

Impacting Patient Outcomes Through Design: Acuity Adaptable Care/Universal Room Design

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To succeed in today's challenging healthcare environment, hospitals must examine their impact on customers—patients and families—staff and physicians. By using competitive facility design and incorporating evidence-based concepts such as the acuity adaptable care delivery model and the universal room, the hospital will realize an impact on patient satisfaction that will enhance market share, on physician satisfaction that will foster loyalty, and on staff satisfaction that will decrease turnover. At the same time, clinical outcomes such as a reduction in mortality and complications and efficiencies such as a reduction in length of stay and minimization of hospital costs through the elimination of transfers can be gained. The results achieved are dependent on the principles used in designing the patient room that should focus on maximizing patient safety and improving healing. This article will review key design elements that support the success of an acuity adaptable unit such as the use of a private room with zones dedicated to patients, families, and staff, healing environment, technology, and decentralized nursing stations that support the success of the acuity adaptable unit. Outcomes of institutions currently utilizing the acuity adaptable concept will be reviewed.

Key words: *acuity adaptable, decentralized nurse stations, evidence-based design, facility design, healing environment, universal bed*

The existing healthcare environment and current patient clientele are compelling hospitals to abandon the traditional “conveyor belt” approach to care where patients are transferred from unit to unit in search of the proper level of care. Aging baby boomers, who own 75% of the wealth in this country, are savvy consumers who enjoy creature comforts, luxury items, and superior service.¹ Accounting for two thirds of all dollars spent on healthcare, with differing expectations than generations past, baby boomers are demanding a holistic approach to care that focuses on psychosocial as well as medical needs and are expecting services to be provided in a hotellike environment.²

At the same time, because of aging baby boomers, patients are sicker with more comorbidities requiring more technologically complex care during their entire hospital stay. At an average age of 47, nurses are imbedded in this group of boomers and a significant number will be retiring from the profession. Because of stressful working conditions, predictions continue to forecast an overall shortage of qualified caregivers and young people entering the nursing profession. Thus, the future inpatient landscape will reflect increasing numbers of higher acuity patients being cared for by a shrinking pool of aging caregivers.³

In addition, payers are continually forcing hospitals to reduce length of stay. Nurses and physicians are charged with providing more intense care and meeting the patient's needs during an abbreviated time span. The intensity of care is expected to increase as about 10% to 13% of beds today are designated for critical care patients and this number is expected to increase to 20% to 30% in the future.⁴

In response to the current environment, hospitals and planners have begun exploring options that can address this undercurrent of change and enable hospitals to prosper and provide quality care into the future. What has emerged is recognition that to survive into the future will require facilities, infrastructure, and technology that are more flexible and adaptable to change than ever before. Energies must be focused on creating flexibility for the future where it impacts the patient most—the hospital patient room.

ACUITY ADAPTABLE AND UNIVERSAL PATIENT ROOMS

Over the past 8 years, a number of pioneering hospitals have been constructing new room designs intended to provide longterm flexibility and safe patient care based on the Acuity Adaptable and Universal Room concepts. The Acuity Adaptable and Universal Room models have been implemented in a number of hospitals and are beginning to provide valuable lessons for future hospitals and care practices. As these concepts have matured, their application and purpose have evolved and, in some cases, become interconnected. Sometimes these concepts have been expressed as serving the same purpose, when in fact they serve distinct purposes.

Acuity adaptable

The Acuity Adaptable concept has evolved as a means of maintaining the patient in the same patient room or nursing unit from admission until discharge, regardless of the patient's level of acuity. The required level of care is brought to the patient instead of having the patient endure multiple transfers. Acuity adaptable beds minimize bottlenecks and delays in the patient flow because of the unavailability of the correct level of care. Utilizing this model of care delivery requires combining critical care staff with progressive or medical-surgical nursing staff to eliminate hand-offs and provide a more seamless comprehensive care practice.

An early pioneer of the Acuity Adaptable concept was Loma Linda University Medical Center in California. In the late seventies, this facility implemented a practice of aggregating and maintaining its cardiothoracic patients in the same unit through its entire course of stay until discharge. The facility determined that patient transfers introduce a number of disruptions to safe patient care and impose a significant amount of additional work on nursing staff and hospital operations.⁵

In the early 1990s, MedCath, a nationwide group of physician-owned, specialty heart hospitals, embraced eliminating transfers of their cardiac patients in the newly constructed facilities. In addition, the design of these new 40- to 50-bed heart centers incorporated standardized or “Universal” room designs. Patient rooms throughout the hospital shared a uniform design and were equipped with the appropriate cardiac care technology and capable of handling any type of cardiac patient, to help maximize flexibility and facility utilization.⁶

More recently, community hospitals initiating open-heart surgery programs in regions where tertiary institutions have been performing cardiac surgery for years have gravitated to the acuity adaptable concept. They feel that they are able to better compete by marketing such a patient-centered care approach to the consumer. In addition, they believe that the ability to adjust the room and its resources within minutes ensures that patients' fluctuating or episodic clinical needs will be promptly addressed with minimal disruption for them or the staff.

