USING A SYSTEMS APPROACH TO DESIGNING A SAFER AND MORE ERGONOMIC OPERATING ROOM

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1/8" scale OR Model


High fidelity mock-up


OR concept rendering

OR is a highly complex risk prone area

5 out of every 1000 ambulatory surgical procedures results in a post surgical acute care visit for surgical site infections (SSI)

Disruptive developments in medical technology and medical practice are impacting how surgeries are being performed today

Distractions and errors contribute to medical errors leading to patient harm

OR design has lagged behind and OR environmental features are often latent conditions impacting patient safety in the OR

BACKGROUND

The incidence of adverse events such as surgical site infections and surgical errors are a huge problem in the operating room (OR) due to the highly vulnerable state of the patient and the complex interactions required between providers of different disciplines and a range of equipment, technology and the physical space where care is provided. Clemson University and the Medical University of South Carolina have been awarded a 4-year grant from the Agency for Healthcare Research and Quality to develop a learning lab focused on patient safety in the OR. This learning lab, titled 'Realizing Improved Patient Care through Human Centered Design in the OR (RIPCHD.OR)' is a multidisciplinary initiative involving architects, human factors experts, industrial engineers, nurses and anesthesiologists. The goal of this paper was to develop a systems approach for observing and analyzing the OR work system and to describe how this systems approach was used to analyze operating rooms environments, finally leading to the development of design guidelines for designing operating rooms.

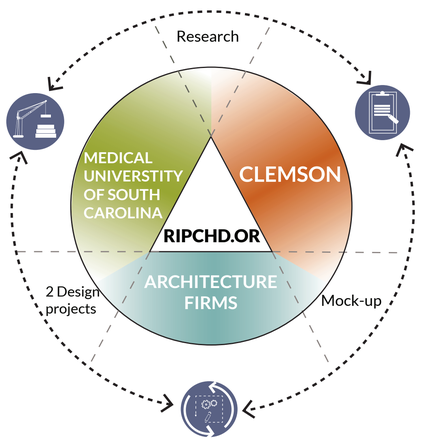
METHODOLOGY

An in-depth literature review was conducted to develop and refine a systems approach for studying the OR work system. The OR work system (people, tasks, technology, built environment, processes) was then studied through analysis of videotapes of 35 surgeries in three different departments (general, orthopedic and pediatric). Additionally, three case studies were conducted to understand alternate approaches and best practice in OR system design. Finally, design guidelines were created to help translate research findings into the design of a prototype OR.

IMPLICATIONS

A systems framework provides a rigorous multi-dimensional approach for researching and designing a complex environment such as an operating room. This is a more holistic approach to designing healthcare facilities that allows for a deep understanding of the complex interplay between people, tasks, processes, technology and the built environment.

PARTNERS AND PROCESS



PROJECTS

UNMASKING OF ANESTHESIA-RELATED ALARMS AND COMMUNICATIONS

This work extends what is known about alarms, interruptions, and distractions in the operating room by examining them from a systems perspective.

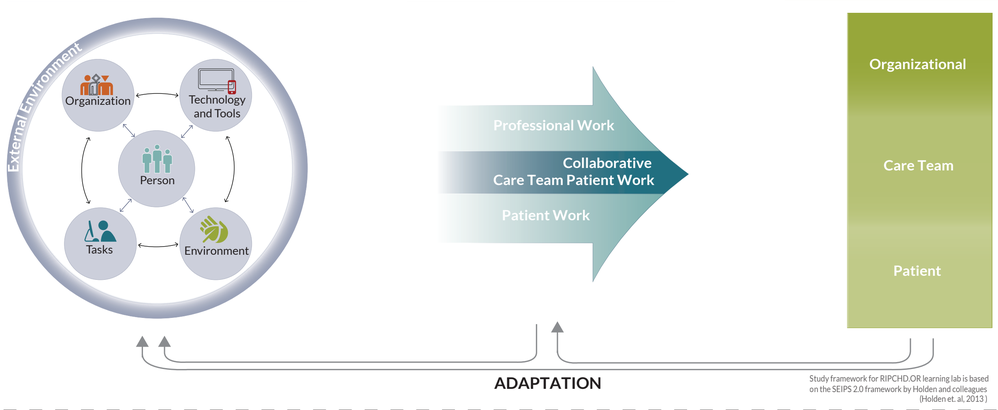
TRAFFIC FLOW AND DOOR OPENINGS IN THE OR

This project will focus on understanding factors impacting traffic flow in the OR suite.

