Waiting Rooms are No Longer Just For Sitting:

Multi-model spaces providing family education and communication

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OBJECTIVE Improving family to provider communication throughput and efficiency by providing a collaborative filtering family education web-based system in a multi-model environment increasing provider time with patients.

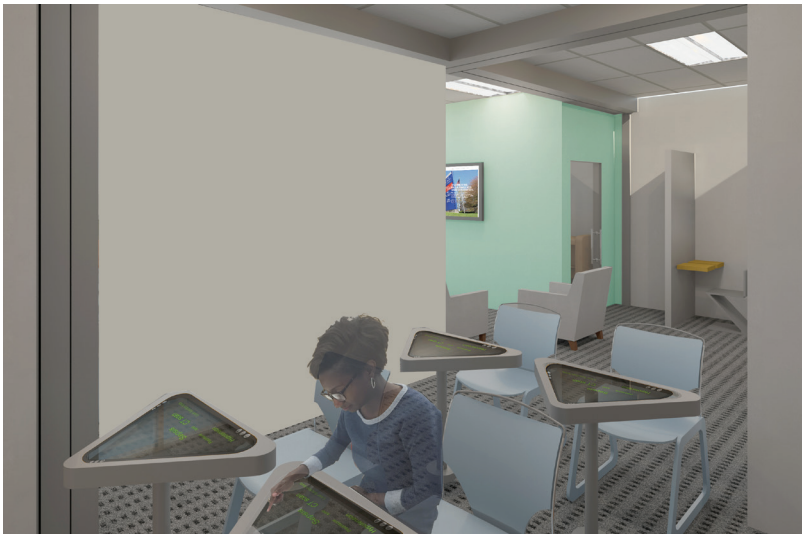
Problem Statement :

A patient and family centered ICU opens the ICU to family members in order to improve the quality, safety, and satisfaction with care of families and patients. Family members who are not properly trained decrease the amount of care that can be provided to patients through inefficient and ineffective communication with care providers and become a safety risk for patients

Objective:

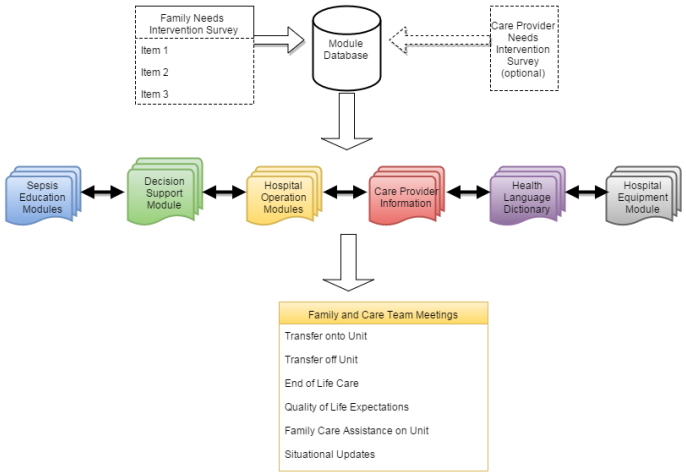
The objective of this waiting room redesign and enhancement is to improve the quality of patient care provided in ICUs. Using Sepsis care as a model, we design a generalizable system to improve patient care through family communication with the care team improvements. Communication efficacy and efficiency between care providers and families is increased by improving the overall contextual knowledge of families and decreasing their anxiety. We accomplish this task through a cost effective mix of automated education, targeted human communication, and physical space adaptability.

Additional value is added by redesigning inefficiently used waiting room space to provide family education, improved privacy, and anxiety reduction in already available space.



Education System

The core of our system provides collaboratively filtered education modules to families through an online system. Family Members and care providers complete surveys that are used to generate critical content for family education. These modules cover everything from unit operation to critical concerns for end of life decision making. These automated digital sessions are supplemented by post education communication with care providers allowing for more efficient and effective communication.



