridors and going into rooms, which creates added noise," Hutchins says. "We experienced flooring failures with the old LVT product installed in the area. It delaminated over time."

Kate Bautista, LEED AP, NCIDQ, associate vice president of HGA Architects and Engineers, was selected as the lead interior designer on the project.

To make the remodeled inpatient unit a quieter, calm, healing environment, hospital decision-makers conducted research to identify the most appropriate flooring. She

was impressed with an engineered, high-quality homogenous vinyl surface fusion bonded to 5 millimeters of vulcanized composition rubber.

"Making the right selection on flooring is really critical in areas that are occupied 24/7," Hutchins says. "We were interested in this product because of its acoustic properties and resilient design."

"When it comes to patient safety in the health-care setting, acoustics and falls are among the top issues to address," Bautista adds. "Slip resistance, footfall noise, and comfort underfoot then become the factors to consider when selecting flooring."

Hutchins and the team

requested and reviewed background research from the flooring manufacturer on its flooring line, which included touring other product installations at the Mayo Clinic Health System in Sparta, Wisconsin, and Johns Hopkins Hospital in Baltimore.

The second phase of the assessment included extensive in-house testing. A mockup was used to assess cleanability, waterjet cutting, heat welding, patching, push/pull of heavy equipment, and static load indentation recovery.

During the design and evaluation process, the hospital also considered feedback from patients and families. "We met with representatives from the Patient and Family Advisory Council (PFAC) on several occasions to show them the product, present test results, and make some design adjustments based on their aesthetic preferences."

With testing and evaluation complete, the team chose the rubber-backed vinyl flooring in a wood-grain look for patient rooms. For a more modern look in the corridors, a combination of the product in more solid colors was selected. "The soothing, tonal nature of the flooring acts as a timeless backdrop to the modern design," Bautista says. In total, the installations covered 13,500 square feet.

"All of the feedback we have gotten so far on this particular unit has been really positive," Hutchins says. "Everyone really likes the floor with regard to comfort, and ergonomically it is definitely less stress on people's knees. The unit is very quiet, too, even with noisy shoes like heels."

CASE STUDY: JOHNS HOPKINS HOSPITAL



The vulcanized composition rubber-backed flooring specified for a unit of John Hopkins Hospital met a number of criteria, including resiliency and cleanability.

When Johns Hopkins Hospital (JHH) in Baltimore, decided it needed an alternative to carpet, the designer relied on science to determine an alternative. “We cannot keep carpet clean,” said Teri Bennett, RN, CID, CHID, IIDA, NIHD, EDAC, lead interior designer, Architecture & Planning Department, JHH.

Under the direction of the hospital’s Facility Planning and Maintenance Team, JHH conducted a system-wide multidisciplinary research floor testing study over 90 days from November 22, 2014 to February 21, 2015. The test protocol and process utilized the 2014 edition of the FGI Hospital/Outpatient Guidelines and focused on overcoming four challenges.

JHH’s first two challenges were to reduce the use of underperforming, environmentally harmful, expensive, and high-maintenance surfaces and to establish a no-carpet flooring policy. JHH tested 20 products: 11 resilient surfaces and nine acoustic, non-carpet surfaces. This included textile composite, rubber, rubber composite, vinyl rubber composite, and heterogeneous and homogenous resilient flooring.

The third challenge was for all renovation projects to incorporate green/sustainable material specifications. “We had little experience with green, recycled products, and products made from alternative materials,” says Andrea Hyde, AAHID, MDCID, planner designer, Architecture & Planning Department, JHH.

The fourth and fifth challenges for JHH were to test and establish new standard cleaning procedures and protocols to comply with sustainable, low-VOC guidelines, and to also meet infection control and aging issues by eliminating the use of high-gloss surfaces, prior to implementation.

The JHH test area chosen for the 20 surfaces was the corridor connecting JHH Main Campus and JHOPC, including the Metro

subway entrance to JHH East Baltimore Campus. This area receives more than 20,000 estimated footfalls per day. Each of the 20 product test sites measured 6 feet by 18 feet with 4 feet of walking width. The result: “Some of the most sustainable products failed really miserably,” Hyde says. “They needed more care than we could give, or material collected soiling due to the inherent open-pore design.”

One of the products that performed the best was a floor made specifically for health-care settings that features an engineered resilient surface comprised of heterogeneous vinyl fusion bonded to a 5-millimeter vulcanized composition rubber backing. The result: a surface that reduces the risk of injury associated with falls, and offers sound control and comfort underfoot.

