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Accountable Design for Accountable Care

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Delivering Value With Design Research

In 1984, Roger S. Ulrich published a study in *Science* examining how access to nature through a window view could speed up patient recovery from gallbladder surgery, among other benefits. Elaborating on prior studies on the restorative effects of nature views, Ulrich's study is often cited as the tipping point in the research on the healing impact of design for patients. It is one of numerous studies in design research, a field of study devoted to understanding interrelationships between people and their environments.

As design research has grown in prominence, so has the concept of "patient-centered" care, the backbone of The Patient Protection and Affordable Care Act (PPACA). PPACA's strategy rewards well-intended innovation in healthcare proven to shift the patient and healthcare provider relationship to one that is "patient-centered." Research constitutes the proof. While there is no one definition of patient-centered care, common tenets include viewing the patient as a person and sharing power and responsibility with the patient (Mead & Bower, 2000). Viewing the patient as a person acknowledges the patient as an individual who has a unique experience with an illness. Sharing power and responsibility connotes providers' responsiveness to an empowerment of the patient's role in care delivery. The shift toward patient-centered care has direct implications for design research and the design of healthcare facilities—namely that design research will be a valued part of meeting and exceeding PPACA's aims during and following building project delivery. Simply put, what we build and how we build it by incorporating design research will dictate healthcare providers' bottom lines for years to come.

Under PPACA, the Centers for Medicare & Medicaid Services (CMS) will shift its emphasis from quantity of services to quality of services. This is a radical departure from the past, when hospitals and physicians earned more revenue from CMS and insurers by performing more services, regardless of

the benefit or lack thereof to patients. An increase in quality will result in cost savings that are to be shared among a group of providers and suppliers of services (e.g., hospitals, physicians and others involved in patient care) or accountable care organizations (ACOs). Shared savings are tied to performance in five key areas: patient/caregiver experience of care, care coordination, patient safety, preventive health and at-risk population/frail elderly health. If performance standards are not met, CMS can impose penalties and demand repayment from providers.

This paper will examine healthcare in the United States and the context for PPACA. Then, it will illustrate how healthcare design impacts the aims of accountable care with three case studies from design research of hospital inpatient units that look at unit configurations and layouts, decentralized nursing and family-centered care.

To illustrate how design research during design delivery can achieve the aims of accountable care, we will discuss a few examples from the context of architectural and engineering practice for inpatient unit design. Why inpatient units? Though there is a shift toward outpatient care, inpatient care continues to grow due to the healthcare needs of retiring Baby Boomers. Historically, care delivered in a hospital setting has taken the lion's share of healthcare spending, at around one-third, or $814 billion, of healthcare spending (Kaiser Family Foundation, 2012b). To conform to The PPACA, many U.S. hospitals need to invest in facilities that support healthcare delivery.

Finally, this paper will explore several immediate actions that can be taken to integrate facility design research into the strategic toolkit needed to improve healthcare facility design and patient care. These are: widespread adoption of pre-occupancy evaluations, industry incentives and the requirements for credible design research during building project delivery.

Unit Configurations and Layouts

A typical acute care inpatient unit consists of patient rooms, nurses' stations, hallways and a core of support spaces. Some of the more common unit configurations include the triangle, square, circle, cross and racetrack layouts. Figure 1 illustrates some of these approaches.

