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Vision, Mission, and Purpose

The ***Health Environments Research & Design Journal*** (HERD) is an interdisciplinary, peer-reviewed journal whose mission is to enhance the knowledge and practice of evidence-based healthcare design by disseminating research findings, discussing issues and trends, and translating research into practice.

The vision of HERD is to improve measurable healthcare outcomes as a result of enhancing healthcare environments for those receiving and providing care.

HERD is the only journal featuring evidence-based articles on the design of health environments and the design-related outcomes associated with safety, clinical results, organizational performance, economics, and the human experience. The commitment to an interdisciplinary design process is reflected in HERD's interdisciplinary Editorial Board, with representatives from healthcare (including nursing, medicine, and healthcare administration), the design industry (architecture, engineering, interiors, graphics), environmental and behavioral psychology, neurosciences, systems and organizational effectiveness, art, music, and other complementary fields. The journal centralizes knowledge about healthcare innovations and design while addressing significant industry challenges to improve patient outcomes, reduce errors, and enhance the work environments of healthcare professionals.

As a translational journal linking research to practice, HERD features both rigorous research from academic sources and applied research from practice. Submissions from both scholars and practitioners are welcome. All will be held to high standards.

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To illustrate the process, one healthcare design-related issue, privacy and confidentiality, was assessed for a linear design model with a central core. Phase 1 observation results indicated that most confidential conversations were contained within the core. However, Phase 2 focus groups revealed staff concerns regarding the level of privacy and confidentiality due to the open design. The use of multiple methods provided greater information and a more complete picture of the emergency department environment and design.

This study presents a comprehensive framework for diagnostic post-occupancy evaluation in healthcare design. The findings indicate that a systematic, multi-methodological approach developed around a conceptual framework, the client's guiding principles, and the design team's objectives can lead to higher quality evaluations. In diagnostic POEs, one size does not fit all.

RESEARCH

The Influence of Ambient Scent and Music on Patients' Anxiety in a Waiting Room of a Plastic Surgeon

Waiting for an appointment with a plastic surgeon can increase patients' anxiety. It is important to make the waiting time before an appointment with the surgeon more pleasant and to reduce patient's anxiety.

Ambient environment features such as temperature, lighting, noise, music, and scent are often imperceptible, but they may have strong effects on people's mood, cognition, and behavior. This experimental study was performed to test whether ambient scent and music can help to reduce patients' anxiety. The results demonstrate that when used separately, music and scent can significantly reduce the level of patient's anxiety. However, the combination of scent and music may be not effective. Adding more ambient elements to environment

could raise patients' level of arousal and thus increase their anxiety. Therefore, ambient environment features can help to reduce patients' anxiety, but they need to be used with caution.

RESEARCH

A Hospital's Contemporary Art Collection: Effects on Patient Mood, Stress, Comfort, and Expectations

Can an art collection of diverse subject matter, media, and imagery in the hospital environment play a significant role in mitigating the psychological stresses and physical pain associated with a hospital visit? Or improve patients' satisfaction with their care? The variety of contemporary art displayed in Cleveland Clinic served as a case study to assess the qualitative and quantitative effects of such a collection on patient health and experience. Investigators sought to assess whether this diversity would positively affect patient mood, comfort level, stress level, and expectation of visit.

A survey was sent to members of an online Patient Panel. A majority of respondents noticed the artwork; had improved moods and stress levels due to the artwork; and reported that the art collection positively impacted their overall satisfaction and impression of the hospital. Our findings demonstrate that this particular art collection has a significant effect on the patient experience and on self-reported mood, stress, comfort, and expectations. These results suggest that patients may respond positively to the diversity of the collection, and to other types of art in addition to nature art.

INDEPENDENT POE

A Comparative Evaluation of Swedish Intensive Care Patient Rooms

How can we ensure that design strategies achieve their intended positive outcomes? What effect do design strategies actually have on a building's users? This case study investigates how design strategies in three recent intensive care units in Sweden impact patients, families, and staff. Methods of investigation include analysis of design layouts, staff questionnaires, staff interviews, and systematic observation.

The results indicate that in some patient rooms, access to daylight and/or outdoor views was excellent, while other rooms access was hindered by frosted glass or adjacent bushes or buildings. Single-bed rooms gave family members improved privacy and greater ability to stay in the patient room. Some patient room layouts provided efficient patient observation and staff collaboration, but more noise and reduced patient privacy. Other layouts provided a calm patient room environment, but caused some staff to feel isolated and have difficulty in getting assistance.

The evaluation of the three projects reveals variation in whether or not design strategies successfully achieve their desired outcomes. Varying designs of the patient room layouts affect users in unique ways and reveal that design gives the challenging opportunity of balancing privacy, visibility, quietness, and staff access to assistance.

EXECUTIVE SUMMARY OF KEY CONCEPTS

THEORY

Exploring the Function and Use of Common Spaces in Assisted Living for Older Persons

The use of Swedish assisted living facilities (ALFs) is currently changing in relation to the intended user group. Increased home care and home services, publicly initiated accessibility measures in ordinary housing, improved health status and the emergence of other residential solutions for older people has resulted in a group of users who are older, frailer, and suffer from more ailments and diseases.

Observations, interviews and questionnaires were used in a multi-methodological research strategy to explore the daily use of common spaces.

Both the residential and workplace perspectives must be considered when planning for assisted living facilities (ALFs). Otherwise, inherent conflicts will manifest as a result of the physical design. Common spaces in ALFs incorporate both perspectives and contain diverse functions, reflected in their spatial organization. It is suggested that residents and staff have different objectives for use of these spaces and that residents, staff, and other stakeholders have different views about the demarcation of home and workplace and the role of common spaces as venues for social interaction. This suggests that these spaces have ambiguous meanings which affects usability and may lead to ineffective use of the spaces.

THEORY

Environmental Cues: Their Influence within Assisted Living Facilities

As adults continue to age, they generally experience a decline in the functioning of their five senses, which can lead to, among other things, an increased risk of falling and subsequent injuries. Using information derived from Lawton's theory of environmental press, it was proposed that the amount of environmental sensory cues in assisted living facilities (ALFs) may play a role in the number of falls occurring within those spaces.

When data was collected from ALF public spaces using an environmental cue checklist, however, results varied depending on room type and facility size, indicating a need for further investigation into the complex variables involving environmental sensory cues. Nevertheless, it remains imperative for design professionals to have an understanding of the impact of the built environment on resident quality of life.

RESEARCH METHODS

Evaluating Evidence: Defining Levels and Quality Using Critical Appraisal Mixed Methods Tools

Appraising research is an important aspect of understanding options and solutions in evidence-based design (EBD) in order to translate findings into design recommendations. However, the evaluation of relevant literature that contains information from a variety of sources including quantitative research, qualitative

EXECUTIVE SUMMARY OF KEY CONCEPTS

research, and gray literature can be difficult to summarize into a cohesive whole. This article outlines the current state of science for evaluating evidence in healthcare design, drawing on previous discussion articles in this journal, and introduces a Mixed Methods Appraisal Tool (MMAT), which could be used by professional designers to evaluate and critically appraise research evidence for healthcare design. Although an experienced researcher may be required at times to assist professional designers in assessing evidence, whether due to time or expertise, the dual method outlined in this paper provides both a validated appraisal tool to add depth of understanding with a matrix representation to give a quick visual assessment of the evidence.

Interprofessional Practice: Magic at the Intersection

Jaynelle F. Stichler, DNS, RN, NEA-BC, EDAC, FACHE, FAAN

Reflecting back on my career as a nurse, I am amazed at how the various positions I have held have shaped my perspectives on so many issues. After a great career in clinical nursing and hospital management, with involvement in the planning and design of a large specialty hospital, I was invited to join an architectural firm as a nurse consultant. The role included teaching less experienced architects about healthcare operations, care delivery processes, and patient and staff needs that might influence design decisions, and to accompany the design team when interfacing with the healthcare clients. In essence, I was an interpreter between the two languages in the worlds of healthcare and architecture. I must confess that the first few months in the architectural firm were a bit rugged for me. I was a pioneer in a new role with minimal skills, little orientation to the architects' world of thinking, and toolkit full of the wrong tools… or so I thought. Feeling like a fish out of water, I decided to surround myself with nursing memorabilia in my new avant-garde design office (*what was a nurse doing in an office like this?*). Still not comfortable in my new role, I re-read Florence Nightingale's *Notes on Nursing*, and then I knew why I was embedded in an architectural firm. Florence Nightingale was not only a nurse, but the first to bring attention to the need for changes in the design of healthcare facilities to ensure an environment that facilitated healing.

Jaynelle F. Stichler, DNSc, RN, EDAC, NEA-BC, FACHE, FAAN

After the first few client visits and work sessions, the importance of a nurse embedded in the design world was very apparent. Nurses and physicians could relate to me in ways that they could not relate to architects. They trusted me, because I was one of their own, and they were certain that architects didn't understand them or know how they were "different" from all other hospitals in the world. Hospital leaders also trusted me, because I was experienced in hospital operations, finance, and patient care—"what do architects know about that?" was the general question. In hospital meetings, I was in my comfort zone, but back in the office, it took some time for me not to feel that I was in foreign ter-

ritory. I made it my personal goal to prove my worth and to be a value-added asset to the firm.

There is a purpose for my revealing such personal information. I hope to demonstrate in this editorial that there is "magic at the intersection," where true interprofessional practice intersects and positive outcomes can be achieved as a result of the synergy that occurs among different professionals who come together with a common purpose and goal.

Recognizing the Intersections in Healthcare Design

Even the term *healthcare design* indicates the intersection of two different disciplines that have merged into a new discipline with its own language, guidelines, and standards; science with rigorous research to guide practice decisions; and even certification examinations to recognize individuals who have mastered a body of knowledge that can be translated to quality decisions, service, and outcomes in healthcare design. All of these have come together at the intersection of two worlds; however, each of these distinctly different worlds has subsets of disciplines within them, making the intersection all the more complex. As an example, in healthcare the subsets of disciplines include healthcare administration, nursing, medicine, all the therapies, and numerous other disciplines that shape and support patient care. On the other hand, the design discipline also comprises subsets, including architecture; interior design; environmental psychology; structural, electrical, and mechanical engineering; and a host of other disciplines that support the planning, design, and construction of healthcare facilities. Clearly the healthcare design discipline is a complex system and can be best understood and explained using the theory of quantum science and complexity theory, which describe the world as one of complexity and chaos with multiple constantly moving and often unpredictable parts that comprise the structure of a whole system (Plsek & Greenhalgh, 2001). The authors of this classic article summarize complexity theory as applied to healthcare and indicate that:

- Individuals' actions are based on internalized rules based on personal beliefs;
- Both the individuals and the system are adaptive over time;
- Systems are embedded within other systems and may evolve together;
- Tension and paradox are a part of the complexity;
- Interaction among the parts leads to emerging and novel behaviors; and
- The organizing factors of a complex system are both non-linear and unpredictable but create an inherent pattern.

When we think of healthcare design in this fashion, we can better understand the need for recognizing and valuing the intersections among multiple disciplines, perspectives on issues, and even visions of what the potential of a new facility can be.

Quantum science and complexity theory can also explain how a minor change in the design of one space can ultimately affect multiple other spaces, processes, and human behaviors. Porter-O'Grady and Malloch (2011) explain that no one act is independent of another, and "every element interacts with every other element in some way, and all the elements together constitute a complex mosaic of movement and intersection" (p. 22). This notion makes traditional planning—where everything is linear and outlined—obsolete, recognizing that while we try to have control over the planning process, we must also recognize and appreciate the circular and constant change inherent in the complex system of healthcare design. Porter-O'Grady and Malloch also explained that leaders in these types of complex systems must also be good signpost readers recognizing new changes and trends on the horizon and how these changes and trends will direct the current and future realities. So how can we possibly prepare leaders in healthcare design to assume new roles as change agents in healthcare design process? It doesn't seem possible to achieve leadership in complex systems without first recognizing the interdependence among the various stakeholders and players in the healthcare design process.

Valuing Interdependence and Collaboration

The recognition and acceptance of interdependence is a critical first step in achieving true interprofessional collaboration (Stichler, 1995). By definition, *interdependence* is the recognition that a goal cannot be achieved unless the involved stakeholders realize that they cannot achieve the goal individually. True collaboration is dependent on the recognition of interdependence, and includes three other essential attributes to be fully appreciated or operationalized: the balance of power; sharing our exchange of valued assets, skills or information; and finally the interpersonal valuing of each contributing party (Henneman, Lee, & Cohen, 1995; Stichler, 2013). True collaboration means that individuals, regardless of their level in the hierarchy of the organization, have equal and valued input that is respected by others and that there is an open and transparent sharing and communication among the team members. Can you imagine the effect of this if true collaboration really existed in our healthcare design charrettes, focus groups, and other planning group activities?

Oftentimes, a decision-making structure is appropriately defined that is critical to the overall control of the project's budget and schedule, but too much control with a decision-making authority resting only with non-care providers can result in a design that negatively affects patient care processes and patient, provider, and organizational outcomes. It is critical that healthcare administrators and architects appreciate the critical importance of having actual healthcare providers at the decision-making table to reflect the needs of patients and point-of-service nurses and support professions. Their unique contribution is vital in the planning and design of healthcare facilities that are safe, operationally effective, and supportive of the day-to-day bedside activities essential in patient care. The magic occurs as the team collectively imagines the potential in the new design to meet the needs of the future while balancing the realities of budget, schedule, and regulatory requirements.

Creating Synergies with the Emergence Process

Systems and complexity theories also reference emergence theory, which describes the self-organizing process inherent in the chaos of multiple inputs or entities. Emergence theory provides the framework for "magic at the intersection," because differing perspectives can merge at the intersection in truly collaborative environments and cause a synergy that leads to congruence in thinking and a commonly valued and adopted end point or decision. The beauty of emergence is that the stakeholders believe in the final stage that it supports their initial perspective because their "frame of view" has been ultimately changed in the process of the interaction with others whom they value and trust.

I believe that we are entering a higher stage of development in healthcare design, and we are moving beyond simple interprofessional workgroups in the design of hospitals. It is evident at the annual Healthcare Design (HCD) Conference, where practioners of multiple disciplines merge in learning from each other in the dissemination of project outcomes or to discuss new evidence and research ideas. It is also exciting to witness developing changes to curricula in baccalaureate and graduate level studies in healthcare disciplines and design disciplines with the merging of the knowledge from both fields. Because research has a common language that is understood by all disciplines, emergence of new concepts, theories, and notions (hypotheses) about healthcare design are being explored at the doctoral level where research is most emphasized. New courses and curricula changes can be seen in the graduate education for nursing, medicine, physical therapy, and the design fields where students from one discipline are immersed in the theories and their operational applications in another discipline.

In the *Future of Nursing* report prepared by the Institute of Medicine and the Robert Wood Johnson Foundation (Institute of Medicine, 2011), there are clear recommendations with supporting evidence about the critical importance of interprofessional education and integration with nursing and other disciplines in the planning, implementation, and evaluation of the healthcare needs of the nation. This sentinel report supports the need for more educational programs that integrate healthcare providers with healthcare designers to enhance the outputs that can result from "magic at the intersection." I am especially touched by and impressed with my partner and co-editor of *HERD*, who took the risk of seeking a doctoral degree in Nursing & Healthcare Innovation rather than choosing to study for his doctorate in the architectural discipline. I am certain that there has been reciprocal learning with what he has gained from being immersed in the nursing and healthcare theoretical frameworks, from interactions with others not from his own discipline, and the value he has brought to the table from a vast experiential knowledge base in architecture and healthcare design. This interprofessional approach to education likely enhances the learning of both professors and students as they explore differing perspectives in the worldview of healthcare design.

As previously mentioned, research has a common language and process that is understood by all disciplines even if the research questions are vastly different. Research and the use of evidence in practice creates "magic at the intersection"

and the emergence of new ideas and concepts that flow from the chaos and complexity of divergent perspectives, beliefs, and ideas.

HERD is another example of the synergies developed with the integration of the research, knowledge, and experience of multiple disciplines that have merged together to expand the science of healthcare design. There clearly has been magic at the intersection and *HERD* has accelerated the change to an evidence-based approach to healthcare design and has facilitated decision making among designers, healthcare executives, and healthcare providers using current available evidence or research methods to measure results.

Back to the Beginning

As I worked more with the design team on-site in the various hospitals, taught the less experienced architects about the healthcare delivery process, reviewed their designs, and made recommended changes based on provider input and my own experiences in patient care, there was a recognition of the value of nurses' contributions in healthcare design. The teacher was a learner as well, and what I learned from my architectural, engineering, and interior design colleagues was immeasurable. Watching them interact with healthcare providers and translate design knowledge into a language easily understood by those who often could not visualize square footage, adjacencies, or even schematic drawings was illuminating. Clearly there was magic at the intersection merging the differing perspectives of the healthcare and design disciplines.

Over the past two decades the field of healthcare design has grown into a discipline with an expanding scientific base and evidence to guide design decisions. Theories and scientific findings are borrowed and merged from multiple professional disciplines, and the outcomes from this process have expanded the field of healthcare design worldwide. With increasing numbers of nurse consultants and nurse researchers in many architectural and design firms across the nation, a non-profit organization has emerged, the Nursing Institute for Healthcare Design (NIHD). Members of NIHD now organize a clinical track with peer-reviewed presentations offered at the annual HCD Conference. As designers and healthcare providers and leaders learn together, share their respective knowledge and experiences, and envision a new future for healthcare design, there will be magic at the intersection.

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One Size Does Not Fit All: A Diagnostic Post-Occupancy Evaluation Model for an Emergency Department

Lindsey Guinther, MSArch; Allison Carll-White, PhD; and Kevin Real, PhD

ABSTRACT

OBJECTIVE: This study presents a detailed account of processes and multiple methodologies used in conducting a diagnostic post-occupancy evaluation (POE) in an urban hospital emergency department.

BACKGROUND: Healthcare design POE research findings can lead to improved work environments for healthcare providers and higher levels of staff, patient, and visitor satisfaction.

METHODS: This evaluation was conducted in two separate phases over 12 months, with data analysis occurring after each phase. Phase 1 involved 200 hours of observation, physical measurements, and occupancy counts. Phase 2 included surveys (n = 315) of staff, visitors, and patients. In addition, eight distinct staff focus groups (e.g., Nursing, Housekeeping, Physician, etc.) were conducted.

RESULTS: To illustrate the process, one healthcare design-related issue, privacy and confidentiality, was assessed in light of the linear design model with a central core. Phase 1 observation results indicated that most confidential conversations were contained within the linear core. However, Phase 2 focus groups revealed that many staff members had concerns regarding the level of privacy and confidentiality due to the core's open design. The use of multiple methods provided greater information and a more comprehensive picture of the emergency department environment and design.

CONCLUSIONS: This study presents a comprehensive framework for diagnostic post-occupancy evaluation in healthcare design. The findings indicate that a systematic, multi-methodological approach developed around a conceptual framework can lead to higher quality evaluations. Diagnostic POEs should be grounded in extant literature and customized based on the setting, the client's guiding principles, and the design team's objectives. In diagnostic POEs, one size does not fit all.

KEYWORDS: Case study, design process, interdisciplinary, post-occupancy, privacy and confidentiality

AUTHOR AFFILIATIONS: Lindsey Guinther is an Assistant Professor in the College of Design; Allison Carll-White is a Professor in the College of Design; Kevin Real is an Associate Professor in the College of Communication and Information, all at the University of Kentucky in Lexington, Kentucky.

CORRESPONDING AUTHOR: Lindsey Guinther, lindsey.guinther@uky.edu; (859) 257-2286.

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With its growing desire to integrate evidence-based information into the decision-making process, the design industry has demonstrated increased interest in conducting post-occupancy evaluations (POEs), specifically within the area of healthcare design. POEs have been conducted since the 1960s, stemming from human environmental research. Historically, the design industry recognized POEs as an academic-based research methodology and the final step in the design process. Preiser, Rabinowitz, and White (1988) define post-occupancy evaluations as "the process of evaluating buildings in a systematic and rigorous manner after they have been built and occupied for some time" (p. 3). POE studies focus not just on the building design itself, but also on the requirements of its occupants, and can provide important information to drive future designs. Consequently, resources related to POEs have expanded to include data collection tools, data repositories, and evidence-based design guidelines and recommendations. While the use of and resources for POEs have grown, there are a number of barriers still in place preventing POEs from becoming common practice in healthcare design. These barriers include issues of cost and time, the lack of research expertise within firms, and the unwillingness of design firms to publicly expose problems or failures within a designed environment. However, innovative models of practice have been introduced that are changing this cultural mindset (National Research Council, 2002). When implemented in healthcare design, the research findings of POEs can positively impact patient and visitor experiences and satisfaction, create supportive work environments for staff and caregivers, and help achieve organizational objectives (The Center for Health Design, 2010).

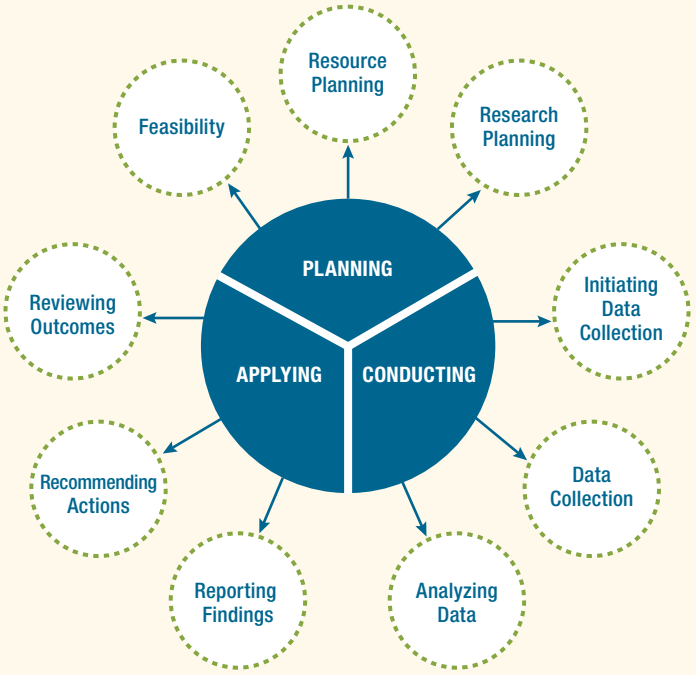
The use of diverse methodologies that vary widely has grown as post-occupancy evaluations have increased over time. Preiser (2002) defined three levels of effort that constitute a typical POE, as well as a cyclical process for carrying out the research that involves planning, conducting, and applying (see Figure 1).

Each POE must be carefully tailored to address a building's specific objectives and the intent of the design firm and client(s).

Level one, an *indicative* POE, the simplest, leads to an "awareness of issues in building performance" (p. 11). An *investigative* POE, the second level, yields a more "thorough understanding of the causes and effects of issues in building performance" (p. 11). A level three *diagnostic* POE gathers the most information and can lead to "the creation of new knowledge about aspects of building performance" (p. 11). While depth and breadth are significant, it is important to understand that there is no single standardized method or set of tools for conducting a POE. In diagnostic post-occupancy evaluations, one size does not fit all. As confirmed by Zimring and Reizenstein (1980), each POE must be carefully tailored to address a building's specific objectives and the intent of the design firm and client(s). It is also crucial that the process used to conduct a POE be documented to inform future evaluations and studies.

The goal of this study is to present a detailed account of the process and methodology used in conducting a *diagnostic* POE carried out for an emergency department (ED) located in an urban academic healthcare organization. This POE utilized a multi-methodological approach including extensive observations, sur-

Figure 1. Cyclical POE process diagram.



Source: Adapted from Preiser, 2002, p. 12.

veys, focus groups, and interviews in order to develop a comprehensive framework for a diagnostic post-occupancy evaluation in a healthcare design setting. Data were collected on multiple design issues. However, because process rather than results is the focus of this article, only one specific healthcare design-related issue, privacy and confidentiality, will be assessed. This case illustrates how multiple data sources provide an accurate picture of design issues that can help researchers and practitioners correctly interpret data.

The significance of this particular POE will be of interest to the multiple practices and disciplines engaged in healthcare design. This evaluation, conducted over the span of 12 months, reflects a collaborative effort between an architectural firm, a healthcare provider, and a university. This report provides an account of how this POE was conducted in two separate phases, with data analysis occurring after each phase. Phase 1 involved observation, physical measurements, and occupancy counts, which enabled the research team to become familiar with the emergency department context and lay the groundwork for the rest of the study. In Phase 2, staff, visitors, and patients completed questionnaires; in addition, interviews with key personnel and focus groups of distinct categories of staff were conducted. Taken together, both Phases delivered a robust set of findings that will add to the knowledge base for healthcare and design professions. There have been few rigorous reports of in-depth, multi-methodological diagnostic POEs in the healthcare design literature. This study will contribute to a better

understanding of diagnostic POE processes and methodologies in healthcare design.

Literature Review

A review of the existing literature reflected a multiplicity of methodologies utilized to conduct POEs within healthcare environments and suggested best practices for conducting a diagnostic POE. Certain features such as questionnaires were common among all studies reviewed. The order in which the methodologies were used differed, as did the level of effort. In addition to questionnaires, the methodologies most commonly used were interviews, behavioral mapping, observation, and a review of existing literature. Some studies included both pre- and post-occupancy data collection. All studies were conducted at least 6 months after the completion of the building and resulted in suggestions to be considered for enhancing future designs. This review offers a comparison of methods used in order to assist in structuring site-specific POEs.

A multi-methodological POE of a women's health center, conducted by Shepley, Bryant, and Frohman (1995) determined whether the designers' intentions had been effectively executed, provided feedback to the hospital administration regarding the facility's effectiveness, and suggested future design guidelines. Data were collected using questionnaires, interviews, and behavioral mapping. According to Shepley, Bryant, and Frohman, "The advantage of multi-methodology techniques is that the inadequacies of one methodology can be compensated for by the strengths of another" (1995, p. 17). Administrators, physicians, and nursing staff were surveyed using questionnaires, with 22 individuals responding. Because the number of questions included (218) was considered to be excessive, a recommendation was made to shorten the questionnaire. Interviews informed by the completed questionnaires ranged in length from 45 to 60 minutes and were conducted with eight staff members who had participated in the programming process. A behavioral mapping pilot study examined the use of the decentralized nurses' stations, movement patterns in the Neonatal Intensive Care Unit, and patient care time by nurses and family members with five infant patients. The study examined both building factors, such as functionality, security, and interior aesthetics, and human factors, such as patient–staff interaction and staff morale. The research resulted in an extensive list of design recommendations, although the authors noted the need to confirm the generalizability of the findings.

A POE resulting from a collaboration of a healthcare provider, architectural firm, and university researchers at San Diego's Grossmont Hospital offered important insights (Shepley, Boerger, & Viets, 2006). The pilot post-occupancy evaluation examined the 24-bed critical care unit and the 43-bed emergency department to evaluate the design's effectiveness relative to goals outlined in the architectural programming. This study also used questionnaires (n = 14), interviews, and behavioral mapping as the data collection methods. The emergency department questionnaire consisted of 33 questions answered on a 6-point Likert scale and three open-ended questions. Interviews were conducted with the architect and four staff members. Behavioral mapping was done in two 1-hour

segments in both the critical care unit and the emergency department waiting room. This study confirmed the importance of utilizing guidelines in the architectural programming as a basis for testing, and confirmed the value of developing the research process through input from an interdisciplinary team.

A study by Brown, Wright, and Brown (1997) used a post-occupancy evaluation to assess wayfinding in a 1-year-old pediatric hospital. Wayfinding aspects that were studied included signs, maps, consistent use of terms, site, and layout. The methodologies consisted of interviews with staff (n = 66) and visitors (n = 47), staff-maintained logs (n = 46) to record visitors' requests, photograph traces in problem areas, 16 hours of behavioral observation, and cognitive maps drawn by patients and their parents. The results of this study supported the importance of triangulation, or the use of multiple methods, to develop a complete assessment of the environment as discrepancies across methods were revealed.

Pre- and post-occupancy studies are important because they allow data to be compared to determine the success of the design objectives in the new facility. A POE by Kotzer, Szacharakis, Raynolds, and Buenning (2011) examined family and staff satisfaction of an old and new pediatric hospital in Denver. Pre- and post-descriptive survey designs were used to gain feedback from family and staff on features such as light, noise, temperature, aesthetics, safety, security, and privacy. According to the authors, "Survey questions were based on features that reflected the guiding principles used during the design and construction process and on relevant research literature" (p. 67). Staff surveys (n = 306, pre; n = 434, post) consisted of 53 questions using a 5-point Likert scale to rate level of satisfaction. Respondents were also asked to assign a high or low level of importance to each statement, yielding two responses per question. The family survey (n = 60, pre; n = 60, post) was similar and consisted of 48 questions. A Spanish version of the family questionnaire was made available, although few responses to this version were received. For both groups, opportunities were provided for open-ended written comments. Participants were personally asked to participate and given a 2-week time period to respond, yielding a low return rate. This was noted as a limitation to the study.

Another pre- and post-occupancy study piloted a building performance evaluation tool at an acute care hospital in Calgary, Canada (Knudtson, Fontaine, Steinke, Webster, & Taylor, 2011). This project, part of The Center for Health Design's Pebble Project research initiative, compared responses from two inpatient units. The Building Performance Evaluation (BPE) Scorecard was used to measure four performance dimensions: physical, financial, service, and functional. In this study, seven new design elements were evaluated using patient and staff surveys, observational studies and photography, and secondary data collection. Sample size was not reported. Because this was a pre- and post-occupancy study, the time and resources necessary to conduct the research were considerable. The researchers found it difficult to maintain momentum due to the start-and-stop nature of the research. This project illustrates an attempt to test a standardized set of POE tools for data collection.

Nanda (2011) conducted a post-occupancy evaluation to examine the effect of art selection and placement in five clinics at the M.D. Anderson Cancer Center in Houston. Using a short, 13-question survey, 210 patients and visitors were approached in person and asked to evaluate both the quality and emotional and/or healing effect of art. A total of 240 staff members also completed a 19-question survey online. Visitor and patient responses were compared to those of the staff. The results indicated that both the quality of the artwork and its emotional and healing effects were positively perceived by users, and the findings added to evidence-based research on art selection and placement. This study represented a large survey sample, which contributed to the validity and reliability of the findings and demonstrated two methods for soliciting responses.

Reviewing the literature on healthcare-related POEs yielded a number of lessons to be learned. Most importantly, as stated earlier, a POE must be tailored to a specific building type and its design objectives. The methodology should be designed to evaluate the effectiveness of the design's response to the client's guiding principles and design requirements of the designers, users, and owners. Second, as will be demonstrated, a multi-methodological approach utilizing both quantitative and qualitative data is critical in order for outcomes to be validated. Specific methodologies need to be designed to focus on a single attribute of the setting, as opposed to collecting data from a more holistic point of view (Zimring & Reizenstein, 1980). However, data collection tools such as behavioral observations, questionnaires, and focus group outlines should be designed around a conceptual framework so that outcomes can inform other findings within the study and comparisons can be made. Further, because each building and set of users is uniquely different, researchers must be cautious about the generalizability of the findings. The literature review confirms that pre- and post-occupancy evaluations provide the richest information to validate the findings. Finally, the literature suggests that partnerships among design firms, healthcare providers, and educational institutions can be formed to assist design practitioners in carrying out POEs. Such partnerships offer greater objectivity in the evaluation, increased research expertise, and the ability of the partners to contribute valuable evidence-based design information to the knowledge base.

A Diagnostic POE Methodology

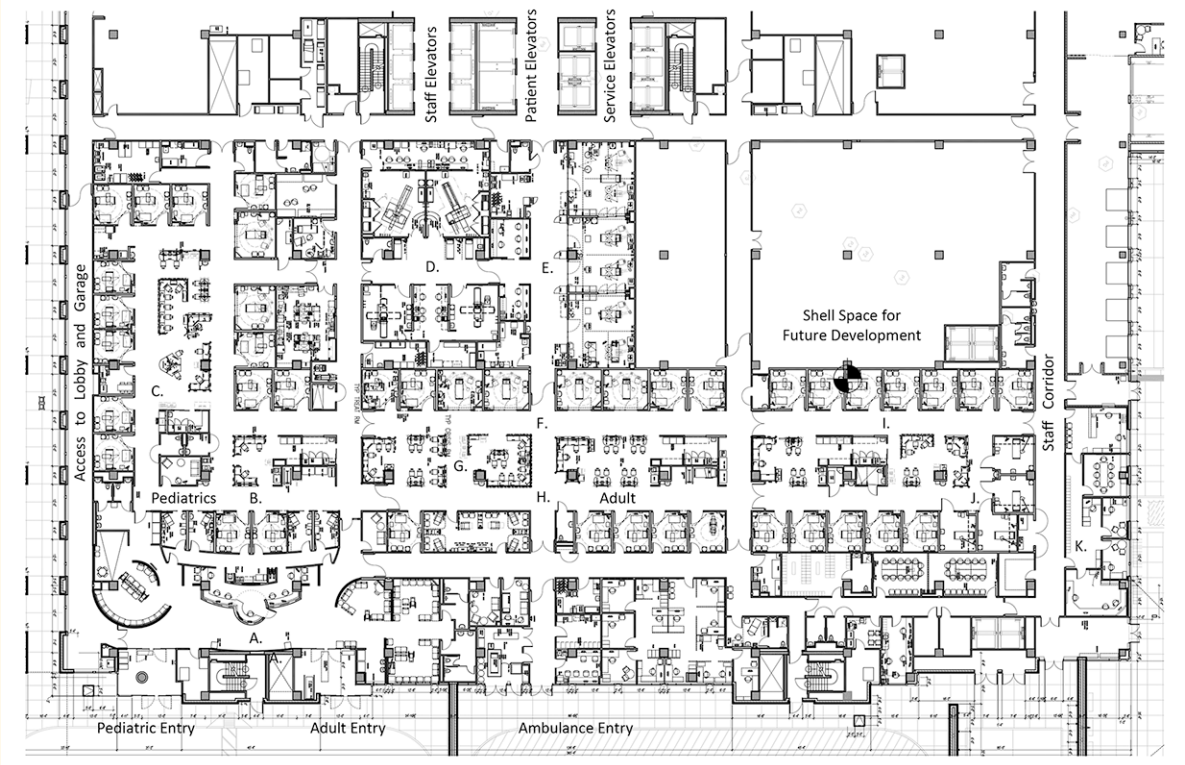
Seeking feedback on the design of a recently completed medical center, university researchers were contacted by the architectural firm to conduct a post-occupancy evaluation of the facility's emergency department. This request resulted in a three-way partnership between the university, the architectural firm, and the hospital administration. The Centers for Disease Control and Prevention (2013) reported 129.8 million visits to EDs in 2010. One of several key factors in maximizing functional efficiency in dealing with these large patient numbers is the design of the emergency department environment.

The new ED in the recently completed medical center, a Level 1 Trauma Center, had been open for 18 months prior to the design firm's request for a post-occupancy evaluation. The old ED had encompassed a 40-bed treatment area occupying 19,000 square feet. In comparison, the new ED occupies 40,000 square

feet with 62 treatment rooms. Separation between the pediatric and adult treatment areas was requested by the hospital. The pediatric unit has a separate waiting room, two triage rooms, and 12 treatment rooms, two of which service high acuity or crisis and/or trauma patients. There are four treatment areas (swing rooms) that may be used when needed based on patient volume. On the adult side, there are two adult triage locations, six chairs in the chair-centric treatment area, four express care rooms, 16 acute care rooms, eight critical care rooms, and eight trauma bays. The hospital also wanted to have the behavioral treatment areas physically separate from the pediatric ED. The imaging unit is adjacent to the trauma bays and in close proximity to both the adult and pediatric treatment spaces in order to facilitate efficient treatment (see Figure 2). The building program also included administrative and staff support areas in the emergency department.

Guiding principles were agreed upon by the key stakeholders: "[T]he space was to be patient centered with patient access and care being priorities; the academic mission of the university was a key consideration, as was integration of clinical services, with a focus on seamless episodes of care; and efficiency, flexibility, and image were also considered integral components to the project" (Howard, Proud,

Figure 2. Emergency department floor plan.



KEY: EMERGENCY DEPARTMENT FLOOR PLAN UNIT LOCATION

A. Registration & Waiting	B. Triage	C. Pediatrics Unit	D. Imaging	E. Trauma Unit	F. Critical Care
G. Physicians' Pod	H. Express Care/Chair Centric	I. Acute Care	J. Behavioral Treatment Rooms		K. Security

Table 1. Architectural Firm's Core Areas of Evaluation

ENVIRONMENT	EXPERIENCE	OPERATIONS
Focusing on the detailed environmental qualities of spaces or places and their impact on care delivery	Focusing on the design's impact on patients, families, and caregivers	Focusing on the design's layout and its impact on delivering efficient, dependable, and safe care
Same-handed treatment room design and its impact on care delivery	Impact of waiting area design on patient satisfaction	Patient segregation at intake and the alignment of the physical environment
Spaces: Reception, Registration, Waiting, Triage, Treatment Rooms, Trauma Rooms, Nurse Stations, Physician Support Areas, Medications, Soiled/Clean Utility, Imaging Rooms, EMT Support, Disaster Preparedness Support	• Impact of patient self-navigation on patient and caregiver satisfaction • Relationship of onstage and offstage space with caregiver satisfaction • Impact of unit wayfinding on patient stress level • Use of positive distractions on the care experience	• Impact of layout of triage on care delivery • Impact of unit compartmental configuration on care delivery • Relationship of nurse station to patient care areas and its impact on care delivery • Impact of physical interdepartmental relationships on ED operations

Courtesy of GBBN Architects.

& Humphries, 2012, p. 555). A quiet environment was also a priority. Consequently, a linear design model with a central core was selected to allow staff to be located close to the patient point of service and to address the issue of privacy by containing the exchange of confidential information.

Background for Developing the Methodology

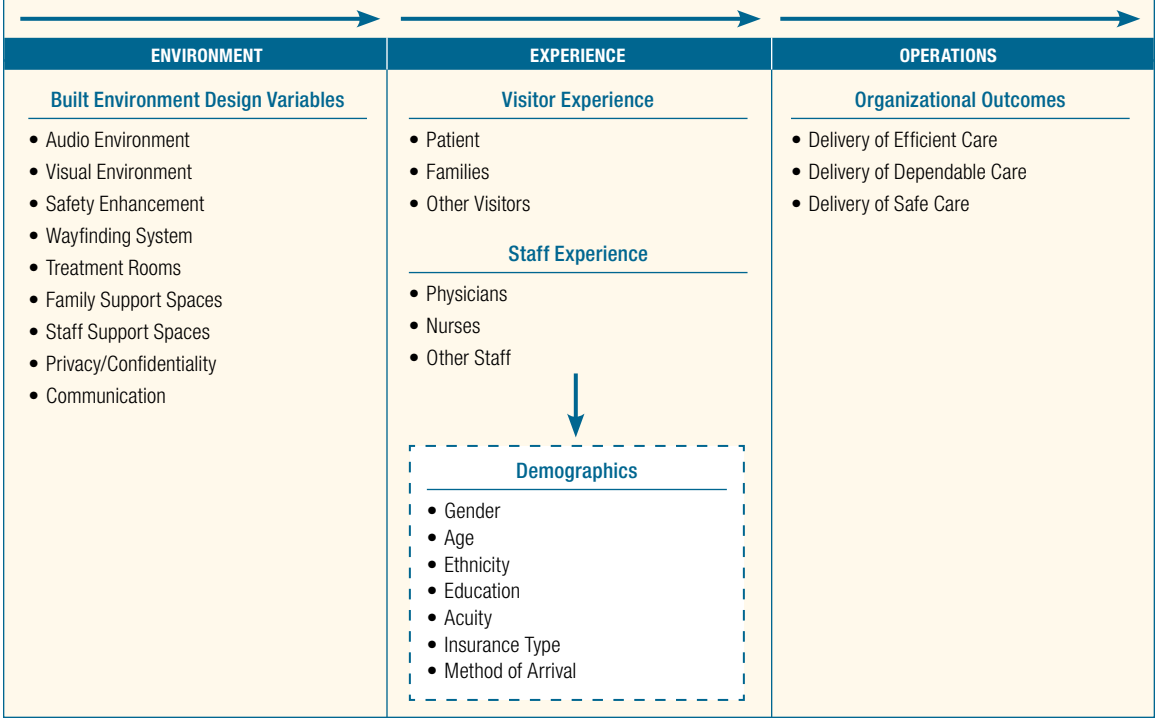
After conducting an extensive review of literature and determining that no extant evaluation tools were available to specifically test the implementation of the hospital's guiding principles and the architectural firm's design objectives, the university researchers developed a set of evaluation tools to meet their specific needs using a conceptual framework proposed by Ulrich, Berry, Quan, and Parish (2010). Within this framework, the authors examine the interrelationship between built environment design variables, participant outcome variables (patients, family, staff) in addition to demographics, and organizational outcome variables. Core areas of evaluation provided by the hospital's architectural firm (see Table 1) were assessed through the lens of Ulrich, Berry, Quan, and Parish's conceptual framework to help determine how well the client's guiding principles were addressed in the design of the emergency department. The conceptual framework that was developed for this POE is illustrated in Figure 3.

