Abstract: Design and Health

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This paper presents a post-occupancy/building performance evaluation framework for case studies on health care facilities, with a focus on the lessons learned, both positive and negative. The author has carried out a number of case study evaluations on such facility types as Kaiser-Permanente medical office buildings, the Barrett Cancer Center at the University of Cincinnati, and the Primary Pediatric Care center at Children's Hospital in Cincinnati, among others. The findings and recommendations of the above case studies resulted in guidance for retro-fit of existing facilities, as well as programming input for future similar facilities. Examples of evaluation/programming concepts that emerged from the above case studies will be highlighted, and, in reference to the emerging design paradigm for the 21st Century, i.e., universal design, directions for a future research agenda are outlined.

Introduction

The field of health care facilities planning, ranging in scale from solo practitioners' medical offices to huge, complex hospital campuses, is undergoing continuous change, due to phenomena which distinguish it from many other more mundane building types: budget pressures from HMOs; over-capacity and mergers; technological change; staffing patterns; longer than normal building delivery cycles; and, last but not least, consumers demanding higher quality of care and care facilities. Competition of the marketplace is a driving factor, and demographic trends, such as ex-migration of the population into the suburbs, have resulted in dislocations and closings of central city health care facilities. When offered a choice, the consumer will decide which care provider is most conveniently located and offers the best health care environment.

As Motoko Rich (2002) stated in an article on "Healthy Hospital Designs":

"Hospitals, long a bastion of bad design and dreary décor, are finding that improving their layouts and their looks can translate into better health for their patients."

The article continued to highlight features of hospitals that were replacing or updating décor and design, including: softer colors like pastel blues and greens on the walls; warmer, indirect lighting; wider hallways and doors; pullout sofas for visitors; private toilets for each patient; atrium gardens; local art; access to natural light; decentralized nursing stations with flip-down desks and computers outside patient rooms for charting purposes; and, rooms provide erasable white boards that patients' families or staff can make notes on.

All of the above features are intended to create a healthier atmosphere in hospitals by de-institutionalizing the ambiance, decentralizing nursing stations, protecting privacy of patients, and introducing more "humane" designs, for example. This trend was introduced more than a decade ago by designing Alzheimer care facilities (Calkins, 1991), which recognized the different stages of the disease and subsequently, created supportive environments, in correspondence with the abilities of the patients. At last, it is gratifying to see that this humanizing trend has invaded literally all of health care facilities design. Without it, health care providers will not be able to compete in the future.

Toward a Building Performance Evaluation Framework

On the surface, the above-cited design features appear to be primarily visual/ aesthetic in nature, while some deal with workflow and efficiency, and others with spatial dimensions, privacy, and so on. Health care design, it is argued, extends well beyond these features and should be based on a comprehensive framework for programming, designing, and evaluating health care facilities. Systematic feedback and feedforward mechanisms are needed to learn from the lessons of the past as to successful and unsuccessful health care facilities design, so that they can be deposited in databases, translated into design guidance, and used in future projects. Distilling the lessons learned and capturing such data in in-house databases is a growing trend in leading practices specializing in health care facilities design. This approach is also called "knowledge-based design." An example of such knowledge building is the evaluation of an NBBJ (2003) designed hospital in Iowa , which was carried out by NBBJ's programming staff, who coincidentally were trained as registered nurses additional with business degrees. This fact is important because it is the thorough understanding of the processes (patient flow; paper flow; materials flow; and others) that are integral to health care facilities that test evaluations are validated. Such evaluations, also called facility visits, are usually carried out six months to one year after occupancy.

An attempt to develop a framework for Building Performance Evaluation was presented in Time-Saver Standards for Architect Design Data (Preiser and Schramm, 1997), and has been adapted for this paper.