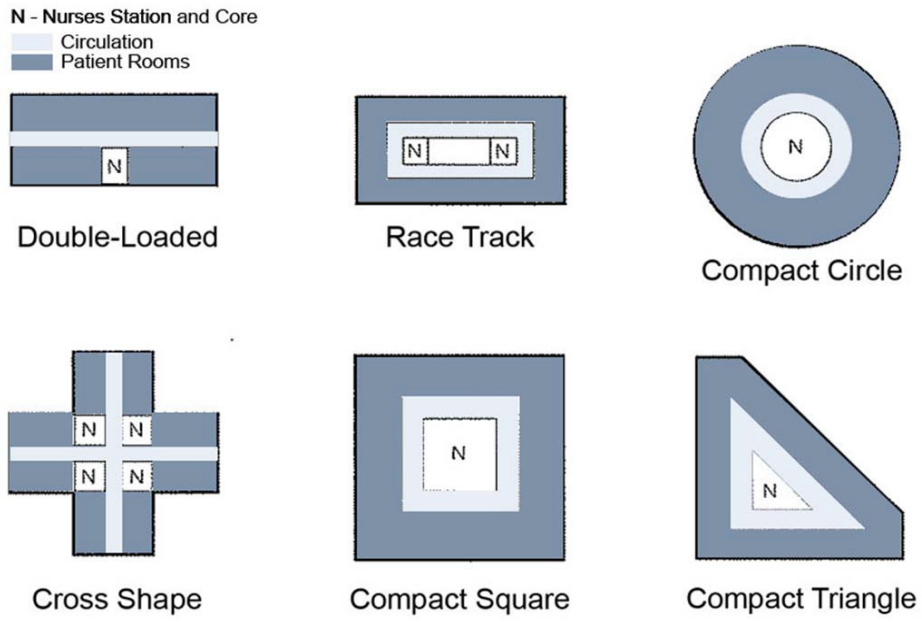

Figure 1: Inpatient units come in a variety of configurations as seen above. "N" represents where a nurses' station is typically located within each unit configuration. (Image courtesy of HOK.)

Staff travel distances, patient safety, visibility and communication, proximities and room distance, and standardization are among competing factors when deciding which unit configuration and layout is optimal for accountable care.

Staff Travel Distances

Design research since the 1970s has found that nurses on circular units walk less distance and spend more time performing patient care activities when compared to nurses on rectangular units (Shepley & Davies, 2004; Sturdavant, 1960; Trites, Galbraith, Sturdavant, & Leckwart, 1970). Given this and other research, it has been speculated that smaller inpatient units may necessitate less walking. This argument has been getting a lot of attention because inpatient units are getting larger, due to a trend toward private patient rooms with embedded family zones. The increased square feet may lead to more walking for staff. However, research of smaller, non-radial units versus larger inpatient units has found

that nurses may actually walk more on smaller units (Lu & Seo, 2012). Why? Smaller units may afford more visibility for nurses who can see more of each other. The higher visibility contributes to additional walking by nurses because there can be more opportunities for extra stops and spontaneous interactions with other nurses (Seo, Choi, & Zimring, 2011; Lu & Seo, 2012).

Patient Safety

A rule of thumb is that staff should see the upper third of the patient's bed when door or room blinds are open so that a patient's head, hands and chest can cue staff of respiratory distress, delirium and harmful behavior (Catrambone, Johnson, Mion, & Minnick, 2009). Such a visibility condition is increasingly recognized as critical to patient safety. In a retrospective study of an intensive care unit, Leaf et al. (2010) found that severely ill patients admitted to rooms not visible from the nurse station had significantly higher mortality rates when compared to similar patients in rooms within view of the nurses' station.

Visibility and Communication

In addition to enhancing patient safety, high patient visibility has been associated with patient and family satisfaction and appears to aid nurses in work tasks and interaction. A study of rectangular versus radial units found that patients and their family members were more satisfied with the radial unit because of improved visual contact with staff (Sturdavant, 1960). Lu and Zimring (2011) found that nurses positioned themselves on a unit so that they had high visibility of their patients, especially when interacting with other nurses.

Unit configurations with higher visibility encourage more communication among staff, patients and patients' visitors. This, in turn, leads to better patient-centered care and reduced risk of medical errors. In an ongoing natural experiment of triangular versus rectangular inpatient units, communication between the staff and a patient's visitors was worst on the triangular unit after controlling for other factors (Watkins, Peavey, Nanda, English, & Chabot, 2012c). Watkins et al. (2012c) additionally found that communication between staff and patients' visitors was essential to care delivery as

patients' visitors routinely took part in care delivery and served as patients' advocates. These results are contrary to recommendations that triangular units are optimal for a variety of anecdotal reasons, including minimal walking distances due to compactness, flexibility, utilization of available area (i.e., lack of unusable space) and maximum daylight exposure (Advisory Board, 2006).