In 1999, Clarian Health System's Methodist Hospital in Indiana opened a 56-bed comprehensive cardiac critical care (CCCC), which maintained its cardiac medical patients in the same room until discharge. This pioneering project incorporated many innovative concepts such as distributed nursing stations and family zones that better supported the single stay model of care and was one of the first institutions to methodically collect data and document the impact of the acuity adaptable concept on patient and efficiency outcomes.⁷

In fall of 2004, The Ohio State University (OSU) Medical Center opened the Richard M. Ross Heart Hospital, an acuity adaptable 90-bed hospital, offering the full spectrum of cardiovascular services from interventional cardiology to cardiac surgery and transplantation. It is the first comprehensive academic dedicated cardiovascular hospital fully integrated with the OSU Medical Center, including the Dorothy M. Davis Heart and Lung Research Institute, and the OSU College of Medicine and Public Health. The academic medical center setting not only provides the highest level of research-based, quality care but also allows for an outstanding educational opportunity for students to experience the acuity adaptable model of patient care delivery.⁸

The success of the acuity adaptable concept has spurred other institutions to utilize this care approach for their general and vascular surgery patients and even neurology and neurosurgery patients.⁹ From a clinical perspective, all patient populations can benefit from the acuity adaptable concept, but economically building this type of room for patient populations who tend not to utilize intensive care unit (ICU) services may not be feasible. However, adaptations in room design would be able to accommodate most patient acuities. A hospital in the Midwest is building a 200-bed facility with 149 acuity adaptable rooms to accommodate the majority of inpatients and 18 superintensive care beds to meet the needs of only the most severely ill patients such as those with multiple traumas.¹⁰

Universal room

In comparison, the Universal Room concept shares similar characteristics to the Acuity Adaptable concept but operates in a traditional clinical manner with patients being transferred between units and levels of care. As the acuity and complexity of the entire inpatient population grows, hospitals that are remodeling or expanding have begun to task the design community to create patient rooms that are universal or flexible enough to accommodate the increasing patient acuity over time. The high cost of construction projects is likewise causing hospital administrators to seek building solutions that would not be obsolete and require reinvestment within a decade of opening. Thus the Universal Room began to evolve as the concept of a flexible patient room design that could accommodate a variety of patient types and an increasingly higher acuity mix of patients over its extended life.

A comparison of the Acuity Adaptable and Universal Room concepts reveals comparable features and design as well as a similar goal of providing flexibility for changing patient acuity. The primary difference is related to purpose. The Acuity Adaptable concept is centered on eliminating patient transfers by providing a comprehensive care combined staffing model where the flexibility is utilized real time, patient-to-patient. The Universal Room's focus is to provide an adaptable room design that can accommodate changing acuity or clinical needs over a period of years, and does not specifically alter the current care practice and transfer of patients.

DESIGN CHARACTERISTICS OF THE ACUITY ADAPTABLE AND UNIVERSAL ROOM

Acuity Adaptable and Universal Room concepts share a number of similar characteristics derived from evidence-based design research of more than 600 studies linking patient health and quality of care to architectural elements.⁹

Privacy and private rooms

Acuity adaptable/universal bed concepts utilize private rooms, with a square footage ranging from 270 to 400 ft², inclusive of the bathroom. The larger overall room size is able to accommodate the patient's critical care needs with space for equipment and procedures commonly performed at the bedside, and to provide unencumbered staff access to the patient. The room is organized into zones—Patient Zone, Clinical Zone, and Family Zone (Fig 1a).

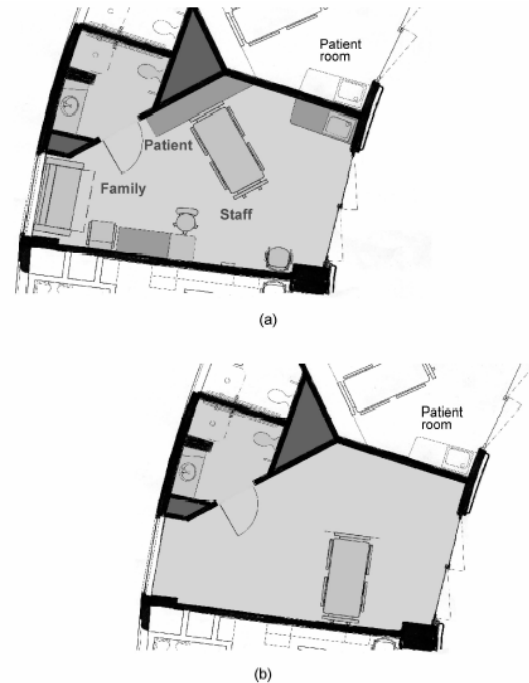


Figure 1. Acuity adaptable/universal bed room design. (a) Final Ohio State University Ross Heart Hospital room design and (b) initial room design. Courtesy of Ohio State University Medical Center, DesignGroup, Columbus, Ohio, and Hammel, Green, and Abrahamson, Inc, Minneapolis, Minn.

