

Evidence-Based Design in Health Care

December 2024, Volume 26, Number 12: E897-969

From the Editor

- How Design Affects Health 899
Joy C. Liu, MD, MPH

Case and Commentary

- Who Should Contribute to Decisions About Health Care Space Design? 901
Diana C. Anderson, MD, MArch and Stowe Locke Teti, MA, HEC-C

- How Should We Respond to Spatial Injustice in Health Care Organizations? 909
Ian M. Johnson, PhD, LCSW

- Which Values Should Guide Health Care Organizations' Retrofit Expenditures on Patient-Centered and Evidence-Based Design? 916
Ellen Taylor, PhD, MBA, BArch

Medical Education

- What Should Health Professions Trainees Learn About Built Environment Activism? 925
David A. Deemer, MD, MA and William J. Hercules, MArch

State of the Art and Science

- Evidence-Based Design and Liability Risks for Health Care Organizations 932
D. Kirk Hamilton, PhD and A. Ray Pentecost 3rd, DrPH

Policy Forum

- How Innovative Designs Can Help Ease Ethical Tension in Good Dementia Caregiving and Decision-Making 938
Emily Roberts, PhD

History of Medicine

When Designs Became Interventions in Hospitals 948
Jeanne Kisacky, PhD, MA, MArch

Hospital Design Standards and the AMA 963
Jorie Braunold, MLIS

Podcast

Health Care Space and Structure Designs as Interventions: An Interview With Dr Jeanne Kisacky and John Meyer



AMA Journal of Ethics®

December 2024, Volume 26, Number 12: E899-900

FROM THE EDITOR

How Design Affects Health

Joy C. Liu, MD, MPH

Can you heal in the same environment in which you got sick? Regardless of the answer, the question is based on an underlying awareness that health is affected by the built environment. Health care settings, where much of the action intended to cure or heal occurs, are no exception. It was shown 40 years ago that views of nature decrease postsurgical patients' pain medication use and length of stay.¹ Similarly, high-visibility intensive care unit plans promise to improve patient care.² High lighting, minimized noise, and acuity-adaptable rooms reduce medical error.³

Design of health care spaces matters for everyone involved in healing, caregiving, and improving health. Design interventions are increasingly used in efforts to improve patient, clinician, and community health in noninvasive, nonpharmacologic ways. Dementia villages like the Hogeweyk in the Netherlands are designed to be **friendlier environments for people with dementia** than institutional settings because they include places like stores, parks, and cafes.⁴ By designing for community instead of only focusing on safety, the hope is to reduce patient agitation and improve overall well-being. Green spaces, such as community gardens, have been promoted as one way to enhance the physical and mental health of health care workers as well as patients.⁵

Decades of this work have coalesced into a **field known as evidence-based design**, which uses scientific research to design and build spaces for best outcomes.⁶ It applies to the field of design a process of inquiry, research, and evaluation similar to that typically used in medical interventions. This month's issue of the *AMA Journal of Ethics* explores questions that arise when evidence-based design is applied to health care. The articles, podcasts, and visuals trace the history of the field as a story, linger on dementia care environments and their ethical questions, and propose tensions that the field must reconcile to move forward.

Along the way, contributors ask questions such as the following: *What should every health profession trainee know about how the built environment influences health? Who should decide whether needs are met in hospital design, particularly when certain groups of people have been excluded from that process in the past? What are the **implications of hostile architecture** in health care spaces?* Ultimately, evidence-based design raises questions about architectural and design standards of care for health care spaces. As occupants of those spaces, whether as patients, caregivers, or health workers, all of us are ultimately affected by design decisions.

References

1. Ulrich RS. View through a window may influence recovery from surgery. *Science*. 1984;224(4647):420-421.
2. York G. Improved patient care at a glance. *Patient Safety and Quality Healthcare*. January/February 2006. Accessed December 12, 2023. <https://www.psqh.com/janfeb06/visibility.html>
3. Ulrich RS, Zimring C, Zhu X, et al. A review of the research literature on evidence-based healthcare design. *HERD*. 2008;1(3):61-125.
4. Renault M. 99% *Invisible*. Episode 557: Model village. October 24, 2023. Accessed December 12, 2023. <https://99percentinvisible.org/episode/model-village/>
5. Using green spaces to support local health. NHS Providers. Accessed December 12, 2023. <https://nhsproviders.org/being-an-anchor-institution/using-green-spaces-to-support-local-health>
6. About EBD. Center for Health Design. Accessed December 12, 2023. <https://www.healthdesign.org/certification-outreach/edac/about-ebd>

Joy C. Liu, MD, MPH is a hospice and palliative medicine fellow at the Icahn School of Medicine at Mount Sinai in New York City. Her work in public policy, health equity, and global health has been featured in *ABC News*, *Undark Magazine*, and *Doximity*.

Citation

AMA J Ethics. 2024;26(12):E899-900.

DOI

10.1001/amajethics.2024.899.

Conflict of Interest Disclosure

Author disclosed no conflicts of interest.

The viewpoints expressed in this article are those of the author(s) and do not necessarily reflect the views and policies of the AMA.



AMA Journal of Ethics®

December 2024, Volume 26, Number 12: E901-908

CASE AND COMMENTARY: PEER-REVIEWED ARTICLE

Who Should Contribute to Decisions About Health Care Space Design?

Diana C. Anderson, MD, MArch and Stowe Locke Teti, MA, HEC-C

Abstract

This commentary on a case considers how and by whom decisions about health care structures and spaces should be made and suggests merits and drawbacks of shared decision-making as one approach to Certificate of Need assessments.

Case

Dr A is an internist widely known for their work in evidence-based health care design. As part of a conference in design innovations in community-based health care, Dr A has been asked to lead a half-day working session for health professions students, clinicians, patient advocates, and community leaders. Dr A explains that Certificate of Need programs are means by which many states are supposed to regulate supply of health care services in their jurisdictions. Dr A then poses to audience members, “Let’s say you’re submitting a Certificate of Need application to build a new hospital. In your proposal, which features in your design drawings and descriptions will you talk about and why?”

Some audience members’ priorities focus on ventilation and waste removal streams, numbers of computer stations, and supply rooms’ proximity to patient care areas. Others suggest why features such as window sizes in patients’ rooms, access to and visibility of a garden courtyard, parking availability, sign clarity and navigability to patient care areas, locations of bathrooms and other common spaces, and easy outside access to municipal transit stops should be design priorities.

As Dr A expected, session participants identified numerous design features. The rest of the half-day, Dr A guided a discussion about how design priorities express stakeholders’ health care infrastructure needs.

Commentary

One purpose of a Certificate of Need is to demonstrate public need for a proposed project. As such, a Certificate of Need purports to speak for a community and necessarily involves value propositions, a priority ranking, and decisions about community interests that a proposed project could serve. How a decision should be made cannot be divorced from who should be part of making it. We and our colleagues have argued elsewhere that health care design involves significant ethical questions

and should be evidence based.^{1,2} Among ethical concerns at the patient level are disclosure, informed consent, and freedom of choice. Macro-level concerns include just distribution of shared, limited resources and procedural justice with respect to public goods such as representation and democratic deliberation. Expanding the group of stakeholders is about not only getting more opinions but ensuring the people affected by the decisions interact with those who have project-specific expertise. Thus, appropriately answering questions about the need for design elements begins with determining 2 things. First, who needs to be present to provide a technically informed, evidence-based answer? Second, who should have a voice in the working session in virtue of being most affected by the outcome? Hospitals are expensive and difficult to modify; any elements that would pose risks of harm or incur unjust distribution of resources will exist for decades and therefore should be carefully considered.¹

Stakeholders

Dr A has included health professions students, clinicians, patient advocates, and community leaders in the working group, but there are 4 conspicuous absences. First, while Dr A is widely known for their work in evidence-based design (EBD), that work is almost certainly avocational as far as actual design goes; Dr A is not an architect, let alone a certified health care architect with subject matter expertise in designing, planning, and constructing health care buildings.³ That means that no one in the working group has the depth of knowledge to review the plans for the new hospital, assess potential failings, and evaluate the pros and cons of competing solutions.⁴

Second, while there are patient advocates in attendance, there are no patients or their families in the working group. Patient advocates are not a substitute for diverse patient experience, which is recognized as an important dimension of health care, alongside clinical effectiveness and patient safety.⁵ Patients are heterogenous; some use the emergency department frequently but are never admitted, whereas others with chronic conditions frequently have long admissions. An admission to an intensive care unit (ICU) is entirely different from a psychiatric admission. Still others have disabilities that make movement or communication difficult. As many patients rely on surrogate decision-makers who are typically family members, family members' hospital experiences matter. Families have experience with waiting areas and navigating public parts of the hospital—things patients themselves rarely experience. Yet family areas are often afterthoughts in facility design,⁶ although family members, safety,⁷ and good health care outcomes⁸ are also critical to patient well-being⁹ and, therefore, should be considered key parts of health care service design.¹⁰

Given the heterogeneity of patient and family experiences and the importance of family member presence in patients' outcomes, it's likely advantageous to involve representatives from different patient populations in working groups for specific purposes. An obstetrics wing or birth center might benefit from input from families who recently had deliveries. Former ICU patients and their families likely have insight on improving ICUs, waiting rooms, and family meeting rooms. Cardiac, pulmonary, and neurology patients and families could provide input on rehab facilities. Likewise for oncology, adolescent medicine, and pediatrics.

Third, nonclinical staff are not typically represented in design decisions. Several accounts in the literature describe a lack of space parity: hospitals have well-designed and appointed spaces for patients and families but not for staff. In particular, a documented decline in staff social spaces signals a devaluing of health care

professionals and denigration of their daily work experience and productivity.^{11,12} Notably, there are no hospital administrators in the working group. Yet there are operational, logistic, and financial realities that must be considered for the working group to focus on realizable features rather than unachievable flights of fantasy. Hospital administrators are essential for providing knowledge of a health care system's or campus's overall vision and future growth strategy.

The first and last oversights can be remedied with the inclusion of health care architects and hospital administrators, but the second will be more difficult; a representative set of concerns would likely require analysis of surveys of patients, family members, and staff. We and our colleagues have argued that, as hospitals already have teams of people who study outcomes and report them as required to oversight agencies, it would be relatively simple to expand quality improvement metrics to include elements of the built environment.¹ Even after a hospital is constructed, opportunities exist for ongoing performance assessment that can inform operational changes. For example, locked space for medication storage that serves an ICU may turn out to be insufficient to bridge resupplies from the central pharmacy, necessitating an expansion of storage near the ICU. Ongoing performance assessment can identify such shortcomings so leadership can guide investment prioritization.

Process

At this point, we have a set of stakeholders who have the necessary expertise in EBD and those who will be most affected by the decisions. The question, *Who should decide whether and how stakeholders' needs are met?* can be answered in the same way we make other decisions in health care that involve technical expertise and normative concerns: shared decision-making.

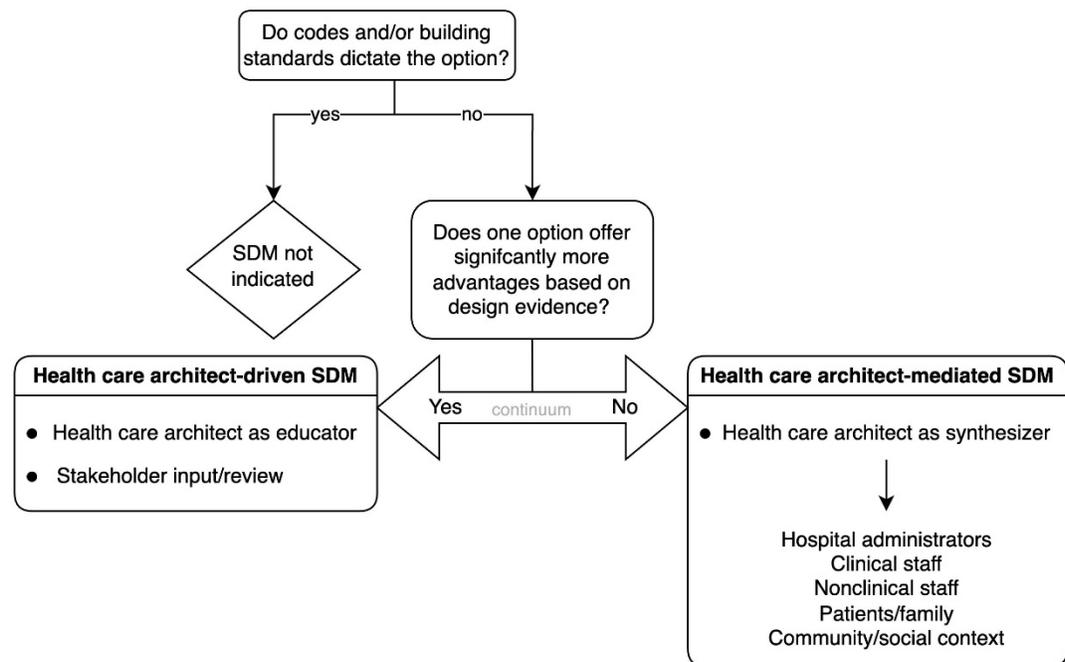
In shared decision-making, clinicians are responsible for determining the range of appropriate options based on the best available evidence or clinical judgment born of long practice and relying on the patient or duly appointed surrogate to choose from among that range of appropriate options based on their values and preferences.¹³ Shared decision-making frameworks have been developed for mediating authority depending on specific features of a given situation and decision. Both Opel's 4-step framework¹⁴ and Teti and Silber's framework¹³ apply this distinction.

Construction of a hospital involves many decisions that are akin to plan-of-care decisions and have myriad effects on patients, families, and staff.¹ Rather than being based on the interests of a single representative patient, however, a hospital's design and construction should result in a facility that serves the community in which that hospital is situated. The hospital might serve only a local community, or it might be part of a regional network that ensures that advanced therapies are available in all regions of a country.

Any decision-making process can be broken down into individual decision points like a plan of care. Some elements are dictated by code, for example, and are not optional; like standard care, all hospitals must meet the various requirements for safety and function. Other decisions involve normative considerations. While some hospital administrators might be tempted to install expensive artwork or sculpture to impress donors, the clinical and nonclinical staff might point out that money would be better spent on providing spaces for staff to meet and interact away from the bedside. The health care architect might point out that design can be used to improve a sense of well-

being—a compelling funding priority after a *New England Journal of Medicine Catalyst* report noted that 83% of clinicians, leaders, and executives viewed physician job satisfaction and burnout as an ongoing issue in their organizations.^{15,16} If they knew of staff needs, patient and family stakeholders might agree that increasing opportunities for health care staff to interact could improve communication and therefore care coordination.¹⁷ It seems likely that Dr A's group would not choose to spend money on or allocate space to art installations if that **money could be used for design elements** that improved performance of health care teams. By adapting a shared decision-making framework, decision-making authority can be organized around both value considerations and the differing epistemic standing of the stakeholders (see Figure).

Figure. Architects' Roles in Developing the Final Design Concept



Abbreviation: SDM, shared decision-making.

Successful **decision-making** involves selecting from among competing choices with any evidential basis. If more than one option remains and no strong evidentiary basis exists for selecting one option versus another, employing a consensus approach with stakeholders affected by the decision is ethically appropriate (see Figure).¹⁴

Scores of decisions pose fertile ground for improving hospital operation and patient outcomes through built space in health care. Consider the following example. It is common today for disagreements to occur about myriad aspects of maternal care in hospitals: mothers' refusal to wear fetal monitoring for fear of higher risk of cesarean section (C-section) is common in our experience, with monitoring contributing to unnecessary C-sections.¹⁸ These disagreements can lead to conflicts that result in disruption of services, poor patient experiences, and an unpleasant work environment. In the case, the health care architect on the project could direct the group of stakeholders to Ariadne Labs' research on the causes of unnecessary C-sections.^{19,20} Ariadne Labs found support for the hypothesis that rates of C-sections could be partly explained by the physical layout and space design of birth facilities. The study authors

posited that unnecessary C-sections could be reduced with design interventions that lessen throughput pressure in birth facilities—for example, by allocating relatively greater space to natural birth areas than operating areas. Through this evidence-based approach, the facility design could incorporate Ariadne Labs' pressure tank model to identify design elements that influence cesarean delivery and put in place steps to mitigate pressure to move patients to C-sections apart from medical need.

To take another example: disruptions to sleep-wake cycles in older patients are known to pose health risks.²¹ Clustering multiple interventions that would normally be spaced throughout the night into a single encounter is a common technique to minimize room entries and exits. However, these patients and their families could work with clinicians to further improve clustered care. They might propose that task lighting be made available for nurses and techs to perform their work in darkened rooms. For charting at the bedside, computer monitors could allow for rotation away from the patient's bed to minimize waking patients unless necessary. Some room designs allow clinicians to look into the room without opening the door. Such simple steps can confer lasting benefits.

In addition to patient care, another clear benefit of an evidence-based approach is improved operations. For example, there are opportunities to use the built environment to reduce conflict and workplace violence by applying existing research on the role of foot traffic flow, “energetic” décor, color schemes, lighting, and discomfiting noise, heat, or furnishings in these behaviors.²² The color Baker-Miller Pink, for example, has been studied in relation to suppression of human aggression.²³ There is already existing precedent for diminishing violence through design in numerous venues, including prisons,²⁴ urban settings,²⁵ and even psychiatric units wherein better design resulted in reduced aggressive behavior and improved staff safety.²⁶

Throughout the shared decision-making process, the stakeholders could evaluate their decisions based on the hospital's or health system's mission, vision, and values. These often include commitments such as putting the patient first, working as a unified team, remaining dedicated to transparency and integrity, and so on. Through shared-decision-making, the built health care environment could come to exemplify these values rather than just hold billboards restating them.

An Answer

A Certificate of Need must include all the elements required by code and jurisdiction, but the purpose of the requirement is to ensure that all proposed building projects meet a need of the community. The goal is to protect existing communities from unfettered development that might contribute nothing to or might damage the fabric of the community. Accordingly, the proposal should address the specific site of the project and any challenges or benefits it has. The proposal should also account for the infrastructure demands of a new hospital: are sufficient power, water, and other resources available? How will developing the site affect existing traffic, and will there be sufficient parking? One challenge is that paying for parking can become very expensive for families who come daily to visit patients with long hospital stays, and this expense can disadvantage patients whose families have limited resources. Benefits to be considered are whether the proposal includes specialty services aligned with the needs of the community (eg, older or younger, urban or rural). An ethically informed proposal that takes into account the views of proposed stakeholder groups would explain how the hospital design is inclusive of different cultures and faiths and if there is a specific community the hospital is intended to serve. For example, if the hospital serves a community in which large

families are common, family meeting rooms should accommodate those larger families and make them feel welcome. If the setting is rural or offers advanced services patients travel for, such as organ transplant, affordable accommodations should be located nearby. Inclusion of representative stakeholders in a process of shared decision-making that mediates decisional authority can promote ethically informed, evidence-based hospital design practices, leading to improved building performance and health outcomes.

References

1. Anderson DC, Teti SL, Hercules WJ, Deemer DA. The bioethics of built space: health care architecture as a medical intervention. *Hastings Cent Rep.* 2022;52(2):32-40.
2. Anderson DC, Hercules B, Teti SL. The bioethics of built healthcare spaces. *Hastings Bioethics Forum.* January 13, 2021. Accessed May 8, 2024. <https://www.thehastingscenter.org/the-bioethics-of-built-health-care-spaces/>
3. Becoming certified. American College of Healthcare Architects. Accessed July 29, 2024. <https://healtharchitects.org/becoming-certified/>
4. Hamilton DK, Pentecost AR 3rd, McKahan D. ACHA evolves with the health care design profession. American College of Healthcare Architects plays a vital role in maintaining the profession's integrity. *Health Facilities Management Mag.* Feb 1, 2017. Accessed May 8, 2024. <https://www.hfmmagazine.com/articles/2676-acha-certification-stands-test-of-time>
5. Oben P. Understanding the patient experience: a conceptual framework. *J Patient Exp.* 2020;7(6):906-910.
6. DiNardo A. Family and visitor spaces: an opportunity to innovate. *Healthcare Design Mag.* June 6, 2014. Accessed May 8, 2024. <https://healthcaredesignmagazine.com/trends/architecture/family-and-visitor-spaces-opportunity-innovate/>
7. Correia T, Martins MM, Barroso F, Pinho L, Longo J, Valentim O. The family's contribution to patient safety. *Nurs Rep.* 2023;13(2):634-643.
8. Clay AM, Parsh B. Patient- and family-centered care: it's not just for pediatrics anymore. *AMA J Ethics.* 2016;18(1):40-44.
9. Mohsen S, Moss SJ, Lucini F, et al. Impact of family presence on delirium in critically ill patients: a retrospective cohort study. *Crit Care Med.* 2022;50(11):1628-1637.
10. Prior SJ, Campbell S. Patient and family involvement: a discussion of co-led redesign of healthcare services. *J Particip Med.* 2018;10(1):e5.
11. Landy J. How architects ruined healthcare. *Globe and Mail.* May 24, 2019. Accessed May 8, 2024. <https://www.theglobeandmail.com/opinion/article-how-architects-ruined-healthcare/>
12. Uys C, Carrieri D, Mattick K. The impact of shared social spaces on the wellness and learning of junior doctors: a scoping review. *Med Educ.* 2023;57(4):315-330.
13. Teti SL, Silber TJ. Parental permission, childhood assent, and shared decision-making. In: Nortje N, Bester JC, eds. *Pediatric Ethics: Theory and Practice.* Springer Nature; 2022:111-125.
14. Opel DJA. A 4-step framework for shared decision-making in pediatrics. *Pediatrics.* 2018;142(suppl 3):S149-S156.
15. DiNardo A. Workplace meets healthcare: mix & match. *Healthcare Design Mag.* June 17, 2019. Accessed May 8, 2024.

