

Patient Safety

Enhancing the Traditional Hospital Design Process: A Focus on Patient Safety

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Given the unique opportunity of building a new hospital, St. Joseph's Community Hospital recognized the opportunity to increase patient safety and promote a patient-safe culture by improving the traditional hospital facility design process. Typically, hospitals are in a continuous cycle of remodeling and expanding their existing facilities to adapt to changing demands. St. Joseph's identified the need to develop a set of safety-driven design principles and design process recommendations that could be used by all health care organizations, whether they are building new facilities, remodeling, or expanding existing facilities. The time line for the safety-driven hospital design process is shown in Figure 1 (page 116).

St. Joseph's Community Hospital is a member of *SynergyHealth*, a regional health care system that serves more than 125,000 residents in the greater Washington County (WI) community. The hospital is an independent, nonprofit, approximately 80-bed acute care facility located in West Bend, Wisconsin, near Milwaukee. Its affiliate, West Bend Clinic, is a multi-specialty group of 45 physicians that serves patients in three locations.

A Learning Lab for Patient Safety

Inspired by the Institute of Medicine (IOM) report *To Err Is Human: Building a Safer Health System*,¹ internal discussion at St. Joseph's in 2001 focused on how design of a new facility could affect patient safety. Initial discussions centered on whether to remodel the existing facility or build a new one. Hospital leaders determined

Article-at-a-Glance

Background: In 2002 St. Joseph's Community Hospital (West Bend, WI), a member of *SynergyHealth*, brought together leaders in health care and systems engineering to develop a set of safety-driven facility design principles that would guide the hospital design process.

Designing for Safety: Hospital leadership recognized that a cross-departmental team approach would be needed and formed the 11-member Facility Design Advisory Council, which, with departmental teams and the aid of architects, was responsible for overseeing the design process and for ensuring that the safety considerations were met. The design process was a team approach, with input from national experts, patients and families, hospital staff and physicians, architects, contractors, and the community.

Outcome: The new facility, designed using safety-driven design principles, reflects many innovative design elements, including truly standardized patient rooms, new technology to minimize falls, and patient care alcoves for every patient room. The new hospital has been designed with maximum adaptability and flexibility in mind, to accommodate changes and provide for future growth. The architects labeled the innovative design The Synergy Model, to describe the process of shaping the entire building and its spaces to work efficiently as a whole for the care and safety of patients.

Conclusion: Construction began on the new facility in August 2003 and is expected to be completed in 2005.

Time Line for Safety-Driven Hospital Design Process

January 2002	Selection of owner's representative
February 2002	Selection of architectural and construction firms
April 2002	Patient safety learning lab
May 2002	Initial meetings with equipment planner
May 2002	Technology fair
June 2002	Retreat/matrix development related to equipment, technology, facility
June 2002	Web-ex 1
August 2002	Selection of Facility Design Advisory Council
August 2002	FMEA training
August 2002	Community Focus Group—looking at patient room
September 2002	Functional space programming - FMEA
September 2002	Department design team—human factors training
September 2002	Web-ex 2
October 2002	Anonymous error reporting system implemented
November 2002	Schematics design FMEA
November 2002	Med/surg mock-up
March 2003	Web-ex 3
March 2003	Town hall meeting
May 2003	Community focus groups—Med/Surg and NLC rooms
May 2003	Design development FMEA
August 2003	Groundbreaking—construction began

Figure 1. *The safety-driven hospital design process began after hospital leaders decided to design a new facility rather than to remodel the existing facility. FMEA, Failure Mode and Effects Analysis; Web-ex, conferences with learning lab participants to update them on progress; NLC, New Life Center (maternity department).*

that the costs to remodel and to build were comparable. In addition, building a new facility located near a major highway would provide convenient access to care for a growing population; allow the hospital to expand easily, if needed; and provide the opportunity to design around patient safety without the impediments of an infrastructure built in 1920.

Although errors (active failures) happen at the point of service (for example, a nurse administering the wrong drug, a physician ordering a drug that a patient is allergic to), the cause is often the result of latent conditions in the system or facility design, such as high noise levels or inadequate communication systems.

Although it is widely acknowledged that the physical environment has a significant impact on health and

safety, hospitals have not been designed with the explicit goal of enhancing patient safety through facility design innovations. Despite the recent trend to design patient-centered health care facilities, little assessment of the impact of the built environment on patient outcomes has been conducted.² Studies have focused primarily on the effects of light and noise, yet there are many more considerations in facility design that can influence the quality of care, such as patient movement, patient visibility, and standardization.

