

EXPLORING ALTERNATIVES FOR CRITICAL ACCESS HOSPITALS: RESEARCH-BASED DESIGN FOR RURAL HOSPITALS

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ABSTRACT: This paper reports a series of research and design activities that explore an innovative model of healthcare delivery in rural areas. In spring 2016, a group of researchers in the School of Architecture, Design, and Urban Planning and School of Engineering at the University of Kansas organized a think tank titled “Innovations in Rural Healthcare Environments.” The symposium brought together more than 100 healthcare providers, policy makers, and designers to outline specific research issues about how innovative design solutions can improve the efficiency and effectiveness of rural healthcare systems. Several major themes emerged from the panel discussions: 1. Rural healthcare facilities will need to adapt to changing practice models and constricted economic conditions by blending themselves into the fabric of the surrounding communities they serve and partner with local communities; 2. “Community Outpatient Hospitals” (COH), a new type of facilities that concentrate on primary and outpatient services, community-based health maintenance programs, and information technology rather than bricks and mortar will replace the obsolete “Critical Access Hospitals” (CAH) model; 3. Future rural healthcare designs should recognize the root causes of community health issues and also address individual uniqueness; 4. One size doesn’t fit all.

These key themes were used in a research-based design in the Health and Wellness graduate capstone studio. Students explored a range of design options that addressed the ways that traditional rural inpatient hospitals could be repurposed and refocused using Philips and Harper counties in Kansas as examples. In addition to in-depth analysis of socio-economic status, community health, and physical infrastructures of these two typical rural communities, students also conducted onsite observations, workflow mapping using spaghetti diagrams, and focus group interviews to inform innovative prototypical solutions for rural hospitals. The inter-disciplinary evidence-based design approach has been proven to be effective for student engagement and deeper understanding of rural conditions.

KEYWORDS: Rural Healthcare, Critical Access Hospital (CAH), Community Outpatient Hospitals (COH), Research-based design, Design Education

INTRODUCTION

Rural hospitals provide health services to a large portion of the US population, especially in the Midwest. Based on a 2017 survey conducted by American Hospital Association Hospital Statistics, there are 1,829 rural community hospitals, which account for 37.6% of total community hospitals (American Hospital Association 2017). In Kansas, the 95 small rural hospitals represent 75% of the 127 community hospitals in the state (Flex Monitoring Team 2017). However, as the United States becomes more urbanized, and the healthcare systems become focused on specialized and centralized delivery modalities, populations in remote rural settings are being underserved and marginalized. Meanwhile, the increasing elderly population keeps adding pressure to the existing healthcare system. More than 16.5% of rural Americans are aged 65 and older, which is a higher proportion than in the rest of the country (Coburn and Bolda 2001).

The traditional methods and practice models of healthcare delivery based on Critical Access Hospitals (CAH) that have served rural America for the past few decades have become strained. Most rural CAHs, which were built after World War II under the Hill-Burton programs, have reached the end of their useful lives. These outdated facilities cannot support new outpatient and preventive care based models. The state of Kansas – similar to the states throughout the Great Plains and agricultural Midwest – is facing a crisis in maintaining, upgrading, and replacing aging healthcare facilities. The rural healthcare environment is at the crossroad for innovative solutions. Currently, there is very limited research on rural healthcare from the perspective of facilities. This paper explores an alternative to CAH to provide more efficient rural health care. It presents a research-based design model that integrates expert opinions and evidence-based design research as an integral design process in informing innovative design solutions for the rural healthcare environment.

1.0 LITERATURE REVIEW

1.1. Rural-urban health disparity

Evidence exists that, compared with non-rural residents, rural residents experience health disparities on many indicators of population health. According to existing research, rural areas have higher death rates from unintentional injuries and chronic obstructive pulmonary disease (Eberhardt, Ingram, and Makuc 2001). Infant mortality rates are

higher in rural areas (Eberhardt and Pamuk 2004). According to the 2014 update of the rural-urban chartbook (Meit et al. 2014), there are a higher teen birth rate, children who are overweight, diabetes incidence, and more preventable hospital stays in rural areas compared to metro urban areas.

