HUMAN SYSTEM INTEGRATION: Operating Rooms

This project was conducted as a part of Human System Integration Workshop at Institute of Design, Illinois Institute of Technology. The project aims to investigate quality of care and efficiency of activities in the operating rooms (ORs) at the University of Chicago Hospital, in collaboration with Operative Performance Research Institute (OPRI).

We focused our research efforts in understanding the root causes of communication when relating to situational awareness. Our goal is to get insights into the workings of the ORs and suggest possible solutions to enhance the efficiency and quality of surgeries in OR.

**Human Systems Integration approach**

We applied Human Systems Integration approach for understanding the complex environment in operation rooms. In order to fully understand the complexity of the OR we analyzed it from multiple perspectives such as: Information Systems perspective (EPIC), Activity Flow of the system, People’s Flow within the OR, and Roles and Communications.

**Project Description:**

After conducting observations of 15 surgeries, we created diagrammatic representations for different aspects of the OR. This step helped the team identify issues and analyze the potential causes. Following which insights were developed and used to guide conceptual solutions from systematic and holistic perspectives.

Conceptual solutions have been depicted as scenario sketches to illustrate the future direction of OR systems development.

**INSIGHT 1**

**Lack of situation awareness causes performance degradation**

In complex surgery there are more people in the OR increasing the possibility of communication breakdown. Inconsistent communication leads to a lack of performance degradation.

Communication is affected by physical barriers. For instance, surgical masks and a team member’s positioning can affect communication and situation awareness.

Inconsistent communication leads to a lack of awareness among the team. This causes significant inefficiencies in how team members assess tools and information necessary for their role.

The circulating nurse serves as the communication hub. As a result, she is overloaded by the responsibility to distribute shared knowledge. When the circulating nurse leaves the room, she no longer has access to valuable information.

**SOLUTION 1**

**SOLUTION STORY**

In the OR transition so frequently, it’s difficult for nurses to develop the level of rapport necessary to have the relational fluency that would make for an ideal OR experience. Our solutions highlight future possibilities that alleviate this problem.

OR should have an electronic personnel identification system that records team members’ entrance and exit—relieving the circulating nurse from this responsibility. Also, the personnel information can be persistently displayed on OR information displays for quick orientation.

Adjustable lighting and standardized “sign language” could serve as environmental cues to show the surgery status. While monitors and environmental cues allow visitors to quickly orient themselves to the exact point of surgery, the circulating nurse is equipped with wearable technology so she is aware of the constantly changing situation and can stay informed of her responsibilities.

All team members wear color-coded uniforms allowing others to readily identify their roles despite their disguised faces.

Circulating Nurse outside the OR receives a notification on her mobile from the surgeon requesting a tool.

People in PostOp check real-time surgery status from their computers.

**INSIGHT 2**

**Lack of situation awareness causes performance degradation**

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Overloaded members as well as crowded ORs.

Inconsistent communication leads to a lack of performance degradation.

INSIGHT 2

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LACK OF FEEDBACK AND REFLECTION HINDERS PROFESSIONAL AND PROCESS IMPROVEMENT

Feedback and reflection are important tools of personal training and professional process improvement. We noted several instances, like debrief, where feedback could have been given and reflection done but teams did not engage in any such activities.

There’s a need for a timely, qualitative feedback system to reinforce good practices.

Debrief is a valuable opportunity for feedback and learning. However, the OR staff’s attention is usually divided among multiple tasks and they do not pay attention.

Preference cards are updated infrequently because there is not a proper feedback loop in place, nor ownership or accountability.

There is an informal and somewhat inconsistent communication system used to transmit information among team members through binders, notebooks, and papers.

Some checklists have become burdensome—maybe it’s time to re-evaluate protocols around checklists and their necessity.

Operating rooms need feedback for professional development. Also, organization needs frequent reflection and improvement to allow for consistent and continuous process improvements. This solution provides for such opportunities during surgery phases of Time out and Debrief.

The implementation of systematic feedback during timeout and debrief can create moments for reflection and more streamlined communications. For instance, during timeout the surgeon can draw the attention of the team by explicitly prompting for it, causing everyone to stop the task at hand. With focused attention, the team can collectively share knowledge regarding both, the patient’s profile and surgical details. Post surgery, the team can review surgery summary reports that offer useful information to improve feedback. For example, preference cards reports could be generated that show the effective use of instruments and supplies. Furthermore the reports could allow for easy updates such that better case carts are made available in the future.

SOLUTION 2

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Later, in the office, surgeons review reports with team surgical statistics. Also, prompts in the system allow for easy preference card update.

A team member checks patient’s wrist ID for information.

Lights dim, everyone gathers in space and stops what they are doing. Someone checks patient’s wrist ID for information.

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Role responsibilities and demands of team are often at conflict

All members in the OR are experts of their domains and have significant individual responsibilities. Also, as part of the team, they have to be constantly aware of the team’s work activities and participate as needed. We observed that these two avatars (of the members) are at odds all the time.

INSIGHT 3

SOLUTION STORY

Within the OR there is a need for a cohesive system to alleviate the disruptions caused by conflict between individual roles and demands of team dynamics. This solution would help team members learn how to communicate effectively and share critical feedback constructively.

An experienced surgeon with track record of managing high performance teams could serve as a “Coach.” The coach would facilitate regular critical conversations, address inter-personal issues and team synergy. When the coach is present in the OR, he facilitates decisions before and after surgery by acting as mediator. Because of this experience he has the bandwidth to offer tips and catalyze overall improvement.

Additionally, OR staff could participate in team building exercises periodically to help foster better relationships. Overall, these new practices improve patient care and team dynamics during surgical procedures.

When the patient enters the OR the display screens are showing pleasant images and provide pleasant background sounds.

The ‘Coach’ works with an individual doctor on OR leadership

The experienced surgeon or nurse “coach” counsels the team on the patient care strategy.

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After surgery, the team huddles to review performance with the coach.

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Physical barriers interrupt task flow, traffic, and cause safety and efficiency issues

Physical interruptions in the room can cause inefficient movements and interfere with the surgery and could lead to safety and quality issues of OR environment. The current physical infrastructure of the OR and arrangement of equipment could be improved.

Solution Story

To solve the problems of cables on floor, blocked pathways, some of the cables, cords and equipment can be moved to the ceiling maximizing spatial use and optimizing operational efficiency. Other solutions should involve providing flexible orientation for circulating nurses’ stations such that she has a view of the surgical area other areas. Mapping of surgical floor area could be done such that the OR can organize her tables and carts to preset arrangements. This mapped area should be reflective of the team’s traffic patterns and sensitive to the activities of the particular surgery. These changes will enable team members and avoid workarounds caused by poor positioning of equipment in the environment.

Similar to assembly of automotive manufacturers, cabling is wired from the ceiling

Ad hoc objects such as bins and auxiliary tables are incorporated in the system layout for safety and efficiency

Placement of workstation limits the ORs overall awareness and the ability to view her teammates and the surgery itself

Items are moved and placed throughout OR causing blocked pathways and obstructs movement. For instance, the cables on the floor and step stools restrict movement of the members.

Circulating Nurse has a portable workstation that allows her to face the team and the surgery

Non-compliance with material handling protocols or lack of standardized practices in the OR would contribute to health and safety hazards, such as, haphazard handling of bloodied gauzes while disposing into trash cart or specimen handling after extraction

INSIGHT 4

SOLUTION 4