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1 Letter from the Editor

2 Bench-to-Bedside: Translating Medicine, Motivating Patients & Sustaining Environments

10 Opportunities for Sustainable Designing in Skilled-Nursing Culture Change

20 Evolution of the ED

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Questions?
Please direct inquiries to AAH@aia.org.

About the Academy

The Academy of Architecture for Health (AAH) is one of 21 member communities of the American Institute of Architects. The AAH is unique in the depth of its collaboration with professionals from all sectors of the healthcare community, including physicians, nurses, hospital administrators, facility planners, engineers, managers, healthcare educators, industry and government representatives, product manufacturers, healthcare contractors, specialty subcontractors, allied design professionals, and healthcare consultants.

The AAH currently consists of approximately 6,893 members. The Academy improves the quality of healthcare through design by developing, documenting, and disseminating knowledge; educating healthcare architects and other related constituencies; advancing the practice of healthcare architecture; improving the design of healthcare environments; and affiliating and advocating with others that share our vision and promoting research.

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Letter from the Editor

This is the 15th edition of the *Academy Journal*, published by the AIA Academy of Architecture for Health (AAH) knowledge community. As the official publication of the Academy, the *Journal* electronically publishes articles of particular interest to AIA members and the interested public involved in the fields of healthcare architecture, planning, design, research, and construction. Since 2005 we have also published a hard copy version of the *Journal* that has expanded our distribution worldwide. The goal has always been to promote awareness and educational exchange between architects and healthcare providers and to broaden our base of understanding about our clients.

Articles are submitted to, and reviewed by, an experienced nationally diverse Editorial Review Committee (ERC). Over the years, the committee has reviewed over 183 submitted articles and responded to countless writers' inquiries, and encouraged and assisted numerous writers in achieving publication. The *Journal* has provided valuable opportunities for new and seasoned authors from the architecture and healthcare professions. With this issue, three articles have been selected and printed supporting the enhancement of the built environment for healthcare. Throughout the 14-year history of the *Journal*, the authors have included architects, physicians, nurses, other healthcare providers, academics, research scientists, and students from the United States and many foreign countries.

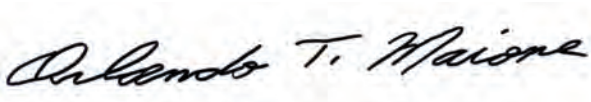
Mission of the Academy Journal

As the official journal of the AIA Academy of Architecture for Health (AAH), this publication explores subjects of interest to AAH members and others involved in the fields of healthcare architecture, planning, design, and construction. The goal is to promote awareness, educational exchange, and advancement of the overall project-delivery process and building products.

Published articles have explored a broad range of medical topics, including trends and the future of healthcare architecture, cardiac care, future and evolving technology, patient rooms and patient safety, lighting design for healthcare, psychology, workplace design, cancer care environments, emergency care, women's and children's care, and various healthcare project delivery methods. Visit the *Academy Journal* archives at www.aia.org/practicing/groups/kc for earlier articles you may have missed. We would like to encourage more graduates who have received healthcare research scholarships and others involved with research within the architecture for healthcare fields to submit their research to the *Journal* for publication consideration. We will continue to develop a cross-referenced article index and a broader base of writers and readers. The deadline for the 2014 Call for Papers is May 30, 2014.

My special thanks to the AIA for its continued support and hard-working staff, and to the many volunteers who have contributed to our growing and continued success. I would especially like to thank the other members of the 2013 ERC: James G. Easter Jr., FAAMA, Assoc. AIA (Tenn.); Ed Jakmauh, ACHA, LEED AP (Pa.); Joyce Redden (Tenn.); John Sealander, AIA, ACHA (Calif.); Professor Kent Spreckelmeyer, PhD, FAIA (Kan.) and Janice Stanton, RN, MBA, EDAC, LEED Certified (Ill.).

As always, we appreciate your feedback, comments, and suggestions by calling AIA Knowledge Communities Manager Susan Parrish at 202-626-7332 or me at 631-246-5660.