Conducting the POE

In planning the research study, the researchers determined that the post-occupancy evaluation should be conducted in two phases, with Phase 2 building upon Phase 1, and allowing time for data analysis in between. Specific objectives for the multi-phased POE included:

- Assess the detailed environmental quality of spaces or places and their impact on care delivery;

Figure 3. Conceptual framework.



- Determine the design's impact on family, patients, and caregivers; and
- Analyze the design layout and its impact on delivering efficient, dependable, and safe care.

The study population consisted of anyone visiting or working in the emergency department, including patients, family members and other visitors, physicians, nurses, technicians, paramedics, housekeeping, security, reception, and general staff. The sample was all-inclusive, with subjects of all ages, genders, and ethnic backgrounds.

Phase 1 Methodologies

For researchers to become familiar with this particular ED environment, observational methodologies were primarily used in the first phase. These methodologies included behavioral mapping and occupancy counts, with additional physical measurements such as acoustic and lighting levels taken to supplement the observations. Additionally, patient wait times and time spent in triage were calculated, as was the use of positive distractions in the pediatric areas. Because POEs need to individually examine specific attributes of the environment, the Phase 1 observations were organized first by issues to be studied and then by location (see Table 2). This organization allowed for multi-methodological data collection to be simultaneously conducted within individual units of the emergency department. Institutional Review Board approval was obtained prior to data collection. No confidential patient information was collected.

Table 2. Phase 1 Data Collection Methods

SYSTEMATIC OBSERVATIONS	DATA COLLECTION METHOD	LOCATION OF DATA COLLECTION
Circulation	**Behavioral Mapping:** Using a floorplan of the unit, researchers observed and recorded paths of travel for the identified study population to determine the efficiency and use of the linear design floorplan. Maps were changed every 15 min.	• Pediatric ED Unit, Adult ED Unit, Trauma, Imaging
	Through Traffic: Researchers documented the frequency of through traffic in specific areas of the ED.	• Trauma, Imaging
Information Exchange	Researchers documented where the exchange of confidential occurred and with whom. Data were collected in 15-min. time intervals.	• All patient treatment areas and central core
Walkability Studies	Using pedometers, researchers determined physician, nurse, and technician travel distances within the care area environment. Data was collected in 4-hr. periods of time. Data documentation correlated to behavioral mapping.	• Entire ED
Waiting Times	Utilizing a stopwatch, researchers determined actual waiting times of patients entering and exiting the primary waiting areas and time spent in triage rooms in the ED.	• Adult and Pediatric Waiting Areas and Triage Rooms
Occupancy Counts	Researchers determined the quantity and acuity levels of occupants in various parts of the ED. Data were collected in either 15- or 30-min. intervals, depending on the location.	• Adult and Pediatric Waiting Areas, Adult and Pediatric Treatment Rooms, Trauma, and Imaging
Built Environment Variables	**Positive Distractions:** Researchers documented use of environmental stimulations in the waiting areas, corridors, and treatment rooms (interactive art, computer stations, toys, game systems, furnishings, television). Data were collected in 15-min. intervals.	• Pediatric Waiting, Treatment Rooms
	Wayfinding: Researchers documented patient response to signage and wayfinding information.	• Waiting Areas, Corridors, and Treatment Rooms
	Acoustical Properties: Researchers recorded noise levels throughout the ED using digital sound level meters. Data were collected in 30-min. intervals per 4-hr. observation time period.	• Waiting Areas, Corridors, and Staff Work Spaces
	Lighting: Researchers measured the illumination level of the care area environment using a digital light meter.	• Central Travel Areas, Staff Work Spaces, Pharmacy
	Use of Supply Cabinets: Researchers tallied the use of the custom-designed Personal Protection Equipment (PPE) cabinets by the staff.	• Corridors and Patient Treatment Areas
	Use of Medical Equipment: Researchers tallied the frequency of use of linen supplies, medical equipment, and pyxis stations.	• Imaging and Trauma

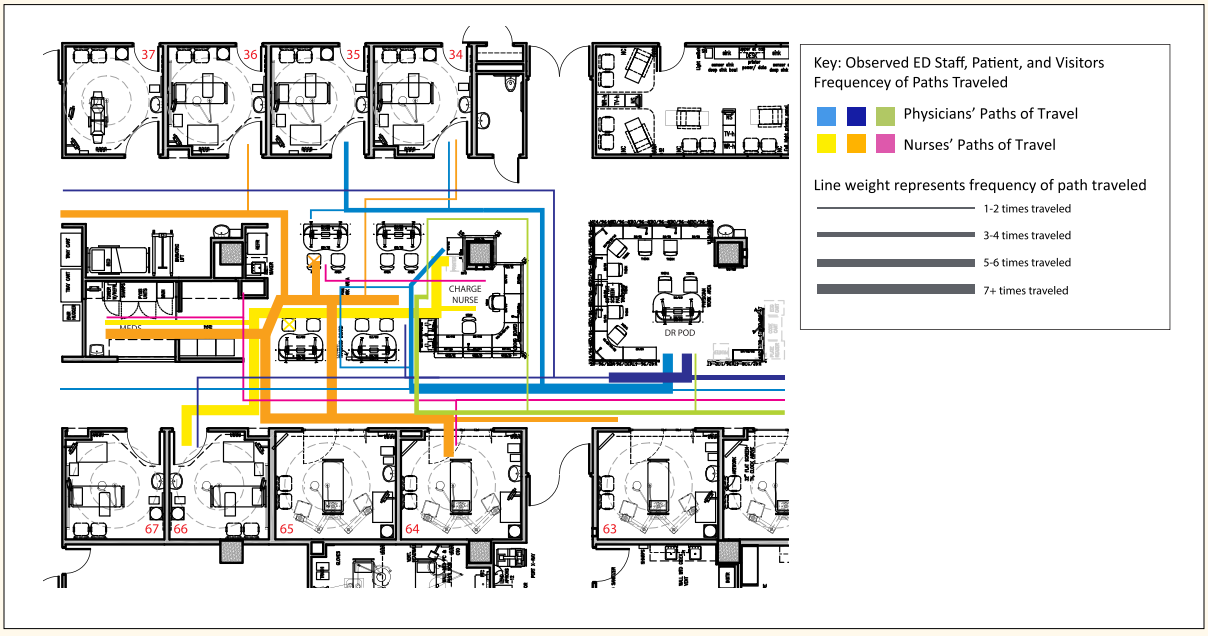
Because of the extensive nature of the observational studies, the first two of the authors of this article, Guinther and Carll-White, engaged eight graduate and undergraduate students in the POE process in order for them to gain first-hand experiential learning in an unfamiliar environment and further their knowledge of the research process. Data collection occurred over a 10-week period coinciding with the academic calendar, with specific research objectives set on a weekly basis. The primary researchers, Guinther and Carll-White developed weekly data collection tools that were piloted and revised to best capture the desired information. After being reviewed by the architectural firm and healthcare provider, the revised tools and objectives were disseminated to the students; training in the use

of the tool(s) being used then occured. The 10 researchers were paired into teams of two; each team observed for one 4-hour time period per week. Over the course of 10 weeks, this yielded a total of more than 200 hours of observation occurring over a range of times and days due to the ever-changing nature of the emergency department. Following each observation period, the POE teams analyzed and discussed a tool's effectiveness and the observation experience.

Behavioral mapping was completed in the trauma, pediatric, acute, and critical care areas of the ED, and constituted a significant portion of the observational studies (see Figure 4). Color coding was used to create a distinction between the walking patterns of physicians, nurses, and technicians. Physicians' walking patterns were recorded in cool colors, nurses' in warm colors, and technicians' in black, grey, and brown.

Each tool provided space for capturing impromptu observations by the researchers and relevant staff comments, adding to the richness of the findings. During the last week of observation, all 10 researchers were positioned throughout the entire emergency department to record all movement from one area to the next. This exercise validated the findings from the individual unit mappings. All observational data were then analyzed and reviewed with the design team and served to inform the second phase of the study. To demonstrate the value of these multiple methodologies, an example of how the data from Phase 1 were used to assess privacy and confidentiality in a linear design model with a central core is discussed below.

Figure 4. Behavioral mapping in critical care unit.



Example of Privacy and Confidentiality from Phase 1 Data Sources

Because it is the primary purpose of this article to focus on process rather than the overall findings, one design issue will be examined through the lens of the POE data to assess the linear core design model and its impact on privacy and confidentiality in the ED. Doing so will demonstrate the importance of using a multi-methodological approach and its effect on validating individual research findings.

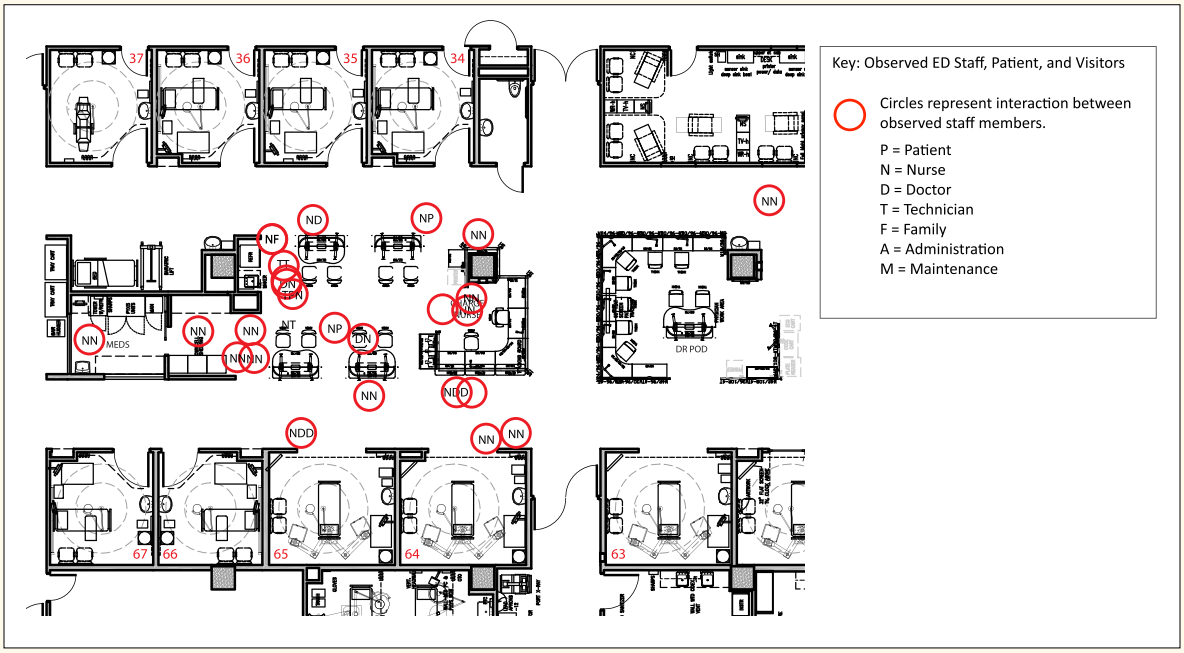
Because of HIPAA (Health Insurance Portability and Accountability Act) legislation, privacy and confidentiality are of primary importance in the healthcare setting. To maintain privacy and confidentiality, private patient information (verbal or written) may not be revealed to others by the healthcare provider without the patient's consent. Research conducted by Ulrich et al. (2008) suggests that privacy breaches frequently occur in emergency departments because of the high number of patients and staff, severity of diseases or injuries, and the necessity for confidential patient conversations. According to Mlinek and Pierce (1997), an observational study of an emergency department revealed that all members of the healthcare team committed privacy and confidentiality breaches. Mlinek and Pierce concluded that both patient confidentiality and audible and visual privacy were influenced by the design of the ED. More specifically, Karro, Dent, and Farish (2005) found that the number of patient privacy incidents increased with patient length of stay (LOS) and the absence of walled cubicles or private treatment rooms. Further, privacy and confidentiality issues may influence the amount of information that patients share with their healthcare provider as well as the exchange of patient-related information among staff members working in an open plan (Mlinek & Pierce, 1997).

The hospital's design team hypothesized that utilizing a central-core open plan would decrease breaches of privacy.

For the ED under study, the hospital's design team hypothesized that utilizing a central-core open plan would decrease breaches of privacy. One of the questions raised in the POE planning process was whether the central core linear design model achieved this objective or if conversations that may lead to privacy breaches were occurring in other places (J. Lennon, personal communication, January 5, 2012). This question informed an important aspect of the behavioral mapping studies. To test this hypothesis, observations of verbal interactions between staff, patients, and visitors were recorded concurrently with the behavioral mapping. The documentation technique used circles and letters to identify where and with whom potential breaches of confidentiality were occurring (see Figure 5). Both the interaction and mapping data were transferred to an electronic format in 1-hour increments. Documentation of the data in a digital format offers opportunities for isolating or layering maps to identify those areas where problems are occurring. The data revealed that the location of the workstations contributes to the majority of patient-related conversations being held within the centralized core.

Noise levels in emergency departments also can influence privacy and confidentiality when patient information is being shared among the patient care team members and with visitors and family members (Ceilings & Interior Systems

Figure 5. Observations of verbal interactions between staff, patients, and visitors.



Construction Association, 2010). The World Health Organization suggests that hospital noise levels should not exceed 35 dB(A) during the day and 30dB(A) at night, although research shows that these levels are not adhered to within emergency departments. Orellana, Busch-Vishniac, and West (2007) found that there were substantial noise level variations between locations within the emergency department at Johns Hopkins Hospital. Sound levels averaged between 61 and 69 dB(A), which raises concerns because staff frequently rely on oral communication. Additionally, a study by Buelow (2001) found that in four Phoenix emergency departments, noise levels ranged from 55.9 dB at their quietest to 75.6dB at their peak. The aggregate average of all four facilities was 69.7dB.

Design attributes included in the ED under study that contribute to lowering noise levels include the use of single patient rooms, floor-to-ceiling solid partitions, acoustical tiles, and solid core wood doors on most treatment rooms. Four adult rooms and two pediatric rooms have glass doors. In addition, the chair-centric area offers six chairs separated with curtain partitions. Four private consultation rooms were also provided throughout the ED. Additionally, the staff uses personal communication devices to diminish the noise created by overhead paging.

To assess the noise levels within various locations of the emergency department, acoustical measurements were taken throughout the patient treatment areas. This occurred every 30 minutes during each 4-hour observation period over the course of 5 weeks. In the waiting areas, acoustic levels were measured every 15 minutes during each 4-hour observation period over the course of 1 week. The

mean of the sound level in the waiting areas was 56.56 dB. For other locations within the ED, the mean of the sound levels ranged from 54.75 dB to 59.86 dB. These sound levels confirm that the goal of creating a quiet emergency department environment for the hospital was largely achieved. Although these noise levels were below those of other hospital settings, however, they still did not conform to noise levels suggested by the World Health Organization (see Joseph & Ulrich, 2007).

Occupancy levels within the ED also can influence speech privacy and patient confidentiality. Privacy and confidentiality are likely to be most problematic when the ED is at full capacity, with beds and visitors positioned in the hallway directly outside patient rooms. When designing the emergency department, "no hallway beds were planned. There would be no admitted patients (boarders) in the emergency department; the clinical decision unit [outside the ED] would be the destination of choice for admitted patients when inpatient beds were not available" (Howard, Allison, Proud, & Humphries, 2012, p. 556). However, because of the rapid rise in patient volumes and lack of available hospital rooms, this turned out not to be the case. To facilitate patient care, treatment areas are set up in the corridors when the volume of the emergency department reaches full capacity, because no more private rooms are available. Determining the amount of time the ED is at full capacity provides insight into patient and visitors' perceptions of privacy and confidentiality issues. To collect occupancy rates, counts were performed in 30-minute intervals over the course of 1 week. Beginning in the waiting rooms, observers moved throughout the ED taking counts of occupants in each separate unit. A count, completed for each room, documented patient occupancy and number of visitors. In addition, age and acuity levels were recorded. Table 3 presents one aspect of this data, illustrating that individual units of the ED were at full capacity from 7.5% to 55% of the time.

In addition to patient volume, Karro, Dent, and Farish (2005) noted that the likelihood of overhearing private conversations increases with length of stay. To determine average lengths of stay, the researchers requested existing data from the emergency department. Before beginning POE research, the types of data collected by the institution should be assessed to avoid duplication of efforts.

Table 3. Emergency Department Volume by Unit

UNIT	CAPACITY	MINIMUM	25TH PERCENTILE	MEDIAN	75TH PERCENTILE	MAXIMUM	AT FULL CAPACITY
Pediatric	12	4	7	9	10	12	7.5%
Chair Centric	6	0	2	3	5	6	10.0%
Express	4	0	3	4	4	4	55.0%
Acute	16	0	13	14	15	16	12.5%
Critical	8	4	5.5	6	7	8	10.0%
Trauma	8	1	3	4.5	6	8	10.0%

In the old emergency department, the average length of stay was 404 minutes. While an average length of stay of 180 minutes is the goal of the new emergency department, the LOS over the past year reflects an average of 327 minutes. This suggests that there is a greater likelihood of confidential information to be overheard.

Impromptu observations and unsolicited staff comments that were recorded also validate findings related to privacy and confidentiality. Content analysis was conducted through the lens of the conceptual framework to organize various impromptu observations and staff comments relevant to the built environment design variables. Under the category of privacy and confidentiality, three sub-categories were identified. The first suggests patient and visitor privacy issues. In numerous instances, patients, family members, and visitors were observed either wandering or hovering in the corridors of the emergency department, creating opportunities to overhear confidential conversations. Other visual and auditory privacy issues resulted from open doors or curtains in the treatment rooms. In other instances, patient families and visitors were asked to wait in the corridors while physicians cared for the patient or shared private information within the treatment rooms. Conversely, one researcher specifically recorded the following: "I asked how many people were in room number 43 and the nurse got all worked up. Apparently a doctor was currently in the room doing a procedure with four visitors in the room, and the nurse commented this was very inappropriate." A comparison of the findings suggests that these privacy concerns could be addressed by including a small visitor respite area within the ED where families and visitors could be directed, to avoid remaining in the treatment room during procedures or wandering in the corridors.

The second category revealed communication and privacy issues related to the staff. On several occasions, physicians and/or nurses were observed talking with other staff members face-to-face or on the telephone outside patient treatment rooms. This was confirmed in the behavioral mapping. Further, open treatment room doors create the possibility of conversations being overheard by others. However, when the ED had lower levels of occupancy, conversations between staff members generally occurred within the central core, although privacy and confidentiality continued to be a concern noted by the observers.

Lastly, impromptu observations and staff comments frequently revealed privacy and confidentiality breaches occurring in the waiting, registration, and triage areas of the ED. Many people in the waiting areas were observed discussing confidential information on their phones. Although this type of breach is not the hospital's responsibility, findings suggest that providing secluded areas for cell phone usage in close proximity to the waiting area would be an appropriate design response. On other occasions, when all of the chairs in the waiting areas were occupied, large groups of people were forced to stand in close proximity to the registration desk. This is problematic in that it provides opportunities to overhear confidential information. Physicians and nurses were occasionally observed interacting with families in the waiting area. Again, these events occurred at times when the ED was at its greatest capacity.

These observations, combined with the other findings, lead to a clearer understanding of privacy and confidentiality issues within the emergency department. The methodologies used in Phase 1 revealed that despite the fact that the majority of conversations were being held within the central linear core, privacy and confidentiality breaches were still occurring. While the findings from the first phase revealed that the overall level of noise within the ED met the design team's goals, both the literature and study findings confirm that as patient volume and LOS increase so too does the likelihood of overhearing confidential information. To further clarify and give meaning to the Phase 1 assessment and perceptions regarding privacy and confidentiality, the qualitative and quantitative information collected during Phase 2 of this POE was essential.

Phase 2 Methodologies

In the second phase, data were collected from questionnaires administered to patients, visitors, and staff, as well as staff focus groups and interviews (see Table 4).

Data collection occurred over a period of 10 weeks, beginning with the administration of the questionnaires. Because there were no extant research tools that specifically addressed the range of information desired for this emergency department, questionnaires were developed for each group. This survey development was based on findings from Phase 1, review of the literature, and re-examination of the POE conceptual framework, guiding principles, and design objectives as determined by the hospital and architectural firm. An emergency department survey, sent out by the hospital after patient visits to solicit feedback on the patient experience, was used as a model.

The patient questionnaire consisted of seven categories comprising a total of 44 questions, with responses based on a 5-point Likert scale. The categories included assessments of arrival and waiting, treatment rooms, the physical environment, safety and staff support, specific environmental variables, and an

Table 4. Phase 2 Data Collection Methods

	DATA COLLECTION METHOD	PARTICIPANTS
Questionnaires	**Staff Questionnaire:** Online questionnaire distributed by ED Leadership. Additional participants were personally solicited at staff meetings and shift changes. **Patient and Visitor Questionnaire:** Using the developed questionnaire, researchers personally requested participation while the patient was awaiting discharge or waiting to be admitted to the hospital. Questionnaires could be completed in private or administered orally with a correlating card illustrating the Likert Scale responses.	• Attending and Resident Physicians, ED Leadership, Nurses, Technicians, Paramedics • Adult Patients, Adult Visitors, Pediatric Parents and Visitors
Focus Groups	Seven core questions were asked of all focus groups with additional questions tailored to each group. Each session was 1 hour in length, audio recorded, and later transcribed.	• Physicians, Nurses (2), Technicians, Paramedics, Housekeeping, Patient Relation Assistants, Security
Interviews	Seven core questions were asked of all participants with additional questions tailored to each person. Each interview was 1 hour in length, audio recorded, and later transcribed.	• Hospital CEO, ED Director, ED Patient Care Manager, Trauma Nurse Coordinator

overall rating of the emergency department experience, as well as demographic information. The visitor questionnaire consisted of 49 questions, many of which were similar or identical to the patient questionnaire, in the same seven categories. Additionally, the visitor questionnaire included six questions for parents or guardians of pediatric patients. Opportunities for open-ended comments at the end of each category were provided. This allowed participants to offer qualitative feedback on more specific areas of the emergency department. For each questionnaire, researchers documented the date and time of the survey, patient age and acuity level, and whether the patient was discharged or admitted, all of which was accessed from the ED monitors. Additionally, it was noted if the questionnaire was administered orally by the researcher or completed by the patient or visitor. For questionnaires orally administered, a correlating card illustrating the Likert scale responses was given to the respondent for reference. A Spanish version of the surveys was made available to interested participants, although it was not widely used due to a preference for the English version.

Based on information gained in the literature review, it was determined that requests to participate should be solicited in person and questionnaires should be completed at that time. The first two named authors of this article (the primary investigators) plus one graduate research assistant carried out this data collection. After working with the study statisticians to determine the desired number of respondents, a schedule for administering the questionnaires was developed. In 4-hour periods over the course of 4 weeks, six shifts were scheduled for Sunday, Monday, Tuesday, another six shifts for Wednesday and Thursday, and the final six shifts covered Friday and Saturday. Each grouping of six shifts encompassed all 24 hours on the clock. For each shift, the researcher was responsible for obtaining 17 completed questionnaires: 5–6 from adult patients, 5–6 from visitors, and 6 from pediatric parents or guardians (see Table 5). The request for participation was made as the patient was awaiting discharge or waiting to be admitted to the hospital as noted on the ED monitors; this allowed respondents to reflect on the totality of their emergency department experience. A total of 117 patient questionnaires, 111 visitor questionnaires, and 87 pediatric visitor

Table 5. Patient and Visitor Questionnaire Data Collection Schedule

SHIFTS	NUMBER OF HOURS	TIME OF DAY	TOTAL NO. OF QUESTIONNAIRES	SUN., MON., & TUE.	WED. & THU.	FRI. & SAT.
1	4 hrs.	23:01–3:00	51	17	17	17
2	4 hrs.	3:01–7:00	51	17	17	17
3	4 hrs.	7:01–11:00	51	17	17	17
4	4 hrs.	11:01–15:00	51	17	17	17
5	4 hrs.	15:01–19:00	51	17	17	17
6	4 hrs.	19:01–23:00	51	17	17	17
	Totals:		**306**	**102**	**102**	**102**

questionnaires were completed and eligible for analysis. This method of soliciting questionnaire responses proved to be particularly successful because the researchers could briefly explain the purpose of the study and why the respondents' input was important. Because the researchers were responsible for the dissemination and collection of the questionnaires, this methodology alleviated any burden on the staff.

Using a similar format, the staff survey consisted of 68 questions distributed among 10 categories based on a 5-point Likert scale. The categories consisted of respondent demographics; unit configuration; efficiency; furnishings, equipment and storage; the physical environment; specific environmental variables; treatment rooms; privacy and safety; staff satisfaction; and a question regarding level of satisfaction with the design of the emergency department. Again, space was provided for open-ended comments. Three additional questions were provided for comparison by staff that had also worked in the old ED, and differences in responses can be analyzed to provide a greater depth of understanding.

Initially, the staff questionnaire was distributed online with a request for participation from the emergency department administration. Due to the number of questionnaires that the staff receives, participation responses did not meet the researchers' desired rate of response. A total of 46 responses were initially received, some of which were incomplete. At that point the researchers decided to personally solicit participation from the staff, as this method had proved to be successful with patients and visitors. Attending weekly staff meetings was the most efficient method of gathering responses and yielded a total of 86 usable questionnaires.

In order to understand and further clarify the findings from Phase 1 (observation, physical measurement, occupancy count) and the questionnaires from Phase 2, eight focus groups were developed as the next component of this extensive POE framework. The focus groups comprised two groups from nursing and one group each from housekeeping, security, physicians, paramedics, technicians, and patient relations assistants. It was decided that each staff group would participate separately in order to better understand the perspective of each group. The number of participants per sessions ranged from three to 10, with an average of five participants per group. Seven core questions were asked of all focus group participants to provide a common body of information, maintain consistency, and allow for cross-group comparisons. Additional questions were included that were tailored to address the unique aspects of each group. Each session was an hour in length, audio recorded, and later transcribed. The third author, Real, who is experienced in facilitating focus groups in healthcare settings, conducted each focus group session. In addition, one other author attended each focus group for note taking and further probing when necessary. This methodology proved to be an informative aspect of the study; it validated previous findings and offered multiple perspectives for data analysis.

Finally, several interviews were conducted with emergency department supervisors and key hospital administrators to probe their perceptions about the design of the emergency department. To maintain consistency and allow comparisons

to be made, the conceptual framework was again used, as were the core questions developed for the focus groups. All interviews were no more than 1 hour in length, audio recorded, and later transcribed.

The data collected from the second phase provided meaning to the Phase 1 outcomes and helped clarify why observed behaviors were occurring. In particular, the focus groups revealed some of the most interesting information from the study but would not have been as meaningful without an understanding of the previously collected data, as will be demonstrated in the Phase 2 example.

Example of Privacy and Confidentiality: Phase 2 Data Sources

The Phase 2 findings clarified perceptions from Phase 1 about the use of the linear core and its ability to support private and confidential conversations. Data collected from the surveys, focus groups, and interviews confirm that the issue under investigation cannot be fully understood without the use of multiple methodologies.

Six questions on both the patient and visitor questionnaires explored privacy and confidentiality issues and four questions were included in the staff questionnaires. All responses were based on a 5-point Likert scale with 1 being "Strongly Disagree" and 5 being "Strongly Agree." The individual responses for patients, visitors, and staff are shown in Tables 6, 7, and 8.

Overall, the survey data suggests that both patients (M = 3.92; SD = 1.02) and visitors (M= 4.17; SD = 1.03) were more satisfied with the levels of audible and visual privacy than staff (M = 2.98; SD = 1.03). Of greatest concern to the patients was the possibility that other visitors could overhear their private information during the registration process (Table 6). Conversely, family and visitors noted that they overheard some breaches of confidentiality while in the patient rooms (Table 7). While the staff agreed that places existed to talk confidentially with families, the data reveal greater concern with their ability to privately converse with other staff members (Table 8).

In the focus groups, staff concerns regarding privacy and confidentiality were reinforced. Overall, the staff believed that the individual rooms decrease privacy breaches. However, a number of nurses suggested that the linear core design might negatively impact patient privacy and confidentiality at times. According to one nurse, "I think a lot of times in the nurse's station we lose track of volume and what we say because we think 'well they're in their rooms, and this is our area,' but it's all wide open and if their doors are open, they can hear anything we say." Another nurse noted that most of the time, they try to keep their volume down; otherwise they'll go in the hallways or glass enclosed medical supply room to have private discussions with other staff members. Several staff commented that they preferred the nurses' and physicians' workstations in the trauma area, because these too were surrounded by glass.

The synthesis of the Phase 1 and Phase 2 outcomes proved to be essential in developing a holistic understanding of the issue under examination and is critical for developing future design recommendations.

Table 6. Patient Questionnaire Outcomes for Privacy and Confidentiality

PATIENT PRIVACY & CONFIDENTIALITY QUESTIONS	MEAN	SD
Our visual privacy was respected while in the treatment area	4.24	0.76
I feel like I had privacy while in this (treatment room)	4.10	0.90
I could hear other patient information while in the (treatment) room*	4.01	1.06
I could hear the staff talking about other patients while in the room*	3.95	1.05
I feel like other people could hear my private information	3.71	1.11
Other visitors could hear my private information when I checked in	3.49	1.22

NOTE:
*Indicates question response was numerically reversed.

Table 7. Visitor Questionnaire Outcomes for Privacy and Confidentiality

VISITOR PRIVACY & CONFIDENTIALITY QUESTIONS	MEAN	SD
I was happy with the patient's level of privacy while in this (treatment) room	4.47	0.69
Our visual privacy was respected while in the treatment area	4.41	0.76
The patient had privacy while in this (treatment) room	4.31	1.00
I was happy with the level of privacy during the check in process	4.29	0.94
I feel like other people could hear the patient's private information*	3.85	1.31
I could hear other patient information while in the (treatment) room*	3.70	1.47

NOTE:
*Indicates question response was numerically reversed.

Table 8. Staff Questionnaire Outcomes for Privacy and Confidentiality

STAFF PRIVACY & CONFIDENTIALITY QUESTIONS	MEAN	SD
Places exist that allow me to talk confidentially with patient families	3.62	0.78
Places that exist that allow me to talk confidentially with other staff members	2.88	1.08
The ED provides a variety of places to talk privately	2.79	1.07
The location of the central core workstations allows me to privately discuss patient issues	2.64	1.18

NOTE:
*Indicates question response was numerically reversed.

Another concern expressed during the staff focus groups was a lack of privacy in the chair-centric area. The patient, visitor, and staff questionnaire outcomes also identified this as a problematic area with regards to privacy. According to one paramedic, "There is nothing private about that space; confidentiality is thrown out the window there." The focus groups further confirmed the questionnaire outcomes in regard to a potential lack of privacy during the check-in process and recommended that privacy panels be installed between stations. Finally, many physicians, nurses, and technicians noted breaches of confidentiality related to their personal communication devices, which were used throughout all areas of the ED. Although most staff members support personal communication devices as a successful means of communication, some concern was noted about their conversations being overheard.

The information gathered in Phase 2 stimulated the researchers to re-examine their initial findings within a broader context. While many aspects of the linear core model appear to be effective in maintaining privacy and confidentiality from an observational standpoint, the feedback from the questionnaires, focus groups, and interviews revealed specific aspects of the design that were not working as effectively as intended. Thus, the synthesis of the Phase 1 and Phase 2 outcomes proved to be essential in developing a holistic understanding of the issue under examination and is critical for developing future design recommendations.

Conclusion

This extensive research process—consisting, of more than 200 hours of observation, a robust sample of 315 survey responses, and eight focus groups in addition to other types of data collection—makes three significant contributions to the literature. First, the multi-method approach was deemed critical to ensuring the success of conducting an effective diagnostic post-occupancy evaluation. A key advantage of this approach is that limitations of one methodology can be countered using the strengths of another. This approach also demonstrated how Phase 1 methods inform the development and implementation of methods used in Phase 2. Throughout the POE process, the order in which the selected methods are utilized is important, with each step informing the next. For example, observations in Phase 1 provided important contextual information for the team to build on and to develop research questions that were examined in Phase 2. Systematic observations develop a deeper understanding of the POE setting, reveal specific attributes needing further investigation, and suggest additional methods for capturing data.

Systematic observations develop a deeper understanding of the POE setting, reveal specific attributes needing further investigation, and suggest additional methods for capturing data.

The second contribution of this study is the findings from the examples of privacy and confidentiality, which further demonstrate the importance of a multi-method and multi-phased approach to conducting diagnostic post-occupancy evaluations. If the research had been concluded after Phase 1, the findings may have suggested that although minor concerns were expressed about privacy and confidentiality in the linear core design, there was no compelling evidence to indicate

Data collection must be systematically developed around a conceptual framework.

that this was an important design issue. Therefore, the study would have concluded that most confidential conversations were being contained within the linear core and attributes of the design contributed to a quiet environment. To verify these conclusions, the Phase 2 methodologies were developed to gain a deeper understanding of issues related to privacy and confidentiality. Findings from the questionnaires provided evidence that privacy and confidentiality were indeed areas of concern, particularly for the staff. The focus groups allowed the researchers to dig deeper and examine what design attributes might contribute to the concerns. Thus, the Phase 2 findings offer a different perspective of the linear core design model than the Phase 1 observations and validate the importance of a multi-phased, multi-methodological approach.

The third contribution of this study is that it provides an extensive framework for a diagnostic post-occupancy evaluation. As noted, the questions that a POE should address should be unique to the POE setting, the client's guiding principles, and the architectural firm's design objectives. Thus, in diagnostic POEs, one approach does not fit all designs. According to Zimring and Reizenstein (1980), "Systematic evaluations should consider organizational issues, should use multimethod techniques and should consider the design process that produced the setting" (p. 446). To successfully test these individual attributes, data collection must be systematically developed around a conceptual framework that utilizes multiple methods for gaining qualitative and quantitative feedback about the environment. Utilizing a structured approach presents opportunities to investigate a very specific aspect of the environment or to broadly examine a number of variables, creating a more holistic picture. These findings and the methods used should then be added to the evidence-based design literature. Outcomes from diagnostic POEs add to the knowledge base of the design profession and support important design decisions that can impact the building occupants' quality of life.

Implications for Practice

- This study presents a comprehensive framework for diagnostic post-occupancy evaluation in healthcare design.
- The findings indicate that a systematic, multi-methodological approach developed around a conceptual framework can lead to higher quality evaluations.
- The need for more healthcare design researchers and practitioners is increasingly important as the demand for healthcare environments continues to grow. Engaging students in the diagnostic POE research process within a healthcare setting familiarizes them with these important areas of expertise.

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The Influence of Ambient Scent and Music on Patients' Anxiety in a Waiting Room of a Plastic Surgeon

Anna Fenko, PhD, and Caroline Loock, MSc

ABSTRACT

OBJECTIVE: This study investigates the influence of ambient scent and music, and their combination, on patients' anxiety in a waiting room of a plastic surgeon.

BACKGROUND: Waiting for an appointment with a plastic surgeon can increase a patient's anxiety. It is important to make the waiting time before an appointment with the surgeon more pleasant and to reduce the patient's anxiety. Ambient environmental stimuli can influence people's mood, cognition, and behavior. This experimental study was performed to test whether ambient scent and music can help to reduce patients' anxiety.

METHODS: Two pre-studies (n = 21) were conducted to measure the subjective pleasantness and arousal of various scents and music styles. Scent and music that scored high on pleasantness and low on arousal were selected for the main study. The field experiment (n = 117) was conducted in the waiting room of a German plastic surgeon. The patients' levels of anxiety were measured in four conditions: (1) without scent and music, (2) with lavender scent; (3) with instrumental music; (4) with both scent and music.

RESULTS: When used separately, each of the environmental factors, music and scent, significantly reduced the level of patient's anxiety compared to the control condition. However, the combination of scent and music was not effective in reducing anxiety.

CONCLUSIONS: Our results suggest that ambient scent and music can help to reduce patients' anxiety, but they should be used with caution. Adding more ambient elements to environment could raise patients' level of arousal and thus increase their anxiety.

KEYWORDS: Healing environments, patient, patient-centered care, quality care, satisfaction

AUTHOR AFFILIATIONS: Anna Fenko is an assistant professor of Marketing Communications and Consumer Psychology on the Faculty of Behavioral Sciences at the University of Twente in Enschede, Overijssel, The Netherlands. Caroline Loock is a marketing manager at Stadt-Parfümerie Pieper in Herne, Germany.

CORRESPONDING AUTHOR: Anna Fenko, University of Twente, GW (Cubicus), P.O. Box 217, 7500AE Enschede, The Netherlands; a.fenko@utwente.nl; +31 53 489 2157.

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Introduction

The body of research addressing the effects of the physical environment on the healthcare experience and the well being of patients is steadily growing (Van Rompay & Tanja-Dijkstra, 2010). The waiting environment plays an important role in the healthcare experience of patients, because they often spend a long time waiting for the doctor, sometime more time than the actual appointment lasts. Becker, Sweeney, and Parsons (2008) stress the value of investing in the physical attractiveness of patient areas and indicate the need for further research to identify specific physical elements that contribute to positive attributions related to quality of care. The current study aims to investigate the possibilities of improving the patient experience in the waiting room of a plastic surgeon by using ambient environmental stimuli (scent and music).

A growing number of people are choosing to have plastic surgeries (Grover & Sanders, 1998). Each year plastic and reconstructive surgeons help patients with congenital malformations (such as cleft lip and cleft palate), disfiguring wounds, animal bites, burn injuries, as well as those requiring reconstruction after surgery for malignancy or other chronic conditions. Cosmetic plastic surgery includes procedures that reshape normal structures of the body in order to improve appearance and self-esteem.

Although patients of a cosmetic surgeon are usually able to live a physically healthy life, their concerns should not be underestimated. Aesthetic problems can cause serious psychological pain. Mental health problems might be more frequent in patients that are interested in cosmetic surgery than in the general population (Sarwer et al., 2004). Research into attitudes toward cosmetic surgery has demonstrated that greater bodily dissatisfaction (Henderson-King & Henderson-King, 2005; Sarwer et al., 2005), poorer self-assessed attractiveness (Frederick, Lever, & Peplau, 2007; Swami, Chamorro-Premuzic, Bridges, & Furnham, 2009), and appearance investment (Delinsky, 2005; Sarwer et al., 2005) are associated with more favorable views of cosmetic surgery.

People who are dissatisfied with certain parts of their body often tend to avoid social contact. They have difficulty finding a partner and may become lonely and depressed over time. For these people undergoing a plastic surgery might have a significant impact on their emotional distress (Deaton & Langman, 1986). Socially acceptable appearance can have a positive impact on interpersonal relationships, sense of self-worth, and overall adjustment (Bersheid & Gangestad, 1982; Harris, 1981; MacGregor, 1982). Subjective perceptions of attractiveness after the surgery have been related to feelings of confidence and improved objective outcomes such as job advancement (Edgerton, Langman, Schmidt, & Sheppe, 1982; Pertschuk & Whitaker, 1982). Other findings indicate significant improvements in body image, including more positive evaluations of patients' appearance and easier body exposure during sexual activities (Bolton, Pruzinsky, Cash, & Persing, 2003).

People often feel ashamed to talk openly about their body dissatisfaction and appearance insecurity. Furthermore, the subjective evaluation of attractiveness and bodily dissatisfaction differs greatly from one person to another. For patients

considering cosmetic surgery, it is often hard to discuss their aesthetic concerns with others. That is why people waiting for their appointment with the plastic surgeon may feel even more nervous than other patients awaiting surgery.

Healthcare Experience

This study focuses on three aspects of healthcare experience: (1) the perceived waiting time, (2) the evaluation of the waiting environment, and (3) the anxiety of patients while they are waiting.

The Perceived Waiting Time

The time spent waiting for a service is a pervasive and often unavoidable experience that appears to be a strong determinant of overall satisfaction with the service (Pruyn & Smidts, 1998). Waiting time has to be differentiated between objective waiting time and the perceived duration, that is, the subjective estimate of the waiting time (Hornik, 1984). It has been suggested that customers' reactions to waiting are more strongly affected by perceived than by objective waiting time (Hornik, 1984; Pruyn & Smidts, 1993).

