

THE ENVIRONMENTAL SERVICES PERSPECTIVE ON HOSPITAL ROOM DESIGN: A MIXED-METHODS APPROACH

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Our aim is to enhance the safety and efficiency of all healthcare staff by designing patient rooms that meet the physical and cognitive needs of those providing direct and indirect patient care in hospital settings. A mixed-methods study was employed, where findings were compiled from twenty-six environmental services personnel across study activities. The insights were grouped into six categories of challenges with the design of hospital rooms in acute care settings: room cleaning, bathroom, room size, furniture, communication, and a miscellaneous 'other' category. There are design implications for storage, room design features, locations of room items, and fabrics and finishes.

INTRODUCTION

Our aim is to enhance the safety and efficiency of all healthcare staff by designing patient rooms that meet the physical and cognitive needs of all stakeholder groups who work in hospital patient rooms on a daily basis. Until recently, there has been only limited published input on patient room design from ergonomics specialists based upon research eliciting the needs of primarily registered nurses (France et al., 2005, Hignett and Lu, 2007, Hignett & Evans, 2006, Gallant & Lanning, 2001).

In an extensive systematic review, interventions to reduce the risk of infections with environmental services personnel ranged from organizational design, guidelines, education, training, and auditing approaches. In this review, optimum ergonomics was identified as an important factor, and specifically was defined as having easy availability of alcohol-based hand rub at the point

of care and sinks stocked with soap and single-use towels (Zingg et al., 2015). Although there is currently no evidence to support that single rooms reduce infections, there is an increased use of single rooms for this purpose in new designs and remodeling efforts and the available evidence suggests that environmental service costs are higher with single rooms (Maben et al., 2015).

Surprisingly, there are no known studies or interventions related to identifying and meeting the physical or cognitive needs of environmental services personnel during cleaning tasks beyond supporting hygiene control in the same way as for other personnel who enter, work in, and exit the hospital patient room. In this paper, we make an initial step to fill this gap in the literature through an exploratory study. We ask the question: What aspects of the patient room design make cleaning challenging for environmental services personnel to do comfortably, easily, and efficiently?

METHODS

This mixed-methods study was approved by the Institutional Review Board. Twenty-six environmental services personnel participated in the study activities.

Study data were collected during: (1) five hours of direct ‘in situ’ observations of four environmental services personnel while cleaning a hospital room with a patient in the room, with the patient out of the room for a procedure, and after the patient was discharged; two 90-minute focus groups with a total of nine environmental services personnel; (2) a 60-minute interview with an environmental services manager with 25 years of experience; and (3) two mock-up room design concept critiquing sessions with 12 total environmental services personnel.

A paper form was used to record data real-time during observations. The focus groups and interview were digitally audio-taped and the design critiquing sessions were audio recorded. ‘Hot wash debriefs’ conducted by the investigators about the key insights gained from the sessions that was just run were video recorded. Detailed transcriptions of all audio records were generated by a professional transcriptionist.

During the critiquing sessions, five rooms which had been developed in a prior stage of the four-year research effort which were judged to best meet the needs of all stakeholders working in the room were critiqued by groups of 4-5 environmental services workers. An example of the mocked-up bathroom sink vanity unit, patient bed, staff storage, staff work surfaces, and headwall is provided in Figure 1. During these sessions, actual cleaning supplies were brought into the mocked-up patient rooms, including mops and buckets, to help participants to judge the physical positions that would need to be held to clean relevant surfaces and what furniture would need to be moved to bring and position the supplies in the room.



Figure 1. Example of mock-ups in critiquing sessions

Analysis was initially conducted by having each investigator review in detail assigned transcripts from the focus groups and interviews and video data from the design critiquing sessions, including the ‘hot wash’ debrief data.

Subsequently, challenges were compiled and uniquely assigned to related concept clusters by one investigator [SL]. Next, all challenges were sequentially reviewed and reworded and differences among investigators were resolved by discussion. As the key step, the findings were visually represented in draft form, at which time further modifications to grouping, labels, and descriptions were made iteratively as a group during a series of three weekly 90-minute interdisciplinary meetings.

FINDINGS

The insights were grouped into six categories of challenges with the design of hospital rooms in acute care settings: room cleaning, bathroom, room size, furniture, communication, and a miscellaneous ‘other’ category.

The first category, room cleaning, is displayed in Figure 2.

