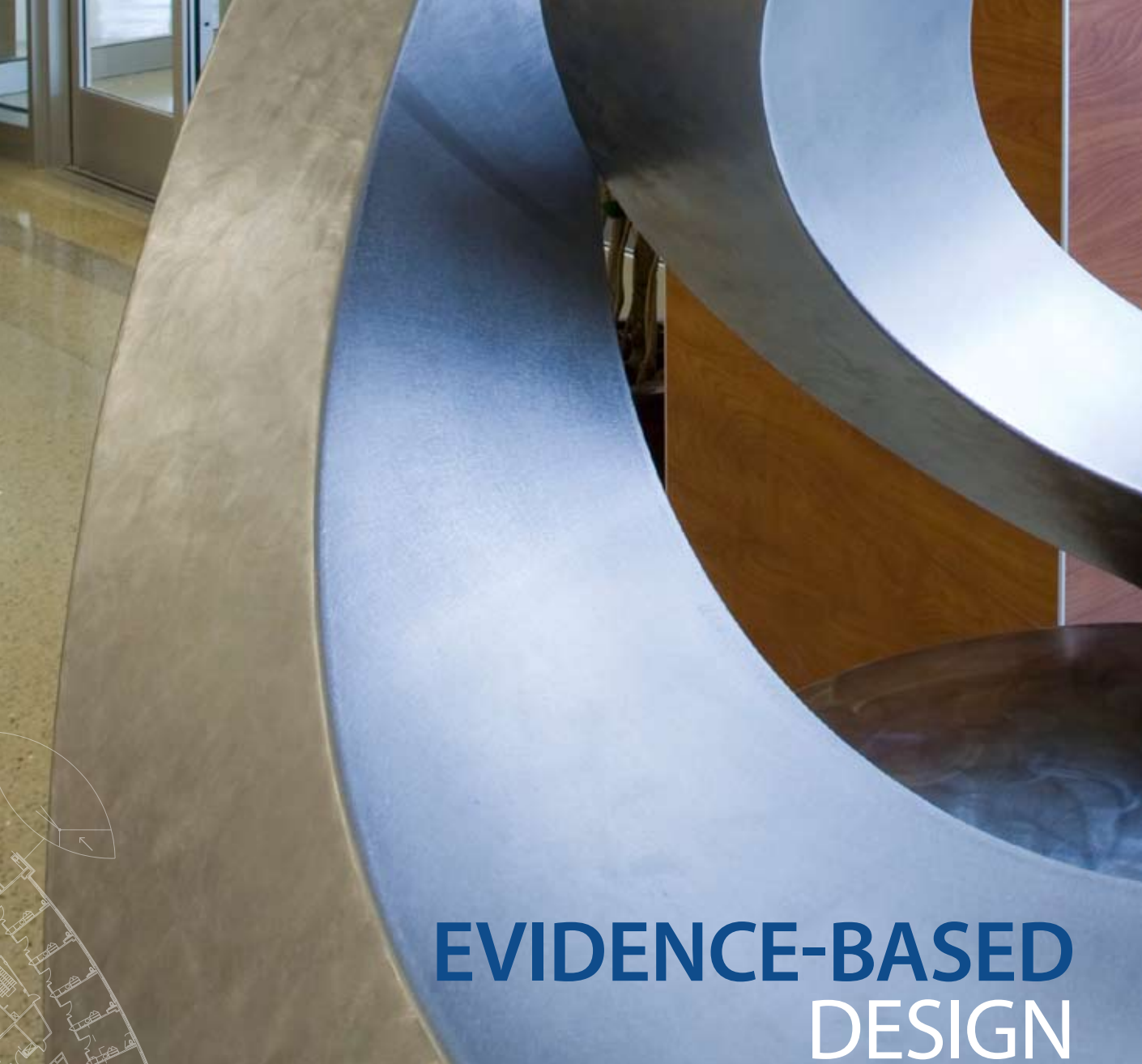

EVIDENCE-BASED DESIGN

FOR HEALTHCARE FACILITIES

Cynthia McCullough, Editor

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Edited by Cynthia McCullough, RN, MSN

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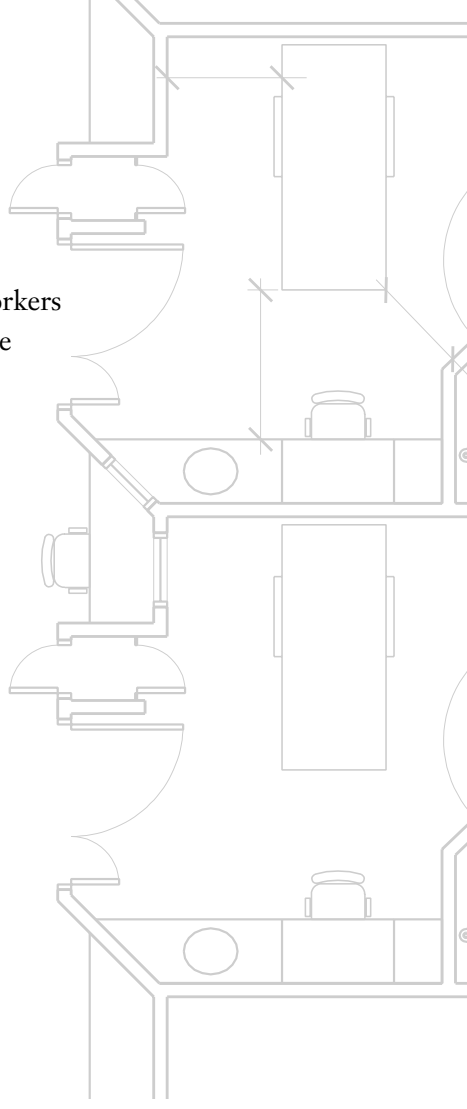
Dedication

This book is dedicated to my many talented and devoted coworkers at HDR Architecture, Inc., who continually strive to create healthcare environments that empower our clients to *Heal, Care, and Work BETTER.*

–Cynthia McCullough



The cover image features a sculpture in the lobby of East Carolina Heart Institute in Greenville, North Carolina, and symbolizes the importance of each element and every detail that goes into healthcare facility design. Design can make a powerful impact on well being in more ways than is currently known. This book begins to tell the story of the healing elements of architecture and design being measured and documented in healthcare facilities now.

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My sincere thanks to the contributing authors of this book for taking the time to share their expertise and real-life examples.

I am especially grateful to HDR team members Jan Bishop, Nicole Brown, Jodie Johnson, Steve LaHood, Michael McManus, Dee Schlautman, Sarita Schroeder, Katie Sosnowchik, and my friend Mae Timmons for assistance in checking references, proofreading, and preparing graphics and photographs for the book.

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Barbara Buechler is administrator of the Betty H. Cameron Women's and Children's Hospital at New Hanover Regional Medical Center in Wilmington, North Carolina. She recently led staff in the planning process, from vision to transition, for a new Women's and Children's Center. Buechler has a master's degree in healthcare administration from the University of North Carolina-Chapel Hill.

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Steve Goe is a former hospital chief executive officer with Scripps Health System, Scripps Memorial Hospital, and Daniel Freeman Memorial Hospital Medical Center. Currently, he is senior vice president and director of strategic services for the Healthcare Consulting group of HDR Architecture. Goe guides organizations through the process of developing future scenario models for population-based and strategic facility planning. A fellow of the

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Karen Sweeney has 35 years of healthcare experience in various settings. Currently, she is chief nurse executive of Alegent Health Lakeside Hospital, which opened in August 2004. Her dedication to patient care assisted her in successfully operationalizing Lakeside Hospital, creating a culture of service excellence that has led to numerous expansion projects. The most recent project involves build-out of a new tower, adding 63 inpatient beds and expanding patient support services. She is a member of the American Organization of Nurse Executives (AONE) and is active in the Nebraska AONE chapter. She recently led Lakeside Hospital to Magnet designation. Sweeney received her Master of Science in Nursing Administration from Nebraska Wesleyan University in 2006.

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Marcia Vanden Brink is director of product development for HDR Architecture and an interior designer certified by the National Council for Interior Design Qualification (NCIDQ). She has been responsible for the interior design, space planning, and coordination with multidisciplinary design teams for various projects. In addition to traditional healthcare projects, she has developed an expertise in the design of facilities for women and children. Vanden Brink has served as a designer and project manager for HDR's collaborations in product designs for Milliken's Soul and Sense carpets, Architex International's Remedé and Remedé II collections, Peter Pepper, and the award-winning SYNC by Nurture collection.

Pamela Wenger, BA, RN

Pam Wenger is director of patient care operations at St. Mary's Medical Center North in Powell, Tennessee. St. Mary's Medical Center North is a state-of-the-art facility that was designed based on safety features, patient-centered care, and a decentralized care model. The medical center opened in August 2007, with Wenger leading the team from a concept of decentralized patient care to a functioning model in reality. She is a fellow of the Advisory Board Company and an active member of the Tennessee Organization of Nurse Executives.

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Michaella Wittman is a senior vice president at HDR Architecture and founder and director of its Sustainable Design Solutions group. A strong proponent of matching sustainable strategies to the goals and characteristics of each project, she has worked closely with a multitude of clients to balance environmental, economic, and social equity goals. Her aptitude for leadership, innovation, and integration has led clients in all industry sectors to the successful completion of projects that have benefits such as reduced environmental impact, increased productivity, improved quality, and reduced operations and maintenance

expenditures. Wittman holds a degree in electrical engineering and was a contributing author to *Creating Responsive Solutions to Healthcare Change*.

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Foreword

A number of books have been published on evidence-based hospital design. What separates this one from the pack is that it is geared toward an audience that not only is critical to a successful design process, but also is a key stakeholder in day-to-day operations within healthcare facilities—nurse leaders.

Though evidence-based design is a relatively new field of study when compared to evidence-based medicine, in the last decade a number of watershed studies have built a solid foundation for this emerging body of work. It is often said that great buildings require both an inspired design team and an inspired client. I would add that great buildings also take a well-informed client and interdisciplinary design team. For this reason, I am excited to see a reference geared directly to a community of professionals with a unique body of knowledge that can help ensure that future healthcare facilities are built to improve clinical outcomes, as well as reduce operating costs. Dore Shepard, one of The Center for Health Design's Pebble Project Partners and a nurse leader at Barbara Ann Karmanos Cancer Institute, described it best when she said, "The patient should be spending energy fighting the disease, not the environment."

With healthcare reform on every U.S. political agenda, we clearly are in the middle of a sea of change. Our models of care will continue to evolve and adjust as healthcare is reinvented to provide affordable, quality care to all. As we envision what our future will look like a decade or even just a year from now, it is vital to challenge any preconceptions and redesign our healthcare environments to support improved health outcomes at a reduced cost of care. To achieve this goal, we must understand how topics in this book—sustainability, family-centered care, transition planning, and healing environments—come together to create high-performing healthcare facilities.

The built physical environment has become a vital tool in the arsenal to fight escalating healthcare cost, improve clinical outcomes, reduce patient and staff stress, and reduce medical errors. Involvement of an interdisciplinary design team—one that includes nurse leaders

and uses an evidence-based design process—is critical to ensure that future healthcare facilities will not add to the stress on our already overburdened healthcare system and will meet the needs of patients, staffs, and families.

In this book, diverse industry experts have brought together a wide range of subjects that are critical for those participating in a design process to understand, to attain the goal of creating evidence-based healthcare facilities that support quality care. The authors' use of case studies, diagrams, and photos of completed projects to support concepts allows the reader to study and gain insight into a topic from a range of perspectives, regardless of one's previous level of knowledge.

Whether you are called upon as a nurse leader to participate in the planning and design process of a facility remodel or an entirely new hospital, or you are looking for a deeper understanding of the relationship between the built environment and quality of care, this is a must-have primer for your bookshelves that you will reference again and again. This new addition to the body of knowledge will help ensure that healthcare facilities are designed to meet the diverse needs of patients, families, and staff and that they are conscientious corporate-citizen members of our communities.

Debra J. Levin, EDAC
President and Chief Executive Officer
The Center for Health Design

Preface

Healthcare delivery is more than who provides what and when. I hope this book opens the door to recognition of the importance of the environment—how it impacts the health and welfare of the patient and what needs to occur for the patient to receive the best care.

Using a body of knowledge to make decisions about the patient's environment is not a new activity, but it has evolved rapidly in the last few years. Now it is considered risky if the quality of the environment is not based on research findings and other evidence. Much has been written about evidence-based practice, but little about evidence-based design. This book provides not only important data about how the environment of the hospital has changed and is changing, but also how these changes are consistent with other trends in healthcare delivery.

The authors of this book provide important information about various aspects of the healthcare environment, such as how aesthetics of the environment are identified and supported by current studies. The book also provides up-to-date information on healing environments and the major impact such environments can have on the patient's welfare. Though not a new idea, healing environments have become more prevalent and understandable as studies demonstrating their value and prevalence have come along.

This book also contains information about family-centered care, staff workflow, process improvement, and sustainability, based on new "green standards" acquired from research findings. Of equal importance are discussions about transitioning from the old to the new and what researchers have learned by using case studies of real experiences. The text is fully supported by photos, diagrams, tables, case studies, and information about the ways "benchmarking" has been used to document change.

This is a book every nurse and healthcare worker should read to better understand what underpins the newest changes in the hospital environment. At one time, changes in healthcare environments were based on ideas, competition, product availability, or accreditation requirements. Although these criteria still influence hospital changes,

contemporary changes are based on careful thought, supported by studies that demonstrate the effect of these changes on patients' wellness.

Patient satisfaction, competition, technological advancements, and the need to replace aging facilities are only some of the reasons this book is vital to understanding recent changes. I am both pleased and honored to suggest that this book is not only a valuable addition to the literature, but also a resource everyone should read.

By Fay L. Bower, DNSc, FAAN

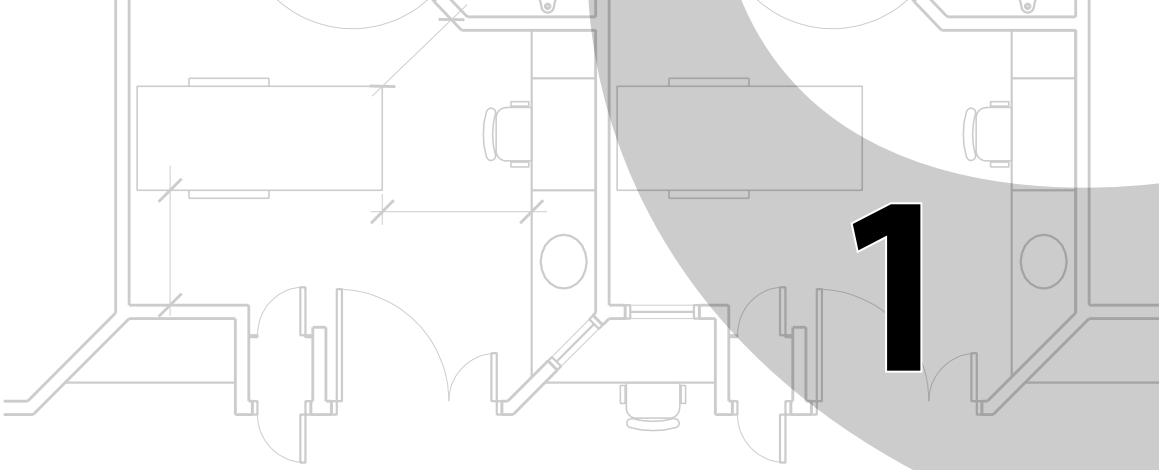
Introduction

Spurred by the healthcare building boom, evidence-based healthcare facility design is an important and growing trend in creating safe patient-care environments. Hospital administrators are continually searching for proven, cost-effective strategies to do everything from enhancing patient safety and staff efficiency to improving the budget and bottom line. Even for those familiar with principles of evidence-based practice, finding reliable and valid data is no easy task. What's more, once you have the data, how do you evaluate, categorize, and synthesize the evidence when it comes to building and space design?

- Chapter 1, "Evidence-Based Design," presents a clear, concise, and easily understandable argument for why evidence-based design is so critical to improving healthcare—in good economic times and bad—and why it cannot be overlooked as a tool for hospitals to both advance healthcare and lower costs and expenses.
- Chapter 2, "Aesthetics and New Product Development," looks at how aesthetics, an important facet of healthcare design, impact the environment and, ultimately, patient recovery. The chapter includes discussion and examples about what to do when a functional and aesthetically pleasing product is not available.
- Chapter 3, "Healing Environments," describes how elements within healing environments can be balanced with global project requirements for a successful result, including patient outcomes. In addition, the chapter includes case studies to demonstrate how to design a theme for a healing environment.
- Chapter 4, "Family-Centered Care," looks at evidence behind creation of family-centered care environments and how that movement has influenced the design and look of healthcare facilities.

- Chapter 5, "Benchmarking," includes a discussion of the conceptual and practical aspects of benchmarking, along with the tools and resources that are needed. Benchmarking is an essential component of the successful use of evidence-based concepts in healthcare facility design.
- Chapter 6, "Efficiency," explores process improvement methods that healthcare workers are using and the importance of examining staff workflow and patient flow before designing a new facility. The authors present examples of process improvement, along with discussion about the impact on design.
- Chapter 7, "Sustainability," explores the purpose, importance, and benefits of LEED (and green) standards in healthcare design.
- Chapter 8, "Transitions," includes four case studies written by individuals who have led the transition from an old to a new environment or the start-up of a new facility within a healthcare system. The chapter includes success factors and lessons learned.
- Chapter 9, "Preparing for the Future," concludes the book with a discussion of healthcare trends over the past 10 years and what can be expected in the years ahead.

Whether you are an architectural designer, a hospital administrator, a staff nurse, or a student, the book offers you everything you need to understand evidence-based design for healthcare facilities.



1

Evidence-Based Design

By Cyndi McCullough

Proactive, evidence-based healthcare facility design is an important and growing trend in healthcare. There are a number of reasons for this growth, including:

- The need to replace aging facilities.
- A competitive marketplace for healthcare services.
- The need to improve staff and material flow to achieve operational efficiencies.
- The ability to accommodate technological advances.
- Consumer demand for privacy and family-centered care.
- The need to reduce preventable, hospital-acquired injuries and infections.

The critical nature of this last point is underscored when you consider that the Centers for Medicare and Medicaid Services and some private insurers are refusing to reimburse for certain hospital-acquired, preventable conditions, including nosocomial infections; pressure ulcers; catheter-associated urinary tract infections; fractures, dislocations, or other hospital-acquired injuries; and blood incompatibilities (Infectious Disease Society of America, 2007).

As a result, hospital administrators must respond by planning for safer environments for care and implementing technologies to help staff be more efficient and minimize errors.

Hospital administrators are constantly searching for proven cost-effective strategies that:

- Improve patient safety.
- Improve patient outcomes.
- Increase patient, family, and staff satisfaction.
- Improve the efficiency and effectiveness of staff.
- Have a positive impact on the budget.

Often, only first-time costs are considered with a new project because the client does not have enough information to evaluate the return on investment when implementing certain strategies. For example, adding a handwashing sink at the doorway of each patient room may be rejected by the project leaders due to the cost of the sink and the extra plumbing; however, an increase in hospital-acquired infections may occur due to this action and the ongoing savings would far outweigh the initial cost of the sink and plumbing. A recent trend in healthcare design advocates for the use of evidence-based design (EBD).

Evidence-Based Design

Evidence-based design (EBD) is a process used by healthcare professionals in the planning, design, and construction of healthcare facilities. An evidence-based designer, along with an informed client, makes decisions based on the best information available from research, from project evaluations, and from evidence gathered from the operations of the client. EBD should result in demonstrated improvements in the organization's utilization of resources.

At The Center for Health Design, an organization that supports healthcare and design professionals to improve the quality of healthcare through evidence-based building design, researchers have

proposed the definition of EBD as "the process of basing decisions about the built environment on credible research to achieve the best possible outcomes" (The Center for Health Design, 2009).

Research

More than 1,000 research studies suggest healthcare design can improve patient care and medical outcomes and can decrease medical errors and waste (Marberry, 2007). Stankos and Schwarz (2007) suggest the number of EBD studies cannot be described as a knowledge base because there are too few that are distributed across too many topics. EBD is not a complete discipline, nor will it be soon. Because the building of healthcare facilities cannot be postponed while we create a body of knowledge that definitively supports evidence-based design, many believe it necessary to balance what is available with common sense and established design features that are flexible and can adapt to new ideas as the research evolves.

Some believe EBD is being used by design firms as a marketing tool (American Society for Healthcare Engineering [ASHE] 2008; Looker, 2008). It is clear that EBD provides designers with suggestions for better design but does not guarantee better outcomes. Another critical point to understand is that the same approach may not translate to the same outcomes from one facility to another.

Measuring the Effect of the Design

Measuring the effect of a certain design element on a desired health outcome is a complex endeavor, one in fact that has yet to be fully accomplished. The process for planning, designing, and constructing a new healthcare facility can take from 3 to 9 years, depending on the scope of the project and where the facility is being built. This time gap affects both what is measured and reported and whether or not any measurement is obtained at all. The most common reason for this discrepancy in planning and measuring the design elements is because staff members who began the planning process might have good

intentions of measuring and publishing the results, by the time move-in day occurs, those staff members might not work at the healthcare institution anymore or might still work there but have forgotten what they initially planned to measure. The immediate focus of most staff members at occupancy is on transitioning to the new environment. At this stage, the staff is usually inefficient as they learn a new way of doing things, and thus, become less interested in, disenchanted with, or do not see the need for measuring outcomes.

Processes Needed to Investigate EBD Principles

Clients who are building or renovating a facility and their design team can take steps to ensure positive patient outcomes and a financial return on investment. Successfully implementing EBD principles in the design process involves a combination of streamlining processes, examining new technologies, and then creating a design that can adapt over time to accommodate improved processes and new technologies. An example of validating EBD principles occurred with the Pebble Project.

Pebble Project

The Pebble Project is The Center for Health Design's research program that showcases healthcare facility design that has made a difference in quality outcomes and financial performance. Saint Alphonsus Regional Medical Center in Boise, Idaho, with the research team at The Center for Health Design, conducted a study to determine ways to reduce noise on a patient unit prior to building a new patient tower. Prior to renovation, noise levels exceeding recommended standards for patients in hospital settings were measured on all shifts.

The patient unit renovation included:

- Installation of thicker, more sound-absorbing ceiling tiles than had been previously used;
- Elimination of overhead paging systems;
- Installation of a quieter nurse communication system;

- Installation of carpeting in hallways and public areas;
- Installation of a sound-absorbing, non-slip flooring in patient rooms.

In addition, the staff differentiated their work areas from patient areas through the use of color, lighting, and shape. Staff went another step further and intentionally closed patient doors during change of shift report.

Data collected after the renovation reported the actual decibel rate per patient room to be less than 51.7, which contributed to an improvement in the quality of patient's sleep from 4.9 to 7.3 (on a scale from 0 to 10) (Kroll, 2005). In addition, the results of hospital satisfaction surveys collected throughout the entire institution indicated the renovated unit scored higher in all categories measured when compared to all other units. A questionnaire completed by the nursing staff on the renovated unit reported an unexpected benefit—nurses went home from their shift feeling less stressed than they did when they worked in their previous environment. The collaboration among the user, designer, and The Center for Health Design research staff led to the success of this research project.

Best Practices

In addition to using research that is available, clients can access other information to help them determine the best design for their facility. Clients can find other sources of information in the following ways:

1. Requesting positive and negative "lessons learned" from other clients who had similar issues.
2. Obtaining copies of examples of unpublished research.
3. Attending a conference where both clients and designers are presenting.
4. Asking for contact information of other clients who have worked with the design company.
5. Observing the current environment with established evaluative criteria.

Requesting Lessons Learned

Clients can look to the design firms with which they are working to share "lessons learned" gathered from other clients who have been involved with similar projects. Understanding why administrators of a healthcare facility made a certain decision is valuable. Perhaps the administrators made decisions because of budget constraints or because of an executive mandate that a process be done a certain way. Other times administrators might be forced to make compromises because of the space that is available.

Obtaining Unpublished Research

Consultants and designers often encounter interesting solutions that a client has studied and implemented, but for one reason or another, the outcomes did not get published. For example, one consultant visited a 129-bed, long-term care building with 48 single-occupancy rooms and 40 double-occupancy rooms on a campus tour while working on a master plan for a facility. The facility, which opened in 2003, is part of York General Health Care Services in York, Nebraska. Staff had conducted a significant but unpublished comparison of lift-related injuries within the organization before and after the new facility was opened. Both the incidence and severity of lift-related injuries were reduced following the installation of ceiling-mounted patient lifts (Personal communication from Jane Thompson and Tamara Wiens, January 9, 2009). They installed a total of 45 lifts at a cost of $360,000. Ten lift-related injuries occurred in a 33-month period prior to the move to the new facility, and the worker compensation expenditures for the ten injuries totaled $101,900. The average injury rate was 0.31 per month, and the average cost was $10,190 per injury.

Nine lift-related injuries occurred in the 62-month period the facility had been open. Three of nine injuries resulted from staff failure to use the overhead lift. Worker compensation expenditures for the nine injuries totaled $22,500. The injury rate was 0.145 per month with an average cost of $2,250 per injury. If the three injuries that resulted from staff not using the lift were excluded, the average injuries per month was 0.097, and based on the average cost per

injury, the total worker compensation expenditure post lift installment was $13,500. During this time period, York General Health Care Services' workers compensation premium was reduced from $380,630 to $144,347 and the experience rating dropped from 1.37 to 0.88 (Personal communication from Jane Thompson and Tamara Wiens, January 9, 2009).

Attending Healthcare Design Conferences

Attending conferences about healthcare design is another way to get first-hand knowledge about what other clients are studying. Attending sessions where clients and designers are presenting together is most beneficial. At these conferences, clients and designers usually include research recently completed or in progress along with lessons learned from the client perspective.

Networking with Other Clients

Another method of obtaining information during various stages of redesigning involves connecting clients who have similar projects in different phases so they can learn from each other. For example, one consultant invited a client, Client A, who was in the early phases of a major surgery unit renovation, to join Client B, located in another state, in transitioning meetings. Client B, who was 6 months from opening a very large surgery center, was having trouble understanding how technology was going to assist them in their processes. Client A, on the other hand, had very advanced technology solutions and streamlined processes, but needed a better facility to support them. Client A helped Client B understand how the technology works while simultaneously gaining important information regarding the value of organizing a transition team and the time commitment necessary to assure an uneventful move into the new facility.

Observing the Current Environment

Observing and paying attention to how people work in the current environment is another way to gain valuable information. After you develop a plan for observing, individuals can be taught to collect data

using the observation tool. This next example illustrates how you can see, hear, and feel a healing environment.

A consultant was asked to assist a client to improve a patient unit design. The current unit had been in operation for 3 years. Elements of this environment included private patient rooms, decentralized workstations, separation of patient and public flow, family space, and a state-of-the-art nurse communication system. Patient, staff, and physician satisfaction scores of those associated with this tower were consistently high.

When an older patient tower in the same institution needed to be replaced, administrators and board members wanted to just repeat the newer and successful model. A complete mock-up of the unit had been designed in a parking garage so staff could use it as a learning lab. However, new staffing standards recently imposed would limit the flexibility of the staffing model with the current design, raising the potential for greater operational costs. Nurse leaders wanted to look at some other, perhaps more cost-effective, design options. Therefore, the consultant was asked to help the client improve on the current patient-care unit.

To observe the differences, the consultant asked to tour both the newer and older units and was surprised at how obvious the differences were.

Both units included 32 private patient rooms and equal numbers of staff. On the day of the tour, both units were full. That is where the similarities ended. As the consultant stepped off the elevator on a floor of the new tower to a lobby with a lot of natural light, she found navigating through the unit (wayfinding) was intuitive. She was immediately greeted by a nurse who made eye contact and asked, "How may I help you?" The consultant explained why she was there, so the nurse gave the consultant permission to walk through the unit. Nurses worked from their decentralized stations, and no equipment cluttered the hallways. The nurse call system was very quiet, and no overhead paging was used. During the tour, a patient's visiting family member offered the consultant unsolicited comments. He stated the unit was "great." He never felt like he was in the nurse's way when they cared for his wife.

He, too, had noticed how everything had its place and how the design supported what the nurses were doing.

From there, the consultant went to the older, centralized unit. She stepped off the elevator to a dark, noisy lobby. She immediately felt tension and presumed that her blood pressure had risen because of the way she felt at the time. She found the central nurse station was enclosed with wired glass. Several people were working in the station, but all had their heads down. Therefore, no one greeted her or saw the need to question her presence. Because no one acknowledged her presence, she decided to look around. Compared to the first unit, this one was much noisier. The communication system was loud and also included an intercom system. She looked down one cluttered hallway and counted 14 objects (IV poles, portable blood pressure monitors, laundry hampers, medication carts, and food carts). The nurses were rushing from room to room, always with their heads down. Having worked in a unit like this in the past, she intuited that they were thinking something along the lines of, "Please don't ask me anything. I don't have time to talk. I am an hour late distributing medications. If I don't make eye contact, you will probably go away."

Later when the consultant met with the user group that was planning the new patient tower, she shared this experience and discovered most of the people who worked in the older tower had never even visited the newer tower. Two "work cultures" definitely existed in this facility. She found it obvious that the process, technology, and design had definitely combined to create a healing, working environment in the new tower. They had a great opportunity to measure and compare differences in patient outcomes and staff and family satisfaction between the two cultures, but everyone was too busy to think about it. Such reflection was not a priority. And, for those who worked in the old environment and then moved the new environment, they intuitively knew the new environment was better. They did not need to measure anything to know that.

Staff often become desensitized to a noisy environment and are not aware of how noise affects them or patients physiologically. This experience is an excellent example of how movement from a centralized

to a decentralized environment can make a difference. Everyone immediately noticed that the absence of the large central nurse station contributed to a significantly quieter environment.

Process and Design

In the quest for creating safer patient environments, the patient room is at the forefront. The location of proposed design solutions—decentralized workstations, location of handwashing sinks, location of the patient toilets and bathrooms, use of patient servers and handrails, family space, and same-handed rooms—is critical and needs to be considered carefully. After all, the patient room is where patients spend most of their time and interact with their family and a number of caregivers.

However, no "one size fits all" design solution exists, and administrators are confused by the minimal and conflicting evidence to support these design features. Each design is influenced by the processes and technology used and the level of involvement of the family in the care of the patient. Some of the data are supported by research; some are based on observation and opinion. A review of the various ways to organize these design features to create an efficient, patient-centered, family-friendly patient room follows.

Centralized Workstations

The debate between a central nurse station and a decentralized caregiver workstation is interesting. The central nurse station serves as the information hub of the unit. It contains the workspace for all caregivers on the unit and is preferably at the geographic center of the unit. Physicians come to the station to retrieve patient charts and obtain the latest patient information. The unit secretary and charge nurse process orders here while others document inpatient charts, socialize, or eat their lunches. It is a noisy environment because of these characteristics.

Often the most acute patients are placed in rooms near this centralized station so nurses can readily observe them. However, most patients/families request the patient be moved further from the central

station because it is too noisy. Staff members who take breaks in this area are perceived by the public as not working. Better ways to manage patient information using a decentralized concept have demonstrated significant improvement to the inherent problems of the central station.

Decentralized Workspaces

In a decentralized environment, caregiver workspace is dispersed throughout the patient unit. These workspaces are placed closer to (immediately outside the patient room) and sometimes within the patient room. In fact, the workspace usually contains a window that allows the nurse to observe the patient and the surroundings when necessary.

Some practitioners believe a decentralized environment cannot work without electronic medical records. This argument has been proven false. Managing patient information in a paper environment is much easier when the chart resides with the patient. When all caregivers have access to the patient's chart when they need it, the chance of error is reduced, and patient treatment occurs faster, which can lead to a decreased length of stay for the patient.

Patient Servers

Observations of caregivers who work in a decentralized environment have highlighted several activities that need attention. For example, to eliminate frequent trips to/from the supply and linen rooms, caregivers often stockpile supplies and linen on an over-bed table in the hallway outside the patient room or, worse yet, stack them on the window ledge in the patient room. Although this activity is more efficient, it can lead to waste, clutter, and increased costs because unused supplies are often discarded when the patient is dismissed. A better solution is to provide cabinets near the patient room for a minimum level of supplies and linen.

In intensive care units that do not yet have private rooms, the caregiver often creates a workstation at the foot of the patient bed.

Supplies and paper charts or a computer on wheels are part of this makeshift workstation. Similarly, an ergonomic workstation that provides space and visibility of the patient can easily be created.

Handwashing Sinks

The placement of handwashing sinks in patient rooms and treatment areas has led to a decrease in hospital-acquired infections. However, just placing a sink in the room does not by itself improve infection rates. The sink in combination with staff and patient education lessens the chance for infection. Sensor technology that shines a light above the sink when a person enters the room can give a visual cue for caregivers or family members to wash their hands.

During the design phase, users have many ideas about where the sink should be located in the room. Infection control staff suggest —and most caregivers agree —the sink should be immediately inside the room where it is visible to all who enter and also where the patient can observe the staff washing their hands. Some staff want the sink closer to the head of the patient bed near the caregiver work area. This location is feasible, but you need to take some precautions. A situation reported by Branswell (2008) provides an example of why the placement of the sink is important. Between December 2004 and March 2006, 17 immunosuppressed patients died at Toronto General Hospital. All the deaths were attributed to the design and placement of handwashing sinks, which led to a *Pseudomonas aeruginosa* outbreak. The sinks were shallow, and because of their design, pressure from the spout splashed water out of the drain that sprayed nearby surfaces. The sinks were located a little more than 10 feet from the head of the patient's bed. Using fluorescent gel in the drain and an ultraviolet light, investigators determined that when the sink was being used, droplets of water had traveled at least 10 feet. On the strength of that evidence, the facility installed new sinks with a different design that included splash guards between the sink and the treatment preparation area. This example demonstrates the careful thought facility planners need to give to both the type of sink installed and its placement.

Toilet Type and Location

When clients plan a patient room, the discussion about the location of the bathroom gets the most attention. Should the bathroom be located on an interior (inboard) or an exterior (outboard) wall? Should it be on the same wall as the head of the patient bed (headwall) or on the wall near the foot of the bed (footwall)? Some clients want the bathroom to be located inboard to preserve the entire outside wall for a window. With this configuration, the opportunity for a decentralized caregiver workstation with a viewing window into the patient room is limited. Because the bathroom and patient door take up most of the interior wall, it is difficult to create a pass-through patient server (to store supplies, linen, and medications). In these configurations, the patient room door and the bathroom door often interfere with each other. Locating the bathroom on either the headwall or the footwall on the exterior wall alleviates this problem and also creates a nook for family space. Locating the bathroom on the footwall of the exterior wall creates the most flexible room. This configuration allows for maximum headwall space so the room can be adapted to the highest level of care. This preserves the space between the patient bed and the exterior wall for a bassinet or space for a chair so loved ones can sit close without blocking the bathroom.

Handrails

Many believe providing a handrail from the head of the bed into the bathroom can help prevent falls. However, some clients are concerned that if a rail is provided, patients might attempt to ambulate unassisted when they should ask for help. Others who want to preserve the space on the headwall for equipment opt for a bathroom on the footwall. In actuality, the examination of patient fall data reveals that the location of the bathroom is less important than having a well-lit, clear path to the bathroom and a non-slip floor product. The combination of caregivers being closer to the patient (decentralized workstations) and family members spending the night in patient rooms also leads to fewer falls. In addition to these strategies, some clients use bed-escape technology that alerts the caregiver when the patient is getting out of bed.

Family Space

Most private patient rooms are designed to include space for a family member to spend the night. In addition some include a desk, Internet access, individual television, and locked storage. Clients should give consideration to patient and caregiver needs first when deciding where to locate this space within the room.

Same-Handed Rooms (Standardization)

Same-handed rooms feature an identical, repeated layout, meaning the patient bed, technology, caregiver space, family space, bathroom, and handwashing sink are in the same location in every room. Based on standardization principles used in manufacturing and the airline industry, same-handed rooms encourage intuitive processes in patient care. The opposite of same-handed rooms are mirrored rooms. With mirrored rooms, the headwall of the patient in one room is shared with the headwall of the patient in the adjacent room. The headwall has multiple penetrations for items such as medical gas, lights, communication equipment, data jacks, and switches. Every hole allows sound to enter a room. Fick and Vance (2008) found same-handed rooms limit noise (something that is measurable) because they have fewer penetrations in the walls between rooms.

Studies are underway to evaluate the efficacy of the same-handed room. Most administrators agree standardization of rooms is important in healthcare, but all know same-handed rooms represent an increased cost and no hard data exist so far to show a return on investment. Staff who work in same-handed environments report that they are more efficient to work in and that it takes less time to orient new staff (Personal communication, Pam Wenger, November 15, 2008).

The patient room layout in Figure 1.1 shows a configuration that captures the same-handed design features. The decentralized workstation (A) is located so a caregiver can observe two patients when needed. Between this workstation and the patient room door is a pass-through patient server (B) located so supplies, linen, and medications can be stocked from the corridor and used by the nurse from either the corridor or the patient room. The handwashing sink (C) is located just

inside the door, visible to all who enter and also to the patient. The patient bathroom (D) is located outboard and on the footwall in this configuration. This preserves the patient's view to the outside from the bed. If the bathroom were located on the headwall, the configuration of the room would be slightly different to allow the patient a view from the bed. The family space (E) is located near the window and away from the entrance to the room so staff members have clear access to the patient. The patient space is designated as (F). Caregiver space on the inside of the patient room (G) is to the right of the patient server.

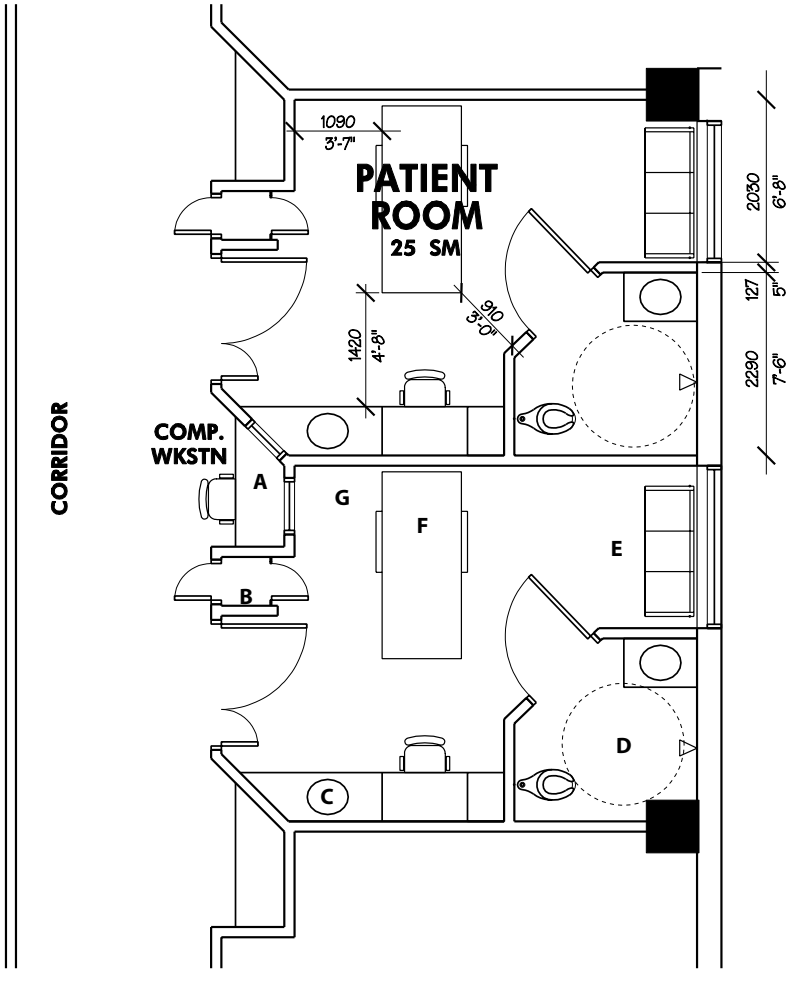


Figure 1.1 Schematic diagram demonstrating up-to-date design features.

This schematic is just one example of a patient room configuration using EBD concepts. The designer needs to have a good understanding of what EBD is, how it influences the environment's health outcomes, and how it impacts the quality and safety of healthcare delivery. A mock-up room or a unit to test the location of the critical pieces and to test critical situations is always advised.

Opportunities for Nurses

It is usual for a client (owner) project manager to work closely with the design firm project manager for the duration of a project no matter how large or small the project. The planning and design process is composed of several phases. The planners/designers work with the owner as a team to develop the plans for the facility in a logical progression of detail, with regular breakpoints for review and approval before proceeding to the next level of refinement. The project phases typically include strategic planning, project visioning, functional and space programming, schematic design, design development, construction documents, contract administration, and transition planning. Most organizations use a multidisciplinary team process to realize the vision of the project. New healthcare construction projects create new opportunities for nurses in planning, coordinating, and managing roles. These new roles may include leading:

- Strategic planning committees
- Project steering committees
- Interdisciplinary study teams
- Research initiatives
- EBD teams
- Transition to a new care delivery model
- Process improvement teams

Examples that highlight the nurse's leadership role in project design are found throughout this book.

Final Thoughts

The healthcare building boom and creation of safe patient care environments have spurred a need for EBD. Finding reliable and valid data is no easy task for users who are already busy and lack the skills to evaluate, categorize, and synthesize what is found. However, ways to locate this knowledge do exist. The Center for Health Design, InformeDesign, *Health Environments Research and Design* journal (HERD), and the Health Care Advisory Board are sources of this valuable information and an important database for evidence-based design. A body of knowledge about the cost to implement EBD is beginning to develop, so users and designers can make informed decisions.

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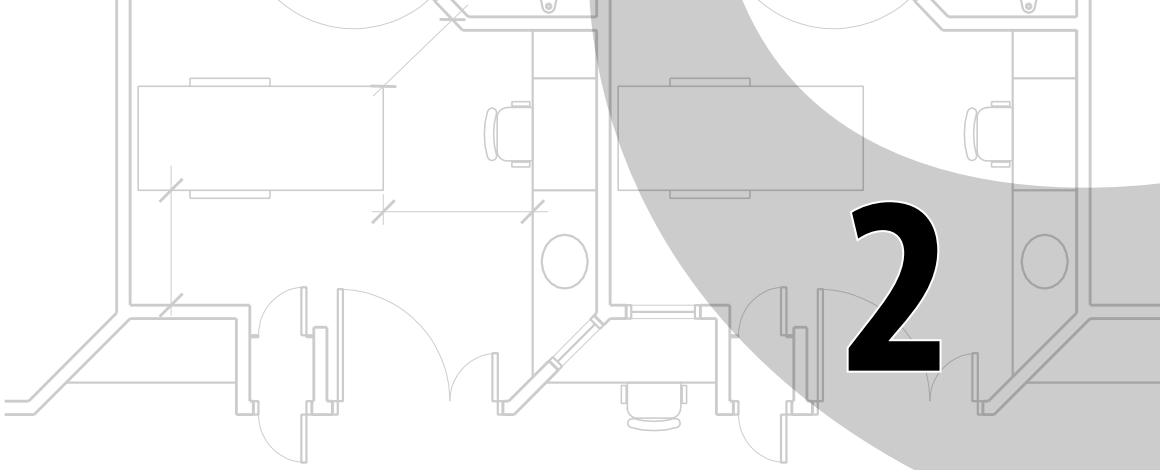

2

Aesthetics and New Product Development

By Steve LaHood and Marcia Vanden Brink

Aesthetics are by no means the most subjective component of evidenced-based design (EBD). We all intrinsically know the right aesthetic has a positive effect on staff, patients, and family, but no research supports that a certain color scheme or a pattern is the direct cause of positive outcomes. However, aesthetics are one of the strongest non-quantifiable components of EBD. The right aesthetic can set the tone, provide a natural distraction, and reinforce the quality of the care received. The right combination of pattern, color, lighting, texture, and positive distraction can set the stage for an encouraging experience. Because patients expect to get good care no matter where they go for healthcare, the finer details are what separate one institution from another, which makes the aesthetic of a healthcare facility an element that cannot be ignored. Two case studies that demonstrate the importance of aesthetics are presented at the end of this chapter.