The waiting time before a surgery might be perceived as even more traumatic than the surgery itself. Patients are usually asked to be at the hospital at least 1 or 2 hours before the surgery. It is during this time that anxiety usually rises because the surgical environment intensifies it (Haun, Mainous, & Looney, 2001). Waiting for an appointment with a plastic surgeon, presenting the body nakedly, and talking openly about personal feelings and desires can also make people feel very uncomfortable. For all these reasons it is important to make the waiting time before an appointment with the surgeon more pleasant. Patients who perceive the waiting time duration as acceptable might evaluate the healthcare environment and the overall healthcare experience more positively and might feel less anxious before meeting the surgeon. In a study that examined the relationship between the attractiveness of the physical environment of healthcare facilities and patient perceptions of quality, service, and waiting time, Becker and Douglass (2008) determined that the more attractive the environment, the higher the perceived quality of medical care and the greater reported reduction of anxiety.

Waiting Environment

The negative effects of waiting can be reduced by improving the attractiveness of the waiting environment (Pruyn & Smidts, 1998). Specific elements in the environment such as lighting, color, and spatial layout have been shown to influence time perception during waiting (Baker & Cameron, 1996). Pruyn and Smidts (1993) found that an attractive waiting environment positively influences satisfaction with the service.

A study on waiting areas of medical units (Arneill & Devlin, 2002) showed that patients perceive a better quality of care when settings are warm, well furnished, well lighted, decorated with artwork, and contain many magazines, health-related pamphlets, and other information. These findings support previ-

ous research that suggested that positive distractions in the physical environment can reduce stress and make positive changes across different physiological systems—for example, by reducing blood pressure (Ulrich, 1991). When patients are able to occupy themselves with stimuli (visual, tactile, auditory, etc.), their stress decreases because they are able to think of something other than the issue for which they are in the waiting room or hospital.

Anxiety

Much research has been done regarding pre-operative anxiety. According to Haun, Mainous, and Looney (2001), patients who are awaiting surgery are generally experience tension and anxiety. Pre-operative anxiety is accompanied by autonomic nervous system (ANS) arousal, which leads to an increase in blood pressure, heart rate, and respiratory rate (Haun, Mainous, & Looney, 2001). Anxiety can have negative effects on a person's cognitive abilities and cause mental and physical discomfort (Vaughn, Wichowski, & Bosworth, 2007).

Research has shown that patients do not want excessive medication to reduce their anxiety. They prefer to listen to music or read (Hyde, Bryden, & Asbury, 1998). According to Thorgaard, Ertmann, Hansen, Noerregaard, Hansen, and Spanggaard (2005), music occupies the patients' minds with something soothing and familiar. It allows patients to relax and escape into another world and focus their awareness on the music. Research has shown that music might reduce patients' anxiety (Korhan, Khorshid, & Uyar, 2010), affect their time perception (Spangenberg & Yalch, 2000) and their evaluation of the healthcare environment (Ferguson, Singh, & Cunningham-Snell, 1997). Specific scents might also have relaxing effects on people (Gueguen & Petr, 2006; Field et al., 2004; Lehrner, Eckersberger, Walla, Pötsch, & Deecke, 2000), improve mood and decrease arousal (Knasko, 1992; Lehrner et al., 2000), improve satisfaction (Morrison, Gan, Dubelaar, & Oppewal, 2011) and reduce anxiety (Lehrner et al., 2000).

Physical Environment Features

Research in environmental psychology has demonstrated that physical environment appears to be an important determinant of how people think, feel, and act (see Van Rompay & Tanja-Dijkstra, 2010, for a review). Environmental features can be classified into three groups: (1) ambient conditions such as temperature, air quality, noise, and music; (2) functional features, such as furnishing and equipment; and (3) signs, symbols, and artifacts, such as a style of décor and personal artifacts (Bitner, 1992). Harris, Ross, McBride, and Curtis (2002) distinguish four environmental categories: ambient features, architectural features, interior design features, and maintenance and housekeeping.

In this research we focus on ambient features. Bitner (1992) defines *ambient features* as background conditions of the environment such as temperature, lighting, noise, music, and scent. Even when these factors are imperceptible, they may still have strong effects on people. In the current study we manipulate two ambient features: music and scent. These two variables have received the most research attention in the retail context (Turley & Milliman, 2000), but have

been relatively understudied in healthcare research. In addition, both music and scent are relatively low cost and easily applicable in healthcare facilities.

Music as an Ambient Feature

Research focusing on music as an ambient feature in healthcare environments has long history. In 1906 the study of Foster and Gable indicated that listening to music affected the rapidity and shallowness of breathing, but the regularity of breathing was not affected. More recently, several studies have examined the effectiveness of music on stress and pain reduction in different healthcare settings. Lee, Chao, Yiin, Chiang, and Chao (2011) found that music is effective in reducing patients' anxiety before a surgery. Ikonomidou, Rehnstrom, and Naesh (2004) found that music can reduce patients' anxiety both before and after surgery. There is some evidence from a recent systematic review to suggest that music is effective in reducing dental anxiety (Moola, Pearson, & Hagger, 2011). There are distraction and relaxation components at work when patients listen to music (Good, Anderson, Ahn, Cong, & Stanton-Hicks, 2005).

Several studies have investigated the effects of music on patients' evaluation of a healthcare environment. In a cardiac laboratory study, Thorgaard et al. (2004) showed that patients undergoing coronary procedures evaluated the sound of medical equipment as more pleasant when accompanied by music than without music. A similar study among patients in need of mechanical ventilatory support demonstrated that music reduces blood pressure and other potentially harmful physiological responses arising from anxiety (Korhan, Khorshid, & Uyar, 2010). Ferguson, Singh, and Cunningham-Snell (1997) demonstrated that music may have either detrimental or beneficial effects on environmental appraisals depending on patient characteristics. A study explicitly focusing on relaxing music showed that calm and soothing music is the most appropriate in reducing anxiety (Wong, Lopez-Nahas, & Molassiotis, 2001). Bernardi, Porta, and Sleight (2006) measured cardiovascular and respiratory variables while patients listened to six types of music with differing rhythmic, harmonic, and melodic structures. They found that fast tempo music induced an arousal effect, while slow or meditative music induced a relaxing effect.

Scent as an Ambient Feature

A number of experimental studies have shown that specific scents have a positive impact on human emotions, cognition, and behavior. For example, Ehrlichman and Halpern (1988) found that women exposed to a pleasant scent produced a significantly greater percentage of happy memories than did women in an unpleasant or neutral scent condition. Knasko (1992) found that a pleasant scent positively affected mood and decreased arousal, while unpleasant scent negatively affected mood and increased arousal. Kirk-Smith and Booth (1987) reported that subjects exposed to a pleasant scent rated peoples' attractiveness on photographs higher than they did in a control condition. In a study by Bone and Ellen (1999), scent increased the time that people needed to finish a decision task.

Several studies have investigated the effects of different types of scent. According to Field et al. (2004), the scent of lavender improves mood and makes people feel more relaxed. Peppermint and cinnamon serve as stimulants and may enhance motivation, performance, and alertness (Raudenbush, Grayhem, Sears, & Wilson, 2009). The scent of vanilla has positive effects on shoppers' satisfaction (Morrison, Gan, Dubelaar, & Oppewal, 2011).

Scent as an environmental feature has been studied extensively in the context of consumer behavior. For instance, lavender scent was shown to have a relaxing effect on customers and increased their length of stay in a restaurant.

Research into the effects of scent in healthcare environments is very limited. One example is the study of Lehrner et al. (2000), which showed that women indicated less pre-treatment anxiety, improved mood, and increased calmness when orange scent was diffused in a waiting room of a dental practice.

Scent as an environmental feature has been studied extensively in the context of consumer behavior. For instance, lavender scent, as opposed to lemon scent, was shown to have a relaxing effect on customers and increased their length of stay in a restaurant (Gueguen & Petr, 2006). Hirsch (1995) conducted a study in which a slot machine area was scented during 1 week. The amount of money gambled in this area in this week was greater than the amount of money gambled in the same area before and after it was scented.

Combinations of Environmental Features

A number of studies in the area of consumer psychology have investigated the effects of different environmental features used in combination and identified interaction effects. For instance, a study of Spangenberg, Grohmann, and Sprott (2005) demonstrated the importance of congruency between the scent and music in shopping environment. The evaluation of a Christmas scent in a store was more positive in combination with Christmas music. The combination of a Christmas scent with non-Christmas music in the store led to more negative evaluations. Morrison et al. (2011) found a significant interaction effect of music and vanilla scent on young fashion shoppers' feelings of pleasure and time spent in a store environment. North, Hargreaves, and McKendrick (1999) showed that French music in a supermarket led to French wine outselling German wines, while German music had the opposite effect.

The study of Mattila and Wirtz (2001) investigated the effects of different types of scent and music tempo. They made a distinction between high and low arousal scents and high and low arousal music. The results showed significant main effects of scent and music on shoppers' evaluations and behavior and a significant interaction effect of scent and music on arousal. Customers responded more positively if the arousing qualities of the music and the type of scent were congruent. In another study, Morrin and Chebat (2005) found negative interaction effect of scent and music. They used citrus scent and low-tempo music in a mall and varied these over time. The results showed that the amounts of money spent were the lowest when both scent and music were present in the mall.

Although the majority of the studies on interactions between environmental stimuli have been conducted in the fields of retailing and services marketing, they might be also important for healthcare design (Van Rompay & Tanja-Dijkstra, 2010). The current study aims to contribute to the experimental data in this field.

This study aimed at investigating the effects of scent and music in the waiting room of a plastic surgeon. In particular, we were interested to discover whether specific scents, types of music, or their combinations could be used in a waiting room to reduce the perceived waiting time duration, improve the evaluation of the waiting environment, and reduce patients' anxiety.

The pre-studies were aimed at selecting stimuli (scent and music) for the main study that are perceived as both pleasant and relaxing. Based on the results of the pre-studies, the stimuli that had highest scores on both scales were used in the main study.

Pre-Study 1: Selecting Music

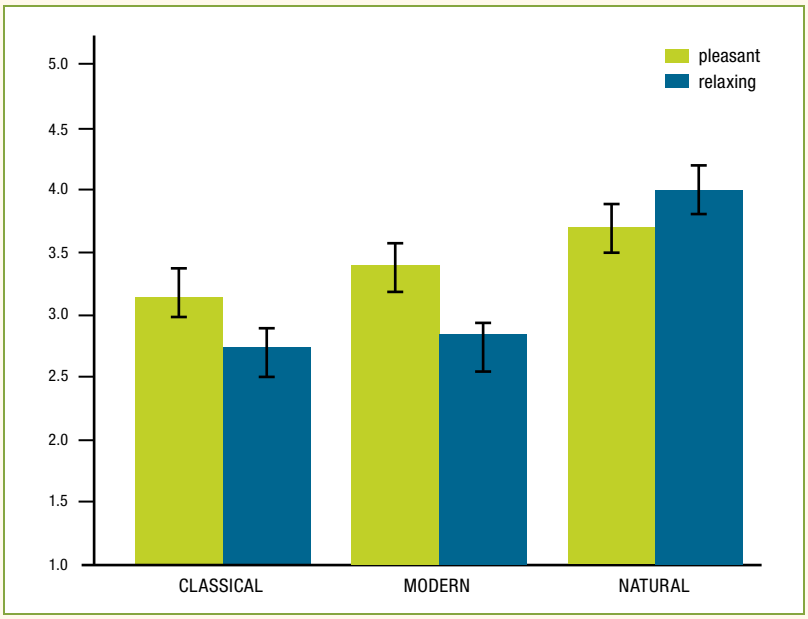
The aim of the first pre-study was to select the type of music that is perceived as both pleasant and relaxing, in order to use it as ambient feature in the main study.

Method

Three different types of music that might be perceived as relaxing and pleasant were included in Pre-Study 1: classical music, calm modern music, and instrumental music with nature sounds. Four different songs were selected for each music type from commercial collections of "calming music" and "music for relaxation." Classical music included Handel's "Water Music," Beethoven's "Für Elise," "A Little Night Music" by Mozart, and "Swan Lake" by Tchaikovsky. Calm modern music included "Set Fire to the Rain" by Adele, "Grenade" by Bruno Mars, "I Can't Help Myself" by Kelly Family, and "Still" by Jupiter Jones. The third music type included four different instrumental songs of unknown artists. The songs included sounds of wind, water, or animals.

Randomly selected participants (n = 21) took part in the Pre-Study 1, including 15 women aged between 20 and 63 years; mean age 31 years. The questionnaire was sent to participants by e-mail. Participants first had to indicate their gender and age. Then participants had to click on a link to listen to a song. For each song two questions were asked: "How pleasant do you find the song?" and "How relaxing do you find the song?" Participants answered on a 5-point Likert-scale from "not at all pleasant" to "very pleasant," and from "not at all relaxing" to "very relaxing." Participants were instructed to listen to a song for at least 50 seconds before evaluating it.

Figure 1. Mean pleasantness and relaxation ratings (with SE) of the three different types of music.



Results

Repeated measures ANOVA was performed to compare the effect of the three different music types on pleasantness. A significant main effect of music type on pleasantness was found ($F(2, 19) = 3.67$; $p < 0.05$). Post-hoc analyses with Bonferroni adjustment were performed to test the significance of the differences between means. Pairwise comparisons indicate a significant difference in pleasantness ($p < 0.05$) for classical music (M = 3.14) and instrumental music with nature sounds (M = 3.69). Comparisons between modern music (M = 3.38) and the two other music types were not significant ($p > 0.05$).

Another repeated measures ANOVA was performed to compare the effect of the three different music types on relaxation. A significant main effect of music type on relaxation was found ($F(2, 19) = 21.72$; $p < 0.001$). Pairwise comparisons indicate a significant difference in relaxation for instrumental music with nature sounds (M = 4.00) and classical music (M = 2.70), $p < 0.001$; for instrumental music with nature sounds (M = 4.00) and calm modern music (M = 2.77), $p < 0.001$. No significant difference was found in the scores of relaxation between classical music (M = 2.70) and calm modern music (M = 2.77).

Based on the results of this pre-study, instrumental music with nature sounds was selected as auditory stimulus for the main study.

Pre-Study 2: Selecting Scent

The aim of the second pre-study was to select the scent that is perceived as both pleasant and relaxing, in order to use it as ambient feature in the main study.

Method

Eight different scents were included in Pre-Study 2: vanilla, lavender, mint, lemon grass, rose, magnolia, orange, and mango. Some of these scents (e.g., vanilla and lavender) proved to have had relaxing effects in earlier studies. Other scents (e.g., mint) had had opposite effects, and some scents were included to represent different scent categories (e.g., flowery and fruity scents).

Randomly selected participants (n = 21) took part in the pre-study, including 15 women aged between 20 and 80 years; mean age was 41 years.

Participants were asked to smell scent oil from the bottle and to evaluate how pleasant and relaxing they found the smell on a 5-point Likert-scale from "not at all pleasant" to "very pleasant," and from "not at all relaxing" to "very relaxing." Before evaluating the next smell, participants were asked to smell their own skin to neutralize the previous smell. The sequence of the eight stimuli was randomized between participants to control for contrast effect. The names of the scents were provided to the participants after the experiment to make sure that the participants' answers were not based on previous experience.

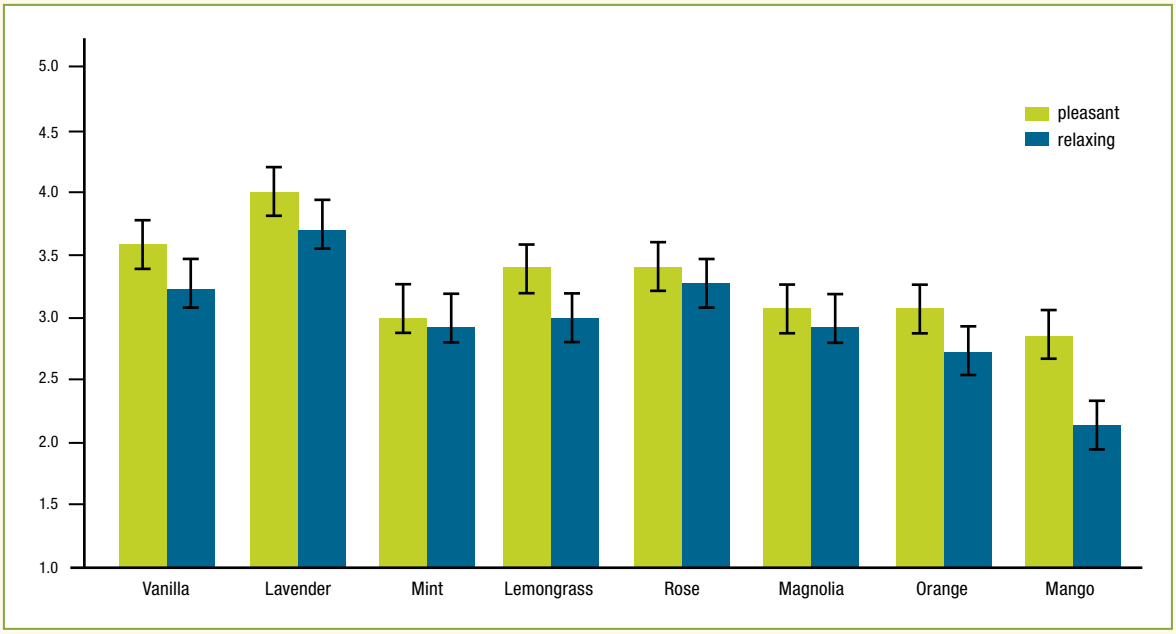
Results

A repeated measures ANOVA was conducted to compare the effect of the eight different scents on pleasantness. No statistically significant effect of type of scent on pleasantness was found (F (7, 14) = 2.47, ns). All scents were approximately the same in pleasantness.

Another repeated measures ANOVA was conducted to compare the effect of the eight different scents on relaxation. A significant effect of scent on relaxation was found (F (7, 14) = 3.90; $p < 0.05$). Post-hoc analyses with Bonferroni adjustment were performed to test the significance of the differences between means. Comparisons of the eight groups indicated a significant difference in the scores of relaxation between vanilla (M = 3.24, SD = 1.30) and mango (M = 2.10, SD = 1.18), $p < 0.05$. Also significant differences in relaxation were found between lavender (M = 3.71, SD = 1.10) and lemon (M = 3.00, SD = 1.00), $p < 0.05$; lavender and magnolia (M = 2.90, SD = 1.38), $p < 0.05$; lavender and orange (M = 2.62, SD = 1.16), $p < 0.05$; and lavender and mango (M = 2.10, SD = 1.18), $p < 0.001$. No significant differences were found between the other pairs (all ps > 0.05).

Figure 2 presents the mean scores of the eight different scent types referring to pleasantness and relaxation. Because lavender scores were significantly higher on relaxation than most of the other scents, it was selected as the olfactory stimulus for the main study.

Figure 2. Mean pleasantness and relaxation ratings of different scents (with SE).



Main Study

The aim of the main study was to investigate the effects of relaxing scent and music used separately and in combination on patients' level of anxiety, evaluation of the waiting environment, and perceived waiting time.

Method

Field experiment was conducted with 2 (scent present vs. absent) by 2 (music present vs. absent) between-subjects design with patients of a plastic surgeon in Germany.

Participants

The patients of plastic surgeon Dr. Abdul Yousef at the Elizabeth Hospital in Recklinghausen (Germany) took part in the experiment. The patients mainly suffered from functional problems with their hands (hand surgery) and aesthetic concerns (breast and face surgery).

Participation in the experiment was absolutely voluntary. All participants gave written permission to use their data, which were treated anonymously. Participants had an opportunity to ask questions and receive information about the purpose and results of the research.

In total 117 patients took part in the experiment; 28 in the No Scent–No Music condition, 28 in the Scent condition, 28 in the Scent–Music condition, and 33 in the Music condition. The sample consists of 28 men (23.9%) and 89 women (76.1%), with a mean age of 47.92 years. The ages ranged from 14 to 88 years. There were 82 first-time visitors (70.1%) and 35 repeat visitors (29.9%). Referring to the type of concern, 49 of the patients had an aesthetic concern (41.9%) and 68 a functional concern (58.1%). Table 1 shows the mean age, gender, familiarity with the environment, the type of concern, and the mean severity of concern among patients in the four experimental conditions. Statistical analyses were performed to test whether the experimental groups differ in any of these characteristics. *T*-tests were used to compare the mean age and the mean severity of concern between the four groups. Chi-square tests were used to compare the differences in gender, familiarity with the environment, and the type of concern. All tests revealed that the sample characteristics did not significantly differ between the four experimental conditions (all *p*s > 0.05).

Stimuli

The experiment included four experimental conditions. In the control condition, neither scent nor music was present in the waiting room. In the second condition lavender scent was present but no music was present in the waiting room. In the third condition lavender scent and instrumental music with nature sounds were both present in the waiting room. In the fourth condition instrumental music with nature sounds was present but no scent was present in the waiting room.

To establish the level of intensity for both stimuli, preliminary tests in the waiting room were performed. For the scent condition, three scent diffusers with lavender oil were initially placed in the center of the waiting room (Figure 3). Patients were asked to evaluate the intensity of the scent. Because a number of patients indicated that the scent was too intense, the experiment continued with two scent diffusers. In this condition there were no complaints about the intensity of the scent. Therefore, it was decided to use two scent diffusers for the experiment.

Table 1. Participant Characteristics per Experimental Conditions

		NO SCENT – NO MUSIC	SCENT + MUSIC	MUSIC	SCENT
N		28	28	33	28
Mean age		47.6	51.2	46.4	46.7
Gender (%)	Male	21.4	28.6	21.2	25.0
	Female	78.6	71.4	78.8	75.0
Type of patient (%)	First-time visitor	60.7	60.7	75.6	82.1
	Repeat visitor	39.3	39.3	24.2	17.8
Type of concern (%)	Aesthetical	39.3	42.8	48.5	35.7
	Functional	60.7	57.2	51.5	64.3
Mean severity of concern		3.39	3.68	3.64	3.69

Figure 3. Scent diffusers placed in the waiting room of plastic surgeon.

Figure 4. Auditory equipment placed in the waiting room of a plastic surgeon.

The loudness of music was also tested before the actual experiment. The instrumental music with nature sounds was played in the waiting room with a CD player (Figure 4). Patients were asked about the preferred loudness of music. Based on this feedback, a preferred level of loudness was used for the experiment. The CD collection used in the experiment provided three hours of instrumental music with nature sounds. Patients did not have to listen to the same songs several times while waiting, which might have been annoying.

Measurements

The level of anxiety, evaluation of the waiting environment, and perceived waiting time duration were measured with a questionnaire (in German). Demographic questions, the type of concern ("rather functional" or "rather aesthetical") and the severity of concern were also included in the questionnaire. The severity of concern was measured on a 5-point Likert scale from "not at all serious" to "very serious." Participants were also asked whether they were first time or repeat visitors. We suggested that the type and the severity of patients' concerns and their familiarity with the healthcare environment might affect the anxiety level of participants prior to the experiment.

To measure anxiety, eight statements were selected from *Clinical Anxiety Scale* (Snaith, Baugh, Clayden, Husain, & Sipple, 1982) and the German version of the *State-Trait Anxiety Inventory* (Laux, Glanzmann, Schaffner, & Spielberger, 1981). Furthermore, an existing German version of the *Hospital Anxiety and Depression Scale* (Ketterer, 2008), which was originally developed by Zigmond and Snaith (1983), was also used. Participants indicated on a 5-point Likert scale whether they agreed to statements such as "I am nervous" or "I am calm." The reliability of the scale was appropriate (Chronbach's $\alpha = 0.80$).

The type and the severity of patients' concerns and their familiarity with the healthcare environment might affect the anxiety level of participants prior to the experiment.

For the evaluation of the waiting environment the four-item *Physical Environment Quality Scale* was used (Voorhees, Baker, Bourdeau, Brocato, & Cronin, 2009). Patients had to indicate on a 5-point Likert scale to what extent they found the waiting room "pleasant," "attractive," "clean," and "comfortable." The reliability of the scale was high (Chronbach's $\alpha = 0.94$).

The perceived waiting time was measured with three items (short or long, unacceptable or acceptable, and reasonable or unreasonable) assessed on a 5-point Likert scale (Voorhees et al., 2009). The reliability of the scale was appropriate (Chronbach's $\alpha = 0.82$).

Patients also were asked to indicate the number of minutes that they approximately had waited (objective waiting time).

When scent and/or music were present in the waiting room, participants were also asked if they perceived scent and/or music. If they answered "yes," they were

further asked to assess how pleasant and relaxing they perceived the scent and/or music on a 5-point Likert scale.

Participants were also asked to give their written permission to use their data anonymously. Finally, the researcher thanked the patients for participation and provided a telephone number and e-mail address for questions and comments.

Procedure

When a patient registered at the front desk, he or she was asked by the receptionist to fill in a questionnaire about patient satisfaction while waiting for the appointment with the doctor. Patients that were willing to fill in the questionnaire received it together with a pen and verbal instructions. Patients were instructed to fill in the first part of the questionnaire (the demographic questions, evaluation of anxiety, and waiting environment) while they were sitting in the waiting room before their appointment. The questions about the objective and perceived waiting time and manipulation check questions about perceived scent and music were answered after the appointment when patients were checking out at the front desk.

The data collection took place during consultation hours (3 days a week). After at least 25 questionnaires had been gathered for one experimental condition, the new condition started on the next day. The whole experiment took about 7 weeks in spring and summer 2012.

Data Analysis

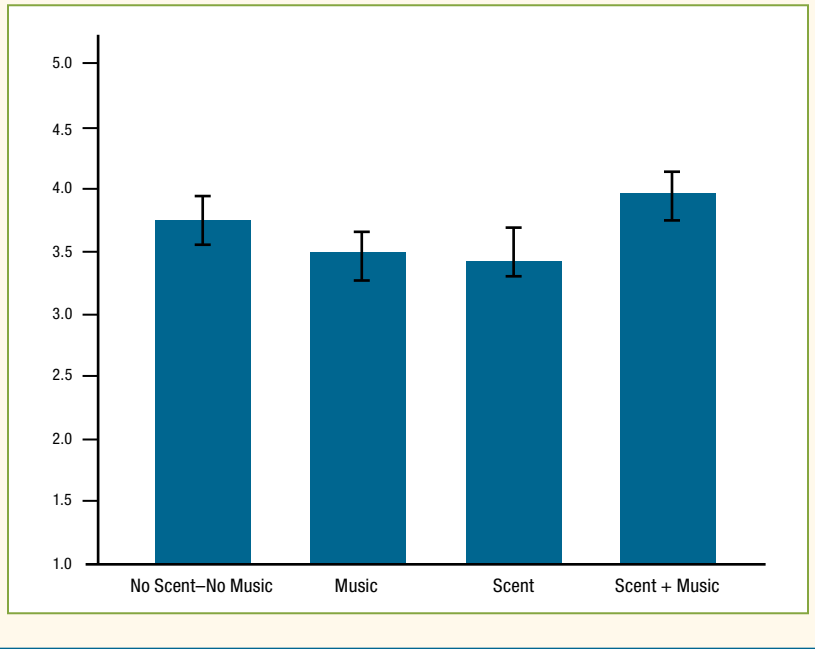
Two-way ANOVAs with Scent and Music as independent factors and Anxiety, Evaluation of Healthcare Environment, and Perceived Waiting Time as dependent variables were performed. Individual characteristics of respondents (age, gender, familiarity with environment, type of concern, and severity of concern) were considered as possible moderators. Post-hoc analyses with Bonferroni adjustment were performed to test the significance of the differences between the means.

Results

The majority of patients noticed the experimental manipulations. In the scent condition, 71.4% of the patients indicated that they noticed the scent while waiting. In the music condition, 68.9% of patients noticed the music in the waiting room. We can conclude that the intensity levels of scent and music were not too penetrative, but were high enough to be consciously perceived by the majority of the patients.

The patients who had noticed scent and/or music were asked to rate how pleasant and relaxing the scent and music were on a 5-point Likert scale (from 1 = "totally not pleasant/relaxing" to 5 = "totally pleasant/relaxing"). Lavender scent was perceived as "rather pleasant" (M = 3.83, SD = 1.20) and "relaxing" (M = 3.78; SD = 1.26). The instrumental music with nature sound was also perceived

Figure 5. Mean anxiety rates (with SE) in four experimental conditions.



as "rather pleasant" (M = 3.57, SD = 1.23) and "relaxing" (M = 3.55, SD = 1.33). These results were in line with the results of the pre-studies and showed that both music and scent were perceived as intended.

Effects of Scent and Music on Anxiety

Two-way ANOVA was conducted with Music and Scent as the main factors and Anxiety as the dependent variable. Results showed no significant main effect of either scent ($F(1, 117) = 0.07$; $p > 0.05$) or music on the level of anxiety ($F(1, 117) = 0.14$; $p > 0.05$). However, the interaction effect of scent and music was significant ($F(1, 117) = 6.62$; $p < 0.05$).

Pairwise comparisons with Bonferroni adjustment showed that in the condition without scent, anxiety was significantly lower when there was music present (M = 3.43, SE = 0.14) than when there was no music (M = 3.95, SE = 0.16; $p < 0.05$). In the scent condition, the presence of music did not significantly change the anxiety level (M = 3.77, SE = 0.16; $p > 0.05$). In the condition without music, the presence of scent significantly reduced the level of anxiety (M = 3.51, SE = 0.16) compared to the condition without scent (M = 3.95, SE = 0.16; $p < 0.05$). In the presence of music, the scent did not significantly change the level of anxiety ($p > 0.05$) (see Figure 5).

We also tested whether patients' familiarity with the environment, the type of concern (functional or aesthetic), the severity of concern and demographic variables (age and gender) had any effects on anxiety. The severity of concern was found to have a significant main effect on anxiety ($F(1, 117) = 13.10$; $p < 0.001$).

Patients with the more severe concern experienced higher levels of anxiety (β = 0.67, $t(115) = 10.4$; $p < 0.0001$). Therefore, the severity of patients' concern could serve as an indicator of patients' stress level prior to the experiment. However, there was no interaction effect between the severity of concern and both environmental factors (scent and music). Therefore, the severity of concern did not moderate the effects of scent and music on anxiety. Familiarity with the environment, the type of concern, and demographic characteristics (age and gender) did not have effects on the level of patient's anxiety (all ps > 0.05).

Effects of Scent and Music on Evaluation of Waiting Environment

Two-way ANOVA was conducted with Scent and Music as independent factors and Evaluation of the Waiting Environment as the dependent variable. Results showed no significant main effect of scent (F (1, 117) = 0.01; $p > 0.05$) or music on evaluation of waiting environment (F (1, 117) = 0.11; $p > 0.05$). The interaction effect of scent and music on evaluation of waiting environment was also not significant (F (1, 117) = 1.55; $p > 0.05$).

We also checked whether age, gender, familiarity with the environment, objective waiting time duration, the type of concern, or the severity of concern had any effects on the evaluation of waiting environment. No significant effects of the individual differences were found (all ps > 0.05).

Effects of Scent and Music on Perceived Waiting Time

Two-way ANOVA was conducted with Scent and Music as independent factors and the Perceived Waiting Time duration as the dependent variable. Objective waiting time duration was used as the covariate. The results showed no significant main effect of scent (F (1, 117) = 1.05; $p > 0.05$) and music on perceived waiting time duration (F (1, 117) = 0.03; $p > 0.05$). No significant interaction effect of scent and music on perceived waiting time duration was found (F (1, 117)= 0.06; $p > 0.05$). Objective waiting time duration was found to have a significant effect on the perceived waiting time (F(1, 117) = 54.24; $p < 0.001$). Patients had to wait for the appointment from 5 minutes to 3 hours; the mean waiting time was 50 minutes. Participants who waited up to 30 minutes were more likely to evaluate their waiting time as "short" compared to the rest of the patients ($p < 0.01$). Participants who waited up to 60 minutes more often evaluated their waiting time as "appropriate" compared to those who waited longer than 60 minutes ($p < 0.05$). Participants who waited more than 1 hour were more likely to evaluate their waiting time as "long" and "unreasonable" compared to patients who waited less than 60 minutes ($p < 0.01$).

We also tested weather age, gender, the familiarity with the environment, the type of concern, and the severity of concern had any effects on the perceived waiting time duration. No significant main or interaction effects of any of these variables on perceived waiting time duration were found (all ps > 0.05).

Discussion

The aim of this research was to find out whether scent and music could be used to reduce patients' anxiety in the waiting room of a plastic surgeon. We found that both of the environmental features, music and scent, could significantly reduce anxiety, but only when used separately. The combination of scent and music in the waiting room did not have any positive effect compared to the absence of these ambient features.

One of the possible explanations of these results can be found in Berlyne's (1960) optimum arousal theory. Berlyne suggested that the relationships between the level of arousal and an individual's affective state could be represented as a bell-curved function. Individuals usually prefer medium levels of arousal. If stimuli cause a too high or too low level of arousal, it results in a negative affect. In the current experiment, the initial level participants' arousal (anxiety) was rather high due to the upcoming appointment with the plastic surgeon. Therefore, stimuli with a low arousal potential were needed to reduce the level of arousal (anxiety). The results of our study suggest that lavender scent and instrumental music with nature sounds both had an appropriate arousal potential to reduce patients' level of anxiety. However, when scent and music were combined, the level of patient's arousal increased. This might be the reason why the combination of two stimuli (scent and music) did not reduce the patients' level of anxiety.

Very low arousal can be pleasant (relaxation) or unpleasant (boredom), while very high arousal can be pleasant (excitement) or unpleasant (anxiety).

An alternative explanation of our results can be found in Apter's (1982) reversal theory. This theory suggests that two different mechanisms account for the affective reactions to arousing and relaxing stimuli. Very low arousal can be pleasant (relaxation) or unpleasant (boredom), while very high arousal can be pleasant (excitement) or unpleasant (anxiety). These two opposite ways of interpreting arousal can be reversed depending on a specific situation (serious or playful) or individual goals. "At one moment a person may crave excitement and at another avoid exactly those arousing situations which he was so keen to experience a short time before" (Apter, 1984, p. 274). In several studies, Walters, Apter, and Svebak (1982) showed that in different situations the same participants preferred either arousing "warm" colors (red and yellow) or relaxing "cool" colors (blue and indigo), while the neutral color (green) was chosen extremely rarely. In our study, the participants were clearly in a situation where they interpreted arousal as anxiety rather than as excitement. This may explain why the increase in the amount of external stimulation in the combined scent and music condition was perceived more negatively than the conditions with either olfactory or auditory stimulation.

Reversal theory may also explain why the results of this study seem to contradict previous findings of positive influence of congruent scent and music in retail environment (e.g., Mattila & Wirtz, 2001; Spangenberg, Grohmann, & Sprott, 2005). In a shopping situation people may feel more relaxed and playful, and they might experience increased arousal positively, as increased excitement. Hence, the effects of the chosen music and scent might be different in other situations. When people are bored and crave excitement, the chosen stimuli might not have any positive effects separately, but be successful in combination. When

people are positively aroused (excited), the effects of pleasant and relaxing scent and/or music and their combination might also be different.

Limitations of the Current Study and Suggestions for Future Research

In our Pre-Study 1, participants listened to the music for approximately 1 minute, while in the main study patients often had to listen to the music for a longer period. Although the music was evaluated positively both times, a small number of participants in the main study indicated that the music was annoying. Some studies suggest that music might become annoying when listening to it for a long period (Witvliet & Vrana, 2007).

The effects of music might also change over time due to sensory habituation (Brentar, Neuendorf, & Armstrong, 1994). Some studies have found that exposure increases the enjoyment of music (e.g., Bradley, 1971; Brickman & D'Amato, 1975), while others have found that affective responses to music follow an inverted-U pattern, with increased exposures to music (e.g., Brentar, Neuendorf, & Armstrong, 1994; Hargreaves, 1984; Heyduk, 1975). Bernardi, Porta, and Sleight (2006) found no habituation effect, while Witvliet and Vrana (2007) found a polarization effect of exposure on music liking: with exposure, negative music was liked even less, whereas positive music was liked even more. Because different studies of habituation effects of music have yielded contradictory results, more research is clearly needed into the dynamic effects of exposure to music.

Another interesting question that needs further exploration is whether the effects of music and scent on anxiety found in our study occur automatically or require patients' attention. Literature suggests that ambient environmental features might affect people's affective and cognitive reactions without their full awareness (Krishna, 2012; Herz, 2010). In our study, the level of olfactory and auditory stimulation was calibrated in such a way that the presence of scent and music would not be too obtrusive. The post-exposure questions showed that about 30% of participants did not notice music and scent in the waiting room. Our results demonstrate a significant anxiety reduction in the music only and scent only conditions compared to the control condition. However, our study does not provide enough data to conclude whether conscious awareness or attention moderated the effects of ambient stimuli. The question of whether these effects require awareness or attention needs further research.

Many of the participants in our study were 70 years and older. Because sensory perception decreases as we age, these patients might have perceived the scent and music differently than younger patients. The perception of the stimuli in our study was also influenced by the fact that the door and the windows of the waiting room were always open. When used in closed spaces, scent and music might be perceived differently. Future research needs to take this into account while investigating psychological effects of the environmental stimuli.

In future studies, it also would be interesting to investigate the effects of scent, music, and other ambient features (such as lighting and temperature) in differ-

ent healthcare or other waiting environments (a waiting room of a dentist or a pediatrician, a hotel lobby, an airport terminal, etc.). By manipulating the initial level of a patient's anxiety or boredom, it might be possible to find an optimal level of sensory stimulation that can ensure the desired effects of relaxation or excitement for specific groups of customers.

Implications for Practice

- This study demonstrates that scent and music can be used in healthcare environments for reducing anxiety of the patients.
- A relaxing scent (such as lavender) and relaxing music (such as instrumental music with nature sounds) can be used separately in a doctor's waiting room in order to reduce patients' level of anxiety.
- Ambient stimuli like relaxing scent and music might be effective in other healthcare environments where patients wait for their appointment and are likely to experience anxiety (such as a dentist's waiting room). They could also be used to reduce people's anxiety in other waiting situations, such as airports or examination facilities.
- Our study also demonstrates that using relaxing scent or music in combination may be less efficient in reducing people's level of anxiety than using these ambient features separately. The combination of two or more ambient features should be considered with caution, especially in situations where the initial level of arousal is high. It might be more effective to use two or more ambient environmental features in situations where people feel bored (but not physically threatened), such as waiting for a train or in a bank.

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A Hospital's Contemporary Art Collection: Effects on Patient Mood, Stress, Comfort, and Expectations

Meghana Karnik, BA; Bellamy Printz, MFA; and Jennifer Finkel, PhD

ABSTRACT

OBJECTIVE: It is not firmly established whether an art collection of diverse subject matter, media, and imagery in the hospital environment can play a significant role in mitigating the psychological stresses and physical pain associated with a hospital visit, or whether it improves patients' satisfaction with their care. The variety of contemporary art displayed in the institution investigated in this paper served as a case study to assess the qualitative and quantitative effects of such a collection on patient health and experience. We sought to assess whether the diversity in subject matter, imagery, and media would positively affect patient mood, comfort level, stress level, and expectation of visit.

BACKGROUND: Previous research concluded that nature art (i.e., representational depictions of nature) has positive effects on patient health outcomes. Studies to date have assessed the effects of individual units of artwork rather than that of an art collection as a whole.

METHODS: A survey was sent to 4,376 members of an online Patient Panel, comprised of patients who volunteer to evaluate their experiences at Cleveland Clinic. For this study, Panel members were screened based on whether they had been to the Main Campus in the past 12 months.

RESULTS: A majority of respondents noticed the artwork, had improved moods and stress levels due to the artwork, and reported that the art collection positively impacted their overall satisfaction and impression of the hospital.

CONCLUSIONS: Our findings demonstrate that this particular collection has a significant effect on the patient experience and on self-reported mood, stress, comfort, and expectations. These results suggest that patients may respond positively to the diversity of the collection, and to other types of art in addition to nature art.

KEYWORDS: Art, healing environments, hospital, patient-centered care, satisfaction, case study

AUTHOR AFFILIATIONS: Meghana Karnik is an MA student at Columbia University. Bellamy Printz is a Curator at Cleveland Clinic Art Program, Arts & Medicine Institute. Jennifer Finkel is a Curator at Cleveland Clinic Art Program, Arts & Medicine Institute.

CORRESPONDING AUTHOR: Jennifer Finkel, PhD, finkelj@ccf.org; (216) 448-0233.

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The hospital environment is an essential component of a patient-centered practice. Art in particular plays a significant role in the healthcare setting because it can mitigate the psychological stresses and physical pain associated with a hospital visit or stay, improve patients' satisfaction with their care, provide an opportunity for intellectual engagement, and reduce hospital length of stay (LOS). This study took place at a tertiary care academic medical center with an in-house art program that acquires and installs art throughout the health system, which had over 5 million patient visits in 2012. The program's mission is to enrich, inspire, and enliven the experience of patients, visitors, employees, and community, and to embody the core values of the institution: collaboration, quality, integrity, compassion, and commitment.