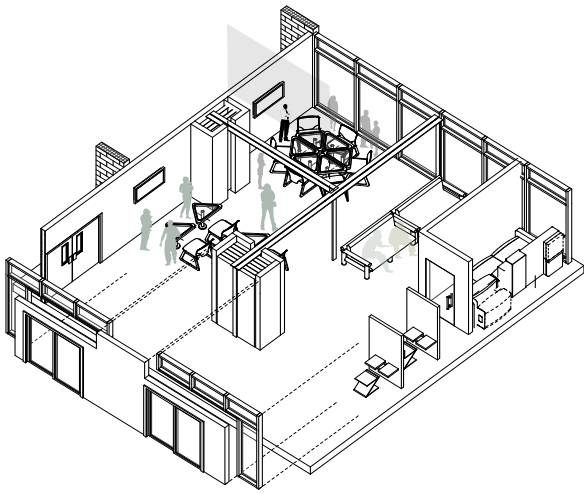
Table

Education takes place on our modular automated table system. This table interface performs two critical functions. It primarily serves the platform for delivering educational content to families through the automated collaborative filtering system. In this way it prepares families for effective communication before face-to-face conversation with the care team. On a secondary level, it can support a family's communication during face-to-face communication by providing an interactive glossary of terms used by the care team. Profiles of family members' use will allow for information to be provided at levels that can be properly understood.

Figure 3: Interactive Table

Overall Waiting room design

The overall waiting room has a number of features that will further support the two previously described interventions. Efficient use of space, family privacy, and family anxiety are three important concerns that are addressed by our system. Current space usage in a waiting room limits the variety of critical activities that can take place in the space. Our redesign offers privacy through the use of transparency via shifting walls/ windows. These windows/walls allow spaces to transition between private and open spaces while creating sound proof private spaces for families to use. These transitional spaces allow for decreased anxiety as families want to know that they are viewable by staff while having privacy, two goals that are usually at odds.