Definition of Aesthetics

Aesthetics is generally considered to be the branch of philosophy that deals with art, its creative sources, and its effects, or, the nature and expression of beauty. An aesthetic is an expression of visual quality. It is the application of design principles and the orchestration of the individual components of color, light, finish, and texture that when used in effective combination provide the viewer with a cohesive visual story.

Aesthetics are considered very subjective. Selected colors and patterns are influenced by biases based on cultural, geographical, gender, age, and educational differences. No one universally accepted aesthetic exists, and every person has his or her own individual preference or taste. A client once said he refused to incorporate the color green into his hospital because his grandmother made him sit on a green sofa whenever he was being punished. This client had a negative association with the color green and therefore despised anything in that color. This subjectivity makes orchestrating the aesthetics of the healthcare facility challenging, but at the same time, an intrinsic part of evidence-based design (EBD).

Inspired (Functional) Design

Healthcare interiors are famously difficult to design because one must fully understand the ins and outs of medicine and technology to truly grasp the needs of patients and medical staff. The patient room, the waiting room, and the physician's office each have a specific purpose where the design and use must be complementary and durable. Healthcare spaces should be categorized into two areas: on-stage and off-stage. This concept of on- and off-stage spaces has been successfully employed by the Disney Corporation at its resorts for years and has since been translated into many service industries (Cruoglio, 2007).

On-Stage Spaces

On-stage spaces include all areas a patient or family member is going to touch. These spaces include waiting rooms, lobbies, gardens, cafeterias,

restrooms, and so on. Some patient rooms and patient treatment spaces are considered off-stage because they are not viewable by the general public, but because a patient and family member are going to be in the room, they should be considered on-stage. The same goes for patient transport elevators. Although not always in plain sight, these elevators transport patients to surgery and testing and should be considered on-stage.

Off-Stage Spaces

Off-stage spaces are areas for the employees. These are the spaces patients and family members do not normally see. Off-stage spaces include employee lounge areas, technical employee-only spaces, and departments, offices, internal corridors, and so on.

Cooperatively Assessing Space Needs

Meeting with key stakeholders early in the design process to determine the overall guiding principles of the interior design is important. These meetings ideally include all disciplines involved, including the architectural designer, interior designer, mechanical engineer, structural engineer, and staff who are going to be working in the space. Each component of a building's design affects the overall aesthetic of the environment. For example, the lobby at Saint Alphonsus Regional Medical Center in Boise, Idaho, was created by a team of individuals representing several disciplines. The charge from those involved with aesthetics was to design a welcoming, relaxing transition space that reflected the culture and spirit of Boise. The electrical engineer was integral in creating an even distribution of light that was comfortable as a transition from the outside world. The structural engineers were responsible for making sure the suspended sculptural artwork and waterfall were supported and connected. The mechanical engineers were charged with streamlining mechanical spaces and creating the right control of air flow so those working at the reception desk were not cold at night. Staff from all disciplines worked together for the most successful outcome.

When working with a client to develop the guiding principles for the aesthetics of a healthcare facility, it is important to get a unified answer to the following questions.

1. What is the message you want to send to the community by the design?
2. Define the aesthetic of your community. Should a relationship exist between the hospital and the community aesthetic?
3. Should there be a theme? This theme can be either literal or figurative. For example, stakeholders from Reid Hospital in Richmond, Indiana, created a "theme" centered on butterfly habitats. This theme was reflected just in the shape of the outpatient tower and evident only to those intimately involved in the process.
4. What kind of experience do you envision for patients, visitors, and staff?

These questions are a good starting point, but the best way to help a group collectively come to an agreement on aesthetics is to let them see an aesthetic for themselves. You can accomplish this through visits to other healthcare facilities or by reviewing photographs of them. Hospital staff need to visualize the possibilities, and they also need to see specifically what they do not like. These examples can then be used as the foundation to guide designers to develop the right aesthetic for the facility.

Key Design Elements

Although functionality should be at the forefront of the designer's mind, interiors do not have to look "funcstitutional" —just because a space needs to be functional does not mean it needs to look institutional. Although functional, the classic patient room with fluorescent lighting, wallpaper border, and uncomfortable furniture does not measure up to current standards. And throwing a patterned pillow on a bed and hanging a curtain on a window does not fix the problem. Comfort and aesthetics need to play a large part in the functionality of a room and need to be considered equally important.

For example, a child might feel out of place and a bit overwhelmed in a large patient room. By providing positive distractions such as artwork, colored walls, and child-like accents, the child's mood might be altered, aiding in the healing process. The function of a patient room is to provide a healing space. If the interiors and aesthetics promote healing, then the interior designer has succeeded in providing an aesthetic that complements the function of the space.

Positive distractions, lighting, color, finish materials, furniture, and wayfinding are key design elements that define how comfort and aesthetics can play various roles in the overall hospital aesthetic.

Positive Distractions

A key phrase mentioned throughout this chapter is providing a "positive distraction." This positive distraction can be a fireplace, strategically placed artwork, a game table with a puzzle partially complete, or even access to the outside via a patio or large window. These simple distractions can assist in altering a person's frame of mind and play a key role in successful healthcare aesthetics.

Art in architecture is perhaps the most evident positive distraction a designer can provide. Art comes in various forms—paintings, sculptures, photography, and so on—but in healthcare interiors, it all follows the same premise: to inspire and support healing. This premise is not represented in the literal sense (that is, by showing people healing in the art) but rather by providing positive and simple works of art that are both familiar and inspiring.

Many healthcare administrators and designers question if abstract art is appropriate in a healthcare setting. The consensus among most interior designers is that abstract art, if used, should be considered for the more public areas of a hospital rather than for patient care and waiting spaces. In the intimate setting of a patient care space, no one should have to sit down to try to understand a piece of art, because that process can be frustrating. However, abstract art can be very successful in a lobby transition area where people can connect with the art on a more observatory level (see photo 2.1 in color insert).

Roger Ulrich, a pioneering researcher on the use of art in hospitals, believes that because abstract art is ambiguous and open to interpretation, if a patient feels poorly, the interpretation is likely to be frightening, which could trigger negative feelings (Friedrich, 1999). Also, if human-shaped figures are used, they should be ambiguous. For example, if a cancer patient who recently lost her hair sees a painting in a hospital of a woman with long flowing hair, this painting could be perceived as disheartening to the patient and lead to a negative mindset.

More than anything, art and positive distractions provide a connection to humanity. Art is a very human thing, done by another human being and created for others to enjoy. It has, therefore, an innate wonder and warmth. Architecture puts materials together for a function. Art is, in and of itself, created solely for someone else to look at and enjoy.

Lighting

Proper lighting is critical in a healthcare setting where people's lives are in the hands of professionals with trained eyes. The eyes need to see, and the eyes need appropriate light to see well.

Although lighting comes in two forms, artificial or natural, natural light has no benefits over artificial for the performance of visual tasks (Boyce, Hunter, and Howlett, 2003). However, as noted later in this paragraph, some studies have shown that natural light offers both patients and caregivers substantial health benefits—physical and mental—that coincide with a general economic benefit to the facility. Interior designers often get requests to "bring the outdoors inside" to create a connection with nature. Natural lighting is a key tool in creating this connection. By aiding in the body's natural circadian system, which is the innate biological clock that regulates sleep and waking and controls the daily swings in emotion, natural lighting bridges the gap between indoors and out. Natural lighting is specifically beneficial to patients who have long hospital stays because they have the ability to look out their windows to see the time of day and observe the weather. Studies also show that natural daylight reduces depression among patients with seasonal affective disorder and bipolar depression (Benedetti et al., 2001); decreases length of stay in hospitals (Benedetti, Colombo, Barbini,

Campori & Smeraldi, 2001; Federman, Drebing, Boisvert & Penk, 2000: Beauchemin and Hays, 1996); improves sleep (Joseph, 2006); lessens agitation (Lacgrace, 2002); can be used to treat hyperbilirubinemia among infants (Ulrich, Zimring, Joseph, Quan, & Choudhary, 2004; Miller, White, Whitman, O'Callaghan, & Maxwell, 1995); and eases pain (Walch et al., 2005). Although natural lighting is ideal, it is sometimes hard to control and can cause uncomfortable glare and heat.

Building orientation and fenestration design—design and placement of windows in a building—are critical components in maximizing the amount of useful daylight available to patients and other building occupants (Personal communication, Trevor Hollins, December 20, 2008). Hollins, a lighting designer, says careful consideration must go into window orientation, size, and location and to the selection of proper shading solutions like overhangs, vertical fins, light shelves, or even environmental objects, including mature trees or nearby buildings. Only properly designed spaces along the exterior of the building can take advantage of the benefits of natural light; areas closer to the building's core must rely on electric sources. When electric sources are used, they should have the highest possible color rendering index and an appropriate color temperature.

Evidence-Based Lighting

Two questions that should always be asked when starting the lighting selection is, "What visual effect will the lamp selected have on the space that is being designed? And, "Will it affect the room in a positive manner?"

The final lamp selection will be affected by two lamp properties: Color Rendering Index (CRI) and Correlated Color Temperature (CCT).

The CRI relates to the ability of a light source to accurately reproduce colors. There is a color shift that happens when an object is observed under different light sources, and this shift can be negative if the CRI of a light source is low. Think of the way an object looks under direct sunlight (CRI 100) and the way the same light looks under a yellow street light (CRI 60). A CRI of 100 is very good; a CRI of 0 is very bad. When selecting light sources, the highest CRI possible should be selected.

The color of white light can vary greatly. In order to classify the hue of white light, all lamps are rated using CCT. A light bulb that produces light perceived as yellowish white will have a color temperature of around 2700K. As the color temperature increases to 3000K-3500K, the color of the light appears less yellow and more white. When the color temperature is 5000K or higher, the light produced appears bluish white. Unlike CRI where the higher the number the better, the CCT selection of a light source is a subjective process. The majority of applications in hospitals use lamps in the 3500K to 4100K range. The best way to select CCT is to base the color selected on the finishes being used in a hospital. Comparing the finish boards under lamps of the same source with different CCTs will allow the designer to select the color temperature that is most complementary to the building. For most modern hospitals, this CCT will be around 3500K.

The CRI and the CCT standards have been adopted by most hospital designers to provide neutral lighting with good color rendering. This helps ensure that skin tones will not be misleadingly altered and also provides a soothing environment for patients.

Designers have the responsibility to alleviate the apprehension that comes with a hospital stay by creating environments that are calming and make people look the best they can. For this reason, a good amount of high-quality indirect light in hospitals is important. Direct light, which has been the default for many years, can cause dark walls, which make spaces seem confined and serious. Direct lighting can also cause harsh shadows under patient's eyes, thus making them appear more ill than they really are. Indirect light, not necessarily artificial, delivers a more relaxed atmosphere. The use of high window placement and the proper use of shading, such as light shelves, can give a space a high level of quality indirect light.

Corridors should be illuminated with a combination of indirect and direct illumination. If a patient is being wheeled on a gurney down a corridor with direct lighting, the patient is rhythmically passing under bright lights that not only cause discomfort from the glare, but also cause the patient to see spots as an aftereffect of the high luminance of the lamp. A patient being wheeled down a corridor illuminated entirely by indirect light, however, does not experience these glare issues.

Color

Color is the most subjective element of aesthetics. Color is subject to gender preferences, generational preferences, geographical preferences, and even cultural preferences. For example, red symbolizes good luck in China, whereas western cultures use red to symbolize danger. Understanding the community, employee, and patient populations served by the healthcare facility can help determine colors to avoid or incorporate.

Many healthcare designers share an understanding that natural, warm, and cool colors are most fitting for healthcare environments. The inspiration stems from commonly used palettes found in the hospitality and spa industry. But according to Tofle, Schwarz, Yoon, and Max-Royale (2004), no clear evidence proves a certain color makes a difference in patient health, staff effectiveness, or healthcare facility efficiency.

A summary study by Young (2007) indicates not enough evidence exists to promote a relationship between environments painted in particular colors and patient healthcare outcomes. Although previous studies have shown that color-mood association exists, no evidence suggests a one-to-one relationship between a color and an emotion. Certain colors can evoke a sense of spaciousness or confinement, but the perception of spaciousness is attributed to the brightness or darkness of color and is influenced by contrast effects, particularly brightness distinctions between objects and their background (see photo 2.2 in color insert).

Since most guidelines and design decisions are based on personal beliefs, there should not be universal guidelines for colors in healthcare settings. The complexity of user groups and the multiple uses of the environment make efforts to prescribe universal guidelines fruitless.

Young (2007) also concludes the judgment of color in certain settings is a result of multiple layers of experience. Reaction to color is based on perception, cognition, and physiology. So, analysis of color in any environment means respecting other kinds of processing forces, such as culture, time, and location.

Color choice should ultimately be determined by the guiding principles developed by the design team and hospital staff—principles that take into consideration the gender, generational, cultural, and geographical preferences often associated with color.

Textiles and Materials

The key to a long-lasting aesthetic is using the most durable and pleasing products available. This is not always as easy as it sounds and requires a constant balance between budget and material cost. Many materials are proposed in the planning phase where the "life-cycle cost" of the material is compared to the first cost. For example, a client selected a plastic laminate countertop over a better product because of the initial cost. Shortly after the facility opened, the client reported a problem. The plastic laminate countertops located near sinks were delaminating. The areas were replaced with a solid surface material. Although the initial cost was more than plastic laminate, the solid surface material would have saved money on long-term cost and maintenance.

Cleaning is an obstacle at any institution. Together with the facilities and maintenance staff, the designer can work to find the best material for the application. No finish is self-cleaning, and all require some sort of maintenance. Using rubber flooring and linoleum flooring has become popular in the healthcare setting because they are durable and sustainable, require minimal maintenance, and are available in European color trends. Products manufactured in Europe usually have more progressive color palettes that require 2 or more years to become accepted in the U.S. mass market. But understand that these products still require cleaning, upkeep, and can even require an occasional "finish coat." Flooring receives the most wear in a healthcare facility, so allocating an appropriate budget for that product is imperative.

Many materials are appropriate for a healthcare setting. So, how does one choose from the list? Criteria used to select finish material can result from asking the following questions:

- Is the area used 24 hours a day?
- What are there code requirements for specific materials?

- What is the maintenance program in place and can the client maintain the proposed product?
- What is the level of wear and tear in the institution for the public and staff?
- What is the planned protection for walls, doors, and so on?
- What is the material application and traffic pattern? In some cases, a more delicate finish can be used in public spaces with lower traffic flow and/or open spaces that might not be touched.

Also keep in mind that many materials "ugly out" before they wear out. Careful planning and selection of materials benefit the aesthetics in the long run. Material selection and noise control go hand in hand. Soft surfaces (carpet, ceiling tiles, fabric wrapped panels, etc.) have a higher rate of noise absorption. Strategically placed materials can have a profound impact on the quality of the experience from the perspective of the staff (easier to concentrate and fewer incidents of information transfer), the patient (easier to sleep and/or rest), and the visitor (the environment is perceived as less chaotic) (Moeller, 2005).

Hospital interior designers are taking inspiration from the fashion and hospitality industry, and you can see this inspiration reflected in the patterns used on carpets, walls, furniture, and cubicle curtains. Bonnie Momsen Brill, vice president of marketing for Architex International, says simple textiles are the best option. Simplicity, without being too cold, creates a calmer space that's simple and easy to understand. Too many different textile elements can be distracting and create too many different things to focus on. The coordination of textiles throughout the interiors will make a big difference in the way the place feels (Personal communication, Bonnie Momsen Brill, December 19, 2008). How materials are actually applied is also very important. Designers often look for the most permanent materials (hard surface flooring, door finishes, stone, etc.) to be the anchors of the palette. Materials easier to replace such as paint, upholstery, wall coverings, and textiles are often used as accents.

Furniture

When selected and placed well, furniture can appear to be custom-made to fit the interior space. It can also help reinforce the guiding principles for the project, foster collaboration among caregivers, provide support and comfort, and promote interaction. Just as was the case with materials, performance and maintenance should be the first criteria for furniture.

Furniture finishes have a varied range but include wood, metal, laminate, and composite materials. Consideration of the area of use can lead the designer to the correct selection of a finish. Furniture scale (the size relationship to the interior space) and designer layout are important factors. The right scale visually fits into the space but also includes a comfort factor. Often, a waiting room is planned for the highest volume projections, and therefore, the seating area looks like a sea of identical chairs. Instead, consider providing space for television viewing, quiet reading, knitting, or computer work. Seating needs to accommodate a variety of bodies as well. Recliners; single-side chairs; lounge chairs in single, loveseat, and sofa lengths; and specialty needs (hip chairs, seating for children, etc.) should all be considered (see photo 2.3 in color insert).

Good furniture planning can give life to large waiting spaces. Creating sanctuaries within the space has become widely accepted by the healthcare community to foster interaction or privacy when desired.

Wayfinding

Visitors want to reach their destination within a hospital as quickly as possible and get quality and prompt service without confusion or question. Wayfinding solutions strive to help that by making the navigation of a hospital pain free and positive. Wayfinding is a subliminal tool used in healthcare interiors that delivers an experience free from frustration and stress for visitors and staff by providing pertinent and memorable information at critical locations. The objective is to provide the “big picture” to the first time visitor through

a variety of cues, including signage, landmarks, maps, human sources of information (information desks), directories, shape, color, texture, light, and sound. Using a consistent and logical layering of cues creates the best opportunity for visitors to orient themselves to the facility (see photo 2.4 in color insert). The layering also allows for a variety of people, languages, and cognitive abilities to absorb and process the information.

Spatial organization is considered the most important piece of good wayfinding design because it makes the space easier to understand. Identifying zones in a building, creating clear sightlines from vantage points, and organizing the different areas can promote and improve wayfinding.

Different strategies are used to solve wayfinding problems. The strategy used reflects cognitive processes about and the proclivity toward wayfinding as well as what is available in the environment. Generally speaking, strategies fall into two categories: route, or linear, strategy and orientation strategy.

Route or Linear Strategy

This strategy uses point-to-point information. For example, using route or linear strategy, a person would obtain directions from point A to point B. If they needed to go farther, they would obtain directions from point B to point C, continuing in a linear fashion.

Orientation Strategy

This strategy uses sources of information so individuals can orient themselves. A map is a good example of this type of orienting information.

An example of an effective wayfinding strategy is a large and unique fountain. There can only be one of these within the building for it to be effective. The fountain serves as one point in a set of points in giving directions. For example, go to the fountain, take a left, and so on, and it can also be used as a point of reference or pivot point in the orientation strategy.

In a building with multiple entry points (see photo 2.5 in color insert), each entry should provide a unique feature specific to that location. This feature not only serves as a cue on entry, but more importantly, it provides assurance to the visitor on the exit. Audio chimes or voice overlay at entrance portals can be an additional layer of information, for example, "You are now entering through entrance four." Depending on the scale of the building, each floor can also be developed with a specific visual story or theme that is layered and integrated with interior finishes, artwork, and color. The combination and coordination of these elements serves to knit the entire visual story together.

Lighting is another opportunity to aid navigation. Based on the level of illumination in an area or pathway, the designer can deter or encourage its use. People are generally drawn to light, so a reduction in light levels, along with changes in the finish level of floor and wall materials, can be used to reduce traffic into areas that might be considered off limits. These areas considered "back of house" or "offstage" generally are for staff use. Light and finishes properly used can save visitor frustration and staff time in having to redirect visitors. Conversely, lighting can dramatically enhance features and colors to draw them out of the visual palette and reinforce the wayfinding story.

The process of designing effective wayfinding delivers solutions based on thoughtful analysis, observation, and interviews with various staff and visitors that make things as simple as possible for visitors.

Product Development

In the design world, you often face difficulty when searching for products to meet each client's individual needs. Product development stems from a need for something better. Whether it is the need to work more efficiently with a new caregiver workstation or the desire to have textiles that not only look good but work well, healthcare products are developed to meet the needs required by the ever-changing healthcare market.

Many assume a designer's main goal is to make things look beautiful. While visual appearance is extremely important in design, it ranks after

the practicality, functionality, and durability of the products. The list of healthcare interior products available is mind boggling; unfortunately, finding the products that are able to withstand the wear and tear that is often associated with healthcare facilities is not easy.

Interior designers and healthcare staff are sometimes frustrated with the products being developed by manufacturers for the healthcare market. The consensus among some designers has been that patterns, functions, durability, and colors have not progressed and kept up with the trends of hospitality, fashion, and other design influencers. Therefore, staff at HDR Architecture, a leading healthcare architecture firm, responded to these issues by teaming with manufacturing companies to develop healthcare products when they could not find one available to meet the needs of the client.

Design Collaborations

The following examples demonstrate how collaboration with the right people at the right time can lead to better healthcare products.

Caregiver Workstations

The SYNC healthcare furniture line, designed by HDR Architecture in collaboration with Nurture by Steelcase, is a caregiver workspace solution that addresses the emerging needs of caregivers by connecting people to technology and people to people. In essence, SYNC is a product meant to replace the antiquated built-in nurse stations and systems furniture solutions that have been used for decades (Trevarrow, 2008).

The need for a system such as SYNC had been apparent for some time. With fewer caregivers, more demands, and faster-paced healthcare environments, employees needed to accomplish twice as much as quickly and efficiently as possible. Additionally, they also needed a product that encouraged collaboration among medical professionals and allowed the use of advanced technology without

letting wires and equipment hinder the work process (see photo 2.6 in color insert).

During the first meeting with the product team, designers decided the new product needed to blur the lines between architecture and systems products. It needed to be a "universal workstation" that provided the opportunity to shape spaces differently to allow group work, to support technology, and to be competitively priced. After the criteria for the product were determined, the design, or "big idea," came next.

The design for the product was handled much like a design competition. All team members were given two weeks to sketch design ideas for consideration. After all of the designs were submitted, the team voted on the strongest designs. In this case, two "big ideas" were selected for further development, which entailed building foam core models of the products for evaluation. At this point, to be successful, the team put aside any egos associated with the two ideas and invested all concentration into improving the design, function, and salability of the final product.

Because SYNC was a product to be used by other design professionals, the team needed to put in place methods to validate the concept and product as a whole. This was achieved first by inviting a healthcare architect from HDR unfamiliar with the product thus far to review the concept and comment on its design and use. Next, the team did a formal validation of the concept by inviting healthcare designers from some of the nation's top healthcare design firms to review the product. To eliminate bias, the design firms did not know who created the design.

Overall, they were extremely impressed with the SYNC product and concept. This reaction was tremendous validation and gave the project team the green light to move into the final product engineering. As soon as the product was created, the team asked staff from several architectural offices to review the product line and do "test-to-fits" with the product in current projects.

The initial meeting for this collaboration occurred in December 2006. The product was ready for market in the spring of 2009. SYNC is the outcome of collaboration with a firm that had extensive practice in designing and planning caregiver workstations (personal communication, Michael Love, January 24, 2009). The SYNC healthcare furniture line has been honored with numerous awards, including a prestigious Nightingale Award for product innovation from *Contract* magazine and a "Best of Year" award by *Interior Design* magazine.

Textile Collection

In this example, designers desired to break away from the "healthcare" patterns found in typical materials. Finding beautiful patterns with fresh colorations in textiles and materials that could withstand the rigors of a healthcare setting was a constant struggle. The Remedé Textile Collection, designed by HDR and offered by Architex International, was a response to this concern.

Designers first considered performance qualities when collaboration on the Remedé Collection began in 2005. When the product team met for the first time, they considered the problems the healthcare field was facing and what designers were looking for. They identified two main problems: the lack of durability and cleanability. These two issues helped place the product focus on designing a line of high-performance fabrics, easily cleaned, with a forward-thinking design (see photo 2.7 in color insert).

The goal of the collection was to create textiles that could soothe the spirit and create a visual oasis within healthcare environments. The team needed to create patterns in a range of performance technologies and color palettes to provide unlimited opportunities to create spaces for reflection and celebration. Additionally, these products needed a durable finish and a level of cleanability that could withstand even the harshest settings.

The Remedé Collection includes a spectrum of options that enables a design group to choose among varying capabilities and coordinating

fabrics for maximum flexibility because meeting every criteria a hospital might have with one fabric is difficult if not impossible. This textile collection is the first in the industry that has all types of fabric elements.

Patient Room Amenities

Another collaboration, this one with Peter Pepper Products, Inc., an accessories manufacturer with a strong focus on the healthcare market, resulted in the development of two patient room accessories designed to improve amenities and convenience for both patients and their families. The Guest Center provides an adaptable environment for family, caregivers, and visitors. It combines a work surface with storage, a task light, and a power receptacle for convenient phone, laptop, and MP3 player charging. The modular panels accommodate options, including specialty materials, tack panels and writing surfaces, and areas for mounting a flat-panel monitor, artwork, or accessories. An optional top shelf displays comforting cards, flowers, or other personal items. The Guest Center is wall-mounted, requiring minimal space (see photo 2.8 in color insert).

The Message Center was created to improve patient communication. By integrating a glass writing surface, analog clock, shelf and pen storage, the center reduces clutter while using minimal wall space. Staff can communicate relevant schedules to the patient by circling the time they will be having a test, or when they should ambulate while the lower glass is ideal for other messages. A versatile card retainer and top shelf is suitable for holding cards and other personal items.

The process of collaborating with HDR on new concepts for patient room amenities proved to be a successful venture with the development of the Guest and Message Center products. The HDR team from several offices pooled their collective experience addressing the need in the patient room to consolidate several functions into one product. The design objectives included de-cluttering the environment while addressing the basic caregiver, family, and patient needs for

communication, display, storage, and convenient work surface. Several rounds of product ideations resulted in a functional, adaptive, and aesthetically pleasing group of products (Personal communication, Kip Pepper, Vice President of Sales & Marketing for Peter Pepper Products, Inc., January 26, 2009).

Developing products such as those just mentioned requires time and effort on the part of every team member. In each of the examples presented, there was a real need for a better product. In all examples, the team validated the need for the product, set guidelines for its development, developed it, and then asked the industry for validation.

Case Examples

Words are meaningless until they are actually put into action. The following case studies examine aesthetics and demonstrate how the key design elements discussed throughout this chapter—and others—impact the overall aesthetic of each environment. The process used to create the aesthetics is also examined.

Sentara Williamsburg Regional Medical Center, Williamsburg, Virginia

Sentara Williamsburg Medical Center is a 139-bed, 310,000-square-foot replacement hospital located in the heart of a recently developed 120-acre wellness campus in Williamsburg, Virginia. The design team gave careful consideration to the interiors to create a design that embraced the human desire for aesthetics, art, comfort, and warmth due to the center's affiliation with the National Planetree Alliance. (The Planetree Alliance is a nonprofit organization of hospitals and healthcare institutions. It was founded in San Francisco, California, in 1978 and is now headquartered in Derby, Connecticut. The organization seeks to improve patient care through practices that make the medical experience less intimidating for the patient and their family.)

After conducting an interior design retreat, designers determined that the interiors of the new medical center needed to embrace the

spirit, body, and mind of its patients and community and needed to be customer-oriented, comfortable, soothing, and welcoming to all. The design team drew inspiration from the historic Williamsburg community and created a hospitality-inspired environment that is aesthetically pleasing and patient-focused. The Planetree approach to the aesthetics was implemented so successfully that the hospital was featured at the 2007 Planetree annual conference.

Visitors and patients who walk into the lobby of the medical center are greeted by a towering water sculpture with warm metal planes that pull attention upward into the light-filled rotunda. Water features affect all five senses, and in this case, the water feature became a beautiful piece of art and focal point of the lobby space. Furniture in the lobby is arranged to promote family interaction, and a warm neutral color palette complements the scenery viewable through the lobby's numerous windows.

The first two levels of the building form an ancillary base. The departments are organized along two parallel and curving circulation spines to support the concept of "on-stage" and "off-stage" circulation. Patients and staff move along a rear corridor with natural light and views. Thoughtful lighting and detailing of the ceilings soften the experience of moving through medical spaces. The front circulation spine, which connects important public nodes, is graced by numerous windows and views into the outdoor gardens. Registration, waiting, and other outpatient-focused services, such as cardiology and imaging, are located just off this spine near the rotunda for easy wayfinding.

Triangular-shaped patient floors on the top two levels are joined by a large, curved glass element that contains public waiting and family spaces. Glass and brick stair towers accent the opposing points on the two triangles.

This arrangement implies arms outstretched for a welcoming embrace. The expansive use of glass is an important design element for the interior, and many of the carefully designed corner windows form vistas for the interior corridors (see photo 2.9 in color insert).

All patient rooms are private and appropriately sized for family involvement. Wood-look vinyl flooring and DuPont Corian solid-surface countertops aid in making the patient experience more hospitality driven. Additionally, the design team used two tones of wood flooring to emphasize the family zone as a distinct space within the patient room. A large window provides natural lighting and a connection to the outdoors. Art niches are also built into the walls, both in the patient rooms and throughout the hospital corridors, to incorporate art as a positive distraction and add depth to the interior space.

The successful aesthetics of the hospital, coupled with the overall facility design, helped raise the hospital's patient satisfaction score, as measured by NRC Picker, from the 17th percentile to the 81st percentile nationally (Eagle, 2007). Contemporary architectural and medical innovations are consistently complemented throughout the hospital by soothing color palettes, natural materials, ample daylight, and outdoor views—a sensitive physical environment conducive to patient-centered care (see photo 2.10 in color insert).

American Family Children's Hospital, Madison, Wisconsin

American Family Children's Hospital is a 380,870-square-foot, state-of-the-art hospital located in Madison, Wisconsin. Prior to the opening of the new facility, the specialty children's services were dispersed throughout the University of Wisconsin Hospital and Clinics and did not have their own collective identity. Because children have unique emotional and physical needs, the hospital's leadership team believed that a new hospital focused on providing world-class healthcare to children was necessary.

The state of Wisconsin encompasses a broad host of unique industries and diverse geographical regions, so the aesthetic of the interiors was developed around "All Things Wisconsin." Designers divided areas of the hospital according to natural features within the state. Although the interiors followed a whimsical theme, the design team was clear not to make the aesthetic childish, but instead child-like by infusing positive distractions throughout each themed floor.

For example, on the first floor a faux sugar maple tree, a movie theater with full-sized flashing marquee, a Fond du Lac lighthouse replica, and a guest reception area modeled after an old-fashioned train station all recreate small-town Wisconsin (see photo 2.11 in color insert).

On the second floor, milk bottle-shaped pendant lights, corrugated tin wainscoting, a tree house reading nook, and tractor tire play forms pay homage to the farmlands of Wisconsin (see photo 2.12 in color insert).

The third floor focuses on the Lake Michigan area of Wisconsin. Nautical lights, a mural scene of the lakeside, water and beach floor patterns, and an aquarium welcome patients and visitors. Buzzing prairie bug lights and backlit acrylic panels featuring real, suspended native grasses represent the prairies found throughout Wisconsin and are prominent on the fourth floor (see photo 2.13 in color insert).

On the fifth floor, branch and fallen leaf floor patterns, leaf-adorned pendant lighting, and backlit acrylic panels (with actual wood ferns) take visitors on a journey into the North Woods of Wisconsin (see photo 2.14 in color insert).

The color palette for the clinic is decidedly livelier, with vivid hues that can be found on everything from ceiling tiles to floor patterns and furniture. More important than the colors and positive distractions, though, is the focus the design team placed on including family in the healing process. At 250 square feet each, patient rooms are double the size of previous rooms, providing more than enough space for families to participate in the caregiving process. Inpatient rooms also include a family sleeper sofa (specifically designed by the manufacturer based on family feedback), large wardrobe cabinets for family storage, and a flat screen television with DVD player. A small workstation with data jack and its own lighting allows parents to stay connected to the outside world without disturbing a resting child. Custom mirrors with nightlights and focused lighting at a staff writing surface provide gently diffused light, and large window expanses in each patient room provide for a healing connection to the outdoors (see photo 2.15 in color insert).

Additionally, thoughtful touches, big and small, make this facility one of a kind. Theater lighting provides a dramatic touch throughout the main lobby, and echo labs and radiology rooms have awe-inspiring ceilings full of fiber optic lights, designed to distract children from unfamiliar and often scary environments and equipment. The salon-like, playful Positive Image Center, the only one of its kind in the nation specifically designed for children, eases a patient's anxiety about appearance-altering illnesses. From wigs to makeup application, the center supports each child in a way that responds to individual physical and emotional needs and desires (see photo 2.16 in color insert).

By extensively using positive distractions and other design elements geared toward children, this magical facility has successfully translated hopeful visions into a spectacular reality. One patient's mother said, "It's so big and bright and open; it's just a happier place."

Saint Alphonsus Regional Medical Center Patient Tower, Boise, Idaho

The Saint Alphonsus Regional Medical Center Patient Tower is a 9-story, 400,000-square-foot acute care facility. The project was conceived, designed, and constructed to reflect the growing national trend toward healthcare facilities that improve patient healing and provide privacy, comfort, and safety. It is also designed for the well-being of staff and patient families.

From the start of planning and design, hospital administrators and staff agreed that the hospital needed to be both healing and therapeutic. An integral part of this belief was the understanding that art holds the potential to ease pain and stress and to lift the spirits of patients, staff, and family. This belief led the design team into a close relationship with a local art consultant to make art a major focus in the hospital. The art consultant aided the design team in selecting pieces of art that focused energy away from psychological stress and toward positive emotions. Regional artwork was selected to give the hospital a sense of place and familiarity and to create a connection to humanity.

The lobby is a warm and textural space with an emphasis on a simple combination of honed granite flooring, textural wall plaster, and a honey wood finish. The volume of the lobby connects the public circulation space between the first and second floors. A two-story water wall, which is tucked behind the monumental stair, is featured in the lobby. The combination of the calm associated with cascading water and the impressive nature of the fountain's size make this a focal point in the lobby. The movement of the water wall is complemented nicely by the glass, suspended sculpture. The glass pieces move ever so slightly and glisten in the lobby. The viewing angles of the piece are endless, making it fascinatingly unique (see photo 2.17 in color insert).

A restful space welcoming to all religions but paying homage to the Catholic faith was created for the chapel. The warm, rich wheat color permeates the upholstered walls, a design feature used to aid in sound absorption. The layout is flexible to accommodate various activities. A terra cotta marble path assists with wayfinding, leading the visitor to the meditation garden. Local art is a signature element in this space, starting with the glass doors, stained glass and holy water fount divider wall, stained glass exterior window, wood cross, and alter. The handcrafted feeling of the art pieces helps the visitor feel welcomed and not alone in the room.

Hospital administrators and staff requested there be privacy, noise mitigation, and a sense of control in the waiting rooms. To accomplish these goals, the design team used wood and decorative dividers to break the room into smaller areas. Each area has flexible furniture, a positive distraction (fireplace, television, window to exterior, recliners, etc.) to allow the waiting family member a choice. The natural leaf pattern carpet sets off the elegance of the wood dividers. The lighting is indirect where applicable, being controlled by a lamp by the waiting family member. Furniture is wood framed and echoes the comfort found in the home. In addition to lounge chairs and loveseats, game tables, recliners, children's furniture, and hip chairs are all provided to appeal to a wide audience (see photo 2.18 in color insert).

Final Thoughts

In the past, healthcare aesthetics were driven by cost and often appeared to be layered on a facility. Today, designers look for ways to integrate elements of aesthetics into the healthcare environment where the use of light, color, artwork, signage, and attention to detail sets the tone for a functional and therapeutic environment.

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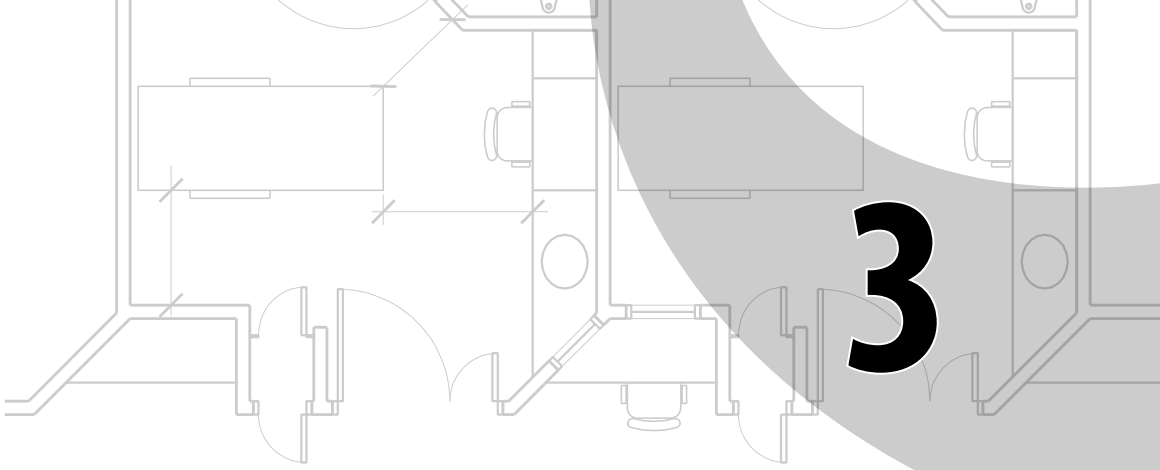

3

Healing Environments

By Barbara Dellinger

The concept of healing has broadened dramatically in the last century; this has resulted in striking changes in the design of healthcare environments and a positive effect on the healing process of individuals. In the past, the design of healthcare environments was targeted mainly for the benefit of physicians and nurses; however, the central focus of environmental design today is directed toward patients and their families. Subsequently, staff have reaped the benefits of working in these improved surroundings. To ensure the designs remain effective, those who plan and design healthcare spaces must remain attentive to any evidence that verifies the effect of healing environments on patients, their families, and healthcare personnel.

Healing Environments: What Are They?

Generally, healing environments are considered to be:

- A place to heal the mind, body, and soul.
- A place where respect and dignity are woven into everything.
- A place where life, death, illness, and *healing* define the moment and the building supports those events or situations.

Frequently, administrators and staff in many healthcare organizations lack a clear idea about what constitutes a healing environment. Some believe a few cosmetic renovations, such as new flooring or a new color palette, qualify as meeting one of the elements of a healing environment. Even though such changes might make a facility more attractive, alone they do not create a healing environment. Author Eileen Malone states: "Leadership must make a commitment to the principles behind creation of the healing environment and ensure that these principles are incorporated into their entire organizational culture" (Zimring et al. 2008).

The Center for Health Design has clearly defined evidence-based design (EBD) as "the process of basing decisions about the built environment on credible research to achieve the best possible outcomes" (The Center for Health Design, 2009). A few years ago, little research existed to indicate the connection between healing environments and positive patient outcomes (McCullough, 2001, p. 111). There is now a growing body of research with more than 1,000 papers relevant to the relationship of design to outcomes, including topics such as patient safety and stress reduction for patients and staff (Hamilton, 2008; Zimring, 2008). Zimring (2008) notes, "It is now widely recognized that well-designed physical settings play an important role in making hospitals less risky and stressful, promoting more healing for patients, and providing better places for staff to work" (p. 63).

Their review of 450 empirical studies was based on an initial keyword search. Of these 450, 320 articles met their criteria for inclusion in the study, and 270 were actually used for the report and cited. It is clearly good news that the number of empirical studies is growing each year. Do gaps in the desired research findings still exist? Yes. But this gap will slowly narrow as more and more people conduct relevant empirical studies (National Association of Children's Hospitals and Related Institutions/Center for Health Design, 2008).

Some still argue that just using EBD techniques does not necessarily make the environment a healing one. Malkin (2008) emphasizes that research contributes to the concepts that can be used

to create a healing environment, but the inclusion of these elements does not automatically make the setting a "healing environment." The organization and the design team must translate the EBD findings into design solutions for their individual hospitals.

While debate is ongoing about an exact definition of healing environments, many of the basic components of a healing environment have been clearly identified. According to Malkin (1992, p.10), they include:

- Air quality
- Thermal comfort
- Noise control
- Privacy
- Light
- Views of natures
- Visual serenity for those who are very ill
- Visual stimulation for those who are recuperating

Over the last decade, those working with healing environments have expanded this list to include:

- Access to nature
- Positive diversion
- Access to social support
- Options and choice (control)
- Elimination of environmental stressors such as noise, glare, and poor air quality

Patient and staff safety and elimination of stress remain at the top of any definition of a healing environment, but a healing environment is more than a safe building. It is one that embraces patients, visitors, and staff while supporting them during the time they are in the building.

The purpose of this chapter is to describe the stressful effects of environments in many healthcare facilities and how the senses might react to the environment and, in turn, contribute to the stressful situation. In addition, the chapter discusses examples of projects that incorporated EBD principles in accordance with the institution's goals and objectives to create a healing environment.

Effect of Stress on Individuals in Healthcare Environments

Evans (1999) has reviewed the measurement of environmental stressors that potentially impact health outcomes, including noise, crowding, and architectural elements. An individual's appraisal or perceptions of the event rather than the event itself are predictive of the deleterious effects of stress on health and wellness (Joseph, 2007; Smith, 2007). Regardless of the situation, the body's reactions to continued high levels of stress or arousal are part of the General Adaptation Syndrome (GAS), which is the body's natural reaction to too much of anything, including both positive and negative situations. In stressful (negative) situations, the body feels overloaded and fatigue sets in.

When stress continues, the body's reaction may result in illness, memory loss, nausea, and many other problems. Some people have difficulty with logical thought processes while under stress. Physical symptoms, such as a rise in blood pressure and an increase in heart rate and respirations, occur. Because of the "fight or flight" response, the individual's senses might respond positively; however, this response differs among individuals. Sometimes the body shuts down and is unable to return to the neutral state.

Stress levels are increased in hospitalized patients; however, stress is also very intense for healthcare providers. The intense and ever-changing healthcare setting, with its exceptionally high performance standards and demands on employees, often forces dedicated workers to be in a high level of stress for 8 to10 hours per day.

How Design Interventions Can Help Reduce Stress on the Senses

Senses impact the individual's perception of the environment and aid in recovery when a stressful situation occurs. Design is a powerful tool for reducing the stress that impacts the senses of both patients and staff.

Design Interventions to Reduce Stress Due to Sound

Typical hospital sounds—beeping equipment, carts with noisy wheels, overhead speakers and paging systems, loud conversations, and unwanted television chatter—can cause a variety of problems, such as impaired sleep, anxiety, raised blood pressure, and increased need for pain medications. Florence Nightingale first noted this in *Notes on Nursing*, originally published in 1860, "Noise which creates expectations . . . causes damage to the patient. Unnecessary noise then is the cruelest absence of care" (1969, p. 47).

Sound can be minimized or eliminated in many ways in healthcare facilities through proper design of the physical environment. Suggestions include the following:

- Create "on-stage/off-stage" areas so that staff can congregate behind closed doors in lounges or in an enclosed business office. Private or personal conversations can occur without fear of upsetting a patient or family member. In this way, staff can be at their best when they are "on stage" with patients and families.
- Stagger doors to interior work spaces so they are not opposite patient rooms.
- If mirrored rooms are necessary, stagger the medical gas outlets on the headwall and add extra insulation to keep sound in the room.
- Use carpet in the corridors to help absorb sounds and soften foot traffic (see photo 3.1 in color insert).

- Specify high (over 0.80) noise coefficient rating (NCR) ceiling tiles. In a study where subjects were diagnosed with acute myocardial infarction and admitted to an Intensive Care Unit (ICU), Hagerman et al. (2005) reported the use of the proper sound-absorbing tiles lowered blood pressure and heart rate and reduced the incidence of readmission.
- Plan the facility with no or minimal overhead paging systems, staff "quiet rules," and individual nurse call systems.
- If possible, introduce a water feature in the public area as the sound of gently falling water is always calming (see photos 3.2, 3.3, 3.4 in color insert).
- Introduce music as therapy. According to Kemper & Danhauer (2005), music can enhance well-being, reduce stress, and distract patients from unpleasant symptoms. Although individual preferences for music vary, music appears to exert direct physiological effects through the autonomic nervous system.

Design Interventions to Reduce Stress Due to Touch

Research has confirmed much of what we have known throughout history—that touching and being touched are very important to our well-being. Huelat (2007) describes an example of the damaging effects of lack of touch among children in various orphanages. In 1915, pediatrician Dr. Henry Dwight Chapin, in a report on children's institutions in 10 different cities, reported that these children were literally dying, and in fact, all but one child under the age of 2 died. After eliminating nutritional problems and diseases as the cause, those examining the problem found that sanitation "rules" prohibited caregivers from touching or even handling the children, and most died (Ornstein & Sobel, 1997, p. 42).

