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# The Business Case for Better Buildings

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LEONARD L. BERRY, PH.D.; DEREK PARKER; RUSSELL C. COILE, JR.; D. KIRK HAMILTON; DAVID D. O'NEILL, J.D.; AND BLAIR L. SADLER, J.D.

**SUMMARY** • The buildings in which customers receive services are inherently part of the service experience. Given the high stress of illness, healthcare facility designs are especially likely to have a meaningful impact on customers. In the past, a handful of visionary “healing environments” such as the Lucille Packard Children’s Hospital at Stanford University in Palo Alto, California; Griffin Hospital in Derby, Connecticut; Woodwinds Health Campus in St. Paul, Minnesota; and San Diego Children’s Hospital were built by values-driven chief executive officers and boards and aided by philanthropy when costs per square foot exceeded typical construction costs. Designers theorized that such facilities might have a positive impact on patients’ health outcomes and satisfaction. But limited evidence existed to show that such exemplary health facilities were superior to conventional designs in actually improving patient outcomes and experiences and the organization’s bottom line. More evidence was needed to assess the impact of innovative health facility designs.

Beginning in 2000, a research collaborative of progressive healthcare organizations voluntarily came together with The Center for Health Design to evaluate their new buildings. Various “Pebble Projects” are

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**LEONARD L. BERRY, PH.D., IS DISTINGUISHED PROFESSOR OF MARKETING AT TEXAS A&M UNIVERSITY IN COLLEGE STATION, TEXAS. DEREK PARKER IS DIRECTOR OF ANSHEN + ALLEN ARCHITECTS IN SAN FRANCISCO. RUSSELL C. COILE, JR., PRIOR TO HIS PASSING IN 2003, WAS EDITOR OF *RUSS COILE'S HEALTH TRENDS* IN WASHINGTON, TEXAS. D. KIRK HAMILTON IS SENIOR PRINCIPAL AT WATKINS HAMILTON ROSS ARCHITECTS, INC., IN HOUSTON, TEXAS. DAVID D. O'NEILL, J.D., IS CEO OF ALAMEDA HOSPITAL IN ALAMEDA, CALIFORNIA. BLAIR L. SADLER, J.D., IS PRESIDENT AND CEO OF CHILDREN'S HOSPITAL AND HEALTH CENTER IN SAN DIEGO.**

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now engaged in three-year programs of evaluation, using comparative research instruments and outcome measures. Pebble Projects include hospital replacements, critical care units, cancer units, nursing stations, and ambulatory care centers. The Pebble experiences are synthesized here in a composite 300-bed “Fable Hospital” to present evidence in support of the business case for better buildings as a key component of better, safer, and less wasteful healthcare. The evidence indicates that the one-time incremental costs of designing and building optimal facilities can be quickly repaid through operational savings and increased revenue and result in substantial, measurable, and sustainable financial benefits.

“WE SHAPE OUR buildings, and afterwards our buildings shape us.”

—Winston Churchill, October 28, 1943, speech to Britain’s House of Commons

Patients and their families typically arrive at healthcare facilities under considerable stress. Unlike “want” services, such as entertainment and telecommunications, healthcare is a “need” service that, to varying degrees, patients dread. An important question for healthcare executives is whether their organization’s facility compounds the stress of patients and families or helps moderate it.

Healthcare can be defined as an inseparable service because customers usually are present to receive the service performed. Just as customers must be in the taxicab to receive that service, so must they be in the operating room to have surgery. Indeed, healthcare takes inseparability to the extreme in that some customers not only visit the service “factory” but also actually live in it. Very few service industries provide beds for their customers; healthcare is one that does.

Healthcare is an intangible “product” that is used but not possessed. More than almost any other service, healthcare is highly complex and technical. The provider knows much more than the customer, and thus the customer must trust the provider to perform the right service in the right way.

Healthcare is an inherently personal service. No other service requires consumers to bare themselves as much physically and emotionally. Healthcare is also the single most important service consumers

buy. If the local hardware store makes a mistake, the consequences are unlikely to be catastrophic; if a doctor, nurse, or lab technician makes a mistake, the patient may suffer great harm. Quality of life and life itself are at stake for healthcare consumers.

How do patients evaluate a service as proximate, diffuse, complex, personal, and important as healthcare? The answer is that they are especially attentive to what they can see and understand so that they can interpret what they cannot see and understand. The nature and significance of healthcare service turn its customers into detectives looking for clues to reassure themselves of the institution’s competence—and caring.

Healthcare buildings, equipment, furnishings, displays, signs, colors, art, landscape, and other sensory stimuli offer a torrent of clues about the provider organization, and these clues have a disproportionate impact on customers’ overall evaluation of the service (Berry and Bendapudi 2003). In effect, facility design for a service like healthcare offers significant surrogate evidence; the facility tells a story about the service that the service cannot entirely tell by itself.

Healthcare facility design also is critical in earning employees’ commitment to the institution. Employees, after all, spend more time in the facilities than do patients. Healthcare not only is stressful for patients but also is a physically and emotionally demanding service to deliver. Facilities communicate to the staff, too. Without words, facilities tell employees a great deal about management’s concern for them. Few, if any, service

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industries are experiencing more severe skilled labor shortages—or have more at stake in retaining staff—than healthcare. Few, if any, service professionals are more prone to on-the-job burnout than are healthcare providers. Evidence shows that healthcare facility design offers strong reinforcement of a health organization's values and is effective in staff recruitment and retention (Coile 2002).