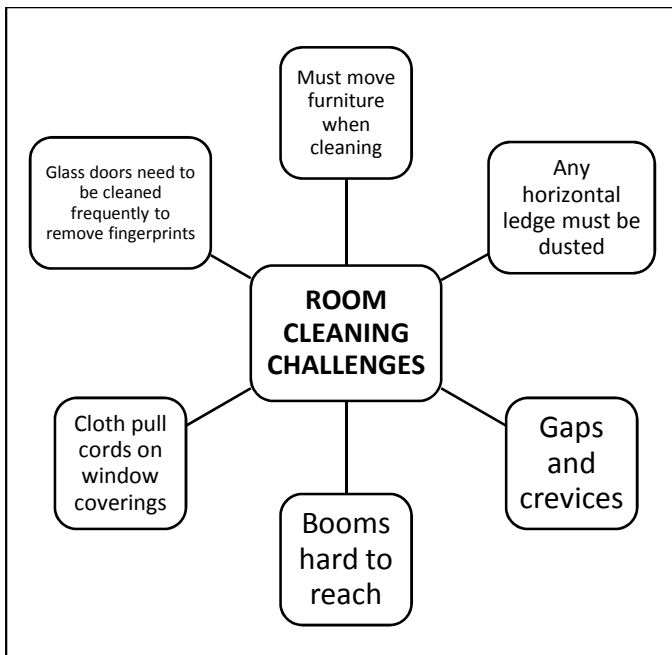


Figure 2. Challenges with room cleaning

The second category, bathroom, is displayed in Figure 3.

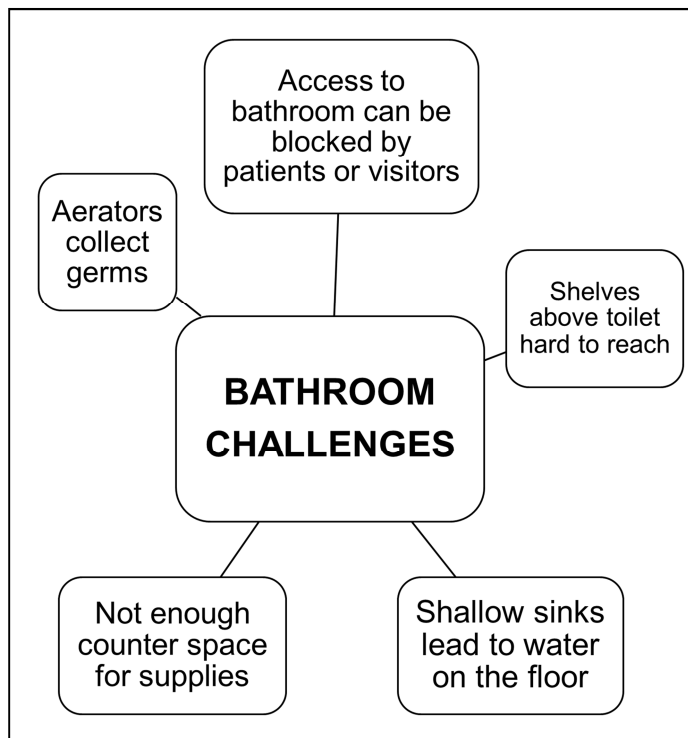


Figure 3. Challenges with the bathroom

The third category, room size, is displayed in Figure 4.

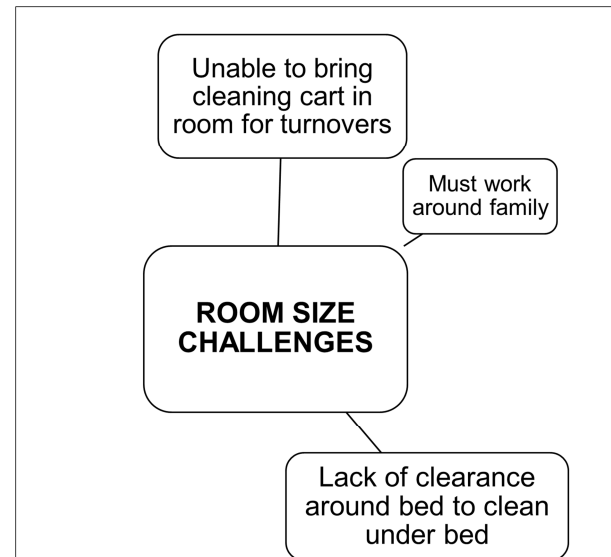


Figure 4. Challenges with room size

The fourth category, furniture, is displayed in Figure 5.

