



Using Color to Create Healing Environments

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Tara Rae Hill, ASID
Healthcare Interior Designer
LittleFISH Think Tank

Abstract

A rapidly growing body of credible research strongly links patient health and overall quality of care to the way a health care facility is designed—including both architectural and interior design elements. As a result, today's leading health care design professionals are using principles of evidence-based design to create a “total healing environment” for patients, families and staff. This white paper explores the trend toward evidence-based design, and the role color can play in creating more therapeutic environments across various areas of a health care facility.

Designing for Positive Patient Outcomes

Today's health care facilities are complex environments. They must deliver state-of-the-art medicine and technology as efficiently as possible, while also meeting the physical and emotional needs of patients, family and staff. Emerging research continues to reveal the influence of architecture and design on all aspects of health care, including speed of patient recovery, length of hospital stays, frequency of medical errors, and rate of staff turnover. Based on the findings from several landmark studies, it has become clear that clinical care cannot be separated from the building in which it is delivered.

As a result, today's leading health care architects and design professionals are incorporating principles of “evidence-based design” to reduce anxiety and assist healing across a wide variety of health care applications.

This trend is especially important given the considerable increase in health care construction. In 2004, hospitals spent more than \$16 billion on new buildings and renovations, a number that is expected to reach \$20 billion annually by decade's end.¹ This rapid growth can be attributed to the expectation of baby boomer demand for health care, as well as new technology that requires changes to building designs.

As the health care industry continues to experience an unprecedented construction boom, architects and designers have a unique opportunity to inform hospital and health care leaders about the important link between the physical environment and positive patient outcomes—creating a far-reaching impact for generations to come.

Foundations of Evidence-Based Design

The term “evidence-based design” refers to the practice of making design decisions based on the best available information from existing research and project evaluations. By incorporating research findings into the design process, architects and designers can transform traditional health care spaces into “therapeutic environments” that promote maximum healing for patients, encourage family participation in the care process, and allow staff members to work more efficiently.

The core principles for evidence-based design come from hundreds of laboratory and clinical studies. A large analysis of the available research was commissioned by the Center for Health Design (CHD) and conducted by research teams from Texas A&M University and Georgia Institute of Technology, led by Roger Ulrich and Craig Zimring. After analyzing more than 600 published articles, reports, and research programs, the collective findings established a strong link between the physical environment in which patients receive care and patient outcomes, as well as staff satisfaction.

In his report, Zimring asserted that “evidence-based design can:

- Enhance patient safety by reducing infection, risk, injuries from falls, and medical errors;
- Eliminate environmental stressors, such as noise, that negatively affect outcomes and staff performance;
- Reduce stress and promote healing by making hospitals more pleasant, comfortable, and supportive for patients and staff alike.”²

As a result, architects, designers and hospital administrators are now incorporating statistics and scientific studies in much the same way medical professionals have used research to inform clinical decisions.

Creating Therapeutic Environments

Based primarily on the analysis of research completed by Ulrich and Zimring, a “therapeutic environment” is frequently defined as a health care environment that achieves three critical measures, including:

- Provides clinical excellence in the treatment of the body
- Meets the psycho-social needs of patients, families, and staff
- Produces measurable positive patient outcomes and staff effectiveness

The research teams found several design principles that contributed significantly to achieving these goals. Notably, the 2004 report “The Role of the Physical Environment in the Hospital for the 21st Century: A Once-in-a-Lifetime Opportunity,”³ published by Roger Ulrich et al, indicates five key factors that are essential for the psychological well-being of patients and their families, including:

- Provide access to nature
- Reduce or eliminate environmental stressors
- Give a sense of control
- Provide positive distractions
- Provide social support spaces

Specific examples of characteristics that embody these principles include:

- Access to nature or views to the outdoors
- Harvested daylight
- Healing gardens
- Use of materials that evoke nature
- Positive distractions such as therapeutic art and sculpture
- Private rooms and increased patient privacy
- Noise reduction and elimination of overhead paging
- Patient-controlled lighting, acoustics, and audio/visual electronics
- Cafes, family resource areas, libraries, and health-related retail shops

Current research continues to reaffirm these design principles, demonstrating that health care settings which lack these design elements will not meet a patient’s psychological needs, and may lead to increased patient anxiety, elevated blood pressure levels, and an increased need for pain-relieving drugs. Conversely, therapeutic environments that foster a sense of control, provide greater privacy and access to nature along with positive distractions, can induce greater relaxation, which in turn can lead to reduced medication needs, reduced blood pressure, and a shorter length of stay. Haya Rubin, M.D., Ph.D, and Director of Quality of Care Research at Johns Hopkins states, “There is suggestive evidence that aspects of the designed environment exert significant effects on clinical outcomes for patients receiving medical care.”⁴

Putting Theory into Practice

Creating a “total healing environment” is fast becoming the goal for many health care facilities. Many of those who have begun to use evidence-based design are part of the Pebble Project initiated by the CHD in 2000.