Massage is a great healer and has been identified as a therapy in most cultures around the world throughout the ages.

In addition to using the benefits of physical touch to help relieve stress, organizations can make use of the tactile appeal of fabrics and textures. Fabrics with a soft feel can replace hot and sticky vinyls. Carpeting can provide a feeling of coziness, and even solid surface counter tops have become synonymous with a luxurious feeling.

Design Interventions to Reduce Stress Due to Sight

For most people, first impressions influence how we feel about a particular person or place. A run-down, crowded waiting room in a clinic with a vinyl tile floor and ugly or torn chairs lining the walls are probably *not* a calming sight to most people.

Clearing the visual clutter from a typical hospital is important. Whether the unsightliness is truly clutter (such as beds, carts, or IV poles stored in a corridor), unfamiliar equipment, or seldom-used medical gas outlets that can be viewed by the patient, being cognizant of what the patient sees can assist in the revision of the patient's environment. Careful planning for adequate storage of mobile equipment and extra beds so they are kept out of sight is essential. Providing a hospitality-like environment where patients feel cared for the moment they enter the facility can be well worth the upfront costs. Features can include the following:

- Appropriate carpet.
- Wood and wood tones.
- Harmonious colors and a unified color scheme throughout the facility.
- Comfortable seating arranged in groups for families to talk in private.
- Abundant art.

Think about everything patients see, from the minute they walk into the facility until the minute they leave. Create an experience for them.

Another important intervention that can reduce sight stress is a logical and well-coordinated wayfinding program, supported by staff education to reinforce that their words and phrases match the signage.

Design Interventions to Reduce Stress Due to Smell

The sense of smell can immediately recall events that occurred years ago, good and bad, and trigger similar physiological reactions. As soon as the mind associates something with a smell, that association is difficult to erase. In addition to the institutional look of older healthcare facilities, patients usually remember unpleasant smells they experienced during the hospital experience.

Advanced air filtration systems can keep the air cleaner; however, many smells reach the patient before they can be removed. Many hospitals are instituting "green" cleaning methods, meaning they no longer use products that contain toxins or can be harmful. Wax, heavy-duty cleaners, disinfectants, and other chemicals often give people headaches and interfere with the healing process.

Design Interventions to Reduce Stress Due to Taste

Unappealing food that is cold by the time it reaches the patient is not acceptable. Be sure to include the planning and serving of nutritious and aromatic food in new healthcare facilities. A 24/7, on-demand type of menu has become standard in many hospitals. In a truly healing environment, patients need to be able to eat when they are hungry, rather than when it is convenient for the dietary department to serve a meal.

Translating Evidence-Based Research into a Healing Environment

The design professional has the responsibility to continually review the literature and appropriately apply research findings to the development of EBD related to healing environments. The goal of creating a healing environment is to reduce stress and, thus, reduce

the problems that arise from it, such as medical error, the inability to concentrate, and the physical symptoms noted earlier in this chapter. Through EBD, you can accurately define which environmental factors help ease stress and make each situation more healing.

According to Eileen Malone, former Commander of the DeWitt Army Community Hospital and, currently, Senior Partner of Mercury Healthcare Consulting, LLC, the Military Health System's (MHS) approach to using research to create a healing environment began with the development of five EBD principles (Personal communication from Eileen Malone, 2007). These principles are reviewed in the following sections; possible suggestions under each principle help create the desired healing environment.

Principle 1: Create a Patient- and Family-Centered Environment

This principle encourages environments for both the patient and the family members. Some examples of successfully meeting this principle include the following:

- Increase social support by incorporating a large, comfortable family zone in the private patient room (see photo 3.5 in color insert), enclosed "team" rooms where staff can talk without fear of being overheard by patients or family members, and employee entrances designed to communicate "you are important" to the employees. Provide private areas where waiting families can congregate. Use sound-absorbing tiles to help keep conversations private and further reduce stress.
- Reduce spatial disorientation. Identify what a person experiences as he or she navigates through the building, and consider how the building's features, such as long, straight corridors versus curved corridors, help or hinder the journey through and perception of the space. Providing views of the outside at the ends of corridors or full-height windows whenever possible help people remain cognizant of their location in the building.

- Improve patient privacy and confidentiality by grouping furniture in waiting areas with dividers between them, by using staggered and screened check-in and checkout areas (see photo 3.6 in color insert), and by carefully placing patient monitoring screens and private areas for consultations and grieving.
- Provide adequate and appropriate light exposure by conforming to the recommendations of foot candles (unit of light intensity) in certain work areas, such as pharmacy or medication areas. Also, access to natural light is crucial for reducing spatial disorientation, elevating moods, and potentially reducing the amount of pain medication needed by the patient.
- Support optimal patient nutrition. The cafeteria should offer balanced, nutritious meals for visitors and staff, and meals for patients should be available on-demand—not only when convenient for the kitchen staff. In large facilities, coffee and snack kiosks or delicatessens can offer nutritious items for convenience or when the cafeteria is closed.
- Improve patient sleep and rest. This point is extremely important in the healing process. Private rooms with carpeted corridors, minimal paging, and ceiling tiles with high sound-absorption ratings help reduce noise and provide the proper environment.
- Decrease exposure to harmful chemicals by using a "green" cleaning program, and conscientiously selecting finishes with low Volatile Organic Compounds (VOCs) to minimize the release of chemicals into the air.
- Eliminate glare and buzzing from fluorescent lights.
- Provide resource areas for families to research their loved one's disease or illness to help them to better understand and feel more in control of the situation (see photo 3.7 in color insert).
- Provide staff lounges and break rooms with views of the outside, comfortable lounge seating for relaxing, and ergonomic seating at computer areas.

- Provide access to nature through exterior gardens and views of the outside (see photo 3.8 in color insert).

Principle 2: Improve the Quality and Safety of Healthcare

Improving safety should be at the top of the goals and objectives in any new construction or renovation. Suggestions from the MHS and other sources include the following:

- Reduce hospital-acquired infections (airborne, contact, and water transmissions). Design interventions that have demonstrated the ability to help reduce nosocomial infections include the following:
    - Locating handwashing sinks in highly visible and separate locations
    - Locating several antimicrobial gel dispensers in patient rooms and exam rooms
    - Increasing use of HEPA filtration systems in patient rooms, emergency exam rooms, and other zones with the most vulnerable patients, such as cancer care
- Provide private rooms for all patients. Private rooms reduce infections and stress for the patient and family members (see photo 3.9 in color insert).
- Reduce medication errors. Provide increased lighting in pharmacies, laboratories, and other areas where high visibility can help minimize mistakes. Decentralized medication administration provided in patient rooms has also been effective in reducing medication errors.
- Prevent patient, employee, and visitor falls.
    - Locating a decentralized caregiver area just outside the patient room, with a window so the caregiver can see into the room, has proven successful for many hospitals (see photo 3.10 in color insert).

    - Using slip-resistant flooring, especially in patient bathrooms, can reduce slip/fall rates.
    - Educating the facilities engineers regarding the use of very large walk-off mats placed directly inside entrances during rain or snowstorms can reduce falls. Some manufacturers recommend at least 30 feet of mat to assure that shoes are completely dry and free of dirt. Handrails along both sides of long corridors might cost more in the beginning of a project but could ultimately save thousands of dollars in healthcare or liability costs if someone falls.

- Reduce noise and improve speech intelligibility. When noise is reduced, people generally process their thoughts more efficiently and effectively (Fick and Vance, 2008; Moeller, 2005). For example, in a busy workroom, a nurse might find it difficult to hear what a doctor is saying if sounds are bouncing around. Carpeting and ceiling tiles with a high noise-reduction coefficient can help cut down on unnecessary sound. Also, eliminating noisy overhead paging systems (except in an emergency) also helps.

Principle 3: Enhance Care of the Whole Person by Providing Contact with Nature and Positive Distractions

Providing connections to nature by offering views to the outdoors and access to gardens can decrease patient, staff, and family stress (see photo 3.11 in color insert). They also provide a temporary distraction from the stress associated with diagnostic and treatment activities. Design elements to be considered include:

- Providing rooms with views of nature can elicit positive emotions, thereby reducing stress and distracting patients from focusing on their pain.
- Providing windows in staff areas can help personnel stay oriented regarding the time of day and weather conditions and can help improve their well-being.

- Providing control over light, glare, and temperature in work spaces helps staff adjust the environment to their own personal needs. Even providing the option of higher light levels for older eyes is beneficial and helps reduce errors and eyestrain.

Principle 4: Create a Positive Work Environment

Healing environments not only contribute to patient well-being, but also to the well-being of the physicians, nurses, facilities staff, and administrators who work in the building. These positive work environments contribute greatly to improved staff recruitment and retention—two critical factors as the healthcare field faces labor shortages. Some of the ways design can improve the work environment are listed below.

- Decrease back pain and work-related injuries and help reduce staff fatigue by installing patient lifts in all patient rooms, designated exam rooms, and procedure rooms.
- Eliminate noisy and chaotic environments by lowering the decibel levels to 35 in patient areas. This is considerably lower than the average conversation at 60 decibels (Fick and Vance, 2008).

Principle 5: Design for Maximum Standardization, Future Flexibility, and Growth

Constant advances in medical diagnostics and treatment modalities, along with their associated technologies, means hospital administrators must have the capability to adapt to these changes efficiently and with minimal investment. Designers and planners can accommodate this need by designing in flexibility. For example, a facility designed around a modular concept is typically most flexible. At the new Fort Belvoir Community Hospital in northern Virginia, four clinic buildings totaling more than 500,000 square feet are being planned. Each clinic will have waiting and reception at one end (with full-height

windows), offices to the rear, and interchangeable offices and exam rooms in the center. This concept is repeated dozens of times throughout the buildings, allowing future programs to expand or contract as needed.

Many design interventions can help create a healing environment. Deciding which aspects of a healing environment to focus on and ultimately measure must be determined on a case-by-case basis. The MHS uses a checklist like the one shown in Table 3.1 so that all constituents keep the goals in mind throughout planning and construction.

Table 3.1 Checklist for EBD Healing Environment

EBD Principle	*EBD Responses and Features*	*Present*	*Comment*
Increase social support	• Create a family zone in patient rooms • Provide family respite locations, such as lounges, meditation rooms, and healing gardens • Provide waiting rooms and lounges with comfortable and moveable furniture arranged in small, flexible groupings • Provide a variety of seating to accommodate the widest range of persons • Strive for a residential, not institutional, look		
Reduce spatial disorientation	• Carefully consider external building cues • Provide visible and easily understood signage (i.e., theme approach) • Use common language in signs with logical room numbering		

EBD Principle	*EBD Responses and Features*	*Present*	*Comment*
	• Provide directional signs before or at any major intersection • Provide "you-are-here" maps oriented with the top signifying the direction of movement		
Provide adequate and appropriate light exposure	• Provide large windows for access to natural daylight inpatient rooms, along with provisions for controlling glare and temperature • Maximize use of natural light • Orient patient rooms to maximize early-morning sun exposure and natural light • Provide high lighting levels for complex visual tasks. • Provide windows in staff break rooms to increase exposure to natural light		
Support optimal patient nutrition	• Provide a design that encourages family participation in patient nutrition • Provide convenient food facilities		
Improve patient sleep and rest	• Use single patient rooms with comfortable beds and bedding • Maximize exposure to daylight • Control noise		
Increase patient privacy and confidentiality	• Use single patient rooms • Provide rooms enclosed with walls in areas where patients would be expected to disclose confidential information • Use high performance sound-absorbing ceiling tiles		

Table 3.1 Checklist for EBD Healing Environment *(continued)*

EBD Principle	*EBD Responses and Features*	*Present*	*Comment*
	• Avoid physical proximity between staff and visitors		
Decrease patient stress	• Provide secure access to nature, such as central green zones and healing gardens • Provide positive distractions that can be controlled by the patient, such as music and art • Provide multiple spiritual spaces and haven areas • Establish a Patient and Family • Design Review Committee		

Positive Distractions

Positive distraction can be anything that helps divert attention, even for a short time, and causes a positive emotional response. Because hospitals are not typically places people go to because they want to, most people feel some level of anxiety. Integrating "wow" features to help distract people from their negative feelings can change a dull or even negative experience into one that is tolerable and possibly relaxing and enjoyable (see photo 3.12 in color insert).

Most positive distractions are based on some form of nature (water, gardens, and other views of nature); however, they can also be constructed items, such as statues, interesting patterns in interior brick or stone on the wall, mosaic tile scenes on walls or floors, and aquariums. Even a beautiful reception desk with wood carving can divert attention. Most positive distractions fall under three primary categories: water features, artwork, and gardens/nature.

Water Features

Water features of various sizes are being designed in hospital lobbies as a welcoming landmark and wayfinding element. Joseph (2006) found that water features have a calming effect and help reduce stress. Unfortunately, many administrators fear that water features will foster and spread disease, even though little proof has emerged concerning actual problems that have occurred (Huelat, 2007, p. 23).

Of course, immuno-compromised patients should not be directly exposed to water features as a rule, as noted in the Facility Guidelines Institute (FGI) 2006 Guidelines. "Where provided, open water features shall be equipped to safely manage water quality to protect occupants from infectious or irritating aerosols" (*FGI Guidelines*, 2006, p. 18).

Healthcare administrators must decide if the benefits of installing a water feature are worth the effort, and many are deciding that it is after doing their own research. They find that if the water feature is designed appropriately, it can offer many positive aspects.

Artwork

Patients and their families judge a healthcare facility by many factors. The appearance of the facility ranks high on that list. Few environments seem complete without art on the walls, and a hospital is no exception. In EBD discussions art generally falls in the "positive distractions" category and, as such, helps bring calm to an otherwise stressful environment.

Planning for the right type of art is important. Kathy Hathorn, president of American Art Resources, in Houston, Texas, said:

> The proper selection and placement of art can reduce patient stress, create a sense of security for patients, promote a bond between patient and caregiver, and perpetuate an image of excellence for the facility (Kaiser, 2007, p. 8).

Most involved in healthcare facility planning believe that non-threatening, realistic nature art in any medium is best for most

healthcare settings. However, in certain settings—corridors of labor and delivery or other specific types of areas—photos of people that patients and staff can relate to are sometimes desirable. Joye (2007) has found that particular landscape configurations have positive effects on human functioning and can reduce stress. A biophilic scene—one that is calm and has no threatening shadows or scary places for the mind to wander—can help rejuvenate and can actually cause relaxation. A landscape scene with a river in the distance and trees in a sunny foreground is much more relaxing than the same scene just before sunset with dark unrecognizable shadows in the foreground or even in the clouds. The latter could trigger an anxiety attack in a heavily medicated patient or a young child.

Designers can also use art to establish and reinforce a sense of place. For example, at New Hanover Regional Medical Center in Wilmington, North Carolina, the art program is based on the theme of the building, a cozy beach house. Further, the majority of the pieces are photos of local landscapes (beaches, marshes, gardens, the ocean, etc.) (see photo 3.13 in color insert); florals (close-ups of gardens); and many local birds (egrets, ducks, swans, etc.). A donation made for art in the chapel allowed for the commissioning of a beautiful curved metal sculpture depicting the beach and a lighthouse.

At St. Mary's Medical Center North in Powell, Tennessee, the entire art program consists of originals and prints of landscapes in the surrounding lakes and the Great Smoky Mountains. Because it is a Catholic hospital, much of the art has a religious theme, including a spectacular 15-foot copper sculpture representing the 12 disciples that was commissioned from a local artist (see photo 3.14 in color insert).

Hathorn & Nanda (2008) summarize the types of scenes and subjects that their research has found to be appropriate in specific settings within the institution. Table 3.2 displays their findings.

Table 3.2 Appropriate Art for Specific Settings

Main public areas	Geographically familiar. Use of abstract drawings is inappropriate.
Dining areas	Tranquil scenes.
Chapel	Meditative (landscape or seascape) scenes.
Mammography	Flowers or soft and feminine landscapes.
Patient Rooms	Soft, natural, relaxing scenes, and as large as possible.
Psychiatric Units	Avoid harsh colors, jagged lines, or images with chaotic movement. No abstract art.

Gardens and Nature

If you can experience a beautiful courtyard garden, linger on a comfortable bench, and even smell the roses or lavender, your senses are heightened, and stress often subsides, at least for awhile. Both large and small gardens are being included in healthcare facilities. Research regarding the effect of nature on patient outcomes continues to grow. It is noted that mounting scientific evidence, including that from prospective randomized controlled studies, has shown that exposing patients to nature can produce substantial and clinically important alleviation of pain. It is also suggested that patients experience less pain when exposed to higher levels of daylight in contrast to lower levels of daylight in their hospital rooms, therefore reinforcing the importance of designing healthcare facilities to harness nature, light, and other environmental factors to enhance pain control (Ulrich, 2008; Malenbaum, Keefe, Williams, Ulrich, & Somers, 2008; Ulrich, Zimring, Quan, & Joseph, 2006).

"Investigators have reported consistently that stress-reducing or restorative benefits of views of nature are manifested as a constellation of positive emotional, psychological and physiological change" (Ulrich, 2008, p.88). Ulrich's landmark 1984 study determined specific

postoperative outcomes based on patients' exposure to views outside a window while hospitalized for abdominal surgery. He reported the subjects provided views of nature, in contrast to others who viewed a brick wall, had better postoperative outcomes, including the need for less pain medication, shorter lengths of stay, and fewer minor complications (such as headaches or nausea), and generally reported better emotional well-being.

Katcher, Segal & Beck (1984) note that restoration from the stressed state is manifested within 3 minutes, and sometimes as fast as several seconds, when a nature-based element is introduced into the space. They cite one scientific study that measured recovery from anxiety in patients waiting to undergo dental surgery. On some days, an active aquarium was placed in the waiting room, and on other days, it was removed. The results showed that anxiety was lower on days when the aquarium was present. Additionally, the clinicians noted that patients' compliance during surgery was higher as a result.

Another study indicated that patients viewing even a color picture with a well-lighted view of trees and water (Ulrich, Lunden, & Eltinge, 1993) needed fewer doses of strong pain drugs than did patients who viewed abstract images or a wall with no art.

When designers plan a healthcare facility, they need to make actual nature, such as healing gardens or landscaped areas with private seating, or the suggestion of nature (through photos, pictures, murals, or sculpture), an integral part of the design.

Balancing the Elements of a Healing Environment with the General Project

Defining the goals of the project for revising the healthcare setting is a critical first step. How a healing environment is going to be achieved must be defined. Most hospitals today use the term *healing environment* in some manner to describe what they expect as the end result; thus, what planners specifically mean must be defined at the start. Then, before the remainder of the design for healing environments is

solidified, the general project requirements need to be met, including regulatory codes and standards, infection control, and safety measures. The next section details important factors to consider when defining the project goals for a healing environment.

The Age of Patients

Although age of the patients seems an obvious consideration, it is sometimes overlooked. For example, although nature subjects depicted in art have been found to be calming for adults, the same might not be true for adolescents.

The Culture

Demographics and culture play a significant role in defining what a healing environment might be for a given population. For example, for a project in Puerto Rico, key users requested very bright, tropical colors. Therefore, planners used bright pink, lime green, and teal—colors the users live with day to day—in the interior design scheme.

The Theme

A theme or story can help define the hospital and make it unique and memorable. For example, the New Hanover Regional Medical Center, in Wilmington, North Carolina, is only 8 miles from the beach. For the new Betty H. Cameron Women's and Children's Hospital, they selected the theme of a cozy beach house. They noted in the visioning session that the general population of Wilmington had chosen to live there because they love the ocean and all things "beachy"; therefore, adopting this theme in a soft, feminine way made perfect sense.

Aesthetics

It is critical to determine how the project owner wants its facility to be perceived by the public. During the planning process, a list of adjectives should be gathered that describes the desired image. Should the facility be sleek and contemporary? Or cozy and friendly? An effective way to clearly define this image is to tour existing, similar facilities and noting

which design features the clients like and, just as importantly, which elements they dislike.

Technology

No matter how thorough the planning process, project planning teams will always encounter elements that need to be included at the tail end of a project. For example, when the clients at a surgery center made a last-minute decision to add a large, flat-screen patient tracking device in the waiting area, interior designers had to rethink the art for this wall. Another example might be wayfinding kiosks that were intentionally not part of the project at the beginning but might get added when funding becomes available. The space and power supply needed for them might not be available. Thus, the design team must be prepared to adapt the latest technology into their plan at any given moment.

Evidence-Based Design

The degree to which EBD will impact design decisions also needs to be identified early in the process. There are a number of questions designers need to ask and answer. Are the findings of the latest research being incorporated into the project? Will actual research be done using "before and after" criteria? Is funding for research planned into the project from the beginning?

Ideally, an EBD champion on the team will continually reinforce concepts and communicate effectively with all team members. Additionally, an EBD checklist that clearly defines each goal is helpful. If the budget dictates that items are eliminated from the wish list, the EBD champion should be able to reiterate the benefits of EBD intervention so that the design solution or item can be saved.

Hours of Operation

Will the facility be operational 24/7, typical of most hospitals? Or does it function as a clinic, closing in the evenings? This decision drives many other decisions, including the type of chairs and fabric selected for workstations. Chairs that are to be used in a 24/7 environment are often

sturdier than typical office chairs. Also, chairs used in a busy emergency department must withstand much more use and abuse than chairs in a surgeon's waiting room that is open only a few mornings per week.

Developing the Vision

The terms *patient-centered* and *family-centered* are often found in healthcare Project Vision Statements, but it is up to the design team to translate the meaning into the physical design.

During the developmental phase, questions frequently asked of the client by the architectural firm include the following:

- What will your healing environment actually look like?
- How will it be unique?
- How do you include all the elements you have identified as important to your healing environment (those covered throughout this chapter) into the building and not miss any?

Having a vision for the new building or space helps put a unifying envelope around the desires expressed by the architectural team. Often, conducting a visioning session produces helpful information that might not have been considered previously. The concept of the vision, after defined and refined, then begins to shape and guide many other decisions. For example, a hospital in an urban setting would most likely have a very different "theme" than one in a rural locale.

Just as retail stores or hospitality environments are designed to create a message to the consumers, healthcare settings can benefit by having a clear direction for the physical environment. A well-designed environment conveys an experience that can differentiate one brand from another in the consumers' minds (Ries and Trout, 2001).

The healthcare setting should provide a clear message about the organization to all who enter the building, and preferably from the moment they first see the campus.

A clear and concise vision helps to build management commitment

and aligns the team members, creating champions of the vision who carry it forward to others involved in the project. As the project progresses, the vision guides the team, particularly the architectural team, in their decisions and recommendations.

In creating a compelling vision, you will find it helpful to understand

- Where the organization has come from.
- Where the organization is now.
- The desired future state after visioning (Malan and Bredemegen, 2000).

The actual visioning can be achieved in different ways. Hosting a visioning session often produces dramatic and eye-opening results. Invitees should include the senior management team as well as heads from all departments that will occupy the new space. Additionally, representatives from facilities management, environmental service, infection control, finance, and other related departments should be included.

Various "warm-up activities" will encourage the group to think creatively. Show photographs of various types of spaces to foster thinking about buildings and features other than those of their existing hospital. The goal is to brainstorm ideas and then vote on them to arrive at the preferred message, image, and amenities desired in the new space. This type of visioning exercise does not replace the need for a well-developed set of business strategies, but rather complements those strategies and assists the hospital in further defining the vision.

Case Studies: Hospitals with a Vision

According to Pine and Gilmore (2003), goods and services are often not enough; customers now want experiences. "Experiences can offer enjoyment, knowledge, diversion and beauty," but customers are also looking for an experience that engages them in a personal and memorable way (p. 163). The challenge for the healthcare

organization is to integrate everything they offer into the theme. This integration begins with the vision.

New Hanover Regional Medical Center, Wilmington, North Carolina

Two major new buildings were planned for the New Hanover Regional Medical Center Campus in 2005 to allow for much-needed expansion by nearly every department within the system: a new women's and children's center (about 220,000 square feet) and a new surgical pavilion (about 144,000 square feet).

Project goals were to provide the best environment for mothers delivering babies and to consolidate the care of ill or injured children, bringing together the pediatrics unit, the Neonatal Intensive Care Unit (NICU), and the Neonatal Transitional Care Unit (NTCU). A new Pediatric Intensive Care Unit (PICU) was planned to add critical care for children in the region.

In the summer of 2005, planners and designers led a half-day visioning workshop for each of the two new projects with the aim of defining specific ways the buildings could support the goal of bringing family-centered care to all patients. To achieve this goal, the environment must support families participating in the care of their loved one, which means addressing social, educational, and cultural needs associated with the patient's family. This goal particularly applies to the care of children.

The design of the hospital was based on the latest research, EBD recommendations, and patient and user interviews. Safety, patient- and family-centered care, and inclusion of the latest technologies were major goals. All patient rooms, including the NICU/NTCU rooms, are private.

Betty H. Cameron Women's and Children's Hospital

The design team chose a beach house theme for the Betty H. Cameron Women's and Children's Hospital. Each of the four floors was given its own color scheme based on a commissioned study through the

Pantone Color Institute to find out which colors women of childbearing age prefer in the coastal south. The results of the research indicated that several palettes should be appreciated by patients. The design team also studied the colors used on the homes along the shore, and these colors were woven into one of the palettes recommend by Pantone.

- **Main Lobby, atrium, porch, and dining**—Entering the main lobby, you see many "wow" features, including the following:
    - The two-story atrium with 25-foot trees, two-story windows, and a table with fresh flowers at the entry to greet people as they enter (see photo 3.15 in color insert).
    - Logical directories and a large round reception desk with antiqued wood trim and tiles made of shells (see photo 3.16 in color insert).
    - A large water feature with a nautilus shape engraved into the granite (see photo 3.17 in color insert).
    - Porcelain floor tiles that resemble windswept sand with inserts of bold patterned carpet.
    - Views of and access to the covered porch with rocking chairs and ceiling fans (see photo 3.18 in color insert).
    - A glass-enclosed gift shop with the water feature (mentioned previously) flowing into it.
- **NICU**—Located just off the main lobby, the NICU has 45 private patient rooms, a family lounge with comfortable seating, a spiritual room, and a nourishment area. The NICU is themed around the starfish, and the shape repeats in the carpet tiles, the glass tiles on the reception desks, and in the art. Colors in this area are soft greens, purples, and beiges (see photo 3.19 in color insert).

- **Antepartum/High Risk**—Because women could possibly stay on this unit for an extended amount of time—weeks or months—the color scheme is very spa-like, with soft gold and beige tones. A retreat suite with a balcony, large area for visiting, and resource center are all nearby. The nautilus shape, repeated throughout the hospital, can be found in the carpet pattern, in the glass tiles on the reception desk, and in the artwork.
- **Mother/Baby**—The top floor with great views and a lot of natural light is the mother/baby floor with a color palette of soft teal, gold, and beige—very calming and refreshing colors, reminiscent of the coastal areas (see photo 3.20 in color insert). The beach theme on this floor is of sea oats and grasses, which can be found in the carpet tiles, the glass tiles within the business centers, and even embedded in the resin divider walls in the family lounge areas. The art is reflective of the beach and surrounding gardens.
- **Pediatrics Unit and Pediatric Clinic**—Children entering or staying in these units might be surprised to see how quickly they can forget they are sick. Both units reflect an underwater and beach theme, including carpet tiles and murals with schools of fish used for wayfinding and to absorb noise (see photo 3.21 in color insert).

The Surgical Pavilion

The Surgical Pavilion has been designed as the "garden." Many Wilmington residents of all ages are gardeners, and the theme resonates with both men and women. Colors, textures, and symbols were developed to be compatible with the beachy feeling established for the Betty H. Cameron Women's and Children's Hospital, but are unique to the Surgical Pavilion. Planners decided that the calming effects of nature should be used as much as possible.

The Surgical Pavilion consists of 30 operating rooms and 76 private pre-op and post-op holding rooms. It has four specialty zones and a Post-Anesthesia Care Unit (PACU).

Each of the zones in the pre-op and post-op areas have their own identification based upon flowers native to the local area, including magnolia, oleander, dogwood, azalea, and rose (used in the PACU).

Caregiver workstations in each zone are identified with their floral symbol (see photo 3.22 in color insert). Photos of the flower in the front of the station help with wayfinding and add a touch of nature to a clinical setting. The staff can tell a family member that their loved one is in the Dogwood section, for instance, and easily direct them there. The staff has commented that they love the concept and find that looking at the photos is calming. A floor pattern with a coordinated color insert adds additional recognition that a person is in the correct area. Signage corresponds to the flower designated in each zone. Art consists of large photos of the particular flower of that zone.

The main lobby, with 18-foot floor-to-ceiling windows, comfortable groupings of seating, and large original art of gardens in the area is a blend of all of the floral elements (see photo 3.23 in color insert). Two large-screen televisions are available, one in the main waiting area and one in the children's area. There are also quiet areas for reading or conversation. Visitors can even go outside to wait for their loved one in the garden area just off the main lobby.

Fort Belvoir Community Hospital

The Fort Belvoir Community Hospital is a 1.2-million-square-foot facility, scheduled to open in September 2010 as part of the Base Realignment and Closures (BRAC) Act. In January 2007, Dr. William Winkenwerder, Assistant Secretary of Defense for Health Affairs, directed that, going forward, EBD must be used to create healing environments in all military healthcare facilities. Therefore, many EBD elements are being incorporated in both inpatient and outpatient areas of the hospital. Primary design principles for Fort Belvoir are as follows:

1. Create a patient- and family-centered environment.
2. Improve the quality and safety of healthcare delivery.

3. Enhance care of the whole person (contact with nature and positive distractions).
4. Create a positive work environment.
5. Design for maximum standardization and flexibility.

Patient focus is the first priority. To the extent possible, all critical elements of EBD, such as access to nature and natural light, private patient rooms, healing environments, air quality, and family areas, are planned into the buildings.

In June 2007, members of the planning team, along with patients, met in a day-long visioning session to brainstorm and correlate ideas, which began with an EBD overview for the participants.

The results of the brainstorming session provided information to be used to develop design concepts for the hospital's interior design master plan. Nearly 100 people from many organizations participated, including Walter Reed Army Medical Center, DeWitt Army Hospital, Health Facility Planning Agency, and the U.S. Army Corps of Engineers.

"Caring for our own" became the overarching theme. Other ideas with a majority of votes included the following:

- Symbolically include the bald eagle.
- Demonstrate that the United States protects its past and present service members and their families.
- Display the history and future of military medicine.
- Recognize the natural resources where the base is located.

Fort Belvoir is located on 8,000 acres of land, bordering the Potomac River, just south of Alexandria, Virginia, and Washington, D.C. Nearly 2,000 acres of this area are dedicated to wildlife preserves, sandy beaches, forests, streams, trails, open fields, and meadows. The planning committee unanimously agreed to honor nature by incorporating these elements into the hospital's theme.

Major displays in all public corridors will be dedicated to military history and military medicine. Large display cabinets, as well as dozens of recessed niches along the public corridors, will allow for permanent or temporary displays.

The healing properties of nature became the basis of design. After this idea was established, everything else fell into place, and the theme began to influence all design decisions. Planners developed a palette of warm neutrals for the poured terrazzo, the sheet rubber for the clinics, the low-volatile organic compound paint, the bio-based tile, and the solid surface countertops. Elements of the theme and specific colors influenced the following:

- Building designation color and symbols.
- Directional and signage colors and symbols.
- Floor patterns and flooring material colors in terrazzo, rubber flooring and carpet
- Glass tile features in the galleries connecting the buildings.
- Scenic photos behind clinic reception desks.
- Repetition of colors and symbols in inpatient units.
- Colors toned up or down for specific departmental needs (e.g., brighter colors in the pediatrics unit and very calm, spa-like colors in the cancer clinic).

Thus, the five major buildings and their components will have the following themes.

Building A—Riverside

Recognition of the many bodies of water in and around the campus will be included in this scheme. Colors include various shades of teal, earth tones, and neutrals.

Building B—Featherstone

Elements in this building will recognize the hundreds of species of birds, including the bald eagle, which has become the overall symbol for the project through art and educational displays. The color scheme will incorporate rich clay (earthy) colors, spice and shrimp tones, and warm grays and golds.

Building C—The Oaks

The symbol of the oak tree will be used in Building C, the largest of the five buildings, which actually comprises three buildings, including the seven-story patient tower. This symbol was chosen because the facility is being built on a former golf course, and many large oak trees had to be removed. Some trees are being preserved and will be made into benches for the public areas. The oak leaf will be present in carpet patterns in cut-outs in the sheet rubber flooring, and embedded in the resin panels on nurses' stations and waiting room divider walls. The art and displays will not only be of the mighty oak trees, but of many other species of trees found in the surrounding wooded areas.

Building D—Sunrise

This building was themed to recognize the importance of natural light in a healthcare setting. All the Fort Belvoir buildings will have an abundance of floor-to-ceiling windows in all public spaces, allowing the sunlight to filter into waiting areas, the galleries connecting the buildings, inpatient rooms, and corridors. Specifically, the color scheme of this building will contain various shades of soft golds, warm beiges, and accents of spice and warm brown. Art and signage will contain images of the rising sun, bringing hope and inspiration.

Building E—The Meadows

Many fields and open areas on the site have low vegetation and flowers. This building's colors—various shades of green with rose tones—its art, and other design features will recognize the flora and fauna of the meadows.

As the project progresses, the integration team will begin using the theme as the story for recruitment, for educating current staff about the project, for tours, and for many other activities. FBCH is well on its way to becoming a world-class hospital and a model for the entire Military Health System.

Final Thoughts

Ultimately, the definition of a "healing" environment must be developed by the healthcare facility's multidisciplinary team. They must first understand the mission, goals, and objectives for the project and understand and translate the EBD research into a meaningful and financially sound design and construction plan.

According to Zimring et al. (2008):

> The lofty motto in the annual report matters much less to patients than the long waits in the shabby waiting room. What differentiates successful projects is the CEO with the ability to implement effectively; establish the mission, vision, goals and strategy; and put in place the appropriate, disciplined process for achieving an organization's desired end state. …. Many complex decisions will be made during an EBD journey: the effective CEO shapes a culture and process that ensures that the best decisions are made for the organization" (p. 8).

Creating a healing environment for the patient is the driver in any new healthcare facility plan. Consumers and staff have an expectation that a new healthcare building will not only cure but also help heal the patient. But a healing environment can also be measured by how often, for example, someone says, "You exceeded my expectations in the care of my loved one!"

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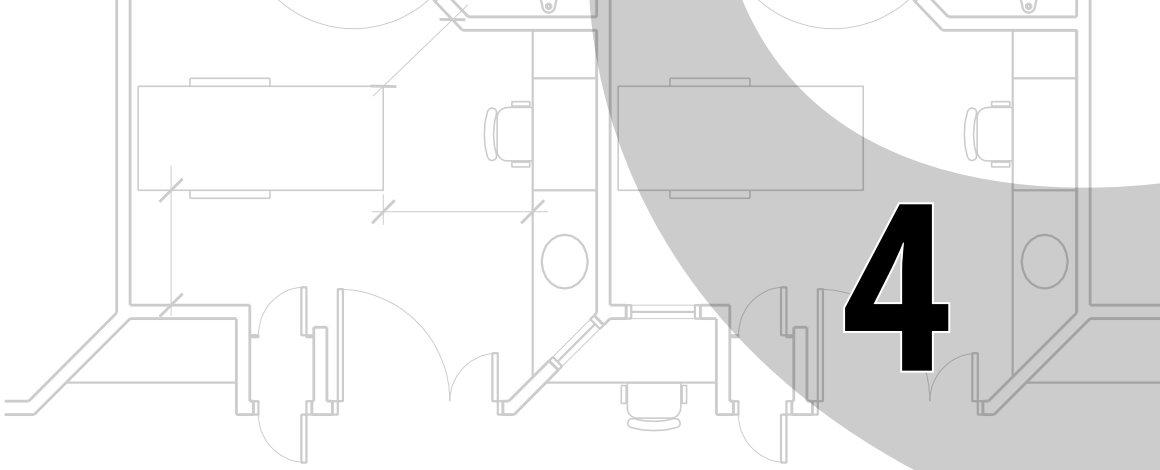

4

Family-Centered Care

By Cyndi McCullough

In 1956, when I was 3 years old, I was hospitalized for 6 weeks following a car accident. I was in a room with five women (all adults). I was confined to bed, and the room had no television. My parents could visit often but not my siblings. Whenever one of the other patients needed a treatment, my parents had to leave. The room had no space for anyone to spend the night, and I was scared.

In 1975, when I was 19, I was hospitalized for 3 days to have my wisdom teeth extracted. It was during a flu epidemic, so no one was allowed to accompany me to the hospital. I was in a semi-private room. While lying on a gurney outside the surgery suite, I overheard the nurses talking about how the oxygen wasn't working in surgery, and I was scared. I had a bad reaction to the anesthesia and wasn't able to get out of bed for 2 days without fainting. As soon as I could stand up on my own, I was sent down a long, cold, tile-walled corridor to a group shower.

In 1992, when I was 36, I was hospitalized for a week with some type of virus. I was in a private room, had a television and a window, but my window faced a brick wall. Because they didn't know what was wrong with me, I was not allowed visitors, and I was lonely and scared. *It doesn't have to be this way.*

The need for family involvement in the care of patients has long been ignored in healthcare settings. Many older facilities were not designed to encourage the involvement of families in the care of patients. Patients and families were considered more of an afterthought rather than the center of care. In some cases, they were even considered an annoyance and "in the way."

The first real attempt to include families in the care of patients was initiated in the 1960s and 1970s when fathers were allowed in delivery rooms to observe the births of their children. Parents were also permitted to visit their children in intensive care wards, but only during specified visiting hours. Since the late 1970s, models of care such as Planetree, patient-focused care, and cooperative care were created to address the social needs of patients who wanted their loved ones to be involved with their care. These three models focused on the patient and family rather than on the healthcare providers.

Because of common beliefs, intensive care units, neonatal intensive care units, critical care units, after-surgery care units, and emergency departments have implemented restrictive visitation policies to protect the patient from germs and the stress of too many visitors. Actually, limitations involving family in the care of the patient have been largely linked to the amount and type of space available. Semi-private patient rooms, open wards for intensive care patients and post-surgical patients, and curtained spaces in the emergency department have greatly limited the involvement of families.

In 2007, the Society of Critical Care Medicine, the largest international society representing intensive care professionals, recommended open visiting hours and increased family involvement in intensive care units (Landro, July 2007). However, some staff still restrict visitation at change of shift and when physicians are "making rounds" of their patients (Rashid, 2006). Despite concerns of staff members, family-centered rounds are becoming more popular, and staff are beginning to realize the benefits of a unified care plan for the patient (Muething, Kotagal, Schoettker, Gonzalez del Ray, & DeWitt 2007; Sisterhen, Blaszak, Woods, & Smith, 2007).

The Planetree, patient-focused care, and cooperative care models have many similarities regarding the way they involve families. In addition to consumer wants and needs, these models have influenced the design of healthcare facilities over the past 15 years.

Planetree Model

Angelica Thieriot founded the Planetree model in 1978 in San Francisco, California. Ms. Theirot was from Argentina and had a hospital experience in the United States that she described as cold, frightening, and inhumane. She felt isolated from the support of her family and friends and uninformed about her condition. She believed healthcare should be delivered with a holistic approach that addressed the body, mind, and spirit. She described the ideal hospital as one that combined the best of spas with the best of hotels and the best of hospitals to become a truly healing environment (Gaeta, Gilpin, Arneill, Nuelsen & Frasca-Beaulieu, 2000).

The Planetree model was instituted in a San Francisco hospital, but since that time, Griffin Health Services in Derby, Connecticut, operates the Planetree National Alliance. The Planetree model exemplifies a holistic approach to care in a healing environment and includes the following principles of patient-centered care.

- Patients have the right to open and honest communication in a warm, caring environment.
- The patients, their families, and the professional staff play unique and vital roles in the healthcare team.
- The patient is not an isolated unit but a member of a family, community, and culture.
- The patient is an individual with rights, responsibilities, and choices regarding his or her lifestyle and health.
- A supportive, friendly, and caring environment is an essential component of providing high-quality healthcare.

- The physical environment is vital to the healing process and should be designed to promote healing and learning, as well as patient and family participation in care (Gaeta et al., 2000).

One of the outstanding benefits provided in the first Planetree Unit in San Francisco was the Health Resource Library. The public had access to medical information and research services (Frampton, Gilpin, & Charmel, 2003). This service became very popular and consumers moved forward with a demand for education and resource centers in all healthcare facilities. Today, finding space dedicated to this service in the main lobby of healthcare facilities is common, with electronic libraries available on individual patient units.

In many Planetree facilities, patients are visited daily by a chaplain to determine individual spiritual needs. Unless it is refused, spiritual care is coordinated by the chaplain.

Other specific family-focused design elements associated with the Planetree model include a kitchen where patients and families can cook and store food, a patient lounge for relaxing and visiting with family and friends, open caregiver workstations to remove barriers between staff and patients and families, and a choice between a quiet waiting area and one that includes a television or music. In addition, Planetree facilities often offer alternative services, such as aroma, pet, massage, and ambient therapies.

The Sentara Williamsburg Regional Medical Center in Williamsburg, Virginia, opened in 2006. Using the Planetree model with a major focus on patient and family needs, designers carefully intertwined flexibility and function into the planning and design process. The facility used architectural elements to balance patient control and privacy with family participation in care. Patients, families, and staff are provided spaces for solitary and social activities. Gardens, fountains, artwork, and waterfalls help connect patients, staff, and families with the relaxing and healing aspects of nature.

Patient and family amenities at this facility include the following:

- Patient/family/staff collaboration desks (see photo 4.1)
- Open charts

- Libraries
- Kitchens
- Lounges
- Outdoor gardens
- Indoor and outdoor dining areas
- Activity rooms
- Non-denominational chapels and meditation space
- Walking paths (see photo 4.2)
- A Health Resource Center (see photo 4.3)
- A gift shop

Patient-Focused, Patient-Centered Care

In the mid 1980s, in an effort to improve healthcare settings, administrators from five hospitals formed a consortium and began to discuss ways to streamline hospital operations and make more efficient use of resources. The result was a new model of healthcare delivery—patient-focused care. Keystone developments of the patient-focused care model include:

- Bringing services closer to the patient.
- Streamlining documentation.
- Creating healing environments.
- Cross-training staff and empowering them to make decisions (Moore and Komras, 1993).

The patient-focused care model improved service and efficiency. For example, at Bishop Clarkson Hospital in Omaha, Nebraska, a study conducted by the consulting firm Booz Allen Hamilton helped the hospital's leadership determine that the infrastructure of the hospital contributed to long delays in delivering services to patients. This study

scrutinized the workflow of the pharmacy, radiology, dietary, respiratory, documentation, patient orders, admissions, medical records, laboratory, and surgery in detail. As a result of the findings, the hospital eliminated middle management and helped staff learn to be autonomous. They streamlined processes, implemented technology to enable better care, and renovated units to decentralize care to the patient's bedside. They organized and individualized care for the patient. This model resulted in a strong bond between the patient and the caregiver while providing a comprehensive approach to care. Early results proved patient-focused care improved service performance, increased patient and staff satisfaction, reduced operating costs, and increased physician productivity (Lee, 1993; Teschke, 1991).

Although this model permitted more involvement of families, the original definition of patient-centered care, as discussed in the literature, did not include the concept of patients and families as advisors and essential partners in the care of the patient. So, while this approach was a move to focus on the patient, it did not include the family.

The Anschutz Inpatient Pavilion in Aurora, Colorado, was designed to best meet the physical, mental, and spiritual needs of the patient and families. Amenities in this facility that support patient-focused care include the following:

- Private rooms with family sleeping areas.
- Decentralized nurse workstations close to patient rooms.
- Library services for patients and families.
- Free valet parking.
- Wireless keyboards for patients and families.
- Outdoor gardens (see photo 4.4 in the color insert).
- Gathering spaces in lobby with piano and fireplace (see photo 4.5 in the color insert).
- Separate corridors for patients and public (Shepherd, 2004).

Cooperative Care

Cooperative care models require a care partner—a close friend or family member —to be available to assist patients with daily activities and to learn how to care for the patient. The first Cooperative Care Center was established at New York University in 1979. In this setting, patients and their care partners reside in private, home-like care suites that include at least two beds, a living room, a kitchenette, TVs, Internet access, and refrigerators. Today, this model is often used in the care of transplant, cancer, and rehabilitation patients. It is frequently used when parents are learning how to care for a child in the Neonatal Intensive Care Unit (NICU).

