



White Paper:

FLOORING SELECTION POSITIVELY IMPACTS POST-OCCUPANCY EVALUATION AT NEMOURS ALFRED I. DUPONT HOSPITAL FOR CHILDREN

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In addition to design schemes and project budgets, the selection of flooring must consider product performance characteristics that impact outcomes, safety and patient satisfaction, as well as caregiver retention and operational efficiency. With this in mind, administrators at Nemours Alfred I. duPont Hospital for Children selected nora® premium rubber flooring for the expansion of their health system.

Two years ago, Nemours Alfred I. duPont Hospital for Children, in Wilmington, Delaware, completed a 557,000-square-foot hospital expansion. The \$272.8 million project included 144 single patient rooms, 44 emergency department exam rooms and 200,000 square feet of nora® premium rubber flooring. Since then, project team members, including the project manager, designer, construction manager, nurse manager and environmental services (EVS) operations manager, have used a post-occupancy evaluation (POE) to study the contributing factors and outcomes the flooring selection has had on clinical efficiency. A POE includes collecting data and obtaining feedback on a building's performance when

it is in use.ⁱ At Nemours, the evaluation used Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS) scores, as well as feedback from caregivers, patients and families. The results are proving invaluable as a reference for making informed decisions regarding the built environment.

As a structural component of the building, one that covers every square inch, flooring greatly influences the entire palette of products selected. But what influences the choice of flooring? At Nemours, a number of factors contributed to the final selection of premium rubber flooring for large portions of the hospital. Such factors included acoustics, staff fatigue and retention, health and safety concerns, operational optimization, environmental considerations and life-cycle cost analysis. Environmental factors such as infection control and safety were part of the material selection strategy.ⁱⁱ

Additionally, the ability to create zones through the use of color played an important role, particularly for the design of a children's hospital. A "pattern with purpose" discreetly designated patient, caregiver and family spaces within the patient rooms.

Performance Criteria

Using a mock-up, strategically located in an everyday-use location, the hospital conducted a fair evaluation of flooring products under consideration. The mock-up played a critical role in the selection process. In any project of this magnitude, a variety of stakeholders want to provide input—patients, families, nurses, design team members, facility managers, administrators and environmental services employees. Mock-ups provide a means for them to have a voice in the design and selection process. At Nemours, more than 250 clinicians and staff members provided feedback regarding the various flooring choices installed.

Specific performance criteria used to evaluate floor coverings centered on assessing durability, maintenance, safety, sustainability, ergonomics and acoustics. Other performance criteria, that are no less important in the final selection process included, warranty, installation, price and a true life-cycle cost analysis.





Flooring Impacts HCAHPS

The economic climate of the healthcare system as a whole influences the choice of floor coverings. For example, the HCAHPS survey reports results pertaining to a patient's experience of care.

ⁱⁱⁱ The eight domains or measures of hospital quality and patient satisfaction include:

1. Communication with nurses
2. Communication with doctors
3. Responsiveness of hospital staff
4. Pain management
5. Cleanliness and quietness of hospital environment
6. Communication about medicines
7. Discharge information
8. Overall rating of hospital

Flooring attributes have an actionable impact on the perception of cleanliness and quietness in the built environment, as it relates to patient care and caregiver safety.

Evidence-based Design Supports Rubber Flooring Selection

In the 2001 Institute of Medicine Report, *Crossing the Quality Chasm*, the report suggested 10 fundamental rules to elevate the quality of healthcare. Rule number five challenged providers to use evidence-based decision making and to employ that evidence in healthcare delivery. More than a decade later, it is well established that an evidence-based design approach enables decision making on the same level as scientific practices for operational optimization and well-being in the healing environment.

Using an evidence-based design (EBD) approach, hospitals like Nemours are finding that flooring has an actionable impact on these performance-improvement goals, as evidenced by a 2012 study conducted by The Center for Health Design, "Achieving EBD Goals Through Flooring Selection & Design."^{iv}

1. Reduce slips, trips and falls: Caregivers at Nemours found the continuous flooring surface in the new facility minimized surface transitions and simplified the maintenance protocol. This new approach requires little more than water and eliminates the need for wax. This protocol, along with the inherent slip-resistant properties of premium flooring, reduces the number of slips, trips and falls. Additionally, the flooring fosters health and wellness through the use of a non-coated product. As a result, staff are better able to respond quickly to emergencies with enough traction to eliminate concerns for slipping, while safety is improved.