<https://healthcaredesignmagazine.com/trends/architecture/workplace-meets-healthcare-mix-match/>

16. Swensen S, Strongwater S, Mohta NS. Leadership survey: immunization against burnout. *NEJM Catalyst*; 2018. Accessed May 8, 2024. https://qi.elft.nhs.uk/wp-content/uploads/2018/04/Immunization-Against-Burnout_Swenson-2018.pdf
17. O'Daniel M, Rosenstein AH. Professional communication and team collaboration. In: Hughes RG, ed. *Patient Safety and Quality: An Evidence-Based Handbook for Nurses*. Agency for Healthcare Research and Quality; 2008:chap 33.
18. Ledbetter A. C-section rates are way too high. We need to hold doctors and hospitals accountable. *Scientific American*. July 21, 2023. Accessed September 11, 2024. <https://www.scientificamerican.com/article/c-section-rates-are-way-too-high-we-need-to-hold-doctors-and-hospitals-accountable/>
19. Shah N. Designing capacity for high value healthcare: the impact of design on clinical care in childbirth. Ariadne Labs; 2015. Accessed May 8, 2024. https://www.ariadnelabs.org/wp-content/uploads/2017/04/170223_Ariadne-Report_Final.pdf
20. Shah N, Barker K. Doctor-architect collaboration explores whether hospital design impacts care during childbirth. Ariadne Labs. December 14, 2015. Accessed May 8, 2024. <https://www.ariadnelabs.org/resources/articles/doctor-architect-collaboration-explores-whether-hospital-design-impacts-care-during-childbirth-2/>
21. FitzGerald JM, O'Regan N, Adamis D, et al. Sleep-wake cycle disturbances in elderly acute general medical inpatients: longitudinal relationship to delirium and dementia. *Alzheimers Dement (Amst)*. 2017;7(1):61-68.
22. Conflict and violence in pubs: design issues. MCM Research; 1992.
23. Irish J. The surprisingly dark history of the color pink. *Fast Company*. September 28, 2018. Accessed September 11, 2024. <https://www.fastcompany.com/90243505/the-surprisingly-dark-history-of-the-color-pink>
24. How Norway turns criminals into good neighbours. *BBC*. July 6, 2019. Accessed May 8, 2024. <https://www.bbc.com/news/stories-48885846>
25. Shepley M, Sachs N, Sadatsafavi H, Fournier C, Peditto K. The impact of green space on violent crime in urban environments: an evidence synthesis. *Int J Environ Res Public Health*. 2019;16(24):5119.
26. Ulrich RS, Bogren L, Gardiner SK, Lundin S. Psychiatric ward design can reduce aggressive behavior. *J Environ Psychol*. 2018;57:53-66.

Diana C. Anderson, MD, MArch is an assistant professor of neurology at Boston University in Massachusetts and a health care principal at Jacobs, a global solutions firm. She completed her fellowship in bioethics at Harvard Medical School's Center for Bioethics. As a "dochitect," she combines educational and professional experience in both medicine and architecture to explore questions about ethics of built spaces.

Stowe Locke Teti, MA, HEC-C is a senior clinical ethicist at Inova Health System and an instructor of medicine at the University of Virginia School of Medicine in Charlottesville. He is also an instructor of family medicine at the Georgetown University School of Medicine, where he teaches at the Pellegrino Center for Clinical Bioethics. His recent research, writing, and presentations have included shared decision-making theory, the use of data in clinical ethics, and the bioethics of built spaces.

Editor's Note

The case to which this commentary is a response was developed by the editorial staff.

Citation

AMA J Ethics. 2024;26(12):901-908.

DOI

10.1001/amajethics.2024.901.

Conflict of Interest Disclosure

Authors disclosed no conflicts of interest.

The people and events in this case are fictional. Resemblance to real events or to names of people, living or dead, is entirely coincidental. The viewpoints expressed in this article are those of the author(s) and do not necessarily reflect the views and policies of the AMA.

CASE AND COMMENTARY

How Should We Respond to Spatial Injustice in Health Care Organizations?

Ian M. Johnson, PhD, LCSW

Abstract

Hostile design is a built environment strategy to discourage unwanted behaviors or limit use by unwanted users in a space. This commentary on a case identifies how hostile design choices perpetuate spatial injustice in both health care settings and the surrounding community and argues that health care organizations have duties to mitigate adverse health consequences of such spatial injustices. This commentary then describes strategies for identifying overt and covert hostile design of health care spaces and proposes future practices and translational research to make health care environments' designs accessible, approachable, and more just.

Case

AA has lived with chronic obstructive pulmonary disease (COPD) for over 10 years. During the past year, AA's symptoms became more severe, and AA is now being hospitalized for the third time in 2 months for an acute exacerbation of COPD.

Even with the door closed, AA's hospital room is noisy, with hallway bustle and television noise intrusion from a neighboring room. AA's room has a single chair but no suitable furnishing to accommodate a cousin, whom AA would prefer to stay overnight. When AA feels well enough to walk the hallway, they feel anxious about having no seating on which to rest.

Given AA's increased COPD exacerbations, a home nebulizer has been prescribed by their pulmonologist, Dr P. Before being discharged from the hospital, AA was given written instructions about how to assemble and use the nebulizer, but the nebulizer is still not working properly. "Why do they make it so hard to use this thing?" AA wonders aloud. "Medical equipment and hospital rooms are supposed to help!"

Commentary

Hostile architecture is a design strategy used to deter unintended use of space. While such strategies can be innocuous, such as pigeon spikes to prevent roosting, strategies to reduce the visibility of poverty and promote economic revitalization of urban centers can also intentionally aim to exclude and enact separation among social groups.¹ Overt

examples of such strategies include seat dividers on park benches or public transportation and—to decrease the presence of homelessness—placement of large boulders under overpasses and bright lighting in overhangs and alleyways.^{2,3} Covert strategies such as the installation of public art projects or electronic bike docks have also been deployed to intentionally displace groups from public space⁴ with plausible deniability.⁵

Hostile architecture has primarily been explored in urban public outdoor settings,⁶ but health care institutions are not exempt from **design choices that reduce accessibility**, exacerbate symptoms, discourage future engagement, and contribute to exclusion. In AA's case, the built environment of the hospital offers overexposure to unwanted stimuli (eg, noise, lack of privacy) and, simultaneously, not enough desired contact with formal and informal caregivers. AA's case also reminds us of how spatial inequities are perpetuated in health care institutions—for example, how increased privacy is offered as a luxury for patients who can pay an extra cost.

Whether intentional or not, health care design strategies generally do not consider patient experiences or how these experiences fit into broader patterns of people's interactions with built environments in the community. As the primary health care access point for community members who have no or inadequate insurance, have low income, or have no immigration documentation,⁷ safety net health care sites must self-examine their roles as both contributors and counterpoints to spatial representations of hostility. Accordingly, safety net health care sites must generate possible action steps to advocate for spatial justice—the resolution and transformation of place-based inequity⁸—within their walls and throughout the community.

Identifying Unjust Design

Place is neither static nor neutral. While architects and builders create the initial version, place is constantly reshaped by its use and the interactions occurring within it.⁹ It follows that place can hold different—even competing and conflicting—meanings for different people or at various times. AA's walks along the chairless hallway aroused a sense of fear and anxiety, which are often pronounced emotional responses during COPD exacerbations.¹⁰ Like other “invisible” impairments, shortness of breath and correlated anxiety symptoms are underattended to as medical needs warranting access to care.¹¹ To meet patient needs like AA's, hospitals could include accommodations such as increased seating and handrails, interventions to reduce noise and visual stimuli, and elements to promote calm and regular breathing (eg, plants, cool paint colors).

If individual experience gives meaning to health care places, larger sociopolitical and cultural forces inform how such places are made and the functions they serve. In the dawn of Fordism, health care planners adopted principles from factory and manufacturing design, placing a spatial focus on maximizing scale, efficiency, and profit.¹² Institutional aesthetics of health care places can also reproduce individual, intergenerational, and cultural harms, particularly for patient populations experiencing structural vulnerabilities.¹³ While US hospitals have long served as sites of containment—guided in part by actual contagion prevention—the spatial realities of hospitals can also reflect moral contagion, whereby those with low income,¹⁴ mental illness,¹⁵ or medically stigmatized conditions^{16,17} are exiled and contained to ensure perceived safety for society writ large. More contemporarily, stories emergent from the COVID-19 pandemic indicate that minoritized people experienced inequitable social

isolation, companionship, and care in nursing homes¹⁸ and in hospitals and other health care facilities,¹⁹ in part due to spatial arrangements by which care is distributed and performed. Design strategies like limited seating or unmovable or nonadaptive furniture discourage patient-patient interactions and the presence of loved ones. Such design decisions also limit possible engagement and health education of loved ones as care partners, as in the case of AA, who struggled to assemble the nebulizer alone.

In the wake of findings of acute and longitudinal health benefits of resident-centered and inclusive urban design,²⁰ the hospital is charged with being a sanctuary that ensures safety and health through its design. When decision-makers in health care acknowledge the historical, personal, and intergenerational trauma experienced by many patients, they can be attentive to human-environment interactions that could incite harm—for example, lighting, sound, extent of audiological and visual privacy, where security is positioned in and around the grounds, or ease of access to basics such as toilets, water, and food. Interfaces and transitions between public space and the hospital must be considered—including entrances, lobbies, atria, outdoor space, and walkways²¹—as patient dumping,²² self-discharge,²³ and complex health care needs²⁴ can place vulnerable people in such interstitial spaces. Waiting rooms and intake spaces are the next spatial layer of the health care space. Physical barriers such as glass partitions produce feelings of segregation and othering for some; perceptible audiovisual information about someone's presence or health condition can increase both stigma and discrimination; and cramped seating areas discourage emotional regulation and sensory modulation.²⁵ Moreover, placing gender-binary restrooms within the sight line of a security desk might encourage exclusionary interactions. The final spatial layer of the health care space comprises patient rooms. On hospital units, “institutional feel”—stark white walls, uncomfortable furniture, lack of proximity between patient and staff-designated spaces—can reinforce hostile interactions between staff and patients that lead to restraint and seclusion.²⁶ More research is needed on how the atmosphere and meaning of an examination room is shaped by what is hanging on the wall, what seating is offered, how staff and patients interact in the space with instruments like a blood pressure cuff, and how much time patients spend alone in the space.

Toward Spatial Justice in Health Care

While security and exclusion have long been central features of architectural innovation, design of health care spaces and public urban landscapes has recently centered accessibility, joy, and well-being. Decreasing the institutional feel of medical settings is a common design goal, often enacted by altering one variable of the environment (eg, noise, paint color, lighting) to increase quality of care.²⁷ Natural elements such as gardens that are frequently incorporated in health care environments enhance privacy, facilitate personal reflection, aid in therapeutic modalities (eg, physical and occupational therapy and pastoral care), and increase patient visitation.²⁸ In addition, windows and sight lines have been considered as possible factors that affect patient interactions.²⁹

Best practices suggest that comfort, community, and choice should guide design decisions.³⁰ For example, there has been a growing emphasis on barrier-free design and increased flexibility (eg, movable furniture) within health care institutions to increase patient and visitor sense of agency and comfort.³¹ Other architectural elements that uphold these values include open, circular floor plans and wide hallways,³¹ as well as design features like natural lighting and window access and proximity of nursing stations.^{31,32} Exemplar inclusive design sites attempt to accommodate diverse needs for

and uses of public and semi-public space and to reduce barriers and increase convenience among the most disenfranchised.³³ For AA, such design features could reduce ambient noise, increase their perceived sense of safety, and enhance visitor comfort.

While the site planning, construction, and design of health care spaces may be far out of the reach of clinicians, health care workers can respond strategically to the impact of hostile architecture on and off site. Health care professionals already manipulate the built environment to enhance care provision³² and can continue to do so by centering patients in how they choose to interact with spaces. Health care workers can hone their attention to hostile design's role in patient experience, symptoms, and care and promote consciousness-raising in training, consultation, and internal **advocacy** apparatuses. Public health workers are also responsible for advocating for environmental changes in the larger community that affect health and can speak out against hostile architecture in their community from a valuable vantage point, providing anecdotal evidence of the human consequences. Health care workers can also integrate spatial and geographic factors into their patient assessments to better ensure treatment adherence. Even in times of budget restrictions and resource scarcity, clinical-level interventions can offset patient discomfort in cases such as AA's—such as when clinicians provide a white noise machine or a chair outside the room. In discharge planning, AA's team could more deeply explore how a nebulizer could fit into AA's current daily rhythms in order to learn how and with whom to provide instructions on its use.

Medical ethicists and allied health professionals can align with community activists, architects and designers, and scholars who are actively responding to hostile architecture by taking a public stand against its installation, raising community awareness, and expressing concerns about its health care impacts in policy forums. Cities across the country now host hostile architecture tours to raise awareness of diverse sponsors from libraries, design firms, art museums, and tourism companies.^{34,35} Nonprofit organizations have developed informational resources and advocacy tools.³⁶ The development of accessible, approachable health care environments also requires more translational research that engages with **marginalized stakeholders** at each step of the research process. Methods for this research could include archival analyses of health policy and news documents, ethnographic observation of health care spaces, walking interviews, focus groups, and participatory mapping.

Conclusion

Recognizing hostile design within health care spaces is one step toward addressing disparities in social determinants of health. As demonstrated in AA's case, spatially just hospitals could offer opportunities for enhanced patient care and satisfaction, treatment adherence, and community-hospital relations. Framing place as dynamic and historical can help reveal the duality of the hospital as a site for both respite from hostile design and replication of that hostility. Health workers are ethically obligated to become engaged in institutional consciousness-raising and collective community action that responds to hostile design deployed in health care spaces. True healing extends beyond medical intervention, encompassing an environment that welcomes, embraces, and empowers the most vulnerable. Through patient-centered and intentional design choices, all who seek care can experience trust, dignity, and belonging.

References

1. Toolis EE, Hammack PL. "This is my community": reproducing and resisting boundaries of exclusion in contested public spaces. *Am J Community Psychol*. 2015;56(3-4):368-382.
2. Petty J. The London spikes controversy: homelessness, urban securitisation and the question of "hostile architecture." *Int J Crime Justice Soc Democr*. 2016;5(1):67-81.
3. Cellini M. Design against humanity. National Coalition for the Homeless. Accessed January 29, 2024. <https://nationalhomeless.org/design-against-humanity/>
4. Balliger R. Painting over precarity: community public art and the optics of dispossession, gentrification and governance in West Oakland, CA. *J Urban Cult Stud*. 2021;8(1):81-107.
5. Understanding hostile architecture: the cause and effect of restricting public space. Neighborhood Design Center. October 2, 2023. Accessed January 29, 2024. <https://ndc-md.org/news-and-stories/understanding-hostile-architecture-the-cause-and-effect-of-restricting>
6. de Fine Licht KP. Hostile urban architecture: a critical discussion of the seemingly offensive art of keeping people away. *Nordic J Applied Ethics*. 2017;11(2):27-44.
7. Hefner JL, Hogan TH, Opoku-Agyeman W, Menachemi N. Defining safety net hospitals in the health services research literature: a systematic review and critical appraisal. *BMC Health Serv Res*. 2021;21(1):278.
8. Soja EW. *Seeking Spatial Justice*. University of Minnesota Press; 2010.
9. Lefebvre H. *Critique of Everyday Life*. Verso Books; 2014.
10. Halpin D, Hyland M, Blake S, et al. Understanding fear and anxiety in patients at the time of an exacerbation of chronic obstructive pulmonary disease: a qualitative study. *JRSM Open*. 2015;6(12):2054270415614543.
11. Gysels M, Higginson IJ. Access to services for patients with chronic obstructive pulmonary disease: the invisibility of breathlessness. *J Pain Symptom Manage*. 2008;36(5):451-460.
12. Ahuja NK. Fordism in the hospital: Albert Kahn and the design of Old Main, 1917-25. *J Hist Med Allied Sci*. 2012;67(3):398-427.
13. Giesbrecht M, Stajduhar K, Mollison A, et al. Place-based experiences of formal healthcare settings by people experiencing vulnerability at the end of life. *J Pain Symptom Manage*. 2018;56(6):e56.
14. Brown P. *The Transfer of Care: Psychiatric Deinstitutionalization and Its Aftermath*. Routledge; 2024.
15. Ben-Moshe L, Chapman C, Carey AC, eds. *Disability Incarcerated: Imprisonment and Disability in the United States and Canada*. Palgrave Macmillan; 2014.
16. Gaudlip A. Revisiting Louisiana's medical legacy: the national leprosarium in Carville. Preservation Resource Center of New Orleans. May 1, 2020. Accessed January 29, 2024. <https://prcno.org/revisiting-louisianas-medical-legacy-national-leprosarium-carville/>
17. Rangel JC, Holmes D, Perron A, Miller GE. Biopower under a state of exception: stories of dying and grieving alone during COVID-19 emergency measures. *Med Humanit*. 2022;48(4):471-479.
18. Krupar S, Sadural A. COVID "death pits": US nursing homes, racial capitalism, and the urgency of antiracist eldercare. *Environ Plan C Polit Space*. 2022;40(5):1106-1129.

19. Lee D, Kett PM, Mohammed SA, Frogner BK, Sabin J. Inequitable care delivery toward COVID-19 positive people of color and people with disabilities. *PLOS Glob Public Health*. 2023;3(4):e0001499.
20. Irvani H, Rao V. Health benefits of new urbanism. *Public Square*. February 4, 2019. Accessed September 16, 2024.
<https://www.cnu.org/publicsquare/2019/02/04/health-benefits-new-urbanism>
21. Setola N, Borgianni S. *Designing Public Spaces in Hospitals*. Routledge; 2016.
22. Venkatesh AK, Chou SC, Li SX, et al. Association between insurance status and access to hospital care in emergency department disposition. *JAMA Intern Med*. 2019;179(5):686-693.
23. Foster K, Caswell A, James L, et al. The risk factors, consequences, and interventions of discharge against medical advice—a narrative review. *Am J Med Sci*. 2023;366(1):16-21.
24. Johnson IM. Aging in the downtown corridor: mapping the neighborhood experiences of Seattle’s unhoused adults over age 50. *J Aging Stud*. 2022;60:100997.
25. Liddicoat S. The therapeutic waiting room: therapist and service user perspectives on the psychologically supportive dimensions of architectural space. *HERD*. 2020;13(2):103-118.
26. Oostermeijer S, Brasier C, Harvey C, et al. Design features that reduce the use of seclusion and restraint in mental health facilities: a rapid systematic review. *BMJ Open*. 2021;11(7):e046647.
27. Sternberg EM. *Healing Spaces: The Science of Place and Well-Being*. Harvard University Press; 2009.
28. Sagha Zadeh R, Eshelman P, Setla J, Kennedy L, Hon E, Basara A. Environmental design for end-of-life care: an integrative review on improving the quality of life and managing symptoms for patients in institutional settings. *J Pain Symptom Manage*. 2018;55(3):1018-1034.
29. Shopworks Architecture; Group 14 Engineering; University of Denver Center for Housing and Homelessness Research. Designing for healing, dignity, and joy: promoting physical health, mental health, and well-being through trauma-informed design. Shopworks Architecture; 2020. Accessed May 6, 2024.
https://shopworksarc.com/wp-content/uploads/2020/06/Designing_Healing_Dignity.pdf
30. Williams AM. Therapeutic landscapes as health promoting places. In Brown T, McLafferty S, Moon G, eds. *A Companion to Health and Medical Geography*. Wiley; 2009:205-223.
31. Nuamah J, Rodriguez-Paras C, Sasangohar F. Veteran-centered investigation of architectural and space design considerations for post-traumatic stress disorder (PTSD). *HERD*. 2021;14(1):164-173.
32. Frandsen AK, Gottlieb SC, Harty C. Spatial configurations of healthcare practices. In: Thurairajah N, ed. *Proceedings of the Joint CIB International Conference: Management of Construction: Research to Practice*. Birmingham School of the Built Environment; 2012:1062-1073.
33. Anders C, Bloom C, Braouzu V, et al. Hospitals. In: Buxton P, ed. *Metric Handbook: Planning and Design Data*. 7th ed. Routledge; 2021:chap 20.
34. Northwest Ohio Coalition for the Homeless. Hostile architecture—Carnegie West Library. PocketSights. Accessed May 6, 2024.
<https://pocketsights.com/tours/place/Hostile-Architecture-Frank-Novak-Park-84255:8643>

35. Hostile architecture tour. Architecture Lobby. Accessed May 6, 2024. <https://architecture-lobby.org/event/hostile-architecture-tour/>
36. Get involved. National Coalition for the Homeless. Accessed September 16, 2024. <https://nationalhomeless.org/get-involved/>

Ian M. Johnson, PhD, LCSW is an assistant professor of social work at the University of Texas at San Antonio. His research, service, and practice focus on health and housing justice for older adult populations.

Editor's Note

The case to which this commentary is a response was developed by the editorial staff.

Citation

AMA J Ethics. 2024;26(12):E909-915.

DOI

10.1001/amajethics.2024.909.

Conflict of Interest Disclosure

Author disclosed no conflicts of interest.

The people and events in this case are fictional. Resemblance to real events or to names of people, living or dead, is entirely coincidental. The viewpoints expressed in this article are those of the author(s) and do not necessarily reflect the views and policies of the AMA.

CASE AND COMMENTARY: PEER-REVIEWED ARTICLE

Which Values Should Guide Health Care Organizations' Retrofit Expenditures on Patient-Centered and Evidence-Based Design?

Ellen Taylor, PhD, MBA, BArch

Abstract

When built environments in health care result from an evidence-based design (EBD) process, they are interventions that can improve patients' health outcomes. This commentary on a case discusses which ethical values should guide organizations' capital expenditure decisions about retrofits, which might be more costly than the original budget. This discussion urges reevaluation of the common assumption that capital improvements are "sunk costs," since such improvements can promote long-term positive health outcomes for an organization's patients, thereby advancing both financial value and ethical values. This commentary also suggests that EBD offers key interventions that are clinically and ethically relevant.

Case

A large health system has contracted with an architectural firm to develop plans for renovations of one of its hospitals. Originally built in the late 1960s, the building is in an urban-based community. During a planning meeting, the architect considers suggesting incorporating a white noise sound system, other sound-masking equipment, and good lighting in the design plans, since there is evidence that these features promote more peaceful inpatient environments. Despite the likelihood that these retrofits would improve patients' experiences, the architect is concerned that they will cost far more than the contract's budget allocates and wonders whether to suggest the retrofits.