The framework's distinguishing features are: Each of its six phases has a review loop to ensure that the project's outcomes are in line with intended goals: for example, needs analysis, using facility audits, occurs in strategic planning; once a budget is identified, the project commences with the programming phase, followed by the design and construction phases; post-occupancy evaluation, in this framework, is only one of six phases and it occurs after the building is commissioned and occupied. It is distinct from post-construction evaluation, which typically results in punch/ to do lists prior to the owner accepting the facility; the final phase (six), recycling, concludes the life cycle of a building and, in line with today's quest for sustainability, may result in adaptive re-use or recycling of building materials.

In carrying out evaluations, the author proposes to apply evolving performance criteria which, from a holistic perspective, will result in "healthy designs." The main categories of performance criteria can be grouped into three segments and are shown in Figure 2, Evolving Performance Criteria.

The implication here is that no health care facility can obtain the seal of approval in terms of quality, if one or several of the nine categories are under performing. Needless to say, these

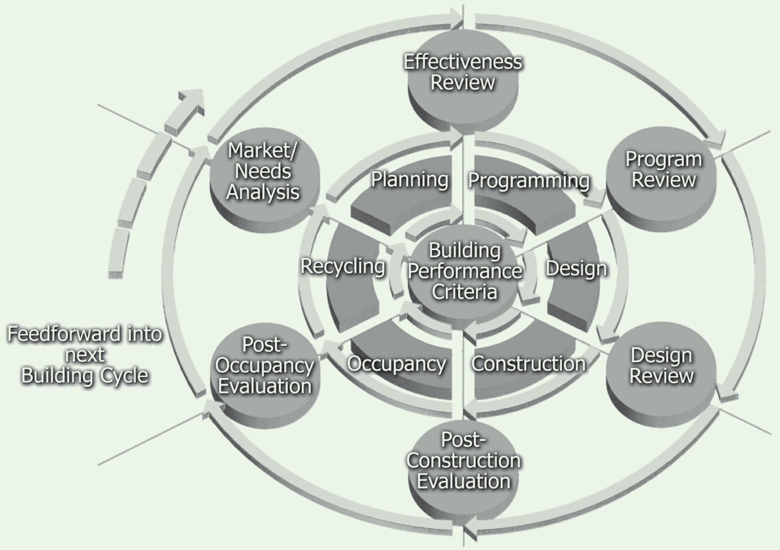


FIGURE 1 - Building performance evaluation framework

performance criteria categories have to be translated and operationalized for the programming and design phases of the building delivery cycle. For example, required amounts of space are to be specified; light levels and effects need to be identified in both quantitative and qualitative ways; safety criteria need to be clarified, such as non-slip surfaces, surface characteristics for wheelchair use, characteristics of treads and risers of stairs, emergency lighting, etc. This is the task of the programmer, whereas the designer will select the systems and models that will deliver the required performance. In this context, the triad of post-occupancy evaluation, database development and facility programming assumes a core role when attempting to improve the quality of health care facilities design.

Enter universal design (Preiser and Ostroff, 2001), which some have called the new design paradigm for the 21st Century. In a nutshell, it is simply good design which does not discriminate, does not single out any one user group (e.g., the disabled), and it follows our democratic principles by providing equal access to and use of not just facilities, but products, interior architecture, urban design, transportation systems, as well as information technology.

The Seven Principles of Universal Design, devised by the Center for Universal Design (1997) extend the notion of building performance criteria into usability by most or all people. If there is any one facility type that this new paradigm should be applied to, it is health care facilities. Inclusive universal design principles overlap with the above-mentioned evolving performance criteria (Figure 2). Again, as Figure 3 shows, their lofty, rather idealistic principles need to be operationalized for application in actual buildings (see Figure 3).