“The entire side that we were testing acoustics on was interesting,” Hyde says. Using rolling carts, JHH conducted acoustic tests over all of the test products. “You hit the granite tile, then you rolled over our resilient floor, then you hit the granite tile again, and then you rolled over the acoustic test floor,” Hyde explains. “We felt the products we were testing on that side were truly making a sound difference as people rolled on that side of the floor.”

With regard to cleaning, some products changed color with the Oxi-Clean or Oxi-Seal. “The specialty product never had an issue at all,” Bennett says. “There were no issues with cleaning at all on both sides (sealed and unsealed). And the seam remained intact throughout the test.”

As a result of the vulcanized composition rubber-backed flooring’s positive performance and because it fulfilled JHH’s four criteria challenges, JHH specified it, as well as another product from the company’s collection, for installation in 56 inpatient rooms in the JHH Meyer Neuro & Rehab facility.

An added benefit is that this surface is more conducive to meeting sanitary maintenance requirements of the healing environment. This clearly solves a multitude of problems in health-care settings.

ERGONOMICS

Selecting the right surface can contribute to the comfort of the people using it, in addition to potentially reducing the risk of serious injury from a fall. When it comes to the comfort of a surface underfoot, the force

reduction and energy restitution of a surface must be considered.

Ergonomic surfaces balance the absorption of force and the return of energy. Two common terms used to describe this relationship are force reduction and energy restitution.

Force reduction: This is how much energy a surface absorbs; for example, when a person walks on it. Surface of concrete would have extremely low force reduction because it absorbs very little energy, returning most of it back to the person’s feet, legs, and body.



Energy restitution is how much energy a surface returns. Force reduction is how much energy a surface absorbs.

This is tested and measured by ASTM F2569-11: Standard Test Method for Evaluating the Force Reduction Properties of Surfaces for Athletic Use.

Energy restitution: This is how much the surface returns energy. A surface of sand has very little energy restitution and high force reduction, meaning it will absorb almost all the energy and return very little back to the person’s body, making walking difficult and fatiguing.

When specifying flooring for a health-care space, it should be selected based on the force reduction and energy restitution desired for the application.

SLIPS AND FALLS

The health-care industry has been guided by long-standing requirements for coefficient of friction (COE) to prevent slips. But what has never been addressed is the actual impact that happens when a fall does occur. And falls do occur even when strict protocols are followed. Ironically, there are playground safety standards as noted in ASTM F 1292 for Height Impact Criteria. Yet no such standard exists for hospitals or senior care facilities.

Therefore, it is incumbent on the designer or specifier to pay attention to the flooring being considered and how it affects impacts. A lessened impact could make the difference between a minor and a major injury.

HYGIENIC SURFACES

Up to this point, we are already asking a lot from our health-care setting flooring: comfort, noise reduction, fall impact reduction, etc. But there is another element that is especially critical in health-care settings in these times: surfacing that helps prevent the spread of viruses, germs, and bacteria. Flooring that helps stop the spread of pathogens must perform well on three levels: 1) be a cleanable surface, 2) be compatible with cleaning products, and 3) have welded seams.

While much attention is given to surfaces such as countertops and handrails where viruses can be transmitted from person to person, viruses can also be transmitted on flooring from room to room. Research is underway regarding the migration of microbes through shoe traffic. Specifying a flooring material that can be effectively and efficiently cleaned is more important now than ever.

Plus, the flooring surface must be impervious to the robust cleaning products used in a health-care setting. This means it should not discolor or deteriorate when cleaning products are used.

Finally, the flooring should be seamless, with welded seams impervious to topical spills and liquids, especially in the flash coving. There is a critical need for sealed floors in patient rooms and corridors.

The case study on the next page shows how the proper specification of flooring contributes to the ability of a highly respected hospital to prevent the spread of pathogens.