Commentary

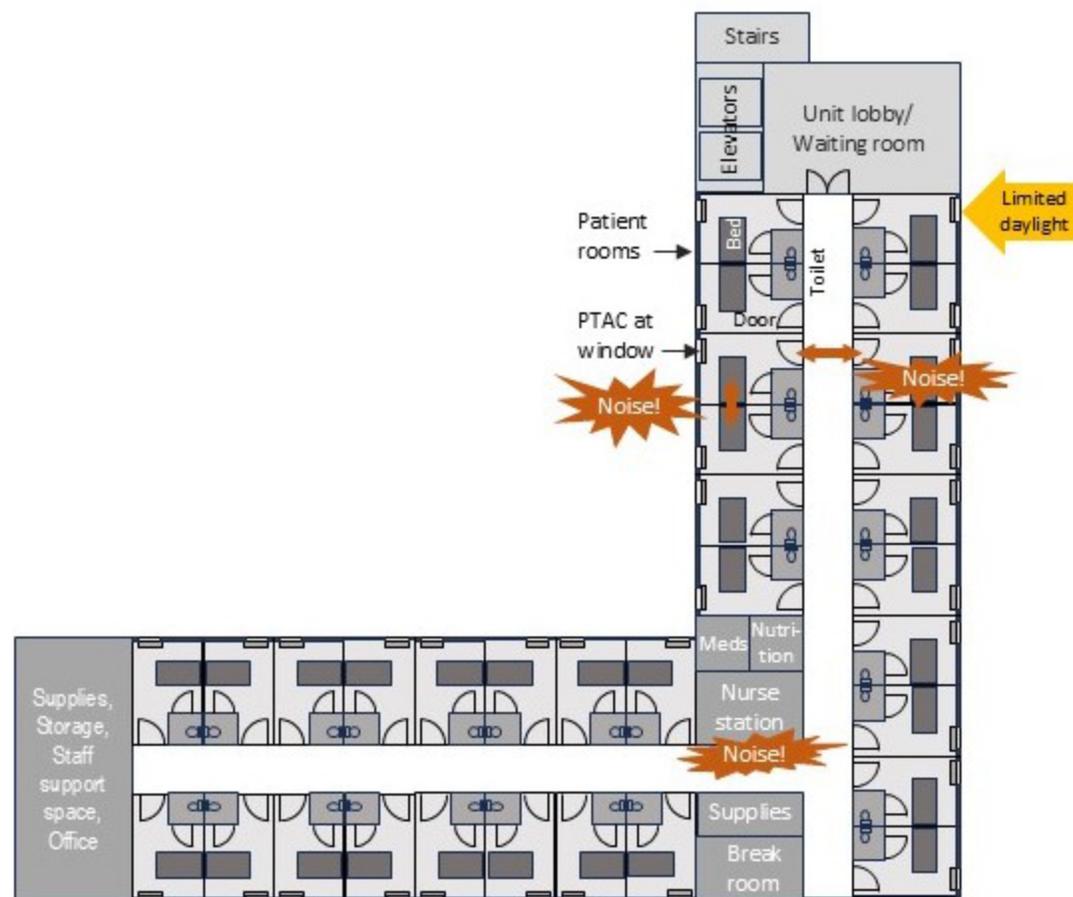
When renovating a facility, stakeholders have an opportunity—and an ethical obligation¹—to do more than base decisions on personal preferences and budgets. Health care organizations undertaking a facility design project should require an evidence-based design (EBD) process, wherein the team bases "decisions about the built environment on credible research to achieve the best possible outcomes."² The long-term benefits of improved outcomes should shift the view of the project from being a "sunk cost" (ie, a cost that will never be recovered) to being an investment with the potential for payback over the usable life of the project. The return is calculated based not only on hard "dark green" dollars (ie, measurable financial outcomes, such as resource use, length of stay, and staffing), but also on soft or "light green" dollars (ie,

harder-to-quantify organizational consequences, such as reputation, patient and staff satisfaction, and workplace safety).³ Accordingly, the priority in renovating a facility shifts from *How much should we spend?* to *What design decisions will contribute to improved clinical performance and improved financial outcomes?* Furthermore, just as clinical ethical principles are applied to medical practice,⁴ so they can equally be applied to the practice of facility design. We should also ask: *What is our obligation to align design decisions affecting care delivery with the principles of beneficence, nonmaleficence, autonomy, and justice?* and *How do we value such design decisions (literally and figuratively)?* This article describes a framework for decision-making about EBD renovations that are both clinically relevant and ethically sound.

Identify Challenges in EBD

The first step in meeting the obligation for renovations that improve clinical outcomes is to identify challenges in the project, including environmental conditions and ethical tensions, and to define the problems that need solving. In this case (hypothetically illustrated in the Figure), there are a host of design features that influence conditions of noise and light, as well as other environmental conditions that might lead to undesirable health-related outcomes.

Figure. Fictional 1960s Medical-Surgical Unit



Abbreviation: PTAC, packaged terminal air conditioner.

While noise and lighting are identified challenges, these are not the final outcomes of interest. The environmental conditions should be considered in the context of adverse

health-related outcomes to first identify clinical ethical principles relevant to possible solutions (see Table 1).

Table 1. Design Features, Environmental Conditions, Outcomes, and Ethics

Design feature	Environmental condition	Adverse outcome	Ethical principle ^{4,5,6}
Centralized nurse station	Noise	Interruptions and distractions could lead to safety concerns.	Nonmaleficence ^a
Centralized nurse station, hallways	Noise	Loud conversations could create ambient noise in patient rooms.	Beneficence ^b
PTACs	Noise	Noisy on-off cycles disrupt sleep.	Beneficence ^b
Walls that extend to ceiling	Noise	Sound travels through wall into adjacent patient room, potentially disrupting sleep.	Beneficence ^b
Doors across from each other	Noise	Conversations more easily heard across the hall in the opposite patient room, creating privacy concerns.	Autonomy ^c
Absence of ICU windows	Light	Lack of daylight could disrupt circadian rhythms of staff and patients.	Beneficence ^b
Small private rooms	Layout	Inappropriate caregiver space could result in nurse injury.	Nonmaleficence, ^a distributive or procedural justice ^{d,e}
Small rooms	Layout	No space for families or visitors to support the patient.	Distributive justice ^e
Small windows	Light	Limit patient views.	Beneficence ^b
Non-dimmable lighting	Light	Nighttime tasks that require room lights to be turned on disrupt patient sleep, which can lead to injurious falls.	Nonmaleficence ^a
Fluorescent lighting	Light	Older technology is less energy efficient than LED lighting and contributes to hazardous waste.	Distributive justice ^e

Abbreviations: ICU, intensive care unit; LED, light-emitting diode; PTACs, packaged terminal air conditioners.

^a Nonmaleficence is the obligation to prevent harm (eg, medication errors, falls).

^b Beneficence is the obligation to provide care that benefits the patient and promotes their welfare (eg, quality sleep/appropriate melatonin production for healing, positive distractions).

^c Autonomy is the obligation to respect the patient's capacity for self-determination, but autonomy is more explicitly aligned here with the obligation to protect patient confidentiality.

^d Procedural justice entails the process used to realize fair outcomes and distributive justice (eg, including end users in decision-making to mitigate the risk of injury).

^e Distributive justice is the obligation to fairly and equitably distribute scarce resources (eg, environments supportive of staff and of the patient and family experience, potential cost savings through consideration of financial benefits and cost avoidance).

Built Environment Interventions

Because built environments contain features that directly or indirectly influence health,⁷ an essential component of an EBD process is to examine the existing evidence of environmental conditions, such as noise and light, related to outcomes of interest in order to identify design opportunities for improving care that align with clinical ethical principles.

Noise. Noise is most consistently referenced in the context of disrupted sleep, but hospital noise is also linked to speech privacy, cognitive processing, and even posthospital syndrome.^{8,9,10} Noise also affects nurse anxiety, stress, and burnout.¹¹ Noise is so important that it is included in national patient experience surveys—the Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS)—that are collected and publicly reported for nearly every US hospital.¹² HCAHPS scores have been shown to be influenced by minimum sound levels,¹³ as well as by the occurrence

rate of peak sound levels.^{13,14} The “quiet at night” question, a proxy for quality sleep,¹⁵ has been one of the lowest performance scores since the survey’s inception. According to 2023 data, only 62% of patients reported that the area around their room was always quiet at night.¹⁶ Supporting the principle of beneficence, research has demonstrated that white noise (eg, ocean sounds) can improve sleep,¹⁷ which can reduce depression¹⁸ and heart rate¹⁹ for some patient populations.

Light. Like noise, **lighting can also contribute to disrupted sleep**^{10,20,21} and negative health outcomes resulting from disrupted circadian rhythms.²² Good lighting might be defined in a number of ways. In addition to providing appropriate light levels for tasks with energy-efficient fixtures, the nonvisual biologic effects of lighting should be considered in the early phases of hospital design. Research suggests that using dynamic lighting (eg, circadian, tunable) can improve sleep duration for some patients,²¹ thereby supporting the principle of beneficence. Blue-depleted lighting might result in less suppressed melatonin levels, increased sleep time, increased rapid eye movement sleep, and lower neurocognitive arousal.²³ Accordingly, the Society of Anesthesia and Sleep Medicine has called for patient sleep optimization measures in patient care guidelines.²⁴

Furthermore, modern lighting technology is more energy efficient, using perhaps 40% less energy than older florescent fixtures.²⁵ In this case, it is fortuitous that the same dynamic lighting design intervention might support independent goals of attaining sustainability targets (eg, energy efficiency) and improving the patient experience (eg, quality sleep). This example illustrates a common occurrence in the EBD process, wherein a design intervention may influence multiple outcomes that may or may not be mutually exclusive. In the context of distributive justice, potential cost savings can be considered in future resource allocation decisions.

Light and noise can also contribute to medication errors that affect patient health and safety, adding to an economic burden associated with increased length of stay, death, and use of postdischarge resources.²⁶ Additionally, as indicated above, light and noise can result in disrupted sleep, and sedative hypnotic drugs prescribed for sleep-wake dysfunction can have adverse effects, including falls and delirium.²⁷

EBD and Business Decisions

One aim of an EBD business case is to weigh costs of construction against returns for alternatives that contribute to improved outcomes. In a theoretical example of a business case for better health care design, researchers estimated cost avoidance of adverse events to offset incremental costs of construction, resulting in a simple payback period of 1 to 3 years.^{28,29} The EBD business case recognizes that improved outcomes and reducing avoidable harm are inseparable from the life-cycle cost of operations. This approach, which takes into account both financial and ethical value, provides an additional opportunity to consider the alignment of solutions with ethical principles.

Cost. Construction costs are often called first costs, but there are operating (life-cycle) costs (eg, maintenance, replacement) to be considered as well. Newer approaches to aid **decision-making** aim to forecast the long-term costs of construction and ownership (costs and revenues) over the estimated building lifespan.³⁰ This holistic approach is better suited to a broad concept of financial value that can be realized in indirect social and ethical outcomes, as well as in direct monetary outcomes. Projects can be compared using net present value (NPV), a discounted cash flow that reflects the time-

value of money, with a higher NPV reflecting a higher rate of return.³¹ The discounted payback allows a ranking of alternatives so that organizations can more objectively decide which projects to pursue and the opportunities that may be lost through choice selections (the opportunity cost). There is a myriad of deterministic and probabilistic methods that can be used to create financial models.⁷ While NPV typically applies to projects, it can also apply to individual decisions within a facility design project. As discussed below, part of the outcomes-related decision should include consideration of clinical ethics.

Value the values. Organizational values in the form of a vision statement and guiding principles, which often include the patient experience and safety, often drive projects. Nevertheless, short-term priorities, such as the project budget, easily dominate design decision-making. Containing the budget is one organizational value and aims to protect and preserve the distribution of resources across organizational imperatives, but there is rarely (if ever) a consideration of bioethical principles. In this case, the architect is reluctant to suggest design interventions with known positive effects solely due to containing the budget, one value among many. Is it ethical to ignore the potential influence of design on improved health and outcomes? Who has the responsibility to raise the issues? Do we really value the patient experience beyond marketing language? An EBD process that includes a truly interdisciplinary team (with bioethicists) could create a space for ethical discussions that frame the desired outcomes. However, **advocating for ethical design interventions** that are known to influence outcomes could be even more powerful when accompanied by the EBD business case. Valuing the values might aid in resolving the potential conflict between ethical and traditional business decision-making principles.

Valuing solutions. For this case, the team will need to consider the scope of improvements, their incremental costs (the amount in excess of the “standard” condition), and the benefits associated with improved outcomes. For noise, the team should evaluate the best solutions to mask the most disruptive sources commonly identified in the literature (eg, staff conversations). The cost of a noise-masking system would be evaluated against the potential for beneficence (eg, improved health and welfare), as well as higher HCAHPS scores that might lead to higher reimbursement from the Centers for Medicare and Medicaid.^{32,33} This financial benefit would help turn light green dollars into dark green dollars. For lighting, the team should consider that reduced energy use with modern light-emitting diode lighting results in lower utility costs, such that the new lighting could pay for itself over time. Funding might also be obtained through energy grants, incentives, or rebates. However, in the EBD business case, while reduced energy use directly affects operating costs, the indirect costs of ethical medical care (eg, improved sleep) might be valued with respect to reduced prescriptions to improve hospital sleep,^{34,35,36} reduced posthospital syndrome, and reduced follow-up care.^{10,37} While savings from improved health-related outcomes might be light green dollars, they are important considerations for ethical medical care that can also lead to dark green dollars in the avoidance of 30-day readmission reimbursement penalties.³⁸

A Proposed Framework

With EBD, the interdisciplinary team can make informed decisions related to interventions and outcomes. While no project can incorporate every idea, the framework of the business case offers the opportunity for a more evidence- and ethics-informed decision-making process. A process to pursue the EBD business case is presented in Table 2.

Table 2. Framing a Process for the EBD Business Case

Step	Description	Example
1	<ul style="list-style-type: none"> Identify the problem(s). Align solution with ethical principles. Define EBD business case scope (eg, setting, population, timeframe). 	<ul style="list-style-type: none"> Noise and poor lighting negatively impact patient safety. Appropriate acoustics upholds nonmaleficence. Medical-surgical and ICU (settings); adult patients (population); 10 years to next refurbish or replacement (timeframe)
2	<ul style="list-style-type: none"> List health and health care-related outcomes associated with Step 1. Continue to align solution with ethical principles. Identify available measures. 	<ul style="list-style-type: none"> Sleep quality, falls, delirium, sleep medication, posthospital syndrome, and so on Appropriate acoustics upholds beneficence (eg, improved sleep) and nonmaleficence (eg, avoidance of harm from falls). HCAHPS, falls/1000 pt days, medications prescribed, readmissions
3	<ul style="list-style-type: none"> Choose and innovate design solutions that influence desired outcomes for population(s) identified. 	<ul style="list-style-type: none"> Evaluate noise-masking and noise-reduction solutions for different areas, choose energy efficient lighting (unit-wide) and dynamic lighting (patient rooms, nurse station).
4	<ul style="list-style-type: none"> Target improvement metrics. Establish revenue/cost avoidance measures associated with related outcomes.^a 	<ul style="list-style-type: none"> Improve HCAHPS one quartile.^b Reduce falls by 2 per year at current rate/1000 pt days (\$64.5K/fall with injury³⁹); reduce energy use 40%; reduce sleep medications 10%.
5	<ul style="list-style-type: none"> Document incremental construction costs (region-specific) for each design alternative. 	<ul style="list-style-type: none"> Work with cost estimator or contractor to establish costs of the “standard” solution, as well as the incremental differences in cost of the alternatives.
6	<ul style="list-style-type: none"> Estimate benefit(s) attributable to each intervention alternative. Be transparent! 	<ul style="list-style-type: none"> Agree on assumptions (eg, 50% of HCAHPS improvement is attributed to sound masking and dynamic lighting; 50% of falls reduction [20 falls over 10 years] and 75% of energy use is attributed to new lighting).
7	<ul style="list-style-type: none"> Establish modeling to be used. Conduct financial calculations. 	<ul style="list-style-type: none"> Simple payback, probabilistic analysis (depends on feasibility) Calculate the payback and/or ROI.^c
8	<ul style="list-style-type: none"> Finalize design decisions. Commit to measure outcomes and financial results after occupancy. 	<ul style="list-style-type: none"> Based on the payback for each alternative, make choices. Use the framework created to measure results and validate the EBD business case. Share the business case results; publish when possible so others may benefit from new evidence.

Abbreviations: EBD, evidence-based design; HCAHPS, Hospital Consumer Assessment of Healthcare Providers and Systems; ICU, intensive care unit; ROI, return on investment.

^a Use published literature or organizational data, if available.

^b Use organizational data to calculate achievement and improvement rates' impacts on reimbursement.

^c Use incremental first costs and future maintenance replacement and revenue/cost avoidance per year.

Teams should discuss calculation methods based on their feasibility and the goal of creating a narrative, a deterministic analysis, or a probabilistic assessment.³⁹

Conclusion

EBD processes for health care facilities regard design as an intervention to improve outcomes. While the evidence base for design has been growing, the related EBD business cases, like the ethics discussions in design, are sparse. While health care organizations focus more often on the dark green dollars of tangible choices than on the light green dollars that result from societal value and improved health outcomes, facility project stakeholders (eg, architects, designers, clinicians, health care governing bodies) have a responsibility to consider design decisions in the context of medical ethics. Developing a business case for built environment interventions can be complicated, however. There is rarely a one-to-one relationship of interventions and outcomes; there are moderating and confounding variables; and, unfortunately, there is a lack of easily

accessible data. However, in order to best provide patients and staff with safe and health-promoting environments, decision-making must balance the ethics of improving outcomes with the recognition there will be not only short-term costs but also long-term financial implications. What is built today does not end with construction; there is an ethical imperative for investments that can promote health and mitigate the risk of negative outcomes for many years to come.

References

1. Anderson DC, Teti SL, Hercules WJ, Deemer DA. The bioethics of built space: health care architecture as a medical intervention. *Hastings Cent Rep.* 2022;52(2):32-40.
2. About EBD. Center for Health Design. Accessed December 26, 2023. <https://www.healthdesign.org/certification-outreach/edac/about-ebd>
3. Institute for Healthcare Improvement; National Patient Safety Foundation. Optimizing a business case for safe health care: an integrated approach to safety and finance. Institute for Healthcare Improvement; 2017. Accessed May 15, 2024. <https://www.ihl.org/sites/default/files/2023-10/OptimizingBusinessCaseSafeHealthCare.pdf>
4. Varkey B. Principles of clinical ethics and their application to practice. *Med Princ Pract.* 2021;30(1):17-28.
5. Beauchamp TL, Childress JF. *Principles of Biomedical Ethics*. 5th ed. Oxford University Press; 2001.
6. Dauda B, Denier Y, Dierickx K. What do the various principles of justice mean within the concept of benefit sharing? *J Bioeth Inq.* 2016;13(2):281-293.
7. Taylor E. Close the loop: business cases and economic evaluations. *HERD.* 2024;17(2):263-268.
8. Jue K, Nathan-Roberts D. How noise affects patients in hospitals. *Proc Hum Factors Ergon Soc Annu Meet.* 2019;63(1):1510-1514.
9. Loupa G. Influence of noise on patient recovery. *Curr Pollut Rep.* 2020;6(1):1-7.
10. Mansour W, Knauert M. Adding insult to injury: sleep deficiency in hospitalized patients. *Clin Chest Med.* 2022;43(2):287-303.
11. Terzi B, Azizoğlu F, Polat Ş, Kaya N, İşsever H. The effects of noise levels on nurses in intensive care units. *Nurs Crit Care.* 2019;24(5):299-305.
12. HCAHPS: patients' perspectives of care survey. Centers for Medicare and Medicaid Services. Updated September 6, 2023. Accessed July 10, 2024. <https://www.cms.gov/medicare/quality/initiatives/hospital-quality-initiative/hcahps-patients-perspectives-care-survey>
13. Bliefnick JM, Ryherd EE, Jackson R. Evaluating hospital soundscapes to improve patient experience. *J Acoust Soc Am.* 2019;145(2):1117-1128.
14. Buxton OM, Ellenbogen JM, Wang W, et al. Sleep disruption due to hospital noises: a prospective evaluation. *Ann Intern Med.* 2012;157(3):170-179.
15. Gulati J, Arora V, McDaniel L, Affini M, Mason N, Orlov N. Which hospitals promote a sleep-friendly patient experience? *J Patient Exp.* 2023;10:23743735231151544.
16. Patient survey (HCAHPS)—national. Centers for Medicare and Medicaid Services. April 24, 2024. Accessed July 22, 2024. <https://data.cms.gov/provider-data/dataset/99ue-w85f>
17. Farokhnezhad Afshar P, Bahramnezhad F, Asgari P, Shiri M. Effect of white noise on sleep in patients admitted to a coronary care. *J Caring Sci.* 2016;5(2):103-109.

18. Yoon H, Baek HJ. External auditory stimulation as a non-pharmacological sleep aid. *Sensors (Basel)*. 2022;22(3):1264.
19. Farokhnezhad Afshar P, Mahmoudi A, Abdi A. The effect of white noise on the vital signs of elderly patients admitted to the cardiac care unit. *J Gerontol*. 2016;1(1):27-34.
20. Pamuk K, Turan N. The effect of light on sleep quality and physiological parameters in patients in the intensive care unit. *Appl Nurs Res*. 2022;66:151607.
21. Giménez MC, Geerdinck LM, Versteyleen M, et al. Patient room lighting influences on sleep, appraisal and mood in hospitalized people. *J Sleep Res*. 2017;26(2):236-246.
22. Craig T, Mathieu S, Morden C, Patel M, Matthews L. A prospective multicentre observational study to quantify nocturnal light exposure in intensive care. *J Intensive Care Soc*. 2023;24(2):133-138.
23. Vethe D, Scott J, Engstrøm M, et al. The evening light environment in hospitals can be designed to produce less disruptive effects on the circadian system and improve sleep. *Sleep*. 2021;44(3):zsa194.
24. Hillman DR, Carlucci M, Charchafieh JG, et al. Society of Anesthesia and Sleep Medicine position paper on patient sleep during hospitalization. *Anesth Analg*. 2023;136(4):814-824.
25. Liu L, Keoleian G, Lewis G. Life cycle cost analysis of LED retrofit and luminaire replacements for four-foot T8 troffers. *Light Res Technol*. 2024;56(4):403-420.
26. Elliott RA, Camacho E, Jankovic D, Sculpher MJ, Faria R. Economic analysis of the prevalence and clinical and economic burden of medication error in England. *BMJ Qual Saf*. 2021;30(2):96-105.
27. Morse AM, Bender E. Sleep in hospitalized patients. *Clocks Sleep*. 2019;1(1):151-165.
28. Sadler BL, Berry LL, Guenther R, et al. Fable hospital 2.0: the business case for building better health care facilities. *Hastings Cent Rep*. 2011;41(1):13-23.
29. Berry LL, Parker D, Coile RC Jr, Hamilton DK, O'Neill DD, Sadler BL. The business case for better buildings. *Front Health Serv Manage*. 2004;21(1):3-24.
30. Boussabaine A, Kirkham R. *Whole Life-Cycle Costing: Risk and Risk Responses*. John Wiley & Sons; 2008.
31. Hoogmartens R, van Passel S, van Acker K, Dubois M. Bridging the gap between LCA, LCC and CBA as sustainability assessment tools. *Environ Impact Assess Rev*. 2014;48:27-33.
32. Elliott MN, Beckett MK, Lehrman WG, et al. Understanding the role played by Medicare's patient experience points system in hospital reimbursement. *Health Aff (Millwood)*. 2016;35(9):1673-1680.
33. Richter JP, Muhlestein DB. Patient experience and hospital profitability: is there a link? *Health Care Manage Rev*. 2017;42(3):247-257.
34. White B, Snyder HS, Patel MVB. Evaluation of medications used for hospitalized patients with sleep disturbances: a frequency analysis and literature review. *J Pharm Pract*. 2023;36(1):126-138.
35. Youn S, Hann CWC, Park B, et al. The sleeping pill prescription rate for inpatients at a general hospital. *Sleep Med Res*. 2016;7(1):33-38.
36. Heinemann S, Klemperer J, Hummers E, Nau R, Himmel W. Reducing the use of sleep-inducing drugs during hospitalisation by a multi-faceted intervention: a pilot study. *Eur J Hosp Pharm Sci Pract*. 2024;31(2):117-123.
37. Stewart NH, Arora VM. Sleep in hospitalized older adults. *Sleep Med Clin*. 2018;13(1):127-135.