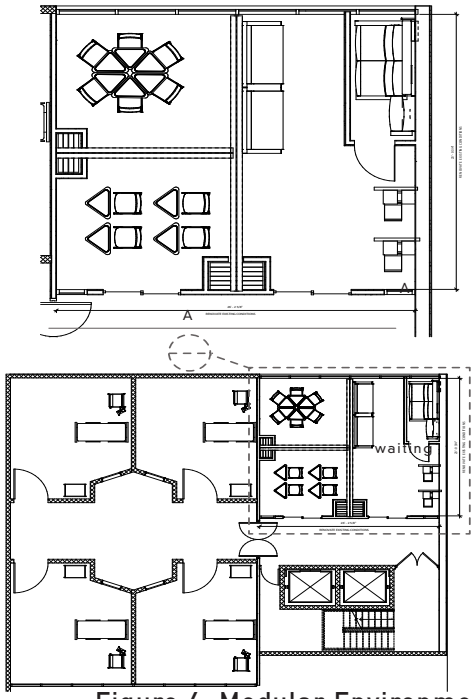


Figure 4: Modular Environment

Family Space

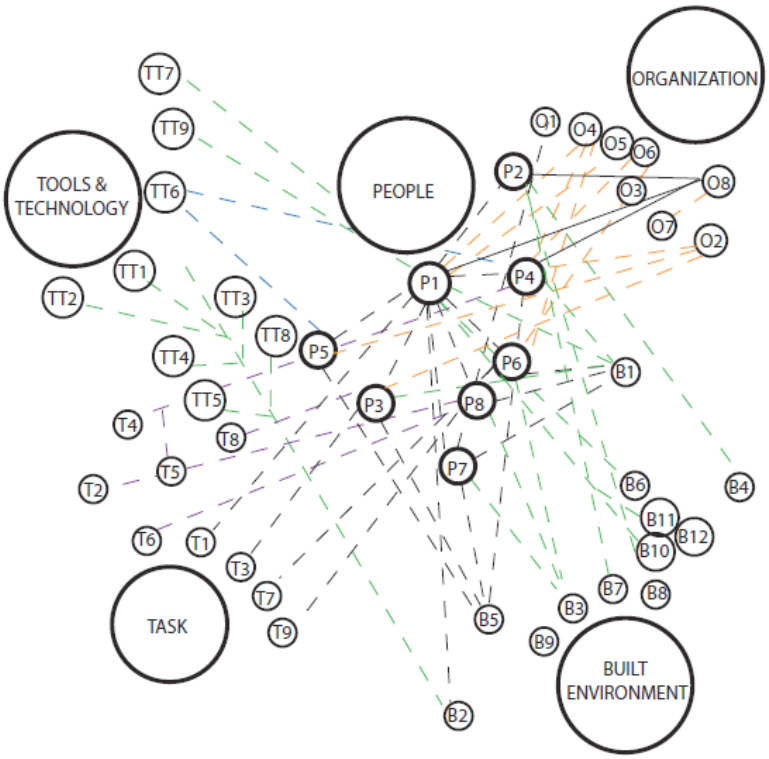
The overall waiting room has a number of features that will further support the two previously described interventions. Efficient use of space, family privacy, and family anxiety are three important concerns that are addressed by our system. Current space usage in a waiting room limits the variety of critical activities which can take place in the space. Our redesign offers privacy through the use of transparency shifting walls/ windows. These windows/walls allow spaces to transition between private and open spaces while creating sound proof private spaces for families to use. These transitional spaces allow for decreased anxiety as families want to know that they are viewable by staff while having privacy, two goals that are usually at odds.

Understanding the ICU

Intensive Care Units (ICU) or Critical Care units (CCU) care for patients in hospitals with the most acute diagnoses. Patients suffering from life threatening conditions including but not limited to: acute respiratory failure, cardiac failure, major trauma, disaster medicine victims and deep coma, receive stabilizing care in the ICU setting. The ICU provides increased access to specialized staff, near constant observation, as well as priority access to equipment (Takrouri, 2004). Technology readily available in the ICU that may not be available at other care levels include "artificial ventilation, supporting the circulation, management of shock and renal dialysis" (Takrouri, 2004). Concentrating intensive care into single units has reduced expected mortality by up to 60% in some cases (Takrouri, 2004).

While ICUs treat a variety of conditions, of particular interest to us will be the treatment of Sepsis and Septic Shock. "Sepsis is defined as the presence or presumed presence of an infection accompanied by evidence of a systemic response called the systemic inflammatory response syndrome... Severe sepsis is

TRANSITION IN CARE ONTO AND OFF THE ICU



PERSONS

- P1 PATIENT
- P2 FAMILY
- P3 UNIT DOCTOR
- P4 UNIT NURSE
- P5 ICU DOCTOR
- P6 ICU NURSE
- P7 BED TRANSFER
- P8 TRANSPORT

TOOLS & TECHNOLOGY

- TT1 DESIGN OF ELECTRONIC MEDICAL RECORD
- TT2 MONITORS (TRANSPORT, IN-ROOM)
- TT3 PUMPS (VENTILATION, IN-ROOM)
- TT4 COMPUTERS (ACCESS TO MEDICAL RECORDS)
- TT5 INTERVENTION DEVICES
- TT6 MOBILE COMMUNICATION
- TT7 TRACKING PATIENT (RFID BAND)
- TT8 IV SYSTEM
- TT9 NUTRITION SYSTEM

BUILT ENVIRONMENT

- B1 OUTPATIENT HALL
- B2 UNIT ROOM
- B3 STAFF AREAS
- B4 RECEPTION
- B5 TELEPHONE
- B6 RECIEVING AREA
- B7 WAITING ROOM
- B8 SPATIAL ENVIRONMENT
- B9 EXTERNAL ENVIRONMENT
- B10 VISUAL ENVIRONMENT
- B11 ACOUSTIC ENVIRONMENT
- B12 SPATIAL ENVIRONMENT

