

# The Business Case for Building Better Hospitals Through Evidence-Based Design

## Abstract

**Purpose:** After establishing the connection between building well-designed evidence-based facilities and improved safety and quality for patients, families, and staff, this article presents the compelling business case for doing so. It demonstrates why ongoing operating savings and initial capital costs must be analyzed and describes specific steps to ensure that design innovations are implemented effectively.

**Background:** Hospital leaders and boards are now beginning to face a new reality: They can no longer tolerate preventable hospital-acquired conditions such as infections, falls, and injuries to staff or unnecessary intra-hospital patient transfers that can increase errors. Nor can they subject patients and families to noisy, confusing environments that increase anxiety and stress. They must effectively deploy all reasonable quality improvement techniques available. To be optimally effective, a variety of tactics must be combined and implemented in an integrated way. Hospital leadership must understand the clear connection between building well-designed healing environments and improved healthcare safety and quality for patients, families, and staff, as well as the compelling business case for doing so. Emerging pay-for-performance (P4P) methodologies that reward hospitals for quality and refuse to pay hospitals for the harm they cause (e.g., infections and falls) further strengthen this business case.

**Recommendations:** When planning to build a new hospital or to renovate an existing facility, healthcare leaders should address a key question: Will the proposed project incorporate all relevant and proven evidence-based design innovations to optimize patient safety, quality, and satisfaction as well as workforce safety, satisfaction, productivity, and energy efficiency? When conducting a business case analysis for a new project, hospital leaders should consider ongoing operating savings and the market share impact of evidence-based design interventions as well as initial capital costs. They should consider taking the 10 steps recommended to ensure an optimal, cost-effective hospital environment. A return-on-investment (ROI) framework is put forward for the use of individual organizations.

**Key Words:** Evidence-based design, cost savings, hospital facility environment, business case, trustee and leadership involvement, implementation steps

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# The Changing Healthcare Landscape

Today hospitals and their leaders are dealing with a host of daunting and often competing demands: unpredictable reimbursement, workforce shortages, skyrocketing costs, increasing disclosure requirements, mounting consumer and employer expectations, and aggressive union tactics. Most important, a quality and safety revolution is sweeping the country (Institute of Medicine, 2000, 2001) . Consumers, employers, and payers are demanding that hospitals dramatically reduce system-based errors that harm and even kill thousands of patients annually (Sadler, 2006b) .

The speed of the quality revolution has accelerated dramatically, spurred on by many converging forces, including the Leapfrog Group<sup>1</sup> on behalf of employers; the Centers for Medicare and Medicaid Services (CMS) /Premier Hospital Quality Incentive Demonstration project, also known as pay for performance (that is being adopted in various forms by individual states and commercial payers) ;<sup>2</sup> a greater emphasis in Joint Commission standards to improve safety and quality;<sup>3</sup> and two innovative nationwide campaigns coordinated by the Institute for Healthcare Improvement (IHI) .<sup>4</sup> The IHI 100,000 Lives Campaign was so successful in reducing harm to patients that in late 2006 it revamped its efforts into the Protecting 5 Million Lives from Harm Campaign, which includes 12 specific ways for hospitals to intervene. Hospital boards of trustees as well as clinicians and managers are now being pressured to get much more involved. Over 3,700 hospitals are currently participating in this campaign (Institute for Healthcare Improvement, 2008) .

Furthermore, many hospital facilities have simply come to the end of their useful lives, while in several states seismic requirements are mandating major facility upgrades. As a nation, we have entered a major hospital construction boom. It is projected that the already strong healthcare construction sector will grow by 13% to a total of \$53.8 billion in 2008 and will continue to experience a high growth rate through 2011 (H. Jones, 2007) . In the year 2011 this figure is projected to reach \$71 billion (FMI, 2007) . These forces provide unprecedented opportunities to build better hospitals (and renovate existing ones) that can measurably improve care and working conditions. Indeed, there is now a significant body of evidence that shows the physical environment is a critical component of any program to improve safety and quality for patients and to provide a safer working environment for staff. As part of a comprehensive program, the physical environment can help eliminate avoidable conditions such as patient falls and hospital-acquired infections and must be carefully considered when designing new or renovated facilities (Agency for Healthcare Research and Quality, 2007; Clancy, 2008; Henriksen, Isaacson, Sadler, & Zimring, 2007) . The physical environment also has a major impact on revenue enhancement and cost avoidance, making it an important long-term investment.

As the U.S. Director of the Agency for Healthcare Research and Quality (AHRQ) said, “As hospital leaders continue to seek ways to improve quality and reduce errors, it is critical that they look around their own physical environment with the goal of ensuring

the hospital contributes to, rather than impedes, the process of healing (p. 68) .” AHRQ has developed a video for boards and hospital leaders and disseminated it to more than 5,000 hospitals in the United States.<sup>5</sup>