The Pebble Project is a collection of hospitals, health systems, and long-term care providers who are using evidence-based design in new construction or renovation projects. Partner organizations are given access to research and recommendations about design. In return, the organizations document and analyze the impact on patient outcomes and staff productivity once construction is complete.

Initial reports from the Pebble Project indicate that therapeutic design not only improves the quality of care for patients, but also has a considerable financial impact—by attracting more patients, facilitating faster healing rates, decreasing length of patient stays, and increasing the recruitment and retention of staff.

In one example, the Mayo Clinic, a national leader in implementing healing design in its facilities, has reported an annual 3%-4% nursing turnover compared to the national annual average of 20%.²

The Bronson Methodist Hospital in Kalamazoo, Michigan, is another Pebble Project partner that has incorporated evidence-based design into the construction of its new 343-bed hospital. The new facility has private rooms for all patients with special accommodations for family members. It also features state-of-the-art technology, a high-performance ventilation system and a greater number of sinks to encourage frequent hand washing. Artwork, music, outdoor light, and natural elements have been combined to create an aesthetically pleasing environment.⁵

Results cited in the report from Bronson Methodist included a “95-97% overall patient satisfaction; improved staff satisfaction; and 6% increase in market share.”² Employee turnover also declined dramatically. Chief Nursing Executive Katie Harrelson stated, “In 2005, we had a 5% RN turnover. Before we opened the new facility, we were at 19% or 20%.” After opening the new facility, Bronson had to initiate a waiting list for nursing staff seeking positions.⁵

With a growing focus on evidence-based design, modern health care facilities are emphasizing wellness over illness, prevention over treatment and self-care over practitioner care. Therapeutic environments that provide patient-centered designs can empower patients and families, as well as provide tangible impacts to the bottom line, including reduced cost of operations, shorter patient stays, reduced pharmaceutical usage, and higher staff retention.

The Influence of Natural Elements on Healing

One of the key research findings making its way into leading health care designs is the use of natural elements. Incorporating elements of nature into design has been proven to provide positive distraction for both patients and visitors.

A landmark 1984 study by Roger Ulrich clearly demonstrated that exposure to nature positively impacts patient outcomes. In this study, Ulrich compared the length of stay, number of negative evaluative comments in nurses' notes, and quantity of pain killers required for two groups of matched post-surgical patients. Those in rooms with views of trees had shorter stays, fewer negative comments, and required less pain medication than those who were in similar rooms but had views of a brick wall.⁶

Since that time, many other studies have been conducted to evaluate the correlation between natural elements and clinical performance. For example, one study found that adult patients who looked at a ceiling-mounted nature scene while undergoing a painful bronchoscopy procedure reported experiencing less pain than patients who looked at a blank ceiling.³

In another controlled experiment using volunteers in a hospital setting, the pain tolerance of patients who watched a nature video (without sound) was compared to that of patients who viewed a blank screen. The group that viewed the nature video reported a higher threshold for detecting pain and greater tolerance for pain than those who viewed a blank screen.³

Likewise, research on patients with severe burns found that a significant reduction in both anxiety and pain intensity was achieved when these patients watched a videotape of nature scenes, such as forests, flowers, oceans, and waterfalls, while their burn dressings were being changed.³ Two studies of female cancer patients showed similar findings. Patients who experienced a virtual reality nature walk depicting a forest with bird sounds reported reduced anxiety and less symptomatic distress.³

Studies such as these continue to affirm the powerful impact of natural elements on patient recovery and stress reduction. Thus, it is clear that interior designs which integrate natural elements can create a more relaxing, therapeutic environment that benefits both patients and staff.

The Role of Color in Healing Environments

As the practice of evidence-based design expands, leading health care experts continue to focus on interior visual elements as a primary source of impact. The visual qualities of interior spaces can be equal to, if not more important than, factors such as patient control and social support areas. Evidence-based design shows a strong correlation between healing and interiors that are stimulating—spaces that are not overly neutral, have interesting use of color, and introduce positive distractions that focus on nature and color. The days of drab interiors that lack pleasing contrast levels and color, or which rely on artificial lighting that can dull the senses, are increasingly considered antiquated.

Based on numerous studies by Drs. Morton Walker, Gerard and Faber Birren, the link between color and physiological response has been well documented. Their research demonstrated that an individual's pituitary gland sends signals to the adrenal gland and adrenaline is released when exposed to red. Conversely, when exposed to blue, an individual's brain secretes hormonal neurotransmitters that have a tranquilizing effect.