TASK

- T1 CONNECT TO MONITORS
- T2 ASSIGN NEW BED
- T3 COMMUNICATE PATIENT INFORMATION
- T4 RECORD PATIENT INFORMATION
- T5 GATHER INFORMATION FROM SYSTEM
- T6 MOVE PATIENT
- T7 MONITOR PATIENT
- T8 COMMUNICATE WITH FAMILY
- T9 ACCURACY OF DISCUSSION (AND EFFECTIVENESS)

ORGANIZATION FACTORS

- O1 AVAILABILTY OF NEW BED
- O2 NORMS ABOUT PHYSICIAN, NURSE, PATIENT AND FAMILY IN DECISION MAKING PROCESS
- O3 EDUCATION OF PATIENT AND FAMILY ABOUT TREATMENT AND OPTIONS
- O4 TIME PRESSURE FOR TREATMENT
- O5 NEED FOR OLD BED
- O6 POLICIES REGARDING TRANSFER OF INFORMATION
- O7 ACCESS OF CLINICANS TO DIFFERENT E.M.R
- O8 ELEVATORS AND LOCATION

defined as the presence of sepsis and 1 or more organ dysfunctions. Organ dysfunction can be defined as acute lung injury; coagulation abnormalities; thrombocytopenia; altered mental status; renal, liver, or cardiac failure; or hypo perfusion with lactic acidosis. Septic shock is defined as the presence of sepsis and refractory hypotension (Nguyen et al., 2006). Severe sepsis and septic shock have a mortality rate that approaches 50% (Nguyen et al., 2006). A significant portion of potential septic patients present themselves at the Emergency Department. Strong controls for identifying patients who are most susceptible to a septic diagnosis can lead to vastly improved outcomes. As a time dependent diagnosis, clear chains of communication and systematized care and evaluation are essential to improving the quality of care received at hospitals. "A significant decrease in mortality has been observed when surgical interventions are undertaken early."(Nguyen et al., 2006)" (Dellinger et al., 2013)

Decision Making Steps

In order to understand our design process one needs to first understand how our analysis began. Our initial focus was on the transport processes onto and off the ICU. Every patient needs to be transported to the ICU and effective treatment can be difficult if this step is not completed in a satisfactory manner.

Transport processes in the hospital sit at the intersection of two professional work systems. The transferring and accepting units both have professional work systems and process operating with the end outcome/ goal maximizing the efficacy of care for all the patients receiving care in the system. These systems also have agents who are ensuring the patient centeredness of care by doing collaborative professional-patient and patient work. The outcome sought by transport processes is the efficient and safe handoff of patients from one work system to another. During the transfer process, a new work system orientation that combines the receiving and sending unit comes into play.

Work Configuration

Figure SEIPS 2.0 model (Holden et al., 2013). The work system configuration that we explored focused on the subset of processes at work during patient transport onto the ICU. SEPSIS has been chosen as a condition of interest because of its high acuity and the time dependent nature of care. We chose to focus on the family and their interactions

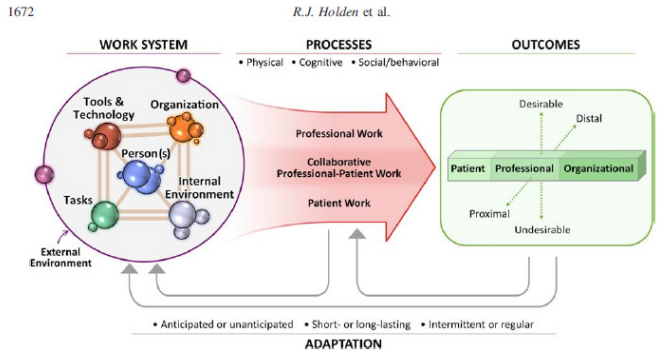


Figure 1. SEIPS 2.0 model.