A family zone inclusive of seating and amenities, and perhaps sleeping accommodations, allows the family to be close to the patient, and therefore able to be actively involved in selected aspects of care. Family centered rooms have been seen to decrease patient falls, and may reduce the requirements of nurse hours per patient because of family participation in the caregiving process. Patients fare better overall as social contact with family members reduces stress and improves patient health.¹¹

Although the patient room must address critical care needs, privacy must be accommodated during later stages of recovery since patients typically require intensive care services for only a limited period of time. Although breakaway glass doors are typically used in critical care settings, hospitals using the acuity adaptable room have allowed for visibility in other ways such as through the use of large windows and doorways equipped with miniblinds for patient privacy. At Clarian Health System's Methodist Hospital, the window to the patient's room can be made opaque at the flip of a switch, facilitated by an electronically charged window.⁷ Other design elements known to impact privacy are the location of the bathroom and the placement of the patient's bed.¹²

Patient safety principles

There are many other design principles that are not unique to the acuity adaptable/ universal bed concepts that should still be incorporated into room design to positively impact patient outcomes. Staff handwashing sinks should be situated for convenient use in the room to reduce nosocomial infections. The location of sinks as well as the private room design at Bronson Methodist Hospital in Michigan resulted in a 10% decline in overall nosocomial infection rates.¹³

Studies have shown that most falls occur in patient rooms particularly when the patient is alone and attempting to reach the bathroom.¹⁴ Therefore, the design of the room should focus on situating the bathroom to be directly accessible to the patient so as to reduce patient falls. After careful review by the staff, the OSU Ross Heart Hospital acuity adaptable room was reconfigured to include relocation of the bathroom so that even hardwired patients could use the toilet safely (Fig 1b). In an acuity adaptable room, where visualization of the critically ill patient is key, consideration should be given to placing the bathroom on the outboard side of the room (away from the hallway) to provide better visual observation of the patient from the hallway and easier entry for beds and equipment.

Technology requirements

The acuity adaptable room must accommodate the technology needs of the critical care patient. This includes advanced monitoring capabilities as well as the ability to provide a sufficient complement of medical gases. With the universal bed, the need for ICU technology may evolve over a period of time leading to differing design approaches. One approach to offering longer term flexibility, but not spending today's dollars, is to initially install a minimum complement of medical gases as part of the headwall, but providing additional piping capacity behind the wall or accessible wall panels that can be connected later in time. We have seen 3 approaches to providing headwall solutions for acuity adaptable and universal rooms.

1. *Fully loaded ICU capacity*: The headwall is equipped with an ICU level complement of medical gases, electrical outlets, and communication and data ports. In addition, a wall-mounted patient monitor and other patient devices are incorporated into the headwall.
2. *Flexible capacity, "plug-N-play"*: The headwall is equipped with a moderate complement of gas outlets, but can be increased through the use of flexible hose outlets that can be installed at another time. The patient monitor may be rolled in on a computer on wheels, and other medical devices can be added to accessory tracks.
3. *Conceal and reveal*: Similar to the concept used in labor, delivery, recovery, postpartum, the headwall is designed to conceal the outlets and devices behind sliding panels or bifold doors. These are often intended to look like cabinetry or casework with attractive wood finishes presenting more of a "hospitality" look. When the patient requires advanced monitoring and intensive care services, the panels may remain open until the use of these services is discontinued (Fig 2).



(a)



(b)

Figure 2. The Ohio State University Ross Heart Hospital acuity adaptable room. (a) Progressive care mode and (b) critical care mode. Photos: courtesy of The Ohio State University Ross Heart Hospital.

Healing environment

Hospitals building acuity adaptable units generally incorporate other principles of evidence-based design such as the healing environment with the goal of reducing stress. Noise is considered one of the biggest stressors in a hospital with medical equipment and voices producing noise levels approaching those in a busy restaurant or an urban street.¹⁰ Change of shift report time in a busy centralized nursing station is considered louder than a truck.¹⁵ Apart from worsening sleep, there is strong evidence that noise increases stress in patients and heightens heart rate and blood pressure.¹⁶ Acuity adaptable units reduce noise-induced stress by offering private rooms, providing decentralized nurse stations, and often utilizing doors that staff intuitively shut, rather than the always-open glass breakaway types traditionally used in ICUs.