Kurt Goldstein and many others have demonstrated that a person's autonomic nervous system is stimulated on nearly a universal basis in relation to color perception. Science has shown that warm hues (reds, oranges, and Earth colors) have longer wavelengths which can stimulate the nervous system. Conversely, the nervous system is slowed when an individual experiences cool hues (blues and cool greens) which have shorter wavelengths.

Physiological responses to colors continue to be studied. While color remains a contested element of therapeutic design, certain studies suggest that color may be more scientific rather than aesthetic in nature. Studies of light wavelengths show that the rods in human eyes respond differently to different wavelengths. For example, "the wavelength that produces red requires the eye to adjust to catch it. Therefore, in purely physiological terms, red is an agitating color. Blue and green wavelengths are easier for the eye to perceive and, therefore, these colors are physiologically restful."⁷

Roger Ulrich has investigated the effects of visual stimulation and how it impacts patient recuperation rates and found that patients surrounded in "vibrant" surroundings recovered three-quarters of a day faster, and needed fewer pain killers, than those who did not. Additional studies have confirmed that even brief encounters with nature significantly reduce stress levels—whether or not the nature interaction is real or simulated.³

Further, the positive impact of nature expands beyond literal indoor references such as plants. Large views to the outside, figurative references seen in art and large-scale graphics, nature-inspired colors, as well as wood, stone, and metal textures can have an equally positive impact. Conversely, stark interiors that lack references to natural elements, color, personality, or visual stimuli can raise a patient's anxiety and cause ill effects.

As a result, color is being used more purposefully to complement other design materials and textures that evoke nature. Evidence-based design suggests that it is better to err on the side of color, than the lack of it. While science may not yet explain the extent to which specific colors impact individuals, or how specific colors may be implemented to achieve universal results, many psychiatrists and psychologists studying the subject agree that color has the effect of directing an individual's attention outward, providing a diversion that can relieve the stress of internal mental tensions.⁸

Therefore, colors previously considered "too bright for health care settings," such as vibrant golds, citrus greens, crimsons, and Caribbean blues, are now thought to be vital therapeutic tools that directly promote healing.

Healing Colors for Specific Applications

The following are some general guidelines for pleasing colors that may promote better outcomes in various health care environments.

Waiting Rooms, Solaria, Recreation Rooms, and Social Support Spaces

Because these are shorter term stays, these areas have more potential for color freedom and visual activity than other public and clinical areas. Visually stimulating, interesting, and textural materials are suggested, along with richly saturated to vibrant colorations on walls, floors, ceilings, and in upholsteries. Vibrant options include colors such as marigold, pumpkin, crimson, turquoise, and grass greens. If these areas are pediatric, a mixture of clear, vibrant hues balanced with neutrals is recommended. Research has shown that young patients respond very well to clear, vibrant saturations because they provide a positive distraction for adventurous youngsters, which can be a welcome relief for their families.

Patient Rooms

Because the patient and family spend an extended amount of time in patient rooms, the overall walls, cabinetry, and ceilings should remain in soft tints, while accent walls, floors, and countertops can receive more saturated hues and/or deeper tones. Either warm or cool hues are acceptable. However, if using warm hues they should not feel “hot or aggressive” and cool hues should not feel “too monotone, drab, or cold.” If the space is too cool and lacking in contrasts, it is believed to cause depression for many patients and their families.

Exam Rooms & Treatment Rooms

Though the visit may be considerably brief, often the patient and family have tension associated with the administered treatment. However, it is important that these areas do not feel clinical and drab, but instead, inviting and safe. Therefore, color is recommended on floors, walls, and sometimes the ceiling. And depending on the type of treatment and age of patient (which can dramatically vary) the level of saturation and contrast could be from light to mid-tones. Or, if vibrant color is selected, keep it to minimal portions and complemented with neutrals. Similar to patient rooms, “hot” color or large portions of cool colors that feel sterile are not recommended. And if these rooms could receive patients with open wounds and/or if treatment could pierce the patient’s skin, avoid reds.

Surgery

To combat glare from high intensity lighting and potential surgeon “afterimage” (when the eye stares at one color for too long, becomes fatigued, and begins to see its complement), many surgery rooms use light to mid shades of green or green-based blues. This is to help reduce brightness and relieve the stress on surgeons’ eyes that view blood for extended lengths of time. This is because green, being the complement of red, helps to negate “afterimage.” Avoid red completely in all surgical applications.

X-Ray, Trauma, Physiotherapy Rooms

Patients in these rooms often experience high stress levels, and may be accompanied by family members and practitioners. All colors should be soothing, low in contrasts, and minimal visual stimuli. Soft colors are beneficial, such as topaz, sky, sage, or coral.

DuPont™ Corian® Healing Colors Collection

DuPont is proud to join the health care architects and design professionals who are using evidence-based design to achieve excellence in health care.