This can best be accomplished through case study evaluations on actual buildings, using interpretations of The Seven Principles of Universal Design, and the implications and guidance that can be developed from them. Obviously, these would vary with the type and scale of health care facility. Accordingly, the

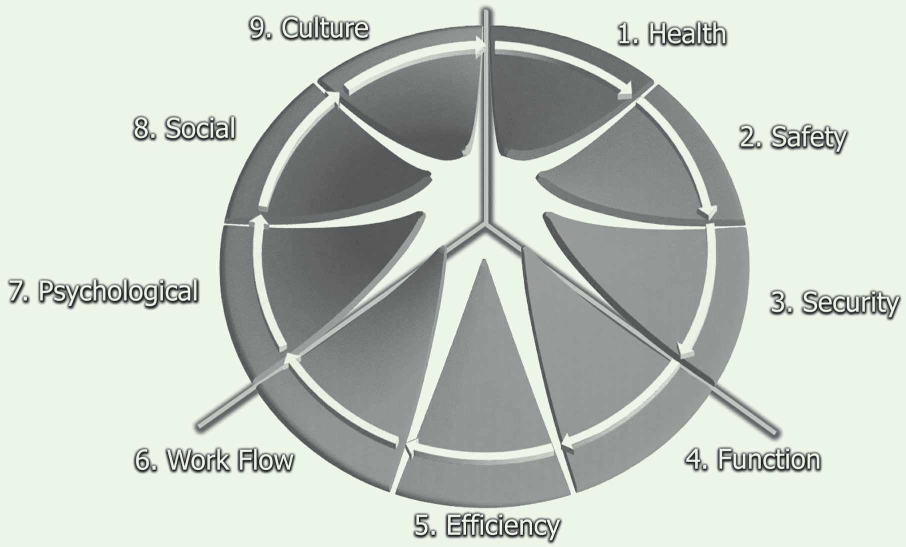


FIGURE 2 - Evolving performance criteria

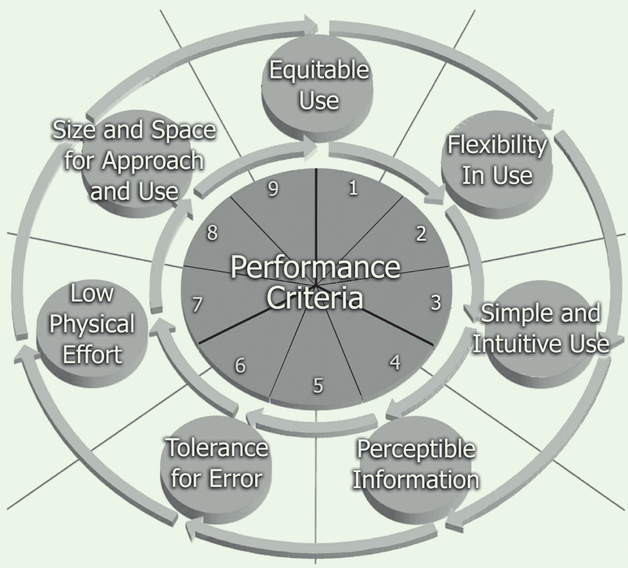


FIGURE 3 - Universal design principles versus performance criteria

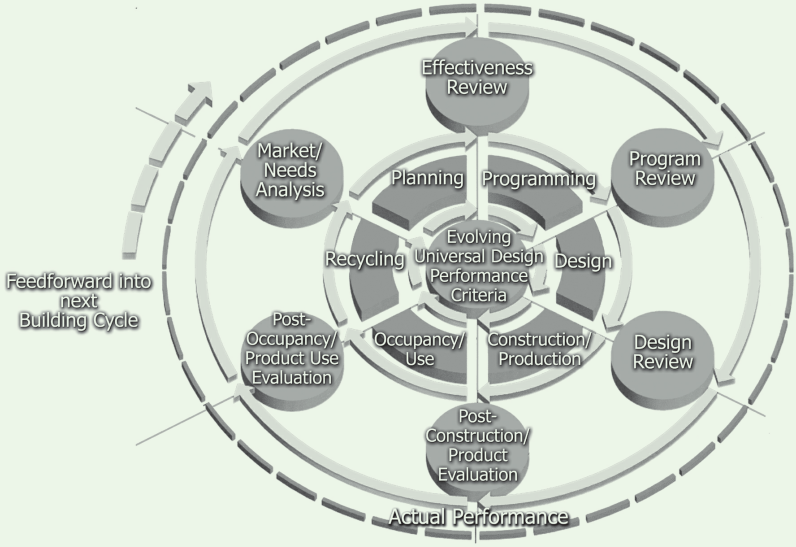


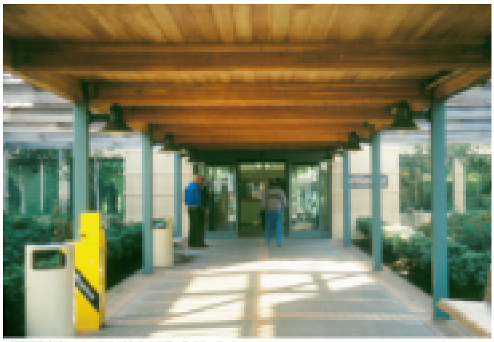
FIGURE 4 - Universal design evaluation framework

above-mentioned building performance evaluation framework has been extended into a framework for universal design evaluations (UDEs). Typically, facility visits would be carried out using interviews, observations, and photography to ascertain how common-place tasks/activities in a given facility type are supported by its design and features. An outline of the steps involved in facility visits is given in Section X below.

Examples of Findings From Case Study Evaluations

1. Kaiser-Permanente Medical Office Building in Longview/Kelso, Washington

This facility was featured in Modern Health Care , as an award-winning design for a medical office building. The facility visit was carried out with staff of the Portland, Oregon, Northwest Regional Office of Kaiser-Permanente (Preiser, 1996). Surveys and interviews of doctors and staff were followed by an on-site visit and walkthrough evaluation.
Facility Layout: While the facility rated very positively on most aspects of performance (functionality, workflow, aesthetics, etc.), it had one “fatal” flaw: Heart patients had to cover rather long distances from the parking lot to the member check-in desk, and the medical care units, resulting in stress and code calls, i.e., incidents where patients’ health and well-being was endangered. Thus, in the future, it may not be advisable to repeat the single-story layout of the facility, although it is aesthetically very pleasing and its performance overall was excellent.



