

Bridging the Gap: Multidisciplinary Collaboration in Medicine and Architecture

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Abstract

As the world becomes increasingly connected and information is freely shared, a trend toward interdisciplinary collaboration is taking place in both industry and education. This trend is highlighted by recent collaboration between clinicians and architects in both research and design. In the design of healthcare spaces, architects are working with clinicians and researchers to employ an evidence-based approach to making design decisions. The advent of Evidence-Based Design represents a shift from basing design decisions solely on tradition or opinion to an approach that emphasizes the importance of using credible research to inform design decisions. The research expertise of clinicians is vital to the practice of Evidence-Based Design, which traces its origins to the well-established concepts of Evidence-Based Medicine. In the context of healthcare, Evidence-Based Design focuses on design interventions that help make hospitals safer and more comfortable for patients and staff, that promote healing, and that are fiscally sustainable. Through case studies and other examples, this paper will illustrate how the growing body of credible research regarding the impact of the built environment on people creates unique opportunities for architects and clinicians to work together toward a common goal of evidence-based practice.

As the world becomes increasingly connected and information is freely shared, a trend toward interdisciplinary collaboration is taking place in both industry and education. This trend is highlighted by a growing collaboration between clinicians and architects. Spurred by the development of Evidence-Based Medicine (EBM) and the subsequent development of Evidence-Based Design (EBD), architects and clinicians have a unique opportunity to work together toward a

common goal of evidence-based practice. Given this growth in evidence-based practice, it is highly likely that medical professionals will have the opportunity to collaborate with designers during their career. This paper will demonstrate a number of ways in which medicine and architecture can interface, describe the value of such collaboration, illustrate opportunities for interdisciplinary collaboration that arise out of evidence-based healthcare design, and provide case studies of interdisciplinary collaboration between designers and clinicians.

Introduction to Evidence-Based Practices in Medicine and Architecture

The birth of EBD parallels the development of EBM. Just as EBM, which was first formally recognized in an article in the *Journal of the American Medical Association* in 1992,¹ represented a shift in medical thought in response to the availability of data from a large body of reliable research, so too the advent of EBD represented a shift from basing design decisions solely on tradition or opinion to an approach that emphasizes the importance of using credible research to inform decisions.² In the context of healthcare design, EBD often focuses on design interventions that help make hospitals safer while promoting the healing of patients.³ The term “Evidence-Based Design,” officially defined in 2003 by healthcare architect D. Kirk Hamilton,⁴ has evolved as it has been applied. The Center for Health Design, formed in 1993 and committed to advancing the idea that design could be used to improve patient outcomes in healthcare environments,⁵ now defines EBD as “the process of basing decisions about the built environment on credible research to achieve the best possible outcomes.”⁶

EBD was founded on the basis of a body of research that had begun to link aspects of the built environment to healthcare outcomes. As far back as 1968, The Environmental Design Research Association (EDRA) was pioneering research to bridge the social sciences with the design of the environment. The body of literature created by EDRA continues to grow and, more recently, has been supplemented by other individuals and organizations conducting research on the built environment. One such example is a landmark study published in 1984 by Roger Ulrich, a Professor of Health Facilities Design at Texas A&M University (TAMU), and a faculty fellow of the Center for Health Systems and Design, an interdisciplinary center housed jointly in the colleges of architecture and medicine at TAMU.⁷ Dr. Ulrich’s study, “View through a Window May Influence Recovery from Surgery,” published in *Science*,⁸ brought the relationship between the built environment and health outcomes to the forefront. The study compared the recovery records of gall bladder surgery patients who had a bedside window view

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of either trees or a brick building wall with no nature. The outcomes data showed that those with the nature view, compared to those who looked out at the wall, had shorter hospital stays, suffered fewer minor post-surgical complications (such as persistent headache or nausea) and needed far fewer doses of strong narcotic pain drugs. The above findings indicated that views of nature in hospitals could enhance clinical or medical outcomes and, furthermore, the results suggested that nature could improve economic outcomes by reducing the costs of care due to shortened lengths of hospital stays.

