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Developing Evidence-Based Design Guidelines for Medical/Surgical Hospital Patient Rooms That Meet the Needs of Staff, Patients, and Visitors

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Abstract

Objectives: This research investigated medical/surgical (Med/Surg) patient room design to accommodate the needs of hospital staff, while at the same time accommodating the needs of patients and their visitors. **Background:** Designing hospital patient rooms that provide a comfortable healing experience for patients, while at the same time meeting the needs of the hospital staff, is a challenging process. Prior research has shown that many hospital patient room designs adversely affect the ability of hospital staff to perform their tasks effectively, efficiently, and safely. **Method:** Twenty-seven design sessions were conducted in which 104 participants, representing 24 different occupations, worked in small mixed occupational groups to design an ideal single patient Med/Surg patient room to fit their collective needs using a full-scale mock-up. During analysis, the investigators reduced the resulting 27 room designs to 5 hybrid designs that were sequentially reviewed by patients and visitors and by staff to address design conflicts. **Results:** This design process identified 51 desirable room design features that were incorporated into 66 evidence-based design guidelines for the different areas within the Med/Surg patient room including the entry way (16 guidelines), the patient clinical area (22 guidelines), the bathroom (17 guidelines), the family area (8 guidelines), and storage areas for patients and their visitors (3 guidelines). **Conclusions:** The guidelines developed through this study identified many opportunities for improving the design of hospital Med/Surg rooms to allow staff to be more effective, efficient, and safer, while at the same time addressing the design needs of patients and their visitors.

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In understanding the challenge of designing hospital patient rooms, it is useful to consider an illustrative example of one of the many people who enter the room in order to conduct work during their shift. Debra, a sonographer, needs to conduct an exam in a hospital patient room. Her hospital is trying to provide these types of services in the patients' rooms to minimize the stress on the patients and better control hospital-acquired infections. As she starts to roll her ultrasound equipment into the patient's room, she discovers that there are currently other activities going on in the room, so she must return later to conduct the ultrasound exam on this patient. When she returns, she finds she has to move some of the room furnishings and some of the patient's personal effects to create a space that can accommodate her equipment. Other than her cart, there is no available surface on which she can put newspapers and books that are lying on the patient's bed because the bedside table is occupied by a food tray for the patient and lunch for the family members. Debra searches for an available electrical outlet to power her equipment. Most of the outlets are already being used by medical equipment already in the room, the patient's electronic devices, and by the patient's family members. She sees an electrical outlet that can be reached once she moves the patient's recliner out of the way, where the patient's mother is currently sitting. After leaning down to plug her equipment into the outlet, she can begin using her equipment. As a first step, she needs to dim the lights to see her monitor. There are multiple light switches on the wall, and there is no consistency from one part of the hospital to another as to which switch controls which light, and there are no labels on the switches. She attempts three different switches before she finds the correct one and then begins the exam.

When asked about her work, she describes herself as a part-time sonographer and part-time furniture mover. She wishes that she worked in a facility where there was a system that notified her when activities were going on in a patient's room that will require her to reschedule her work, where there was adequate space in the patient rooms, so that it would not be necessary for her to move furniture to get access to the patient in the bed, where there is a horizontal surface that is available for staff to use, where there are more than enough electrical outlets, and where there is standardization regarding the layout of the light switches and which lights they control.

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The objective of this research was to develop room design guidelines, specifically focusing on the design of medical/surgical (Med/Surg) patient rooms, that address the needs of occupational stakeholders like Debra for whom patient rooms are a workplace, as well as the needs of patients and visitors for whom these rooms are healing spaces. The overarching research hypothesis is that the design of the patient room, which includes physical size and shape of the room, the layout of the furniture, and the task-based components, affects the way work is performed in the room, which in turn affects productivity, worker health and safety, and patient outcomes (Figure 1).

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Our prior work identified many unmet needs, related to patient room design, of workers from 23 occupational groups who work part or most of the time in patient rooms (Lavender et al., 2015).

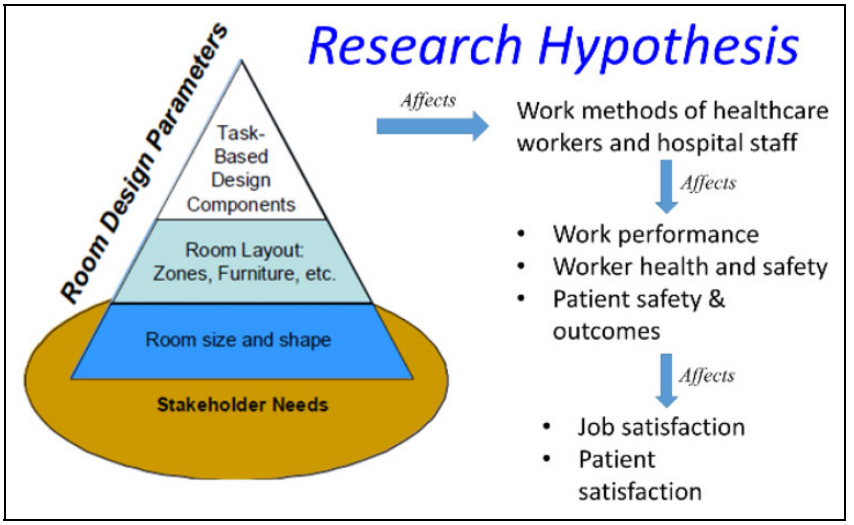

Figure 1. Impact of patient room design.

As defined by the International Ergonomics Association, "Ergonomics (or human factors) is the scientific discipline concerned with the understanding of interactions among humans and other elements of a system, and the profession that applies theory, principles, data and methods to design in order to optimize human well-being and overall system performance." Hospital patient rooms are complex, dynamic systems and yet to date, the field of ergonomics has made only limited contributions to the design of these particular physical systems, including studies space requirements to perform specific critical care tasks (Hignett & Lu, 2007) and patient transfer tasks (Hignett & Keen, 2005).

Of the 10 sectors of private industry listed by the U.S. Bureau of Labor Statistics (BLS, 2016), Education and Health Services ranks second in number of reported nonfatal lost time injuries and illnesses (Resource Table R44). In 2016, about 80,000 injuries were experienced by workers who interact with patients or are likely to work part of the time in patients' rooms. About 54% of those injuries occurred to nursing aides and attendants, 26% to registered nurses, 5% to janitors and housekeeping staff, 5% to therapists and their aides, 3% to imaging technologists (Smith, Wolf, Xie, & Smith, 1997), and 7% to licensed practical nurses (LPNs). In addition to patient handling tasks, worker motion, floors, machines, and furniture contribute to injuries to people who provide direct or indirect patient care in hospital settings (BLS, 2016; Resource Table R99). These sources and types of injuries also affect workers employed in government healthcare settings (e.g., county hospitals and Veterans Administration (VA) facilities; Menzel, 2008) who are not counted in the aforementioned statistics. Overall, the costs to individuals in terms of disability; to organizations in terms of workers compensation, reduced efficiencies, and care quality; and to a society trying to control healthcare costs are tremendous and present an important research-to-practice opportunity.

Many researchers have addressed this problem by investigating patient handling tasks and the use of patient handling equipment. One research area that has received relatively little attention, however, is the design and layout of patient rooms (Hignett & Lu, 2010). As Hignett and Lu (2010) point out in their review of design recommendations made between 1866 and 2008, only 1 of the 34 recommendations was based on empirical evidence stemming from classical work analysis techniques. But as Hignett and Lu (2007) noted in their work with intensive care unit rooms, the patient rooms are "the most important and

largest repeating space envelop in a healthcare facility" and are the center of much nursing and patient care activity therein emphasizing the need for further investigation into the ergonomic issues that can be addressed through patient room design. Historically, the lack of focus on this area by ergonomics researchers may be understandable, given the life span of hospital facilities and the limited opportunities for change. But going forward, patient room designs need to consider: "(1) patient safety, (2) staff efficiency, (3) circulation, (4) infection control, (5) patient considerations, and (6) family amenities" (Pati et al., 2009).

It is also important that the design of the patient room considers the design of the bathroom as this is where many patient falls occur. For example, approximately 11% of the patient falls in Krauss et al.'s (2007) retrospective study of nine hospitals were associated with bathroom use. Forty-six percent of the falls in Mandi et al.'s (2013) study of an orthopedic hospital were associated with bathroom use. In another study, also conducted at an orthopedic hospital, the percentage of falls associated with bathroom use was 64% (Ackerman et al., 2010). There are several potential design elements within the bathroom that could impact patient stability and physical demands on hospital staff.

Some emerging trends in healthcare will also impact the design of hospital patient rooms. First, there is a trend toward acuity-adaptable rooms which can be configured to accommodate the needs of patients as they progressively regain their health. Researchers have described the value of this design philosophy with regard to measures of operational cost, patient safety and error reduction, and patient satisfaction levels (Bonuel & Cesario, 2013; Emaminia et al., 2012; Hendrich, Fay, & Sorrells, 2004; Kitchens, Fulton, & Maze, 2018). Second, rather than transporting patients throughout the healthcare facility to obtain services, there is a trend toward the provision of in-room clinical services (Patel, Satiani, Mong, Baetz, & Spiezio, 2006). These trends suggest that there will be more healthcare workers and hospital staff providing services in patient rooms of the future. Third, largely driven by infection control, new patient rooms within the United States are single patient occupancy. Fourth, the population is getting heavier (Center for Disease Control and Prevention, 2019), meaning that patients will need larger beds, visitors will need larger furnishings, which means less work space for healthcare workers and hospital staff to use in performing their respective tasks. These trends indicate a need for evidence-based guidelines for designers of healthcare facilities that address the ergonomic needs of healthcare workers and staff, while at the same time considering the environmental, social, and cultural design needs of families and visitors. The decision designers make as they create new healthcare environments will significantly impact the way work is done and consequently the health and safety of healthcare workers and hospital staff for many years to come.

An earlier stage of this research (Figure 2) started with an exploration of the issues facing hospital employees ($n = 147$ participants), representing 23 different occupational groups that perform work-related activities within patient rooms (Lavender et al., 2015). These findings were categorized by different stages in the work process which included (1) entering the patient room, (2) preparing to conduct their primary activities within the patient room, (3) doing their primary activity(ies) within the patient room, and (4) leaving the patient room. The purpose of this article is to describe the later stages of the research that led to the development of Med/Surg patient room design guidelines, based on multiple stages of interaction with hospital staff members from a wide range of professions and interactions with patients and family members. This research included a participatory design stage that engaged staff members in a full-scale, readily reconfigurable patient room simulation, reviews by patients and visitors, and a final conflict resolution stage. Data obtained in each stage were used to shape the guidelines presented in this article.

