
Flooring Selection for Acute Care Facilities:
Safety Implications

Slipping and falling, pushing heavy objects and standing all day are the three main culprits of flooring-associated injuries in hospitals. Thus, when specifying flooring, it is important from the perspective of risk management and Medicare “never-events” to consider how slip-resistance, rolling mobility and anti-fatigue properties of different floor coverings impact the safety of a space, and consequently, hospital performance.

Data from the Bureau of Labor Statistics shows U.S. hospitals recorded 253,700 work-related injuries and illnesses - 6.8 cases per 100 full-time employees in 2011.¹ This rate exceeds the rates in the construction and manufacturing industries and is nearly double the rate for private industry overall.² Forty-eight percent of the injuries reported by U.S. hospitals were caused by over-exertion from motions such as lifting, bending or reaching and 25% were resulting from slips, trips and falls.³

Hospitals also have the highest rate of employees with injuries and illnesses resulting in lost work days - 157.5 cases per 10,000 full-time employees in 2011.⁴ Sprains and strains accounted for 54 percent of these cases.⁵ Slips, trips and falls are among the most common causes of these injuries.⁶

Registered nurses (RNs) and nursing aides suffer more injuries than almost any other occupation nationwide. Between 2005-2009, the average indemnity and medical costs for lost time claims was \$25,000 for slips, trips and falls, and about \$23,000 for injuries due to strains.⁷

An estimated 700,000 to 1,000,000 people fall in U.S. hospitals annually, according to the Agency for Healthcare Research and Quality.¹¹

The aging of the nursing workforce contributes to the problem in that aging bodies are more susceptible to injuries. Data collected from the 2010 Census by the U.S. Department of Health and Human Services’ (HHS) Health Resources and Services Administration (HRSA) shows the average age of a nurse is 44.6 years.⁸ A 2013 survey conducted by the National Council of State Boards of Nursing and The Forum of State Nursing Workforce Centers found that 55 percent of registered nurses (RNs) are age 50 and older.⁹

Slip Resistance

Hard-surface flooring is often used in healthcare facilities due to the misconception that polished flooring is clean. While a well maintained aesthetic is important, a more substantial issue, such as slip resistance, should take precedence over the perception of cleanliness when selecting a floor covering. Research by professor Alan Hedge of Cornell University shows that 46 percent of people who slip and fall on hard, shiny surfaces suffer injuries requiring medical attention, compared to 17 percent of people who fall on carpet.¹⁰

An estimated 700,000 to 1,000,000 people fall in U.S. hospitals annually, according to the Agency for Healthcare Research and Quality.¹¹ Falls are the most frequently reported incident in adult inpatient units. They are associated with longer hospital stays and higher costs.¹² The number one cause of slips, trips and falls in healthcare facilities is contaminants on the floor. This includes liquids such as cleaning solutions, water and urine.¹³

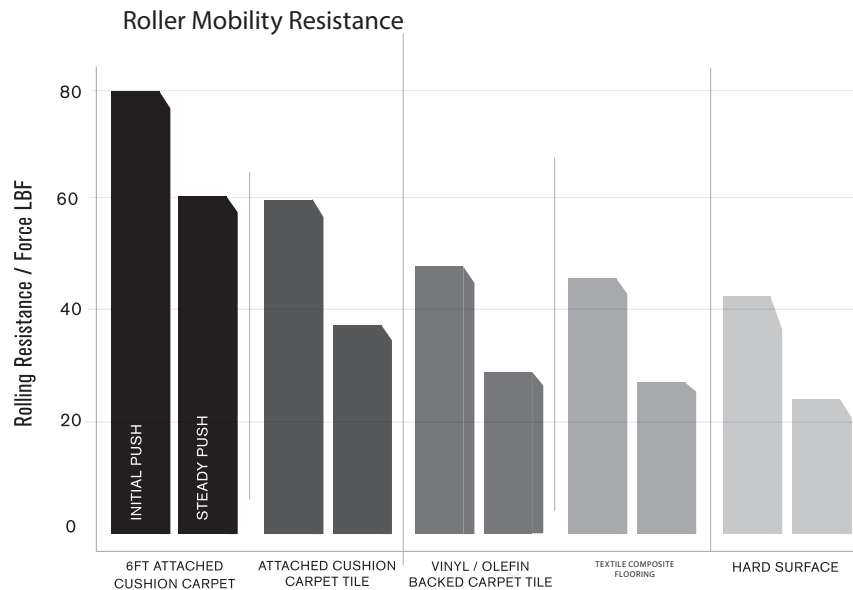
Because bones thin and weaken with age, older adults are at higher risk of serious injury from falls. More than 95 percent of hip fractures are caused by falling, a large proportion of fall deaths are due to complications following a hip fracture, and one out of five hip fracture patients dies within a year of their injury, according to the Centers for Disease Control and Prevention.¹⁴

