The art of medicine

The convergence of architectural design and health

> "During my medical residency, I realized how much burnout affected us as trainees on the front lines of care. In particular, I noticed that much of that difficulty was tied to the areas in which we worked—constant noise, poor lighting, and lack of daylight. Space design made patient care challenging at times, too; for example, not being able to access the correct side of my patient to perform the physical exam as I had been taught. I often considered that the built environment could improve care delivery with more collaboration amongst designers and clinicians."
>
> *Diana Anderson*

The disciplines of public and environmental health have long recognised the impact of the built environment on health. Yet clinicians have limited opportunity to engage with architects and design professionals, and the impact of health-care design is largely absent from health policy discussions. However, this is beginning to change.

Clinician-informed ideas have been incorporated by architects at Perkins+Will, who have collaborated with clinicians, students, patients, and families to address cognitive, circadian, acoustic, and ambulatory needs in the design of a new outpatient building at the University of Cincinnati Gardner Neuroscience Institute that is expected to open in 2019. Meanwhile, leading architects, including Frank Gehry, the late Zaha Hadid, and Richard Rogers, were involved in the development of cancer support centres through the network of Maggie's Centres in the UK and Hong Kong. Examples from Scandinavia include the New North Zealand Hospital in Denmark, designed by Herzog & de Meuron and Vilhelm Lauritzen Architects, a clover-shaped building that is under development and will be set in the middle of a forest, combining biophilic design with a focus on clinically informed design. Advancing from earlier work by Florence Nightingale, ergonomists, and the methods of evidence-based medicine, such architects have been developing a research-based approach towards health-care design. The design-thinking movement in health care is gathering momentum.

View Pictures/Getty Images

Professionals in health care and design increasingly seek shared knowledge and expertise, as clinical practitioners and designers work together across disciplinary boundaries. There has long been a need for such collaborations. As the architect Louis Kahn said, "Once challenged, the architect will find completely new shapes and means to produce the hospital, but he cannot know what the doctor knows." Examples of architectural oversights in hospitals that could have potentially been avoided with the input of clinicians include the placement of sinks that discourage hand washing; the absence of spaces for confidential discussions between clinicians about patients; or spaces for staff to reset emotionally after difficult moments. Design can also affect patients' experiences. A window and a view, or exposure to natural light, can impact patients' wellbeing, heart rate variability, or other circadian responses. Areas yet to be explored further include how the built environment may enhance clinician wellness and prevent negative patient outcomes, such as inpatient falls.

Designers and architects are increasingly adopting scientific methods to assess the impact and value of design in clinical settings. As these experts design together, it is essential that the expertise and experiential knowledge of clinicians and clinical researchers identify key issues, evaluate proposed design solutions, and provide insight for the future of care. In addition to the design of new buildings, renovations and modifications of existing spaces must accommodate evolving technologies and changes in clinical practice. What roles will clinicians adopt as sophisticated technologies shift certain decision making away from human operators? How and where should care be provided to patients with complex chronic conditions? How can design impact complex and chronic conditions to provide for independent living and rehabilitation? Such questions need to inform the way we think about designing health care. The way we might build clinical spaces in the future could provide some of the answers.

Future design innovations might include an emphasis on patient mobility given the recognised hazards of hospitalisation itself, incorporation of virtual reality to promote experiences and communication for isolated

patients, and the incorporation of high-level informatics at the start of design projects to avoid the need for retrofits later. The use of real-world mock-ups and virtual simulations could assist clinicians as they evaluate how design options may influence their workflow and reveal essential changes that may not be obvious in architectural plans and drawings.

How can this future be realised? While clinician engagement is crucial for developing a human-centric design process, there are barriers to communication and collaboration between architects and clinicians. For the clinician, intense paroxysms of activity occur alongside the constant call of patient care and academic and administrative duties. By contrast, the work rhythm of architects is typically driven by the sequence of the design process, project timelines, and scope. Too rarely does either profession include the other in their undergraduate curricula, postgraduate activities, or practice. It is essential that patients, users of health-care spaces, and design experts engage more fully with each other, sharing knowledge about organisational dynamics, team functions, and communication strategies from the earliest stages of design through construction.

Potential ways to improve cross-disciplinary understanding could be facilitated by on-site shadowing and research studies, predesign clinical observations, physical mock-ups, and innovative virtual reality simulations to explore design. By incorporating design workshops within medical school curricula, future clinicians would be equipped with the knowledge base and skill to collaborate with designers on health-care projects. There is also a need to develop more formal centres with a focus of scholarly and practical engagement between the disciplines. Examples of existing clinician-led design centres include JeffDESIGN, based at Thomas Jefferson University in Philadelphia in the USA, which teaches medical students to apply design thinking to solve health-care challenges. Located in Toronto at the University Health Network, Canada's research hospital, OpenLab is a design and innovation shop that leads creative projects to improve health-care experience and service delivery. Another approach can be found at the Centre for Excellence in Universal Design, a design-led initiative based in Dublin, Ireland, that focuses on environments that can be accessed, understood, and used to the greatest extent possible by people irrespective of their age, size, ability, or disability. The centre collaborates with health professionals to develop standards for various built environments—for example, home-based dementia care guidelines.