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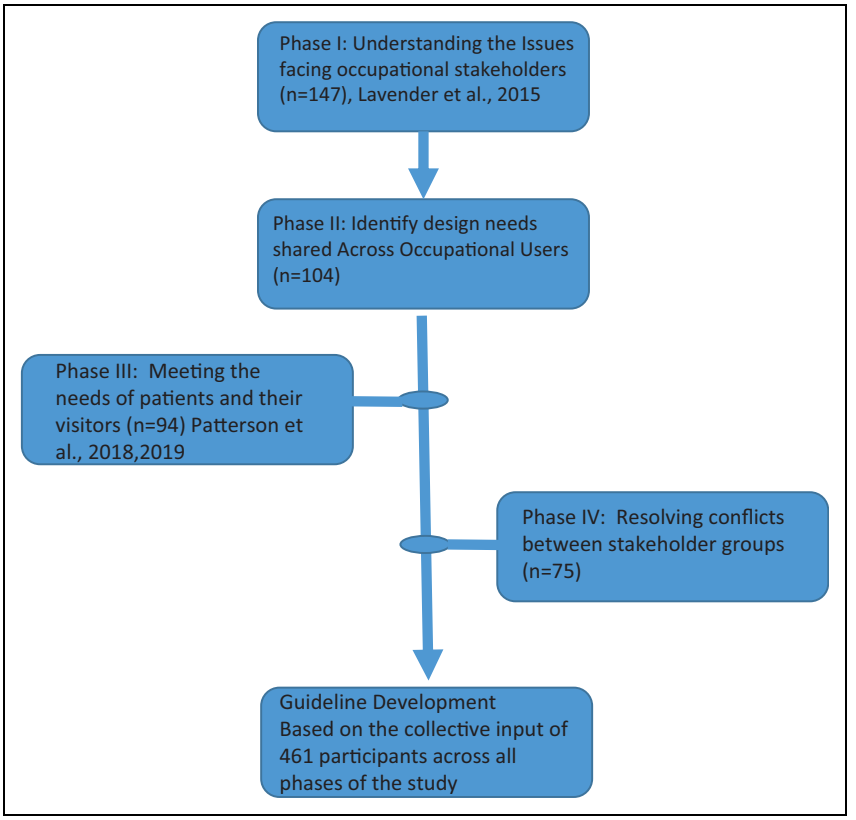

Figure 2. Study process that supports the development of the guidelines presented in this article.

Method

Approach

The initial exploration stage described in Lavender et al. (2015) was followed by a participatory design stage, in which small mixed occupational stakeholder groups designed Med/Surg patient rooms to fit their needs. The single patient Med/Surg room being designed was a 28 m^2 (300 sq ft) rectangular space with a width dimension of 4.6 m (15 ft) and a length dimension of 6.1 m (20 ft). This space included a private bathroom. This design exercise was constrained by the size and shape of the space. The doorway to the room was located along one of the 4.6 m walls and the opposite wall included simulated window(s). In addition, the bathroom needed to be included within the 28 m^2 space and could not be located between adjacent rooms.

Participants

During this phase of the study, 27 participatory design workshops were held, in which 104 individuals, representing 24 occupational stakeholder groups were recruited for the study (Table 1). Intentionally and by convenience, each session comprised a heterogeneous mix of occupations. This ensured that one occupational group did not design a room that wouldn't work well for other occupations.

Apparatus

At the beginning of the design exercise, the contents of the simulated patient room consisted of a patient bed, a sleeper sofa (on wheels), and moveable bathroom walls positioned randomly in the space. The remainder of the items in the room would be brought in by the researchers and

Table 1. Description of Participants in the Phase II Design Exercise.

Stakeholder Group	*n*
Nurse	22
Patient care assistant	14
Physician	11
Respiratory therapist	6
Mechanical shop	5
Physical therapist	5
Social worker	5
Diet technician	4
Speech language pathologist	4
Transporter	4
Dietitian	3
Cardiovascular technologist	3
Nutrition aide	3
Radiologic technologist	3
Occupational therapist	2
Safety care associate	2
Clinical engineer	1
Interior designer	1
Information technology	1
Medical student	1
Physician assistant	1
System shop	1
Unit care assistant	1
Vascular technologist	1
Total	104

positioned in the room by the participants. These bathroom walls and the room walls were covered with loop Velcro material which allowed any items that needed to be attached to a wall to be positioned by the participants (e.g., hand sanitizer dispenser, headwall displays, outlets, light switches). A list of all required and optional items included in this simple mock-up (Peavey, Zoss, & Watkins, 2012) that were used in this design exercise are listed in Table 2.

Procedure

All research procedures and informed consent procedures described in this article were reviewed by the authors' institutional review board (ethics committee) prior to their initiation. Participants first gathered in a conference room. After reviewing and signing the informed consent document, the participants were presented with the goals of the design exercise. They were then presented with a whiteboard that was used to represent the top view of a patient room and included movable shapes representing the bed and sleeper sofa. They were asked to draw on the whiteboard where they would like the bathroom to be located and also position the bed and sofa on the layout. After they discussed and placed these items, the participants were taken across the hall to the full size mock-up room. The initial placement of the bathroom walls, bed, and sofa was put in place to be consistent with the whiteboard layout; however, these could be, and frequently were, changed by the participants once they were in the full-scale mock-up space. It should be noted that the sofa in the room did not have the length of the intended sleeper sofa that allows one person to sleep lengthwise. Participants were asked to leave space to accommodate a lengthier version or one that would become longer when needed.

Once these initial layout decisions were executed, the research staff brought in 45 items that were required to be in the room and bathroom (Table 2, Category 1 items). These included fixtures and other items that belong in the bathroom, structural components of the patient room, utility items, and hygiene items. Once these items were placed in the room, several items brought by patient and visitors that must be accommodated during a patient's stay were brought in the room (Table 2, Category 2 items). Once the participants placed all these items in the room, several optional items were then introduced (Table 2, category 3 items). The participants would decide whether each of these category 3 items should be included and, if so, where they would be placed. The resulting room layouts were then tested by having the investigators bring in additional items used in the provision of patient care (Categories 4 and 5 in Table 2), if they were relevant to the participants of the specific session, so the participants could discuss and demonstrate how these items would be accommodated in the layout for different patient care task scenarios. In all room layouts, the bathroom was evaluated to ensure there was 60-in. diameter circular space to accommodate wheelchair access to meet Americans with Disabilities Act (ADA) requirements. Where this was

Table 2. All Required and Optional Items Included in the Full-Scale Mock-Up Room Layout.

Category 1: Items *required* to be in the room			
Bathroom	☐ Bathroom walls	☐ Bathroom door	☐ Shower area
	☐ Toilet	☐ Patient sink	
Patient room	☐ Patient bed	☐ Sofa	☐ Room door
	☐ Staff sink	☐ Supply storage	☐ Linen storage
	☐ Storage for patient	☐ Overbed table	☐ Visitor chair(s)
	☐ Patient chair (recliner)	☐ TV(s)/info/entertainment system	☐ Deep Vein Thrombosis (DVT)—prevention pump
Utilities	☐ Whiteboard/info source	☐ Code blue button	☐ Electrical outlets
	☐ Light switches	☐ Lighting overbed	☐ Nurse call buttons
	☐ Telephone	☐ Wall clock	☐ Intravenous (IV) therapy pole/IV pump
	☐ Headwall	☐ Blood pressure unit	☐ Room thermostat
	☐ Physiologic monitor	☐ TV control	
Hygiene items	☐ Hand sanitizer	☐ Glove dispenser	☐ PPE (gowns/masks)
	☐ Soap dispenser	☐ Sharps container	☐ trash can
	☐ Soiled linen basket	☐ Paper towel dispenser	☐ Urinal bottle
	☐ Shower seat	☐ Mirror	☐ Handrails
Bathroom items	☐ Bedpan	☐ Trash can	☐ Soap dispenser
	☐ Toilet paper dispenser	☐ Urine collection "hat"	
Category 2: Patient items that must be accommodated during patient's stay			
☐ Luggage	☐ Shoes	☐ Cell phone/charger	☐ Greeting cards
☐ Clothing	☐ Flowers	☐ Laptop/tablet PC/iPod and charger	☐ Entertainment materials (books, etc.)
☐ Health-related items (eye glasses, dentures, hearing aids)		☐ Personal care items (lip balm, toothbrush, facial tissues)	
Category 3: Optional items that may be included			
☐ Nightstand	☐ Artwork	☐ Wall hooks	☐ Shelves
☐ Ceiling lift	☐ Small table for visitors	☐ Foldable tray	☐ Privacy curtain(s)
☐ Small safe for patient items		☐ In-room computer workstation	
Category 4: Items brought in by occupational stakeholders that have to be temporarily accommodated			
☐ Meal tray	☐ Vitals monitoring unit	☐ Ultrasound machine	☐ X-ray machine
☐ Lift equipment	☐ Computer on wheels	☐ Step ladder	☐ Transport gurney
☐ Tablet computer			
Category 5: Items related to patient's condition			
☐ Walker	☐ Bedside commode	☐ Wheelchair	☐ Chair for sitter
☐ Respirator	☐ Dialysis machine	☐ Ventilator	☐ Chest tube box

not the case, the participants were asked to adjust their design accordingly. At the completion of the design exercise, participants were asked to provide a narrated tour of the patient room and describe to the investigators the features they had included and their rationale for doing so. This tour was audio and video recorded for subsequent analysis. Photographs of the room, including each wall surface, were taken to provide a photographic record of each item's