INTEGRATED OR SUITE DESIGN

This project aims to develop an overall framework and methodology for designing an ergonomic and human-centered operating room that will improve patient and staff safety and outcomes in the OR.

PROJECT FRAMEWORK

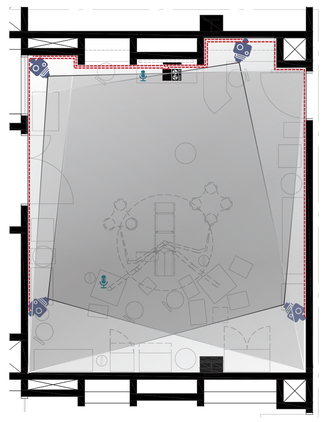


FINDINGS

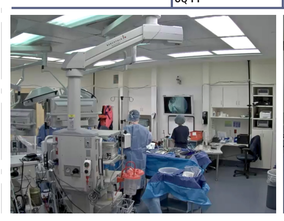
Findings: Using a systems approach yielded rich insights about the tasks and activities of key stakeholders, the locations of people, objects and equipment, space needs during different phases of surgery and also the inter-dependencies and relationships between key players in the OR. The operating room needs to be flexible and adaptable to meet current and future needs. Key areas of consideration include the amount and location of storage to minimize door openings in the OR, relative location of zones in the OR to optimize flows and the need to promote situational awareness among team members for optimal communication.

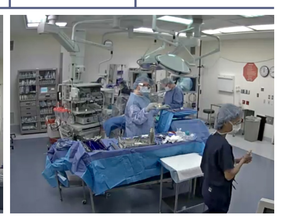
1. Circulating nurse makes trips to all different parts of the OR, though she/he spends the maximum time at the circulating nurse desk and interacting with the scrub nurse
2. Anesthesia storage is primarily used by anesthesia personnel while general storage is accessed by all team members, though primarily the circulating nurse
3. The number of door openings and duration are proportionate to the length of the surgery. However, this does not seem to hold true for some of the pediatric surgeries observed.
4. Some surgeries had a large number of clean core door openings
5. Layout related disturbances were the most frequently observed SFDs in all observed surgeries
6. High number of SFDs observed in the shorter pediatric surgeries. Also duration of door openings higher in those surgeries. Link with room size and design
7. Proportion of disturbances as a proportion of surgery time very high in the smaller OR in main

VIDEO CAPTURE

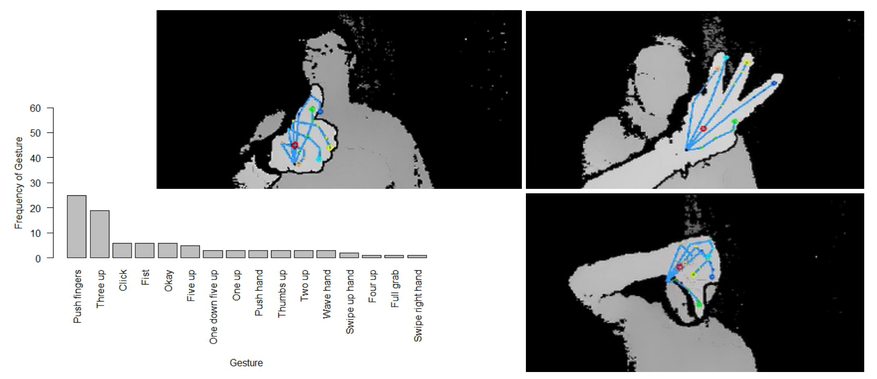


Type of surgery	PEDIATRIC	ORTHOPEDIC	GENERAL
Number of surgeries	9	1	7
Range of length of surgery	30-77 min	154 min	54-181 min
Range for total number of	7-11	8	7-10
Room size	Main OR 11: 390 SQ FT	Main OR 14: 542 SQ FT	Art OR 5: 690 SQ FT





GESTURE FUNCTIONS MAPPING



DESIGN MOCK UPS

DESIGN CONCEPTS