This institution's fine art collection is composed of non-representational, abstract, and representational imagery, including nature imagery; an assortment of artistic media; and covers a variety of subject matter. For the purposes of this article a "collection" is defined as multiple units of artwork. The collection comprises more than 5,300 works by artists of all career stages from local, national, and international communities; and includes paintings, prints, works on paper, photography, sculpture, and videos. "Nature art" in this institution's collection is defined as imagery referencing the outside world, depicting nature, and produced through various media. "Abstract art" is defined as non-representational or stylized, in various media.

The fine art is installed in public spaces and public corridors. In addition to fine art, this hospital installs art posters in exam and patient rooms and in clinical corridors. The posters are of a wide variety of subject matter from nature and landscape to abstract imagery, which mirrors the diversified fine art. The majority of the posters in exam and patient rooms feature nature or abstracted landscape imagery. Key curatorial themes of the collection are the human condition, global connections and diversity, popular culture, innovation, and collaboration. These themes are evidenced by the inclusion of portraiture, still life, landscape, conceptual, and text-based work. The art program identifies contemporary art in particular as encouraging a dialogue on topical interests, fostering an environment of creative excellence, and inspiring viewers to experience different points of view. Contemporary art for this paper is defined as artwork that has been produced within the last 30 years and therefore encompasses a broad variety of styles, genres, and media. The collection includes works by artists such as Vik Muniz, Jennifer Steinkamp, Los Carpinteros, Jonathan Borofsky, Willie Cole, and David Levinthal. There are site-specific installations by Iñigo Manglano-Ovalle, Alyson Shotz, Catherine Opie, Jaume Plensa, Sarah Morris, and others. Contemporary art also complements the institution's hospital environment, which is both modern and minimalist. Against this backdrop, the art collection accompanies patients from every entrance to examination room to patient room to discharge (Figure 1).

The goal is to exhibit a set of diverse artworks that create a cohesive visual impression and narrative—a "patient-centered curatorial practice."

The art program's curators recognize that art in the medical setting can assist in the healing process and well being of patients and visitors. The curators attempt

Figure 1. Admitting and Registration, Main Campus.

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to identify variables that would affect a viewer's perception of an artwork, such as health conditions, length of stay, demographics, purpose of visit, etc., and each artwork is considered on an individual and collective basis for each particular situation. Curators regularly meet with caregivers, administrators, architects, and construction management to assess the needs of specific patient populations. The goal is to promote a restorative patient experience by exhibiting a set of diverse artworks that create a cohesive visual impression and narrative within the environment—a "patient-centered curatorial practice."

Background and Context

Past research has established the positive effects of one specific type of art—nature art, that is, representational depictions of nature (Ulrich et al., 2008). Some studies measured patient preferences of artwork while others were clinical that measured the impact of certain genres of artwork on patient health outcomes (Ulrich et al., 2008). For example, a preference study of hospital patients and design students concluded that nature art is appropriate for hospital settings because patients consistently preferred nature and realistic content over abstract or stylized content for their rooms (Nanda, Eisen, & Baladandayuthapani, 2008).

In a study done by Ulrich, Lundén, and Eltinge (1993), patients were randomly assigned to rooms that provided exposure to either an image of nature, an abstract image, or no image. Patients exposed to the nature image experienced

less postoperative anxiety and were more likely to switch from strong analgesics to weaker painkillers during their recovery than either of the other groups. Patients exposed to an abstract image experienced more anxiety than those with no image (Ulrich, Lundén, & Eltinge, 1993). The abstract images used in the study were computer-generated, created for the study to represent "abstract art." Some researchers question whether the results would be different if the abstract images had been developed by an artist's hand instead (Nanda, Eisen, & Baladandayuthapani, 2008).

Current research has not analyzed the impact of a variety of genres within one study, or that of a diverse collection of visual artwork on patient well being. This study was initiated to address this gap in research by asking patients to participate in a post-visit, self-reported patient experience survey. The diverse collection of contemporary art at the institution in this study presented an opportunity to collect data on patient experience rather than patient preferences. This is not a clinical study.

Materials and Method

This study was exempted from IRB approval. The institution is a tertiary care academic medical center located in the Midwestern United States. The institution's Market Research and Analytics team implements primary research for various departments, including administrative, clinical, operational, and patient experience. For this study, this department developed a survey with the art program in order to capture and analyze responses to the art collection. The survey was then emailed to all members of the Patient Panel, comprising patients who volunteer to evaluate their experiences at the institution to gain insight on patient experience, awareness, and satisfaction. Patients are recruited for the Patient Panel through a variety of methods, including community meetings, direct mail, and emails. To comply with HIPAA regulations, patients who are interested in joining must double opt in by answering two series of questions that

Table 1. Demographics of Respondents

DEMOGRAPHIC		SAMPLE
Gender	Male	36.3%
	Female	63.7%
Age	18–24	0.05%
	25–34	3.4%
	35–44	8.4%
	45–54	20.7%
	55–64	36.3%
	65+	30.7%
Race	Caucasian	93.9%
	African American	2.8%
	Other	3.3%

help categorize them according to age, gender, race, and ethnicity (see Table 1). Panel members also have the option to list any health issues.

At the time of the current study (April 2012), there were 4,376 active panelists consisting of patients who had received care at the institution within the previous 2 years. No more than 10% of the panel consisted of current employees. A soft launch was deployed to 350 Patient Panel members before sending the survey to the entire Patient Panel population. The soft launch ensures that all questions were programmed correctly and no panel members had any confusion answering the questions. An email was sent to all 4,376 members of the panel inviting them to take the survey. The survey was open for one full week (April 9–16, 2012). The email also stated that those who completed the survey would be entered into a lottery to win one of four $50 checks. We employed a screening criterion where respondents had to have been to the institution's Main Campus within the previous 12 months. Respondents were disqualified if they indicated that this had not been the case and were screened out. The Main Campus comprises both inpatient and outpatient buildings, including specialty centers.

Survey Design & Data Analysis

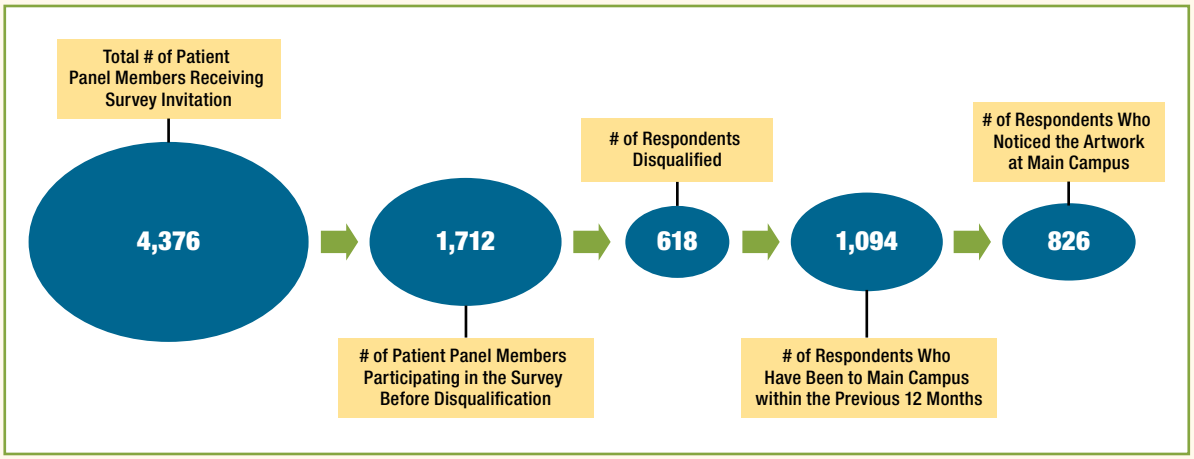
All panelists were first asked to answer a set of questions about the environment of Main Campus and then asked to report whether they had noticed the artwork. Only those who answered "yes" were asked to proceed with the rest of the survey. The survey included qualitative, quantitative, and open-ended questions. For the quantitative questions, the panelists were asked to score a number of descriptors using a 5-point Likert scale. All the questions on mood, comfort/pain, and stress were scored on an anchored scale ("significantly worsened," "somewhat worsened," "no effect," "somewhat improved," "significantly improved," N/A). The anchored scale was used to have a negative side and positive side with "no effect" in the center. The descriptors were not accompanied by definitions but respondents had the option of reporting "not sure." The results in this article are reported as percentages based on top box scores (4 or 5 on the Likert scale). Demographic and previous medical history was not collected from the survey, rather the data was collected when the participant joined the Patient Panel. The survey did include questions relating to length of stay (1 day, 2 to 3 days, more than 3 days), type of appointment (outpatient, outpatient procedure/surgery, inpatient), and type of visitor (employee, patient, family member).

Using SPSS version 19, cross-tabulation and frequencies were used to examine the percentage of patients' responses for each question. Statistically significant differences (p value < 0.05) between subgroups were calculated using the Chi-Square Test of Independence. Under identical survey conditions, 95% of the time, the results of this survey should fall within a +/–2.96% margin.

Results

Figure 2 illustrates how participants qualified for the study. Among these 1,094 respondents who noticed the art on Main Campus, 81% of those in the 35–44

Figure 2. Flow chart of survey sample.



year age group were most likely to notice the artwork, versus 78% in the 25–34 and 45–54 age groups; 74% in the 55–64 group; and 73% in the 65 and up group. Of the female respondents, 76% reported that they noticed the artwork, versus 74% of the male respondents.

The longer the respondents were on Main Campus, the more likely they were to notice the artwork. Of patients or visitors who were there for only 1 day, 74% noticed the artwork. For respondents who were in the hospital for 2 to 3 days, 78% noticed the artwork. Of the respondents who were in the hospital for 3 or more days, 95% noticed the artwork ($p < 0.05$).

Atmosphere

Respondents were asked to evaluate the overall environment and atmosphere using five descriptors: *Healing, Inspiring, Stark/Bare, Inviting/Welcoming,* and *Calming* (see Figure 3). These descriptors are the top five commonly used terms in previous patient testimonials to describe the overall environment. Of patients who visited for a single day, 50% of respondents who noticed the art felt that the environment was *Inspiring*, compared to the 31% who did not notice the artwork. If the patient stayed for 2 days or more, 60% of those who noticed the art described the environment as *Inspiring.* Of the patients who visited for a single day, 71% of those who noticed the art described the environment as *Inviting/Welcoming*, versus 60% of those who did not notice the artwork. If the patient stayed for 2 days or more, 77% of those who noticed the art described the environment as *Inviting/Welcoming.* Patients who visited for a single day found the hospital setting *Calming* (57% who noticed versus 42% who did not notice the art). If the patient stayed for 2 days or more, 73% of those who noticed the art described the environment as *Calming.* The surroundings of the hospital were also described as *Healing* by patients who visited for a single day (53% who noticed versus 42% who did not notice the art). If the patient stayed for 2 days

Figure 3. A majority of patients and visitors found the atmosphere to be *Inviting* and *Calming* increased with length of stay.

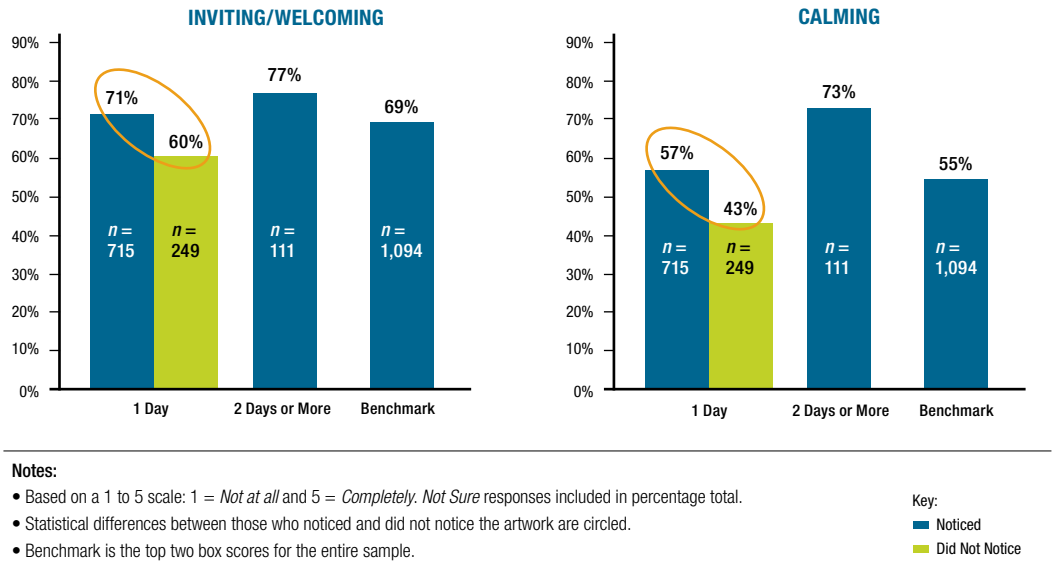
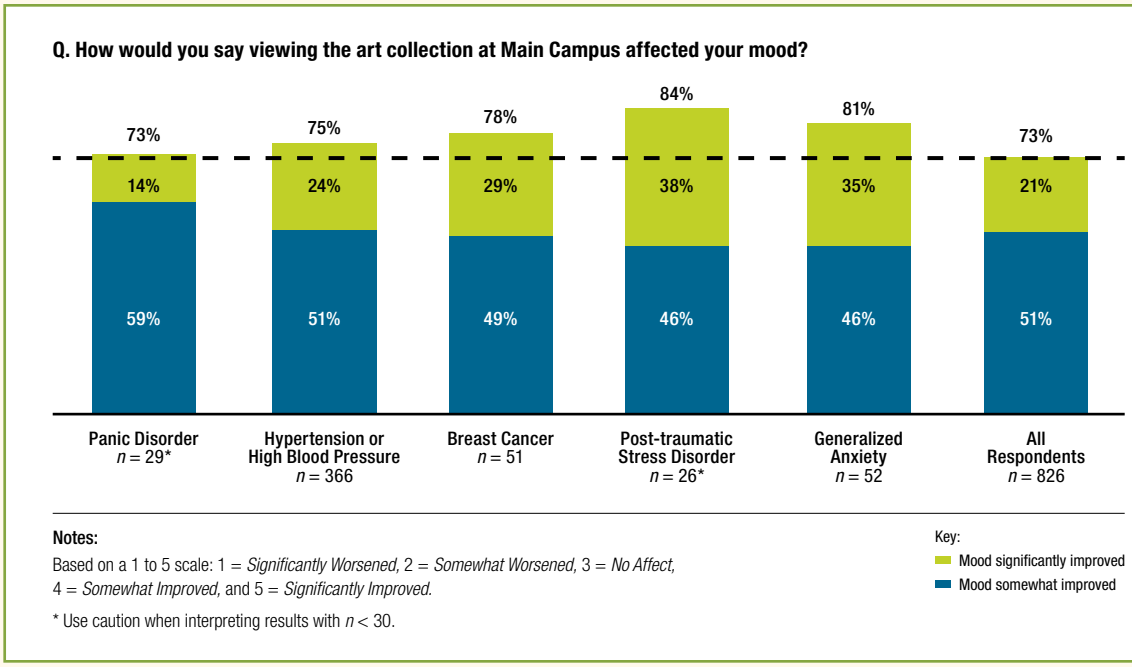


Figure 4. Mood improved as a result of viewing the art for an average of 72% of all respondents.



or more, 67% of those who noticed described the environment as *Healing.* Of patients who visited for a single day, 21% of those who noticed the art described the environment as *Stark/Bare,* as opposed to 20% who did not notice the art.

Mood

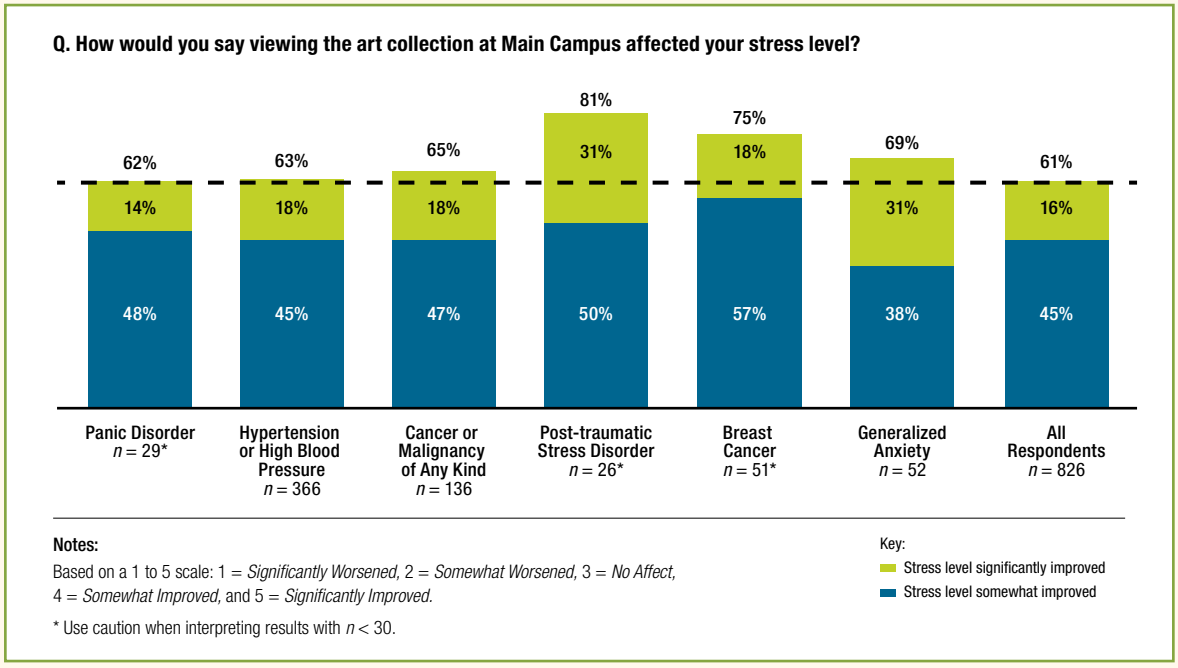
Of the 826 respondents who noticed the artwork, 73% said that their mood somewhat or significantly improved. Patients who reported having hypertension, breast cancer, panic disorder, post-traumatic stress disorder (PTSD), or generalized anxiety, in particular, indicated that their mood somewhat or significantly improved, ranging from 73% (panic disorder) to 84% (PTSD) (Figure 4). Of the 56 respondents who were at Main Campus for 2 to 3 days, 91% reported that the artwork improved their mood versus 71% of the 715 single-day visitors.

Of the 826 respondents who noticed the artwork, 73% said that their mood somewhat or significantly improved.

Stress Level

Of the 826 respondents, 61% said that the artwork somewhat or significantly reduced their stress levels. Of patients with cancer or a malignancy of any kind, 65% reported an improvement in their stress levels; 75% of breast cancer patients experienced improvement in their stress levels. Additionally, 69% of patients with generalized anxiety and 81% of patients with PTSD saw an improvement in stress level. Among patients with PTSD and generalized anxiety who noted an improvement in their stress level, 31% noted a significant improvement rather

Figure 5. Stress levels improved as a result of viewing the art for an average of 61% of all respondents.



than describing it as "somewhat improved" (Figure 5). Of the 56 patients who were at Main Campus for 2 to 3 days, 72% said the artwork somewhat or significantly improved their stress levels in general, compared with 60% of the 715 single-day visitors. Of those respondents who spent 2 to 3 days at the hospital, 27% reported that their stress level significantly improved.

Comfort or Pain Level

Of the 826 respondents, 39% said that the artwork somewhat or significantly improved their comfort or pain level. Fifty-four percent of patients with PTSD and 49% of patients with generalized anxiety noted that their comfort/pain level improved. Forty-seven percent of patients with osteoarthritis and 43% of cancer patients responded with an improved pain/comfort level (Figure 6).

Descriptors of Environment

Of the 826 respondents, 65% reported that the artwork reflected *Innovation,* 64% said it reflected *21st century* or *Cultural Diversity,* 59% said it reflected *A Healing Environment,* and 18% said that it reflected a *Traditional Hospital Environment* (Figure 7).

Descriptors of Artwork

Respondents were asked to rate a list of 24 descriptors of the artwork on a scale of 1–5 (see Figures 8a and 8b). Of the 826 respondents, 73% described the art

Figure 6. Comfort or pain significantly improved as a result of viewing the art for an average of 39% of all respondents.

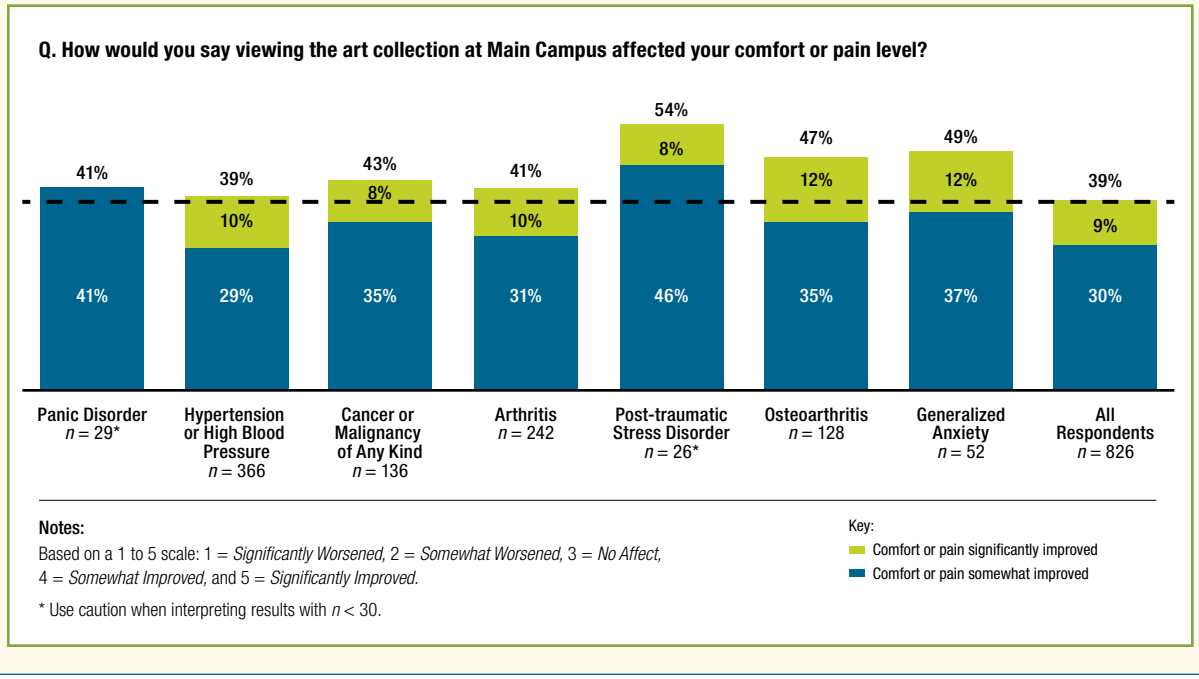
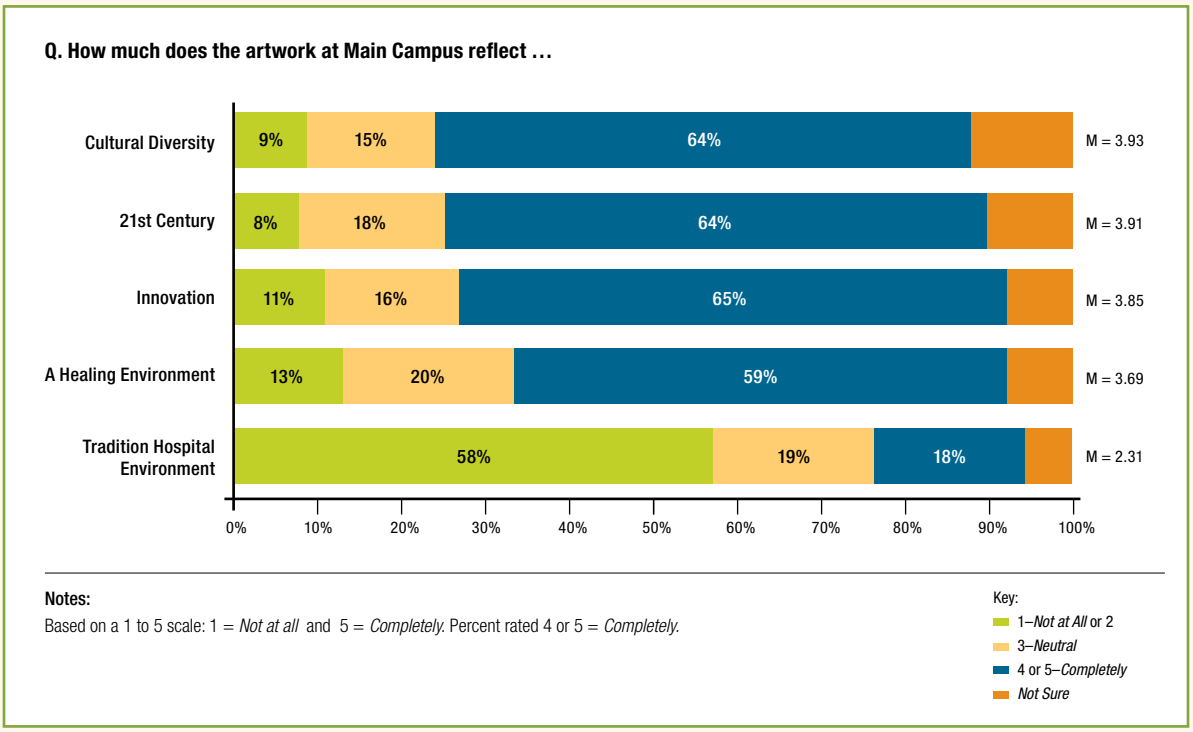


Figure 7. Artwork reflects hospital's commitment to *Cultural Diversity, 21st Century, Innovation, A Healing Environment,* and less so a *Traditional Hospital Environment.*



collection as *Beautiful,* 81% as *Tasteful,* and 73% as a *Positive Distraction.* In addition, 7% described the artwork as *Cold,* 6% as *Unnecessary and Boring,* and 5% as *Ugly.* In the section where respondents could write their own descriptors, words like "nice," "interesting," "variety," and "enjoy" were commonly used.

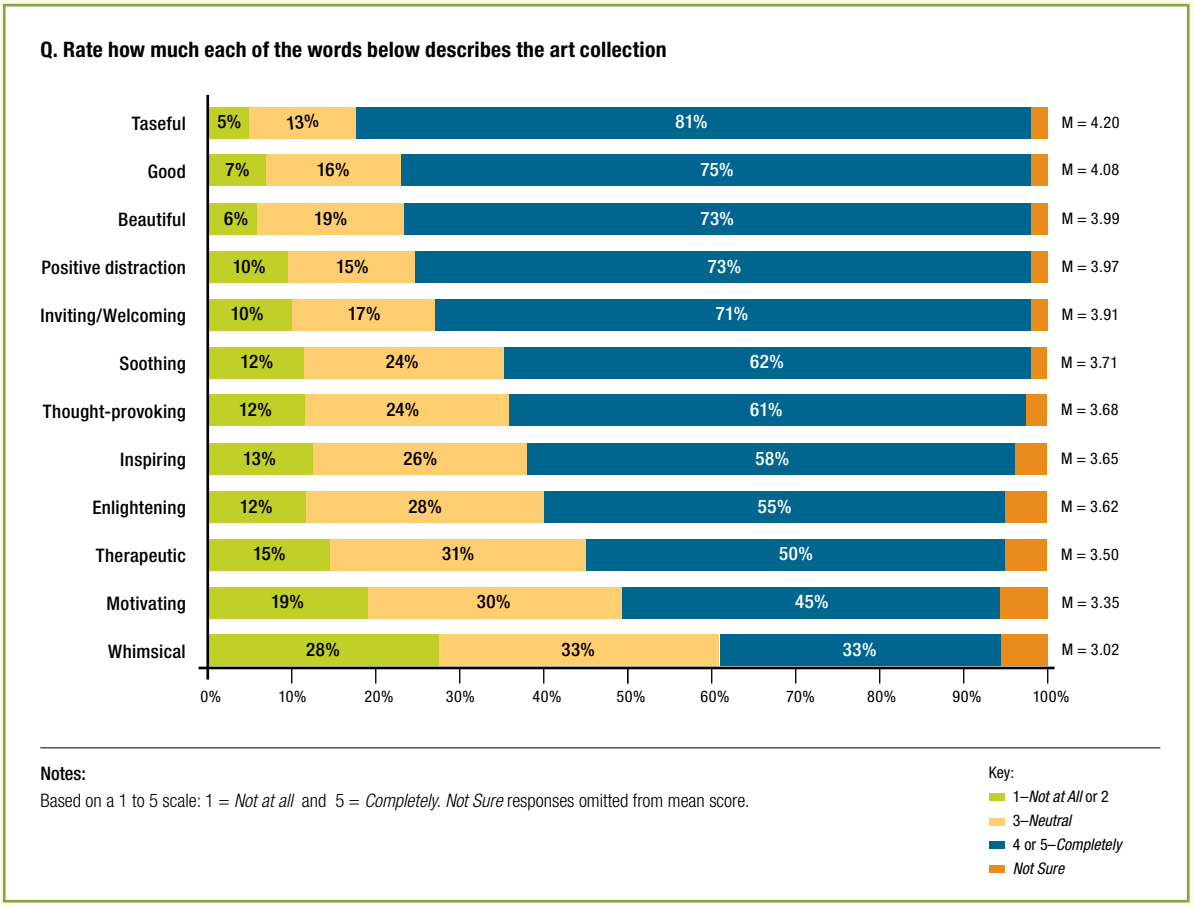
Overall Impressions

Of the 826 respondents who noticed the artwork 78% reported the art collection had a positive impact on their overall impression of our institution; 61% said that viewing the art collection at Main Campus improved their overall satisfaction with their experience; 68% reported that they did not expect to see this kind of artwork in a hospital.

Other

Of the 826 patients who noticed the art, 77% read the didactic labels that accompany the artwork at some point during their visit; 14% of respondents read most of the labels; and 63% read some of the labels. Only 8% of respondents indicated that they were with children during their visit. Among the individuals with children, 58% were able to recall that the child had noticed the artwork.

Figure 8a. List of 12 positive descriptors.



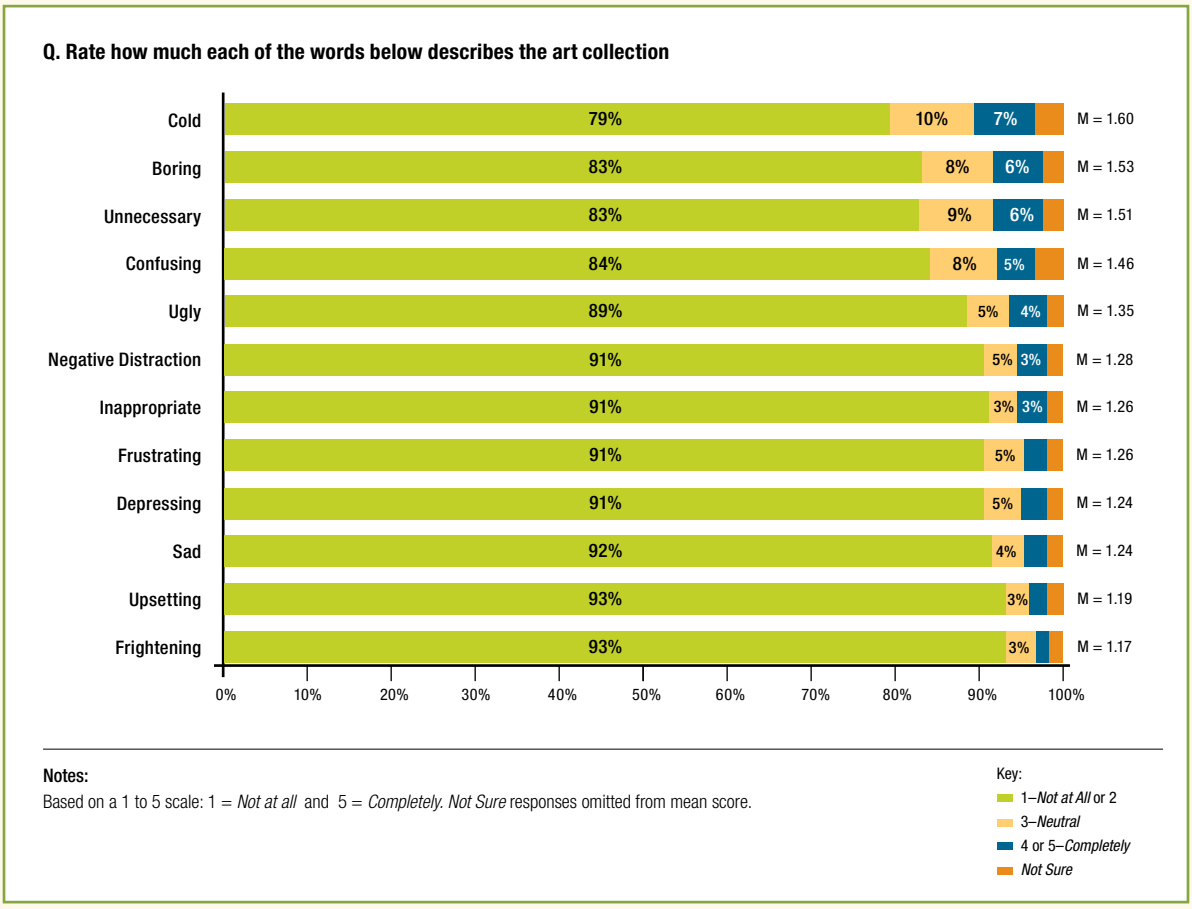
Discussion

The results of this post-visit study can serve as a primer for further research and clinical trials. The institution at hand is a fertile testing ground to assess the qualitative and quantitative effects of a diverse contemporary art collection on patient experience.

One of the key findings of this study was that most of the respondents (76%) noticed the artwork after a visit to Main Campus, which may be due to the art program's use of a patient-centered curatorial practice. In this practice, part of the goal is to create a collection of artwork that is broad in scope rather than homogenous. This variety is one possible explanation for why the majority of the respondents remember noticing the artwork after their visit. As expected, the longer respondents were on Main Campus, the more likely they were to notice the artwork.

Through length of stay and frequency of visits, patients can develop familiarity with or interest in the artwork and the environment. In the qualitative responses

Figure 8b. List of negative descriptors.



in this survey, patients frequently mentioned specific artworks that they return to each time they come to Main Campus. One respondent wrote, "I cannot tell you how much of a positive effect it has. I remember when I would I accompany my aunt who was coming for cancer treatment… Although she had terminal cancer, was experiencing discomfort, and was in a wheelchair, I would wheel her around to view various pieces of art and read the descriptions. She enjoyed it and found it comforting. She particularly liked to sit and watch the projected tree that changed with the seasons." The speaker is referring to *Mike Kelley 1,* (2007) a video work by artist Jennifer Steinkamp (Figure 9). This projection of a digitally animated tree, located in the main lobby of the hospital, continuously cycles through the seasons and has become a primary destination for visitors, patients, and employees to view, interact with, and contemplate. In this work, the tree's movement diverges from reality; its branches spin, sway, and undulate in an artificial but fluid way. The impact and popularity of this work is particularly notable to consider, as permanent seating has been added to accommodate the number of viewers and length of the video.

The goal is to create a collection of artwork that is broad in scope rather than homogenous.

Figure 9. Artwork in main lobby, Main Campus. Jennifer Steinkamp, *Mike Kelley 1,* 2007, video installation.

In addition, some inpatients reported that the artwork increased their motivation to get out of bed to view the artwork in the corridors. One patient wrote, "[The artwork] made you want to get out of your room with your bedmate. Also made you think about getting to the art museum, which I haven't been to in years." Both patients and their caregivers commented on their experiences of walking the corridors and areas of the hospital to view art.

The architecture, lighting, interior design, and artwork together inform patients' experiences with the hospital environment, which was described by a majority of respondents as *Inviting* and *Calming.* The institution's design approach is organized, such that every object has its place and there is no clutter. There is a conscious effort and practice to reduce stimulation: there are no extraneous colors, patterns, or textures in the interior design. Natural light is emphasized and where possible, views to the outdoors are maximized. In the open-ended, qualitative questions of this survey, patients frequently used words such as "clean," "pleasant," and "helpful" to describe the atmosphere and overall environment (Figure 10).

Figure 10. Clinical waiting area, Main Campus. Geert Goiris, *Slowfast,* lambda print, 2007.

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Most respondents reported that interacting with or about the art, either by seeing it, reading the didactic labels, or having a conversation about it, improved their mood. The artwork presents a moment of distraction or diversion that elevates the moods of our patients, regardless of the condition of their health. The fact that patients with post-traumatic stress disorder and generalized anxiety in particular reported a significant positive change in mood due to the artwork indicates that further research should be completed on these specific patient groups. According to one visitor, "It takes you away—you seem to transcend into another world. From the rocks being caressed by the clear water; to the tree showing off its leaves in an endless cycle, to the radiance from pictures, the medias come together and offer peace and joy on some level, allowing us—if just for a moment—to transcend their anxieties and smile."

A hospital is an inherently stressful environment for almost everyone who steps over the threshold. Most respondents found that the art significantly improved their stress level. Architects and planners at our institution have considered alleviating stress to be an important part of the patient's first impression of the hospital. Likewise, the selection of the art reflects this principle. Patients with post-traumatic stress disorder, generalized anxiety, and breast cancer, positively identified the artwork as improving their stress level in significantly higher percentages. These results imply that further research about the impact of art on stress should be completed on these particular groups. A patient wrote, "You go to an art museum to be uplifted by the art. The same happens when you see fine art in appropriate settings. This is a stilling experience for those feeling the stress of illness."

Most respondents found that the art significantly improved their comfort or pain level. This result suggests that there is a need to examine the potential for palliative responses to art in the clinical setting. Further research about the effects that visual art can have on comfort or pain level should be completed on patients at the bedside. Moreover, further studies monitoring patients with post-traumatic stress disorder, generalized anxiety, and osteoarthritis (the most positive responses to the art) should be conducted.

In one of the scaled sections of the survey, patients ascribed more positive descriptors to the artwork than negative. In addition to this, the open-ended questions that allowed for written responses showed similar language, such as "interesting," "calming," "beautiful," and "inspiring." These descriptors reflect the viewers' overall impression of works in the collection. Beyond this, most respondents found the artwork reflected the descriptors *Innovation, 21st century, Cultural Diversity,* and a *Healing Environment.* The artwork seems to echo the mission of the institution. As previously stated, the art program identifies contemporary art as encouraging a dialogue on topical interests, fostering an environment of creative excellence, and inspiring viewers to experience different points of view. These survey results suggest that patients respond positively to this diversity and these qualities of contemporary art.

These survey results suggest that patients respond positively to this diversity and these qualities of contemporary art.

Another interesting finding was that most of the respondents read the didactic labels accompanying the artwork. The didactic labels, an educational component of the art collection, exist to make the art more accessible. One visitor commented, "Makes me think of art in a different way, not all to my taste but I see myself as being able to learn something from art…I like to see 'real art' as opposed to merely decorative artistic paintings or drawings that are 'typical' or art as décor…." (Figure 11).

Finally, most respondents found that the art positively improved their satisfaction with their experience and their overall impression. The patients' perceptions and expectations of their hospital visit were changed from negative to positive through their physical and intellectual engagement with the environment. If the artwork improved patients' satisfaction, they may have felt more nurtured in the environment and therefore more committed to a positive outlook about their visit, which consequently affects their recovery. By infusing the environment with opportunities for positive intellectual, emotional, and compelling distraction, the presence of the artwork encourages a sense that Main Campus is a space for healing.

To date, research on art in the healthcare setting does not account for the diversity and complexity of experiencing visual art. These findings show that patients respond positively to a diverse collection, one that is made up of a broad selection of subject matter, media, and imagery. This study also shows that patients respond positively to different genres including nature art. Some researchers believe that art improves health by creating a positive distraction—an environmental feature that elicits positive emotions and captures attention without

Figure 11. Art exhibition space, Main Campus. *Building Identity: Contemporary Cuban Art from the Private Collection of Donald and Shelley Rubin* (November 19, 2011–March 30, 2012).

stressing the individual (Ulrich et al., 1991). Answers to the open-ended questions in the research suggest that patients are intellectually engaging with the artwork in the collection. Though patients may prefer abstract art to nature art, or vice versa, viewing a carefully curated collection and reading didactic labels provide a unique experience in the hospital. This sense of curiosity or novelty could be what improves their stress, mood, overall satisfaction, and overall impression of the hospital. Rollins (2011) has theorized that the intense curiosity aroused in the viewer by art brings about cognitive and perceptual change, potentially improving patient health outcomes. In future studies, theories and research on human curiosity could be used to better understand the impact of art on patients in the healthcare environment.