## The Impact of Pay for Performance

In the past few years a fundamentally new concept has emerged in the reimbursement of hospitals and physicians. This is the most significant new reimbursement concept since the enactment of Medicare and Medicaid and the adoption of diagnosis-related groups. The approach is called *value-based purchasing* or *pay-for-performance*, and it will have a profound impact on the business case for quality improvement, including the physical environment in which people work and care is received. Three years ago, CMS and Premier, Inc., launched a major demonstration program involving more than 260 hospitals that voluntarily agreed to submit data about their level of compliance with 34 well-accepted quality measures that should be performed 100% of the time in five high-volume clinical focus areas (acute myocardial infarction, coronary artery bypass graft surgery, heart failure, pneumonia, and hip and knee replacement surgery) . Using two core concepts—transparency and a potential financial bonus for outstanding performers—the goal was to test the impact of these concepts on hospital and physician behavior. The results were significant with the average hospital score improving by 11.8% in the first two years of the program. The quality scores in all the focus areas moved up, with acute myocardial infarction, coronary artery bypass graft surgery, and hip and knee replacement surgery practices achieving more than 90% compliance (Premier, Inc., 2006) . In addition, the individual scores for hospitals in the top fiftieth percentile are posted on the Premier website so that consumers can make more informed choices to get the best quality care available.<sup>6</sup> These findings have caught the attention of Congress and the nation.

The National Quality Forum (NQF) has identified 27 Never Events that are largely preventable and that should simply never occur in hospitals (National Quality Forum, 2006) . Building on this work, in September 2007 CMS took the P4P approach to a new level. CMS selected eight types of events from the NQF list of Never Events and announced that there will be *no* Medicare reimbursement for these events if they are caused by the hospital. One of the eight conditions specifically identified is hospital-acquired patient injuries, such as those that occur with falls. Several types of hospital-acquired infection were included in the 2007 rule and several more have been proposed for consideration in 2008 (Revision to Hospital Inpatient Prospective Payment Systems—2007 FY Occupational Mix Adjustment to Wage Index; Implementation; Final Rule, 2006) .

Medicaid programs and commercial payers will likely follow the CMS lead and begin to announce that they will not reimburse hospitals for harm that they cause. While the details are far from clear, it seems reasonable to assume that within three to five years virtually no payers will reimburse hospitals and physicians for serious harm that they cause. Further, these hospitals will be less likely to be included in payer networks, thus

causing measurable shifts in market share toward better-performing hospitals. Consumers will have easy access to clear outcome measures and will make choices about where to go for their care based on this information. Consumers increasingly will be channeled to payer-preferred networks based on quality measures. Poorly performing hospitals will risk losing significant market share. The P4P revolution has arrived.

## **Another New Reality: Some Hospitals No Longer Charging for Errors**

In this new era of transparency and public reporting, hospitals in some states have voluntarily decided not to charge payers and patients for errors committed by the hospitals. The connection between such a policy and an organization's reputation seems obvious. The connection between hospital errors and the incidence of litigation also has been effectively described (Gosfield & Reinertsen, 2005) .

Indeed, a no-charge policy for hospital-caused errors may soon become standard practice. The hospital associations of Minnesota and Massachusetts have adopted a “no charge for errors” policy in advance of the CMS rules taking effect, and many other states will likely follow (Beaudoin, 2007) . We are entering a new era—one in which patients and payers will no longer pay for poor performance.

## **Patient Satisfaction and Transparency: HCAHPS Raises the Bar**

Another significant emerging trend is the increasing transparency of reporting patient experiences in hospitals. With support from CMS and the AHRQ, the Hospital Care Quality Information from the Consumer Perspective (HCAHPS) survey was developed to: (1) produce comparable data on patients' perspectives of care on topics that are important to consumers; (2) through public reporting, create incentives for hospitals to improve care; and (3) increase public accountability through greater transparency in quality of care. The survey is composed of 27 items, 18 of which encompass critical aspects of the hospital experience, including cleanliness and quietness of the hospital environment and an overall rating of the hospital.

Effective July 2007, those hospitals subject to the inpatient prospective payment system (IPPS) payment provisions are mandated to collect and submit HCAHPS data to receive their full IPPS annual payment update (APU) for fiscal year 2008. CMS is connecting data submission to payment and indicated that those hospitals that do not submit HCAHPS data may receive an APU that is reduced by 2% (Centers for Medicare and Medicaid Services, 2007) . Although there are no data available yet to report from this new trend, it seems reasonable to predict that hospitals with more comfortable, safe,

and patient-centered physical environments will be rated higher by patients in the HCAHPS survey, and this could have a significant influence on patients' choice of hospitals with a resulting impact on hospitals' market share and financial bottom line.

Hospital leaders and boards are beginning to face this new reality: They can no longer tolerate preventable infections, falls, and other types of harm, including harm to their employees, such as back and other musculoskeletal injuries associated with patient handling. They can no longer tolerate unnecessary intra-hospital patient transfers that can increase errors; or have patients, families, and staff subjected to noisy, confusing, environments that increase errors, anxiety, and stress. They must effectively harness all reasonable quality improvement techniques available. To be optimally effective, these techniques must combine tactics and implement them in an integrated way. The change packages in the 100,000 Lives Campaign and the 5 Million Lives Campaign are excellent examples of the changes in people, processes, technology, and culture that must occur in an integrated way to maximize results.

## **Connecting Safety and Quality Improvement to the Physical Environment**

The physical environment in which people work and patients receive their care is an essential element in resolving a number of preventable hospital-acquired conditions. Research now shows that the physical environment has a measurable and quantifiable impact on both patients and caregivers (Joseph, 2006a, 2006b, 2006c; Joseph & Ulrich, 2007; Ulrich, Zimring, Joseph, Quan, & Choudhary, 2004) . Indeed, the environment can significantly assist or impede an organization's safety and quality improvement agenda (Henriksen et al., 2007) .