Fenestration: Daylight coming through windows and skylights was seen to be a positive feature on one hand. On the other, skylights also produced glare on critical signage/wayfinding systems, which became almost unintelligible due to the reflections.

FIGURE 6 - Glare on Directory

Staff Lounge Outdoor Area: Having an outdoor extension of the staff lounge was seen as a stress reducing feature, allowing staff to have lunch and/or gather socially during break periods out of doors.

Overflow Waiting Area: Having an overflow area with patient seating during times of flu epidemics, for example, was seen to be as a necessary performance aspect. In times like these, temporary signage would be improvised and put up to cope with the overload and to direct patients.

Patient Privacy: Privacy was thought to be compromised and stress caused by one-way mirror glass in patient exam rooms on the periphery of the building. Patients did not know that it was one-way mirror glass, and people on the outside could not see through, unless they came very close to the windows.

Emergency Entrance: The aesthetically very pleasing design prevented emergency vehicles from entering the building with their gurneys directly from the outside and adjacent to the main entry.

2. Kaiser-Permanente Medical Office Building in Mission Viejo, California

This facility is located adjacent to Leisureland, which serves primarily senior citizens. Staff of the Southern California Regional Office of Kaiser Permanente in Pasadena carried out the facility visit , which was very similar to case study # 1.

Elevators: The two-story facility had only one elevator. When it was malfunctioning or being serviced, many of the patients who were elderly and used assistive devices could not reach the upper floor, thus making certain medical departments inaccessible. A least two elevators should be provided, in the facility, even if the second elevator is primarily a service elevator.