Another component of a healing environment is the use of positive distractions such as views of a healing garden that includes elements of nature such as green vegetation, flowers, and water. These elements tend to reduce stress experienced by patients during their hospital stay and promote recovery according to Ulrich. Ulrich had conducted a landmark study in the 1980s and determined that postsurgical patients in rooms with a view of trees had a lower length of stay and required fewer potent analgesics than patients whose windows faced a brick wall.¹⁷ Other positive distractions often built into the acuity adaptable room are pleasing artwork, soft music, and a home-like soothing environment, all easily incorporated into a private room design.

Decentralized nurse stations

The trend to decentralize the nurse station is a response not only to better meet patient needs but also to reduce the overworked nurse's travel time and increase efficiency. The added patient surveillance gained by placing nurses closer to the bedside has been shown to reduce patient falls. After placing nursing mini-stations between every 2 rooms, Clarian Health System's Methodist Hospital saw a decrease in patient falls by 75%.⁷

Decentralized nurse stations can also reduce nursing workload by minimizing the time spent traveling to multiple locations to gather supplies and medications.

Successful decentralized nurse stations untether the nurse from the central station by providing all required supplies and technologies at the mini-station. This includes computer access to patient information (if the patient chart and medication administration record are still paper-based, they must be safely located at the mini-station), wireless communication options for telephone use and patient call bell responses, medications, linens, and various patient supplies. Nurse substations are often built as brightly lit alcoves in-between patients' rooms with a window for patient surveillance and a desk area with seating.

At the OSU Ross Heart Hospital, nursing documentation occurs in the room collocated with all of the required technologies and conveniences. As patients become less acute, the nurse is able to work at multiple substations (circled on the drawing) on the unit equipped with computers for documentation (Fig 3). The substations allow nursing staff to discuss clinical patient issues with physicians and other colleagues and consult with each other. In addition, each unit has a multidisciplinary station that is centrally located (seen in the square), which serves as an information clearinghouse on the unit for families, physicians, and ancillary "visiting" staff, and also houses the unit clerk.

When Desert Samaritan Medical Center in Arizona opened its acuity adaptable unit for surgical patients, it chose to build decentralized nurse stations outside patients' rooms to bring the nurse closer to the bedside and minimize walking distances. The center also chose to create 4 nursing substations located at equal distances throughout the unit, set back from the hallway so that staff can consult with each other on patient issues with some degree of privacy.¹⁸

Recently built Banner Estrella Medical Center in Arizona designed nurse alcoves outside each patient room and replaced the centralized nurse station in each unit with a clinical integration station. The clinical integration station is a common work area with computing resources and small conference rooms where physicians, nurses, and allied professionals can collaborate on patient care.¹⁹

A Corazon survey of institutions using the acuity adaptable model of care delivery showed that 42% of respondents had both decentralized nurse stations and some type of a centralized multidisciplinary location to promote consultation with physicians and colleagues. Although those hospitals with only central nurse stations complained about noise, increased walking distances, and less time spent with patients, they were focused on adding decentralized nurse stations but not deleting the central station. No hospitals used decentralized stations alone.⁹

Today's patients are the best-informed, most health-aware group of consumers that healthcare has ever known, demanding care that meets their physical, emotional, and spiritual needs. They insist on control over their own healthcare decisions, a right to privacy, family involvement, and a certain level of comfort expected by today's society standards not always seen in hospitals. When designing an acuity adaptable unit, one must understand the research demonstrating that overall patient satisfaction is based on positive evaluations of the patient room and satisfaction with the hospital environment.³ A large impact on satisfaction is the need for a single occupancy bed as these patients feel that their privacy and confidentiality needs are better met.⁴ In addition, it is thought that healthcare professionals have more private and, often more thorough, consultations with patients in private rooms. Patients in private rooms feel that their hospital stay is less stressful as roommates can be unfriendly, are noisy, and have too many visitors. Patients fare better with private acuity adaptable rooms as they are consciously designed to accommodate families. Social contact with families reduces stress and improves patient healing.¹¹ An acuity adaptable room with a focus on a healing environment incorporating natural light, elements of nature, soothing colors, and the ability to control one's environment results in positive patient outcomes.²⁰ The preference for private rooms is so strong that patients are willing to pay out of pocket for the accommodations. At an additional rate of \$100 to \$600 per day, with average length of stay (LOS) on the decline for most inpatient diagnoses, an increasing number of patients feel that the extra cost is worthwhile.²¹

Continuity of care is provided with the acuity adaptable concept since patients remain in the same room during their entire hospital stay. They are able to build trusting relationships with a consistent staff leading to an increased patient confidence in nursing skills. Interacting with a smaller number of caregivers leads the patients to view the nurses and physicians as a cohesive team. At the OSU Ross Heart Hospital, patient satisfaction has exceeded all other areas of the OSU Health System, particularly in the categories of coordination of care and team communication (J. Gilliam, oral communication, July 27, 2006). At St Clair Hospital in Pennsylvania, where they utilize an acuity adaptable unit for their open heart surgery patients, cardiac surgery volumes have exceeded unit capacity. At times stable patients are transferred to the floor to accommodate immediate postoperative patients. Satisfaction of patients who are cared for in the cardiovascular unit during their entire hospital stay is consistently higher and the number of complaints lower than that of those cardiac surgery patients who are transferred to a telemetry unit (C. Loughman, oral communication, August 6, 2002).