38. Hospital Readmissions Reduction Program (HRRP). Centers for Disease Control and Prevention. Updated September 10, 2024. Accessed September 13, 2024. <https://www.cms.gov/medicare/quality/value-based-programs/hospital-readmissions>
39. Dykes PC, Curtin-Bowen M, Lipsitz S, et al. Cost of inpatient falls and cost-benefit analysis of implementation of an evidence-based fall prevention program. *JAMA Health Forum*. 2023;4(1):e225125.

Ellen Taylor, PhD, MBA, BArch is vice president for research at the Center for Health Design, where she leads various research initiatives, including the translation of applied research in the design of health care facilities. Dr Taylor is a member of the American Institute of Architects who received MBA degrees from Columbia University and London Business School, as well as a PhD degree from Loughborough University.

Editor's Note

The case to which this commentary is a response was developed by the editorial staff.

Citation

AMA J Ethics. 2024;26(12):E916-924.

DOI

10.1001/amajethics.2024.916.

Conflict of Interest Disclosure

Author disclosed no conflicts of interest.

The people and events in this case are fictional. Resemblance to real events or to names of people, living or dead, is entirely coincidental. The viewpoints expressed in this article are those of the author(s) and do not necessarily reflect the views and policies of the AMA.

MEDICAL EDUCATION: PEER-REVIEWED ARTICLE

What Should Health Professions Trainees Learn About Built Environment Activism?

David A. Deemer, MD, MA and William J. Hercules, MArch

Abstract

This article offers examples of connections between built environments and health outcomes and discusses the current state of regulation of built environments. This article also suggests ethical questions about oversight and how health professions trainees can advocate for healthier built environments.

Regulating Built Environments

Built environments—human-built, inhabited places—are some one of the most regulated features of our daily lives. However, the goal of most regulations is to prevent occasional tragedies, not affirm health-generative, evidence-based design. Despite mounting evidence that built environments influence behaviors and affect important health outcomes,¹ many organizations' policies and recommendations on the built environment seldom extend beyond harm reduction. Building codes, perhaps surprisingly, specify minimum requirements, not best practices. This emphasis is especially problematic when considering how the built environment has been used for decades to maintain discrimination in communities across the United States.² If the next generation of health professionals is to address communities' social determinants of health, it must also improve communities' built environments. Trainees are in a unique and authoritative position to advocate for better building codes and more responsible community development because they witness firsthand how built environments influence people's health. By promoting civic discussions of the impact of built space on health—along with architects, policy makers, health professionals, bioethicists, and public health experts—health professions trainees can begin to rebuild trust with economically and socially disadvantaged community members by advocating for designs that demonstrably improve community health outcomes and well-being.³ This article aims to empower and motivate health professions trainees to advocate for better built environments in their communities.

Built Environments' Health Influences

The connections between the built environment and health outcomes are wide and varied. Several examples are provided here, although this summary is by no means exhaustive.

Within **dementia care facilities**, design elements have been used to control residents' behaviors and reduce residents' behavioral and psychological symptoms of dementia that lead to the use of sedative medications and physical restraints, as both sedatives and physical restraints have been associated with negative health outcomes, including death,⁴ pneumonia,⁴ and fall risk.⁵ These harm-reducing design elements may be as simple as using floor patterns or mats to limit residents' exit attempts^{6,7,8} or as complex as immersive dementia villages that allow residents to wander in areas that are closed off from the world but designed to resemble normal community elements and foster a sense of autonomy.^{9,10} Visuospatial processing is often impaired in dementia,¹¹ so the effect of these design interventions may be largely due to residents' dementia-related impairments. This conclusion is relevant because most facility designs are implemented outside formal research protocols—perhaps surprisingly, given the evidence of how design elements can influence and control the behavior of this particularly vulnerable population. Health professions trainees should advocate on behalf of all vulnerable community members in civic settings, especially where oversight or bioethics expertise is lacking.

Within hospital facilities, studies of the impact of the built environment on health outcomes have demonstrated that the proximity of sinks affects handwashing rates,¹² that nursing station visibility affects intensive care unit mortality,¹³ and that some design features of a birthing unit, such as a higher ratio of operating rooms to labor and delivery rooms, can increase the number of cesarean sections performed (and the consequential increase of maternal morbidity).¹⁴ One might expect that hospitals, in contrast to dementia care facilities, would have more uniform design standards due to the care they provide, but adoption of standardized hospital design codes varies by state, from spotty to nonexistent.¹⁵ Given that patients and their families have limited ability to influence the environments in which they receive care, health professions trainees need to call for standardization and enforcement of existing codes and to hold organizations accountable for implementation of best practices.

Beyond health care-related architecture, community design elements, such as green space,¹⁶ “enabling places” (environments that provide specific health-promoting benefits),¹⁷ and even higher-density housing¹⁸ have been associated with better social connection and less **loneliness**. Loneliness is a major health determinant and is linked to many detrimental health outcomes, including depression, anxiety,¹⁹ and mortality.²⁰ The effect of social connection on likelihood of survival has been estimated to be comparable to that of smoking cessation (quantified as an approximately 50% greater likelihood of survival over a 7.5 year period).²¹ In addition to their effects on health, community-level built environment elements raise broader issues of inclusion (or lack thereof) in the design process and equity or inequity in implementation. Health professions trainees can weigh in on these matters to amplify the voices of community members that are lost in the input of larger, more well-connected interest groups.

Regulation and Well-Being

Despite the evidence of built environments' influence on well-being and health, multiple regulatory agencies omit the promotion of health in their policies. The National Fire Protection Association, an organization publishing widely cited building codes for almost 130 years, focuses on fire and life safety, property protection, and hazard management—not the direct promotion of occupant health through design.²² The International Code Council, another organization producing building codes and operational standards, omitted health promotion from its Vision 2025 goal to keep

people safe in built environments.²³ By contrast, the Facility Guidelines Institute, which develops health care-specific building codes, has begun in recent years to acknowledge the health impact of various design elements in its publications.²⁴ Perhaps most surprisingly, the Joint Commission's current priorities focus on infection prevention, workplace violence, suicide prevention, and emergency management—but do not acknowledge the impact of design on health.²⁵ While the goals of these organizations are prudent, effective, and even laudable, their conspicuous omission of the evidence linking the built environment to health outcomes demonstrates the need for increased advocacy from health professionals.

To its credit, the broader architectural community is becoming more receptive to many of these ideas. Since the late 1980s, the Center for Health Design, a nonprofit founded to improve the quality of health care facility design, has been cataloging articles at various levels of peer review related to health outcomes and the built environment, and its Knowledge Repository included more than 6200 articles as of July 18, 2024.²⁶ Despite spotty implementation over the past 10 years, the American Institute of Architects' guidance has increasingly focused on health outcomes,²⁷ such as by adding design for well-being as a component of its Framework for Design Excellence.²⁸ In similar fashion, several architecture firms have begun to develop an evidence-based focus on generative health (rather than health care alone). However, no profession-wide effort currently exists in the architectural or medical professions to study the health effects of specific elements of the built environment or the more dynamic long-term health effects of community design elements at scale.

Advocacy

Much of the current built environment was constructed at a time when urban design was used to create and maintain separation of ethnic minorities and low-income groups.²⁹ These elements—the interstate highway system,³⁰ redlining,³¹ and gated communities with physical walls³²—are hardwired into our urban fabric and continue to affect the lives of many living in modern-day communities. Many patients' asthma and obesity are significantly influenced by environments marked by poor infrastructure, air pollution, food deserts, and other harms created by design choices made decades ago.³³ These decisions—literally, elements of structural racism³⁴—continue to **adversely impact the health of millions** of people in the United States and form the basis of environmental injustice.³⁵

Health professions trainees can and should advocate for healthier, fairer built environments. Practically, trainees should contact local officials about development projects, national organizations about building codes and the need for a greater emphasis on health promotion, and nonprofit organizations dedicated to improving communities' built environments and health. They should also help educate the general public about how built environments influence health, which can be done both individually when seeing patients and collectively through civic engagement. Responses to these efforts will likely vary, as certain elements of the built environment are more easily and intuitively understood to be beneficial than others. Shade, trees, natural light, and views of nature, for example, are widely accepted elements of a healthy built environment: people frequently feel a sense of relaxation when outdoors in natural environments, consistent with studies suggesting that frequent exposure to green space is associated with slower epigenetic aging.³⁶ However, other design elements may be expensive to implement or less obviously influential, such as the impact of heating,

ventilation, and air conditioning systems on indoor air quality and associated health outcomes,³⁷ or the impact of various spectra of light on resident fall rates within long-term care facilities.³⁸ Health professions trainees have a professional obligation to educate the public on the many built environment factors impacting health, especially those with more subtle, less intuitive influences that inequitably affect vulnerable groups.

Conclusion

Built environments significantly influence communities' health.¹ Their effects are increasingly better understood, engendering a responsibility among health professionals to advocate for evidence-based designs that prioritize the health of communities and decrease the harms associated with built spaces. A similar rationale underlies the widely accepted responsibility to understand and apply evidenced-based therapies in medical practice. Despite many parties' involvement in regulation, most regulations of the built environment are reactionary responses to tragic events aimed to prevent specific harms and often do not emphasize the broader goal of promoting occupants' health and well-being. The inclusion of health and well-being as primary goals of the built environment is warranted not only by the evidence but also by the built environment's tainted history as an instrument of segregation, structural racism, and discrimination. If successful, regulations that govern the built environment can evolve to prioritize the health of the occupants. Compliance with these regulations could be achieved through evidence-based design techniques, thereby eliminating built environments that harm communities and attaining higher levels of regenerative design. The built environment's durability in this case could be an advantage, as advocacy efforts could result in built environments that improve the health of their occupants for generations. Such efforts will necessarily be multidisciplinary, including architects, policy makers, health professionals, bioethicists, and public health experts, all working with members of the community to craft spaces that promote health and well-being for years to come.

References

1. Anderson DC, Teti SL, Hercules WJ, Deemer DA. The bioethics of built space: health care architecture as a medical intervention. *Hastings Cent Rep.* 2022;52(2):32-40.
2. Schindler S. Architectural exclusion: discrimination and segregation through physical design of the built environment. *Yale Law J.* 2015;124:1934-2024.
3. Deemer DA, Peavey EK, Teti SL, Hercules WJ, Wong J, Anderson DC. How should organizations be held accountable for promoting environments that foster social connection? *AMA J Ethics.* 2023;25(11):E825-E832.
4. Tampi RR, Tampi DJ, Balachandran S, Srinivasan S. Antipsychotic use in dementia: a systematic review of benefits and risks from meta-analyses. *Ther Adv Chronic Dis.* 2016;7(5):229-245.
5. Fernández Ibáñez JM, Morales Ballesteros MDC, Montiel Moreno M, Mora Sánchez E, Arias Arias Á, Redondo González O. Physical restraint use in relation to falls risk in a nursing home. Article in Spanish. *Rev Esp Geriatr Gerontol.* 2020;55(1):3-10.
6. Hewawasam L. Floor patterns limit wandering of people with Alzheimer's. *Nurs Times.* 1996;92(22):41-44.
7. Hussian RA, Brown DC. Use of two-dimensional grid patterns to limit hazardous ambulation in demented patients. *J Gerontol.* 1987;42(5):558-560.
8. Klosterman C. Nursing-home pitfalls. *New York Times.* February 28, 2014. Accessed July 18, 2024.

- https://www.nytimes.com/2014/03/02/magazine/nursing-home-pitfalls.html?ref=theethicist&_r=0
9. Johnson K. “Dementia village” creates artificial reality. *Medscape*. September 11, 2019. Accessed July 18, 2024. <https://www.medscape.com/viewarticle/918026?form=fpf>
 10. The Hogeweyk®—normal life for people living with severe dementia. Dementia Village® Associates. Accessed May 28, 2024. <https://hogeweyk.dementiavillage.com>
 11. Laczó J, Parizkova M, Moffat SD. Spatial navigation, aging and Alzheimer’s disease. *Aging (Albany NY)*. 2018;10(11):3050-3051.
 12. Deyneko A, Cordeiro F, Berlin L, Ben-David D, Perna S, Longtin Y. Impact of sink location on hand hygiene compliance after care of patients with *Clostridium difficile* infection: a cross-sectional study. *BMC Infect Dis*. 2016;16(1):203.
 13. Lu Y, Ossmann MM, Leaf DE, Factor PH. Patient visibility and ICU mortality: a conceptual replication. *HERD*. 2014;7(2):92-103.
 14. Ariadne Labs. Designing capacity for high value healthcare: the impact of design on clinical care in childbirth. Ariadne Labs; 2017. Accessed July 18, 2024. https://massdesigngroup.org/sites/default/files/file/2017/170223_Ariadne%20Report_Final.pdf
 15. Adoption of FGI *Guidelines*. Facilities Guidelines Institute. Updated February 7, 2024. Accessed July 18, 2024. <http://3.80.232.221/guidelines/adoption-map/>
 16. Astell-Burt T, Hartig T, Putra IGNE, Walsan R, Dendup T, Feng X. Green space and loneliness: a systematic review with theoretical and methodological guidance for future research. *Sci Total Environ*. 2022;847:157521.
 17. Duff C. Exploring the role of “enabling places” in promoting recovery from mental illness: a qualitative test of a relational model. *Health Place*. 2012;18(6):1388-1395.
 18. Lam J, Wang S. Built environment and loneliness among older adults in South East Queensland, Australia. *J Appl Gerontol*. 2022;41(11):2382-2391.
 19. Weziak-Bialowolska D, Bialowolski P, Lee MT, Chen Y, VanderWeele TJ, McNeely E. Prospective associations between social connectedness and mental health. Evidence from a longitudinal survey and health insurance claims data. *Int J Public Health*. 2022;67:1604710.
 20. Holt-Lunstad J. The potential public health relevance of social isolation and loneliness: prevalence, epidemiology, and risk factors. *Public Policy Aging Rep*. 2017;27(4):127-130.
 21. Holt-Lunstad J, Smith TB, Layton JB. Social relationships and mortality risk: a meta-analytic review. *PLoS Med*. 2010;7(7):e1000316.
 22. National Fire Protection Association. *NFPA 1 Fire Code*. National Fire Protection Association; 2024.
 23. International Code Council. 2025 vision: strategic plan for the future. International Code Council; 2019. Accessed July 18, 2024. https://www.iccsafe.org/wp-content/uploads/19-17577_ICC_2025_Strategic_Plan_FINAL_PAGES_MIDRES.pdf
 24. Facility Guidelines Institute. *Guidelines for Design and Construction of Hospitals*. Facility Guidelines Institute; 2022.
 25. Ongoing quality and safety priorities. Joint Commission. Accessed August 29, 2024. <https://www.jointcommission.org/our-priorities/>
 26. Knowledge Repository. Center for Health Design. Accessed July 18, 2024. <https://www.healthdesign.org/knowledge-repository>

27. Design for well-being—Framework for Design Excellence. American Institute of Architects. Accessed July 18, 2024. <https://www.aia.org/design-excellence/aia-framework-for-design-excellence/well-being>
28. The AIA Framework for Design Excellence. American Institute of Architects. Accessed July 18, 2024. <https://www.aia.org/design-excellence/aia-framework-design-excellence>
29. Swope CB, Hernández D, Cushing LJ. The relationship of historical redlining with present-day neighborhood environmental and health outcomes: a scoping review and conceptual model. *J Urban Health*. 2022;99(6):959-983.
30. Karas D. Highway to inequity: the disparate impact of the interstate highway system on poor and minority communities in American cities. *New Vis Public Aff*. 2015;7:9-21.
31. Nardone A, Chiang J, Corburn J. Historic redlining and urban health today in US cities. *Environ Justice*. 2020;13(4):109-119.
32. Low SM. The edge and the center: gated communities and the discourse of urban fear. *Am Anthropol*. 2001;103(1):45-58.
33. Brisbon N, Plumb J, Brawer R, Paxman D. The asthma and obesity epidemics: the role played by the built environment—a public health perspective. *J Allergy Clin Immunol*. 2005;115(5):1024-1028.
34. Yang Y, Cho A, Nguyen Q, Nsoesie EO. Association of neighborhood racial and ethnic composition and historical redlining with built environment indicators derived from street view images in the US. *JAMA Netw Open*. 2023;6(1):e2251201.
35. Landrigan PJ, Rauh VA, Galvez MP. Environmental justice and the health of children. *Mt Sinai J Med*. 2010;77(2):178-187.
36. Kim K, Joyce BT, Nannini DR, et al. Inequalities in urban greenness and epigenetic aging: different associations by race and neighborhood socioeconomic status. *Sci Adv*. 2023;9(26):eadf8140.
37. Ferguson L, Taylor J, Davies M, Shrubsole C, Symonds P, Dimitroulopoulou S. Exposure to indoor air pollution across socio-economic groups in high-income countries: a scoping review of the literature and a modelling methodology. *Environ Int*. 2020;143:105748.
38. Grant LK, St Hilaire MA, Heller JP, Heller RA, Lockley SW, Rahman SA. Impact of upgraded lighting on falls in care home residents. *J Am Med Dir Assoc*. 2022;23(10):1698-1704.e2.

David A. Deemer, MD, MA is currently a geriatrics and palliative care fellow at Mount Sinai Hospital in New York City. An internist and bioethicist, he is interested in medical education, geriatrics, palliative care, electronic health record ethics, and the ethics of built space.

William J. Hercules, MArch is the founder and chief executive officer of WJH Health. He works to inspire health care leadership teams by shaping their future places of care.

Citation

AMA J Ethics. 2024;26(12):E925-931.

DOI

10.1001/amajethics.2024.925.

Conflict of Interest Disclosure

Authors disclosed no conflicts of interest.

The viewpoints expressed in this article are those of the author(s) and do not necessarily reflect the views and policies of the AMA.

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 expected to go in discovery of rigorous scholarship to inform their 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.

References

1. Ulrich RS. View through a window may influence recovery from surgery. *Science*. 1984;224(4647):420-421.
2. Ulrich RS, Zimring C, Zhu X, et al. A review of the research literature on evidence-based healthcare design. *HERD*. 2008;1(3):61-125.
3. Stichler JF, Hamilton DK. Evidence-based design: what is it? *HERD*. 2008;1(2):3-4.
4. Laursen J, Danielsen A, Rosenberg J. Effects of environmental design on patient outcome: a systematic review. *HERD*. 2014;7(4):108-119.
5. Mead M, Ibrahim AM. Strategies to evaluate the quality of hospital design with clinical data. *J Hosp Med*. 2023;18(6):538-543.

6. Ulrich RS. A theory of supportive design for healthcare facilities. *J Healthc Des*. 1997;9:3-7.
7. Ulrich RS. Evidence-based health-care architecture. *Lancet*. 2006;368:S38-S39.
8. Li Y, Leung GM, Tang JW, et al. Role of ventilation in airborne transmission of infectious agents in the built environment—a multidisciplinary systematic review. *Indoor Air*. 2007;17(1):2-18.
9. Sehulster LM, Chinn RYW, Arduino MJ, et al. *Guidelines for Environmental Infection Control in Health-Care Facilities. Recommendations From CDC and the Healthcare Infection Control Practices Advisory Committee (HICPAC)*. American Society for Healthcare Engineering; American Hospital Association; 2004. Accessed July 24, 2024. https://www.cdc.gov/infection-control/media/pdfs/guideline-environmental-h.pdf?CDC_AAref_Val=https://www.cdc.gov/infectioncontrol/pdf/guidelines/environmental-guidelines-P.pdf
10. Willis L. Legionnaires' disease is back, and litigation is hitting courts. *Daily Business Review*. April 19, 2024. Accessed July 24, 2024. <https://www.law.com/dailybusinessreview/2024/04/19/legionnaires-disease-is-back-and-litigation-is-hitting-courts/>
11. Dawson D. City facing \$3.25M lawsuit over deadly 2022 *Legionella* outbreak. *Orilliamatters*. February 26, 2024. Accessed July 24, 2024. <https://www.orilliamatters.com/local-news/city-facing-325m-lawsuit-over-deadly-2022-legionella-outbreak-8357077>
12. Leaf DE, Homel P, Factor PH. Relationship between ICU design and mortality. *Chest*. 2010;137(5):1022-1027.
13. Hercules WJ, Anderson DC, Teti SL, Deemer DA. Exploring the world of architecture and bioethics. *Health Facil Manage*. 2022;35(1):28-31.
14. Anderson DC, Teti SL, Hercules WJ, Deemer DA. The bioethics of built space: healthcare architecture as a medical intervention. *Hastings Cent Rep*. 2022;52(2):32-40.
15. Malpractice. Merriam-Webster Dictionary. Accessed July 24, 2024. <https://www.merriam-webster.com/dictionary/malpractice>
16. Negligence. Merriam-Webster Dictionary. Accessed July 24, 2024. <https://www.merriam-webster.com/dictionary/negligence>
17. Heisse JR. The measure of malpractice: a rebuttal to the “threshold approach” to evaluating errors in design. *J Am Coll Constr Lawyers*. 2011;5(2):1-25.
18. American College of Healthcare Architects. Application process. In: *ACHA Certification Handbook*. American College of Healthcare Architects; 2024:3-4. Accessed July 22, 2024. <https://healtharchitects.org/wp-content/uploads/2024/02/ACHA-handbook-2024-B.pdf>
19. Moore T. Presentation of American College of Healthcare Architects (ACHA) data at the ACHA past president's meeting. Presented at: Summer Leadership Summit; July 21-23, 2023; Chicago, IL.
20. Sackett DL, Rosenberg WM, Gray JA, Haynes RB, Richardson WS. Evidence based medicine: what it is and what it isn't. *BMJ*. 1996;312(7023):71-72.
21. Hamilton DK. The moral responsibility of leadership for design outcome. *HERD*. 2012;5(3):129-132.
22. Hamilton DK. Evidence, bioethics, and design for health. *HERD*. 2022;15(2):13-21.
23. Ross C, Swetlitz I. IBM pitched its Watson supercomputer as a revolution in cancer care. It's nowhere close. *STAT*. September 5, 2017. Accessed July 24, 2024. <https://www.statnews.com/2017/09/05/watson-ibm-cancer/>

24. 5725-W51 IBM Watson for Oncology. IBM. August 1, 2023. Accessed July 24, 2024. <https://www.ibm.com/docs/en/announcements/watson-oncology?region=CAN>
25. Trouble at the lab. *The Economist*. October 18, 2013. Accessed July 24, 2024. <https://www.economist.com/briefing/2013/10/18/trouble-at-the-lab>

D. Kirk Hamilton, PhD is a professor emeritus at Texas A&M University in College Station, where he spent 18 years as a faculty member in the graduate Design for Health Program. Previously, he was engaged in international practice as a hospital architect. An advocate for evidence-based design, he is a founding coeditor of *Health Environments Research & Design*.