FIGURE 7 - Mission Viejo Medical Office Building

Entrance Location: Long distances had to be covered from curbside to the main patient entry of the building. There was no shelter or place to sit for patients awaiting transportation, thus resulting in discomfort and stress.

Waiting Area: Waiting room seating was arranged in such a way that many of the seats faced away from the registration area, thus introducing uncertainty and stress in patients waiting to see their doctor.

3. Barrett Cancer Center, University of Cincinnati

The Barrett Cancer Center was programmed and designed with very limited input from medical staff, simply because there was no previous cancer center and organization at the University of Cincinnati.

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Signage and Wayfinding: Finding the facility was difficult, partly because there were multiple (six) entrances, two of which connected the Center with adjacent buildings through skywalks and tunnels. Patients were confused and entered through the wrong entrances, such as the ambulance entrance or radiation therapy entrance at the lower level, and subsequently got very confused and lost. A single, major entrance with a clear street address and adjacent to parking should have been provided.

Elevator Signage: Elevator signage was very confusing, due to elevators opening both in the front and the rear, and patients not knowing what the front and the rear was. Elevator buttons should be stacked vertically instead of side by side, as it customary.

Staff Lounge: Official policy stipulated that Barrett Cancer Center staff utilize the main cafeteria of the University of Cincinnati Hospital and Medical Center, approximately 10 minutes walk away, using tunnels, skywalks and connector corridors. Waiting lines in the hospital cafeteria were very long. The result was that Barrett Cancer staff did not have enough time to use it. Instead, they created improvised staff lounge areas in rooms that were dedicated to purposes such as storage, locker/bathroom areas, etc. It was recommended that one of the entryways to the building (it was not accessible to the disabled due to staircases), be closed and converted into a staff lounge, which has since been done.

Color-Coded Signage: In addition to problems with elevator signage, directional signage in the building was very confusing. It was recommended that block diagrams and color-coded signage be utilize, in order to make wayfinding easier.

Staff Back Entrance: The patient exam room area had no back entrance, which would permit doctors to leave without being seen by their patients in the patient waiting area. On one occasion, a patient actually died and had to be removed through the patient waiting area, a sight which may not instill much confidence in waiting patients.

Waiting Area: The waiting area was crisscrossed by a route from the main hospital to the adjacent family practice building. It was heavily used by doctors and staff, as well as service personnel transporting materials with hand trucks. This route cut through waiting lines of patients trying to register at the registration desks, thus creating stress. It was recommended to route this traffic around the waiting area on the periphery of the building and to provide some enclosure to the seating clusters. This has since been implemented successfully.

Furnishings: Seating individuals in groups should provide choices for patients and accompanying persons to suit their needs, such as chairs with and without arm rests.

Canopy: A stretch of about 40 feet of rough pavement had to be crossed in order to reach the atrium/main entrance of the cancer center. In inclement weather, there was no protection from the elements and a canopy was recommended. This has yet to be implemented.

Privacy at Check-in: Acoustic and visual privacy at check-in is very important when patients provide health and personal/financial data to the registering clerk.

This can be achieved through partitioning panels between registration cubicles with patient seating.

I.V. Therapy Rooms: These were found to be too few and too small, and they were occupied by mixed gender patients, thus providing virtually no privacy for confidential conversations. Seating for accompanying persons was extremely limited for patients that may have to endure I.V. therapy for long periods of time. More and private, larger patient rooms were recommended, thus accommodating accompanying persons better.

Charting Stations in Corridors: These were installed post-facto, and because they infringed on the already narrow escape route and 5-foot-wide corridors, they were basically illegal from the fire marshal's perspective. A better solution would have been alcoves with charting stations serving three-patient exam rooms each, to be used standing or from high stools.