In addition to such efforts, the frontier of clinician involvement can be advanced by developing centres that include collaborative research studies and short courses to familiarise clinicians with the factors and imperatives inherent in building projects and accredited courses for clinicians, architects, and project managers.

To further address this growing need for exchange between medical professionals with interests in design, Clinicians for Design (CfD), a non-profit international network of clinicians and scientists, was formed in 2017. CfD seeks to unite these professionals across academia and design practice. Its mission is to advance the interface between health care and design through research, education, and policy development. Initiatives include hosting colloquia and educational sessions, leading evidence-based design research, developing guidelines, and enhancing building codes. These endeavours all work towards creating new models of practice and built environments.

There are diverse challenges to be addressed as clinicians engage with design. Currently, the methodologies used in architectural practice and medical research are very different. However, as research-based design converges with clinically informed design, translational design might become more rigorous. In the future, we hope that clinicians, researchers, and designers work together to develop new metrics on the value of design. Controlled studies could show how built features within health-care environments could be measured in terms of patient and provider outcomes. Such data would encourage funding of educational programmes, and the development of new design recommendations and guidelines that could be implemented within health-care settings.

Professionals in medicine, architecture, and research seek a convergence of career models and the creation of an enduring connection between clinical practice and design. Clinicians and designers have begun to identify the benefits and challenges of this transdisciplinary approach. The vision of health-care settings must also change. A convergence of design thinking and health-care innovation would benefit from combined expertise and enthusiasm of clinicians and clinical researchers who can become valuable advocates for health and design. Creating stronger connections between the fields of architectural design and health is likely to enhance patient outcomes and to create a new vision of our clinical roles and care communities.

*Diana C Anderson, Steph A Pang, Desmond O'Neill, Eve A Edelstein

Center for Bioethics, Harvard Medical School, Boston, MA 02115, USA (DCA); Faculty of Medicine, McGill University, Montreal, QC, Canada (SAP); Trinity College Dublin, Dublin 2, Ireland (DO'N); and Perkins+Will, San Francisco, CA, USA (EAE)
diana.anderson@dochitect.com

DCA and EAE are co-founders of Clinicians for Design. DCA was a Fellow at the Hx Lab at Perkins+Will from 2017 to 2018 and has been an invited speaker at the Centre for Excellence in Universal Design. EAE is research director of the Hx Lab at Perkins+Will and was the research lead for the University of Cincinnati Gardner Neuroscience Institute design team. SAP received a Clinicians for Design Student Fellowship from Perkins+Will in 2017. DO'N has been a collaborator in research with the Centre for Excellence in Universal Design, funded by the Meath Foundation and the Health Research Board. The essay was written after a Clinicians for Design workshop that was supported by the Hx Lab, which explores the human experience of design, and health-care architects, including Elizabeth van den Brink, at the international design firm Perkins+Will.

Further reading

Adams A. Decoding modern hospitals: an architectural history. *Archit Des* 2017; **87:** 16–23

Bekdik B, Thuesen C. Reinventing the hospital—a study of lost synergies in Danish healthcare. Engineering Project Organization Conference; June 28, 2016. http://orbit.dtu.dk/files/126260733/Bekdik_and_Thuesen_EPOC_2016.pdf (accessed Nov 20, 2018)

Edelstein EA. Research-based design: new approaches to the creation of healthy environments. *World Health Des J* October 2013; 62–69

Grey T, Kennelly S, de Freine P, Mahon S, Mannion V, O'Neill D. Towards a building typology and terminology for Irish hospitals. *Ir J Med Sci* 2017; **186:** 1–16

Halpern NA, Anderson DC, Kesecioglu J. ICU design in 2050: looking into the crystal ball! *Intensive Care Med* 2017; **43:** 690–92

Keys Y, Silverman SR, Evans J. Identification of tools and techniques to enhance interdisciplinary collaboration during design and construction projects. *HERD* 2017; **10:** 28–38

Nightingale F. Notes on nursing and notes on hospitals. London: Harrison and Sons, 1859

Ulrich R. View through a window may influence recovery from surgery. *Science* 1984; **224:** 420–21

Zimring C, Bosch S. Building the evidence base for evidence-based design. *Environ Behav* 2008; **40:** 147–50