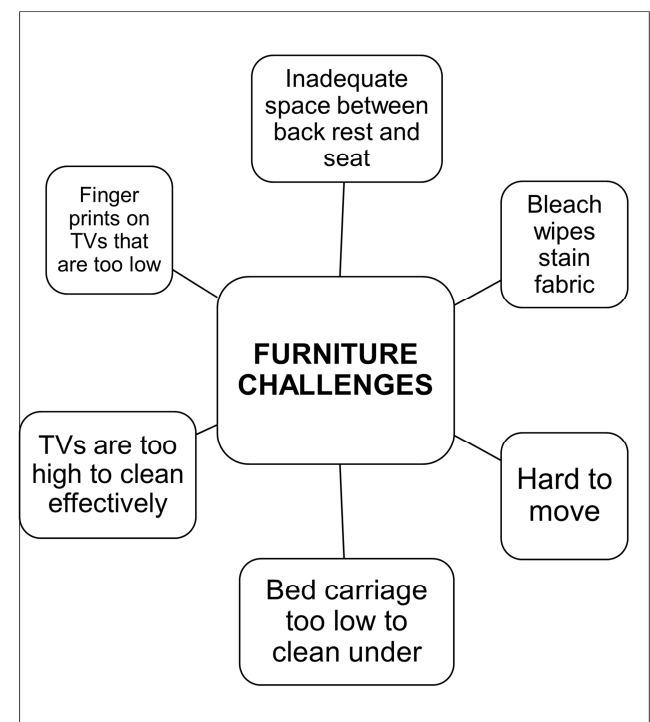


Figure 5. Challenges with furniture

The fifth category, communication, is displayed in Figure 6.

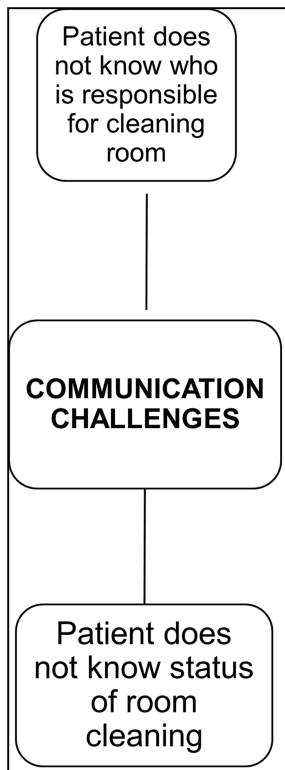


Figure 6. Challenges with communication

The sixth and final miscellaneous category, other, is displayed in Figure 7.

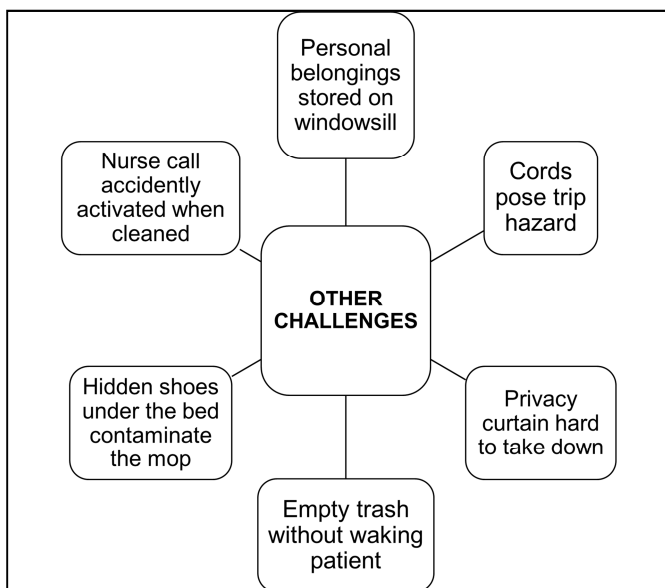


Figure 7. Other challenges

DESIGN IMPLICATIONS

Our findings have design implications for storage, room design features, locations of room items, and fabrics and finishes. These are summarized below.

Design for Storage

- Provide dedicated storage for patient and visitor belongings.
- Provide storage for patient's shoes that is out of the way (and not under the bed).
- Provide adequate counter surface in bathroom.
- Do not put shelves above the toilet.

Room Design Features

- Incorporate sliding bathroom door into design.
- Select furniture on lockable casters so it is easily moved when cleaned.
- Avoid crevices in vertical or horizontal surfaces.
- Specify how the overhead booms must be cleaned.
- Avoid shallow sinks to keep water off the floor.
- Provide cord support systems to keep cords off the floor.