The lack of available data on how the design of health care facilities affects the quality and safety of patient care led St. Joseph's to seek the advice of leaders in patient safety, quality improvement, and human

factors. The belief was that an opportunity existed to learn collectively about how a facility could be designed to improve patient safety.

In April 2002 leaders in systems engineering, health care administration, health services research, human behavior research, hospital quality improvement and accreditation, hospital architecture, medical education, pharmacy, nursing, and medicine participated in a conference, "Charting the Course for Patient Safety—A Learning Lab," sponsored in part by a grant from the University of Minnesota, Carlson School Program in Health Administration. Participants were educated in facility design and safety, using lessons learned from the nuclear and transportation industries and spacecraft design. The

Table 1. Precarious Events*

- Operative/postop complications/infections
- Inpatient suicides
- Correct tube—correct connector—correct hole
- Wrong-site surgery
- Oxygen cylinder hazard
- Events Relating to medication errors
- Deaths of patients in restraints
- Transfusion-related events
- Patient falls
- MRI hazards

* MRI, magnetic resonance imaging.

primary message was that safe hospitals could be designed by doing the following:

- Using a process that supports the anticipation, identification, and avoidance of failure
- Designing against the latent conditions and active failures compromising physical and organizational defenses
- Creating an organizational culture of safety³

Participants were then directed to small work groups and led through a structured process designed to develop recommendations that St. Joseph’s could use in designing a safe hospital. Participants were asked to consider designing around 10 specific precarious hospital events (Table 1, above) identified earlier through a review of the Sentinel Event Database of the Joint Commission on Accreditation of Healthcare Organizations⁴ and the safety topics of the Veterans Administration National Center for Patient Safety.⁵

Recommendations given by each work group led to the development of safety-driven design principles that guided the design process at St. Joseph’s (Table 2, page 118). These principles focus on creating an environment that minimizes latent conditions and active failures in the health care facility. The goal at St. Joseph’s is to enhance the mission of providing personalized, trusted care for patients and their families, with improved quality and safety.

Incorporating Safety into the Traditional Design Process

The traditional hospital design process requires that architects be given program objectives (role and

program), which are then translated into room requirements (functional space program [FSP]) and followed by the creation of department adjacencies (block diagrams). Once this preliminary information has been provided, room-by-room adjacencies are developed, and then a detailed design of each room is completed (schematic and design development). Architects then convert room-by-room design to construction blueprints that represent how individuals, equipment, and technology in hospitals will function together. Equipment and technology planning generally occur in the later stages of the design process. Typically, no discussions of patient safety or designing around precarious events are raised, creating an opportunity to repeat latent conditions existing in current hospital designs that contribute to active failures (adverse events or sentinel events). Human factors and the interface and impact of equipment, technology, and facilities are also not typically discussed or explored early in the process.

The challenge at St. Joseph’s was to change the traditional hospital design process to incorporate the safety-driven design recommendations gleaned from the learning lab. Rather than just direct architects to design the new facility based on existing models, the new development process would be driven by a constant focus on designing for the safety of patients. In addition, the design process was approached from a patient’s perspective, from admission through discharge. This allowed us to identify areas of patient care that could be streamlined and develop initial adjacency recommendations. Preliminary retreats and a technology fair were conducted to understand and prioritize facility features, technology, and equipment opportunities to meet safety-driven design principles, such as designing around precarious events. Participants included the construction team (architects, general contractors, and the owner’s representative), hospital employees and physicians, and equipment and technology experts. The result was a matrix of prioritized opportunities of equipment, technology, and facility features that would maximize safety and quality within the proposed budget.

Additional changes to the traditional hospital design process included the following:

Table 2. Facility Design Principles*

Visibility of Patients to Staff

- A window between the charting alcove and patient room will enhance visibility. Every patient care room should be wired for cameras and have proper lighting so that staff can see patients consistently and accurately, day and night.

Standardization

- Patient rooms should be truly standardized, including materials, gases, and head wall design.

Automate where possible

- New technology has been shown to promote safety by adjusting for human limitations in memory and thought processes. Examples include bar-coding of medications, electronic medical records, and physician order entry; centralized scheduling; and a tube system for delivery of materials.