By infusing the environment with opportunities for positive intellectual, emotional, and compelling distraction, the presence of the artwork encourages a sense that Main Campus is a space for healing.

Limitations

It is important to note that the study asked respondents to reflect on their experience at this institution and respond to the environment post-visit, meaning this data is based on patients' recollection of their visit rather than on direct observation. This survey was designed to capture the responses to a collection and the institution's Patient Panel was deemed the best method for capturing this data. The Patient Panel comprises patients who volunteer to participate in online surveys and are solicited to do so no more than two times per month. Though the respondent pool was representative of all health conditions, 94% of the respondents in this study were Caucasian, meaning that the results are not confirmed in a representative sample among other racial and ethnic categories. Because the results of this study indicate significant impacts on patient health, future studies at this institution should target responses from a more racially and ethnically diverse respondent pool. Future studies should also involve interviews with in-patients

and direct observation of the artwork in the rooms, corridors, and public spaces to better understand how different types of artwork in specific settings can impact patients.

Implications for Practice

- The impact of a diverse collection of contemporary artwork in a patient setting clearly has positive results, which can improve mood, alleviate stress, and increase comfort and overall patient satisfaction.
- This study's findings validate the methodology that the curatorial team has used with a patient-centered curatorial practice, and the commitment of the institutional leadership to include art as part of the hospital environment.
- The potential for using art as a method for increasing positive patient experiences is dependent not on the amount of artwork, but on the diversity and quality.
- It is essential to have a curator with expertise in collections management, knowledge of contemporary art and art history, an aesthetic and practical understanding of a hospital environment, and familiarity with art markets and budgeting when considering an institutional commitment to an arts program.
- A successful art collection stems from curators working with architects, administrators, and users to gain a full and comprehensive understanding of how the patient experiences the environment, whether this is through the patients' particular medical condition, medications, or cultural demographic. This in turn engages the employees and staff to consider the positive affects of artwork in the hospital setting.
- Using art images as a navigational tool is a particularly effective way to direct patients and familiarize staff with the often confusing hospital layout.

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A Comparative Evaluation of Swedish Intensive Care Patient Rooms

Michael Apple, MSc, LEED AP, EDAC

ABSTRACT

OBJECTIVE: This study investigates how design strategies in three recent intensive care units in Sweden impact patients, families, and staff. The area of focus is the patient room "module," usually consisting of a pair of patient rooms and a joint location for monitoring and documentation.

BACKGROUND: Many countries are expanding their number of intensive care beds and are also in the process of incorporating evidence-based design strategies such as single-bed patient rooms and access to daylight and nature. This situation provides a significant opportunity to review and learn from facilities leading the way in these areas.

METHODS: Three intensive care units completed since 2010 were evaluated in relation to a combination of criteria. Methods included plan drawing analysis, staff questionnaires (n = 72), staff interviews (n = 9), and systematic observation (6 hours).

RESULTS: In some patient rooms, access to daylight and/or outdoor views was excellent, while in other rooms such access was hindered by frosted glass or adjacent bushes or buildings. Single-bed rooms gave family members improved privacy and greater ability to stay in the patient room. Some patient room modules provided efficient patient observation and staff collaboration, but more noise and reduced patient privacy. Other modules provided a calm patient room environment, but caused some staff to feel isolated and have difficulty in getting assistance.

CONCLUSIONS: The evaluation of the three projects reveals variation in whether design strategies successfully achieve their desired outcomes. Varying designs of the patient room module affect users in unique ways and must balance privacy, visibility, quietness, and staff access to assistance.

KEYWORDS: Critical care/intensive care, organizational transformation, outcomes, post occupancy, work environment

AUTHOR AFFILIATIONS: Michael Apple was affiliated with Chalmers University (Sweden) for the duration of the study, and is now affiliated with HDR Architecture.

CORRESPONDING AUTHOR: Michael Apple, mapple@hdrinc.com; (813) 262-2738.

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This study provides knowledge informing future decisions in the design of intensive care units (ICUs). The study evaluates three recently built intensive care units in Sweden, investigating how the design of the physical environment impacts building users. The spatial area in focus is the patient room "module," consisting of a pair of patient rooms and a joint location for monitoring and documentation. The thematic area in focus is an investigation of how the design and layout of the module impacts family involvement, staff efficiency, and the well being of patients and staff. In each unit these focus areas were evaluated in relation to a combination of criteria: intended design goals, staff perceptions, and design best practice.

In northern Europe demand continues to increase for new intensive care beds (Bergsland, 2010; Hope, 2010; Snygg, 2012). Further, in many countries around the world, intensive care units are in the midst of a transition from multi-bed patient rooms to single-bed patient rooms. This change in the physical design of ICUs has a dramatic and significant effect on many aspects of intensive care, including initial construction costs, long-term operating costs, healthcare outcomes, staff efficacy, etc. (Boardman & Forbes, 2011; Chaudhury, Mahmood, & Valente, 2005; Ulrich, 2007).

Many studies describe a connection between the built environment and specific effects on people and organizations (Carthey, 2006; Steinke, Webster, & Fontaine, 2010; Ulrich et al., 2008). In healthcare, for example, these outcomes may include patient pain, patient length of stay, nurse satisfaction, and unit profitability. Due to the importance of these outcomes, it is imperative that design decisions be made based on credible information, with clear goals and outcomes in mind (Hamilton & Watkins, 2008).

Systematically assessing a building after it has begun to be used is an important component of a continuous improvement process.

Once designs are accomplished, it is valuable to obtain objective information on "real life" performance of the built environment, including determining whether intended goals and outcomes have been achieved. Systematically assessing a building after it has begun to be used by its occupants is an important component of a continuous improvement process intended to constantly improve the quality and value of the built environment.

This study investigates the effects of design decisions made in the three selected ICU projects, providing timely design feedback in light of the increasing demand for ICU beds and the transition to single-bed rooms.

Table 1. Basic Data of the Selected ICUs

Unit	Approximate Completion Date	Total ICU Beds	Beds in Single Rooms	Single Room Size (m^2/sq.ft.)	Beds in Double Rooms	Double Room, Area per Bed (m^2/sq.ft.)
ICU 1	March 2010	6	2	27 / 290	4	23 / 247
ICU 2	Feb. 2012	9	5	21 / 226	4	23 / 247
ICU 3	Sept. 2010	14	12	31 / 333	2	33 / 355

As of 2012, ICU 3 contained the highest proportion of single-bed rooms in Sweden (see Table 1). The design is a "hybrid" between a single and double room: a large sliding door connects two patient rooms together.

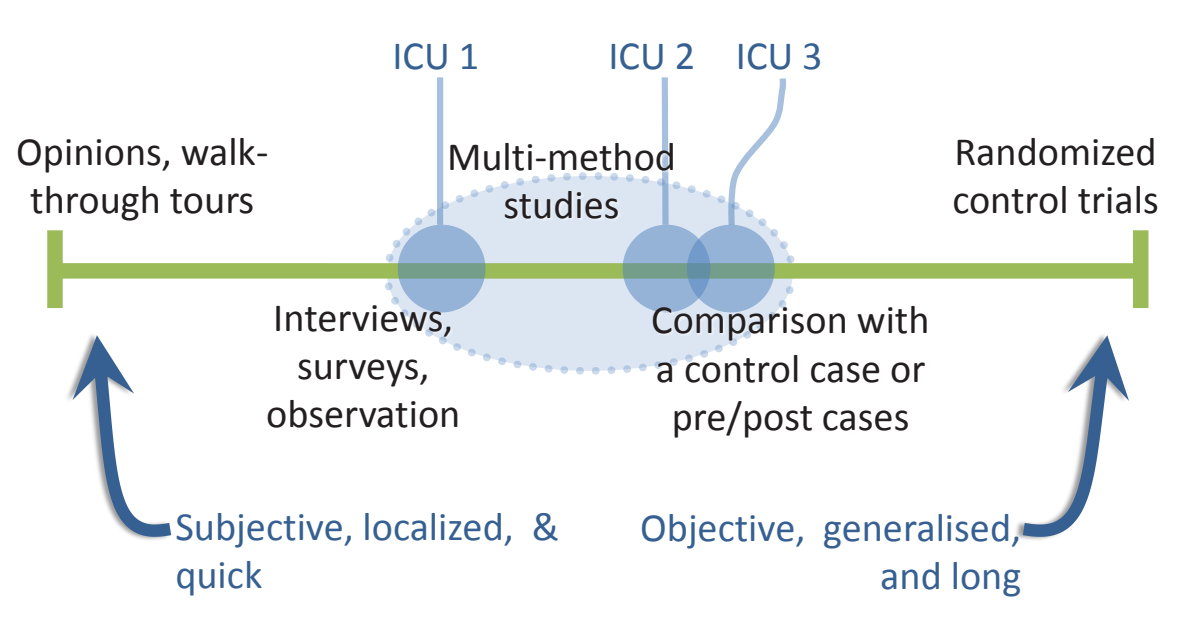
Methodology

The study was designed as a comparative evaluation of the results of three recent ICU designs. This approach allowed a variety of design strategies to be evaluated individually and also compared together (see Table 2). The study used multiple methods of data collection to corroborate results. Considering the wide-ranging spectrum of design "research" rigor, this study lies roughly in the middle of the spectrum (see Figure 1).

This study investigates the effects of design decisions made in the three selected ICU projects, providing timely design feedback.

The author's university department and each of the intensive care units approved the study. The participants of the study included nurses, assistant nurses, and physicians. Patients and family members were not directly involved in the study because of study resources and the amount of time available. The impact of the designs on patients and families was investigated in terms of staff perceptions and by assessing the presence and function of baseline criteria in each unit. For example, the literature suggests many design criteria that have an effect on patients and families. The units were evaluated to determine if such criteria were present in the design, and, equally as important, if the included features were functioning as intended.

Figure 1. A spectrum of rigor in design research.



Source: Inspired by Becker, Hamilton, Zimring, and Shepley, 2008; Evans, 2003; and Hamilton, 2012.

Table 2. Key Design Strategies in Each Unit

Design Strategies		Rooms for family respite	Other amenities for families	Conveniently located sinks	Ceiling lifts	Ceiling pendant equipment systems	Observation window for nurse	Single-bed patient rooms	Larger patient rooms	Individual patient toilets	In-room charting/documentation
ICU Projects	ICU 1	●	◗	◗	●	●	◗	◗	●	◗	—
	ICU 2	●	●	●	❍	◗	●	◗	●	◗	◗
	ICU 3	●	●	●	❍	●	●	●	●	❍	●

LEGEND: ● Includes feature ◗ Partially includes feature ❍ Does not include feature — Information not known

The study was conducted in three phases to allow criteria and results to be refined and confirmed during the process (see Figure 2).

Phase one of the study included a literature review, an interactive walk-through tour of each unit, and an interview of a nurse manager at each unit.

Phase two involved analysis of plan drawings and the implementation of a questionnaire. The plan analysis included evaluating room sizes, functional relationships, and visibility between spaces. The two-page questionnaire included demographic information, 4-point Likert scales, and open-ended questions. The

Figure 2. Phased process of the study.

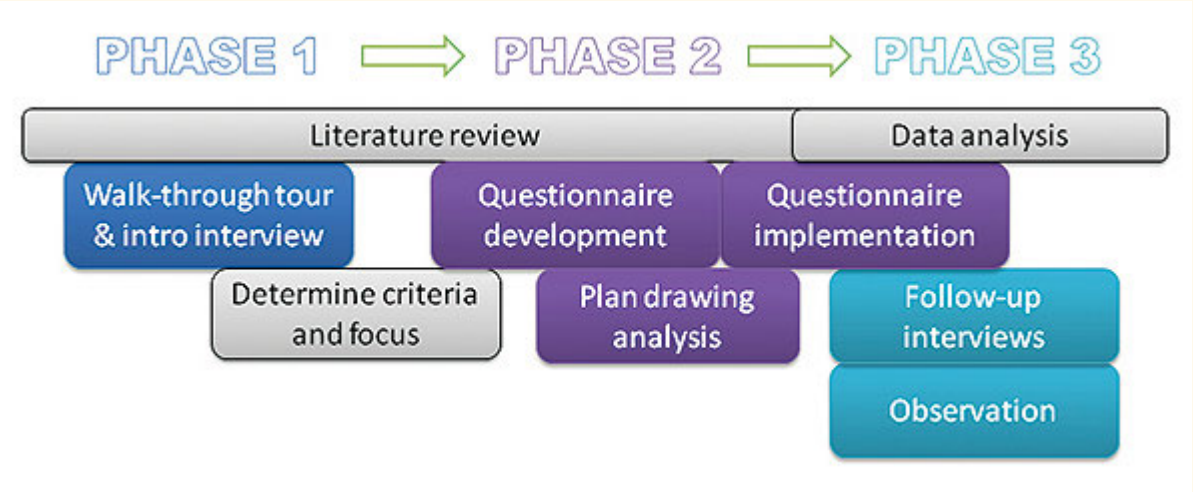


Figure 3. Patient room in ICU 3, showing the decor of the room, conventional lighting, and the window view of shrubbery.

questionnaire content and format was reviewed with nurse managers and local healthcare researchers before implementation. The length of time available for staff to complete the questionnaire was 7–10 days, which was dictated by study logistical constraints and availability of nurse managers to assist coordinating the questionnaire distribution. Response rates varied by unit, ranging from 14% to 42% (total n = 72). Variations in response rate are believed to be due to staff on leave and that the questionnaire was advocated and followed up on differently at each unit.

Phase three was conducted only at ICU 2 and ICU 3 and involved semi-structured interviews with six nurses as well as observations of the use of the environment. The interviews averaged 30–40 minutes in length and content analysis was performed on the resulting information. Observations involved the author recording on a plan drawing the flow of people in the patient room module and the type and frequency of interactions that occurred. Observation was performed in sessions of 15–30 minutes, for a total of 6 hours.

The resulting data was a mix of qualitative and quantitative items. Data compilation and analysis was done for each ICU individually, and then the resulting data from all three ICUs was compared.

Results

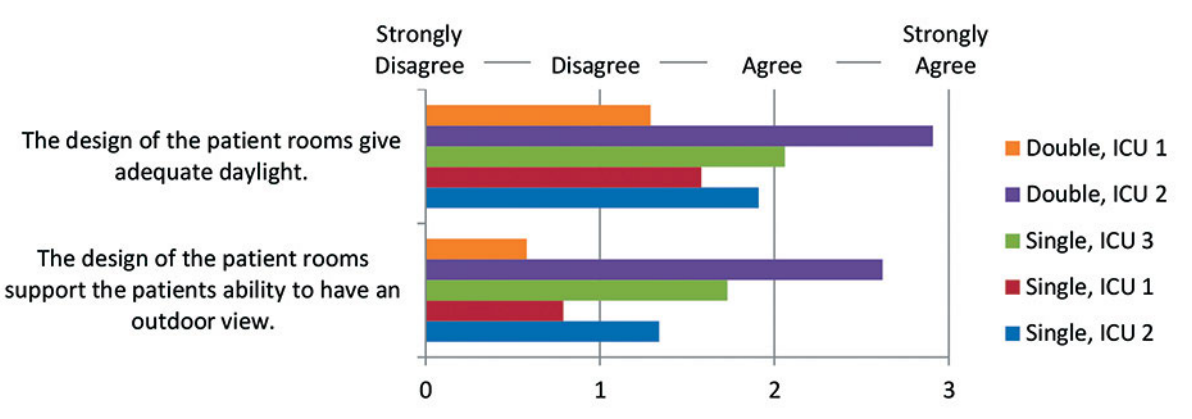
This paper consolidates and compares the results at all three units together and presents the results thematically. Specific and detailed results from each individual unit are available in a separate report (Chalmers University, 2013).

Figure 4. Staff break room in ICU 2 with decorative lighting, wood furniture, and accent colors.

Patient Well Being and Healing Environment

Most patient rooms were designed with a "clean-looking" appearance on the walls and ceiling, with occasional accent colors. In ICU 3 in particular, staff made comments that the room appeared "sterile" and "impersonal" (see Figure 3). Staff areas generally had a more welcoming ambience with softer lighting, more color, and natural materials (see Figure 4).

Figure 5. Results of Questionnaire: Daylight & Views.



The quality of exterior views varied by patient room and by unit.

The quality of exterior views varied by patient room and by unit. Some windows had frosted glass hindering the view, while other views were predominantly of bushes (see Figure 3) or a nearby building. Rooms with these types of views were rated much lower in the questionnaire (see Figure 5).

In the double-bed rooms in ICU 2, the window view and daylight was excellent, and most staff were also satisfied with the options provided to control privacy (see Figure 6).

Patient rooms in all units featured operable windows, which were used regularly. Some patient rooms in ICU 3 featured exterior doors, which were rarely used.

Staff at all units felt that single-bed rooms were better for the patient, listing benefits such as privacy, family involvement, and reduced noise and disturbances. In both single-bed and double-bed rooms, some staff expressed concern that interior windows allowed excessive light to enter the patient room at night (either via the documentation/monitoring room or via the adjacent patient space in double-bed rooms).

Figure 6. Double-bed patient room in ICU 2.

Picture shows the large window with a full view of the outdoor environment. Sedated patients usually face away from the window, toward the nurse documentation station, while alert patients often face the window. Photo courtesy of Eva Ek.

Family Involvement

In the questionnaire results, staff at all units had similar levels of satisfaction with how well the patient room supports family involvement. However, higher levels of family involvement were observed in ICU 3 (large "hybrid" single rooms) than in ICU 2 (double rooms and smaller single rooms).

Interview comments stated that single-bed rooms were beneficial for improved privacy, fewer disturbances, and greater ability for family to stay in the room during care activities. Factors supporting family involvement were said to include larger patient room sizes, patient room amenities (e.g., coat hook or designated family chairs), unit amenities (e.g., family rooms), supportive unit visitation policies, and staff attitudes supportive of family involvement. For example, in ICU 2, a sign outside the unit entry requested a limitation of two visitors per patient, while in ICU 3 there was no such limit on visitors.

In ICU 3, family members preferred to be in the patient room as much as possible, even sometimes sleeping in the room in a makeshift bed. However, staff in ICU 3 also suggested that family members could become physically and/or mentally fatigued from staying in the patient room for excessive periods of time.

Patient Room Module Layout

In each unit, the tasks of documentation, charting, and monitoring could be done on a computer in the patient room or in an adjacent documentation room.

Staff expressed a desire to be closer to the patient.

In ICU 2, the large documentation room was used for accessing patient records, preparing medications and IVs, and conversing with other staff. The documentation room of ICU 1 was similar in size and function to that of ICU 2. In ICU 3, the documentation room was most often used for conversing with other staff (sometimes while also viewing patient records).

In ICU 3, while visibility of the patient room from the documentation room was excellent, staff expressed a desire to be closer to the patient and to be able to hear what was happening in the patient room. As a result, most documentation was performed inside the patient room.

In ICU 2, the doors between the documentation workroom and the patient rooms were usually held open. This created an efficient workflow for staff, and an ability to hear what was happening in the patient room, but also caused more noise to enter the patient room.

In ICU 3, the sliding door between patient rooms was most often left partially open. Staff often passed through the doorway, met in the middle to interact, or remained in the middle of the doorway with efficient observation and access to each room. The door was closed when needed, for example, in case of a procedure, in times of extensive family involvement, or with a terminally ill patient.

Figure 7. A view of the patient room in ICU 3.

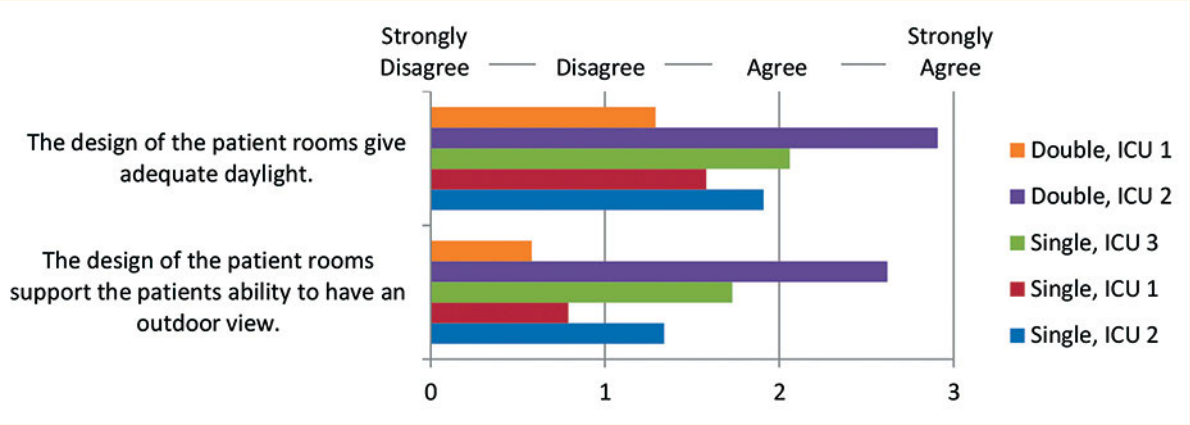
Far left is the room entry door, documentation room window is center, and sliding door connecting two patient rooms is on the right.

The double-bed rooms at ICU 2 and the "hybrid" single-bed rooms at ICU 3 had a similar staffing ratio of one registered nurse and one assistant nurse for every two patients. However, ICU 3 required extra staff circulating in the corridor to provide additional assistance where needed.

The questionnaire results, interviews, and observations were in agreement that double-bed room modules were more supportive of staff collaboration and effective visibility of patients. The resulting effects at each unit were dramatic: single-bed rooms at ICU 1 were not used often, due to the extra staffing needed; single-bed rooms at ICU 2 were used only for lower acuity patients; the rooms at ICU 3 with no sliding doors (isolation rooms) were used less often due to the extra staffing needed.

In ICU 3 (with hybrid single-bed rooms), staff shared varying opinions on the module design. Some staff described their feelings with words like "isolated" and "alone," while others used words like "calm" and "focused." Some staff stated that they did not feel able to effectively observe/care for two patients without utilizing the sliding door. In the questionnaire for ICU 3, only 15 of 37 staff agreed with the statement, "When I work in the patient room it is easy to contact another person for help."

Figure 8. Results of Questionnaire: Visibility & Collaboration.



Discussion

Similar to other studies (e.g., Ulrich et al., 2008), the results of this study suggest that single-bed rooms provide enhanced privacy for patients and families, reduced disturbances of patient sleep, and a greater ability for families to be in the patient room. However, the results also suggest that staff collaboration and observation is more challenging in single-bed rooms than in double-bed rooms. The "hybrid" single-bed room in ICU 3 is an innovative attempt to maintain the efficiencies of a double-bed room while gaining the benefits of a single-bed room. The presence of a sliding door between rooms supports efficient staff observation and collaboration, yet it is not clear if this "hybrid" room layout still achieves single-room benefits such as reduced medical errors, reduced patient stress, and reduced spread of infection. The question remains then: can the new paradigm of single-bed rooms maintain the positive characteristics inherent in double-bed room layouts?

Some staff described their feelings with words like "isolated" and "alone."

The patient room modules each included interior windows in various locations in order to provide visibility within the module itself, and also between the module and the corridor. The layout and visibility characteristics of a module appear to have an effect on staff well being and the model of care delivery.

All units featured a high level of visibility from the documentation room to the patient room. However, the units were not in agreement on the role of the "documentation" room, ranging from a small station for charting and conversation (ICU 3) to a medium/large workroom for tasks including medication prep (ICU 2). The extensive use of the larger room in ICU 2 brought concerns of patient privacy, noise entering the patient room, and excessive light entering the patient room at night. The lesser use of the smaller room in ICU 3 raised questions on whether the room was necessary.

The units were not in agreement on the role of the "documentation" room.

In all units there was a low level of visibility from the patient room module to the corridor. In ICU 3 with only two or three staff members per module, the low level of visibility may have contributed to staff members feeling alone, not aware of their colleagues, and having challenges in getting assistance. However in ICU 1 and ICU 2, with four to six staff members working together in a module, these concerns were much less significant. In all units, the low level of visibility from the corridor into the patient room was generally effective in preventing views by people walking by in the corridor. The exception was for single-bed rooms in ICU 2, in which the patient room doors were often kept open. These rooms were usually for patients of lower acuity level.

The presence of nature, fresh air, and daylight is highly valued in Scandinavian culture, and as a result these features have historically been incorporated in many building designs. The presence of operable exterior doors and windows appears to be appreciated in ICU settings, both for the benefit of staff and the patients. However with the exterior doors rarely utilized, it is possible that operable windows alone may suffice in providing satisfactory personal control of fresh air. In a situation with an extremely contagious patient in an isolation room, the exterior doors may be useful for allowing the patient to enter or exit the room without passing through the unit.

Considering the cultural values regarding light and nature, it was surprising to discover the sometimes unsatisfactory provision of daylight and outdoor views in the units. All units were located on the ground floor or first floor, and as a result there were challenges in balancing privacy and transparency. For example, in ICU 3, located on the ground floor, frosted window treatments were added after occupancy due to a reported lack of privacy, causing some rooms to lose a

Figure 9. Illustration of visibility within the patient room module in ICU 2.

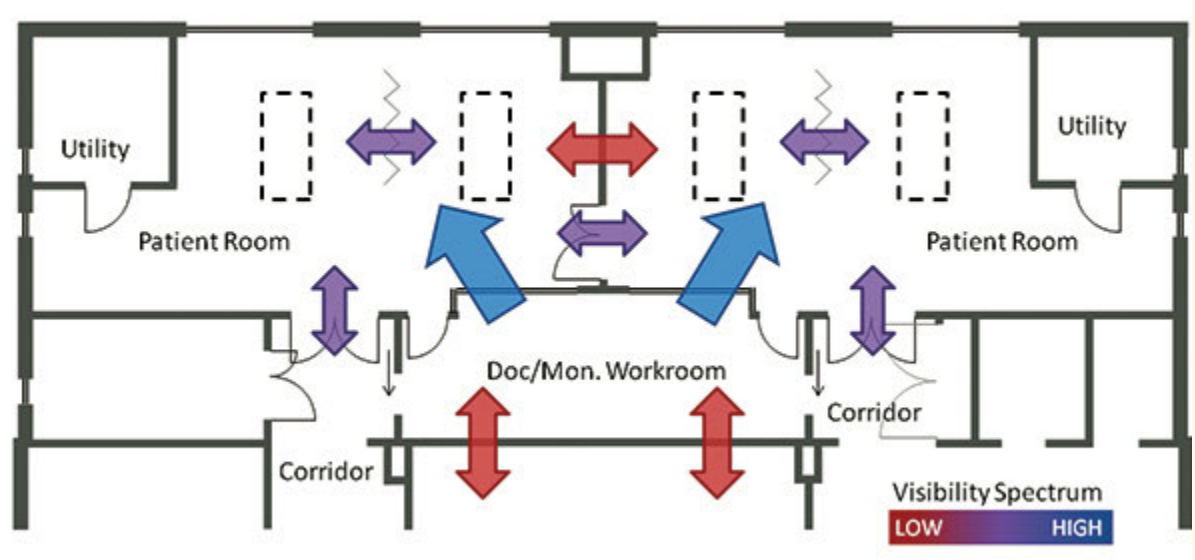
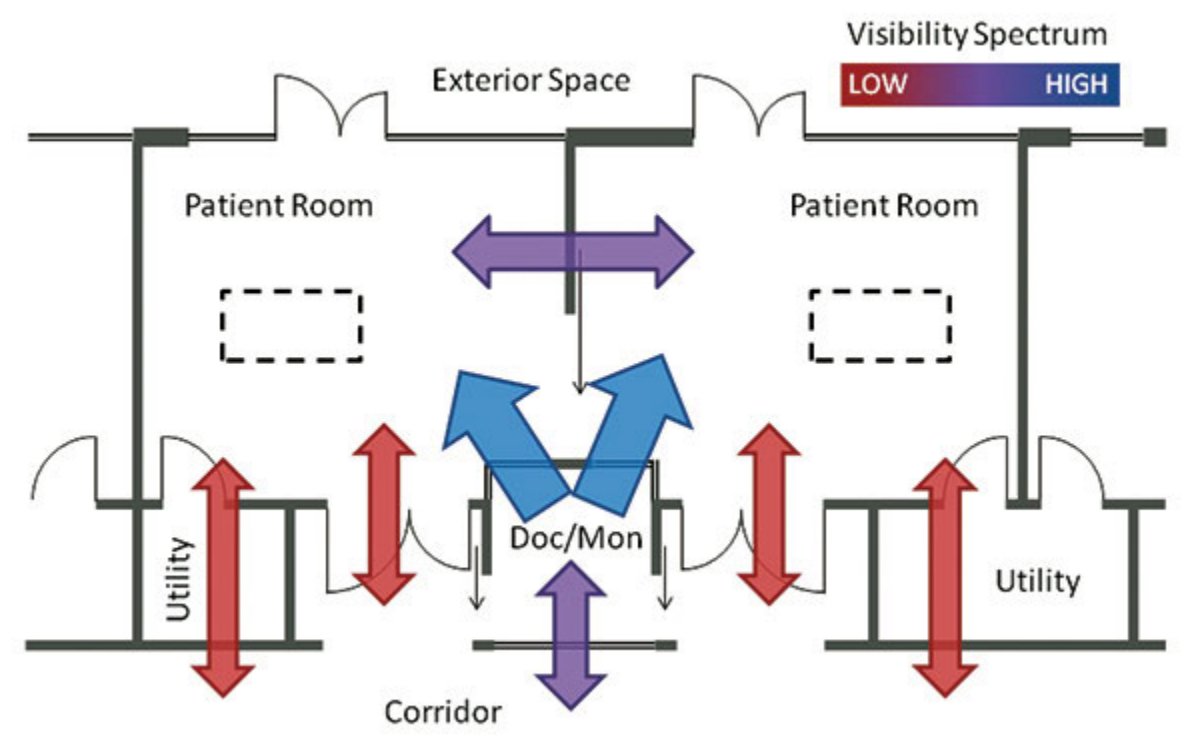


Figure 10. Illustration of visibility within the patient room module in ICU 3.



clear view to the outdoors. In ICU 2 located on the first floor, the provision of mobile screens and interior and exterior blinds was generally sufficient in controlling privacy. The dissatisfaction with window views at ICU 1 and the single-bed rooms in ICU 2 imply that the type and quality of an outdoor view is a significant design factor.

Many studies have shown that the presence of daylight and outdoor views have important and positive effects on ICU patients and staff (Cheung, 2008; Shepley, Gerbi, Watson, Imgrund, & Sagah-Zadeh, 2011; Ulrich et al., 2008; Wilson, 1972). Considering the hindrances to successful implementation of daylight and views that were found in this study, it is a reminder that the context and implementation of design strategies should be reviewed to improve their chances of success.

It was surprising to discover the sometimes unsatisfactory provisions of daylight and outdoor views.

The interior design of staff and family rooms was generally found to be more home-like and pleasant in comparison to patient rooms. One reason stated for maintaining a restrained patient room décor is the concern that excessive visual stimulation could be detrimental to severely ill patients, particularly those with ICU delirium.

There does not appear to be a consensus regarding the location in which the task is performed.

Another factor affecting interior design is the organization of the healthcare system. Swedish healthcare is administered by each regional government and is intended to encourage collaboration rather than competition. In the United States, for example, with relatively high levels of competition between healthcare providers, the trends of "home-like" and "hotel-like" patient rooms have played a significant role in attempting to increase patient satisfaction and market share.

Each of the three units incorporates similar care processes and tasks, such as documentation, observation, staff communication, patient hygiene, medication preparation, etc. For many of these tasks, there does not appear to be a consensus regarding the location in which the task is performed. For example, in ICU 3, most medication preparation is performed in a dedicated medication room near the center of the unit; in ICU 2, most medication preparation is done in the documentation workroom; in another ICU in the same region, most medication preparation is done in the patient room.

These varying care processes reflect the unique cultures of each organization and the unique design of each patient room module. Therefore, it is suggested that a successful design strategy may be one that allows short-term and long-term flexibility in performing care tasks in different ways.

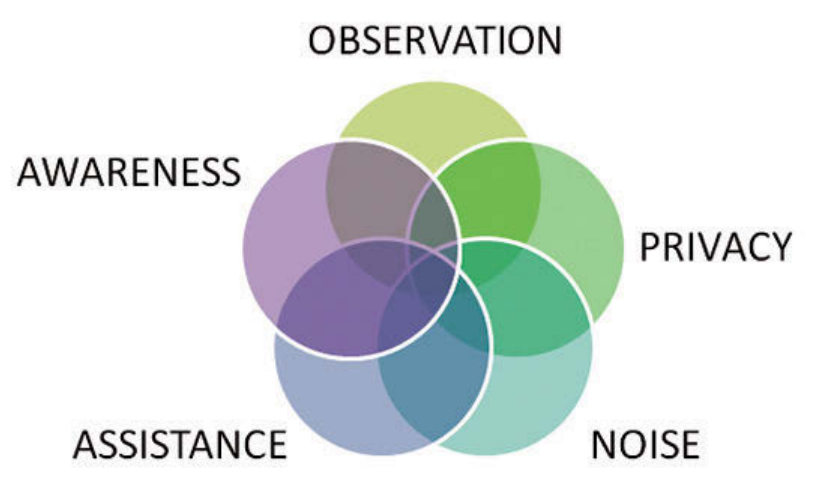
To accomplish these tasks in an optimal manner the environment must support a balance of an interdependent set of characteristics. Ideally all characteristics will be present to a full extent, but their interdependency makes this rarely possible. For example, in ICU 2 with double-bed rooms and an adjacent documentation workroom, the characteristics of staff awareness, patient observation, and staff assistance are optimized. Patient privacy and environmental quietness may suffer. In ICU 3 with "hybrid" single-bed rooms, a different set of strengths and weaknesses emerge. Further, with the use of the sliding door, blinds, etc., the balance between these environmental characteristics can fluctuate and rebalance as a situation changes.

The environment must support a balance of an interdependent set of characteristics.

While staff recognized that single-bed rooms enhance patient-centered care and family involvement, double-bed rooms were sometimes preferred for their familiarity, enhanced collaboration and observation, and lower staffing costs. This dilemma was realized and discussed from the very inception of each project—how can we provide the best environment for patients and families, the most effective work environment for clinical staff, and a sustainable cost of operations?

The traditional Swedish model of intensive care involves close staff presence at the patient bedside, an ability to observe multiple patients at once, and a staff awareness of where colleagues are and what they are doing. These qualities are natural in a double-bed room layout, but difficult to achieve after transitioning to a single-bed room. There are two predominant responses: transforming the culture/model of care or utilizing a greater number of staff members per patient.

Figure 11. Interdependent characteristics of an ICU care setting.



The latter case was the viewpoint of the units studied, resulting in a preference to use double-bed patient rooms when possible, in order to manage staffing costs.

Limitations to this study include the lack of direct patient and family involvement and a low response rate for the questionnaire at some units. Because this is an important topic of study, further research is suggested to include direct feedback from patients and families; a more rigorous analysis of the relationship between the identified "interdependent characteristics" and their relation to staffing costs; and an analysis of efficiency and accuracy in medication prep and medical record charting, based on the location in which the activity is performed.

Conclusion

Healthcare organizations commonly face challenges when transitioning to a different unit design and/or a different model of care. The transition to single-bed patient rooms has elsewhere been correlated with challenges in staff communication, visibility, and social isolation (Bonuel & Cesario, 2013; Friesen, Trojan, & Suter, 2008; Smith, Schoenbeck, & Clayton, 2009). This study has investigated how design decisions had an impact on staff, patients, their families, and the model of intensive care provided. Some design features may not function as effectively as intended, and some units may encounter difficulty in adapting their designs to changing models of care. As healthcare design continues to evolve, designers and clinicians have the opportunity to work together in creating effective and flexible design solutions.

Implications for Practice

- Different nursing units have different ways of working, and as a result design solutions ideally will fit the local context. Further, design solutions can be prepared to adapt as ways of working change over time.
- Design strategies for patient room modules must balance a set of interdependent factors including nurse awareness of their colleagues and access to assistance; nurse ability to observe patients; patient and family privacy; and noise reduction.
- Transitioning from double-bed patient rooms to single-bed patient rooms is a significant change in design strategy and is most effective when accompanied by a corresponding shift in unit culture. In this study the new designs were said to be beneficial to patients and families, yet staff encountered challenges with feeling isolated and lacking support.
- Considering the hindrances to successful implementation of daylight and views that were found in this study, it is a reminder that the context and implementation of design strategies should be reviewed to improve their chances of success.

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Research Informed Design, Best Practice, and Fresh Perspectives: Can We All Get Along?

D. Kirk Hamilton, FAIA, FACHA, EDAC

D. Kirk Hamilton, FAIA, FACHA, EDAC

Some healthcare design practitioners have adopted a design process that relies on information gleaned from credible and relevant research studies. Others continue to work in the realm of "best practices" derived from long experience and deep understanding of their clients' issues. Some vocally advocate for the fresh perspectives of designers who are not burdened by ingrained habits and dogmatic assumptions about the best way to design for healthcare settings, contending that the only way to create great healthcare architecture is to avoid the so-called healthcare design experts. Are these mutually exclusive stances, or is there a possibility that there is a meaningful place for each approach? Can they all be applied in a single project situation?

Research Informed Design

HERD has been a bully pulpit for advocacy of research informed design, or evidence-based design. The journal's editors and sponsoring organizations are on record as supporting the idea that better healthcare design decisions may be made by practitioners who refer to the scholarly literature and research findings in order to interpret their implications for a current design project.

It is difficult, if not impossible, to argue that the opportunity for a better design decision addressing an issue deemed important by the client should be missed. If interpretation of credible scientific evidence and carefully measured outcomes from completed projects can help produce better results, possibly including better clinical outcomes, there would seem to be a significant, even moral, obligation to utilize a rigorous, research informed design process for the current project.

When a highly regarded organization identifies reducing drug mixing errors as a key design issue for its proposed cancer center project, it might be helpful to turn to the literature to see what is known about the topic. An evidence-based practitioner might convert the design issue into researchable questions about drug mixing errors, environmental factors, and behavioral factors that could lead to relevant information that would influence development of design concepts intended to reduce errors. A better understanding of the role of interruptions, lighting, fresh air, and barcode technologies, as a few examples, could result in superior design decisions.

Although such committed advocacy for a research informed design process sounds unwavering, it does not mean that every possible project, or every decision on a project, deserves the same rigorous process. A rigorous, evidence-based design process is advisable for addressing one or two key design issues on a project for which there is little available information, or for which there is no obvious solution consensus. That same extra effort and possible time commitment may be unreasonable if extended to a large number of less important design decisions. Which means that the vast majority of decisions on a healthcare project will likely be made on the basis of accepted best practices.

Best Practice

Healthcare design has long been a specialty within the design field, based on the complexity of the clients' enterprise, and the extreme importance of life and safety for highly vulnerable populations. A number of design practitioners have developed a specialization in healthcare design, and practice at a high level of competence based on experience and continuous learning. These practitioners are using what the profession and the courts call *best practice*. They depend on detailed knowledge about the clients' requirements, and draw from a storehouse of relevant experience and local knowledge about the best way these issues have been addressed in the past.

Organizations like the American College of Healthcare Architects (ACHA) and the American Academy of Healthcare Interior Designers (AAHID) set minimum standards for individual board certification in the specialty of healthcare design, and verify qualifications through examination and review of a practitioner's experience. Other organizations such as the American Society for Healthcare Engineering (ASHE) and the Nursing Institute for Healthcare Design (NIHD) represent memberships with a focus on healthcare environments. There are widely read professional magazines and journals, like *HERD*, that are devoted to the specialty. There is a rich, cross-discipline culture associated with the healthcare design specialty that interacts on projects and through participation in professional societies, conferences, and continuing education.

The vast majority of design decisions for North American healthcare institutions are made by experienced design practitioners who have developed a track record of experience within the specialty of healthcare. Just as it is unlikely for a major high-rise developer to hire an architect that has never done a high rise, it is unlikely that an inexperienced architect would be engaged for a major, complex

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healthcare project. It is increasingly rare to hear of an architect who has never designed a hospital being engaged for a project because of, for example, a family relationship to the board chair. When an inexperienced firm must deliver a complicated healthcare project, it is normal to add an experienced employee, or to associate with an experienced firm.

It is difficult to imagine a successful result if someone with no experience were to be required to design and build a complex healthcare environment, such as a contemporary, state-of-the-art imaging center with the demands of technical equipment like biplane fluoroscopy, CT scanners, MRI machines weighing many tons, and a unique workflow based in digital images. Of course it might be possible, but there would likely be be complications, delays, revisions, and perhaps even poor budget control. Most likely, of course, is that an experienced practitioner would be invited to play an expert role on the team.