Proximities and Room Distance

Patients in rooms located farther away from nurses' stations or harder-to-access locations are associated with lower staff and visitor responsiveness to a patient's condition, less time spent by nurses at the patient bedside and greater walking distances (Hendrich, Chow, Skierczynski, &Lu, 2008; Hendrich et al., 2009; Leaf, Homel, & Factor, 2010; Watkins et al., 2012a Watkins, Peavey, English, Nanda, & Chabot, 2012c). Hendrich et al. (2008) conducted a work sampling study and found that nurses spend almost four times as much time on documentation than on physical assessment and surveillance of patients. The overwhelming majority of nurses' time (38.6% of a nurse's shift) was spent at a main nurses' station, away from patients. In another study, documentation at main nurses' stations and away from the patient bedside was associated with more walking by the nurses, greater patient pain, more patient falls and fewer trips by the nurses to the patients' rooms (Watkins et al., 2012a).

Standardization

Inpatient units should be configured so that spaces are standardized, safer and better for patients. Results from a natural experiment indicated that when inpatient units had all patient beds oriented the same way (i.e., same-handed), staff were encouraged to approach patients from the patients' right hand side. The consistent right-sided approach to the patients was associated with fewer instances of patients having to catch themselves from falling (Watkins et al., 2011). Also, not as much noise was transmitted between room walls, and sleep quality was improved because headwalls were not mounted back to back on the same wall. Additional arguments for same-handed rooms include their adaptability for other safety and satisfaction-related design elements, including canted (i.e. slanted) walls and consistently placed hand-washing stations and handrails. Figure 2 illustrates the differences between same-handed and mirrored inpatient rooms.

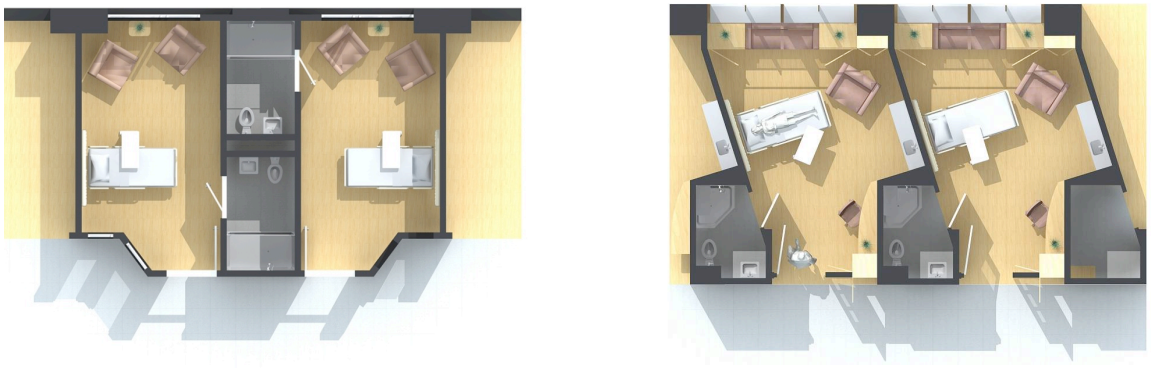

Figure 2: To the left, a template for a mirrored unit with beds oriented in different directions and shared headwalls. To the right, a template for a same-handed unit with all the beds oriented in the same direction and without shared headwalls. In this generic example, staff are encouraged to approach all patients from the patients' right side. The rooms are canted to improve clinicians' visibility of the patient and to orient patients toward daylight and views. (Image courtesy of HOK.)

