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STATE OF THE ART AND SCIENCE: PEER-REVIEWED ARTICLE Evidence-Based Design and Liability Risks for Health Care Organizations D. Kirk Hamilton, PhD and A. Ray Pentecost 3rd, DrPH

Abstract

Since the 1980s, science about how built environments influence human health has been used by architects, engineers, and designers to inform decisions about health care organizations' structures and spaces. Because design influences health outcomes, ignoring evidence-based design can be a source of clinical, ethical, legal, and organizational liability. This article introduces concepts related to designs' influence on patient and community health outcomes and suggests strategies for health-legal partnering to promote rigor in health care organizational design practices that promote quality and equity in health service delivery.

Evidence-Based Design for Health Facilities

Architects, engineers, and design practitioners have long used empirical observations, science, and research to inform their design decisions. In 1984, Roger Ulrich published a groundbreaking paper in *Science*,¹ which reported that randomly selected surgical patients in rooms with a view of trees had better outcomes than those in rooms with a view of a brick wall. This might have been the first peer-reviewed study whose findings linked design of the physical environment to clinical outcomes, such as reduced use of pain medications and shorter lengths of stay. Since its publication, Ulrich's paper has inspired a growing body of research² in what has become known as the field of evidence-based design (EBD),³ which examines how design decisions impact clinical and psychological outcomes.^{4,5} Ulrich went on to propose a theory of supportive design⁶ based on the recognition that all known clinical conditions are exacerbated by stress and therefore recommended designs to reduce stress.

The body of EBD research studies and their findings has grown rapidly since the early 2000s.^{6,7} For example, there is strong evidence that mechanical air handling systems can help prevent the spread of dangerous pathogens.⁸ Additionally, evidence supports the idea that positive pressure in patient rooms protects those who are vulnerable and immunocompromised, while negative pressure in rooms of isolated infected patients protects everyone outside the room.⁹ There are also examples of hospital mechanical systems transmitting infectious diseases. In particular, hospital water systems have harbored *Legionella* due to water temperatures that permitted pathogen growth,⁹ and cases have been litigated on patient harm from *Legionella*.^{10,11} To take another example, Leaf and colleagues¹² found that the mortality of severely ill patients was

significantly higher in rooms not visible from the intensive care unit central nursing station than in other rooms. Florida architect William Hercules and colleagues have questioned whether knowledge of this research would lead to litigation if patients in low-visibility rooms died.^{13,14} Unlike the pathogen that causes Legionnaire's disease, however, visibility is only one of multiple factors that might contribute to a sentinel event. Others include patient acuity, staffing levels and management protocols, staffing training and competence, medication errors, and equipment failure. This article discusses possible legal liabilities related to design and challenges to and strategies for implementing EBD to promote quality and equity in health service delivery.

Possible Liability Related to Design

Health system boards and executives have a significant ethical and moral responsibility to choose wisely the design professionals who will work on their projects, as the design team will be creating a space that will impact the health of all who work in that facility. The challenge is to identify a design team that is not only competent but capable of, and committed to, using design research to ensure that the building is a healthy place in which to deliver health care.

Choosing a design team raises several questions. What level of professional performance is reasonable to expect of the modern health care design team? Is it negligence or malpractice if design professionals fail to utilize readily available, credible, relevant evidence? Merriam-Webster defines malpractice as "a dereliction of professional duty or a failure to exercise an ordinary degree of professional skill or learning by one (such as a physician) rendering professional services which results in injury, loss, or damage."15 On the other hand. Merriam-Webster defines negligence as "failure to exercise the degree of care expected of a person of ordinary prudence in like circumstances in protecting others from a foreseeable and unreasonable risk of harm in a particular situation."16 Even a cursory review of legal terms and practices in architecture and engineering reveals subtleties concerning issues like malpractice, as well as liability, negligence, ignorance, and standard of care or practice.¹⁷ Avoiding architectural malpractice, like avoiding medical malpractice, requires an understanding of minimally competent practice standards as well as of baseline expectations of knowledge about the field. Health care organizations also need to understand both the commonsense ethics of well-intended professionalism and the oft-unforgiving precision of codes and regulations designed to protect against the relativism of personal judgment.

Hospitals' potential legal liability. If health care organizations engage qualified design professionals to undertake a project who have established at least one design hypothesis about intended outcomes associated with design features, then they have an obligation to measure the resulting outcomes to determine whether the hypotheses were supported or not. Since organizations need to evaluate building performance, there are multiple measures that may be useful. Self-evaluation tools include simulation studies, mock-ups and field testing, designs and outcomes applied research, and independent third-party postoccupancy evaluation, among others. If credible evidence indicates that certain design features can improve clinical outcomes and patient safety, there might be liability for boards and executives who do not insist on evidence-based project decisions and therefore do not implement those features. Given that health care organizations are responsible for construction projects and budgets, boards and health care executives, including medical and nursing officers, have a moral responsibility to select qualified design practitioners and encourage them to utilize relevant evidence in the design process.