2. Reduce patient and staff injuries associated with falls:

The environmental services staff at Nemours reports a reduction in injuries, thanks to the cleaning procedures for rubber flooring. The physicality of the cleaning regimen provides for less physical exertion and fatigue to the musculoskeletal system. An automatic scrubber can clean and buff rubber floors rapidly by applying water to the floor via a scrubbing pad. Water is removed using a squeegee, leaving a clean, dry floor in about the same amount of time it takes to mop. This process eliminates the need to use harsh chemicals. Premium rubber floors also eliminate the labor-intensive application of sealants, finishes or strippers.

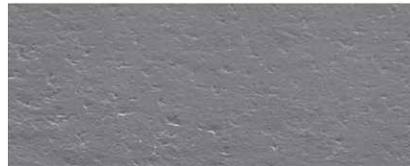
3. Reduce noise levels: For the patient, evidence-based research studies show noise has a direct, measurable and negative impact on healing. Noise can cause sleep disruption, which affects wound healing and increases the need for medication as well as the length of a patient’s stay.^v So pervasive is the issue of noise, that question #9 on the HCAHPS patient satisfaction survey asks, “During this hospital stay, how often was the area around your room quiet at night?” It is important to note this question consistently receives the lowest patient scores.^{vi}

At Nemours, data collected as a part of the POE noted that footfall sound is no longer heard with the nora floor, and HCAHPS scores for acoustics improved. Caregivers report the perception of quiet has greatly improved, with the premium rubber floor covering absorbing many of the sounds associated with hospital alarms and equipment.

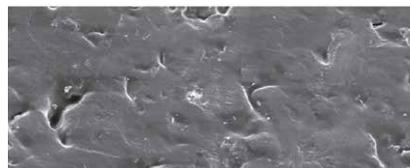
4. Reduce staff fatigue: Even though the new building requires more travel distance, there is a direct correlation to the floor for caregivers and members of the environmental services team, who spend most of their work day on their feet. Hard, unforgiving flooring surfaces can cause fatigue and negatively impact performance by limiting their ability to perform personal and work-related activities. Musculoskeletal injuries are chronic in nature and the result can be reduced productivity, increased absenteeism, opportunities for errors, and costs associated with workers’ compensation, retraining and retention.

On the other hand, surface density is the foundation of premium rubber flooring. The unique cross linking of materials in production ensures that “not all rubber is created equal,” so making an informed flooring decision is key.

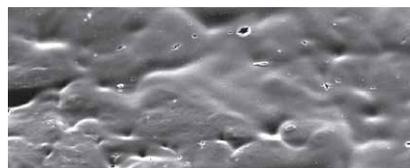
Premium rubber supports caregiver outcomes and retention and offers a comfort feature when it comes to fatigue and aching backs, legs and feet. Its content and structure make the floor covering



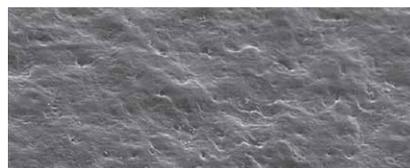
nora® rubber surface
magnification 1:100



vinyl surface
magnification 1:100



linoleum surface
magnification 1:100



competitive rubber
magnification 1:100



especially resilient, easing the stress of walking and standing while ensuring comfort underfoot and allowing nurses to concentrate on their patients.

At Nemours, caregivers reported their legs do not ache while walking on rubber flooring as they previously did on VCT flooring, even though pedometer data indicates many of them are walking greater distances in the new building. In fact, one caregiver noted she no longer needs to wear compression stockings.

5. Reduce surface contamination and Hospital-Acquired

Infection (HAI): When it comes to creating safer spaces, healthcare settings demand flooring that can be efficiently cleaned and disinfected. So, it is important to note that the extremely dense, closed surface of premium rubber flooring is inherently dirt repellent and does not serve as a media to microorganisms. It does not encourage or produce bacteria, in turn, supporting infection control drivers in the built-environment.

Caregivers at Nemours also point to minimal seaming and floor welds as a way to prevent contamination, given premium rubber is a dimensionally stable product. The EVS team notes that hand sanitizer does not erode or discolor the floor finish as it did with VCT in their old building. Additionally, because they are confident the floors are free of infectious materials, caregivers do not worry that family members who climb into bed with patients bring infections picked up from the floor, eliminating cross-contamination concerns.

6. Improve the patient experience: Nemours identifies a number of things that have improved the patient experience, beginning with the floor covering's low-luster finish. Glare can alter cognitive perception and visual acuity, thus creating trip hazards.^{vii} At the same time, the perception of the floor's cleanliness contributes to a positive patient experience and played a role in the HCAHPS perception of cleanliness scores, as it pertains to question #8:^{viii} "During this hospital stay, how often were your room and bathroom kept clean?" Nemours saw their score rise from the 60th to the 90th percentile for patient experience. Additionally, patterns in the floor support wayfinding and clearly define patient/caregiver/family zones, which improves caregiver access to the patient and contributes to a positive patient experience.



