

Barriers to Infection Control due to Hospital Patient Room Factors: A Secondary Analysis of Focus Group and Interview Transcripts

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Infection control is of central importance when designing hospital rooms, particularly to reduce hospital-acquired infections. Existing room design standards include private rooms, toilets, and showers, ample space between a patient's bed and a family member's bed, and separate spaces for clean and dirty nursing activities. We investigated various hospital room factors that make it challenging for staff to reduce hospital-acquired infections. Focus groups and interviews were conducted with multiple stakeholder groups as part of a larger research effort to generate guidelines for hospital room design. Transcripts were generated for eight of these stakeholder groups, including housekeeping staff, and qualitatively analyzed for emerging themes. The insights suggest additional areas for consideration during the design of hospital rooms, in particular the need for standardized, dedicated locations for supplies brought into the patient room and inclusion of the perspective of housekeeping staff in the design process.

INTRODUCTION

Infection control is of central importance when designing hospital rooms, particularly to reduce hospital-acquired infections (HAIs). Standards were disseminated in 2010, by the International Federation of Infection Control (IFIC), for the hospital room design to reduce infections by the International Federation of Infection Control (IFIC). The standards are grouped by levels: basic, standard, and ideal. Isolation rooms for patients known to be infected are ideally recommended to have a separate private room, negative air pressure, and air ventilation. For regular hospital patient rooms, their ideal recommendations are:

- a private room with sufficient space for a bed for a family member
- two meters between a patient's bed and family member's bed
- private toilet
- private shower
- separation of spaces for clean (e.g., preparing medications) and dirty (e.g., bedpans) nursing activities
- bed reprocessing materials (linens) stored in the room.

Even when ideal standards are met, concerns remain about nosocomial rates due to hospital room design factors (De Angelis et al., 2014, Stone et al., 2014, Berenholtz et al., 2014). One promising area of investigation is to identify unmet needs of stakeholders, beyond nursing personnel, who enter the patient rooms. In addition, given the central role that janitorial staff play in cleaning the hospital room while patients are in the room and between patients (Armin et al., 2014), it is of particular interest to understand infection control barriers and facilitators from their perspective.

In the last year, a series of focus groups and interviews were conducted from primarily one hospital system with nineteen stakeholder groups as part of a larger research effort to generate guidelines for hospital room design. Although infection control was not defined *a priori* as a specific area for investigation in the larger research effort, it was not surprising that it emerged as an important concern for all of the stakeholder groups. It was discussed during all of the focus groups and interviews to some extent. Therefore, a secondary analysis was conducted using data from the existing focus group and interview transcripts focusing exclusively on insights to reduce infection.

METHODS

Data were from an existing set of de-identified verbal transcripts generated by a professional transcriptionist from digitally recorded audio data. Focus groups and interviews were previously conducted and professionally transcribed for 17 nurses, 6 hospitalist physicians, 20 occupational or physical therapists, 5 respiratory therapists, 10 patient transporters, 3 safety care associates (sitters), 4 mechanical shop employees (plumbers), and 10 housekeepers.

From the relevant sections of the transcript, synthesized notes were written by a single investigator to summarize the insights regarding infection control in a succinct manner. For example, from one registered nurse focus group transcript, the following notes were generated:

- Locations of hand sanitizer and gloves are inconsistent between rooms
 - Keep hand sanitizer and gloves together

- Motion activated hand sanitizer
- Can't wash hands in isolation room
 - Sink used as a storage space
 - Contaminated anyway
 - Have to go to the nurse's station
 - Sink by the door to wash in and wash out
 - Convenient for patient if outside bathroom

For the secondary analysis focused on infection control, seven of the stakeholder groups were selected for targeted analysis. A single investigator used search terms generated from initial preliminary analyses of emerging themes from the transcripts by the larger team of investigators in order to identify statements pertaining to infection control. The search terms were used for every transcript and were: infection control, hygiene, sanitizer, gloves, hand gel, and wash. Findings were confirmed and extended by reviewing summary sheets of stakeholder group themes. In addition, the transcript analysis searches augmented the analysis and were added together into a single table with identified barriers categorized as mentioned or not mentioned by the stakeholder group relating to their role in the hospital.

In addition to analyzing the issues of stakeholders who enter the patient room in order to do clinical or maintenance tasks, we analyzed in detail the entire set of transcripts from two focus groups conducted with housekeeping staff. In addition, we interviewed the Manager of Environmental Services who has 25 years of experience in housekeeping and is responsible for 35 managers and 285 employees. Housekeepers were also directly observed by an investigator for five hours in both single and double rooms in the following settings: patient in room, out of the room for a procedure, and discharged.

Because their primary job is to clean and disinfect the patient room, the housekeepers described a particularly relevant set of barriers to ensuring room cleanliness that were qualitatively different from the other stakeholder groups. The investigator with the most intimate knowledge of the housekeeping staff members, due to being the lead analyst and participating in the sessions personally, conducted an analysis of the data based upon reviewing all of the transcripts, the summary sheet (Figure 1), notes from the sessions, and from observations of housekeepers at the hospital by a PhD student in physical ergonomics. The investigator summarized the main issues and representative examples of each category that were identified from housekeeping staff members.