Our purpose in this article is to develop the business case for building better healthcare facilities. We focus on the hospital, but the framework we propose applies to all healthcare facilities. The time to summon our imagination and raise our aspirations for what a hospital can be—and for what it can accomplish—is now. The window for building better hospitals in the United States is opening wide for three reasons.

First, the American healthcare industry is in the midst of a construction boom spurred by diminished capital investment in new and replacement hospitals in the 1990s; the aging of the population; and the increasing number of hospitals experiencing bed shortages and capacity bottlenecks in their emergency rooms, surgical suites, and critical care units. About 90 percent of executives from large hospitals indicated in a recent poll that their institutions were likely to launch major building projects in the next few years (*Wall Street Journal* 2004).

Second, healthcare institutions are being challenged by the government, employer coalitions such as the Leapfrog Group, the Joint Commission on Accreditation of Healthcare Organizations, and others as never

before to become safer, more productive, efficient, and effective, as well as financially stronger. Smart facilities design contributes to these aims.

Third, a new science is emerging to guide the design of better healthcare buildings. Called *evidence-based design*, this new field guides daring with data, blends imagination with empiricism. We have before us the rare opportunity to use the developing science of evidence-based design to build better buildings during a healthcare construction boom (Hamilton 2003).

In this article, we define a *better building* as one that facilitates physical, mental, and social well-being and productive behavior in its occupants. In addition, through measured superior performance, it improves the organization's financial results.

#### **EVIDENCE-BASED DESIGN**

Evidence-based design has its roots in the type of health services research now generally referred to as evidence-based medicine (Dartmouth Medical School 1998; Ellwood 1988). A study by Roger Ulrich (1984) stimulated the development of evidence-based design. He evaluated surgical patients randomly assigned to rooms on the same corridor that were identical except for the window view: half of the patients overlooked trees, and half viewed a brick wall. Patients with views of nature went home three-quarters of a day sooner, had a \$500 lower cost per case, used fewer heavy medications, had fewer minor complications such as nausea, and exhibited better emotional well-being (Ulrich 1984).

Since Ulrich's influential study, dozens of additional studies have

reported health benefits associated with medical facilities design features, such as natural lighting, views of nature, and artwork. A meta-analysis of clinical literature on the effect of facilities and furnishings on patient outcomes was reported by Rubin, Owens, and Golden (1998). Most health facilities have yet to incorporate the fruits of this research, however, and just as evidence-based medicine is not yet standard practice, neither is evidence-based design.

To help accelerate the movement of evidence-based design into the mainstream, The Center for Health Design has embarked on a multiyear research effort in partnership with various healthcare organizations committed to improving the patient-care environment. These partner institutions are called *Pebbles* to connote the anticipated ripple-effect influence of their case studies on the industry (Sadler 2001). The core principle shared by all Pebbles is rigorous measurement of outcomes associated with facility design initiatives. Intuitive design benefits offer an insufficient basis to overcome old habits and severe cost pressures in a healthcare profession built on the foundation of science. Evidence-based design offers a methodology for scientific scrutiny and testing of building design benefits in healthcare and can be considered in three categories: stress reduction, safety, and ecological health.

### Stress Reduction

A starting point for a theory of emotionally supportive design is the well-documented fact that most patients experience considerable stress (Ulrich

et al. 1991). Two major sources generate stress on patients: (1) illnesses that involve reduced physical capabilities, uncertainty, fear, and painful medical procedures and (2) physical-social environments that are noisy, invade privacy, or offer little emotional support. From a psychological standpoint, stress can be manifested as a sense of helplessness or in feelings of anxiety and depression. Physiologically, stress causes changes in the body, such as increased blood pressure, higher muscle tension, and high levels of circulating stress hormones. Behavioral impacts of stress can include verbal outbursts, social withdrawal, passivity, and sleeplessness (Ulrich et al. 1991; Rosch 1996).

Healthcare is an unusual service in that it is not only stressful for the customer but also for the provider. Caring for sick people is physically and emotionally fatiguing. Undue stress generates negative effects on caregivers just as it does on patients, including emotional burnout; mental mistakes; and the psychological, physiological, and behavioral impacts enumerated above. Many of the design features that help relieve patients' stress also help relieve caregivers' stress (Whitehouse et al. 2001).

Healthcare cannot be separated from the settings in which it is delivered (Malkin 1992, 2002). As Linton (1992) stated at an early healthcare design conference:

There are tremendously powerful healing potentials within each human being. When we are talking about designing and organizing healing environments, what we are really trying to

**“Positive distractions” with moderate levels of stimulation can foster a sense of engagement and well-being.**

do is find effective ways to engage those inner-healing potentials within each human being.

Ulrich (1991) and Malkin (2001) identify five areas of research in health facility design that fall within the domain of stress relief: connection to nature, options and choices, social support, pleasant diversions, and the elimination of environmental stressors.

#### *Connection to Nature*

A growing body of research shows that connection to the natural world aids healing by reducing stress. Looking at a fireplace or an aquarium, for example, can reduce blood pressure (Ulrich et al. 1991). As Malkin states, “Seeing the sky or feeling the sun on your skin can literally make you feel better . . . our surroundings affect our well-being” (Mack 2001). Woodwinds Health Campus in St. Paul, Minnesota, was designed to take advantage of a 24-acre naturally wooded site with a pond to create a facility that evokes feelings of a north woods resort. The CHRISTUS St. Michael Health Center in Texarkana, Texas, was designed with 17 different gardens for meditation, play, viewing water, outdoor dining, and meetings.