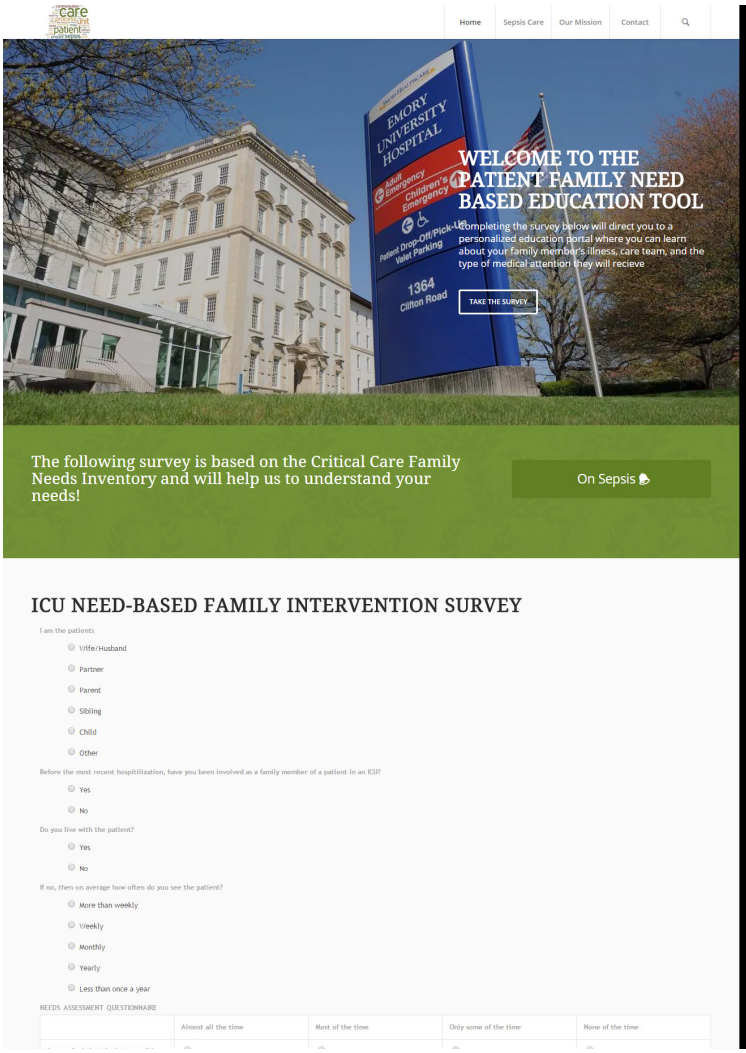
or lack thereof during transitions onto the ICU. The findings herein will be presented in a general form where possible in order to derive the maximum benefit for all patient families in the system.

The work system of interest has been presented in Figure 1: Transition in Care onto and off the ICU. The active agents are listed as persons in the diagram. The Unit Doctor, ICU Doctor, Bed Transfer, and Pharmacists are primarily in "Professional Work" processes as described by Holden et al. Their interactions are primarily with other professionals who are ensuring effective communication of the patients care profile to the new units. Due to their role in the work system, nurses interface with both the professional and patient work; as such their work operates primarily in the collaborative professional-patient work. Our design therefore tends to focus on the tasks and tools that would be pertinent to families and nurses.

Supporting Evidence For Education System

Previous research has proven that family participation in critical care can be extremely effective in increasing the quality and safety of care provided to patients. (É. Azoulay et al., 2003; Bailey, Sabbagh, Loiselle, Boileau, & McVey, 2010; Bell, 2015; Malliarou, Gerogianni, Babatsikou, Kotrotsiou, & Zyga, 2014) Families in these situations have a number of specific needs to be met if they are to be effective partners in a patient centered critical care environment. (Davidson, 2009; Kentish-Barnes, Lemiale, Chaize, Pochard, & Azoulay, 2009; Rukholm, Bailey, Coutu-Wakulczyk, & Bailey, 1991) Research over time has proven the effectiveness of educational elements such as leaflets in providing general information to families. (E. AZOULAY et al., 2002) As we continued to delve into the topic we found that needs-based education of families offers the most effective intervention for family participation, but that previous attempts to incorporate it were highly resource intensive. (Chien, Chiu, Lam, & Ip, 2006; El-Masri & Fox-Wasylyshyn, 2007). Interviews with care providers, specifically the nurse staff that participated in the class, led us to believe that an effective needs based program, also needed to minimize the time burden on nursing staff, which led us to our collaborative filtering education system solution.