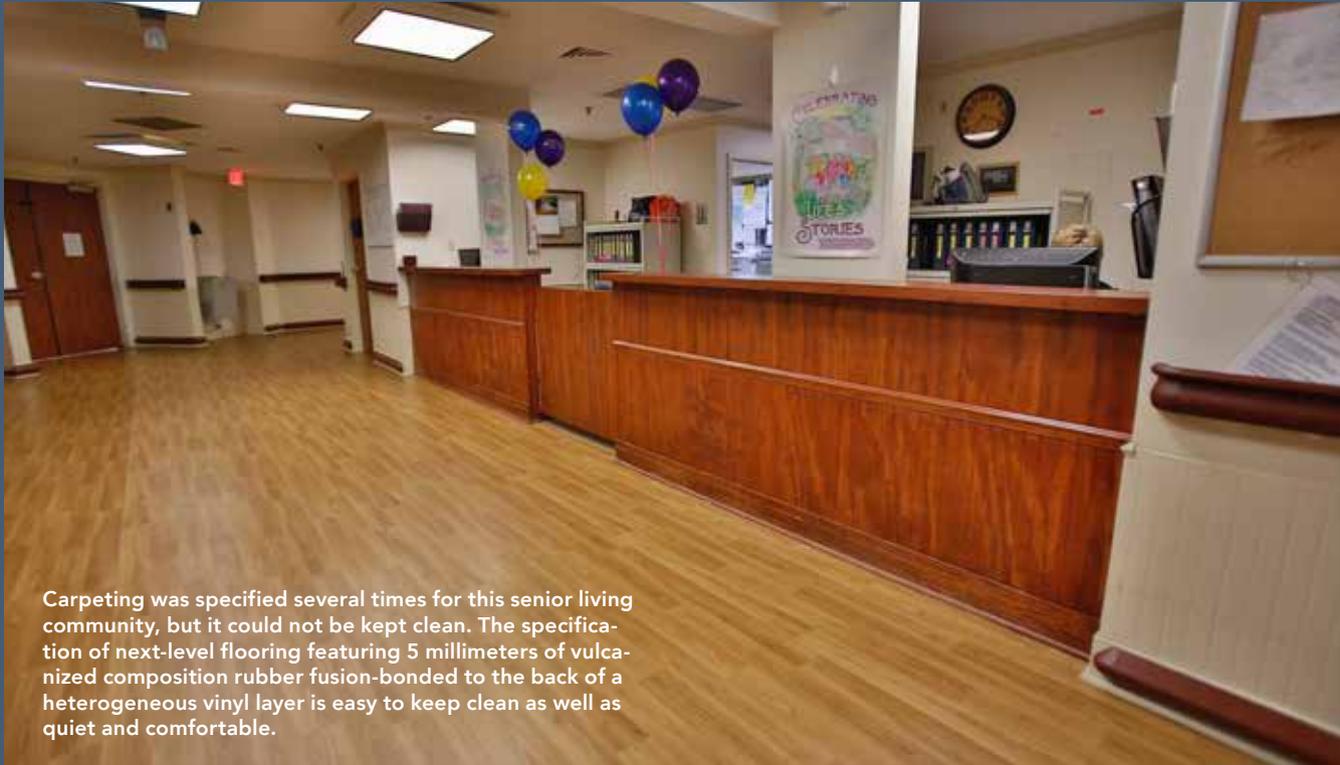
SPECIFYING THE RIGHT FLOORING PRODUCT FOR THE APPLICATION

The key to savvy specification of flooring for health-care settings is to identify the needs of the client and how the specification will impact staff, patients, and residents. With the basic assumption that the flooring must meet performance standards for durability, maintainability, and both static and rolling load weights, other priorities to consider include:

PERFORMANCE ASSESSMENT BY APPLICATION									
Application		Durability	Maintainability	Mobility	Affordability	Acoustics	Ergonomics	Safety	Sanitary
Acute Care									
Critical Care	ICU, PACU, NICU, Palliative Care, ED	✓✓✓	✓✓✓	✓✓	✓✓	✓✓✓	✓✓✓	✓✓	✓✓✓
Clinical	Behavioral, Orthopedic, Neurology, Oncology	✓✓✓	✓✓✓	✓✓✓	✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓
In-Patient	Corridors, Nurses Stations, Patient Rooms	✓✓✓	✓✓✓	✓✓✓	✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓
PT/Rehab		✓✓	✓✓	✓✓✓	✓✓	✓✓	✓✓✓	✓✓✓	✓✓
Pharmacy	Retail, Compounding	✓✓	✓✓✓	✓✓	✓✓	✓	✓✓✓	✓	✓✓
Labs		✓✓	✓✓✓	✓	✓✓	✓✓	✓✓✓	✓	✓✓
SeniorCare									
Fitness Gyms		✓✓	✓✓	✓✓✓	✓✓	✓✓	✓✓✓	✓✓✓	✓✓✓
Community Rooms		✓✓✓	✓✓	✓✓✓	✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓
Dining Rooms		✓✓	✓✓✓	✓✓✓	✓✓	✓✓✓	✓✓	✓✓✓	✓✓
Patios		✓✓	✓	✓✓	✓✓	✓	✓✓✓	✓✓✓	✓
Resident Rooms		✓✓	✓✓✓	✓✓✓	✓✓	✓✓✓	✓✓	✓✓✓	✓✓
Bathrooms		✓✓	✓✓✓	✓✓	✓✓	✓✓	✓✓	✓✓✓	✓✓
Corridors		✓✓	✓✓	✓✓✓	✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓

Key: ✓ = important, ✓✓ = very important, ✓✓✓ = critically important

CASE STUDY: SILVER BLUFF VILLAGE



Carpeting was specified several times for this senior living community, but it could not be kept clean. The specification of next-level flooring featuring 5 millimeters of vulcanized composition rubber fusion-bonded to the back of a heterogeneous vinyl layer is easy to keep clean as well as quiet and comfortable.

When Silver Bluff Village, a family-owned and operated senior living community offering short-term rehab, long-term care, and independent living, sought to refresh the design of its main skilled nursing building, a long-term care facility serving more than 120 patients, it was faced with some challenges. These included replacing the carpet without creating a louder environment, and specifying a surface that was easier for the staff to clean and maintain.

"Our main building was built in 1984, and it originally featured luxury vinyl tiles (LVT) throughout," says Lisa Leatherwood, MSN, RN, administrator and a third-generation family owner of Silver Bluff. "Nurses, staff, patients, and families all use the halls, and noise was a major issue."

In the first renovation, Leatherwood chose to replace the LVT with carpeting. "It did not take long for the carpeting to get dirty," she says. "It ended up looking terrible and was difficult to clean."

For the next major remodeling in 2009, Leatherwood considered reinstalling a hard surface in the halls, but she was met with opposition because noise is a major issue in senior living communities. "We have staff rolling patients, linen carts, food carts, and refuse barrels up and down the halls continuously 24 hours a day, and that can create a lot of noise," she explains.

In response to the feedback, Leatherwood decided to forgo installing a hard surface and instead opted for a high-end carpeting product that was 40 percent more expensive than regular carpeting.

"We were told the higher-end carpet would clean up fine, that we would not have any issues, and that it would last for a long time," Leatherwood says. "That turned out to be completely wrong."

As a result, Leatherwood began searching for an alternative to carpet. She learned about a sophisticated flooring choice after attending a skilled nursing convention.

"I was immediately interested in the company's rubber-backed resilient flooring products, specifically the health-care line," she recalls. Leatherwood made the decision to install the engineered resilient surface in the hallways of all four resident wings, a business office area, and a short wing that leads to the assisted living building attached to the long-term care building.

The next-level flooring features 5 millimeters of vulcanized composition rubber fusion-bonded to the back of a heterogeneous vinyl layer. This combination creates a surface that may possibly reduce the risk of injury associated with falls while offering sound control and comfort underfoot.

Before long, the Silver Bluff residents and staff realized the positive results of the flooring installation. "No one noticed a difference in noise between the carpet and the new flooring, and we did not receive a single complaint," Leatherwood says.

According to Leatherwood, staff also noted that it was easier to roll their carts and move residents around, as well as clean the surface.

"We are extremely satisfied with the floors," Leatherwood adds. "They are beautiful, they really are as quiet as carpet, and everyone is enjoying them so much. We could not be happier."

CONCLUSION

As we have seen, there are many challenges in a health-care setting, and recent events have only heightened our awareness of these challenges. We have also seen that flooring can be part of the solution to these problems.

The bar has been raised on what flooring can do, and higher expectations must be met. New technologies in flooring can directly affect the well-being of staff, patients, and the bottom line. As a result, engineered, resilient performance surfaces featuring a VCR backing that are durable, easy to maintain, contribute to mobility, reduce noise, are hygienic, and create a safer environment must be specified in health-care applications. With this data-based knowledge, architects, designers, and specifiers now have the information they need to bring benefits to everyone who comes into contact with a health-care setting.

END NOTES

¹“Through the Eyes of the Workforce: Creating Joy, Meaning, and Safer Health Care.” Lucian Leape Institute. National Patient Safety Foundation. 2013. Web. 12 September 2020. <<http://www.ihf.org/resources/Pages/Publications/Through-the-Eyes-of-the-Workforce-Creating-Joy-Meaning-and-Safer-Health-Care.aspx>>.