A. Ray Pentecost 3rd, DrPH is the director of the Center for Health Systems & Design, jointly managed by the Texas A&M University (TAMU) School of Architecture and the TAMU Health Science Center, which includes the Schools of Medicine, Nursing, and Public Health. An ordained minister and health care architect, he was previously a faculty member at Texas Tech University and in private practice.

Citation

AMA J Ethics. 2024;26(12):E932-937.

DOI

10.1001/amajethics.2024.932.

Conflict of Interest Disclosure

Authors disclosed no conflicts of interest.

The viewpoints expressed in this article are those of the author(s) and do not necessarily reflect the views and policies of the AMA.



AMA Journal of Ethics®

December 2024, Volume 26, Number 12: E938-947

POLICY FORUM: PEER-REVIEWED ARTICLE

How Innovative Designs Can Help Ease Ethical Tension in Good Dementia Caregiving and Decision-Making

Emily Roberts, PhD

Abstract

Internationally, there is a long history of improving dementia care quality by focusing on patients' strengths and supporting environments that normalize their daily routines. The European dementia village is a pioneering health care site: 4 acres of integrated housing and amenities that include large exterior walkways around gardens, restaurants, and shops. A US-based conceptual model is the dementia friendly city center, which integrates health care service delivery into adaptive reuse and urban revitalization. This article discusses how these models envision structures and spaces of caregiving and habitation.

The American Medical Association designates this journal-based CME activity for a maximum of 1 AMA PRA Category 1 Credit™ available through the [AMA Ed Hub™](#). Physicians should claim only the credit commensurate with the extent of their participation in the activity.

Modeling Memory Care

It is estimated that more than 5 million Americans have some form of dementia.¹ As the population of North Americans 65 years and older is projected to grow from 54 million in 2015 to 95 million by 2050,² so, too, will the numbers of new cases of dementia.¹

Neuropsychiatric symptoms in individuals with dementia are heterogeneous and largely unpredictable, affecting emotional experience, thought content, perception, and motor function.³ People living with dementia might need help with their daily activities while making the most of their present strengths.⁴ This manuscript addresses the ethics of past and future memory care models, with a specific focus on the existing European dementia village (DV) model and a newly proposed model, both of which negotiate risk and autonomy in [decision sharing and decision-making](#).

Living With Dementia

Historically, the experience of living with dementia can be overwhelming for individuals and their families without appropriate support. Once family caregivers no longer feel competent in their caregiving role, an individual with dementia might be institutionalized, leading to negative outcomes, including a feeling of disconnection from home, family, community, and meaningful activities.⁵ Meaningful activities in particular can stimulate a sense of well-being and personal fulfillment and promote both physical

and mental health—in essence, by creating daily meaning. Although it is imperative that vulnerable populations be provided care settings that allow for personal fulfillment, traditional medical models of memory care engender a sense of isolation and depression in residents through the organizational culture and physical layout of the setting. This biomedical approach to care focuses on symptoms and on social distance between residents and staff, with the requirements of organized routines trumping residents' personal preferences. As has been written elsewhere, “these environments are institutional in design and size, with little access to outdoor spaces” due to lack of adequate and safe adjacent space for walking, gardening, and other outdoor activities.⁶

Barrett et al describe a holistic approach to memory care in which the impacts of multiple dimensions of the built environment on the well-being of people living with dementia are individually targeted in specific environments.⁴ This emphasis on multidimensionality captures how people experience the built environment in daily life—not as discrete environmental elements but as those elements combined. In particular, Barrett et al suggest an individual's baseline capacity “can be augmented by a combination of the empowerment provided by the physical/technological environment, the support of the caring/social environment” and treatment through medical means.⁴ The importance of these environments to well-being is demonstrated by Zimmerman et al, who found that, in nursing homes, the physical environment of the facility (poor environmental quality) and the social environment of the facility (lack of privacy, low visitation rates) were associated with high rates of hospitalization for infection.⁷

Autonomy is seen as an overarching problem, not only because institutions limit residents' freedom, but also because the existential conditions that create the need for long-term care undermine autonomy conceived of as independent self-sufficiency by bioethicists.⁸ Filling the gap between “ideal” autonomy and dependency is crucial if the holistic approach to the built environment set out above is to be operationalized. Dementia care stakeholders, therefore, face a range of daunting environmental and ethical challenges in searching for improved models of care.⁹

Dementia Friendly Initiatives

Internationally, dementia friendly initiatives have been developed to support the creation of enabling environments that maximize independence for individuals living with dementia through collaboration with diverse community stakeholders.¹⁰ Originally termed Dementia Friendly Communities in England, these communities are often cities, towns, or villages where a concerted effort is made to educate citizens about dementia so that those living with the disease are understood, respected, and supported. In addition, dementia-friendly environments are deeply rooted in design efforts that center on the fulfillment of very basic human needs. With that said, environments for people with dementia do not have a fundamentally different appearance from other environments.¹¹ A growing number of cities and communities are implementing dementia friendly initiatives with stakeholder advocacy, which requires sharing of ideas between networks of people representative of the local community and involving people affected by dementia.¹²

A Dementia Village Model

Addressing the challenges of improved dementia care settings requires attention to the ethics of past and future care models and, in particular, the European DV model. The first of these model villages opened on 4 acres in 2009 in the Netherlands. Since then, the model has been successfully repeated in other countries.¹³

The first DV, Hogeweyk, has been operated with the intention of humanizing care while providing a normal life to residents. It is designed as a traditional Dutch neighborhood, with opportunities for residents to wander freely while taking part in programs and activities throughout the village, such as shopping at supermarkets and dining at restaurants and cafes.¹⁴ Purposefully designed to maximize resident autonomy while still minimizing safety concerns, the site is laid out around the outdoor areas with one primary outside entrance. The outdoor area includes gardens, seating, and bike paths designed by landscape architects who designed several different unique courtyards for residents' walking experiences.¹⁵ Figures 1 and 2 show the principle public spaces, including the supermarket and outdoor walkway with a café and bar.

Figure 1. Dementia Village Public Space



Reproduced with permission of Sage © 2023 from Roberts.⁶

Figure 2. Dementia Village Walkway



Reproduced with permission of Sage © 2023 from Roberts.⁶

The village model is organized in such a way that personal care is integrated into daily routines, with 6 to 8 residents living in each of the 23 households. Each household has its own kitchen, living and dining room, and individual resident bedrooms with attached bathrooms. In addition, rather than the traditional staff hierarchy in which tasks are divided among specific care staff (eg, cooking and cleaning staff, certified nursing assistants for bathing and dressing), care staff in the household model work in one household only and conduct most tasks of daily living as a universal worker. The universal care team organizes the shopping, cooking, and laundry within each household, while residents give input on what meals they want and when to eat them and are encouraged to help out with chores.¹³

Previous studies have shown that staff working within a universal model of care experience more job satisfaction, higher motivation, and less burnout than staff working in traditional care settings.¹⁶ This finding is important, because as staff become engaged in their universal duties of care, cooking, and cleaning in their household, they often acquire a sense of empowerment, resulting in lower turnover rates. In addition, as care staff get to know residents more deeply, they are better able to observe changes in individuals' physical and mental health.¹⁶

To date, there have been no developments in the United States on the scale of the Hogeweyk Dementia Village, as providers may not have the appropriately sized property to offer multiple activities and advanced medical services for residents or the funding to develop them.¹³ Providers are also concerned about the bottom-line costs associated

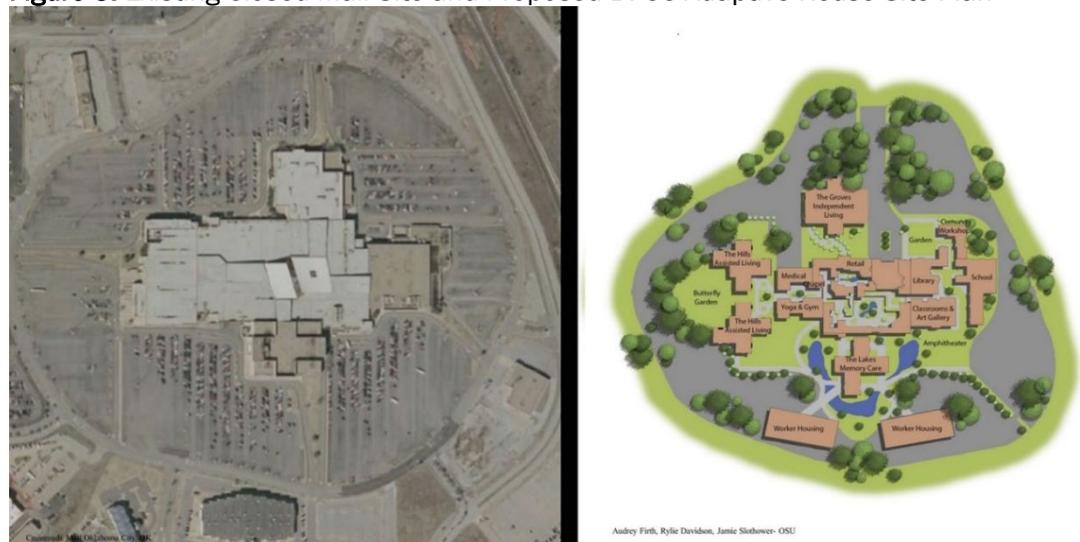
with new construction of a care setting this size. One solution to the perennial challenges faced by providers, planners, and designers is to think more creatively: How do we design with what we have?

Dementia Friendly City Center Case Study

Referring to the DV model as a precedent, the author and a research team at a Midwestern university began to look for new ways of addressing the needs of those living with dementia in their community.¹³ In searching for innovative options, repurposing existing structures—in particular, vacant urban malls—was identified as an option for the large sites needed for the European model of DVs. These settings were identified as dementia friendly city centers (DFCCs).

A working group of stakeholders in health care, design, and development identified several closed mall sites that could align with community needs with respect to location, size, and layout and decided on a permanently closed 800 000 square foot mall to serve as a case study site for initial DFCC conceptual designs. Figure 3 shows the DFCC case study site and conceptual site plan. Figure 4 shows a birds-eye view of the existing mall and the 3-D rendered model of the DFCC from a similar vantage point.

Figure 3. Existing Closed Mall Site and Proposed DFCC Adaptive Reuse Site Plan



Reproduced with permission of Sage © 2021 from Roberts and Shehadeh.¹³

Figure 4. Birds-Eye View of Existing Mall and Proposed DFCC Services and Attached Housing



Reproduced with permission of Sage © 2021 from Roberts and Shehadeh.¹³

Through several community workshops and focus groups, 3 key topics were developed and addressed, along with the development of conceptual designs.¹⁴ Figures 5 and 6 show the designed DFCC central courtyard and a typical outdoor walkway.

Figure 5. Proposed DFCC Central Courtyard



Photo courtesy of Emily Roberts.

Figure 6. Proposed DFCC Exterior Walkway



Photo courtesy of Emily Roberts.

Organizational factors. Adaptive reuse is taking place in mall sites around the United States for education and health care. Being able to convert malls for uses appropriate for individuals living with dementia can be seen as an opportunity but also as a challenge. Several key organizational factors are necessary to create a viable city center

solution, including wayfinding elements—such as landmark clocks, sculptures, and signage—and universal design elements that allow of ease of use, such as ramps, unobstructed entryways, and interior spaces. A principal advantage of adaptive reuse is sustainability, in that a large structure is not being demolished with tons of debris being placed in a landfill. The building is being saved, and there is an energy cost savings of not having to produce bricks or steel for new construction. The infrastructure is all there in a closed mall site, with structural elements that allow designers to take away and build back in flexible configurations.¹⁴

Onsite amenities. The DFCC case study designs include an integrated medical complex that can provide general medical care for both onsite residents and the general public. Also included is a “supermarket, library, full-service restaurant, and several outdoor areas for eating and socializing.”¹³ Pedestrian walkways connect adjacent housing, and the removal of several sections of the existing roof provides large internal courtyards. Three levels of purpose-built housing are proposed, “including independent living apartments for caregiver/care recipient dyads, assisted living, and 24/7 memory care.”¹³

Public-private partnerships. Many types of innovative public-private partnerships can be created within the DFCC care model for fiscal viability. A development corporation or group of owners can take on the adaptive reuse of the mall and lease the converted space to a medical provider, adult day center, or public institutions such as libraries, community workshops, or education centers. The partnership can create income from amenities, and, in turn, multiple providers can proceed with the development of adjacent purpose-built independent living, assisted living, and 24/7 memory care housing.¹⁴

Discussion

The current moment in time could be propitious for innovative change in dementia care in the United States through models like the DFCC. Malls around the country are struggling, and mall owners are becoming more responsive to community needs.¹⁷ The proposed mixed-use pallet in the DFCC creates a city center with living environments and amenities, potentially raising the value of economically distressed properties and communities. And, perhaps most importantly, resident proximity to outdoor amenities allows for socialization, meaningful activities, and sensory stimulation that encourage engagement with community members and confer psychological and physical as well as social benefits. What happens outside of the home—where one can explore and socialize—is perhaps the most distinct and powerful benefit of the existing village and proposed city center models.

In the United States, where the standard memory care environment is restrictive, the DFCC concept allows for flexibility of programming and spaces that fit the needs of many residents’ lifestyles and personal styles of engagement. Some residents enter the environment wanting to be in the middle of the action, while others prefer to be in a more private setting that can give them the opportunity to see what is going on before deciding if they want to participate. That ability for **choice and autonomy** in how one spends one’s day is central to the ethics of dementia care. In addition, the flexibility of the housing types in the DFCC allows intergenerational residents as well as spouses to live together. In essence, the DFCC can be seen as a form of respite for the caregiving spouse living in an independent living apartment, as it allows the caregiver to step outside of that role whenever they wish without guilt or concern about whether their

spouse will be in a safe and secure environment. Being able to go to work or a class or just run errands allows the caregiving spouse to maintain the normalcy of life that prevailed before the spouse's dementia diagnosis.

Finally, due to the size of the repurposed malls in the DFCC model, there is the opportunity to align the DFCC with a university or teaching hospital to bring in students for practicums who would help with the day-to-day operations within the city center. This initiative, as well as volunteerism within the larger community, will play an important role in the ability of residents to remain autonomous while having support available when and where they need it.

Conclusion

Separately and together, we can work to deliver new interventions that can make a difference for those living with dementia and their families. The village and city center care models provide an ethical roadmap for the future by not only addressing well-being of residents, but also taking on larger, more global issues such as sustainable building practices, regreening urban landscapes, and their economic impact. Further exploration of the DFCC model is required to address possible financial and regulatory constraints that accompany the development of necessary public health infrastructure.

The impact of social isolation in our current care system must be weighed against the frequent overregulation of the daily movements of those living with dementia. Viewing individuals with dementia as patients who must be kept safe at all costs is not realistic. According to our cultural norms, if you age without a diagnosis of dementia, then you can live life taking any risk that you want—you can go skydiving (think former President George H. W. Bush). But if you have a **dementia diagnosis**, often it might seem that everything stops around you. This might be many communities' biggest ethical challenge: to see people living with dementia not as patients but simply as people who have a set of needs requiring different types of support to live with those needs.

Often it is problematic to introduce an innovative idea without an understandable precedent or prototype. Identifying precedents like the DV model in Europe and thinking outside of the box with proposed models like the DFCC here in the United States can begin to motivate new ways of thinking about memory care environments. It is imperative that, as a society, we turn from paternalism to inclusivity in dementia care policy. From the inception of the first DV in 2009,⁶ there was a shared vision and mutual understanding of goals among its founders and architects. The proposed DFCC is more than simply a physical location; it is an inclusive community designed to meet the special requirements of people living with dementia and their spouses, while at the same time creating a desirable living environment for those with or without dementia.

Clinicians and designers are beginning to understand that current and future generations of older adults will not accept living in an environment in which they do not have choices in how to spend their days. So, ask yourself the question, *What options would I like to see in my future environment, with or without dementia?* Thus begins the conversation about the ethics of dementia care.

References

1. Olivari BS, French ME, McGuire LC. The public health road map to respond to the growing dementia crisis. *Innov Aging*. 2020;4(1):igz043.

2. He W, Goodkind D, Kowal P; US Census Bureau. *An Aging World: 2015*. US Government Printing Office; 2016. International Population Reports P95/16-1. Accessed December 13, 2023. <https://www.census.gov/content/dam/Census/library/publications/2016/dem/p95-16-1.pdf>
3. Cerejeira J, Lagarto L, Mukaetova-Ladinska EB. Behavioral and psychological symptoms of dementia. *Front Neurol*. 2012;3:73.
4. Barrett P, Sharma M, Zeisel J. Optimal spaces for those living with dementia: principles and evidence. *Build Res Inform*. 2019;47(6):734-746.
5. Boamah SA, Weldrick R, Lee TJ, Taylor N. Social isolation among older adults in long-term care: a scoping review. *J Aging Health*. 2021;33(7-8):618-632.
6. Roberts E. A conversation about the ethics of past and future memory care models: perspectives from the first two European dementia villages. *Inquiry*. 2023;60:469580221150565.
7. Zimmerman S, Gruber-Baldini AL, Hebel JR, Sloane PD, Magaziner J. Nursing home facility risk factors for infection and hospitalization: importance of registered nurse turnover, administration, and social factors. *J Am Geriatr Soc*. 2002;50(12):1987-1995.
8. Agich G. *Dependence and Autonomy in Old Age: An Ethical Framework for Long-Term Care*. Cambridge University Press; 2003.
9. Black BS, Johnston D, Rabins PV, Morrison A, Lyketsos C, Samus QM. Unmet needs of community-residing persons with dementia and their informal caregivers: findings from the Maximizing Independence at Home Study. *J Am Geriatr Soc*. 2013;61(12):2087-2095.
10. Turner N, Morken L. *Better Together: A Comparative Analysis of Age-Friendly and Dementia Friendly Communities*. AARP International Affairs; 2016. Accessed September 5, 2024. <https://www.aarp.org/content/dam/aarp/livable-communities/livable-documents/documents-2016/Better-Together-Research-Report.pdf>
11. Marquardt G, Bueter K. Extending the continuum of care of people with dementia: building resilience. In: Ferdous F, Roberts E, eds. *(Re)designing the Continuum of Care for Older Adults: The Future of Long-Term Care Settings*. Springer; 2023:217-236.
12. Lehning A, Smith R, Kim K. "Friendly" initiatives: an emerging approach to improve communities for vulnerable populations. *J Policy Pract*. 2017;16(1):46-58.
13. Roberts E, Shehadeh A. Community visioning for innovation in integrated dementia care: stakeholder focus group outcomes. *J Prim Care Community Health*. 2021;12:21501327211042791.
14. Glass AP. Innovative seniors housing and care models: what we can learn from the Netherlands. *Seniors Hous Care J*. 2014;22(1):74-81.
15. Archer D. Stepping back in time: help for Alzheimer's. *Psychology Today*. April 12, 2012. Accessed December 16, 2023. <https://www.psychologytoday.com/us/blog/reading-between-the-headlines/201204/stepping-back-in-time-help-alzheimers>
16. Roberts E, Carter HC. Making the case for centralized dementia care through adaptive reuse in the time of COVID-19. *Inquiry*. 2020;57:46958020969305.
17. Baily H. How to save a dying mall? Try moving in. *ctpost*. January 16, 2022. Accessed July 22, 2024 <https://www.ctpost.com/columnist/article/Hugh-Bailey-How-to-save-a-dying-mall-Try-moving-16776034.php>

Emily Roberts, PhD is an associate professor at Oklahoma State University in Stillwater, Oklahoma, with backgrounds in design and gerontology. As an environmental gerontologist, she has an interest in the impact of the physical, social, and psychological aspects of the built environment on the well-being of older adults and their families with a focus on the provision of healthy environments, technologies, and supportive organizations through integrated programmatic systems and interventions.

Citation

AMA J Ethics. 2024;26(12):E938-947.

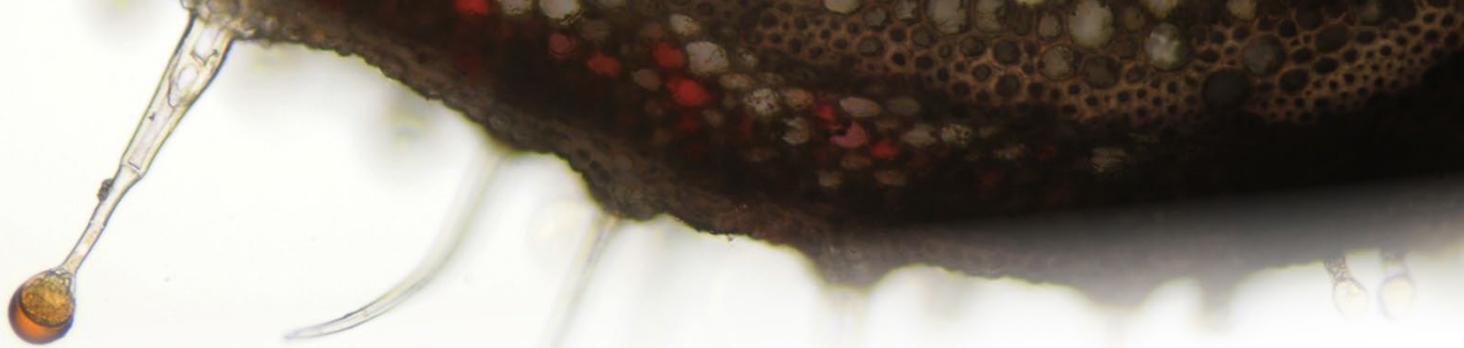
DOI

10.1001/amajethics.2024.938.

Conflict of Interest Disclosure

Author disclosed no conflicts of interest.

The viewpoints expressed in this article are those of the author(s) and do not necessarily reflect the views and policies of the AMA.



