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Contribution of the Designed Environment to Fall Risk in Hospitals

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Abstract

The vast majority of fall-reduction interventions are multimodal, addressing both intrinsic and extrinsic factors. Because it is often not feasible to make significant environmental modifications to the built environment once it is built, many of the extrinsic factors included in research tend to be more related to environment-in-use variables. There has been very little research that systematically examines the role of characteristics of the built environment such as room and unit layout, relationship of the bed to the bathroom, or layout and features of the bathroom on falls. Cross-sectional analysis of 27 units in 12 hospitals using archival fall data identified a number of design characteristics that were associated with greater or fewer falls, including visibility to staff work spaces, presence of a dedicated family space in the room, bathroom layout and supportive features, and more. This project lays the foundation for a prospective study that will more directly link falls with specific environmental characteristics.

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Executive Summary

In-patient falls consistently compose the largest single category of reported incidents in hospitals, affecting from between 2% to 10% of annual hospital admissions (Hendrich, Nyhuis, Kippenbrock, & Soja, 1995). Further, it has been estimated that 30% of in-patient falls result in injury, with 4% to 6% resulting in serious injury (Hitcho, et al., 2004). In addition, hospital-acquired injuries from falls in patients' rooms are included in the list of Never Events published by the Centers for Medicare and Medicaid Services. Never Events are hospital- acquired conditions that the National Quality Forum defines as "errors in medical care that are clearly identifiable, preventable, and serious in their consequences for patients, and that indicate a real problem in the safety and credibility of a health care facility." Thus there is clear evidence of the importance of understanding the range of factors that impact falls and fall risk.

Fall risk is generally articulated in terms of intrinsic and extrinsic factors, and thus intervention studies typically focus on moderating intrinsic (poor balance, weakness, drug effects) and extrinsic (reducing barriers, eliminating hazards, adding external reminder cues) conditions. The aim of this study was to systematically examine the role of the physical environment of the patient room, and more specifically the designed environment (fixed elements such as flooring and lighting as opposed to temporary characteristics such as clutter or spills), on falls in hospitals.

Costs of Falls

Chang et al. estimated that the total cost of fall injuries for older people was $20.2 billion per year in the United States in 1994, and that by 2020 it would reach $32.4 billion (in 1994 U.S. dollars) (Chang, et al., 2004), while others put the 2020 costs at $43.8 billion (Englander, Hodson, & Terragrossa, 1996). Beyond total healthcare system costs, costs can be examined in terms of cost per fall. Swift (2001) found that older persons who fell and required hospitalization incurred, on average, a subsequent 18-day hospital stay (as cited in Ward, Candela, & Mahoney, 2004).

Finally, there are costs that are typically not included in the estimates presented above such as direct insurance costs and legal/liability costs and consequences to hospitals (National Center for Injury Prevention and Control, 2006; Zinn, 2003). "According to AON, patient falls/injuries and bed sores are never events that comprise a large portion of all HPL costs. Patient falls and injuries encompass 12.5% of total costs, and bedsores encompass 2.1% of total costs. Consequently, the *HPL claims from these two never events will cost an estimated $463 per hospital bed in 2010"* (Johnson, 2009).

Risk Factors

Fall risk is clearly a multimodal function. If a person is weak, he or she may fall while trying to get up from bed, even if there is a bedrail (which, it should be noted, are actually associated with increased fall rates). A loose rug or deep threshold at a doorway may cause a fully healthy and ambulatory individual to trip and fall and injure him or herself. Most often, it is a combination of factors that leads to a fall. Intrinsic factors include history of falls, difficulty in transfers or ambulating, dizziness and balance, delirium, visual impairment, polypharmacy (taking more than 6 medications), incontinence, and toileting frequency (Papaioannou, et al., 2004; Sattin, 1992; Nevitt, Cummings, & Hudes 1991; Tinetti, Speechley, & Ginter, 1988). Higher risks rates of falls in hospitals follow from an increase in falls in the general population, due in large part to the shift in demographics toward a more aged society.

The majority of hospital adult falls are related to intrinsic causes, with fewer than 10% to 15% caused by the environment alone (Hendrich, 2006). While there are some references that address extrinsic risk factors in healthcare settings, the vast majority of these studies employed a multimodal approach in the study, and thus there is virtually no evidence of the impact of a single environmental variable. Betrabet Gulwadi and Calkins (2008) produced an excellent summary of this literature. That report addressed factors related to the designed environment, interior characteristics, sensory aspects of the environment, and environment-in-use factors. One finding is that very few studies look at elements of the *designed* environment. The main reason is that the results of these studies are meant to be used by practitioners (medical care staff), who have limited ability to impact the designed environment.

Methodology

It was necessary first to construct an evaluation tool that would be appropriate for assessing the design of healthcare settings. The Falls Environment Evaluation Tool (FEET) was developed and reviewed by an expert Delphi panel in a cyclical process. Pilot-testing demonstrated inter-rater agreement ranged between .93 and .96. FEET is structured to assess over 40 environmental characteristics of the patient room. Some items are completed for each room individually, while others are completed in a typical room (e.g., color of the flooring).

In addition to the FEET assessment, the following information was requested for each unit: unit type (med-surg, cardio, orthopedic, etc.), total number of patient days for a preceding 12 months, and average age of patients on the unit during that 12-month period. The primary outcome variable was number of falls per patient room and was based on for the preceding 12 months (except in two cases of newly built hospitals). Because of the use of retrospective data, only falls that resulted in an incident report being filed were included.

It is possible that different hospitals used varying definitions of a fall, as research reported by Haines, Massey, Varghese, Fleming, & Gray (2009) suggests is quite common. Haines et al. further suggests that many events that would be classified as a fall by the World Health Organization are likely not recorded in incident reports. Thus, it is probably that the number of falls reported by each hospital under represents the total number of falls that actually occurred. In a prospective study, the definition and requirements for reporting incidents can be better controlled.

The final sample included 12 hospitals, 27 units, 670 patient rooms, and a total of 995 falls were included in the analysis. Because each unit had different number of rooms, the falls data were converted to number of falls per 1,000 patient days, thus providing comparable data across the different units. Falls per 1,000 patient days ranged from 0.0177 to 0.6552—which represents a 37-fold difference in fall rates, irrespective of unit size and total number of patients cared for.

Findings

There were several strong relationships that support current thinking about how the environment might impact falls. First, the presence of a bathroom that is only accessed by patients in one patient room is associated with significantly fewer falls than in rooms where either the bathroom is shared between two patient rooms ($p<0.000$) or there is no bathroom in the room at all ($p<0.002$).

The ability to have the bathroom door remain in an open position was significantly related to fewer falls. There were roughly twice as many falls per 1,000 patient days in rooms where the bathroom door had to remain closed to be out of the way of traffic as when the door could remain open and out of the way ($p<0.041$). Thus it is possible that patients with dementia, and possibly others, were better able to find and navigate to the bathroom when they did not have to manage opening a door. This is also supported by the finding of an almost 4.5-fold increase in falls when there was not 18 inches on the opening side of the bathroom door vs. when that space was available ($p<0.000$). Somewhat unexpectedly, there were more falls when the bathroom was on the headwall than on the footwall.

Having the toilet located on a sidewall in the bathroom was associated with fewer falls than when the toilet was directly across from the entrance ($p<0.032$). It may be that having to cross the bathroom to get to the toilet and possibly not having a continuous handrail to the toilet (which might be available with a toilet on a sidewall) makes a difference. Related to the location of the toilet is grab-bar location in the bathroom. There were more falls when there was only one wall-mounted grab bar in the bathroom ($p<0.000$). At the toilet, having two grab bars, one on each side of the toilet, appears to help prevent falls over having grab bars mounted on the walls of the bathroom. The effect size of these differences is strong, with almost 4 times more falls occurring with wall-mounted grab bars as when there are grab bars on both sides of the toilet.

Outside of the bathroom, there are other characteristics of the design of the patent room that are associated with fewer falls. A key finding is that there are roughly half as many falls in patient rooms that have a designated family area as rooms that have no designated family area ($p<0.01$).

Two characteristics of flooring were assessed. Pattern in the flooring was described as small (less than 1 inch wide), medium (1 inch – 6 inches wide), or large (wider than 6 inches). In the patient room, having medium-size pattern was associated with greater falls than no pattern, small pattern, or large pattern. Linoleum flooring in the bedroom was associated with significantly more falls than either vinyl composition tile (VCT) or vinyl ($p<0.000$). In bathrooms the rate of falls was 10 times higher for linoleum flooring than for VCT or ceramic tile.

At the level of the design/layout of the unit, visibility from the upper third of the bed to staff work locations was evaluated. Surprisingly, the rate of falls was significantly higher ($p<0.000$) for rooms with direct visibility to commonly occupied workstations than to infrequently used workstations or rooms with no direct. This is most likely due to policies that place patients with high fall risk in rooms closest to the nursing stations.

The last set of variables that showed a relationship to falls related to noise. Falls were significantly higher on units where alarms and overhead paging were rated as being heard frequently ($p<0.000$).

There were a number of variables that did not show any relationship to falls, such as nightlights, number of lights the patient can control, lighting, storage for wheelchair or walkers, and a few other small room features. This was expected, as the goal in this phase of the research was to be as inclusive as possible to see which characteristics of the design of the patient room appear to be associated with the rate of falls. These items will be eliminated in the next version of the FEET, making it a more manageable instrument to use.

There are also a number of limitations to this study that limit its generalizability. Some are related to the sample (convenience), some to the design of the study (disconnect between time of assessment and occurrence of a fall), and some to instrumentation (missing variable in the FEET and potential reliability or validity issues with some items).

Introduction

In-patient falls consistently compose the largest single category of reported incidents in hospitals, affecting from between 2% to 10% of annual hospital admissions (Hendrich, Nyhuis, Kippenbrock, & Soja, 1995). Patient falls in healthcare settings cause increased morbidity, mortality, and lengths of stay and have significant cost impacts. One study found that an estimated 30% of hospital-based falls result in serious injury (Stevens, 2005), while another found that 50% of elderly patients fall while hospitalized (Granger, 2005).

In addition, hospital-acquired injuries from falls in patients' rooms are covered in the list of Never Events published by the Centers for Medicare and Medicaid Services (CMS). Never Events are hospital-acquired conditions that the National Quality Forum defines as "errors in medical care that are clearly identifiable, preventable, and serious in their consequences for patients, and that indicate a real problem in the safety and credibility of a health care facility." Hospitals are held responsible for all Never Events and are denied complete reimbursement if one such event does occur. The CMS has identified falls with injury on its current list of Never Events (Condra & Cline, n. d.).

Thus, there is clear evidence of the importance of understanding the range of factors that impact falls and fall risk.

Fall risk is generally articulated in terms of intrinsic and extrinsic factors, and thus intervention studies typically focus on moderating intrinsic (poor balance, weakness, drug effects) and extrinsic (reducing barriers, eliminating hazards, adding external reminder cues) conditions. Intervention studies generally suggest that the most effective interventions are multimodal addressing multiple risk factors. The challenge with multimodal interventions, however, is that they limit ability to adequately estimate the impact from many individual variables, and often do not include variables that may be having a significant impact.

The aim of this study was to systematically examine the role of the physical environment of the patient room, and, more specifically, the designed environment (fixed elements such as flooring and lighting as opposed to temporary characteristics such as clutter or spills) on falls in hospitals. An exploratory approach was used, designed to include as broad a range of designed elements of the environment of the patient room as possible.

Background/Literature Review

Prevalence Rates of Falls in Hospitals

The statistics on the frequency and negative consequences of falls in hospitals are well-documented, although the data are reported in different ways, which makes comparison difficult. Hitcho et al. (2004) described prevalence in terms of falls per 1,000 patient days, and indicated the rate varies between 2.3 to 7 falls per 1,000 patient days. Another study used patient falls per 10,000 admissions, with ranges from 62 to 238 (Raz & Baretich, 1987). In their much-cited report on the prevention of falls in older adults, the American Geriatrics Society and the British Geriatrics Society (along with other organizations) found that the rate of falls reaches 1.5 per bed annually, which is almost 3 times the rate for community-dwelling elderly persons (American Geriatrics Society, British Society of Gerontology, and American Academy of Orthopaedic Surgeons Panel, 2001). Finally, Raz and Baretich (1987) found that patient falls account for 25% to 89% of all patient incidents reported in hospitals. Regardless of the structure of the reported data, it is clear that falls constitute a major issue in healthcare settings, particularly hospitals and long-term care settings.

One of the reasons why high fall rates are so alarming is the seriousness of the complications from falls. It has been estimated that 30% of inpatient falls result in injury, with 4% to 6% resulting in serious injury (Hitcho, et al., 2004). Hendrich et al. (1995) put this figure at 35%, clarifying that a serious fall is one that further compromises the patient's health status and increases healthcare costs by extending the length of stay and the complexity of the patient's care and rehabilitation (Hendrich, Bender, & Nyhuis, 2003; Morse, 1998).

Given that the No. 1 predictor of a fall is a previous fall in the prior 12 months, it is worth noting that in 2003 more than 1.8 million seniors were treated in emergency departments for falls, of whom more than 421,000 were hospitalized (HHQIOSC, 2008). Kane reports that of elders who fall, 1 in 40 will be hospitalized, and of those hospitalized, only half will be alive at the end of the year (Kane, Ouslander, & Abass, 1994). Thus, many people, especially seniors, are being admitted to the hospital with a fall history, which increases their risk for another fall significantly. Additionally, risk of hip fracture from a fall was found to be 11 times greater in hospital patients compared to those in the community (Papaioannou, et al., 2004). Finally, the Emergency Care Research Institute (ECRI) estimates that approximately 10% of all fall-related injuries occurred in healthcare institutions (ECRI, 2006), while Granger (2005) found that 50% of elderly patients fall while hospitalized. This is particularly serious, as the percentage of patient days in hospitals that are utilized by seniors is estimated to be roughly 48% (Agency for Healthcare Research and Quality, 2008).

Costs

Fall-related costs will be examined in terms of overall costs to the healthcare system (including primarily falls that occurred outside of the hospital) and as incremental costs associated with falls that occur in hospitals. The estimated cost of falls varies significantly, depending in large part on what, and who, is included in the costs. Starting at the higher end, Chang et al. (2004) estimated that the total cost of fall injuries for older people was $20.2 billion per year in the United States in 1994, and that by 2020 it would reach $32.4 billion (in 1994 U.S. dollars), while others put the 2020 costs at $43.8 billion (Englander, Hodson, & Terragrossa, 1996).

The Centers for Disease Control, meanwhile, estimated direct medical costs totaled $179 million for fatal and $19 billion for nonfatal fall injuries in 2002, but refers to all fall-related injuries, not just seniors (as cited in HHQIOSC, 2007). These figures are considerably more than the figure cited by Gilmore in 2000, who stated that falls occurring in older persons cost the healthcare community $406 million annually (as cited in Ward, Candela, & Mahoney, 2004).

Beyond total healthcare system costs, costs can be examined in terms of cost per fall. A decade ago, the average healthcare cost for a fall injury (without factoring in physician services) was close to $20,000 (Rizzo, Friedkin, Williams, Nabors, Acampora, & Tinetti, 1998) and it continues to rise. In 2004, Haumschild, Karfonta, Haumschild, Phillips, and Wilson (as cited in Ward, 2004) quantified the costs associated with patient falls at $22,000. These costs included: direct patient care, increased length of stay, patient claims, and rising insurance premiums. Swift (2001) found that older persons who fell and required hospitalization incurred, on average, a subsequent 18-day hospital stay (as cited in Ward, 2004).

It is also important to examine the costs of falls that occur in a hospital, as these are costs incurred *in addition* to the costs of other care being given. Of the $43 billion figure given above by Englander et al., they approximate that at least $3.6 billion of this is estimated to be from falls that occur within a healthcare setting (Englander, et al., 1996).

Finally, there are costs that are typically not included in the estimates presented above. First, risks of recurrent falls and injuries from falls present both direct insurance costs and legal/liability costs and consequences to hospitals (National Center for Injury Prevention and Control, 2006; Zinn, 2003). Prior to 2007, health professional liability [HPL] claims had been decreasing for 7 straight years, and then the trend reversed. In 2010, HPL claims will be approximately 2.06% per bed, about 5.3% higher than in 2006 when HPL frequency trends began to rise. AON, the leading global provider of risk-management services, suggests several different theories to explain the claim increases, including the downturn in the U.S. economy, changes to CMS reimbursement rules regarding Never Events, and changes in public sympathy toward healthcare providers.

Never Events, in particular, have received extra attention from attorneys representing clients because they have been designated by CMS as entirely preventable, and thus nonreimbursable. As a result, hospitals are perceived as having a significantly weaker defense against Never Event claims (Johnson, 2009). "According to AON, patient falls and injuries and bed sores are Never Events that comprise a large portion of all HPL costs. Patient falls and injuries encompass 12.5% of total costs, and bed sores encompass 2.1% of total costs. Consequently, the *HPL claims from these two never events will cost an estimated $463 per hospital bed in 2010***.** The large HPL costs of these select Never Events run in addition to the costs already incurred by the hospital due to CMS never event non-reimbursement" (Johnson, 2009)

Second, none of the above-mentioned costs account for the long-term consequences of these injuries to the people who fall, such as functional disability, decreased productivity, relocation to an assisted living or nursing home community, and/or reduced quality of life. (HHQIOSC, 2007). These costs are almost impossible to quantify, but surely should not be ignored.

Risk Factors

Fall risk is clearly a multimodal function. If a person is weak, he or she may fall while trying to get up from bed, even if there is a bedrail (which, it should be noted, is actually associated with increased fall rates). A loose rug or deep threshold at a doorway may cause a fully healthy and ambulatory individual to trip and fall and injure himself or herself. Most often, it is a combination of factors that leads to a fall. Betrabet Gulwadi and Calkins (2008) suggest that in developing a framework from which to examine fall risk, it is useful to refer back to Lawton and Nahemow's competence press model (1973). Adapting a model originally developed by Lewin (1951), they suggested events are the result of individual, environmental, and interactive factors, represented by the equation

$$B = f(P, E, (PxE))$$

In this model, B (behavior, or in this case, falls or fall risk) is the interface between P—the person (intrinsic factors), E—environment (extrinsic factors), and PxE—or the unique interaction between the person and the environment (for instance, how a person performs an activity or views the environment). Thus clearly, to impact B (falls) the most efficacious strategy would be to modify all the elements on the other side of the equation: P, E, and PxE. And indeed, most falls studies in healthcare settings examine, and occasionally manipulate, intrinsic, extrinsic, and interaction factors.