Fresh Perspectives

Some voices in the field have suggested that the body of contemporary healthcare architecture does not meet the highest standards of design. It is possible that they may be right, as so many hospitals and clinics are still bleak, institutional and confusing warrens, although much design work in the field has been quite strong in recent years. There is no doubt that the current inventory of healthcare facilities could be improved by some fresh thinking.

It has been suggested that healthcare design needs a new, outsider's perspective from skilled practitioners without an ingrained bias about the way things have been done in the past. There are calls to add outstanding non-healthcare designers to awards juries. Some have gone so far as to suggest that anyone associated with a long record of hospital design should be removed from consideration.

It should not be controversial to engage a skilled design practitioner with little healthcare experience to prepare the site plan, landscape plan, parking garage, entry, lobby, principal circulation patterns, gift shops, chapel, and food service aspects of a hospital project. None of these require an intimate knowledge of clinical practice or the complexities of medical gas distribution. In fact, designers drawing inspiration from experience having nothing to do with healthcare may bring wonderfully creative ideas to the project.

A hospital's departmental renovation that simply relocates some personnel and alters some walls, doors, and air conditioning ductwork would not seem to need a rigorous search of the literature. It would seem that it might be designed and implemented by best practice methods, or by designers not burdened by highly technical requirements for medical equipment or utilities.

No Place for Misguided Ego

If a designer lacking healthcare experience is carried away by a sense of self-importance and a tendency to serve individual ego rather than the client's best interest, problems could arise. When aspects of design can be random or sub-

jective, there is a danger that a self-absorbed designer can make arbitrary decisions on the basis of personal preference, misunderstanding, or ignoring the project's fundamental requirements. Such decisions can reduce the effectiveness and operational performance of the project. Such projects can never fulfill their maximum potential contribution to the organizations and the communities they serve. A good designer working in a new area knows how and when to ask others for advice and explanatory background information.

Participatory Involvement of the Users

One important way to assure that the requirements of the organization and the users are met is to effectively involve them in the design process. Most experienced healthcare practitioners work with some form of a participatory process. I have always believed that while it is possible to design a healthcare facility independently, the result will always be better if the physicians, nurses, support staff, and executive leadership have a meaningful role in the decision making. This would appear to be true whether in a best practice or an evidence-based process, and even more important for an inexperienced designer or design team.

Collaboration

I believe there is a place for each decision-making model of practice in a successful project. I am convinced that each of these successful design processes can comfortably co-exist. Any complex healthcare project deserves an evidence-based approach for a certain number of key decisions. At the same time, serious healthcare projects deserve the focused expertise of best practice for the vast majority of the design decisions related to clinical practice, stringent code requirements, and complicated utility infrastructures. And yet, there must be room in projects for the innovation and creativity brought by fresh eyes, especially in areas that impact campus and circulation planning, public spaces, user experience, non-clinical settings, and the aesthetics of a design solution. This kind of collaboration is probably already occurring at some firms where these complementary skills and methods are being applied in concert, or on other projects where the teaming of firms provides a respectful mix of capabilities in service to the client.

Highest Value Found in a Cooperative Mix

It is time for advocates of these different perspectives to admit that there is real value for clients in each model. It is plausible that clients can best benefit from the judicious application of each distinct way of designing healthcare projects, and potentially from a combination of models, depending on the individual, unique project requirements. Architecture, engineering, and design must serve healthcare clients with the best combination of experienced best practice decision making, supported by research informed design for critical issues, and fresh, new ideas from creative minds willing to look elsewhere for inspiration. Design practitioners with skills in these areas must work together with collaborative, supportive respect to deliver the best results.

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Exploring the Function and Use of Common Spaces in Assisted Living for Older Persons

Morgan Andersson, PhD; Nina Ryd, PhD; and Inga Malmqvist, PhD

ABSTRACT

OBJECTIVE: This exploratory study examines the function and use of common spaces in assisted living facilities (ALFs) from the residential and workplace perspectives.

BACKGROUND: The impact of the physical environment on human activities in healthcare settings has been emphasized in many studies. Few studies, however, have explored the daily use of common spaces and the impact on the usability of ALFs.

METHODS: Four explorative methods–observation, group interviews, individual interviews, and questionnaires—were used to investigate 14 ALFs in Sweden. The study involves residents, staff, relatives, architects, and people responsible for planning and construction of eldercare. This research strategy combines quantitative and qualitative methods to enhance the validity of the results. Method triangulation and data triangulation were used and the data were analyzed using Qualitative Content Analysis (QCA).

RESULTS: The results show that residents and staff have different objectives for use and these differences affect usability, although explicit conflicts are rare. The residents, staff, and other stakeholders have different views about the demarcation of home and workplace and the role of common spaces as venues for social interaction.

CONCLUSIONS: Both the residential and the workplace perspective must be considered when planning assisted living facilities. Otherwise, inherent conflicts between these perspectives will manifest as a result of the physical design. Common spaces have diverse functions that are reflected in their spatial organization. Therefore, ALFs should be designed so the intended function of a specific space is apparent to all users.

KEYWORDS: Built environment, elderly, planning, satisfaction, staff

AUTHOR AFFILIATIONS: Morgan Andersson is an architect and visiting researcher; Nina Ryd is an architect and associate professor; and Inga Malmqvist is an architect and associate professor, all at Chalmers University of Technology in the Department of Architecture in Gothenburg, Sweden.

CORRESPONDING AUTHOR: Morgan Andersson, Chalmers University of Technology, Department of Architecture, S-412 96 Gothenburg, Sweden; morgan.andersson@chalmers.se; +46 (0) 70 604 35 60.

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Introduction

This article deals with communal aspects of assisted living facilities (ALFs) in relation to the home and workplace perspectives.

Scope and Relevance

Common spaces are the principal venue for daily social interaction in assisted living (AL) situations. In this article, we discuss the functions of common spaces, existing in both a home and a workplace, and how they are used by the primary users—the residents and staff. These users represent the residential and workplace perspectives. Besides the primary users, other stakeholders are included in the study to broaden these perspectives. These other stakeholders include relatives, architects, and people with strategic functions in eldercare or in the planning of eldercare environments. We hope to add knowledge about the usability of common spaces in AL and how they are perceived and demarcated in buildings. We also discuss the actual use of the spaces in relation to their intended function(s). The issues addressed here are valid for other eldercare environments and the results are transferrable to AL and similar environments worldwide. Earlier publications have presented results from the observations (Andersson, Lindahl, & Malmqvist, 2011).

Several studies have documented the importance of common spaces as venues for social interaction in AL and similar environments for the elderly (Frankowski, Roth, Eckert, & Harris-Wallace, 2011; Moore, 1999; Nord, 2011b; Yang & Stark, 2012; Zavotka & Teaford, 1997) and some studies have focused on the functions of common spaces in relation to their actual use (Ice, 2002; Nord, 2011a; Zimmerman et al., 2007). Moreover, research has considered how healthcare environments influence human health and activities (Dijkstra, Piterse, & Pruyn, 2006; Lorenz, 2007; Ulrich et al., 2008). Special attention has also been given to the interaction between eldercare environments and the residents/patients (Andersson, 2011; Day, Carreon, & Stump, 2000; Verbeek, van Rossum, Zwakhalen, Kempen, & Hamers, 2009). In addition, some researchers have concluded that staff members act as social facilitators in eldercare environments (Ball et al., 2009; Ryvicker, 2011; Williams & Warren, 2009; Zimmerman et al., 2003). All of these studies are important as the number of elderly people is increasing worldwide (Lutz, Sanderson, & Scherbov, 2008), a trend that is forecasted for most of Europe, including Sweden. This demographic trend brings about both social and economic challenges.

Assisted Living

The Swedish Social Services Act requires municipalities to provide state subsidized special housing for older people in need of care (SFS 2001:453). In this article, the term *assisted living* refers to this form of special housing. AL requires an assessment procedure executed by the municipal eldercare authority (Swedish Government, 2008). People may live permanently in AL or for shorter periods in short-term or respite care. An assisted living facility (ALF) unit contains from 5 to 20 apartments, mainly single, and shared common spaces for social

activities. The apartments are private homes with legal tenures (National Board of Health and Welfare, 2011). The intended functions of the common spaces in AL include "functions and equipment for cooking, daily social interaction and dining" (Swedish National Board of Housing, Building and Planning, 2012). The collective idea is an integral part of the structural scheme with groups of residents sharing common spaces for social interaction, conditions that encourage socializing among residents. This scheme is found in most countries and entails a subdivision in residential care units or groups with common spaces for social activities and staff available around the clock (Kalymun, 1991; Paulsson, 2002; Zimmerman & Sloane, 2007). In addition, most units for people with dementia, referred to as "dementia units" and "somatic units" in this article, are smaller than units for people with mainly somatic disorders. Different countries, however, organize eldercare housing according to their own care concepts and their residents' needs. Furthermore, there are differences with respect to the number of residents, the physical setting, and domestic character between different countries (Verbeek et al., 2009).

Swedish eldercare has adopted the principle of *aging in place,* "remaining in the same residence where one has spent his or her earlier years" (Harris, 1988). Other actions such as home care and home services are always considered before AL.

An ALF provides three main functions for the residents: an individual housing unit or home, domestic care, and a social context.

The number of assisted living facilities (ALFs) have been reduced because of increased home care and home services, publicly initiated accessibility measures in ordinary housing, and improved health status. As a result, residents in ALFs are older, frailer, and suffer from more ailments and diseases. In Sweden, approximately 5% of all people 65 years old or older and 14% of the population 80 years old or older live permanently in ALFs (National Board of Health and Welfare, 2013). Of this latter group, 69% are women. In this study, the average age of residents was 88.2 years (89.8 years for women and 84.4 years for men). A major, and increasing, number of these residents suffer from dementia and other cognitive diseases: in 2006, 64% suffered from dementia or other cognitive disease (National Board of Health and Welfare, 2007). Most AL units are intended either for persons with dementia and other cognitive disorders or for residents with mainly somatic disorders, although people developing dementia may live in somatic units.

Home in Assisted Living

An ALF provides three main functions for its residents: an individual housing unit or home, domestic care, and a social context (Swedish Government, 1990; SFS 2001:453). From a sociological standpoint, Gurney and Means (1993) describe how one's home becomes increasingly important with age. Older people become increasingly reluctant to move from their friends, neighbors, and physical home. From a gerontological perspective, Sixsmith (1990) describes the meaning of home as an increasing attachment to the place paralleled with a decreasing physical range, a view also shared by Pastalan and Schwarz (1977). Paulsson (2002), studying AL from an architectural perspective, describes four

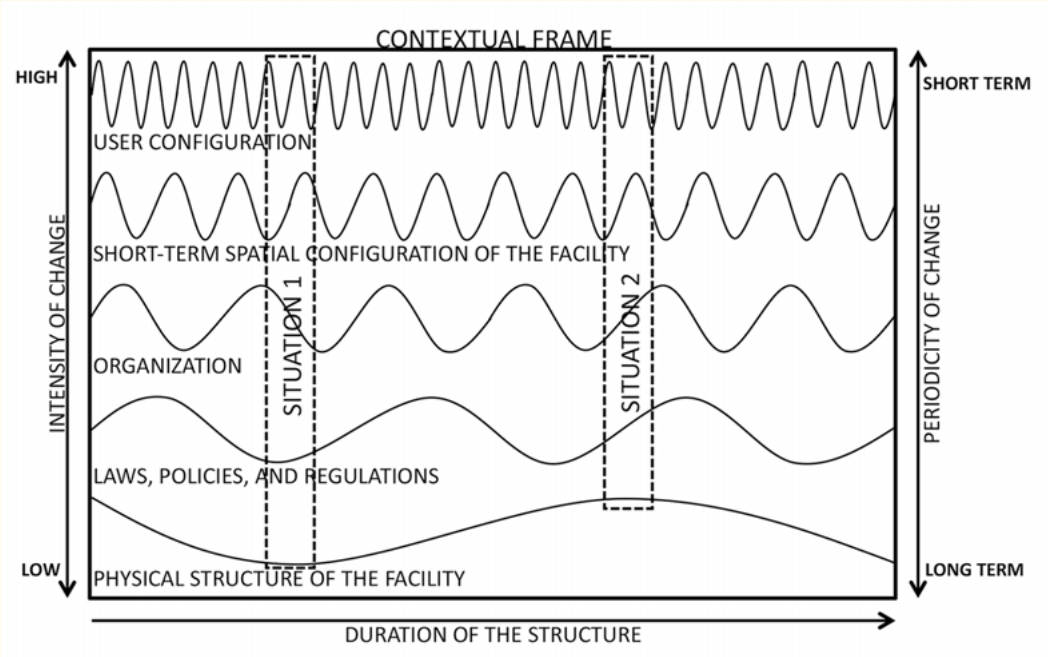
dimensions of a home: the practical, the location and design and other physical characteristics; the social, the interaction between people; the communicative, communication and wayfinding; and the existential, the subjective perception of the place. Although an individual apartment is a private housing unit and the common spaces are shared, some of the action that usually takes place in the privacy of the home (e.g., eating and socializing) is carried out in the common spaces (Lundgren, 2000). Previous research has pointed out that people create private spaces in common places and the private may become public in an AL situation (McColgan, 2005; Nord, 2011a; Twigg, 2000).

Usability in Built Environment

The International Organization for Standardization (ISO) defines usability as "the extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use" (International Organization for Standardization, 1998). Usability is an effect of the interaction between users and artifacts, here the physical environment (Blakstad, 2001). This effect must be related to the functionality of the artifact to define the extent of usability (i.e., the effect of the human–environment interaction) (Warell, 2001). Functionality is related to whether a task can be performed. Fänge and Iwarsson (2003) describe three components related to the concept of usability: person, environment, and activity (P-E-A transactions).

Figure 1. Varying contextual landscape.

This figure attempts to show the varying contextual landscape of the usability of a building in use. All parameters have to be considered in the specific situations (situation 1 and 2). Changes in the physical structure are related to a low intensity of change, in terms of rebuilding, etc., and to a long-term periodicity of change. Changes in the user configuration are, contrarily, related to a high intensity of change and to a short-term periodicity of change.



Based on the Ecological Theory on Aging (Lawton & Nahemow, 1973), Wahl, Iwarsson, and Oswald (2012) have discussed the concept of *agency* as an aspect of use. As with us, they also stress the complexity of Person–Environment (P-E) interactions and that the "user interface" must be assessed in its specific context. Use, from our perspective, contains the activity aspect. The environment consists of the physical structure in the specific context or situation in a building in use (see Figure 1). How the usability of the built environment is perceived depends on the continuously changing context and the attitudes of the users (Rasila, Rothe, & Kerosuo, 2010).

One major problem is how to identify present and future users and, as a consequence, how to obtain and interpret relevant information. A multi-methodological strategy is used to describe the complexity of usability (Blakstad, Hansen, & Knudsen, 2008). By exploring the daily use of the common spaces, users' knowledge can be incorporated during the design and construction process through multi-method data collection of the daily use of common spaces by primary users (residents and staff). Several researchers have recognized the importance of feedback from the primary users throughout a building's life cycle (Alexander, 2006; Blakstad, 2001; Fenker, 2008; Kärnä, Junnonen, & Nenonen, 2010; Leaman, 2000).

Research Questions

Three questions are posed:

1. How do the diverging objectives for use among the primary users affect the usability of the common spaces?
2. How do users and other stakeholders demarcate the common spaces regarding their function and significance in relation to the concept of home in a social context?
3. How do the incongruences between the primary users' experiences and other stakeholders' preconceptions of the function and significance of the common spaces influence planning?

The objective of the first question is to explore the functionality and to illuminate the contextual complexity by displaying diverging objectives for use among the primary users. The objective of the second question is to explore how users and other stakeholders demarcate the common spaces as venues for social interaction in relation to the concept of home. This question also concerns the demarcation of the individual home. In addition, this question looks at how the participants view the different functionalities of the common spaces (e.g., kitchen, sitting room, and dining room). The objective of the third question is to display diverging preconceptions about the AL concept among primary users and other stakeholders, and it addresses the importance of exploring the actual use in relation to the planning stages, (i.e., the stages in the building process preceding the construction stage).

Table 1. Methods Used in the Study

Method	Participants	Persons Involved	Date(s)	Time in Hours
1. Participant observation	Residents	199	2009, 2010, 2012	200
	Unit staff	103	—	—
2. Group interviews	Unit staff	24	2011	10
3. Individual interviews	Residents	10	2012	10
	Relatives	4	2012	6
	Planners	4	2012	8
	Architects	3	2012	6
4. Questionnaire	Unit staff, heads	193	2012	50

Total number of persons involved: 540
Total number of hours: 290

Design and Methods

To define the problem more fully, we relied on four exploratory research methods: observations, group interviews, individual interviews, and questionnaires (see Table 1).

Methodological Considerations

We combined quantitative and qualitative methods (Groat & Wang, 2002; Patton, 2002) to enhance the validity of the results (Onwuegbuzie & Johnson, 2006; Tashakkori & Teddlie, 2010). Specifically, we used *method triangulation* (different methods) and *data triangulation* (different data sources) (Denzin, 1978).

The results were analyzed using Qualitative Content Analysis (QCA) based on Graneheim and Lundman (2004). This analysis required that the material from the observations be coded by identifying *meaning units* or "the constellation of

Table 2. Themes

SPATIAL THEMES	USER THEMES
• Common spaces • Apartments and related space • Other indoor spaces • Staff and service space • Outdoor and balconies	• Degree of use • Somatic vs. dementia units • Intended vs. actual use • Residential vs. workplace perspective • Assistive equipment • Mobility • Organization and routines • Conflicts • Environmental aspects • Social aspects and external contacts • Group characteristics • Models and ideals

words or statements that relate to the same central meaning" (p. 106). From these meaning units, a number of themes were derived related to space and users (see Table 2).

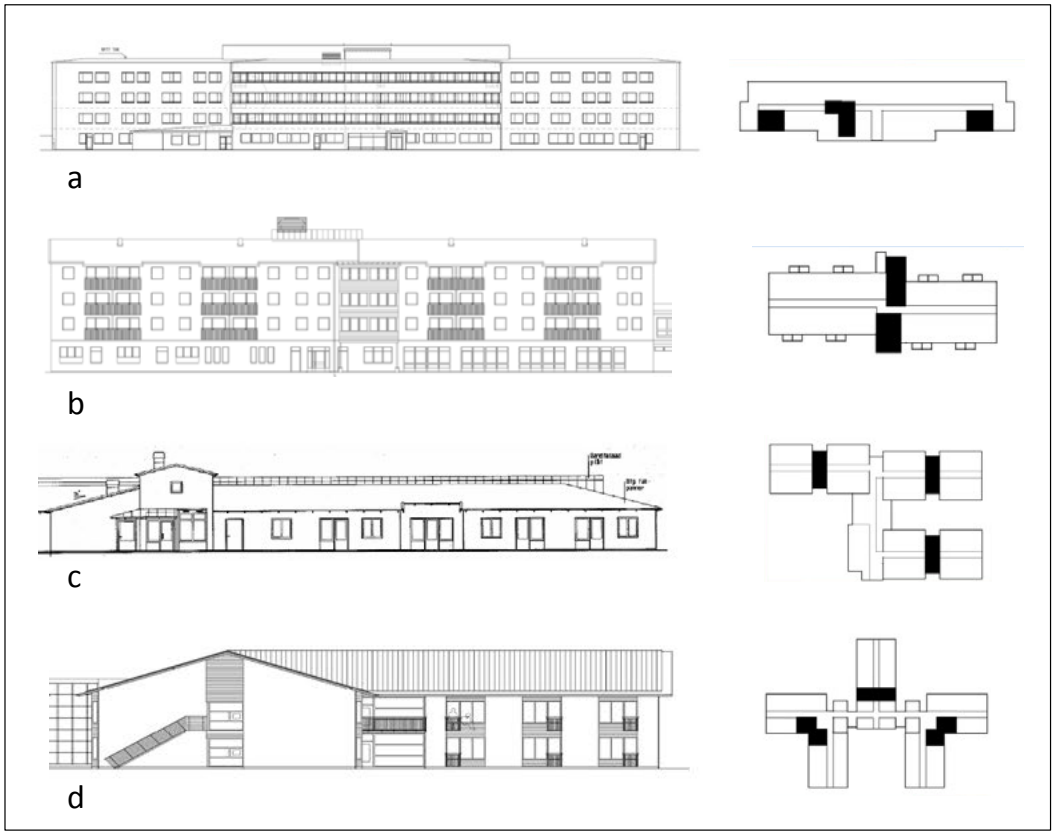
The results are replicable in relation to the specific research questions and the outcome is transferable to eldercare environments in Sweden and worldwide due to the structural similarities of AL facilities or similar environments.

Research Strategy

The 14 ALFs included in this study reflect the development in eldercare facilities during the last century and are representative of the majority of facilities used for AL in Sweden. Figure 2 shows four of the facilities included in the study. The sample represents diverse locations, building periods, original use, and size (see Table 3). Data were collected using structured and non-structured participant observation, semi-structured interviews with groups or individuals, and a self-completion questionnaire. Facility "a" was built as a nursing home in 1971 and rebuilt for AL in 2005 (White Architects, 1970; Krook & Tjäder Architects,

Figure 2. Elevations and schematic plans

Elevations and schematic plans of four of the facilities included in the study (a–d). Common unit spaces marked in black. The drawings are not made to scale.



2004). Facility "b" was built for service housing in 1980 and rebuilt in 2009 for AL (Kullenberg Architects, 1979; Lundberg Architects, 2009). Facility "c" was built for AL in 1993. The architecture is small-scale and all apartments have individual garden terraces (Lundberg Architects, 1992). Facility "d" was built for AL in 2001. The facility presents larger scale architecture but the apartments are smaller, compared with the other facilities (Arkotek Architects, 2001).

The observation sessions were conducted in two rounds in five of the 14 facilities and included six dementia units and nine somatic units (Table 3). The first round of observations contained non-structured participant observation sessions at various times to capture the daily use (McKechnie, 2008). Performed 1 year later, the second round comprised structured observations (Bryman, 2008), with the primary aim being to explore the residents' presence in the common spaces. The degree of participation was moderate (Dewalt & Dewalt, 2002), allowing verbal interactions between the observer and participants without the observer participating in the actions.

The second method used was the semi-structured group interview. Five groups, consisting of between three and seven participants from all 24 members of the unit staff, were interviewed. The participants were chosen randomly depending on who was working during a specific session, and they came from both somat-

Table 3. Facilities and Units Included in the Study

FACILITIES					UNITS		
Original Function	Location	Built	Rebuilt	Residents per Facility	# of Dementia Units	# of Somatic Units	Method(s)*
Private apts.	Central Gothenburg	1912	1992	39	1		4
Home for aged	Smaller municipality	1959	1994	66		1	4
AL	Smaller municipality	1966	1984	61	1		4
AL	Smaller municipality	1966	2011	52		1	3
Nursing home	Central Gothenburg	1968	2009	138	1	1	4
Nursing home†	Central Gothenburg	1971	2005	75	2	2	1, 2, 3, 4
Service apts.	Suburban Gothenburg	1971	2005	50		1	3
Hotel	Central Gothenburg	1976	2008	60		1	3
Service apts.†	Central Gothenburg	1980	2009	98	2	2	1, 2, 3, 4
AL†	Suburban Gothenburg	1993	—	24		2	1, 2, 3, 4
AL†	Rural Gothenburg	1993	2007	20	1	2	1, 2, 3, 4
AL	Larger municipality	1994	—	71	1		3
AL	Rural Gothenburg	2000	—	38		1	4
AL†	Suburban Gothenburg	2001	—	72	1	1	1, 2, 3, 4

Total number of facilities included: 14
Total number of units included: 10 (dementia); 15 (somatic)

NOTES:
* See Table 1.
† Facilities included in the observations.

ic and dementia units. An interview guide (Bryman, 2008; Patton, 2002) was used, with 30 open questions based on the coded themes from the observations.

The third method, the individual semi-structured interview, included 21 people and used a revised interview guide based on the observations and the group interviews (Table 4). First, 10 residents (5 women and 5 men) were interviewed. They were chosen to represent maximal age distribution (73 to 102 years), different sexes, varying mobility (two used wheelchairs and seven could walk independently (with or without walking aides) (Figure 3), and time of residence (from less than 1 to more than 7 years). Finally, 11 persons were interviewed who represented other stakeholders in the planning or management of eldercare facilities. Of these, four had key positions in eldercare planning or were responsible for eldercare facilities in Gothenburg. After that, three architects involved in the design or research of eldercare facilities in Sweden were interviewed. Finally, four relatives were interviewed.

The fourth method was a quantitative self-completion questionnaire with 19 closed questions (Bryman, 2008), either with single or multiple response options. The questionnaire was sent to 177 unit staff and 16 heads in the 14 facilities (Table 3). The total response rate was 55%. The questions were based on the

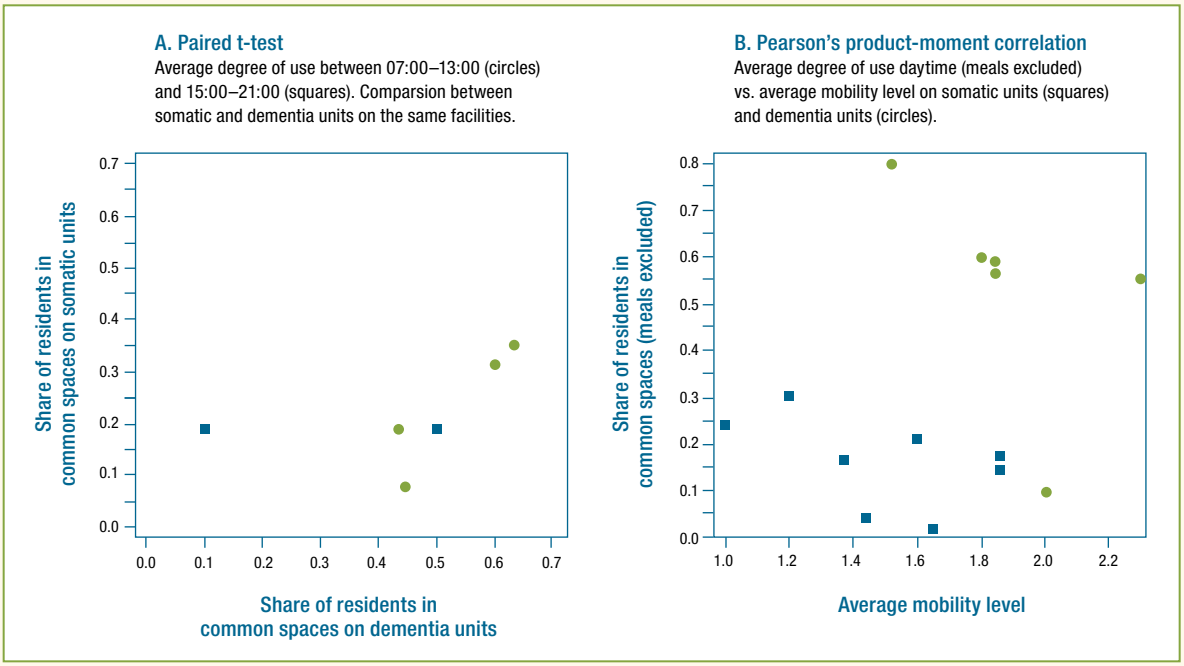
Table 4. Individual Interviews

FUNCTION	PREREQUISITES
Residents in the Five Facilities Included in the Observations	
• Female resident	92 years old, resident for 5 years on somatic unit, mobility 1*
• Female resident	92 years old, resident for 1 year on somatic unit, mobility 2
• Female resident	89 years old, resident for 7 years on somatic unit, mobility 1
• Female resident	87 years old, resident for 2 years on somatic unit, mobility 1
• Female resident	83 years old, resident for 7 years on somatic unit, mobility 1
• Male resident	102 years old, resident for 4 years on somatic unit, mobility 1
• Male resident	94 years old, resident for 3 years on somatic unit, mobility 1
• Male resident	87 years old, resident for 4 years on somatic unit, mobility 1
• Male resident	82 years old, resident for 3 years on somatic unit, mobility 2
• Male resident	73 years old, resident for 1 year on somatic unit, mobility 1
Other Stakeholders	
• Female relative	Born 1960, with demented mother on dementia unit in mid-size town
• Female relative	Born 1963, with aged father on somatic unit in central Gothenburg
• Male relative	Born c.1950, with recently deceased mother on somatic unit in smaller municipality
• Male relative	Born c.1960, with mother-in-law on somatic unit in suburban Gothenburg
• Female architect	Born c.1970, with experience designing AL facilities
• Female architect	Born c.1950, with experience of research on environments for older people
• Male architect	Born c.1955, with experience designing AL facilities
• Female head	Born c.1960, with strategic tasks concerning eldercare in Gothenburg
• Male head	Born 1962, with strategic tasks concerning eldercare facilities in Gothenburg
• Male head	Born c.1950, with strategic tasks concerning eldercare facilities in Gothenburg
• Male head	Born c.1960, with strategic tasks concerning eldercare in Gothenburg

NOTES:
* See Figure 3.

Figure 3. Diagrams of a paired *t*-test and Pearson's product-moment correlation.

Diagram A shows a paired *t*-test. Each circle or square represents the residents' average presence on one somatic and one dementia unit in the same facility. Mean value on somatic units were 0.24 and on dementia units 0.54. **Diagram B** shows Pearson's product-moment correlation. The squares represent eight somatic units and the circles six dementia units. An average share of all residents living on the unit, who were present in the common spaces, is related to the average mobility level of the residents on each unit. According to the classification below, the residents' average mobility in the dementia units was 1.9, compared with 1.6 in the somatic units. *Mobility 1:* The resident can walk independently, with or without walking aides. *Mobility 2:* The resident uses a standard size wheelchair for transportation. *Mobility 3:* The resident is dependent of assistance for transportation and uses a large size wheelchair.



revised interview guide and corresponded to the themes derived from the observations and interviews.

The degree of presence was measured by the average number of residents concomitantly present in the common spaces (Figure 3, Diagram A). This was analyzed by using the paired *t*-test (Hazelwinkel, 2001). The relation between mobility and presence (Figure 3, Diagram B) was analyzed using Pearson's product-moment correlation (Rider, 1932). Both diagrams show a higher presence on the dementia units. No significant correlation can, however, be found between mobility and presence.

Results

The results are presented in accordance with the three research questions and triangulate the results from observations, interviews, and questionnaires.

Objectives for Use

How do the diverging objectives for use among the primary users affect the usability of the common spaces?

ALFs encompass the dichotomous functions of home and workplace, two user perspectives, and diverging objectives for use between residents and staff. The observations showed that this conflict is discernible at a functional or structural level concerning the physical environment and at an organizational level concerning persons and routines (Andersson, Lindahl, & Malmqvist, 2011).

At the functional level, two conflict areas are related to the planning stage. The first area concerns the lack of space, a limitation that causes conflicts between the residential and workplace perspectives. For example, many of the units lack space for service functions or documentation and the increasing use of assistive technology such as wheelchairs, lifts, and walkers causes conflicts between the intended and the actual use. In the questionnaire, the staff ranked which parts of the physical environment they were most satisfied with (multiple options). The documentation spaces and sanitary spaces scored lowest, an 8 and a 12, respectively (both scores are out of 212 possible points). The same spaces scored highest when the participants were asked which spaces they were least content with (multiple options), 66 and 31, respectively (both scores are out of 182 possible points).

The group interviews reveal another conflict between the residential and workplace perspectives in the dementia units. An open design with combined kitchen and dining areas, which is the case in all 15 units in the observation study, promotes overview and closeness between food preparation and serving, but also causes acoustic disturbances and obliges the staff to keep drawers and refrigerators locked.

The second conflict area occurs when the original function of the building is altered through a rebuilding. Functional properties of the building remain in the structure and cause divergence between the actual and the desired function. This may be the case when a new subdivision of the facility requires reorganized common spaces.

At the organizational level, two conflict areas are also discernible. The first conflict area is related to long-term contextual divergences between the current use and the intended function of the building. The common spaces are intended for social interaction, but this is counteracted by the declining capabilities of the actual users and reflected in the low degree of use (Andersson, Lindahl, & Malmqvist, 2011). The second conflict area that is related to the organizational level is represented by short-term contextual variations related to daily use. The observations showed that the lighting routines in the common spaces vary considerably. In some units, the dome lights were turned off in the corridors, creating dark spaces. In some cases, all artificial lighting in the common spaces was turned off after supper, after which they were not used. Another example is that in half of the units the televisions were continuously turned on, in many cases with high volume. Both examples suggest a divergence between the residential and workplace perspectives—the staff's routines dominate over the residents' possibilities to use the common spaces.

The usability of the common spaces depends on a number of other contextual parameters and can only be discussed in relation to other situations (see Figure 1, above). Three contextual perspectives can be related to this discussion. The *actor perspective* means that the perceived usability will differ depending on the user. The *time perspective* means that use inevitably will change over time due to both functional and organizational aspects. Finally, the *space perspective* addresses the various functions of AL: as a private home for the resident; for care, closely related to workplace issues; and as a social context, specifically pertinent to the common spaces. The options of being private and socializing both comprise private and public or semi-private aspects. Social activities taking place in the common spaces display a variation from public entertaining to private activities, activities that normally take place in a private home (Lundgren, 2000). The questionnaire asked the staff to rate six factors that possibly affect the residents' use of the common spaces: the design of the sitting and dining room; staff's attitudes; staff's routines; the residents' mental capacities; the residents' physical mobility; and the residents' need for social interaction. Out of 227 possible points (multiple options), "the residents' need for social interaction" scored highest at 77 and, surprisingly, "the staff's attitudes" and "routines" scored lowest, 31 and 26, respectively.

Another issue, partly related to the organizational level, is the diverging degree of use between common spaces in dementia and somatic units, suggesting diverging objectives for use of space. The observations indicated a higher presence on dementia units compared to somatic units, where residents spent more time in their apartments (Andersson, Lindahl, & Malmqvist, 2011). To provide a social context is a core issue for staff for all the units, whereas to maintain a certain degree of surveillance is a dominant issue on the dementia units. The higher presence on the dementia units is confirmed by the majority of the staff. The responses to the questionnaire, however, displayed significant divergence between dementia unit and somatic unit staff. The questionnaire asked the staff whether the sitting and dining rooms, to a great extent or completely, were frequently used by the residents on their unit (single option). This question scored 29 out of 33 possible points on the dementia units. The corresponding result on the somatic units was 35 out of 52 possible points (i.e., a lower share). Another question was whether the residents with dementia, to a great extent or completely, were more likely to stay in the sitting and dining rooms compared to other residents (single option). This scored 24 out of 32 possible points on the dementia units, compared to 25 out of 50 possible points on the somatic units, which is a lower share, compared to the dementia units.

The staff was also asked how the physical environment impacted the residents' opportunities for social interaction and the staff's routines. Out of 197 possible points (multiple options) "the residents' opportunities for social interaction" scored highest (78) and "the staff's routines" scored lowest (26).

The staff gave diverging views on home–workplace conflicts in the questionnaire. The staff were asked if, and how often, explicit conflicts concerning the use of the common spaces occurred on their unit (single option); "seldom or never" scored 103 out of 106 possible points. They were then asked what conflicts

would occur (multiple options). Out of 88 possible points, "between residents" scored 45, "between staff" scored 24, "between residents and between residents and staff" scored 12, and "between staff and residents" scored 7. These results indicate that the staff seldom experience explicit conflicts. They also suggest that conflicts between the residents dominate and conflicts between the residents and staff are rare. The results are further validated by the residents, four of whom said that they have experienced conflicts with other residents.

The Demarcation of Home

How do users and other stakeholders demarcate the common spaces regarding their function and significance in relation to the concept of home in a social context?

The main purpose for AL is to provide a home-like housing environment with residential care. The collective idea is discernible both in the congregation of persons in the same predicament and in the physical structures. To apply the home concept to AL, we have to explore the demarcation of home in this context. The staff in the group interviews displayed an ambiguous relation to the concept of home in AL with ansewer such those below.

> **Staff:** It's a form of hospitalizing when they move here. It's not like moving to another apartment.
>
> **Staff:** I don't think you can feel at home any other place than when you are "at home." We try to create a home-like environment.
>
> **Staff:** The whole house is their home. Of course we work in their home.

The staff was asked to associate AL with one of three alternatives: home or housing unit; hotel; or healthcare institution (single option). Out of 106 possible points, "Home environment" scored 58, "hotel" scored 22, and "healthcare environment" scored 26. The same disparities are found among the 10 interviewed residents. Four associated AL to a home environment, three to a hotel, and three to a health care institution. Nine out of 10 residents, however, stated that the AL was their home. Circumstances had forced seven residents to leave their previous homes, leaving them no other choice. Their responses included:

> **Resident:** Yes, this is my home! But not really.
>
> **Resident:** Yes, now I feel at home here. I can't cope to live anywhere else.
>
> **Resident:** Yes, this is home, because I couldn't have two places and I couldn't cope on my own. They mistreated me with medications and I became blind. My cousin lives in the house where we all grew up. I would have liked to live there, but it's not possible.

There is an obvious demarcation between the apartments and other spaces. This is confirmed by the residents. Nine of 10 residents consider the apartment more as their home.

Resident: No, the apartment is my home. The day room [sitting room and dining room] is more for socializing.

Resident: I don't live in the common spaces. I just spend time there.

Resident: The apartment is my home. The sitting room is more like a lounge. If you want to be alone, you can stay in the apartment.

The questionnaire asked the staff whether they agreed, either completely or to a great extent, that they enter a home when they enter an apartment or unit (i.e., a group of apartments with shared common spaces). Out of 103 possible points (single option), "apartments" scored 86 and "unit" scored only 33. This relation is mainly confirmed in the group interviews.

Another demarcation is suggested with respect to the common kitchen. Although it is a part of the residents' housing arrangement, common kitchens are regarded more as the staff's domains. In the observations, residents were never seen using the kitchens. Furthermore, none of the 10 interviewed residents ever used them. The questionnaire asked the staff how they perceived the common kitchens: as their workplace or the residents' home (single option). "Workplace" scored 60 out of 103 possible points. The same question was asked regarding the sitting and dining rooms (single option); in this case "home" scored 86 out of 104 possible points.

The residents were presented with four options to how they perceive their fellow residents: a family-like group, neighbors, fellow guests, or strangers. The results diverge considerably. Two relate to the others as neighbors and two describe them as more like a family. Two place them between family and neighbors. One resident said that some are neighbors and some are members of a group of guests. One resident said that they are all like guests in a hotel. Finally, two said that although they are neighbors, they are even more like strangers to them because they cannot talk to them, as would be the case in ordinary housing. Nearly all staff in the group interviews stressed that they are not like a family group, as they do not have the same close relation to their fellow residents. The same options were presented in the questionnaire. Out of 104 possible points (singe option), "neighbors" scored 67, "guests at a hotel" scored 24, "family group" scored 10, and "strangers" scored 3.

The common spaces do not belong to individual persons. Although they are a part of the housing arrangement, the conception of the "common" spaces among both residents and staff seem to be concentrated to sitting and dining rooms, partly excluding the kitchens. Earlier research (Andersson et al., 2011; Frankowski, Roth, Eckert, & Harris-Wallace, 2011; Moore, 1999; Nord, 2011a) has shown that the most frequent and reoccurring events are the communal meals. This, in turn, makes the dining room function the most used and implies another demarcation between the communal dining room and the sitting room. The functions can be described in a public–private continuum between the private and public domains (see Figure 4).

Figure 4. A continuum from private to public is related to the functions of AL spaces.

Primary Users versus Other Stakeholders

How do the incongruences between the primary users' experiences and other stakeholders' preconceptions of the function and significance of the common spaces influence planning?

The staff members in the group interviews and the interviewed residents were unanimous in stressing the importance of the common spaces as venues for social interaction. One limitation is that the interviewed residents all lived in somatic units and that the experiences of the residents with cognitive disorders were explored via direct observations respectively mediated through the staff. Although the significance of the common spaces is further pointed out in the group interviews and the questionnaires, the other stakeholders are more ambivalent. The small number of other stakeholders presents another limitation. It can be argued, however, that the great divergence in this small selection is as significant as finding convergence in the larger group of residents and staff:

> **Key person:** Yes, but you must not exaggerate their importance! When I have been on an AL unit, there has not been a living soul in the common spaces. The apartments are the essential.
>
> **Architect:** I suppose they are important. They can be tragic–often there are a few persons sitting there. It is difficult to socialize. Most people are in their rooms. They roll out the sick to watch TV, but often they are too sick to register what is happening.
>
> **Relative:** They are not particularly important today, considering the status of the residents. They are so tired, demented, deaf. They don't feel like socializing.