On-Stage/Off-Stage

A fairly recent trend in healthcare design utilizes on- and off-stage strategies. The famous Disneyland Main Street is divided into an onstage area for performances and entertainment while spaces behind Main Street are reserved for routine operations that support the performances, like costume changes. In healthcare, the idea has translated similarly into the division of entire hospitals into on and off stages that divide patient and staff circulation. Inpatient unit staff can have their own dedicated "offstage" spaces in the core of the unit while patients and their visitors occupy the "onstage" of patient rooms and surrounding corridors.

Surprisingly, there is scant empirical research to demonstrate the benefits of off- and on-staging in healthcare settings or how to effectively design for them. Maybe this is because, as with unit configurations, the benefits seem intuitive and therefore are assumed not to require research. In fact, design research suggests that on- and off-staging strategies can backfire. Research of inpatient unit layouts is indicating that staff misuse offstage spaces to perform care delivery tasks away from the patient bedside (Watkins, Peavey, English, Nanda, & Chabot, 2012c). Related research has demonstrated that when staff are tucked away, it is difficult for patient visitors to access them and advocate for the patients to staff (Rashid & Boyle, 2012).

Decentralized Nursing

The traditional approach for nursing used a main nurses' station at the front or center of an inpatient unit and was the only nurses' station on the unit. Figure 3 illustrates some of the more common layouts for nurses' stations, including the centralized model. Though the centralized nurses' station has become a familiar icon of hospital design, it can have noteworthy drawbacks for staff workflow and patient-centered care. For instance, nurses who use centralized nurses' stations are likely to walk more, make fewer visits to their patients' rooms and have patients who report more slips, falls and greater pain (Watkins et al., 2012a). In response to these challenges, there is a growing number of decentralized and hybrid (i.e., centralized and decentralized) nurses' station options that hospitals are experimenting with to improve staff responsiveness and vigilance to patients' needs. .

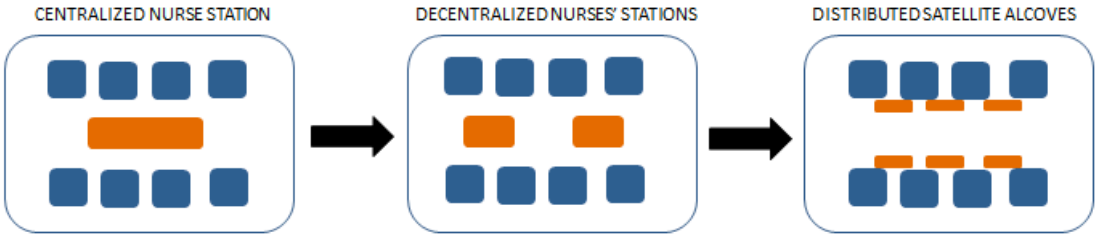

Figure 3: Illustration of various centralized and decentralized nurses' station configurations. The evolution of nurses' stations is shown from left to right. Image courtesy of HOK.

A fairly recent strategy for decentralized nurses' stations is distributed via satellite alcoves. When the alcoves are outside patient rooms, they can maximize visibility of patients with windows into the rooms. In general, these alcoves can serve any number of capabilities, including medication storage, supply storage, hand washing facilities, work surfaces for charting, a computer and telecommunication devices (Rashid, 2006). However, there is scant research demonstrating what capabilities an alcove should have. What little research there is indicates there is an advantage of lockable patient medication cabinets near the patient bedside: nurses are not distracted when medications are being prepared and dispensed (Barker et al., 1984; Watkins et al., 2012a).

Research has suggested that decentralizing nursing stations can lead to efficiencies for the staff. In one study, nurses on units with decentralized stations engaged in fewer administrative duties (e.g., phone, computer and paper administration) than nurses on units with centralized nurses' stations (Zborowsky, Bunker-Hellmich, Morelli, & O'Neill, 2010). Nurses also walk less on units with decentralized nurses' stations, ostensibly allowing them to spend more time with their patients (Hua et al., 2012). However,

the research involving nurses' testimonials does suggest a drawback; decentralization may well lead to a feeling of isolation and fewer opportunities for communication, learning and collaboration among staff, especially newer employees.

