

RESEARCH IN PROFESSIONAL PRACTICE: HOW A SEED GRANT FROM THE AIA EVENTUALLY ENABLED THE CREATION OF A RESEARCH ENTITY

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Frameworks on flexibility are available in published literature. However, the uniqueness of healthcare processes highlights numerous areas of knowledge gaps. In 2006, the HKS Research team developed a study proposal to understand what flexibility means to end-users in inpatient care units, and to identify domains of design decision-making that impact operational flexibility. Funded by the AIA 2006 RFP and a grant from Herman Miller, the study examined the issue at six acute care hospitals across the U.S. Data analysis identified nine domains of design decision-making that impact operational flexibility on hospital bed units. Since the conclusion of the study, findings have been reported in four peer-reviewed and industry publications, two webinars, and three conferences. In 2009, this study received the 'Best International Research Award' from the International Academy for Design and Health at the 6th Design and Health World Congress in Singapore. Findings of the study have been used extensively in numerous HKS bed tower projects since initial publication. It has since provided a common vocabulary for diverse stakeholders in the decision-making process, and offered a structured approach to design decision-making. The study created a foundation for two follow-up research projects. An ongoing study funded by Herman Miller, in collaboration with the Texas Health Resources hospitals, is examining the impact of decentralization of caregiver support spaces on a number of operational outcomes. The second study, also funded by Herman Miller, is examining systemic and cultural factors that impede designing for operational flexibility.



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Flexibility in Building Design

The topic of flexibility is not new to the building design industry, which continually faces demand for change arising from such factors as technology, finance, and fashion. Seminal works by Stewart Brand¹ and Francis Duffy and Les Hutton² have provided strong frameworks for examination of the concept. Essentially, they proposed solutions based on a system of shearing layers. To enhance flexibility to adapt to changing business practices or to convert a building to a different occupancy type, a classification structure of building systems was proposed based on control, system life, and resilience to change. These frameworks were, however, founded on commercial and residential building types, perhaps with the supposition that mapping the concept to other building sectors would be reasonably straightforward.

A review of the literature revealed very few publications on flexibility in the healthcare sector. A significant contribution was a concept propounded by Dr. Stephen Kendall³ (The Open Building Paradigm), which was custom-made for hospital architecture. It was a structured mapping of the shearing layer system from workplace to healthcare occupancy type.

Healthcare, however, has unique necessities, and mapping flexibility concepts from other building sectors may not fully satisfy the flexibility demands in hospital care delivery. For instance, the need and demand for operational change in healthcare is very frequent. Unlike residential and commercial buildings, facilities constructed to accommodate hospitals do not typically experience significant changes in occupancy types. As a result, some notions of flexibility pertaining to commercial and residential buildings may not find a perfect fit in healthcare.

As an example, references to adaptability in workplace literature allude to affecting changes in the physical environment in order to adapt to a changing workplace practice. Workplace adaptability is necessarily associated with changes being made in the physical environment. In comparison, adaptability in healthcare design is dissociated from any prerequisite changes to the physical environment. A good example of flexibility to adapt includes universal patient rooms. Those rooms are fitted with the quantities of medical gas outlets that would accommodate patients with any level of acuity. Thus, when an acute care unit is replaced with a critical care unit, no changes to the physical design of the room are rendered necessary.

Similarly, workplace convertibility has been discussed in the context of a change in occupancy type—from commercial to residential, for instance. However, the notion of convertibility in healthcare may or may not be associated with a change in basic occupancy type. Further, convertibility in healthcare design is associated with simple minor renovation, and not such major renovation work as needed in changing facility occupancy. Acuity adaptable patient rooms constitute a good example of convertibility. The rooms are not fitted with medical gases and equipment for all levels of care. However, converting acute care rooms to critical care rooms could be accomplished with minor renovations, since necessary plumbing, square footage, and soft corridor walls are incorporated during unit design.

The Knowledge Gap

Three factors promoted the need for a study to explore the notion of flexibility in inpatient care units: (a) the subtle but meaningful differences in notions of flexibility between healthcare and other building sectors, (b) the absence of any literature on the topic in scientific publications, and (c) the ignorance regarding what flexibility means to the end users—the clinicians and support staff.