While the concept of EBD draws its inspiration from EBM, there are some important differences between the two (Table 1). Unlike EBM, which is based on a large body of credible research compiled over decades, EBD research is relatively recent, but growing. EBD practitioners emphasize the need for hypothesis-driven qualitative studies and are striving to raise the level of rigor in research through education and partnering with clinicians and PhD researchers who have expertise in the research process. Since EBD deals with measures such as clinical outcomes as well as environment-behaviour interactions, the approach to EBD often combines both qualitative with quantitative methods.²

Given the synergies between the concepts of EBD and EBM, there is a significant opportunity for collaboration between designers and clinicians to further explore the correlation between clinical outcomes and design decisions. EBD practitioners look to the medical field for their expertise in evidence-based decision-making. Evidence-based practices can be especially fruitful when undertaken in collaboration between various disciplines. In recognition of the benefits of cross-disciplinary collaboration, the National Institute of Health recently revised grant requirements to allow for multiple Principal Investigators (PIs), creating exciting opportunities for research across varied disciplines.¹⁰

Interdisciplinary Collaboration in Medical & Design Journals

The crossing-over between EBD and EBM is evident in that medical journals have recently begun featuring articles on topics related to healthcare design.^{11,12} In 2008, the *Journal of the American Medical Association* featured a commentary piece on the relation of single-patient rooms to patient safety,^{13,14} while the *Canadian Medical Association Journal* has published several *News* and *Humanities* reviews in recent years on current issues facing the healthcare design community.^{15,16} The *New England Journal of Medicine* featured a perspective article in 2010 on the emerging importance of patient amenities in hospital care, reporting that patients believe the nonclinical experience is twice as important as the clinical reputation in making hospital choices.¹⁷

The development of peer-reviewed publications for Evidence-Based Design research has also been seen in the health care design community, notably with the initiation of the peer-reviewed *Health Environments Research and Design Journal* (HERD) in 2007¹⁸ and the *World Health Design Journal* (WHD), developed in 2008 by the International Academy for Design and Health.¹⁹ WHD features a blend of articles on recently constructed projects in addition to peer-reviewed research papers covering various EBD topics.

In upcoming years, we expect to see a growth in the trend of EBD research featured in medical journals, in addition to physicians and medical staff contributing to the peer-reviewed architectural journals. This crossover and blend of interdisciplinary research will be invaluable to the advancement of the knowledge gained from studying the impact of the physical environment on clinical outcomes.

Table 1. Comparison of Evidence-based Design and Evidence-based Medicine

Category of Comparison	Evidence-Based Design (EBD)	Evidence-Based Medicine (EBM)
First Formal Recognition	2003 ⁴	1992 ¹
Types of Research Literature	Hypothesis-driven quantitative methods are increasingly used and a growing body of meta-analyses exist. EBD, which often deals with environment-behavior interactions, is commonly approached from a qualitative perspective. ²	Quantitative methods (including systematic reviews, meta-analyses, and randomized controlled trials) rank highest on the evidence pyramid.
Quantity of Literature Available	Relatively small, but growing body of rigorous studies relating to healthcare design. ²	Approximately 25,000 randomized controlled trials and controlled clinical trials published yearly. ⁹
Education	Growing emphasis on research skills in design education. ²	Research skills, methods, and concepts are ingrained in undergraduate and post-graduate education. ²
Level of Rigor	Rigor can be misunderstood by designers. Many designers have begun to partner with MDs or PhDs to design better, more rigorous studies. Architectural educational institutions have begun to teach the EBD process.	Relatively high level of rigor in EBM. The education system teaches clinicians how to read, evaluate, and apply literature as well as how to conduct their own research.
Opportunities	Many designers are looking to partner with clinicians to evaluate the effects of design interventions on patients, staff, and others who spend time in a hospital or clinic.	There are a wealth of potential research topics that relate the built environment to clinical outcomes or fiscal performance. For example: environmental variables that may contribute to the spread of infection or the effects of the NICU environment on a neonate's future health outcomes.