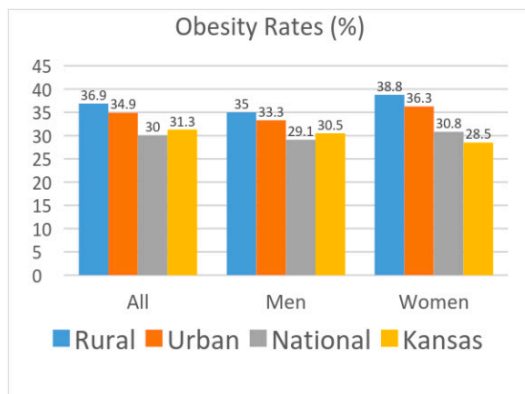


Figure SEQ Figure 1* ARABIC 1: Rural urban disparities of obesity prevalence among adults age 18 and above, 2010-2011, source: data based on the 2014 update of the rural-urban chartbook (Meit et al. 2014)

The health disparities are driven by demographic and social economic factors. Rural residents are older, with lower income, and higher unemployment rate. In addition, rural areas have fewer physicians, nurse practitioners, and even fewer specialists per 100,000 inhabitants than urban areas (Meit et al. 2014, Merwin, Snyder, and Katz 2006). Health behavior and risk factors also contribute to health differences among rural and non-rural residents. Rural adults are more likely than their urban counterparts to be physically inactive, overweight (Fig.1) and have poorer access to healthy food (Rural Health Information Hub 2014).

1.2. Historical Development of CAH

Several approaches have been undertaken to address the urban-rural health disparity issue. CAH is one of the attempts. CAH is a designation given to certain rural hospitals by the Centers for Medicare and Medicaid Services (CMS). This designation was created by Congress in the 1997 Balanced Budget Act (BBA) through the Medicare Rural Hospital Flexibility program (Flex Program) in response to a string of hospital closures in the 1980s and early 1990s. CAHs must be located in a rural area and be more than 35 miles from another hospital (15 miles by secondary roads or in mountain terrain) or have been certified before January 1, 2006, by the State as being a necessary provider of health care services. Additionally, to be considered a CAH, the hospital must have an emergency room that operates 24 hours per day and 7 days per week using either on-site or on-call staff. A CAH is normally limited to 25 inpatient beds used for either inpatient or swing bed services. CAHs are also subject to a 96-hour (4-day) limit on the average length of stay. As of October 12, 2016 there are 1,337 CAHs in the United States, which account for 73.1% of rural hospitals (Flex Monitoring Team 2017).

However, CAHs are at a critical time as a result of rapid changes in economics, rural demographics, and healthcare policies. Many CAHs are suffering from maintaining bottom line and retaining health care workforce. In addition, there are concerns with regards to hospital care quality in CAHs. Compared with non-CAHs, CAHs have fewer clinical capabilities and worse measured processes of care (Joynt et al. 2011). When compared using quality indicators of acute myocardial infarction, heart failure, and pneumonia, CAH have a lower satisfactory performance on most of these indicators compared to non-CAH, urban acute care hospitals. In addition, through a pooled time-series, cross-sectional data analysis from 34 states for the period 1997 – 2004, average estimated cost inefficiency was greater in CAHs (15.9%) than in non-converting rural hospitals (10.3%) (Rosko and Mutter 2010).

Moreover, since 2010, there has been a steadily increasing of CAH closures across the nation as a result of proposed cost cutting under health reform and the lack of Medicaid expansion in some states (Kaufman et al. 2016). According to the NC Rural Health Research program's (2017) real-time tracking, there have been 80 CAH closures to-date. Approximately 673 rural hospitals are vulnerable to closure and 68% of these hospitals critical access hospitals. The CAH closures will make the rural-urban health disparities more severe. The vulnerable rural populations will have no timely access to care, which can be life threatening in emergency cases. More importantly, rural hospitals play a major role in the economic vitality of small cities and towns. They serve as critical sources of employment and act as economic engines within their communities (Brooks and Whitacre 2011, Holmes et al. 2006). The closure of rural CAHs can lead to the decay of the entire rural community.