Even when building sites have limited views of nature, designers are using interior spaces to create healing gardens and walls of windows to connect inside and outside. In San Diego, the Scripps Memorial Hospital’s drug and treatment facility used \$150,000 in local philanthropic donations to transform a concrete court into a tranquil healing garden. The garden

experience is based on the Alcoholics Anonymous “Twelve Steps and Twelve Traditions,” with each of the 12 steps engraved in stone paving and set among fountains, seating areas, and commissioned artwork (Aesthetics and Schmidt Design Group 2001). Mayo Clinic’s 20-story Gonda building in downtown Rochester, Minnesota, offers a three-story wall of glass to allow maximum natural light to stream into the lobby and patient waiting areas (Berry 2002).

#### *Options and Choices*

Research on hospitalized patients shows that a sense of control is important for feelings of self-esteem and security. Individuals’ perceptions of control over their environment have an inverse relationship with stress (Evans and Cohen 1987). A patient’s feeling of loss of control is inherent in being hospitalized. An important design challenge is to minimize unnecessary control loss. A good example is one of the early Pebbles, Methodist Hospital of Clarian Health Partners in Indianapolis, which redesigned its cardiac critical care unit and reopened it in 1999. This acuity-adaptable 56-bed unit has realized significant improvements in patient and nursing satisfaction, cost, and patient safety. Important design innovations are the patient, family, and caregiver “zones” for each 400-square-foot patient room.

The zone concept empowers users (Parker 1993). The family zone includes a chair bed, refrigerator, computer hookup, voice mail, and TV/VCR. Waiting areas feature an indoor garden, aquarium, kitchenette,

and lockers. Patients can control lighting, temperature, and privacy as their condition improves. Nursing stations with computers are located outside each patient room. All equipment and supplies needed for critical-care patients are accessible to caregivers within the patient zone, the result of research showing that most nurses were traveling several miles during each shift to get supplies (Hendrich, Fay, and Sorrells 2002).

#### *Social Support*

Healing environments provide space and infrastructure for social interaction, encouraging family and friends to spend more time in the facility with patients. Health psychologists find that individuals with a high level of social support experience less stress and attain higher levels of wellness. For example, cardiac patients with higher social support recover more quickly after hospitalization for heart disease (Fontana et al. 1989).

Social interaction in health facilities can be influenced by furniture placement and floor/room layouts. Heavy or immovable furniture inhibits social interactions, whereas comfortable, movable furniture positioned in small, flexible arrangements has the opposite effect (Sommer and Ross 1958; Holahan 1972). One design trend to increase social support is multiple family waiting areas situated closer to patient rooms. Woodwinds Health Campus includes fireplaces in several waiting areas and on nursing units. Some hospitals have redesigned nursing units to include family social areas with small kitchens, large-screen TVs with VCRs, and small libraries of

consumer health publications relevant to patients on the unit.

#### *Pleasant Diversions*

Healthcare designers are learning that “positive distractions” with moderate levels of stimulation can foster a sense of engagement and well-being. Environmental features that elicit positive feelings and hold attention may include artwork, music, an aquarium, water elements, and healing gardens. The core principle of pleasant diversion is reducing patients’ preoccupation with their pain and illness through sensory stimulation that elevates mood and coping skills. Diette and colleagues (2003) randomly assigned adult patients undergoing flexible bronchoscopy while conscious to procedure rooms in which they either viewed a ceiling-mounted nature scene and listened to nature sounds or viewed a blank ceiling and heard no nature sounds. Patients experiencing the nature distraction reported significantly less pain.

Lack of positive stimulation can be numbing and depressing for patients. In a moving story, *Bed Number Ten*, a victim of Guillain-Barré syndrome chronicles her despair while she was helpless in a hospital bed for months, staring at the wall or ceiling tiles (Baier and Schomaker 1986). Her story powerfully illustrates the devastating effects of residing in the void of a drab healthcare environment.

#### *Elimination of Environmental Stressors*

Hospitals are a fertile source of negative stressors. Environmental elements can increase stress if their presence is uncontrollable and difficult to ignore.

*Just as a healthcare facility can be designed to moderate stress, so can it be designed to enhance patient safety.*

Negative distractions may be embedded in the physical environment or in processes not under the patient's control. Noise in the hospital setting, for example, is a severe environmental stressor. It has been found to produce harmful psychophysiologic effects, including elevated blood pressure, increased heart rate, and sleeplessness (Hilton 1985; Baker 1992; Byers and Smyth 1997; Fogari et al. 2001).

Noise is a pervasive problem in hospitals for several reasons. First, noise sources are numerous (pagers, alarms, hallway conversations) and loud (use or movement of medical equipment, shift changes). Second, patients in multiple-occupancy rooms are subjected to the additional noises of roommates and their visitors and caregivers. Press Ganey patient satisfaction data consistently show that patients without roommates are far more satisfied with the noise level in and around their rooms than patients with roommates (Malone 2004). Third, environmental surfaces in hospitals (floors and ceilings) are usually sound reflecting rather than sound absorbing, contributing to poor acoustic conditions (NHS Estates 2003).

Nurses in the surgical thoracic intermediate care area of Mayo Clinic's Saint Mary's Hospital used a noise dosimeter to obtain continuous recordings of decibel levels in the unit during two night shifts. The dosimeter was placed inside empty patient rooms without the night staff's knowledge. Shift change commotion and equipment such as portable x-ray machines, hallway phones, and bedside monitor alarms

caused the highest decibel peaks. The 98 decibels recorded for a portable x-ray machine, for example, is as loud as a motorcycle. A number of staff and equipment changes were instituted following the research. These changes included routinely closing the doors to patients' rooms, stopping middle-of-the-night supply deliveries to the nursing unit, softening the noise of charts being returned to holders outside patient rooms by padding the holders, modifying bedside cardiac monitors so the alarms could be set at a lower level, and performing routine chest x-rays earlier in the evening (Cmiel et al. 2004).