When considering how to create an effective automated learning platform, collaborative filtering of content quickly became the only reasonable solution. The research we collected showed that a robust system would need to adapt to a wide pool of users including: age ranges from youth to elderly, a variety of relationship to the patient, and a wide variety of health literacy levels (Bell, 2015). In order to accommodate these differences we settled on a collaborative filtering solution that would incorporate the needs of a family through survey responses as well as care provider directives through the back end. Collaborative filtering systems have proven to be quite effective educational tools in many other environments and allow for needs based solutions in our ICU waiting room design. (Bobadilla, Serradilla, & Hernando, 2009; Herlocker, Konstan, & Riedl, 2000; Li, Lu, & Xuefeng, 2005)



A variety of research also points to needs based interventions reducing family anxiety and PTSD (Bell, 2015; Chien et al., 2006; Girard, Pandharipande, & Ely, 2008; HealthTalk, 2015). All of the strategies above allow the system to reduce the communication burden on the staff while improving the efficacy and efficiency of communication with the family. We postulate that our education strategy should increase patient outcomes through two mechanisms: increasing the amount of resources available to patients by decreasing the amount of time families need for effective communication with staff AND increasing the effectiveness of family presence in the ICU through needs based education.

Supporting Evidence For Interface Design

The tables are suitable to be put into the waiting room even when the space is small. It has three edges and everyone has a triangle interface to work on. When the number of the patient's families are different, they can be assembled into different groups.

The first function of the tables is to show the website. After they finish the survey on the website, their knowledge level will be judged and information will be provided based on their knowledge level. Before the doctors come, a list of core medical words that are needed for discussion will show on the table surface. When the doctors are speaking, the medical words the doctors are actually using will show on the table surface using voice input technology. If the families don't understand, they can click them and get suitable level of explanation based on their knowledge level. As suggested by Continuous Speech Recognition for Clinicians, 97 percent accuracy can be obtained by the speech recognition system supported by a commercial medical dictionary (Zafar, Overhage, & McDonald, 1999). It helps families to catch up with the doctors and let the doctors know where the patient's families don't understand.

Supporting Evidence For Physical Environment

In wanting to create a healing environment that is appropriate for the support of patient education we considered a number of design improvements over current waiting rooms. The literature pointed us to two competing concerns for families: families simultaneously crave visibility by staff and privacy from others. Evidence also pointed to the need for strategies to relieve family anxiety and distress. In order to meet these needs, we consider adaptable environments for families including the elements of movable furniture and transitioning windows. (Brown & Gallant, 2006; Reiling, Hughes, & Murphy, 2008)

Color can affect an individual's emotional state, inducing cheerfulness, agitation, or calmness. We utilize calming color schemes such as blues, greens, and violet. (Rubert, Long, & Hutchinson, 2007)

- Blue has relaxation, serenity, loyalty effects.
- Green brings feelings of healing, nurturing, unconditional love.
- Violet is related to spirituality, stress reduction and feelings of inner calmness.

Noise is one of the most insidious environmental stressors found in the hospital environment. On any ward, harmful noises can include the hum of medical equipment; bubbling of chest tubes; staff conversations; pagers and intercom systems; ringing of telephones; opening and closing of doors, cabinets, and supply carts; and even the clattering sounds from the wheels of a passing cart. These unfamiliar and unexpected noises can startle anyone, but especially a patient already stressed from a physiological strain. So we reduce environmental stress caused by noise using sound-absorbent materials such as acoustical ceilings. We can also construct single family spaces and provide headphones (Bazuin & Cardon, 2011).