The DuPont™ Corian® Healing Colors Collection contains timeless colors that can complement today’s therapeutic environments—and also deliver superior surface characteristics that are ideal for health care environments.

The DuPont™ Corian® Healing Colors Collection is inspired by natural elements. It draws on a wide variety of colors and textures found in nature. The collection is divided into several inviting color categories—giving you a broad range of options to complement the other elements of your design to help provide a positive impact on patient health.

The color categories include:

H₂O

With shades of Caribbean blue, topaz, azul, indigo, and beach glass, H₂O reflects the cool, soothing colors of water. H₂O colors are calm and contemplative, which may be helpful in areas that require low-contrast, soothing tones such as trauma centers or emergency rooms. Like a refreshing spring rain, H₂O colors have a stillness to them that can promote peace and serenity.

Flame

Flame colors are festive, seductive, and dynamic, like the ambient glow of flickering candlelight. With shades of red, wine, rust, marigold, and bronze, Flame colors warm the spirit and inspire optimism, which may make them ideal for areas focused on increasing patient energy such as orthopedic therapy areas or children's cardiology centers. Like a warm fireside glow, Flame colors can illuminate an environment to promote vigor and vitality.

Earth

Rich and decadent, Earth colors are comfortable, familiar, and grounding. Shades of rock, stone, and soil, colors of terracotta, espressos, and camel connect us to the natural world. Because they are enduring and inviting, Earth colors can help to promote feelings of security and comfort for day practitioner spaces, outpatient surgery centers or hematology areas. They partner well with accompanying hues to create peaceful, comfortable spaces.

Wood

With shades of soft moss, lichen, and luscious leaves, Wood colors promote balance and harmony. Harnessing both warm and cool tones, Wood colors can both rejuvenate the senses and evoke relaxation—a combination that can make them a healthy option for pre- or post-operative areas or outpatient centers. Drawing from botanical elements, they convey renewal, rebirth, growth, and life, providing a sense of serenity and enthusiasm.

Alloy

Enigmatic and understated, Alloy colors have a quiet beauty of their own and can showcase other colors to their fullest. Shades of dove, charcoal, and silver are elegant and classic, providing subtle contrasts that allow the colors and materials around them to take center stage—creating a soothing backdrop for areas with dramatic architectural elements such as lobbies or patient waiting areas.

Oxygen

Atmospheric, light, and ethereal, Oxygen colors can project an airy, weightless luminance. They can create sharp contrast for bright color palettes or soothing complements for more subtle color combinations. Shades of white, linen, and cream help to promote hope, sincerity, and spirituality—which can be an ideal combination for medical spa environments. They partner with other colors to convey quality and integrity, bringing levity and translucency to all that they touch.

Natural Inspirations—For Surfaces that Work Virtually Everywhere

DuPont™ Corian® is a high-performance surfacing solution that can stand up to the demands of modern health care facilities. It's easy to clean, easy to renew, and has several important characteristics that make it ideal for health care facilities, including:

Nonporous for better cleaning

Because Corian® is a nonporous surface, it's easy to keep clean. Corian® does not promote the growth of mold and mildew when properly cleaned. Corian® meets all the criteria in the *2006 Guidelines for Design and Construction of Health Care Facilities* published by the Facility Guidelines Institute (FGI) and American Institute of Architects (AIA).

Easy to renew

Corian® is a solid material—the color and pattern continue all the way through the surface. Scratches, stains, or discolorations can be easily removed by scrubbing the surface with an abrasive pad, or by sanding it. Scrubbing and sanding simply expose more Corian® that is identical to the surrounding area.

Long-lasting performance

Corian® resists scratches, stains, impact damage, and heat, making it easy to maintain a “like-new” appearance that continues to look stunning long after other materials need to be replaced. So you can provide your clients the best long-term value for their investment.

Maximum design versatility

The DuPont™ Corian® Healing Colors Collection includes a wide range of colors and textures to help you bring life and a sense of nature to any design vision. The unique structure of Corian® makes it malleable and easy to customize to create dramatic design elements. It can be used to create thermoform shapes and unique design effects such as translucence, bas-relief, inlay, and embedded images.

Meet or exceed industry health care codes

Corian® can help you ensure that your designs meet critical industry standards. In addition to meeting surface guidelines outlined in the *2006 Guidelines for Design and Construction of Health Care Facilities*, DuPont Surfaces are GREENGUARD Indoor Air Quality Certified®, NSF/ANSI Standard 51 Certified, and can help contribute to LEED® building credits.

At DuPont, we're committed to helping you create dynamic health care spaces that combine high style with high performance to promote better patient health.

Using colors inspired by natural elements, the DuPont™ Corian® Healing Colors Collection makes it easy to design inviting surfaces that also offer a variety of benefits to help you create more beautiful and durable health care spaces that can influence positive outcomes for both patients and staff.

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