1.3. “Save Rural Hospitals Act” and Community Outpatient Hospital (COH)

The rising rate of closures suggests that existing model and policy support may no longer be sufficient to maintain the financial health of rural hospitals. A bill (H.R. 3225) introduced by Reps. Sam Graves (R-Mo.) and Dave Loebsack (D-Iowa) in July 2015 aimed to provide financial and regulatory relief to rural hospitals. The Save Rural Hospitals Act would create a new classification – Community Outpatient Hospitals – that would include a 24-hour emergency room and observation care (not to exceed an annual average of 24 hours), 24 hours per day, 7 days per week, coupled with outpatient services and primary care. There would be no inpatient beds, but the hospital would be required to have a transfer agreement with another facility to transfer patients who require a higher level of care (NRHA 2015). Even though there have been discussions regarding the new COH classification and the implications on financial model and policy, no research has been conducted to investigate its impacts, considerations, and constraints posed on the built environment. It is unclear where the future of rural health facilities is heading.

2.0 METHODS

This is the context that formed a multi-phase research/design project to explore innovative rural healthcare environment of the future. The project was developed in three phases: 1. gathering expert opinions to inform new delivery models; 2. conducting onsite empirical study; 3. translating research to design.

2.1. Gather expert opinion through “innovations in rural healthcare environment” think tank

To bridge the rural health policy, new health delivery model and facility design, a group of researchers in the School of Architecture, Design, and Urban Planning and School of Engineering organized a one-day think tank titled “Innovations in Rural Healthcare Environments” at the University of Kansas in Lawrence in spring 2016. The think tank brought together more than 100 healthcare providers, policy makers, and designers to outline specific research issues about how innovative design solutions can improve the efficiency and effectiveness of rural healthcare systems.

The panel discussions during the day focused on three topic areas: healthcare system challenges and opportunities; policy implications for rural healthcare; and the role of innovation and technology in rural healthcare. The first panel session discussed the ways that healthcare providers will need to adapt to changing practice models and constricted economic conditions in rural settings in the future. Decreases in service lines of care and in the number of solo practices will continue to put pressure on rural providers in isolated and remote healthcare environments. The concept of “stealth-health facilities” was presented by Michael Pulido, chief administrative officer of Mosaic Life Care, as a possible way to blend traditional medical environments into the fabric of the surrounding communities they serve. In this model, the local gas station—not the critical access hospital—may be the appropriate rural setting to initiate primary care healthcare discussions. A major theme that emerged from the second panel on policy was the likelihood that the traditional critical-access hospital model would be replaced in the near future by a facility type that concentrated on primary and outpatient services, community-based health maintenance programs, and information technology rather than bricks and mortar. This new rural healthcare environment has been called by several names including “community outpatient hospital,” “primary health center,” and “integrated rural clinic.” Rural healthcare environments will likely be viewed as “community organizers” rather than freestanding and independent institutions in this new model, and medical services will be delivered outside the confines of traditional settings. Brock Slabach, senior vice president for member services at the National Rural Healthcare Association (NRHA), reminded designers to be much more attuned to the realities of “form follows finance” in an era that includes Medicaid expansion, results-based reimbursements, and financial rewards for improving population health. The final panel discussed the roles of technology and design innovation in rural healthcare environments. Building on the panel discussions, the narrative of this session focused on finding ways to use environmental quality to improve the rural community’s well-being. A common theme shared by the panel was the concept of the healthy village, where the hospital was only part of the equation for community health. “Eat well, stay well, get well” was proposed as an approach for the continuum of healthy living. The panelists also highlighted the importance of population health and partnerships with the local community. Future rural healthcare designs should recognize the root causes of community health issues and also address individual uniqueness. Big data could support the understanding of the holistic patient profile, but Erik Gallimore, director of rural health at Cerner Corporation, also stressed the importance of designers listening to the individual stories within rural communities.

The keynote address was delivered by Marci Nielsen, chief executive officer of the Patient-Centered Primary Care Collaborative. She focused on the shifting emphases in American medicine from illness to health, from the provider to the patient and family, and from inpatient to outpatient services. She challenged the audience to conceive of a rural healthcare system that sustains itself through local community values and strength, and to recognize that there was not a uniform definition of “rural healthcare,” but rather a continuum of healthcare needs in rural settings. In short, four major themes emerged from the panel discussions: 1. Rural healthcare facilities will need to adapt to changing practice models and constricted economic conditions by blending themselves into the fabric of the surrounding communities they serve and partner with local communities; 2. “Community Outpatient Hospital” (COH), as a new facility type that concentrates on primary and outpatient services, community-based health maintenance programs, and information technology rather than bricks and mortar will replace the obsolete CAH model; 3. Future rural healthcare designs should

recognize the root causes of community health issues and also address individual uniqueness. Big data could support the understanding of the population health and the holistic patient profile; 4. One size doesn't fit all, which addressed applying a modular design that can adapt to various rural community needs.