Light has healing properties, and light therapy has been instituted as part of the treatment plans of many diseases. Full-spectrum light is best derived from natural daylight and can be achieved through windows, skylights, and atriums; however, full spectrum lighting fixtures are a reasonable alternative if natural daylight is not available (Rashid, 2010).
Staring at the same four walls can have just as deleterious a consequence on a patient's recovery as the chaotic environment produced in the critical care environment. A revolutionary study found that postsurgical patients recovered more quickly when exposed to a window view than did those without this view, suggesting that changing the healthcare landscape reduces stress and has a positive effect on medical outcomes, including speed of recovery, and reductions in length of stay and cost. So we use transparency shifting windows to allow families privacy during closed meetings, and visibility during open space time. (E. Azoulay et al., 2001; Bazuin & Cardon, 2011; Maxwell, Stuenkel, & Saylor, 2007; Rukholm et al., 1991)

Use Cases

To conclude our report we will present four specific use cases of our design in order to elucidate design elements.

Family A

This family group is involved with a patient who is in the process of or has recently been transferred onto the ICU. This family group can involve members of many ages and is experiencing extreme distress and anxiety as they move to an unfamiliar place. In previous system designs, this group can often be forgotten by the system as the two working environment interface.
In our new waiting room this family would be placed in the private family space and quickly oriented to the collaborative filtering education system. The survey that they would take will filter the needs based education materials that would most assist them and prepare them for communication with the care staff after the acute needs of the patient are met.

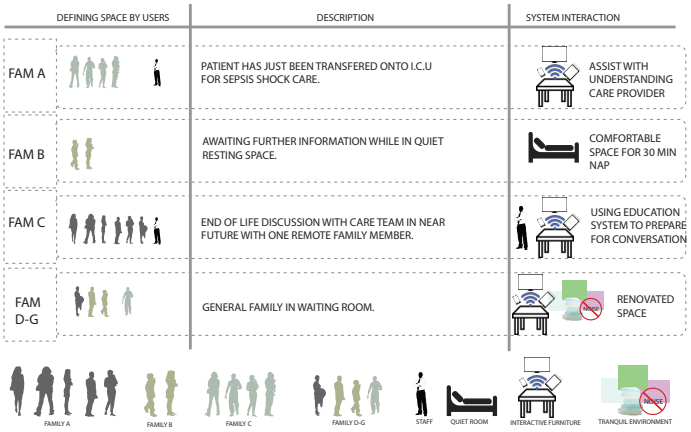


Figure: Family use typology diagram

Family B

This family's associated patient may have been on the ward for any period of time. While waiting for further information they are using the built in sleeping space to rest in a relaxing environment. Critically they have signed in with the staff to ensure that their location is known in the case of an emergency.

Family C

Preparing for an End of Life or Transfer in Care discussion can be extremely difficult. Before meeting with a care provider, this family type would be brought up to speed on the prognosis and decision node that they now face. By choice this family can make this time more private by utilizing the transition windows to create a self-contained private space. This family is also afforded the use of video conferencing in order to incorporate geographically dispersed members into the decision making process.

Family D

In previous waiting rooms, this archetype describes the use case of all families. In our new design these families can also utilize the table platform to educate themselves

Our design allows for a variety of family needs and concerns to be addressed in the same space that previously only served one purpose without changing staffing needs or burden.

Presentation and next steps:

There were many insightful questions asked by participants and industry members during our presentation. These questions brought into focus many of the next steps required of and additional questions around our project.

ROI – The return on investment for a hospital needs to be clearly stated. Whether financial or qualitative the value proposition needs to be clearly drawn out.

Modular Installation – A modular installation plan may need to be developed to both prove ROI and alleviate the high capital cost of the over all project.