Beginning in October 2008, The Centers for Medicare and Medicaid Services discontinued payments to hospitals for most increased costs due to injury resulting from a preventable inpatient fall.¹⁵ Other third-party payers are following suit. This shift has increased the need for comprehensive fall prevention programs that are both effective and strictly enforced.¹⁶

Any surface becomes dangerous to walk on when it has a coefficient of friction measuring less than 0.4.¹⁷ Ice typically has a coefficient of friction of about .3, depending on shoe sole material and tread pattern.¹⁸ Results of independent laboratory tests comparing surface traction of different floor coverings reveal that a wet, soapy, hard surface such as vinyl flooring is more slippery than ice. Wet, soapy, vinyl flooring and wet, soapy carpet have coefficients of friction of .15 and .55, respectively.¹⁹ Wet, soapy textile composite flooring has a coefficient of friction of .63.

Rolling Mobility

Initial rolling resistance refers to the amount of force needed to push a hospital bed, wheelchair, food service cart or other wheeled object forward from a stopped position. The rolling resistance coefficient, or coefficient of rolling friction, refers to the amount of force needed for steady pushing. In both cases, the lower the resistance, the easier it is, or less work it takes, to push the object.



The average hospital bed, without a patient in it, weighs 850 pounds. An occupied bed may exceed 1,000 pounds. Floor coverings that easily compress under pressure, such as those with soft cushion backings, create higher rolling resistance which, in turn, requires people to exert more force when pushing and increases the risk for injury. Pushing and pulling heavy objects such as hospital beds is often associated with shoulder and back injuries.²⁰

Healthcare risk managers participating in a 2012 Aon Risk Solutions study of workers compensation for the healthcare industry identified push/pull injuries as their second highest concern. The reason: push/pull injuries had the second highest average indemnity payment—\$11,800 in 2011. The top concern was patient handling which had an average indemnity payment of \$12,000 that year.

The flooring industry does not have a standard test method for measuring the rolling resistance of different floor coverings. Instead, the method used by hospital bed manufacturers can serve as a guide. Their method uses a digital force gauge to measure the amount of force required for the initial push to overcome inertia and get the bed rolling as well as the amount of force needed to keep the bed moving.

The three most important safety factors to consider when specifying flooring are: slip resistance, rolling mobility and anti-fatigue properties

Independent laboratory tests reveal that not all carpet has the same rolling resistance. These tests also show that carpet with cushion has higher rolling resistance and greater pushing-related injury potential than carpet without cushion. Carpet without cushion has rolling resistance similar to hard surfaces, which have the lowest rolling resistance, and the same lower, pushing-related injury potential as a hard floor.

The test data shows that when vinyl-cushioned carpet is on the floor approximately 95 pounds of force is needed to push a hospital bed forward from a dead stop, and about 80 pounds of force are needed for steady pushing. When urethane-cushioned carpet tile is on the floor about 80 pounds of force are needed for the initial push, and about 60 pounds of force are needed for steady pushing. A hard surface such as vinyl flooring requires about 70 pounds of force for the initial push and about 40 pounds of force for steady pushing. With textile composite flooring, about 75 pounds of force are needed for the initial push and about 45 pounds for steady pushing.

