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Blair L. Sadler, JD
Jennifer R. DuBose, MS
Eileen B. Malone, RN, MSN
Craig M. Zimring, PhD

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1 of 5

THE BUSINESS CASE
FOR BUILDING BETTER
HOSPITALS THROUGH
EVIDENCE-BASED DESIGN



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

EXECUTIVE SUMMARY

Building a new hospital or undertaking a major renovation is likely to be the biggest financial decision that a CEO or hospital board of trustees will ever make. There is a growing body of evidence that now links the physical environment with safety and quality outcomes for patients and staff. As part of their management and fiduciary responsibilities, hospital leaders and boards must base decisions about built-environment investments that include cost-effective evidence-based design (EBD) interventions in their strategic plan and investment portfolio or risk suffering the economic consequences in an increasingly competitive and transparent environment.

This paper provides an EBD toolkit for leaders to use when considering a major building project, as well as a proposed return-on-investment framework to evaluate the business case for each EBD feature included. These features, when combined with a transformation of the organization's culture and processes, maximize the capital investment by quantifiably improving patient safety and quality, enhancing workforce recruitment and retention, and producing a significant multi-year return on investment.

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

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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, work-force 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, even kill thousands of patients annually (Sadler, 2006).

Further, 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 continue grow to a total of \$67.2 billion in 2012 (FMI, 2008).

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 in any program to improve safety and quality for patients and provide a safer working environment for staff. *(For an in-depth review of the available research, see “A Review of the Research Literature on Evidence-Based Healthcare Design” by*

Roger S. Ulrich, Craig Zimring, Xuemei Zhu, Jennifer DuBose, Hyun-Bo Seo, Young-Seon Choi, Xiaobo Quan, and Anjali Joseph.) 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.

CONNECTING SAFETY AND QUALITY IMPROVEMENT TO THE PHYSICAL ENVIRONMENT

Evidence-based design is the process of basing decisions about the built environment on credible research to achieve the best possible outcomes (Center for Health Design, 2008). The physical environment in which people work and patients receive their care is one of the essential elements to resolve a number of preventable hospital-acquired conditions. Research now shows that the physical environment in which patients are cared for and in which caregivers work has a measurable and quantifiable impact on them (Joseph, 2006a, 2006b, 2006c; Joseph & Ulrich, 2007; Ulrich, Zimring, Joseph, Quan, & Choudhary, 2004; Ulrich et al., 2008). Indeed, the environment can significantly assist or impede an organization’s safety and quality improvement agenda (Henriksen

et al., 2007). (For more on the environment's impact on the work force and patient care, see "Maximizing the Impact of Nursing Care Quality: A Closer Look at the Hospital Work Environment and Nurse's Impact on Patient-Care Quality" by Ann Hendrich and Marilyn Chow.)

So with the mounting pressure to improve quality and safety, and the evidence that 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 that haven't, the barriers are often perceived to be economic.

"One of the happy sides to this idea of evidence-based design is that, unlike some calls for changes in healthcare, it really thoroughly unites the interests and life experience of the work force in healthcare with that of the patient."

– Don Berwick, MD, MPP, FRCP, President and CEO, Institute for Healthcare Improvement, as quoted in "Transforming Hospitals: Designing for Safety and Quality" (Agency for Healthcare Research and Quality, 2007).

Balancing One-Time Capital Costs and Ongoing Operating Savings

Central to the business case is the need to balance one-time construction costs against ongoing operating savings and revenue enhancements. The first attempt to analyze this balance was published in 2004 by a multi-disciplinary team that reviewed published research and the actual experience of healthcare organizations that used evidence-based design in portions of their construction projects. Many of these were pioneering hospitals, called Pebble Project partners, which were part of a collaborative learning program sponsored by The Center for Health Design. They designed a hypothetical Fable Hospital™. (The name *Fable* was chosen because it had not then been built.) When they analyzed the operating cost savings resulting from reducing infections, eliminating unnecessary patient transfers, minimizing patient falls, lowering drug costs, lessening employee turnover rates, as well as improving market share and philanthropy, they concluded that, with effective management and monitoring, the financial operating benefits would continue for several years, making the additional innovations a sound long-term investment (Berry, Parker,

Coile, Hamilton, O'Neill & Sadler, 2004). In short, there was a compelling business case for building better, safer hospitals.

Going Green:

Another Dimension of the Business Case

In addition to evidence-based design features that attend to patient and staff safety, there are a number of emerging sustainable or *green* building features and strategies that can improve the healthcare environment. Some of these can be implemented with little or no capital cost and should be considered for inclusion in new projects.