Intrinsic factors include history of falls, difficulty in transfers or ambulating, dizziness and balance, delirium, visual impairment, polypharmacy (taking more than 6 medications), incontinence, and toileting frequency (Papaioannou, et al., 2004; Sattin, 1992; Nevitt, Cummings & Hudes 1991; Tinetti, Speechley, & Ginter, 1988). Age is also a significant risk factor, although it is not age itself that is the risk. "Age alone does not predict fall potential for an individual. There are just as many 70-year-olds who play golf and swim each day as those who fall. Age appears to be a risk factor because it is often correlated with the true risk factor of altered or ineffective gait and mobility (Hendrich, et al., 2003). Thus, when the previously mentioned risk factors are coupled with decreased reflexes, decreased bone density, muscle stiffness, sensory changes, and other age-related health problems, patient falls among older persons produced more serious secondary problems than falls among younger persons (Radhamanohar, 2002). Further, risk increases as the number of these factors increases (Sattin, 1992; Nevitt, et al., 1991; Tinetti, Douchette, Claus, & Marottoli 1995; Tinetti, et al., 1988).

Thus, higher risks rates of falls in hospitals follow from an increase in falls in the general population, due in large part to the shift in demographics toward a more aged society.

The majority of hospital adult falls are related to intrinsic causes, with fewer than 10% to 15% estimated to be caused by the environment alone (Hendrich, 2006). The majority of identified extrinsic risk factors, especially environmental factors, are related to falls in the home or community. There are numerous excellent references for assessing environmental hazards at home (only a few are referenced here) (American Geriatrics Society, British Society of Gerontology, and American Academy of Orthopaedic Surgeons Panel, 2001; Bakker, Iofel, & Lachs, 2004; Chang, et al., 2004; Gillespie, 2004; Kochera, 2002; MacDonell, 2005; National Institute on Aging, 2004). Unfortunately, the vast majority of recommendations in these resources are simply not applicable to a hospital setting where there are no throw rugs, steps are minimized, lighting is generally good, etc.

There are some references that address extrinsic risk factors in healthcare settings, particularly hospitals. The vast majority of these studies, however, employed a multimodal approach in the study, and thus there is virtually no evidence on the impact of a single environmental variable. Betrabet Gulwadi and Calkins (2008) produced an excellent summary of this literature, and thus only highlights will be summarized here. In this report, environmental factors were divided into spatial organization, interior characteristics, sensory attributes, and use of environment. Table 1in the Appendix provides a summary of their literature review on environmental factors associated with falls in healthcare settings.

Spatial Organization of the Environment

Factors pertaining to the spatial organization of rooms and spaces within the healthcare setting mentioned in the literature include the layout of the unit (e.g., proximity of nurse station to high fall-risk rooms), layout of the patient room, layout of the bathroom, and location of the bathroom within the room. At the scale of unit design, Hendrich (2006) suggests that inefficient work processes (hunting and gathering supplies), the physical distance nurses travel on a hospital unit to care for patients, as well as the location of staff workstations impact the ability of nurses to implement fall-prevention strategies. The combination of a unit design that incorporated shorter distances, decentralized storage, and had workstations adjacent to all patient rooms (along with other organizational changes) reduced falls by 75% over 5 years. Angled doorways and room layouts that provided patients with better sightlines were associated with a 6% reduction in falls at the Barbara Ann Karmanos Cancer Institute in Detroit, MI (Livingston, 2004).

Brandis (1999) found that 24% of inpatient falls occur in bathrooms. It has been hypothesized that having the bathroom on the headwall, especially with a clear and supported path to the bathroom, will decrease falls, though there is not yet solid evidence to support this. Acuity-adaptable rooms, which can significantly reduce the number of patient transfers, may also be associated with a reduction in falls (Hendrich, Fay & Sorrells, 2004).

The major challenge with research at this level of design is that it basically requires a whole new building—which necessarily also changes many other aspects of the setting. Thus is it very difficult to identify the role that specific design features have on a reduction in falls.

Interior Characteristics of the Environment

Despite the fact that interior features of the environment, such as the type of flooring, furniture, and presence of safety features, such as call lights, are more easily modified and studied, there are still only a few well-controlled studies examining the impact of a specific variable on falls in hospitals.

Flooring

There are no studies specifically examining the effects of flooring on risk of falls in healthcare facilities, although flooring is mentioned as a risk factor in some multimodal interventions.

Dickinson, Shroyer, & Elias (2002) studied the effect of commercial grade carpet on postural sway and balance strategy among 45 healthy older adults who had not fallen more than twice in the 6 months preceding the study and concluded that carpeting, in and of itself, may not be a fall risk factor. Further, carpeted floors are associated with fewer fall injuries than vinyl floors (Healey, 1994, as cited in Lord et al., 2001).

Perritt, McCune, and McCune (2005) studied carpeting with different piles (depth) and patterns with a sample of 107 older adults with dementia who either participated in adult day health programs or lived in a shared residential facility. Carpeting with high contrasting patterns was associated ($p<.0001$) with more incidents (stumbles, reaching for handrail, veering, purposeful stepping, pausing, stopping) than carpeting with low-contrast patterning.

Describing a multimodal intervention for preventing falls in nursing homes, Theodos (2003) reports that transitions in flooring—for example, from carpeting to hard flooring surfaces—could also be a risk factor. Hazards such as contact between rubber tips of canes or crutches and the flooring have also been pointed out (Burnside, 1981).

Furniture

The literature suggests that the presence and location of furniture may be associated with a risk of falling, though the vast majority of literature is focused on home environments, not healthcare settings. Of relevance here is one study that suggested appropriately locating furniture in each space so as to prevent it from becoming an obstacle and to enable clear circulation paths within the patient room (Newton, 2003). The depths, heights, and sizes of furniture in the patient room may impact their supportiveness in independent use, transfer, and daily activities (Tideiksaar, 1998; Shroyer, Elias, Hutton, & Curry, 1997; cf. Dickinson et al., 2004).

Unlocked bed wheels and unstable furniture (e.g., medical equipment and IV poles, over-bed tables that move when grasped for support) have also been identified as risk factors in the literature (Quang Vu, Weintraub, & Rubenstein, 2004; Theodos, 2003; Morse, 1987). Tideiksaar (1998) also mentions factors such as sagging bed mattress edges (increases the possibility of fall when transferring,) and shelf layouts in closets (having to reach high or bend low to retrieve objects from high or low shelves) as risk factors. Braun and Capezuti (2004) suggest that low beds that can be elevated electronically for transfer and activities of daily living may mitigate fall risk. None of these factors have been examined empirically.

Assistive Environmental Features for Ambulation

Fixed assistive features in the patient environment such as adequate and appropriately secured handrails and guardrails in the bathrooms, corridors, and pathways are considered supportive factors for fall prevention. A lack of handrails and guardrails in the home environment has been associated with risk factors for falls (Marshall, Runyan, Yang, Coyne-Beasley, Waller, Johnson, & Perkis, 2005). Lord et al. (2001) include handrails in their list of environmental interventions for fall prevention. No research was found that specifically linked the presence, absence, or location of handrails in healthcare settings to fall rates.

Sensory Characteristics of the Environment

Many people in healthcare settings experience changes to or deficits in their sensory systems—either as a reaction to medications and/or treatment or because of age-related declines in sensory systems—that can impact fall risk.

Visual Environment

Lighting is a significant part of the patient's experience in the space. Poor lighting is a key risk factor for falls mentioned by Quang Vu et al. (2003), Rogers, Rogers, Takeshima, & Islam (2004), and Tideiksaar (1998). Creditor (1993) refers to subdued lighting as a risk factor for recently hospitalized elderly, causing delirium among those who may have left their eyeglasses behind at home, for example. Meyer, Eveloff, Bauer, Schwarts, Hill & Millman (1994) measured light levels in respiratory and medical intensive care units (ICUs) in a hospital setting and looked in particular for peak light levels that could disrupt sleep patterns. Disrupted nighttime sleep has been associated with daytime sleepiness and linked as a potential risk factor for falls among community-dwelling older adults (Brassington, King, & Bliwise, 2000). However, Meyer et al. found that peak light levels in the ICUs were dependent on window orientation and shading and coincided with daytime-nighttime rhythms, thereby not influencing sleep disruption in the hospital.

Contrast between surfaces for visual acuity is another factor that influences a risk for falls (Harwood, 2001). There is much evidence to indicate that dementia is associated with a deficit in contrast sensitivity function (Gilmore, 1996; Gilmore, Neargarder, & Morrison 2005). Ivers, Mitchell, & Attebo (1998) found independent relationships between poor vision and reduced contrast sensitivity and recurrent falls.

Auditory Environnent

Meyer et al. (1994) studied the sound levels in a medical ICU, a multiple bed respiratory care unit (RCU) room, a single bed RCU room, and a private room. Peak daytime and nighttime sound levels were significantly higher than recommended values by the Environmental Protection Agency as acceptable for a hospital environment. Nighttime noise peaks that disrupt sleep patterns may lead to increased drowsiness the next day, which could increase fall risk. However, no research was identified that explored the impact of various noise factors specifically on fall rates.

One takeaway from this brief review of the literature is that very few studies look at elements of the designed environment. Table 2 in the Appendix is from the Veterans Administration Falls Policy Toolkit, and identifies "environmental intervention strategies" (U.S. Department of Veterans Affairs, 2004, p. 35). This is common of a number of other falls resources, which list no aspects of the *designed* environment. The main reason is that these types of studies are designed to be used by practitioners, who have only limited ability to impact the designed environment.

In summary, the existing literature is relatively weak in identifying the impact that the designed and built environment might have on falls. While a number of features are identified as potentially impacting falls or fall risk, virtually no studies actually link these factors with differences in fall rates. Thus, the goal of the current exploratory study is to identify what factors of the designed environment of patient rooms are associated with greater fall risk. No characteristics of the patients who fell/did not fall are considered in this study—only the aspects of the built environment that are associated with greater or fewer falls. This is considered a preliminary study, with the next phase being a prospective study that includes data on environment-in-use factors (liquid on the floor, patient activity at time of falls, presence of other people in the room, etc.).

Methodology

This study was reviewed and approved by the IDEAS Institute Institutional Review Board, which is registered with the Office for Human Research Protections. In addition, it was also reviewed by several hospitals that had their own IRBs.

Instrument Development

The vast majority of existing environmental assessment tools for falls relates to home and community-based settings. Therefore it was necessary first to construct an evaluation tool that would be appropriate for healthcare settings. Drawing on both home-assessment tools and the items identified in the literature review by Betrabet Gulwadi and Calkins (2008), a preliminary version of the Falls Environment Evaluation Tool (FEET) was developed. At this stage the focus was on identifying as many potential factors as possible. Once developed, this alpha version was subjected to two rounds of review by a Delphi panel. Members of the Delphi panel included:

- Rein Tdeiskaar, PhD, president of Fall Prevent, LLC, and an expert in the area of fall prevention
- Mary Matz, MSPH, IH, patient care ergonomic program specialist for the Veterans Health Administration; a nationally recognized expert in patient care ergonomics; and co-author of several peer-reviewed papers on the subject
- Elizabeth A. Capezuti, PhD, RN, FAAN,
- Dr. John W. Rowe professor in successful aging at NYU College of Nursing
- David Stewart, AIA, NCARB, LEED AP, project designer for the national architecture, engineering, interior design, and planning firm Gresham, Smith, and Partners (GS&P)
- Erin Lawler, human factors engineer, Department of Defense Patient Safety Data Analysis Center

Members reviewed the first draft of the FEET and returned it. It was revised in terms of inclusion of some additional items and clarification of language, and returned to the Delphi panel for a second round of review. Determination of whether a third (or fourth) round of review was needed was set at more than 5% of items having suggested revisions by the Delphi panel. After the second revision and review, there were only two items (3%) that were identified as still needing revision. Accordingly, the FEET was then piloted.

The first pilot test consisted of the PI (Calkins) who had primary responsibility for developing the FEET, and another researcher (Brush) who had not been involved in its development, testing the instrument on one unit at a local hospital. Each person completed the FEET assessment independently. When the unfamiliar researcher had a question, she first answered it as best she could, and the item was discussed and notes were made on one of the copies of the FEET. Inter-rater agreement was calculated at .96, although this was somewhat artificially high because of the discussions during the assessment. The FEET was then revised once more.

The second test of the FEET involved the PI and staff with no knowledge of the FEET at a different hospital. This time the assessments were completed totally independently. After the assessments were completed, the PI and hospital staff reviewed items they had had questions on, but no responses were changed. Interrater agreement of this version was .93. This was well-above the .80 level that was set by the protocol.

For both tests of interrater agreement, most questions had near perfect agreement. This is likely because (1) the vast majority of the FEET items were very objective and (2) the instructions for measurement for each question were included on the assessment tool, so there was no need to remember how to measure something. For example, the question below explains exactly where to sit on the bed to determine visibility from the bed to the toilet or bathroom.

Visibility between the bed(s) and the toilet room.

Please check the cell that best described the visibility from the bed to the toilet room. If the room is a shared room, please check 1 cell for each bed location. If the room is used as a private room, check the cell in the private room column. We use "center of the bed" here, because when someone sits up to go to the bathroom, this is where he or she are typically situated to begin the journey to the bathroom.

	PRIVATE ROOM	SHARED ROOM	
		HALL SIDE BED	WINDOW SIDE BED
Direct visibility from center of bed to toilet			
Direct visibility from center of bed into bathroom, but not to toilet			
Visibility to bathroom door			
Bathroom door not visible from center of bed			
No bathroom in patient room			

Those items that were had lower interrater reliability included "clear path to the bathroom" (uncertainty as to what was meant by "clear" vs. "obstructed," and inability to know if it varied from room to room and from time to time), "bathroom layout" (specifically when it was an atypical shape), and "light levels" (a function of where the light meter was placed, differences in daylight into the room, and whether all interior lights were turned on or off). Each of these questions was revised prior to the assessments in the hospitals to provide more clarity.

Recruitment

Hospitals were recruited through multiple means, including personal contacts, referrals from the Delphi panel, referrals from the funder, presentations at conferences, and cold calls to hospitals in the northeast Ohio and western Pennsylvania region. Recruitment was more challenging than anticipated, especially given the emphasis hospitals place on reducing falls at this time. At one conference for Nurses Improving Care for HealthSystems Elders (NICHE), over 100 business cards were collected from individuals indicating interest in participating. With repeated follow-up, only two of these hospitals actually participated. Using the Hospital Compare page on Medicare.gov (http://www.

hospitalcompare.hhs.gov/hospital-search.aspx) we identified 32 hospitals in the northeast Ohio region, and contacted all to participate. Only one agreed.

Measures and Data

The primary measure was the FEET: Falls Environment Evaluation Tool. This is a paper-and-pencil measure that requires the use of a tape measure and light meter to complete. The FEET is divided into three sections. Section 1 includes the main evaluation (which provided the most detailed information) for each patient room type (e.g., single vs. double, corner rooms, different bathroom configuration, etc.) because a given hospital unit is typically designed and built at one time, there is often much consistency between rooms. Some units had one room type, while some had up to 11 room types. It takes about 1 hour to complete the first evaluation of a room type. Other rooms of the same type were only assessed if there was an unexpected change (e.g., in some units different bathroom flooring had been installed in random rooms). Section 2 included questions that needed to be answered for every room (visibility from bed to staff workstations and position of privacy curtains). Section 3 related to lighting and required a light-meter reading in rooms facing different cardinal directions. If the window size was not consistent in all rooms or there were other mitigating factors (columns partially blocking windows), then readings were made for each room or condition. In addition, the FEET includes photographic documentation of the rooms. This was important because in many hospitals, the FEET data were collected by hospital staff and the researchers were never on site.

In addition to the FEET assessment, the following information was requested for each unit: unit type (med-surg, cardio, orthopedic, etc.), total number of patient days for a preceding 12 months, and average age of patients on the unit during that 12-month period. The primary outcome variable was location of falls by patient room, and was generally provided for the preceding 12 months (although in a few newly constructed hospitals, data were reported only for a 6-month period, allowing for a 6 month move-in adjustment time where falls were not included). Several hospitals did not track that data electronically, which required someone to go into the patient records and determining what room the patient had been in when the fall occurred.

Analysis

Sample

The final sample included 12 hospitals, including community hospitals as well as academic training hospitals. They were located primarily in the mid-Atlantic and Midwest regions, although one was in Florida and one was in the Northwest. Between 2 and 5 units were assessed at each hospital. Obstetrics and pediatric/adolescent units were excluded, but any other type of unit was included. Hospitals generally chose their units with the highest number of falls. The specific types of units that data were collected on are listed in Table 3 in the Appendix.

Hospitals ranged in their case mix from 1.213 to 1.855, with one outlier at 2.325. In all there were 670 patient rooms that were assessed, and a total of 995 falls were included in the analysis. The only patient data that were collected was average age of patients on the different units, which ranged from 53 to 79 (mean 65). Each unit also provided the total number of patient days, which ranged from 727 to 17,097. The total number of falls per unit ranged from 4 to 110. One reason for the wide distribution is that 3 units only provided data for 6 months.

Because each unit had different number of rooms, the falls data were converted to number of falls per 1,000 patient days, thus providing comparable data across the different units. Falls per 1,000 patient days ranged from 0.0177 to 0.6552—which represents a 37-fold difference in fall rates, irrespective of unit size and total number of patients cared for. This is significantly fewer falls than has been reported in the literature (Hitcho, et al., 2004). One reason might be the intense interest over the past decade to reduce the prevalence of falls in hospitals. Virtually every hospital now has a falls assessment and prevention program, and many have a falls committee that meets regularly to review and analyze falls and develop protocols to minimize any identified risks.

While the unit of analysis is the individual patient room, rooms on a unit typically share a majority of characteristics. However, for no unit were data for every room identical, because at a minimum location within the unit relative to staff work areas always varied. This can lead to unequal sizes in various response categories. Table 4 provides descriptive of most of the variables included in the study. Some variables (such as length and width of room, or windows, or the Munsell rating of the value of the flooring) are not provided as they are not meaningful as frequencies. Also a few variables that had virtually no variance (what lights can the patient control from the bed, ability to control window treatment from bed, ability to control HVAC from bed) are also not presented.

