



KEY POINT SUMMARY

OBJECTIVES

This study looked to understand the impact of OR features on safety and efficiency, and to identify design features that could be integrated into the design and construction process of ORs to increase safety and efficiency.

An Evaluation of Operating Room Safety and Efficiency: Pilot Utilization of a Structured Focus Group Format and Three-Dimensional Video Mock-Up to Inform Design Decision

Watkins, N., Kobelja, M., Peavey, E., Thomas, S., Lyon, J.
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Key Concepts/Context

While surgical and interventional procedures are the most profitable services within the hospital, the cost of building and maintaining an OR can quickly reduce the profitability of running an OR. Due to this precarious balance of revenue and cost, the planning and design of an OR should look to reduce injury to staff and prevent unnecessary costs, while increasing operational efficiencies. Currently, few techniques exist to give designers a cost-effective, timely way to inform design decisions and implement actionable solutions within the design of new ORs.

Methods

For this research, a structured focus group format with mixed methods was to evaluate a three-dimensional (3D) mockup of a proposed OR setup. The structured focus group sessions were held in a large auditorium. A colored 3-D mockup of the proposed OR was projected in the front of the room. Tables along the sides of the auditorium displayed floor plans, materials, and finishes of the proposed new OR room. A total of 19 participants, consisting of surgeons (N=5), surgical technicians (N = 3), perioperative nurses (N = 7), perfusionists (N = 2), and two undesignated individuals within the OR, took part in four, one-hour structured focus group format sessions throughout the course of one day. Each session started with an introduction, followed by a viewing of the 3-D video mockup of the proposed OR. Participants were then given a questionnaire to complete. The questionnaire was specifically designed for this project using closed questions and open responses.



DESIGN IMPLICATIONS

Findings from this study show that the use of a 3-D mockup with structured focus groups can be a very viable way to include user feedback into projects that are on an aggressive budget and schedule. For healthcare organizations and project teams looking to conduct traditional focus groups and develop mockups, this method should be considered as a way to create a more immersive, sensory-rich environment for participants while keeping cost and time to a minimum.

Closed questions were analyzed using a Likert scale, or they contained “yes” or “no” responses. Open questions allowed room for a participant to qualify an answer. Questions were grouped into the following seven subscales: (1) background information, (2) outcomes associated with the proposed OR, (3) ceiling-mounted booms and setup, (4) participants’ impressions of the proposed OR’s equipment, supplies, and layout, (5) obstructions to workflow in the proposed OR, (6) what the participants would change about the OR and to what extent, (7) the efficacy of the 3-D video mockup of the proposed OR room for visualizing the proposed OR design. Ending the session, participants were led in a group discussion by an environmental psychologist. Questions utilizing the Likert scale were analyzed using principal components analysis (PCA) with Varimax rotation and step-down regression analyses. Open questions were content analyzed using principles from grounded theory. Open coding was used to generate overarching concepts that were further synthesized to implementable recommendations for the project.

Findings

A step-down regression was performed with closed question from the survey to reveal four parsimonious models that are predictors within the proposed OR setup of: (1) flexibility and satisfaction, (2) adverse event prevention, (3) team performance, (4) distraction and interruptions. Predictors for flexibility and satisfaction reported a statistically significant relationship between unnecessary movement, boom accessibility, and clarity regarding where equipment should be during a procedure. The more unnecessary movement and less accessible boom and clarity of equipment location resulted in a lower satisfaction and flexibility rating by participants. These findings were further qualified by the responses to the open questions. Participants conveyed a conflict between anesthesia setup and the nurse workstation zone, the location of the OR table during ear, nose, and throat procedures in relation to the entry and exit of the OR, and possible difficulty in moving the proposed C-arm as potential contributor to unnecessary movement in the OR. Open-ended responses by participants also identified three challenges related to boom accessibility. Participants reported a concern with the location of the boom, OR lights and monitors, and possible collisions. Participants’ concerns specific to clarity of where equipment should be were related to the visual field of each participant. Suggestions were made for moving the nursing station, incorporating additional monitors, relocation of the heart and lung machine and the perfusion boom, and floor demarcation cuing as ways to increase the visual field among participants. Predictors for adverse event prevention reported a statistically significant relationship between the prevention of adverse events and the quality of the visual field. Participants’ responses from the open questions pertaining to the predictors of flexibility and satisfaction and its relation to the quality of the visual field also applied to prevention of an adverse event. Predictors for team performance reported statistically significant relationships between the clarity about where equipment should be during a procedure, ease of documentation, and



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the height of the wall-mounted screens. Participants rated a higher quality of team performance when the clarity about where the equipment should be and the ease of documentation were higher. Also, a lower height in wall-mounted screens related to a higher quality of team performance. Participants further qualified the statistical analysis through the open questions. Participants reported two potential difficulties with documentation in the proposed OR setup relating to the quality of the visual field for nurse charting and utilization of the nurse workstation for anesthesia and the circulating nurse. Participants also offered recommendations for creating an adjustable height for the wall-mount screens. Predictors for distraction and interruptions reported a statistically significant relationship between the participants' perceived distance between equipment and supplies. These findings were further qualified by the responses to the open questions. Participants identified potential direct causes of distraction and interruptions to be movement of monitors in relation to the surgical field, image routing requests, and patient location and contact outside the OR. Participants also shared concerns regarding boom location and inconvenient light switch placement for nurse and technician use.

Limitations

Findings from this study were limited to a specific project and are not therefore generalizable to other projects. Due to the small sample size, statistical comparisons among the OR staff roles were prohibited. While the 3-D model was cost-effective and time sensitive, it did lack details such as phone placement, electric outlet, and waste disposal that would have been present in a full scale mockup. This lack of detail did create some difficulty with participants' ability to fully visualize interactions with such details.