Moving "Light-Green" to "Dark-Green" Dollars:

A Challenge to Address

To fully realize the business-case impact of the costs avoided through the improved outcomes that evidence-based design can deliver (reduced infections, reduced patient falls, improved nurse turnover, etc.), the cost savings must be estimated, captured, and reflected in the organization's financial statements. A full accounting of these costs avoided requires system thinking to capture all associated costs such as the reduced recruiting and training expenditures that come along with reduced nursing turnover rates.

The movement of theoretical savings (light-green dollars) to actual savings to the hospital as reflected in its financial statements (dark-green dollars) is a key success factor to make the business case actually accomplish its objectives. This is true of any quality-improvement innovation, whether or not connected to environmental changes, and was first described by an interdisciplinary team at the Institute for Healthcare Improvement (Nolan & Bisognano,

2006). Documenting actual cost savings in financial forecasts can be invaluable in convincing boards of trustees that evidence-based design investments are cost-effective.

A suggested framework that hospitals can use to calculate the return on investment of a specific evidence-based innovation is included in a subsequent section. Each organization will need to incorporate the latest relevant evidence and its best judgment about cost and revenue impacts of the innovations being considered.

THE CHANGING REIMBURSEMENT ENVIRONMENT: THE REVENUE SIDE OF THE BUSINESS CASE

When fully considering reduced operating costs and revenue enhancements, there is a powerful business case that supports making intelligent evidence-based design decisions. In addition to the multiyear cost-savings opportunities, it is important to consider the implications of several major forces beginning to change reimbursement formulas and require public reporting of quality-safety outcomes as well as comparable patient satisfaction scores.

Pay for Performance

In the past few years, a fundamentally new concept has begun to emerge in the reimbursement to hospitals and physicians. It is called *value-based purchasing* or *pay for performance*, and it promises to have an important impact on the business case for quality improvement, including the physical environment in which people work and care is received. While much of the emphasis so far has been on Medicare patients (driven by the Centers for Medicare and Medicaid Services [CMS]), it seems safe to assume that Medicaid and commercial payers will follow in this direction—indeed some have already begun.

The National Quality Forum's Never Events

The National Quality Forum (NQF) has identified 27 Never Events that are largely preventable and should simply never occur in hospitals (National Quality Forum). CMS has identified specific harms, including infections and falls that should not be reimbursed. While the details are just

emerging, it seems reasonable to assume that, within 3 to 5 years, virtually no payers will reimburse hospitals and physicians for serious harm that they cause. Consumers will have easier access to clear, comparable outcome measures and will begin to make choices about where they go for care based on this information. Increasingly, consumers will be channeled to payer-preferred networks based on quality measures. Poorly performing hospitals could risk losing significant market share.

Hospitals Will no Longer Charge for Their 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 they cause. The connection to such a policy and an organization's reputation is important. In addition, the connection between hospital errors and the incidence of litigation has been effectively described (Gosfield & Reinertsen, 2005).

Several state hospital associations have adopted a no-charge policy for hospital-caused errors, and this may soon become standard practice (Beaudoin, 2007). We are entering a new era—one where patients and payers will no longer tolerate being charged for poor outcomes.

Patient Satisfaction and Transparency: HCAHPS Changes the Rules

Another emerging trend is the mandated reporting of patient experiences in hospitals. With support from CMS and the Agency for Healthcare Research and Quality, the Hospital Consumer Assessment of Healthcare Providers and Systems (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 increased transparency of 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 overall rating of the hospital (Centers for Medicare and Medicaid Services, 2007).

While there is no data yet to report the impact of this new trend, it seems reasonable to predict that those hospitals that have more comfortable, safe, and patient-centered physical environments will be rated higher by patients in the HCAHPS survey. And this could have significant influence on patient choice of hospitals with a resulting impact on a hospital’s market share and its financial bottom line.

While HCAHPS is focused today on Medicare beneficiaries, it seems reasonable to assume that Medicaid and commercial payers will again follow and that this type of public-reporting requirement will apply to most hospitals.

These four trends combine to send a clear signal that hospitals could experience significant negative revenue consequences secondary to providing less than optimal environments that contribute to unacceptable clinical outcomes, lower patient satisfaction scores, and reduced market share.