Physician and staff satisfaction

Both physician and staff satisfaction at the OSU Ross Heart Hospital not only is greater than the entire OSU Health System, but also exceeds the "best-in-class" benchmark set by the company accountable for surveying staff and physicians (J. Gilliam, oral communication, July 27, 2006). Twenty-five percent of organizations using the acuity adaptable model of care surveyed by Corazon stated that physicians were initially skeptical of the concept during the planning stages. They were accustomed to having critically ill patients cared for in a designated ICU. This skepticism disappeared after the acuity adaptable unit was open, and they realized that their own practice was streamlined because it was easier to round on all patients in one unit, they encountered less errors and miscommunications since hand-offs between nurses were minimized, they did not receive requests for transfer orders at all times of the day, and they developed a collaborative relationship and team approach to patient care with a finite number of nurses after becoming comfortable with the scope of staff skills. In one case, a physician had actually spearheaded the move to an acuity adaptable unit to improve clinical outcomes.⁹ Initial physician hesitation underscores the need to involve medical staff in the planning of the acuity adaptable unit so they understand the benefits to patients, staff, and themselves. A physician champion

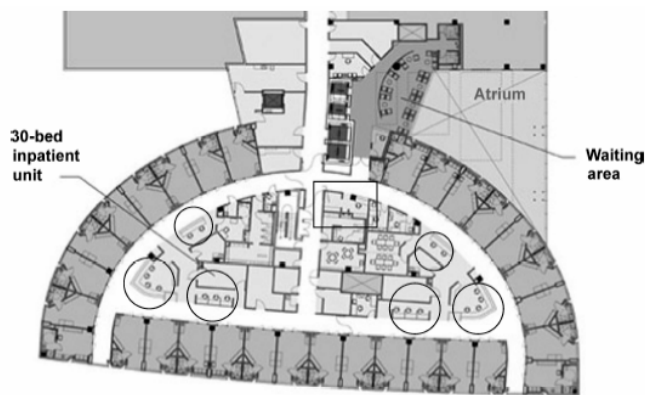


Figure 3. Nursing unit layout. Courtesy of Ohio State University Medical Center, DesignGroup, Columbus, Ohio, and Hammel, Green, and Abrahamson, Inc, Minneapolis, Minn.

ACHIEVING POSITIVE OUTCOMES---LESSONS LEARNED

Patient satisfaction

during the planning process is needed to address medical staff concerns on a peer level.

In the Corazon survey, nursing staff satisfaction with the acuity adaptable unit was generally high with positive comments about seeing patients recover along the continuum of care and developing relationships with patients and families. The felt that the acuity adaptable unit has decreased “burnout” rates generally seen in ICUs with nurses always caring for extremely ill patients.⁹ At the OSU Ross Heart Hospital, nursing staff feel an increased cohesiveness with their colleagues, especially since they work as one patient-focused team throughout the patient’s entire hospital stay and not as multiple units often working as silos with differing goals. They feel that their ability to offer a rapidly adjusted level of care better meets patient needs in a timelier manner (C. Gallaher, oral communication, July 27, 2006).

Staff satisfaction

One misconception about the acuity adaptable concept that impacts nurse satisfaction is the concept of “a nurse is a nurse.” With the complexity of diagnosis-focused treatments at our fingertips, it is unrealistic to think that a nurse can take care of any patient. Physicians as well as nurses tend to practice in a clinical specialty they enjoy. They generally work more efficiently as they have expert knowledge, are able to provide higher quality care, and can troubleshoot more rapidly than a novice. The acuity adaptable concept expands the nurses’ skill set by exposing staff to the entire continuum of care within that specialty. At the OSU Ross Heart Hospital “like” patient populations are aggregated on the three 30-bed inpatient units. One unit is dedicated to cardiovascular surgical patients, another houses medical cardiology and vascular patients, and the last accommodates diagnostic and interventional cardiology patients (C. Gallaher, oral communication, July 27, 2006). Smaller institutions with successful acuity adaptable units have created “closed” unit models where admissions to the unit are limited to certain types of patients such as cardiac surgery, interventional cardiology, and neurosurgery patients as an example.⁹

Nursing skill mix

At the outset nurses can be hesitant about expanding their skills across the entire patient continuum to include both intensive and progressive care competencies. The seasoned critical care nurses without telemetry experience may initially assume that no specialized skills are required to provide telemetry care. Once fully immersed in providing care across the continuum, critical care nurses gain respect for the organizational skills needed to care for more a larger number of patients and acknowledge the expertise required for consistent family communication and patient teaching.²²