An analysis was conducted to determine if the rate of falls on the different units was normally distributed. The mean and stand deviations (SDs) of the number of falls per 1,000 patient days was calculated, and the distribution is roughly normal, with a slight kurtosis (0.03) (See Table 5).

Description of Analyses

Several methods of statistical analyses were used to determine whether patient room variables had a significant relationship with the number of falls per 1,000 patient days in individual rooms. An Independent *t* test was used to determine if there was a significant difference in a categorical variable containing two groups and the number of falls per 1,000 patient days in individual rooms. A one-way analysis of variance (ANOVA) was used to determine if there was a significant difference between a categorical variable containing three or more independent groups and the number of falls per 1,000 patient days in individual rooms.

In addition, Fisher's least significant difference (LSD) post-hoc tests were used to determine if there were significant differences between the groups in the number of falls per 1,000 patient days in individual rooms. A Pearson product-moment correlation coefficient test was used to determine whether a significant relationship between a continuous metric variable and the number of falls per 1,000 patient days in individual rooms was present and, if so, whether there was a positive or inverse relationship between the two variables.

Findings

There were several strong relationships that support current thinking about how the environment might impact falls. Since there is evidence that a significant proportion of falls occur related to bathroom use, those results will be presented first. Note that when a mean value is presented (e.g., $\mu=0.0139$) this refers to the number of falls per 1,000 patient days. In some cases, the sample sizes within a given variable were quite uneven, which suggests additional caution in generalizing the results. When appropriate, sample sizes are provided. Finally, Tables with specific analyses for significant results are presented in the Appendix.

First, the presence of a bathroom that is only accessed by patients in one patient room is associated with significantly fewer falls ($\mu=.0127$) than in rooms where either the bathroom is shared between two patient rooms ($\mu=0.0708$, $p<0.000$) or there was no bathroom in the room at all ($\mu=.0819$, $p<0.002$). Codes now require a bathroom for every patient room, so this isn't much of a new design criterion; however, it is always nice to have the codes validated (see Table 6).

Bathroom location, inboard (on the corridor side of the room) or outboard (on the exterior wall) and on the headwall or footwall was assessed. ANOVA did not identify any significant differences between these four conditions. However, there were more falls when the bathroom was on the headwall than on the footwall (see Table 7). When both headwall ($n=505$, $\mu=0.021$) and opposite wall ($n=142$, $\mu=0.009$) conditions were combined, the difference in falls was significant ($p<0.001$).

This seems counterintuitive, but in a shared room, the patient in the bed furthest away from the bathroom always has to travel past the other bed, which might mitigate the impact of not having to cross the room to get to the bathroom. So the analyses were rerun looking just at private rooms, but the pattern remained. Falls per 1,000 patients days were higher ($\mu=0.0132$) when the bathroom was located on the headwall than on the footwall ($\mu=0.0090$, $p<0.039$).

Visibility to the bathroom from a sitting position at the center of the bed was also assessed separately for private and shared rooms, but was not significant in any conditions.

While visibility to or into the bathroom didn't show strong correlations, the ability to have the door remain in an open position did. There were roughly twice as many falls per 1,000 patient days in rooms where the bathroom door had to remain closed to be out of the way of traffic (n=401, μ=0.0215) as when the door could remain open and out of the way (n=256, μ=0.0128, p<0.041) (see Table 8).

In nursing homes, increasing visibility into bathrooms has been shown to have a significant impact on the ability of individuals with dementia to successfully find and use the bathroom (Namazi & Johnson, 1992; Calkins, 2010).

Thus, it is possible that patients with dementia, and possibly others, were better able to find and navigate to the bathroom when they did not have to manage opening a door. This is also supported by the finding of an almost 4.5-fold increase in falls when there was not 18 inches on the opening side of the bathroom door (μ=0.058) vs. when that space was available (μ=0.012, p<0.000) (see Table 9). Again, this space is now required in accessible rooms by the Americans with Disability Act (ADA) Accessibility Guidelines, and the data certainly confirm the importance of this design characteristic.

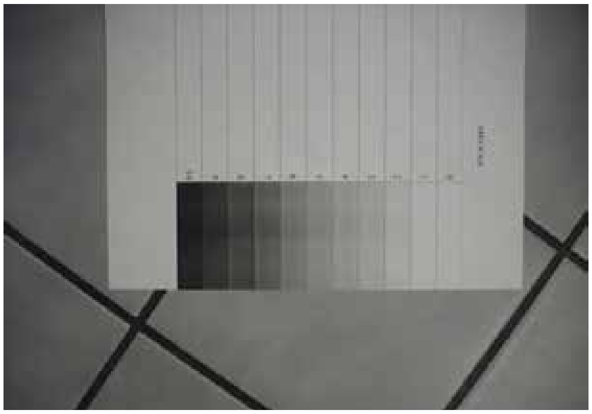
Beyond just visibility, the presence of a supported path from the bed to the bathroom has been the subject of recent discussion and designs. Since a high percentage of falls occur related to getting to the bathroom, it has been hypothesized that providing a clear path and supportive handrail from the bed to the bathroom would reduce falls. The data neither confirms nor supports this hypothesis. There were marginally fewer falls in rooms that had a handrail from bed to bathroom (μ=0.014, n=34) than in rooms that did not (n=623, μ=0.018,), which was not significant (p<0.429) (see Table 10). But there was only one unit in the study that had this feature, so other factors may account for more of the variance in fall rates. Similarly, rooms (n=16) that had a ceiling lift had marginally fewer falls (μ=.013) than rooms (n=640) that did not (μ=0.018), also not significant (p<0.217) (see Table 11). Finally, rooms that were rated as having a clear path from the bed to the bathroom (n=399, μ=0.021) had slightly more falls than rooms that did not have a clear path (n=254, μ=0.013), again not significant ($p<0.063$) (see Table 12). While the first two variables at least trend toward the hypothesized direction (fewer falls with supported path or ceiling lift), the clear path is counterintuitive. It is worth noting that this variable required some interpretation on the part of the rater (what counted as "in the path") and was dependent in part on what was in the room that was being assessed, which may not be what was in the room at the time of any falls. Therefore, the reliability and validity of this item may be questionable.

The design of the bathroom, and specifically the location of the toilet, was assessed. The toilet could be described as being in one of three locations: directly across from the doorway, on the opposite wall from the door but not directly across from the door, or on a sidewall from the door. While the overall model was not significant ($p<0.078$), having the toilet on a sidewall ($\mu=0.011$) was associated with fewer falls than when the toilet was directly across from the entrance ($\mu=0.022$, $p<0.032$) (see Table 13). It may be that having to cross the bathroom to get to the toilet, and possibly not having a continuous handrail to the toilet (which would be more likely to be available with a toilet on a sidewall) makes a difference. When the two categories of "toilet on wall across from the door" were combined, the relationship was significant ($p<0.032$).

Related to the location of the toilet is grab-bar location in the bathroom. Because of the importance of this design feature, the question was asked in two different ways, once for the bathroom as a space, and once specifically for grab bars around the toilet. In terms of number and location of grab bars in the bathroom, having only one grab bar in the bathroom was associated with greater falls. The mean number of falls when there was only one grab bar was 0.036, while having two ($\mu=0.012$, $p<0.000$), three ($\mu=0.009$, $p<0.000$), or four ($\mu=0.012$, $p<0.000$) grab bars were associated with fewer falls (see Table 14).

At the toilet, having two grab bars, one on each side of the toilet, appears to help prevent falls. While there was no significant difference between "2 grab bars mounted on either side of the toilet not attached to the sidewall (either fold down or permanent" ($\mu=0.009$) and "grab bars mounted to a toilet seat riser" ($\mu=0.008$), each of these was associated with significantly fewer falls than "2 bars mounted on the wall, one to the side of the toilet and one at the back of toilet" ($\mu=0.010$, $p<0.001$) and "1 grab bar mounted on wall next to toilet" ($\mu=0.039$, $p<0.000$) (see Table 15). The effect size of

PICTURE 1
Mussel color chart on floor
On this floor, the tile was rated 5, and the grout a 10. This was considered a small pattern.



PICTURE 2
Large scale floor pattern
This was considered a large pattern.

these differences is strong, with almost 4 times more falls occurring with wall-mounted grab bars as when there are grab bars on both sides of the toilet. This clearly suggests that having two bars along either side of the toilet may be protective against falls, over grab bars mounted on walls. These were also checked using the size of the bathroom as a covariate, but bathroom size was not found to be significant.

The presence and design characteristics of a shower in the bathroom were associated with falls. Surprisingly, a shower with a zero threshold entrance was associated with more falls (μ=0.031) than either a bathroom with a shower with a threshold (μ=0.012, p<0.000) or not having a shower at all (μ=0.015, p< 0.040) (see Table 16).

Outside of the bathroom, there are other characteristics of the design of the patient room that are associated with fewer falls. A key finding is that there are roughly half as many falls in patient rooms that have a designated family area (μ=0.012) as rooms that have no designated family area (μ=0.021, p<0.015) (see Table 17).

Flooring in both the patient room and the bathroom were assessed on three levels: value (or lightness or darkness of the flooring), size of any pattern in the flooring, and amount of contrast (lightest value to darkest value). The color value (light to darkness) of the flooring was rated on a 10-point Munsell gray scale (see Picture 1). In the bedrooms, there was no pattern as to which values were associated with greater or fewer falls (see Picture 2). In the bathroom, one Munsell gray scale value (7) stood out as being associated with greater falls.

However, there were only two units that had this value of bathroom flooring, and those units were both at the top end of number of falls per 1,000 patient days. It would be premature, given this data set, to conclude that the value of the bedroom bathroom floor is directly associated with a higher fall rate.

Pattern, however, did seem to make a difference, particularly in the bedroom. Pattern in the flooring was described as small (less than 1 inch wide), medium (1 inch – 6 inches wide), or large (wider than 6 inches) (see Picture 2). In the patient room, having a medium-size pattern ($\mu=0.082$) was associated with greater falls than no pattern ($\mu=0.019$, $p<0.008$), small pattern ($\mu=0.010$, $p<0.003$), or large pattern ($\mu=0.016$, $p<0.006$) (see Table 18). These results should be taken with caution, and the number of rooms with medium pattern was quite small ($n=8$) compared to the other groups (n's ranging from 76 to 484).

In terms of flooring material, rooms that were identified as having linoleum had significantly more falls ($\mu=0.064$) than either VCT ($\mu=0.014$, $p<0.000$), or vinyl ($\mu=0.009$, $p<0.000$) (see Table 19). There were relatively few rooms with linoleum ($n=79$ out of a total of 664 rooms), and an examination of the photos of these units do not suggest any reason why they would be associated with more falls (e.g., they do not appear to be shinier/more reflective). But this relationship also held true in bathrooms, where the mean number of falls was more than 10 times higher for linoleum flooring ($\mu=0.192$) than for VCT ($\mu=0.014$), or ceramic tile ($\mu=0.009$, $p<0.000$) (see Table 20). It is possible that these linoleum floors have a lower coefficient of friction (i.e., were more slippery) than the other floors, though this was not tested in any way.

At the level of the design/layout of the unit, direct visibility from the upper third of the bed to staff work locations was evaluated. Direct visibility was defined as "a clear and unobstructed view from where a staff person is likely to be in the work area (e.g., seated or standing behind desk). Answer this question as if all privacy curtains are open/pushed back against the wall. The 'upper third of the bed' is where a person's head, chest, and hands would normally be positioned, which is what staff want to be able to monitor for distress or unsafe acts." This was evaluated for each bed in each room. Results were significant for private rooms, though not for shared rooms. The rate of falls was significantly higher ($p<0.000$) for rooms with direct visibility to commonly occupied workstations ($\mu=0.032$) than to infrequently used workstations ($\mu=0.015$, $p<0.012$) or rooms with no direct visibility ($\mu=0.012$, $p<0.000$) (see Table 21).

An earlier analysis conducted on a partial data set found 4 times more falls in shared rooms than in private rooms. However, with the complete data set, this difference, while still significant ($p<0.027$) showed only twice as many falls in shared rooms ($\mu=0.025$) than private rooms ($\mu=0.013$), which is likely due to higher census in shared rooms (see Table 22).

The last set of variables that showed a relationship to falls related to noise. There were four noise variables: earphones for the TVs, ceiling treatment, frequency of overhead paging, and frequency of alarms. The first two variables, described here, each had significant sample size issues, and thus should be taken with caution (and hence these results are not presented in a table). TV earphones were not related to fall rates, but there were very few instances where earphones were used regularly ($n=54$) or sometimes ($n=18$), while they were seldom or never used by a much larger number of rooms ($n=593$). Unequal sample size may be impacting this result. Ceilings were described as having acoustic tile ($n=563$), drywall ($n=102$), or acoustic treated drywall ($n=0$). Acoustic tile was associated with greater falls ($\mu=0.0202$) than drywall ceilings ($\mu=0.0114$, $p<0.007$).

When paging was rated as occurring "frequently," falls were statistically higher ($\mu=0.072$) than when paging was "moderately frequently" ($\mu=0.012$), "infrequently" ($\mu=0.011$), and "almost never used" ($\mu=0.013$) ($p<0.000$ for the whole model as well as for each individual paired relationship) (see Table 23). The results were essentially the same for audible alarms: falls occurred 5 times as often when alarms occurred "frequently" ($\mu=0.054$) than when there were rated as "moderately frequently" ($\mu=0.011$), "infrequently" ($\mu=0.001$), and "almost never" ($\mu=0.00207$, p<,0.000) (see Table 24).

There were a number of variables that did not show any relationship to falls, such as nightlights, number of lights the patient can control, lighting, storage for wheelchair or walkers, and a few other small room features. This was expected, as the goal in this phase of the research was to be as inclusive as possible to see which characteristics of the design of the patient room appear to be associated with the rate of falls. These items will be eliminated in the next version of the FEET, making it a more manageable instrument to use.

Multivariate Analyses

Several multiple regression models were run to determine the amount of variance explained by the environmental variables. The initial model used a backwards method that entered the 18 most significant individual variables. These included:

S1Q39	How often are other audible alarms (elevators, call bells) heard in the patient room?
S1Q17	Which of the following best describes the handrails in the bathroom?
S1Q14	Which of the following best describes the handrails/supportive devices for mobility in the patient room?
S1Q16	Are there supportive devices (ceiling lift) to support mobility from bed to bathroom?
S1Q24	Does the flooring in patient room have a pattern?
S1Q3	Which best describes the bathroom option for this room?
S1Q9	Bathroom layout
S1Q2	Is this a shared room?
S1Q18	Which of the following best describes grab bar(s) around the toilet?
S1Q15	Is there a continuous handrail from bed to bathroom?
S1Q6	Are there supportive devices to support mobility from bed to bathroom?
S1Q7	If the door is a swing door, is there at least 18" of space adjacent to the opening side of the bathroom doorway as it opens toward the individual?
S1Q38	How often is overhead paging audible within patient room (with door open)?
S1Q13	Is there a designated family area in the room?
S1Q8	Path to bathroom
S1Q37	Which best describes the ceiling?
S1Q4	Which best describes the location of the bathroom?
S1Q12	Is there a designated storage for a wheelchair or walker in the patient room?

Together all 18 variables accounted for 23.7% of the variance in falls in patient rooms. Removing 7 variables reduced the total variance to 23.3%. (See Table 25)

A stepwise multiple regression analysis was conducted with the most significant 9 variables. They were entered into the model in the following order:

S1Q37	Which best describes the ceiling?
S1Q38	How often is overhead paging audible within patient room (with door open)?
S1Q4	Which best describes the location of the bathroom?
S1Q3	Which best describes the bathroom option for this room?
S1Q18	Which of the following best describes grab bar(s) around the toilet?
S1Q9	Bathroom layout
S1Q7	If the door is a swing door, is there at least 18" of space adjacent to the opening side of the bathroom doorway as it opens toward the individual?
S1Q17	Which of the following best describes the handrails in the bathroom?
S1Q2	Is this a shared room?

As seen in table 26, the first variable, ceiling treatment, accounts for 12% of the variance in predicting the rate of falls in patient rooms, and the full model with the 9 variables accounts for 22% of the variance. The ANOVA (Table 26) indicates these are all significant to $p<.000$. While 22% is not a significant amount of variance, it must be remembered that this study *only* looked at the role of the designed environment. This is only one part of the multifactorial system of elements that impact fall risk.

Limitations of the Study

As with any research project, especially exploratory ones, there are a number of aspects of the research that limit generalizability. First this represents a convenience sample of hospitals and units. No attempt was made to identify a sampling frame that included representational proportions of different types of hospitals. Nor were the units selected on any specific basis, except that they typically reflected the hospitals units with the highest fall rates.

Second, clearly, the absence of any patient or staffing data means there are any number of variables that might account for difference in fall rates between different hospitals and different units besides the design factors considered here. A secondary analysis of this data using a within-unit framework may shed some light on this by controlling for some of those factors. On a related note, most of the hospitals have a practice of placing individuals who are known to be high fall risk in rooms closest to the nursing station, so staff can more easily see when they are getting out of bed or moving around the room. Two units had a specifically designed “fall room,” which had glass windows and a place for staff to be adjacent 24/7. Thus the finding of higher numbers of falls in rooms with staff visibility is undoubtedly confounded by where high fall-risk patients are placed within the unit. Further, there may have been discrepancies in what was recorded and reported as a fall between different hospitals. Since the data were retrospective, and hospitals differed on what data they record at the time of the fall, it is possible that differences in data collection impacted the number of falls reported, leading to either an under- or over-reporting of incidents.

Third, it was not possible to identify where in the patient room falls occurred, or what activity the patient was engaged in at the time of the fall. So, for instance, the finding that there were more falls in rooms where the shower in the bathroom had no threshold may be completely spurious, since we do not know if any of the falls occurred in or around the shower. This type of information will be included in the next phase of this research. Related to this, it was not possible to obtain data on number of patient days by specific room. Patient days counts are typically compiled for units, and if there were rooms that were less frequently used, they may have been attributed more “patient days” than were actually used.