7. Improve Indoor Air Quality (IAQ): Rubber flooring's dense, homogenous surface helps repel dirt. As a result, the floor tends to stay clean longer and can be maintained with regular dust mopping. When deeper cleaning is required, a mop and tap water is often sufficient. Further, premium rubber floors do not require the application of coatings or waxes. The absence of finishes and other chemicals benefits everyone in a healthcare setting, especially those who might be sensitive to smells or suffer from asthma or allergies these products aggravate.^{ix}

The absence of finishes and chemicals also means patients will not need to be moved, or large areas of a facility closed for an extended period of time, while floors are cleaned and coatings or finishes are applied and allowed to dry. This time savings is especially important for flooring that supports patient outcomes, as healthcare facilities



operate 24/7, 365 days a year. Informed flooring decisions support operational optimization and clinical efficiency.

The chemical-free cleaning process also allows for faster patient room turnover. Nemours has experienced a marked decrease from 4 hours to 45 minutes to turn over a patient room and attributes much of this operational optimization to the ease of caring for rubber flooring.

8. Return on investment: The simpler maintenance regimen for premium rubber flooring has resulted in an 11 percent decrease in the annual cost of floor cleaning supplies at Nemours. This translates to annual savings of \$31,000, which goes right back to the health system. Additionally, the hospital reports a reduction in overtime hours for care and maintenance of floor coverings, and a 75 percent labor efficiency increase has been realized and is attributed to nora premium rubber flooring.

Construction and Basis of Design (BOD) Decisions

During the value engineering phase for Nemours, the contractor made suggestions for substitutions of various interior finishes. The end user and architectural firm steered the hospital back to their BOD, encompassing all the aforementioned performance characteristics. The benefits of premium rubber flooring far outweighed what could have been a detriment to the life-cycle cost to the facility, its intended outcomes and safety for its patients and caregivers.

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To make informed flooring decisions, we need to look at the true cost of product de-selection. De-selection simply means that a product, like flooring, that is specified for a project is subject to value engineering (VE) due to total project costs. General contractors and construction project managers tend to try and de-select or substitute a less expensive product for the specified flooring product. It can be a short-sighted decision, one that many times is made without communicating with the designer or end user. It's a decision that serves the project budget but ultimately impacts operational optimization and clinical efficiency for the health system. It's also a decision that leads to long-term costs for the end user over the life of the flooring product due to maintenance protocol, potentially costing the health system millions of dollars over the life of the substitute floor. This is the true cost of de-selection.^x

Flooring Impacts Performance Goals and Outcomes

The built environment affects outcomes and making informed decisions, as hospitals like Nemours Alfred I. duPont Hospital for Children have discovered. Flooring is the foundation of the healing environment and as such, has a tremendous impact on operational and clinical drivers for their health system. Although it is true that floors must still support an attractive design and adhere to budget guidelines, just as important is their ability to improve patient outcomes, safety and satisfaction, along with caregiver retention and operational efficiency. Premium rubber flooring does all this, meeting the requirements of various stakeholders while creating attractive, inviting and safer spaces with a life cycle as long as 30 years.

End Notes

- i <https://postoccupancyevaluation.com/>
- ii <https://www.healthdesign.org/chd/knowledge-repository/sound-control-improved-outcomes-healthcare-settings-2>
- iii *<https://www.cms.gov/medicare/quality-initiatives-patient-assessment-instruments/hospitalqualityinits/downloads/hospitalhcahpsfactsheet201007.pdf>
- iv Nanda, U., Malone, E., and Joseph, A. (2012) wrote Achieving EBD Goals through Flooring Selection & Design. Concord, CA: The Center for Health Design.
- v Heidi Boehm, MSN, RN, and Stacy Marasat, RN, BSN, NE-BC wrote Quiet Time. AJN, November 2009, Vol. 109, No. 11 Supplement.
- vi <https://www.cms.gov/medicare/quality-initiatives-patient-assessment-instruments/hospitalqualityinits/downloads/hospitalhcahpsfactsheet201007.pdf>
- vii Stephen R. Lord, Catherine Sherrington, Hylton B. Menz, and Jacqueline C.T. Close wrote Falls In Older People: Risk Factors and Strategies for Prevention.
- viii <https://www.cms.gov/medicare/quality-initiatives-patient-assessment-instruments/hospitalqualityinits/downloads/hospitalhcahpsfactsheet201007.pdf>
- ix <https://www.ahcmedia.com/articles/121293-workers-become-ill-from-floor-strippers>
- x Suzanne R. Barnes (1999), AIA, CFFM wrote How to Make Business Decisions for Facility Flooring. Symposium on Healthcare Design.