



KEY POINT SUMMARY

OBJECTIVES

The objective of this study was to evaluate the impact of the physical space on staff workflow, access to equipment and patient, to understand team integration in hybrid scenarios, and to identify any issue or barriers that would affect patient care in the ITOR space.

Human factors evaluation of an interventional trauma operating room mock-up

Biesbroek, S., Shultz, J., Kirkpatrick, A., & Kortbeek, J. 2012 | *Symposium on Human Factors and Ergonomics in Health Care*. Pages 73-78

Key Concepts/Context

Trauma operating rooms and angiography procedure rooms are separate entities in hospitals. An Interventional Trauma Operating Room (ITOR) with scope for both traditional surgery and interventional radiological procedures was designed to reduce the risk involved in moving unstable patients between the two treatment areas. Ceiling-mounted equipment was installed in this OR. This study examined the impact of the physical space on the interactions between staff and equipment and among staff using patient simulation and scenario enactment in a mock-up. This was followed by recommendations for making design changes to overcome inefficiencies in workflow, equipment access, and maintaining the sterile field.

Methods

Patient simulation and scenario enactment in a full-scale mock-up within an ITOR shell to conduct this study. Real and mock-up ceiling-mounted angiography, and surgical, medical, and patient monitoring equipment were installed in the shell ITOR space according to design specifications. A patient simulator mannequin was used as over 30 staff enacted three clinical scenarios. Digital video cameras positioned in different areas of the space recorded all staff interactions and conversations. It took between 30-60 minutes to complete each scenario. The completion of a scenario was followed by a focus group discussion in which all scenario participants participated. About 32 hours of video were analyzed – staff interactions, movements, difficulties, collisions, and verbalizations were tagged and categorized and put into a spreadsheet for data analysis. The movement and collisions of the staff were tracked using link analysis.



DESIGN IMPLICATIONS

The implications for design inferred from this study (as suggested by the authors) were:

- When designing hybrid spaces with large portable equipment (like the angiography c-arm), in addition to adequate space for clearance the equipment carriers should be provided with long tubing for increased flexibility.
- The supplies should be located away from the surgical table to reduce contamination.

Findings

The findings from the study were categorized as follows:

Physical space issues:

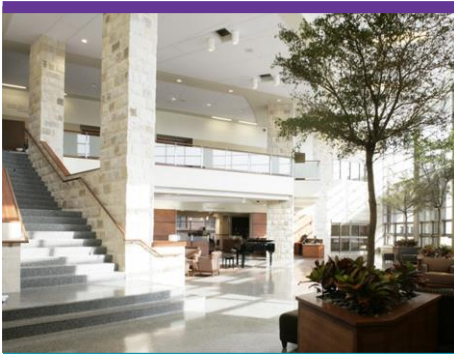
- There was limited physical space in the nursing area.
- There was difficulty in accessing the surgical equipment, carts, and other supplies.

Equipment access and workflow inefficiencies:

- Location of the supply and warming cabinets on the left side of the room impacted:
 - The efficiency of the nursing workflow
 - Increased traffic around the surgical supplies
 - Nurses repeatedly to and from the foot of the operating table to the supply cabinets
 - It was difficult to maintain the sterile field when gathering supplies.
- Ceiling booms:
 - There was limited flexibility of space; when the interventional equipment was rolled into the ITOR, the equipment carriers held by the ceiling boom could not be moved out of the way, as movement placed tubing at risk to be pulled out of the patient.
 - The close proximity of the equipment carriers to the patient affected access to both patient and equipment. This resulted in:
 - Inefficiencies in workflow
 - Increase in risk of contamination
 - Forcing the anesthesia team to take a roundabout path to tend to the patient, brushing past equipment, resulting in the contamination of the sterile field near the surgical tables

Patient monitoring:

- Patient monitors were installed on the arms of the boom. The length of the tubes of equipment carriers allowed for these monitors to be placed in proximity to the patient. This created the following issues:
 - There was less available space for the monitor arms around the operating table.



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- There was a distinct reduction in the visibility, flexibility, and use of the monitors.
- The monitors could not be properly positioned by the staff.
- The monitors were placed at a low level, disrupting optimal visibility and causing a lot of head bumps because of the low clearance.
- A second monitor was placed on the back wall behind the anesthesia equipment.
 - Staff positioned at the head of the operating table had to turn away from the patient and procedure to view the monitor.
 - Staff felt that the monitor was too far from the surgical area to be of use.

Limitations

It may be noted that the use of patient actors, instead of patient simulators, during the enactment of the mock scenarios may have enriched the data by providing useful patient perspective.

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