For example, published research tells us that::

- single-patient rooms save lives and reduce harm because of fewer infections;
- wider patient bathroom doors contribute to reducing patient falls;
- more access to natural light reduces anxiety and depression while shortening length of stay;
- variable-acuity rooms reduce costly, dangerous, and unnecessary patient transfers;
- High-efficiency particulate air (HEPA) filtration systems reduce the frequency of airborne-caused infections in immunosuppressed patients; and
- providing positive distractions through music and art can improve the care experience and the perception of pain (Ulrich et al., 2004) .

Some of this research also clearly demonstrates the positive economic impact of evidence-based design.

So with mounting pressure to improve quality and safety, and evidence that the design of the physical environment can contribute to both, why haven't all hospitals rushed out and implemented these evidence-based design innovations? Some have. For those who have not, the barriers are often perceived to be economic.

## **Balancing One-Time Capital Costs and Ongoing Operating Savings**

Frequently, the greatest barrier to building optimal hospitals is the rapidly escalating cost of construction. Incorporating the best design innovations can add to capital costs initially. However, many evidence-based design features do not cost more. Many people do not realize that these features can significantly reduce operational costs over the life of the project, more than offsetting initial incremental capital costs. This lack of awareness is understandable because, until recently, we did not have the evidence from which to develop solid financial operating impact assessments.

Based on published evidence and the actual experience of pioneering healthcare organizations, in 2004 a multidisciplinary team analyzed the data and designed a hypothetical Fable Hospital™. It was called Fable because it had not yet been built—but it could be, at any time by anyone (and, in fact, a few are now in design) . In 2004, Fable Hospital was a 300-bed replacement hospital costing \$240 million—the average cost of building a hospital at that time. At Fable Hospital, its leaders decided to incorporate all appropriate evidence-based design innovations (Berry et al., 2004) .

After detailed analysis, they estimated that including these changes would require a relatively modest one-time capital cost of \$12 million (or 5% of the \$240 million base cost) . When they analyzed the operating cost savings that would result from reducing infections, eliminating unnecessary patient transfers, minimizing patient falls, lowering drug costs, lessening employee turnover rates, and improving market share and philanthropy, they were amazed. The additional \$12 million capital cost would be more than offset by the end of the second year. With effective management and monitoring, the financial operating benefits would continue year after year, making the additional innovations a sound long-term investment. In short, there was a compelling business case for building better, safer hospitals.

## **Current Costs and Evidence**

Since 2004 when the Fable Hospital article first made a strong business case for evidence-based design, considerably more evidence of the cost implications of facility design has been produced. It is increasingly clear that improved design can lower the

life-cycle costs of hospitals and that many improvements can be made with no increase in initial cost. A complete update of the Fable article is beyond the scope of this paper. However, it is important to highlight some of the most important changes that have occurred since its publication.

The cost of hospital construction has skyrocketed. A combination of the increased costs of concrete, steel, and other building materials in a competitive global market; the cost of labor; and much more stringent building code requirements have driven construction and project costs to unprecedented levels. This trend is likely to continue—although, most experts believe, at a less dramatic rate—for the next five years or more. In addition, there continue to be wide variations in cost between one state or region and another. Despite these substantial increases in the cost of construction, the business case for building better hospitals has become even stronger because of the significant impact of evidence-based design innovations on patient safety, quality of care, and workforce well-being.

More research providing evidence of the positive impact of key design elements has been conducted. Since the 2004 Fable Hospital article, new research has been published that provides evidence for additional features, and a comprehensive review of relevant English-language literature has just been completed (Ulrich et al., 2008) . For example, in the interim, single-patient rooms have become the standard. They are included in the 2006 American Institute of Architects (AIA) minimum standards, and their advantages are so well documented that they are no longer considered a luxury (Facility Guidelines Institute, AIA Academy of Architecture for Health, & U.S. Department of Health and Human Services, 2006) . Because of the strong evidence regarding reduced infections, clear patient preference, enhanced patient-centered care, and greater efficiency and flexibility for optimal use, single-patient rooms are now a basic requirement for most hospitals being built today.

Studies show that installing ceiling lifts can significantly reduce the costs associated with workforce injuries resulting from lifting patients (Chhokar et al., 2005; Joseph & Fritz, 2006) . At PeaceHealth in Oregon they saw an 83% reduction in the annual cost of patient-handling injuries after installing ceiling lifts, resulting in payback on their initial investment in less than 2.5 years. This includes the indirect costs of light-duty worker salaries, replacement salaries, and training costs (Joseph & Fritz, 2006) .

Several new detailed studies have been released documenting the increased costs (ranging from \$8,000 to over \$40,000) incurred for treating patients with hospital-acquired infections (Morrissey, 2004; Murphy & Whiting, 2007; Pennsylvania Health Care Cost Containment Council, 2006) . The state of Pennsylvania found that in 2005 there were 19,154 cases of hospital-acquired infection, or 12.1% per 1,000 admissions, which accounted for 394,129 hospital days and \$3.5 billion in hospital charges in its 168 hospitals. A comparison of the cost of cases with and without hospital-acquired infection was \$185,260 and \$31,389, respectively (Pennsylvania Health Care Cost Containment Council, 2006) . See Table 1 for details. These studies point out that not only does it

cost more to treat such patients, but their length of stay is greater, which can reduce a hospital's unused capacity and thus limit its potential to admit new patients.