Orlando T. Maione, FAIA, ACHA, NCARB
Editor, Academy Journal
November 2013

Bench-to-Bedside: Translating Medicine, Motivating Patients & Sustaining Environments

By Sharon E. Woodworth, AIA, ACHA

Designing environments for the treatment and cure of chronic neurological disorders is among the greatest challenges in healthcare architecture

Abstract

Vancouver's University of British Columbia Centre for Brain Health is a 135,000-square-foot clinical research facility containing wet and dry labs in addition to patient clinics, all of which are dedicated to neurological and psychiatric diseases ranging from Lou Gehrig's disease, Multiple Sclerosis, Parkinson's, and Alzheimer's to resistive Psychosis. Designing environments for the treatment and cure of chronic neurological disorders is among the greatest challenges in healthcare architecture, made even more so when the driving vision for this institution was to have 100% patient participation in research. Three aspects aligned to support that vision and advance a new building typology: Translating Medicine, Motivating Patients, and Sustaining Environments. This paper addresses each aspect with the belief that when the fields of education and healthcare architecture overlap, this triad must be considered in order to achieve true design excellence. Translating Medicine provides an overview of the history, challenges, and architectural motif inherent in a translational medicine facility; Motivating Patients describes the specifics of how a neuro-psychiatric environment can be supportive, the value of a supportive environment for patients of any clinical diagnosis, and the interior design motif intrinsic to translational medicine facilities; and Sustaining Environments offers a summary of what a translational medicine facility can achieve for the environment and society in general.

Article

A University Teaching Hospital's Neuro-Psychiatric Vision

Designing environments for the treatment and cure of chronic neurological disorders is among the greatest challenges in healthcare architecture—case in point: The 135,000-square-foot Djavad Mowafaghian Centre for Brain Health is a clinical research facility containing wet and dry labs in addition to patient clinics, all of which are dedicated to neurological and psychiatric diseases ranging from Lou Gehrig's disease, Multiple Sclerosis, Parkinson's, and Alzheimer's to resistive Psychosis. This soon-to-be-completed facility was conceived over 10 years ago by Dr. Max Cynader, along with a host of research faculty, neuroscientists, psychiatrists, nurses, and clinical staff. The site provided for this long-awaited project is the gateway to the Health Science departments on the University of British Columbia campus in Vancouver with a direct adjacency to Vancouver Coastal Hospital. For the architectural team, both entities are clients: Cynader is procuring the construction funds for the facility and Vancouver Coastal Health Research Institute will operate the building upon its completion.

The driving vision for this institution is Cynader's objective to have 100% patient participation in research. Three aspects aligned to support that vision and advance a new building typology: Translating Medicine, Motivating Patients, and Sustaining Environments. This paper addresses each aspect, as outlined below, with the belief that when the fields of education and healthcare architecture overlap, this triad must be considered in order to achieve true design excellence.

- Translating Medicine—provides an overview of the history, challenges, and architectural motif inherent in a translational medicine facility.

- Motivating Patients—describes the specifics of how a neuro-psychiatric environment can be supportive, the value of a supportive environment for patients of any clinical diagnosis, and the interior design motif intrinsic to translational medicine facilities.

- Sustaining Environments—offers a summary of what a translational medicine facility can achieve for the environment and society in general.

Translating Medicine

In the field of medicine, "caring" and "curing" are two different disciplines: the former involves clinicians focused on a patient's needs, while the latter involves researchers dedicated to conquering a disease. As modern medicine has evolved, these two branches of healthcare have grown in parallel directions with less and less crossing of the two disciplines, but in the last decade medical professionals have begun seeking a new breed of medicine that blends the art of caring with the science of curing. This blended typology is commonly referred to as "translational medicine" where healing and learning are meant to intertwine, with the insights of one discipline informing the other.