PRIORITY DESIGN RECOMMENDATIONS

The following design recommendations have been developed based on the strength of the evidence available and their impact on safety, quality, or cost (Table 1). These recommendations can be

**TABLE 1:
DESIGN INTERVENTIONS THAT ANY HOSPITAL CAN UNDERTAKE**

	Design Interventions	Quality and Business-Case Benefits
1	Install handwashing dispensers at each bedside and in all high patient-volume areas.	Reduced infections
2	Where structurally feasible, install HEPA filters in areas housing immunosuppressed patients.	Reduced airborne-caused infections
3	Where feasible, install ceiling-mounted lifts.	Reduced staff back injuries
4	Conduct a noise audit and implement a noise-reduction plan.	Reduced patient and staff stress, reduced patient sleep deprivation, increased patient satisfaction
5	Install high-performance sound-absorbing ceiling tiles.	Reduced patient and staff stress, reduced patient sleep deprivation, increased patient satisfaction
6	Use music as a positive distraction during procedures.	Reduced patient stress, reduced patient pain and medication use
7	Use artwork and virtual-reality images to provide positive distractions.	Reduced patient and staff stress, reduced patient pain and medication use
8	Improve wayfinding through enhanced signage.	Reduced staff time spent giving directions, reduced patient and family stress

implemented in any facility at any time without significant modification to the facility and at relatively low cost.

consider including these cost-effective design strategies as part of their quality-improvement efforts.

HOW TO UTILIZE EVIDENCE BASED DESIGN: A TOOLKIT FOR ACTION

Ask An Additional Question

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 cost strategically of not proceeding?

“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.”

– Dr. Carolyn Clancy, U.S. Director of the Agency for Healthcare Research and Quality, as quoted in the *American Journal of Medical Quality* (Clancy, 2008, p. 68).

Other strategies require greater financial investment and significant physical modifications and are best incorporated as part of a major renovation or a new construction project (Table 2). Healthcare leaders should seriously

TABLE 2: DESIGN INTERVENTIONS AS PART OF CONSTRUCTION OR MAJOR RENOVATION		
	Design Interventions	Quality and Business-Case Benefits
1	Build single-patient rooms.	Reduced infections, increased privacy, increased functional capacity, increased patient satisfaction
2	Provide adequate space for families to stay over night in patient rooms.	Increased patient and family satisfaction, reduced patient and family stress
3	Build acuity-adaptable rooms.	Reduced intrahospital transfers, reduced errors, increased patient satisfaction, reduced unproductive staff time
4	Build larger patient bathrooms with double-door access.	Reduced patient falls, reduced staff back injuries
5	Install HEPA filtration throughout patient-care areas.	Reduced airborne-caused infections
6	Install handwashing dispensers at each bedside and in all high patient-volume areas.	Reduced infections
7	Install ceiling-mounted lifts in majority of patient rooms.	Reduced staff back injuries
8	Meet established noise-level standards throughout the facility.	Reduced patient and staff stress, reduced patient sleep deprivation, increased patient satisfaction
9	Use music as a positive distraction during procedures.	Reduced patient stress, reduced patient pain and medication use
10	Provide access to natural light in patient and staff areas.	Reduced patient anxiety and depression, reduced length of stay, increased staff satisfaction
11	Use artwork and virtual-reality images to provide positive distractions.	Reduced patient and staff stress, reduced patient pain and medication use
12	Build decentralized nursing stations.	Increased staff time spent on direct patient care
13	Include effective wayfinding systems.	Reduced staff time spent giving directions, reduced patient and family stress

2. **Appropriateness:** Is the proposed plan the most reasonable and prudent in light of other alternatives?
3. **Cost:** Is the cost/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?

When planning to build a new hospital or renovate an existing facility, hospital leaders should address a sixth key question:

How will the proposed project incorporate all relevant and proven evidence-based design innovations to optimize patient safety, quality, and satisfaction, as well as work-force safety, satisfaction, productivity, and energy efficiency?

(For more information on the decision-making process, see “Implementing Healthcare Excellence: The Vital Role of the CEO in Evidence-Based Design” by Craig Zimring, Godfried L. Augenbroe, Eileen B. Malone, and Blair L. Sadler.)

From Questions To Action:

A Framework for Evaluating the Business Case for Evidence-Based Design Features

To address question number 6 effectively, a hospital should have a process for critically evaluating proposed evidence-based design features to determine which ones will have the greatest impact on their operations. A return-on-investment (ROI) framework is offered below that describes the business-case issues that need to be considered when evaluating specific evidence-based design innovations.

Each organization must incorporate the latest evidence and apply its best judgment regarding the cost and revenue impacts of design innovations. 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 achieve safety-quality goals.