## Pennsylvania Healthcare Hospital-Acquired Infection Summary

Case Type	Number of Cases	Mortality Number	Mortality Percent	Average Length of Stay	Average Charge
HAI	19,154	2,478	12.9%	20.6 days	\$185,260
Without HAI	1,550,010	36,238	2.3%	4.5 days	\$31,389

Many indicators suggest that the rate of hospital-acquired infection is increasing. The evidence has become sufficiently strong that it is safe to assume that the strategic placement of hand-washing dispensers in every patient room and in high-volume treatment areas has become a necessity and should be included in any new or existing hospital as a component of an infection-reduction strategy (Bischoff, Reynolds, Sessler, Edmond, & Wenzel, 2000; Trick et al., 2007) . HEPA filtration systems are effective in reducing airborne-acquired infections and are a worthwhile investment in areas that treat immunocompromised patients (Petska & Young, 2006, as quoted in Joseph & Fritz, 2006) .

Injuries from patient falls are another cost that will become more financially significant as reimbursement rules change. Not including any savings for litigation avoidance, the cost of falls with injuries is estimated to be \$19,000 per fall (Hendrich, personal communication, September 26, 2007) . Research indicates that the physical environment is an important component of a total fall-reduction program. As such, modification of the physical environment is one of the measures recommended by the IHI Transforming Care at the Bedside initiative funded by the Robert Wood Johnson Foundation (Institute for Healthcare Improvement, 2007) .The changes needed in the physical environment are not necessarily costly, for instance larger patient bathrooms with double-door access can be built for as little as \$400 extra per room (D. Edwards, personal communication, September 14, 2007; Hendrich, Bender, & Nyhuis, 2003) . The concept of decentralizing nursing stations to improve line-of-sight visibility to patients and to increase the amount of direct patient care time with patients has gathered considerable momentum. Many believe that there is no additional cost to this concept because it results in the same amount of overall square footage, though in a different configuration (Edwards, personal communication, September 14, 2007) . For a 300-bed hospital, reduced patient falls could result in over \$1 million in annual savings.<sup>7</sup>

The acuity-adaptable room is one of the most powerful innovations to improve care by reducing unnecessary intra-hospital transfers and has the threefold benefit of reduced errors and falls, significantly increased patient satisfaction, and a reduction of nonproductive staff time. As acuity-adaptable rooms are more widely adopted, data on

their impact will become available. Dublin Methodist Hospital in Columbus, Ohio, estimates the incremental cost of including additional oxygen and vacuum systems in room headwalls to be about \$5,700 per room, and the possibility of dramatically reducing costly transfers is enormous (Edwards, 2007; Ulrich & Zhu, 2007) . Significant work in nurse training and culture support is required to realize the benefits made possible by acuity-adaptable rooms.

Noise reduction innovations—acoustical ceiling tiles in patient rooms, corridors, and nursing stations—are effective, economical features. Carpet is also effective in reducing noise and can actually cost less than other floor coverings, such as vinyl (Edwards, 2007) . All hospitals should undertake a simple “sound audit” to identify the noisiest areas and put innovations in place, such as eliminating overhead pagers and moving noisy equipment; these yield significant benefits in patient satisfaction (Sharkey, 2007) .

It is increasingly recognized that appropriately selected music can also reduce patient anxiety and increase satisfaction with the healthcare experience. “Carefully selected music can reduce stress, enhance a sense of comfort and relaxation, offer distraction from pain, and enhance clinical performance” (Kemper & Danhauer, 2005, p. 286) . Music can also reduce the need for anesthesia in certain circumstances. “On the day of surgery, patients exposed to music in combination with therapeutic suggestions required less rescue analgesic compared with the controls. Patients in the music group experienced more effective analgesia the first day after surgery and could be mobilized earlier after the operation” (Nilsson, Rawal, Unestahl, Zetterberg, & Unosson, 2001, p. 812) .

Many well-designed innovations involving music and the arts have been shown to have measurable positive impact on reducing anxiety, stress, sleep deprivation, and in improving patients' perceptions of their experience. Most of these interventions are extremely low cost and can be implemented in virtually any hospital at any time. In addition, funding for these projects frequently can be provided by philanthropy from the arts community, so it need not compete with other needs of the hospital that are funded by philanthropy.

The need to reduce employee turnover and improve retention has never been greater. A recent detailed and thorough calculation of nursing turnover estimates the cost for each RN lost to be from \$62,100 to \$67,100 (C. B. Jones, 2005) . This study calculated the actual costs from four hospitals, including the costs of advertising, hiring temporary staff, training, and reduced productivity of the new nurse and of the nurse leaving the hospital. An improved, quieter work environment can reduce stress and contribute to improved nurse satisfaction scores (PricewaterhouseCoopers LLP, University of Sheffield, & Queen Margaret University College—Edinburgh, 2004) .

These represent some of the most significant evidence-based design interventions that measurably reduce operating costs and, in many cases, increase market share. They are summarized in Table 2. Others will be described in the updated literature review in this issue by Ulrich and Zimring.