These key themes were used in a research-based design in the Health and Wellness graduate capstone studio. Students were charged to explore a range of design options that reflect future rural health models and address community needs, using Philips and Harper counties in Kansas as examples. In addition to in-depth analysis of socio-economic status, community health, and physical infrastructures of these two typical rural communities, students also conducted an onsite empirical study in Philips County Hospital, KS to gain a comprehensive understanding and tangible experience of the current state of CAH, especially in the Midwest region.

2.2. Onsite evaluation: Philips County Hospital (PCH)

Philips County Hospital is a typical run-down CAH with a building from the 1950s. It has gone through several additions and small partial interior remodels. The facility is exemplary of many CAHs that have not fully updated or replaced their built environment to reflect the state-of-the-art technologies. The case study was conducted using multiple methods, including focus group interview with hospital staff, post-occupancy evaluation (POE) of clinics and medical surgical nursing unit design using standardized toolkits, and spaghetti diagram to map patient and staff flow.

2.2.1. Focus group interview

A focus group interview was conducted with 12 key clinical staff and administrators of PCH, including CEO, nursing director, director of rehabilitation, operating room manager, director of radiology, lab director, director of maintenance, director of material management, director of food service, clinic administrator, registration, and community coordinator. The interview had three components: the hospital's relationship with the local community, the workflow and departmental adjacencies, and the financial and operational aspects of the hospital. Regarding community relationship, despite many community outreach efforts and community health promotion events, the strong bond between the community hospital and the local community is difficult to maintain. Several deficiencies of existing spaces were identified: multiple entrances, unclear wayfinding system, non-ideal adjacencies of functions within the hospitals, large distance between clinics and hospital, and in compliance with handicap accessibility and HIPPA. For the financial performance, the outpatient services, especially rehabilitation services were identified as revenue generators, while inpatient bed occupation rate is as low as seven patients per day and out of the seven patients usually around two are acute care patients. New facilities are viewed as a mechanism to attract local patients and quality providers.

2.2.2. POE

Students were divided into three teams and conducted POE for the rural outpatient clinic, specialty clinic, and inpatient units. A standardized POE toolkit from the Center for Healthcare Design (CHD) was adopted to evaluate the quality of the physical environment in both clinics (The Center for Healthcare Design 2015a). This audit tool provides a rating system for a set of design features at major clinic spaces. The inpatient unit POE was conducted using the CHD design medical-surgical patient room POE tool (The Center for Healthcare Design 2015b). The POE tool is organized around 23 Evidence-Based Design (EBD) goals that link design with desirable healthcare outcomes. Students walked through spaces together with clinical staff where each rated how well the features meet certain criteria. On a scale of 1 to 5 (with 5 indicating the highest evaluation rating), the PCH outpatient clinic received an average score of 2.20, specialty clinic received an average score of 2.11, and the inpatient room received a score of 1.91 (Fig. 2). All POE ratings were on the unsatisfactory side, which demonstrates that existing facilities cannot support high-quality patient care experience and staff work experience.

OUTPATIENT CLINIC

Exterior	2.17
Interior	1.12
Check-In Waiting	2.72
Patient/Clinician Interaction Spaces	2.48
Staff Spaces	2.51
Total Overall	2.20

SPECIALTY CLINIC

Exterior	2.20
Interior	1.41
Check-In Waiting	2.56
Patient/Clinician Interaction Spaces	2.40
Staff Spaces	1.97
Total Overall	2.11

INPATIENT UNIT - EBD GOAL SCORES

1. Improve Mobility	2.70	12. Improve Patient Engagement	2.25
2. Reduce Risk of Injury	1.47	13. Improve Patient Satisfaction	2.50
3. Reduce Contamination	2.71	14. Improve Family Engagement in Care	1.83
4. Improve Hand Sanitation	1.88	15. Improve Comfort	2.17
5. Provide Safe Delivery of Care	1.50	16. Reduce Noise	1.50
6. Provide Efficient Delivery of Care	0.86	17. Respect Privacy	2.00
7. Improve Communication	3.17	18. Ensure Durability	2.42
8. Improve Staff Health	2.20	19. Improve Air Quality	1.58
9. Improve Job Satisfaction	2.50	20. Provide Secure Environment	1.82
10. Reduce Patient Stress and Anxiety	1.50	21. Enable Change Readiness	1.34
11. Enable Patient Sense of Control	1.84	22. Enhance Sustainability	1.67
		23. ROI	0.67
		Total Overall	1.91