Location of Room Items

- Mount TV at a height low enough to clean yet high enough so children can't reach.
- Position trash and dirty linen storage near room door.
- Plan on space for overnighting family members.

Fabrics and Finishes

- Test cleaning of fabrics before selection.
- Select non-cloth and non-braided emergency call pull cords.
- Use wood, rather than glass, room doors.
- Use disposable privacy curtains that are easily changed during room each turnover.

DISCUSSION

Overall, our findings highlight that environmental services are an important team member that works in the hospital patient room. Therefore, they should be included in the design and remodeling process along with the other 22 stakeholder groups identified by Lavender et al. (2015). In addition, to make it easier for patients and family members to interact with them, information about the environmental services staff should be included along with information about other clinical staff. For example, their name and photograph should be displayed on an electronic whiteboard along with the time that the room was last cleaned by anyone in environmental services.

A methodological recommendation during the process of designing a hospital room is to have samples of all of the

wall, floor, furniture, technology, and furniture materials cleaned using all of the cleaning agents that will be used at any time during the cleaning process. Ideally, the effectiveness of cleaning these surfaces with the cleaning protocols will be empirically tested for the reduction of contamination levels (*cf.* Sharpe and Schmidt, 2011).

A particularly important function of the environmental services staff is preventing hospital acquired infections by cleaning the room in-between patients. Designing the hospital room in a way that makes it easy to accomplish this mission is likely extremely important to the health and safety of patients, visitors, clinical staff, other hospital staff who enter the room, and the community in which the hospital is located. During infectious disease outbreaks such as Ebola or the avian flu, this role is even more vitally important. For all hospital personnel that work in the room, we identified a number of barriers to infection control with respect to hospital room design (Patterson et al., 2014). For environmental services personnel, relevant insights include having furniture that is easy to move, surfaces and curtains that are easy to reach, adequate space to bring in all of the necessary cleaning materials without placing them on the floor or dirty surfaces, clearance around the patient bed, avoiding placement of shoes underneath the bed or in other places where it is easy to require changing the head of a mop, and technological equipment (including nurse call) that can be cleaned without activating a button.

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REFERENCES

France, D. J., Throop, P., Walczyk, B., Allen, L., Parekh, A. D., Parsons, A., ... Deshpande, J. K. (2005). Does patient-centered design guarantee patient safety? Using human factors engineering to find a balance between provider and patient needs. *Journal of Patient Safety*, 1, 145–153.

Gallant, D., & Lanning, K. (2001). Streamlining patient care processes through flexible room and equipment design. *Critical Care Nursing Quarterly*, 24, 59–76.

Hignett, S., & Evans, D. (2006). Spatial requirements in hospital shower and toilet rooms. *Nursing Standard*, 21, 43–48.

Hignett, S., & Lu, J. (2007). Evaluation of critical care space requirements for three frequent and high-risk

tasks. *Critical Care Nursing Clinics of North America*, 19, 167–175.

Lavender, S.A., Sommerich, C.M., Patterson, E.S., Sanders, E.B-N., Evans, K.D., Park, S., Radin Umar, R.Z., Li, J. (2015). Hospital patient room design: The issues facing 23 occupational groups who work in medical/surgical patient rooms. *Healthcare Environment Research and Design*, 8, 98-114.

Maben J, Griffiths P, Penfold C, et al. Evaluating a major innovation in hospital design: workforce implications and impact on patient and staff experiences of all single room hospital accommodation. Southampton (UK): NIHR Journals Library; 2015 Feb. (Health Services and Delivery Research, No. 3.3.)

Patterson, E. S., Murray, J., Park, S., Sanders, E. B. N., Li, J., Umar, R., ... & Lavender, S. A. (2014, September). Barriers to infection control due to hospital patient room factors: a secondary analysis of focus group and interview transcripts. In *Proceedings of the Human Factors and Ergonomics Society Annual Meeting* (Vol. 58, No. 1, pp. 1266-1270). Sage CA: Los Angeles, CA: SAGE Publications.

Sharpe, P. A., & Schmidt, M. G. (2011). Control and mitigation of healthcare-acquired infections: designing clinical trials to evaluate new materials and technologies. *HERD: Health Environments Research & Design Journal*, 5(1), 94-115.

Zingg, Walter, et al. "Hospital organisation, management, and structure for prevention of health-care-associated infection: a systematic review and expert consensus." *The Lancet Infectious Diseases* 15.2 (2015): 212-224.