Further, at the time of this study, healthcare was experiencing one of the biggest construction booms in U.S. history, with massive investments in new and replacement facilities. Major investments were being channeled into bed units. The study was intended to inform the design of new inpatient units that will serve the American population over the next century.

The Study

With grant funding from the AIA and Herman Miller, the HKS research team initiated a study in collaboration with the University of Texas at Arlington, School of Nursing. Data were collected from six large hospitals from across the U.S.: (a) Parker Adventist Hospital, Parker, Colorado; (b) Clarian West Medical Center, Avon, Indiana; (c) Laredo Medical Center, Laredo, Texas; (d) McKay Dee Medical Center, Ogden, Utah; (e) Bon Secours St. Francis Hospital, Charleston, South Carolina; and (f) St. Rose Dominican Hospital – Siena Campus, Henderson, Nevada.



Figure 1: Paul Hyett of HKS-UK receiving the Academy award on behalf of HKS Research team from Mungo Smith and Eve Edelstein.

Key Findings

Data analysis identified nine areas of design decision-making that affects operational flexibility at the individual or the team/unit level:

1. Flexibility to Adapt:
 - a. Peer lines of sight
 - b. Patient visibility
 - c. Multiple division and zoning options
 - d. Proximity of support
 - e. Resilience to move, relocate and interchange units
 - f. Ease of movement between units and departments
 - g. Multiple administrative control and service expansion options
2. Flexibility to Convert
 - a. Adjustable support core elements
3. Flexibility to Expand
 - a. Expandable support core

Confirmatory Research

A key finding regarding patient visibility affecting operational efficiency received a confidence boost when a separate study arrived at the same conclusion. In that study, involving a national representative sample of twenty hospitals, a team of researchers from Stanford University Center for Health Policy and Harvard Business School focused on operational and physical design factors affecting patient safety in healthcare settings.⁴ It was found that facility failure (or physical design related factors) was the top factor affecting patient safety (sharing the top slot with equipment and supply failure). One of the factors was the difficulty in observing patients. A key conclusion reached by the authors was that factors affecting safety also affect operational efficiency, and both safety and efficiency can be optimized together.

Award

In 2009, this study received the ‘Best International Research Award’ from the International Academy for Design and Health at the 6th Design and Health World Congress in Singapore (Figure 1).

Dissemination

Originally titled “Inpatient Unit Design: Defining the Design Characteristics of a Successful Adaptable Unit” for the AIA report, this study has found its way to numerous scientific journals and industry magazines:

Pati, D., Harvey, T., & Cason, C. (2008). Inpatient Unit Flexibility: Design Characteristics of a Successful Flexible Unit. *Environment and Behavior*, 40(2), 205-232.

Pati, D. & Harvey, T. (2009). Inpatient Unit Flexibility: Design characteristics of a successful flexible unit. *World Health Design*, 2(3), 56-63.

Evans, J., Pati, D., & Harvey, T. (2008 - April). Rethinking Acuity Adaptability. *Healthcare Design*, 22-25.

Harvey, T. & Pati, D. (2008 - February). Functional Flexibility: Nine attributes of adaptable hospital spaces. *Health Facilities Management*, 21(2), 29-34.

The study was also accepted for presentation at several academic and industry conferences and webinar, namely:

Pati, D., May, J., and Burger, A. (2008). Flexible Design Solutions for Health Care Facilities! *Practice Green Health Webinar*, US Green Building Council's, Green Guide for Health Care (GGHC), November 14, 2008.

Harvey, T. & Pati, D. (2008). The Design Characteristics of a Successful Adaptable Inpatient Unit. *Center for Health Design 2008 Webinar Series*, May 1, 2008.

Harvey, T.E. & Pati, D. (2007). Defining the design characteristics of a successful adaptable inpatient unit. *Health Care Design Conference*, Dallas, TX, Nov 3-6, 2007.

Pati, D., Harvey, T., & Carolyn, C. (2007). Defining the design characteristics of a successful adaptable inpatient care unit. *EDRA 38*, Sacramento, CA, May 30 – June 3, 2007.