Fourth, although some interrater reliability tests were conducted, these were rather limited. Thus it is possible that there is instrumentation error, and that staff at hospitals who competed the FEET responded differently than IDEAS Institute staff would have had they done the assessment. This was not an unintentional oversight. Rather it was expected that this first full version of the FEET would be rather longer and more cumbersome than it ideally would be in the future. Before the next phase of this research, the FEET will be revised, simplified, and shortened to the elements that appear to be most related to falls. More rigorous validity and reliability tests will be done at that time. Further, despite the rigorous and cyclic reviews of the FEET, several items were omitted: width of the bathroom door, height of the toilet seat, 18 inches space at the opening side of both the bedroom and bathroom doors, type of window treatment and typical position (open or closed or partial). Finally, the phrasing of several questions could have been made clearer: window size should have specified measuring only the glazed area, not the window frames, and greater specification of where in the staff work areas staff could be to see a patient to have it count as "visible."

While the unit of analysis was the individual room, there is clearly much less within-unit variability than between-unit variability. Therefore, if 1 or 2 units had a high (or low) rate of falls per 1,000 patient days, any unique characteristics of these units might show as statistically significant, where in fact the relationship is spurious. However, the sample size is too small to adequately determine how individual features of rooms on a single unit might impact the results.

Some of the data clearly reflect the unit on the day it was assessed (e.g., sound levels, light levels, curtain positions) and not how it was at the time of a fall. These were used as "generalized" metrics that would be indicative of normal patterns on the units: the assumption being that a unit that is noisy on a given day is more likely to be noisy on other days than a unit that is very quiet. Despite strong positive findings related to sound levels, the generalizability of this data to noise levels when actual falls occurred is questionable. Further, the light-meter readings, even when done by IDEAS Institute staff, did not always seem to reflect the perceived light levels in different rooms. This could be instrument or operator error.

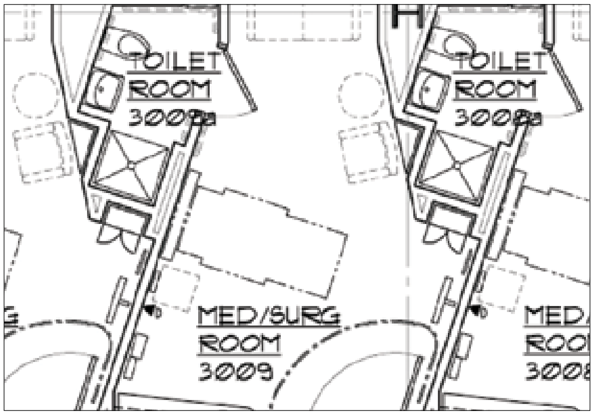
In summary, this is clearly preliminary and exploratory research whose goal was to identify factors or characteristics of the designed environment that might be related to increased fall risk. Further study is needed to identify specific relationships between these variables and falls.

Recommendations for the Guidelines

The hospital units included in this study included ones built in the 1950s and 1960s as well as several that opened during the course of this study. Thus they reflect a broad range of eras in design approach, in both layout and materials. A number of the findings supported current design practice and guidelines or codes, such as having a bathroom for every patient room and allowing at least 18 inches on the opening side of a swing door so a person using an assistive mobility device has sufficient space to be while opening the door. Preliminary analysis on a partial data set had suggested that private rooms might be a protective factor against falls. That analysis suggested there were 4 times as many falls in shared rooms as in private rooms. Unfortunately, that finding did not maintain significance with the complete data set. Falls in shared rooms were twice as frequent as in private rooms, which, while significant, is likely due to higher number of patient days in those rooms.

What did stand out, and should be considered in guidelines for future designs of hospitals, is that the presence of a space specifically dedicated for families was associated with half as many falls per 1,000 patient days as rooms that did not have this space (see Pictures #3 and #4). And unlike some other variables, the sample size of each group was relatively robust (n=182 for rooms with family space, n=482 for rooms without family space) which means these results are not based on data from just one or two units.

PICTURE 3
Example of family area
Family area is differentiated with carpet.



PICTURE 4
Plan of room with family area

Another strong finding is that two grab-bars on either side of the toilet was associated with fewer falls than grab bars mounted on the wall alongside the toilet (see Pictures #5-#8 for varying grab-bar configurations). There was a 4-fold difference in fall rates, with fewer falls associated with fold-down type grab bars, permanent bars on either side of the toilet, or grab bars attached to a toilet seat riser. Yet ADA Guidelines and American National Standards Institute (ANSI) standards do not specifically permit fold-down grab-bars, which appear to be most supportive for frail patients, in accessible units. Similarly, this research supports other work done with individuals with dementia on the positive impact of a bathroom design where the door can remain open. Previous studies explored increased continence, while this study suggested there might be fewer falls if the doors can remain open. There are basically three designs that support

PICTURE 5
Bathroom with no grab-bars accessible to the toilet

PICTURE 6
Bathroom with single diagonal grab-bar at the toilet

PICTURE 7
Bathroom with grab-bars on multiple walls
Paoli Patient Care Pavilion

PICTURE 8
Bathroom with grab-bars on both sides of toilet
New Bridge on the Charles (long-term care setting)

PICTURE 9
Bathroom door that can remain in an open position, toilet not visible

PICTURE 10
Bathroom door that can remain in an open position, toilet visible

PICTURE 11
Door that open out and can remain open

PICTURE 12
Example of sliding door

the bathroom door remaining open and out of the way: a door that swings into the bathroom and against a wall (see Pictures #9 and #10), a door that swings outward, but can remain open without blocking paths (see Picture #11), and a sliding door (see Picture #12). It may be a bit premature to specifically recommend one of these design solutions, but the evidence from this and other studies do seem to suggest that increased visibility into the bathroom may improve a number of outcomes.

PICTURE 13
Grab-bar between bed and toilet
(left)

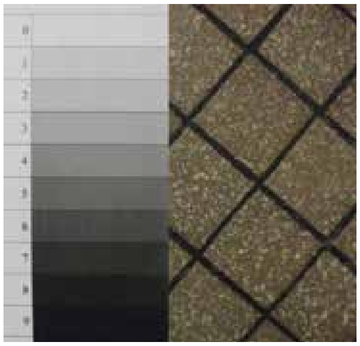
PICTURE 14
Supportive handrail from bed to bathroom, although placement of chair impedes walking path.
(right)

Having a grab-bar along the path from the bed to the bathroom (see Pictures #13 and #14) has been posited to reduce falls. While this was not borne out in this research, there was only 1 unit with such handrails.

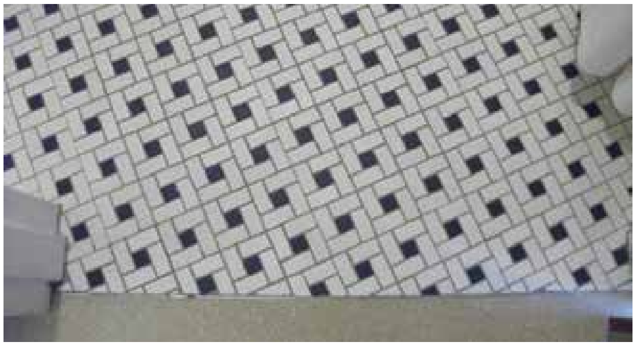
There was some evidence in this study that patterned flooring, particularly in the bedroom where patients may be walking with fewer supports, with moderate size patterning in the flooring may increase fall risk. This would make sense: very small patterning (1 inch or less) tends to be seen as part of the field of the floor, while very large patterning tended to be whole sections of rooms (see Pictures #15-#18). However, because of unequal sample sizes, this result should be considered with caution.

PICTURE 15
Large floor pattern

PICTURE 16 Another large floor pattern
Paoli Patient Care Pavilion



PICTURE 17
Flooring with medium



PICTURE 18
Flooring with small pattern

The final set of recommendations relates to reducing noise. Joseph and Ulrich's (2007) review of research on sounds in hospitals clearly indicated many negative consequences of noisy hospital environments, but did not identify any research related to falls. Surprisingly, drywall ceilings were associated with fewer falls than acoustic tile ceilings. However, we did not attempt to rate the quality of the acoustic tiles, or noise reverberation or noise reduction coefficient of any of the ceilings. Any number of other factors may account for this finding. This study found that frequently heard overhead paging and alarms were associated with greater falls, by a 4- to 5-fold increase. Caution should be used when weighing this evidence, however, as noise was not assessed at the time that falls occurred. Still, when combined with other research results, it suggests that efforts to reduce noise generation may be beneficial.

Next Steps

As stated previously, this is the second of several research projects that will provide more specific understanding of how specific characteristics of the built environment might impact falls and fall risk. The next steps will be to refine and further validate the FEET, and use it in a prospective study, gathering data on the environment at or around the time a fall occurs. For example, tracking whether a family member was present in the room at the time of a fall may shed light on how important a dedicated family space is.

Assessing the coefficient of friction of different flooring materials *in situ* under ecologically valid cleaning conditions (hospitals may not always follow manufacturer's instructions for cleaning, which can change the coefficient of friction of flooring) will shed light on whether this is as important a factor as it appears from this study. Clearly, more exploration of the path to the bathroom, and the bathroom configuration—especially the placement of grab bars, is needed. The data in this study related to private vs. shared rooms was quite mixed, and should be explored in greater detail. The finding that there were more falls when the bathroom entrance was on the same wall as the headwall was unexpected and counterintuitive, and should also be examined in greater detail.

Other topics that would benefit from additional research include identifying whether specific conditions (vision, neurologic, orthopedic, etc.) or medications make patients more sensitive to specific environmental conditions. Clearly, lighting levels are likely to have a greater impact on individuals with very low vision. Are there conditions that make patients more sensitive to the effects of noise? Is the impact of noise on falls a direct relationship, or is it mediated through reduced sleep hygiene? Color and patterning of flooring in the bedroom and bathroom should also be studied with greater attention to details, such as the location of changes in floor color in relation to the path from the bed to the bathroom.

Several hospitals have indicated an interesting in continuing to explore how these environmental factors affect falls. A simple first step is to make sure that the appropriate data are collected at the time of the fall, and that this data are in an easily accessible format. Thus, data can begin to be collected now for future analysis. While some of the factors identified cannot be easily incorporated into existing patient rooms (i.e., the addition of a dedicated family space), others can (i.e., fold-down grab bars at the toilet). Well-controlled interventions studies are needed to examine the influence of specific and individual environmental characteristics.

References

Agency for Healthcare Research and Quality. (2008). *HCUP facts and figures: Statistics on hospital-based care in the United States, 2008.* Retrieved March 11, 2011, from http://www.hcup-us.ahrq.gov/reports/factsandfigures/2008/TOC_2008.jsp

American Geriatrics Society, B. G. S., and American Academy of Orthopaedic Surgeons Panel. (2001). Guideline for the prevention of falls in older persons. *Journal of the American Geriatrics Society, 49(5)*, 664–672.

Bakker, R., Iofel, Y., & Lachs, M. (2004). Lighting levels in the dwellings of homebound older adults. *Journal of Housing for the Elderly, 18*(2), 17–27.

Betrabet Gulwadi, G., & Calkins, M. (2008). *The impact of healthcare environmental design on falls*. Concord, CA: The Center for Health Design.

Brassington, G. S., King, A. C., & Bliwise, D. L. (2000). Sleep problems as a risk factor for falls in a sample of community-dwelling adults aged 64–99 years. *Journal of the American Geriatrics Society, 48*(10), 1234–40.

Braun, J. A., & Capezuti, E. A. (2004). Bedrail entrapment: Is your facility safe? *Nursing Homes Long Term Care Management, 53,* 56–61.

Burnside, I. M. (1981). Psychosocial issues in nursing care of the aged. *Journal of Gerontological Nursing, 7(11),* 689–684.

Calkins, M. (2010). *Environmental modifications to manage continence in homes, ALs, and NHs* (Grant IIG 06-26091). Chicago, IL: Alzheimer's Association.

Chang, J. T., Morton, S. C., Rubenstein, L. Z., Mojica, W. A., Maglione, M., Suttorp, M. J., et al. (2004). Interventions for the prevention of falls in older adults: Systematic review and meta-analysis of randomised clinical trials. *British Medical Journal, 328*, 680–687.

Condra, D., & Cline, E. (n.d.). An assessment of falls in patient rooms and methods for prevention (pp. 6). Nashville, TN: Dalcon Communication Systems. Retrieved March 18, 2011, from http://www.dalcon.com/cms/dalcon.com/cms/wp-content/uploads/2009/11/White-Paper-An-Assesment-of-Falls-in-Patients-Rooms.pdf

Creditor, M. (1993). Hazards of hospitalization of the elderly. *Annals of Internal Medicine, 118(3),* 219–223.

Dickinson, J. I., Shroyer, J. L., & Elias, J. W. (2002). The influence of commercial-grade carpet on postural sway and balance strategy among older adults. *The Gerontologist, 42(4),* 552–559.

Dickinson, J., Shroyer, J., Elias, J., Curry, Z., & Cook, C. (2004). Preventing falls with interior design. *Journal of Family and Consumer Sciences, 96(2),* 13–20.

Donoghue, J., Graham, J., Gibbs, J., & Mitten-Lewis, S. (2003). Who, where, and why: Situational and environmental factors contributing to patient falls in the hospital setting. *Australian Health Review*, *26(3),* 79–87.

Emergency Care Research Institute (2006). Falls Prevention Strategies in Healthcare Settings. Plymouth Meeting PA: ECRI

Englander, F., Hodson, T. J., & Terragrossa, R. A. (1996). Economic dimensions of slip and fall injuries. *Journal of Forensic Science, 41*, 733-746.

Gillespie, L. (2004). Preventing falls in elderly people. *British Medical Journal, 328*, 653–654.

Gilmore, G. C. (1996). *Visual processing deficits in Alzheimer's disease*. Cleveland, OH: UCAH.

Gilmore, G., Neargarder, S. A., & Morrison, S. R. (2005). Enhanced stimulus contrast normalizes visual processing of rapidly presented letters in Alzheimer's disease. *Vision Research, 45(8),* 1013–1020.

Granger, R. (2005, November). *Early cause identification through formal retrospective fall analysis.* Paper presented at the 38th Annual Sigma Theta Tau International Convention, Indianapolis, IN.

Haines T. P., Massey B., Varghese P., Fleming J., & Gray, L. (2009) Inconsistency in classification and reporting of in-hospital falls. *Journal of the American Geriatrics Society, 57*(3), 517–23.

Harwood, R. H. (2001). Visual problems and falls. *Age and Ageing, 30-S4*, 13–18.

Hendrich, A. (2006). Inpatient falls: Lessons from the field. *Patient Safety and Quality Healthcare, 3*(3), 26–30.

Hendrich, A., Fay, J., & Sorrells, A. (2004). Effects of acuity-adaptable rooms on flow of patients and delivery of care. *American Journal of Critical Care 13(1),* 35–45.

Hendrich, A., Nyhuis, A., Kippenbrock, T., & Soja, M. (1995). Hospital falls: Development of a predictive model for clinical practice. *Applied Nursing Research, 8*(3), 129–139.

Hendrich, A. L., Bender, P. S., & Nyhuis, A. (2003). Validation of the Hendrich II Fall Risk Model: A large concurrent case/control study of hospitalized patients. *Applied Nursing Research, 16*(1), 9–21.

Hitcho, E., Krauss, M., Birge, S., Dunagan, W., Fischer, I., Johnson, S., et al. (2004). Characteristics and circumstances of falls in a hospital setting. *Journal of General Internal Medicine, 19*, 732–739.

Home Health Care Quality Improvement Organization Support Center (HHQIOSC). (2007). *Best practice intervention package—fall prevention* (Publication No. 8SOW-PA-HHQ07.465). Harrisburg, PA: Quality Insights of Pennsylvania.

Home Health Care Quality Improvement Organization Support Center (HHQIOSC). (2008). *The ACH connection: Fall prevention.* Retrieved December 16, 2008, from www.homehealthquality.org/shared/content/hhqi_campaign/bpip_falls_prevention/Falls%20Prevention%20BPIP_bbk%20final%2011.5.pdf

Ivers, R., Mitchell, P., & Attebo, K. (1998). Visual impairment and falls in older adults: The Blue Mountain Eye Study. *Journal of the American Geriatrics Society, 46(1),* 58–64.

Johnson, E. (2009). *2009 hospital professional liability and physician liability benchmark analysis*. Chicago: American Society for Healthcare Risk Management.

Joseph, A., & Ulrich, R. (2007). Sound control for improved outcomes in healthcare settings (pp. 15). Concord, CA: The Center for Health Design.

Kane, R., Ouslander, J., & Abass, I. (1994) *Essentials of clinical geriatrics (3rd ed)*. New York: McGraw Hill Inc.

Kochera, A. (2002). *Falls among older persons and the role of the home: An analysis of cost, incidence, and potential savings from home modification.* Washington, DC: AARP Public Policy Institute.

Lawton, M. P., & Nahemow, L. (1973). Ecology and the aging process. In C. Eisdorfer & M. P. Lawton (Eds.), *Psychology of adult development and aging*. Washington D.C.: American Psychological Association.

Lewin, K. (1951). *Field theory in social science*. New York: Harper & Row.

Livingston, H. (2004, April 19). Design matters in health-care facilities: And the Pebble Project has the stats to prove it. *AIArchitect*. Retrieved January 10, 2006, from http://aia.org/aiarchitect/thisweek04/tw0416/0416pebble.htm

Lord, S., Sherrington, C., & Menz, H. (2001). *Falls in older people: Risk factors and strategies for prevention.* Cambridge: Cambridge University Press.

MacDonell, C. (2005, July/August). Prevent falls by removing environmental barriers. *futureAge, 4,* 29.

Marshall, S., Runyan, C., Yang, J., Coyne-Beasley, T., Waller, A., Johnson, R., et al. (2005). Prevalence of selected risk and protective factors for falls in the home. *American Journal of Preventive Medicine, 28(1),* 95–101.

Meyer, T., Eveloff, S., Bauer, M., Schwarts, W., Hill, N., & Millman, R. (1994). Adverse environmental conditions in the respiratory and medical ICU settings. *Chest, 105(4),* 1211–1216.

Morse, J. (1998). Nursing research on patient falls in health care institutions. *Annual Review of Nursing Research, 11*, 299–316.