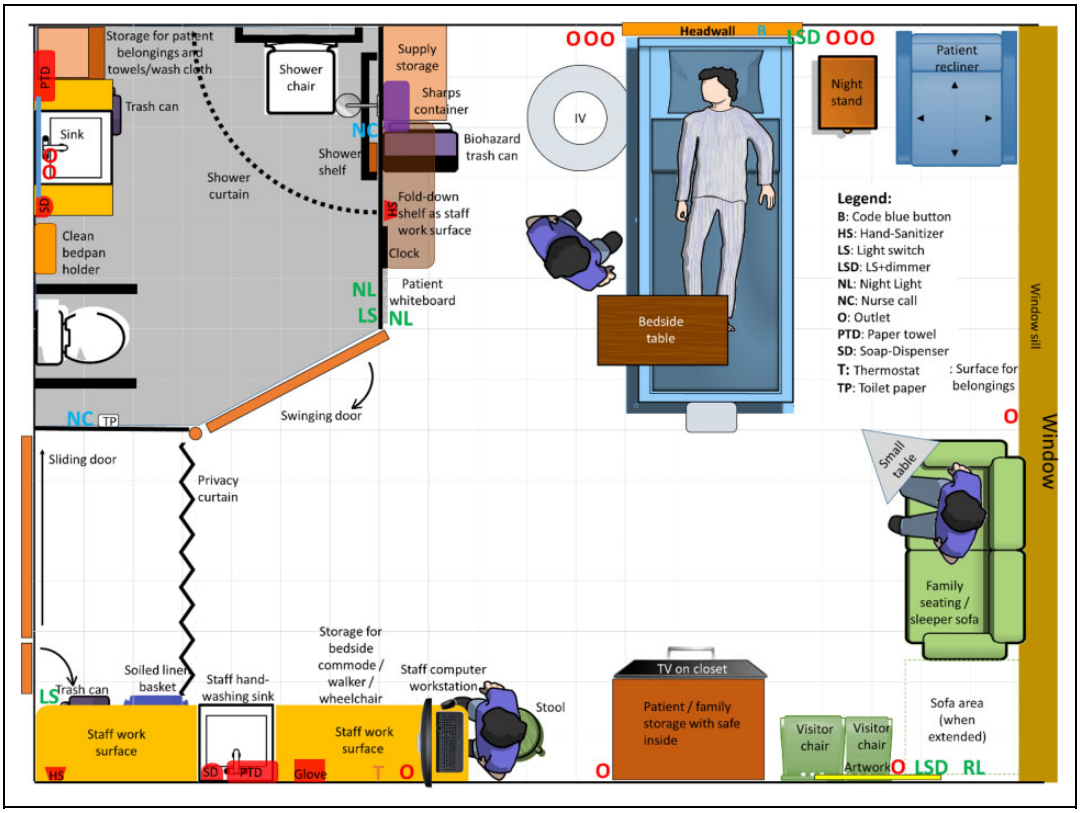

Figure 3. The hybrid room design based on 12 layouts where the bed is located adjacent to the inboard bathroom.

placement. Once the participants left the session, the research team video recorded a "hot wash" where the key ideas that emerged from the just concluded session were discussed.

Data Analysis

Following the session, the location and orientation of each item in the room was recorded using a three-dimensional grid system. The room layout was then replicated in a top view using drawing tools in PowerPoint software (Microsoft Office Professional Plus, 2013). In addition, novel features of each design were noted by viewing the room photos, the video tour, and the investigator hot wash session.

At the completion of the 27 sessions, the 27 layouts were reviewed and clustered based upon bathroom location, bed location and orientation, and the location of the family area. This process resulted in five layout clusters that characterized the major differences in the room layouts. Within each cluster, the most representative and potentially most effective and feasible design features were identified by the research team, and these were used to create a hybrid design representative for that cluster of designs. This analysis process resulted in the compilation of five hybrid layouts, one representing each layout cluster.

Results

Of the 27 layouts, 12 layouts were characterized as having the "bed located adjacent to the inboard bathroom." A hybrid layout representing the key features from this cluster is shown in Figure 3. Key features of this hybrid room design were a sliding room door with a secondary door that could be opened when more than 48 in. of doorway access space is needed. The bathroom

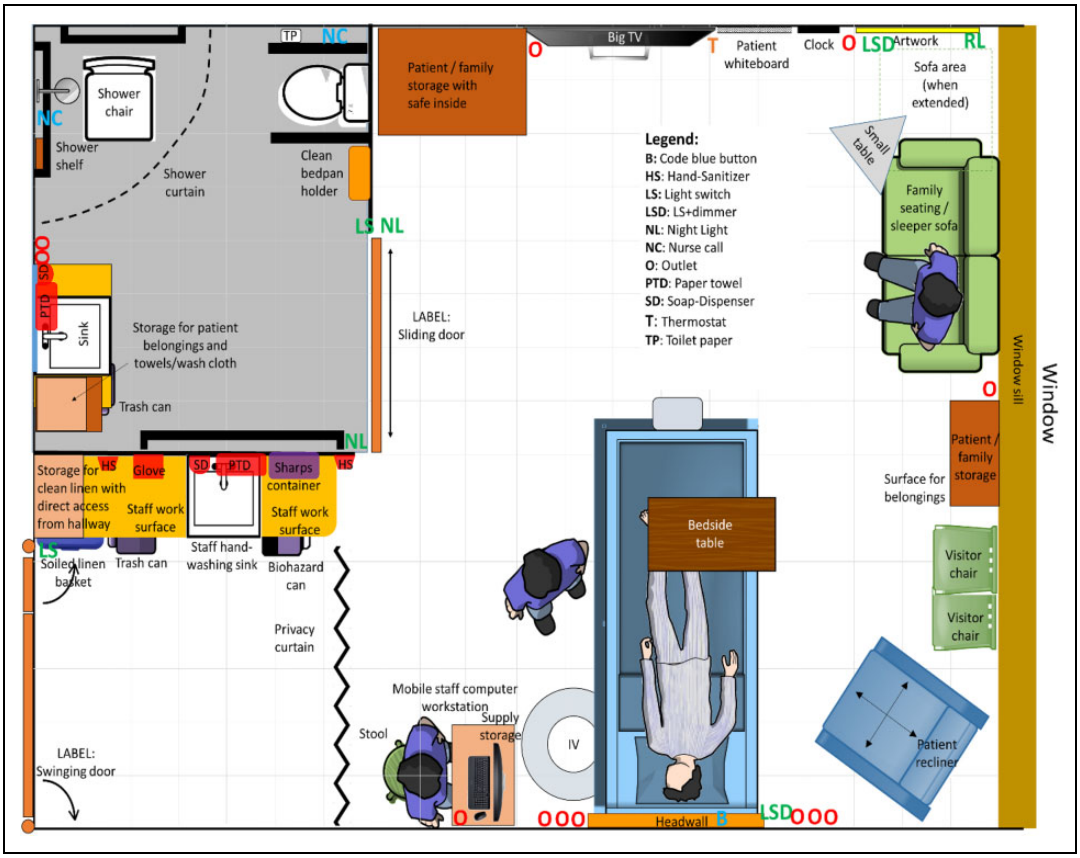

Figure 4. The hybrid design based on four room layouts where the bed is located across from an inboard bathroom.

doorway was angled to facilitate staff seeing the patient from the doorway. There was a dedicated staff work surface near the patient bed and in the entryway. In the bathroom, the toilet and bathroom sink were placed along the corridor wall to facilitate plumbing access. The family area was placed along the window beyond the foot of the bed to ensure staff had access to both sides of the bed.

The remaining 15 layout designs comprised four design clusters, with each cluster based upon three or four individual layouts. Four rooms were characterized as having a "bed across from an inboard bathroom." The notable feature with these rooms is that the patient is clearly visible to staff from the corridor. Staff members indicated this was valuable for rounding and being able to determine whether activities were going on in the room that should not be interrupted. Two of these rooms included French-style bathroom doors that could swing either direction, thereby allowing them to be pushed out of the way when the patient was either entering or leaving the bathroom. Two of the rooms had sliding bathroom doors. Figure 4 shows the hybrid room created from these four layouts which included a sliding door configuration for the bathroom and entry doors. While the patient bed is in full view of the doorway, a privacy curtain can be used when desired by the staff or the patient.

Four of the rooms designed by participants were characterized as having an "outboard bathroom across from the patient's bed and where the head of the bed was offset from the room door." The hybrid room in Figure 5 includes design features such as a supply storage that can be restocked from outside the room, a large staff work surface along

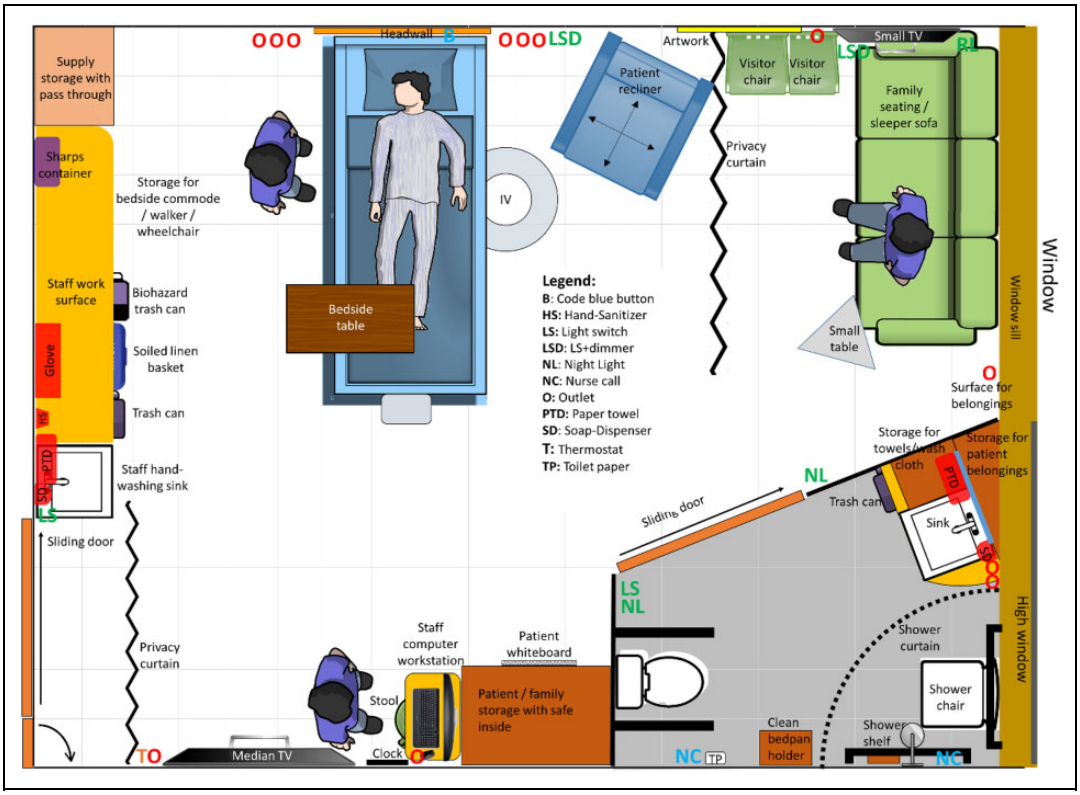

Figure 5. The hybrid design based on four room layouts where the bed was offset from the corner door with outboard bathroom.

the corridor wall, a second privacy curtain to separate the family area when patient care activities are going on in the room, a sliding bathroom door, and a toilet oriented such that a minimal turn of the patient is required to seat the patient on the toilet.