Scalability and Adaptability

- Forecasting the future is risky, and the facility must have the capability to easily accommodate, expand, and adjust to changes in technology and work processes. Facility design requires the flexibility to eliminate unsafe or outdated conditions with respect to ceiling height, wiring, tubing, lighting, door and hall width, building materials, and locations to expand major services in the future.

Immediate access to information at the point of service.

- Critical information that is used for decision making should be close to the patient, with easy access at the point of service. Additionally, the design must accommodate an integrated information system to manage care processes from any point in the hospital. Lack of complete, accurate, and timely information creates errors in problem solving, the patient's condition and treatment plan.

Noise Reduction

- Noise is correlated with fatigue and distractions that could lead to lapses and mistakes by staff. It is also correlated with poor sleeping habits of patients, leading to slower immune system recovery. Examples to minimize noise include no overhead paging, and use of vibrating pagers, carpet, and sound-absorbing ceiling tiles.

Patients Involved with Care

- Facility design should encourage patients and their family members to be involved with care. Empowering patients and families with the knowledge and encouragement to ask questions regarding treatment and medication will promote safety and teamwork. Spaces should be available for patients to be with their families.

Minimize Fatigue

- Fatigue is correlated with increased errors. Ways to minimize fatigue include reducing noise, allowing staff to sit as much as possible, having a "soft" floor, and minimizing distances staff must travel to provide patient care.

Use FMEA at each stage of the design process.

- FMEA was recognized by participants in the learning lab as a basic design tool for patient safety. They recommended using FMEA at each stage of the design process to identify potential failures associated with proposed design solutions. The three key stages where FMEA should be used for design are adjacencies (block diagrams), schematics, and design development.

Design for Vulnerable Patients

- Designing with patient interaction as the focal point will provide opportunities to examine and change major organizational work processes, such as the movement of patients within the hospital and the admission and discharge of patients. When making design choices, the solution should work for the most vulnerable patient.

Human Factors Review

- The impact of equipment/technology and facilities on human performance needs to be considered throughout the design process. Important human factors concepts such as standardization and simplification need to be applied throughout the design process.

Design Around Precarious Events

- Ten specific precarious hospital events[†] were identified through a review of the Sentinel Events Database of JCAHO and the Veterans Administration National Center for Patient Safety.[‡] Facility designs should anticipate and reduce the occurrence of these events as much as possible.

* FMEA, Failure Mode and Effects Analysis; JCAHO, Joint Commission on Accreditation of Healthcare Organizations.

[†] As shown in Table 1 (page 117).

[‡] Joint Commission on Accreditation of Healthcare Organizations: *Sentinel Event Alert*. <http://www.jcaho.org/about+us/news+letters/sentinel+event+alert/sentinel+event+alert+index.htm> (accessed Dec. 10, 2003); Veterans Administration National Center for Patient Safety: *Safety Topics-FYI*. <http://www.patientsafety.gov/alerts.html> (accessed Dec. 10, 2003).

Excerpt from the Guiding Principles Checklist

<i>Guiding Principles Checklist</i>	
<input type="checkbox"/>	Visibility of Patients to Staff Examples: Wiring for cameras, proper lighting, charting alcove with window Comments: _____ _____ Have you incorporated this principle into your department design? <input type="checkbox"/> Yes <input type="checkbox"/> No
<input type="checkbox"/>	Standardization Examples: Location of equipment, gases, and supplies, room design Comments: _____ _____ Have you incorporated this principle into your department design? <input type="checkbox"/> Yes <input type="checkbox"/> No
<input type="checkbox"/>	Automate Where Possible Examples: Bar coding medications, tube system/delivery of materials, nurse call system, dumb waiter/elevator adjacencies, centralized scheduling, bedside registration, Comments: _____ _____ Have you incorporated this principle into your department design? <input type="checkbox"/> Yes <input type="checkbox"/> No

Figure 2. The design teams use a checklist (excerpt shown here) to document use of the facility design principles shown in Table 2 to be used by the design teams.

- Gaining input from a wide variety of persons including learning lab participants, safety experts, patients and families, hospital employees and physicians, and community members
- Developing a checklist of the facility design principles to be used by the design teams (Figure 2, above)
- Using Failure Mode and Effects Analysis (FMEA) at three design stages (adjacencies and schematic and design development)
- Initializing mock-up and equipment planning at the onset of the design process
- Conducting focus group meetings and hospital staff and community surveys.

