SYNOPSIS

KEY POINT SUMMARY

OBJECTIVES

To determine the ideal flooring type for reducing fall-related injuries by testing both shock absorption as well as horizontal pulling force required to move wheeled objects.

A comparison of floor surfaces for injury prevention in care settings: impact forces and horizontal pulling force required to move wheeled equipment

Keenan, B. E., Hallas, K., Drahota, A. K., Evans, S. L. 2020 | Osteoporosis International, Volume 31, Issue 12, Page(s) 2383-2394

Key Concepts/Context

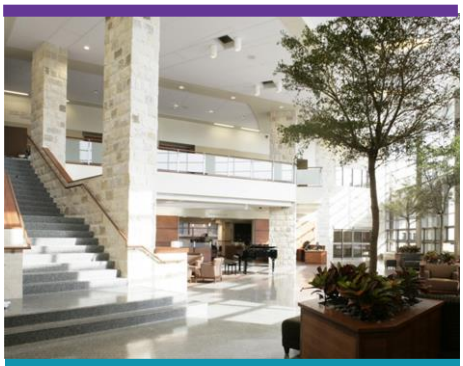
Injury-inducing falls frequently occur in both care homes and hospitals. One way to prevent fall-related injuries is shock-absorbing flooring. The authors of this study note that at the time of writing, there are no established standards for what type of flooring is most effective for injury prevention. The results of this study suggest that an appropriately designed rubber underlay significantly reduces peak impact when compared to standard vinyl flooring.

Methods

Fourteen different flooring samples sourced from five different suppliers were tested in this study. These samples were chosen by a regional governmental research agency which also commissioned the study. The samples included rubber and vinyl flooring, with some featuring shock-absorbing foam layers of varying thicknesses. Two samples were simply underlays (as opposed to complete flooring systems); these were combined with different overlays for testing purposes.

All samples were broadly categorized as “standard vinyl” (i.e., not intended for shock absorption, resilient sheet flooring), “foam-backed” or “rubber-backed” vinyl (often these are sold for sound insulation or sports purposes), and “novelty health floors” (i.e., flooring specifically designed for shock absorption in medical care settings). The samples within these broad categories varied in layering techniques, surface finishes, and material densities.

Mechanical impact testing was conducted according to the Canadian Standards Association Z325 Hip Protectors document, which is also applicable to compliant surfaces that form parts of flooring systems. Using a drop tower impact system, the impact to femur forms during simulated falls was tested on different floor samples. Tests were also performed to assess the amount of force required to move wheeled



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objects across the different flooring samples. This was done using a single wheel attachment (125mm diameter, 27mm width) resembling those used for hospital beds mounted onto a test rig featuring a moveable carriage. Lastly, the relationships between core material, floor thickness, impact force, and horizontal force required to pull wheeled objects were all analyzed.

Findings

A wide range of impact reduction was observed across all of the different floor samples, from 0.7% reduction to 25%. Rubber flooring with specially designed honeycomb structures performed well during lab tests, while flooring such as standard vinyl styles proved unlikely to provide any protection during a fall. However, the authors note that there is no standard threshold for impact reduction within flooring styles, and there likely will never be due to the different variations in bone strengths and fall events. Generally speaking, higher force attenuation will help prevent some injuries, but it would be difficult for flooring to prevent all injuries.

No simple relationship between horizontal pulling forces and impact reduction properties were found. In other words, it was not necessarily more difficult to pull wheeled equipment across floor coverings with greater shock absorbency. Aside from this observation, it was found that the peak force reduction of up to 25% was achieved with a specially designed rubber underlay featuring a honeycomb design. Additionally, increased floor thickness was correlated with higher levels of horizontal pulling force; however, this did not apply to rubber floors. While core material and thickness do account for some variation (82.3% for impact, 66.5% for wheel movement), the authors note that there are clearly other unmeasured factors that are influencing floor performance.

Limitations

The results from this study are derived from a controlled laboratory environment involving a wide range of preconfigured parameters and a specific array of flooring choices and testing apparatuses. The results may not be generalizable even where the same materials or similar wheeled devices are deployed in different healthcare environments. The authors note that aspects of their test rig designs prevented a variety of wheel orientation scenarios from being investigated during the study.

Design Implications

This study found that specially designed rubber flooring underlays featuring honeycomb designs may provide an ideal balance between fall impact reduction as

well as lower levels of wheel rolling resistance. It was observed that flooring systems involving rubber seemed to be generally more balanced in this regard, and that vinyl flooring offered little to no discernable protection from fall impacts.