Innovations in health information technology have added another dimension to decentralized nursing and nurses' stations. In a broad sense, health information technology "refers to systems that serve as repositories for healthcare data that can be accessed by care providers for purposes of retrieval, transfer, communication and/or analysis." (Moore & Fisher, 2012, pg. 157). Subsets of health information technology include technologies for the retention and accessibility of clinical information at the point of patient care so that errors can be avoided. These include electronic health records (EHR), clinical decision support systems (CDSS) and computerized provider/physician order entry (CPOE) instead of written prescriptions and picture archiving (Moore & Fisher, 2012). Mobile health information technology, like smartphones and tablets, for decentralized nursing may require little or no dedicated space for nurse charting.

A challenge with health information technology is getting over the hump of its initial adoption in a given facility or unit. It can initially lead to more work and staffing, thereby obviating immediate efficiencies and savings (Ball, 2011). A paradox of health information technology is that it can bring clinicians and patients into closer proximity while also alienating them (Almquist et al., 2009; Watkins et al., 2012a). Readers of this paper and others can probably recount being offended or intimidated by instances wherein clinicians would rather look at and talk to a computer or wireless device instead of them.

Challenges aside, healthcare information technology is appearing to pay off in the long-term because there is mounting research demonstrating it successfully prevents medical errors (Poon et al., 2010).

With the advent of health information technologies, various ideas for decentralized nursing strategies have fallen in and out of favor. From a human perspective, however, research on the trend provides valuable lessons for contemporary and future health technologies. A few years ago, a common strategy for decentralizing nursing was to forego stations and provide clinicians with workstations on wheels. The logic was that clinicians would bring the workstation on wheels close to the patient bedside to administer medications and coordinate care with the patient. Though the research suggested that a workstation on wheels did lead to more care at the patient bedside, much of the same research indicated that there was a stronger propensity for clinicians to park workstations on wheels outside in

the corridor where they were distracted by other staff during critical care delivery tasks, like medication preparation and administration (Watkins et al., 2012a). Research of handheld technologies (e.g., PDAs, computer tablets and smartphones) indicates they are valued by health educators and clinicians for convenient access to patient data and for clinical knowledge (Topol, 2012). However, like with workstations on wheels, these health information technologies are often used away from the point of care and in areas like hallways (Andersen, Lindgaard, Prgomet, Creswick, & Westbrook, 2009).

Are there ways for design and health information technology to work in concert so that clinicians have meaningful and safe face-to-face interactions with patients? One idea is to have computers mounted at or near the patient bedside. However, computers near the patient bedside tend to open nursing staff to distractions from patients and their visitors during medication administration and other sensitive tasks (Watkins et al., 2012a). One study involved a group of 40 nurses who suggested that a dedicated clinical position with some level of noise privacy be provided at each patient room. The nurses felt this setting could prevent noise distractions from the main nurses' station, hallway and patient bedside while maintaining visual connectivity with the unit and patient during activities that require concentration, such as documentation, order entry, medication preparation and prescription entry.

Family-Centered Care

Family-centered care is developed through working alliances among patients, clinicians and family members. Patient- and family-centered care are inextricably linked because patients' mental and physical health are related to their family members' mental and physical health.

Research has demonstrated that a family member's self-efficacy and empowerment are good predictors of patients' health, especially if the patients are children. In essence, family members' sense of self-efficacy rubs off onto the patient (Dunst & Trivette, 2009).

There are four key concepts to family-centered care. First, respect and dignity are involved in the active participation of patients and their family members in the healthcare decision-making process while incorporating their values and beliefs. Second, timely, accurate and useful information is provided to patients and family members so they can make informed decisions. Third, patients and families are given a choice on what level of participation they would like to have in the decision

making. Fourth, family and patient involvement can have direct implications for institutional issues, including policy, facility design, professional education and delivery of care (IPFCC, 2010).