The question is, how much work is too much? The “Liberty Mutual Manual Materials Handling Tables” (also referred to as the Snook and Ciriello Tables) are often used by various agencies to set guidelines for exertion in the workplace. Calculations for work such as pushing an occupied hospital bed are based on rolling resistance data as well as data regarding the worker’s hand-height when positioned for pushing, pushing frequency and pushing duration. These tables reveal that under typical conditions—an average bed weight of 850 pounds, average patient weight of 200 pounds, average bed wheel diameter of 6 inches and a hard surface floor such as vinyl or rubber—49 percent of women and 65 percent of men can be expected to push an occupied hospital bed from a dead stop.

Anti-Fatigue Properties

A study of work-related foot pain or discomfort among more than 500 RNs revealed that the floor surface of a care unit is a factor causing increased stress on the structures of the foot.²¹

Heel spurs (plantar fasciitis) is a repetitive stress injury caused by repeated impact of the foot against a surface and the most common lower extremity injury suffered by bedside care providers.²² This condition is marked by a painful inflammation of the connective tissue on the sole of the foot. Heel spurs often require surgery. In hospitals, nurses with heel spurs may have difficulty walking to a patient's bedside and delivering optimal care, which can lead to errors and Medicare never-events.

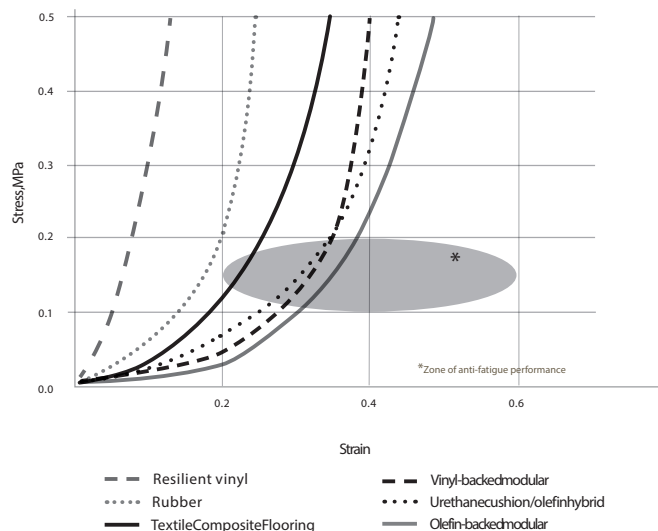
Specifying flooring with anti-fatigue properties can help prevent heel spurs. An anti-fatigue surface has low compression resistance, or crush resistance. This means it compresses when stepped on and dissipates foot pressure. A surface lacking anti-fatigue properties does not absorb energy, putting greater pressure on feet.

Although there is no hospital standard for flooring anti-fatigue performance, the type of testing that's used in the athletic footwear industry to develop running shoes and man-made athletic surfaces suggests that rubber and resilient vinyl flooring are not anti-fatigue surfaces, whereas some types of carpet are.

Athletic footwear companies use compressive force displacement testing to measure a material's compressive modulus and surface-energy density as a function of foot pressure. According to qualified biomechanics experts, this test speaks directly to the relationship between floor cushioning and medical conditions such as heel spurs.²³

Independent laboratory test data shows that carpet tile and textile composite flooring are the only two floor coverings exhibiting anti-fatigue performance. It also shows that non-cushioned carpet tile, which has the low rolling resistance that is desirable for pushing hospital beds, is just as effective in preventing standing fatigue as cushioned carpet tile which has higher rolling resistance.

Cushioning Properties of Flooring



Additionally, most types of carpet with anti-fatigue properties perform about the same. Cushioning is not necessary to achieve anti-fatigue performance. Both carpet tiles and textile composite flooring with a high-density backing and soft textile surface have demonstrated the ability to absorb foot pressure and potentially reduce repetitive foot stress injuries and injuries related to frequent walking and standing.²⁴

Conclusion

Safety is an important consideration when specifying flooring for hospitals. One of the most abundant finishes in the built environment, flooring has great potential to improve the safety and comfort of a space, positively impact productivity, and limit liability and costs of flooring-associated injuries.

The three most important safety factors to consider when specifying flooring are the product's slip resistance, rolling mobility and anti-fatigue properties. Independent laboratory tests show that carpet, carpet tile and textile composite flooring, when specified appropriately, contribute more to an environment's safety and comfort underfoot than any other type of floor covering.

Notes

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- ⁵ Ibid.
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