SYNOPSIS

KEY POINT SUMMARY

OBJECTIVES

The purpose of this study was to investigate how the layout and adjacencies of an operating room affect the travel patterns and workflow of the CN, and to what extent they influence surgical flow disruptions (SFDs).

The Impact of Operating Room Layout on Circulating Nurse's Work Patterns and Flow Disruptions: A Behavioral Mapping Study

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Key Concepts/Context

While there are studies focused on the effect that architectural layout, space planning, and adjacencies have on workflow patterns at the unit level, there are few studies at the micro level of individual procedure rooms or surgical suites. The layout of the OR and the placement of equipment may contribute to extraneous and unnecessary movement or create barriers to safety and efficiency, resulting in surgical workflow disruption (SFDs).

As an advocate for patients whose protective reflexes are compromised while under anesthesia, the circulating nurse (CN) plays a crucial role in ensuring patient safety and an efficient environment during surgery. The CN is the most mobile member of the team, observing, monitoring, managing, and documenting the activities, threats, and events throughout all phases of the procedure. While the CN's workstation is the main hub for the CN, most activities in the operating room (OR) require movement through multiple zones.

Methods

A sample of 25 surgeries in three ORs of different configurations ranging in size from the smallest at 390 sq. ft., to 463 sq. ft., to the largest at 690 sq. ft. The procedures observed involved 12 pediatric cases and 13 general adult cases over a period of 37 hours.

The OR's were divided into functional zones and first classified into eight categories based a study by Ahmed et al. (2016). These zones represented five areas where primary functions occurred: console for the CN, anesthesia, sterile field, and supply zones, plus one "transitional" zone. Further refinement of these zones resulted in a total of 20 different zone categories. Bubble diagrams were created to represent the adjacencies of zones in each of the three OR's.

Activities of the CN were divided into the following categories, designated by the acronym PEMSI: patient-related, equipment-related, material/supply-related, and information-related. Surgical flow disruptions (SFDs) were categorized based on existing taxonomy (Palmer et al.) into six types; however, this study focused on the two categories relevant to physical environment: general layout and environmental hazards.

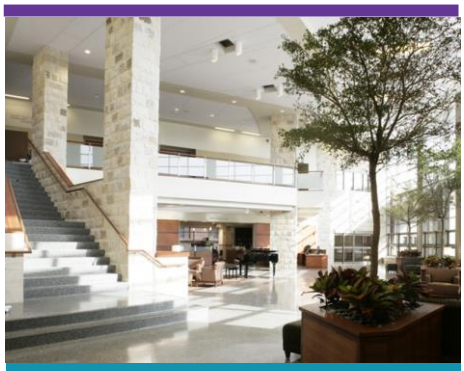
Behavioral mapping techniques were used to observe and code CN movement patterns throughout the surgical procedure. Unobtrusive observations were made possible by the use of four cameras of Media Recorder in each OR. Simultaneous viewing of all four videos was facilitated by Observer XT software. The observers included 11 graduate students and research associates with oversight from clinically trained research team members.

The CN's movement patterns were observed throughout the procedure and were coded by the observers looking at activity type, time duration of the activity, number of zones travelled through, and SFDs experienced by the CN during the activity. Coding taxonomies were based on literature review and existing coding protocols and taxonomies. The research team validated the initial framework through 12 inter-person observations, further refining the coding process with two additional pilot studies. These iterations produced an interrater reliability of more than 80%.

Results of observations and coding of activities through zones were documented in 1) spaghetti diagrams showing the CN's travel path for each surgery from entry into the OR until exit at the end of the procedure, 2) amount of time and number of specific PEMSI activities, 3) frequency of movement through zones, and 4) number of and location of environmental and hazard-related SFDs.

Findings

There were 2,200 observed SFDs throughout the 25 surgical procedures. Of these, 584, or 26%, were environmental hazard and layout related, with environmental hazard accounting for 152 occurrences and layout accounting for 432 occurrences. 58.3% of SFDs occurred in transitional zones and 28% occurred in surgical table zones. While the study is limited by the small (25 procedures) sample size, flow diagrams indicate that the CN's work and movement patterns are similar in varied types of surgical procedures.



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Travel through multiple functional zones was material related 31% of the time, information related 31% of the time, equipment related 20% of the time, and patient related 8% of the time.

The CN's workstation was the most frequently visited zone, and the adjacencies between the CN station and the most frequently visited zones, specifically the transitional equipment and material support zones, could benefit from direct proximity, thus potentially reducing the number of SFDs with the highest occurrence rate (58%).

The next most-frequent SFD occurrences took place between the CN zone and the surgical table. The CN must be able to respond quickly to needs at the surgical table, but must avoid contamination of the sterile area in passing. These two zones may benefit from indirect adjacency, reducing the rate of SFD occurrences (28%) in this zone.

Limitations

The sample size was limited to a convenience sample of 25 surgeries, thus cautioning against making broad generalizations for the implications of the results. The surgeries performed were general adult and pediatric cases. And while there were strong similarities in the flow of activities of the CN across these procedures, there is a need to study a range of surgical procedures in order to determine if these similarities can be observed in these different situations.

Design Implications

The interior of the OR presents design challenges to ensure safety and efficiency of a large team focused on a single goal. The CN's role in the OR is critical to patient safety and the efficient functioning of the entire team. Incongruous adjacencies may increase the zones through which the CN must travel, which may increase the number of surgical flow disruptions encountered. This study focused on the relationship between the CN's workflow patterns and the layout and equipment placement of the OR. CN station and the support zones, specifically material and equipment support zones, could benefit from direct adjacency, allowing easy access to necessary items without incurring SFDs.The CN station and the surgical table zones could benefit from indirect adjacency to allow quick access to the table, but not forcing the CN to have to adapt their movements in order to avoid contaminating the sterile area.