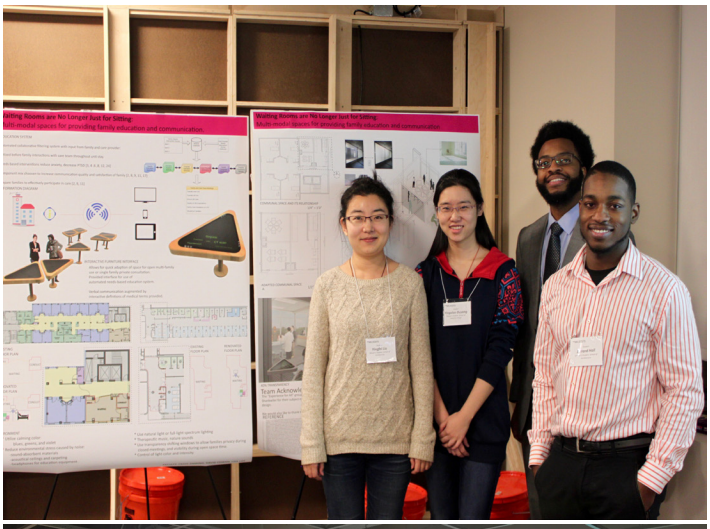
An adaptable table design should be considered as technology intervals are much shorter than furniture purchase intervals.

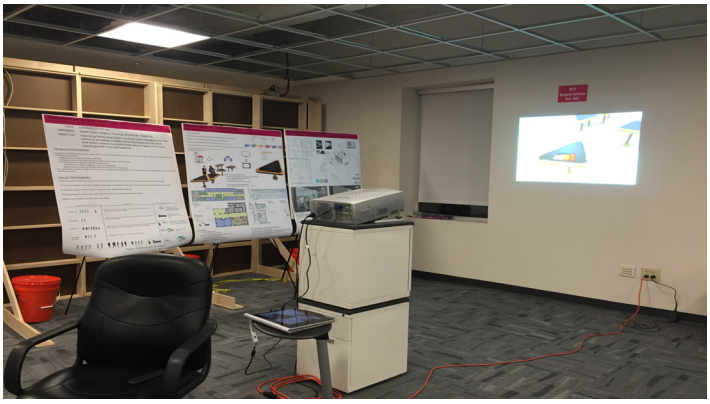
Adaptability to an ED – The education and technology system may be adaptable to a ED environment. We might consider how to best incorporate our design elements into different hospital systems.

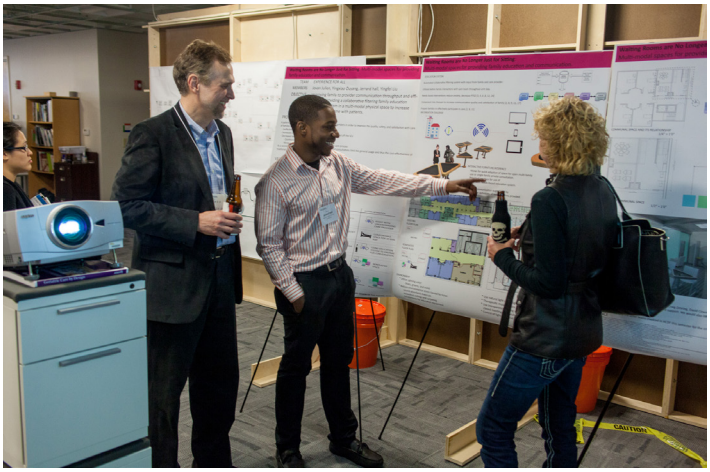
Reflections

"The final presentation is really formal and when we presented our ideas, the industry professionals will value our project in a more practical way. After talking with them, many practical problems are disclosed by them which make us think more. But they also give us a lot of encouragement and see value in our solution which is inspiring. "

"The final presentation was a good way to end the course this semester. We were allowed to smoothly present our polished ideas in-front of industry professionals. The information and feedback was very beneficial and thought provoking. For example, "think post prototype why would I as a CFO buy your table" This statement solidified the semester's work, along with presenting an opportunity to further develop our ideas. "







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