Noise in the hospital affects staff as well as patients. In the coronary intensive care unit of a Swedish hospital, researchers periodically rotated sound-reflecting and sound-absorbing ceiling tiles to test the effects on staff and patients. Good acoustics had positive effects not only on patients (e.g., lower incidence of rehospitalization) but also on the staff. These include improved quality of patient care, better sleep quality at home, and better speech intelligibility (Blomkvist et al., in press).

### **Safety**

A better building is a safer building. Just as a healthcare facility can be designed to moderate stress, so can it be designed to enhance patient safety. The combination of process design improvements, such as computerized physician order entry and bar code verification technology, and facilities design improvements can save lives, money, and institutional reputations (Parker 2002).



Safety-related building improvements include improved air filtration systems, better separation of “clean” and “dirty” areas on patient floors, transportation modalities that separate patients from potentially infectious materials and wastes, standardization and consistency of layout, and glare-free lighting. Three of the most promising facility design investments to enhance patient safety are readily available hand-hygiene stations, single-occupancy patient rooms, and acuity-adaptable patient rooms.

Nosocomial infections affect nearly 10 percent of hospitalized patients, lengthening hospital stays, increasing morbidity and mortality, and raising costs (Burke 2003; Trampuz and Widmer 2004). Proper hand hygiene of caregivers is considered the single most effective and practical means of reducing nosocomial infections (Trampuz and Widmer 2004), yet adherence to recommended hand-cleaning practices remains low (Pittet, Mourouga, and Perneger 1999). Two basic hand-hygiene alternatives are available: soap and water and alcohol hand-rub preparations. Alcohol hand rubs are recommended over soap and water except when hands are visibly soiled. Alcohol rubs are far more effective against viruses than hand washing, simpler to use (no towels are required), and less irritating to the skin (Trampuz and Widmer 2004). Positioning alcohol-rub dispensers near the patient bed in the sight line of caregivers should improve compliance.

Another source of hospital-acquired infections for a patient is the germs of roommates who share the

same bathroom. A significant facilities design decision from a safety standpoint is the use of single-occupancy patient rooms. In 2000, Bronson Methodist Hospital in Kalamazoo, Michigan, a Pebble partner, replaced its existing facility with a dramatically different facility containing 348 single-bed rooms. Bronson measured and compared the nosocomial infection rates for the two years prior to its move into the new facility against the rates for the first two years in the new facility. The data show that the infection rate (infections per 1,000 patient days) declined by 10.1 percent in the period following the move. The improvement is attributed to the exclusive use of private rooms, which reduces the opportunity for cross-transmission of microbial pathogens from other patients. Single rooms also eliminate the need to transfer patients to a different room because of roommate incompatibility. Patient transfers have safety implications in addition to cost implications. For example, medication errors are more likely when patients are transferred from one care team to another (NHS Estates 2003).

Acuity-adaptable rooms also reduce the need to transfer patients to different rooms. Acuity-adaptable rooms are standardized rooms designed with the space, dimensions, and features to accommodate a wide variety of patient conditions, needs, equipment, and staffing during changing stages of illness and recovery. Methodist Hospital in Indianapolis has attained strong results with its redesigned, acuity-adaptable 56-bed cardiac critical care unit. The acuity-adaptable rooms eliminated nearly all patient moves,

***“Green” hospitals are resource efficient in design, construction, operation, maintenance, and demolition.***

contributing to decreases in both patient falls and medication errors. Methodist compared two years of baseline data prior to the new design with three years of data following the opening of the unit using the indices of patient falls and medication errors per 1,000 patient days. The fall index decreased from 6 to 2, and the medication error index decreased from 10 to 3. Decentralized nursing stations and multiple observation points also are credited with helping reduce patient falls (Hendrich, Fay, and Sorrells 2002).

### **Ecological Health**

A better healthcare building also is an ecologically healthy building. Process and materials enhancements can improve indoor air quality; conserve materials, energy, and water; and safely convert contaminated and hazardous waste products. These improvements will eventually pay for themselves, although the payback period is less immediate than other design initiatives already discussed.

Indoor air pollution, according to the Environmental Protection Agency, is one of the top five environmental risks to public health. Construction materials emit dangerous gases such as volatile organic compounds (VOCs), including formaldehydes, while at the same time harboring infectious molds and fungi. Polyvinyl chloride (PVC), the most widely used plastic in medicine, is found in IV bags and tubing, gloves, medical trays, and equipment. The potential impact of PVC on patient health has been well documented, as have the environmental impacts from its disposal

through incineration. Health institutions committed to ecological health will implement a PVC-reduction policy and will require in their construction specifications PVC-free products, no or low VOCs in paints and adhesives, and tiles that do not support bacteria and fungi growth.

The movement to ecologically based decisions regarding waste, energy consumption, and indoor air quality is consistent with the primary core value of medicine—first, do no harm. “Green” hospitals are resource efficient in design, construction, operation, maintenance, and demolition. They subscribe to the Leadership in Energy and Environmental Design rating system of the U.S. Green Building Council. They minimize light pollution from parking lots; reduce water use within the building and use recycled water for irrigation; reduce energy use for heating, ventilation, and air conditioning systems, hot water, and lighting; employ renewable energy systems such as photovoltaics; reduce construction waste by recycling concrete from demolished structures; and use building materials with postconsumer-recycled content. Finally, they maintain significant open space with trails, gardens, and other amenities for public use.

