



1 REDUCE SLIPS, TRIPS, AND FALLS		P/A/?/NA
s	Flooring material is stable, firm, and slip resistant* (ADAAG - U.S. Dept. of Justice, 2010).	
s	In areas where spillage is likely (like bathrooms, suites, sink areas, lab areas, etc.) flooring is impermeable, easily cleaned and textured (OSHA, 2003; NHS - Healey, 2007).	
p	Depending on flooring type, flooring is tested for optimal performance under different conditions (wet/dry/greasy).	
r	Contrast in flooring patterns is low (Perritt et al., 2005; Calkins, 2012).**	
r	Finish has low reflectance value to prevent glare (Wilmott, 1986; Dvorsky, 2007).	
s	Flooring thresholds are less than ¼ inch vertical, or between ¼" & ½ inch, beveled (ADAAG, 2010).	
s	If carpet is used, pile height is 1/2 inch (13 mm) maximum (ADAAG, 2010).	
s	Exposed edges of carpet are fastened to floor surfaces and have trim on the entire length of the exposed edge (ADAAG, 2010).	
p	Joints and seams are minimized to ensure that sharp edged objects like walking sticks or heels do not cause trips.	
p	Area rugs, walk off mats at building entry and floor mats, if used, have beveled edges and are firmly anchored to facilitate ADA transition guidelines.	
p	Appropriate finishes and cleaning procedures are used in accordance with standards and manufacturer recommendations.***	
OVERALL LEVEL OF EVIDENCE LINKING FLOORING PROPERTIES TO SLIPS, TRIPS AND FALLS		LOW
RESEARCH NEEDED LEVEL		URGENT

*Note that increasing slip resistance through textured finish can create maintenance/ cleanability issues. These must be balanced during the selection of the flooring. Also note that a standard for COF is not available right now because slip-resistance can vary from surface to surface, or even on the same surface, depending upon surface conditions and employee footwear (OSHA, 2003). The industry norm is between 0.5 and 0.6.

**Note that high contrast patterns may be used for way finding in public areas where patients are not unaccompanied. Also, patterns pose a larger concern for older populations and are used more commonly in pediatric settings. More research is needed on the effect of contrast on age.

*** Note that the floor finish is the final contact surface. Finishing products and cleaning protocols can significantly impact the performance of the floor in terms of slips and trips.

2 REDUCE PATIENT AND STAFF INJURIES ASSOCIATED WITH FALLS		P/A/?/NA
r	Floor has a balance of energy-absorbent properties (to absorb the force of impact that causes injury) and firmness (to reduce the risk of falling due to poor balance) (Wright, 2011; Redfern, 2000).*	
r	If rigid materials are used, then underlays can be used to provide adequate cushioning to reduce the impact of the fall (Laing, 2009; Sran & Robinoviyich, 2008).**	
OVERALL LEVEL OF EVIDENCE LINKING FLOOR FINISH TO TRIPS AND FALLS		MEDIUM
RESEARCH NEEDED LEVEL		HIGH

*Note that impact due to a fall can depend on the sub-floor, underlay, as well as the floorcovering material. While deciding on the impact on injuries, make sure you consider the property of the entire flooring system.

**Make sure the underlay does not create an increase in effort for mobility (see EBD Goal 4).

3 REDUCE NOISE LEVELS		P/A/?/NA
p	Flooring with high footfall noise (such as corridors) should have high sound absorbing properties and low sound transmitting properties while accommodating roller mobility and balance.	
s	The floor finish and the sub-floor structure in healthcare facilities should mitigate noise levels transmitted by an impact in an adjacent space, such as footfall or cart rolling (GG Technical Report, 2007).	
p	Resilient/acoustic underlays should be used to lessen footfall and other traffic noise, for floorcoverings with low IIC.	
OVERALL LEVEL OF EVIDENCE LINKING FLOOR PROPERTIES TO NOISE LEVELS		MEDIUM
RESEARCH NEEDED LEVEL		URGENT

Note that there is no evidence that currently links flooring property to reduction of airborne sounds. The acoustical benefit of flooring is primarily on impact noise reduction. Standards are currently lacking on ideal NRC levels since these differ greatly between different flooring materials.

4 REDUCE STAFF FATIGUE		P/A/?/NA
r	Provide more cushioning for areas that require standing for extended periods of time. For areas where infection control is a key issue (such as OR), non-porous/impermeable flooring materials should be used with anti-fatigue mats to provide cushioning where surgeons/staff stand for long durations. If anti-fatigue mats are used, surface should have an anti-skid finish and edges should be tapered to reduce risk of trips (Hughes, 2011).*	
p	Cushioning properties should be balanced with roller mobility for walking areas used for equipment transfer (Gray, 2009).**	
p	Greater roller mobility for high traffic areas like corridors.	
OVERALL LEVEL OF EVIDENCE LINKING FLOOR PROPERTIES TO STAFF FATIGUE		LOW
RESEARCH NEEDED LEVEL		URGENT

*Note that while there is some evidence on the impact of floor mats on underfoot comfort, the research that investigates this across an entire flooring type is minimal. Additionally effects on fatigue are only seen after an extended period of standing. In the design of healthcare environments cushioning (under-foot comfort) and roller mobility must be balanced, based on the activities performed in an area.