AMA Journal of Ethics®

December 2024, Volume 26, Number 12: E948-962

HISTORY OF MEDICINE: PEER-REVIEWED ARTICLE

When Designs Became Interventions in Hospitals

Jeanne Kisacky, PhD, MA, MArch

Abstract

Design is and always has been interventional and clinically relevant. Modern evidence-based designers' lineage was prominently shaped between 1800 and 1970. This article investigates hospital designs during this period that were correlated with patients' health outcomes and suggests how this history influenced our present-day understanding of evidence-based design.

The American Medical Association designates this journal-based CME activity for a maximum of 1 AMA PRA Category 1 Credit™ available through the AMA Ed Hub™. Physicians should claim only the credit commensurate with the extent of their participation in the activity.

Evidence-Based Design

It is a common assumption that evidence-based design (EBD)—“the process of basing decisions about the built environment on credible research to achieve the best possible outcomes”¹—is a recent development kindled by Roger Ulrich's 1984 study that documented that patients in rooms with a view of trees recovered more quickly and at higher rates than patients with a view of a brick wall.² Attempts to situate EBD in a larger historical trajectory have noted Florence Nightingale's work in the 1860s but mention few precursors.^{3,4,5} This narrative is like telling the history of aviation from the Wright brothers to commercial air travel with no intermediate steps; accordingly, this article aims to fill in a few key gaps. The examples of hospital designs from the 1800s to the 1970s presented in this article show that the use of evidence has been the norm, not the exception, in clinically influential hospital **design decisions**.

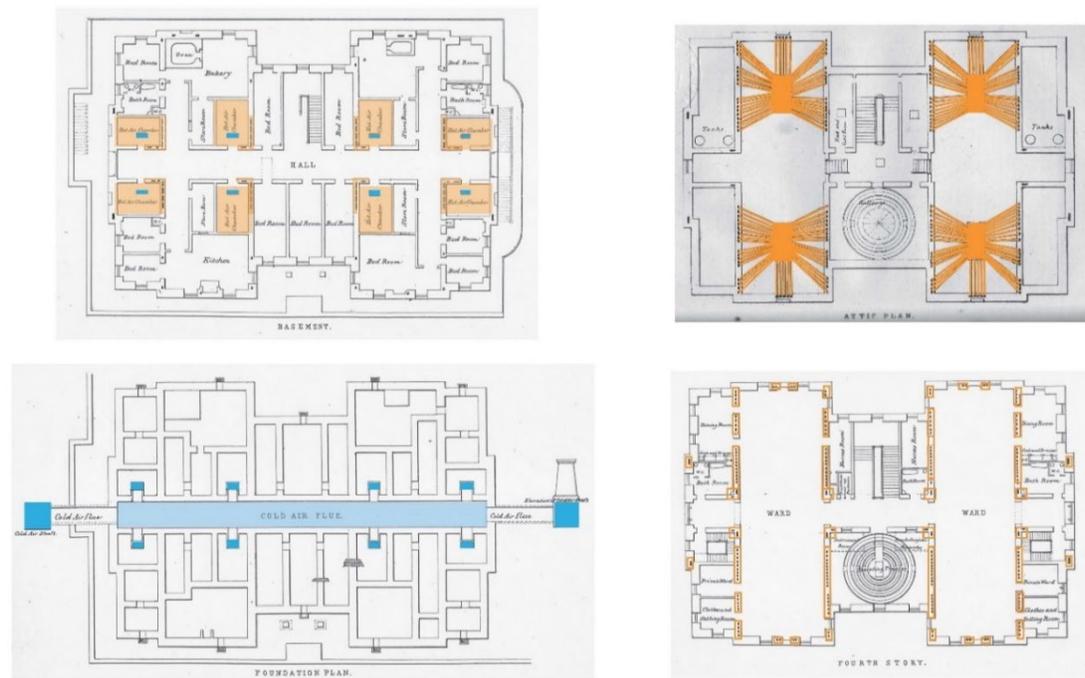
Infection Prevention (1800s-1900s)

Early 19th century hospital design strategies based on evidence focused on preventing hospital-acquired infections. Medical theories of the time considered bad air as the cause of diseases, and hospital practitioners related morbidity and mortality outcomes in various hospitals (and even in individual hospital rooms) to the architectural features that influenced air quality and flow.^{6,7,8} In response, hospital designers developed buildings that provided pure air in specific volumes and flow patterns with the intent to reduce internal disease transfer.⁹

As ongoing research redefined what constituted “pure” or “healthy” air, the variables studied and the design solutions proposed evolved. By 1800, hospital designers

emphasized providing a minimum air space around each patient and maximizing natural (ie, open window) air flow.^{10,11} Yet natural air flow was inconstant; it varied with weather conditions. To create a more constant air flow, industrialist, fire-proof construction advocate and inventor William Strutt designed the new Derbyshire General Infirmary building with a novel closed-window, ducted heating and ventilation system.¹² By the 1820s, early American architect Charles Bulfinch included a similar system in the new Massachusetts General Hospital.¹³ In the 1850s, Dr John Watson, a ventilation-obsessed surgeon at the New York Hospital, advocated similar closed-window, ducted systems in renovations of existing hospital buildings and in new construction (see Figure 1).¹⁴

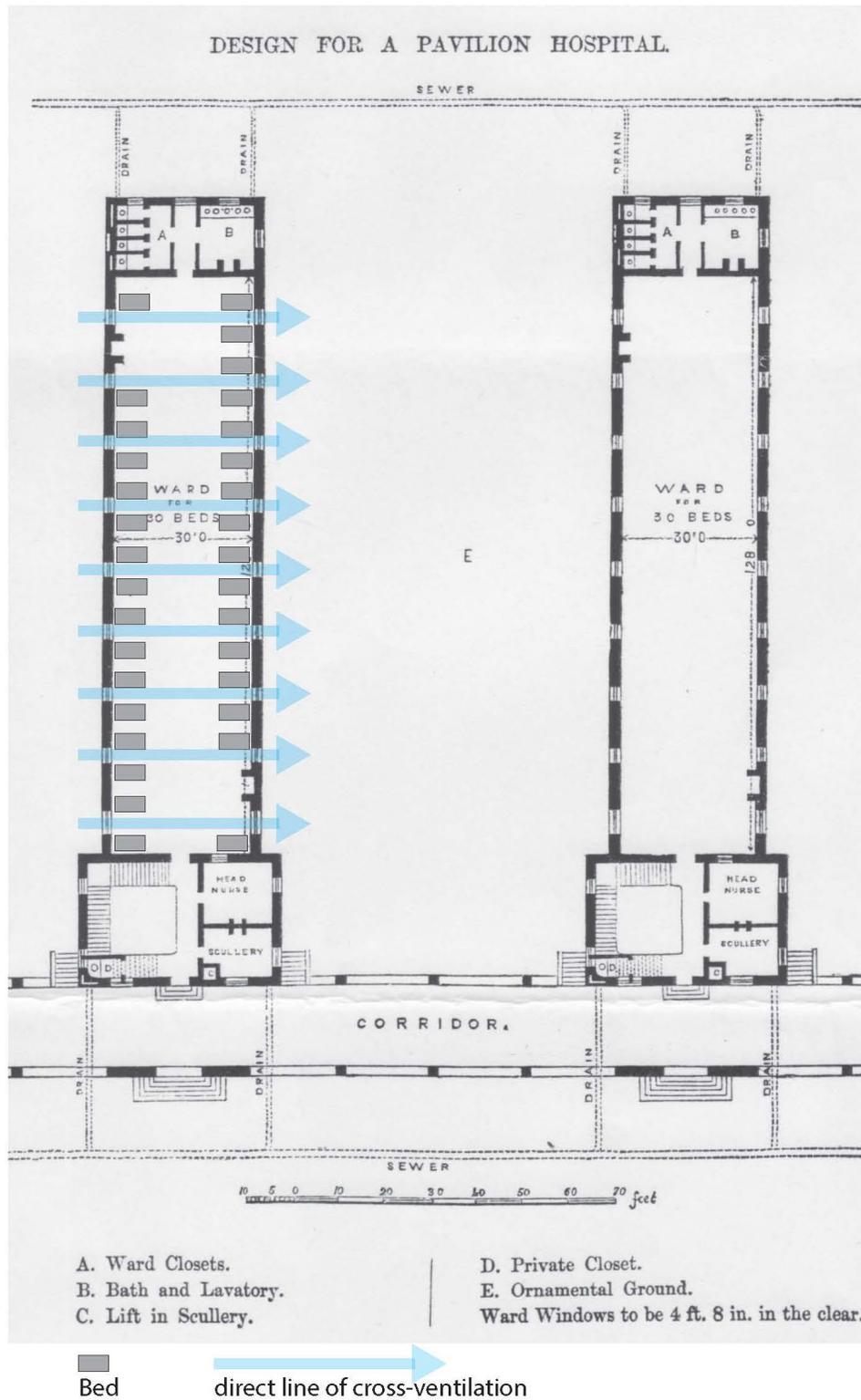
Figure 1. Foundation, Basement, Upper and Attic Floor Plans of South Building, New York Hospital



Reproduced from Smith JM. An address delivered on the occasion of the inauguration of the new South Building of the New York Hospital. ST Callahan & Co; 1855. Figure shows cold air intake in basement (blue), hot air chambers in basement (light orange), ducts in walls on upper story (orange), and exhaust ducts in attic (orange).

By the 1850s, Florence Nightingale presented copious statistical evidence that patient outcomes in **well-ventilated hospitals** were vastly better than in poorly ventilated ones.¹⁵ Her “pavilion-ward” hospital design maximized open-window ventilation in a prescribed spatial relation to patient beds as a means of not only preventing airborne hospital-acquired infections but also improving outcomes through therapeutic exposure to fresh air (see Figure 2).^{9,16,17}

Figure 2. Ideal Pavilion-Ward Plan

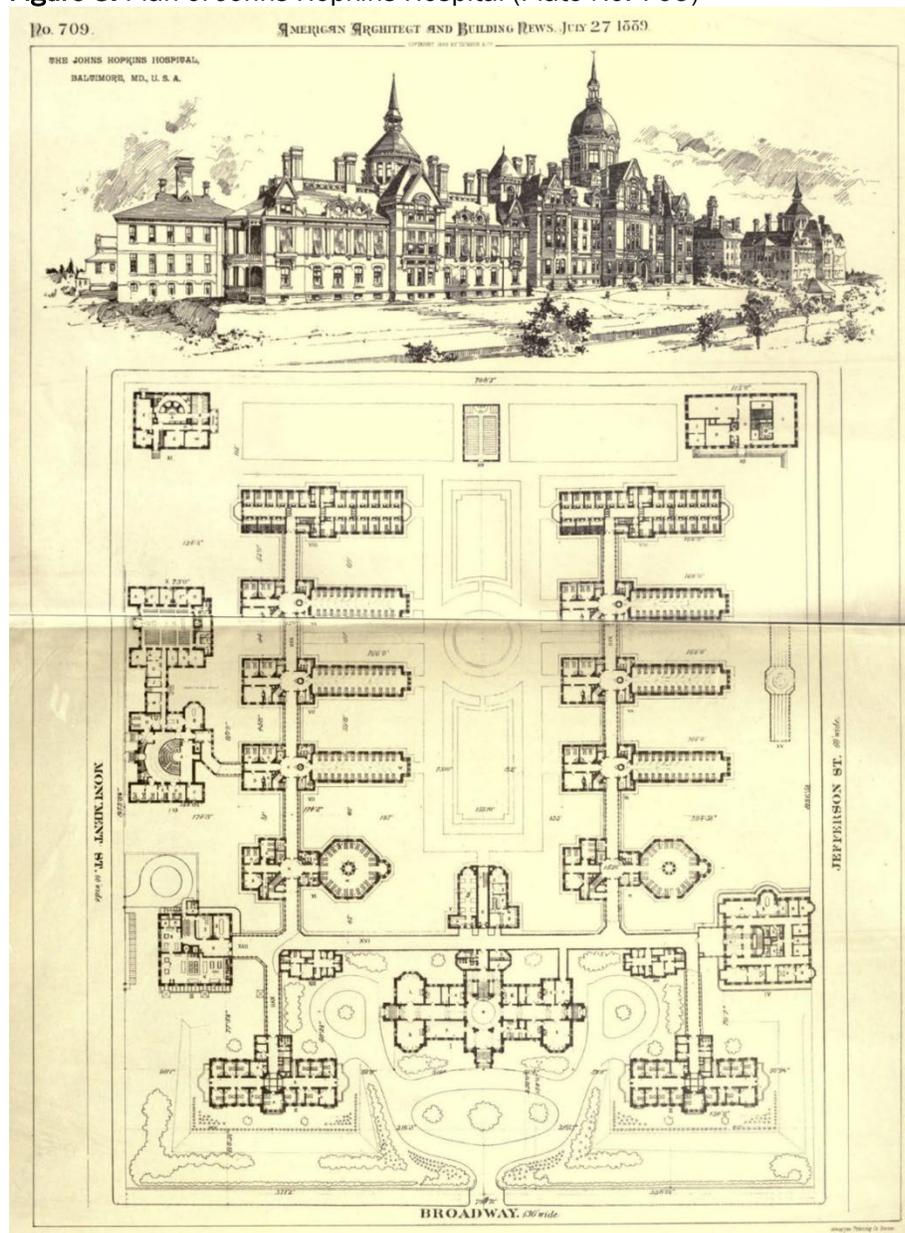


Reproduced from Nightingale F. Hospital construction. Wards. *The Builder*. 1858;16(816):641-643.

Figure shows window placement for maximum natural ventilation between beds, with graphic indications of beds and lines of window-to-window cross-ventilation added by author.

Early germ theory in the late 1860s provided evidence that dust-borne microbes caused disease; in response, hospital designers experimented with mechanically directed, closed-window ventilation systems that filtered out dust.^{18,19,20} In the 1870s, the board of governors of the newly endowed Johns Hopkins Hospital hired John Shaw Billings—a surgeon, Civil War military hospital doctor, and author of a postwar report on the healthiness of hospitals and barracks—to oversee the design of the new institution. Billings intentionally planned the new hospital facility as a “laboratory of heating and ventilation” with a variety of ward layouts and heating and ventilation system designs to provide data that would establish which ones yielded the best outcomes (see Figure 3).^{21,22,23}

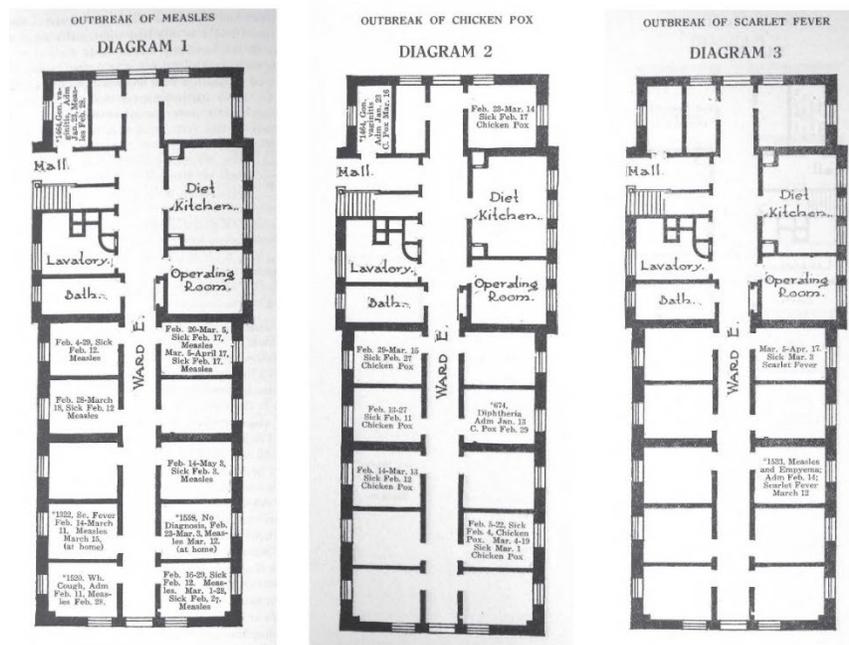
Figure 3. Plan of Johns Hopkins Hospital (Plate No. 709)



Reproduced from *American Architect and Building News*, 1889:26(709). Patients were housed in octagonal wards, rectangular wards, and single-bed rooms in the isolation ward.

By the 20th century, increasing attention to direct contact as the means of spread of disease shifted attention from air to the interaction of design features and microbes. Designers of the Contagious Disease Unit of the Providence City Hospital in Rhode Island downplayed air flow and emphasized details that facilitated aseptic procedures (see Figure 4). Studies of materials, decontamination processes, functional details, and layouts that reduced the environmental microbial load and thereby minimized hospital-acquired infections continued for decades.^{24,25,26,27,28,29,30,31}

Figure 4. Contagious Disease Buildings, Providence City Hospital



PROVIDENCE CITY HOSPITAL

Reproduced from *Annual Report of the Providence City Hospital* (photo from 1910 issue, frontispiece; diagrams 1-3 from 1912 issue, pp. 38-40).

Based on extensive research by hospital supervisor D. L. Richardson and his collaborations with hospital architects, Martin & Hall, the Contagious Disease buildings (completed in 1911) were designed to limit contact infection and disregard air as a means of transmission. Active cases were assigned to doorless single-bed cubicles with extensive aseptic features to support aseptic barrier nursing techniques. In the first years of operation, all incidences of secondary infections were studied and mapped with the intent of determining if aerial infection was or was not a factor in transmission. Procedures and design details were changed in response to incidence.

Throughout the 19th and 20th centuries, publications did not keep pace with the rate of research and innovation, and designers undertook “study tours” to new and innovative hospital facilities to gather evidence for improved hospital designs.³² In the 1860s, surgeon and public health advocate Dr Stephen Smith and architect Carl Pfeiffer undertook an extended tour of hospitals in Europe and America prior to designing the new Roosevelt Hospital in New York City.^{33,34} Similarly, influential hospital architect Edward F. Stevens gained detailed knowledge of hospital operations and designs through his extensive travel to hospitals.³⁵ Dr Christian R. Holmes, a physician and chair of the Board of Hospital Commissioners of Cincinnati General Hospital, determined the best design for the new model hospital facility after a travel study tour.³⁶

Designs to Promote Healing (1900s-1950s)

Studies of therapeutic influences of specific environmental conditions and designs that realized those conditions blossomed in the 20th century.³⁷ In 1906, prominent New York City physician Dr W. Gilman Thompson sent patients with a variety of diseases to a new, experimental rooftop “fresh air” ward and tracked their rates of improvement relative to those in the traditional enclosed wards.^{38,39} The widely publicized positive results encouraged hospitals across the country to add fresh air facilities.^{9,40}

With the development of increasingly sophisticated mechanical ventilation systems that could humidify, cool or heat, and ventilate, studies examining the influence of “internal” controlled climate on patients also proliferated. By 1920, a geographer and advocate of the (now discredited) theory of environmental determinism, Ellsworth Huntington, demonstrated that air conditions in hospitals affected the postoperative death rate; this finding focused designer attention on providing the optimum environment for patients.^{41,42,43,44,45} Hospital practitioners built and assessed experimental “climate” or “weather” rooms in which the environmental conditions could be tailored to the exact therapeutic needs of a specific patient.^{46,47,48,49} Reports of unanticipated problems (eg, high humidity rooms for patients with breathing difficulties experienced condensation and mildew) and possible design solutions to those problems appeared alongside reports of clinical successes.⁵⁰ After Boston Children’s Hospital pediatrician Kenneth D. Blackfan published a study in 1933 with public health engineer Constantin P. Yaglou and pediatric nurse Katherine MacKenzie Wyman showing that improved outcomes for premature infants were correlated with improved air conditioning, installation of air conditioning in nurseries became standard practice.^{51,52,53} In operating rooms, studies showed that air conditioning at the proper humidity balance made surgeons more comfortable, reduced condensation that could drip onto the operating field, and prevented deadly anesthetic gas explosions by reducing static electricity sparks.^{54,55,56,57}

Design for Efficiency (1860s-1950s)

Hospital layouts influenced patient outcomes by directly influencing nursing and medical care efficiency. Even Nightingale and her followers advised that the number of patients one head nurse could oversee determined the size limit of a pavilion ward.^{16,58} By the early 20th century, studies measured nursing efficiency using the pedometer. To reduce distances traveled by caregivers in the course of their duties, designers experimented with ward layouts that had standard rooms for patients with shorter and fewer corridors, more centralized nurse stations, improved supervision (via use of glass), and more numerous utility cabinets.^{9,59,60,61,62,63}

Personnel and material shortages during the Second World War prompted hospital practitioners to study efficiencies in all corners of the hospital.⁶⁴ This focus was evident

not only in numerous studies of designs that improved specific services or functions, but also in extensively researched, standardized model plans (called “type” plans) published by the US Public Health Service as a resource to help hospital administrators maximize personnel efficiency, minimize materials used, and improve patient outcomes.⁶⁵ Postwar hospital efficiency studies incorporated new methods and new concerns, including task-level time and motion studies for doctors, nurses, and staff.^{66,67,68} The Greater Baltimore Medical Center’s horizontal layout (built at a time when hospital designs were trending vertically) was determined by “operations research” that studied hospital traffic patterns and developed a layout that would make for the most efficient pattern.⁶⁹ During the 1950s and 1960s, designers regularly based experimental ward unit layouts on evidence gained from construction of full-scale model patient rooms.^{70,71,72,73,74,75}

In operating rooms, standardization of room designs supported standardization of surgical procedures, which reduced infections and minimized the time clinicians needed to spend tending a patient.^{67,76,77} The ever-changing technologies and procedures of up-to-date surgical practice, however, guaranteed a constant reassessment of both procedures and design features. For example, in the early 1900s, hospitals often included a “recovery” room (often noisy and disruptive) where postoperative patients came out from under anesthesia.⁷⁸ By the 1930s, recovery rooms were no longer considered best practice, as they required extra handling of the patient.⁷⁹ In the 1940s, the widely reported improved outcomes for wounded soldiers in military hospital surgical recovery rooms staffed by experienced nurses and stocked with specialized equipment (eg, suction, oxygen) made recovery rooms again essential in postwar surgical suites.^{78,80} By the 1950s, the success of surgical recovery rooms fueled the spread of **intensive care units**.