# Effective Design Interventions Strongly Supported by Evidence

Single-Patient Rooms	Reduced infections; increased privacy; increased functional capacity; increased patient satisfaction
Acuity-Adaptable Rooms	Reduced intra-hospital transfers; reduced errors; increased patient satisfaction
Larger Patient Bathrooms with Double-Door Access	Reduced patient falls; reduced staff back injuries
Strategically Placed Hand Hygiene Facilities	Reduced infections
Decentralized Nursing Stations	Increased staff time spent on direct patient care
HEPA Filtration	Reduced airborne-caused infections
Noise Reduction Measures	Reduced patient and staff stress; reduced patient sleep deprivation; increased patient satisfaction
Maximum Access to Natural Light	Reduced patient anxiety and depression; reduced length of stay
Ceiling-Mounted Lifts	Reduced staff back injuries
Appropriate Art and Music	Reduced patient anxiety and stress; increased patient satisfaction

## Going Green: Further Enhancing the Business Case

In addition to evidence-based design features that address patient and staff safety, there are a number of emerging sustainable or “green” building features and strategies that can improve the healthcare environment with little or no capital cost and that should be considered for inclusion in new projects. Sustainable design increasingly is being recognized as a key component of the hospital safety agenda. In addition, incorporating proven green building features is positive for hospitals, as good community partners, to consider for improving the overall environment.

At the end of 2007 a coalition of large hospital systems and nonprofit organizations created the Global Health and Safety Initiative specifically to address the triple safety agendas of patients, workers, and the environment. While a comprehensive review of sustainability features appropriate for healthcare design is beyond the scope of this paper, a few are highlighted here because of their relationship to the business case. A detailed examination of sustainability in healthcare facilities was recently published by Guenther and Vittori (2008) .

Similar to the evidence-based design features discussed above, sustainable design does not necessarily have a cost premium. The most widely cited study of green building, conducted by Kats (2003) , found that green office and school buildings, on average, had at most a 2% capital cost premium, and that these costs were more than recovered through operational savings—primarily energy and water savings. Moreover, green buildings may well deliver health and productivity benefits that standard buildings, known as “brown buildings,” do not. Kats' research in the office and school sectors correlates improved productivity and reduced absenteeism with green buildings, both of which can be translated into cost savings.

While no definitive study of the cost of green hospital buildings has been published as of this writing, the cost-consulting firm Davis Langdon recently published the “Cost of Green Revisited,” which compares the capital cost of green and brown ambulatory care facilities in California (Matthiessen & Morris, 2007) . Their study found that the capital costs of green ambulatory care facilities were indistinguishable from their brown counterparts. There are low-cost and high-cost green buildings, just as there are low-cost and high-cost brown buildings. Ultimately, capital cost differences within a building type in a geographic area are attributable to program issues, team experience, site factors, and a range of other local factors.

In addition to the obvious financial benefits associated with energy and water reduction, green buildings are incorporating innovative materials and products that are proving to reduce the operational cost of buildings. Green materials often have performance benefits above and beyond their environmental attributes, because manufacturers have been reluctant to introduce green products at premium pricing without additional improvements. Rubber flooring is an example of a product that can have benefits to the bottom line and the environment, and it makes for a safer and better-performing hospital. Kaiser Permanente and Herman Miller have found that its initial cost premium when compared with standard vinyl flooring is offset by a combination of reduced maintenance costs and improved safety. The environmental benefit is that it replaces polyvinyl chloride, which relies on components and manufacturing processes linked to detrimental health effects and which must be maintained by labor-intensive waxing and stripping protocols that negatively impact indoor air quality. Additional benefits arise from improved traction (reduced slip and fall) and from its noise-dampening quality, which creates a more tranquil environment (Fudge, 2006) . Last but not least, it is softer underfoot, reducing strain on caregivers who walk miles per shift.

Another green strategy that intersects with evidence-based design to improve the quality of the environment is maximizing access to daylight. Studies have shown that access to natural light and views can improve healing outcomes, reducing the length of stay (Beauchemin & Hays, 1998; Federman, Drebing, Boisvert, & Penk, 2000) . Studies in office and school environments have correlated access to daylight and views with improved productivity and learning (in healthcare, this is likely to translate to reduced medical error) . One study concluded that nurses in Alaska had twice the errors in darker months (Booker & Roseman, 1995) . Access to natural light reduces the demand

for electricity to power artificial lights and improves the resiliency of the building during extended periods of power loss.

Many green strategies that improve indoor air quality have no cost premium at all and simply require thoughtful selection and procedures. Material finishes that have low volatile organic compound emissions are readily available with little if any additional cost. As green building becomes more pervasive, the range of product offerings increases, and the cost premiums associated with innovation give way to the competition of the marketplace.

Finally, a number of strategies can intersect to actually reduce initial construction cost, and they sometimes yield unanticipated benefits. At the Modesto Hospital, for example, Kaiser Permanente found that the installation of porous paving was less expensive (porous paving allows storm water to move directly through the surface of the pavement to recharge the groundwater directly) (Guenther & Vittori, 2008) . The savings that accrued from eliminating the underground storm water conveyance system more than covered the premium associated with the pavement. It also provided an unanticipated benefit: no wet feet on rainy days, eliminating slips and falls in the lobby. Including emerging new evidence relating to green, sustainable buildings has become an important component of any business case analysis.