Another divergence concerns user involvement. The group interviews revealed ambivalence concerning the planning of the localities and furnishing of the common spaces. It is evident that the staff's experience and knowledge has not been used or has been used too late, but there is also recognition of the need for professional skills as well as involving the residents:

> **Staff:** We came here to have a look before it was finished and we pointed out a number of deficiencies, but they didn't pay attention to them, because everything was already planned.
>
> **Staff:** We would have needed professionals to help out with the furnishing.
>
> **Staff:** One person cannot decide, but the residents should have influence.

The other stakeholders mainly agree with the staff. There is consensus about user involvement at an early stage in the process and that the representation should include as many interests as possible. No one knows exclusively what the result should look like:

> **Architect:** People from different staff categories must be involved in the process as early as possible.
>
> **Key person:** The residents must participate if possible. Relatives must also participate to represent the residents.

There are, however, a number of problems associated with user involvement (Ryd & Fristedt, 2007). One major issue, pointed out by both staff and other stakeholders, is how to involve the residents. One obstacle here is to find the most representative residents; another is that these may not be the same throughout the process. Another problem is how to communicate with the users. Furthermore, there is a problem in forecasting future use.

Discussion

Assisted living serves two primary functions: as a home and a workplace. The diverging objectives for use among the primary users of ALFs result in conflicts, implicit or manifest, on both a functional and an organizational level, although explicit conflicts are rare. When manifested, conflicts between residents dominate. This study confirms that the concept of home applied to AL is complex. There is also great divergence between the groups and between different data sources. The short residential periods (2.5 years on average in this study), the diminutive apartments, the increasing focus on care aspects, and the expanding use of assistive technology compromise the residential aspects.

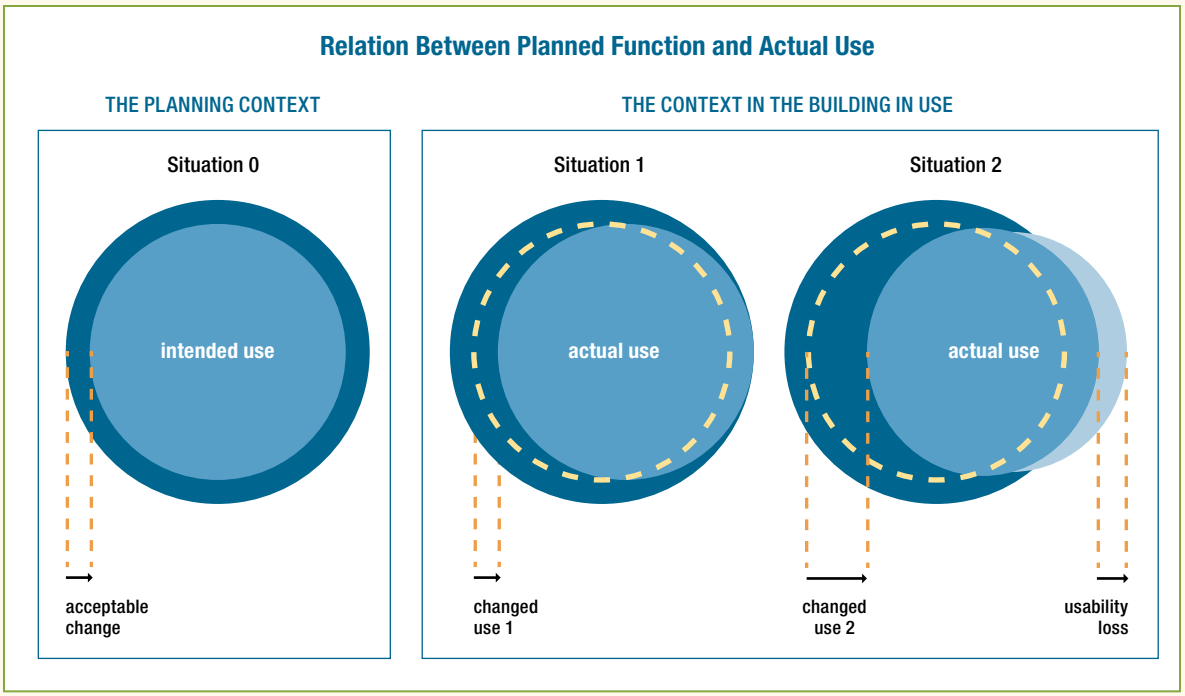
Although the results support a higher presence on the dementia units, it is suggested that the staff on the dementia units were more likely to agree than the staff on the somatic units. The results also demarcate the kitchens as primarily the staff's workplace. Furthermore, the reoccurring common meals demarcate the dining room as the most used space. The staff plays a major role as social facilitators; however, the results of the questionnaire diverge from the other data, as staff rate their attitudes and routines lowest when assessing the impact on the use of the common spaces.

Diverging approaches to the concept of home and to the function and significance of the common spaces are indicated between primary users and other stakeholders. No straightforward explanation to this is suggested. One issue may be the varying closeness to the AL experience. Another issue could be that the social interaction at mealtimes is sufficient for the majority of the residents who can choose for themselves. Further research is needed to address this issue properly.

Long-term as well as short-term contextual factors have to be considered when discussing the usability of common spaces. These factors concern the contextual perspectives of users, time, and space and involve change, which can be

Figure 5. Planning, actual use, and loss of usability.

Situation 0 shows the planning context, with room for an acceptable degree of change. **Situation 1** shows how the actual use is changed, in relation to the planning context but fits within the intended function. **Situation 2** shows how the actual use no longer fits within the intended function, which causes a loss of usability.



expressed by the difference between the intended and the actual use. Figure 5 illustrates the relation between planned, or intended, function and actual use. The black circles represent the intended function. This difference has been an overarching issue here.

A great challenge is how to involve the residents in the planning. Finding representative users, communicating with them, and predicting use present problems. There are also large cohort variations related to age, sex, economic and social status, etc. (Uhlenberg, 1988). The residential perspective is represented by both residents and staff and the staff possesses knowledge about both the usability of the facilities and about the requirements of the residents. Another issue is the collective idea related to the common spaces, pointing out the importance of implementing a general design scheme generally agreeable to the majority.

It is evident that more knowledge is needed in the conception and designing of ALFs. Clearly, such knowledge is to be found among users, among the other stakeholders, and among researchers. One objective for future research is to explore and map this knowledge, but also to translate the particularities and the residential and workplace perspectives into schema that are valid in a greater context and over time.

It is evident that residential aspects in AL have to be discussed concomitantly with workplace aspects. Regardless of how the localities are initially designed and physically organized, the continuous contextual changes reshape the requirements on the physical environment. If we cannot foresee the requirements, inherent conflicts inevitably will become manifest as a result of the physical design. Therefore, it is relevant to identify and describe these conflicts from the residential and workplace perspectives and to explore the actual use versus the intended use of the common spaces.

It is evident that residential aspects in AL have to be discussed concomitantly with workplace aspects.

ALFs may never be real private homes, but it is important to discuss a home-likeness in common spaces that is generally agreeable to the majority of residents. The demarcation between the diverse functions of the common spaces suggests diverse approaches congruent with the findings in the study. If a private apartment and the common kitchen mark two extremes, the dining and sitting rooms, along with complementary spaces, represent transitional spaces. Hence the common spaces can be seen as a composition of several sub-concepts in the intersection of different perspectives.

One of the great challenges in ALFs, as well as in many institutional environments, is to stimulate residents or patients to take possession of the physical room. A design of the different spaces better adapted to fit the different functions could promote or counteract interaction, depending on whether interaction is considered desirable or not. The issue would be to create different home-likenesses depending on the functions of the spaces.

How to involve the elderly residents in the planning of contemporary or future ALFs is a core issue. We identify two strategies to deal with future use. One is to identify who the users will be and accordingly how a space will be used; a number of problems are implied here related to the contextual variations. The other is to build robust environments that admit a certain degree of flexibility of the building in use. Both strategies imply problems related to specificity and generality, respectively.

This article explores the daily use of existing buildings to find directions for future planning and construction of ALFs. The collective idea of AL or similar environments will presumably persist in the future. The general tendency in Sweden, as well as in many other countries, seems to be an increased focus on care. This focus implies a risk that residential aspects may be underemphasized, but it also puts the focus on the physical environment as part of the care concept. It is both in the long-term building and rebuilding processes and the short-term spatial configurations where users' knowledge and experience, along with new research contributions, can impact AL, both in the present and in the future.

How to involve the residents, or the elderly, in the planning of contemporary or future ALFs is a core issue.

Implications for Practice

- There are a number of functional demarcations in the physical environment on AL units. A more diversified design is suggested, in order to elucidate these functions.
- The kitchens are included in the common spaces, but used very little by the residents. They are also more regarded as the staff's workplace than the residents' home. It is suggested that special attention be given to the functions of the common kitchens in the planning of AL facilities.
- The common spaces are between the private and public domains, representing both the residential and workplace perspectives. A different approach to home-likeness is suggested here, compared to the apartments and to other spaces in the facilities. It would be appropriate to take both perspectives into consideration at the planning stage so that conflicts do not become manifest in the physical environment.
- The common spaces are regarded as important for the social interaction between residents and between residents and staff. They represent a physical addition to the apartments, without parallel in ordinary housing. It is suggested that extra value in the daily life on AL units can be added by giving special attention to these spaces at the planning stage.
- The residential perspective is poorly represented by the actual users. Although the users are continuously changing, to include residential perspective would be useful in future planning. And while forseeing future needs would be useful, it would also be helpful to build robust environments that allow changes in use.
- Care aspects dominate, given that AL residents are old and multi-diseased. Residents may live for many years in AL facilities, but there is an obvious risk that the residential perspective is under-emphasized.

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Environmental Cues: Their Influence within Assisted Living Facilities

Jeanneane Wood-Nartker, PhD, IDEC; Denise A. Guerin, PhD, FIDEC, FASID, IIDA; and Emily Beuschel

ABSTRACT

OBJECTIVE: This observational study examined the relationship between the number of environmental sensory cues within assisted living facilities (ALFs) and the number of falls by residents, using Lawton's environmental press theory as framework.

BACKGROUND: A result of declining physical health is unintentional injury, for example, falling, which is one of the leading causes of death for older adults. Physical limitations increase largely due to age-related physical and sensory decline, which can increase the risk of people falling. Therefore, fall prevention becomes essential (Willis, 2000).

METHODS: On-site interviews were scheduled with 140 ALF directors located in the lower peninsula of Michigan. The researchers collected physical environmental data using a sensory cue checklist on a subset of rooms, for example, Lounge/Living Room, Dining Room, Corridor, Public Restroom, and Foyers in ALFs, because of the prevalence of falls within these rooms.

RESULTS: Findings showed that fall rates and environmental cues sometimes have a negative correlation. A positive correlation was found between the number of residents living in an ALF and the mean number of cues included in the overall environment. Finally, there were a greater number of environmental cues incorporated when design professionals were involved.

CONCLUSIONS: The need to control for facility size and for some room types when relating environmental cues to falls became clear. In addition, design professionals should have a thorough understanding of the nature of the facility and the need to control some factors in facilities, especially when including environmental cues.

KEYWORDS: Built environment, elderly, evidence-based design, falls, safety

AUTHOR AFFILIATIONS: Jeanneane Wood-Nartker is a Professor of Interior Design at Central Michigan University in Mt. Pleasant, Michigan. Denise A. Guerin is the Morse-Alumni Distinguished Professor of Interior Design at the University of Minnesota in Minneapolis, Minnesota. Emily Beuschel is a Research Assistant at Central Michigan University in Mt. Pleasant, Michigan.

CORRESPONDING AUTHOR: Dr. Jeanneane Wood-Nartker, PhD; wood1bj@cmich.edu; (989) 774-5549.

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Objective

As people age, their chances of falling escalate. Falls are the leading cause of unintentional injuries and death among adults aged 65 or older (Ray & Horvak, 2011). In addition, there were 2.3 million non-fatal fall injuries treated in hospital emergency rooms in 2010 (Centers for Disease Control, 2011), up from 1.8 million in 2005. Because of the potential for serious consequences, falls for older adults are a major healthcare concern, one which can be impacted by the physical environment in which people age (Calkins, 2009).

The physical environment is especially important because of two trends occurring within the United States that have implications for society as a whole. The first trend is the increasing older adult population. Baby boomers are now approaching retirement age, and better health, wealth, and education have increased the number of people living to 80 years and beyond. The second trend involves safely providing universal access to the built environment, which has become a focus since the adoption of the Americans with Disabilities Act (ADA) in 1992.

One built enviroment in which it is imporant to ensure universal access is the assisted living facility (ALF). ALFs seek to provide a residential-like housing option for older adults (Schwarz, 2001). They are viewed as positive alternatives to nursing homes, and sometimes even as favorable alternatives to living at home because of the available support services for residents.

The built environment can function more effectively for ALF residents through the use of appropriately designed environmental stimuli, such as a contrasting colored door serving as a cue to alert residents of an unauthorized room. Furthermore, environmental stimuli can communicate to residents through multiple sensory systems to ensure that messages about the environment are received. To that end, the purpose of this study was to explore whether there was a relationship between the number of sensory cues available within public spaces in ALFs and their impact on falls.

Background

In 2010, the number of older adults 65 years or older in the U.S. had grown to 40.3 million, representing 13% of the population. By 2030, this number is expected to increase to 72 million, representing 20% of the population (Environmental Protection Agency, 2010). As these adults continue to age, the number of people age 85 years or older is expected to quadruple to 20.9 million by 2050 (Federal Interagency Forum, 2008). Of this number, it is anticipated that more than half will have some type of physical limitation or diminished levels of physical and cognitive abilities, which decrease the ability to process information about their environments and increase older adults' risk of falls (Ray & Horvat, 2011).

Older Adult Physical and Sensory Issues

Age-related physical, emotional, and mental decline is an issue for older adults. Physical decline such as the loss of sensory acuity is typical to the aging pro-

The built environment can function more effectively for ALF residents through the use of appropriately designed environmental stimuli.

cess (Ray & Horvat, 2011). Sensory deterioration can impact a person's functional ability, mobility, and balance, all of which can increase the risk of falling. For older adults aged 85 years and older, the most common sensory losses include hearing and sight, which can make it difficult to acclimate to dangerous places and can affect depth perception judgments (Ray & Horvat, 2011; Willkom, 2001). Loss of vision can also affect balance (Matheson, Darlington, & Smith, 1999; Ray & Wolf, 2008; Wall, Merfeld, Rauch, & Black, 2003) and influence overall safety. This is problematic since the oldest old adults are already sensitive to external environmental influences. These losses often reduce the ability of older adults to remain independent and increase the likelihood of falls (Cacchione, 2012; Ray & Horvat, 2011).

Similarly, the balance system itself is affected by the aging process. Our system of balance enables people to sense where they are and to maintain their equilibrium while standing and walking. Impairment of the balance system can be a disabling condition for some, resulting in serious consequences such as falling (Ray & Horvat, 2011; Ray & Wolf, 2008; Spirduso, 1995; Wall et al., 2002/2003). For example, inner ear changes affect balance and can often lead to falls. In fact, more than half of accidental deaths among older adults are the result of balance-related falls (Kresevic, 2008).

Falls within the Interior Environment

The rate of falls among older adults increases with age and is higher among people who are living in institutional settings than those living independently within the community. The annual rate of falls for older adults over 65 is 33% (Centers for Disease Control and Prevention, 2010; Ray & Horvat, 2011), as high as 40% for an 80-year-old adult, and may approach 100% for institutionalized elderly adults (Rubenstein & Josephson, 2006). The mortality rate from falls increases dramatically with age, demonstrating the significance of declining functional abilities for older adults (Best, 2006; Cesari et al., 2002; Fuzhong, Fisher, Harmer, McAuley, & Wilson, 2003). Older adults generally have difficulty recovering from a fall, which decreases their quality of life. Therefore, research that focuses on design elements that reduce the incident rate of falls is vital (Dickinson, Shroyer, Elias, Hutton, & Gentry, 2001; Willis, 2000).

Housing Alternative: Assisted Living Facilities

Approximately 75% of older adults age 85 years and older choose to live in their own home, and nearly 17% choose to reside within long-term care (LTC) facilities, with one of those alternatives being assisted living. If the physical environment of assisted living facilities (ALFs) can be designed to maintain or enhance residents' physical capabilities, then residents may have an increased ability to age in place. "Aging in place" within an ALF means that after the initial move has occurred, facility staff members are able to provide additional services as resident impairments increase. This is done in the least restrictive and most home-like environment possible, often within the same facility (Chapin & Dobbs-Kepper,

2001; Molica, 2005). Because ALFs promote aging in place, identifying environmental characteristics that may decrease falls can enhance quality of life issues and longevity for a large number of older adults.

Environmental Press

The physical, psychological, intellectual, and social abilities of an individual, combined with the positive or negative demands of the environment, often enable or constrain a person from coping independently with the environment (Lawton, 1980). According to Lawton and Nahemow's (1973) docility hypothesis, adaptation can be achieved by changing the functional capacity of the individual or by changing the influence of the environmental demand. Too much stimulation can increase negative environmental press, as can too little stimulation.

Pastalan, Mantz, and Merrill's research (1973) expanded this idea by sensitizing interior designers and architects to older adult limitations through Empathic Modeling, which seeks to replicate the normative aging process for observers by modifying each of their bodily senses. One principle that emerged from their work was organized space as stimulus, which is the concept of people receiving cues about the environment through stimulation of multiple senses. Senses that have been reduced to a point where a message cannot get through, or can get through only weakly, may cause a person to respond to a given situation inappropriately.

As designers, it is possible to load the environment with multiple cues to communicate a consistent message. For example, a door leading to a dangerous location may be finished in a different color to provide a visual message not to enter, as can signage, an alarm sound, or even texture through knurled door hardware. If one sense has experienced a decline, then the same message may be communicated through an alternate sense to help provide a consistent message of non-entry.

An awareness of older adults' declining sensory abilities and increased fall risks, combined with the need to focus on interventions that minimize these risks is beneficial to the interior design and architectural community as they seek to expand research regarding safely and adequately developing long-term housing options. To that end, the purpose of this observational study was to determine the relationship between the number of environmental sensory cues within ALFs and the number of falls by residents using Lawton's environmental press theory as the framework.

Method

A checklist instrument consisting of 110 environmental sensory cues was developed to document their presence/non-presence in ALF public spaces. It was then used in 140 ALFs to document the type and number of sensory cues present in the public rooms of ALFs located in Michigan's Lower Peninsula. Sensory cues within public spaces were compared to the number of falls reported by ALF directors within those same rooms to determine whether there was a relationship between the number of sensory cues and the number of falls. Sensory cues

are normally varied within the built environment, but this study targeted multiple visual cues and one auditory cue. Vision-related questions included finishes, lighting/electrical, alarms/signals, furniture/accessories, signage/text/artwork, and color contrast; the auditory cue related to an elevator alarm. On the checklist instrument, each cue was rated from 0 to 2—"0"meant that the cue was not present within the space; "1" meant the cue was present in some places; and "2" meant the cue was present everywhere in the space.

Demographic information gathered from the ALF facilities included the overall number of residents; type of institution (privately owned, public entity, or government owned); the number of falls that occurred in the last year; average length of time that residents had lived in this facility; and caregiver ratio.

Observer Training

Observers included interior design students enrolled in a class focusing on designing environments for children, elderly, and the disabled. This course provided background information on state and national building codes and the Americans with Disabilities Act (ADA) guidelines, and was intended for students to develop sensitivity to aspects of the built environment impacting older adults' quality of life. Students were provided with copies of the ALF Checklist and its use was explained. The researcher then walked through several examples of how to appropriately mark the sensory cues in the room they were sitting in, along with a rationale for the response. The students completed the next five items on the checklist on their own, followed by discussion of the appropriate response and rationale. This pattern continued until the students had a fundamental understanding. Then, the students completed one full page and discussed appropriate responses, in an attempt to increase inter-rater reliability. The group moved to a second room and continued the process until everyone provided consistent responses. The researcher and nine observers completed the instrument independently, then compared responses and their experiences to determine what adjustments needed to be made. Some wording adjustments were made, and, following revisions, the researcher and 12 different student observers returned to the same site to complete the checklist instrument again.

During this second trial, the observers simultaneously completed a public room, reviewed and discussed results, and continued to a second public area. To increase inter-rater reliability, the same procedure for training occurred until the ALF portion of this facility was completed. As a result of the training, one part of the process was modified. Initially, ALF directors were asked to complete the demographic information with the observer while the observer was on site. This part of the process was changed to sending the directors a request for all demographic data in advance to insure that time was available to provide accurate data specifically related to the number of falls occurring within the ALF. Data from the pilot studies were not used in the final analysis.

Sample

ALFs were identified through a random selection of ALFs located in Michigan on www.anywho.com. A random selection of the facilities was performed until 315 facilities had been selected. Of the 315 ALFs, 140 participated. No individual resident data was requested, and data was gathered consistent with IRB standards.

Once an ALF was selected for visitation, the researcher contacted the director, stating that an observer would be following up to request permission to visit the site and to schedule a visit if permission was granted. Upon approval, electronic copies of the consent form and demographic questions were sent to the director prior to the site visit to allow time for acquiring the data required for quality responses related to the demographic characteristics.

The observer completed the checklist instrument on site, first collecting the facility demographics from the director, then touring the facility. Each public space was identified separately on the checklist instrument and assessed for environmental cues. These data were entered into Excel and then downloaded into SPSS.

Results

Observers reported the existence of environmental cues and did not modify anything on site, making this an observational, exploratory study. Each room was coded with a facility number and a room number. Demographic variable frequencies were initially run to determine ALF characteristics. Next, the frequency, mean, and standard deviation of all cues were run to determine the extent to which cues were incorporated into ALFs.

When facility size was controlled, the mean number of sensory cues increased as facility size increased.

Preliminary Analysis: Overall Facility Sensory Cue Patterns

Tests analyzing the list of 110 environmental cues within ALFs produced results that were contrary to expected outcomes. When tests were run on all facilities, it was shown that the higher the number of sensory cues, the higher the number of falls occurring within ALFs. The reason for these unexpected findings remained unclear.

Secondary Analysis: Facility Sensory Cue Patterns

In an effort to assess whether the environmental cue patterns were different across all ALF room types based on facility size, mean scores were analyzed as shown in Table 1. When facility size was controlled, the mean number of sensory cues increased as facility size increased. The level of significance indicated that the size of the facility influenced the mean number of cues that were present.

Table 1. Environmental Cue Data within Each Facility Size

Facility Size	Number of ALF Rooms	Mean Number of Environmental Cues (Std. Dev)	F	Level of Significance
1	175	19.52 (7.41)	44.61	0.000
2	498	25.61 (7.00)		
3	282	26.93 (7.69)		
4	27	29.04 (2.19)		
Total	**982**	**25.00 (7.66)**		

Preliminary Analysis: Measure Validity

When data from the checklist instrument were initially analyzed, there were limitations to the coding method developed to identify which sensory cues were present in the environment. For example, 92 (65.7%) of the 140 facilities had only one floor. One of the checklist items asked if the stairway handrails extended at least 12 inches beyond the top and bottom steps. In 880 of the 1033 (85.2%) rooms, researchers indicated "0–this cue is not present." However, this did not clarify whether there were no existing stairs because this facility was one floor or whether stairs existed but the handrails did not extend 12 inches. To address this, any sensory cue that might only peripherally affect falls was omitted from the secondary analysis.

The coding method impacted the immediate outcomes as a research tool and so multiple questions were removed from analysis. For future use, the checklist instrument was revised to include a fourth category of "not applicable," so that it would be apparent whether a cue was missing because it did not apply to that room, or was not present because it was missing within that particular room, as shown in Table 2. This discovery demonstrated one of the purposes of pilot and exploratory studies; even these unfortunate findings were helpful.

Once the coding issue was recognized, 18 visual cues and 1 auditory cue were retained from the original list of 110 items for subsequent data analysis, with

Table 2. Checklist Instrument Clarification of Suggested Revision

Checklist Instrument Question #	Question Wording	SENSORY CUE	
		Original Coding Method	Revised Coding Method
21	Matte finishes are used on furniture	0, 1, 2	N/A, 0, 1, 2
Original KEY:	0 = Cue not present 1 = Cue present in at least one place 2 = Cue present in more than one place		
Revised KEY:	N/A = Not applicable 0 = Cue not present 1 = Cue present in at least one place 2 = Cue present in more than one place		

some additional cues added, as appropriate, depending on room type. Because one auditory cue and 18 visual cues were retained, these 19 cues will be referred to as "environmental cues" throughout the remainder of the article. In total, these 19 cues were identified for use based on their potential impact on falls and their application to all rooms. Validity was confirmed on this subset using factor analysis to determine how well these sensory cues were associated, as shown in Table 3. To measure internal reliability between these items, Cronbach's Alpha was run and was 0.846, indicating that high inter-item correlation exists for this measurement tool.

Secondary Analysis: Individual Room Environmental Cue Patterns

The wide variation of mean falls in ALFs of different sizes made it desirable to analyze data focusing on room types. Table 4 shows rooms that were present across all ALFs. The Lounge/Living Room, Dining Room, Corridor, Public

Table 3. Component Matrix of the 19 Environmental Cues: Overall Components

Environmental Cue Checklist Instrument Number and Wording	1 Contrast	2 Wayfinding	3 Lighting/Electrical	4 Floor Graphics
22: Matte finishes are used on furniture	0.640			
23: Matte finishes are used on the floor	0.567			
23: Matte finishes are used on the floor				0.814
32: Graphic images are used on wall surfaces		0.444		
50: Full spectrum bulbs are used on overhead lighting	0.386		0.408	
51: Electrical receptacles are located ≥ 12' apart	0.522		0.468	
52: Sensored lighting is provided		0.548		
53: Room alarms include visual cues such as blinking lights	0.602		–0.600	
55: Room alarms include auditory cues	0.590		–0.584	
59: Permanent signage is placed in a consistent place by the door	0.664			
66: Different colored walls assist with wayfinding	0.312	0.708		
67: Artwork, photographs/memorabilia assist with wayfinding		0.683		
68: Door hardware contrasts with the door	0.653			
69: Door frames/moldings contrast with the walls	0.635			
70: Handrails contrast with walls		0.712		
76: Floors are clearly defined from walls	0.708			
77: Walls are clearly defined from the ceiling	0.740			
78: Furniture is clearly defined from the floor	0.611			
79: Switch plates contrast with walls	0.561			

NOTES:

Cases Valid:	982	(95.1%)
Excluded:	51	(4.9%)
Total:	1,033	(100.0%)
Cronbach's Alpha:	0.846;	$n = 19$

Restroom, and Foyer were selected as the subset of rooms to run factor analysis due to the prevalence of falls within these ALF rooms.

Each test included the 19 environmental cues from the factor analysis, and incorporated additional cues in each of the rooms, as seemed applicable to that space, as shown in Table 5. These additional cues were part of the original 110 cues incorporated in the checklist instrument, which remained unaffected by the need to add the not applicable category in coding. However, each cue was not relevant to each room. For example, not all Public Restrooms, Corridors, or Foyers included seating, but it was likely that all Living Room/Lounges and Dining Rooms would. Therefore, environmental cues relative to seating were added to the Living Room/Lounge and Dining Rooms' factor analyses. This exploration was appropriate for developing the environmental cues most appropriate to each room. Next, factor analysis was run for each room's cues to validate these as a reliable measure in later statistical analysis with fall data.

To demonstrate that these selected cues were appropriate, a principle first component was needed. The grouping of scores on the first factor verified that there

Table 4. Fall Occurrences within Room Types

Room Name	*n*	Sensory Cue Mean	Standard Deviation	Room Name	*n*	Sensory Cue Mean	Standard Deviation
Lounge/Living	**138**	9.86	21.70	Multipurpose	10	5.00	5.96
Dining Room	**130**	7.65	15.20	Hair Salon	8	8.52	14.27
Corridor	**126**	9.97	20.08	Mailbox Area	8	7.88	8.64
Public Restroom	**92**	9.54	21.44	Laundry	8	4.38	3.42
Foyer	**71**	6.07	7.82	Spa	6	4.33	3.01
Hair Salon	48	8.52	14.27	Chapel	5	3.00	3.08
Game Room	40	13.30	24.28	Other	5	1.40	2.19
Kitchen	37	4.19	6.11	Pool	4	28.00	43.40
Director's Office	33	6.09	9.29	Sunroom	4	1.75	2.87
Exterior Entrance	33	4.64	5.55	Parking	4	2.00	4.00
Outdoor Space	30	4.83	6.04	Gift	3	11.00	6.08
Library	29	10.31	24.26	Craft Room	3	6.00	4.00
Assistive Shower	21	5.81	6.70	Conference	2	55.50	53.03
Reception	20	12.05	20.38	Porch	2	6.00	2.83
Nurse's Station	19	18.37	29.86	Restaurant	1	26.00	
Media Room	18	13.50	29.58	Piano Room	1	26.00	
Treatment Space	18	11.83	20.81	Auditorium	1	10.00	
Exterior Deck	18	7.94	6.42	Elevator	1	6.00	
Exercise Room	17	7.18	7.34	Storage	1	2.00	
Café/Coffee Shop	15	14.07	22.97	Bird Room	1	0.00	
Stairs	10	12.50	28.52	**Total**	**1,033**	**8.86**	**18.00**

Table 5. Environmental Cues Factored in Five Rooms

Environmental Cue Checklist Instrument No. and Wording	Living Rm./Lounge	Dining	Corridor	Public Restroom	Foyer
22: Matte finishes are used on walls	X	X	X	X	X
23: Matte finishes are used on the floor	X	X	X	X	X
31: Graphics are not used on flooring surfaces	X	X	X	X	X
32: Graphic images are used on wall surfaces	X	X	X	X	X
50: Full spectrum bulbs are used in overhead lighting	X	X	X	X	X
51: Receptacles are located ≥ 12' apart	X	X	X	X	X
52: Sensored lighting is provided	X	X	X	X	X
53: Alarms include visual cues	X	X	X	X	X
55: Alarms include auditory cues	X	X	X	X	X
59: Permanent signage is consistently placed by doors	X	X	X	X	X
66: Different colored walls assist with wayfinding	X	X	X	X	X
67: Artwork, photographs/memorabilia assist with wayfinding	X	X	X	X	X
68: Door hardware contrast with the door	X	X	X	X	X
69: Door frames/moldings contrast with walls	X	X	X	X	X
70: Handrails contrast with wall	X	X	X	X	X
76: Floors are clearly defined from walls	X	X	X	X	X
77: Walls are clearly defined from the ceiling	X	X	X	X	X
78: Furniture is clearly defined from the floor	X	X	X	X	X
79: Switch plates contrast with walls	X	X	X	X	X
Additional Visual Cues					
21: Matte finishes are used on furniture		X	X		
24: Tinted glass is used on windows					X
29: Flooring material transitions are ≥ 1/4"			X	X	X
34: Lighting is located by exterior entrances					X
57: Corridors are free from clutter on 1 wall			X		
58: Handrails are on at least 1 corridor wall			X		
61: Signage directs people for wayfinding			X		
62: Exit signage is placed < 27" AFF				X	
63: Signage ≥ 80" extends ≥ 4" into the space			X		
64: Signage letters and background contrast			X		
65: Emergency exists are clearly noted			X		
71: Handrails contrast with the walls			X		
74: Restroom grab bars contrast with walls				X	
80: One type of flooring is used in corridors			X		
81: Windows are placed to minimize glare					X
86: Stairs are used to enter this space					X
98: All seating has arms	X	X			
99: All seat cushions are firm	X	X			
100: Seat heights are ~18" or higher	X	X			
101: Chairs have four legs	X	X			
114: Handrails provide messages on back side			X		
115: Handrails provide recessed fingertip grip			X		

was a core construct underlying the measure and that these were not just a random set of items. Next, Cronbach's Alpha was run for each of the five rooms to determine inter-item correlation for the measurement tool, adding to the validity of the measurement tool. Generally speaking, high contrast between surface finishes and furnishings; use of matte finishes; and use of visual and auditory alarms had positive close first associations within each of the five room types. In addition, the overall Alpha level was above 0.83 for each room, confirming that these items measured cues in meaningful ways.

Fall Patterns Based on Facility Size

In analyzing environmental cue patterns, the precedent was established to control for facility size, followed by a study of the five rooms analyzed for fall data (Living/Lounge, Dining Room, Corridor, Public Restroom, and Foyer). To initiate this process, it was helpful to compare the frequency of falls in public versus private resident spaces to determine overall facility fall patterns within ALFs. Individual resident rooms were not visited to assess environmental cues. However, directors were asked to report which specific public room falls had occurred within. They were also asked whether any additional falls had occurred within private areas. There were a total of 3,437 falls, with public spaces accounting for 26.4% (904) of falls, and private spaces 73.6% (2,530) of falls. This averages to 24.55 falls throughout the 140 ALFs. When public and private spaces were calculated separately, there were on average 6.48 of falls in public spaces and 18.60 in private residences.

When facility size was accounted for, the pattern was as expected since a higher number of people anywhere would increase the likelihood of falls. As facility size increased, the mean number of fall occurrences increased, as shown in Table 6. Therefore, it stands to reason that the greater the number of older adults residing in an ALF, the more likely there would be a higher incidence of falls.

Individual Rooms Fall Patterns

As previously mentioned, Table 4 documents the mean number of falls for the Living Room/Lounge, Dining Room, Corridor, Public Restroom, and Foyer. These five rooms had mean falls ranging from 6.07 to 9.97, showing a variation across room type. There were some rooms with a mean above 9, but were specific

Table 6. Fall Occurrences Based on Facility Size

Facility Size	ALF *n*	Mean	Standard Deviation
1: 1–11	33	1.85	2.61
2: 12–62	69	4.38	5.22
3: 63–225	37	12.19	22.17
4: 226+	1	93.00	Fewer than two cases
Total	**140**	**6.48**	**14.56**

Table 7. Correlation of Falls with Environmental Cues

Environmental Cues	Total Public Falls
Mean (Standard Deviation)	25.51 (7.63)
Pearson Correlation	0.184*
Significance	0.030
n	140.00

NOTE:
* Correlation is significant at the 0.05 level (2-tailed).

to a small number of ALFs. These rooms were left to evaluate in greater depth during future study.

Cues Predicting Falls by Size and Room

Previous data in this study presented environmental cue information based on facility size and room type, followed by fall information based on facility size and room type. When the overall mean number of falls was correlated with the overall mean number of environmental cues, the results were significant. Again, the pattern of environmental cues to falls was the reverse of the expected pattern, as shown in Table 7. When the mean number of environmental cues was highest, the mean number of falls was highest. This clarified the need to run additional analysis to identify intervening characteristics since previous research indicated a negative relationship between the environment and falls (Fuller, 2000; Rubenstein, 2006).

Correlation showed variability of results across the five rooms. The Dining Room and Foyer did not show significance but had the lowest mean number of environmental cues of the five rooms (7.65 and 6.07 mean cues, respectively). Like the overall facility analysis, one pattern that emerged was that the mean number of falls increased with facility size within these rooms.

When the mean number of environmental cues was highest, the mean number of falls was highest.

The environmental cues in the Living Room/Lounge showed significant results but were positively correlated to falls. In other words, the Living Room/Lounge had the second highest mean number of cues (9.54) and many falls. These results again ran counter to the expected pattern that the greater the number of environmental cues included, the lower the number of falls. Correlation does not necessarily imply causation so it cannot be said that the addition of cues was contributing to an increased number of falls. However, the association was unexpected and the need to look at how facility sizes differed from one another remained.

A different pattern emerged when data from the Corridor in Facility Size 3, the overall Public Restroom, and the Public Restroom in Facility Size 1 were correlated. A converse relationship existed in these rooms and showed that the greater the number of environmental cues, the lower the number of falls. Although

no causation was determined between the increased presence of cues and fall prevention, the pattern was as expected.

In the analysis of these rooms, it appeared that facility size and room type mattered for falls in some cases, just as facility size and room type mattered for environmental cues in some cases. The reason for such wide variability of results across facility sizes and within diverse room types continued to remain unclear. Because of the number of possible variables that distinguish ALFs of different sizes and room types, it was not easy to determine which factors had the greatest impact, supporting the need to analyze other characteristics that might be influencing overall outcomes.

Other Risk Factors Influencing Environmental Cues and Falls

Calkins (2001) affirmed that environments are as complex and multifaceted as the people who live and work in them, and there are almost never simple solutions to complex questions. To assist in identifying the explanation for this variability, several facility factors were selected for analysis including: ALF business formation type, for example, individually-owned, corporation-owned, for-profit, or non-profit; age of residents in the ALFs; choice in personal care level; average length of time spent by residents living in the ALF; the number of floors in the ALF; ALF inclusion in a chain; and public space accessibility. In addition, facility size and environmental cues continued to be controlled in the analysis to determine whether there was significance.

When assessing ALF business formation type, the highest number of public falls occurred in non-profit, individually-owned ALFs, followed by for-profit, corporation-owned ALFs. For-profit, corporation-owned ALFs had the highest number of mean environmental cues, while non-profit, individually-owned ALFs had

Table 8. Environmental Cue and Falls Assessment by Business Formation Type

Facility Type	*n*	Mean (Std. Deviation)	F	ANOVA
PUBLIC FALLS				
Total	**136**	**6.38 (14.67)**	**0.517**	**0.672**
• For-profit, individually owned	47	4.34 (5.91)		
• For-profit, corporation owned	50	7.20 (18.54)		
• Non-profit, individually owned	20	8.65 (20.50)		
• Non-profit, corporation owned	19	6.89 (11.29)		
VISUAL CUES				
Total	**136**	**25.40 (7.62)**	**1.56**	**0.203**
• For-profit, individually owned	47	26.13 (8.02)		
• For-profit, corporation owned	50	26.30 (7.36)		
• Non-profit, individually owned	20	22.35 (6.92)		
• Non-profit, corporation owned	19	24.47 (7.62)		

the lowest. However, based on ANOVA results, there were no significant differences among formation types, as shown in Table 8.

As a next step in determining whether there were additional ALF characteristics that might be helpful in explaining the difference between facility types, the age of ALF residents was controlled by facility size. In order to clarify whether the residents' ages were significantly related to falls and environmental cues, correlation was run to show the contribution age made to environmental cues and falls. ANOVA tests were run to analyze falls across age groups, as shown in Table 9. Significant relationships existed between these factors for the oldest old (100+), although not for any other age group. Facilities that housed residents 100 years old or older reported an increased number of falls (0.033). In addition, the ANOVA test showed a significant association between falls, age of residents in ALFs, and facility size (0.006), showing additional confirmation for the impact of facility size.

The next risk factor that was analyzed in an attempt to clarify differences among facility types was the caregiver-to-resident ratio, shown in Table 10. A Post Hoc

Table 9. Falls Assessment by Age Based on Facility Size

Age of Residents Housed by ALFs		Age of Residents Housed by ALFs	
Falls: Age 65–74		**Falls: Age 100+**	
• Mean (Std. Dev.)	0.62 (0.487)	• Mean (Std. Dev.)	0.29 (0.454)
• Pearson Correlation	0.121	• Pearson Correlation	0.181*
• Significance	0.156	• Significance	0.033*
ANOVA between Groups		ANOVA between Groups	
• F	0.896	• F	1.82
• Significance (2-tailed)	0.604	• Significance (2-tailed)	0.021
• *n*	139	• *n*	139
Falls: Age 75–84		**Sensory Cues**	
• Mean (Std. Dev.)	0.88 (0.329)	• Mean (Std. Dev.)	.25.51 (0.637)
• Pearson Correlation	0.122	• Pearson Correlation	0.184*
• Significance	0.152	• Significance	0.033*
ANOVA between Groups		ANOVA between Groups	
• F	0.760	• F	0.907
• Significance (2-tailed)	0.773	• Significance (2-tailed)	0.589
• *n*	139	• *n*	140
Falls: Age 85–99		**Facility Size**	
• Mean (Std. Dev.)	0.86 (0.345)	• Mean (Std. Dev.)	2.04 (0.728)
• Pearson Correlation	0.089	• Pearson Correlation	0.181*
• Significance	0.296	• Significance	0.030*
ANOVA between Groups		ANOVA between Groups	
• F	0.403	• F	2.07
• Significance (2-tailed)	0.993	• Significance (2-tailed)	0.006*
• *n*	139	• *n*	140

NOTE:
* Correlation is significant at the 0.05 level (2-tailed).

Table 10. Falls Assessment by Caregiver Ratio Based on Facility Size

Facility Size	*n*	Mean (Std. Deviation)	F	Significance
1: 1–11	3	0.22 (0.09)	4.031	0.02
2: 12–62	63	0.16 (0.08)		
3: 63–225	29	0.20 (0.13)		
Total	**125**	**0.18**		

NOTE:
*Correlation is significant at the 0.05 level (2-tailed).