Strategies behind this model include maximizing outpatient care and using family and friends to provide basic needs for the patient. With this model, the staff transfer more responsibility for patient care to the care partner. Because the control is with the patient and the care partner, the transition from hospital to home is much easier.

Proven benefits of this model are as follows:

- Improved patient outcomes.
- Faster recoveries.
- Fewer medication errors.
- Fewer falls.
- Easy transition from hospital to home.
- Improved staff morale.
- Less staff turnover (Teschke, 1990).

The Lied Transplant Center in Omaha, Nebraska, is an example of a Cooperative Care facility. Each patient is required to bring a family member or friend with them to the center to assist with the care of the patient. The center combines research, education, and clinical care in one setting. This model produces many benefits, including:

- The environment supports interaction among different disciplines.

- Basic nursing skills are taught to the patient and family.
- Programs focusing on health practices are offered to the community.
- Research is disseminated to the staff who work there.

Family-Centered Care

Family-centered care is based on the premise that patients are members of families and families are important for recovery. Families are encouraged to be present and to participate in the patient's care. Family-centered care was first defined in 1987 as part of former Surgeon General C. Everett Koop's initiative for family-centered, community-based, coordinated care for children with special healthcare needs and their families (Bissell, n.d.). The key elements of family-centered care are as follows:

- The family is the constant in the child's life, whereas the service systems and personnel within those systems fluctuate.
- Complete and unbiased information about the child's condition is shared with the family on an ongoing basis in an appropriate and supportive manner.
- Family strengths and their individuality and methods of coping are respected.
- Referrals for parent-to-parent support are encouraged.
- Parent/professional collaboration at all levels of healthcare—care of an individual child, program development, implementation, and evaluation policy formation—is facilitated.
- The design of healthcare delivery systems is flexible, accessible, and responsive to families.
- Appropriate policies and programs that provide emotional and financial support to families are implemented.

- The developmental needs of children and families are incorporated into the plan of care (Bissel, n.d.).

These key elements were further refined in 1994 by the Association for the Care of Children's Health and are widely accepted by families and professionals.

Family-centered care is built on partnerships between families and professionals. Although originally intended for children with special needs, family-centered care is relevant for family members of all ages in all healthcare settings. In a family-centered environment the caregivers are expected to:

- Empower family members to become partners and decision makers in the care of their loved one.
- Establish respect for each family's values, beliefs, and religious and cultural backgrounds.
- Educate families so they have the right information to determine choices about the care of their loved one.
- Create an environment of trust to promote information sharing.
- Support the patient and family by meeting their social, developmental, and emotional needs.
- Be flexible to meet the diverse needs and preferences of all families.
- Collaborate with the family in the best interest of the patient.
- Educate families in the care of their loved one (family-centered care).

Patient and family-centered models have many benefits. One is that they do not increase cost. In fact, patients and visitors are less anxious in the hospital setting and the quality and effectiveness of communication is improved. As a result, many problems are prevented or handled before they get out of control and result in costly solutions.

Implementing patient- and family-centered care models does require commitment from the administration of the organization. Staff must be provided with time and education to learn how to work in these environments. Authors of the article "The Business Case for Better Buildings" have cited evidence that suggests the one-time incremental costs of planning, designing, and building a patient- and family-centered facility can be quickly repaid through operational savings and increased revenue over time (Berry, Parker, Coile, Hamilton, O'Neill, et al., 2004). Thus, the outcomes achieved in family-centered environments include the following:

- Decreased length of stay.
- Fewer medication errors.
- Better informed patient and caregivers.
- Fewer falls.

A Family Maternity Center (FMC) opened at Saint Alphonsus Regional Medical Center (SARMC) in 2006. Staff at the FMC encourage patients and family members to be partners in care. Patient rooms (see photo 4.6 in the color insert) were designed to include 6 zones:

1. Patient
2. Family
3. Caregiver
4. Support
5. Hygiene
6. Technology

Each patient room has space for a day bed and dining table and can accommodate a full-size bed.

Staff at SARMC participated in the Pebble Project, a research partnership between The Center for Health Design and leading healthcare institutions. The impact of the facility design on the quality of care and financial performance is being studied.

Another good example of a facility designed to support a family-centered care model is in Powell, Tennessee. St. Mary's Medical Center North opened in August 2007. It was designed around the principles of patient safety and family involvement in care within a healing environment. Family amenities include the following:

- In-room dietary service.
- Indoor and outdoor dining areas (see photo 4.7 in the color insert).
- Sleep area with a dedicated family TV within the patient room (see photo 4.8 in the color insert).
- Chapel and meditation areas.
- 24-hour visitation.
- Decentralized nurse workstations.
- Bedside admission service.
- Wireless Internet access in patient rooms and waiting areas (Griffith, 2007; Thomas, 2007).

Research has shown that bright lights and noise in the traditional Neonatal Intensive Care Unit (NICU) create adverse effects such as increased heart rate, increased blood pressure, increased respirations, and decreased oxygen saturation for infants (Bremmer, Byers, & Kiehl, 2003). Over the past 10 years, efforts to correct those issues combined with a desire to create family-centered, developmentally supportive care environments for infants have led to the private room model (Thear & Wittmann-Price, 2006; Harris, Shepley, White, Kolberg & Harrell, 2006; Bowie, Hall, Faulkner, & Anderson, 2003; White 2003; and Berens, 1999).

The private room allows personal space for the parents and family with access to the infant at all times. This environment allows the parents to participate as partners in the care of their child. In addition to being a very positive experience for the parents, involving the family in all aspects of care of their infant has improved outcomes for the infant.

Sadler & Joseph (2008) have reported the benefits of the private NICU room and have indicated the following are essential elements of a family-centered environment:

- Decreased noise.
- Privacy for breastfeeding and kangaroo care.
- Confidentiality of information regarding the infant and the parents.
- Decreased hospital acquired infections.
- Decreased length of stay.
- Improved fetal brain development.
- Decreased days on oxygen, ventilators, and total parental nutrition.
- Increased parent and staff satisfaction.

Caregivers often resist the private room model in the NICU because they want to be in close proximity to the infant. Decentralized workstations with a window between every two rooms and technology that alerts staff of the infants' condition has helped meet these caregiver wishes. Distributed support space to decrease the travel distance for caregivers combined with a hands-free communication system allow the caregivers to provide care in an optimal environment. Staff at New Hanover Regional Medical Center planned a NICU with 45 private rooms based on the principles listed previously. It opened in the fall of 2008. Staff are currently studying the impact of the private NICU versus multi-bed NICU rooms. A second study is focused on nurse perception and satisfaction with the private NICU design as they adapt to a new practice model.

Alleviating anxiety and keeping patients and families informed are ways to improve the patient/family healthcare experience. Tracking systems that provide family and friends with real-time updates ease anxiety for families who are waiting for surgical patients. Monitors that are similar to those that provide gate information for arriving

and departing flights at an airport are located in areas where family members might gather—the cafeteria, resource centers, and main waiting areas. Patients are assigned a code, and the screens provide information to the families and friends about the patient's progress. The use of pagers (like the ones restaurant personnel use to let diners know their table or order is ready) is another method to give families freedom to move about the facility while they wait for their family member who might be in surgery or might be having a procedure (O'Connor, 2007).

Consumers expect a different kind of healthcare experience than they have experienced in the past. Since 1996, the Institute for Family-Centered Care has created patient and family advisory councils to help plan healthcare facilities. Other studies that explore patients' perception of healthcare environments are helping to improve family-centered care and teaching (Landro, August 2007; Muething, Kotagal, Schoettker, Gonzales & DeWitt, 2007; Wall, Curtis, Cooke, & Engelberg, 2007; Douglas & Douglas, 2005).

Final Thoughts

Over time, technology and family involvement in patient care have changed the way healthcare spaces are designed. It was hard to convince administrators and planners of the benefits of a healing environment 10 or 15 years ago. Today, a healing environment is an expectation. Everyone wants it and expects it. Now everything is about privacy, safety, and how much space should be dedicated to family. The cold, impersonal hospital described by Angelica Thieriot is rapidly being renovated or replaced with a more nurturing facility that is centered on the patient and his or her family. The link between the physical facility and the healing process continues to be studied and considered in all healthcare settings. Successful projects occur when the patient and family are considered first, the staff second, and cost third.

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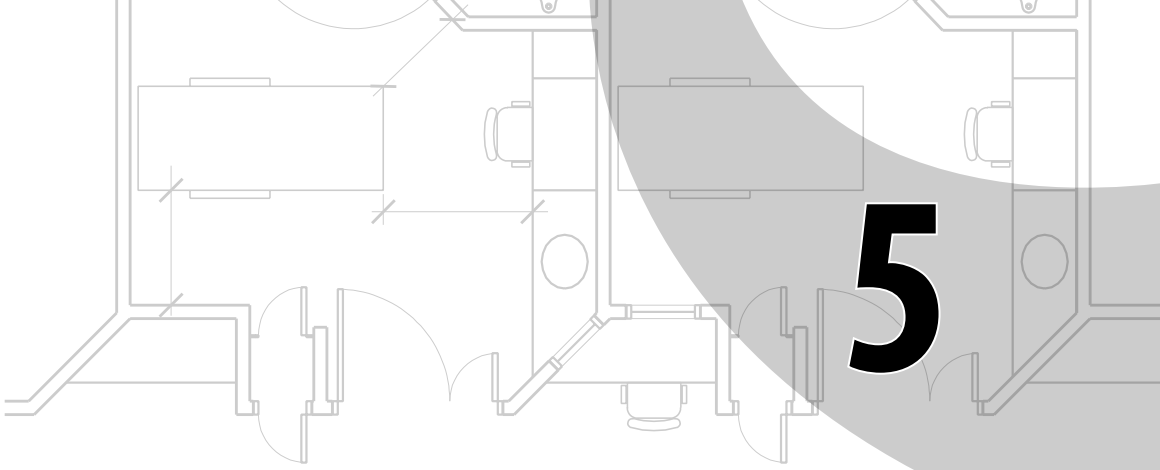

5

Benchmarking

By Michael Doiel and Debra Sanders

Benchmarking is most simply defined as a standard or point of reference by which the quality or value of something can be measured or judged. Benchmarking has been used to compare and determine acceptable and excellent standards and then to evaluate how to improve on those. Benchmarking studies are used to establish or apply the best practice for an industry to help organizations to improve and maintain the highest quality outcomes. Benchmarking authority Robert Camp's preeminent work on the subject suggested a 12-stage methodology for the process. It included the following:

- Find a problem.
- Define the problem and process.
- Identify team members.
- Identify data sources.
- Collect data.
- Determine the gap.
- Establish process differences.
- Target future performance.
- Communicate.

- Adjust goal.
- Implement.
- Review and recalibrate (Camp, 1989).

Since Camp's work in 1989, the benchmarking process has been revised and adapted to apply to a number of industries and applications, from strategic planning and management to financial performance, product enhancement, and process improvement. In nearly every case, the process involves:

- Identifying a problem.
- Establishing desired outcomes.
- Researching to determine the highest standards (industry best practice).
- Measuring current outcomes.
- Developing a plan of action to achieve the best practice standard.
- Implementing, reviewing, and re-evaluating to continuously improve quality.

Benchmarking Process in Healthcare Design

Benchmarking is an essential component of the successful use of evidence-based concepts in healthcare facility design. The benchmarking process used for this purpose is typically a version that involves six steps:

1. Define the project.
2. Establish the starting point (current state).
3. Determine where you want to be (ideal state).
4. Understand where you can be (achievable state).
5. Measure results.
6. Apply and share lessons learned.

Current industry research indicates a strong link between facility design and clinical and operational outcomes. Therefore, healthcare administrators can use benchmarking to assess their organization's current state and identify opportunities and recommendations for improvement through facility planning in order to achieve the desired state. After they establish recommendations, the staff need to continue benchmarking throughout the entire facility planning and design process. Projects are typically benchmarked at the stage of functional and space programming, concept and schematic and final design, as well as other key milestones throughout the facility planning and design process. When the construction of a new facility is completed and operational, the staff can conduct benchmarking to assess the achievement of the desired ideal state and to identify opportunities for continuous quality improvement.

Define the Project

The first step in effective benchmarking is to define the project. In nearly every case, this hinges on creating an overall project vision and a set of guiding principles for developing and realizing that vision. Typically, an executive-level steering committee is formed to articulate the vision and guiding principles. Committee members also review key milestones and decisions to ensure the ongoing plans are in line with the vision and principles.

Designing and programming a new facility is an incredibly involved process that often requires difficult decisions. During every key decision point in a project, the design team needs to step back and evaluate if the choice or option is in line with the guiding principles. The principles instruct actions and guide the decision making process.

For example, being family- or patient-focused is a common guiding principle. So, when the design process comes to a key decision point—for example, whether the patient registration process should be centralized or decentralized—the team can refer to the guiding principle when evaluating the benefits and drawbacks. If any of the choices are not patient-focused, then the steering committee and the design team need to revisit options that are in line with the guiding principles. The vision

and guiding principles are invaluable in planning a facility based on the desired ideal state.

Establish a Starting Point

In this phase of the process, the planners and designers assess the organization's current-state environment. Evaluating the existing (current state) environment is crucial to understanding opportunities for future facility development. Simply stated, you cannot determine a path to a future ideal state until the current state is clearly understood. Asking questions and evaluating the current state also helps determine how to measure the new facility against best practices. The ideal best practice has limited value without understanding the true benchmark. This process represents the only way to develop an accurate gap analysis. Staff should examine every element of the facility and project, including functional and design elements and metrics such as patient satisfaction levels, quality of care, and clinical outcomes. Finally, they can evaluate additional factors in their current state such as the community, marketplace, and historical context.

A thorough evaluation of the current state includes identifying and considering possible constraints. Different preconceptions and expectations exist for a facility that is being remodeled than they do for one that is a being designed from the ground up. Existing facilities offer different benefits and pose more constraints.

The budget and, more importantly, operational costs must also be established early in the process and considered every step of the way. Economic viability needs to be a target as much as any benchmark standard. The budget and costs can and should offer guidance in choices and philosophies for the design and programming. The cost/benefit analysis is an important piece of data in establishing the benchmark in any facility design.

Determining and measuring the exact condition of a facility and properly considering the project scope, budget, and cost savings make it easier to create realistic comparisons to the ideal state (industry best practice).

Determine the Ideal State

Benchmarking is recognized most for the value in making comparisons to industry best practice. In this process, the goal is to determine the ideal state. For an organization to properly understand the gap between the facility and the ideal, their assessment must be rigorous and thorough.

Establishing the ideal state can call for many types of research. Visits to the most highly rated or efficient facilities are common. Industry standards and published results are reviewed and carefully considered. Continuous research at the local level helps as well. This process includes evaluating enhancements to existing plans and programs. The ideal state should also factor in public perception and the market for the facility and services. The guiding principles of a project need to be considered in identifying the ideal state as the best practice because one component might be in conflict with another.

Understand the Achievable State

The reality of the current state and the vision of an ideal state come together when the "achievable state" is considered. The best practices need to be weighed carefully against the functional realities and the guiding principles of a project.

For example, a steering committee might consider the facility's status as a teaching hospital as a guiding principle. Functionally, best practice might call for certain square footage per room in a teaching hospital to allow for nursing student and preceptor work areas. However, if the project is a facility renovation, existing infrastructure limitations might preclude adequate space allowances for the desired outcome. This example demonstrates what is meant by achievable state—narrowing or eliminating the gap between the current state and the ideal state within the reality of the situation.

Measure Results

Measurement is at the heart of the benchmarking process and happens continually. The most meaningful measurement occurs following the

implementation of a preferred option and after a new facility has been occupied. The true test of benchmarking and EBD is whether it can be linked to improved quality, efficiency, and efficacy or effectiveness. In other words, does the space work as designed?

Organizations should compare research such as patient satisfaction scores, quality-of-care measurements, and clinical results pre- and post-occupancy. They should also measure business metrics like productivity, costs analysis, and market research to gauge the business impact of the design and planning. Quantifying the impact on patients and the bottom line makes it easier to apply discoveries and share them for future use.

Apply and Share Lessons Learned

Benchmarking aims to create continuous improvement. This improvement is accomplished only when the measurable results are applied and the lessons learned are shared. If a design or programming element did not achieve the intended purpose or has an unforeseen effect on the facility or patients, that facility needs timely discovery and correction. Also, the improved outcomes at one new facility or portion of a facility can sometimes be implemented across an entire healthcare organization. Not only do stakeholders, patients, and staff benefit from the continual application, but also the organization can minimize the perception of "have" and "have nots" for certain parts of the system.

Sharing the lessons learned from effective evidence-based planning can also improve the field and help establish new benchmarks for the industry. Further, sharing the clinical and operational improvements realized by a new facility based on these planning concepts can have a positive effect on the public perception of safe, quality, and affordable healthcare.

Case Studies

The best way to gain a broad understanding of the benchmarking process is by looking at the details of specific projects and facilities. Case studies illustrate the value benchmarking brings to the evidence-based planning process.

To date, completed work on benchmarking in healthcare facilities has focused on trip frequency (the number of trips staff make to gather supplies and equipment), travel distances (the distance staff walk from the patient to the areas where supplies and equipment are stored), and improved throughput (total time for procedure or treatment) for patients who require services like surgery, imaging, and emergency or clinic visits. One premise is that a significant reduction in travel distance enables more time for task productivity, which ultimately is directly proportional to the bottom line.

When designing an efficient environment, a staff member needs to develop critical travel distance criteria and optimal numbers of trips per shift and procedure and then measure the desired criteria against the current design, proposed designs, and the final design. This data can be compared to benchmarked projects and best practices.

Productivity can be subjective and depends upon the care delivery model. The proposed care delivery model should be one that enables patients to be cared for in a safe and quality care environment but with staff efficiency always in mind. In some instances, organizations can suggest a potential reduction in total staff with improved staff-to-patient time, although the care and outcomes should never be compromised under any circumstances.

The case studies include facilities that are similar in size and patient case mix and are a combination of new, expansion, and renovation projects. Comparisons have more validity under these circumstances, therefore providing the credibility necessary when predicting outcomes for post-occupancy.

Examples of project types benchmarked include medical/surgical units, intensive care, maternity services, and surgical suites. The projects presented are all recently completed and occupied.

TriHealth System—Bottom Line Improvement Measurement Process

TriHealth is a community partnership between Bethesda North and Good Samaritan Hospitals in Cincinnati, Ohio. In addition to

these two acute care hospitals, TriHealth offers a range of clinical educational, preventive, and social programs through 50 other locations in the area.

TriHealth Good Samaritan embarked on the largest single project since the formation of the hospitals under the Catholic Health Initiatives system governance and was under extreme pressure to justify the significant capital expenditure. To allay the fears and uncertainties encountered in the process, they needed additional justification. They decided to use a four-pronged Bottom Line Improvement Measurement Process (BLIMP) to examine and improve the bottom line, particularly through the development of a highly efficient care delivery model that illustrated maximized use of new and renovated square footage.

The study involved four key components:

1. Planning principles ranking.
2. A program plan to actual plan comparison.
3. A trip and travel benchmarking exercise.
4. A best practice healthcare of the future test.

The first component involved rating the planning principles against the final design. The project included 10 development principles that ranged from reconsidering facility configurations for long-term growth to improving the way patients and visitors accessed and circulated within the building. Those involved in the project evaluated the response to each of the 10 principles. All told, they rated four of the principles as exceeding the project's expectation against final design. They rated three others as meeting the criteria and two as partially meeting the principles. Of those two, one involved real estate surrounding the facility, which was out of the steering committee's and design team's control. Refer to Figure 5.1 for a summary of the evaluation of the planning principles.

Figure 5.1 Evaluation of planning principles.

Planning Principle	*Unmet*	*Partially Met*	*Met*	*Exceeded Expectation*
Planning Principle 1:		●		
Planning Principle 2:		●		
Planning Principle 3: Relocate Street				●
Planning Principle 4: Modify traffic flow			●	
Planning Principle 5: Move toward constructive demolition			●	
Planning Principle 6: De-emphasize old and embrace new			●	
Planning Principle 7: Turn the tables on parking; make it a powerful tool for meeting access, service convenience, wayfinding objectives				●
Planning Principle 8: Create a sense of arrival				●

The second component of the study involved comparing the final program plan to the original program. For every programmed function, they examined the overall design layout to see if it conformed with the clinical, operational, and design configurations. In all 16 programs, the review showed that the programmed function was met. In fact, several times the implemented plan included enhancements related to the teaching environment in addition to the completed program. Additionally, file

rooms, workstations, break rooms, patient lockers, and other elements that enhanced the original program were developed and implemented during the normal course of the design process. The BLIMP analysis literally helped them to "find space" and include more rooms than was prescribed in the original program.

Another part of the BLIMP comparison examined a space-related element—in this case, how caregivers can most efficiently cover their shift in patient care units while communicating between the most commonly traversed support bays. They conducted a trip and travel benchmarking exercise across existing and proposed plans for the medical/surgical, intensive care, critical care, and labor and delivery units. In each case TriHealth's existing, "H"-shaped departments were benchmarked against best-practice facilities for the distance (feet) traveled by caregivers each shift, each day assuming three 8-hour shifts and one caregiver to a proportion of patients based on service line. Figure 5.2 illustrates a 1,440-feet benchmark as the preferred threshold for trip frequency over a 24-hour period. The results showed a significant decrease in trip and travel because of decentralized supplies, better distribution of support space, and the more efficient geometrical curved design of the units. They noted that the patient tower configuration named the "French Curve" went well beyond architectural aesthetics versus functional reality. Fewer feet traveled and fewer trips made, less trips over an operational shift in a more economical floor plate led to an ideal outcome. The cost/benefit analysis referenced earlier supports the hypothesis.

The final element of the BLIMP study was to test the facility against standards and preparedness for Healthcare Facilities Design of the Future or "best practices." The review involved all large modalities and patient care areas including emergency services, surgery, patient rooms, and diagnostics, as well as primary and ancillary departments of laboratory and pharmacy. For each area, they identified and discussed key issues. They tested and scored a total of 17 key concepts as meeting the standards, having mixed results, or not meeting the standard. Figure 5.3 presents a summary evaluation of the proposed facility design to Design of the Future components. Only two of the key concepts were rated as not meeting the healthcare of the future standards

and again this can be attributed to the fact Good Samaritan Hospital was an existing facility. This in-depth and forward-looking study enabled TriHealth to identify, share, and address potential issues well in advance and support the decision tree that had been established at the beginning of the project, always referring back to the cost/benefit model as the final metric.

Figure 5.2 Patient Unit Benchmarking Exercise

AVERAGE TRAVEL DISTANCE FROM PATIENT ROOM TO FREQUENT SUPPORT ROOMS
Trips per day assuming no decentralization of supplies or workstation
Frequent support bays located 60 feet from most distant inpatient room

Inpatient Bed Unit	**20**	**40**	**60**	**80**	**100**	**120**	**Trips**
Utility Clean	5	5	5	5	5	5	30
Utility Linen Cart	3	3	3	3	3	3	18
Utility Soiled	4	4	4	4	4	4	24
Crash Cart Storage	0	0	0	0	0	0	0
Medication Cart Storage	3	3	3	3	3	3	18
Medication Pyxis	2	2	2	2	2	2	12
Blanket Warmer	1	1	1	1	1	1	6
Nourishment Center	4	4	4	4	4	4	24
Trips Per Day	24	24	24	24	24	24	144
Distance	**480**	**960**	**1,440**	**1,920**	**2,400**	**2,880**	**288**

For TriHealth, the four components of the litmus test in the BLIMP study—rating the planning principles, the plan/program comparison, the travel benchmarking analysis, and the healthcare of the future test—were all rated as either having met or exceeded the industry standards or the proprietary metrics (see Figure 5.4). This thorough benchmarking exercise suggested a dramatically improved bottom line performance while maximizing the expanded and renovated space available for new programs.

Figure 5.3 Healthcare Facility Design of the Future Test Score

Key Concepts	*Test*	*Comments*
Adaptability	X	Bed unit configuration accomodates changes in nursing model and technology; dept stacking limits adaptability
Flexibility	M	Universal sized rooms for flex between Medical/Surgical and intensive care levels; new cath labs are sterile for advanced procedures
Cost Efficiency	X	Decentralized work stations not on Medical/Surgical floor; moderate improvement in inter-departmental workflows
Staff Retention/ Recruitment	M	Enhanced nursing environments
Patient/Family Centered	M	Accomodation of families in larger rooms
Outpatient Focused	X	Pre-admission testing (PAT) center; Surgi-Center; imaging not decentralized for easy OP access
Disappearing Dept Boundaries	M	Some consolidation of like functions; traditional admitting
Healing Environment/ LEED	M	Interior design concepts reflect Healing Principles
Accommodates Future Technology	X	ORs sized well but adjacencies, dept boundaries and floor to floor heights in existing buildings restrict adaptation
Safety/Security	X	Rooms are not "same-handed" but are all private; views, large toilets, good configuration, family spaces
Emergency	X	Adjacent to cath labs; traditional registration and triage flow; limited expansion capability; observation capability not apparent; flexibility for shifts in acuity not apparent

Key Concepts	*Test*	*Comments*
Acute Beds	X	Inefficient number of beds for RN staffing on Medical/Surgical floor (21); no decentralization of workstations, supplies, meds, support, rooms are not redundant for patients safety; all beds private and universally sized
Surgery/Interventional	M	Good adjacency of cath labs to surgery and ED and good combination with other special procedures; cath labs are designed with sterile environment; large ORs accomodate technology/robotics; cath labs share pre/post areas
Laboratory	D	Lab not phased for reduction or offsite location; poor location
Imaging	X	All imaging centralized instead of decentralized to OP, ED and ORs; limited capacity for future new technology; phase out of Nuclear Medicine not anticipated; registration is at time of care; limited expansioncapability anticipated.
Pharmacy	D	Limited rooms to expand for future demand & robotics
Support & Other	X	PAT efficient but does not include imaging; registration centralized and not aided by internet or telephone technology; Central Sterile Supply distant from ORs

Litmus Test Score: X=Mixed M=Meets D=Does Not Meet

An unexpected outcome of this process was the ability to cross-reference the comparisons and outcomes for a similarly sized project at the Bethesda North Hospital in the same system. Because director-level staff manage service lines at both hospitals, the new operating models introduced to improve operational efficiency were familiar.

Figure 5.4 All four components of the litmus test in the BLIMP study all rated as either having met or exceeded the industry standards or the proprietary metrics.

Litmus Component	*Unmet*	*Partially Met*	*Met*	*Exceeded Expectation*
Litmus Component 1: Planning Principle Rating			●	
Litmus Component 2: Program/Plan Comparison			●	
Litmus Component 3: Benchmarking Analysis				●
Litmus Component 4: Healthcare of the Future Test			●	

The New Reid Hospital—Access, Adaptability, and Flexibility

Reid Hospital (see photo 5.1 in the color insert) is a not-for-profit, 233-bed regional referral medical center located in Richmond, Indiana, serving east central Indiana and west central Ohio. In designing and planning the new campus (The New Reid), the client was especially concerned about ensuring that the new facility was accessible, adaptable, and flexible among other guiding principles because this facility would replace a 100-year-old facility with the community expectation that the new facility last another 100 years.

The new campus was to be situated on several hundred acres a few miles north of the existing "to be abandoned" facility. Whereas the ample space provided many options and opportunities, it also created challenges. The initial thinking during concept design was to develop a very

horizontal campus with a low-rise building meandering over a relatively flat site. The initial premise was that a low-profile building offered greater accessibility along the length, plus it would be less imposing to patients and visitors. This concept was diametrically opposed to a very vertical scheme that provided excellent exposure from Interstate 70 and a major thoroughfare through Richmond.

In this example conducting a facility planning–wide, comprehensive benchmarking study to examine travel times and distances for patients, visitors, and caregivers from the parking lot to points of service was possible because everything was new, including street, drop-offs, and entrances. The budget impact was easily measured here because the various geometrical options and building configurations could be priced and compared in addition to the benchmarked time and travel.

At Reid, the travel distances went beyond just patient units, beginning with the distance from a parking space to the preferred point of entry and continuing to elevator and movement on the elevator to a patient room or to clinical delivery services. Figure 5.5 illustrates point-to-point travel time and includes distances such as emergency department to surgery, emergency to intensive care, main entrance to the furthest medical room, from the laundry department to the furthest medical unit, and from dietary to the service elevator. Those involved measured both horizontal distances (feet) and vertical distances (floors). They measured horizontal times (on floors), as well as wait times for elevators. Elevator wait times were averaged at 30 seconds, and elevator ride time was averaged at 10 seconds per floor. The total average travel time for one travel or trip was calculated, as was the total trips and total elapsed time for those trips on a yearly basis.

All of these measures were benchmarked against industry standards to improve and develop the final design decisions. What became evident during this process was the variance a comprehensive travel study exhibited in that the metrics were more time sensitive overall versus a very repetitive trip and travel analysis of a patient unit that tended to focus on a repeatable, predictable series of tasks. Those involved applied best practices for travel and wayfinding throughout the

Figure 5.5 Travel distance and time comparison

ASSUMPTIONS

1. Average travel walking distance (with cart or stretcher): 3.50 feet/second

2. Average wait time in Service Elevator Lobby: 30 seconds

3. Average elevator ride time: 10 seconds/floor

4. All travel times are one way (point to point) for study purposes

PATIENT AND SERVICE MOVEMENT *Area to area*	*Horizontal Distance (feet)*	*Horizontal Time (seconds)*
1. Emergency department to farthest inpatient room	1,042	298
2. Emergency department to surgery department	318	91
3. Emergency department to diagnostic imaging	360	103
4. Emergency department to intensive care unit	441	126
5. Surgery department to farthest inpatient room	912	261
6. Farthest inpatient room to diagnostic imaging	791	226
7. Main entrance to farthest inpatient room	574	164
8. Materials handling to farthest inpatient room	792	226
9. Food service to farthest inpatient room	942	269
10. Laundry department to farthest inpatient room	979	280

design process and established assumptions for travel speed and wait times. They revisited the guiding principles throughout the process and considered future expansion and potential changes in treatment protocol that might affect operations and use of space.

In the end, "The New Reid" was configured by weighing all of the significant travel data and design recommendations. This process resulted in a series of connected buildings that were both low-rise and high-rise, affectionately referred to as "vertizontal" by the planning and design team. To meet the original requirement of parking space–to–door time, they aligned multiple entry points with the multiple ser-

Avg. Wait Time (seconds)	*Vertical Distance (floors)*	*Vertical Distance (seconds)*	*Total Travel Time (seconds)*	*Total Travel Time (minutes)*	*Total Trips (per year)*	*Total Trips Time (hours)*
30	2	20	348	5.80	6,838	661
30	1	10	131	2.18		
0	0	0	103	1.71		
30	1	10	166	2.77		
30	1	10	301	5.01	2,000	167
30	2	20	276	4.60		
30	2	20	214	3.57		
30	3	30	286	4.77		
30	3	30	329	5.49	201,000	18,961
30	3	30	340	5.66		

vice needs of this facility, including special needs entrances and tenant entrances.

Previous research had already determined that curved geometry for inpatient units could result in improved efficiency and square footage. The "butterfly"-shaped, twin, 36-bed inpatient units flanked by separated visitor and service elevators resulted in a pleasing design image while supporting functional effectiveness for access and adaptability—critical guiding principles.

Advocate Good Samaritan—Model of Efficiency

Advocate Good Samaritan is part of the Advocate Health Care system in Chicago, Illinois. This Level 1 Trauma Center is located in western Illinois, a suburb of Downers Grove. This circa 1960s facility has experienced continuous growth since opening. However, only minimal improvements were made to surgical services over the years, and the facility now represents an approximate case mix of 50/50 inpatient/outpatient, including a broad range of general surgery, cardiothoracic, orthopedic, endosurgery, and other specialty procedures.

Surgery suites are very expensive to build and operate and quite inefficient when surgeons and staff are underutilized. A fully staffed operating suite not in use costs several thousand dollars per minute. The Good Samaritan Surgical Pavilion addition provided an opportunity to plan a cost-effective model as well as one that is a safer surgical environment for patients.

Those involved conducted a benchmark study to look at projected caseload, using cases per room per 8-hour shift over 250 days worked per year. Considering the 50/50 case mix previously mentioned and best practice turnaround times, along with an average of 4 cases per room per day, they established a benchmark of 875 cases per suite per year and compared that to other previous projects that were representative of the industry's best.

The planning team began with a "zero percent" review analyzing the existing suite design versus a preliminary plan prepared during programming and then against the best practice design room across the industry and the design team members' experiences. The result was a consolidated universal design that could accommodate all of the specialty cases and the major surgical case load that Good Samaritan experiences as a Level 1 Trauma Center. The design team developed further metrics for improved efficiency within the surgical suite, suggesting pass-through supply cabinets and specially designed warming cabinets and workstations to limit movement in

and out of the sterile environment, thus reducing infection potential while achieving minimal travel distances through a single loop design (in contrast to an earlier consideration of two 8-room suites). The emphasis on efficiency and utilization resulted in a maximum 40 foot travel distance for all cases and applied the best practice technologies to improve the movement of sterile supplies, surgical staff, and support staff.

The Good Samaritan surgery suites (refer to photo 5.2 in the color insert) exceeded the benchmark of 875 cases per suite per year. In fact, as Figure 5.6 illustrates, even considering a worst-case scenario with 10 suites operational, the Good Samaritan surgery center could handle 887 cases per room per year. This compared at a level greater than or equal to the best practice examples, all of which operated more suites. This project was benchmarked throughout the design process, which resulted in better design and equipment selections to meet the metrics established.

Figure 5.6 Surgical services benchmark compared to competitors.

	Hospital 1	*Hospital 2*	*Hospital 3*	*Advocate Good Samaritan*
ORs	17	12	26	10
Mix	50/50	49/50	49/51	50/50
Turnaround	20	20	27	20
Volume	14,523	11,000	22,667	8,874
Cases/OR/Year	859	917	871	887
Benchmark	875	875	875	875

Post-occupancy results illustrate that the new surgery configuration generated several residual benefits other than just increased efficiency. The advanced technology used in the suites improved the quality of recording and documentation. The pass-through supply cabinets drastically decreased the number of times a sterile field was violated. Any time that best practices can result in improved quality outcomes as well as improved efficiency, you have attained a win-win situation.

Benefits of Benchmarking

By measuring programs and designs against existing, proposed, and ideal plans and designs, benchmarking provides several benefits to healthcare facilities and systems. The first is financial improvement and cost savings. This benefit is accomplished by operating more efficiently and effectively by meeting or exceeding established benchmarks identified in the operating plans. Healthcare leaders can also use benchmark studies to demonstrate a tangible return on investment when it comes to their capital expenditures. With the cost of healthcare, executives find it vitally important to demonstrate the value of all money invested in a facility. Rigorous benchmark testing can show the value proposition of the enhanced design and program choices.

Benchmarking helps improve patient care, both directly and indirectly. By continuously measuring the quality of care and service for patients, one can discover the elements that drive measurements, like patient satisfaction, and enhancements that are in line with the guiding principles set forth for the project. Perhaps most importantly, benchmark studies can be used to create better direct outcomes for patient care. By designing and programming facilities to best practice standards, events such as patient falls and medication errors can also be reduced. Benchmarking allows for those results to be captured, understood, shared, and continuously improved.

Final Thoughts

Benchmarking is commonly defined as the act of continuously measuring practices, products, and processes against the best in the industry. It has been widely established across many industries and fields. For healthcare, the benchmarking process involves six steps:

1. Define the project.
2. Establish the starting point.
3. Determine where you want to be.
4. Understand where you can be.
5. Measure results.
6. Apply and share lessons learned.

The measurement and comparison process ultimately improves the planning and design of a new healthcare facility, though many additional factors—including the project's budget and especially the guiding principles—must be considered at key decision points in the process.

The case studies illustrate positive and tangible results from applying benchmarks to planning and design. The benefits of benchmarking include demonstrating return on investment, increasing utilization and efficiency, enhancing patient satisfaction, and improving outcomes for direct patient care.

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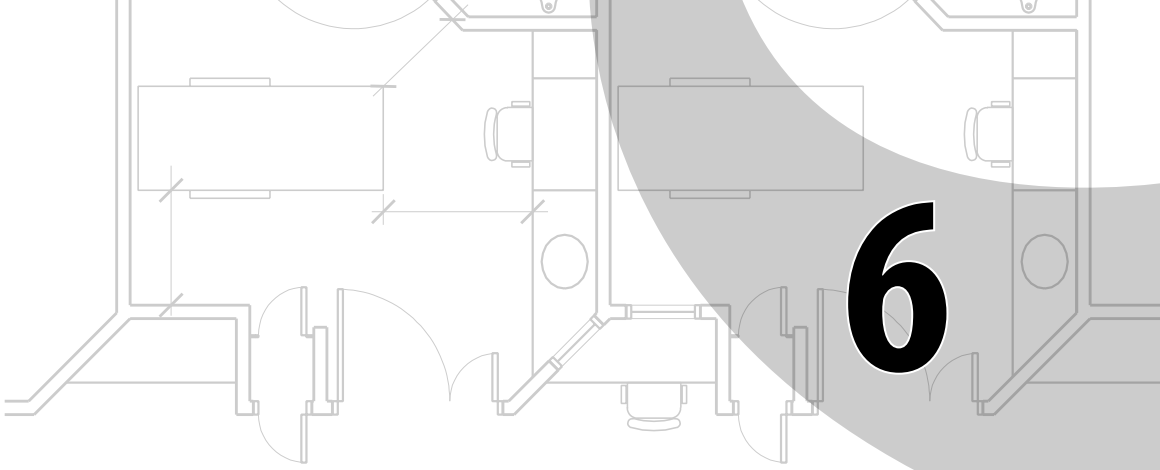


6

Efficiency

By Barbara Pille and Pam Richter

Why do healthcare work processes need to be re-evaluated and redesigned? Staff members tend to develop steps or systems they believe manage problems, bottlenecks, or inefficiencies that have developed over time. Often these solutions are done quickly and actually result in increased inefficiency and waste. Examples include extra forms created or copies that are made and filed so that certain information is available when needed, supplies and/or equipment that is stored or hidden in a department so they are available in an emergency but another department cannot locate them in a timely manner, and the stash of unused medical supplies and extra bed linens that are brought into a patient room to reduce the number of trips staff must make to and from storage areas. Often many of the items are unused and, therefore, disposed of when the patient is discharged. Sometimes staff cannot understand that an elevator ride to another floor might take less time than pushing a patient or cart full of supplies to another area on the same floor might take, because the existing elevators are old, too slow, or too small to accommodate efficient patient transport. These practices need to be discussed during the planning process so that new facilities or spaces are not designed to accommodate inefficiencies and the old way of working.

When planning and designing the healthcare facility of the future, planners need to give significant effort in the early phases to create space and flow that responds to client expectations and supports an efficient care delivery

model for the next 10–15 years. The challenge for management and design teams is to envision how work will be done in the future and not just replicate how it is done today. How future technology potentially impacts work processes and flows is another factor to include in the analysis and planning. Because of the size and complexity of healthcare institutions, design teams beginning this planning process should focus practically on the high volume and critical workflows rather than on the entire facility. In some instances, defining, detailing, and re-engineering processes can occur simultaneously with the facility design by having parallel teams work to achieve the goal of creating an efficient work environment.

An example of a Six Sigma (process improvement) team working in tangent with the planning and architectural design team occurred with the recent renovation of an existing patient floor to accommodate adult Intensive Care Unit (ICU) beds at The Nebraska Medical Center. At the same time planners were determining how much space was needed, subject matter experts and clinical staff, led by a Six Sigma Black Belt, were evaluating critical processes that had an impact on decisions about the location and size of space needed. The simultaneous use of this process expedited the design of the space to complete a fast-track construction project. Using the expertise of the critical care team during this process resulted in a very efficient staff- and patient-friendly work environment.

One of the main drivers of efforts to create a more efficient work place is the labor shortage. The aging workforce of baby boomers nearing retirement is leading to a projected massive shortage of healthcare workers in the immediate future. A federal government study conducted by Biviano, Tise, Fritz, and Spencer (2004) predicts nursing vacancies will reach 1,016,900 or 36% by 2020 (p. 27). Workers who remain in the workforce must be able to do more work without expending more effort. Research completed by the Agency for Healthcare Research and Quality (AHRQ) found that lower nurse-to-patient ratios were associated with higher rates of nonfatal adverse outcomes (Hickam, Severance, Feldstein, Leslie, & Gorman et al. , 2003). Efficient work environments have also been cited as staff recruitment and retention tools (Gatmaitan & Morgan, 2006).

Another major driver for designing an efficient work environment is the need to reduce errors in the delivery of healthcare services. Ross Baker and colleagues in their 2004 article state, "The greatest gains in improving patient safety will come from modifying the work environment of healthcare professionals" (p. 1685). Evidence has shown that nurses spending more time at the bedside has the potential to reduce medical errors (Gatmaitman & Morgan, 2006) and patient lengths of stay (Brown and Moreland, 2007).

Designing Efficient Work Environments

How and when do clients begin the multi-step process to design efficient work environments? Hiring a consultant from outside their organization is one way. Meetings with other healthcare organizations that have completed a similar process and reading published research are also good sources of information. Regardless of whether support is internal or external, designing efficient environments begins as soon as a project is identified.

To create a more efficient environment, clients must first understand the existing conditions. The following research study demonstrates baseline measurements about how nurses spend their time on an inpatient unit. According to Hendrich, Chow, Skierczynski, & Lu (2008), patient care activities accounted for only 19.3% of a nurse's time (81 minutes/shift). Travel time to fetch supplies took up 36 minutes/shift. Documentation consumed 2.5 hours per 10-hour shift and care coordination another 86 minutes/shift. Nurses walked an average of 3.1 miles/day. This information can be used to create an environment where nurses can spend more time with the patient and decrease the travel distance walked during their shift.

Though process improvement activities and better building design can help improve staff efficiencies, technology adds even more. It has greatly changed how work is and will be performed in healthcare facilities. The electronic medical record and computerized physician order entry are quickly eliminating the need for large business centers

(nurses' stations) to process orders and paperwork. Chart racks have become obsolete. Patient information is captured in real time from equipment, lab results can be accessed from processors, and assessment information can be entered one time at the bedside by the nurse via a handheld device. Patient personal identification and insurance information can be input by the patient from a home computer or an identification card can be swiped at a kiosk when the patient arrives at the healthcare facility. How these actions influence healthcare facility design and how the building accommodates future technology, including robots, also needs to be discussed early in the planning process.

In December 2008, California HealthCare Foundation released a report that examined health information technologies and the impact on nurses' work environments, and the safety, efficiency, and quality of patient care (Turisco & Rhoads, 2008). The report reviewed such technologies as wireless communication systems, real-time location systems, delivery robots, workflow management systems, wireless patient monitoring, electronic medication administration with bar coding, electronic documentation systems, and interactive patient systems. According to the report, when these technologies are linked with alarm/event messaging and biomedical device integration, clients see significant value added to the way nurses coordinate and deliver care.

Clients can also look within their organization to quality or process improvement groups that can assist them as they work through evaluation of the facility. Review of information gathered from customer satisfaction surveys might further help identify potential opportunities to improve customer service. A quick visit to key departments during peak hours of operation can help identify those departments that need additional focus.

For most healthcare organizations, these key departments, including the Emergency Department (ED) and ambulatory care centers where outpatient procedures are performed, are the entry points for customers. These entry points provide abundant opportunities to evaluate and redesign work processes that, in turn, influence the design of the department.

Technology

Technology has taken humans a long way toward achieving efficiency as manual labor has been replaced by machines. However, healthcare remains a very labor-intensive business with greater ranges of quality outcomes because of the human elements involved. Only small work segments in healthcare have been mechanized or automated, and quality initiatives have just begun to have an impact on the healthcare environment. Organizations need to examine how technology solutions can enhance the efficiencies gained with process improvement initiatives. In some cases, the use of technology can have a large impact on space. Communication, staff and materials tracking, and robotic systems play a major role in the design of efficient healthcare facilities.