Patient Comfort (1900s-1960s)

The importance of the effect of patient comfort on outcomes also gained attention in the early 20th century. In 1906, students at Columbia University studied the sources of external noise around a hospital, and their findings became the basis for the creation of hospital quiet zones.⁸¹ With the development of color theory, designers decried the negative influence of the ubiquitous all-white hospital surfaces and suggested the beneficial influence of colors.^{82,83,84} Opportunistic paint manufacturers soon published pamphlets describing which paint colors were best for a room based on exposure (north or south light) and patient ailment.⁸⁵ By the 1940s, modernist architect Alden B. Dow incorporated a color scheme designed to provide a positive, more cheerful, patient experience in Midland Hospital in Michigan. Each room provided a therapeutic view of natural surroundings and incorporated its own unique color balance to promote a positive response, with softer, more restful, colors for design elements (eg, dark green floors, light green walls, blue ceilings, and pink woodwork) in patient rooms and more brilliant, stimulating colors for design elements (eg, orange-red floors, white walls, and green ceilings) in public spaces.^{86,87} Postoccupancy qualitative surveys quoted patients as commenting that “It’s a beautiful place to be sick in, if you have to be sick.”⁸⁸ Similar attention to the positive effects of art and music on patient outcomes brought all sorts of new entertainments and distractions to the mid-century patient’s bedside.^{89,90,91}

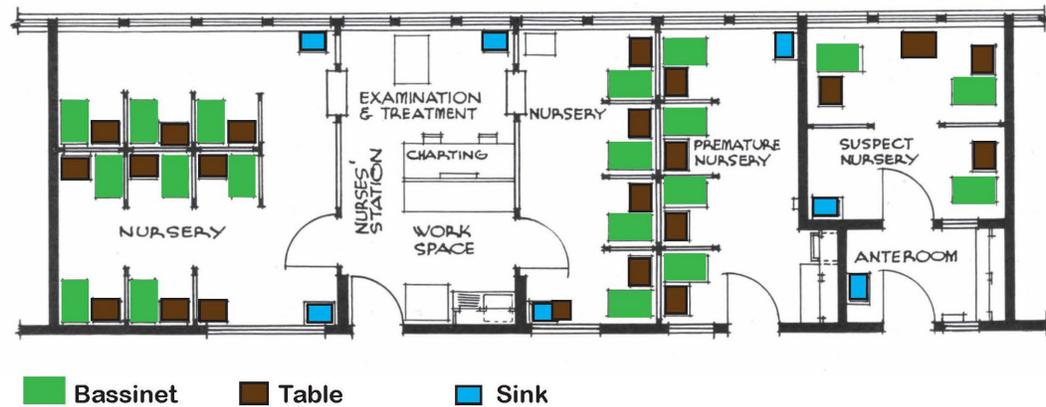
By the 1960s, new strategies of gathering data on patient experiences fueled the new field of architectural psychology and many resultant design refinements.⁹² In Topeka, Kansas, a new environmental research building even offered a complete spatial laboratory for studying architectural variables and their effects on patients.⁹³

Rooming-in Obstetric Units (1940s-1960s)

The above examples show that evidence has provided a basis for hospital design for decades. One additional example will show how deep that history might go within each example.

Early 20th-century obstetric unit designs included sterile formula rooms (which were designed at the level of aseptic detail of the surgical suite) and centralized nurseries, which could hold dozens of infants and which typically required gowning and masking for access (see Figure 5).^{94,95} This layout was intended to reduce infections, but it also reduced infant-parent interactions.

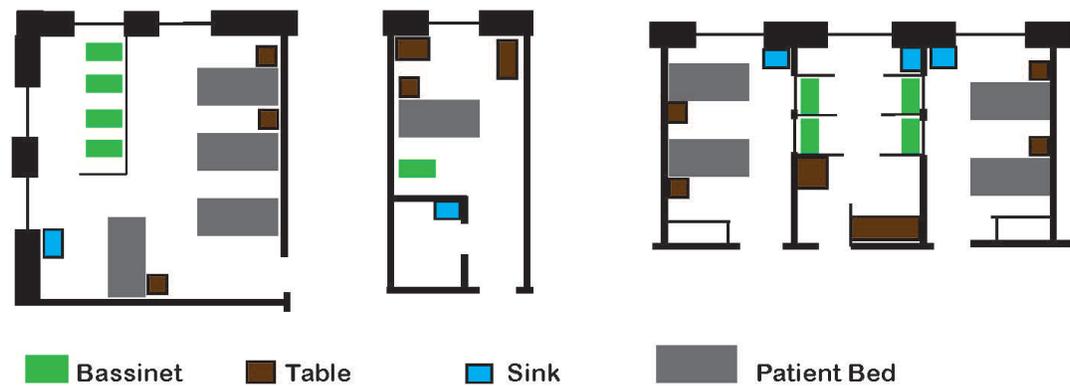
Figure 5. US Public Health Service Type Plan of Central Nursery Layout^a



Plan reproduced from Dunham et al,⁹⁴ with graphic indications of bassinets, sinks, and tables added by author.
^a For hospital expecting 700 live births per year.

In the early 1940s, the Cornelian Center of Detroit—citing literature that showed behavioral problems could stem from infancy—redesigned its childbirth suites to house the infant in the same room with the mother and reported increased bonding between parents and infant, encouragement of breastfeeding over formula feeding, reduced crying, and reduced nursing load.⁹⁶ To gather more data, the George Washington University Hospital included several different nursery and maternity room designs in a new maternity facility in 1945 (see Figure 6). Postoccupancy analyses summarized the benefits of each layout but led to the general conclusion that smaller nurseries in greater proximity to the mother reduced infection, increased mother-baby interaction, and encouraged breastfeeding over formula feeding.⁹⁷

Figure 6. Rooming-in Layouts



Graphic by author, based on Montgomery TL, Keast M.⁹⁸

By 1948, the Grace-New Haven Community Hospital in Connecticut reported numerous positive outcomes (happier mothers, healthier babies, more efficient nursing, and—though inconclusive because of the small sample size—possibly fewer infections) associated with its experimental rooming-in unit (see Figure 6).⁹⁹ Over the next few years, rooming-in suites appeared in hospitals across the country, each reporting positive outcomes.^{98,100,101,102,103,104,105}

Setting the Stage for EBD

Modern EBD is understood as an active and intentional research process involving the gathering, analysis, and publication of data on which to base design decisions.¹ In each of the historical examples presented above, the designers followed that process. If there is a clear difference between EBD then and now it is in the greater present emphasis on the methodological and analytical framework of the research.

If hospital designers have been basing designs on evidence for decades, architects more generally only began to express awareness of how little they knew about the effects of their designs on the occupants in the 1950s.^{92,106,107,108,109,110} Conscious attempts to incorporate research as a basis for design gained traction in professional architectural circles beginning in the 1960s.^{111,112,113,114,115} Since then, evidence-based architectural research has grown ever more sophisticated, more detailed, more rigorous, and more central to the profession. Situated in this larger context, Ulrich's 1984 publication and the development of EBD becomes part of a much larger, much longer transformation of design. The examples given in this article suggest the extent of the history that is still waiting to be told.

References

1. About EBD. Center for Health Design. Accessed December 30, 2023. <https://www.healthdesign.org/certification-outreach/edac/about-ebd>
2. Ulrich RS. View through a window may influence recovery from surgery. *Science*. 1984;224(4647):420-421.
3. Levin D. Evidence-based design origins. *Healthcare Design Mag*. May 20, 2014. Accessed May 30, 2024. <https://healthcaredesignmagazine.com/trends/architecture/evidence-based-design-origins/?hilite=evidence-based+design+origins>
4. Mitchell E. Hospitals and evidence-based design part 2: the revolutionary 100 years. EOSCU blog. March 25, 2022. Accessed May 30, 2024.

<https://blog.eoscu.com/blog/hospitals-and-evidence-based-design-part-2-the-revolutionary-100-years>

5. Theodore D. Better design, better hospitals. *CMAJ*. 2016;188(12):902-903.
6. Tenon J. *Memoirs on Paris Hospitals*. Science History Publications; 1997.
7. Howard J. *An Account of the Principal Lazarettos in Europe; With Various Papers Relative to the Plague: Together With Further Observations on Some Foreign Prisons and Hospital; and Additional Remarks on the Present State of Those in Great Britain and Ireland*. 2nd ed. J Johnson, C Dilly, & T Cadell; 1791.
8. Tilton J. *Economical Observations on Military Hospitals: And the Prevention and Cure of Diseases Incident to an Army: In Three Parts: Addressed I to Ministers of State and Legislatures, II to Commanding Officers, III to the Medical Staff*. J Wilson; 1813.
9. Kisacky JS. *Rise of the Modern Hospital: An Architectural History of Health and Healing, 1870-1940*. University of Pittsburgh Press; 2017.
10. Bruegmann R. *Architecture of the Hospital, 1770-1870: Design and Technology*. Dissertation. University of Pennsylvania; 1976.
11. Kisacky J. Breathing room: calculating an architecture of air. In: Gerbino A, ed. *Geometrical Objects: Architecture and the Mathematical Sciences 1400-1800*. Springer; 2014:247-280.
12. Sylvester C. *The Philosophy of Domestic Economy: As Exemplified in the Mode of Warming, Ventilating, Washing, Drying and Cooking, Contributing to the Comfort of Domestic Life*. Barnett; 1819.
13. *Some Account of the Medical School in Boston, and of the Massachusetts General Hospital*. Phelps & Farnham; 1824.
14. Watson J. *Thermal Ventilation, and Other Sanitary Improvements, Applicable to Public Buildings, and Recently Adopted at the New York Hospital: A Discourse, Delivered at the Hospital, February 8th, 1851*. Wm W Rose; 1851.
15. Nightingale F. *Notes on Hospitals*. 3rd ed. Longman, Green, Longman, Roberts, & Green; 1863.
16. Thompson JD, Goldin G. *The Hospital: A Social and Architectural History*. Yale University Press; 1975.
17. Taylor JRB. *The Architect and the Pavilion Hospital: Dialogue and Design Creativity in England 1850-1914*. Leicester University Press; 1997.
18. Kisacky JS. Restructuring isolation: hospital architecture, medicine, and disease prevention. *Bull Hist Med*. 2005;79(1):1-49.
19. Wells TS. Some causes of excessive mortality after surgical operations. *BMJ*. 1864;2(196):384-388.
20. New York Hospital Building Committee. *Report of the Building Committee: Together With an Address Delivered on the Occasion of the Inauguration of the New Building, on the 16th March, 1877*. LW Lawrence; 1877.
21. Billings JS. *Johns Hopkins Hospital: Reports and Papers Relating to Construction and Organization. No. 5, on Heating and Ventilation*. Wm K Boyle & Son; 1878.
22. Fair A. "A laboratory of heating and ventilation": the Johns Hopkins Hospital as experimental architecture, 1870-90. *J Archit (Lond)*. 2014;19(3):357-381.
23. Billings JS. *Description of the Johns Hopkins Hospital*. Isaac Friedenwald; 1890.
24. Kisacky J. Germs are in the details: aseptic design and general contractors at the Lying-In Hospital of the City of New York, 1897-1901. *Constr Hist*. 2013;28(1):83-106.

25. A Laboratory Technist. Infections caused by “slips” in operating room technic. *Mod Hosp.* 1915;5(6):411-413.
26. Connolly JI. Safeguarding the sterile water supply. *Mod Hosp.* 1935;45(1):61-65.
27. Hart D. Control of air-borne pathogenic bacteria by bactericidal radiant energy. *Mod Hosp.* 1936;46(6):79-81.
28. Wells WF. Air-borne infections. *Mod Hosp.* 1938;51(1):66-69.
29. Golub JJ. Infections challenge planning. *Mod Hosp.* 1939;52(3):68-71.
30. Hurst V, Grossman M, Ingram FR, Lowe AE. Hospital laundry and refuse chutes as source of staphylococcic cross-infection. *J Am Med Assoc.* 1958;167(10):1223-1229.
31. Walter CW, Kundsinn RB, Brubaker MM. The incidence of airborne wound infection during operation. *JAMA.* 1963;186(10):908-913.
32. Logan C, Willis J. International travel as medical research: architecture and the modern hospital. *Health Hist.* 2010;12(2):116-133.
33. Smith S. *Principles of Hospital Construction.* Trustees of the Roosevelt Hospital; 1865.
34. Pfeiffer C. A report upon “sanitary relations to health principles of architecture.” *Public Health Pap Rep.* 1873;1:147-156.
35. Adams A. *Medicine by Design: The Architect and the Modern Hospital, 1893-1943.* University of Minnesota Press; 2008.
36. Finest hospital in the world. *New York Times.* December 1, 1912. Accessed May 30, 2024. <https://www.nytimes.com/1912/12/01/archives/finest-hospital-in-the-world-in-cincinnati-elaborate-plant-on-the.html>
37. Greenhalgh I, Butler AR. Sanatoria revisited: sunlight and health. *J R Coll Phys Edinb.* 2017;47(3):276-280.
38. Hospital’s strong ally—an open air roof ward, experiment at the Presbyterian Institution a success. *New York Times.* December 9, 1906. Accessed May 30, 2024. <https://www.nytimes.com/1906/12/09/archives/hospitals-strong-ally-an-open-air-roof-ward-experiment-at-the.html>
39. Pneumonia being conquered in the open air, instead of hot rooms and equal temperature, the hospital roof and the winter’s blast are utilized with success in the treatment of this scourge. *New York Times.* January 26, 1908. Accessed May 30, 2024. <https://www.nytimes.com/1908/01/26/archives/pneumonia-being-conquered-in-the-open-air-instead-of-hot-rooms.html>
40. Thompson WG. The treatment of pneumonia, especially by outdoor air. *Am J Med Sci.* 1908;135(1):13-18.
41. Huntington E. Air control and the reduction of the death rate after operations. *Mod Hosp.* 1920;14(1):10-15.
42. Huntington E. Air control and the reduction of the death rate after operations. Part II. Variability. *Mod Hosp.* 1920;14(2):111-114.
43. Huntington E. The purpose and methods of air control in hospitals. Part I. *Mod Hosp.* 1920;14(4):271-275.
44. Huntington E. The purpose and methods of air control in hospitals. Part II. Methods of air control and their results. *Mod Hosp.* 1920;14(5):348-353.
45. Short CA. *The Recovery of Natural Environments in Architecture: Air, Comfort and Climate.* Taylor & Francis; 2017.
46. Dwight PW. Bringing climate to the patient. *Mod Hosp.* 1922;19(3):199-202.
47. Myers JA. Ventilation: temperature and humidity. *Trained Nurse Hosp Rev.* 1928;81(5):593-599.

48. Barach AL. Keeping patients comfortable by means of the health room. *Mod Hosp.* 1929;33(6):89-91.
49. Oseroff A. The weather rooms—a step forward in oxygen therapy. *Mod Hosp.* 1936;46(4):60-62.
50. Price DL. Three experts answer questions about high humidity rooms. *Mod Hosp.* 1952;78(5):60-61.
51. Blackfan KD, Yaglou CP, Wyman KM. The premature infant: a study of the effects of atmospheric conditions on growth and on development. *AMA Am J Dis Child.* 1933;46(5, pt 2):1175-1236.
52. Blackfan KD, Yaglou CP. Controlling environmental conditions in premature nurseries. *Mod Hosp.* 1935;45(6):83-86.
53. Woolrich PF. Proper air conditioning is essential to the health and comfort of infants in the nursery. *Mod Hosp.* 1948;70(2):108-112.
54. Eisenman FJ. Protecting patients through air conditioning. *Mod Hosp.* 1936;46(5):62-64.
55. Phillips VB. Safeguarding the operating room against explosions. *Mod Hosp.* 1936;46(4):81-86.
56. Phelps RA. Safeguarding the operating suite—I. *Mod Hosp.* 1951;77(5):122-128.
57. Phelps RA. Safeguarding the operating suite—II. *Mod Hosp.* 1951;77(6):126-134.
58. Galton SD. *Healthy Hospitals. Observations on Some Points Connected With Hospital Construction.* Clarendon Press; 1893.
59. Thompson WG. Efficiency in nursing. *J Am Med Assoc.* 1913;61(24):2146-2149.
60. Goodnow M. Conservation—the waste of human energy in hospitals. *Trained Nurse Hosp Rev.* 1914;52(1):14-17.
61. Bacon AS. Efficient hospitals. *J Am Med Assoc.* 1920;74(2):123-126.
62. Doane JC. Shortening nurse travel lanes. *Mod Hosp.* 1939;52(3):62-63.
63. Northrup, O'Brien, Schmidt, Garden, Erikson, Brown RE. “Race track” plan cuts down the distance from nurses’ stations to patients’ rooms. *Mod Hosp.* 1950;75(4):59-63.
64. McLin WC. If your personnel needs a lift: motion and time studies are in order. *Mod Hosp.* 1942;59(4):54-56.
65. McDonald NF, Shaffer M. Planning suggestions and demonstration plans for acute general hospitals. *Hospitals.* 1943;17(7):35-68.
66. Maus SE. Time and motion studies increase efficiency and reduce worker fatigue. *Mod Hosp.* 1950;75(5):126-130.
67. Markus FE. Time and motion studies in the operating suite. *Mod Hosp.* 1952;78(5):83-84.
68. Brown E, Roche J. Methods study shaped team nursing plan. *Mod Hosp.* 1966;107(3):121-123.
69. Operations research helped shape this hospital design. *Mod Hosp.* 1966;107(5):122-125.
70. Pflueger MT; Skidmore Owings & Merrill Associated Architects. Structural details of model room, Mount Zion Hospital, San Francisco. *Mod Hosp.* 1948;71(3):62-63.
71. Se D, Holzinger KJ Jr, Bachmeyer AC; Erhart Eichenbaum & Rauch Architects. 600-bed general hospital in Arkansas changes the health map. *Archit Forum.* 1950;93(1):90-95.

72. Gorschalki R, Bird T. Two-bed unit simplifies operation. *Mod Hosp.* 1950;75(5):81.
73. Stone DD, Mulloy LB, Marraccine SP. Two-bed room designed with a difference. *Mod Hosp.* 1950;74(3):70-71.
74. Wilhelm NA. The minimal room offers privacy at a price the patient can pay. *Mod Hosp.* 1951;77(3):51-55.
75. Booth ON. Merits of the model: find mistakes before you build. *Mod Hosp.* 1966;106(3):104-106.
76. Doane JC. Is standardization of surgical technique possible? *Mod Hosp.* 1931;36(1):81-84.
77. Markus FE. Time and motion studies in the operating suite. *Mod Hosp.* 1952;78(6):80-81.
78. Hamilton DK, Kisacky J, Zilm F. Critical care 1950 to 2022: evolution of medicine, nursing, technology, and design. *Crit Care Clin.* 2023;39(3):603-625.
79. Hannaford HE. Planning the general hospital. *Archit Forum.* 1932;57(5):319-398.
80. Wawro NW. The recovery room has much to recommend it. *Mod Hosp.* 1949;73(5):64.
81. Rice MIL. Law aids the hospitals. *New York Times.* December 6, 1907. Accessed May 30, 2024. <https://www.nytimes.com/1907/12/06/archives/law-aids-the-hospitals-its-hand-stretched-out-to-make-quiet-around.html>
82. Ludlow WO. Color in the modern hospital. *Mod Hosp.* 1921;16(6):511-513.
83. Birren F. The psychologic value of color. *Mod Hosp.* 1928;31(6):85-88.
84. Birren F. Color is more than beauty. *Mod Hosp.* 1952;78(1):58-60.
85. Simmons. Convalescents are helped by color. *Mod Hosp.* 1927;29(2):177-180.
86. Dow AB. Careful planning makes each a cheerful room. *Hospitals.* 1945;19(6):54-55.
87. Midland Hospital by Alden B. Dow. Alden B. Dow Home & Studio. November 11, 2022. Accessed 13 July 2024, 2024. <https://www.abdow.org/midland-michigan-hospital-alden-dow/>
88. Morrill C. A practical demonstration of color in balance. *Hospitals.* 1945;19(6):53-55.
89. Hollway M, Eilola R. The ceiling reflects new hope for the handicapped. *Mod Hosp.* 1948;70(2):79-81.
90. Action by the auxiliary makes children's ward a fairyland. *Mod Hosp.* 1949;72(3):92-94.
91. Brown RE, Livingstone HM, Willard J. Silent music soothes the surgical patient. *Mod Hosp.* 1949;72(4):51-53.
92. Knoblauch J. *Architecture of Good Behavior: Psychology and Modern Institutional Design in Postwar America.* University of Pittsburgh Press; 2020.
93. Berger A, Good L. Architectural psychology in a psychiatric hospital. *AIA J.* 1963;40(6):76-80.
94. Dunham EC, Shaffer M, MacDonald NF. Standard plans for nurseries for newborn in hospitals of 50 to 200 beds. *Hospitals.* 1943;17(4):16-21.
95. US Public Health Service Hospitals Facilities Section. Notes on hospital planning. *Archit Rec.* 1946;100(2):101-116.
96. Moloney JC, Montgomery JC, Trainham G. The newborn, his family and the modern hospital. *Mod Hosp.* 1946;67(6):43-46.

97. McLendon PA, Parks J. Nurseries designed for modern maternity. *Mod Hosp.* 1945;65(1):46-49.
98. Montgomery TL, Keast M. In some form or other rooming-in is here to stay. *Mod Hosp.* 1951;76(3):82-84.
99. Snoke AW. Rooming-in unit; an experiment in the care of mothers and newborn. *Mod Hosp.* 1948;71(3):72-74.
100. Hamrick HR, Montgomery TL, Shenk EP. An administrator, an obstetrician and a maternity supervisor evaluate the rooming-in plan. *Mod Hosp.* 1949;73(2):47-52.
101. O'Neil W. Introducing Mount Sinai of Minneapolis. *Mod Hosp.* 1949;73(4):77-80.
102. Garfield SR. Permanente has the answer to living-in problems. *Mod Hosp.* 1951;77(1):61.
103. McBryde A. Compulsory rooming-in in the ward and private newborn service at Duke Hospital. *J Am Med Assoc.* 1951;145(9):625-628.
104. Snoke AW. Rooming-in and natural childbirth. *Mod Hosp.* 1951;77(3):98-110.
105. Temkin E. Rooming-in: redesigning hospitals and motherhood in Cold War America. *Bull Hist Med.* 2002;76(2):271-298.
106. Neutra RJ. What architects should know about patients. *Mod Hosp.* 1960;95(4):90-93.
107. What should be the logic of the way we plan our hospitals for the people? A modern hospital round table. *Mod Hosp.* 1966;106(3):114-122, 164-170.
108. Bailey R. Needed: optimum social design criteria. *Mod Hosp.* 1966;106(3):101-103.
109. Osmond H. Design must meet patients' human needs. *Mod Hosp.* 1966;106(3):98-100.
110. Stainbrook E. Architects not only design hospitals: they also design patient behavior. *Mod Hosp.* 1966;106(3):100.
111. Jacobs J Jr, Hyde R. The architect's guide to surgical infection. *AORN J.* 1963;1(3):47-63.
112. Evans BH. What is research for architecture? *AIA J.* 1964;41(5):87-89.
113. Evans BH. AIA research programs. *AIA J.* 1964;41(1):57-59.
114. Horowitz H. An introduction to research methods for architecture. *AIA J.* 1964;41(1):62-65.
115. Rolfe WT. Research and the architect. *AIA J.* 1964;41(1):59-61.