Translating the Literature into Architectural Practice

Architects are formally trained to understand human behaviour and apply this knowledge to design solutions. Furthermore, healthcare designers spend years developing expertise in the functional considerations of healthcare design. To supplement this wealth of experiential knowledge, many architecture firms are also incorporating medical professionals into the architecture practice and office setting. Due to the growing need for EBD research, a number of design firms are hiring doctorate-level full-time staff to oversee research initiatives. In addition, some firms have integrated clinically-trained staff (e.g., Registered Nurses, Respiratory Therapists, or others) to help educate the firm, to lead client meetings, to assist with strategic planning, and to help guide design decisions. Less than a handful of firms have hired individuals with physician (MD) qualifications. During hospital user group meetings for a design project, physicians, nurses, and others with clinical expertise provide valuable input into the staff flow patterns and clinical needs within various settings.

Professional Associations

Another place in which the crossover between medicine and architecture can be seen is in professional medical associations, where architects have begun to join as members in recent years. Most notable perhaps is the Society of Critical Care Medicine (SCCM), which today is the leading international organization dedicated to ensuring excellence and consistency in the practice of critical care. There are 14,000 SCCM members in 80 countries.²⁰ Of this membership, there is a handful of architect members primarily involved in a 17-year annual design competition co-sponsored since 1992 by the SCCM, with the American Association of Critical Care Nurses (AACN) and the American Institute of Architects Academy of Architecture for Health (AIA/AAH). Entries are judged by several panels of physicians, nurses, and architects. Winning Intensive Care Units (ICUs) have subsequently been studied and design trends over the years have been identified.^{21,22}

Evidence-Based Design Guidelines

The SCCM, along with a few other professional organizations, has published evidence-based design guidelines to assist in the planning and design of hospitals. The SCCM ICU Design Guidelines, published in *Critical Care Medicine* in 1995,²³ provides architects and planners with a guide for designing critical care units in order to address patient, family and staff needs. These guidelines are currently being revised in order to reflect an evidence-based approach to design elements. Additionally, the American Institute of Architects (AIA) Academy of Architecture for Health initially developed *Guidelines for Design and Construction of Health Care Facilities* in 1987,²⁴ the most recent version in 2010 was published by the Facilities Guidelines Institute.²⁵ These Guidelines are updated on a four-year cycle by the multidisciplinary Health Guidelines Revision Committee. Individuals knowledgeable about health care practices and health care facility design (doctors, nurses, facility managers, architects, and engineers) and those who apply the document in the field (state and federal authorities having jurisdiction) serve on the committee.²⁶ As these comprehensive guidelines

are becoming required code in much of North America and best practice beyond, it is important that physicians are aware of the need for further research on the effects of environmental features on health outcomes, as this research will make up the basis of future hospital design guidelines.

In Ontario, building codes have placed a special emphasis on the design of hand-washing sinks. In health care settings, adherence to hand hygiene recommendations is the single most important practice for preventing the transmission of pathogens and directly contributes to patient safety.³ Perhaps one of the most comprehensive documents for hand hygiene best practices has been developed in Canada by the Province of Ontario's Ministry of Health and Long Term Care.²⁷ With respect to design criteria, this document includes indications for the placement of hand-washing sinks in health care facilities. These recommendations are some of the most stringent and advanced for preventing infections, and were initiated after the 2003 near pandemic SARS (Severe Acute Respiratory Syndrome) outbreak, which resulted in 43 deaths in the Greater Toronto Area.²⁸ Examples of design recommendations include: sinks should be free-standing (not be inserted into or immediately adjacent to a counter); sinks should not have storage underneath them (due to proximity to sanitary sewer connections and risk of leaks or water damage); the design of hand-washing sinks (e.g., depth, position of drain) should prevent splash back that may contaminate hands or faucets; controls (faucets) should be hands-free; and electric eye operation or foot-, elbow-, or knee-operated handles/blades are acceptable.²⁷

It is likely that in the future, additional guidelines will be developed in order to refine the existing recommendations as well as incorporate supplementary evidence as more research on how the physical environment impacts patient well-being, staff efficiency and healthcare costs is undertaken.

Case Study: Design to Support Multidisciplinary Care Teams

Collaboration between the disciplines of architecture and medicine addresses the increasing frequency of a multidisciplinary design process when building or renovating health-care spaces. As the general focus of patient care shifts from disease and illness to patient health and well-being, an increased emphasis on integrative medicine also appears to be a growing trend within clinical practice.²⁹ This trend has created a need for healthcare spaces that accommodate a variety of care disciplines to address patient needs, as described by the following case study.