Communication Systems

Wireless communication systems, such as Voice over Internet Protocol (VoIP), allow increasingly mobile caregivers to communicate promptly and efficiently. A single wireless hands-free device replaces multiple communication devices such as phones and pagers. Nurses can communicate with team members without having to travel to a central station to find a phone. Users report an increase in direct patient care time and process efficiencies, resulting in improved patient and staff satisfaction while reducing staff stress levels. These wireless systems can also be integrated with clinical applications, sensors, patient monitoring equipment, and nurse call systems.

Patient and Materials Tracking

Patient tracking systems or workflow management systems such as NaviCare and Awarix collect information from a variety of sources and display key highlights to caregivers. Using "real-time whiteboards," these systems display information for caregivers to alert them about care needs, pending test results, patient location, outstanding orders, and other metrics. Having this information readily available reduces staff time spent calling and/or searching for it and expedites patient

care. The patient tracking system is also an invaluable tool for the "Bed Czar" (the person responsible for assigning patient rooms for a healthcare facility). Efficient and effective bed placement results in optimal bed utilization and eliminates bottlenecks that result in delayed placement or bypass situations.

Bar Coding

Bar coding is used to identify and track assets, patients, and medications. Many hospitals primarily use it for medication administration to reduce errors and to improve documentation accuracy. According to Kohn, medication errors nationally cost an additional $2 billion each year (2000). Inventory control and patient tracking can be accomplished using the same technology. Bar code scanners are being incorporated into laptops, handhelds, or other portable devices that can be taken to the patient bedside, making their use more practical and making staff more efficient.

Radio-Frequency Identification Devices

Radio-frequency identification devices (RFID) use wireless technology to transmit product serial numbers from tags to scanners without human intervention. Scanners are placed intermittently throughout the facility similar to using an antenna for telemetry. Caregivers then can view a central scanner to locate personnel and supplies. This technology has the potential to replace bar code inventory tracking systems because it has immediate and automatic data capture resulting in fewer potential medication errors, reduced travel time for caregivers, and improved inventory control.

Healthcare Robots

Telemedicine robots, surgical assist robots, telerobots, and service robots are becoming more popular in healthcare facilities (Cohen, 2008). Telemedicine robots collect and transmit patient information to remotely located physicians for diagnosis and treatment. One growing use of the telemedicine robot is for stroke teleconsultations in rural Emergency Departments (EDs). Surgical assist robots such

as the da Vinci Surgical System are guided by surgeons using 3-D visualization to perform minimally invasive surgery (Tsui & Yanco, 2007). Telerobotic surgery is being tested for surgeons to operate on patients in other locations. Service robots are primarily used to pull supplies, including medications and equipment, or to haul soiled linens and waste through healthcare facilities. The use of robots to do delivery types of services frees staff to perform other patient-centric activities. Buildings, however, need to be designed to accommodate the technology that supports the increased use of robots.

Nurses reportedly spend an estimated 2-to-3 hours per shift manually completing forms and documenting patient care (Poissant, Pereira, Tamblyn, & Kawasumi, 2005). Beyond the inefficiency of handwriting information, these statistics often raise concerns about legibility and completeness of records. However, though the benefits of an electronic medical record are numerous, to improve staff utilization and efficiency, the technology needs to be mobile and easy to use. Handheld wireless devices and tablets with docking stations can be taken to the bedside for nurses to document care at the time it is completed. Real-time data input from equipment further saves the nurse time transferring that information. Improved efficiency and accuracy result. As other software applications are developed, building layout and design must support decentralized documentation.

Building on the interest and ability of patients to use technology in their personal lives, healthcare facilities are integrating interactive patient technologies into their designs. The multimedia and communication systems being offered include customized patient education programs; entertainment options of cable, Internet access, movies on demand, and video games; and hospital service options such as food service orders, housekeeping requests, and satisfaction surveys. Other interactive patient technologies include registration and information kiosks. Registration kiosks function similar to those used in airports and hotels for check-in, check-out, and appointment scheduling. Interactive maps of the building and campus are provided in facility lobbies. Besides being a customer convenience, these interactive technologies free hospital staff to provide other services. They impact design by reducing the amount of needed space.

When designing healthcare facilities, plan for the technology infrastructure needed to support future innovations. The ultimate design goal is the full integration of clinical and building systems (Koch, 2007). Use additional planning to convert vacated space after the new technology is implemented. One good example of how technology significantly reduces the need for space is the impact of an electronic medical record on the amount of space needed in the medical records department.

History of Process Improvement

The Total Quality Management (TQM) or Continuous Quality Improvement (CQI) programs used by healthcare organizations in the 1990s have evolved into today's Six Sigma, Lean Six Sigma, and Lean Healthcare (Lean) programs. These programs are built on years of success in the industrial sector, especially the auto industry, using process improvement tools.

The question of how more high quality work (product or service) can be produced in the same or less time while using fewer resources and maintaining a safe environment has been aggressively pursued by numerous industries. Answering that question has been the life work of many industrial engineers and management consultants throughout the 20th Century. Frederick W. Taylor, William Edwards Deming, Phillip Crosby, and Joseph Juran are the major names identified with these efforts.

Six Sigma aims to reduce defects or errors from the present level to a standard of 3.4 per million opportunities though the use of statistical analysis techniques, problem solving, and quality principles (Trusko, Pexton, Harrington & Gupta, 2007). Lean Six Sigma methodology adds the concept of improving cycle and process speed. It also introduces the concept of value. Any activity that creates value for the customer is termed value-added. The goal of Lean is to eliminate any non-value-added steps or waste, thus increasing the process speed by letting value flow from beginning to end without interruption. This results in enhanced customer satisfaction (Trusko, Pexton, Harrington & Gupta, 2007).

Whereas Six Sigma is more often used with manufacturing processes, Lean has been adapted by service industries, including healthcare. Both Six Sigma and Lean promote a culture of continuous improvement to eliminate waste, reduce process time, reduce costs, effectively use employees, and work toward best practices through standardization. Both need a sponsor or champion for long-term effectiveness.

Identifying waste in healthcare is part of the Lean process. Liker and Meier (2006) describe eight major types of non-value-adding activities (waste) in the manufacturing process. They are

1. Overproduction: Overproduction results in making more than is necessary or doing things faster than needed. In healthcare, unused printed lab reports and scheduling unnecessary lab visits are two examples of overproduction.
2. Defects: Defects in work result in the need to repeat or rework. For example, incorrect order entry, medication errors, and redrawing blood specimens because of inadequate samples cause rework.
3. Waiting: Waiting is considered a delay in any process. Patients waiting for physicians, for laboratory results, or for a ride home when dismissed are examples of delays.
4. Transportation or conveyance: Multiple patient transfers and a nurse walking a specimen to the lab are examples of unnecessary transportation.
5. Over-processing or incorrect processing: Excessive processing results in redundant or repetitive work flow. Each time a patient is asked about demographics and each time charge tickets are printed are examples of excessive processing.
6. Excess inventory: Supplies, beds, and pharmacy stock that is greater than the required amount is an example of excess inventory.
7. Unnecessary movement: Excessive travel distances or disorganization, such as searching for misplaced equipment, results in excess staff travel.

8. Unused employee creativity: Brainstorming ideas and then not using them is an example of not capitalizing on creativity (pp. 35–36).

Applying Lean concepts to healthcare providers and customers can result in improved patient and staff satisfaction and cost reductions. Streamlined processes reduce the number of handoffs and steps along the way for patients, resulting in improved patient throughput and resource utilization. As healthcare facilities become more organized and orderly, the environment becomes a safer place for staff and patients with an end result of fewer adverse incidents, fewer steps walked by staff, and reduced inventory.

Process Improvement Tools

Most healthcare administrators already have process improvement initiatives in place and can quickly assemble teams to work with the design team. Design teams can employ many of the same process improvement tools used in these initiatives to begin reworking organizational and departmental workflows to make them more efficient. These tools include

- Process flow charts
- Spaghetti diagrams
- Value stream mapping
- Simulation modeling
- 5S visual control
- A3 problem solving

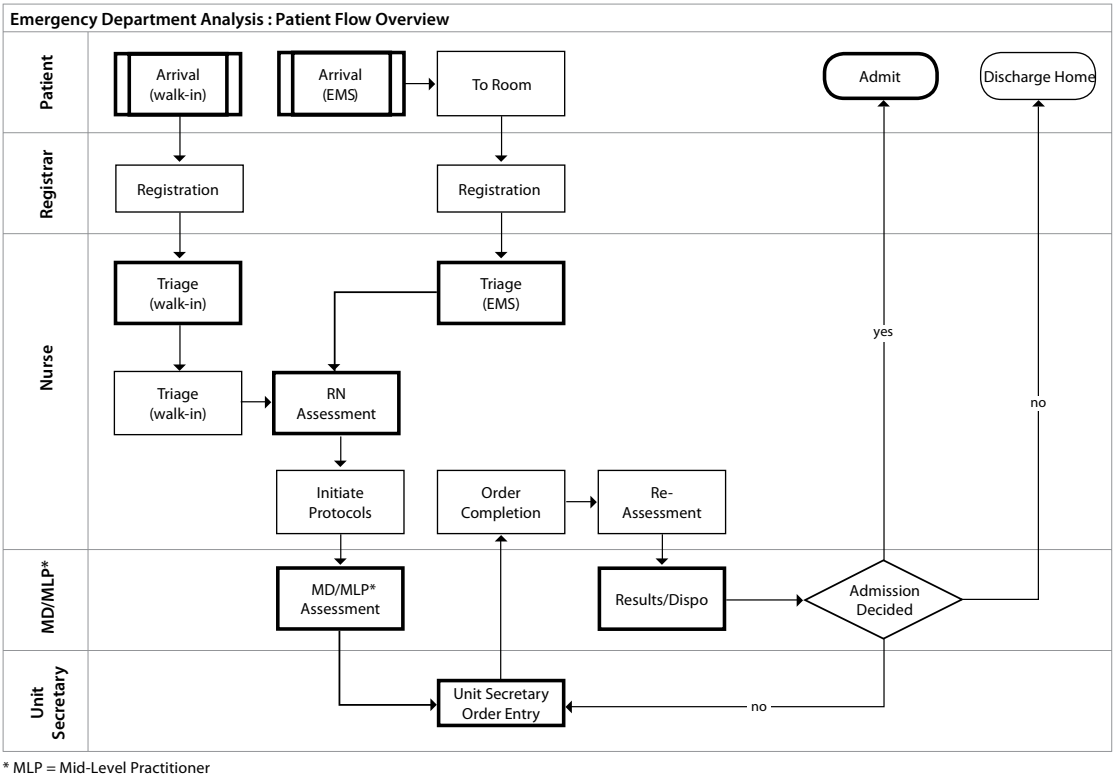
Flow Charts

The first step is to identify the key process from the customer's perspective.

- Where and how do they enter the process?
- What happens to them in the facility?
- What happens to them in the department?
- How much delay do they experience?
- How many handoffs are involved in the process?
- Is this a singular process or multiple-step process?
- What decision points exist?
- Where do they exit?

After the current process is defined, teams can begin to identify how future operations and flows might be improved and what facility changes might support the desired efficiencies. Refer to Figure 6.1 for an example of a departmental flow chart.

Flow charts (process charts, process mapping) document each step in a key process from beginning to end. The process often used by consultants is to write each step on a sticky note (so it can be easily moved around as edits occur) and place it in order of occurrence on a larger surface (wall or whiteboard). Decision points are documented, and critical paths are identified. Ideally, representatives from all departments and shifts help identify and detail the flow and validate the steps. The outcome is a comprehensive, step-by-step process description, including identification of extra steps, redundant steps, workarounds, waiting times, and interdepartmental relationships. The next phase is to determine an ideal process. Additional flow charts can be added to the current one to fully understand the process and interaction with other departments. For example, a hospital team wanted to increase the size of the ED because they believed extra exam rooms would improve patient flow and reduce length of stay in the department. While the patient volume supported additional exam rooms, to develop the best design for the future ED, they created a flow chart detailing how patients arrived and were treated in the department.



* MLP = Mid-Level Practitioner

Figure 6.1 Departmental Flow Chart.

The flow chart visually demonstrated that two key processes, registration and patient triage, required further breakdown and analysis so they could design ideal work spaces. They had to make operational decisions regarding where and how the ED nurses would triage patients and how implementing bedside registration impacted department flow. They also discussed using kiosk registrations for outpatients. Each of the decisions would impact the size and location of both the emergency and registration departments.

Refer to Figure 6.2 for an example of the proposed registration process.

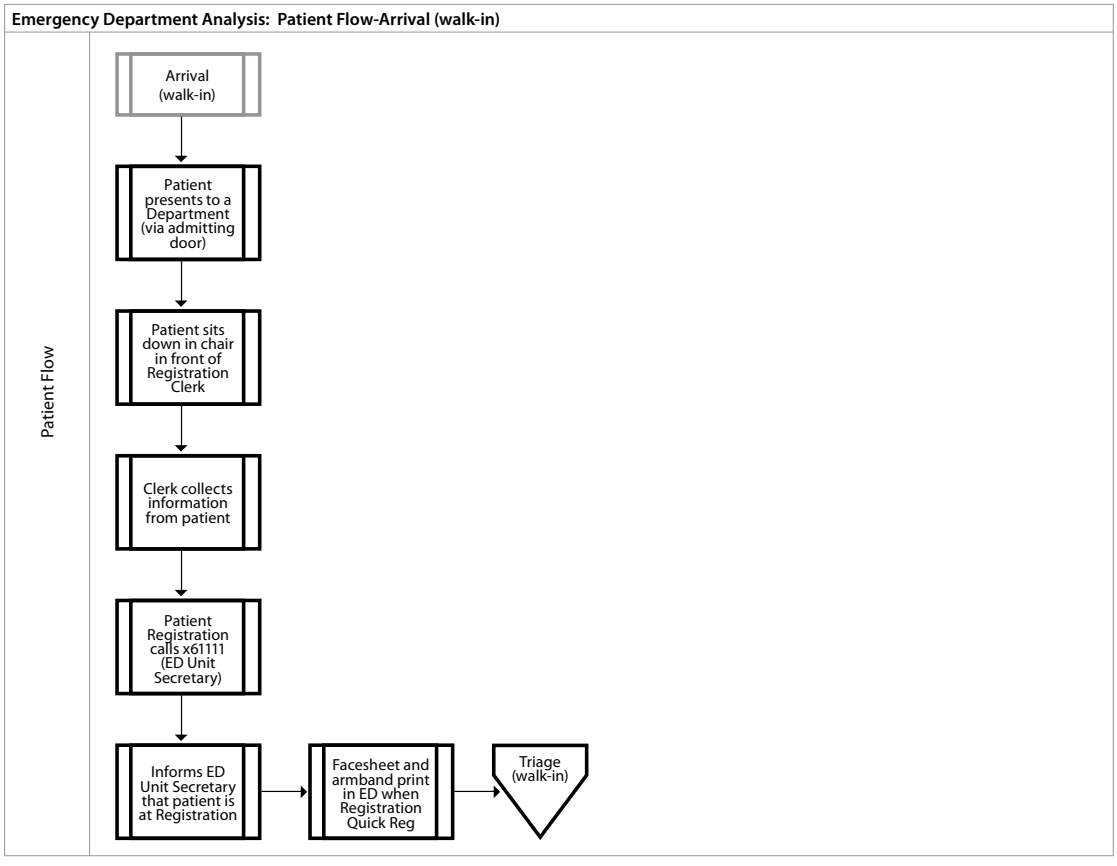


Figure 6.2 Proposed Registration Process.

Spaghetti Diagrams

An easy way to help staff understand flow within a department is to create a spaghetti diagram. The purpose of this tool is to identify and visualize inefficient layouts, unnecessary travel distances, and wasted time and movement for staff. The goal is to find the "sweet spot" for operational efficiency.

To begin the process, create a diagram of the department or floor plan. Each time a staff member makes a trip, draw a different colored line. Typically, a single day of observation is recorded on one copy of the diagram. The number of trips taken, the travel time spent, side

trips, and delays are also recorded. This information forms the basis for evaluating changes.

For example, spaghetti diagrams can be used in the initial design of a new clinic. When the first floor plan is completed, the architectural team works with the clinicians to identify traffic flow. The team first considers staff providing direct patient care and what shift activity would look like. Other staff activities are then overlaid on the first round of flows. Finally, the clinical and design group evaluate the proposed layout, the flow, and data collected and make recommendations on room locations.

Figure 6.3 illustrates staff movement in a clinic using a spaghetti diagram.

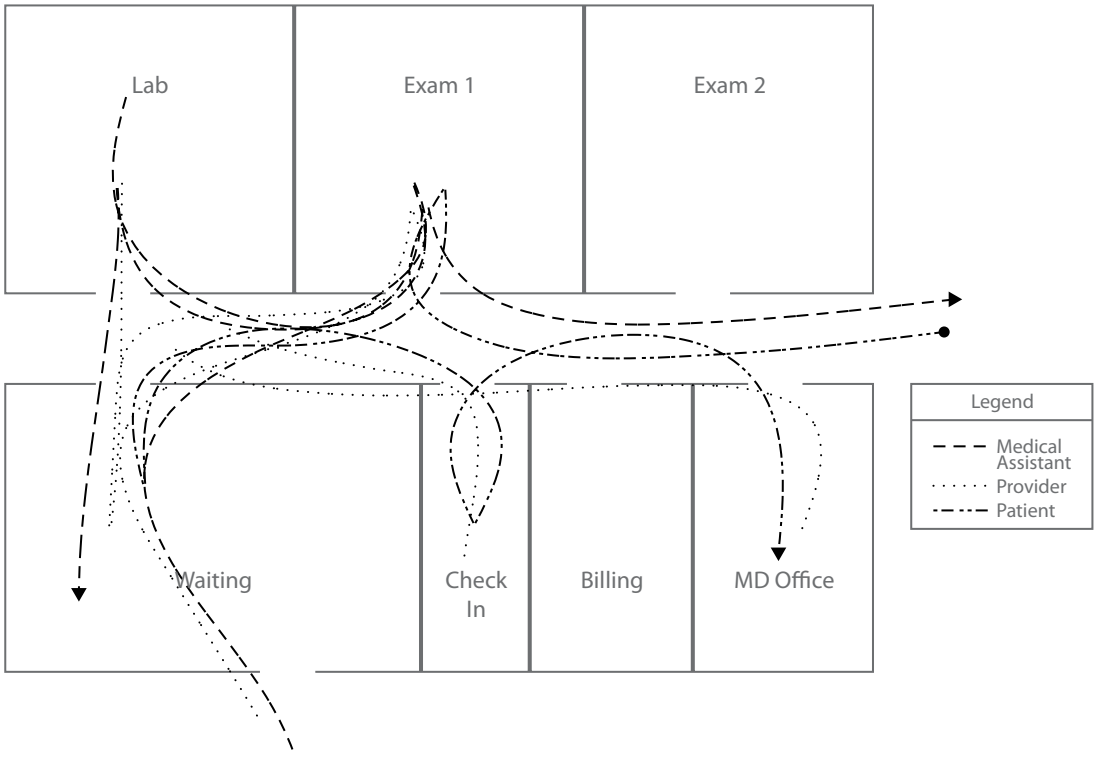


Figure 6.3 Spaghetti diagram of staff movement in a clinic.

Value Stream Mapping

Value stream mapping is a Lean tool that defines all process steps, including rework, delays, and waiting time, associated with turning a customer need into a delivered product or service. It examines the process from the customer's perspective and helps staff see an entire process, including interdepartmental communications and interactions. Value stream mapping is not as detailed as a process flow chart. The goal is to take the "current state" and eliminate all the waste and non-value-added steps to arrive at a faster, more flexible process (future state). The importance of value stream mapping is to improve the overall flow before working on individual process steps.

In the design of an outpatient registration area for a client, an organization created current and future state maps. Figures 6.4 and 6.5 illustrate the key components of the value stream map that identify patient and information flow, operational connections, problems that surface, and any unusual steps that affect the flow.

One of the Lean principles to improve flow in the value stream is to locate equipment or task rooms into a "cell" or line. This creates product or service flows from beginning to end without backtracking in a compact or streamlined area. Ideal locations to implement this concept are the ED, clinical laboratories, and inpatient pharmacies.

Simulation Modeling

Software packages available today can create process flow charts, spaghetti diagrams, and value stream maps as well as measure travel distances and wait and process times. The simulation software uses 2-D or 3-D animation to display the departmental flow. It can be coordinated with architectural software like Revit to demonstrate the effect of process or layout changes. After the process is defined, many of these packages have the ability to modify certain elements and then evaluate the effect. With this information, the clinical and design teams can make decisions regarding the optimum location of support spaces.

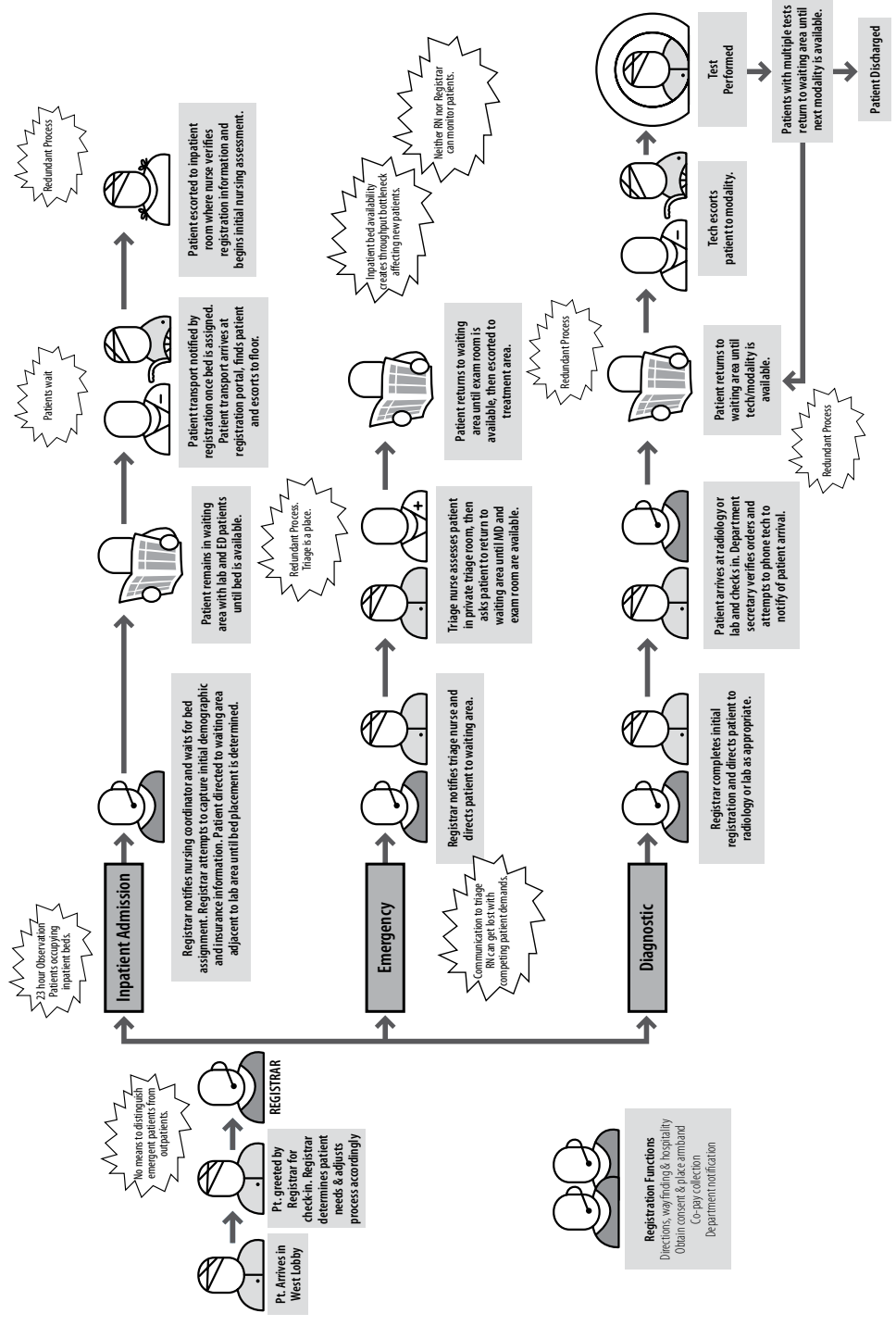


Figure 6.4 Value stream map of current state.

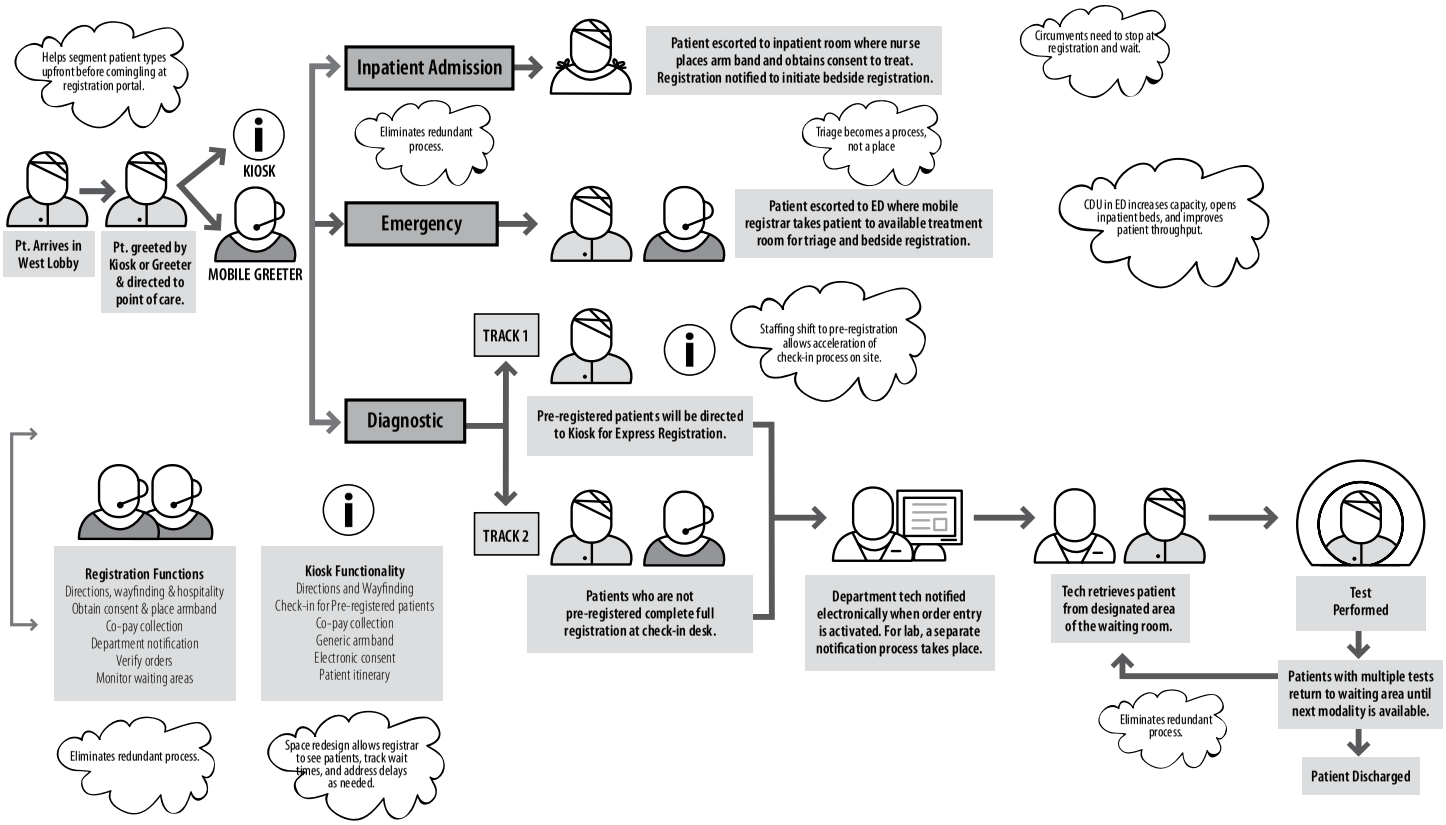


Figure 6.5 Value stream map of future state.

5S—Visual Management of the Workplace

The 5S methodology includes the following steps:

- **Sort:** Clear out rarely used or unnecessary items.
- **Straighten:** Organize and label items so you have "a place for everything and everything is in its place."
- **Shine**: Clean and look for ways to keep it clean.
- **Standardize**: Develop a system to maintain the area and monitor the first three steps.
- **Sustain**: Check regularly to maintain the discipline of the organization.

As a Lean process improvement tool, 5S is the easiest and quickest concept to implement and is generally one of the first that staff undertake. Assisting them to clean, organize, and standardize the workplace early in the planning and design process might eliminate or reduce the amount of unnecessary space programmed for supply or equipment storage. The 5S methodology can be used for the smallest area, such as a desk top or drawer, to the largest department with immediate results.

The 5S program promotes a pleasant, tidy, and less frustrating work area, improved efficiency through ease of finding items, and reduced costs associated with missing items or wasted time spent looking for them.

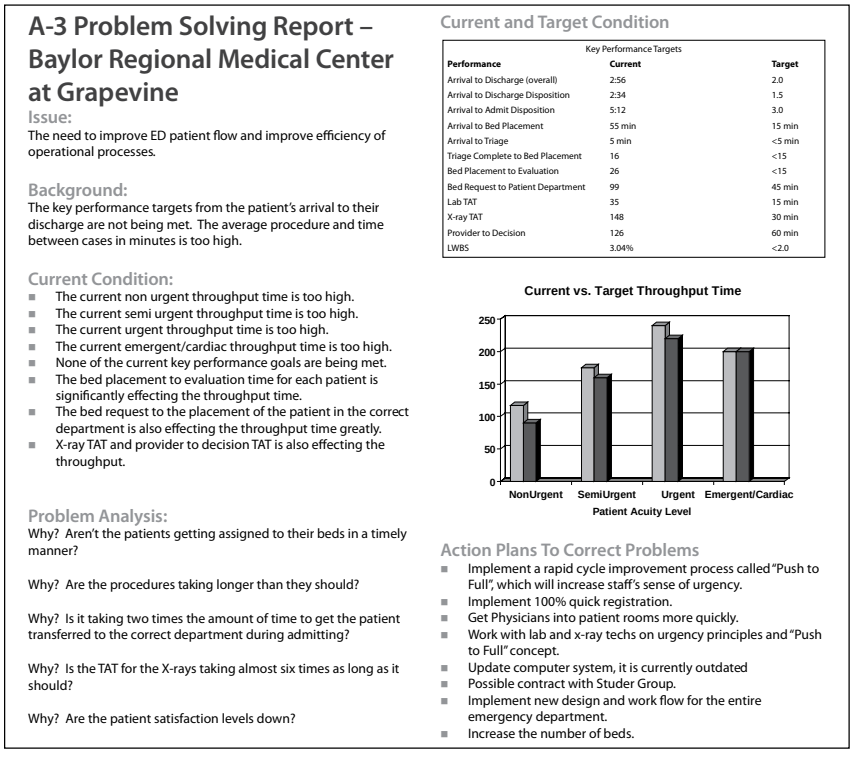
A3 Problem-Solving Report

The A3 problem-solving report is another Lean tool teams use to identify process improvement issues. The key to its success is in forcing the improvement team to be succinct as they work through the problem-solving process. The five key areas of the A3 form include the following:

- Describing the current condition (which might include a current value stream map).

- Providing supporting statistical analysis including root cause analysis.
- Detailing implementation of the planned improvement (which might include a future value stream map).
- Identifying the benefits and costs of the targeted outcome.
- Outlining future steps to be taken.

Involved stakeholders and those responsible for follow up and re-evaluation are identified and listed on the form. Figure 6.6 shows an example of an A3 problem-solving process created during planning for a replacement ED at Baylor Medical Center in Grapevine, Texas.



A-3 Problem Solving Report – Baylor Regional Medical Center at Grapevine

Issue:
The need to improve ED patient flow and improve efficiency of operational processes.

Background:
The key performance targets from the patient's arrival to their discharge are not being met. The average procedure and time between cases in minutes is too high.

Current Condition:
- The current non urgent throughput time is too high.
- The current semi urgent throughput time is too high.
- The current urgent throughput time is too high.
- The current emergent/cardiac throughput time is too high.
- None of the current key performance goals are being met.
- The bed placement to evaluation time for each patient is significantly effecting the throughput time.
- The bed request to the placement of the patient in the correct department is also effecting the throughput time greatly.
- X-ray TAT and provider to decision TAT is also effecting the throughput.

Problem Analysis:
Why? Aren't the patients getting assigned to their beds in a timely manner?

Why? Are the procedures taking longer than they should?

Why? Is it taking two times the amount of time to get the patient transferred to the correct department during admitting?

Why? Is the TAT for the X-rays taking almost six times as long as it should?

Why? Are the patient satisfaction levels down?

Current and Target Condition

Key Performance Targets

Performance	Current	Target
Arrival to Discharge (overall)	2:56	2.0
Arrival to Discharge Disposition	2:34	1.5
Arrival to Admit Disposition	5:12	3.0
Arrival to Bed Placement	55 min	15 min
Arrival to Triage	5 min	<5 min
Triage Complete to Bed Placement	16	<15
Bed Placement to Evaluation	26	<15
Bed Request to Patient Department	99	45 min
Lab TAT	35	15 min
X-ray TAT	148	30 min
Provider to Decision	126	60 min
LWBS	3.04%	<2.0

Action Plans To Correct Problems
- Implement a rapid cycle improvement process called "Push to Full", which will increase staff's sense of urgency.
- Implement 100% quick registration.
- Get Physicians into patient rooms more quickly.
- Work with lab and x-ray techs on urgency principles and "Push to Full" concept.
- Update computer system, it is currently outdated
- Possible contract with Studer Group.
- Implement new design and work flow for the entire emergency department.
- Increase the number of beds.

Figure 6.6 A3 problem-solving report for Baylor.

In 2006, the organization determined low patient satisfaction scores in the ED were caused by process delays and inadequate communication with the patient. Staff began making changes to improve the patient process. In May 2007, the department implemented a service and efficiency improvement project named the "Push to Full." It was designed to decrease the time the patient waited from arrival at the ED until they were seen by a physician, otherwise called "door-to-doctor time." Eight weeks after initiating the project, patient satisfaction scores had improved, and the door-to-doctor time was reduced 40%. By the end of 2008, the rate of patients who tired of waiting and left the ED without being treated (LWOT) decreased from 5.4% to 0.5%. This result positively compares to a national average of 2% (Powell, 2008).

As a result of these improvements, the staff at Baylor Grapevine received two national awards in 2008 for dramatically improving patient satisfaction as measured by Press Ganey.

Virtua Health used several of the Six Sigma and Lean tools during the planning and design of a replacement hospital and ambulatory care center in southern New Jersey, which will open in 2010 (Fendrick, Kotzen, Gandhi, & Keller, 2007). As part of the architect selection process, they screened candidates for their knowledge and use of these tools.

Other Tools

Other tools used to improve healthcare environments include parallel processing and mock-up rooms and units.

Parallel Processing

Massachusetts General Hospital and the Center for Medicine and Innovative Technology have used parallel processing successfully to become more efficient and reduce waste. After a problem was identified, they developed an "Operating Room of the Future" to increase surgical volume. They planned the new operating room with an induction room that allows for parallel processing: one patient is having a surgical procedure while another is in the induction room being prepared for

his or her procedure (see Figure 6.7). This process eliminates the waste that inherently occurs in the OR from the time the room is ready to be occupied by the next patient until the operation is started (Sokal, Craft, Chang, Sandberg, & Berger, 2006).

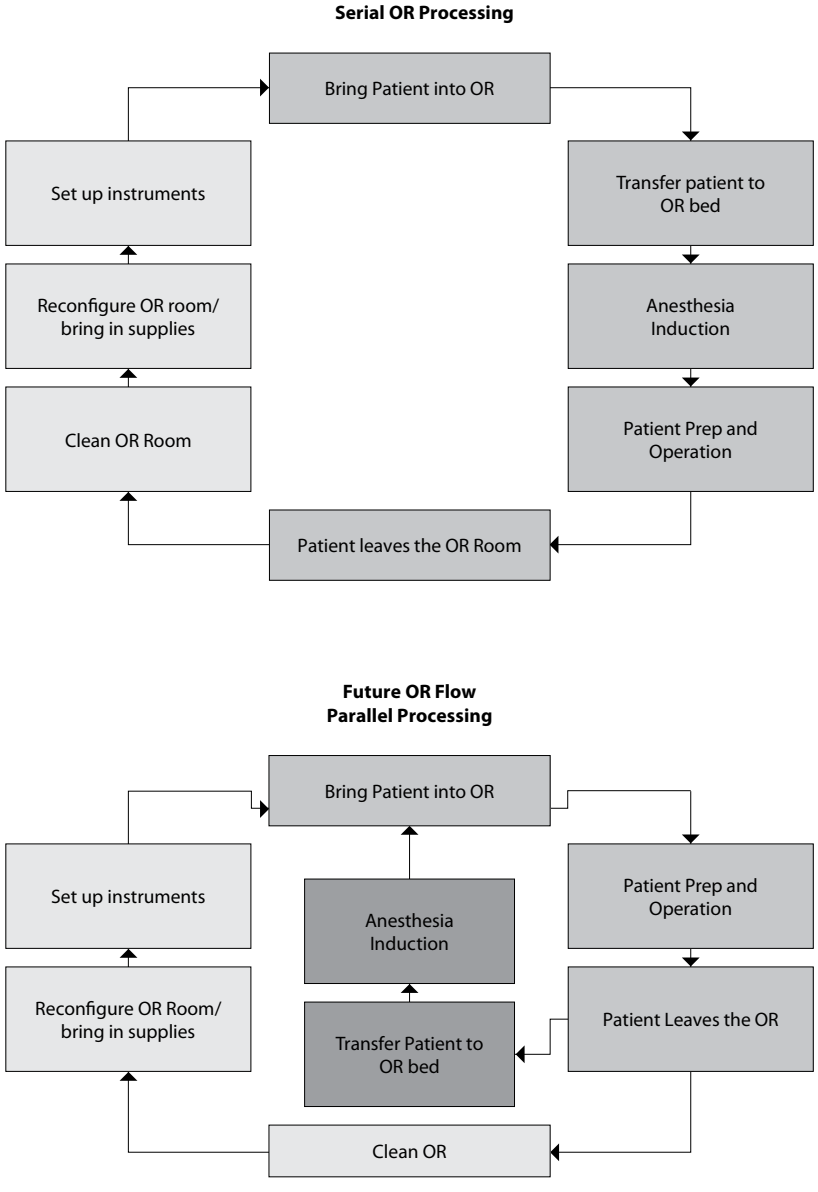


Figure 6.7 Comparing serial and parallel operating room flow.

Mock Rooms and Units

Healthcare consultants and designers typically recommend clients use mock rooms to test the functionality and efficiency of the size and layout of a new room or unit, visualize staff/patient/family movement, and determine equipment size and placement. Medical equipment companies often provide equipment for a trial period so staff can decide how it works in the room. Setting up a mock room is ideal for both adult and pediatric rooms as well as exam rooms and operating and imaging suites. Obtaining staff input during this phase encourages debate and discussion before final decisions are made and results in a better design. Mock rooms can be built out of cardboard or the materials that will be used in the new facility. A room or unit renovated and used to test new processes and equipment yields the best results (see photos 6.1-6.4 in the color insert for sample mock rooms).

Design Standardization

One of the trademarks of Lean processing is standardization. The more that processes and designs are standardized, the easier and more efficiently staff will find it to adapt and function in that environment. For example, in a standardized patient room, staff always know where to find equipment and supplies. Staff can also address the patient in the same manner and make observations/assessments in the same order. Checking and administering medications occur in the same way, and documentation of patient care occurs in the same system in the same location in each room. The amount of wasted time is substantially reduced, as are errors. Refer to Figure 6.8 for a diagram of standardized patient rooms.

The same is true of standardized floor plans for patient care units. Business centers, decentralized work areas, imaging viewing stations, meeting rooms, offices, supply and equipment storage areas, and soiled utility and housekeeping rooms are all placed in the same location on all floors. This standardized design makes it easier and more efficient for physicians and staff to move about in the facility. Supply and dietary staff who deliver goods to each unit can do their job more

efficiently in a standardized environment. Further, standardization can reduce the cost of the design process and make for easier future expansion or addition of services. Refer to Figure 6.9 for a standardized 36-bed patient unit.

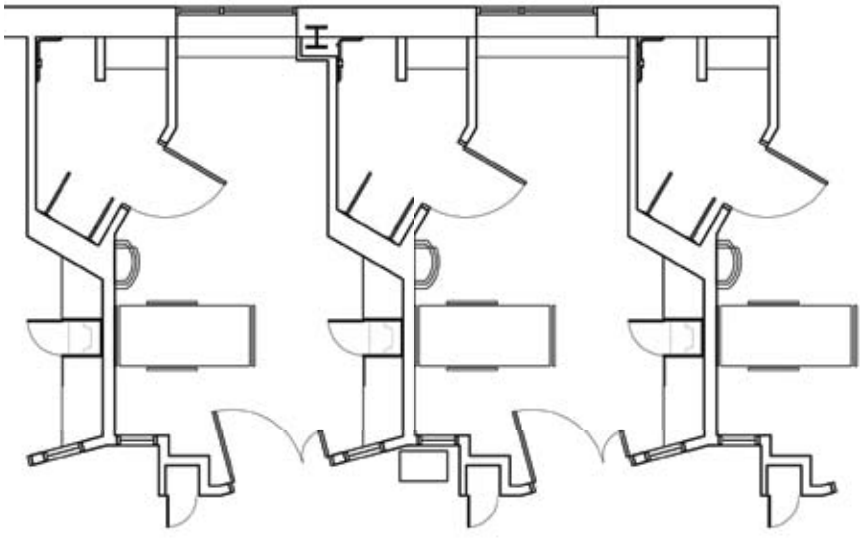


Figure 6.8 Standardized patient room diagram.

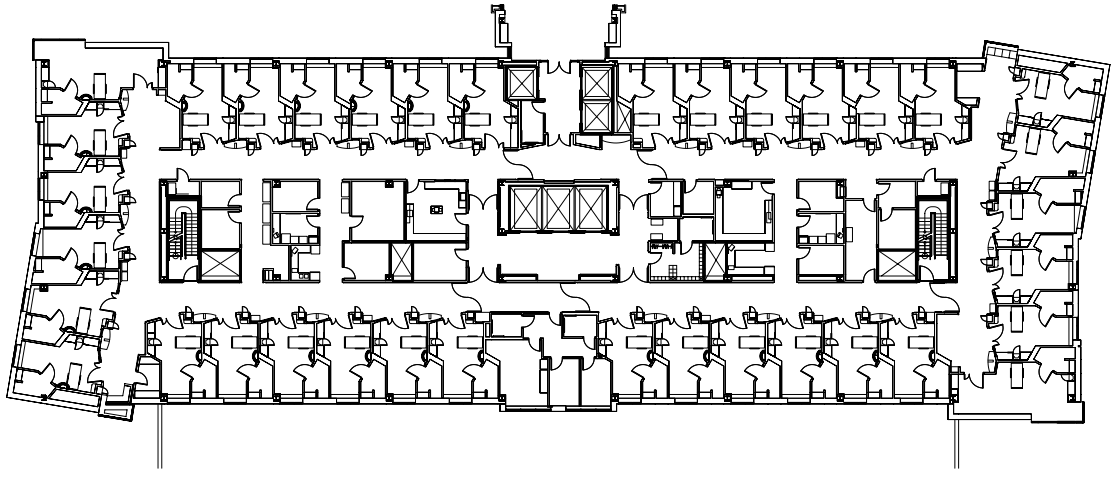


Figure 6.9 Standardized 36-bed patient unit.

Reportedly, each time patients are transferred from one unit to another, their length of stay is increased by approximately half a day (Hendrich, Fay & Sorrells, 2004). In addition, transferring a patient increases the opportunity to lose patient items, creates a potential for a staff injury from pushing a heavy bed, decreases patient and family satisfaction, and creates delays in treatment until other staff catch up with the patient in a new location. Some facilities have implemented the process in which patients remain in their rooms for the duration of their stays and staffing levels flex according to the patient's acuity (acuity flexible staffing). Specialty services such as cardiac, burn, or trauma work well with that model of care delivery. However, some who have changed to that model find it difficult to implement and maintain, primarily because of staffing competencies (Evans, Pati, and Harvey, 2008; Rawlings and White, 2005). Because the acuity-adaptable room has many benefits for the patient, nursing leadership need to consider a staffing pattern allowing staff to flex according to acuity but let the patient remain in the same room.