Privacy in Patient Exam Rooms: Both visual and acoustic privacy in exam rooms is of great concern. Partitions and walls don't usually go all the way up to the ceiling and the drop-in ceilings permit overhearing of conversations next door. Furthermore, visual privacy can be achieved by having the door swing open inward with the exam table behind it, thus protecting patients from being seen by passersby.

4. Primary Pediatric Care Facility, Children's Hospital, Cincinnati.

This facility was housed in the former emergency room in the oldest part of Children's Hospital in Cincinnati. It had been reprogrammed and designed a few years earlier to serve the primary pediatric care purposes, with the result that spaces were dysfunctional, special relationships and distances excessive, and the overall ambience of the environment very institutional and not child-friendly. Furthermore, the facility had very low ceilings (7-1/2 feet clearance in many places), and floor level differences of six inches in some areas would have to be ramped. Worst of all, multiple columns, both load-bearing and/or pipes coming from the upper floors, could not be moved.

Adaptive Reuse: Because of the above-mentioned difficulties, this project was seen to be a temporary solution only until a more ideal, free-standing facility with easy access could be built in the future. This, in fact, has be accomplished in the interim.

Process Analysis: In a time of staff reductions, changing procedures and technology, as well as processes, the way doctors and staff operate, a so-called process analysis is critical. This was carried out by studying the flow of patients, staff and doctors, as well as paperwork (patient records). This was documented in a process chart which, in turn, lead to the below concept of the "core area."

Core Area: This area contained all the essential services, such as registration, nurses' room, doctors' team room, medication room, etc. Around this core patients would be routed in a uni-directional manner, thus avoiding backtracking or confusion, all the way to the exit, next to which a window was located for future appointments and payments to be made.

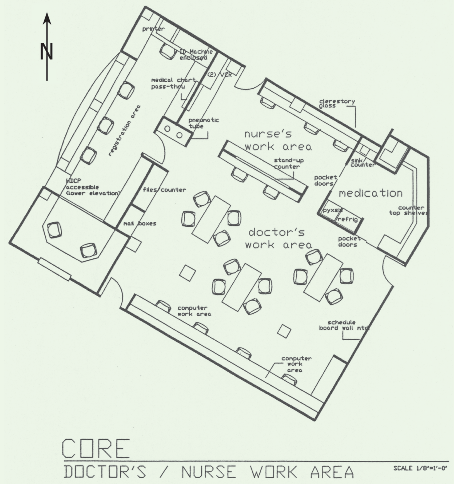

FIGURE 9 - POE-based, efficient core area redesign

Reduced Travel Distance: Through the process analysis, core area concept and uni-directional flow, the travel distances and time for doctors and staff were reduced by about 50% (compared to the original layout), thus saving energy, costs and fatigue.

Modular Design: Patient weigh areas were out in the open and stressful because of lack of privacy. The new patient exam rooms were planned in clusters of five, with one weigh room each. Rooms sizes were 8 X 10 feet. This arrangement was proposed in light of the fact that the facility would be converted to serve the research function of the hospital in the not-too-distant future, and thus could house offices for research assistants at that point in time.

Conclusions

As the above case study examples indicate, feedback on the performance of a variety of design features, (including operational considerations), can be used to develop criteria for correcting problems in existing facilities, as well as the programming and design of future ones. Investing in feedback/feedforward of this type can produce great value to organizations (Preiser, 2002), especially with repetitive types of health care facility and building programs. In each of the case studies and conclusions, reference must be made to universal design. Furthermore, the findings/observations from these studies should be organized in a prioritized, methodical way, and deposited in dedicated databases and clearinghouses. As mentioned earlier, the need to operationalize the Principles of Universal Design into programming and design criteria for a cross section of health care facility types, such as: community health clinics; medical office building;: day surgery centers; small, medium and large size hospitals; laboratories; and, entire medical centers. Implied in this are short, medium and long-term research agendas to be funded by governmental and not-for-profit agencies. Examples of such research are regularly reported in the Coalition for Health Environments Research (CHER) News (2003).

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