Both initial and lifecycle incremental costs and savings 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.

Using the goal of reducing hospital-acquired infections as an example, this framework requires specific performance information to identify the scope of the problem and target improvement goals. This framework should work equally well for other types of evidence-based design innovations. This ROI framework contains five steps and requires filling in each table with your hospital's data.

Step 1: Identify scope of the problem and improvement opportunity.

Begin by creating a multidisciplinary leadership team and developing a compelling vision of the goals that will achieve measurable safety-quality improvements involving patients, families, and staff, as well as volume and the bottom line.

Based on these goals, evaluate current practice and develop a baseline for each. For example, determine the current rates of infections, transfers, employee turnover, patient falls institutionally and at the patient-unit level. Identify the baseline operating costs associated with these outcomes.

Set measurable postoccupancy improvement targets. For example, goals might include a reduction in hospital-acquired infections from X to Y,

increase in patient satisfaction rates from A to B, decrease in work-force lift injuries from C to D, and reduction in patient transfers from E to F. These measurable improvement targets must be widely agreed to by all key stakeholders and effectively communicated. Key staff members must be included in this process and become active advocates. To be successful, it is essential to build an organizational culture of support for these changes.

For example, for hospital-acquired infections, you would gather the following data and use it to complete Table 3.

- Identify total admissions that occurred in the previous year. (You may want to capture this data for several previous years to develop an average baseline or trend.)
- Of those admissions, determine how many patients contracted HAIs.¹
- Identify the number of patients with specific HAIs that will not be reimbursed by payers or under your hospital policy.
- Identify the average hospital cost per admission for patients with and without an HAI, splitting out nonreimbursable cases if desired.
- Identify your improvement goal: e.g., reduce HAIs to X number per year.

Step 2: Estimate improvement costs.

In order to estimate the costs for achieving your goals, you need to identify the specific evidence-based design strategies as well as clinical and administrative strategies you will use to reach your goals and identify associated initial and lifecycle costs (Table 4). Management, medical staff, and board leadership must collaborate with the architect to determine which cost-effective evidence-based design interventions will support their vision for the new project.

If your goal is to reduce hospital-acquired infections, your analysis would be similar to the following:

Examples of evidence-based design interventions are provided below.

- Create 100% single-patient rooms.
- Ensure that there are separate handwashing sinks for staff in patient rooms and that the sinks are unavoidably visible and available.

**TABLE 3:
PROBLEM SCOPE AND IMPROVEMENT OPPORTUNITY**

Outcome	Number of Cases	Rate per 1000 Admissions	Average Hospital Cost per Admission
HAI		(Number of HAI cases/total admissions) x 1,000	
No HAIs		(Number of non-HAI cases/total admissions) x 1,000	
Unreimbursed HAI		(Number of unreimbursed HAI cases/total admissions) x 1,000	
Total admissions	Number of HAI + number of non HAI		
Incremental cost for all HAI cases			Average cost HAI – Average cost non-HAI
Incremental cost for unreimbursed HAI cases			Average cost unreimbursed HAI – Average cost non-HAI

¹ A guideline to identifying patients with HAIs can be found in the Pennsylvania Health Care Cost Containment Council report's technical section, found at <http://www.phc4.org/reports/hai/>

**TABLE 4:
IMPROVEMENT COSTS SUMMARY**

Intervention	Initial Cost	Annual Cost
100% single-patient rooms	Single-patient rooms are now the standard for new hospital construction and, therefore, no additional cost is assumed.	No additional cost assumed
Separate sinks for staff in patient rooms	Separate staff sinks are now considered standard for new hospital construction and, therefore, no additional cost assumed.	No additional cost assumed
Alcohol-based gel devices	Cost of device x additional number of devices per room x number of rooms	Replacement, maintenance, and gel refill costs
Increased HEPA filtration	Incremental cost of HEPA-capable air handlers x number of air handlers	Increased energy and incremental filter replacement cost
Clinical and administrative interventions, e.g., education	Training program and educational materials	New employee training and evaluation of compliance
Total cost of improvements		

- Provide alcohol-based hand-gel disinfection devices in multiple locations in patient rooms, such as on either side of the patient’s bed, in the family zone of the patient’s room, in the patient’s bathroom, etc.
- Install HEPA filters in ventilation system.

Examples of clinical and administrative strategies are provided below.