As care is focused on the patient and more services are brought to the patient (patient-focused care), administrators need to consider how design can help caregivers be more efficient. Nurses and caregivers no longer need to access a central nurse station for information because that information is at the patient's bedside in the form of the electronic medical record (EMR). Therefore, in the design process, designers must examine every interaction the caregivers have with the patient and locate work areas where they are most needed.

Decentralized caregiver workstations located outside each patient room or between every two rooms allow a caregiver to work efficiently while observing and caring for patients. Additional decentralized "teaming" workstations provide space for several caregivers to collaborate about the patient's care.

Supplies and medications must be close to the patient in a decentralized model of care for staff efficiency. To accommodate the items needed to care for the patient, nurse/patient storage units are located by each patient room. These "servers" can open from the hallway side so support staff can stock them without entering the patient room.

Supplies can be retrieved from the hallway side or in some cases from a door in the patient room. These pass-through servers can house linen, non-billable supplies, daily medications, and linen hampers. In a Lean facility, staff use the 5S methodology to determine par levels of supplies for the servers.

Process Improvement Case Examples

This section includes case study examples of Lean planning to improve processes for a renovated and a replacement facility.

Renovated Facility

During the planning process for the renovation of cardiology and radiology departments, a hospital in the Midwest decided to implement Lean planning. The process involved current and future flow charting for patients that were admitted with an acute myocardial infarction (MI) to Cardiology and patients who required a CT of the abdomen in the imaging department. They identified problems including lack of patient privacy, inefficient staff flow, and outdated departments that did not allow for accommodation of technology. Staff in both departments used the 5S tool to organize work areas and reduce par levels and inventory. Designers analyzed the proposed floor plans for the renovated departments using spaghetti diagrams before and after to identify the travel distances for caregivers as well as patients. As a result of this process, they significantly improved travel times for the renovated departments. Nurse and technician travel time was reduced 33% in the catheterization lab and as much as 50% for technicians in imaging. Other benefits included improved lab turnaround time and improved patient travel time with relocation of the patient changing area.

Replacement Facility

Planning a new or replacement hospital offers the greatest opportunity in Lean design. During 2008, staff at Sentara Princess Anne Hospital

in Norfolk, Virginia, went through the planning process for their new hospital. The plan for the ED was to care for 60,000 patient visits per year. Hospital administration's goal was to maximize patient throughput while reducing travel times and improving efficiencies for the staff.

They used flow diagrams and departmental floor plans to map patient and staff pathways. In the current ED, staff implemented bedside triage following the initial "quick assessment" when a patient arrives. They wanted to maximize that process in the new design. A traditional triage room was planned; however, it would be used primarily during peak times when other backup options were unavailable. To maximize the throughput, they planned an internal sub-waiting area for patients who were ready to be discharged but were awaiting final lab results, thereby keeping the main treatment rooms highly utilized. Patients who needed to be observed for greater than 2 hours would be placed in the critical decision/observation unit located adjacent to the ED. In addition to using this unit for extended patient care, the observation unit could be used during peak census times to further optimize patient throughput. During planning, the team addressed questions on where lab specimens would be drawn and where results would be processed and on adjacency and access to imaging. The goal was to optimize patient and staff flows and reduce staff steps and waiting time for patients.

Final Thoughts

To create a healthcare design that supports safety and quality initiatives, administrators must learn how staff spend their time, improve processes, and determine how technology can enable the caregiver to be more efficient and effective. Consultants can plan and architects can design wonderful spaces, but the success of the project lies in the amount of staff involvement when it comes to determining how care will best be delivered.

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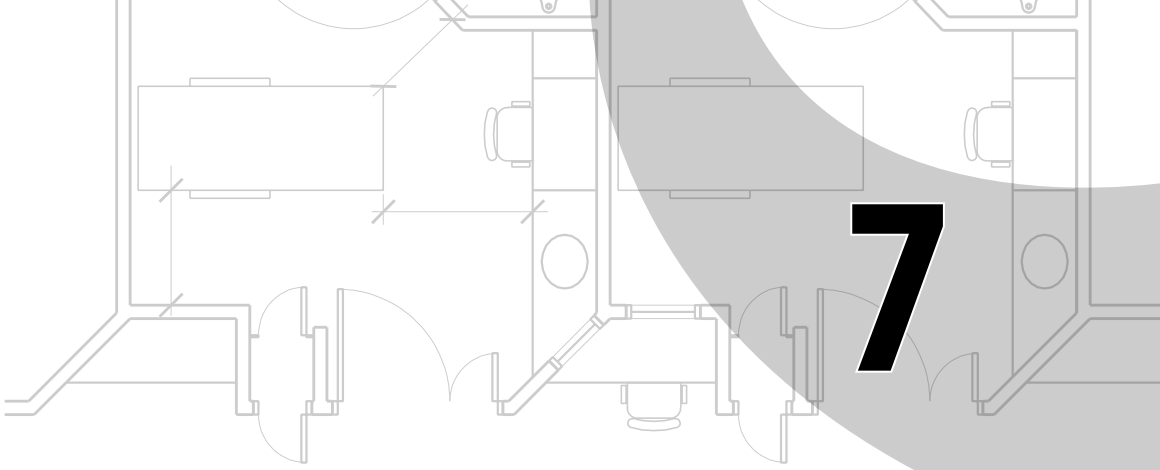

7

Sustainable Healthcare Design

By Michaella Wittmann

Every industry leaves an indelible footprint on the environment in terms of what it extracts from the earth and what it releases in the form of waste. For the healthcare industry, the issue of environmental impact is especially paramount. The profession is committed to doing no harm, yet many issues related to the design and operation of healthcare facilities contradict this principle tenet. For example, healthcare facilities are among the largest U.S. consumers of energy, thus contributing to greenhouse gas emissions and climate change, and one of the biggest producers of waste, some of which is toxic. As a result, the healthcare industry is contributing to the very problem it is trying to solve (Guenther & Vittori, 2008).

Gary Cohen, co-executive director of Health Care Without Harm (HCWH), states:

> Increasingly it is clear that in order to prevent diseases in the general public, we need to understand the environmental links to those diseases and do whatever we can to reduce environmental exposures. Of all the sectors of society who

> should understand this growing science, it should be the healthcare sector—they're in the healing business. And they have a responsibility to clean up their own house. We think that one very important objective for the 21st century is ensuring healthcare facilities operate with the least amount of environmental exposure as possible, and to move to a model of a high-performance healing environment—an environment that actually promotes healing, as opposed to contributing to further disease or exposure to infection (Pioneer Team Blog, 2008a).

By doing so, the entire healthcare paradigm could change. Total healthcare spending in 2007 represented 17% of the gross domestic product (Keehan, Sisko, Truffer, Smith, Cowan et al., 2008). The implications of environmental improvements in healthcare facilities can reach far beyond the scope of the profession.

In fact, the greening of the healthcare industry is gaining tremendous momentum. The increasing incorporation of sustainable building (design, construction, and building operations) strategies in healthcare environments was underscored in a survey conducted for *Health Facilities Management* magazine and the American Society for Healthcare Engineering (ASHE) of the American Hospital Association. The survey, conducted during the spring of 2008, was designed to measure hospitals' sustainability efforts in current construction and renovation as well as in energy efficiency programs (Carpenter, 2008).

According to survey respondents, energy topped the list of recent measures undertaken by hospitals. Poll participants cited conducting an energy audit as the most common step taken to become more environmentally friendly (59%), followed by selecting energy-efficient or Energy Star–qualified products for equipment and appliance replacement or new purchases (52%); promoting environmentally friendly practices among employees, patients, and the community (49%); purchasing environmentally friendly products (46%); and commissioning or retro-commissioning their facility's systems (41%).

This chapter explores these and other issues relating to sustainable building practices and discusses ways in which healthcare practitioners who are concerned with safeguarding physical and psychological well-being can incorporate sustainable design practices into their facilities.

The Built Environment's Impact on Human Health

Buildings are really living systems that continually use the earth's resources and generate waste from the time construction starts through the operation to the final destruction or de-construction. Buildings of any kind, in and of themselves, are not sustainable.

This problem is magnified in healthcare facilities, which often include spaces that overflow with chemicals. Chemicals exist in medical devices; equipment; computers; copiers; building materials and finishes that cover floors, walls, ceilings, and the furniture upon which patients are examined, sit, and sleep. Building occupants are exposed to these chemicals through touching chemically contaminated building and furniture surfaces and through exposure to the chemical concentrations in the indoor air. Emerging science links many of these chemicals to environmental contamination and negative human health effects (Silas, Hansen & Lent, 2007).

What can result are a number of ailments which, though not unique to the healthcare industry, can be classified as sick building syndrome, building-related illness, and multiple chemical sensitivity conditions.

- The term *sick building syndrome (SBS)* describes situations in which building occupants experience acute health and comfort effects that appear to be linked to time spent in a building and exposure to a range of airborne volatile organic compounds (VOCs), but no specific illness or cause can be identified. The complaints might be localized in a particular room or zone or might be widespread throughout the building.

- In contrast, the term *building-related illness (BRI)* is used when symptoms of diagnosable illness are identified and can be attributed directly to airborne VOC building contaminants (U.S. Environmental Protection Agency).
- Another form of environmental illness is called *multiple chemical sensitivity (MCS)*. With this condition various symptoms reportedly appear after a person has been exposed to any of a wide range of airborne VOCs. The exposure might occur as a major event, such as a chemical spill; as a short-term exposure to a high chemical dose; or from long-term contact with low levels of chemicals, such as in an office with poor ventilation. As a result of exposure, people with MCS develop sensitivity and have reactions to the chemicals even at levels most people can tolerate (MedicineNet.com, 2004).

As places of healing, healthcare facilities are expected to be the last places to encounter environmental illnesses caused by the building. Yet hospital patients and staff are just as likely to fall victim to BRI as office workers. A recent study by the National Institute for Occupational Safety and Health found that outside of the manufacturing sector, work-related asthma rates are higher among those employed in the healthcare industry than they are in any other group of workers (*BusinessWeek*, 2008).

When it comes to the indoor environment of healthcare facilities, physicians are primarily concerned about infection control, especially because weakened immune systems are more susceptible to contagious diseases. Plenty of justification for this concern exists: the Institute of Medicine estimates that nosocomial infections—those contracted by a patient while under medical care—account for more deaths annually in the United States than motor vehicle accidents (Institute of Medicine, 1999).

Benefits of Sustainable Healthcare Design

In the short term, sustainable healthcare design seeks to address the multitude of issues that contribute to the built environment's negative impact on human health. The long-term goal is for buildings to be restorative, contributing positively to the physical, emotional, and even spiritual well-being of occupants. By reducing environmental impacts, healthcare facilities also reduce environmental contaminants. This reduction, in turn, helps decrease the potential for negative health impacts to the surrounding community as the result of toxic waste disposal and incineration, which release these contaminants into the soil and air. An examination of the specific benefits sustainable design offers to a healthcare facility and its occupants shows that many are inextricably intertwined. They include improved patient outcomes, improved patient and staff safety, improved patient and staff satisfaction, better community image and loyalty, greater cost savings, and increased productivity.

Improved Patient Outcomes and Safety

As an increasing number of sustainable design strategies are introduced in healthcare facilities, a corresponding body of evidence grows to support the idea that green building practices translate into improved patient outcomes. For example, a case study at the Mackenzie Health Sciences Centre in Edmonton, Alberta, Canada, found that depressed patients with access to sunlight had an average stay of 16.9 days versus a stay of 19.5 days for those in dull rooms (Beauchemin & Hays, 1996). A similar study at Inha University Hospital in Korea reported a 41% reduction in average length of stay for gynecology patients in sunlit rooms (Benya, 2007). Other studies reported significant decreases in nosocomial infections as the result of improved ventilation rates in hospital rooms (*BusinessWeek*, 2008).

Improved Staff Safety

Sustainable healthcare design also addresses the issues of staff safety. A first-ever national survey of nurses' exposures to chemicals,

pharmaceuticals, and radiation on the job suggests links between serious health problems such as cancer, asthma, miscarriages, and children's birth defects and the duration and intensity of these exposures. The survey included 1,500 nurses from all 50 states (Environmental Working Group, 2007).

Survey findings chronicled how nurses daily confront low-level but repeated exposures to mixtures of hazardous materials that include residues from medications, anesthetic gases, sterilizing and disinfecting chemicals, radiation, latex, cleaning chemicals, hand and skin disinfection products, and even mercury escaping from broken medical equipment. At this time, no workplace safety standards have been established to protect nurses from the combined effects of these exposures on their health (through touch, injection, or inhalation).

Improved Patient and Staff Satisfaction and Well-Being

Numerous studies have demonstrated that building occupants who are in sustainably designed and operated buildings are more satisfied. These effects have been shown to be related to such issues as improved indoor air quality, a connection to the natural environment, access to sunlight and views, and overall improved perception of the work environment (Heerwagen, 2000).

According to Heerwagen (2000), an environmental psychologist, medical models of health integrate behavioral, social, psychological, and mental processes. So, too, should buildings be models of health and well-being. Ironically, many of the prominent features of green buildings are likely to have their greatest impact on cognitive and psychosocial well-being. For example, Herwagen reports that contact with nature and sunlight penetration has been found to enhance emotional functioning.

Positive emotions, in turn, are associated with creativity and cognitive "flow," a state of high task engagement. Other green building features, such as indoor and outdoor relaxation areas with vegetation and views, are likely to enhance social interaction and one's sense of belonging, both of which are associated with organizational attachment, a topic of enormous interest among organizations today. Drawing on research

from a variety of studies in the U.S. and Europe, you can more fully identify links between these well-being outcomes and building features. See Figure 7.1, extracted from Heerwagen (2000), for a display of those links.

Table 7.1 Links between well-being outcomes and building features.

Health Dimensions	*Building Design Features*
Physical well-being	Interior cleaning/maintenance HVAC operation and maintenance Ventilation conditions Materials selection Temperature conditions Personal control of ambient conditions
Psychosocial well-being	Daylight Sunlight penetration Window views Contact with nature Social spaces Lack of crowding Acoustical privacy Personal control of ambient conditions
Neurocognitive well-being	Temperature conditions Ventilation conditions Interior cleaning/maintenance Materials selection Personal control of ambient conditions Light levels appropriate for task Lack of glare from ceiling lights/ windows Window views Perceived visual distance Contact with nature

Source: "Do green buildings enhance the well-being of workers?," by Judith Heerwaggen, Environmental Design & Construction, *July/August 2000*

The stories of healthcare facilities undertaking sustainable design initiatives resonate greatly with the communities where they are located. Healthcare facilities where sustainable practices are used for design and operations send a positive message to the surrounding community regarding environmental stewardship. Actions that convey a respect for the condition of the natural environment—especially those that appear to go above and beyond ordinary efforts—also appear to respect those who have a stake in it. This contributes to the creation of highly valuable, albeit intangible, assets such as goodwill, a positive image, and enhanced loyalty (Bonda & Sosnowchik, 2006).

Cost Savings through Optimized Operations

Sustainable design requires thinking for the long term, so life cycle cost becomes as important as first investment cost. Sustainable buildings are designed for flexibility, long-term use, and high-performance. Buildings that are designed to optimize operations and maintenance are ultimately less costly to operate over the long term.

Increased Productivity

A 1:10:200 relationship between the investment in building construction and the 30-year operation of a healthcare building means every dollar spent on capital construction requires $10 related to building operation (energy costs and maintenance), and $200 related to salary expenses (the cost of healthcare staff) over the first 30 years. This relatively high proportion of cost related to salary suggests that long-term, financial benefits can come from investing in sustainable building design and operations (Guenther & Hall, 2007).

Sustainable Design Elements and Strategies

A number of critical elements contribute to a sustainable healthcare facility. Indoor air quality, materials and resources, daylighting strategies, connections to nature, cleaning practices, and food service are among them and are discussed in more detail in the following sections.

Indoor Air Quality

The U.S. Environmental Protection Agency reports that Americans spend, on average, 90% of the day indoors. During that time, Americans breathe outdoor air that has been brought inside (already contaminated with numerous chemicals, formaldehyde, and ozone), which subsequently is combined with more chemicals and pollutants that are emitted from building materials and furniture, occupants' clothing and personal care products, and chemicals and ozone emitted from office equipment and cleaning products.

The result is that indoor air is a complex chemical soup whose ingredients include VOCs emitted from building materials, contents, and cleaning agents; semi-volatile organic compounds (SVOCs) from fire retardants, pesticides, and plasticizers; microbial organisms and microbial volatile organic compounds (MVOCs) from mold; inorganic chemicals such as carbon monoxide, nitrogen dioxide, and ozone; and particulate matter generated by fuel combustion, occupant activities, and equipment. Recent research indicates that secondary chemical reactions also occur, caused by ozone reacting with indoor VOCs to form SVOC compounds and formaldehyde, both of which also impact health (Bernheim, 2008).

Though the design for good indoor air quality (IAQ) is a complicated endeavor, the implementation of four basic design principles can go a long way to providing healthier indoor environments (Bernheim, 2008). They are as follows:

- **Source Control:** By reducing indoor air chemical concentrations, the pollutant burden added to the outdoor air brought inside also is reduced, lessening occupants' exposure to potentially harmful chemicals. The selection of low-VOC content materials is a first step; much more important is the selection of low-emitting materials. Research has shown that some low-VOC content building materials and particularly some paints might still emit VOCs and formaldehyde.
- **Ventilation Design:** If natural ventilation is used, particular attention should be given to the quality of the outside air. With

a build-up of greenhouse gas emissions and an increase in outdoor temperatures, a related build-up of ozone in the outdoor air occurs. Local ambient air quality and ozone data determines if the air is suitable for human use and good health. If a mechanical system supplements or replaces operable windows, then adequate filtration, ventilation rates, and humidification should be considered.

- **Building and IAQ Commissioning:** Originally intended to ensure energy efficiency, commissioning—the process of testing and evaluating mechanical and electrical systems to ensure they are installed properly and operate in an efficient manner—also ensures improved air quality and occupant comfort. Regular building re-commissioning helps continually fine-tune the building and catch air quality and efficiency deficiencies. Air quality testing should occur before occupancy, before and after the flush-out (a period of 2 weeks between when the building is completed and before move in), and after occupancy.
- **Building Maintenance:** Maintaining mechanical systems (filter changes) and cleaning with environmentally friendly cleaning agents protects the building asset and can significantly improve the air quality and occupant health over the long term.

Materials and Resources

The design, construction, and operations of buildings, in general, use an enormous amount of materials that generate significant byproducts and waste. When designing a facility, considering the type of materials and resources that can reduce the impact of the materials' life cycle is essential.

Historically, common criteria for selecting finishes for a facility include cost, aesthetics, durability, and maintenance, with little or no thought given to a product's life cycle or the impact it will have on the

environment and people over its useful life. Though a true life cycle analysis of all materials is difficult (requiring the evaluation of a material's production, transportation, use, and eventual reuse or disposal), some material issues should not be overlooked, such as the impact of materials on indoor air and durability of materials. Also, durable and easy to maintain materials should be selected to reduce waste and prevent unnecessary expenditures for material replacement and maintenance.

Numerous material recommendations can be integrated into a facility plan that could benefit building occupants and the natural environment, including recycled content and recyclable materials that minimize resource consumption and waste; materials with low or no VOC emissions to minimize indoor air quality impacts; and bio-based materials made from rapidly renewable resources. (See Figure 7.1 for a comprehensive strategy for specifying materials that minimize environmental impacts.)

Potential harm introduced from the use of materials in a facility can be significant. For example, mercury, chemical reagents, cadmium in bio-hazardous bags, and phthalates in polyvinyl chloride (PVC) intravenous bags and tubes pose potential threats to the environment and human health. Two of the most common materials used extensively in healthcare facilities are PVC and mercury.

Polyvinyl chloride is a polymer, or large chain-like molecule, composed of repeating units of vinyl chloride (a monomer). It is commonly known as vinyl or PVC. Many products in the hospital and construction industry contain PVC, which has come under scrutiny because of two key problems. Dioxin, a known human carcinogen, can be formed during the manufacture of PVC and during the incineration or burning of PVC products. DEHP, a phthalate used to soften PVC plastic that can leach from PVC medical devices, is linked to reproductive birth defects and other illnesses according to animal studies (HCWH, 2008d).

Criterion 1: Do not use materials that contribute to the formation of persistent organic pollutants (POPs) as defined by the Stockholm Convention

Criterion 2: Do not use materials that contain or emit highly hazardous chemicals, including:

a. Do not use materials that contain:
- Persistent, bioaccumulative, toxics (PBTs) or
- Very persistent, very bioaccumulative (vPvB) chemicals

b. Avoid materials that contain:
- Carcinogens
- Mutagens
- Reproductive or developmental toxicants
- Neurotoxicants
- Endocrine disruptors

c. Avoid Materials that emit criteria levels of VOCs

Criterion 3: Use sustainably sourced bio-based or recycled and recyclable materials

a. Prefer sustainably produced bio-based materials that are:
- Grown without the use of genetically modified organisms (GMOs)
- Grown without the use of pesticides containing carcinogens, mutagens, reproductive toxicants, or endocrine disrupters
- Certified as sustainable for the soil and ecosystems
- Compostable into healthy and safe nutrients for food crops

b. Prefer materials with the highest post-consumer recycled content.

c. Prefer materials that can be readily reused or recycled into a similar or higher value products and where an infrastructure exists to take the materials back.

Criterion 4: Do not use materials manufactured with highly hazardous chemicals, including those described in Criterion 2.

Source: Rossi, M. and Lent, T. Creating Safe and Healthy Spaces: Selecting Materials that Support Healing, in Designing the 21st Century Hospital: Environmental Leadership for Healthier Patients and Facilities, Center for Health Design & Health Care Without Harm, 2006 *www.swif.org/files/publications/other/Design21CenturyHospital.pdf*

Figure 7.1 Green materials hierarchy for healthcare.

In the United States, the Food and Drug Administration (FDA) has issued a Safety Assessment and a Public Health Notification urging healthcare providers to use alternatives to DEHP-containing devices for certain vulnerable patients. That report followed closely on the heels of a similar report by the Center for the Evaluation of Risks to Human Reproduction of the National Toxicology Program. In Canada, an expert advisory panel to Health Canada has recommended healthcare providers not use DEHP-containing devices in the treatment of pregnant women, breastfeeding mothers, infants, males before puberty, and patients undergoing cardiac bypass hemodialysis or heart transplant surgery (HCWH, 2008a).

According to the nonprofit group HCWH, concerns about PVC use are increasingly bringing to market new alternatives. Many of the devices are cost competitive with PVC products. (A list of PVC-free medical devices can be found at www.noharm.org.)

Healthcare administrators who are committed to eliminating use of PVC are communicating the message to manufacturers, who are responding with new PVC-free products. Health Care Without Harm advocates that healthcare administrators take action to reduce their reliance on PVC products and materials by:

- Establishing an organization-wide PVC reduction policy.
- Performing an audit to identify PVC medical devices and building materials.
- Identifying PVC-free alternatives for medical devices and building materials.
- Reducing PVC throughout the institution.

Mercury is another chemical commonly found in healthcare settings that has come under scrutiny because of its associated health risks. Mercury is a neurotoxin that affects the development and functioning of the nervous system. The EPA considers mercury to be a persistent bio-cumulative toxin (PBT). *Persistent* means that mercury never degrades in the environment. *Bio-accumulative* means that the mercury accumulates in living tissues and is not metabolized and excreted from the body.

Toxin means that mercury has toxic effects, including brain and kidney damage (Health Care EPP Network, 2000).

In the past, mercury has been prevalent in the healthcare industry in blood pressure monitors, thermometers, esophageal dilators, cantor tubes, Miller-Abbott tubes, and histology fixatives and stains. Mercury might also be found in cleaning products, lamps, batteries, motors, and other electrical equipment. After mercury is released from medical facilities and other sources and enters the environment (especially bodies of water), it can be converted by microorganisms or chemical reactions to its most toxic form, methylmercury. Methylmercury is the form of mercury that most readily concentrates in the living tissues in fish, wildlife, and humans (National Association of Physicians for the Environment, 2000).

HCWH and the World Health Organization have launched a global partnership to substitute mercury-based medical devices with safer, accurate, and affordable alternatives. The initiative aims to replace 70% or more of all mercury thermometers and blood pressure devices around the world with digital and aneroid alternatives within the coming decade (HCWH, 2008b).

Several countries have already taken steps to mandate safer, more accurate, and more affordable alternatives to mercury-based medical devices. Finding a mercury thermometer in the United States today is virtually impossible, and the European Union and Taiwan have banned them outright. The Philippines has mandated a phase-out of all mercury medical devices by 2010, while hundreds of hospitals in Latin America also are moving toward alternatives (HCWH, 2008b). See Table 7.2 to see the connection between building design features and health dimensions.

Table 7.2 Building design features impact health dimensions.

Health Dimensions	*Very Important*	*Somewhat Important*	*Not Important/ Not a Factor*
Lower energy cost	78%	20%	2%
Quality of indoor environment	65%	30%	5%
Long-term cost benefits/sustainability	59%	35%	6%
Access to financial incentive programs	47%	40%	13%
Right things to do environmentally	46%	43%	11%
Positive impact on surrounding community	44%	46%	10%
Fits with hospital mission	44%	43%	13%
Demonstrates environment/social responsibility	41%	48%	11%
Required by local/state programs	28%	41%	31%

Source: Health Facilities Management/ASHE 2008 Green Design & Operations Survey

Any discussion of the elimination of toxins needs to extend beyond the scope of toxin use in medical devices and equipment. Harmful chemicals can also be found in the materials used to build healthcare facilities and in the fabric, furniture, and furnishings found throughout the interiors. For example, PVC is a common component in pipes, siding, roofing materials, flooring, wall covering, upholstery, and cubicle curtains. Urea formaldehyde, a known carcinogen, is commonly found in standard particle board, doors, fiberglass insulation, paints, adhesives, and sealants.

Navigating the materials maze to identify products manufactured with alternatives to dangerous chemicals is a complicated task. The good news is that an increasing number of third-party standards and certification programs can help identify the human health effects of various building materials. One of the newest tools is called the Pharos Project. It is an initiative of the Healthy Building Network whose goal is to redefine the way materials are manufactured and purchased

by defining a framework for evaluating products using environmental, resource, and social performance criteria.

Some healthcare organizations are also using the power of their purchasing dollars to encourage manufacturers to develop healthy building material alternatives. For example, in the mid 1990s, Kaiser Permanente began incorporating environmentally preferable purchasing specifications into contracts for medical, chemical, and building products. The goal was to convey to manufacturers and suppliers the importance that Kaiser Permanente places on reducing its life cycle ecological footprint while continuing to improve overall public health (Kaiser Permanente, 2008).

Use of Daylighting Strategies

Taking advantage of natural light minimizes the need for electric lighting during the daytime, saves energy, saves money, and lifts the spirits of building occupants. When daylight is properly controlled and complemented by good views and glare control, the combination is a powerful component of green interiors, and few strategies can top it for impact (Bonda and Sosnowchik, 2006).

Increasing evidence also underscores the beneficial health aspects of "daylighting" interior spaces. According to Dr. Richard Hobday from the University of West of England, daylighting helps to control disease. Bacteria and viruses are naturally controlled by daylight. In hospitals, hospital-acquired diseases such as drug resistant staph are becoming a leading cause of death. Daylighted hospital units have been noted to have less bacteria and related health issues (Benya, 2007).

Daylighting also helps prevent Vitamin D deficiency, Hobday explains. Because humans receive 90% of Vitamin D from sunlight, interior-centric living exposes people to less sunlight, and among the major outcomes is weakening of the immune system. Finally, Hobday posits that daylighting also helps prevent clinical depression, making it a potentially valuable treatment component, especially if, as predicted, clinical depression will be second only to cardiovascular disease as a leading cause of death and disability by 2020 (Murray & Lopez, 1996).

When measured in controlled situations such as hospitals, patients in daylighted spaces suffer less depression and recover more quickly (Benya, 2007).

Connections to Nature

Survey findings of both patient and non-patient groups demonstrate that simply viewing certain types of nature can significantly ameliorate stress within only 5 minutes or less (Ulrich, 1999). The mood improvements and physiological changes include lower blood pressure and reduced heart rate. Additional research found that prolonged exposure to nature views not only calms patients, but also can have a more far-reaching influence on medical outcomes. For example, a study of surgery patients found that those whose rooms had a bedside window experienced a more favorable recovery course than patients whose views overlooked a brick wall (Ulrich, 1984).

In *The Biophilia Hypothesis*, Harvard entomologist E. O. Wilson theorized that because humans evolved in nature, they are inherently imbued with *biophilia* or love of life and tend to seek out and thrive in surroundings that mimic the natural world (Wilson & Kellert, 1995). Nearly 15 years later, Kellert, along with Heerwagen and Mador, published a new book that explores how natural experiences, whether real or symbolic, evoke positive responses in human beings. In *Biophilic Design: The Theory, Science and Practice of Bringing Buildings to Life*, the authors posit that by melding biophilic principles and low-impact design, planners can achieve restorative environmental design or "true sustainability."

Biophilic design in a healthcare setting, then, suggests that utilizing environmental features (natural materials or plants) or natural shapes and forms (botanical motifs) helps improve outcomes such as pain reduction (Kellert, Heerwagen, & Mador, 2008).

Dr. Howard Frumkin, MD, PhD, also advocates for the positive health effects of exposure to nature. The Emory University professor points to the health benefits of four kinds of contact with the natural environment—contact with animals, contact with plants, viewing

landscapes, and contact with wilderness—as non-medical approaches to treatment and prevention versus the standard clinical paradigm that involves medication (2004).

The growing evidence linking nature and improved medical outcomes provides some of the impetus for the increased prevalence of including healing gardens and green roofs in healthcare facilities. Though the concepts of healing gardens in healthcare settings is more than 1,000 years old, their use declined in the past century as healthcare administrators, under pressure to control or reduce building and technology costs, considered them an inessential design element. As the restorative benefits of nature on both patients and staff have gained recognition, however, hospital executives are rethinking this belief. The particular stresses associated with nursing mean that dedicated areas for staff rest and relaxation, especially outside spaces, gardens, and landscaping, are significant factors that attract and retain nursing staff (Commission for Architecture & the Built Environment, 2004, p. 8).

Cleaning Materials and Practices

The chemicals used in many conventional cleaning agents can contribute greatly to poor indoor air quality. As a result, the conversion to cleaning agents and processes with reduced environmental health impacts has become an important element in a hospital's efforts to go and stay green.

Practice Greenhealth—a membership and networking organization for institutions in the healthcare community that have made a commitment to sustainable and eco-friendly practices—champions the green cleaning process for hospitals. Green cleaning is the process of maintaining and improving cleanliness and supporting infection control while protecting workers and the environment from the risks posed by cleaning materials and processes. Green cleaning is not simply switching one product for another; rather it needs to encompass a broad set of practices focused on overall "quality cleaning"—standardized operations, effective tools and cleaning chemicals, increased ventilation during and after cleaning, uniform dispensing systems, comprehensive staff

training, proper protective equipment, and clearly written policies and protocols for the various levels of cleaning and response to blood and body fluid spills. It also includes ongoing performance evaluation and improvement (Practice Greenhealth, 2009).

Food Service

The National Society for Healthcare Foodservice Management estimates that the total U.S. healthcare market for food and beverages in 2007 was about $1.2 billion (2008). Because hospitals are places of healing, hospital administrators have a natural incentive to provide food that is healthy for people and the environment. Providing a food supply can be done in a variety of ways, all of which have consequences in terms of nutrition, disease risk, public health, environmental health, and social and economic well-being. These consequences are linked in complex ways. From the way food is grown to the way it's packaged, shipped, consumed, and discarded, choices made in selecting food for these venues can have a profound effect on human health from both an ecological health perspective and individual health perspective (Sattler & Hall, 2007).

Healthcare administrators are taking concrete steps nationwide to change food buying practices to more sustainably produced, healthier choices for patients, staff, and visitors. A report from HCWH states that 127 facilities in 21 states across the country, including some that serve over 9,000 meals every day, have pledged to source local, nutritional, sustainable food. By signing the organization's Healthy Food in Health Care Pledge, these hospitals have signaled that they recognize that their healthcare food dollars are an important investment in preventive medicine (HCWH, 2008c).

The Healthy Food in Health Care Pledge outlines the steps the healthcare industry needs to take to improve the health of their patients, local communities, and the environment. This Pledge Report details the food purchasing steps the member facilities are making. For example:

- 80 facilities (70%) are purchasing up to 40% of their produce locally.

- Over 90 facilities (80%) are purchasing recombinant Bovine Growth Hormone (rBGH)-free milk. rBGH is a synthetic growth hormone injected into dairy cows in the United States and some other countries in order to force the cows to produce more milk than their bodies would otherwise to increase output and profitability (HCWH, 2008b).
- 100% of the facilities have increased fresh fruit and vegetable offerings.
- 50 facilities (44%) are purchasing meat raised without the subtherapeutic use of antibiotics and growth hormones.

As Cohen states:

> We know there's an important link between food and health and hospitals should be using meals as an opportunity to educate people about the essential connection between healthy food and healthy lives. And more than that, if hospitals are supporting organic and sustainable agriculture in their community, it's an extension of what we call community benefit. By using their purchasing power to support sustainable agriculture, it means less environmental exposures in the larger society—an example of the kind of transformation around food production that we need to see broadly in our society (Pioneer Team Blog, 2008a).

Barriers to Sustainable Healthcare Design

Though many healthcare executives readily acknowledge the benefits that sustainable design can bring to their organizations, they remain reluctant to readily embrace all that sustainable healthcare design represents. For the most part, hesitation stems from two critical concerns: cost and the absence of a champion to see a sustainable project through from inception to completion.

Cost

According to the *Health Facilities Management*/ASHE green healthcare survey, more than anything else, worries about possible costs are holding back hospital administrators from plunging deeper into green and sustainability spending. Money is at the root of most of the biggest challenges or barriers to environmentally friendly practices cited by survey respondents: higher initial cost (78%), increased cost over traditional materials and systems (73%), competing investment and spending priorities (72%), a perceived lack of immediate return on investment (47%).

Numerous experts argue that green is a financially sound investment, yet hospital executives are reluctant to test those theories, especially because various estimates place green construction costs anywhere from 1%–7% more than conventional construction costs. Some healthcare executives, however, argue that green facilities don't have to cost more, especially if sustainable design goals are integrated into the design process early on so that features effectively support one another Advocates also argue that the higher initial outlay should be viewed as an investment cost and can be made up over the long-term because green hospitals use up to 30% less energy and because environmentally friendly designs lead to better patient outcomes and shorter stays (Carpenter, 2008). See Table 7.3 for factors that influence the selection of environmentally friendly construction materials.

Table 7.3. Factors Influencing the Selection of Environmentally Friendly Construction and Renovation

Health Dimensions	*Very Important*	*Somewhat Important*	*Not Important/ Not a Factor*
Lower energy cost	78%	20%	2%
Quality of indoor environment	65%	30%	5%
Long-term cost benefits/sustainability	59%	35%	6%
Access to financial incentive programs	47%	40%	13%

Table 7.3. Factors Influencing the Selection of Environmentally Friendly Construction and Renovation *(continued)*

Right thing to do environmentally	46%	43%	11%
Positive impact on surrounding community	44%	46%	10%
Fits with hospital mission	44%	43%	13%
Demonstrates environment/social responsibility	41%	48%	11%
Required by local/state programs	28%	41%	31%

Source: Health Facilities Management/ASHE 2008 Green Design & Operations Survey

Champion (Leadership)

The *Health Facilities Management*/ASHE survey notes hospital leaders are a key element in determining green progress. Survey respondents said the primary drivers for green/sustainable efforts in hospital construction and renovation projects are facilities management (75%), architect/design team (51%), administration (46%), environmental services (24%) and health and safety department (20%) (Carpenter, 2008).

"The healthcare systems that have made the most comprehensive changes always have buy-in from the executive level," noted Cohen. "Once the CEO says that we're going to make this change happen, then the rest of the system gets in alignment and people are given a mandate to implement change, whether it has to do with their built environment or their purchasing or their operations" (Pioneer Team Blogs, 2008a).

Increasingly, though, healthcare institutions are finding that environmental champions are willing to swim against the tide in an effort to transform their workplaces in models of environmental stewardship. Traditionally, these champions have resided in the facilities management department where they have been able to influence to some degree decisions regarding design, construction, and operations practices.

In the past few years, nurses have rallied to support sustainable healthcare practices. For example, 10 Constituent Member Associations (CMAs) of the American Nurses Association (ANA) collaborated to develop the document "Guidance for Developing an Environmental Health Task Force." Similar task forces are developing educational programs and activities regarding environmental stewardship values that promote environmental health (Sattler & Hall, 2007).

The Luminary Project: Nurses Lighting the Way to Environmental Health is an effort to capture the illuminating stories of nurses' activities to improve human health by improving the health of the environment. The Luminary Project posts stories on their Web site to show how nurses are creatively and strategically addressing environmental problems and illuminating the way toward safe hospitals and communities with clean air (Luminary Project, 2005).

The Integrated Design Process

A sustainable, green, and high-performance building is one that is designed, constructed, and operated to make the world a better place by improving the environment through nurturing lives, restoring environmental assets, and offering inspiration by drawing on the collaborative experience of a multi-disciplinary team of professionals. Sustainable building practices are an integral component of environmental stewardship and, when successful, make a positive contribution to the earth by minimizing a building's impact on the global, regional, and local environment.

Achieving good design for long-term sustainability must start at the beginning of a project and continue throughout its life in what is called the *integrated building process*. This process follows current building practices, but places an emphasis on increased team collaboration and design work taking place early in the project. The six steps in this process are as follows:

1. **Define the project:** This is the opportunity in the process to develop an understanding of the client's mission, vision, and

goals and the project site's context. Best current sustainable building practices for the type of healthcare facility should be collected and used to illustrate what might be achievable and to assist in developing the project sustainability goals.

2. **Identify integrated sustainable building strategies:** With the project team and the client working collaboratively, this is the time to identify possible integrated sustainable building strategies by using intensive planning sessions such as charrettes and workshops. For ease of developing solutions, strategies are identified in categories including siting, energy, indoor environmental and air quality, resources, and societal.
3. **Sustainable building measurement:** The potential success of the integrated sustainable building strategies should be evaluated using established metrics, third-party sustainable building rating systems, and various green material certifications and should meet the minimum requirements of the applicable codes, laws, and guidelines.
4. **Sustainable building opportunities and limitations:** The proposed integrated sustainable building strategies should be evaluated in terms of initial investment costs and the potential government or utility company incentives to determine the initial project cost impact. This information should be balanced with the benefits offered by these strategies and the risks associated with implementing or not implementing them. At the end of this step, the most appropriate integrated sustainable building strategies should be selected for implementation in the project.
5. **Implementation:** The selected sustainable building strategies should be integrated into the project during the design, construction, and operational phases.
6. **Life cycle management:** After the project is completed and occupied, post-occupancy evaluations can help in understanding the lessons learned from the project, in re-commissioning, and in performing ongoing measurement

and verification to assist the building owners and operators to more efficiently operate their facility.

The sustainable building process should be implemented by an integrated design team with skills consistent with the project needs. Integrated collaborative teams should be carefully constructed to include representatives from the key project stakeholders including administrators, physicians, nursing staff, facilities personnel, and even patient (user) groups.

Tools and Resources

Clients have available to them a number of resources that can be used to inform the sustainable design decision-making process. They include LEED for Healthcare, Green Guide for Health Care, the American Society for Healthcare Engineering, Practice Greenhealth, and Health Care Without Harm.

LEED for Healthcare

The LEED for Healthcare Green Building Rating System has been specially formulated to address the design and building challenges unique to healthcare facilities, including inpatient care facilities, licensed outpatient care facilities, and licensed long-tem care facilities. LEED for Healthcare can also be used for medical offices, assisted living facilities, and medical education and research centers. It addresses issues such as increased sensitivity to chemicals and pollutants, traveling distances from parking facilities, access to natural spaces, and the 24/7 nature of healthcare operations.

LEED for Healthcare builds on the early work of the Green Guide for Health Care (GGHC), which attempted to introduce healthcare–specific aspects to existing LEED rating systems. Working collaboratively with the U.S. Green Building Council (USGBC), GGHC provided expertise in developing LEED for Healthcare, helping streamline LEED for Healthcare's development schedule by aligning with the LEED for New Construction rating system's

organizational structure and by conducting public comment periods and a pilot program that included more than 100 healthcare facilities (for more information, visit www.usgbc.org).

Green Guide for Health Care (GGHC)

The Green Guide for Health Care (GGHC) was the healthcare sector's first quantifiable sustainable design toolkit integrating enhanced environmental and health principles and practices into the planning, design, construction, operations, and maintenance of facilities. GGHC is a voluntary, self-certifying metric toolkit of best practices that designers, owners, and operators use to guide and evaluate their progress toward high performance healing environments. Since its inception in 2002, GGHC has attracted 160 registered projects, representing close to 40 million square feet of green healthcare facilities in the United States and abroad.

With the introduction of LEED for Healthcare, the GGHC has significantly revised its operations section to emphasize continuous improvement and frame best practices in operations and maintenance protocols, keeping abreast of the momentum in policy and practice toward green building and operations methods and materials.

Revision highlights include the following:

- Updated regulatory standards, best practices, and resources reflecting the most current available information.
- An expanded scope that addresses merging priorities in healthcare operations and maintenance, including emissions reporting, low-impact grounds maintenance, sustainable food service, and multi-attribute environmentally preferable purchasing policies.
- An emphasis on continuous improvement and integrated operations and education.

The Green Guide for Health Care is available as a free download from the GGHC Web site: www.gghc.org.

American Society for Healthcare Engineering (ASHE) Initiatives

The Green Building Committee of the American Society for Healthcare Engineering (ASHE) developed the Green Healthcare Construction Guidance Statement to take advantage of significant opportunities to improve environmental quality through green planning, design, construction and operations, and maintenance practices consistent with the American Hospital Association's recent voluntary agreement with the U.S. Environmental Protection Agency to reduce waste volume and toxicity. The statement was formulated to protect health at three levels: the immediate health of building occupants, the health of the surrounding community, and the health of the larger global community and natural resources. The ASHE guidance statement examines vision, goals, and suggested strategies for:

- Integrated design
- Site design
- Water
- Energy
- Indoor environmental quality
- Materials and products
- Construction practices
- Commissioning
- Operations and maintenance
- Innovation

Go to www.ashe.org/ashe/products/index.html to download the statement.

Practice Greenhealth

Practice Greenhealth is a membership and networking organization for institutions in the healthcare community that have made a commitment

to sustainable, eco-friendly practices. Members include hospitals, healthcare systems, businesses, and other stakeholders engaged in the greening of healthcare to improve the health of patients, staff, and the environment.

Practice Greenhealth offers information, best practices, and solutions for greening the many facets of the healthcare industry from facilities management to design and construction, environmental purchasing, waste management, clean energy, and chemicals and pest management.

A variety of tools, educational opportunities, and services aimed at greening the healthcare industry including webinars, workshops, training, consulting, data tracking tools, and idea exchanges are available from Practice Greenhealth.

For more information, visit Practice Greenhealth at www.practicegreenhealth.org.

Health Care Without Harm

Health Care Without Harm is an international coalition with a mission to transform the healthcare sector worldwide, without compromising patient safety or care, so that it is ecologically sustainable and no longer a source of harm to public health and the environment. Members include hospitals and healthcare systems, medical professionals, community groups, health-affected constituencies, labor unions, environmental and environmental health organizations, and religious groups.

HCWH goals include the following:

- Create markets and policies for safer products, materials, and chemicals in healthcare. Promote safer substitutes, including products that avoid mercury, PVC plastic, and brominated flame retardants.
- Eliminate incineration of medical waste, minimize the amount and toxicity of all waste generated, and promote safer waste treatment practices.

- Transform the design, construction, and operations of healthcare facilities to minimize environmental impacts and foster healthy, healing environments.
- Encourage food purchasing systems that support sustainable food production and distribution and provide healthy food on-site at healthcare facilities.
- Secure a safe and healthy workplace for all healthcare workers.
- Ensure patients, workers, and communities have full access to information about chemicals used in healthcare and can participate in decisions about exposures to chemicals.
- Promote human rights and environmental justice for communities impacted by the healthcare sector while ensuring that problems are not displaced from one community or country to another.