## **A Challenge: Converting “Light Green” to “Dark Green” Dollars**

To fully realize any of the financial benefits of the above analysis, it is essential to make cultural and operational changes in tandem with the changes to the physical environment. For example, reducing intra-hospital transfers by means of variable-acuity rooms will not occur through physical environment changes alone; a significant investment in culture and training must be made and implemented. Further reducing these transfers will have significant patient satisfaction benefits and reduce errors, but it won't produce efficiency savings in the bottom line unless staffing levels are adjusted downward and labor costs are reduced.

To fully document the impact of the costs avoided by reducing infections or patient falls, they must be estimated, captured, and reflected in an organization's financial statements. Similarly, the savings associated with reduced nursing turnover that entails a reduction in recruiting and training expenditures must be captured as well.

The movement of theoretical savings (light green dollars) to actual savings for the hospital as reflected in its financial statements (dark green dollars) is key to making the business case accomplish its objectives. This is true of any quality improvement innovations, whether or not they are connected to environmental changes, and it was first described by an interdisciplinary team at IHI (Nolan & Bisognano, 2006) .

Documenting actual cost savings is invaluable in convincing boards of trustees that evidence-based design investments are cost effective.

A framework for analyzing the ROI of a design improvement is presented in Appendix 1. Each organization should fill in its own data to determine actual financial impact over time.

## Case Studies

The following three case studies demonstrate how different organizations have successfully incorporated evidence-based design into their capital projects. The first two describe specific design innovations that have had a significant measurable economic benefit in completed projects. The third describes a clear commitment to incorporate evidence-based design in all new military health facilities.

### PeaceHealth Medical Center, Eugene, Oregon

Like most hospitals, PeaceHealth Medical Center (PHMC) was confronted with a significant number of back injuries from nurses involved in lifting and moving patients. They explored several mechanical devices that were being tested in conjunction with a “no manual lift” policy.

Based on available evidence about the benefits of using ceiling lifts, they installed ceiling lifts in 26 of 33 intensive care unit (ICU) rooms in late 2002 and in all 24 neurology rooms in late 2003. Incident reports spanning a period of 60 months (January 2001 to December 2006) were obtained from both units. In the ICU, there were 10 injuries related to patient handling in the two years before ceiling lifts were installed. The annual cost of patient-handling injuries was \$142,500. In the study period after lifts were installed in more than 75% of the rooms, there were no injuries from moving patients with the lifts (Joseph & Fritz, 2006) .

In neurology, there were 15 injuries related to patient handling in the three years before the installation of ceiling lifts. The annual cost of patient-handling injuries in this unit was \$222,645. In the two years since installation on the unit, there have been six injuries, many of them with extenuating circumstances (e.g., failure to use the lift, a combative patient) . The annual cost in neurology after installation was \$54,660.

Sacred Heart Medical Center (SHMC) emphasizes the need for a “no manual lift” policy and ongoing education about and reinforcement of the importance and benefits of using ceiling lifts

PHMC is building a new replacement hospital (SHMC at Riverbend) . Based on the dramatic findings of the study, they have decided to make 309 rooms lift-ready and will initially install 234 transverse rails and lifts. They expect to receive a return on their investment within approximately 2.5 years in the new facility. The authors conclude: “With PeaceHealth's new ergonomics program in place and 100% compliance in using ceiling lifts, the savings could be phenomenal” (Joseph & Fritz, 2006, p. 13) .

## **Methodist Hospital, Clarian Health Partners, Inc., Indianapolis, Indiana**

Clarian recognized that delayed transfers of patients between nursing units and lack of available beds are significant problems that increase costs and decrease quality of care and satisfaction among patients and staff. Patients are transferred as often as three to six times during their stay to receive care that matches their level of acuity. In a pioneering project, the team led by Ann Hendrich replaced a multi-level ICU with single-variable acuity-adaptable rooms. In designing the new 56-bed ICU (28 rooms on two floors) , each single room was equipped with acuity-adaptable headwalls, which were equipped with the gases and equipment needed to provide care as patient acuity changed.

Twelve outcome-based questions were formulated. Two years of baseline data were collected before the unit was moved, and these were compared with three years of data collected after the move.

They found significant improvements post-move in many key areas: patient transfers decreased by 90%; medication errors decreased by 70%; and there was a drastic reduction in the number of falls. Run charts are included in the published article (Hendrich, Fay, & Sorrells, 2004). The costs savings are also significant, making a very strong business case for this approach.

## **The Military Health System**

The Military Health System (MHS) provides care to 9.2 million beneficiaries with approximately 130,000 staff in 70 military hospitals, 411 primary care clinics, and 417 dental clinics around the world. Consequent to several recently enacted laws, including the 2006 Base Realignment and Closure Act, plans to increase the number of soldiers and Marines serving, and plans to move some military units back to the United States, the MHS finds itself with a \$6 billion portfolio of healthcare facility projects planned over the next five years. These projects include closing the historic Walter Reed Army Medical Center and merging its missions with the National Naval Medical Center seven miles away to create the Walter Reed National Military Medical Center at Bethesda. It also includes a new, robust community hospital at Fort Belvoir in Northern Virginia to serve the almost half-million beneficiaries in the nation's capital. As a result of these and

many other health facility projects, the MHS finds itself with a once-in-a-lifetime opportunity to transform its worldwide healthcare infrastructure and contribute to the body of evidence-based design science. Embracing evidence-based design features and responses sets the stage for the next-generation healthcare infrastructure, which will support the outcomes that our warriors and their families deserve. So how are they organized to succeed?