Some of the most compelling work on the benefits of design supporting family-centered care has been performed on neonatal intensive care units (NICUs). Many contemporary NICUs are a dramatic departure from the open-plan units of yesterday. In general, they consist of private rooms for infants and their family members, often called single-family rooms.

Single-family rooms have provisions for family members to stay overnight. There is equipment and storage for breast feeding and skin-to-skin contact between the neonate and a parent. Special incubators with adjustable heights, clearances under the incubators and contiguous portholes can adjust to the ergonomics of a seated parent so he or she can cradle and touch their infant (Marshall-Baker, 2011). These provisions, which promote parents' nurturing behaviors, are linked to improvements in an infant's weight gain, immune system, cognition, motor skills and neurophysiological development (Shepley, 2003).

Moreover, single-family rooms can help an infant spend fewer days in the hospital, give the infant less time on a ventilator and introduce breast milk earlier. Benefits have also been found for staff members who walk less per square foot of space and are perceived by mothers as more supportive. Additionally, the staff on NICUs perceive single-family rooms to have improvements in: work environment, quality of patient care, safety and security, overall satisfaction and teamwork when compared to staff in open plans. (Carlson, Walsh, Wergin, & Schwarzkopf, 2006; Shepley, 2002; Shepley, Harris, & White, 2008; Stevens et al., 2010).

Solid research on designs supportive of family-centered care in adult inpatient settings is growing. Bosch & Choi (in press) found that visitors on an intensive care unit with patient rooms with dedicated family zones spent more time in patients' rooms. In a study of medical-surgical inpatient units, Watkins et al. (2012c) found that the longer patients' visitors stayed with the patient, the more the visitors helped with manual care delivery tasks, like helping patients in and out of bedside chairs. Patients who had visitors reported more control over ambient conditions that was, in turn, related to decreases in patient falls. Calkins et al. (2012) found that patients in rooms with dedicated family zones experienced half as many falls as patients in rooms without family zones. These findings suggest that patients are being assisted by visitors and thereby prevented from falling.

Toward Accountable Design, Right Now

It is often stated, "We cannot manage what we do not measure." By extension, if we do not measure something, we cannot hold it accountable. Accountable care directly relates providers' bottom-line to various performance measures. Care providers will experience cuts in reimbursements or penalties, for: dissatisfied patients, medical errors, hospital-acquired infections or hospital readmissions following treatment. The Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS) questionnaire, a standardized CMS questionnaire, solicits patient feedback on hospital stay and environment. Categories on the questionnaire focus on communication with doctors and nurses, responsiveness of hospital staff, pain management, cleanliness and quietness of the hospital environment, and instructions about medications and discharge. Scores on HCAHPS provide a national standard for comparison across hospitals and for reimbursement.

Research is the tool to help the design industry create optimal facilities and improve patient care. Rigorous research is the means through which we hold design accountable for its impact on health and well-being. Clinical trials of pharmaceutical and surgical interventions are the norm in the medical industry. By analogy, routine design research of facilities can assess whether a design facilitates healthcare delivery and positive patient outcomes. However, design research has more often been aligned with the aims of healthcare clients and has not been a consistent part of design practice. At the crossroads with its healthcare clients, the design industry needs to ask whether design research will respond to and react to the market or define and lead it (Watkins & Keller, 2008). Can and should the design process be held accountable for its impact on users just as much as it is held accountable for the cost of square footage and, increasingly, energy performance? If so, what steps should be taken?