Visit www.noharm.org for more information.

Case Study—Metro Health Hospital, Wyoming, Michigan

In July 2002, during the planning for a replacement hospital, Metro Health Hospital administrators decided that just building a single "green" facility was not enough. They decided to pursue the creation of an entire complex to reflect the principles of sustainability. Thus, they began the development of Metro Health Village, a 170-acre campus located approximately 12 miles south of Grand Rapids, Michigan (see photos 7.1, 7.2, and 7.3). Even though the Health Village is currently home to only the new replacement hospital, future plans include 40 complementary medical, retail, and hospitality businesses, all within walking distance of the hospital. Metro Health Hospital administrators set an aggressive goal for a healthcare campus by requiring all buildings be LEED-certified.

The 403,926-square-foot, 192-bed replacement hospital was the first to undergo the LEED process. The location was chosen to better

address the needs of an underserved part of the community. Their vision for the hospital was to create an environment that was healthier for the patients and environmentally friendly. Primary design concepts included right-sizing the building to maximize space, installing a green roof for patient viewing, preserving and taking advantage of the wooded areas on site, encouraging recycling, and implementing a green housecleaning program. In addition, the careful site selection resulted in reduced travel time by patients, employees, and medical personnel to the facility.

During programming and design, planners led user groups in visioning sessions to develop a Project Mission Statement. The client used benchmarking to assist in making decisions. At each milestone in the design process, the user groups referred to the Project Mission Statement to ascertain design compliance.

The integrated design team consisted of

- Hospital user groups, medical, and administrative staff members.
- Hospital focus groups for healing garden design, patient safety, and sustainable design.
- Community representatives.
- Construction managers and architects.
- Representatives of approving agencies of the city and state.

The building, as designed with the team's input, reflects the intended uses extremely well. User groups toured the building during construction to view the implementation of their original visions. As a result, very few surprises occurred during construction and occupation of the building. Giving users the opportunity to make changes during construction is a great risk to the schedule and budget. A strong management team was in place to evaluate the requests, and the project finished ahead of schedule and under budget.

Some sustainable solutions that designers implemented at Metro Health Hospital relate to air quality, lighting, occupant views, materi-

als and resources, transportation, landscaping, open space, water efficiency, and energy.

Patients confined to a hospital spend nearly 100% of their time indoors. Air quality, especially in a hospital, is imperative to a patient's health and well-being. An environment that aids healing is beneficial to the hospital (competition with other medical facilities), the patient (shorter length of stay, reduced healthcare costs, quicker healing timeframe), and employers (patient returns to work sooner, reduced downtime, improved productivity).

For interior materials, the project specified the following products with recycled content, low-VOC content, and zero formaldehyde emissions: ceiling tiles, paints, adhesives and sealants, wood doors, casework, carpet, furniture and seating, linoleum, resilient tile, handrails, guardrails, and wall protection. For occupant health, the project employed baseline air quality testing and low-energy, low-mercury personal lighting systems. The building entrances have recessed entrance grates to capture dirt and particulates. Designers constructed housekeeping areas with deck-to-deck partitions to create an enclosed mechanically ventilated air space with separate outside exhaust to prevent chemical emissions from traveling to other interior spaces.

Occupant Views

Metro Health's southwest-northeast orientation responds to the natural surroundings by conforming to natural contours and preserving the native forested vegetation of the site. Nestled between the Health Village and natural beauty of a wooded area, the patient rooms in the patient tower have picturesque views. Designers placed tranquil healing gardens in courtyards within the building footprint, along with windows at the end of corridors to allow natural light to filter through to the public and staff areas, thus reducing energy use.

Lighting and Daylighting

Using the natural slope of the site to the best advantage, the building's lower level rear walk-out allows daylight into an area of the building that would normally have none. In areas other than patient rooms,

motion sensors for lighting conserve energy. Most lighting is indirect for patient comfort. Daylighting controls limit energy consumption and use available sunlight. Each private patient room has the ability to control the temperature within set points. Large energy-efficient windows in patient rooms provide abundant daylighting.

Materials and Resources

Sustainable projects use materials and resources in an efficient manner to reduce costs (e.g., transportation, materials, and natural resources) and improve air quality. Metro Health Hospital's initiative in this area can serve as a model for healthcare facilities.

Waste Diversion

The project used an aggressive construction waste management program diverting 70% of construction debris or approximately 1,793 tons of material. Those involved in the construction sorted waste on-site and placed it in dedicated dumpsters for wood, drywall, ceiling tile, ceramic tile, cardboard/paper, concrete, metal, and general waste.

Recycled Content

The project used more than $5.2 million of recycled content, or more than 9.5% of the default materials cost.

Regional Content

Over 20% of materials were manufactured and 25% of materials were extracted from within 500 miles of the project site, reducing transportation costs, improving construction times, and reducing the pollution associated with materials transportation.

Sustainable Site

To create a place where all services would be within walking distance of each other required a detailed site selection process. Planners wanted to facilitate the handling of a patient's medical needs, while

saving time and money and ultimately improving air quality and reducing the overall carbon footprint.

Transportation Features

In the previous location, hospital administrators often fielded complaints from patients and staff regarding the 15-mile average travel distance to reach the facility, a factor that impacted the selection of the new site. Two bus lines serve the new site, with priority parking for car or van pools; in addition, there are approximately 40 bike stalls and a pedestrian network through the Health Village that makes biking and walking viable alternatives to driving. Two park areas along with walkways incorporate the beauty of the wooded areas who have been preserved and enhanced. Parks include a playground, fountains, and an amphitheater.

The Health Village has gone to great lengths to be a good neighbor. One example is the reduction in parking spaces below city code. The project worked with the city first to reduce the number of parking spots required, because most of the occupants would be patients who did not need to have a vehicle on site, and second to reduce the width of the parking spots from 10 feet to 9 feet. These two steps reduced the total parking lot space by 16,000 square feet.

Landscaping

As part of the LEED certification process, Metro Health Hospital adopted vegetative Best Management Practices (BMPs) not typically used in hospital landscaping to improve storm water management processes. The site employs three such BMPs:

- A 48,500-square-foot vegetated “green” roof.
- Infiltration bioswales (rain gardens) in two parking lots.
- Two detention basins that outlet to an infiltration basin.

Landscape planners incorporated native plants into developing rain gardens and bioswales to reduce storm-water runoff, add natural

beauty to the parking areas, and develop mini-ecosystems. Water not absorbed into the rain gardens is collected in a pond and then used as needed for irrigation. As a result, irrigation water comes completely from the site; no city water is needed. In addition, the rooms in the inpatient bed tower have a view of the brilliant, multi-colored rooftop garden on the one-story outpatient building. This green roof reduces the heat island effect and storm water runoff. Other roof areas covered with white thermoplastic polyolefin (TPO) membrane to reduce the heat island effect.

The hospital received a grant from the state of Michigan to monitor performance of the vegetated BMPs and test the ability of these structures to manage the quantity and improve the quality of storm water runoff. The staff will assess each parameter by comparing the "before" and "after" conditions following significant rainfall events.

This demonstration project has significant applicability:

- The project improves water quality and decreases the burden on municipal wastewater treatment facilities.
- The evaluation data can help develop performance standards that support the use of vegetative BMPs in other municipalities.
- It can provide educational opportunities by sharing:
    - Project description and quarterly results posted on Metro Health Hospital's Web site
    - Public-access, Web-based streaming of live data from green roof and swale monitoring systems
    - Educational tours of green roof and bio-retention swales for the public and businesses

Open Space

The Health Village plans integrated some of the land's natural features. They preserved vegetated shelterbelts (windbreaks) as much as possible for wildlife habitat, and the shelterbelts' patterns guided the

layout of the Health Village street system. They protected native trees already on the site. They seeded vast areas of native grass prairies to replicate the open fields of the previous land use. They used deciduous vegetation exclusively in the parking lot islands to reduce the heat island effect. A regional tree farm located within 12 miles of the site donated more than 300 spruce trees to the hospital. The trees would have been destroyed to make way for another development, but the hospital was proactive in retaining and transplanting them. In addition, they rescued more than a dozen more mature, deciduous trees from an abandoned nursery and located them throughout the site.

Water Efficiency

The low-volume irrigation system has a custom command irrigation controller and is equipped with a moisture/rain sensor that interrupts the system when rain and moisture are adequate for plant health. No potable water is used for irrigation; all irrigation water comes from the retention pond. The area designated for sprinkled irrigation comprises only 44% of the open area that could potentially be irrigated if more "traditional" high maintenance sod surfacing was chosen. Native grasses, wildflower mixes, and some areas of single species grasses are used for the large areas of the site.

Healthcare facilities' strict requirements regarding water use limits flexibility in designing to maximize water efficiency. However, waterless urinals were used with an estimated savings of roughly 45,000 gallons of water per fixture, per year.

Energy and Atmosphere

Designers used a number of energy-saving measures in the facility. Fan horsepower was reduced in the air-handling units by using larger-than-normal duct work to reduce total static pressure. To reclaim energy, a heat recovery loop was installed between the building exhaust air ducts and outside air ducts. Energy consumption is reduced in the winter by preheating the cold outside air, and in the summer by pre-cooling the hot outside air.

Boiler stack economizers preheat the boiler makeup water. Heat is reclaimed from the boiler blow down lines and the condenser water loop to preheat the incoming domestic hot water makeup lines. A water-side economizer provides cooling water when needed. Separate energy measuring for HVAC, lighting, and general power allows each to be monitored and analyzed. In areas other than patient rooms, designers installed two-level lighting controls and motion sensors. Photo cell sensors limit energy consumption and use available sunlight.

Final Thoughts

The success that Metro Health Hospital administrators had in adopting environmental sustainable changes is one example of what can happen when an integrated design team develops a project mission and works to achieve it. Healthcare designers and administrators have an obligation to consider the impacts designing and building healthcare facilities have on the environment and research and use solutions that are less harmful to the environment.

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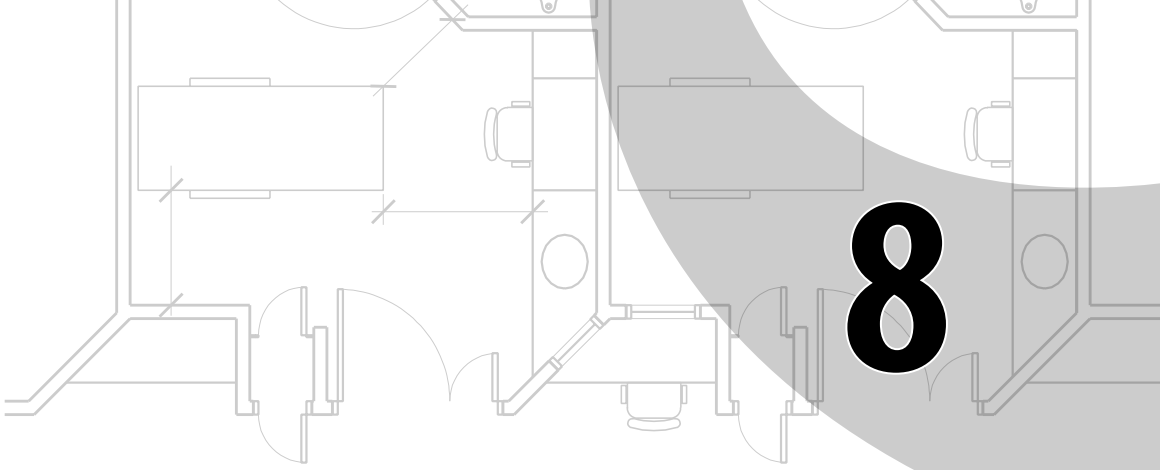

8

Transitions

By Cyndi McCullough, Karen Sweeney, Pam Wenger, Anita Davis, and Barbara Buechler

The entire process of planning, designing, and constructing a new healthcare facility requires a great deal of time and organization; therefore, it might take 3 to 9 years until the final product is a reality. Typically, a large number of administrative, healthcare, and other staff members who work in healthcare facilities participate in the planning process in the early stages. They join together to discuss their vision of a new environment that includes innovative processes, technology they might have only read about, and a design that supports staff efficiency. After construction begins, the individuals who have participated in this process focus on their usual job responsibilities and wait for the construction of the building to be completed.

Then about a year before the scheduled opening of a healthcare facility, staff members' interest peaks again. They start to wonder how they are going to function day-to-day in the new environment and, more importantly, how they are going to fit into the new culture this facility is going to foster. This period can be a very stressful time. By this time, most have forgotten the time it took to establish the guiding principles (see Table 8.1 for general guiding principles) regarding the project and the dialogue about how things would be done differently that took place during the original planning phase. On the

other hand, newly employed staff members who did not participate in the initial planning processes might be faced with daunting task of figuring out a transition plan.

For example, on one occasion, 3 months before the scheduled facility opening, a client called requesting suggestions from the architectural design firm about how to change their culture and how to assist staff members—those who had not experienced the earlier planning phases and processes—to see themselves as part of the healthcare team in this soon-to-be new environment. Even though this client had spent many hours planning and discussing this future new environment, a champion for the project had never emerged. The Project Vision and Guiding Principles were well written, and the building definitely reflected what they wanted to achieve. However, no formal plans had been initiated for explaining the planned changes, dispelling any rumors, and informing the staff members about how the transfer to the new facility would occur. A review of their master plan showed detailed documentation about what they wanted to achieve with their new facility; nevertheless, what this client lacked was a move-in plan and a champion to help the staff assimilate into the new culture.

Hospital administrators often forget to budget for staff training and education prior to a move to a new facility. If this education does not occur, staff are going to attempt to work in the new environment using old processes, and they frequently become frustrated. Most remain wedded to the old processes because they are familiar with them, and they have not been offered a different way to manage their day-to-day workload. In addition, most directors and managers underestimate the amount of time and energy it takes to guide and assist people to work differently in a new environment. Changing behavior does not occur overnight. Managers and directors need to allow staff to be *inefficient* for a period of time while they change their behaviors and learn new ways of doing things. When leaders embrace change and plan for the transition, they will find great results occur. The transition period is shortened when staff members can try out the new process in their old environment. This trial period isn't always possible because of facility constraints, but it should always be considered.

Table 8.1 Sample project guiding principles

Focus on the need of the patient and create a holistic approach to patient care (body, mind, and spirit)
Incorporate entire care team in patient care
Develop care delivery model that responds to workforce issues and future patient needs
Create flexible and adaptable environment
Reduce process transition (handoffs) and waiting
Minimize patient transfers with same level of care
Provide multi-potential physiologic monitoring throughout hospital
Increase bed capacity
Develop a full continuum of care starting coordination of care “at the front door"
Foster improved coordination of community agencies
Increase direct clinical care (hands-on direct care) time to 60%
Develop employee health programs that focus on health and wellness
Enhance communication
Achieve cost efficiency and staff efficiency
Provide continuous staff education

Service and Operational Excellence Models

In organizations where transition to a new culture and physical environment occurs smoothly, several things are apparent. First, the culture of the organization is evident. Workforce management and leadership elements of the Studer, Disney, and Planetree models can help managers influence patient-centered environments where leaders and staff are accountable. Discussion of the highlights of each of these three models follows.

Studer Model of Leadership

More than 400 hospitals and health systems subscribe to the Studer methods for changing an organization's culture. Quint Studer developed the Studer model after having spent 20 years working in a healthcare facility and serving in a number of roles including chief operating officer. He has developed a number of tools and techniques to assist healthcare staff in creating world-class organizations.

Using the tools and techniques based on the principles of the Studer model (2008) should result in eliciting key behaviors from staff that make the healthcare facility a better place for patients to recover and staff to work. The core of these 9 principles centers on an approach to achieve service and operational excellence. The 9 principles are as follows:

1. Commit to excellence.
2. Measure the important things.
3. Build a culture around service.
4. Create and develop leaders.
5. Focus on employee satisfaction.
6. Build individual accountability.
7. Align behaviors with goals and values.
8. Communicate at all levels.
9. Recognize and reward success (pp. 61–62).

Healthcare organizations that subscribe to the Studer outcomes-based approach to creating and sustaining service and operational excellence include New Hanover Regional Medical Center in Wilmington, North Carolina, and York General Health Services in York, Nebraska.

Disney Model of Customer Service

The formula for success of the Disney model of customer service is a combination of common sense, specific corporate values, and attention

to detail. This formula was established by the famous entrepreneur, Walt Disney, who designed and managed the most profitable and customer friendly theme parks throughout the world. This model presupposes people are hired for attitude and trained for skill. Before a potential employee is interviewed, the expectations and corporate values are explained. Potential employees can then decide if the organization is a good fit for them before progressing to an interview.

Healthcare leaders can use the major emphasis of this model to create the ultimate patient experience. In particular, making eye contact with patients, families, and staff; maintaining a clutter-free environment; and looking for opportunities to help someone are examples of how small things can create loyalty. Some simple things staff can do to create a "Disney experience" in healthcare are based on 6 principles of culture building and 5 quality service cues (Disney Institute, 2001). The principles of culture building include the following:

1. Keep it simple.
2. Make it global.
3. Make it measurable.
4. Provide training and coaching.
5. Solicit feedback and ideas from the team.
6. Recognize and reward performance.

The quality service cues include the following:

1. Make a memorable first impression.
2. Communicate the soul of the organization.
3. Speak a service language and wear a service wardrobe.
4. Establish a set of performance tips.
5. Build a performance culture (Disney, 2001, p. 99).

Disney also developed a set of behaviors that staff members should exhibit when encountering the guest. These same behaviors with measurable outcomes can be applied to employees' responsibilities during

encounters with the patient, visitor, or family in a healthcare setting. The guidelines for "guest" services include the following:

1. Make eye contact and smile.
2. Greet and welcome each guest.
3. Seek out guest comment.
4. Provide immediate service recovery.
5. Display appropriate body language at all times.
6. Preserve the guest experience.
7. Thank each and every guest (Disney, 2001, p. 86).

Examples of organizations that have embraced the Disney model to improve the guest experience include: The University of Colorado Hospital in Aurora, Colorado; the D'Amour Center for Cancer Care in Springfield, Massachusetts; and Banner Estrella Medical Center in Phoenix, Arizona.

Planetree Model of Healthcare

Delivering personalized, humanistic care in a healing environment that emphasizes the need for aesthetics, art, comfort, and warmth simply defines Planetree. The components of the Planetree model include spaces for solitary and social activities as well as features such as resource centers, libraries, kitchens, lounges, and activity rooms. One of the principles of the Planetree model is to recognize the need for spirituality in healing. A healthcare facility that subscribes to the Planetree model commonly includes elements such as gardens, meditation rooms, and chapels for patients, visitors, and staff. Planetree-centric healthcare facilities make available both complementary therapies—massage, music, art, pet, and aroma therapy— and conventional therapies.

Healthcare facilities that are Planetree-centric include Sharp Coronado Hospital, Coronado, California; Mid Columbia Medical Center, The Dalles, Oregon; Sentara Williamsburg Regional Medical Center, Williamsburg, Virginia; and Alegent Lakeside HealthPark, Omaha, Nebraska. For more information about Planetree, refer to Chapter 4.

Transitions

As described by Bridges (2000), transition is "the necessary psychological process people go through to come to terms with a new situation" (p. 3). Bridges describes 3 phases to the transition process.

1. The transition period begins with endings (saying goodbye to the old way of doing things).
2. The next phase, the Neutral Zone, is the period of time when the old is gone and the new is here, but it hasn't been totally defined or accepted.
3. The third phase of Bridges' model involves the acceptance of new understandings, values, attitudes, and identities.

Transition occurs for many reasons. This chapter discusses transition as it relates to the *expected* changes employees encounter and measures to help them adapt to a new and improved healthcare environment. When staff move into a new environment, administrators need to emphasize saying goodbye to the old way of doing things. The primary objective of this first phase is to celebrate what was good about it, but prepare to move on.

The Neutral Zone is the period when staff have moved into the new facility but are inefficient because they haven't learned the new processes and technology. Many try to revert to old ways of doing things during this phase. Managers and directors need to be attentive to staff at this time. It's important to reinforce positive behaviors and redirect to the new way whenever necessary. Typically, this period lasts 3 to 6 months when an organization moves into a new healthcare facility.

The third phase occurs when staff have accepted the new environment and understand how to work in it. Now is the time to start measuring results of the new model.

In all successful transitions, a leader or champion who understands transitioning is selected during the planning phase. What follows in this chapter are detailed descriptions of four case studies regarding how

managers or directors served as champions to lead staff through the transition to a new work environment.

- The author of the first example was a long-time employee of the organization and was involved in the planning of the new care delivery model. Planning for the transition occurred over a one-year period.
- The author of the second example had been a leader of the change in the first example and built on that knowledge to lead change in a different organization. This champion was hired 2 years prior to the opening of the new facility.
- The authors of the third example were hired long after the planning for the new facility was complete. Actually, the facility was built before they were hired. These champions had only a few months to orient an entirely new staff to a new facility.
- In the last example, the author was involved with the entire planning process and assumed a leadership/champion role from start to finish.

The authors briefly describe the organization, the project scope, and the steps taken to ensure a positive outcome. They also list the lessons learned from the process. All cases make apparent elements of the Studer, Disney, Planetree, models of healthcare as well as Bridges transitioning model.

Case Study: Bishop Clarkson Memorial Hospital

by Cyndi McCullough

My first experience with changing a culture began in the 1990s with the advent of patient-focused care (PFC). I was fortunate to be employed at Bishop Clarkson Memorial Hospital in Omaha, Nebraska, which was part of a consortium to tackle the idea of changing the way healthcare was delivered and patients were treated. We anticipated that a new

model would lead to cost reduction, more efficient use of employees, and improved patient outcomes and result in an increase in patient and staff satisfaction.

In this case, the physical plant change was well-planned and would occur over several years. Each successive unit renovation allowed for minor changes and alterations based on what was learned from the previous unit renovation. On the downside, this organization was operating in both the old centralized and the new decentralized environments. Until the renovation of the facility was complete, staff could not move to the totally decentralized model.

The cultural change from a centralized to a decentralized environment was drastic and not as well-planned as the physical change. Determining what the decentralized model would look like occupied much time. A major focus was improving the experience for the patient, so time was spent examining processes such as the time from when a patient walked through the front door until he received treatment. The organization studied admitting, pharmacy, radiology, and lab processes in depth with a focus on decreasing wait times and moving services to the patient whenever possible. While some teams looked at process flow, others studied staffing models.

The renovation of the facility made a greater percentage of rooms private. Each patient room included a bathroom with a sink and shower. Each room had a caregiver workstation that included a computer, linen storage, non-billable supply storage, the patient chart, a staff phone, and a locked drawer for unit-dose medications. Admitting staff registered and admitted patients in their rooms.

Because the renovation was done incrementally on a floor-by-floor basis, we could make improvements with each unit. My unit was the second to be renovated, so we benefited by learning from the first unit and improving processes based on their experience. For example, the staffing model for the first unit was known as a *care pair*. This consisted of a Registered Nurse (RN) paired with a Licensed Practical Nurse (LPN) to care for five to six patients. This care pair was always scheduled to work the same days and shifts. The staff liked the team concept and liked the decentralized model.

The staff members reported it was easier to care for patients in this environment because all supplies and equipment were at each patient room. Patients reported they were very satisfied as a result of this model because they knew what caregivers would be assigned to them and could therefore rely on this group of consistent caregivers. However, the organization discovered one drawback to this model after several months: The staff reported it was very difficult to work with the same person everyday. They likened it to working on a marriage. They also expressed the concern that new graduates were not given the opportunity to learn from everyone's expertise because they consistently worked with the same partner.

The managers and staff on my unit started to look at ways to improve this model. We created a staff model where a team of two RNs and one LPN cared for a group of 12 patients. If the acuity of the patient was less severe, we used a model of one RN and two LPNs for the care of a group of 12 patients. Thus, 3 caregiving teams cared for a total of 36 patients. To ensure consistent and adequate communication between the care teams and the physicians, we scheduled three breaks and three lunches so only one member of each team was away from the unit at any given time. Therefore, one member of each team engaged in a break or lunch while the remaining two members of the teams remained on the unit. This plan allowed any physician, other healthcare provider, or family member the chance to discuss the patient's status with a team member who was well versed with the situation.

Orientation of staff for this decentralized 36-bed unit occurred over a 9-week period. One-third of the staff was oriented to the new unit while the remainder of the staff continued to care for patients on a unit that used the centralized model. The orientation class consisted of exercises in team building, education about a new phone and beeper system, and cross-training skills, such as entering orders via computer, performing basic respiratory treatments, and obtaining serum laboratory samples and electrocardiograms (ECGs). Because most units had developed care paths, RN staff was expected to manage the patient care. If a patient was not progressing as expected, the team called in

clinical specialists to assist. In addition, the unit staffed a satellite pharmacy during peak hours. Having a clinical pharmacist on the unit meant we reduced the normal 60-minute turnaround time for medication to less than 5 minutes.

To begin each shift, staff gathered near a large whiteboard located in a staff-only corridor. They listed patient room numbers, initials, and acuity level on this board. The whiteboard also listed the staff assigned to each patient and their beeper numbers. Thus, any caregiver or physician could check the board during the shift to locate the specific nurse caring for their patient. Staff spent the first 5 minutes of each shift at the board receiving assignments and a general report of any critical issues related to any patient located on the unit. Following this general meeting, each care team assigned to the same group of patients dispersed to discuss only this group of patients. Hence, the on-coming and off-going nurses could discuss the assigned patient's progress and plans for the upcoming shift.

Because each patient had more than one physician and because no centralized station existed in this new environment, patient medical records were kept in the decentralized workstation. Thus, no one had to spend time searching for a patient chart; it was always with the patient.

Finding technology solutions for this environment was difficult in the 1990s. We used a beeper system to alert staff of a physician call. Emergency patient calls were relayed through the beeper by a secretary located off the unit. Phones were wired to connect the workstation phone for every six patient rooms. If a nurse paged a physician from the phone in room one, he or she did not have to wait by that phone for a return call, but just needed to be near a phone in rooms one through six.

Although we did not have the technology that is available today to complement this model, it proved a better model for patients, staff, and physicians. After staff worked in the new decentralized environment, they never wanted to go back to a centralized model.

Physicians took a little longer to appreciate the benefits of the decentralized model. They reported it took longer to make rounds because now they had to talk to each nurse and the patients' families while

making rounds. In the previous environment, they talked to just the charge nurse, and the family was not normally present during morning rounds. However, physicians soon discovered that the nurse caring for the patient really knew what was happening with the patient, and because the chart was always with the patient, they had the benefit of all the up-to-date information. In this environment, orders were processed in a timely manner. Physicians realized that calls to their offices about patient care decreased considerably and overall length of stay also decreased.

Transitioning to this decentralized environment was not an easy task. At all stages of the transition a physician champion, a nurse champion, an educator and a behavioral psychologist assisted the manager or director. The expertise and support this team provided were invaluable throughout the process.

After staff learned to work efficiently in this environment, the organization implemented self-directed work teams. The nursing director and medical director for each unit were jointly accountable to the chief executive officer (CEO) for patient cost and quality outcomes. This responsibility ensured a very collaborative work environment, one in which staff truly became accountable for patient care.

The challenges, outcomes, and lessons learned from this transition from a highly centralized environment of care delivery to a highly decentralized environment are summarized as follows.

Challenges

- Developing training and education manuals.
- Working in both a centralized and decentralized model at the same time.
- Difficulty with changing work processes
- Managing patient information.

Outcomes

- Staff vacancy rate decreased from greater than 10% to less than 4%.
- Caregivers doubled the time spent in the direct care of patients.
- Caregivers assumed a leadership role in the care of patients.
- Time spent on paperwork and coordination decreased considerably.
- Redesign of the patient unit reduced the workload for staff and the number of times patients were moved.
- Patient length of stay decreased.

Lessons Learned

- Persistence and patience are essential for a successful transition.
- Empowerment of staff leads to success.
- A healthy respect for criticism is essential.
- Enlist individuals who have skills that complement the leaders' skills in order to help transition occur smoothly.
- Provide the necessary resources and commit to making every employee the best he or she can be.
- Transition is easier when it is something that is wanted rather than mandated.
- Project mission, vision, and goals must be clearly defined to keep everyone on track.
- Executive-level support is crucial to success.
- Establish criteria for measuring success.
- Budget money and time for education/training.
- Develop patient/family evaluation criteria.

- Ensure an environment of open communication.
- Continue to focus on safety, quality, and improvement.
- Know boundaries (regulatory and budget).
- Champions are needed to lead the change.

Although many technological advances over the past 20 years support decentralized environments, managing patient information is still a major concern. Administrators are still trying to identify best practices for working in a decentralized environment without a completely electronic patient chart. The next three case studies demonstrate how technology complements a decentralized model to create a more efficient patient care environment.

Case Study: Alegent Health Lakeside

by Karen Sweeney

The Alegent Health Lakeside Hospital is a full-service hospital that opened its doors on August 4, 2004, in Omaha, Nebraska. It was designed around elements of the Planetree philosophy of care combined with technology solutions to help caregivers deliver better care. The Planetree model recognizes the importance of architecture and interior design in the healing process. Healing gardens both inside and out, along with the use of natural light and live plants throughout the hospital, contribute to the calming effect for patients, visitors, and staff throughout the hospital. In addition to the hospital, the campus includes wellness, ambulatory surgery, physical therapy, urgent care, and lab and radiology centers, as well as primary and specialty physician practices.

I was hired as the chief nurse executive for this facility 2 years prior to its opening. In addition to creating an operating plan for the new facility, I was also in charge of other parts of the campus that were already open. While teams of staff from across the system were organized to work with the architectural design firm to create a facility to

accommodate future technology and focus on a healing environment, I worked with others to address equipment needs, capital and operational needs, staffing projections, and an orientation program.

We hired directors for the new hospital about 6 months prior to opening. The hiring of directors and staff was not difficult. Because we embraced the Planetree culture, we used a behavioral based interview. We gave those interested in working at Lakeside a list of attributes expected of them and told them that the culture was different from traditional hospitals. We counseled applicants not to seek a position in this facility if they did not embrace change and if they did not want to work in a technologically advanced environment. Also, we implemented a uniform (clothing) policy that deterred some potential employees.

Physicians who worked in this institution embraced this new culture. Learning the electronic record was probably the most difficult task for them. We provided around-the-clock support regarding information technology for the first 3 months, and within 6 months all staff were up to speed with the new system. Some physicians have moved their practice strictly to this facility because of the excellent relationship-based nursing care.

The vision for the staff of this organization is to ensure that Lakeside is the "hospital of choice" for the residents of West Omaha and Western Douglas County, residents of Nebraska, and beyond. The organization's goals are to:

- Be the employer of choice for those working in healthcare.
- Provide the highest quality care to patients.
- Be a great place for physicians to practice.

Our core belief is that any patient or visitor at Alegent Health Lakeside Hospital should receive a warmhearted welcome, be overwhelmed with kindness, and receive a warmhearted farewell. This warmth is evident when anyone enters the doors of this facility. A greeter immediately welcomes visitors or patients and directs or escorts them to their destination. Bedside care and family involvement are top priorities.

The culture in this organization is clearly more than a healing environment. It is a culture that is inclusive of body, mind, and spirit. And this culture didn't happen overnight. It was developed through a formal cultural change program for all staff and physicians. As the chief nurse executive, it is my responsibility to make sure everyone who works in this facility understands and lives out the culture. The objectives of the culture program include the following:

1. Communicate the cultural vision for our organization.
2. Define the cultural behaviors established for the health system.
3. Practice techniques that create a culture where communication is open, encouraged, rewarded, frequent, and relevant.
4. Understand the concept of "promoting" each other.
5. Illustrate how the service and operational excellence initiative builds a strong customer base that impacts the success of the organization.

One creative thing we did was to establish the star experience. Though some might think this is silly, it works. We developed 9 key principles of the star experience to serve as behavior standards and to emphasize how staff helps support the culture and the patients' experience. This star initiative is ongoing and involves changing the way we interact with and serve our patients, families, physicians, and colleagues. The principles for the star experience are similar to Studer and Disney customer service behaviors and include the following:

- **Demonstrate a positive attitude.** We treat every customer as if he or she is the most important person in our workplace. We immediately welcome customers with a smile, establish and maintain eye contact, and use a pleasant tone of voice. Open body language and a handshake accompany our introductions, which includes our position and department.

- **Promote communication.** Staff are expected to communicate with courtesy, clarity, and care. We listen attentively to customers to understand their needs and ensure they comprehend the information we provide to them. We always use "please" and "thank you" and end all encounters with, "I have time. Can I help you with anything else?"
- **Constantly improve.** When the healthcare experience does not go right for the patient, we pledge to make things better. We listen and respond with empathy and apologize for not exceeding expectations. We try to anticipate and correct problems before they become complaints. We do not place blame or make excuses, and we attempt to explain any delays. Being proactive in making it right even in difficult situations is a priority.
- **Follow the dress code.** We believe our attitude and behavior can create a positive first impression that is lasting. We wear neat, appropriate clothing and jewelry in compliance with the dress code. Identification badges are worn in a visible, appropriate place. Public spaces and meeting rooms are clean, neat, and clutter-free. Equipment is returned to its proper place. We strive to exceed expectations.
- **Encourage teamwork.** Teamwork is about sharing our successes, failures, information, and ideas. We build each other up. To do this, we greet one another with a smile, communicate openly, respect each other's privacy, treat each other with courtesy, and respect and accept work assignments enthusiastically.
- **Provide privacy.** We are sensitive to the personal nature of healthcare, and we do everything we can to earn the trust that others place in us. To achieve this principle, we never share computer or telephone passwords, give only "need-to-know" information, and are discreet in telephone conversations with or about customers. If others are not following behavioral standards, we use key words or gestures to remind them.

- **Value differences.** We know that our differences, unique talents, and varied backgrounds come together to create a stronger whole.
- **Promote education.** We are committed to helping all employees grow professionally. We encourage innovation and constant improvement in efficiency and effectiveness.
- **Give thanks.** Reward and recognition are central to our culture. We express gratitude and appreciation to one another and openly praise co-workers' accomplishments.

An alliance with Siemens Medical Solutions enabled us to integrate medical advances, diagnostic services, and information systems as a paperless facility from the day we opened. In the beginning, nursing staff used mobile workstations that included a barcode medication administration and documentation system. Over time, workflow challenges emerged that affected nursing satisfaction and risk for error using the mobile workstations. Although we were using electronic devices for patient charting, better options became available. The staff wanted technology that would help them do their jobs better.

Administration and nursing staff explored new types of mobile devices specifically looking at ergonomics, electrical power management, the log-in process, mobility, and the speed at which patient data could be uploaded to the electronic record. We decided to conduct a study using the Motion C5 personal lightweight device. A study by Parker and Baldwin (2008) demonstrated that nurses could remain logged in while they moved from patient to patient, allowing them to be more satisfied and productive. Documentation at the point of care also increased, which improved the accuracy of the clinical chart.

We continually look for ways to improve the healthcare experience for the patients and all who work in this facility. Making sure everyone understands and lives our culture is most important. When that occurs, everything else falls nicely into place. Although we have been open for 5 years, we still have challenges because we always find something new to consider or incorporate to provide better patient care and make staff more efficient.

The challenges, outcomes, and lessons learned from this transition to a high-tech, high-touch environment are summarized as follows:

Challenges

- Time commitment to keep everyone up to date.
- Understanding and learning how to work with new technologies.

Outcomes

- In 2004, Alegent Health Lakeside Hospital was ranked number one in the nation for overall quality of care in the PRC database. Currently, it ranks in the 99th percentile for patient engagement.
- In 2008, it had an 8% staff turnover rate compared with 17% within the system.
- There are waiting lists for staff seeking positions in the obstetrics and emergency departments.

Lessons Learned

- Commitment from executive-level staff is essential.
- Need to develop processes for communication.
- Hire staff with experience when opening a new facility.
- Continually improve processes and adapt new technologies.

Case Study: St. Mary's Medical Center North

by Pam Wenger and Anita Davis

St. Mary's Medical Center North is an acute care hospital that defines twenty-first century healthcare. It is located in Powell, Tennessee, and

opened August 14, 2007. It is a part of the St. Mary's Health System of healthcare facilities and is a testament to the positive benefits associated with EBD, innovative medical technology, and patient/family-centered care. The acute care hospital sits on a 52-acre campus and includes 206,000 square feet of usable space, a floor for future beds, a 12-room emergency department with a space for future expansion, 12 intensive care beds, 60 medical/surgical beds, and 6 operating rooms.

The design process for this new facility began in December 2004, with a visioning session that involved administrators, physicians, board members, and staff. Several board members focused on how technology could improve care for patients and staff. The function, design, space, and equipment programs were validated by the design firm and the steering committee in 2005. Because this was going to be an additional facility for the system, the staff who would be working in it were not yet hired. That meant the vice president of nursing and team leader were not present during the planning phase of the development. Instead, the planners and designers of the facility worked with key administrative staff and department directors and managers to plan and design a facility that met their vision and guiding principles.

The vision statement for the project reads:

> St. Mary's Vision is to create a state-of-the-art hospital facility that is patient centered (designed to provide an environment of patient safety and wellness) and fiscally responsible (enables ongoing operational efficiency and minimizes capital costs).

The guiding principles they developed are:

1. Create an environment of wellness, including finding ways to connect to nature, offering positive distractions, providing easy wayfinding, and minimizing wait times.
2. Create an operationally efficient facility. This included consideration of the ideal location of departments, patient and resource tracking systems, and technologies such as

computer order entry, electronic patient record, and bar coding for billing and inventory control.

3. Build in flexibility. They designed the hospital for both vertical and horizontal expansion, with one patient floor and an area in the emergency department designed to be completed for patient use when needed.
4. Improve the care environment for patients and staff. Suggestions included standardizing rooms and selecting products that would lessen noise levels, minimize slips and falls, and provide various types and levels of lighting.
5. Center the design around patients and families. They suggested creating and on-stage/off-stage approach to design, giving control to patients, providing wireless Internet access in patient rooms and waiting areas, room service dietary, and 24-hour visitation as starting points.

A safety committee was organized to review and oversee plans and develop operational flows for staff and materials and to ensure the guiding principles were met. A 3-D computer rendering of the patient room was created so staff could visualize where areas like the sink and family zone would be located. After everyone reached consensus on a room design, designers constructed a mock-up patient room in the lobby of the main hospital so staff could test different concepts and determine where electrical and gas outlets would be located. Also, anyone visiting the hospital could see first-hand what was planned for the new hospital.

Safety and future concepts guided many design decisions. Large, private, same-handed patient rooms feature non-slip, wood-look flooring and bedside cabinets with continuous handrails so patients can easily move from bed to bathroom with a rail to assistance. The patient-family-centered rooms feature sleep sofas, patient-controlled window coverings, wireless Internet access, and two flat-screen televisions. Decentralized caregiver workstations are located between every two rooms so staff can easily monitor patients when necessary. A pass-through supply/pharmacy cabinet can be stocked from the hallway side while staff

can obtain the supplies, linen and patient medications from the patient room, thus allowing caregivers to spend more time with the patient.

A number of technology solutions that enable staff to care for patients in a timely manner complete the physical design. A hands-free nurse call system allows physicians to contact nurses directly. Staff can communicate with each other instantaneously. The tool provides paging, telephone, and alarm monitoring. A patient tracking board is used by staff, physicians, and family members. It brings together key information from clinical, environmental services, transportation, and location systems in one, easy-to-read map. Patients have control of lighting, TV, window blinds, and nurse call from their bed.

Planners designed other processes to make the patient experience more pleasant. Room service dietary was implemented so patients can receive their meals when they want them. Patients who enter through the front door of the hospital are greeted, have their name entered into the tracking system, and are directed to their rooms. A roving admissions representative is alerted to go to the patient room and complete the registration bedside.

So, how did all the great concepts mentioned so far get operationalized? Up until this point, we—Pam, vice president, and Anita, the team leader—were not a part of the process. As soon as we were hired, we were oriented to the new facility and the technology by the clinical project manager and a staff member from information services. We took over the responsibility of hiring and teaching staff how to work in this environment. We saw the great opportunity and rose to the challenge. Enthusiasm for the facility was infectious. When we looked at the departmental plans and understood how the technology would assist in delivering patient care, we could easily see all the efficiencies and that clinical staff had been a part of the planning process. We could not imagine going back to a traditional model of patient care.

When hiring new staff, we look for people with experience who are willing to accept change and who are interested in using new technology. If they are not interested, this is not the place for them. Staff turnover has been minimal in the first year. For on-going orientation

of staff, we developed the "How do I…" book that includes processes and emergency procedures. It also contains some scripted words and phrases. For example, one scripted response for how to respond to a patient complaint notes how to greet the patient, respond to the complaint, apologize, show accountability, follow up, and always end with "Is there anything else I can do? I have the time." This information is available electronically also.

The first week we opened, physicians requested that the patient chart be centrally located in the business center. Some staff thought that would be an acceptable idea because they did not want to listen to the physician complaints. We had to step in and reinforce the guiding principles of the model we designed. Staff and physicians needed to understand that no one was expected to completely understand how everything worked on day one. We were all out of our comfort zone, but we did understand the vision. Once the guiding principles and vision are set, never let anyone talk you out of them and take the time necessary to learn the new way of doing things.

In August 2008, we had a one-year survivor party to celebrate what we had accomplished. Staff comments included:

- Less anxiety is experienced with standardized rooms.
- Fewer mistakes occur with standardized rooms and units.
- It is easier to orient staff with standardized rooms.
- The patient servers have decreased staff steps to fetch supplies and medications.
- Never give up the hands-free communication devices.
- Patients and their families are very satisfied with 24-hour visitation.
- Room service dietary is a huge success.
- I never want to go back to the old way of doing things.

Physicians quickly learned that having the patient chart with the patient improved the flow of communication. The electronic

whiteboard gives the physician the information necessary to immediately contact a specific nurse.

The challenges, outcomes, and lessons learned from moving into a decentralized environment in a new facility with new technologies and new staff are summarized as follows.

Challenges

- Learning curve for computerized documentation.
- Sensory overload for charge nurse.
- Some team building exercises that occurred the day before opening.
- Lack of knowledge about selected technology.

Lessons Learned

- Staff need education about technology in advance of move.
- A mock-up room with all systems working is ideal.
- Involve equipment planning early in project and track equipment throughout.
- Involve information systems staff early in the process.
- Be patient while people get used to the new processes.
- Do not give in to physician pressure.
- Share what you learn with others.
- Standardize and establish par levels of items in patient servers (re-evaluate use every 6 months).

One-Year Outcomes

- Patient falls are less than targets set for system.
- Press Ganey patient satisfaction scores for rooms are in the 98th percentile, for pleasantness of rooms 99th percentile, and for accommodations and comfort 97th percentile.

- Staff adjusted well to 24-hour visitation on all units.
- Realized a positive net income in month 11.

We often conduct tours for staff who are looking for ideas. At the end of one of these tours, a CEO congratulated us on our patient and staff satisfaction scores. We responded, "Thank you. But you know we would really have to try hard to mess this up. We have it all."

Case Study: New Hanover Regional Medical Center, Betty H. Cameron Women's and Children's Hospital

by Barbara Buechler

In December of 2004, the staff at New Hanover Regional Medical Center in Wilmington, North Carolina, began a master facility plan that included a women's and children's hospital, surgical pavilion, inpatient tower renovation, heart and vascular center, radiology expansion, and emergency department expansion. This case study focuses on the women's and children's hospital, a 179,000-square-foot facility that includes 14 labor and delivery suites, 13 rooms for high-risk pregnancy, 35 mother/baby rooms, 20 rooms for gynecological inpatient services, 23 Level III Neonatal Intensive Care Unit (NICU) rooms, 22 Level II NICU rooms, 6 Pediatric Intensive Care Unit (PICU) rooms, 17 pediatric rooms, and a pediatric specialty clinic. The first meeting for this project occurred in December 2004, and yielded the following project vision and guiding principles.

Vision Statement

New Hanover Regional Medical Center will provide safety focused, state-of-the-art centers of healing that are easy to find and efficient to operate for our patients, their families, staff, and physicians.