## **Transformational Leadership and Strategic Planning**

All transformational endeavors require leaders who can envision the future, articulate goals, and mobilize the organization to reshape its culture and processes. The MHS launched the evidence-based design campaign in January 2007 with clear direction from the Assistant Secretary of Defense for Health Affairs who directed the Army Corps of Engineers and the Navy Facilities Engineering Command:

Instruct the respective design teams to apply patient-centered and evidence-based design principles across all medical construction projects. A growing body of research has demonstrated that the built environment can positively influence health outcomes, patient safety, and long-term operating efficiencies to include reduction in staff injuries, reduction in nosocomial infection rates, patient falls, and reductions in length of hospital stay. Incorporating the results of this research along with changes in concepts of operations into the design of some of our most significant facilities will allow the MHS and the patients entrusted to our care to reap substantial health and system-wide benefits for many years to come. (Winkenwerder, 2007)

The MHS evidence-based design team comprises doctors, nurses, administrators, architects, and engineers engaged in a deliberate planning process that resulted in the creation of an evidence-based design road map, which includes principles, goals, and desired outcomes that are linked to the larger MHS strategic plan and that specify recommended evidence-based design features and responses (Malone, Mann-Dooks, & Strauss, 2007) . A summary of the MHS evidence-based design principles and subsequent goals is presented in Table 3.

# Military Health System's Evidence-Based Design Principles and Goals

## Next Steps: Institutionalizing Evidence-Based Design

Systems improvement represents a complex poetry that demands leader-driven engagement of the entire team to solve the challenging problems facing healthcare today (Berwick, 2007). Harnessing evidence-based design as a transformational force and tool requires deliberate institutionalization activities to ensure the cross-pollination of efforts to improve clinical and business processes and to maximize investments in the built and digital infrastructures. Some of the evidence-based design institutionalization activities that the MHS is currently engaged in include:

- Engaging a range of senior leaders to provide the transformation leadership;
- Partnering with clinical and administrative peers who can lead the necessary clinical and business process reengineering;
- Including patients and family members in all aspects of facility planning;
- Refining evidence-based design cost-estimating guidance to include ROI analysis that links features in the built environment with improvements in patient and staff safety and quality of care, staff satisfaction, and improvements in the bottom line;
- Reviewing and restructuring acquisition processes to streamline the delivery of projects that now include evidence-based design features;
- Reviewing outcome metric definitions and methodology to ensure comparability on a national level;
- Engaging research teams to focus on replicating previous studies in the inpatient environment as well as initiating new evidence-based design research across the entire healthcare continuum, with particular focus on the ambulatory care and dental environments;
- Harvesting emerging evidence-based design application tools and lessons-learned across the many projects in various stages of planning and design and to apply to later projects;
- Disseminating evidence-based design information;
- Refining the post-occupancy evaluation process; and
- Publishing and sharing evidence-based design experiences and lessons learned.

Engaged and focused leadership fuels and focuses the cross-pollination effort and drives disciplined execution at every step of the process by establishing the vision and then coaching, managing, and rewarding the team engaged in the hard work of cultural and process re-engineering. Well-conceived strategies will fail without transformational leaders and disciplined execution. The stakes could not be higher, as the current MHS Assistant Secretary of Defense for Health Affairs, Honorable S. Ward Casscell, MD, reminds us, "...the best isn't good enough for our warriors. Nothing short of excellence is good enough for these patients and their families. We have an unprecedented opportunity to modernize many of our key facilities over the next five years. We can and must ensure that our hospital designs promote integrity during the clinical encounter...empower our patients and families...relieve suffering...and promote long-term health and wellness" (Casscell, 2008).

## Making It Happen: Ask Question No. 6

Traditionally, hospital leaders have asked five questions when considering a major building project:

1. **Urgency**—Is the expansion/replacement actually needed now to fulfill the hospital's mission? What is the strategic cost of not proceeding?
2. **Appropriateness**—Is the proposed plan the most reasonable and prudent in light of other alternatives?
3. **Cost**—Is the cost per square foot appropriate in light of other projects being built in the region?
4. **Financial Impact**—Has the financial impact of additional volume, depreciation expense, and revenue assumptions been reasonably analyzed and projected?
5. **Sources of Funds**—Is the anticipated combination of additional operating income, reserves, borrowing, and philanthropy reasonable and enough to support the project?

However, in light of the compelling business case analysis described above, hospital leaders must also address a sixth question:

6. **Evidence-Based Design**—Will the proposed project incorporate all relevant and proven evidence-based design innovations to optimize patient safety, quality, and satisfaction as well as workforce safety, satisfaction, productivity, and energy efficiency?

As hospital leaders undertake building projects, it is imperative that the ongoing operating savings mentioned above be an integral part of the analysis (Sadler, 2006a). Hospital boards must hold management accountable to new levels of environmental excellence and efficiency. Building a new hospital or undertaking a major renovation is likely to be the biggest financial decision that a board will ever make. It also provides a

unique opportunity to transform the culture and processes of the overall organizational enterprise (Hamilton, Orr, & Raboin, 2008). Indeed, major changes in culture and organizational processes are essential if the beneficial impact of an improved physical environment is to be realized.

## **From Ideas to Action: Creating Your Own Business Case**

As stated earlier, hospitals typically undertake a comprehensive financial analysis before undertaking a major project—including asking the five basic questions. To address the sixth question effectively, financial impact assumptions of evidence-based design interventions should be developed and management and the board must commit to measure and implement them. The chief financial officer must take a leadership role in this effort.