The hybrid design shown in Figure 6 was based on four room layouts that were characterized as having "an outboard bathroom and a segregated family area." Some staff thought that having the family in their own defined portion of the room would eliminate potential space conflicts. Notably, this hybrid room had a large horizontal surface across from the bed that could be used by the staff, patients, and family.

Figure 7 shows the hybrid room based upon three rooms layouts characterized as having the "bed positioned at an angle relative to the rectangular-shaped floor space." In all of these designs, the bathroom was inboard. In two of the three designs, the bed was oriented to facilitate the patient's view out the window. In the hybrid version of this room, the bed is angled toward the window and is pulled out from what normally would be the headwall. This was by design, as participants indicated a need to access the head of the bed during certain procedures (e.g., intubation).

Many innovative features that address the needs of staff and patients were expressed through the room designs. Figure 8 shows the breadth of design ideas, clustered by category, that were obtained through the participatory design process. Many of these design features would allow staff to work more efficiently, but in many cases, these features also reduce physical demands. For example, it is easier to assist patients on/off higher toilets, having adequate horizontal surface space means that staff does not need to move patient or visitor belongings to set up and perform their tasks, having recliners designed with fold-down sides enables staff to

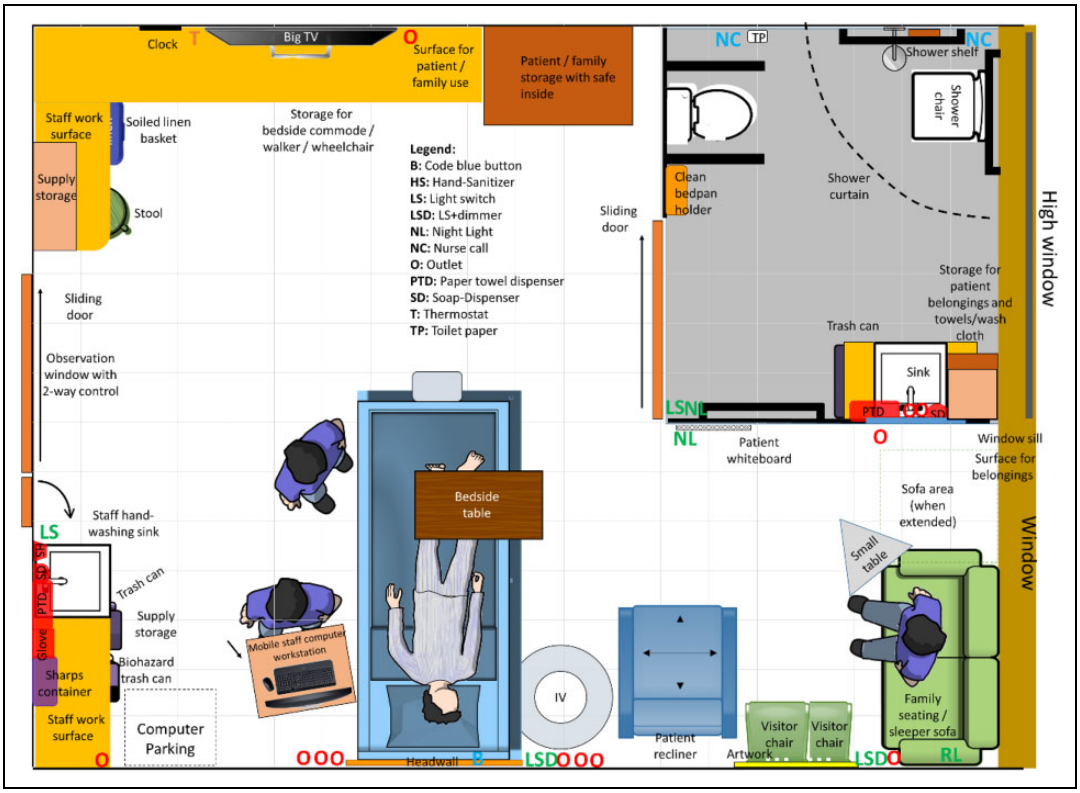

Figure 6. Hybrid design based on the four room layouts with an outboard bathroom and a segregated family area.

more easily provide assistance with sitting or rising from the recliner, and having recliners on wheels with brakes/release mechanisms on both sides reduces reaching and awkward postures. Many other features reduce cognitive and time demands on staff. These include standardized light switch placements and operations, giving the patient a remote control device that activates not only lighting but also window shades and room temperature in order to reduce the number of nurse call requests, providing the patient with accessible electrical outlets they can reach themselves, and having adequate storage for personal items on the overbed table so that patients have easy access to those items without needing to ask for assistance. Many of these items reduce the demands on nursing staff which allows more time to complete clinical tasks and charting; patients also enjoy a degree of autonomy in a situation (being hospitalized) in which much is no longer under their control.

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Given that many patient handling activities take place in the bathroom, a deeper analysis of the bathroom layouts was performed. Bathroom location could also be a factor related to attempted bathroom use and patient falls. Of the 27 room designs created through this participatory process, 19 had an inboard bathroom located just inside the room door and the remaining 8 had an outboard location near the window. The overall size of the bathroom ranged from 4.3 m^2 (46 sq ft) to 6.3 m^2 (68 sq ft) with an average size of 5.4 sq m (58.1 sq ft).

Nurses indicated that they preferred the bathroom close to the room door, so that they could quickly and easily get in to assist patients when needed. Plumbers and housekeepers also liked the bathroom close to the room door, so they would

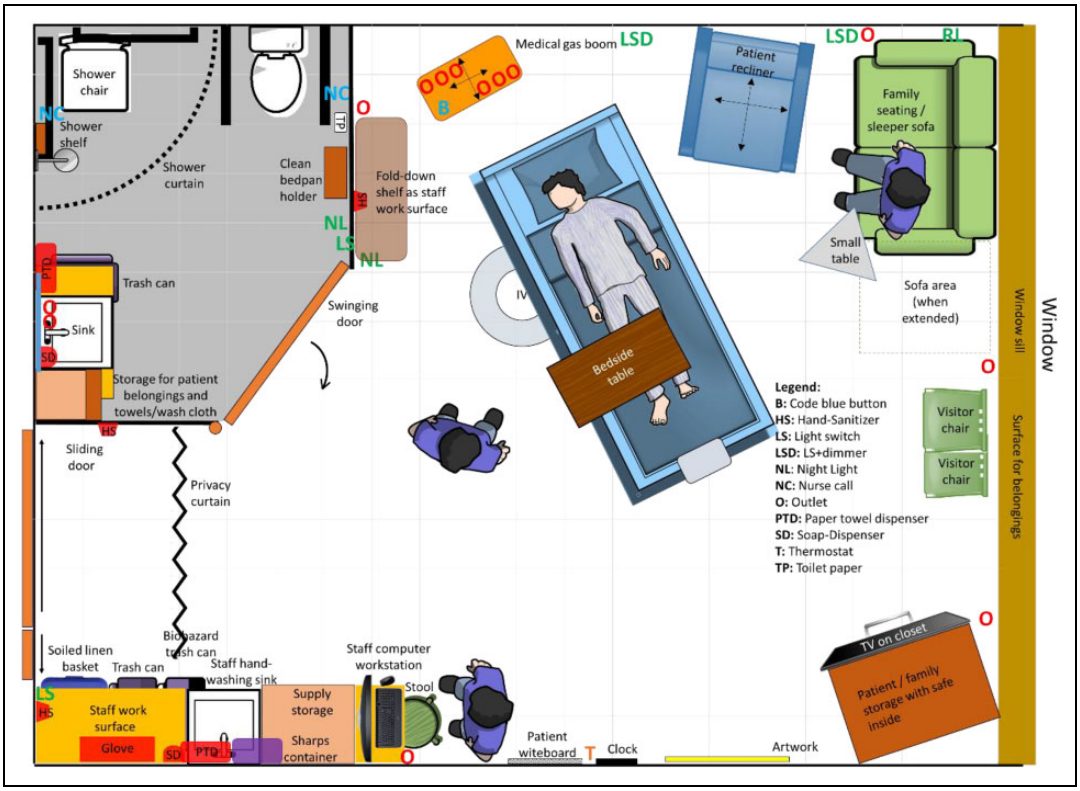

Figure 7. Hybrid design based on the three room layouts with "angled" beds.

not disturb the patient when servicing the room. The doorway to the bathroom could be located on one of two walls or diagonally across the corner of the bathroom. A sliding door along the outside wall of the bathroom was chosen in 16 designs, and split ("French") doors were selected for five bathroom designs. Four designs had a conventional door that swung out and one had a door that could swing in either direction. The type of door affects how difficult it may be for patients with limited mobility, those being assisted by staff, or using mobility aids to enter the bathroom. For example, when opening a conventional hinged door, the patient may need to back up as the door is opened. This may not be true with a sliding door or French-style doors that can swing both ways.

The distance from the center proximal edge of the bed to the bathroom door varied between 1.2 and 4.3 m (mean = 2.0 m). The total distance from the center proximal edge of the bed to the toilet ranged between 3.0 and 6.2 m (mean = 3.5 m). Having a handrail along the wall between the bed and bathroom was only potentially feasible in 14 of the 27 rooms. But this would require that computers or other equipment were not parked so as to block access to the wall-mounted handrail. Once inside the bathroom, it would be feasible to have a handrail along the wall between the toilet and door in many of the layouts developed by the participants. In some layouts, the countertop with the sink, while not grasped as firmly as a handrail, could still help the patient retain stability. Distances and handrail availability also impact staff who are assisting patients with toileting.