Harvey, T. & Pati, D. (2007). Inpatient Unit Design: Defining the Design Characteristics of a Successful Adaptable Unit. *American Institute of Architects National Convention*, San Antonio, TX May 2-5, 2007.

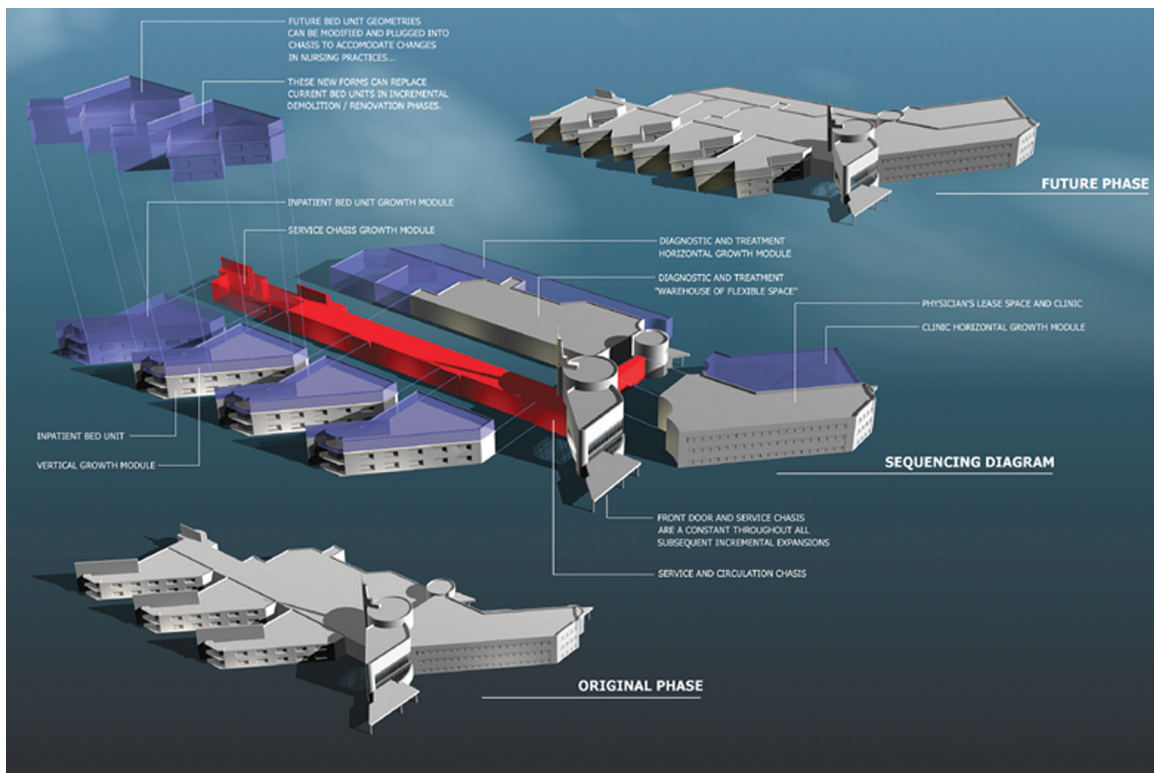


Figure 2: Flexibility concepts in healthcare design - Baptist North Little Rock.

Utilization

Findings of the study have been used extensively in numerous HKS bed tower projects since initial publication (Figure 2). It has since provided a common vocabulary for diverse stakeholders in the decision-making process, and offered a structured approach to design decision-making.

Further Study #1: Towards optimizing inpatient unit design and care model: a measure to predict nurse walking distance on hospital bed units.

The research created a foundation for two additional studies at HKS. The issue of ‘proximity to support’ as a factor affecting operational flexibility and efficiency supported a follow-up (ongoing) study involving an empirical examination of decentralization of caregiver work areas on bed units.