When hospitals first began using acuity adaptable units, they often staffed them with all critical care staff, assuming that nurses with high-tech skills could address all patient issues across the entire continuum of care (Table 1). Over time, it has been realized that although critical care staff are effective during highly critical situations, a focus on meeting the entire needs of the patient including psychosocial support and discharge teaching can be lacking. Some hospitals recruit both ICU and telemetry nurses with the goal of crosstraining all staff. This hiring approach alleviates some of the issues caused by the shortage of trained ICU nurses and allows the hospital to hire from a larger pool of recruits. With the acuity adaptable unit, telemetry nurses training is cost-effective, as the nurse can learn critical care skills and still be productive while caring for the telemetry level of care patient.

Although the majority of telemetry nurses are excited to learn critical care skills, some may not be comfortable in providing such an intense level of care. Not all organizations believe that cross-training every staff nurse is cost-effective, especially in acuity adaptable units where the hours required for ICU care are not high. The staff skill level mix should be tailored to the acuity of the patient populations cared for on the unit. In cases where a high proportion of patients require ICU level of care, such as with cardiac surgery patients, a higher number of critical care-trained

staff should be employed and perhaps the majority of the staff cross-trained. Conversely, a unit with more of a medical cardiology population will not require as many nurses with critical care skills. When staffing the unit, particular attention must be paid to the proportion of ICU nurses versus telemetry-trained nurses on a shift-by-shift basis.²³

Table 1. Staff nurse skill level

Option 1
All critical care nurses
Option 2
Critical care and telemetry mix
Option 3
Critical care and telemetry mix with progressive cross-training

Nurse retention

Many programs report high nurse retention rates and attribute this success to a careful screening of potential recruits along with proactive nurse education. Before the opening of the OSU Ross Heart Hospital, all staff members were interviewed for open positions, even those who currently worked in the cardiovascular areas. Expectations were shared regarding the function of the acuity adaptable care delivery model and the dedication to quality and excellence that was required. The nurses hired were those who were interested in committing to working in the full continuum of care. Prior to the opening of the OSU Ross Heart Hospital, all staff members attended 4-hour educational courses defining the mission, vision, and values of the organization as related to patient care in addition to the required clinical education for the cross-training of staff.⁸ On a smaller scale, the 10-bed acuity adaptable cardiovascular unit at Sharon Regional Health System in Pennsylvania boasts a staff satisfaction rate greater than 95% and a 0% nurse vacancy rate. Since the unit opened 6 years ago, only one nurse left the unit because of dissatisfaction with the care delivery model (J. Darby, oral communication, July 20, 2006). Staff turnover at North Memorial Medical Center in Minnesota decreased from 28.3% to 1.7% since the opening of their acuity adaptable cardiac surgery unit.²⁴ Programs that focused only on teaching clinical skills erroneously assumed that nurses understood the acuity adaptable model of care delivery and experienced initial staff resistance from critical care staff.⁹

Organizations experiencing retention issues must strive to understand the root cause of staff dissatisfaction. Is it the concept of the acuity adaptable model or are there other mitigating factors causing the unrest? Are all nurses viewed competent to care for any patient, or are patients clustered according to diagnosis? Were appropriate screening techniques used during the interview process; did the nurse understand the expectations related to the care delivery model? Were there facility design elements that did not support the staff approach to care? The Methodist Hospital campus of Clarian Health Systems in Indiana experienced a loss of 30 nurses from their 56-bed CCCC unit after renovating the unit and initiating the acuity adaptable concept. Nurses leaving stated that the decentralized nursing unit design hindered interaction with their colleagues and they felt isolated. Since then, turnover has returned to baseline according to administration.²⁵

Clinical outcomes

The acuity adaptable bed concept leads to positive clinical outcomes because the nurse cares for the patient over a longer period of time, and therefore has a more in-depth understanding of the clinical issues pertinent to each patient. The intermingling of critical care knowledge on the unit leads to a more rapid assessment and proactive management of complications, leading to a faster resolution of potentially life-threatening situations (G. Magovern, Jr., oral communication, August 10,

2002). Although risk-adjusted clinical outcomes are difficult to obtain, data from Centers for Medicare and Medicaid (CMS) on more than 3000 coronary artery bypass surgery patients cared for in acuity adaptable units showed an average in-house predicted mortality of 2.8% whereas the actual average in-house mortality was 2.23% with 71% of hospitals achieving below expected mortality.²³ More specifically, North Memorial Medical Center had specifically converted from a traditional multistep open heart surgery recovery program to a cardiac surgery acuity adaptable unit to improve their clinical outcomes. Since converting they have decreased their mortality from 4.2% to 0% in the last 6 years and decreased their deep sternal wound infection rate from 4.2% in 1994 to 0.9% in 2002.²⁴

