KEY POINT SUMMARY

OBJECTIVES

This study reports the challenges of a mirrored patient room configuration, illustrating the variability teams face conducting high-risk care tasks when moving from one configuration to another.

Pediatric intensive care unit (PICU) patient room design: Identifying safety risks in mirrored rooms through a graphical systems analysis

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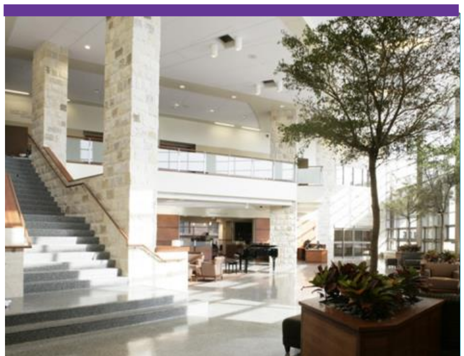
Key Concepts/Context

While same-handed inpatient rooms have been purported to reduce cognitive load for patient care, mirrored rooms provide a potential cost benefit of shared gas and plumbing lines. Few studies have evaluated the implications of a mirrored room on the complex activities of clinical care in an ICU. This study graphically depicts the challenges of a mirrored PICU room, and while not necessarily generalizable, same-handed rooms may better support high-risk care in this organization.

Methods

The case study entailed simulating three clinical scenarios (admission and management of respiratory failure, respiratory failure and cardiac arrest, and ECMO (extracorporeal membrane oxygenation) cannulation) in a PICU mock-up room. Four cameras were mounted in the room to fully capture the simulation activity. Simulation sessions were followed by a debrief of the participating clinical team. Detailed video analysis was conducted and supplemented with interviews with a pediatric intensive care physician experienced in simulation-based testing. The first interview was used to orient the research team to the tasks performed, the roles of the people in the room, the necessary equipment, and built environment considerations for six challenging process points. The identified process points included intubation, cardiopulmonary resuscitation (CPR), patient prep for ECMO, ECMO equipment positioning, ECMO table positioning, and post-ECMO setup for care. Coded plans were generated to identify the location for people, equipment, built environment features, and furniture at the six identified process points (Original Room A) and then mirrored to create Room B. The challenges and potential solutions were coded by the research team as the physical environment,



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people, equipment, tasks, and organizational policy. A final interview with the clinical expert was used to review and clarify the findings.

Findings

While patient rooms are traditionally conceived in three zones for the clinician, patient, and family, additional zones were identified for the respiratory therapist and circulation. In the case of the selected scenarios, all of the zone positions (other than the family zone) change according to the necessary care. Specific challenges in the mirrored room are identified for each scenario: the orientation of the ventilator circuitry, reorientation of the CPR triangle, direction of the bed rotation and rotation of related equipment, positioning of the tubing and ECMO circuitry resulting in impeded access and crowding, the correct positioning of the ECMO machine, and the potential for bumping of the machine and a lack of unobstructed access due to equipment crowding). Potential solutions and tradeoffs are subsequently presented graphically for each challenge. Solutions range from changing the positioning of staff, which may result in inefficiencies, the need for training, and unintended consequences of distraction and disruption; the reassembly of ventilator circuitry, which requires specific equipment for specific rooms; the purchase of new equipment that can adapt to either configuration; and restricting certain procedures to certain rooms or the redesign of a wider same-handed standardized room. The results highlight the challenge of providing standardized care when the environment does not follow the same standardization, as well as the need to provide adequate space for the respiratory therapist. Conducting an analysis should consider the key clinical scenarios to test, running simulation in existing or mocked-up spaces, creating the graphical analysis of the observed activity, creating the representations of the key process points, identifying the challenges, and conceiving possible solutions and tradeoffs through the same graphic representation.

Limitations

The authors note that the study is not necessarily generalized to other ICUs due to differences in care protocols that may exist in other organizations. Additionally, there was only a single round of simulation conducted for each scenario, and subsequent rounds with other clinicians may have yielded different results. The team also noted the need for clinical and simulation expertise to effectively represent the elements of the system being studied.

Design Implications

Given the challenges of changing room size and configuration later in the design process, it is especially important for interdisciplinary teams to conduct simulations with a resulting graphical analysis to identify potential safety issues of care while the design can still be modified. Tradeoffs related to benefits and costs need to be considered.

And Also...

The authors present several figures that provide a detailed visual representation of each room configuration and scenario, with additional representations of potential solutions that are influenced by the built environment.