- Make the reduction of HAIs an organizational patient-safety priority by providing staff, patient, and visitor education.
- Actively identify patients who carry multidrug-resistant organisms (MDROs).
- Use contact and equipment precautions for all MDRO patients.
- Ensure that the environmental cleaning plan includes all surfaces in proximity to patients and frequently touched surfaces on a more recurrent cleaning schedule for known MDRO patients.

Step 3: Revenue improvement through cost avoidance.

To understand the full impact of using evidence-based design strategies, management and medical leadership must incorporate the financial

impact of these improvements into the hospital’s annual capital and operating budgets that are reviewed and approved by the board of trustees. This requires looking at the costs and cost savings that will accrue each year as a result of the changes to your targeted outcomes (Table 5).

Again an example is provided for hospital-acquired infections.

Identify the potential savings associated with reducing HAIs. Using figures calculated in Step 1, determine the annual cost avoided if the HAI goal is achieved. You may want to calculate an average number of HAI cases to develop a baseline number or you may use the figure from the previous year. If your hospital census has changed dramatically, you may choose to use the rate of HAI instead of the absolute number.

**TABLE 5:
REVENUE IMPROVEMENT THROUGH COST AVOIDANCE**

Avoided HAI cases: Baseline number of HAI – targeted number of HAI	Incremental cost per HAI	Annual cost avoidance: Avoided HAI cases x incremental cost per HAI cases
Additional quantifiable improvements: Increased capacity Avoided nonreimbursement Reduced litigation	List each of the additional revenue improvements appropriate to the project	Project annual projected revenue enhancement expressed in dollars
Total		Add the above rows together for total cost avoidance and revenue improvement

Additional quantifiable revenue improvements may be projected because of fewer HAIs:

- **Increased capacity for more admissions.** Reducing the number of patients with HAI and their associated longer lengths of stay will increase the capacity for admitting additional patients and their associated revenue.
- **Avoidance of CMS nonreimbursement for certain HAIs.** As was mentioned earlier, CMS will no longer reimburse hospitals for a growing list of healthcare-associated occurrences that harm patients, many of which are HAIs.
- **Reduced litigation and settlement costs.** There may be fewer HAI-associated litigation and settlement costs for HAI patients who sue because of harm.
- **Improved bond rating.** A hospital's financial strategy, its credit rating, and ability to raise capital for future projects may be improved for those

organizations that include evidence-based design features that improve the quality and safety of patient care and improve the retention, satisfaction, safety, and efficiency of staff and, ultimately, the bottom line (Houston, et al. 2007).

Step 4: Calculate the ROI.

Compare the total annual cost avoidance identified in Step 3 with the total initial cost of the planned interventions in Step 2 to identify the ultimate financial savings over interim points along the hospital's life-cycle. For year 2 and 5 costs, you can assume that you will have the same annual costs and cost avoidance for each year or you can project costs adjusted for inflation (Table 6).

**TABLE 6:
RETURN ON INVESTMENT**

Variables	Initial Year	Year 2	Year 5
Cumulative revenue improvement through cost avoidance	Annual cost avoidance	Annual cost avoidance x 2	Annual cost avoidance x 5
Cumulative cost of improvement	initial cost	Initial cost + annual cost	Initial cost + (annual cost x 4)
Savings	Cost of avoidance - cost of improvements	Cost of avoidance - cost of improvements	Cost of avoidance - cost of improvements

Step 5: Embed the business case in the fabric of the organization.

While the above steps will help you create a business case for evidence-based design, they are not sufficient in and of themselves. To be successful, the leadership team must also do several other critical things:

- Select an architect with a proven understanding of and experience in evidence-based design who will work with you to find fiscally responsible solutions looking beyond the first cost.
- Communicate performance-improvement targets and progress internally to all appropriate stakeholders.
- Communicate performance-improvement targets and progress externally to increase public awareness and recognition that can differentiate the organization in the marketplace and increase market share.
- Share lessons learned and publish results (including financial impacts) with the rest of the healthcare and design communities. In so doing, it will contribute to needed knowledge about the financial and clinical impact of evidence-based design.

(For a more in-depth examination of the full range of steps the leadership team needs to follow to ensure successful implementation of evidence-based design, see Zimring, Augenbroe, Malone, and Sadler.)

CONCLUSION

Hospital leaders and boards face a new reality: They can no longer tolerate allowing preventable patient hospital-acquired conditions such as infections and falls, injuries to staff, unnecessary intrahospital patient transfers that can increase errors, or have patients and families subjected to noisy, confusing environments that increase anxiety and stress. They must effectively deploy all reasonable quality-improvement techniques available. To be optimally effective, techniques will almost always harness a bundle of tactics that, when implemented in an integrated way, will produce best results.