Table 11. Post Hoc Test of Caregiver Ratio Based on Facility Size

	Facility Size	Facility Size	Significance
Tukey HSD	1	2	0.024
		3	0.807
	2	1	0.024
		3	0.164
		1	0.807
	3	2	0.164

Test showed that the number of caregivers was significantly related to facility size as shown in Table 11. Facility Size 1 had the highest ratio of caregivers to residents, while Facility Size 2 had the lowest ratio. A correlation was run to analyze whether caregiver ratio was related to falls. Findings showed that caregiver ratio did not significantly impact falls.

Given that caregiver ratio did not help explain falls within facilities, the next step was to determine what other characteristics might be useful in explaining the fall data. To assist, correlation was run on fall data using multiple risk factors that included the average length of time that residents lived in ALFs, the number of floors, whether the facility was part of a chain, whether public spaces were barrier-free accessible, and facility size.

Overall, three of these characteristics showed an association to falls: accessible public spaces, environmental cues, and facility size. When any of these characteristics were increased, there was an increase in falls (see Table 12). Again, analyses ran counter to expectations given that the expected pattern was to find that when a space was accessible to residents and there were more cues, there would be a reduced number of falls.

The most important finding was the relationship of facility size to the number of falls. There was significance at 0.0, indicating that facility size overwhelmingly impacted the number of falls. The ANOVA test also supported this.

Table 12. Falls Assessment of Risk Factors Based on Facility Size

Total Public Falls			
• Mean (Std. Dev.)	6.48 (14.56)		
Resident Time in ALF		**Public Spaces Accessible**	
• Mean (Std. Dev.)	3.33 (1.06) 3 = 25–36 mos; 4 = 37–48 mos	• Mean (Std. Dev.)	1.07 (0.252) 1 = yes; 2 = no
• Pearson Correlation	–0.028	• Pearson Correlation	0.172*
• Significance	0.742	• Significance	–0.048
• *n*	140	• *n*	140
Number of Floors		**Number of Sensory Cues**	
• Mean (Std. Dev.)	1.58 (1.09)	• Mean (Std. Dev.)	25.51 (0.728)
• Pearson Correlation	0.011	• Pearson Correlation	0.184**
• Significance	0.901	• Significance	–0.030
• *n*	140	• *n*	140
Part of Chain		**Facility Size**	
• Mean (Std. Dev.)	1.64 (0.481) 1 = yes; 2 = no	• Mean (Std. Dev.)	2.04 (0.728)
• Pearson Correlation	–0.112	• Pearson Correlation	0.364**
• Significance	0.187	• Significance	–0.000
• *n*	140	• *n*	140
ANOVA			
• ALF Time between Groups	0.853		
• # of Floors between Groups	0.263		
• Part of Chain between Groups	0.728		
• Public Space Accessible between Groups	0.494		
• Sensory Cues Total between Groups	0.589		
• Facility Size between Groups	0.006		

NOTES:
* Correlation is significant at the 0.05 level (2-tailed).
** Correlation is significant at the 0.01 level (2-tailed).

The Significance of Design Professionals: Predictive Validity

The recognition that the mean number of environmental cues varied across facility sizes and room types clarifies the impact of diverse factors in decision making, including the need for design professionals to have a thorough understanding of the nature of the facility and the need to control some factors in facilities. To that end, an independent *t*-test was conducted to review the impact of the use of design professionals in the design of ALFs.

The overall mean number of environmental cues was analyzed, and significantly showed that when design professionals were used in the original construction or renovation of an ALF, it was not chance that there were a higher mean number of cues. When a design professional was used, the mean number of visual cues was higher in original construction (27.31) and renovation (29.90) compared to ALFs that were not renovated by design professionals (21.73 and 22.08, respectively).

Table 13. Impact of Design Professionals on Environmental Cues Based on Facility Size

	N	Mean No. of Environmental Cues (SD)	Level of Significance
Facility Size 1			
Original Design by Professional			
• Yes	8	21.38 (7.65)	0.461
• No	24	19.29 (6.56)	
Renovation by Professional			
• Yes	2	27.00 (7.07)	0.334
• No	13	20.46 (8.69)	
Facility Size 2			
Original Design by Professional			
• Yes	57	26.72 (6.51)	0.463
• No	12	25.17 (7.17)	
Renovation by Professional			
• Yes	27	29.67 (6.70)	0.009
• No	8	22.37 (5.48)	
Facility Size 3			
Original Design by Professional			
• Yes	31	29.87 (6.63)	0.261
• No	4	26.00 (2.83)	
Renovation by Professional			
• Yes	21	30.48 (6.10)	0.126
• No	4	25.00 (7.62)	

The next step in analysis was to assess whether this same pattern continued when a subset of facility size data was analyzed, as shown in Table 13.

From the data, it was apparent that involvement by a design professional increased the number of cues incorporated into the overall environment, and that larger facilities were more likely to use designers. Both of these factors could impact falls in some instances, but not all.

Design Implications and the Influence of Design Professionals

In the analysis of the Living Room/Lounge, Dining Room, Corridor, Public Restroom, and Foyer, it appeared that facility size and room type mattered for falls and environmental cues in some cases. Analysis also indicated that increased facility size is predictive of whether a designer will be used on the original construction or renovation of an ALF, and facility size and use of a design professional are also predictive of an increased number of environmental cues. When facility size was accounted for, use of a design professional during original construction or renovation, environmental cues, and falls in any of the room types were not significantly related to Size 1 facilities. The Living Room/Lounge, Corridor, Public Restroom, and Foyer were significantly related to the use of a design professional in original construction and the number of environmental cues and falls for Size 2 facilities. However, the Dining Room and Corridor were significantly related to use of a design professional and the number of environmental cues and falls within Size 3 facilities. These analyses illustrate that when facility size and room type were analyzed compared to design professionals' relationship to environmental cues and falls, there was sometimes significance, but there was variability. The reason for such wide variability is unclear, but it appears that

design professionals' involvement in original construction and renovation sometimes matters within ALFs. With the growing recognition that design professionals influence the number and type of environmental cues being integrated into ALF environments, it is important to exercise caution when making simple associations from broad fall and environmental cue data. This exploratory study is the first of its kind to look at whether generic cues influence falls. Findings show that the issue is much more complex and is one area of study for future research.

From the data, it was apparent that involvement by a design professional increased the number of cues incorporated into the overall environment.

It is clear that ALFs are complex environments and that falls are impacted by diverse variables. As Lord, Menz, and Sherrington (2006) shared, the relationship of environmental demand to falls is by no means straightforward. To that end, discussion that allows design professionals to establish a broader understanding of the impact of sensory cues on falls within diverse facility sizes and room types will add to the body of knowledge when creating safe, well-defined, and accessible environments for older adults living within ALFs.

Discussion

Because the results of the environmental checklist were contrary to the original hypothesis in certain room types, it was desirable to analyze the findings in order to determine why this was occurring.

Discussion of Data Analysis Results: Summary Based on Facility Size and Room Type

A consistent inverse relationship between the number of environmental cues and the number of falls occurring within ALFs was not found in this research. Interestingly, fall and cue patterns emerged that were not part of the original hypothesis. First, the number of falls increased as facility size increased. Second, the larger the facility size, the more likely that a design professional was engaged in the original construction or renovation of the ALF. Third, it appears that facility size may be associated with residents' age. In this study, Size 3 facilities were the largest, housed more oldest old adults than any other facility size, and had the greatest number of falls. Size 1 ALFs did not house the oldest old and had the least number of falls. This finding is consistent with Barnes (2006), who found that the dependency levels of older adults choosing to live in larger care homes were higher than smaller care homes, which could be one influencing variable affecting the higher number of falls in larger ALFs. Clarifying the impact of facility size in future studies will make it possible to assess whether a higher number of falls in a larger space may result from higher traffic levels, rather than from the number of environmental sensory cues.

There was not a consistent pattern that emerged related to room type. The Dining Room and Foyer did not show significant results when facility size, room type, falls, and environmental cues were analyzed, and had the lowest mean number of environmental cues of the five rooms. An idea for consideration is that

people who are not in the best health may be taking meals in their private residences, as opposed to visiting the Dining Room. If someone is not feeling well or has declining health that subsequently leads to a transfer to another space, they may not be visiting the Dining Room regularly or may have additional staff assistance in traveling to the Dining Room. An alternate idea is that the Dining Room often serves as a multipurpose space for activities such as strength training or exercise, crafts, parties, and other social events. These activities may draw healthier older adults. This latter idea could also relate to the Foyer. Elderly who are not feeling well are less likely than healthy residents to be exiting or entering the facility through the Foyer, unless they are leaving the facility for medical care. Therefore, the need to be in the Foyer would be at a minimum. A healthier resident, who is less likely to fall, is likely to be in the Foyer if he or she desires to travel to other external destination spots. Therefore, future research should include behavioral room observations to increase understanding relative to falls and how the diverse mobility levels of residents may be influencing falls.

The environmental cues in the Living Room/Lounge, regardless of size, showed significant positive relationship to falls. This unexpected outcome might be explained by the idea that the Living Room/Lounge could be a destination spot for activities and for socializing by all residents. Future research can explore whether a greater number of sensory cues might be over stimulating and whether this influences the positive correlation between the environmental cues and falls. As noted in Lawton and Nahemow's (1973) environmental press theory, too much stimulation can increase negative environmental press, as can too little stimulation.

Another idea to explore is that the positive relationship between cues and falls could also be attributed to increased traffic levels; when more people spend an increased amount of time in a larger room, it might result in more falls. Further, Barnes (2006) identified that in community care facilities, it is common that residents having higher dependency tend to spend increased time in public social spaces, such as the Living Room/Lounge. Calkins (2009) theorized that this occurs because it is easier for caregivers to manage all residents simultaneously in one place. This could mean that there are more people in this space who have varying physical and sensory abilities, which also could influence the number of falls. Future research could look at who spends time in each room, traffic levels, and types of activities occurring there. It is also possible that staff members in smaller facilities provide more personal assistance in getting people to and from Living Room/Lounges. For example, in this study, one director in a Facility Size 1 ALF indicated that there are no falls in her facility because she assists everyone in moving through the environment. Additional research could investigate the level of caregiver influence at each facility size and room type to determine their effect on falls.

A different pattern emerged when data from the Facility Size 3 Corridor, the overall Public Restroom, and the Facility Size 1 Public Restroom were analyzed. The data from these three rooms demonstrated support for the hypothesis; when facility size and room type were accounted for, results showed that the more

environmental cues, the lower the number of falls. This finding shows that facility size and room type sometimes matter.

In the corridor, one line of reasoning to as to why an increased number of cues may be negatively associated with falls is that older adults who are not feeling well and who are in lower health are not as likely to be walking in the corridors, whereas a person who is in middle or high health is likely to travel in the corridor to get to other destinations both within and outside of the facility. Therefore, healthy older adults are more likely to be able to respond to available sensory cues, which may have decreased the number of falls.

The Public Restroom also followed the expected pattern of a negative association between cues and falls. A point that should not be overlooked is that the residents have restrooms in their private residences, yet still chose to visit the Public Restroom, perhaps because it was closer. The increased number of falls could be due to residents moving to restrooms more rapidly due to urinary urgency. Further, most men stand while using the restroom, which can result in a loss of balance. Public Restrooms are also likely to be smaller than the Living Room/Lounges and Dining Rooms and maneuvering within a small space could be more difficult. Future research could track falls for both men's and women's Public Restrooms to determine whether gender issues make a difference in this room's fall rate. Public Restrooms are also likely to be smaller than most other spaces in ALFs, so future research could look at the impact of room scale on resident falls. In addition, Facility Size 1 ALFs may not have Public Restrooms, and staff may have assisted residents in returning to their private or shared restrooms. Support for this idea originates from Calkin's study (2001), which indicated size makes a difference. Smaller units may have increased supervision and contact between residents and staff members. The number of potential variables that differentiate smaller from larger units makes it difficult to determine exactly which factors have the greatest impact on residents' abilities and falls, but may become clearer in future research.

Discussion of Findings: Link to Theory

Lawton's Environmental Press model provided the guiding framework for this study and illustrates the interactions between people and the environment and their ability to balance environmental demands with age-related individual competence (Lawton, 1980).

Table 14. Overall Environmental Cue Recommendations

- High contrast between surface finishes and furnishings
- Use of matte finishes
- Use of color, artwork, photos, and other memorabilia on walls for wayfinding
- Clear, well-placed signage
- Use of visual and auditory alarms
- Use of graphic images on walls
- Non-use of graphic images on floors

Implementation of some, or all, of these significant features will be a step forward in creating safe, well-defined, and accessible environments.

Carp (1976) suggested that the environment can be viewed not only as a source of press but also as a source of resources. Sensory cues were present in all ALFs, but varied in number and by room type. Overall, recommendations for the Living Room/Lounge, Dining Room, Corridor, Public Restroom, and Foyer had high association with the environmental cues listed in Table 14. In existing ALFs, these five room types could be examined by directors or design professionals, or both, to determine which recommendations might be readily achievable. Implementation of some, or all, of these significant features will be a step forward in creating safe, well-defined, and accessible environments that contribute to the ease with which older adults are able to maneuver the environment. Future research will be important to identifying whether inclusion of these cues can be associated with "best practices" and whether there is a relationship to the number of falls within ALFs.

The recognition that the mean number of environmental cues varied across facility sizes and room types is important. It clarifies the influence of diverse factors in decision making, including the need for design professionals to recognize the impact of some factors that could lead to misleading results. Of significance was the number of environmental cues present if a design professional had been involved in the original construction/renovation of ALFs. When this occurred, there was a higher number of environmental cues present compared to when a design professional was not involved, regardless of room type. Although the integration of this higher mean could result from the increasingly strict building codes and focus on the health, safety, and welfare of the public originating in part from the adoption of the ADA, the overall goal of maintaining the highest quality of life possible for all residents is also relevant.

Characteristics of the diverse ALF facility sizes demonstrate how facility features can impact environmental cue patterns. By the end of the analysis, both positive and negative associations were found, not all of which were expected. It appeared that environmental cues did not have equal meaning in each room. Therefore, this influenced the need for separate sub-measures in each room in the analysis and clearly demonstrated that there were many factors influencing the overall results.

Recommendations for Future Research

The baby boomer generation will represent twice as many older adults in 2030 as are in present today's society. It appears that older adults will likely rely on community-based care, with an increasing eye toward ALFs. Therefore, the next 20 years offer a window of opportunity to enact changes before the boomers reach late old age. Achieving intentional goals will require years of effort; therefore, the time to act is now (Alecxih, 2006) so that future ALF environments are supportive, promote quality of life, and can serve to prevent falls.

ALF directors specializing in care for society's oldest old could use research findings to determine whether particular environmental cues are more effective

when compared with environments that house society's young old. It is possible that some environmental cues influenced falls in other facility sizes or room types, but with the subset data required, there were not enough rooms for which to test. This remains an area for future study, and demonstrates a need for even larger sample sizes for these spaces.

In addition, future research needs to examine the distribution of falls. There are room types that have falls, whether cues are present or not. This could be due to systematic bias in under-reporting falls, but could also be due to numerous confounding variables. It is important to standardize the definition of falls and reporting practices. Given the tendency for under-reporting falls, observational studies of specific areas of ALFs using video, for example, to authenticate the number of reported falls and the conditions by which they occur would be beneficial.

Future research could continue looking at the subset of information, for example, public versus private environments, caregiver ratio, for-profit versus non-profit, etc., within each facility size to determine the degree to which these factors impact falls using broader sensory cue data. Barnes' (2006) findings in nursing homes and small residential homes indicated that dependency levels were higher in larger facilities than smaller facilities, showing a need for future research to investigate the relationship of facility size to fall data and the impact of the built environment. In addition, findings in this current study showed that three times the number of falls occurred in private rooms than in public spaces, so future research could be expanded to include these variables as well.

Conclusions

The results of this study have been encouraging but not as straightforward as expected. They have contributed to the development of the initial fundamental body of knowledge related to ALF facility sizes and room types. When financial resources are tight, knowledge of environmental outcomes can serve as an effective measure for prioritizing budgetary issues within projects. Inclusion of environmental cues impacts falls within some facility sizes and within some rooms. Enhanced knowledge can serve to increase the safety, comfort level, and ability of residents to maneuver in public spaces safely. Although it is rarely possible to prevent the cause of all falls, improving even one environmental quality may result in an increase in quality of life for older adults (Calkins, 2001). The goal should be nothing less.

Implications for Practice

- Three times the number of falls occurred in private rooms than in public spaces, demonstrating a need to continue research in both areas.
- The number of falls increased as the facility size increased.
- When a design professional is consulted in the original construction or renovation of an ALF, there are significantly more cues incorporated into the built environment.

- Increased facility size is predictive of whether a designer will be used in the original construction or renovation of an ALF, and predictive of whether more environmental cues incorporated into rooms than in smaller facilities.
- Larger facilities tend to house older residents, who often have increasing physical and cognitive impairments.
- Knowledge of environmental cues can help design professionals target the needs of ALFs, based on facility size and room type, to incoporate an increased number of environmental cues, which in some rooms correlate to a reduction in falls.
- Design professionals who have knowledge of the issues that result from declining sensory abilities will be better equipped to focus on interventions that minimize fall risks, thereby promoting the highest quality of life.

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RESEARCH METHODS SPRING 2014 • VOL. 7 NO. 3, pp. 144–151

Evaluating Evidence: Defining Levels and Quality Using Critical Appraisal Mixed Methods Tools

Ellen Taylor, AIA, MBA, BArch, EDAC, PhD(c), and Sue Hignett, PhD, FIEHF, MCSP, EurErg

Background and Aims

Evaluating evidence for the built environment is not easy, and many professionals struggle with the challenge of identifying the best available research. This article outlines the current state of science for evaluating evidence in healthcare design, drawing on previous discussion articles in this journal and introducing a Mixed Methods Appraisal Tool (MMAT), which can be used by professional designers to evaluate research evidence for healthcare design. Two case studies are provided to illustrate the use of the MMAT with an evidence levels algorithm.

Critical Appraisal Tools

Academic texts often include evaluation tools to assist students in taking a critical stance when reading research papers. For example, *Reading Research* (Davies & Logan, 2012) contains worksheets that can be used to evaluate systematic reviews, qualitative, quantitative, and mixed methods research. Several *HERD* articles and editorials have discussed the importance of evaluating the research used in evidence-based design (EBD) (Hamilton, 2011; Marquardt & Motzek,

AUTHOR AFFILIATIONS: Ellen Taylor is a PhD student at Loughborough University in Loughborough, Leicestershire in the United Kingdom, and the Director of Research at The Center for Health Design in Concord, California. Sue Hignett is a Reader in Healthcare Ergonomics and Patient Safety Loughborough University in Loughborough, Leicestershire in the United Kingdom.

KEYWORDS: Decision making, evidence-based design, hospital, literature review, outcomes

CORRESPONDING AUTHOR: Ellen Taylor, etaylor@healthdesign.org; (925) 521-9404.

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2013; Pati, 2011; Stichler, 2010). Stichler (2010) references the American Association of Critical Care Nurses (AACN) evaluation of 12 different rating systems to propose a new "evidence-leveling system for individual research designs" (Stichler, 2010, p. 5). Stichler suggests using hierarchies to establish internal validity and provide "a guide to the strength of available evidence regarding the research methodology used to measure the effect of design features on specific outcomes and the quality of the research in its elimination of inherent biases" (p. 4). This fulfills Hamilton's (2011) suggestion to use a "recognized evaluation model" (p. 124) to critically appraise (rate the quality of) research evidence. Marquardt and Motzek (2013) subsequently developed a six-step algorithm to assist designers in establishing the hierarchical level of research studies when reviewing available evidence. This follows a well-established systematic approach to literature review (Aveyard, 2010), with additional steps to develop design recommendations and implement and evaluate design decisions.

However, The National Academies Press launched an initiative in education to reflect the notion that matching research methods to the research question was not enough to ensure scientific rigor (National Research Council, 2004). It proposed a system where methods for peer review would be clearly delineated with defined and illustrated scoring levels. More recently, Pati (2011) theorized that because an assessment framework did not exist for healthcare design, it must be developed and that because healthcare design draws on a diversity of disciplines, there is potential for bias among different experts when evaluating studies. While Pati's suggestion offered an overview of study design and methodology for categorizing both evidence levels and quality appraisal, Marquardt and Motzek (2013) commented that to use this framework, the designer would probably need to understand research methods—a critique that also applies to their own algorithm (step 3: appraisal of research study quality).

There are an increasing number of critical appraisal tools designed to evaluate the methodological quality of research studies. Crowe and Sheppard (2011) reviewed 44 Critical Appraisal Tools (CAT), including five CAT tools for multiple study types. One of the five, the open-source Mixed Methods Appraisal Tool (MMAT) (Pluye, Gagnon, Griffiths, & Johnson-Lafleur, 2009) provided the most consistent method of evaluation across study types that might be used in EBD decisions—qualitative, quantitative, and/or mixed method studies. Mixed studies reviews (that include qualitative, quantitative, and mixed methods studies) are becoming better conceptualized and can offer a novel approach to literature review in the health sciences (Pluye & Hong, 2014). We suggest that this approach addresses Pati's (2011) concern about bias due to the diversity of disciplines contributing to healthcare design.

The MMAT has five sections to be used for different study types:

1. Qualitative (e.g., grounded theory, case study);
2. Quantitative randomized controlled (trials);
3. Quantitative non-randomized (e.g., non-randomized controlled trials, cohort study);

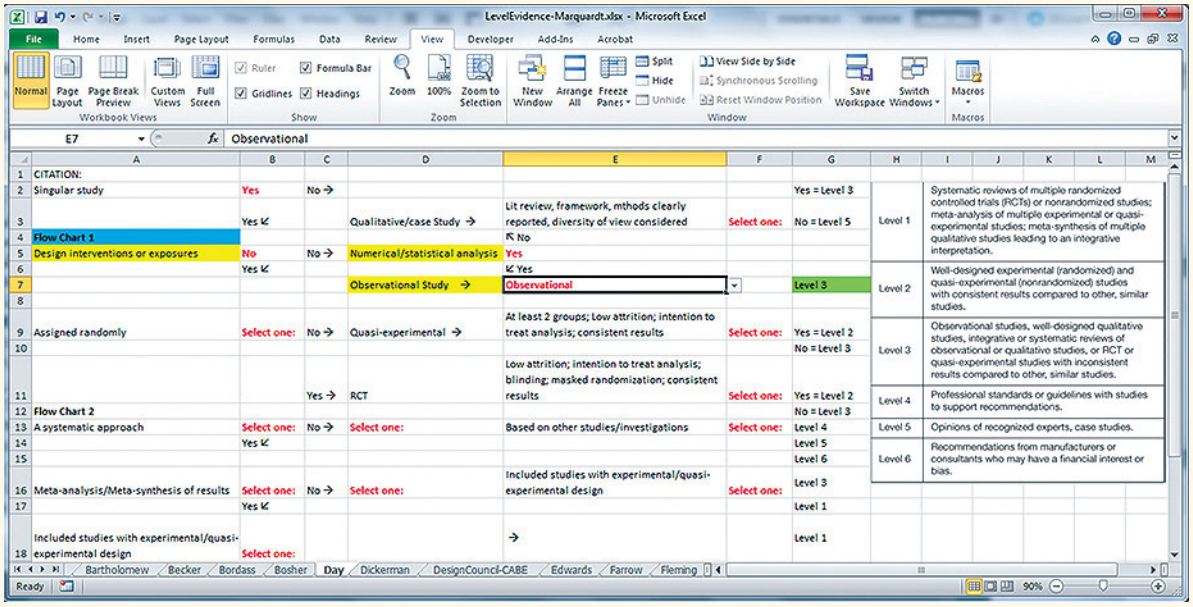
4. Quantitative descriptive (e.g., single-group studies); and
5. Mixed methods (e.g., sequential explanatory design, triangulation design).

Each section contains four questions related to the quality of the specific study design. The Mixed Methods section includes three questions and is used in conjunction one of the preceding sections 1–4 (specific study type). A tutorial is available to support the appraisal process and define terms (Pluye et al., 2011). Depending on the type of study and complexity of the research the appraisal can take as few as 15 minutes to complete.

Case Studies

In an effort to leverage existing methodologies and address the continued shortcoming in the lack of critical appraisal of the broad range EBD-related studies, two case studies were developed using a systematic approach for (1) built environment interventions to reduce falls and (2) design tool development for the built environment. The MMAT, reviewed in Crowe and Sheppard (2011) and validated by Pace et al. (2012) was used for methodological appraisal. This was balanced by the recommendation to quantify the level of evidence for design of the built environment, as proposed by Stichler (2010), through the algorithm developed by Marquardt and Motzek (2013). For the purposes of using the algorithm, a spreadsheet was created with drop-down menus and conditional color coding to allow the easiest path through the process (see Figure 1).

Figure 1. Excel mapping of Marquardt and Motzek (2013) algorithm.



Although these case studies do not include a systematic review (Centre for Reviews and Dissemination, 2009), both were carried out with a systematic approach to searching and retrieving literature using multiple databases, keywords, alternates, and combinations of terms. Research papers were not restricted to empirical research, but were limited to English language. The search results ("hits") were filtered for relevance by title and abstract and then a smaller number were screened by reading the full paper. Seventeen papers were included in the case study for fall reduction, and 21 papers were included in the case study for the design tools review.

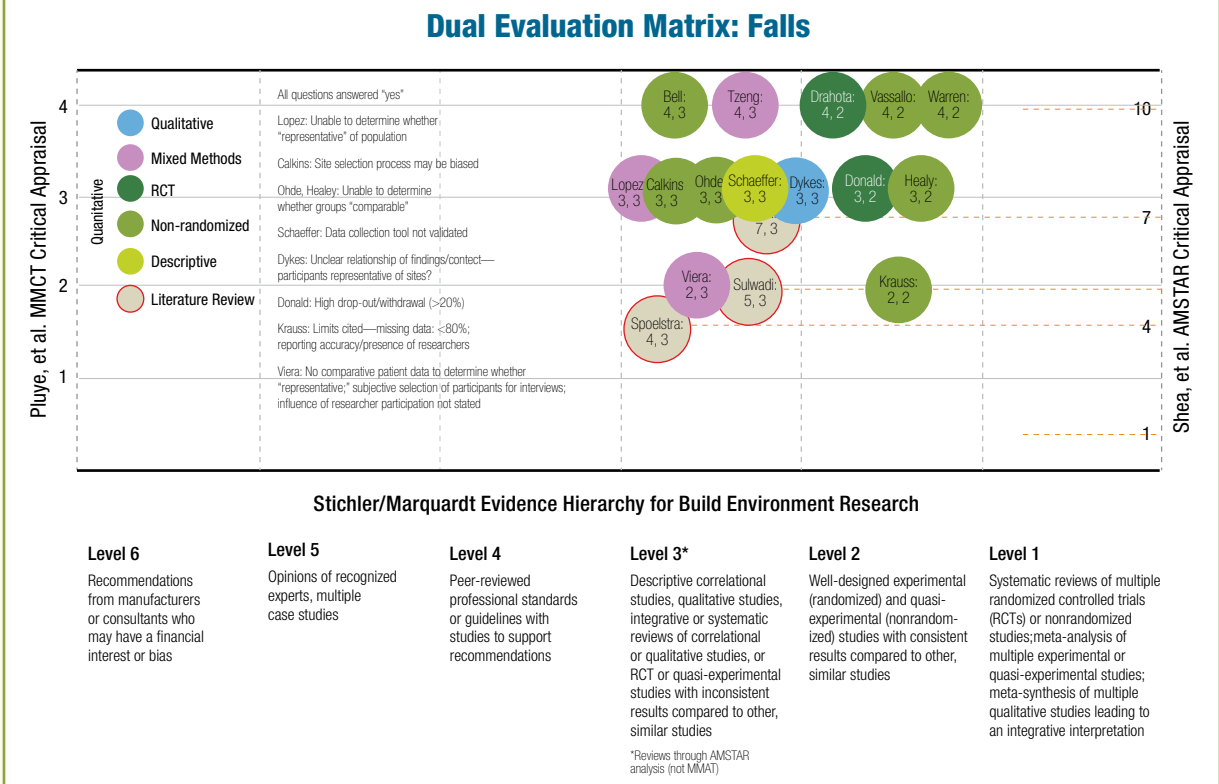
Three literature reviews were included in the falls case study. These were evaluated using Shea's "assessment of multiple systematic reviews" (AMSTAR), which was developed to "assess the methodological quality of systematic reviews, building upon previous tools, empirical evidence and expert consensus" (Shea et al., 2007, Background section, para. 4). This open-source validated tool (Shea et al., 2009) consists of 11 questions and is also included in the Crowe and Sheppard review (2011). A printer-friendly format is available online (http://amstar.ca/docs/AMSTARguideline.pdf).

For each case study, the quality appraisals were charted on a primary and secondary vertical axis (see Figures 2 and 3). The MMAT appraisal was plotted on the vertical axis, supplemented by colors to define one of the five categories of the MMAT. Stichler's (2010) evidence levels as interpreted by Marquardt and Motzek (2013) were charted on the horizontal axis. In the case study regarding fall prevention, the AMSTAR appraisal was included on a secondary vertical axis, although there cannot be a direct comparison of the two vertical axes.

Case Study 1: Fall Prevention in the Built Environment

In the first case study most of the research, including the three literature or integrative reviews, were evaluated at a mid-high range level of evidence, using the Stichler levels and the Marquardt and Motzek algorithm. The additional critical appraisal (MMAT) further defined the methodological strength of the studies, with five receiving high quality appraisal scores (Bell et al., 2008; Drahota et al., 2013; Tzeng & Yin, 2008; Vassallo, Azeem, Pirwani, Sharma, & Allen, 2000; Warren & Hanger, 2013), and two receiving lower quality scores as they were missing half of the four components of the evaluation (Krauss et al., 2008; Vieira et al., 2011) (see Figure 2). For example, Krauss cites missing data as there instances when no one was available to answer questions or when the patient in question had already been discharged, and only 52% of the staff participating in the study took both the pre- and post-intervention test modules. The MMAT indicates 80% data completeness, or a 60% response rate. The fall prevention self-study modules were also developed internally and were not validated or from a standard instrument. In the case of the Vieira study, there was no comparative demographic patient data to determine whether the sample was "representative," and there was a subjective selection of participants for interviews. Additionally, the influence of researchers through their interactions with the participants was not stated.

Figure 2. Evidence categorization and appraisal matrix for design interventions for falls reduction.

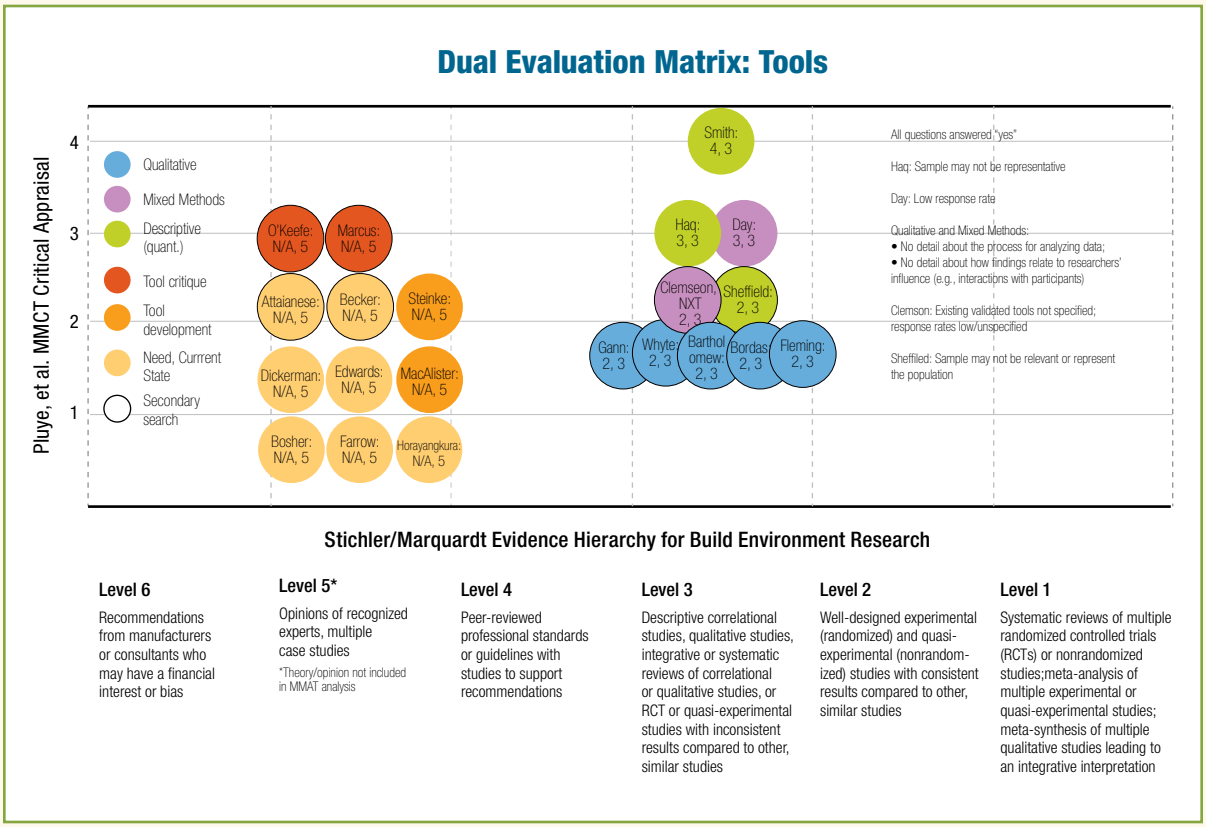


Each of these categorizations highlights the benefit of the matrix method. A higher level of study, as categorized by the Marquardt and Motzek algorithm (i.e., quasi-experimental), may range in its methodological quality, while a lower "level" study (i.e., descriptive correlational studies) may demonstrate a more rigorous approach. A limitation of this approach using the Marquardt and Motzek algorithm is the lack of assessment of "well designed," as defined in a Level 2 study.

Case Study 2: Design Tool Development

In the second case study, many of the included papers were theory or professional expert opinion and were not appropriate for evaluation using the MMAT. While the theories and opinions proposed in these papers were the result of an analytical process drawing on experience and literature, no specific secondary appraisals were conducted. Overall, the evidence levels for this case study were lower, with all papers falling into Level 5 (expert opinion/theory) or Level 3 (descriptive, correlational, etc.). The MMAT evaluation of the Level 3 papers found that very few met the criteria of high quality. While this was not unexpected, because the topic represents a significant gap in knowledge, the secondary appraisal provides

Figure 3. Evidence categorization and appraisal matrix for design tools.



much more clarity about the potential overall weakness of research in this area, peer-reviewed or otherwise (see Figure 3).

Discussion

Appraising research is an important aspect of understanding options and solutions in evidence-based design and then translating these into design recommendations. Evaluating evidence in EBD follows Crowe and Shepherd's (2011) explanation for any systematic review; a search can contain information from a variety of sources including quantitative research, qualitative research, and gray literature, and it can be difficult to summarize this data into a cohesive whole. However, we suggest that there is no need for healthcare designers to reinvent the wheel, but rather to use appraisal tools and methods that are already developed (and validated). The Stichler (2010) levels are based on existing standards, and the advantage of the Marquardt and Motzek (2013) algorithm is that the evaluation is fairly quick and straightforward. The disadvantage is the assumption that study design alone is adequate to appraise a single study or a body of work. Although it is important to have an understanding of study design, this should then be used to select an appropriate critical tool and evaluate the qual-

ity of the research in the context of that study design (Hignett, 2003). There are many times when an experienced researcher may be required to assist professional designers in assessing evidence, whether because of time or expertise. However, the dual method outlined in this paper provides both a validated appraisal tool (MMAT) to add depth of understanding with the matrix representation to give a quick visual assessment of the evidence.

Implications for Practice

- Evidence-based design needs a foundation of critical (quality) appraisal as part of the design process.
- Critical appraisal tools (e.g., MMAT) exist (often validated) for use with a wide range of study types.
- A visual representation of study type and quality can help practitioners evaluate research as part of evidence based design.

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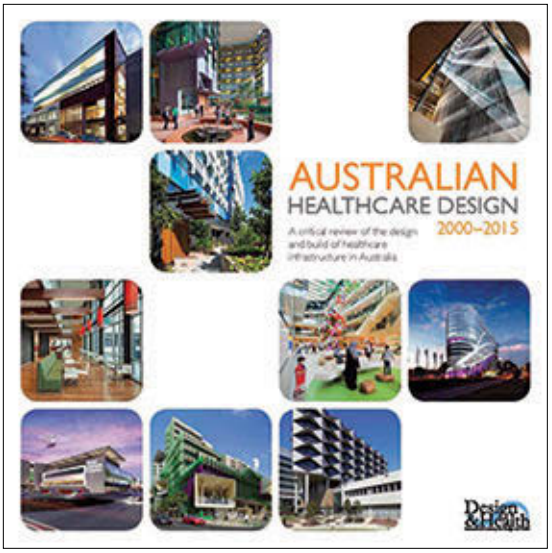
Australian Healthcare Design 2000–2015:
A critical review of the design and build of infrastructure in Australia

Copeland, Kate (Ed.) (2013)
Stockholm, Sweden: The International Academy for Design and Health

Review by Naomi A. Sachs, ASLA, EDAC, and Mardelle McCuskey Shepley, FAIA, FACHA, EDAC, LEED AP



In July, 2013, the International Academy for Design & Health held the 9th World Congress in Brisbane, Australia. Australia's proposal to host the Congress evolved into the book, *Australian Healthcare Design 2000–2015,* which was then published to coincide with the event. Alan Dilani, Founder and CEO of the International Academy for Design & Health, states in the book's preface, "Australia's successful bid to host the event reflects the huge amount of new healthcare building that is taking place across the region, and the body of research and knowledge that has developed there as a result…this book aims to communicate to the rest of the world that the region has some of the most advanced healthcare buildings of our time" (p. 12).

This richly illustrated book appeals to visually-oriented designers, but offers valuable information for scholars and healthcare administrators as well. Many compelling contemporary international healthcare projects are featured in journals and books, but rarely do we get to see so many projects collected together focused on a specific geographic region, as is done in *Australian Healthcare Design 2000–2015.* The book serves as both a compendium and snapshot of the latest research, practice, and design in a large and diverse country. While Australia faces some unique challenges such as the vast distances between cities and the large number of rural community facilities, most issues are those facing every country and society: rising healthcare costs, patient and worker safety, an aging population, and rapidly advancing technology.

The World Health Organization defines health as "… a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity" (1948). Most medical care, and healthcare design, in the second half of the twentieth century followed the "pathogenic" and "biomedical" model, in which mind and body were viewed as separate rather than inextricably linked, and diseases were addressed primarily with pharmaceutical drugs and/or surgery. Healthcare practice and design is now moving in the direction of care that does not just treat the sick after the fact, but instead uses a more holistic preventive care model, encouraging health and wellness in all aspects and through all stages of life. The term "salutogenesis," first coined by Aaron Antonovski in 1979, has begun to be adopted by members of the healthcare design community as an expression of this belief. This approach promotes health and well being—not just for buildings, but for all scales of design (cities, communities, landscapes). Salutogenic design and biophilic design are closely linked to concepts associated with evidence-based design.

The book is organized into two sections: Essays and Projects. Following the Introduction, which includes a preface by Alan Dilani, and Forewords by the editor and the sponsors, are 15 essays by a mix of researchers and professionals, all of whom have practiced in Australia. Their professions include design (architecture, landscape architecture, and engineering); medicine; healthcare administration; and research and teaching in higher education. Among the topics are behavioral health facilities, sustainability, and access to nature. The essays lend gravitas and credibility to a book that might otherwise be viewed more as a promotional piece on new healthcare design and construction.

The second half of the book is devoted to design examples. Thirty-five projects are described in narrative text and color images. Following these projects are 53 briefly documented "feature projects." Both the projects and "feature projects" are organized into categories of Tertiary and Acute Care; Women and Children's Health; Cancer Care; Mental Health; Regional Health; Community Health; and Science, Research, & Education. This organization is useful, as most people will want to see specific healthcare typologies.

Regarding shortcomings of this book, a few essays overlap in content. The narrative on the design projects tends to be laced with promotional phrases (e.g., "an abundance of nature") and does not always provide illustrations of the claims (e.g., "supports evidence-based design"). Regardless, the book is a compendium of useful information.

Australian Healthcare Design 2000–2015 is an important book that expands our knowledge of healthcare design and research in Australia. Global awareness would increase, and health facility design would benefit significantly, if additional countries or regions prepared similar references in the future.

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NAOMI A. SACHS, ASLA, EDAC, is Founding Director of the Therapeutic Landscapes Network and a PhD student at Texas A&M University, within the Center for Health Systems & Design. She can be reached at nsachs@tamu.edu

MARDELLE MCCUSKEY SHEPLEY, FAIA, FACHA, EDAC, LEED AP, is a professor and director of the Center for Health Systems & Design at Texas A&M University. She can be reached at mshepley@arch.tamu.edu