A Team Approach to Design

Hospital leadership recognized that a cross-departmental team approach would be needed and formed the 11-member Facility Design Advisory Council. Members of the council represented various departments within the hospital and included management, staff, and physicians. The council, led by the chief operating officer [B.L.K.], was responsible for overseeing the design process and providing updated design information to hospital employees and administration.

Design teams were formed for each department within the hospital. These department design teams, each ranging from 3 to 10 members, were put together by the department managers. Each design team had multidisciplinary representation, including physicians from clinical areas. Each team, with the aid of the architects, was responsible for ensuring that the safety considerations for each facility design principle were met within its department. It was required to complete a guiding principles checklist for its area and propose design recommendations to hospital

leadership and the Facility Design Advisory Council, which reviewed the design recommendations and worked closely with each department to finalize its plans. The Facility Design Advisory Council's role was to ensure that the safety-driven design principles were met across and within departments in a standardized, uniform, and consistent manner. Retreats, including learning lab participants, content experts, the construction team, employees, managers, and the advisory council, were periodically held to review progress in designing the new hospital to meet the safety-driven design principles.

Throughout the design process, hospital employees were encouraged to share their opinions about existing safety concerns and give suggestions for improvements through e-mail, voice mail, or a suggestion box, or by completing a staff survey. These suggestions were reviewed either by the department design teams or the Facility Design Advisory Council. Updated information on the design process was frequently displayed outside the hospital cafeteria and was provided in the weekly employee newsletter *Take Two*.

Community support was an important part of the design process. Focus groups were formed, and community surveys were conducted to receive input into the

design from patients and families. Focus group suggestions on the patient room design, for example, led to an important relocation of the patient chair to allow an unrestricted path to the bathroom. St. Joseph's has provided the community with regular updates on the facility design process and other efforts to improve patient safety through its *Healthy Living* and *Community Update* newsletters. In addition, SynergyHealth's president/chief executive officer (CEO) [J.G.R.] conducted several community town hall meetings on the building process.

Applying FMEA

The management team, Facility Advisory Council, and department design teams met routinely with architects during the design process. Experts were brought in to advise on critical considerations such as noise reduction and lighting and to educate representatives from the design and architect/construction teams on the use of FMEA, a tool commonly used in other industries, such as aviation and manufacturing, to identify and prevent problems associated with product and process design.⁶ In hospital design, as in other industries, it is easier to fix potential failures during the planning stages than after construction has begun. Although the use of FMEA is very time-consuming and often labor intensive, it is very beneficial in identifying potential failures and developing innovative solutions associated with design considerations.

The design teams determined that the traditional FMEA approach was too complex for health care facility design and developed a modified approach⁶; traditional numeric scoring was replaced with a modified FMEA spreadsheet in which failure occurrence and severity were scored as low, medium, or high.

During the stage of the design process in which block diagrams of proposed adjacencies are determined, FMEA was used to identify potential failures associated with proposed department adjacencies by testing the adjacencies and other key processes when critically ill patients were moved to various departments (see Sidebar 1, right). According to the initial adjacency recommendations, the intensive care unit (ICU) was on a different floor than the emergency care center and radiology. As a result of the application of FMEA to the proposed design, the ICU is now adjacent to emergency care, and the first floor has been designated a critical care level. Radiology,

Sidebar 1. Failure Mode and Effects Analysis (FMEA) Analysis of the Movement of a Vulnerable (Critically Ill) Patient*

In our efforts to adhere to the facility design principles, we used FMEA to identify potential failures associated with proposed department adjacencies.

In the initial design, the intensive care unit (ICU) and the locked mental health unit were located on a different floor than the emergency care center and radiology. Using FMEA, we tested several scenarios in which a vulnerable patient was transported, including the following:

- A critically ill emergency department (ED) patient requiring radiology and direct admission to the ICU
- A critically ill ICU patient in need of radiology and surgery
- An unstable medical/surgical patient being urgently transferred to the ICU
- A violent mental health patient brought to the ED and then admitted directly to the locked mental health unit

Through this analysis, we identified that the more frequently a patient must be moved, especially between floors, the greater the likelihood that errors could occur or equipment could fail, resulting in harm to a patient. In addition, ill patients need skilled staff to accompany them, therefore leaving key departments short of staff and creating the potential for errors and adverse events.