Transfer issues and clinical outcomes

When patients are cared for in the "traditional" patient rooms, geography dictates the level of care that is offered. Critically ill patients are located in the ICU and others are cared for in intermediate, telemetry, and medical/surgical units. In an average hospitalization, a patient can be transferred 3 to 6 times to receive the level of care their acuity requires.⁷ In addition to transferring patients for a different level of care, approximately 15% to 20% of all transfers are caused by roommate incompatibility, adding up to a large number across the United States since only 57% of all inpatient beds are currently private.²⁶ The transfer process is not a clinically benign process and has been shown to cause physiologic and psychologic distress that could lead to negative clinical outcomes. Descriptive research on the clinical impact of patient transfers revealed that 20% of patients became highly distressed about being transferred to a lower level of care stating that "The world had been kicked out from under me. . ." and 40% were anxious about nurse expectations of patient responsibilities asserting that "The ICU considered us "helpless"; the floor "completely independent."²⁷

The transfer stress and anxiety seen in this research study is consistent with prior research showing that within 72 hours of transfer from a coronary care unit, 42% of patients voiced physical complaints and 54% exhibited behavior of anxiety.²⁸

Because of multiple hand-offs, medication and treatment errors and delays often occur related to transcription omissions and misinterpretations. After implementing the acuity adaptable CCCC unit at Clarian Health System's Methodist Hospital, monthly transfers were reduced by 90% with a resultant 70% reduction in medication errors.⁷ In addition to generating medical errors, patient falls can result from transfers as well as an increase in nosocomial infections. Researchers discovered that intrahospital spread of *vancomycinresistant Enterococcus faecium* (VREF) might be facilitated by patients who had been transferred in and out of the ICU multiple times. These patients have a 2 to 3 times higher risk of acquiring VREF than patients who did not require transfers during their hospitalization.²⁹ Another study of postsurgical patients demonstrated that extra hospital cost attributable to nosocomial infections averaged \$40,000 and mortality rates were double than that of patients without infections.³⁰ These are compelling reasons to minimize the number of transfers patients experience during their hospitalization.

The acuity adaptable unit can assist patients who experience untoward events requiring rapid intervention. Staff in the newly constructed 36-bed acuity adaptable unit at Parker Adventist Hospital in Colorado realized the benefits of the care delivery model when a telemetry patient's clinical status deteriorated. Instead of spending time arranging a transfer to an ICU, within minutes staffing assignments were reorganized and the patient was receiving one-on-one care.³¹

Operations---efficiency

Hospitals utilizing the acuity adaptable model of care delivery have realized operational efficiencies and cost savings. Lower complication rates due to increased staff vigilance have the potential to decrease overall length of stay. The elimination of the transfer also has the potential to reduce LOS by at least 0.5

days.³² Loma Linda University Medical Center realized measurable improvements in the LOS of their cardiac patients (Fig 4).

North Memorial Medical Center experienced a reduction of 2.2 days down to an average LOS of 5.3 days for their cardiac surgery patients during the first quarter of implementing their acuity adaptable unit.²⁴ At Trinity Health System in Ohio, coronary artery bypass patients experience an average LOS of 4.79 days in their acuity adaptable cardiovascular unit. Since the cardiac surgery patients have outgrown their space, approximately 25% of patients are transferred to a telemetry unit to allow the immediate recovery of postoperative patients. Although more stable and less complicated patients are generally transferred to the floor, they are seeing a higher average LOS (6.33 days) than patients experiencing 1-stop care (A. Winfield, oral communication, October 12, 2004). Because of its efficiency, the acuity adaptable model of care is used by all MedCath Heart Hospitals. A recent study and report to congress analyzed severity adjusted data and found that MedCath hospitals had statistically significant (23%) shorter LOS for cardiac surgery cases with a lower in-house risk-adjusted mortality than general hospitals performing the same procedures (C. Gallaher, oral communication, July 27, 2006).

The transfer process adds cost to the patient's hospitalization, considering the staff time involved as well as the duplication of certain amenities and missing medications (not to include the cost of lost patient articles and potential for staff injury). Often there are delays in transferring patients out of the ICU because of a lack of available telemetry beds. These delays waste nursing hours, provide a higher level of care than the patient requires, and inflate hours per patient day, and at times even require extra nurses when delays continue into the next shift. By eliminating most transfers at Clarian Health System's Methodist Hospital, they were able to save \$5 million per year by building acuity adaptable rooms.¹¹

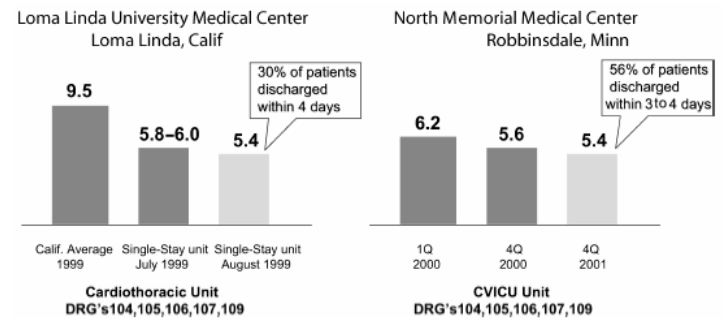


Figure 4. Acuity adaptable bed unit and average length of stay (days). (a) From Nursing Executive Center³³ and (b) from reference 34.