Namazi, K. H., & Johnson, B. D. (1992). Pertinent autonomy for residents with dementias: Modification of the physical environment to enhance independence. *The American Journal of Alzheimer's Care and Related Disorders & Research, 7*(1), 16–21.

National Institute on Aging. (2004). *Preventing falls and fractures*, from AgePage website . p2–10. Accessed at www.niapublications.org/agepages/PDFs/preventing_Falls_and_Fractures.pdf

National Center for Injury Prevention and Control. (2006). *Falls among older adults: Summary of research findings.* Retrieved [retrieved September 28, 2006], from http://www.cdc.gov/ncipc/pub-res/toolkit/SummaryOfFalls.htm

Nevitt, M., Cummings, S. R., & Hudes, E. S. (1991). Risk factors for injurious falls: A prospective study. *The Journal of Gerontology, 46*, M164–M170.

Newton, R. (2003). Balance and falls among older people. *Generations,* 27(1), 28–31.

Papaioannou, A., Parkinson, W., Cook, R. Ferko, N. Coker, E., & Adachi, J. (2004). Prediction of falls using a risk assessment tool in the acute care setting. *BMC Medicine, 2*(1).

Perritt, M., McCune, E., & McCune, S. (2005). Research informs design: Empirical findings suggest recommendations for carpet pattern and texture. *Alzheimer's Care Quarterly*, *6(4),* 300–305.

Quang Vu, M., Weintraub, N., & Rubenstein, L. (2004). Falls in the nursing home: Are they preventable? *Journal of the American Medical Directors Association, 6,* S82–S87.

Radhamanohar, M. (2002). Falls in elderly people. *Nursing and Residential Care: The Monthly Journal for Care Assistants, Nurses and Managers Working in Health*, 4, 14-16, 46-47

Raz, T., & Baretich, M. (1987). Factors affecting the incidence of patient falls in hospitals. *Medical Care, 25*(3), 185–195.

Rizzo, J., Friedkin, R., Williams, C., Nabors, J., Acampora, D., & Tinetti, M. (1998). Health care utilization and costs in a Medicare population by fall status. *Medical Care, 36(8),* 1174–1188.

Rogers, N., Rogers, N. L., Takeshima, N., & Islam, M. (2004). Reducing the risk for falls in the homes of older adults. *Journal of Housing for the Elderly, 18(2),* 29–39.

Sattin, R. (1992). Falls among older persons: A public health perspective. *Annual Review of Public Health, 13*, 489–508.

Shroyer, J. L., Elias, J. W., Hutton, J. T., & Curry, Z. (1997). *Preventing falls: A defensive approach.* Lubbock, TX: Neurology Research and Education Center.

Stevens, J. (2005). *Falls among older adults: Risk factors and prevention strategies* (Vol. Research Review Papers). Washington, DC: National Council on Aging.

Theodos, P. (2003). Fall prevention in frail elderly nursing home residents: A challenge to case management: Part I. *Lippincott's Case Management*, *8(6),* 246–251.

Tideiksaar, R. (1998). *Falls in Older Persons: Prevention and Management.* Baltimore: Health Professions Press Inc.

Tinetti, M. E., Doucette, J., Claus, E., & Marottoli, R. (1995). Risk factors for serious injury during falls by older persons in the community. *Journal of the American Geriatric Society, 43*, 1214–1221.

Tinetti. M. E., Speechley, M., & Ginter, S. F. (1988). Risk factors for falls among elderly persons living in the community. *New England Journal of Medicine, 319*, 1701–1707.

U.S. Department of Veterans Affairs. (2004). National Center for Patient Safety 2004 Falls Toolkit. Retrieved October 2, 2011, from http://www.va.gov/ncps/SafetyTopics/fallstoolkit/notebook/completebooklet.pdf

Ward, A., Candela, L., & Mahoney, J. (2004). Developing a unit-specific falls reduction program. *Journal for Healthcare Quality, 143.* Retrieved February 14, 2010, from http://www.nahq.org/journal/Article/jhq-143.html

Zinn, L. (2003). Riding out the rising tide of litigation. *Nursing Homes/Long Term Care Management, 52,* 34–39.

Appendix

Table 1 Summary of Literature

		Risk Factor or Supportive Factor
Spatial Organization	Location of patient room with respect to nursing station	Move fallers with dementia closer to nurses' stations to increase observation—supportive factor Visual access from nurses' station to patient room—supportive factor Decentralized nurse station—supportive factor
	Bathroom and ward design	Poorly designed bathroom—risk factor
	Location of patient bed and chairs with respect to door of bathroom	Location of bathroom at headwall of bed—supportive factor Angled doorway for better visibility—supportive factor
	Bedroom design	Identical/acuity-adaptable bedroom design throughout facility—supportive factor
Interior Characteristics of the Environment	Floors	Low-pile, tightly woven carpet—supportive factor Carpet with high-contrast pattern—risk factor Type of flooring by coefficient of friction—not a risk factor Vinyl floor—risk factor for injury from falls Low coefficient of friction—risk factor Various characteristics/properties of flooring—risk factor Change in flooring material—risk factor
	Furniture	Appropriate sizes and heights of furniture—supportive factors Siderails—risk factor Unequal heights of chairs and beds—risk factors Low chair—indirect risk factor because of its link to incontinence High beds, bedrails—indirect risk factors because of incontinence Chair design to support ease in standing—support factor
	Handrails	Unstable furniture—risk factor
Sensory Attributes of the Environment	Lighting	Light levels impacting sleep– not a risk factor Poor contrast in surfaces—risk factor Subdued lighting—risk factor Decreased light levels—risk factor Glare associated with increased light levels—risk factor
	Visual interventions and their location	Color-coded flagging and identification system—supportive factor Peak noises at night that potentially disrupt sleep
	Sounds and sound peaks	Sound levels and peaks—risk factor

Table 1 Summary of Literature (continued)

		Risk Factor or Supportive Factor
Use of the Environment	Designation of patient room based on risk of falling	Locating high fall-risk patients near nursing station—supportive factor Specially designated high risk for fall room with video surveillance—supportive factor
	Clutter in hallways and pathways inside room	Clutter/furniture in pathway—risk factor Clear pathways—supportive factor
	Transfer-related	Self-transfer from wheelchair in bathroom—risk factor Transfer from chair to X-ray table—risk factor
	Footwear	Wearing shoes with flat soles—supportive factor
	Wet floors	Wet floors (result of incontinence)—risk factor Wet floors (result of incontinence)—risk factor
	Presence of area rugs if patient-owned	Presence of loose throw rugs—a risk factor Presence of throw rugs—not a risk factor

Table 2 Intervention Strategies From the Veterans Administration Falls Policy Toolkit

Intervention Strategies

Intervention	Level of Risk			Area of Risk					
	High	Med	Low	Frequent Falls	Altered Elimination	Muscle Weakness	Mobility Problems	Multiple Medications	Depression
Low beds	X	X	X	X	X	X	X	X	X
Nonslip grip footwear	X	X	X	X	X	X	X	X	X
Assign patient to bed that allows patient to exit toward stronger side	X	X	X	X	X	X	X	X	X
Lock movable transfer equipment prior to transfer	X	X	X	X	X	X	X	X	X
Individualize equipment to patient needs	X	X	X	X	X	X	X	X	X
High-risk-fall room setup	X	X		X	X	X	X	X	X
Nonskid floor mat	X	X		X	X	X	X	X	X
Medication review	X	X		X	X	X	X	X	X
Exercise program	X	X		X	X	X	X	X	X
Toileting worksheet	X	X			X				
Color armband/ falling star etc.	X			X	X	X	X	X	X
Perimeter mattress	X			X	X	X	X		
Hip protectors	X			X		X	X		
Bed/chair alarms	X			X		X	X		

Note: This list is not all-inclusive, nor is it required to be used.
Facilities should use their best judgment in implementing recommendations.

Note: From National Center for Patient Safety 2004 Falls Toolkit, published by the U.S. Department of Veterans Affairs, 2004. Available from http://www.patientsafety.gov/SafetyTopics/fallstoolkit/index.html.

Table 3 Types of Units Included in Study

# Units	Type of Unit	Mean Age
11	General med/surg	63.6
6	Neuro med/surg	67.1
1	Post-op/surgical med/surg	60
5	Cardiac med/surg	68.8
2	Oncological med/surg	68.7
1	Rehabilitation	68
1	Palliative	61.2

Table 4 Descriptive Statistics (Partial Dataset)

Shared room	298
Private room	326
Designed as shared but private	41
Bathroom for this room only	596
Bathroom shared between two patient rooms	61
Bathroom not associated with room	8
Direct visibility from center of bed to toilet	32
Direct visibility from center of bed into bathroom not toilet	106
Visibility to bathroom door	131
Bathroom door not visible	346
No bathroom	8
Special condition	28
Bathroom door cannot remain open and be out of way	401
Bathroom door can remain open and out of way	256
Swing door with 18 inches of space	434
Not 18 inches of space	96
Not a swing door	102
Clear path to bathroom	399
Obstructed path to bathroom	254
Toilet directly across from bath entrance	353
Toilet is on wall across from the entrance but not directly across	36
Toilet is on sidewall from entrance	267
Toilet is on same wall as entrance	1
Designated storage space for walker	34
No designated space for wheelchair	631
Designated family area	182
No designated family area	482
Supportive device in bedroom, along more than one wall, including wall between bed and bathroom	5
Supportive device in bedroom, along more than one wall not including bathroom or bed	9
Supportive device in bedroom, along one wall from bed to bathroom	30
Supportive device in bedroom, along one wall but not wall from bathroom to bed	3
Ceiling lift	81
No handrails or supportive devices in bedroom	537

Table 4 Descriptive Statistics (Partial Dataset) (continued)	
Bathroom along wall except sink	85
Bathroom grab-bar along three walls	82
Bathroom grab-bar along two walls	188
Bathroom grab bar along one wall	188
No bathroom grab bars	114
Two bars mounted on either side of toilet	25
Two bars mount on wall	327
One grab bar mounted on wall next to toilet	191
Grab bars mounted to toilet seat riser	53
No bars	10
Other	51
Patient room flooring: VCT tile/sheet	465
Patient room flooring: Linoleum	79
Patient room flooring: Vinyl	120
Patient room flooring: No pattern	484
Patient room flooring: Small pattern of less than 1 inch wide	76
Patient room flooring: Medium pattern 1-6 inches	8
Patient room flooring: Large pattern >6 inches	97
Number of nightlights in room: 0	97
Number of nightlights in room: 1	472
Number of nightlights in room: 2	56
Number of nightlights in room: 3	20
Number of nightlights in room: 4	4
Number of nightlights in room: 5	16
Number of nightlights in bathroom: 0	587
Number of nightlights in bathroom: 1	30
TV earphones regularly used	54
TV earphones used sometimes	18
TV earphones seldom used	46
TV earphones not used	547
Overhead paging heard frequently	66
Overhead paging heard moderately frequently	46
Overhead paging heard infrequently	269
Overhead paging almost never used	212
No overhead call system	37

Note: Not included are variables where descriptives are not a meaningful measurement (e.g., mean Munsell rating of the value of the flooring) or where there was virtually no variation in data (what lights can be controlled from the bed).

Table 5: Distribution of the mean number of falls per 1,000 patient days

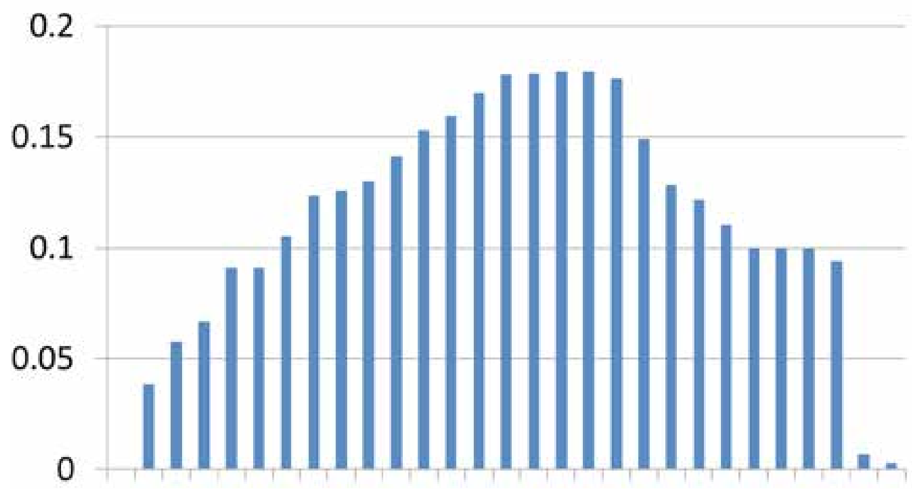


Table 6 Which Best Describes the Bathroom Option for This Room?

Descriptives					
			N	**Mean**	**SD**
Bathroom for this room only			596	.0127	.027
Bathroom shared between two patient rooms			61	.0708	.176
Bathroom not associated with room			8	.0819	.123
Total			**665**	**.0189**	**.065**
ANOVA					
	Sum of Squares	**df**	**MS**	**F**	**Sig**
Between groups	0.219	2	0.109	27.532	**.000**
Within groups	2.629	662	0.004		
Total	**2.848**	**664**			
Multiple Comparisons					
			Mean Diff	**Sig**	
Bathroom for this room only	Bathroom shared between two bedrooms		-.05806	.000	
	Bathroom not associated with room		-.06919	.002	
Bathroom shared between two bedrooms	Bathroom for this room only		.05806 -.01113	.000 .639	
Bathroom not associated with room	Bathroom for this room only		.06919 .01113	.002 .639	

Table 7 Which Best Describes the Location of the Bathroom?					
Descriptives					
	N	**Mean**	**SD**		
Corridor/headwall	428	.022	.0787		
Corridor/footwall	96	.0095	.0086		
Exterior/headwall	77	.0133	.0188		
Exterior/footwall	46	.0108	.0122		
Corridor in toe to toe	10	.0032	.0023		
Total	**657**	**.0181**	**.0642**		
ANOVA					
	Sum of Squares	**df**	**MS**	**F**	**Sig**
Between groups	0.02	4	0.005	1.228	.297
Within groups	2.688	652	0.004		
Total	**2.709**	**656**			

Table 8 Can bathroom door remain open and out of the way?			
Descriptives			
	N	**Mean**	**SD**
No, bathroom door cannot remain open and out of the way	401	.0215	.1204
Yes, bathroom door can remain open and out of the way	256	.0128	.0225
Independent Samples Test			
***t* test**	**df**	**Sig**	
2.052	493	.041	

Table 9 If the Door Is a Swing Door Is There at Least 18" of Space Adjacent to the Opening Side of the Bathroom Doorway as it Opens Toward the Individual?

Descriptives

	N	Mean	SD
Swing door with 18"	434	.012	.019
Swing door, without 18"	96	.058	.157
Not Swing Door	102	.008	.008
Total	**632**	**.018**	**.065**

ANOVA

	Sum of Squares	df	Mean Sq.	F	Sig
Between groups	0.176	2	.088	21.874	.000
Within groups	2.529	629	.004		
Total	**2.705**	**631**			

Multiple Comparisons

		MD	Sig
Swing door with 18"	Swing door without 18"	.045	.000
	Not a Swing door	.004	.531
Swing door without 18"	Swing door with 18"	.045	.000
	Not a swing door	.049	.000

Table 10 Is There a Continuous Handrail From Bed to Bathroom?

Descriptives

	N	Mean	SD
Continuous handrail	34	.014	.024
No continuous handrail	623	.018	.065

Independent Samples Test

t test	df	Sig
0.707	64	.429

Table 11 Are There Other Supportive Devices to Support Mobility From Bed to Bathroom? (Ceiling Lift Was the Only Response)

Descriptives

	N	Mean	SD
Ceiling lift	16	.013	.012
No other support	640	.018	.065

Independent Samples Test

t test	df	Sig
-1.252	47	.217

Table 12 Please Describe the Path to the Bathroom			
Descriptives			
	N	**Mean**	**SD**
Clear path to bathroom	399	.021	.08
Obstructed path to bathroom	254	.013	.02

Independent Samples Test

***t* test**	**df**	**Sig**
1.864	477	.063

Table 13 Which of the Following Best Describes the Layout of the Bathroom?			
Descriptives			
	N	**Mean**	**SD**
Toilet directly across from entrance	353	.022	.085
Toilet on wall across from entrance but not directly across from door	36	.025	.025
Toilet on sidewall	267	.011	.011
Total	**656**	**.018**	**.018**

ANOVA

	Sum of Squares	**df**	**MS**	**F**	**Sig**
Between groups	0.021	2	.011	2.563	.078
Within groups	2.687	653	.004		
Total	2.708	655			

Multiple Comparisons

		MD	**Sig**
Toilet directly across from entrance	Toilet on wall across from entrance but not directly across from door	-.003	.789
	Toilet on sidewall	.011	.032
Toilet on wall across from entrance but not directly across from door	Toilet directly across from entrance	.003	.789
	Toilet on sidewall	.014	.213

Table 14 Which of the Following Best Describes the Handrails in the Bathroom?

Descriptives

	N	Mean	SD
Handrails on four walls except at sink	85	.012	.02
Handrails on three walls	82	.009	.011
Handrails on two walls	188	.012	.023
Handrails on one wall	188	.036	.114
No handrails	114	.008	.008
Total	**657**	**.018**	**.064**

ANOVA

	Sum of Squares	df	MS	F	Sig
Between groups	0.09	4	.022	5.586	.000
Within groups	2.619	652	.004		
Total	**2.709**	**656**			

Multiple Comparisons

		MD	Sig
Handrails on four walls except at sink	Handrails on three walls	.003	.735
	Handrails on two walls	.001	.975
	Handrails on one wall	.024	.004
	No handrails	.009	.711
Handrails on one wall	Handrails on four walls except at sink	.024	.004
	Handrails on three walls	.027	.001
	Handrails on two walls	.024	.000
	No handrails	.027	.000

Table 15 Which of the Following Best Describes Grab Bar(s) Around the Toilet?