To effectively incorporate evidence-based design, hospital leadership must undertake at least the following 10 steps:

1. Create a multidisciplinary team: Management, medical staff, and board leaders must work as a team to develop a common vision, including specific goals (volume and patient/quality improvements) that they wish to achieve in the new project.
2. Choose the right architects: Select architects with a proven understanding of and experience in evidence-based design. Look for actual examples of evidence-based design innovations that they have helped to incorporate in completed or planned projects.
3. Identify evidence-based design interventions: Architects, management, medical staff, and board leadership must collaborate to determine which cost-effective evidence-based design interventions will support the vision that they hope to achieve in a new project.
4. Evaluate current practices and develop a baseline for each: For example, determine the current rates of transfers, employee turnover, and patient falls both institutionally and at the patient unit level. Identify the baseline operating costs associated with these practices.
5. Set measurable post-occupancy improvement targets: For example, a reduction in hospital-acquired infections from x to y; an increase in patient satisfaction rates from a to b; a decrease in workforce lift injuries from c to d; and a reduction in patient transfers from e to f. These measurable improvement targets must be agreed to by all key stakeholders and widely communicated. To be successful, it is essential to build an organizational culture of support for these changes, including developing enthusiastic staff leaders who are strong advocates (Hamilton et al., 2008). A framework for determining the ROI of innovations is included. Each organization must supply this framework based on its actual experience and goals.

6. Incorporate design innovations into capital and operating budgets: Management and medical leadership must incorporate the financial impact of these improvements into the hospital's annual capital and operating budgets, which are reviewed and approved by the board of trustees.
7. Widely communicate improvement targets: Performance improvement targets and the methods used to collect data should be included in all appropriate internal and external communications. This can provide public awareness and recognition that can differentiate the organization in the marketplace and increase market share.
8. Track and report progress: Upon opening of the new facility or renovation, the metrics of impact (including the financial impact) at both the institutional and unit levels should be regularly reported to all key stakeholders, including the board.
9. Continually incorporate new evidence-based design: Regularly review internal experience with and new developments in evidence-based design. Where appropriate, incorporate new evidence-based design interventions into the organization's facility maintenance activities, process, and culture. Though impact should be tracked for at least two years post-occupancy, environmental design and process improvements that emerge should be systematically incorporated.
10. Publish your results: The organization should commit to publishing its results and sharing lessons learned (including financial impacts) with the rest of the healthcare and design communities. In so doing, it contributes to essential knowledge about the financial impact of evidence-based design.

The effectiveness of any evidence-based design intervention does not occur in isolation from other important, proven process improvements that must be implemented concurrently. Similar to the experience of IHI in the 100,000 Lives Campaign and 5 Million Lives Campaign, effective change packages are a bundle of improvements that must be implemented together. The key point is that the environmental design innovations included here are essential ingredients in optimizing safety and quality.

## **A Recommended Framework for Evaluating the ROI of Evidence-Based Design Features**

Appendix 1 presents an ROI framework that helps to lay out all the business case issues that need to be considered when evaluating specific evidence-based design innovations (E. Malone, Unpublished Return on Investment Framework for Evaluating EBD Features, personal communication, February 23, 2008). Each organization must incorporate the latest evidence and apply its best judgment regarding the cost and revenue impacts of design innovations. Using the goal of reducing hospital-acquired

infections as an example, this business plan requires specific performance information to identify the scope of the problem and to target improvement goals. It also calls for an understanding of the evidence-based design features included in the project and the clinical and administrative interventions that are planned to reduce hospital-acquired infections. Both initial and life-cycle or incremental costs are provided for all interventions so that a comparison can be made between the cost of intervention and the enhanced revenue associated with cost avoidance. This framework should work equally well for other types of evidence-based design innovations.

## Conclusion

The business case for implementing proven evidence-based design interventions was strong in 2004 when the first Fable Hospital analysis was undertaken. In 2008, the business case is even stronger. The costs of unnecessary patient harm are greater; the expectations and demands of both the public and employers are far higher; the importance to customer satisfaction is more significant; the emerging benefits of green strategies are more promising; and the reimbursement implications resulting from the emerging P4P methodologies are profound. As part of their management and fiduciary responsibilities, hospital leaders and boards must include cost-effective evidence-based design interventions in all their programs or suffer the economic consequences in an increasingly competitive and transparent environment. Done properly, the responsible use of evidence-based design will improve patient safety and quality, enhance workforce recruitment and retention, and produce a significant multiyear ROI.

## Recommendations

1. When planning to build a new hospital or renovate an existing facility, hospital leaders should address a key question (question number 6): Will the proposed project incorporate all relevant and proven evidence-based design innovations to optimize patient safety, quality, and satisfaction as well as workforce safety, satisfaction, productivity, and energy efficiency? Based on the strength of the research, the recommendations included in Appendix 1 should be carefully considered.
2. When conducting a business case analysis for a new project, hospital leaders should include the ongoing operating savings and market share impacts of evidence-based design interventions in addition to initial capital costs.

To effectively implement a business case analysis, hospital leaders should consider taking the 10 steps recommended to ensure that an optimal, cost-effective hospital environment is achieved, that all potential financial benefits actually are realized, and that contributions to the literature are made.

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