More time at bedside translates to better and safer patient care. However, studies show that nurses spend a sizable proportion of their time in hunting and gathering (non-productive) activities. Besides affecting patient care, it also results in large walking distances. Concerns related to excessive walking by nurses has been widely reported. Moreover, unnecessary time spent walking by nurses is wasted time being paid for using scant resources. The study constitutes an empirical examination of the impact of support space decentralization on a number of operational outcomes.

Funding for the study was provided by Herman Miller. The Research & Education Institute of the Texas Health Resources (THR) is a collaborator in the study. Three of the THR hospitals are providing settings for data validation, namely: (a) Texas Health Presbyterian Hospital Plano, Plano, Texas; (b) Texas Health Harris Methodist Hospital Cleburne, Cleburne, Texas; and (c) Texas Health Harris Methodist Hospital Southwest Fort Worth, Fort Worth, Texas.

Further Study #2: Systemic and Cultural Factors Impeding Designing for Operational Flexibility.

The second ongoing study resulted as a logical follow-up to the AIA-sponsored flexibility study. The main focus in the study is to identify factors impeding the implementation of the flexibility concepts articulated in the first study, especially since implementation of the recommendations is not independent of systemic and cultural issues that could prevent optimization of unit designs for operational flexibility. Such issues could be present at the individual level, unit level, and organization level. For instance, data from the inpatient unit flexibility study suggested that despite the potential positive outcomes of the universal room and variable acuity nursing concept, facilities have not succeeded in implementing the concept. Impediments include cross-training staff, opportunities for collaboration, peer support and mentoring, physician perception, perceived work load, equipment, and maintaining staff competency. Another example of systemic impediments pertains to proximity of support. It is widely acknowledged that point-of-care supply, or distributed supplies in close proximity to patient rooms, constitutes the ideal solution from the viewpoint of caregiver efficiency and patient care time. However, operating challenges (departmental performance silos) pertaining to inventory management, control, rotation and charge capture, and re-stocking responsibility impede implementation of such design solutions in many situations.

This study, funded by Herman Miller, aims to articulate such impediments, which would help stakeholders in healthcare design identify key challenges in optimizing the environment-behavior fit. This study will help identify critical systemic-cultural factors that need to be addressed to enhance flexibility and efficiency of inpatient unit operations. It will also help highlight detrimental interactions between operational cultures and physical design within the framework of operational flexibility.

Hospitals participating in the study include: (a) Homestead Hospital, Homestead, Florida; (b) Dr Philips Hospital, Orlando, Florida; and (c) St Joseph Mercy Hospital, Ypsilanti, Michigan; (d) Methodist Charlton Medical Center, Dallas, TX; and (e) St. Rose Dominican Hospital – San Martin Campus, Las Vegas, Nevada.

Concluding Note

The AIA 2006 grant enabled the undertaking of the first research study by the HKS research team, which was established in 2005. It constituted a significant source of support and encouragement for conducting scientific research in a practice environment. This initial momentum has subsequently enabled seven completed research projects, three ongoing studies, and several in different phases of initiation. HKS research program is expanding beyond healthcare; has published 36 manuscripts in scientific journals, industry magazines and book chapters (5 in press); made 45 research presentations at industry and academic conferences and webinars; conducted research in 21 hospitals; secured funding from nine industry partners, the Academy of Architecture for Health Foundation and the Department of Health and Human Services, in addition to the AIA; and built a collaborative relationship with ten institutions. In 2010, HKS research founded the non-profit Center for Advanced Design Research & Evaluation (CADRE). The crucial initial stimulus for these came from the 2006 AIA grant.

- ¹ Brand, S. (1995). *How buildings learn: What happens after they are built*. New York: Penguin.
- ² Duffy, F., & Hutton, L. (1998). Responding to change. In *Architectural knowledge: The idea of a profession*. London and New York: E & FN Spon.
- ³ Kendall, S. H. (2004). Open building: A new paradigm in hospital architecture. *AIA Academy Journal* (7th ed.), 22-27.
- ⁴ Tucker, A., Singer, S., Hayes, J., & Falwell, A. (2008). Front-Line Staff Perspectives on Opportunities for Improving the Safety and Efficiency of Hospital Work Systems. *Health Services Research* 43(5), 1807-1829.