**Note that cushioning properties are also associated with injury reduction and the reduction of impact sound.

5	REDUCE FLOOR SURFACE CONTAMINATION AND POTENTIAL RISK OF HAI	P/A/?/NA
s	Carpet is avoided in areas where spills are likely to occur (e.g., laboratories, sinks, and janitor closets) or where patients may be at greater risk of infection from airborne pathogens (e.g., burn units, ICUs, and operating rooms) (CDC - Sehulster & Chinn, 2003).	
s	Do not use carpeting in hallways and patient rooms in areas housing immunosuppressed patients (CDC, 2003).	
p	Surface material is compatible with the sanitizing methods as outlined in the CDC 2003 recommendations for general cleaning strategies of patient care areas.	
p	Surfaces (and joints) are nonporous and impermeable to the extent possible without increasing slipperiness.	
p	Right angles joints between walls and floors are covered to facilitate effective cleaning.*	
s	In facilities electing to use carpet for high activity patient-care areas with risk of spillage, carpet-tiles can be considered to allow contaminated tiles to be removed, properly sanitized or discarded and replaced (CDC, 2003).**	
OVERALL LEVEL OF EVIDENCE LINKING FLOOR PROPERTIES TO HAI		LOW
RESEARCH NEEDED LEVEL		URGENT

* For hard/resilient flooring only.

**Note that while it is possible to create moisture barrier backings for the carpet tile, currently there is no method to effectively seal the seams that can act as a moisture barrier without welding the seams together (in which case the tile cannot be replaced). If wall-to-wall moisture impermeability is preferred, then the flooring selected should be both impermeable and welded at the seams following industry standards. Also note that in cases where a spill permeates to the sub-floor, the sub-floor would need to be treated as well and the cost associated with removing, cleaning and replacing tiles, and if needed treating the subfloor can become extensive.

Note that currently there is no evidence linking flooring to HAI, and no causal links between use of antimicrobial treatments and HAI. Additionally there are environmental concerns with using antimicrobial products from an IAQ perspective (See EBD Goal 7).

6	IMPROVE THE PATIENT EXPERIENCE	P/A/?/NA
p	Use floor design to support wayfinding by using colors and patterns in line with the overall design scheme.*	
p	Use flooring materials that are visually appealing and “non-institutional”.	
p	Use thermally insulating material to improve thermal comfort (see EBD Goal 8).**	
p	Use non-glare finishes to avoid strain on sensitive eyes.	
p	Maintain visual appeal by durable surfaces that do not scratch or scuff easily.*	
OVERALL LEVEL OF EVIDENCE LINKING FLOOR PROPERTIES TO STAFF FATIGUE		LIMITED
RESEARCH NEEDED LEVEL		URGENT

*Use of high contrast patterns must be weighed against perceptual issues that may impair balance, especially in areas where patients may have impaired vision (see EBD Goal 1).

**Use of thermal insulation suggests use of thicker material that can trap air, which in turn may increase risk of surface contamination.

Note that all the recommendations in this section are based on best practices and have not been empirically tested.

7	IMPROVE INDOOR AIR QUALITY (IAQ)	P/A/?/NA
s	Floorcovering should have minimum emission of VOCs and meet the requirements of the California Department of Public Health Standard Method for testing and evaluation of VOC emission (LEED, 2009).	
s	All carpet and carpet cushion should meet the Carpet and Rug Institutes (CRI) Green Label Plus (LEED, 2009).	
s	All adhesives and sealants for seams and joints should meet USGBC LEED for Healthcare standards (LEED, 2009).	
s	Tile setting adhesives must meet USGBC's LEED for Healthcare IEQ standards (LEED, 2009).	
s	Cleaning products specified should meet Green Seal GS-37 and GS-40 standards (Green Seal, 2011).	
s	Minimize need for surface coating (EPA, 2007).	
p	Use permanent walk-off mats at entry ways to capture dirt and particulates entering the building. <ul style="list-style-type: none"> • If used, the mats should be maintained regularly by a contracted service organization. • If used, mats should be firmly anchored, and at least 10 feet in length in the primary direction of travel.* 	
OVERALL LEVEL OF EVIDENCE LINKING FLOOR PROPERTIES TO IAQ		MEDIUM
RESEARCH NEEDED LEVEL		MEDIUM

*See EBD Goal about minimize risk of slips, trips and falls.

Note that while there are excellent standards in place that make the selection of materials easier, there remains a lack of empirical research which must be conducted to advance the field.

Please refer to LEED Guidelines for Healthcare for more information.

8	REPRESENT BEST RETURN ON INVESTMENT	P/A/?/NA
p	Balance first time costs with life-cycle costs before making flooring selection First-time cost (materials and installation) balanced with life-cycle costs (maintenance, repairs and replacement) (including the initial maintenance required to prep the flooring (if any) after installation and prior to occupancy)	
p	Carefully evaluate results of safety and durability testing	
p	Ensure that the flooring supports the organizational mission, branding and strategic goals of the organization	
p	Calculate energy savings (if any) based on material properties of thermal insulation	
p	Estimate the extent to which the flooring aids in improving safety and quality outcomes (Goals 1-7) to calculate Return on Investment	
Calculating return on investment is a complex calculation which is based on projected costs and returns. It should be carefully conducted with the right team of experts and a financial analyst.		