The Center for Integrative Medicine and Wellness at Stamford Hospital in Stamford, CT, USA is located in an ambulatory care facility, adjacent to other ambulatory service lines such as cancer treatment, cardiology, and rehabilitation. The Wellness Center is designed to accommodate many different services including: pain management, women's health, integrative cardiology, and integrative medicine. Direct access from the integrative medicine area to breast screening enables women to visit with multiple caregivers in their care team during a single visit. Similarly, pain management patients may go directly between the Wellness Center and the cancer

treatment area. During a single visit to the Wellness Center, a patient may take advantage of multiple services and visit with multiple clinicians. To accommodate a diverse mix of services, the Wellness Center has a flexible area that can serve multiple services- the “meeting area” is a multimedia-ready room that can accommodate a small meeting of a patient with his or her physician, or a larger meeting of a patient with one’s care team or an educational class for a group of patients (Figure 1). Flexibility is key and patient rooms are designed to accommodate all types of visits, from a massage therapy session (with dimmable lighting, music, and a soothing atmosphere) to a physical exam (with bright lighting, easily cleanable surfaces, and storage for equipment and supplies) (Figure 2).



Figure 1. Photograph of team collaboration area with moveable Shoji screens to accommodate large or small groups
(©Woodruff/Brown Architectural Photography)

The design of this Center strives to address the comprehensive and multi-faceted approach taken by this institution to create a positive patient experience while addressing their healthcare needs. It is likely that architects will see a growing need for this type of flexible multidisciplinary design in the future and that clinicians will encounter an increase in interdisciplinary practice.



Figure 2. Photograph of exam/treatment room, designed to accommodate various types of patient visits
(©Woodruff/Brown Architectural Photography)

Case Study: Collaborative Evidence-Based Design Process

This replacement Emergency Department (ED) for Stamford Hospital (anticipated construction completion 2013) was designed using an evidence-based approach. As a teaching hospital, the new 48,000 square foot ED will house 45 private treatment rooms, including a dedicated pediatric area, and is planned to accommodate 45,000 visits per year (Figure 3). The ED design team consisted of architects and interior designers as well as physicians, hospital administrators, nurses, infection control representatives, facilities department representatives, and other hospital staff. In early design meetings, these individuals expressed both clinical needs as well as a desire for the design to be sensitive to the patient experience. In addition to getting input from these experts in their respective fields, a literature review on topics of importance to the design team was conducted. A number of design decisions stemmed from the clinical input and available literature. For example, the waiting areas were placed with landscaped outside views that are accessible from the waiting area. Studies have shown that gardens can provide positive distraction and can also be restorative for people who are under stress.³⁰ Since television has been shown to raise the blood pressure of stressed individuals in a waiting room,³¹ a large portion of the ED waiting area was designated a no-television area. A number of features were chosen to address infection control, including hand-washing stations located in readily accessible areas off the corridors in addition to those in patient rooms. Studies have correlated a higher rate of hand-washing with an increase in number of sinks.^{32,33} Since noise and other distractions can contribute to medical errors, as identified in the draft guidelines of the *Pharmacopeial Forum*,³⁴ medication dispensing areas were enclosed in rooms to minimize interruptions and distractions to nurses while dispensing medication.

The project team, consisting of hospital representatives and designers, went beyond simply using research to help make design decisions; they also identified an area for further exploration- the acoustic environment. While it is known that hospitals can be noisy and that this noise can cause sleep disturbances in the inpatient setting, distractions that may lead to medical errors, and can raise levels of stress hormones,^{3, 35} less is known about the causes and effects of noise in the ED specifically. The project team is currently designing a study to explore causes of noise in the ED with the goal of developing a set of acoustic design recommendations to help mitigate noise in the ED setting. As this project illustrates, despite the growing body of literature relating to healthcare environments, there are still many frontiers for research into the way buildings affect people. Patients as well as staff who work in hospitals stand to benefit from further evidence-based improvements in the healthcare environment.