HOUSE-KEEPER	TASKS	WHAT'S USED		
1.PREP	stock the cleaning cart	cart	storage closet where supplies are	water in bucket
2.ENTER	remove floor standing items from room	bedside commode		
3.DO	wipe with chemical solution on rag	light fixtures	trash can	bed
4.LEAVE	hand hygiene	gloves	hand sanitizer	

Figure 1. Portion of a summary sheet for housekeepers

FINDINGS

The barriers to infection control due to hospital room design parameters that emerged across the seven stakeholder groups are displayed in Table 1. The first two sets of barriers in Table 1 primarily would result in less efficient workflows as personnel “forage” for the materials required to be compliant with best practice strategies for sanitizing hands and wearing personal protective equipment (PPE).

The third set of issues in Table 1 derive from the lack of a clean, dedicated place to store supplies, equipment, or Information Technology devices used by a stakeholder group near the entry zone of the room, thereby increasing the risk of contamination. This is particularly concerning for sterile supplies that come into contact with non-sterile surfaces, but was also mentioned as problematic for non-sterile equipment. Examples of issues stemming from this barrier to infection control include: (1) patients storing a urine collection container on the tray table next to dentures, glasses, and food items, (2) items coming into contact with surfaces such as the toilet, bathroom sink, bathroom floor, shower floor, hospital floor, windowsill, or hallway floor, and (3) items temporarily stored on the patient's bed, including wound dressing supplies, food trays, and clipboards.

The fourth set of issues in Table 1 relate to decreased efficiency due to location of waste disposal containers. If an entryway is cluttered with a trash can and a soiled linen container, it is difficult for a patient transporter to bring a transport bed next to the patient's. These may need to be moved by the transporter in order to obtain access to the patient. Similarly, having a sharps container located such that a sitter needs to move from a chair next to the patient's bed in order for a nurse to clear a path in order to safely dispose of a needle (sharp) is inefficient.

Table 1. Barriers to Infection Control due to Hospital Room Design Parameters for Seven Stakeholder Groups

Task	Barrier	Registered Nurse	Hospitalist Physician	Occupational / Physical Therapist	Respiratory Therapist	Patient Transporter	Safety Care Associate (sitter)	Mechanical Shop (plumber)	Total
Sanitize hands	Inconsistent location	x	x	x	x	x	x	x	7
	Shared sink with patient	x				x	x	x	4
	Location of sink and paper towels poor fit with workflow	x	x		x		x		4
Use Personal Protective Equipment (PPE)	Location of PPE poor fit with workflow	x	x	x		x			4
	Inconsistent location	x	x	x					3
	Trash can too small	x							1
Store medical supplies/ equipment/ IT device	Lack of clean location to store them in the room	x	x		x				3
Dispose of supplies/ equipment	Location of sharps disposal container makes it difficult to access	x		x			x		3
	Location of trash can, linen container clutters room entry	x				x	x		3

Based upon our analysis of the needs of the housekeeping staff, we identified seven themes for barriers to maintaining room cleanliness in an efficient and effective manner. Presumably addressing these issues will increase the ability to reduce hospital-acquired infections. The themes are:

1. **Housekeepers have limitations on where they can put their cleaning equipment and supplies.**
 - They typically leave their cleaning cart outside the door to the patient room and then walk in and out of the room to get supplies while cleaning. They try to put the front of the cart (where the water for cleaning is kept) in the doorway so they can reach the water from inside the room.
 - Surfaces are lacking on which cleaning supplies can be placed, both in the patient room and in the bathroom.
2. **Room design components that are difficult to reach make it challenging to effectively and efficiently clean.**
 - Nothing that needs to be cleaned should be above head height.
 - Avoid unnecessary corners and nooks.
 - Do not use picture frames. It is better to have flat artwork on the walls.
 - Shelves in the bathroom above the toilet can be too high to clean without the housekeeper stepping on the toilet.
3. **Some room design components get in the way of cleaning.**
 - Cords (for power, phone, etc.) get in the way of cleaning the floors.
 - Heavy sofa beds without casters can be difficult to move when trying to clean underneath.
 - Chairs should have casters so they can be moved for cleaning.
4. **Other room design components are difficult to clean.**
 - Seamless surfaces are easier to clean.
 - Curtain dividers need to be removed before they can be sent away to be cleaned.
 - It is hard to clean under wall mounted toilets.
 - It can be difficult to clean between seat pans and seat back in chairs where the seat back is in contact with the seat pan.
5. **There are room design components that cause unsanitary or unsafe conditions.**
 - Shallow sinks can lead to spilling water onto the floor.
 - Aerators on the side of the faucet will collect germs. But if the aerators are removed, water tends to come out at a high velocity and splash on the floor.
6. **There are room design components that look dirty even though they are clean.**
 - Epoxy flooring will give the impression that it is not clean, but it is really just showing signs of wear.