Jeanne Kisacky, PhD, MA, MArch is an independent scholar who has taught classes on the topic of health and architecture at Cornell University, Binghamton University, and Syracuse University. Her research focuses on the history of hospital architecture.

Citation

AMA J Ethics. 2024;26(12):E948-962.

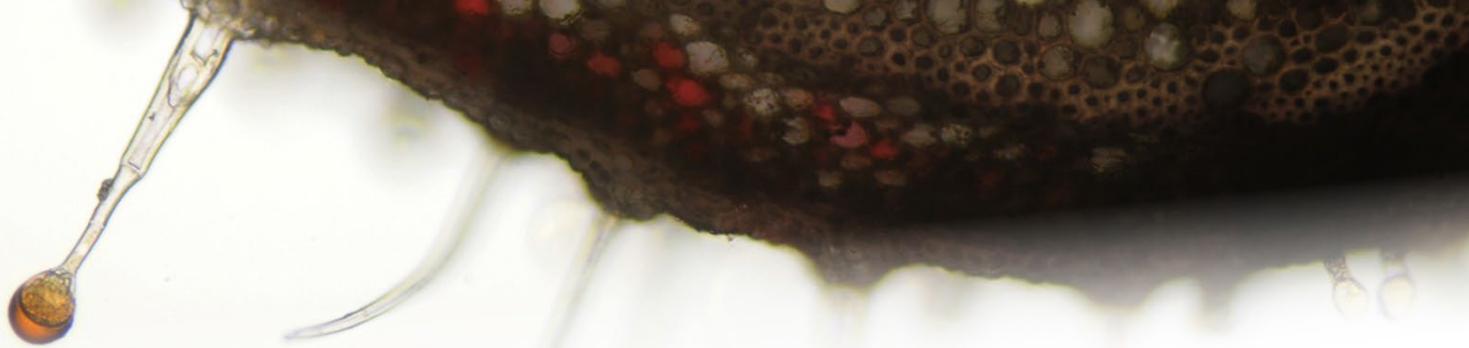
DOI

10.1001/amajethics.2024.948.

Conflict of Interest Disclosure

Author disclosed no conflicts of interest.

The viewpoints expressed in this article are those of the author(s) and do not necessarily reflect the views and policies of the AMA.



AMA Journal of Ethics®

December 2024, Volume 26, Number 12: E963-969

HISTORY OF MEDICINE

Hospital Design Standards and the AMA

Jorie Braunold, MLIS

Abstract

The establishment of the American Medical Association in 1847 launched medical practice standardization in the United States. Consensus on standards was hard won, however, and implementation was not immediate. Hospital design standards, specifically, were debated for decades and were ultimately ceded to nurses and architects. This article describes key moments along that trajectory.

Hospital Structures and Spaces

In the 1800s, hospitals' designs were more products of trial and error than evidence based. Physicians then were the most frequent occupiers of hospitals, so they were well placed to share their insights about design features. The American Medical Association (AMA) and other physicians' groups got to work on establishing medical standards and guidelines but didn't directly engage in designing hospital structures and spaces. Decades after the founding of the AMA in 1847, AMA members and health care organizations continued to ask key questions about hospital design: *How many stories should a hospital be?*¹ *What is the best method of ventilation?*² *Is a handwashing station really necessary?*³

Early Hospitals (1600s-1850)

The beginnings of the first public hospital in the United States dates back to the 1600s.⁴ Early hospitals had a very poor reputation, and any patients who could afford it were treated at home.⁵ The first hospitals in the United States mainly served the military and the indigent (public hospitals grew out of almshouses⁴)—in other words, people without a choice. Generally, hospitals were viewed as dangerous bastions of infection and disease.⁵ Diseases like puerperal fever spread like wildfire through lying-in hospitals, as surgeons would perform autopsies in the morning and deliver babies in the afternoon without washing their hands.⁶ Even into the mid-19th century, hospital buildings were poorly ventilated,⁷ overcrowded⁸ and, due to the general lack of hygiene, smelled so terrible that nurses took to wearing perfumed masks.⁹ Hospitals were built without planning—some had very few windows, no lavatory and bathing facilities (as well as no proper drainage where these did exist), inadequate kitchens, and nowhere for doctors to see patients privately.⁸

A report presented to the Medical Society of the State of New York in 1863 claimed that though these institutions were created with the best of intentions, they had not only failed to accomplish their goals but in many cases “aggravated the very evils they were designed to remove.”⁸ Florence Nightingale, a pioneer in hospital sanitation, publicly wondered whether “a succession of temporary sheds” would be safer than the buildings used as hospitals at the time.¹⁰ It was largely due to her influence that hospitals began implementing sanitation protocols and evidence-based design in the 1850s.¹⁰

Evidence-Based Design (1850-1890s)

In 1854, Nightingale was sent to reform a hospital for injured British soldiers in Crimea where dire conditions caused many unnecessary deaths. Not only did she improve conditions, but she “collected, compiled and communicated statistical data back to Britain to prove the worth of what her team was doing.”¹¹ Her interventions were simple¹²: avoid overcrowding; provide a clean environment with healthy food, fresh linens and uncontaminated water; use data to make decisions about hospital design¹³; improve air circulation¹⁴; and practice good waste management.

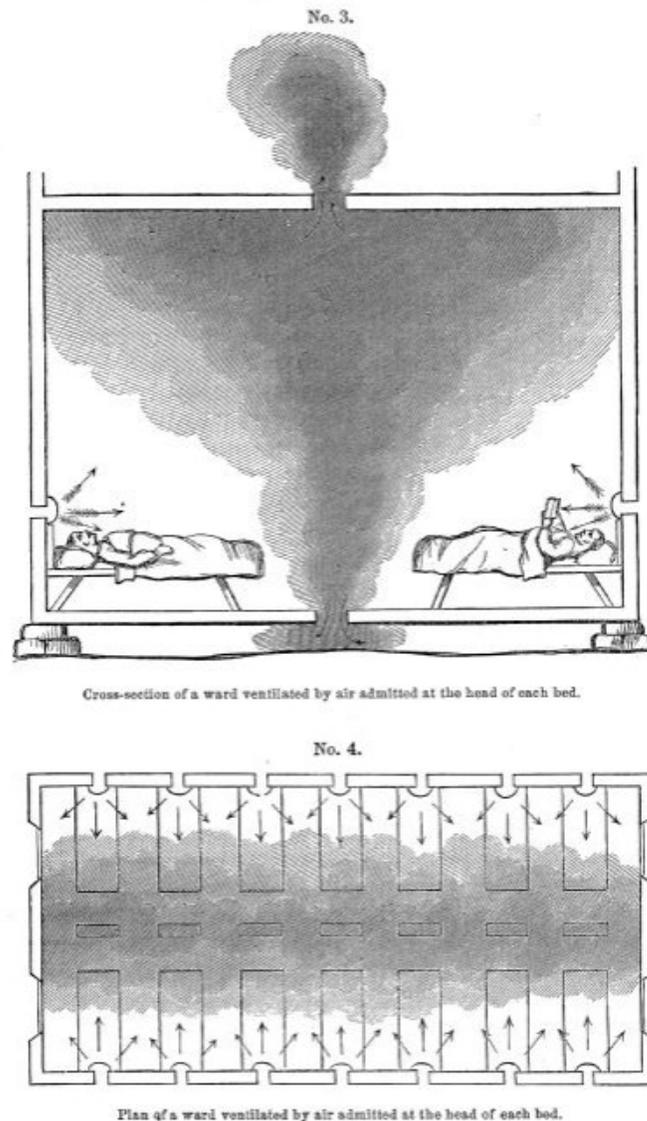
Once Nightingale returned to England, she set about solving some of the major issues facing medical professionals of the day. She recommended the complete redesign of entire hospital floors, providing “detailed notes on how to determine the correct amount of space surrounding each bed, accounting for ventilation, administration and clinical instruction.”¹⁴ She advocated for pavilion style hospitals, which predominated during the latter half of the 19th century, to reduce the spread of infection and provide better ventilation.¹⁴ This style of hospital architecture featured elongated, narrow sections with multiple windows located in opposing pairs for cross-ventilation, promoting enhanced airflow and increased efficiency in treating patients with similar injuries or illnesses. While most hospitals were designed like hotels, the **pavilion style** was more like a tent, its structure offering sufficient ventilation while safeguarding against harsh weather conditions. Frequently interconnected by a shared passageway, this layout also had the benefit of facilitating hospital staff’s swift access to any pavilion ward.¹⁴

One of the innovations included in this plan was to have a “clean area” at one end of the hospital wing and a “dirty area” at the other end. As Campbell explains, “The clean end would contain the entrance(s), nurse’s dayroom, scullery, storeroom, linen closet, coat closet, private watercloset, and staircase, if any. The dirty end would include the patients’ watercloset, lavatories, sinks, and a separate ante-room located prior to the former spaces.”¹⁵ Nightingale’s recommendations were exceptionally detailed, specifying which materials should be used for furniture and flooring, which direction pavilions should face for optimal natural light, and which heat sources should be used.¹⁶

Nightingale was not the only one in the medical field to make these discoveries in the mid-19th century. AMA members were similarly discovering the **importance of proper ventilation** in hospital design at around the same time. As early as 1848, AMA members provided testimony proving that “two of the most alarming and fatal scourges of humanity, typhus and puerperal fevers, are intimately connected with, and in a great degree dependent upon, accumulations of filth, and impure atmosphere, and that their ravages are immediately under the control of sanitary measures, and may be checked by a faithful compliance with proper legislative enactments.”¹⁶ In 1851, AMA members discussed the importance of thermal ventilation in patient care.² An 1864 report in the *Transactions of the American Medical Association* notes that, for wounded soldiers, fresh air and distance from “suppurating wounds” were found to be perhaps the most

effective methods of recovery.¹⁷ The next year, the Committee on Military Hygiene issued a report on faulty construction and selection of hospital buildings, which included ventilation plans (see Figure 1).¹ When hospitals were thought to be well constructed, members of the AMA were invited to tour their facilities,¹⁸ presumably so the hospital administrators could share their methods with a wide audience capable of advocating for them. Later, when the *Journal of the American Medical Association* was created in 1883, articles on new hospital designs and descriptions of existing hospitals popped up from time to time, but by this time the field of hospital design had been outsourced to architects and administrators.

Figure 1. Illustrations of the Effects of Hospital Ventilation Plans



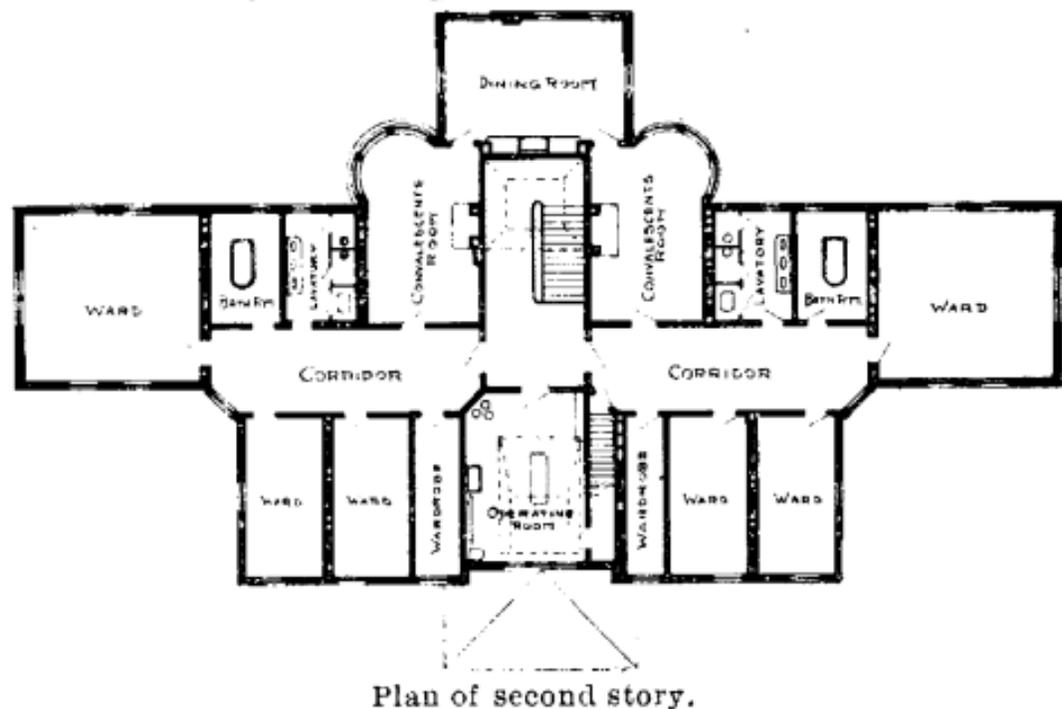
Reproduced from American Medical Association.¹
This diagram was presented at the AMA's Annual Meeting in 1865. It shows how different methods of ventilation moved "foul air" around the hospital ward.

The AMA's position on its role in hospital design is best summed up in an 1859 address to the House of Delegates. Dr Harvey Lindsly stated:

The importance of ventilation to comfort, health, and life, can hardly be overrated, and to medical science is almost exclusively due whatever improvement has been made in this respect in our public and private edifices. A vast deal, to be sure, yet remains to be done, but this must rest with architects, builders, and the people themselves, after the evils of breathing impure air have been so often and so thoroughly exposed by the profession.¹⁹

The AMA also believed that hospital sanitation was best dealt with by nurses rather than physicians. In an 1869 report on the training of nurses, it is said that a nurse's education must consist of the "principles of hygiene"; "methods of preparing food and drink"; "administration of" medicines; "application of leeches, blisters, bandages and other dressings"; and "making up beds, changing sheets, and handling patients exhausted by disease and injury."²⁰ Despite the overlap between many AMA opinions and Nightingale's, she is not mentioned in the AMA's official transactions until 1869, and her specific recommendations are never discussed at all, although the pavilion style hospitals she advocated for were eventually favored by the AMA as well.²¹ As Figure 2 illustrates, new hospital buildings did not necessarily adhere strictly to Nightingale's recommendations but incorporated the principles of design she advocated for, including long corridors with distinct wards.

Figure 2. Plan of the Second Floor of the Peterson Hospital in New York



Reproduced from Spratling.²²

This floor plan, which appeared in an 1898 article in the *Journal of the American Medical Association*, shows the second floor of the Peterson Hospital at the Craig Colony for Epileptics. The hospital was designed for the care and treatment of acute medical and surgical cases only, and its capacity was from 20 to 24 beds. The floor plan was submitted to the journal, along with its specifications, by the medical superintendent of the colony.

Entering the Modern Era (Early 20th Century)

As medical technology advanced, it became apparent that hospitals—in addition to providing a sterile, comfortable environment—must also be bastions of efficiency, with plenty of room for all the new equipment that was being invented. These demands meant that the pavilion plan was no longer practical. To ensure a window in each room, the buildings couldn't exceed a width of 2 rooms, leading to the necessity of constructing multiple lengthy and narrow wings. The resulting sprawling structures incurred **high construction costs**; were excessively expensive to heat, light, and provide water for; and proved inefficient and labor intensive to manage. Time and motion studies were used to determine layouts and locations of different departments, and diagnostic and treatment spaces were redesigned to create more efficient pathways for the movement of supplies, patients, nurses, technicians, and physicians.²³

As hospital design became more complicated, physicians and nurses alike **played a smaller role** in discussions of issues like ventilation and sun exposure, although they often served as consultants to business committees and architects.²³ But the AMA's influence on medical standards continued to contribute to the broader context in which health care professionals and architects collaborated to enhance hospital design and infrastructure.

References

1. Andrews E. Report of the Committee on Military Hygiene. *Trans Am Med Assoc.* 1865;15:167-181. Accessed January 17, 2024.
http://ama.nmtvault.com/jsp/PsImageViewer.jsp?doc_id=6863b9b4-a8b5-4ea0-9e63-ca2ed554e876%2Fama_arch%2FAD200001%2F00000015&pg_seq=207
2. Gaillard PC, Drake D, Emerson G, Desaussure HW. Report of the Committee on Hygiene. *Trans Am Med Assoc.* 1851;4:517-544. Accessed January 17, 2024.
http://ama.nmtvault.com/jsp/PsImageViewer.jsp?doc_id=6863b9b4-a8b5-4ea0-9e63-ca2ed554e876%2Fama_arch%2FAD200001%2F00000004&pg_seq=523
3. B AR. Letter from Vienna. *J Am Med Assoc.* 1886;6(12):333-334.
4. Fiani B, Covarrubias C, Jarrah R, Kondilis A, Doan TM. Bellevue Hospital, the oldest public health center in the United States of America. *World Neurosurg.* 2022;167:57-61.
5. Starr P. *The Social Transformation of American Medicine: The Rise of a Sovereign Profession and the Making of a Vast Industry.* Basic Books; 1982.
6. Shaikh S. "The Contagiousness of Puerperal Fever" (1843), by Oliver Wendell Holmes. Embryo Project Encyclopedia. July 26, 2017. Updated September 11, 2023. Accessed January 12, 2024.
<https://embryo.asu.edu/pages/contagiousness-puerperal-fever-1843-oliver-wendell-holmes>
7. Munson A, Wetmore EA, Benedict ND. Eleventh annual report of the managers of the state lunatic asylum: made to the legislature February 8, 1854. Curtiss & White; 1863. Accessed January 12, 2024.
<https://archive.org/details/b30304714/mode/2up>
8. Lee CA. Remarks on hospital construction, with notices of foreign military hospitals. *Trans Med Soc State New York.* 1863;225:37-66. Accessed January 20, 2024.
<https://books.google.com/books?id=dAegAAAAMAAJ&pg=PA37&lpg=PA37&dq=charles+a+lee+%22remarks+on+hospital+construction%22+1863&source=bl&>

ots=XF7ydNo__z&sig=ACfU3U2KdyeDr2eTgaOqoautmu4KmUdpVg&hl=en&sa=X
&ved=2ahUKEwiV1v-
s2eeDAXUjHjQIHxbyApEQ6AF6BAGOEAM#v=onepage&q=charles%20a%20lee%
20%22remarks%20on%20hospital%20construction%22%201863&f=false

9. McConnell CR. *Hospitals and Health Systems*. Jones & Bartlett Learning; 2020.
10. Bynum WF. *Science and the Practice of Medicine in the Nineteenth Century*. Cambridge University Press; 1994.
11. Hollingham R. The pioneering surgeons who cleaned up filthy hospitals. *BBC*. August 19, 2020. Accessed January 25, 2024. <https://www.bbc.com/future/article/20200812-the-pioneering-surgeons-who-cleaned-up-filthy-hospitals>
12. Karimi H, Masoudi Alavi N. Florence Nightingale: the mother of nursing. *Nurs Midwifery Stud*. 2015;4(2):e29475.
13. Dumitrascu DI, David L, Dumitrascu DL, Rogozea L. Florence Nightingale bicentennial: 1820-2020. Her contributions to health care improvement. *Med Pharm Rep*. 2020;93(4):428-430.
14. Aravind M, Chung KC. Evidence-based medicine and hospital reform: tracing origins back to Florence Nightingale. *Plast Reconstr Surg*. 2010;125(1):403-409.
15. Campbell WT. Pavilion-style hospitals of the American Civil War and Florence Nightingale. National Museum of Civil War Medicine. July 8, 2019. Accessed January 15, 2024. <https://www.civilwarmed.org/surgeons-call/pavilionhospitals/>
16. Wynne J, Thomas JM. Communication on hygiene, from the Medical Department of the National Institute. *Trans Am Med Assoc*. 1848;1:305-310. Accessed January 17, 2024. http://ama.nmtvault.com/jsp/PsImageViewer.jsp?doc_id=6863b9b4-a8b5-4ea0-9e63-ca2ed554e876%2Fama_arch%2FAD200001%2F00000001&pg_seq=315
17. Andrews E. Diatheses: their surgical relations and effects. *Trans Am Med Assoc*. 1864;14:117-137. Accessed January 17, 2024. http://ama.nmtvault.com/jsp/PsImageViewer.jsp?doc_id=6863b9b4-a8b5-4ea0-9e63-ca2ed554e876%2Fama_arch%2FAD200001%2F00000014&pg_seq=119
18. Tyler G, Hall JJC, May JF, et al. Minutes of the eleventh annual meeting of the American Medical Association, held in the city of Washington, May 4, 1858. *Trans Am Med Assoc*. 1858;11:9-28. Accessed January 12, 2024. http://ama.nmtvault.com/jsp/PsImageViewer.jsp?doc_id=6863b9b4-a8b5-4ea0-9e63-ca2ed554e876%2Fama_arch%2FAD200001%2F00000011&pg_seq=28
19. Address of Harvey Lindsly, president of the Association. *Trans Am Med Assoc*. 1859;12:51-60. Accessed January 12, 2024. http://ama.nmtvault.com/jsp/PsImageViewer.jsp?doc_id=6863b9b4-a8b5-4ea0-9e63-ca2ed554e876%2Fama_arch%2FAD200001%2F00000012&pg_seq=57
20. Gross SD. Report of the Committee on the Training of Nurses. *Trans Am Med Assoc*. 1869;20:161-174. Accessed January 12, 2024. http://ama.nmtvault.com/jsp/PsImageViewer.jsp?doc_id=6863b9b4-a8b5-4ea0-9e63-ca2ed554e876%2Fama_arch%2FAD200001%2F00000020&pg_seq=173

21. Wright MB. Pigmentation: a rare disease among infants. *Trans Am Med Assoc.* 1875;26:195-217. Accessed January 12, 2024. http://ama.nmtvault.com/jsp/PslImageViewer.jsp?doc_id=6863b9b4-a8b5-4ea0-9e63-ca2ed554e876%2Fama_arch%2FAD200001%2F00000026&pg_seq=219
22. Spratling WP. The Peterson Hospital at the Craig Colony for Epileptics. *J Am Med Assoc.* 1898;30(22):1265-1266.
23. Kisacky J. When fresh air went out of fashion at hospitals: how the hospital went from luxury resort to windowless box. *Smithsonian Mag.* June 14, 2017. Accessed January 25, 2024. <https://www.smithsonianmag.com/history/when-fresh-air-went-out-fashion-hospitals-180963710/>

Jorie Braunold, MLIS is the archivist for the American Medical Association in Chicago, Illinois. She has an MLIS in library and information sciences with a focus on archives from Dominican University.

Citation

AMA J Ethics. 2024;26(12):E963-969.

DOI

10.1001/amajethics.2024.963.

Conflict of Interest Disclosure

Author disclosed no conflicts of interest.

The viewpoints expressed in this article are those of the author(s) and do not necessarily reflect the views and policies of the AMA.

Copyright 2024 American Medical Association. All rights reserved.
ISSN 2376-6980