* Reiling J., et al.: FMEA: The cure for medical errors. *Quality Progress* 36:67-71, Aug. 2003.

emergency care, surgery, the ICU, and the locked mental health unit are all located on the first floor to minimize the movement of vulnerable (critically ill) patients. The behavioral health and ICU departments are adjacent to the emergency care center, with diagnostics and surgery immediately adjacent to the ICU and emergency care. In addition, a rapid admissions area is planned, with eight private rooms where patients can be observed and/or evaluated for up to 24 hours. Nonemergency patients will begin in the rapid admissions area and have their lab

work, x-rays, and other tests completed and recorded before being transported for treatment. For added safety, all rooms in rapid admissions, ambulatory surgery, and emergency care will be standardized in terms of design and function to provide flexibility in use as patient levels vary in each department.

Planning for Equipment, Technology, and Mock-ups at the Onset of the Design Process

In keeping with the learning lab recommendations, planning for equipment, technology, and mock-ups began. The equipment planner, architects, employees, physicians, contractors, and owner's representative all participated in this planning process.

An on-site technology fair was held, where staff members were given the opportunity to evaluate information systems and other technologies and generate ideas for application. Technology options were developed to determine which systems could be implemented immediately or at the completion of the new facility and which could be acquired in the future. Priorities included using automated systems when possible to eliminate human error and having decision support and patient information available at the point of care. Initial technology plans included centralized scheduling, a nurse call system, pneumatic tube transport, and automated systems for the pharmacy, rapid admissions, and management of materials.

Technology ideas were then juxtaposed with equipment needs and with potential facility design features that could maximize the safety-driven design principles, including precarious events. A matrix was created of specific ideas that would meet each design principle, such as "automate when possible." Each idea was then evaluated to determine whether it could meet many or all the remaining safety-driven design principles. After preliminary cost estimates were developed, priorities were established in implementing these ideas according to the extent to which they would maximize safety by eliminating latent conditions and active failures.

Designing Patient Rooms. Mock-up designs of patient rooms began immediately for the ICU, the medical/surgical floor, and the maternity ward, (the New Life Center). Many different types of mock-ups were used, including two-dimensional and computer-

generated versions and actual physical construction. At St. Joseph's, two mock-up rooms were constructed, one on the medical/surgical floor and the other in the New Life Center.

Physicians, nurses, staff, patients, and family members were invited to view and evaluate the rooms. Suggestion forms were placed in each room to encourage feedback. As a result of suggestions received from staff, the alcove storage was redesigned, desk heights were changed, and the configuration of the bathroom evolved. The rooms went through multiple revisions of such important features as door sizes, locations of patient chairs, and lighting sources and locations.

In addition to contributing to design of a safer environment, mock-up rooms can also be used for simulation of current or redesigned processes. The processes can be routine, such as medication delivery in a patient room, or complex, such as those involved in an emergency code. Mock-up rooms can also be used for planning for education and orientation. Using the mock-up rooms for training until the completion of the remodeled or new space can be helpful in minimizing transition errors.

Patient Rooms. The patient rooms evolved from a "traditional" patient room on the basis of the safety-driven design principles. Each patient room in the new facility will be a private room, allowing more space for staff to provide care and for family members who want to stay close to the patient. A small alcove adjacent to the room will allow nurses to observe patients through a window without disturbing the patient's rest, creating greater visibility of the patient to staff and assisting the nurse in keeping patient information, supplies, and medication separate from those of other patients (Figure 3, page 122).

All rooms will be truly standardized in layout, including location of supplies, equipment, and furniture. A cabinet or "nurse server" in each alcove will hold the patient's bar-coded medication (in a locked box) and all other supplies needed for patient care, allowing the nurse to remain in the room with the patient, reducing fatigue and increasing time spent with the patient. The bathroom will be located at the head of the bed, minimizing distance to the bathroom and ensuring that all patients have the opportunity to use handrail supports throughout their movement. The safety features of the patient room are listed in Table 3 (page 123).