In 10 of the bathroom layouts, the patient would be able to see the toilet from the bed if the bathroom door was open. Twenty-four of the rooms only required one change in walking direction when ambulating from the proximal edge of the bed to the toilet. Two rooms required two directional changes and one room required three directional changes. These directional changes

Figure 8. Design features identified across the room layouts developed in the second stage of the study.

ranged between 10° and 100°. As one walked into the bathroom, the toilet was located approximately along the path of travel (i.e., within 15°) in 14 of the bathroom layouts. A 30–45° turn would be required in eight of the designs and a 50–90° turn would be required in five of the designs. Seventeen bathroom layouts would result in the patient having to turn 180° to sit on the toilet. However, four layouts reduced this to 135° and six of the layouts only required a 90° turn by the patient. Larger directional changes, whether along the path to the toilet or when

sitting on the toilet, can be more destabilizing to patients, thus making it more difficult for staff to physically support these patients. This could lead to a patient fall, injury to staff, or both.

One major concern for patients is their privacy when in the bathroom, especially if they are not able to close the door. With the bathroom door open, the toilet was in view of the family zone in 10 of the layouts. It was visible from the hallway door in four of the layouts. In three of the hybrid rooms, the toilet could not be viewed from the family area (Figures 5, 7, and 8). Only one of the hybrid rooms potentially did not fully conceal the toilet from the hallway (Figure 7).

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Guideline development. Upon completing the process described above, the five hybrid versions of the rooms that emerged from the participatory design process were shown to patients ($n = 37$) and their visitors ($n = 24$) to identify needs of the room occupants. In this process, small groups of patients and visitors were guided through tours of two of the hybrid full-scale mock-up spaces. The specific hybrids viewed were rotated across groups such that all of the hybrid layouts were viewed by between five and seven groups. The session moderator explained the layout, furnishings, and the unique features of each hybrid design concept. While touring each mocked-up room, a survey that addressed 17 room elements and features was completed by the participants. Following each tour, the groups returned to a conference room and discussed what they liked and disliked about the room they had just seen. These surveys and discussions provided feedback from the patients and visitors (Patterson et al., 2017, 2018) that were incorporated into the hybrid versions which were then shown to 75 occupational stakeholders in a process to identify potential design conflicts across the different occupational and nonoccupational stakeholder groups. The recommended changes, already included in the hybrid designs presented in Figures 4–8, were incorporated into a guideline development process. Based on the participants' concerns shared in the initial focus groups, ideas expressed in the design activity, and subsequent hybrid design reviews by patients, visitors, and staff, 66 room design guidelines were developed that should be used when designing new or remodeled Med/Surg patient rooms. Each guideline was the result of a collaborative effort and consensus building within the research team as the research findings and evidence for each guideline was discussed. These guidelines are organized by the different areas of the room (i.e., "zones") to which they apply and resulted in 16 guidelines addressing the entry area, 22 guidelines addressing the patient/clinical area, 17 guidelines addressing the bathroom, 8 guidelines addressing the needs of family members and visitors, and 3 guidelines addressing patient storage needs. For each guideline presented in Tables 3–7, the tables list the primary, and where relevant, a secondary room item related to each guideline, the constraints that need to be considered when implementing each guideline, and the rationale for each guideline from both the staff and patient perspectives. For example, in the bathroom guidelines, one primary item is a horizontal surface that is adjacent to the sink which is the secondary item. This allows the guidelines to be easily searched for information pertaining to specific items found within the hospital patient room. The rationale for each guideline is presented from both the staff and the patient's point of view.

Based on the participants' concerns shared in the initial focus groups, ideas expressed in the design activity, and subsequent hybrid design reviews by patients, visitors, and staff, 66 room design guidelines were developed that should be used when designing new or remodeled Med/Surg patient rooms.

The 66 evidence-based guidelines were presented at the 2017 Healthcare Design conference. During the presentation, an accompanying survey was completed by 54 audience members, an audience that was largely comprised of architects (47%) and interior designers (36%). As each

Table 3. Entryway Design Guidelines.

Primary/Secondary Item(s)	Design Guideline	Design Constraints	Why (Staff)	Why (Patient)	Easy to Do (%)	Already Do (%)
Room door	1. Use an easily operated manual sliding (barn style) door rather than a swing or folding door* (*There is conflict regarding whether the door should be opaque. Staff want to see patient versus. some patients want visual privacy.)	• Door needs to accommodate signage. • Door needs to effectively limit noise transmission to or from the hallway. • Smoke barrier	• Less space is taken in the room. • Removes the need to back away from the door when opening. • Easier for staff to use. • Removes door knob/handle that catches on beds, IV's, and so on.	• Easier for patients to use. • Removes door knob/ handle that can be bumped into or catch IV line.	44	20
Room door/ patient's bed	2. Position room door so that staff can see patient's head from entry way.	• Position the bed such that patient's head is not too close to the doorway.	• Efficient staff rounding balanced with patient privacy and security. • Staff do not want to startle patients when entering the room.	• Patients want the ability to see when people are entering the room. • Patients do not want to be startled when people come in the room. • Patients want to see who is entering the room. • Patients want to have their privacy and control corridor noise. • Patients do not want to feel like they are on display.	46	39
Staff sink/room door	3. Staff sink should be inside the room, near the door.	• Viewable by patient.	• Facilitates staff hand washing upon room entry and exit. • *Clostridium difficile* precautions require hand washing rather than use of hand sanitizer.	• Viewing staff washing hands is important to some patients and visitors.	83	57

(continued)

Table 3. (continued)

Primary/Secondary Item(s)	Design Guideline	Design Constraints	Why (Staff)	Why (Patient)	Easy to Do (%)	Already Do (%)
Biohazard container/ room door	4. Space should be allocated for a biohazard container near the room door.	• Dedicated space has to be large enough to accommodate containers holding isolation apparel and procedural materials. • Container cannot obstruct the entry way.	• Staff needs to dispose of personal protective equipment (PPE) as they exit the room. • Cleaners want to be able to empty waste without disturbing the patient. • Staff bringing equipment in/ out of the room do not want obstructions in the path of travel.	• Patients do not want to be disturbed when waste is removed from the room.	61	48
Nonbiohazard trash can/room door	5. Space should be allocated for a trash can near the room door.	• Allocated space has to be large enough to accommodate trash bins used by the facility. • Trash can placement cannot obstruct the entry way.	• Cleaners want to be able to empty trash without disturbing the patient.	• Patients do not want to be disturbed when trash is emptied. • Patients don't want to smell or see the trash.	68	44
Vital signs monitor/ room door	6. Vital signs data can be viewed from room doorway	• Vital signs monitor should be positioned at a location so that staff working in the room do not bump their heads on the monitor.	• Efficient staff rounding, less disruptions for patient.		33	19
Lighting controls/ room door	7. Provide clearly labeled lighting controls just inside room entrance.	• Separate switches for different spaces within the room. • Mapping of switches should match the room layout. • Consistent switch layout in all patient rooms.	• Reduce staff confusion. • Reduce patient disruptions.	• Patients and their visitors want to be able to determine which light switch should be used.	89	31

(continued)

Table 3. (continued)

Primary/Secondary Item(s)	Design Guideline	Design Constraints	Why (Staff)	Why (Patient)	Easy to Do (%)	Already Do (%)
Horizontal surface in entryway/room door	8. Provide a horizontal surface intended for staff proximal to the room entry door.	• There needs to be separation from the staff sink to keep surface dry. • The surface cannot reduce effective width of the entryway space. • The space should be sufficient for a laptop computer or tablet that is visible from the clinical area.	• Provides staff a place to set things as they enter the room.		46	39
In-room medical supply storage—Permanent option/room door	9. Locate permanent storage near room door or along corridor wall with a pass through design.		• Facilitates restocking with minimal disturbance to patient or other activities going on in the room.	• Restocking can occur without disturbing the patient.	30	15
In-room medical supply storage—Mobile option/ room door	10. Provide adequate space for in-room mobile medical supply storage with a horizontal work surface that can be used by staff.	• Needs to be able to get close to the bed. • Needs to have a parking spot for the storage unit that is accessible to users and doesn't impede workflow.	• Gets supplies close to where they are needed. • Allows staff to work more efficiently. • Work surface allows staff to work more effectively.		33	17
Linen supply/room door	11. Locate linen supply near room door or in the room along the corridor wall with pass through design.	• The pass through may not be permitted by hospital policy.	• Facilitates restocking with minimal disturbance to patient or other activities going on in the room. • Reduces the need to don and discard PPE when restocking.	• Restocking can occur with minimal disturbance to patient.	17	17
Hand sanitizer/room door	12. Locate hand sanitizer near room door and in view of the patient.	• Place inside the room. • Must meet Life Safety Code requirements for alcohol based hand rub dispensers (NFPA101-2000).	• Facilitates use of hand sanitizer upon room entry/ exit.	• Allows patients to see that their caregivers are following procedures that prevent infections.	90	54

(continued)

Table 3. (continued)

Primary/Secondary Item(s)	Design Guideline	Design Constraints	Why (Staff)	Why (Patient)	Easy to Do (%)	Already Do (%)
Glove box/room door	13. Locate glove box just inside room door.	• Glove box should be located in a consistent position relative to the room door in all patient rooms. • Glove box should be located such that it does not stick out from the wall where it can catch on IV's, beds, and so on. Passing through the entryway.	• Allows PPE to be donned prior to interacting with patient.		91	50
Container for noncontaminated soiled linen/room door	14. Locate soiled linen container near entry door.	• A separate bagging system is used for contaminated soiled linen.	• Allows soiled linens to be easily removed from the room. • Less disruption of staff working in the room.	• Reduces odors for patients and visitors. • Less disruption of the patient when soiled linen is removed.	50	24
Status indicator—Room activity/ room door	15. Provide an indicator outside the room door that can alert staff to the occurrence of a procedure or activity in the room that should not be interrupted.	• Indicator system should be clearly visible prior to room entry. • Indicator system should be consistent and uniform across patient rooms. • Only staff should be able to turn the indicator on.	• Allows staff to complete procedures without interruptions. • Allows staff to determine when a room or a patient is accessible.	• Allows for high quality care. • Supports patient privacy.	78	33
Status indicator—patient status/ room door	16. Provide a patient status indicator outside the room door that can alert staff and visitors to restrictions and precautions relative to patient status.	• Indicator system should be clearly visible prior to room entry. • Indicator system should be consistent and uniform across patient rooms. • Staff should be able to easily change indicator status. • New status categories should be easy to create.	• Reduces the risk of staff exposures to infectious diseases and other hazardous conditions. • Supports appropriate patient care.	• Reduces risk of having procedures delayed or associated complications. • Reduces risk of violating restrictions placed on patients due to their condition.	81	35

Table 4. Patient/Clinical Area Design Guidelines.