Descriptives

	N	Mean	SD
Two grab bars on either side of toilet	25	.009	.006
Two bars mounted on walls	327	.01	.014
One grab bar on wall next to toilet	191	.039	.114
Grab bars mounted to toilet seat riser	53	.008	.01
No bars	10	.003	.002
Other	51	.009	.017
Total	**657**	**.181**	**.064**

ANOVA

	Sum of Squares	df	MS	F	Sig
Between groups	0.118	5	.024	5.911	**.000**
Within groups	2.591	651	.004		
Total	**2.709**	**656**			

Multiple Comparisons

		MD	Sig
Two grab bars on either side of toilet	Two bars mounted on walls	-.001	.933
	One grab bar on wall next to toilet	-.029	**.026**
	Grab bars mounted to toilet seat riser	.000	.973
	No bars	.006	.797
	Other	-.000	.998
Grab bars mounted to toilet seat riser	Two grab bars on either side of toilet	-.001	.973
	Two bars mounted on walls	-.002	.861
	One grab bar on wall next to toilet	-.030	**.002**
	No bars	.005	.799
	Other	-.001	.963
One grab bar on wall next to toilet	Two grab bars on either side of toilet	.029	**.026**
	Two bars mounted on walls	.029	**.000**
	Grab bars mounted to toilet seat riser	.030	**.002**
	No bars	.036	.079
	Other	.029	**.003**

Table 16 If the Bathroom Includes a Shower, Which Description Best Applies?

Descriptives

	N	Mean	SD
Shower with zero threshold	218	0.031	0.107
Shower with threshold	337	0.012	0.014
No shower	102	0.015	0.028
Total	**657**	**0.018**	**0.064**

ANOVA

	Sum of Squares	df	MS	F	Sig
Between groups	0.053	2	.026	6.507	0.002
Within groups	2.656	654	.004		
Total	**2.708**	**656**			

Multiple Comparisons

		MD	Sig
Shower with zero threshold	Shower with threshold	.019	.000
	No shower	.016	.040
No shower	Shower with zero threshold	-.016	.040
	Shower with threshold	.004	.578

Table 17 Is There a Designated Family Area in the Room?

Descriptives

	N	Mean	SD
Yes, designated family area	182	.0123	.018
No designated family area	482	.0214	.076

Independent Samples Test

***t*-test**	**df**	**Sig.**
-2.44	597	**.015**

Table 18 Does the Flooring in the Patient Room Have a Pattern?

Descriptives			
	N	**Mean**	**SD**
No pattern	484	.311	.133
Small pattern, less than 1”	76	.243	.243
Medium pattern, 1”- 6”	8	.655	.000
Large pattern, > 6”	97	.276	.193
Total	**665**	**.302**	**.144**

ANOVA					
	Sum of Squares	**df**	**MS**	**F**	**Sig**
Between groups	0.039	3	.013	3.091	**.027**
Within groups	2.809	661	.004		
Total	**2.848**	**664**			

Multiple Comparisons			
		Mean Diff	**Sig**
Medium pattern, 1”- 6”	No pattern	.062	**.008**
	Small pattern, less than 1”	.072	**.003**
	Large pattern, >6”	.066	**.006**
No pattern	Small pattern, less than 1”	.009	.218
	Medium pattern, 1”- 6”	-.062	**.008**
	Large pattern, > 6”	.004	.546

Table 19 Bedroom Flooring: Which of the Following Best Describes the Flooring in the Patient Room?

Descriptives			
	N	**Mean**	**SD**
VCT tile	465	.014	.026
Linoleum	79	.064	.173
Vinyl sheet	120	.009	.012
Total	**664**	**.019**	**.065**

ANOVA					
	Sum of Squares	**df**	**MS**	**F**	**Sig**
Between groups	0.184	2	.092	22.768	.000
Within groups	2.664	661	.004		
Total	**2.848**	**663**			

Multiple Comparisons			
		MD	**Sig**
Linoleum	VCT tile	.050	.000
	Vinyl sheet	.054	.000
VCT tile	Linoleum	-.050	.000
	Vinyl sheet	.004	.574

Table 20 Bathroom Flooring: Which of the Following Best Describes the Flooring in the Patient Room?

Descriptives

	N	Mean	SD
VCT tile	261	.014	.023
Linoleum	24	.192	.277
Painted cement	103	.011	.009
Ceramic tile	268	.009	.013
Total	**656**	**.018**	**.064**

ANOVA

	Sum of Squares	df	MS	F	Sig
Between groups	.757	3	.189	63.183	.000
Within groups	1.951	651	.003		
Total	**2.708**	**654**			

Multiple Comparisons

		MD	Sig
Linoleum	VCT tile	.178	**.000**
	Painted cement	.182	**.000**
	Ceramic tile	.182	.000
VCT tile	Linoleum	-.178	**.000**
	Painted cement	.004	.560
	Ceramic tile	.004	.331

Table 21 Which of the Following Options Best Describe the Visibility From the Nearest Staff Work Area to the Upper Third of the Bed?

Descriptives

	N	Mean	SD
Direct visibility from manned station	32	.032	.066
Direct visibility from unmanned station	43	.015	.021
No direct visibility	310	.012	.024
Total	**385**	**.014**	**.03**

ANOVA

	Sum of Squares	df	MS	F	Sig
Between groups	0.012	2	.006	22.768	.001
Within groups	0.335	382	.001		
Total	**0.356**	**384**			

Multiple Comparisons

		MD	Sig
Direct visibility from manned station	Direct visibility from unmanned station	.017	.012
	No direct visibility	.020	.000
Direct visibility from unmanned station	Direct visibility from manned station	-.017	.012
	No direct visibility	.002	.580

Table 22 Private vs. Shared Room					
Descriptives					
	N	**Mean**	**SD**		
Shared	298	.025	.092		
Private	326	.013	.029		
Designed as shared but used as private	41	.02	.04		
Total	**665**	**.019**	**.065**		
ANOVA					
	Sum of Squares	**df**	**MS**	**F**	**Sig**
Between groups	0.021	2	.011	2.47	.085
Within groups	2.827	662	.004		
Total	**2.848**	**664**			
Multiple Comparisons					
		MD	**Sig**		
Shared	Private	.012	.027		
	Designed as shared but used as private	.006	.599		
Private	Shared	-.012	**.027**		
	Designed as shared but used as private	-.006	.585		

Table 23 How Often Is Paging Heard?

Descriptives

	N	Mean	SD
Frequently	66	.072	.188
Moderately frequently	46	.012	.015
Infrequently	269	.011	.012
Almost never heard	212	.013	.022
No overhead call system	37	.031	.063
Total	**630**	**.019**	**.067**

ANOVA

	Sum of Squares	df	MS	F	Sig
Between groups	.217	4	.054	13.002	**.000**
Within groups	2.610	625	.004		
Total	**2.827**	**629**			

Multiple Comparisons

		MD	Sig
Frequently	Moderately frequently	-.102	**.000**
	Infrequently	-.078	**.000**
	Almost never heard	-.132	**.000**
	No overhead call system	-.227	**.000**
Moderately frequently	Frequently	.102	**.000**
	Infrequently	.024	.270
	Almost never heard	-.031	.165
	No overhead call system	-.126	**.000**

Table 24 How Often Are Other Audible Alarms Heard?

Descriptives

	N	Mean	SD
Frequently	97	.054	.157
Moderately frequently	134	.011	.013
Infrequently	290	.001	.012
Almost never heard	92	.021	.044
Total	**613**	**.019**	**.067**

ANOVA

	Sum of Squares	df	MS	F	Sig
Between groups	.150	3	0.05	11.616	.000
Within groups	2.618	609	0.004		
Total	**2.768**	**612**			

Multiple Comparisons

		MD	Sig
Frequently	Moderately frequently	.043	.000
	Infrequently	.044	.000
	Almost never heard	.033	.001
Moderately frequently	Frequently	-.043	.000
	Infrequently	.001	.906
	Almost never heard	-.010	.262

Table 25a Backwards Regression Analysis

Variables Entered/Removed[b]

Model	Variables Entered	Variables Removed	Method
1	S1Q39, S1Q17, S1Q14, S1Q16, S1Q24, S1Q3, S1Q9, S1Q2, S1Q18, S1Q15, S1Q6, S1Q7, S1Q38, S1Q13, S1Q8, S1Q37, S1Q4, S1Q12[a]	.	Enter
2	.	S1Q24	Backward (Criterion: Probability of F-to-remove >= .100).
3	.	S1Q13	Backward (Criterion: Probability of F-to-remove >= .100).
4	.	S1Q15	Backward (Criterion: Probability of F-to-remove >= .100).
5	.	S1Q12	Backward (Criterion: Probability of F-to-remove >= .100).
6	.	S1Q16	Backward (Criterion: Probability of F-to-remove >= .100).
7	.	S1Q2	Backward (Criterion: Probability of F-to-remove >= .100).
8	.	S1Q39	Backward (Criterion: Probability of F-to-remove >= .100).

a. All requested variables entered.

b. Dependent variable: number of falls in the room per 1,000 patient days

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.487[a]	.237	.212	.05996
2	.487[b]	.237	.214	.05991
3	.487[c]	.237	.215	.05986
4	.487[d]	.237	.216	.05981
5	.486[e]	.236	.217	.05977
6	.486[f]	.236	.218	.05973
7	.485[g]	.235	.219	.05971
8	.483[h]	.233	.218	.05974

a. Predictors: (Constant), S1Q39, S1Q17, S1Q14, S1Q16, S1Q24, S1Q3, S1Q9, S1Q2, S1Q18, S1Q15, S1Q6, S1Q7, S1Q38, S1Q13, S1Q8, S1Q37, S1Q4, S1Q12

b. Predictors: (Constant), S1Q39, S1Q17, S1Q14, S1Q16, S1Q3, S1Q9, S1Q2, S1Q18, S1Q15, S1Q6, S1Q7, S1Q38, S1Q13, S1Q8, S1Q37, S1Q4, S1Q12

c. Predictors: (Constant), S1Q39, S1Q17, S1Q14, S1Q16, S1Q3, S1Q9, S1Q2, S1Q18, S1Q15, S1Q6, S1Q7, S1Q38, S1Q8, S1Q37, S1Q4, S1Q12

d. Predictors: (Constant), S1Q39, S1Q17, S1Q14, S1Q16, S1Q3, S1Q9, S1Q2, S1Q18, S1Q6, S1Q7, S1Q38, S1Q8, S1Q37, S1Q4, S1Q12

e. Predictors: (Constant), S1Q39, S1Q17, S1Q14, S1Q16, S1Q3, S1Q9, S1Q2, S1Q18, S1Q6, S1Q7, S1Q38, S1Q8, S1Q37, S1Q4

f. Predictors: (Constant), S1Q39, S1Q17, S1Q14, S1Q3, S1Q9, S1Q2, S1Q18, S1Q6, S1Q7, S1Q38, S1Q8, S1Q37, S1Q4

g. Predictors: (Constant), S1Q39, S1Q17, S1Q14, S1Q3, S1Q9, S1Q18, S1Q6, S1Q7, S1Q38, S1Q8, S1Q37, S1Q4

h. Predictors: (Constant), S1Q17, S1Q14, S1Q3, S1Q9, S1Q18, S1Q6, S1Q7, S1Q38, S1Q8, S1Q37, S1Q4

ANOVA[i]						
Model		Sum of Squares	df	MS	F	Sig.
1	Regression	.622	18	.035	9.603	.000[a]
	Residual	2.003	557	.004		
	Total	2.624	575			
2	Regression	.622	17	.037	10.186	.000[b]
	Residual	2.003	558	.004		
	Total	2.624	575			
3	Regression	.621	16	.039	10.839	.000[c]
	Residual	2.003	559	.004		
	Total	2.624	575			
4	Regression	.621	15	.041	11.577	.000[d]
	Residual	2.003	560	.004		
	Total	2.624	575			
5	Regression	.620	14	.044	12.407	.000[e]
	Residual	2.004	561	.004		
	Total	2.624	575			
6	Regression	.620	13	.048	13.360	.000[f]
	Residual	2.005	562	.004		
	Total	2.625	575			
7	Regression	.617	12	.051	14.423	.000[g]
	Residual	2.007	563	.004		
	Total	2.624	575			
8	Regression	.612	11	.056	15.577	.000[h]
	Residual	2.013	564	.004		
	Total	2.625	575			

a. Predictors: (Constant), S1Q39, S1Q17, S1Q14, S1Q16, S1Q24, S1Q3, S1Q9, S1Q2, S1Q18, S1Q15, S1Q6, S1Q7, S1Q38, S1Q13, S1Q8, S1Q37, S1Q4, S1Q12

b. Predictors: (Constant), S1Q39, S1Q17, S1Q14, S1Q16, S1Q3, S1Q9, S1Q2, S1Q18, S1Q15, S1Q6, S1Q7, S1Q38, S1Q13, S1Q8, S1Q37, S1Q4, S1Q12

c. Predictors: (Constant), S1Q39, S1Q17, S1Q14, S1Q16, S1Q3, S1Q9, S1Q2, S1Q18, S1Q15, S1Q6, S1Q7, S1Q38, S1Q8, S1Q37, S1Q4, S1Q12

d. Predictors: (Constant), S1Q39, S1Q17, S1Q14, S1Q16, S1Q3, S1Q9, S1Q2, S1Q18, S1Q6, S1Q7, S1Q38, S1Q8, S1Q37, S1Q4, S1Q12

e. Predictors: (Constant), S1Q39, S1Q17, S1Q14, S1Q16, S1Q3, S1Q9, S1Q2, S1Q18, S1Q6, S1Q7, S1Q38, S1Q8, S1Q37, S1Q4

f. Predictors: (Constant), S1Q39, S1Q17, S1Q14, S1Q3, S1Q9, S1Q2, S1Q18, S1Q6, S1Q7, S1Q38, S1Q8, S1Q37, S1Q4

g. Predictors: (Constant), S1Q39, S1Q17, S1Q14, S1Q3, S1Q9, S1Q18, S1Q6, S1Q7, S1Q38, S1Q8, S1Q37, S1Q4

h. Predictors: (Constant), S1Q17, S1Q14, S1Q3, S1Q9, S1Q18, S1Q6, S1Q7, S1Q38, S1Q8, S1Q37, S1Q4

i. Dependent variable: number of falls in the room per 1,000 patient days

Table 26 Stepwise Regression

Variables Entered/Removed[a]

Model	Variables Entered	Variables Removed	Method
1	S1Q37	.	Stepwise (Criteria: Probability-of-F-to-enter <= .050, Probability-of-F-to-remove >= .100).
2	S1Q38	.	Stepwise (Criteria: Probability-of-F-to-enter <= .050, Probability-of-F-to-remove >= .100).
3	S1Q4	.	Stepwise (Criteria: Probability-of-F-to-enter <= .050, Probability-of-F-to-remove >= .100).
4	S1Q3	.	Stepwise (Criteria: Probability-of-F-to-enter <= .050, Probability-of-F-to-remove >= .100).
5	S1Q18	.	Stepwise (Criteria: Probability-of-F-to-enter <= .050, Probability-of-F-to-remove >= .100).
6	S1Q9	.	Stepwise (Criteria: Probability-of-F-to-enter <= .050, Probability-of-F-to-remove >= .100).
7	S1Q7	.	Stepwise (Criteria: Probability-of-F-to-enter <= .050, Probability-of-F-to-remove >= .100).
8	S1Q17	.	Stepwise (Criteria: Probability-of-F-to-enter <= .050, Probability-of-F-to-remove >= .100).
9	S1Q2	.	Stepwise (Criteria: Probability-of-F-to-enter <= .050, Probability-of-F-to-remove >= .100).

a. Dependent variable: number of falls in the room per 1,000 patient days

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.346[a]	.120	.118	.06343
2	.378[b]	.143	.140	.06266
3	.399[c]	.159	.154	.06212
4	.415[d]	.172	.167	.06167
5	.425[e]	.181	.174	.06141
6	.435[f]	.189	.181	.06115
7	.444[g]	.197	.187	.06092
8	.461[h]	.212	.201	.06037
9	.468[i]	.219	.207	.06017

a. Predictors: (Constant), S1Q37

b. Predictors: (Constant), S1Q37, S1Q38

c. Predictors: (Constant), S1Q37, S1Q38, S1Q4

d. Predictors: (Constant), S1Q37, S1Q38, S1Q4, S1Q3

e. Predictors: (Constant), S1Q37, S1Q38, S1Q4, S1Q3, S1Q18

f. Predictors: (Constant), S1Q37, S1Q38, S1Q4, S1Q3, S1Q18, S1Q9

g. Predictors: (Constant), S1Q37, S1Q38, S1Q4, S1Q3, S1Q18, S1Q9, S1Q7

h. Predictors: (Constant), S1Q37, S1Q38, S1Q4, S1Q3, S1Q18, S1Q9, S1Q7, S1Q17

i. Predictors: (Constant), S1Q37, S1Q38, S1Q4, S1Q3, S1Q18, S1Q9, S1Q7, S1Q17, S1Q2

ANOVA[j]						
Model		Sum of Squares	df	MS	F	Sig.
1	Regression	.315	1	.315	78.292	.000[a]
	Residual	2.309	574	.004		
	Total	2.624	575			
2	Regression	.375	2	.187	47.741	.000[b]
	Residual	2.250	573	.004		
	Total	2.625	575			
3	Regression	.417	3	.139	36.015	.000[c]
	Residual	2.207	572	.004		
	Total	2.624	575			
4	Regression	.452	4	.113	29.740	.000[d]
	Residual	2.172	571	.004		
	Total	2.624	575			
5	Regression	.475	5	.095	25.196	.000[e]
	Residual	2.149	570	.004		
	Total	2.624	575			
6	Regression	.497	6	.083	22.130	.000[f]
	Residual	2.128	569	.004		
	Total	2.625	575			
7	Regression	.517	7	.074	19.887	.000[g]
	Residual	2.108	568	.004		
	Total	2.625	575			
8	Regression	.558	8	.070	19.123	.000[h]
	Residual	2.067	567	.004		
	Total	2.625	575			
9	Regression	.575	9	.064	17.664	.000[i]
	Residual	2.049	566	.004		
	Total	2.624	575			

a. Predictors: (Constant), S1Q37

b. Predictors: (Constant), S1Q37, S1Q38

c. Predictors: (Constant), S1Q37, S1Q38, S1Q4

d. Predictors: (Constant), S1Q37, S1Q38, S1Q4, S1Q3

e. Predictors: (Constant), S1Q37, S1Q38, S1Q4, S1Q3, S1Q18

f. Predictors: (Constant), S1Q37, S1Q38, S1Q4, S1Q3, S1Q18, S1Q9

g. Predictors: (Constant), S1Q37, S1Q38, S1Q4, S1Q3, S1Q18, S1Q9, S1Q7

h. Predictors: (Constant), S1Q37, S1Q38, S1Q4, S1Q3, S1Q18, S1Q9, S1Q7, S1Q17

i. Predictors: (Constant), S1Q37, S1Q38, S1Q4, S1Q3, S1Q18, S1Q9, S1Q7, S1Q17, S1Q2

j. Dependent variable: number of falls in the room per 1,000 patient days

FEET – Falls Environment Evaluation Tool

Thank you for taking the time to complete the FEET – Falls Environment Evaluation Tool.