Leaders must understand the clear connection between constructing 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. The physical environment in which people work and patients receive their care is one of the essential elements to address a number of preventable hospital-acquired conditions.

Emerging pay-for-performance methodologies that reward hospitals for quality and refuse to pay hospitals for harm they cause (i.e., infections and falls) further strengthen the business case. At the same time that the costs of unnecessary harm are increasing, public and employer expectations are growing. The emerging practice of not charging for errors and the public reporting of comparable patient-satisfaction scores adds more weight to the revenue side of the business case. While Medicare has driven much of the reimbursement and transparent public-reporting requirements, hospital leaders should take them into account as Medicaid and commercial payers adopt the same or similar practices.

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 risk suffering the economic consequences in an increasingly competitive and transparent environment. Implemented successfully, responsible use of evidence-based design will improve patient safety and quality, enhance work-force recruitment and retention, and produce a significant multiyear ROI.

The effectiveness of any evidence-based design intervention will not occur in isolation from other important proven process improvements that must be implemented concurrently. In 2004, the Institute for Healthcare Improvement (IHI) launched the 100,000 Lives Campaign—a nationwide initiative that significantly reduced morbidity and mortality in American

healthcare. Building on that success, IHI launched the 5 Million Lives Campaign at the end of 2007. Its aim was to protect patients from 5 million incidents of medical harm over the next 2 years. IHI's experiences with both campaigns proved that effective change packages are a bundle of improvements that must be implemented together. The key point is that environmental design innovations included here are essential ingredients in optimally improving safety and quality.

As hospital leaders undertake building projects, it is imperative that the ongoing operating savings mentioned above are an integral part of their analysis. Hospital boards and management must hold each other 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 to maximize the investment. *(For more on cultural change and facility design, see "Culture Change and Facility Design: A Model for Joint Optimization" by D. Kirk Hamilton, Robin Diane Orr, and W. Ellen Raboin.)* Hospital leaders have an opportunity and an obligation to assure that, whether patients are in their care for an hour, a day, a week, or a year that they are cared for in an optimal healing environment.

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AUTHOR BIOGRAPHIES

Blair L. Sadler, JD

Blair L. Sadler is a Senior Fellow at the Institute for Healthcare Improvement, and a member of the faculty at the UCSD Schools of Medicine and Management. He served as President and CEO of Rady Children's Hospital in San Diego from July 1980 until July 2006. Under his leadership, Rady Children's was the first pediatric hospital in the United States to win the Ernest A. Codman Award for its work in developing clinical pathways. He gave the Commencement Address at the 2005 UCSD Medical School graduation on the health care quality revolution and the implications for hospitals and academic medical education. He speaks widely to healthcare Boards of Trustees about their new role in patient safety and quality.

Jennifer R. DuBose, MS

Jennifer R. DuBose is a Research Associate with the College of Architecture at the Georgia Institute of Technology where she is responsible for project development and management. Her research focuses on evidence-based design for healthcare facilities projects. She helped to develop a business case for evidence-based design and collaborated on the most recent exhaustive literature review on the subject, both published in 2008. Additionally, she has a background in sustainable facilities, organizational sustainability and greenhouse gas accounting. Ms. DuBose is a LEED accredited professional and has a master's degree in Public Policy from Georgia Tech.

Eileen B. Malone, RN, MSN

Eileen B. Malone is the Senior Partner for Mercury Healthcare Consulting, LLC located in Alexandria, Virginia. Ms. Malone retired from the United States Army at the rank of colonel having served as a hospital commander (CEO), the Chief Information Officer (CIO) for the Army Medical Department and in many other clinical, administrative and facility project leadership positions. Ms. Malone currently supports the Military Health System by consulting with planners, designers and organizational leaders in their efforts to use evidence based design features over the facility life cycle for a \$6B portfolio to improve patient and staff outcomes, improve the bottom line and contribute to EBD research findings.

Craig M. Zimring, PhD

Craig Zimring is an Environmental Psychologist and Professor of Architecture at the Georgia Institute of Technology in Atlanta, GA. His work focuses on understanding the relationships between the physical environment and human satisfaction, health, performance, and behavior. He has served on the board of several organizations, including the Robert Wood Johnson Foundation's Building Bridges program, National Research Council's Board on Infrastructure and the Constructed Environment, the Environmental Design Research Association, and others. He has won 10 awards for his outstanding research.