Primary/Secondary Item(s)	Design Guideline	Design Constraints	Why (Staff)	Why (Patient)	Easy to Do (%)	Already Do (%)
Bed/window	1. Locate patient bed such that the patient can see out of the window without assuming an awkward posture.	• Provide 3 ft of clearance on the primary access side, and 3 ft of clearance on the distal side and the foot of the bed (The Facility Guidelines Institute, 2018). • Must also comply with patient/clinical recommendations 2 and 3.		• Published data support the importance of exterior views on patient satisfaction, reducing confusion for patients with dementia, and maintaining circadian rhythm.	50	52
Bed/room door	2. Locate patient bed such that the patient can see who is entering the room.	• Need to preserve the patient's sense of privacy from people in the hallway. • Must also comply with patient/clinical recommendations 1 and 3.	• Being able to see who is entering the room prevents staff from startling the patient.	• Enhances patient's feeling of security.	58	44
Bed/sleeper sofa	3. Locate patient bed such that the patient can communicate with people in the family area.	• There needs to be 3′ on the primary access side, and 3′ on the distal side and the foot of the bed (The Facility Guidelines Institute, 2018). • Must also comply with patient/clinical recommendations 1 and 2.	• Facilitates staff communicating with the patient and family members at the same time without asking family members to move.	• Enhances patient's ability to communicate with family and visitors sitting on the sofa.	78	54
Recliner/bed	4. Allow space for the recliner to be positioned near the bed on either side.	• Recliner needs to move easily and have locking casters. • When positioned near the bed, someone sitting in the recliner should be able to comfortably view the TV.	• Facilitates moving the patient between the bed and the recliner.	• Reduces patient fall potential when getting in and out of recliner. • Allows visitor to sit comfortably near the patient while watching TV with the patient.	22	39
TV/bed	5. Position the TV so that the patient can view it comfortably when sitting or lying in bed or the recliner.	• TV should not be blocked by staff as staff perform their normal activities in the room. • Patients may have physical limitations that may limit viewing angles. • Consider the distance from the TV. • Position/angle TV to avoid glare on the TV screen from overhead lights and the window. • TV height should prevent unintended contact with equipment, be out of reach of small children, and allow for easy cleaning.	• Environmental services staff need to be able to clean the TV. • Staff can use TV as a positive distractor for their patients.	• Patients may only be capable or comfortable lying on one side of their body. • Avoid neck discomfort for patients.	86	65
TV/visitor seating	6. Position the TV so that the patient's visitors can view it comfortably while seated.	• TV should not be blocked by staff as staff perform their normal activities in the room. • Consider the distance from the TV. • Position/angle TV to avoid glare from overhead lights and window on the TV screen. • TV height should prevent unintended contact with equipment, be out of reach of small children, and allow for easy cleaning.	• Environmental services staff need to be able to clean the TV. • Out of child reach helps keep the TV clean.	• Patient's visitors need to comfortably view the TV (see visitor seating)	45	52

(continued)

Table 4. (continued)

Primary/Secondary Item(s)	Design Guideline	Design Constraints	Why (Staff)	Why (Patient)	Easy to Do (%)	Already Do (%)
Visual barrier (e.g., privacy curtain)/ bed	7. Provide a visual barrier, such as a privacy curtain, that affords privacy from the hallway and family seating area when needed or desired.	• Visual barrier should be easily cleanable or disposable to facilitate providing each patient with a clean privacy curtain. • Visual barrier(s) should block view of bed from the door and the family area.	• Provides patient privacy during procedures in the room.	• Provides the patient with privacy from the corridor and from their visitors (see family area).	70	52
Whiteboard/bed	8. Position whiteboard such that it can be easily viewed by staff and patients and easily updated by staff.	• Patients need to see the whiteboard comfortably when sitting or lying in bed or the recliner, perhaps without corrective eyewear (see communication board recommendations below). • Position whiteboard such that it is not erased by inadvertent contact by people walking by.	• Informs staff who is on the care team. • More easily kept up to date when it is in an easily accessible location.	• Allows patients to easily view information on the board (e.g., date, daily goals, and names of care team members).	76	56
IV pole (+pumps and/or bags)/bed	9. Provide space for the IV pole(s) next to the bed.	• The IV pole may need to be on either side of the bed.	• Reduce the need to replace IV site after accidental IV removal	• More comfortable for the patient to have the IV pole on the same side as the IV.	86	57
Sharps container/Bed	10. Choose a sharps container location that allows staff to easily dispose of sharps while working at the patient's bed.	• Do not locate the sharp container above or in close proximity to visitor and sitter seating.	• Facilitates the appropriate disposition of the sharps with minimal steps required by staff who are working with the sharps.	• Reduces the likelihood of a head injury when sitting in or standing up from the visitor seating. • Reduces the risk of needle-stick injuries in visitors when staff are disposing of sharps.	66	44
Work surface (staff work)/bed	11. Provide a staff-specific horizontal work surface that is proximal to or can be positioned near the patient's bed or recliner, and near the anatomical site of the procedure.	• Should be in close proximity to the patient • Should be able to be positioned such that staff can control patient's access to the surface, for example, when necessary to avoid contamination. • Location of the surface does not require the caregiver to turn away from the patient to access the sterile items on the work surface.	• Provides a dedicated place to set down tools and materials needed for patient care. • Minimizes staff turning away from the patient.	• Patients do not need to share their tray table space. • Lowers risk of patient infection.	46	26
Seating/bed	12. In addition to space for the recliner, provide space for visitor/staff seating, in addition to the patient's recliner, in close proximity to the patient's bed.	• Needs to accommodate anthropometric variability and disability.	• Allows staff to direct access to the patient.	• Allows visitors to sit with and have eye-level interaction with patients.	60	54

(continued)

Table 4. (continued)

Primary/Secondary Item(s)	Design Guideline	Design Constraints	Why (Staff)	Why (Patient)	Easy to Do (%)	Already Do (%)
Seating/bed	13. In addition to the sleeper sofa, provide easily movable visitor/staff seating for at least two people.	• This seating should be dedicated to the specific patient room. • Chairs should accommodate individuals of varying size and support a range of sit-to-stand abilities. • This does not include seating for a sitter which should have casters and should not be stored in the room.	• Allows staff to sit and have eye-level interaction with patients.	• Allows visitors to sit with and have eye-level interaction with patients.	33	22
Headwall/bed	14. Provide a split headwall that duplicates the medical gases and electrical services on both sides of the bed.	• Medical gas control and flow meters, as well as electrical outlets should be between waist and chest height.	• Reduces reaching, bending, and twisting.	• Moves the cords to the side of the patient.	33	31
Outlets/bed	15. Provide an adequate number of electrical outlets for staff use on the headwall and other locations within the room at waist level or above.	• Needs to accommodate multiple pieces of hospital equipment that should not be unplugged. • Needs to accommodate staff bringing specialized equipment (i.e., imaging) into the room. • Minimum number for each patient bed location is dictated by the National Electrical Code.	• Allows staff to easily plug-in their equipment (e.g., portable X-ray equipment). • Removes the need to ask nurses what can be unplugged by other staff who need to access an outlet.	• Prevents accidentally unplugging life-sustaining equipment (i.e., ventilators)	71	41
Outlets/bed	16. Provide an adequate number of electrical outlets that are accessible by the patient when in bed or in the recliner.	• Need to be able to accommodate up to four electronic devices that might be used by patient or visitors. • Outlets need to be protected from liquid spills.	• Reduces the demands on hospital staff for assistance with plugging in or retrieving charged items from locations out the patient's reach.	• Patients can operate/charge their electronic devices. • Potentially reduces patient falls as they are not getting out of bed to plug-in or retrieve their electronic devices.	58	24
Lighting control/bed	17. Provide the patient with control of the electric lighting, including ambient room lighting and reading light, from the bed and the recliner.	• Lighting controls should be clearly labeled and mapped to room lighting locations. • Configuration, placement, and mapping of lighting controls should be consistent across all patient rooms in the facility. • Patient cannot control the over-the-bed exam lighting, and night lighting.	• Reduces staff confusion regarding lighting controls. • Reduces the patient's dependence on hospital staff.	• *Reduces falls as patients will not need to get out of bed to turn off/on lights or navigate in the dark.* • Provides patient control over lighting. • Provides patient the ability to read or other activities without disturbing others in the room.	69	33
Control pendant/ window coverings	18. Provide the patient with remote control of the exterior window shades/curtains from the bed and the recliner.	• A secondary control is available for staff to override patient control when appropriate (e.g., during imaging procedures).	• Reduces the patient's dependence on hospital staff.	• May reduce falls as patients will not need to get out of bed to control window shades. • Enhances patient and visitor comfort and ability to sleep.	29	17

(continued)

Table 4. (continued)

Primary/Secondary Item(s)	Design Guideline	Design Constraints	Why (Staff)	Why (Patient)	Easy to Do (%)	Already Do (%)
Control pendant/ temperature control	19. Provide the patient with remote control of the room temperature from the bed and the recliner.	• Limit control within a reasonable range given the patient's condition. • A secondary control is available for staff to override patient control when appropriate.	• Limiting the range allows for comfortable working conditions for staff. • Reduces patient complaints and nurse call requests to staff about room temperature. • Reduces clinical staff complaints to engineering staff about room temperature. • Reduces the demands on staff for blankets, and so on.	• Enhances patient comfort. • Limiting range facilitates visitor comfort. • *May reduce falls as patients will not need to get out of bed to control thermostat.*	20	13
Clock/bed	20. Position wall clock in view of patient and staff.	• Should be large enough to see without glasses. • Clock should distinguish between a.m. and p.m. • Not all patients can interpret an analog clock. • Nursing personnel need a means to count seconds.	• Staff use the clock when working with patients.	• Allows patient to maintain daily rhythm. • Allows patient to keep track of time.	97	54
Lighting/nightlight	21. Provide night lighting in the patient room (in addition to the nightlight in the bathroom).	• Automatic	• Allows staff to safely move around the room. • Allows staff to not disturb sleeping patients and visitors when coming into or working in the room.	• Allows patients and visitors to safely move around the room.	77	50
Electrical cord support/bed	22. Provide a cord support system to keep electrical cords and other cords (e.g., pendant, compression pumps) that are under the bed off the floor.	• Keep cords and cables free from any moving bed parts. • Cord support system should be easily accessible.	• Facilitates cleaning the floor under the bed. • Removes trip hazards. • Makes it easier to move the bed short distances.	• Removes trip hazards. • Make it easier for patient to position tray table.	53	19

Note. Italic text in the "why" columns are additional considerations provided by investigators who did not come directly from the data.