7. Some room design components can be damaged when they are cleaned.

Bleach wipes that are used for killing *C. difficile* can stain cloth on furniture.

The housekeeper observation also revealed insights to barriers to infection control such as:

1. The housekeepers were bending down in an awkward posture when performing duties. Selection of equipment that is height adjustable would reduce this.
2. Constrained spaces (bathroom, headwall of patient bed) limit the housekeepers' movements, and this may limit their cleaning capabilities.
3. Housekeepers cannot clean these 4 areas thoroughly because of patient belongings on them due to limited storage space for patient: a) bedside table, b) window sill, c) sink, and d) TV cabinet.

DISCUSSION

Several stakeholder groups enter and exit patient rooms and therefore are vital to infection control efforts. Inconsistent location of hand sanitizer was a common concern for all seven stakeholder groups, as uniformity could increase efficiency as the employees "wash in and wash out," since they do not need to look for the sanitizing station.

Occupational and physical therapists faced the emerging issue of sterile surfaces in the hospital, as their recording devices (whether it be a computer or clipboard) are not able to be sanitized upon entering the room. They have the option of leaving the item in the hallway, but this can lead to inaccurate recording or even theft. Following that, when using these items and interacting with the patients, these professionals have no sanitary space available on which to set the items without risk of contamination. Upon leaving the room, these recording items are often not sanitized, and may be taken to the next room with a new patient, therein putting patients at risk for contamination. Possible solutions could be an entry space in rooms where staff store belongings in order to avoid unnecessary contamination and prevent theft.

Clinical professionals including doctors (hospitalists) and nurses apparently face similar issues in terms of infection control as they perform medical procedures. While both indicated similar infection control issues in the entry zone, they focused on different aspects of infection control in the clinical zone of actual patient interaction.

During focus groups and interviews, most nurses focused on a lack of sterile surfaces use when doing their job. Changing burn dressings is a lengthy procedure which ideally requires having a dedicated clean location to place sterile new

dressings and a dedicated dirty location to place used ones. Some nurses indicated that they ended up "using the patient as a table" because they did not know where to place supplies other than locations which could contaminate them, such as tray tables or sinks. A potential innovation which nurses described could be a retractable surface (similar to a kitchen cutting board) that could slide back into the wall; this surface would need to be easily cleaned after use.

Hospitalists, on the other hand, focused less on medical procedures during interviews and more on patient interaction. For example, for difficult conversations or during longer interactions such as during patient rounds, some physicians wanted to sit in order to be eye level with the patients to build rapport. One participant stated that she used a trash can to do so due to a combination of lack of seating when family members use available chairs as well as having more confidence that the top of the trash can was routinely and thoroughly cleaned in comparison to chairs with fabrics that are difficult to clean. Similarly, some of the physicians described that to build rapport, they wanted to have conversations without the presence of electronic devices, but then quickly access them to show laboratory results, images, or document something following the conversation. They proposed the idea of having a dedicated docking station to park electronic devices in the entry zone of the room where the device could be charged at the same time; theoretically this type of station could also disinfect the device, such as with the use of ultraviolet light.

Overall, the findings of this study confirm the IFIC standards for hospital room design to reduce hospital-acquired infections. In particular, the findings confirm the need for nursing personnel to have a dedicated sterile workspace for tasks such as dressing changes and keeping sterile equipment and supplies clean. In addition, using a tray table that often holds patient meals and personal items, such as eyeglasses, for storing dirty products such as bedpans is less than ideal. Across stakeholder groups, the findings also suggest additional areas for consideration during the design of hospital rooms. In particular, there is a need for standardization of placement of relevant supplies and hand sanitizing materials in order to make it easier and more efficient to follow best practice recommendations when entering and leaving the patient room. Inside the patient room, a lack of dedicated clean storage space is a barrier to reducing the infection of medical equipment brought into the patient room.

Based upon our analysis of the needs of the housekeeping staff, we recommend that standards be expanded to include not only specification of the design of the room and its primary components but to address the design process as well. The perspectives of the housekeepers need to be taken into consideration during the design process.

The interview with the Manager of Environmental Services

was particularly useful in understanding why room design components interact with infection control practices.

Therefore, we recommend that an experienced representative from housekeeping be included in the early stages of design decision making for new and retrofit patient room designs. Their expertise on the cleanability of fabrics, fixtures and furnishings is crucial for infection control. In addition, housekeeping employees should be invited to perform usability and cleanability evaluations on fabrics, fixtures and furnishing prior to selection of these components. The results of their evaluations should be weighed heavily in purchase decisions given the importance and frequency of their tasks.

This research represents the outcome of exploratory, qualitative analysis using a convenience sample of existing data collected for a broader focus. One limitation is that all of the data are from personnel working in one hospital system. Nevertheless, the insights provide new strategies to pursue to further reduce nosocomial infection, which presumably increases patient safety and reduces morbidity and mortality.

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