The disposal of medical, contaminated, and hazardous waste, including needles, is a source of rising costs and increased liability. Green hospitals can employ new technology in the central utility plant that safely converts waste into hydrogen to feed fuel cells with no measurable greenhouse gas emission. The payback of this

investment should take less than five years while greatly reducing risk to staff, landfill issues, and exposure to lawsuits.

### CASE STUDY: FABLE HOSPITAL

Evidence-based design clearly is better for patients. We believe it is also better for every other healthcare stakeholder, including caregivers, investors, and payers. Better healthcare buildings are simply a good investment.

To illustrate our case, we have created Fable Hospital, a composite of recently built or redesigned healthcare facilities that have implemented facets of evidence-based design. Although Fable Hospital does not yet exist, we believe it will be built. A *fable* is defined in the *Encyclopedia Britannica* as a form of imaginative literature constructed in such a way that readers are encouraged to look for meanings hidden beneath the literal surface of the fiction. In the context of this article, we chose to call our hospital Fable because it conveys the power of a story with a moral and the evocative nature of legends.

Fable Hospital is a new 300-bed regional medical center built to replace a 50-year-old facility that had 250 beds. Fable's per-bed cost was \$800,000. Located on an urban site, the hospital provides a comprehensive range of inpatient and ambulatory services, including medical/surgical, obstetrics, pediatrics, oncology, cardiac, and emergency. The cost of the total replacement project was \$240 million.

Fable Hospital's core values include superior quality, safety, patient-focused care, family friendliness, staff support,

cost sensitivity, eco-sustainability, and community responsibility. Management engaged a philosophically aligned design team based on the premise that the building should reflect the organization's core values and strategic aspirations (Hamilton 2002). The designers responded with an array of design innovations and upgrades for the new facility, including the following:

- Oversized single rooms with dedicated space for patient, family, and staff activities and sufficient capacity for in-room procedures; the design maximizes daylight exposure to patient rooms and work spaces
- Acuity-adaptable rooms standardized in shape, size, and headwall (monitoring and communications technology mounted onto the wall at the head of the patient's bed) to eliminate the need to move patients as their condition changes
- Double-door bathroom access, enabling caregivers to more easily assist patients to and from the bathroom on foot, in a wheelchair, or in their bed
- Decentralized, barrier-free nursing stations that place nurses in close proximity to their patients and supplies, most of which are stored in or near patient rooms
- Alcohol-rub hand hygiene dispensers located at the bedside in each patient room to reduce staff-to-patient transmission of pathogens
- HEPA filters to improve the filtration of incoming outside air and eliminate recirculated air

***A first step toward better buildings is to formally define and widely disseminate this vision and keep it in front of organizational members at all times.***

- Flexible spaces for advanced technologies, including operating rooms sized for robotic surgery, endovascular suites for minimally invasive surgery with sophisticated imaging, and imaging rooms designed to support continuous equipment advances
- Peaceful settings, including artwork displays, space to listen to piano music, and gardens with fountains and benches to moderate the stress of the building's occupants
- Noise-reducing measures, including sound-absorbing floors and ceilings and a wireless communications system that eliminates overhead paging to moderate the stress of the building's occupants
- Consultation spaces conveniently located to facilitate private communication between caregivers and families
- Patient education centers on each floor offering brochures, books, videotapes, and Internet access to disease-specific information and online support groups that improve patient and family understanding of illness
- Staff support facilities including a staff-only cafeteria, windowed break rooms with outside access, a day-care facility, and an exercise club

These design innovations and upgrades collectively added \$12 million to the construction budget, shown in Exhibit 1, which appears at the end of this article. In addition to these facility design investments, Fable also invested in computerized

order entry and bar code verification technology to minimize medication errors and improve operational efficiency. (The costs and benefits of these technology upgrades are not included in the exhibits that accompany this article, which focus only on facility improvements.) Combining the best of evidence-based design with the best of quality process improvements in hospitals will produce dramatic results.

Fable's chief executive officer (CEO) shared with the board an initial financial and performance impact assessment of the incremental facilities investment one year after occupying the new building. The assessment was based on management monitoring a series of key performance indicators in the 12 months since opening, part of a planned 5-year evaluation program.

Seeking to be conservative in the analysis, the CEO adjusted downward certain estimates of increased savings and revenues to reflect positive influences other than the new building. The CEO wished to eliminate any concerns that the new facility was given more credit for improvements than warranted. The expense numbers also were adjusted to reflect the larger number of patients served in the new facility.

Even with the adjustments, the CEO was surprised by the significant first-year savings and revenue gains attributed to the facility. Exhibit 2, which appears at the end of this article, shows the first-year financial gains that the CEO presented to the board and details how these numbers were derived. The exhibit indicates

that the incremental costs are virtually recovered after one year and that significant financial benefit will then accrue year after year. *In all cases, the numbers presented in Exhibit 2 are based on actual performance results of Pebble institutions.*

Is Fable Hospital a pipe dream? Can a more expensive building that is better for patients and their caregivers actually provide the financial gains shown in the Fable case study? With values-driven hospital leadership, supportive hospital boards, talented designers, and a willingness to embrace the lessons of evidence-based design, the answer is “yes.”

#### GETTING STARTED

A healthcare executive or trustee who wishes to follow a path similar to Fable Hospital might ask, “What is the best way to begin?” The process begins with the vision that positive impacts on patients, staff, and the community will occur through a collaborative commitment to combining the best design evidence with the core values and belief systems of the organization. Thus, a first step is to formally define and widely disseminate this vision and keep it in front of organizational members at all times.