Blueprint for a Patient Room

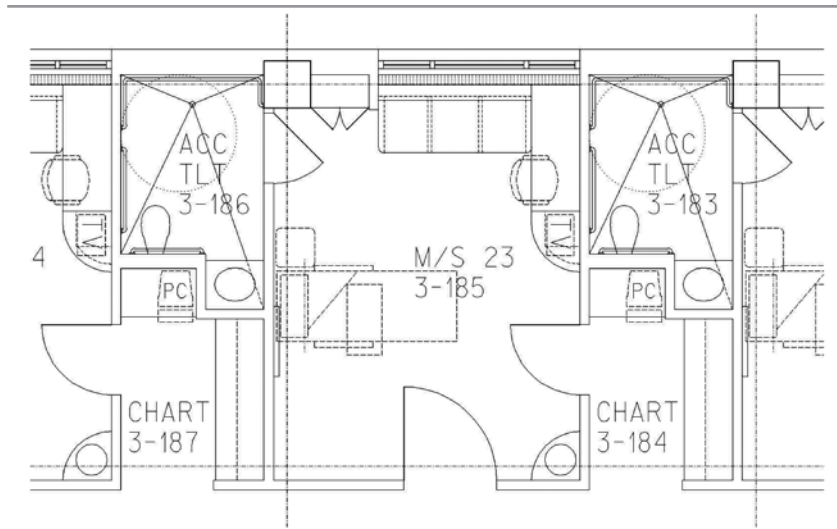


Figure 3. The blueprint for a patient room on the medical/surgical floor is shown. ACC, (handicap) accessible; M/S, medical/surgical; PC, personal computer; TLT, toilet.

Evaluation

Ongoing evaluation of the existing facility and processes has been critical to the design process. Identifying where errors occur and what latent conditions contribute to those errors has assisted in identifying needed technology, improving processes, and creating safer, more efficient space in the new facility.

Several Web-based conferences have been conducted with participants of the learning lab to provide them with updates on the design process and gain feedback. Retreats for members of the design teams and management have also periodically been conducted to review our commitment to and results of designing around patient safety. Literally hundred of ideas were generated and discussed at the retreats, including the following:

- Using infrared technology to reduce patient falls (the “electric eye” notifies the caregiver immediately when the patient sits up or moves toward the edge of the bed)
- Making sinks visible to patients and convenient to staff and providing pharmacy decision support software and electronic medical records (EMRs)
- Providing patient access to medication orders
- Wiring for future applications
- Monitoring a patient’s cardiac rhythm across departments—that is, at any point in the hospital—without

encountering any “dead spots,” as some older facilities do

- Standardizing patient rooms (for example, intravenous [IV] lines, beds) and equipment gases across all departments

Creating a Culture of Safety

The importance of a culture of safety in creating a safe health care experience for patients and staff cannot be underestimated.

The systems within an organization are highly influenced by its culture or are a reflection of its culture. James Reason defines *culture* as “shared values (what is important) and

beliefs (how things work) that interact with an organization’s structures and control systems to produce behavioral norms (the way we do things around here).^{77(p. 192)}

Creating a culture of safety has been an integral part of the design process at St. Joseph’s. As part of the effort to create a culture of safety, management and employees sought the creation of a confidential and anonymous reporting process. How can one minimize or prevent errors if one does not know they exist?

Shortly after the new error-reporting system was implemented, it was further enhanced by eliminating the need for department supervisors to view and sign each error report before submitting it to the performance improvement department. With the new procedure, staff can report errors and near misses directly to the performance improvement coordinator either by phone, by using a standardized written form, or through an anonymous hotline number. This improved process for error reporting, coupled with an existing nonpunitive environment, allowed St. Joseph’s to more efficiently collect information on internal errors and near misses. Tracking and analyzing internal errors, near misses, and adverse events has been essential in identifying existing latent conditions and active failures that could be prevented through improvements in the facility design or changes to existing processes. Medication reports have gone up

500%, and patient fall reports have also increased markedly since the new error reporting process began.

The design process as a whole has improved the safety culture at St. Joseph's. The retreats, design team meetings, staff meetings, and continuous evaluation have made patient safety an important priority throughout the hospital.

Challenges

Three major challenges exist in designing for safety: gaining recognition of the need and opportunity to design a safer facility, maintaining focus on and commitment to the safety-driven design principles, and changing the traditional design process to incorporate the learning lab process recommendations.