Figure 2: POE score cards

2.2.3. Patient flow and staff workflow mapping

In addition, students worked in four teams alongside the clinical staff to create spaghetti diagrams of patient flow and staff workflow in outpatient rural primary care clinic, specialty clinic, surgical department, and inpatient unit. The mapping results demonstrated that the outdated facility had several issues regarding departmental adjacencies, which caused inefficient staff workflow and unnecessary patient trips to get services (Fig.3).

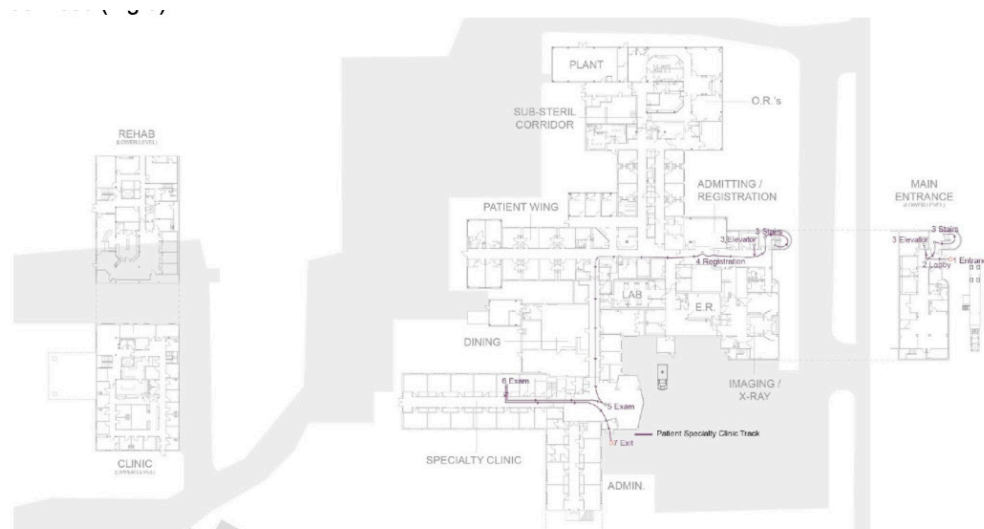


Figure 3: Specialty clinic patient flow

2.3. Translate Research to Design Proposals

Students later synthesized expert opinions and empirical research and translated them to healthcare facilities prototypes for Phillips and Harper counties. They provided a range of design options that addressed the ways that traditional inpatient hospitals could be repurposed and refocused. For instance, Erin Hoffman, Erica Hernly, and Connor Crist's design explored the alternative model of "community outpatient hospital" (COH) that eliminated the inpatient unit of a critical-access hospital. The COH focuses on the role of the rural hospital as a community hub and

an education center for healthy living and preventive care. Many spaces such as café, demo kitchen, and multi-function community space were designed to host community events and bring in community partners for improving population health (Fig.4).



Figure 4: Philips County Replacement Hospital Lobby and Café (Erin Hoffman, Erica Hernly, and Connor Crist, 2016)

In another project, Rachael Wotawa and Briana Sorensen developed a master plan for Cerner Harper County Healthy Village with a full range of health and wellness services, including hospital, nursing home, assisted living, independent living, retail, apartments, educational building, intergenerational activity space, and community center (Fig. 5). They also proposed a universal care room to replace the traditional medical-surgical inpatient room, which could serve as an observation bed for the emergency department and a transitional care bed (Fig.6). Their design considered the implementation of health IT and telehealth throughout the health village, which would support holistic care and the family involvement and bring state-of-the-art care close to home.