The next step is to become familiar with the work of the pathfinders who are blazing the trail for others. This can include reading, attending conferences, and taking benchmarking tours of exemplary projects. One helpful measure would be to ensure that the organization’s guiding coalition grasps the importance of an evidence-based course for decision making on design and construction projects. Another

would be to assemble a strong collaborative team of advisors who have the complementary skills and experience to rigorously follow such a course. A team of programming consultants, architects, engineers, and interior designers who value evidence-based design might be bolstered with social scientists, such as an environmental psychologist or an expert in performance improvement (Hamilton 2003). The prudent executive should be prepared to invest extra time preparing a sophisticated description of the project that goes beyond a simple listing of proposed space requirements. It is helpful to be able to describe a project’s goals and objectives with clarity, including hypotheses concerning outcomes expected from the design.

Resistance to a process that differs from prevailing practice can come from almost any source. In addition to the predictable resistance to any form of change, the team can expect to be challenged at first by skeptics who will question the evidence, the financial assumptions, and the link between facility design and clinical outcomes. This is why a certain amount of study and a team accustomed to rigorous review will be useful. The challenge to financial assumptions will require careful analysis and cautious budgeting that avoids overreliance on previous budget or cost models. It would be wise to involve external consultants early in the process to gain the maximum benefit from their experience.

A typical barrier to success is expecting a project to neatly fit into the same budget and schedule as a

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conventional project when in fact it likely will require an extended pre-design phase to properly define the scope; require identifying, analyzing, prioritizing, and integrating design innovations; and require planning an assessment protocol. The team should be prepared to do more sophisticated life-cycle costing than occurs in a conventional project, as fewer decisions will be based exclusively on the lowest first cost. Just as engineers might recommend a more expensive air conditioning system because of its superior energy performance over the project's life cycle, the ongoing operational costs of alternate designs should be compared before a design is selected. A savvy administrator will insist on using multiple before-and-after measures to assess the project, including financial, clinical, and satisfaction indicators.

#### **THE MORAL OF THE STORY**

Illness is costly—both human suffering and financial expenditures exact high prices. Conversely, well-being pays dividends—both persons and profits are healthier. Investment in better healthcare buildings pays off directly and indirectly through enhanced patient care and employee well-being.

In a world that has begun to understand its resources as finite, maximizing the benefits realized for every dollar invested becomes crucial. The business case for better hospital buildings is strong. In this composite case study of Fable Hospital, based on the actual performance of Pebble facilities, our estimated savings and revenue gains nearly recapture the incremental investment in a better building in just

the first year, despite a deliberate effort to be conservative in evaluating the gains.

Fable Hospital does not exist on one site or in one facility, but neither is it an invention. Benefits associated with its design innovations are actually being achieved. Fable serves as an idealized template to demonstrate how evidence-based design can improve patient and staff satisfaction, medical outcomes, safety, cost efficiency, resource conservation, and financial performance. Given the forecasted construction boom for the U.S. healthcare industry, evidence-based design offers an attractive alternative to the status quo and invites further exploration.

Most hospital boards or management leaders have only one or two opportunities in their professional life to create a permanent legacy that will transform their organization and their community through designing and building an optimal healing facility. It is an opportunity that should not be wasted. We believe that the lesson for all healthcare organizations is clear: provide a built environment that is welcoming to patients, improves their quality of life, and supports families and employees—or suffer the economic consequence in a competitive environment.

#### **ACKNOWLEDGMENT**

Russell C. Coile, Jr., passed away on November 10, 2003. A leading healthcare futurist and author, Coile was a board member of The Center for Health Design. He actively contributed to the development of this article, the last to carry his byline.

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## EXHIBIT 1. INCREMENTAL COST TO ACHIEVE A BETTER BUILDING

Changes	Additional Costs (\$)	Calculations
Larger private patient rooms	4,717,500	Based on an assumption of an increase of 100 square feet for each of 255 single-patient rooms. Fifteen percent of the beds (45) are in an ICU configuration: 100 sq.ft. x 255 beds @ \$185/sq.ft.
Acuity-adaptable rooms	816,000	Assumes additional medical gases and monitor mounts in every room to provide ICU/stepdown capabilities with plug-in monitors: 255 @ \$3,200/rm
Larger windows	150,000	The typical 3' x 5' patient room window is increased to 5' x 8': 300 @ \$500/ea.
Larger patient bathrooms with double-door access	1,509,600	The larger space allows two staff members to assist a heavy patient to the toilet, and the enlarged doorway allows patient beds to be rolled in a sitting configuration closer to the water closet: Additional 32 sq.ft./toilet x 255 = 8,160 sq.ft. @ \$185/sq.ft.
Hand-hygiene facilities	1,071,000	Hand-washing sink with foot-pedals at the doorway to each acute patient room. Alcohol-based hand rub dispenser at the bedside: 255 @ \$4,200/rm
Decentralized nursing substations	556,800	Alcoves proximate to clusters of beds provide a charting surface, medication cassettes, supplies, alcohol-based hand-rub dispenser, and computer access to the information system: 1 per every 4 beds: 64 locations @ \$8,700/unit
Additional HEPA filters	270,000	HEPA 99.97% filtration installed on all AHUs serving patient areas of the hospital. Increases in motor horsepower and fan size of each AHU: 36 AHUs (25,000 CFM each) @ \$7,500/unit
Noise-reduction measures	430,000	Construction materials were chosen for their sound absorption and control characteristics, and carpet was specified in most public areas. Upgraded ceiling and wall materials include additional layers of Sheetrock for sound absorption and acoustical ceiling systems with higher noise reduction efficiencies Upgrade for acoustic materials: \$430,000