Table 5. Bathroom Design Guidelines.

Primary/ Secondary Item(s)	Design Guideline	Design Constraints	Why (Staff)	Why (Patient)	Easy to Do (%)	Already Do (%)
Bathroom door	1. Use a sliding (barn style) door rather than a hinged door.	• Door needs to be opaque. • Door should limit transmission of bathroom sounds. • Door should move easily—consider the force required to move the door.	• Less space is taken in the room to accommodate door swing. • Removes the need to step back from the door when opening the door. • Preferred by staff where there is an inboard bathroom and the swinging door would block the view of the patient in bed from the hallway.	• Less effort to close the door after entering the bathroom to have visual and auditory privacy. • Patients do not have to back up after opening door to enter the bathroom. • Patients believe it would be easier to open and close the bathroom door. • Patients have reported an inability to open/close the door. • Health conditions can restrict physical activities including moving heavy doors.	32	17
Bathroom door	2. Position bathroom door to preserve patient privacy.		• Address staff concerns regarding patient privacy while using the toilet.	• Patients do not want visitors inside the room and people outside the room to see them while using the toilet if the door is not closed.	51	31
Gloves/bathroom door	3. Make gloves available in the bathroom near the door.	• Consistency of placement relative to bathroom door across bathrooms within the facility.	• Staff finds themselves in need of gloves in the bathroom.	• Patients are less likely to fall if staff does not have to leave the patient's side when obtaining gloves.	60	13
Bathroom door/ bed	4. Optimize the location of the bathroom door relative to the bed.	• Should be close enough to avoid patient fatigue. • Distance should be far enough to minimize odor in the patient/clinical area. • No more than one turn should be required by the patient when walking from the bed to the toilet.	• Easier for staff to assist patients into the bathroom. • Minimizing the number of turns makes it easier for patients with mobility limitations and therefore easier for staff to provide assistance with lower the risk of staff injury.	• Reduces potential for falls. • Minimizing the distance and the number of turns makes it easier for patients to safely get to the bathroom.	46	35

(continued)

Table 5. (continued)

Primary/ Secondary Item(s)	Design Guideline	Design Constraints	Why (Staff)	Why (Patient)	Easy to Do (%)	Already Do (%)
Toilet	5. Position the toilet such that two caregivers can provide assistance and the magnitude of the turn required to seat the patient on the toilet is minimized.	• Privacy if the bathroom door is left open.	• Multiple staff members may need to provide toileting assistance for obese patients and/or patients who need higher levels of assistance.	• *Makes it easy for patient to get on and off the toilet seat.*	27	19
Toilet	6. Minimize the turn required to sit on the toilet seat.		• Easier on staff assisting patient.	• *Makes it easy for patient to get on and off the toilet seat.*	40	20
Toilet	7. Use a high toilet seat.	• Use ADA compliant toilet heights. • Support lids down flushing protocol to prevent aerolization of *Clostridium difficile*.	• Easier on staff assisting patient.	• *Makes it easy for patient to get on and off the toilet seat.*	68	28
Toilet	8. Toilets should be floor mounted as opposed to wall mounted.	• Consider designs that can support obese people and designs that facilitate cleaning.	• Less repair of broken toilets by hospital maintenance personnel.	• Reduce patient safety concerns stemming from broken wall mounted toilets.	60	41
Patient sink	9. Make the patient sink easily accessible to promote hand washing.	• Sink should be along path to exit bathroom • Provide sufficient space to allow staff to provide mobility assistance. • Provide sufficient space near the sink to accommodate both the patient and the caregiver. • Provide sufficient structural support to accommodate supporting patient weight. • ADA compliant—with no cabinets or doors under sink.	• Staff needs to be able to assist patient with all hygiene functions. • Prevent injuries to staff as they assist patient in using the sink.	• Makes it easy for patient to get to the sink to wash hands after using toilet. • Supports patient education and assistance on activities of daily living (e.g., brushing teeth).	93	50

(continued)

Table 5. (continued)

Primary/ Secondary Item(s)	Design Guideline	Design Constraints	Why (Staff)	Why (Patient)	Easy to Do (%)	Already Do (%)
Horizontal surface/sink	10. Have adequate horizontal surface and covered storage adjacent to sink for use of personal hygiene items.	• Provide rounded corners on the horizontal surface.	• Avoid staff running into sharp edge of the surface.	• Provides a dedicated place for patient's hygiene items that is separate from staff workspace. • *Promotes patient's personal hygiene.*	47	24
Shower/floor	11. Shower compartment/floor design needs to prevent water on the floor in other areas of the bathroom.	• Avoid trip hazards for patient and staff (e.g., water retainer lip). • Avoid design solutions that could lead to a loss of footing by caregivers and patients.	• Reduce the likelihood of staff falls. • Reduce the need for staff to dry bathroom floor or bring additional towels into the room. • Reduce the likelihood of injuries to staff as they prevent patient falls.	• Reduce the likelihood of patient falls.	38	41
Folding shower bench/shower	12. Include attached folding shower bench or shower chair in each shower.	• ADA compliant shower chair should fold down when needed and fold up when not needed. • Need to accommodate heavier patients.	• Removes concern that shower chairs are not readily available when needed.	• Provides a place for patient to rest while in the shower.	74	50
Handheld shower fixture/shower	13. Include handheld fixture in shower that can be reached while sitting on shower chair.	• Handheld fixture needs to be located so the patient and the caregivers can easily reach it. • Provide a means for the water to drain from the handheld fixture when shower is completed.	• Aids staff in assisting limited mobility patient with shower.	• Reduces patient falls if patient can sit on shower chair while using handheld fixture.	81	44

(continued)

Table 5. (continued)

Primary/ Secondary Item(s)	Design Guideline	Design Constraints	Why (Staff)	Why (Patient)	Easy to Do (%)	Already Do (%)
Shower entry way/shower	14. Shower entry way and shower area needs to be large enough to accommodate patient and caregiver.		• Staff need to be able to assist patients with bathing.	• Allows patients to receive assistance when bathing.	42	30
Lighting/nightlight	15. Provide a nightlight in the bathroom (in addition to the nightlight in the patient room).	• Nightlight should always be on when the bathroom light is off.	• Helps reduce patient falls.	• Helps patient sleep better because the bathroom light is not left on.	88	39
Lighting/ bathroom light	16. Provide an automatic light control sensor that detects when someone is in the bathroom.	• Can be overridden by the wall switch. • Should be amber or reddish.	• Allows staff to use both hands while assisting patients. • Helps reduce patient falls.	• Reduces the likelihood of patient falls. • Helps patient sleep better because the bathroom light is not left on.	81	28
Horizontal surface/shelves	17. Do not put shelves above the toilet.		• Difficult to clean if too high.	• Patient can hit their head if too low.	97	46

Note. Italic text in the "why" columns are additional considerations provided by investigators that did not come directly from the data.

Table 6. Family Area Design Guidelines.

Primary/Secondary Item(s)	Guideline	Design Constraints	Why (Staff)	Why (Visitor/Patient)	Easy to Do (%)	Already Do (%)
Sleeper sofa	1. Provide a sofa that can be converted to a sleeping surface for one tall adult.	• Once converted to a sleeping surface, the sofa should not reduce floor space between the bed and the family area. • Patient's TV should be visible from sleeper sofa.	• Overnighting visitors can assist staff in watching and comforting the patient. • It is important that the sleeping accommodations do not restrict the work area around the bed.	• Patients are less likely to fall if they are helped to the toilet by overnight visitors. • Some visitors desire to stay with patients as much as possible.	61	52
Privacy curtain/family area	2. Provide a visual barrier (e.g., privacy curtain) that separates the patient bed from the family area.	• Should be easily cleanable or disposable.	• Allows staff to conduct procedures without asking visitors to move out of the room.	• Allows visitors to remain seated in the room during procedures while maintaining patient's privacy.	51	20
Horizontal surface—Visitor	3. Provide horizontal surface(s) that is/are dedicated for visitors use.	• Surface should be large enough for meals, reading materials, or a laptop computer. • Surface location should not interfere with staff activities.	• Reduces the need for staff to move visitors' things to create a work surface.	• Patients do not have to share their tray table surface with visitors • Visitors may need to be in the room for extended periods during which times they will need to eat, pass the time, and/or work.	50	33
Lighting—Visitor	4. Provide localized task lighting in the family area.	• Lighting should be controlled by controls in the family area. • Lighting controls should be available to the patient in the event a visitor leaves and has left the light on.	• *Allows staff to control their lighting needs without affecting visitors in the family area.*	• Allows visitors staying for extended periods to read, work, and eat without disturbing a patient who is sleeping/resting.	68	30
Nightlight/visitor	5. Provide adequate illumination for visitor movement in the room at night.	• Nightlights illuminate family and patient areas.	• Allows staff to move through the room at night without turning on the lights, disturbing the patient, or tripping on cords or visitor belongings (e.g., shoes, suitcase).	• Allows visitors to move safely through the room at night to assist patients and to access visitor toileting facilities.	37	35

(continued)

Table 6. (continued)

Primary/Secondary Item(s)	Guideline	Design Constraints	Why (Staff)	Why (Visitor/Patient)	Easy to Do (%)	Already Do (%)
Outlets—Visitor	6. Provide an adequate number of electrical outlets for visitors to use near the bed, near the recliner, and in the family area.	• Needs to accommodate multiple items that visitors may be bringing into the rooms. • Outlets should be at waist level or above.	• Reduces the risk of tripping for staff by avoiding stretching cords in the clinical area when the visitor is sitting near the patient.	• Visitors may be in the room for extended periods and may need to charge phones or use a computer to work in the provided space.	81	35
TV–Visitor	7. Consider providing a separate TV for visitors.	• Visitor TV should have audio only available through headphone jack.	• Headphone jack reduces noise levels for staff, particularly when patient TV is on.	• Allows visitors to watch TV while patient is resting/ sleeping or when visitors (e.g., children) want to watch something different from the patient.	27	7
Storage–Visitor	8. Provide adequate storage for overnight visitors.	• Storage needs to accommodate: visitor suitcase/backpack, outerwear, wet items (e.g., umbrella, boots), and hospital-provided bed linens and two pillows	• The storage keeps the room organized, trip hazard free, and the floors dry.	• Provides a clean place for visitors to place their belongings without cluttering the room.	53	17

Note. Italic text in the "why" columns are additional considerations provided by investigators that did not come directly from the data.