This FEET Assessment Packet is for **SAMPLE HOSPITAL**

At the beginning of the assessment is a copy of the floor plan of the unit to be assessed. Patient rooms have been color coded by room layout. All rooms of the same design are coded the same color. Please start by checking to make sure the room numbers and coding are correct. If not, please mark changes legibly on the next page.

Each room "type" has a set of questions to be completed (Tabs labeled "Room Type I, Room Type II, etc). These questions are easiest to answer if you can find an unoccupied room of this type. Each Room Type section starts with an enlarged plan of that patient room type.

STEP 1: TAKE PHOTOS OF PATIENT ROOM TYPE I (shared room)

The enlarged patient room plan is marked where we want you to take photos:

1. Room number (so we know what type room it is)
2. From the door towards the bed(s)
3. From the door along the wall across from the bed(s)
4. From the exterior wall, towards the bed(s)
5. From the exterior wall, along the wall across from the bed(s)
6. (Optional) If one of these images has not captured the bathroom, please take a photo looking into the bathroom.

STEP 2: ANSWER ALL FEET QUESTIONS FOR ROOM TYPE I

STEP 3: TAKE PHOTOS OF PATIENT ROOM TYPE II (private room)

STEP 4: ANSWER ALL FEET QUESTIONS FOR ROOM TYPE II

Because the design of the room is the same as the shared patient room, most of the questions will have the same answer, and thus have been deleted from this packet. There will only be a few questions to answer.

STEP 5: REPEAT FOR OTHER ROOM TYPES

STEP 6: QUESTIONS TO ANSWER FOR EVERY PATIENT ROOM

These are some questions to be answered for every patient room on the unit. Each patient room has its own page, with the room number at the top of the page. If the master plan on the next page is mis-numbered- please correct any room numbers on these pages as well.

STEP 7: LIGHTING

Finally, there are a few lighting measurements, which we need to have made in a room that faces each different exterior direction (north, east, etc.).

All the equipment you will need to complete the assessment has been provided. This includes:

FEET packet for each unit being assessed
Tape measure
Digital camera
Light meter

When you have completed the assessments, please return all materials in the box provided, which has a postage paid return label in it. Take off the mailing label addressed to you, and replace it with the one addressed to IDEAS Institute. There are also 2 white tie straps that you can use to re-secure the box for shipping.

In case we have questions with the responses, please provide your name and phone number and/or email contact.

Name ____

Department ____

Phone ____

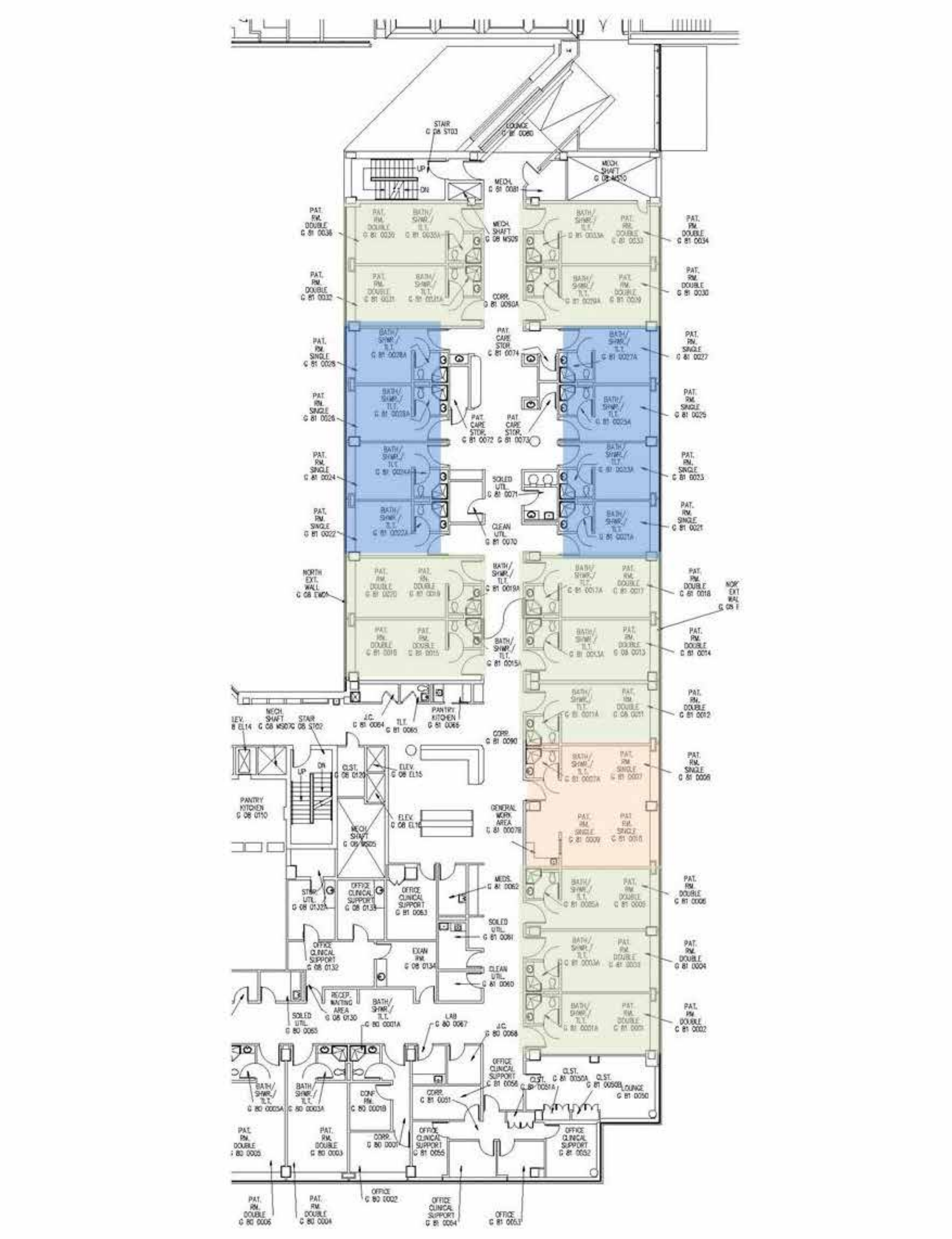
Email ____

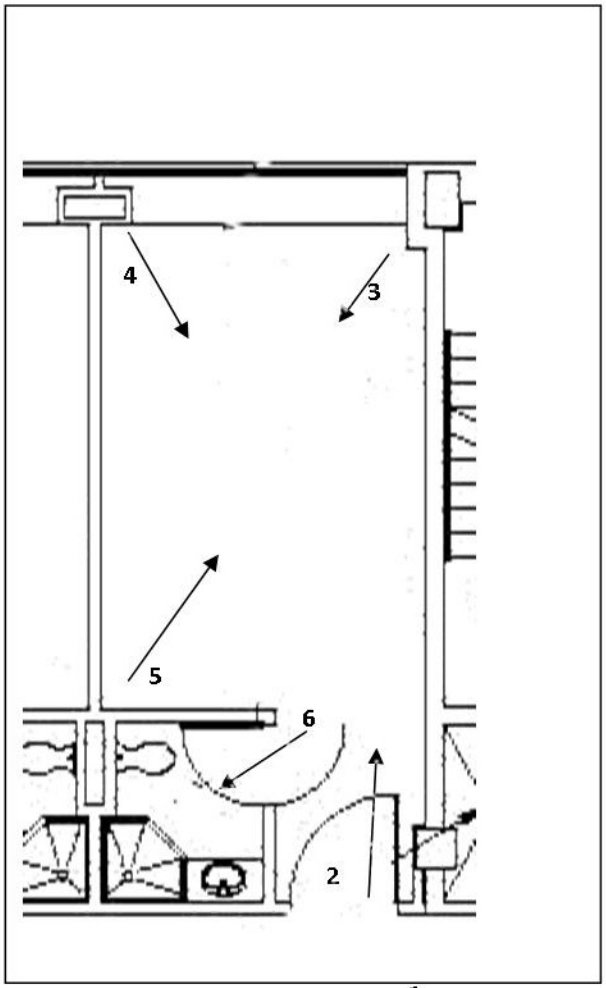
If you have questions while completing the FEET, please contact Dr. Maggie Calkins at 440-256-1880.

Thank you!

SECTION 1: MAIN EVALUATION

Please mark patient room numbers clearly on the plan, if not correct.





1

Photos to be taken (preferably in order)

1) Room number
2) At entrance, toward bed
3) At entrance, toward wall along the left
4) By window, along bed wall
5) By window, along other wall
6) Into bathroom

ROOM TYPE I: SHARED ROOM

Room size:

Hall doorway to exterior wall __________ feet side to side wall __________ feet.
Measure the distance from the hallway entrance to the exterior wall, at floor level. Measure to the most common distance-- i.e., if there are small protrusions (heating/ventilation ducts, window seat), do not measure to these, but measure to the wall. For "side to side wall", again measure from the most common distances (do not measure at protrusions.)

Is this a shared room?

- ❑ Yes
- ❑ No
- ❑ Was designed as shared, but now always used as private

This is regardless of whether the room currently has one or more patients assigned to it. The question relates to whether the room was designed to be occupied by one or more than one patient. Some hospitals have taken rooms that were designed as shared rooms and now only use them for private rooms.

Which best describes the bathroom option for this room?

- ❑ Bathroom for this room only
- ❑ Bathroom shared between two patient rooms
- ❑ Bathroom not associated with patient room

This is regardless of how many patients are in this room. A shared room with a bathroom in it would be coded as bathroom for this room only, even though two people are using it.

Which best describes the location of the bathroom?

- ❑ On the corridor side of the room, doorway on the same side as the head of the bed
- ❑ On the corridor side of the room, doorway on the opposite wall as the head of the bed
- ❑ On the exterior wall side of the room, doorway on the same side as the head of the bed
- ❑ On the exterior side of the room, doorway on the opposite wall as the head of the bed

Visibility between the bed(s) and the toilet room.

Please check the cell which best described the visibility from the bed to the toilet room. If the room is a shared room, please check one cell for each bed location. If the room is used as a private room, check the cell in the private room column.

	PRIVATE ROOM	SHARED ROOM	
		HALL SIDE BED	WINDOW SIDE BED
Direct visibility from center of bed to toilet			
Direct visibility from center of bed into bathroom, but not to toilet			
Visibility to bathroom door			
Bathroom door not visible from center of bed			
No bathroom in patient room			

Use "center of the bed," because when someone sits up to go to the bathroom, it is where they are typically situated to begin the journey to the bathroom. NOTE: In a private room type, if the bed can be in different locations, please draw the different locations on the room plan and note visibility for each location.

Can the bathroom door remain in an open position and be out of the way?

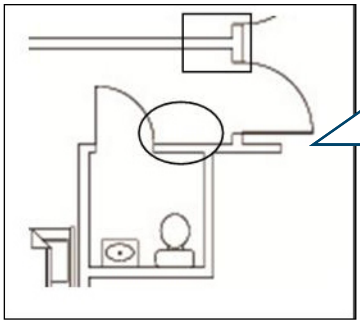
- ❑ Yes
- ❑ No

It doesn't matter whether to door is a swing door on hinges, a sliding or folding door. The point of this question is whether the door can routinely be left open allowing visibility into the bathroom, or whether the door generally needs to be left closed to be out of the way.

If the door is a swing door (as opposed to sliding door), is there at least 18 inches of space adjacent to the opening side of the bathroom doorway as it opens toward the individual?

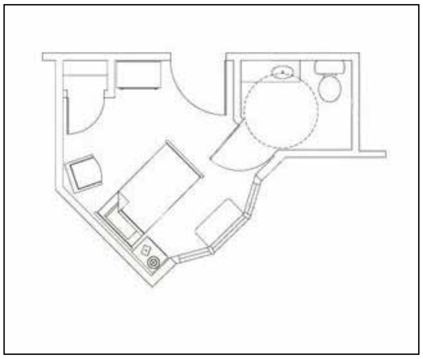
- ❑ Yes
- ❑ No
- ❑ Not a swing door

This space is useful for people who use a walker or wheelchair to be able to be out of the way when opening a swing door toward the individual. See the images on the next page for examples of doors that have 18 inches clear space and doors that do not have 18 inches clear space.



The circle highlights the 18” on the opening side of the door, though the patient room door (marked with a square) does not. The square highlights a patient room door that does not have 18” clearance.

This bathroom does not have 18” clear space to the opening side of the door.



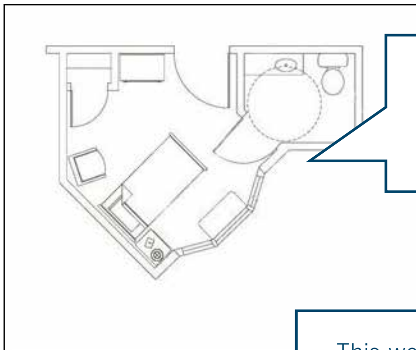
Path to Bathroom

- ❑ Clear, unobstructed, direct path from bed to bathroom (assigned places for furniture and equipments not along path)
- ❑ Commonly used or required equipment/furniture obstructs a clear path from bed to bathroom

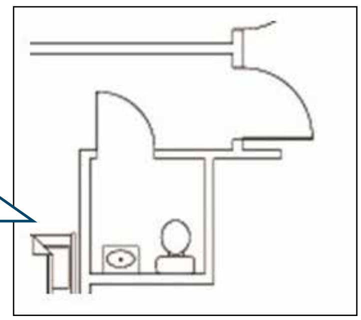
Regardless of the location of the bathroom, is the pathway clear or obstructed by furniture or commonly used equipment?

Bathroom layout

- ❑ Toilet is directly across from bathroom entrance
- ❑ Toilet is on the wall across from the entrance, but not directly across from the door
- ❑ Toilet is on a side wall (left or right) from the bathroom entrance
- ❑ Toilet is on the same wall as the bathroom entrance

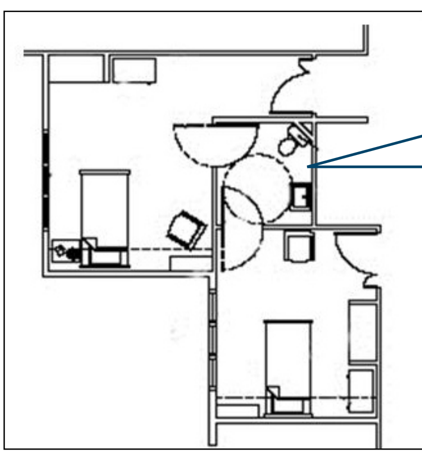


This would be coded as the first response, toilet directly across from entrance.



This would be coded as the second response, toilet across from entrance, but not directly across.

If the bathroom is shared between two patient rooms (and therefore has two doors—see the image on the next page) you may select more than one option if applicable.



This bathroom would be coded the first response for room on left and the second response for room on right.

Bathroom size

Length ______________

Width ______________

If the bathroom includes a shower, which description best applies?

- ❑ Shower with zero threshold entrance
- ❑ Shower with threshold entrance → Height of threshold ___________
- ❑ No shower

Is there designated storage for a wheelchair or walker in the patient room?

- ❑ Yes
- ❑ No

"Designated" storage space is an area that is not meant to be used for other purposes (e.g., cart, furniture, supplies). For instance, this might be an alcove that may have other storage space/shelves above with designated wheelchair storage below.

Is there a designated family area in the room?

- ❑ Yes
- ❑ No

This is more than a chair at the side of the bed, but a place where family and visitors have dedicated space that accommodates at least two people comfortably, and sufficiently out of the way of the bed that care can be given bedside without forcing family to move out of the way.

Which of the following best describes the handrails/supportive devices for mobility in the patient room?

- ❑ Along all walls
- ❑ Along more than one wall, including wall between bed and bathroom
- ❑ Along more than one wall, not including wall between bed and bathroom
- ❑ Along one wall, from bed to bathroom
- ❑ Along one wall, but not the wall from bed to bathroom
- ❑ Present, but not along the walls (e.g. ceiling lift). Please describe:

  ____
- ❑ No handrails/supportive devices for mobility in patient room

This does not include walkers or wheelchairs, but elements that are designed as part of the environment.

Is there a continuous handrail from bed to bathroom?

- ❑ Yes
- ❑ No

For a handrail to be described as "continuous," the layout of the room must be such that furniture and regularly used medical equipment does not block access to the handrail. If the bathroom entrance is not on the headwall, and the patient must cross the room without support, you should respond 'No' to this question.

Are there other supportive devices to support mobility from bed to bathroom?

- ❑ Yes Describe: ____
- ❑ No

This does not include a walker or wheelchair or portable/floor-based lift, but any other devices that are used to provide support from the patient room to the bathroom (e.g. ceiling lift). If you respond yes, please describe and include a photo of this.

Which of the following best describes the handrails in the bathroom?

- ❑ Along all walls (except behind sink)
- ❑ Along three walls
- ❑ Along two walls
- ❑ Along one wall
- ❑ At sink only
- ❑ No handrails

Do not include sinks or towel bars as a handrail, unless it is/they specifically designed to be used as a handrail.

Which of the following best describes grab bar(s) around the toilet?

- ❑ Two bars mounted on either side of the toilet not attached to the side wall (can be fold down, or permanent – do not count toilet seat risers with garb bars)
- ❑ Two bars mounted on wall, one along side and one at the back of toilet
- ❑ One grab bar mounted on wall next to toilet
- ❑ Grab bars mounted to toilet seat riser
- ❑ No grab bars
- ❑ Other __________________________

Which of the following best describes the location of the TV?

- ❑ On swing arm above/beside bed
- ❑ Mounted on wall
- ❑ On stand or piece of furniture
- ❑ Other ______________________________

Flooring – if you know the manufacturer and style of the flooring, please list below (and skip the next two questions). If you do not know the brand name of the flooring, please answer the following two questions.