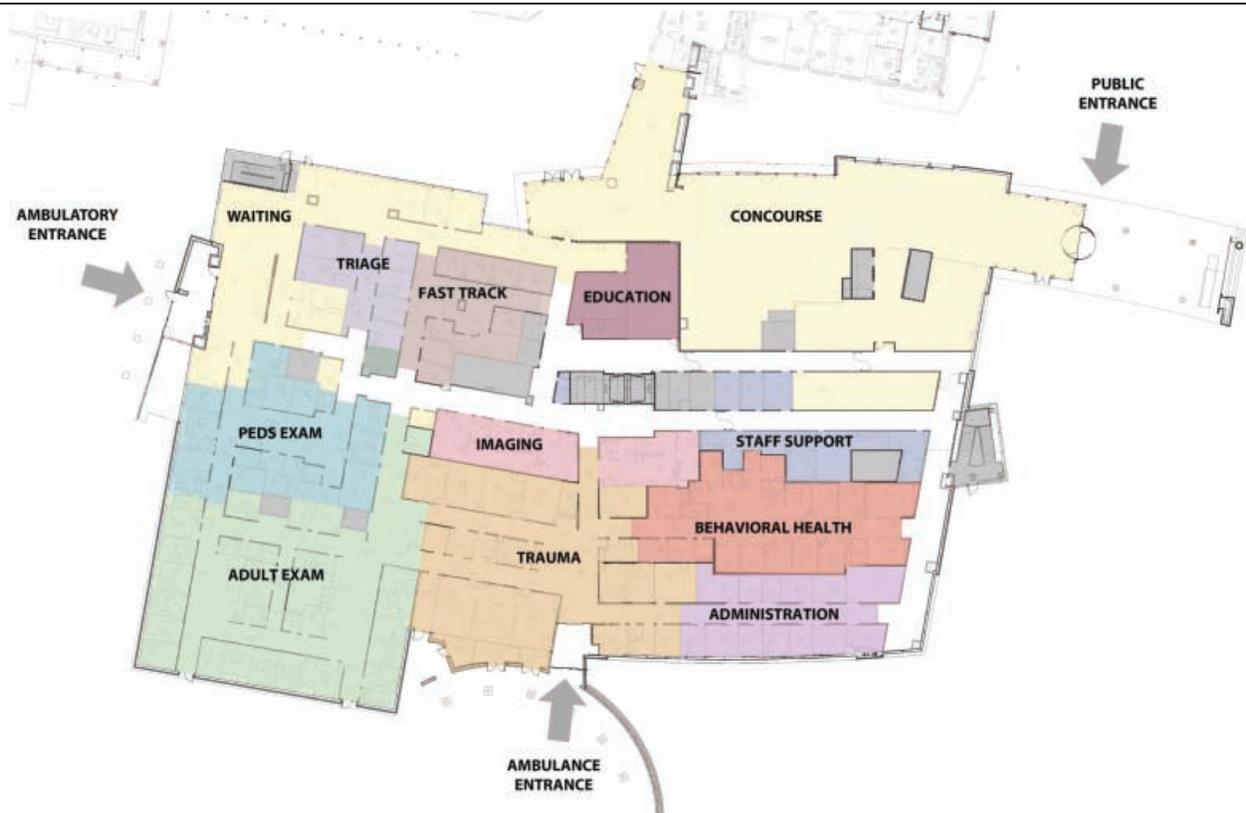


Figure 3. Stamford Hospital Emergency Department Floor Plan
(Image courtesy of WHR Architects, Inc.)

The Future of Medicine and Architecture: Interdisciplinary Collaboration and Evidence-Based Practice

It is likely that many physicians, nurses and other allied clinical staff at some point in their career will be involved with the design of a new facility or renovation of an existing facility. These clinicians should realize that their clinical knowledge and experience are critical to the success of design review meetings. When the project team recognizes a gap in the literature, clinicians may consider this gap to be an opportunity to test outcomes of a design solution and publish their research. By adding to the growing body of literature linking specific design decisions to clinical outcomes, the collaborative interaction between physicians, nurses, and architects will become increasingly valuable for getting the most out of a building project. In applying this evidence-based approach, the disciplines of both medicine and architecture are striving towards a common goal – to address and improve the health and well-being of patients, family and staff using hospital and healthcare buildings.

Conflicts of Interests

The authors report being employed by WHR Architects Inc, which focuses on the design and planning of health care facilities. No other potential conflict of interest relevant to this article was reported.

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