²“Adult Obesity Facts.” Centers for Disease Control and Prevention. Web. 12 September 2020. <<https://www.cdc.gov/obesity/data/adult.html>>.

³Gaines, Kathleen. “This is How COVID-19 is Changing the Future of Nursing for Students and Tenured Nurses.” Nurse.org. 26 June 2020. Web. 12 September 2020. <<https://nurse.org/articles/how-covid19-changing-future-of-nursing-students-rn>>.

⁴Jividen, Sarah. “7 Ways COVID-19 Will Change the Future of The Nursing for The Better.” Aspen University. 21 July 2020. Web. 12 September 2020. <<https://www.aspen.edu/altitude/how-covid19-will-change-future-of-nursing>>.

⁵Fuller, Thomas and Bain, Evelyn. “Moving violations: negative impacts of standing and walking in nurses’ health.” Massachusetts Nurse Newsletter. Massachusetts Nurses Association. 15 October 2008. Web. 12 September 2020. <<https://www.massnurses.org/newsletter>>.



With data-based knowledge, architects, designers, and specifiers can choose flooring that reduces noise, creates a more hygienic environment, contributes to mobility, increases safety, and is durable and easy to maintain.

massnurses.org/health-and-safety/articles/miscellaneous/p/openItem/1358>.

⁶“Caring for Our Caregivers: Facts About Hospital Safety.” Occupational Safety and Health Administration. September 2013. Web. 12 September 2020. <https://www.osha.gov/dsg/hospitals/documents/1.2_Factbook_508.pdf>.

⁷McCarthy, D.O.; Ouimet, M.E.; and Daun, J.M. “Shades of Florence Nightingale: Potential Impact of Noise Stress on Wound Healing.” Holistic Nursing Practice. 1991. Web. 12 September 2020. <<https://pubmed.ncbi.nlm.nih.gov/2061357>>.

⁸Kenney, L. “HCAHPS Scores, the Patient Experience, and the Affordable Care Act from the Facility Perspective.” American Society for Health Care Engineering. 22 April 2016. Web. 12 September 2020. <http://www.ashe.org/management_monographs/mg2015kenney.shtml>.

⁹Berglund, Birgitta; Lindvall, Thomas; and Schwela, Dietrich. 1999. “Guidelines for Community Noise.” Stockholm University and Karolinska Institute for the World Health Organization. 1995. Web. 12 September 2020. <<https://www.who.int/docstore/peh/noise/Comnoise-1.pdf>>.

¹⁰Busch-Vishniac, I.; West, J.; Barnhill, C.; Hunter, T.; Orellana, D.; and Chivukula, R. “Noise levels in Johns Hopkins Hospi-

tal.” Journal of the Acoustical Society of America. December 2005. Web. 12 September 2020. <<https://pubmed.ncbi.nlm.nih.gov/16419808>>.

¹¹Hagerman, I.; Rasmanis, G.; Blomkvist, V.; Ulrich, R.; Eriksen, C. A.; and Theorell, T. “Influence of intensive coronary care acoustics on the quality of care and physiological state of patients.” International Journal of Cardiology. 15 February 2005. Web. 12 September 2020. <<https://pubmed.ncbi.nlm.nih.gov/15686777>>.

¹²Mazer, S. E. “Reduce errors by creating a quieter hospital environment.” Patient Safety & Quality Healthcare. March/April 2005. Web. 12 September 2020. <<http://www.psqh.com/marapr05/noise.html>>.

¹³“Summary of the HIPAA Privacy Rule.” Office for Civil Rights. U.S. Dept. of Health and Human Services. 2003. Web. 12 September 2020. <<https://www.hhs.gov/sites/default/files/privacysummary.pdf>>.

¹⁴Paul, Adam L.; Arena, David A.; King, Eoin A.; and Celmer, Robert D. “Contribution of Floor Treatment Characteristics to Noise Levels in Health Care Facilities.” The Journal of the Acoustical Society of America. 2014. Web. 12 September 2020. <<https://asa.scitation.org/doi/10.1121/1.4920316>>.

Take quiz at ce.architecturalrecord.com

ecore[™]

Ecore empowers human performance with safe, quiet, and ergonomic flooring. It designs and manufacture performance surfaces engineered to help energize the people above them. Built on a legacy that began in 1871, Ecore designs innovative solutions for many industries. www.ecorecommercial.com