Patient room ____

Bathroom ____

Patient Room Flooring – if you don't know the manufacturer and style of flooring, which of the following best describes the flooring in the patient room?

- ❑ VCT tile/sheet
- ❑ Rubber
- ❑ Linoleum
- ❑ Vinyl
- ❑ Tight weave broadloom loop carpet
- ❑ Straight fiber carpet (e.g., Flotex)
- ❑ Carpet tile
- ❑ Other ______________________________

Bathroom Flooring – if you don't know the manufacturer and style of flooring, which of the following best describes the flooring in the bathroom?

- ❑ VCT tile/sheet good
- ❑ Rubber
- ❑ Linoleum
- ❑ Vinyl
- ❑ Tight weave loop carpet
- ❑ Straight fiber carpet
- ❑ Ceramic tile/marble/granite
- ❑ Other ______________________________

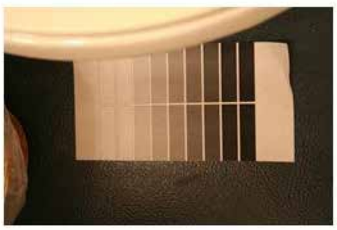
Using the grey scale provided on the back page of the manual, please identify the primary color value of the flooring in the patient room (select predominant color).

________________ (number from 1-10)

Using the grey scale provided in the manual, please identify the primary color value of the flooring in the bathroom (select predominant color).

________________ (number from 1-10)

Place the gray scale on the floor, and look for the bar of grey that is closest to the primary color of the floor. Some find it helps to squint or put on a pair of sunglasses to see this.



This floor would score an 8 on this 10 level grey scale (easiest to count down from the darkest stripe as 10).

Does the flooring in the patient room have pattern? See definitions below.

- ❑ 1-No pattern
- ❑ 2-Yes, small pattern (less than 1" wide)
- ❑ 3-Yes, medium pattern (1"-6" in size)
- ❑ 4-Yes, large pattern (greater than 6")

'No pattern' includes lightly "heathered" or "speckled" texture on the flooring. If you squint your eyes and the floor looks to be basically a solid color, consider this no pattern. If, however, you squint your eyes and still see a pattern (lines, boxes, edging/borders, or other change in floor coloring), then consider it patterned. To determine the size of the pattern, select the largest element in the pattern to measure.

The "flowers" in this carpet are about 4" in size, so this would be coded as the third choice.

Does the flooring in the bathroom have pattern?

- ❑ 1-No pattern
- ❑ 2-Yes, small pattern (less than 1" wide)
- ❑ 3-Yes, medium pattern (1"-6" in size)
- ❑ 4-Yes, large pattern (greater than 6")

If you responded yes (2, 3 or 4) to either of the above questions, please rate, on the grey scale, the lightest and darkest colors on the floor

Patient room	Darkest color __________	Lightest color __________
Bathroom	Darkest color __________	Lightest color __________

To calculate this, use the grey scale as described above, and assess the lightest and darkest colors in the pattern.

The dark area around the flowers is close to black, and thus would score a 9. The light yellow part of flowers are quite light, probably a 3 on the grey scale.

From the bed (lying in bed), please check the box for what lights the patient can control.

- ❑ Overbed light
- ❑ Ceiling light
- ❑ Other lights

From the bed (lying in bed), what other systems can the patient control?

- ❑ TV
- ❑ Window treatment
- ❑ Bed adjustment
- ❑ Heating/Air Cond.
- ❑ Other ___________________________

What are the dimensions of the window(s)?

- ❑ 1) Window #1 H _________ W _________
- ❑ 2) Window #2 H _________ W _________

How high is the window sill? ________________

Measure this from floor to the top edge of the window sill.

How many fixed/non-removable nightlights are there in the patient room (do not count bathroom)? ________________

How far above the floor is/are the nightlight(s)?

____

Measure this to the center of the light(s).

How many nightlights are there in the bathroom? ________________

How far above the floor is/are the nightlight(s) in the bathroom?

____

Measure this to the center of the light(s).

Is there a nightlight between the location of the bed and the entrance to the bathroom?

Yes _______ **No** _______

Do the patient TVs have earphones?

- ❑ Yes, and regularly used
- ❑ Yes, only used sometimes
- ❑ Yes, seldom used
- ❑ No

Which best describes the ceiling?

- ❑ Acoustical tile
- ❑ Drywall - untreated
- ❑ Drywall treated with acoustic treatment (usually a pebbled surface)
- ❑ Other ___________________________

How often is overhead paging audible within patient room (with door open)? (If you are not certain or do not work on this unit, please ask someone on the unit how often overhead pages are made).

- ❑ Frequently (generally at least once per 10 minutes)
- ❑ Moderately frequently (2-5 times per hour)
- ❑ Infrequently (generally not more than once per hour)
- ❑ Almost never (once a day or less)
- ❑ No overhead call system

How often are other audible alarms (elevators, call bells) heard in the patient room with door open?

- ❑ Frequently (generally at least once per 10 minutes)
- ❑ Moderately frequently (2-5 times per hour)
- ❑ Infrequently (generally not more than once per hour)
- ❑ Almost never (once a day or less)

ROOM TYPE II SHARED ROOM

Room size:

Hall doorway to exterior wall _________ feet side to side wall _________ feet.

Is this a shared room?

- ❑ Yes
- ❑ No
- ❑ Was designed as shared, but now always used as private

Which best describes the bathroom option for this room?

- ❑ Bathroom for this room only
- ❑ Bathroom shared between two patient rooms
- ❑ Bathroom not associated with patient room

Which best describes the location of the bathroom?

- ❑ On the corridor side of the room, doorway on the same side as the head of the bed
- ❑ On the corridor side of the room, doorway on the opposite wall as the head of the bed
- ❑ On the exterior wall side of the room, doorway on the same side as the head of the bed
- ❑ On the exterior side of the room, doorway on the opposite wall as the head of the bed

Visibility between the bed(s) and the toilet room.

Please check the cell which best described the visibility from the bed to the toilet room. If the room is a shared room, please check one cell for each bed location. If the room is used as a private room, check the cell in the private room column.

	PRIVATE ROOM	SHARED ROOM	
		HALL SIDE BED	WINDOW SIDE BED
Direct visibility from center of bed to toilet			
Direct visibility from center of bed into bathroom, but not to toilet			
Visibility to bathroom door			
Bathroom door not visible from center of bed			
No bathroom in patient room			

Can the bathroom door remain in an open position and be out of the way?

- ❑ Yes
- ❑ No

If the door is a swing door (as opposed to sliding door), is there at least 18 inches of space adjacent to the opening side of the bathroom doorway as it opens toward the individual?

- ❑ Yes
- ❑ No
- ❑ Not a swing door

Path to Bathroom

- ❑ Clear, unobstructed, direct path from bed to bathroom (assigned places for furniture and equipments not along path)
- ❑ Commonly used or required equipment/furniture obstructs a clear path from bed to bathroom

Bathroom layout

- ❑ Toilet is directly across from bathroom entrance
- ❑ Toilet is on the wall across from the entrance, but not directly across from the door
- ❑ Toilet is on a side wall (left or right) from the bathroom entrance
- ❑ Toilet is on the same wall as the bathroom entrance

Bathroom size

Length ________________ **Width** ________________

If the bathroom includes a shower, which description best applies?

- ❑ Shower with zero threshold entrance
- ❑ Shower with threshold entrance → Height of threshold _________
- ❑ No shower

Is there designated storage for a wheelchair or walker in the patient room?

- ❑ Yes
- ❑ No

Is there a designated family area in the room?

- ❑ Yes
- ❑ No

Which of the following best describes the handrails/supportive devices for mobility in the patient room?

- ❑ Along all walls
- ❑ Along more than one wall, including wall between bed and bathroom
- ❑ Along more than one wall, not including wall between bed and bathroom
- ❑ Along one wall, from bed to bathroom
- ❑ Along one wall, but not the wall from bed to bathroom
- ❑ Present, but not along the walls (e.g. ceiling lift). Please describe:

  ____
- ❑ No handrails/supportive devices for mobility in patient room

Is there a continuous handrail from bed to bathroom?

- ❑ Yes
- ❑ No

Are there other supportive devices to support mobility from bed to bathroom?

- ❑ Yes Describe: ____
- ❑ No

Which of the following best describes the handrails in the bathroom?

- ❑ Along all walls (except behind sink)
- ❑ Along three walls
- ❑ Along two walls
- ❑ Along one wall
- ❑ At sink only
- ❑ No handrails

Which of the following best describes grab bar(s) around the toilet?

- ❑ Two bars mounted on either side of the toilet not attached to the side wall (can be fold down, or permanent – do not count toilet seat risers with garb bars)
- ❑ Two bars mounted on wall, one along side and one at the back of toilet
- ❑ One grab bar mounted on wall next to toilet
- ❑ Grab bars mounted to toilet seat riser
- ❑ No grab bars
- ❑ Other ____

Which of the following best describes the location of the TV?

- ❑ On swing arm above/beside bed
- ❑ Mounted on wall
- ❑ On stand or piece of furniture
- ❑ Other ____

Flooring – if you know the manufacturer and style of the flooring, please list below (and skip the next 2 questions). If you do not know the brand name of the flooring, please answer the following 2 questions.

Patient room ____

Bathroom ____

Patient Room Flooring – if you don't know the manufacturer and style of flooring which of the following best describes the flooring in the patient room

- ❑ VCT tile/sheet
- ❑ Rubber
- ❑ Linoleum
- ❑ Vinyl
- ❑ Tight weave broadloom loop carpet
- ❑ Straight fiber carpet (e.g., Flotex)
- ❑ Carpet tile
- ❑ Other ____

Bathroom Flooring – if you don't know the manufacturer and style of flooring which of the following best describes the flooring in the bathroom

- ❑ VCT tile/sheet good
- ❑ Rubber
- ❑ Linoleum
- ❑ Vinyl
- ❑ Tight weave loop carpet
- ❑ Straight fiber carpet
- ❑ Ceramic tile/marble/granite
- ❑ Other ____

Using the grey scale provided on the back page of the manual, please identify the primary color value of the flooring in the patient room (select predominant color).

_______________ (number from 1-10)

Using the grey scale provided in the manual, please identify the primary color value of the flooring in the bathroom (select predominant color).

_______________ (number from 1-10)

Does the flooring in the patient room have pattern? See definitions below.

- ❑ 1-No pattern
- ❑ 2-Yes, small pattern ***(less than 1" wide)***
- ❑ 3-Yes, medium pattern ***(1"-6" in size)***
- ❑ 4-Yes, large pattern ***(greater than 6")***

Does the flooring in the bathroom have pattern?

- ❑ 1-No pattern
- ❑ 2-Yes, small pattern (less than 1" wide)
- ❑ 3-Yes, medium pattern (1"-6" in size)
- ❑ 4-Yes, large pattern (greater than 6")

If you responded yes (2, 3 or 4) to either of the above questions, please rate, on the grey scale, the lightest and darkest colors on the floor

Patient room	Darkest color __________	Lightest color __________
Bathroom	Darkest color __________	Lightest color __________

From the bed (lying in bed), please check the box for what lights the patient can control.

- ❑ Overbed light
- ❑ Ceiling light
- ❑ Other lights

From the bed (lying in bed), what other systems can the patient control?

- ❑ TV
- ❑ Window treatment
- ❑ Bed adjustment
- ❑ Heating/Air Cond.
- ❑ Other ___________________

What are the dimensions of the window(s)?

- ❑ 1) Window #1 H __________ W __________
- ❑ 2) Window #2 H __________ W __________

How high is the window sill? ____________________

How many fixed/non-removable nightlights are there in the patient room (do not count bathroom)? ____________________

How far above the floor is/are the nightlight(s)?

____

How many nightlights are there in the bathroom? _______________

How far above the floor is/are the nightlight(s) in the bathroom?

____

Is there a nightlight between the location of the bed and the entrance to the bathroom?

Yes _______ No _______

Do the patient TVs have earphones?

- ❑ Yes, and regularly used
- ❑ Yes, only used sometimes
- ❑ Yes, seldom used
- ❑ No

Which best describes the ceiling?

- ❑ Acoustical tile
- ❑ Drywall- untreated
- ❑ Drywall treated with acoustic treatment (usually a pebbled surface)
- ❑ Other ____

How often is overhead paging audible within patient room with door open? (If you are not certain or do not work on this unit, please ask someone on the unit how often overhead pages are made).

- ❑ Frequently (generally at least once per 10 minutes)
- ❑ Moderately frequently (2-5 times per hour)
- ❑ Infrequently (generally not more than once per hour)
- ❑ Almost never (once a day or less)
- ❑ No overhead call system

How often are other audible alarms (elevators, call bells*)* heard in the patient room with door open?

- ❑ Frequently (generally at least once per 10 minutes)
- ❑ Moderately frequently (2-5 times per hour)
- ❑ Infrequently (generally not more than once per hour)
- ❑ Almost never (once a day or less)

SECTION 2: QUESTIONS FOR EVERY PATIENT ROOM

Room _____________

Does this room currently have a patient assigned to it?

❑ One patient ❑ Two patients ❑ No patients

This is whether a patient is currently assigned to the room (or is scheduled to be assigned that day), regardless of whether the patient is in the room when you walk around.

Which of the options below best describes the visibility from the nearest staff work area to the upper third of bed? If this is a shared room, please check one cell in the table for each bed location. If this is a private room, check one cell in that column.

	PRIVATE ROOM	SHARED ROOM	
		HALL SIDE BED	WINDOW SIDE BED
Direct visibility from staff work area/desk that is typically manned most of the time to the upper third of the bed			
Direct visibility from a staff work area/desk that is not typically manned most of the time to the upper third of the bed *(common in decentralized work stations)*			
No direct visibility from staff work areas to the upper third of the bed			

'Direct Visibility' is defined as clear and unobstructed view from where a staff person is likely to be in the work area (e.g., seated or standing behind desk). Answer this question as if all privacy curtains are open/pushed back against the wall. The 'upper third of the bed' is where a person's head, chest and hands would normally be positioned, which is what staff want to be able to monitor for distress or unsafe acts.

Typical position of cubicle curtains: Please indicate whether any of the cubicle curtains are drawn (closed).

If private room:

❑ Between bed and doorway
❑ Between bed and wall across from bed
❑ Between bed and exterior wall

If shared room – hallway side:

- ❑ Between bed and doorway
- ❑ Between bed and wall across from bed
- ❑ Between bed and exterior wall

If shared room – window side:

- ❑ Between bed and doorway
- ❑ Between bed and wall across from bed
- ❑ Between bed and exterior wall

SECTION 3: INSTRUCTIONS FOR QUESTIONS TO BE ANSWERED FORONE PATIENT ROOM FACING DIFFERENT CARDINAL DIRECTIONS

Sunlight into the room as well as ceiling lights can cause significant glare. The plan on the page following the next one is marked to highlight the rooms that face each direction on this unit (labeled Side 1, 2, 3 and 4). Please note on the plan which side faces east (where the sun rises). Then take the lighting measurements, as described on the next pages, in a room that faces each different direction (i.e., one room facing east, one room facing north, etc.). Please also note the time of day these readings are made, and the weather conditions.

About the light meter

How to Assess Light and Reflected Glare on Floor

To assess light levels and glare, you will need to take two light readings in the room. One reading will be read with the meter flat on the floor, and a second reading will be taken with the meter at an angle to get the reflected light. To take a light reading, follow these steps:

1. Remove meter and attached light sensor from the box.
2. Remove cover from light sensor.
3. Turn on overhead and over-bed lights in the room, open the curtains/shades.

Flat on the floor reading

1. Place the light sensor flat on the floor, in the brightest area of the room (usually near a window). Do not put in a direct pool of sunlight, as this will max out the sensor. If there is direct sunlight coming in the window, place the sensor about 6 inches behind (into the room, away from the window) the sunlight.
2. Turn meter on, using red on/off button (top left).
3. Be sure it is set on LUX (visible on the right side of the LCD screen). If it reads "Fc", then push the bottom left button until LUX appears in the readout.
4. The meter reads in 4 different ranges, which are visible on the lower right corner of the screen. If the readout is giving you a number, you are in the right range. If the readout says OL (overload) you need to adjust the range. Push the RANGE button (top right) until you get a number instead of OL. (see note below about OL in bright sunlight)
5. When you are getting readings (which often change as light changes), move the meter around a little (4" – 6") to find where the light is brightest. Be sure you are not casting a shadow over the sensor!
6. Press the MAX button (middle left). This will then keep the highest reading. Leave the sensor on the floor for about 30 seconds. Moving it around slightly is OK.
7. On the next pages, record the meter reading and the range (for instance Reading 179.5; Range 200 – remember the range is in the lower right corner of the readout). Be sure to record for the correct side of the building you are in.

Reflected or Angled reading

8. Next, put the light sensor in the wood holder, so the white face of the sensor is angled down toward the floor. Put it in the same place on the floor as it was for the first reading, facing the light source (usually the window or other night light).

9. Press the MAX button twice (once to clear it from the old readings, and once to reset it to read the current MAX reading). You may need to reset the range. Once you have the range set correctly so you are getting readings, move it around to find the highest readings. Wait 1 minute and record reflected light reading.

10. Either turn the light meter off, or hit the REC-ERASE button (bottom right) to reset before you take readings in the next room.

NOTE if there is direct sunlight coming in the windows, you may get an OL reading at all four levels (#4 above). In this case, make a note of this on the appropriate side of the building, and retake the readings with the curtain/shades closed—as a patient might have the window treatment.

LIGHTING EVALUATION

Time of assessment ______________

Weather (circle one): sunny lightly cloudy/gray heavy clouds rain/snow

Which direction does side one of the building face? (circle one)

North	North-East	East	South-East
South	South-West	West	North-West

Side 1

Flat on the floor	Reading ____________	Range ____________
Reflected	Reading ____________	Range ____________

Side 2

Flat on the floor	Reading ____________	Range ____________
Reflected	Reading ____________	Range ____________

Side 3

Flat on the floor	Reading ____________	Range ____________
Reflected	Reading ____________	Range ____________

Side 4

Flat on the floor	Reading ____________	Range ____________
Reflected	Reading ____________	Range ____________