Changes	Additional Costs (\$)	Calculations
Additional family/ social spaces on each patient floor	510,000	More public spaces added in the form of a family-style “great room” and family kitchen on each patient floor: 4 x 750 sq.ft. = 3,000 added sq.ft. @ \$170/sq.ft.
Health information resource center for patients and visitors	95,200	Each patient floor has a resource center: 4 x 140 sq.ft. = 560 sq.ft. @ \$170/sq. ft.
Meditation rooms on each floor	61,200	Quiet spaces for family and staff meditation are located on each patient floor: 4 x 90 sq.ft. = 360 sq.ft. x \$170/sq.ft.
Staff gym	342,500	A gym with exercise machines, changing rooms, toilets, and showers is provided: 1,500 sq.ft. @ \$175/sq.ft.+ allowance of \$80,000 for equipment
Art for public spaces and patient rooms	450,000	Based on the assumption of an additional art allowance beyond the typical budget. Fable also rotates loaned artwork from local artists and solicits donated art. Lighting enhancements to highlight selected art work: \$100,000 Increase to art and sculpture allowance: \$350,000
Healing gardens (interior and exterior)	1,050,000	Based on the assumption of additional sums above normal landscape cost for outdoor healing gardens, including a meditation garden, a strolling garden, a pond, an outdoor meeting area, outdoor dining, and a children’s playground. Increase to exterior landscape allowance: \$900,000 The interior environment has been enhanced with indoor plantings, fountains, and atrium space. Increase to interior “plantscaping” allowance: \$150,000
<b>TOTAL</b>	<b>\$12,029,800</b>	

*Note:* All numbers are incremental increases above a typical hospital construction cost. AHU = air-handling unit; ICU = intensive care unit.

## EXHIBIT 2. FINANCIAL IMPACT OF DESIGN DECISIONS

Evidence	Savings	Calculations
Patient falls: Reduced	\$2,452,800	<ul style="list-style-type: none"> <li>• Patient falls are common and can cause significant harm. Falls result from patient instability, confusion, unfamiliar surroundings, lack of assistance, poor lighting, and slippery surfaces.</li> <li>• The national unlitigated average cost of a fall is \$10,000 (Hendrich 1995); litigated falls can cost in the millions. Assuming payment for care is on a case-rate basis (e.g., Medicare), the cost of patient falls goes directly to the bottom line.</li> <li>• The national median rate of acute care falls is 3.5 falls/1,000 patient days; this is the rate experienced by Fable's predecessor hospital. Fable reduced patient falls by 80% by locating toilets closer to the patient, putting double doors on bathrooms, using bed exit features that notify a nurse when a patient is out of bed, decentralizing nursing stations, and locating supplies close by to reduce the amount of time the nurse is away from the patient. Fable's reduced patient fall rate is similar to that experienced by Pebble partner Clarian Health Partners Methodist Hospital, Indianapolis (Hendrich, Bender, Nyhuis 2003; Flynn 2003).</li> </ul> <p><b>Savings:</b>            300 beds at 80% occupancy = 240 beds            = 87,600 patient days / 1,000 x 3.5            = 306 falls/year x \$10,000 = \$3,066,000            Reduced by 80% = savings of \$2,452,800<sup>1</sup></p>
Patient transfers: Reduced	\$3,893,200	<ul style="list-style-type: none"> <li>• Transferring patients to a different room creates additional direct and indirect costs. Transfers increase the risk of medication errors and patient falls, add nursing time for transporting and assessing patients, require extra transport equipment, and contribute to hospital flow inefficiencies. Multiple transfers reduce the continuity of patient care, as more caregivers become involved in the care process.</li> <li>• Including only the direct costs of additional nursing labor, laundry and linen, and equipment usage, the estimated average cost of one patient room transfer is \$250 to \$300 (Hendrich and Lee 2003). It is not uncommon for hospital patients to</li> </ul>

Evidence	Savings	Calculations
		<p>be moved three to four times during their stay. The facility Fable replaced averaged one transfer per patient.</p> <ul style="list-style-type: none"> <li>Because of its acuity-adaptable rooms, Fable reduced patient transfers by 80%. Fable's experience is consistent with that of Clarian Health Partners Methodist Hospital, which reduced patient transfers by 90% in its redesigned, acuity-adaptable cardiac critical care unit (Hendrich, Fay, and Sorrells 2004).</li> </ul> <p><b>Savings:</b>  <math>19,466 \text{ patient stays} \times \\$250 = \\$4,866,500 \times 80\% = \\$3,893,200</math></p>
Nosocomial infections: Reduced	\$80,640	<ul style="list-style-type: none"> <li>Recent estimates in the literature of the incidence of nosocomial infections in hospitals range from about 5% of patients (Gardner 2002) to nearly 10% of patients (Burke 2003). Infections are more likely in multibed rooms due to the cross-transmission of microbial pathogens between patients.</li> <li>The average cost of additional hospitalized treatment associated with nosocomial infections was estimated in one report to be in excess of \$7,000 (in 1985 dollars) (Burrington 1999). Pebble partner Bronson Methodist Hospital in Kalamazoo, Michigan, estimates that each nosocomial infection averages \$4,000 in additional costs; Bronson is reimbursed for 58% of these additional costs.</li> <li>Fable reduced its nosocomial infection rate by 4 patients per month by using single rooms 100% of the time, HEPA filters, and increased hand-hygiene stations. Like Bronson, 58% of added infection-related costs were reimbursed.</li> <li>Bronson reduced infections in 4 to 6 patients a month after occupying its new facility (Sandrick 2002). Bronson has 287 staffed beds.</li> </ul> <p><b>Savings:</b>  <math>4/\text{month at } \\$4,000 \text{ unlitigated cost} = \\$192,000/\text{year} \times 42\% = \\$80,640</math></p>
Drug costs: Reduced	\$1,216,666	<ul style="list-style-type: none"> <li>Drugs are an inevitable and expensive part of hospitalization, averaging 14.9%, or \$2,448, of the overall average cost per stay of \$16,438 in 2000 (Solucient 2002).</li> <li>Fable carefully measured pre- and postoccupancy drug usage based on literature that draws a connection between positive distractions in the environment</li> </ul>

