KEY POINT SUMMARY

OBJECTIVES

This two-part study included an extensive review and analysis of the literature related to healthcare design and medication/nursing errors, staff efficiency and safety, infection control, and patient outcomes, as well as multidisciplinary acute-care focus groups working in three hospitals. The research questions, which were designed to elicit practical insights for reducing medical errors, included:
(1) What are the effects of physical environmental variables on nursing errors, nurses' efficiency, and quality of patient care in medical/ surgical nursing units?
(2) What are the effects of physical environmental variables on nurses' job satisfaction and performance, health, and safety in medical/surgical nursing units?

The Effect of Environmental Design on Reducing Nursing Errors and Increasing Efficiency in Acute Care Settings: A Review and Analysis of the Literature

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Key Concepts/Context

In acute care settings, the physical environment plays an important role in staff efficiency and patient safety. Some research suggests that poor environments can result in staff stress, anxiety, and distractions due to noise; artificial lighting; improper or inadequate ventilation; and disorienting layouts of nursing units. There is less research on how environmental factors affect nursing staff health, effectiveness, errors, and job satisfaction.

Methods

For the literature review, the researchers identified, analyzed, and assigned degree-of-evidence ratings based on the rigor of the study (i.e., sample size, research design, tools used, and method of analysis) 352 relevant journal articles, books, book chapters, and reports. The researchers classified literature that presented evidence-based research as empirical (204), while they classified descriptive or conceptual literature as nonempirical (148), which they then further subdivided into expert opinion and anecdotal information. The investigators also conducted three focus groups of multidisciplinary staff at three hospitals in the Pacific Northwest to specifically understand the potential role of the physical environment on medication errors.

Findings

By integrating the major issues identified in the literature review with the key findings from the focus groups, the researchers recommended four design-related

principles: balance between patient accessibility and reduction of disruptions, automation, minimize staff fatigue, and promoting a culture of safety. According to the results, the focus groups identified design responses related to errors associated with medication ordering, storage, delivery, dispensation, preparation, and administration. The authors report that the literature review suggests that the key physical environmental variables that have the most real or potential effect on workplace errors are noise, lighting, ergonomics/furniture/equipment, and design/layout. The results also suggest that high noise levels negatively affect both patients and healthcare workers, and thus compromise patient care. The findings also reveal that nurses function more effectively in environments that minimize artificial lighting and maximizes natural daylight and task lighting. Further, ergonomics, furniture, and equipment create the optimal working conditions for efficiency and safety. Finally, the authors note that the design and layout of the built environment should be convenient, accessible, safe, secure, conducive to the patients' sense of well-being, and enable connections between patients and staff and the outside world.

Limitations

The authors note that conducting this research in two parts—review of empirical and nonempirical literature and user focus groups in several hospital settings—strengthened the degree of generalizability of this study and its findings. However, as an exploratory study, variables, outcomes, and metrics were not clearly defined.

Design Implications

Suggestions originating from the literature review to lessen noise levels include the use of a sound-control center to reduce noise levels, music, carpeted surfaces, sound-absorbing ceiling tiles, sound-attenuating surfaces, private bedrooms instead of multioccupancy rooms, quiet equipment, personal pagers, and enclosed nurse stations. To improve lighting and reduce surface glare, maximize natural daylight, use indirect lighting to diffuse light and create a natural effect, and provide adequate task lighting for work surfaces and patient care. Recommendations for improving ergonomics include maximizing visual and tactile discrimination (i.e., size, color, and texture of materials) to enable easy access and minimize decision time (e.g., patient headboards with blood pressure cuffs on both sides of the bed, different alarm sounds for different medical devices, and the location of patient's in-room equipment), and maximizing bodily safety (e.g., mechanical lift devices). Further, nurses need the proper furniture, equipment, and storage (e.g., beds, tables, trolleys, and wheelchairs that are suitable, available, and maintained) as well as the proper associated training. Recommendations related to design and layout include the use of universal and acuity-adaptable single-occupancy rooms; enhanced direct contact between patients and staff; balancing patent privacy and staff observation; eliminating sensory distracters; automated, computerized
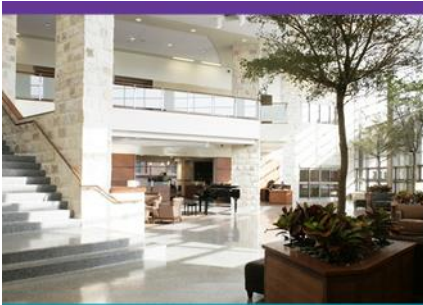
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medical records; patient social supports; incorporating elements of a natural environment; enhancing the personal control for each nurse; and providing communal spaces where information can be exchanged.

Insight from the focus groups regarding to pharmaceutical errors related to the use of shelves to increase visibility of the medication bins, demarcation of various work spaces to reduce interruptions and distractions, and increasing accessibility and privacy. Medication and utility rooms should include adequate counter space and room for multiple activities (e.g., medication dispensation, preparation), as well as appropriate sensory stimulation (i.e., colors, visual cues, and noise reduction). Nurse stations would benefit from sound-absorbing materials and barriers in certain work spaces, computerized physician ordering entry systems (CPOE), and clinical decision support systems. Patient rooms should focus on privacy (i.e., single occupancy) and accessibility (i.e., consistent layout with sink visually accessible and adjacent to the entry as well as supported access to bathroom from bed) to reduce fatigue, inefficiencies, and errors. Patient room would also benefit from incorporating individual patient medication supply system, CPOE, and computerized medication administration records.

Use a participatory planning and design process that involves the nursing staff at various levels of hierarchy to understand the real-life demands of the jobs and identify environmental sources of stress, frustration, and conflicts.