Gaining Recognition of the Need and Opportunity to Design a Safer Facility

Many of us at St. Joseph's did not understand the concepts of latent conditions and active failures and did not appreciate the prevalence of near misses and adverse events. We initially believed that "to err is human" happened in other states and facilities but not in Wisconsin or at St. Joseph's. In addition, the external design team (architects, mechanical/electrical/plumbing architects, the owner's representative, and general contractors) had to go through a culture change. The team members needed to recognize the opportunities for improved safety in designing a health care facility.

Maintaining Focus on and Commitment to Safety-Driven Design Principles

Requiring each design team to complete a detailed checklist forced each team to either incorporate a design principle into its proposed design or explain how it did not apply to its department. In addition, retreats and Web-ex conferences were scheduled to review how the design principles were being met in the design process. Change is difficult for many people; therefore, the need for consistency of purpose from management and the architects is essential.

Changing the Traditional Design Process

We were flying blind for most of the learning lab process recommendations, such as equipment planning and mock-ups. Creating a process to evaluate the interplay

Table 3. Safety Features of the Patient Room

- Standardization in room size and layout
- In-room sink to allow physician/staff hand washing in patient view
- Charting alcove with window to increase patient visibility for nurses, physicians, and staff
- Private room to provide personal privacy
- Close proximity between bed and bathroom to reduce the potential for patient falls
- Bedside computers (1) to allow patient access to records (for example, scheduled medication or other treatments prescribed) and thereby increase involvement with care and (2) to allow nurses or other staff to double-check medication or other scheduled treatment before administration
- Oversized window to increase natural light and provide a "healing" view
- Ceiling heights and room size to allow adaptability/suitability
- Sitting area and guest fold-out bed to encourage family support and involvement with care
- Noise reduction through use of low-vibration steel and special noise-absorbing ceiling tiles and elimination of overhead paging
- Improved technology, including electronic medical records (EMRs), computerized physician order entry (CPOE), and advanced nurse call system (including wireless phones)
- Use of infrared technology to reduce the potential for patient falls

between equipment, technology, and facility to create safety at the beginning of the design process was challenging. We brought in experts to instruct us on the use of FMEA and to advise us on design considerations such as noise, lighting, and equipment. We toured other new health care facilities to gather ideas and view technology in use.

The Outcome

Because the safety-driven hospital design process represented a learning process for everyone involved, many design changes were introduced, especially with regard to department locations and adjacencies. Department adjacencies were key in determining the interior layout to provide ease and safety in movement of patients

during delivery of care and services. The lower garden level will house the pharmacy, the laboratory, the dining area, human resources and administrative offices, environmental services, materials management, and plant operations. The hospital's emergency care center, ICU, locked mental health unit, operating suites, ambulatory surgery, and outpatient services will be located on the first floor—the “critical care level.” New Life Center suites and medical/surgical rooms share the second floor, with additional medical/surgical rooms on the third floor.

The new hospital has been designed with maximum adaptability and flexibility in mind, to accommodate changes and provide for future growth. The entire facility can be altered with minimal disruption through expansion of the wings and the addition of a fourth patient care floor.

During the design process, particular attention was given to the guiding principle “design around precarious events.” As shown in Sidebar 1, design considerations were intended to minimize the occurrence of these precarious events (Table 1).

Now that the design process is completed and construction has begun, we are confident that the new facility will provide a safer environment for both patients and staff. We anticipate reductions in falls, infections, and medication errors and consequently in lengths of stay and average costs per discharge. Studies have indicated that the occurrence of adverse events and near misses can increase length of stay and overall cost of patient care.⁸

Conclusion

St. Joseph's Community Hospital of West Bend has developed a set of safety-driven design principles that can be used by other health care providers, whether they are building a new facility or remodeling an existing

facility. Applying the design principles to a remodeling project may be more complex than with a new facility. For example, standardization or noise reduction may be more difficult to achieve because of the constraints of an existing infrastructure. The critical issue, however, is the commitment of the design team (for example, architects, contractors, owner's representative, hospital leaders) to designing a safer facility.

Making St. Joseph's a safer place for patients and staff is an ongoing process that will continue well beyond the completion of the new facility. It will require a constant focus on safety by hospital leadership, physicians, and staff and will be accomplished only through a continuous cycle of evaluation and improvement of the facility, equipment, technology, and processes.

Construction of the new facility began with a celebration in August 2003. Several hundred people pressed their hands into wet concrete paving blocks, with the handprints serving as a reminder that patient safety is in everybody's hands. The blocks will be used as part of the new hospital facility, scheduled to open in 2005. **J**

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