

## **Evidence-Based Design: Using Design to Improve Patient Outcomes and Clinic Functionality**

Healthcare architectural design is increasingly following in the footsteps of medicine in using scientific research and evidence to improve healthcare outcomes<sup>1</sup>. In recent years, there has been a growing body of evidence connecting the design of health care facilities with improved safety and quality for patients, clinicians, and families<sup>2</sup>. Some of this research has been fueled by the need for hospitals in the U.S. to meet the healthcare demands of a growing elderly population, to update medical technology, and to upgrade aging hospitals built in the 1970s.

Hospital-acquired infections and medical errors are among the leading causes of death in the United States<sup>3</sup>. One out of twenty-five hospitalized patients has a hospital-acquired infection (HAI) every day. Hospitals built using evidence-based design practices have been shown to significantly decrease HAIs and medical errors. This approach also improves mental health, stress rates, patient safety, and healthcare worker satisfaction<sup>1</sup>. As an added benefit, buildings using evidence-based designs are more energy-efficient and reduce their environmental impact, which has been shown both to improve patient outcomes and to be more cost effective<sup>4</sup>.

At Clínica Verde, our leadership and stakeholders understand that careful design can improve not only health outcomes and clinic functionality, but also reduce downstream environmental impacts. With this in mind, Clínica Verde utilized evidence-based design in the design and construction phases of the clinic.

### **Benefits of Evidence-Based Design In Healthcare**

Research demonstrates that a well-designed healthcare facility promotes improved health outcomes<sup>1</sup>. Health outcomes fall into three general categories: 1) patient safety, including lower infection rates, fewer medical errors, and fewer falls; 2) other patient outcomes, including decreased stress, improved communication, less pain, decreased depression, improved privacy, higher patient satisfaction, and more social support; and 3) staff outcomes, including lower stress, more efficient working design, fewer injuries and more satisfaction.

Patient safety is an integral part of evidence-based design. Infections decrease and safety improves when hand washing is facilitated and encouraged, air quality is high

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<sup>1</sup> Ulrich, R. S., Zimring, C., Zhu, X., DuBose, J., Seo, H., Choi, Y., Quan, X., & Joseph, A. (2008). A review of the research literature on evidence based healthcare design. *Health Environments Research & Design Journal*, 1(3), 61-125.

<sup>2</sup> Hamilton, D. K. (2003). The four levels of evidence based practice. *Healthcare Design*, 18-26

<sup>3</sup> Center for Disease Control and Prevention. (2016). National and state healthcare associated infections progress report. Accessed August 2016 at <http://www.cdc.gov/hai/surveillance/index.html>

<sup>4</sup> Sadler, B.L., DuBose, J., & Zimring, C. (2008). The business case for building better hospitals through evidence-based design. *HERD*, 1(3), 22-39.

with the use of proper filters, floors and furniture are easy to disinfect, and the water system is designed to minimize the risk of waterborne infections<sup>5</sup>.

Evidence-based design can impact other health outcomes less directly than health safety. A good acoustic environment can improve patient outcomes by lowering stress, ensuring privacy, and increasing patient satisfaction<sup>1</sup>. Additionally, medical errors can be impacted by lighting and noise. Studies have shown that an unpredictable loud noise can distract healthcare providers, especially if the task is complicated, demonstrating the need for room designs that minimize these distractions<sup>6</sup>. Other design examples that decrease stress and improve patient satisfaction are views of nature, a garden, appropriate lighting, temperature regulation, and floor plans that welcome family visitors to provide social support<sup>1</sup>. Patients with views of nature have also reported less pain compared to patients without a view of nature<sup>7</sup>.

Clinic design can affect patients' levels of stress, the quality of care they receive, their attitude towards the health care service, and the type of role they assume in their recovery<sup>4</sup>. When clinics include diversions for patients, reduce environmental stressors and allow for increased social support, patients are more likely to have a positive experience, and may disclose more relevant health information, improve treatment adherence, and increase the likelihood patients return to the clinic.

Facilities using evidence-based design have improved staff outcomes. Facilities that adopt this approach show decreased levels of clinician stress and improved work satisfaction<sup>1</sup>. Controlled noise levels decrease clinician stress as well as enable healthcare providers to communicate better with patients<sup>8</sup>. Temperature regulation negatively impacts staff stress levels; a lack of regulation may result in lower concentration levels and increased error rates<sup>9</sup>. Last, an efficient and thoughtful layout can enable staff and clinicians to use their time efficiently, encourage clinician collaboration, and can provide privacy with patients to build trust and open communication.

### **Clínica Verde's Evidence-Based Design Approach**

From the initial planning phases, Clínica Verde designers incorporated evidence-based design principles. Recommendations were based on research, experiences and lessons

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<sup>5</sup> Sehulster, L.M., Chinn, R.Y.W., Arduino, M.J., Carpenter, J., Donlan, R., Ashford, D., et al. (2004). *Guidelines for environmental infection control in health care facilities. Recommendations from CDC and the Healthcare Infection Control Practices Advisory*.