Architects' potential legal liability. If the evidence is strong and has been disseminated widely, then ignorance is no excuse for those professionals who have a health, safety, and welfare responsibility to stay current in order to protect the public. Every aspect of schooling, continuing education, and professional training should emphasize the priority of research findings and their ethical use in design.

Licensed design practitioners must meet high standards of education and experience. Architects, for example, must graduate from an accredited 5- or 6-year professional degree program and complete an internship period. Licensure as an architect is granted by states upon examination, with an obligation to protect the health, safety, and welfare of the public. Continuing education is required annually to maintain the license. To become board certified by the American College of Healthcare Architects (ACHA), a candidate must already have been licensed for 3 consecutive years, demonstrate direct work experience on health care projects amounting to the equivalent of at least 3 years, and submit a portfolio along with references.¹⁸ The candidate is then eligible to take an examination that fewer than 70% of candidates pass on their first attempt.¹⁹ ACHA certificants must complete annual continuing education to maintain board certification.

Some believe board certification as offered by the ACHA offers a bit of liability protection, as it suggests the certificant exceeds the standard of a minimally competent practitioner. Others suggest certification in the specialty increases liability risk due to an implied greater professional understanding and competence in the specialized field.

Challenges to EBD

The imperative to utilize the best available, current, relevant evidence to support design decisions is a direct analogy to evidence-based medicine.²⁰ Knowledge creates a moral obligation and expectations of the design team, the design process, and the final design product.^{21,22} Just as physicians have a moral and ethical responsibility to utilize medical evidence that can contribute to improved patient health and better clinical outcomes, so architects, engineers, and design professionals who are responsible for health facility design have a moral and ethical responsibility to utilize evidence that design can contribute to improved clinical outcomes and patient safety. The design and health professional communities must work together with the legal profession to establish the standards of research evidence and rigor in practice that will frame these emerging moral and ethical obligations.

The challenges are real. How can design professionals know when they have tried sufficiently to review the latest design research in order to protect or enhance the health of building occupants? How do medical professionals know when they have reviewed the latest clinical research, read the latest—sometimes conflicting—research findings on drug interactions, or effectively sorted out the most recent findings on pharmaceutical research with their sometimes mixed messages on efficacy, interactions, side effects, and safety? How do design (or medical) professionals proceed with confidence in their profession, knowing that somewhere there might be a piece of research that bears on their circumstances but about which they are unaware? To what lengths is a design or medical professional behavior?

An obvious answer must be making available information to support the continual attempt to stay current with emerging professional and scholarly literature. Design professionals might adopt a policy of documenting the research findings that support important design decisions. Another more global, complex solution might involve some sort of clearinghouse that provides updates on research findings within an assortment of specialties. Efforts at building scholarly collections, such as IBM's WATSON project that actively searched for medical oncology research and treatment protocols, 23,24 suggest that such initiatives are technically possible. Such a database could be maintained at the intersection of multiple scholarly disciplines, including architecture. engineering, construction, medicine, nursing, public health, and a host of other equally relevant fields such as law. Yet some research is flawed, even when it is peer reviewed.²⁵ What happens to design or medical professionals who try to find and use the latest research, only to learn too late that the findings are not trustworthy? Do they receive encouragement for the effort of searching or criticism for flawed or incomplete evaluation of the research or for incurring liability, despite their best efforts, and compromising an ethical responsibility?

Conclusion

Research has already changed the way the design community approaches design, just as surely as it has changed the practice of medicine. The attendant impacts of EBD on engineering, construction, facility management, and project financing are equally real and are already changing standards of professional practice. What is not clear is how thoughtfully these industry transformations will be managed to ensure the fair and ethical treatment of professionals who are, as the saying goes, "being asked to redesign and rebuild the airplane while it is in mid-flight."

Just as evidence-based medicine places moral and ethical constraints on its practitioners, so the growing field of EBD for health creates moral and ethical obligations, if not liabilities, for its practitioners and the organizations that engage them. Organizations must learn to evaluate the capabilities of highly specialized health design professionals as those capabilities relate to stewardship of their investments in design that should necessarily be building code compliant but also reflective of the latest findings in design research. Moreover, all members of the design professions—including, but not limited to, architects, engineers, contractors, medical equipment specialists, furnishings experts, and especially all project team representatives from the health organizations wanting to develop new projects—must work together with the legal profession to establish the standards of research evidence and rigor that will frame the future of the moral and ethical questions related to EBD.

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