Table 7. Patient Storage Design Guidelines.

Primary/ Secondary Item(s)	Guideline	Design Constraints	Why (Staff)	Why (Patient)	Easy to Do (%)	Already Do (%)
Storage	1. Provide storage units (e.g., closet or wardrobe) for the patient's belongings (including shoes).	• Needs to accommodate patient's luggage, coats, shoes, and so on. • Position storage unit(s) (e.g., closet, shelving) for patient's items where patient can see the storage unit from the bed.	• Keeps the floor and area around the bed clear.	• Patients want to be able to keep an eye on their belongings.	71	56
Storage	2. Provide a lockable cabinet/ drawer/safe in the room.	• Needs to be large enough to accommodate a laptop computer and a purse. • Design should address concerns about inappropriate substance storage (e.g., see-through panel) • Design needs to address concerns about patient losing access (e.g., use patient ID as combination)	• Removes the burden on staff of keeping patient's items secure.	• Patients want to know their belongings are secure. • Patients want to be able to access their secured belongings on their own. • Patient's visitors could also use this lockable storage.	52	20
Storage/ bed	3. Patient needs storage within reach while in bed.	• Needs to be easily moved by staff to access patient or horizontal surface	• Reduces patient requests for items that are out of reach or inaccessible.	• Provides independent access to personal items · Protects glasses by placing them in a protective case	31	17

guideline was presented, the audience was asked to rate the ease of implementation of each guideline along a 5-point scale ranging from *easy to do* or *hard to do* (scale end points). They were also asked whether they "already do this." If this was not part of their job classification, then that could also be indicated on the survey by checking the "not my job" box next to the guideline, so that these individuals would not be counted in the summary statistics for that particular guideline. The percentages of respondents who indicated the guideline would be easy to implement (i.e., marked one of the two highest ratings on the 5-point scale) and those indicating that they are already implementing the guideline were tabulated for each guideline and are presented in the two rightmost columns in Tables 3–7. Across all 66 guidelines, the average of the *easy to do* ratings was 58% (range 17–97%). The percentages for each individual guideline as to whether they are currently being complied with ranged between 7% and 65% (mean 35%). These values were relatively consistent across five guidelines tables.

Discussion

Through the design process described above, our participatory process identified many design features that can reduce some of the physical or cognitive demands on hospital staff and provide a better experience for patients and their visitors. Carpenter (2011) describes several room features, including individual room temperature control, in-room family areas, wireless technology for patients, and enhanced patient entertainment and educational systems that are already being incorporated into new room designs. The design of patient rooms represents a unique challenge due to the number of stakeholder groups that perform occupationally related activities within these spaces (Lavender et al., 2015). These design needs were captured in the resulting guidelines. While many of these guidelines are likely to be relatively easy to implement, it should be noted that implementing all of the guidelines makes the design process considerably more challenging as multiple dimensions may need to be considered for each design decision. Nevertheless, each guideline is based on data that indicate it is of value to one or more stakeholder groups.

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There is certainly an overlap between the 66 guidelines presented here and those published by the Facility Guidelines Institute (FGI, 2018). However, in most cases, the guidelines presented here compliment the FGI guidelines by providing more detail, potential design constraints, and by providing the rationale from both the staff and patient perspectives. For example, the FGI guidelines indicate that "the patient's toilet room should be equipped with the following: (1) toilet, (2) a hand washing station, and (3) a bedpan-rinsing device." The guidelines presented herein extend the FGI guidelines by addressing locations of specific items relative to the door of the bathroom, types of fixtures that should be considered, shower compartment considerations, lighting considerations, and supplemental design features such as the inclusion of horizontal surfaces and their locations. With regard to the family area, both sets of guidelines emphasize the need for storage, a work surface, and adequate sleeping surfaces for an adult. However, the guidelines here recommend the inclusion of a privacy curtain, separate lighting for the visitor area, and a night light in this area. With regard to the 22 patient/clinical area design guidelines presented in Table 4, there is little overlap with those presented by FGI (2018); thus, these complement what are already available to aid designers.

Other guidelines have been published in the form of a tool for evaluating designs of hospital patient rooms (Quan, Joseph, & Nanda, 2017). The approach taken by those authors was to develop evidence-based checklists that address 23 design goals that need to be considered when designing these healthcare spaces. As with the FGI guidelines, there is overlap and there is complimentary content that is added by the current study. For example, Quan et al.'s guidelines indicate "large door openings (to the bathroom) to accommodate patient, attached equipment and caregiver." The guidelines provided herein suggest that the door itself be configured as a sliding door to remove the need to step back when opening and such a door does not take up valuable

space within the patient room. They also recommend "Alcohol gel dispensers in visible and accessible locations." The guidelines presented herein are more specific in that they recommend "Locate hand sanitizer near room door and in view of the patient." However, in some cases, our evidence contradicts the guidelines presented by Quan, Joseph, and Nanda (2017), for example, "Room layout minimizes walking distance from nursing stations to patient bed." This was contrary to what we heard from patients, since if one truly minimizes the steps required on the part of nursing staff, patient beds will be located close to the room door. A design layout that was predicated on this principle was not considered acceptable by the patients who reviewed the room designs in the third phase of the current study (Patterson et al., 2017) because they were concerned about privacy and noise when the bed was too close to the room door. Another recommendation by Quan et al. (2017) focused on creating a visually appealing environment; specifically, having "Unappealing elements hidden from view (trash cans, soiled linen, scrub basin, sharps container, etc.)" is in conflict with our guidelines that focus on easy access for staff (including, e.g., nurses and environmental services workers) to have ready access to these room features when necessary.

Consistent with Quan et al.'s (2017) checklist, several design features advocated by staff allow patients to be more independent in their access to their items and access to electrical power, as well as their ability to control lighting, temperature, window coverings, and entertainment. Providing patients with this access and control reduces demands on nursing staff and allows them to focus on higher skill patient care issues with fewer disruptions. While temperature control would need to have reasonable limits, patients were strongly in favor of having control of this aspect of their environment (Patterson et al., 2017). The challenge is to create an intuitive user interface that enables almost all patients to effectively utilize these controls with minimal or no instruction.

We routinely heard about the need for horizontal surfaces near the patient that would be dedicated for staff use. This allows staff to have a place to set down their equipment or prepare for procedures. Our participants reported and Healy, Manganelli, Rosopa, and Brooks (2015) found the overbed table is typically occupied with the patient's items, thus limiting the space currently available to staff. A fold-down or pull-out surface was discussed as a solution that could be made inaccessible to patients and visitors when not in use.

Overall, the guidelines presented in this article focus on many of the ergonomic issues and work demands experienced by hospital staff. Some of these, for example, duplicating headwall controls and electrical services, can reduce awkward working postures or the extra work required by staff as they prepare or perform their specific tasks. In addition to serving the needs of the patient's visitors, there is a need for several different occupational groups to have seating near the bed. For example, physicians, social workers, and case workers want to be able sit and have an eye-level conversation with the patient when discussing certain matters. The musculoskeletal injuries due to patient handling concerns, while discussed, were not a major focus given the extensive literature on this topic (Hignett et al., 2003; Nelson, Motacki, & Menzel, 2009). The participants in the design phases of this study were told to assume that appropriate patient handling equipment (e.g., ceiling lifts) would be included in the future patient room designs. Because room design participants were told a priori that there was a ceiling lift in the room they were designing, discussions about patient handling were about space needs for assisting patients to, from, and within the bathroom. One concern that was routinely heard in the initial phase of this study was the need to move furniture to make way for procedural equipment (Lavender et al., 2015). This points to the need for more space or more effective use of space and for furnishings that can easily be moved by staff when necessary to service the patient.

Many of the guidelines presented herein and by Quan et al. (2017) address patient safety concerns. Falls within hospital rooms continue to be an issue (Calkins, Biddle, & Biesan, 2012; Tzeng, 2011). By providing the patient access to outlets and the ability to adjust lighting and window

coverings without having to get out of bed, the opportunity for patient falls is reduced. Providing easy access to the bathroom also potentially reduces patient falls. Having glove access immediately inside the bathroom also helps prevent falls because staff do not need to leave the patient unattended while retrieving gloves. This can occur when staff members unexpectedly find themselves called upon to assist a patient to or within the bathroom. Night lights and additional lights that can be triggered by motion sensors can also help reduce patient falls.

One limitation of the research evidence behind these recommended guidelines is that the patient room designs all started with a rectangular room where the bathroom took up part of the rectangular space. Newer design models may have angled walls, such that the bathroom is essentially between adjacent patient rooms, and facilitate patient views out the window. Therefore, while this may limit the utility of the hybrid design layouts, the design principles and guidelines were written to apply to rooms of varying shape and size.

Conclusion

This project investigated how the design of Med/Surg patient rooms could be improved to enhance the effectiveness, efficiency, and ergonomics of hospital staff members and how these design features affect patients and their visitors. The results from this study exposed many opportunities for improving the design of these spaces and yielded 66 design guidelines that should assist designers when making design decisions as they create new or remodel Med/Surg rooms in the future. However, smaller, incremental changes can be made to improve these rooms at any time (e.g., adding labels to light switches or uniformly relocating hand sanitizers and glove dispensers).

Implications for Practice

- The design process for hospital patient rooms needs to include all occupational groups that will be working in the planned spaces.
- Patient rooms need to be large enough to accommodate the equipment and working space requirements at the bedside space, while still accommodating the patient's visitors.
- The 66 evidence-based design guidelines for Med/Surg that have been developed will improve the effectiveness, efficiency, and ergonomics of hospital staff, while at the same time providing for the needs of patients and their visitors.

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Supplemental Material

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