Staffing

To appreciate operational saving associated with the acuity adaptable model of care delivery, staffing must be based on patient acuity. In a recent survey of cardiac acuity adaptable programs, either clinical guidelines defining patient severity or a numeric calculation based on the patient's clinical situation and required nursing tasks were used to classify patient acuity and ultimately determine nurse-patient ratios in relation to patient need (J. Darby, oral communication, July 20, 2006) (Table 2). Patient acuity and nursing tasks must clearly be defined so that patients can be assigned in an objective manner. Nurse-patient ratios in acuity adaptable units typically accommodate the ICU patient at ratios of 1:1 and 1:2, intermediate care patients at 1:3, and medical/surgical patients at 1:4 and 1:5. Although in some hospitals, on a medical/surgical unit, nurse-patient ratios may be at a 1:6, in the acuity adaptable unit due to multiple patient severities that can be assigned to one nurse, assignments are usually 1:5 or less.³⁵

The acuity adaptable concept is able to minimize the inefficiencies the "intermediate care" patient causes with traditional, multi-transfer care. This patient population is not acute enough to garner a 1:1 or 1:2 ICU ratio, but is not healthy enough for a medical/surgical unit ratio of 1:5 to 1:6. Traditional care hospitals have created intermediate care units (IMCs) to care for

this lower risk monitored patient population. Unfortunately, because of the advanced skill set of the nursing staff (advanced cardiac life support certification and expertise in the delivery of specific intravenous medications) physicians often place patients in the IMC they feel should “be watched” even when clinical admission criteria are not met. When the unit is full, true intermediate patients are admitted to the ICU, but are cared for at the standard ICU nurse-patient ratio, overusing resources.

Table 2. Nursing acuity scoring tool—sample content*

Admission/transfer in
Discharge/transfer out
Altered mental status
Communication barriers
Activities of daily living
Fluid balance management—complex
Incontinence management
Preventive skin care
Wound management
Pulmonary management
Vital sign frequency
Noninvasive monitoring
Invasive monitoring
Learning needs
Emotional needs
Medication management
Specimen collection
Isolation
Drainage devices
Preparation for test/procedure

*Adapted from Sharon Regional Health System, Sharon, Pa. Courtesy of J. Darby, Nurse Manager, Cardiovascular Unit.

Transfers on and off an IMC are usually plentiful and occur often within the first few hours of admission as the patient’s true clinical situation evolves, increasing staff workload and causing frustration. At Christiana Care Health Systems Delaware, they were able to reduce emergency department wait time to admission (typically to the IMC) from 5.5 to 2.5 hours and reduce nursing costs by reformulating their IMC into an acuity adaptable unit and adjusting nurse-patient ratios to care for the patients until discharge.³⁶ Although they did not address the higher acuity ICU patient within that unit, a true acuity adaptable unit would be able to absorb all levels of care appropriately, as long as staffing is assigned by acuity.

To facilitate the success of acuity adaptable units, protocols must be developed to increase nurse autonomy in progressing the patient along the continuum of care. If the nurse must wait for a physician order to change the level of care from ICU to intermediate care, delays and staffing inefficiencies will result. At the OSU Ross Heart Hospital, patient doors are color coded to inform the physician of the patient’s level of care as nurse-patient ratios are decided using clinical guidelines paired with a scoring tool for staffing (C. Gallaher, oral communication, July 27, 2006). Although most insurers are reimbursing at an overall case rate, patient acuity is tracked at all institutions for statistical purposes and for the evaluation of unit efficiency.

SUMMARY

The United States is in the midst of the biggest hospital construction boom in more than 50 years with the hospital industry, spending almost \$100 billion in inflation-adjusted dollars in the past 5 years on new facilities, an increase of 47% from the previous 5 years.³⁷ Progressive hospitals are incorporating the acuity adaptable model of care delivery and universal room design concepts to meet patient need, enhance quality of care, improve

operational efficiencies, and compete for savvy consumers. However, out of all hospitals renovating or building, only 48% stated that they were incorporating evidence-based design in their construction projects.²⁶ The goal in hospital construction should be to consider the facility’s impact on patient outcomes and long-term operational efficiencies by incorporating concepts such the acuity adaptable bed, versus simply focusing on minimizing capital project costs. Efforts must continue to document the influence of evidence-based design principles such as the acuity adaptable care delivery model on patients, physicians, and staff.

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