<sup>6</sup> Leather, P., Beale, D., & Sullivan, L. (2003). Noise, psychosocial stress and their interaction in the workplace. *Journal of Environmental Psychology*, 23(2), 213-222.

<sup>7</sup> Diette, G.B., Lechtzin, N. Haponik., E., Devrotes, A. & Rubin, H.R. (2003). Distraction therapy with nature sights and sounds reduces pain during flexible bronchoscopy: A complementary approach to routine analgesia. *Chest*, 123(3), 941-946.

<sup>8</sup> Joseph, A., & Ulrich, R. (2007). *Sound Control for improved outcomes in healthcare settings*. Concord, CA: The Center for Health Design.

<sup>9</sup> Mourshed, M. & Zhao, Y. (2012). Healthcare providers' perception of design factors related to physical environments in hospitals. *Journal of Environmental Psychology*, 32 (4), 362-370.

learned by other community clinics such as Ole Health Center in Napa, California. Local stakeholders and physicians in Nicaragua were integrated in the process and provided input and guidance throughout the design phase.

Among the innovative design elements Clínica Verde incorporated are:

**Use of local materials.** Local materials that satisfy safety requirements ensure lower environmental impact. Sourcing locally also enables contractors to replace materials easily and contributes to the local economy and employment base.

**Efficient building orientation.** PG&E assessed the orientation of the facility and helped define the number of windows needed, their size, and location in the building. The study considered local seasonal sunlight to define temperature, lighting, prevailing winds and natural ventilation variables. The strategic use of landscaping along the south and west elevations of the clinic help shade the clinic from the intense tropical summer sun. Operable windows placed in the prevailing wind orientation and interior ceiling fans allow the clinic to passively cool the building with fresh air, eliminating the need for mechanical cooling systems. These design choices help Clínica Verde reduce energy consumption, create optimal natural light for examination rooms and public spaces, and ensure circulation of outside fresh air throughout the clinic.

**Solar panels installation.** Solar panels reduce energy consumption, take advantage of the renewable resources within the region and provide uninterrupted electrical services for the clinic in a region with an unstable power grid.

**Rainwater collection system.** A 40,000 gallon underground cistern captures rainwater during the winter months. In the summer months the clinic uses this valuable resource for irrigating the clinic's demonstration gardens. This eliminates the need to use the more expensive municipal water system and ensures water when the municipal system is unstable.

**Design with views and nature.** Throughout the clinic there are views of the natural scenery, including the clinic gardens and the hills of Boaco. These views give staff, clinicians, patients, and their companions positive distractions and may reduce stress levels.

**Sufficient space in the waiting area for patients and companions.** A prior needs assessment conducted by staff indicated that patients regularly attend medical appointments with at least one companion, and sometimes whole families. Exam rooms were designed to accommodate these companions. In addition, the waiting room was designed to provide a comfortable place that encourages social support, creates positive diversions, and reduces stress levels. The clinic design also provides two exterior social gathering and play spaces for patients and their families. The large, lushly planted entry courtyard is partially covered from the rain and sun. The courtyard provides protection from the prevailing winds and takes advantage of the cool breezes that pass through this mountainous region. The second space is the children's courtyard that allows patients that are waiting for appointments to watch over younger children in a more secured environment.

**Large examination rooms with privacy.** Examination rooms have sufficient space for healthcare providers, patients, and companions. Examination rooms are also designed to give providers and patients a sense of privacy. This enables providers to ask better and more detailed questions, and allows patients to feel more comfortable asking for information, clarifications, and explaining their symptoms.

**Clear design layout and functionality.** The open design of the clinic is easy for providers, patients, and companions to orient and navigate. The facility is divided into four broad areas: 1) a medical examination area; 2) additional services, including pharmacy, dental, and laboratory services; 3) an area for prayer and reflection; and 4) an education and gathering space for the clinic's educational programs. The organization and signposts of the clinic allows patients to understand the services that are offered. Additionally, the breadth of services enables patients to receive several services in a single visit.

**Chapel and garden space.** Spiritual needs are addressed with a prayer or meditation alcove at the entrance to the facility, a critical component of health centers in a predominantly Catholic region. This area gives family members and patients a place for emotional and spiritual support and reflection.

**Rooms designed to support educational programs.** The design of the clinic supports health education including a waiting room large enough to provide health education discussions or *charlas*. A large community room at the back of the clinic provides space for public workshops, classes, cooking demonstrations and nutrition education, as well as a central space for staff to share meals.

Clínica Verde's incorporation of evidence-based design was the first step in creating an environment that supports and provides dignity to patients. Using the latest research in building design principals and health outcomes, Clínica Verde has built a prototype facility that aims to improve health outcomes, patient experiences, staff satisfaction, clinic functionality, and environmental impacts.