Guiding Principles

Our facilities will:

- Be designed to promote family-centered care to meet the needs of our patients and their families.
- Be designed to promote a safe environment.
- Be designed to leverage technology to promote safety and efficiency.
- Be designed as state-of-the-art centers of healing.
- Be designed for accessibility, convenience, and comfort.
- Be designed to promote operational efficiency and to provide additional capacity.
- Have a consistent design standard.

The programming process occurred in January and February of 2005. Multidisciplinary user groups met with the planners and designers to discuss the current environment and what the staff liked and did not like about it. They also discussed future health trends as well as how research and technology have impacts on a design solution. They determined and documented the ideal delivery model and created a room-by-room space list for the facility.

Some of the concepts the teams adopted included acuity adaptable rooms, same-handed (standardized) rooms, room service dietary, expansion of the electronic medical record, decentralized caregiver workstations, decentralized supplies, security, and bringing as many services to the patient as possible.

Universal and *acuity-adaptable* are terms used interchangeably to describe a patient care model concept. This concept supports the position that the patient remains in the same room for the duration of his or her stay and the staffing level is adjusted according to the acuity of the patient. Most institutions where this concept is used have two levels of patient rooms. The clinical teams decided to plan for a universal room concept with their new 6-bed PICU and 17-bed pediatric unit.

This concept was continued with the 45-bed all-private NICU for Level III and Level II infants. Also planned were decentralized caregiver work areas and wireless technology to make the caregivers more efficient. The concepts developed in the user meetings were then applied to the renovation of an existing patient tower to standardize the care environment across the system.

An example of how the NICU would change in the new facility is portrayed in Table 8.2.

Table 8.2 Example of how the NICU would change in the new facility

	Existing	*New Facility*
# of isolettes	**23 Level III, 10 Level II**	**23 Level III, 22 Level II**
Design	One room for Level III, semi-private for Level II, located in three different areas of hospital	All designed as private rooms in one unit for maximum flexibility
Family-centered care	Limited by open facility and limited space	Family accommodations for overnight stay in the patient room
Supplies	Centralized	Decentralized
Secretary	Centralized	Decentralized
Space	50–80 square feet per isolette	200 square feet per private room

The creation of an all-private NICU was not something easily accepted by administration. We compiled the research supporting private NICU environments, including our own study conducted in a 10-bed transitional care unit.

The research supported the anticipated benefits of a private room NICU model, including:

- Improved patient/family satisfaction.
- Improved staff and physician satisfaction.

- Decreased length of stay.
- Decreased days on oxygen.
- Decreased days on total parenteral nutrition.
- Improved infection control.
- Improved patient outcomes.

While we were busy researching equipment, communication devices, and thinking about how the interior would look, builders constructed the facility. About one year before the scheduled opening, we became very concerned. The timeline for the electronic medical record was behind by a few months, and an electronic record would not be implemented when we opened. The planned room service dietary was delayed, and we needed a plan for food service. We had no staff budgeted for security, yet we had a new building with a dedicated entrance that we wanted to use 24 hours every day. We were worried that changes to the facility might be necessary.

In August 2007, we set up a series of meetings with the Women's and Children's Center User Group, the design architect and planner, and a representative from administration to review the original program and planning assumptions. The architectural plans were reviewed with each department that would interact with the new center. Over a 2-day period, we met with pharmacy, medical records, lab, information technology, central sterile, security, respiratory, and food service. We documented the current operational plan for each of these areas, noted any action items needed, and assigned a responsible person for each action item. For example, while reviewing lab processes, we noted a need for additional lab label printers in the areas where nurses would be performing the blood draws. The solution to this problem involved licensing issues and additional equipment. This group continued to meet formally every 2 months at minimum until the facility opened. The majority of the issues involved a process adjustment and/or technology. No major facility redesign was needed.

In addition to the discussions with support services related to process, workflow, and the decentralized care delivery model in our new

facility, we used a move planning methodology suggested by the contracted moving company to assist with the physical move into our new hospital. This model worked with the following teams to organize our move planning:

- Information systems and telecommunications.
- Facility readiness.
- Patient care.
- Public relations and communication.
- Education.

Team leaders for each of the teams were designated. They reported on a regular basis to the move steering committee to ensure a clear integrated move plan was in place. The clinical director and construction director led the steering committee. Respect, understanding, and teamwork between these two individuals were the most important factors in the success of our move. The clinical director understood the challenges of the construction budget and timeline, and the construction director respected the clinical decisions that ultimately had an impact on the construction budget.

One of our most significant challenges was ownership of the systems integration. Our facility was designed to use highly complex integrated technology systems to support our decentralized patient care delivery model. Biomedical services and information services staff were responsible for the implementation of the systems; however, for the implementation of these systems, someone needed to take ownership of the integration. The director of biomedical services became the leader for this integration process.

Staff education for the plethora of new technology presented an even larger challenge. A clinical education specialist became the point person for communicating with representatives from the companies responsible for new physiologic monitors; new nurse call system; new infant security; new wireless phones; new hardwired phones; new printers, copiers, and fax machines; and a new medication dispensing

system. We originally planned for a full 4 weeks of training after the construction company completed the facility. In reality, we completed training while the construction company worked to finish the facility in time for opening.

Our unit-based practice councils became the move planning team for each patient care unit. The unit-based teams took responsibility for planning both the transition to a new care delivery model and the physical move of supplies and patients. The knowledge and expertise of the direct care staff allowed for a remarkably smooth transition to our new facility. The staff determined the location of all supplies in clean supply rooms and supplies placed in the "patient server." They determined the layout of equipment and supplies at each business center including computers, the copier, the physiologic monitor central station, the nurse call central station and the equipment required at each of the decentralized work stations near the patient rooms. They organized patient care drills to ensure safe and efficient care for patients from the moment the new facility was occupied.

The challenges, outcomes, and lessons learned from this transition are summarized as follows:

Challenges

- Value engineering—During all phases of this project, we were challenged to look for ways to decrease costs. Discussions were often emotionally charged. In retrospect, none of the changes we made compromised the basic principles for the facility design or our care delivery model.
- Continued system problem solving as we learn to work in our new environment. Our security plan with all units locked and providing both "family" and "visitor" passes has been difficult to implement. RNs experienced some alarm and communication overload as we worked to streamline integrated communications.
- Continued workflow problem solving as we learn to work in our new environment. We continuously guard against

reverting to old patterns of behavior and, instead, work to improve on our commitment to the decentralized model.

- Physicians who chose not to be involved in planning are now having difficulty adjusting to the new workflow and care delivery model.

Lessons Learned

- Site visits are essential. Take time during programming and design to understand what staff in other facilities learned during similar projects. The consultant and design architect you work with will be knowledgeable; however, nothing can replace seeing and discussing care delivery with real-world clinicians.
- Mock-up rooms are essential. Take time to completely finish mock-up rooms in advance of final decisions being made about size, layout, and casework. Pay attention to the smallest detail, for example, the locations for sharps containers, soap, and paper towels.
- Make sure your medical staff is involved in all stages of planning. Additionally, provide regular follow-up for physicians to ensure their understanding and agreement regarding design, the move process, and changes to the care delivery model.
- Instill a sense of urgency in your colleagues early in the move planning process. We found ourselves rushed to solve issues with support departments in the final days and weeks before the move. Our sense of ownership and urgency was established early in the process, whereas many of our colleagues underestimated the impact of moving into a new facility.
- Simulate patient care delivery in your new facility as part of your education plan.
- Do not compromise on time for education.

Outcomes

- We implemented exactly what our vision called for: a warm, high-touch, family-centered environment supported by a decentralized care delivery model and highly complex integrated technology.
- Patient satisfaction has improved throughout the service line. Our Press Ganey overall ranking hovered around the 60th percentile. In the first quarter following our move, our overall ranking increased to the 90th percentile. We expected an increase in our patient room scores; however, the greatest improvements were in attention to the personal needs of patients and their families.
- Staff satisfaction with our facility is high. They identify decreased stress working in this extremely quiet and serene environment. The decentralized model prevents the noise and chaos of a "central nurse station" for staff as well as for patients. Carpeted hallways help reduce noise throughout the facility.
- Staff can articulate that the environment truly supports improved efficiency. So often new technology appears to increase work for direct care nurses. The nursing staff can identify the decentralized workstations, computers in every room, and the wireless communication system as truly improving safety and efficiency.
- Newly hired staff frequently comment that the efficiency of the workflow is evidence of staff involvement in the design of our facility.
- Staff will be surveyed again in mid 2009 to collect data to compare to initial observations.
- We are beginning to collect data for NICU outcomes related to the private room design.

Final Thoughts

You can design the best healthcare facility ever created, but it takes the right people to make it successful. Although each of the case studies presented involved different situations, they share many similarities. All were successful because the leaders had a vision for what was to be achieved and a passion to make it happen. In all examples, each facility made the patient, family, and staff experience a priority, and each developed a project vision and guiding principles at the onset of the project. In addition, the organizations streamlined processes before moving to the new facility, allocated resources to work on the project, and celebrated successes.

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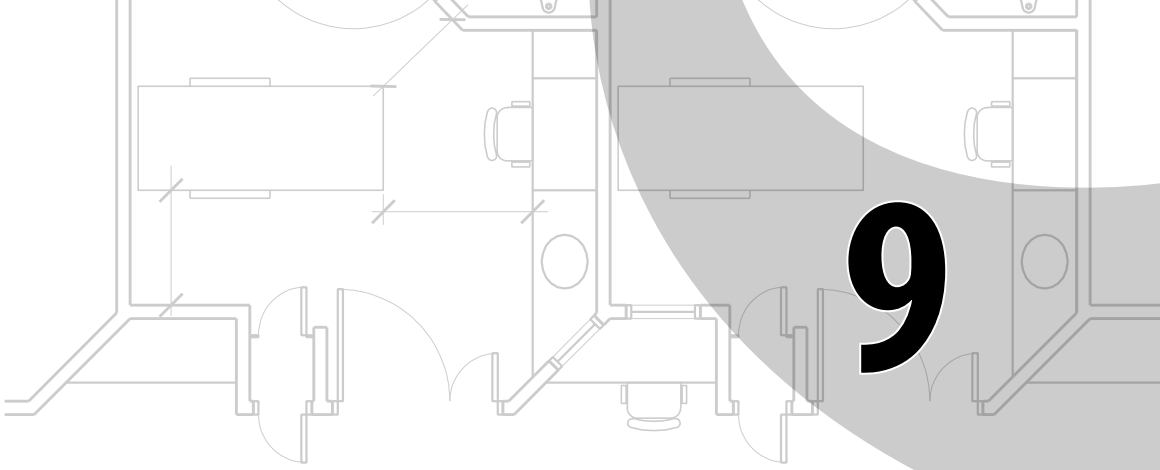

9

Preparing for the Future

By Steven Goe

Healthcare facilities across the United States continue to be remodeled or replaced in record numbers in order to address long deferred improvements, meet current and future demand, or compete more effectively in the markets. The backlog of construction during the 1990s and early 2000s was caused by a historic lack of sources of funding and the uncertainty of future healthcare policy and reimbursement. In 2009, because of the historic downturn in the U.S. economy, a new presidential agenda, and shift in Congressional focus, health systems are once again halting or significantly rethinking their construction plans (Silberner, 2009).

These events, combined with limited access to capital and a significant increase in building costs over the previous five years, partly caused by Hurricane Katrina, foreign use of steel, and high oil and copper prices have forced healthcare administrators to re-examine and redefine their construction projects. Design-based evidence that justifies healthcare construction projects in terms of operational savings, improved patient outcomes, and future flexibility is essential for the long-term viability of healthcare institutions. Today, healthcare administrators need to plan for many unpredictable forces that could

impact healthcare delivery in the future. Evidence-based design tools, as discussed throughout this book, can help healthcare leaders plan facilities flexible and adaptable enough to accommodate an uncertain future, to last many more years than buildings built in the past, and to deliver improved operational and clinical results while improving user satisfaction.

This chapter is intended to guide healthcare leaders through scenarios of the future while forecasting the facility design implications of both certain and uncertain forces. The objective is for healthcare providers to be better prepared for the future by working with their design professionals to plan facilities that are based on solid evidence and are ready for the unexpected.

Trends That Might Affect Future Healthcare Delivery and Facility Design

All indicators today point to a healthcare system in the United States that needs a complete overhaul. U.S. healthcare spending is expected to double to $4.1 trillion by 2016, which will represent about 20% of the national gross domestic product (Center for Medicare and Medicaid Services, 2007). Also foreseen is a healthcare delivery system where:

- Costs for hospital care alone hit $1.2 trillion by the year 2016 (up from $651.8 billion in 2006).
- The number of Americans without medical insurance reaches 47 million.
- Physician malpractice insurance premiums rise as much as 158%.
- Consumer demands, particularly from the aging population, continue to grow.
- Emergency departments and many inpatient bed units remain filled to capacity.

- Nursing, imaging, and other allied professional openings go unfilled.
- Medical and information technologies are not used because of lack of resources (2007).

Recent technology trends and political shifts bring new hope for a future of improved outcomes and safety, empowered consumers, point of care technology and information, operational efficiencies, and care accessible to all Americans. The trends expected to affect the future of healthcare delivery include reimbursement, aging, changes in acute care, consumerism, staff shortages, new generations of staff, emerging technologies, remote monitoring, imaging advances, resource tracking, point of care testing, and procedural technologies. The remainder of this chapter examines the trends and opportunities that lie ahead for health providers, and the facility design implications that result from these trends.

Reimbursement

Two main reimbursement trends seem to loom for the future. First, payment will be based on performance. Second, reimbursement by Medicare might be bundled payments for episodes of care. The Center for Medicare and Medicaid Services (CMS), along with scores of private commercial insurers, are putting an emphasis (and payments) on overall hospital and physician performance. Payment by CMS is proposed to begin a shift in October 2009, from its current market adjusted diagnosis-related group based payment to a total performance score. In its movement to value-based purchasing (VBP), Medicare would withhold between 2% and 5% of its reimbursement to hospitals. Based on a point system that rewards clinical outcome performance and consumer assessment of the quality of facility care, hospitals can earn the higher payments based on how their scores compare to other hospitals.

This proposed change is an add-on to the change from Medicare in October 2008, to withhold reimbursement to hospitals for the treatment of certain conditions that could reasonably have been prevented

or were associated with "hospital-acquired" complications. The list of "never events" continues to be updated by CMS and includes such things as patient falls and hospital-acquired infections. In an attempt to reduce unnecessary deaths and costly complications, Medicare will no longer reimburse hospitals for patient stays that have resulted in one of these negative events. Both of these changes in Medicare reimbursement indicate a movement within CMS from simply being a payor to being a change agent for improvements in patient care delivery and clinical outcomes.

Looking further into the future, many foresee that Medicare will move toward a reimbursement system that bundles payments for full episodes of care, including events that precede and follow hospitalization. With Medicare reserves potentially drying up within the next few decades, reimbursement methodology needs to be radically restructured. Healthcare administrators will be required to work closely with their physicians and other allied health providers to improve efficiency, reduce costs, and improve outcomes across the continuum of care. Medicare, with commercial payors quickly following suit, will reward careful management of care across the spectrum because payment will not only include the hospitalization, but also pre-hospital physician visits, post-acute care (including home), and any readmissions. With episodes of care being reimbursed based on national averages, emphasis will be placed on providing evidenced-based, low-cost care alternatives with the best possible outcomes.

With these possible reimbursement futures, evidence-based facility design becomes even more critical to a hospital's success. How can the built environment reduce falls, reduce nosocomial infections, prevent medication errors, shorten length of stay, and improve the patient's assessment of the care delivery? Proven concepts, discussed in other chapters of this book, such as single-bedded rooms, decentralized workstations, visible handwashing sinks, point of care technological assistance, and standardized room configuration can directly impact the hospital's bottom line by preventing or reducing the incidence of events for which Medicare withholds payment.

Aging

The number of Americans aged 65 years and older total 38.7 million in 2008. By the year 2050, the number of seniors is expected to double to 88.5 million. In addition, those Americans aged 85 years and older are expected to increase from 5.4 million to 19 million in the same time frame (Bernstein and Edwards, 2008). This number has the potential to be even greater if current research yields medications that can slow or reverse the effects on aging. Pharmacogenomics, bioengineered organs, new antibiotics for hospital-acquired infections, vaccines, and artificial organs and tissues might prolong life even longer, or at least postpone eventual dependence. The aging baby boomers will have unprecedented wealth to afford such discretionary remedies. Unlike today's seniors, the over 65 population of the future is likely to extend retirement and avoid nursing home settings by staying at home. More than 60% of them will deal with three or more chronic conditions and will require greater assistance with activities of daily living and increased interactions with healthcare providers to maintain their health. As the number of older adults with acute and chronic conditions grows, health system administrators are challenged to provide new, creative ways of providing care in new settings.

Increasingly, hospital staff members are developing programs to care for both acute and chronically ill older patients, shifting the care from the hospital setting to ambulatory centers and into the home. For example, Johns Hopkins University Medical Center in Baltimore, Maryland has developed an innovative care model of providing hospital-level care in a patient's home as a full substitute for inpatient acute care. Patients who meet certain eligibility criteria receive care at home, including diagnostic care and treatment from physicians and nurses. A demonstration and evaluation study conducted by Johns Hopkins investigators confirmed that patients cared for at home as an alternative to hospitalization received timely hospital-level care that met quality standards and suffered fewer clinical complications than hospitalized counterparts did, all at a lower cost and with higher patient and family satisfaction (Leff, Burton, Mader, Naughton, Burl et al., 2005).

Likewise, chronically ill seniors can live independently at home with a variety of innovative medical and information technologies. Virtual care networks that link healthcare providers and support networks to Web-enabled care plans, personal medical records, daily health logs, and online renewal of prescriptions or ordering of diagnostic tests are emerging (Coye, 2006). Programs like "Meridian at Home," offered to New Jersey residents 60 years of age and older, help patients with chronic diseases live actively at home. Their home is equipped with a wireless PC that is interfaced with a patient's personal portal. Wireless sensors record daily living activities and transmit the data to caregivers. Monitoring devices collect clinical information and send the data to the patient portal where it is measured against preset targets. This model, and hundreds like it across the country, has the potential to prevent unnecessary hospitalizations and to maintain a person's health and independence in the home setting.

Changes in Acute Care

Despite the potential drop in hospitalization rates, the overall number of admissions will increase as the number of people greater than 65 years of age doubles. What health maintenance in the home or assisted living environment cannot prevent, genomics cure, or biotechnology repair will require admission to the hospital inpatient setting. Because of the alternative sites of care in the home and ambulatory settings, the hospital of the future is likely to become more of a high-technology center for mostly traumatic injuries, emergencies, contagious diseases and epidemics, and complex surgeries requiring sophisticated resources such as robotics and interoperative imaging. The inpatient bedrooms and treatment and diagnostic spaces of the future will require greater flexibility to accommodate changes in care delivery or to adapt to new medical technologies. The concept of the same-handed, universal room (discussed in previous chapters of this book) takes on new importance for achieving the flexibility needed for the future. Spaces will require more "plug and play" capability to easily convert from inpatient to outpatient uses or to convert functions, such as evolving from an operating room to an interventional room, as future trends demand. Surgery and less invasive interventional suites are co-located and identically sized so they

can be more easily converted in the future as demand changes or as technology evolves.

Consumerism

With the rapid changes in healthcare funding, the power of making decisions about one's healthcare and the responsibility of paying for those services are falling more on individual consumers as opposed to insurance companies. With more of their own resources at stake, patients are demanding greater control over their healthcare decisions and more involvement in their care. The aging baby boomers demand healthcare "when and where" they want it. We will continue to see the trend toward more care delivered in an ambulatory or "day hospital" setting and in the home or workplace. As an example, with the high cost of construction, we are seeing a growing trend to convert dated shopping malls into satellite health campuses that can help health systems save costs and expand their products to new markets. Hospital systems like Vanderbilt University Medical Center, Nashville, Tennessee, are joining a growing number of providers who are exploring low-cost options to expand their services and gain market share (Butcher, 2009).

As evidenced by the current trend of "medical tourism," purchasing of health services will become more global, as the Web gives easy access to world-renowned brands such as Cleveland Clinic for a variety of surgical services and care management. According to *HealthLeaders* magazine, 88% of American adults are willing to travel more than 100 miles to receive care for life-threatening conditions (Medical travel, 2009). More than 200,000 Americans traveled abroad for healthcare services in 2008 at savings that range from 25% to 75% of U.S rates. Most of the medical travelers from the United States are either uninsured or underinsured, representing a huge demographic market potential. How can U.S. hospitals restructure costs and facilities to retain this market at home?

When they need hospitalization, patients demand environments that are private, give them control over their environment (individual-

ized HVAC, lighting controls) and provisions for their guests (including overnight accommodations and access to diversions, such as the Internet). Facility design and amenities need to promote more family-focused care with features that enhance the healing process.

Privacy and family-focused amenities will become important features for patients when selecting a provider. In addition to outcome data for physicians and hospital providers easily available on the Internet, consumers will also be able to select providers on the basis of their ability to meet personal and family requirements. Consumers are searching for providers who can offer Internet convenience in the comfort of their homes for health information and healthcare purchasing. Patients prefer providers who allow them to use the Web to schedule hospital and physician appointments and preregister for care, to communicate with their providers and care coordinators, to receive diagnostic results, to manage their personal health record, to refill prescriptions, and to purchase health products and services. Despite these preferences by their patients, providers have been slow to respond to the demands, most probably because of cost and regulatory issues. As an example, a surprisingly low 8% of American adults reported in an online survey conducted in 2005 by Harris Interactive, that they had received an email or text message from their physicians (Painter, 2007). The message is clear for future facilities: design to delight customers by exceeding their demands for convenience and accessibility. Designing this way might mean that services might not be provided in traditional facilities at all, but instead in a variety of alternative and virtual environments that provide care where and when it is needed.

Finally, what would happen to the American health system if people started to listen to health care providers and change their poor health habits? What would happen if the 130 million chronically ill Americans started to exercise, stopped smoking, and ate healthier? If only a small amount of unhealthy folks stopped smoking or reached their ideal body weight, the nation's hospitals would see a decrease in emergency department visits and a decrease in admissions, particularly for upper respiratory diseases, diabetes, heart attacks, and strokes. Such a change would require a shift from episodic care to care coordination. In such a

scenario, inpatient beds could be converted to day hospital care and outpatient visits to support independence in the community.

Staffing Shortages

Successful health systems in the future must learn how to do more with less staff. Despite the recent reversal of the nursing decline, indicating a slight increase in the number of licensed registered nurses, survey results from the Health Resources and Services Administration still show that 41% of RNs were 50 years or older in 2004, up from 33% in 2000 (U.S. Department of Health and Human Services [DHHS], 2006). Many experts agree that by 2010 available nursing job openings will outweigh the number of eligible applicants two to one. The outlook for other allied professionals such as radiology technicians, pharmacists, and laboratory workers does not look much brighter. Professional physician organizations such as the American Medical Association also have bleak forecasts for several types of providers, especially primary care physicians.

Even though some care shortages can be filled in part by the potential of service robots (especially supply movement by automated guidance vehicles), hospital administrators need to continue to partner with their facility planners to discover new, innovative ways to help workers be more efficient and productive through planning techniques such as the Toyota-based Lean process and to implement the recommended improvements through facility design solutions. Facility planners and designers should consider ways to consolidate like functions, accommodate mobile workstations, decentralize supplies and frequently used equipment, and improve patient and resource flow by locating interdependent functions and services more adjacent to one another.

New Generations of Staff

Facility planning for the future must consider employees of the future. As the generation of "matures" (those born prior to 1946) and "boomers" (those born 1946 to 1964) begin to retire, new generations of employees emerge with new sets of work habits and new sets of expectations. Employees of the "X generation" (those born 1965 to

1980) tend to work smarter than their predecessors, having been more exposed to technology, but less willing to work long hours. These workers demand a work environment that is efficient, but also permits a quality of life that balances work and relaxation. "Off-stage" spaces that provide respite and opportunity for socialization are particularly rewarding. On the other hand, the newest generation of workers, the "millenials," present new challenges to facility planners. Born between 1981 and 1999, these staff grew up with technology, playing video games, and operating computers as toddlers. This generation grew up communicating via email, cell phone text messaging, and personalized Web pages. These workers expect technological tools to make their work easier and faster and to give them more individual control. These employees don't need large centralized nursing stations if they have the ability to communicate with each other digitally and with hands-free, voice-activated devices from decentralized work areas within a patient unit. This group also learns by individual, Web-based study as opposed to classroom settings. The challenge for facility designers is to create an environment that can meet the work and social requirements of today's workforce, but be engineered to adapt easily to the future needs of new generations of professionals, who will be working alongside their aging counterparts.

Emerging Technologies

This chapter has emphasized the need for healthcare facility planners to anticipate change. Healthcare buildings need to easily change to accommodate new technologies and be readily flexible for changes in care delivery. We do not know today with certainty what new technologies will be available in the future. We are only certain that new technologies will dramatically alter operational efficiency and clinical outcomes. We also can be certain that they will have an impact on our facilities. How we prepare for these inevitable uncertainties today is critical to the success in the future.

The healthcare facility of the future must accommodate evolutionary changes in technology and care delivery without expensive remod-

eling that not only takes both precious time and resources, but also interrupts patient care. Some examples of design features of "future-ready" facilities that are flexible and adaptable are:

- Adequate floor heights.
- Programmed "soft space."
- Modular, multifunctional spaces.
- Multi-level (acuity adaptable) patient rooms.
- Universally configured, same-handed rooms.
- Patient bathrooms on exterior walls.
- Integrated building infrastructure systems.
- Consolidation of similar spaces.
- Plug and play capability.

Wireless Technology

Wireless technology has and will continue to impact the delivery of healthcare in the future. Equipped with a small, handheld wireless notebook computer, or computer on wheels, and with "hands-free" communication devices such as Vocera, caregivers are no longer tied to a central station. Picture archiving and communication systems (PACS), electronic medical records (EMR), patient monitoring screens, order entry, and results reporting can all be accessed at the point of care. Unit administrative support staff will work virtually throughout the bed unit, answering phones, transmitting data to physician's offices, scheduling diagnostic tests, and entering orders from anywhere on the unit. The role of the caregiver could be further supported through the developing role of robotic technology for supply delivery, including medications and lab specimens, pharmacy dispensing, bedside assistance, and transport of linen, trash, and patient meals.

As medical records become more paperless, the need for a caregiver to plan work around a stationary desk becomes obsolete. President

Obama proposes a massive effort to modernize healthcare delivery by requiring that all health records be standardized and digital. His plan calls for all health records to become computerized by 2014. With only 8% of U.S. hospitals and 17% of physicians currently using computerized record keeping systems, a major transformation of healthcare facilities must occur (Goldman, 2009).

Wireless, portable communication and information technology will be the single most important technology to transform the inpatient nursing unit. With 90% of healthcare transactions conducted on paper, fax, or telephone, the change will need to be gradual and evolutionary. Planners should consider how the patient unit will change and be staged over time as new technologies are introduced, as the site of work changes, and as the habits of caregivers evolve. Facility planners should consider what the central nursing unit of today can become in the future when technology fully permits work to be performed at the point of care with wireless devices. For example, as the nursing station begins to decentralize to the point of care as technology allows, the central station could evolve into a business center, conference area, or family lounge.

Remote Monitoring and Patient Management

A growing array of new technologies creates a potential to extend care remotely over great distances and increase caregiver productivity. Both wireless and wired biosensor devices permit remote monitoring of patients with chronic diseases, such as diabetes and congestive heart failure, as well as those with implanted devices, such as ventricular assistive devices and artificial joints. Video monitoring, accompanied by digital data transmission, commonly referred to as telemedicine, allows for remote diagnosis and care management of patients with acute and chronic conditions. Increasingly this technology is being used to care for patients in their home, in remote rural facilities, or in ambulatory settings, bringing sophisticated diagnostic and care management from the hospital setting directly to the patient. As reimbursement for remote care continues to develop, this practice could become more commonplace.

Likewise, many hospitals today use remote oversight of patients in intensive care units, commonly referred to as eICU, to allow an intensivist to remotely monitor multiple critical patients in one or more patient units. Such programs have demonstrated significant improvements in patient mortality, length of stay, and cost of hospitalization (Cerón, 2007). Even though hospital administrators might not be currently considering remote monitoring of patients for their new facilities, they should conduct discussion as to whether the buildings should be planned with the additional cabling, interface hardware, and potential monitor and camera placements in mind.

Imaging Advances

Imaging equipment will continue to evolve into smaller, more mobile devices that can be taken to the point of care (e.g. handheld ultrasound and ECG). Technology will also continue to be decentralized throughout the hospital, for example, CT and general radiology in the emergency department and CT and fluoroscopy in interventional suites, to reduce the amount of travel that a patient currently makes to the main imaging department. With digital imaging and PACS capability, the interpretation of images by the radiologist can remain centralized while the equipment travels, or is located closer, to where the patient requires the technology.

At the same time we can expect great advances in imaging technology—computer-aided imaging, ultrasound technology, and advances in positron emission tomography (PET) and functional MRI to map chemical and molecular changes in real time. Imaging could begin to potentially merge with the laboratory and even pharmacy to become a diagnostic center of the future as advances in molecular diagnostics, genomics, and nanotechnology emerge.

Imaging technology grows at such a fast pace that in the future equipment might have an even shorter life span than it has today before it has to be exchanged or upgraded. Facility planners should avoid designing an imaging room exclusively for one modality, but instead imagine into the future as to what technology could replace it and plan the infrastructure and sizing of the room to easily support that transition.

Some planners are incorporating "technology docking stations," outside and immediately adjacent to the imaging department, into their plans so that a mobile transport vehicle can dock the new or unproven modality at the hospital as an economical way to first test a new technology prior to making the capital investment.

Resource Tracking

An additional technology that has the potential to improve outcomes and reduce operational costs is the real-time location system (RTLS). With the use of radio-frequency identification devices (RFID) staff can track equipment, supplies, patients, and staff movement throughout a healthcare facility. Using this technology hospital administrators have reported significant returns on investment by reducing the amount of lost equipment and improving efficiency in patient transports and transfers. Use of RTLS at the point of care can be an important tool in improving the care delivery process by documenting drug or blood product administration at the point of care or monitoring infection control. Though these systems do not have significant facility design implications, the assumptions of their impact on the efficiency of care processes and the improvement of clinical outcomes are important to the entire planning perspective.

Point of Care Testing

Use of handheld, wireless point of care laboratory testing devices can replace a significant amount of tests that were routinely drawn and sent to the main laboratory by transporters or pneumatic tubes. Increasingly, more and more blood tests are available through portable testing such as i-STAT, reducing the turnaround time for results from hours to minutes and decreasing errors caused by transport and staff handoffs. Faster results reduce overall hospital lengths of stay and reduce patient complications because decisions can be made faster. As more routine tests move to the point of care, the main laboratory has the potential to become more focused on the future role for genomic and proteomics. Even though point of care testing uses handheld devices, designers still need to consider careful space planning for

quiet work areas (not hallway alcoves) with sinks, storage, and work counters with multiple electrical outlets for the devices. The main clinical laboratory should be planned with future changes in mind, possibly located near "soft spaces" for easy and fast expansion or remodeling capability.

Procedural Technologies

Healthcare facilities planners should carefully study the medical and informational technology trends affecting the size and number of operating rooms that will be needed in the future. With advancements in surgical and service robotics and the development of minimally invasive tools for endovascular and endoluminal procedures, more and more procedures have the potential to be done in less invasive settings and in shorter periods of time. The number of cases that shift from the traditional inpatient surgery suite to a less invasive outpatient setting such as a CT-equipped interventional room is anticipated to increase.

Planning for the co-location (and similar sizing) of interventional and heart catheterization rooms and operating rooms, not only for the sharing of pre- and post-support spaces and consolidation of scarce professional staff, but also for the future adaptability of these spaces to accommodate new procedural modalities and therapies, will continue. Facility planners should also push back on the tendency of surgical staff to demand huge operating rooms (greater than 750 square feet). Recently built operating suites in the 650 to 700 square foot range, designed with the latest technologies (booms, PACs, and EMR viewing, teleconferencing, etc.) appear to be more than sufficient for the majority of surgical procedures, including cardiac and trauma. Developers of new surgical technologies indicate that technologies currently in development will be smaller in the future, requiring less space.

Final Thoughts

The trends and developments discussed in this chapter might dramatically alter the way healthcare is delivered and the way

facilities function in the future. Though no one force or trend is certain, healthcare facility planners must prepare for all possible scenarios and likelihoods. Successful healthcare facility projects will be designed to be flexible and adaptable for any possible future. Because so many unknowns are involved, healthcare leaders must start their project planning by examining the impact of all possible scenarios of medical and information technology development, as well as changes in healthcare market and care delivery. Those involved in healthcare planning should develop a broad vision that considers these likelihoods in the design process, yet uses evidence-based solutions to maximize the impact of the total project on ideal care delivery. Further, the planning and design process must include healthcare staff, patients, and their families to achieve transformational improvements in workflow and patient safety and to create patient-centered environments that improve outcomes and enhance the staff and patient experience.

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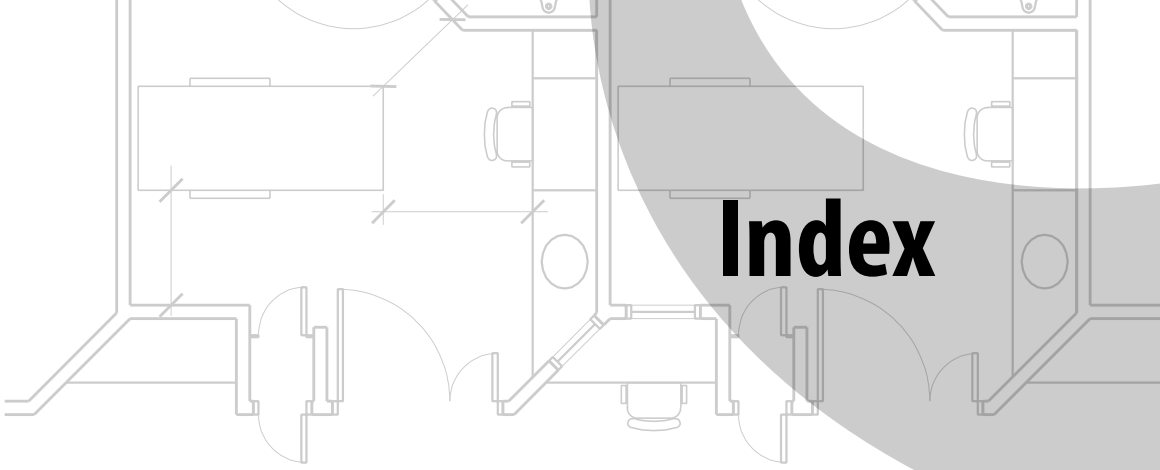

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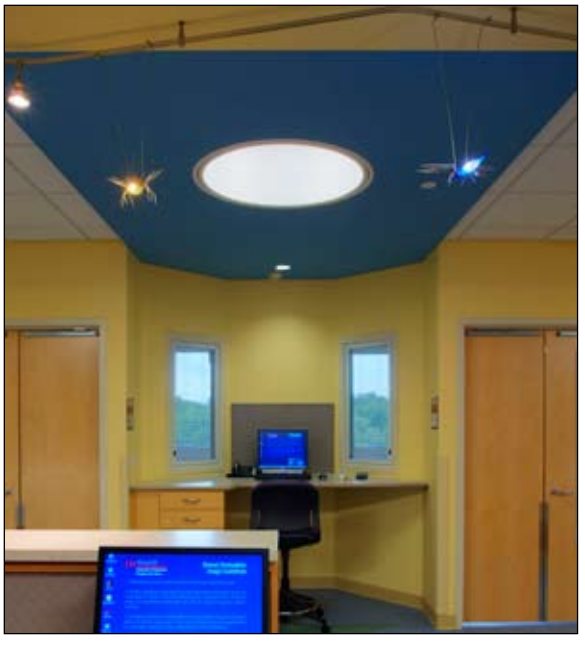

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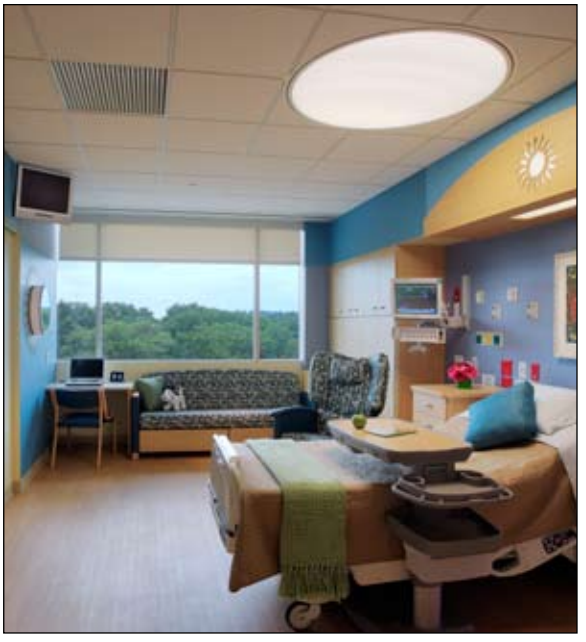

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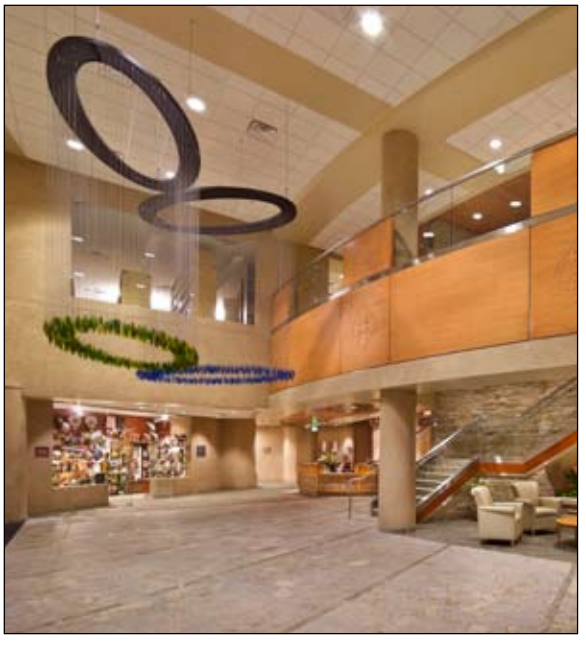

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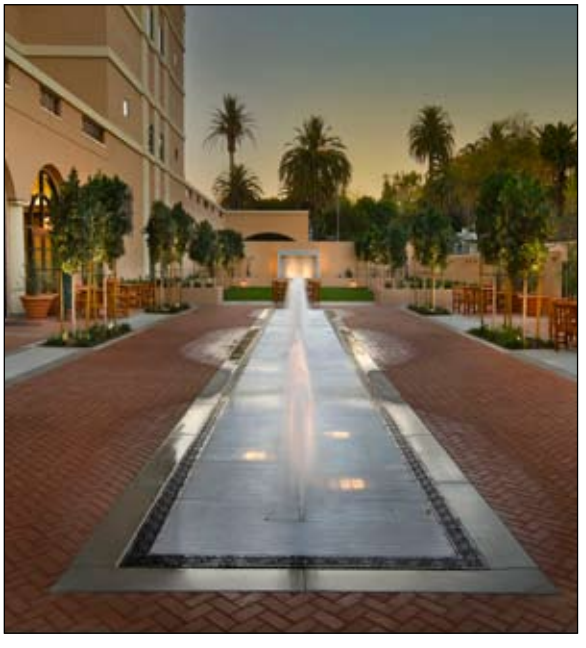

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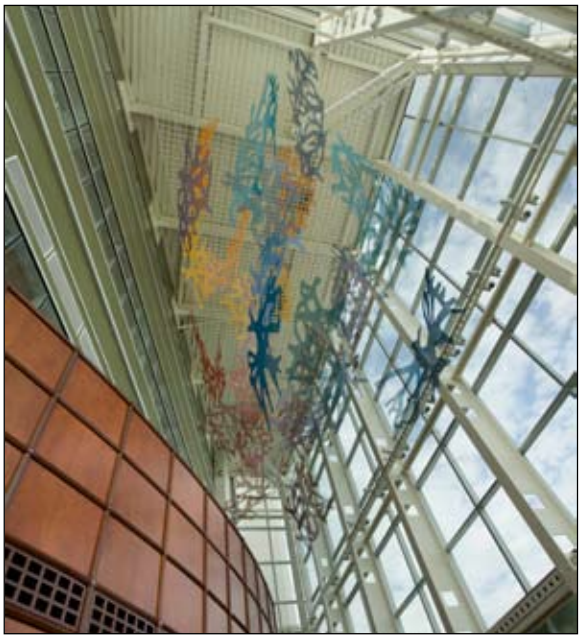

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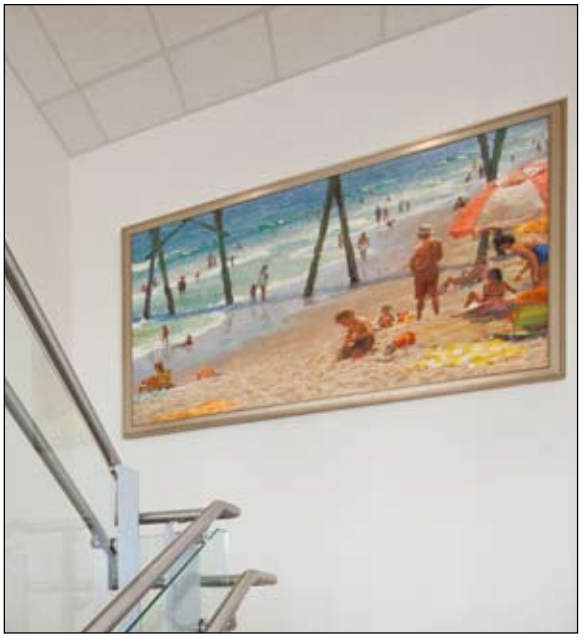

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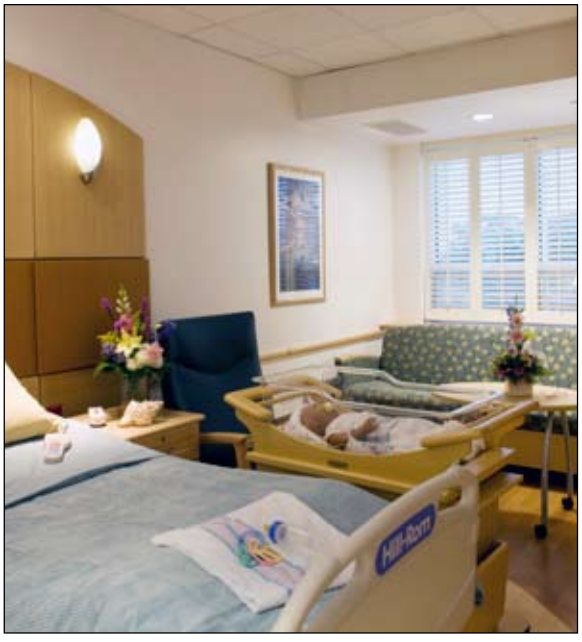

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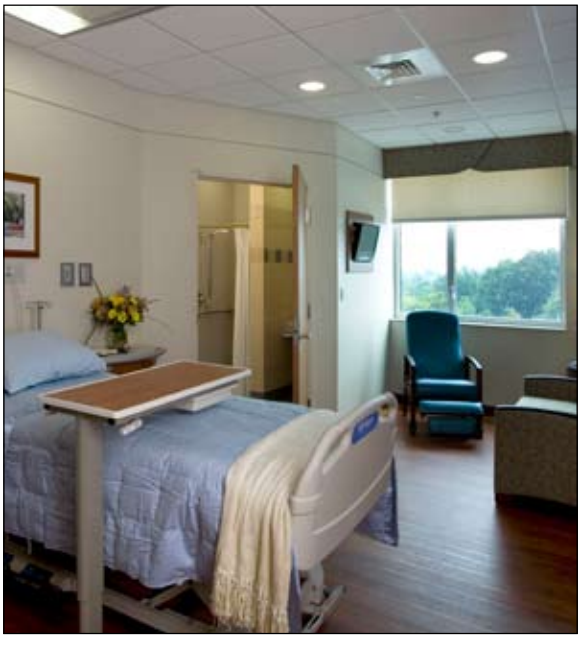

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