Evidence	Savings	Calculations
		<p>(such as art, music, landscape, and family involvement) and patients' reduced need for pain medication (Rubin, Owens, and Golden 1998).</p> <ul style="list-style-type: none"> <li>Fable reduced overall per-patient pain medication use by 5%, a result supported by a 16.4% drop in medication use reported for Pebble partner Karmanos Cancer Institute in Detroit, Michigan, for sickle-cell patients using redesigned facilities (Shepard and Mersch 2001). Fifty percent of Fable's reduced drug costs were savings; the other 50% was reimbursed.</li> </ul> <p><b>Savings:</b>  <math>87,600 \text{ patient days} / 4.5 \text{ days} = 19,466 \text{ patient stays}</math>  <math>\times \\$2,500 / \text{stay} \times 5\% = \\$2,433,333 / 2 = \\$1,216,666</math></p>
Nursing turnover: Reduced	\$164,000	<ul style="list-style-type: none"> <li>The healthcare industry is suffering a severe skilled-labor shortage that includes RNs. High rates of skilled labor turnover plague the industry. Because of the emotional and physical stress of healthcare work and its long hours, the design of the facility plays a particularly important role in staff attraction and retention.</li> <li>The national FTE/occupied bed average is 5.45 staff (Ingenix 2002). Fable's staff equals 1,308 FTEs, of which 30%, or 391, are nurses. The overall appeal of Fable's facility and specific staff amenities such as break, day-care, and exercise facilities contributed to Fable reducing RN turnover from 14% to 10%. These data track the reduced turnover of RNs at Bronson Methodist Hospital after occupying its new building.</li> <li>The estimated cost of one nurse turnover varies widely in the literature (HSM Group 2002). One report estimates the average cost for recruitment, orientation, and retention of a critical care nurse to be \$64,000 (<i>Children's Hospitals Today</i> 2002). Fable estimates its cost to replace one RN is \$20,500. This figure is derived from recruitment costs, higher registry nursing costs during recruitment, and orientation costs. Fable attributes 50% of the credit for its reduced nursing turnover to the new facility and the other 50% to salary adjustments and other retention initiatives.</li> </ul> <p><b>Savings:</b>  <math>39 \text{ nurses leaving (10\% of 391) instead of 55 nurses (14\%)} = \\$328,000 \text{ saved } (\\$20,500 \text{ per turnover}) / 2 = \\$164,000</math></p>

Evidence	Increased Revenue	Calculations
Market share: Increased	\$2,168,100	<ul style="list-style-type: none"> <li>Fable increased its market share by 1.5%. Fable's increase is consistent with Bronson Methodist Hospital, which increased its market share by more than 2% in 2001 and 2002, its first two post-occupancy years.</li> <li>Fable's market share gain boosted net patient days by 1,314; its net patient revenue per diem is \$2,200, a figure that is consistent with Bronson's performance in its new facility. To be conservative, Fable attributes 75% of its market share gain to the new facility.</li> </ul> <p><b>Net Revenue:</b>  1,314 additional patient days x \$2,200 = \$2,890,800  x 75% = \$2,168,100</p>
Philanthropy: Increased	\$1,500,000	<ul style="list-style-type: none"> <li>Fable's new facility played an important role in increasing philanthropic contributions from about \$5 million a year before construction of the new building to \$6.5 million during the first year of occupancy. Naming opportunities in the new facility encouraged increased giving, as did the building's tangible representation of Fable's vision for healthcare in the community.</li> <li>Fable's increased contributions are consistent with the experience of Pebble partner Children's Hospital and Health Center in San Diego. Children's Hospital's management believes the impact of its innovatively designed Rose Pavilion Building was instrumental in raising \$5 million during and immediately following the construction.</li> </ul>
<b>TOTAL</b>	<b>\$11,475,406<sup>2</sup></b>	

<sup>1</sup>In the interest of conservatism, we have assumed all of Fable's acute care patient falls to be unlitigated; in actuality, some of these falls would be litigated, and Fable's costs would be significantly higher in these cases. Thus, Fable's estimated savings due to reducing patient falls by 80% is understated by the exclusion of litigation-related costs from our calculations.

<sup>2</sup>This figure, representing the estimated total reduced costs and increased revenues for Fable Hospital's first year of operation in its new facility, is on the low side. First, we sought to be conservative in our estimates to strengthen the credibility of our message. Given that Fable Hospital is built from the experiences of multiple hospitals and research streams, we wished to err on the side of underpromising rather than overpromising. Second, Fable is benefiting in ways not reflected at all in this exhibit because of insufficient data available to credibly present hard numbers that can be attributed to facility design innovation.

*Note:* FTE = full-time equivalent.