Occupancy evaluations can be performed before and after users move into a new or renovated facility. The advantage of performing both pre- and post-occupancy evaluations on a facility is that results from the pre-occupancy evaluation can be compared to results from the post-occupancy evaluation, thereby finding where there are improvements or decrements. It is also possible to determine what they are caused by and to what extent. Post-occupancy evaluation of a facility's users after they have moved into a facility or renovation is becoming more of the norm in design practice and considered good for maintaining client relationships. Bafflingly, pre-occupancy evaluation has yet to be met with open arms. The primary reasons appear to be misunderstandings about the time, cost and consequences of occupancy evaluations.

Properly planned occupancy evaluations are not expensive or time-intensive. A recent calculation showed that a high-end occupancy evaluation on a $150 million healthcare project is substantially less than 0.001% of the project's budget (Watkins, Peavey, & Clarke, 2012b). Allocating this percentage within existing project delivery is made cheaper by not treating a pre-occupancy evaluation as a stand-alone add-on. Existing project teams consisting of programmers, designers, planners and a doctoral-level researcher can take existing techniques for soliciting user feedback (e.g., traditional focus groups) and improve upon them or replace them. The techniques can then be used to gather objective data (e.g., behavioral observation, time-motion studies, questionnaires calibrated simulations), which most users have difficulty recalling with accuracy or would rather not discuss around others (e.g., walking distances, sick days, number of distractions per a shift, near misses).

Industry incentives and requirements for credible design research during building project delivery are currently nonexistent. To reinforce credibility and responsibility in design research, the Environmental Design Research Association (EDRA) is in the process of developing a program to evaluate and recognize the quality of design research in practice for all building types. Once initiated, the EDRA Certificate of Research Excellence (CORE) program will evolve over time from an award to a credentialing program. Though only in its inception, a program like EDRA CORE holds promise for accountable design for accountable care. The underlying intent is to award not just research and its methods and findings but also meaningful incorporation of design research into building project delivery. Consequently, design research during project delivery will be evaluated by its quality, relevance to the industry and proof of research commitment. Relevance to the industry will be demonstrated by the impact of design research on the financial bottom-line, original contributions to the body of existing industry design research and design innovation.

Healthcare reform meant to advance accessibility to care as well as quality and efficiency of care is nothing new and has a long legacy of failures and partial successes within the United States (WHO, 2000). If the past is to serve as a precedent, there is a real risk that accountable care may go down in the annals of American history as merely another quasi-successful response to the ills of a rapidly evolving healthcare system. Given the nature of their trade, design researchers and designers will be the crux for providing a root, long-term solution that serves as the stage and platform for existing and future generations of patients.

Author Bios

Nicholas Watkins, Ph.D., is HOK's director of research and a firm-wide knowledge specialist. His professional work focuses on those interactions between humans and their built environments that reflect excellence in design and contribute to physical and psychological well-being.

Julie Zook, a Ph.D. candidate, is an analyst with HOK. She is pursuing a Ph.D. in architecture at the Georgia Institute of Technology.

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Richard Saravay, has over twenty years of experience in planning, design and implementation of healthcare facilities from master plans through construction. He has been the principal-in-charge for HOK for the Harlem Hospital Center new Mural Pavilion and has recently completed leading a team to produce the VA Design Guides for Medical/Surgical Inpatient Units and Intensive Care Nursing Units. He has a strong focus on the how the intersection of design with the requirements for care environments can enhance patients' well-being and outcomes.

Erin K. Peavey, M.Arch, Assoc. AIA, is a researcher and medical planner at HOK and a visiting assistant professor at Pratt in New York. Ms. Peavey's areas of focus include healthcare facility design and planning, applied psychology and integrating research in practice.

Timothy M. Gorton, B.S., M.P.A, has over 10 years of experience in healthcare administration, focusing on: operations, revenue management, performance improvement and corporate compliance. He has held leadership positions and is actively involved in Healthcare Leaders of NY, the local chapter of The American College of Healthcare Executives.

Derrek Clarke, AIA, LEED BD+C is a registered architect with HOK's healthcare practice. His research focuses on sustainability and the built environment. He is currently pursuing a master's degree in sustainability management at Columbia University.

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