Figure 5: Cerner Harper County Healthy Village Master Plan (Rachael Wotawa and Briana Sorensen, 2016)



Figure 6: Harper County Hospital Universal Care Room (Rachael Wotawa and Briana Sorensen, 2016)

CONCLUSIONS AND FUTURE WORK

The study on rural hospitals highlighted the urgency of exploring an alternative to critical access hospitals to provide more efficient rural health care. The elimination of health disparities among rural populations will require a population approach that is sensitive to local variations in physical and cultural realities (Hartey, 2004). The transition to a population-based, outpatient driven healthcare has implications in physical environments. Traditionally, the discussion on rural healthcare has focused on policy, care delivery, and financial model, but not on facilities. The think tank and the research-based design studio are one of the early attempts to explore the impacts of new rural health model on the physical environment. The inter-disciplinary evidence-based design approach has been proven to be effective for students' engagement and deeper understanding of rural conditions. More research is warranted to further explore the impact of alternative rural health care models on healthcare facilities and patient outcomes.

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REFERENCES

- American Hospital Association. 2017. "AHA Hospital Statistics Fast Facts 2017", accessed Feb 12. <http://www.aha.org/research/rc/stat-studies/fast-facts.shtml>.
- Brooks, L., and B. E. Whitacre. 2011. "Critical Access Hospitals and Retail Activity: An Empirical Analysis in Oklahoma." *Journal of Rural Health* 27 (1):29-38. doi: 10.1111/j.1748-0361.2010.00336.x.
- Coburn, Andrew F, and Elise J Bolda. 2001. "Rural elders and long-term care." *The Western journal of medicine* 174 (3):209.
- Eberhardt, Mark S, Deborah D Ingram, and Diane M Makuc. 2001. "Urban and rural health chartbook: Health, United States, 2001."
- Eberhardt, Mark S, and Elsie R Pamuk. 2004. "The importance of place of residence: examining health in rural and nonrural areas." *American Journal of Public Health* 94 (10):1682-1686.

- Flex Monitoring Team. 2017. "Critical Access Hospital Locations." University of Minnesota, University of North Carolina at Chapel Hill, University of Southern Maine, accessed Jan12. <http://www.flexmonitoring.org/data/critical-access-hospital-locations/>.
- Holmes, George M, Rebecca T Slifkin, Randy K Randolph, and Stephanie Poley. 2006. "The effect of rural hospital closures on community economic health." *Health Services Research* 41 (2):467-485.
- Joynt, Karen E, Yael Harris, E John Orav, and Ashish K Jha. 2011. "Quality of care and patient outcomes in critical access rural hospitals." *Jama* 306 (1):45-52.
- Kaufman, B. G., S. R. Thomas, R. K. Randolph, J. R. Perry, K. W. Thompson, G. M. Holmes, and G. H. Pink. 2016. "The Rising Rate of Rural Hospital Closures." *Journal of Rural Health* 32 (1):35-43. doi: 10.1111/jrh.12128.
- Meit, Michael, Alana Knudson, Tess Gilbert, Amanda Tzy-Chyi Yu, Erin Tanenbaum, Elizabeth Ormson, and S Popat. 2014. "The 2014 update of the rural-urban chartbook." *Rural Health Reform Policy Research Center*.
- Merwin, Elizabeth, Audrey Snyder, and Elizabeth Katz. 2006. "Differential access to quality rural healthcare: professional and policy challenges." *Family & community health* 29 (3):186-194.
- NC Rural Health Research Program. 2017. "80 Rural Hospital Closures: January 2010-Present." accessed 0212. <http://www.shepscenter.unc.edu/programs-projects/rural-health/rural-hospital-closures/>.
- NRHA. 2015. *Save Rural Hospitals Act*. edited by NRHA.
- Rosko, Michael D, and Ryan L Mutter. 2010. "Inefficiency differences between critical access hospitals and prospectively paid rural hospitals." *Journal of Health Politics, Policy and Law* 35 (1):95-126.
- Rural Health Information Hub. 2014. "Rural Health Disparities." accessed Feb12. <https://www.ruralhealthinfo.org/topics/rural-health-disparities>.
- The Center for Healthcare Design. 2015a. "Clinic Design Post-Occupancy Evaluation Toolkit ". <https://www.healthdesign.org/insights-solutions/clinic-design-post-occupancy-evaluation-toolkit-pdf-version>.
- The Center for Healthcare Design. 2015b. "Patient Room Design Checklist and Evaluation Tool." accessed January 12. <https://www.healthdesign.org/insights-solutions/patient-room-design-checklist-and-evaluation-tool>.