As architects who specialize in either healthcare or research labs, how do we graft these separate building typologies? Successful translational medicine design requires a thought process that sees not the radical differences of each typology but the best features of both environments. To blend the realm of exam tables with the domain of lab benches requires "translational thinking"—that is an understanding of healthcare and research facility design with enough insight to discover where the two parts can come together in support of a new whole.

Discovering this new whole begins with understanding the original purposes for which the philosophy was developed. The divergent roots of translational design stem from both the healthcare industry and natural science's observation that healing capabilities and research achievements had reached a veritable ceiling with current facility templates. The first translational facilities were seen in the field of natural science education, and today multi-disciplinary department buildings are becoming standard fixtures in the collegiate setting. Simply stated, few institutions erect biology department buildings any more. Administrators now invest in "life science" buildings designed to intermingle students and faculty among disciplines, allowing for the exchange (and creation) of new ideas and philosophies.

This university campus dynamic of collaborative environments was soon becoming apparent in the healthcare arena as well. Several industry leaders attribute the idea of collaborative healthcare to cancer centers; over the past decade, these institutions discovered if they could not cure everyone, the least they could do is care for the individual with a terminal illness. To this end, cancer centers developed a multi-faceted focus on providing patient care while continuing to advance progressive insights on treatment and life-saving cures. This natural blending of resources, bringing together clinical and research space, was soon supported financially.

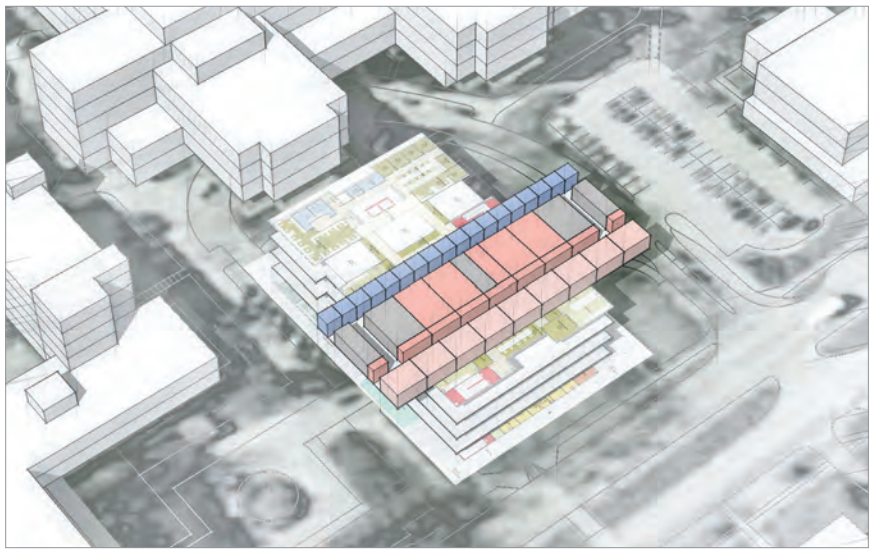
Government agencies that provide research funds—such as the National Institutes of Health (NIH)— discovered the value of blending caring with curing; incentives were established to motivate the industry to consider alternative research approaches by mandating interdisciplinary strategies. These interdisciplinary research operations were quickly followed by building designs that mirrored the blended aspects of caring and curing, where clinician and scientist could see each other on a daily basis with the possibility that sightings of the other might stimulate a conversation leading to an otherwise unrealized discovery.

The parallel aspect of life sciences' focus on "wholeness" and cancer centers' attention to "caring despite a cure" can set the stage for a powerful blending of the best minds and people all in one place. And this place, as a new whole that retains the best features of their original parts—that is environments that are conducive to multi-faceted learning and environments that are favorable to comprehensive care—is the foundation for translational thinking.

Proceeding from this "translational" thought process to successful design requires anticipating the inherent challenges of translational design. Quite simply, the vastly

Successful translational medicine design requires a thought process that sees not the radical differences of each typology but the best features of both environments.

Figure 1: Diagram of Lab Box



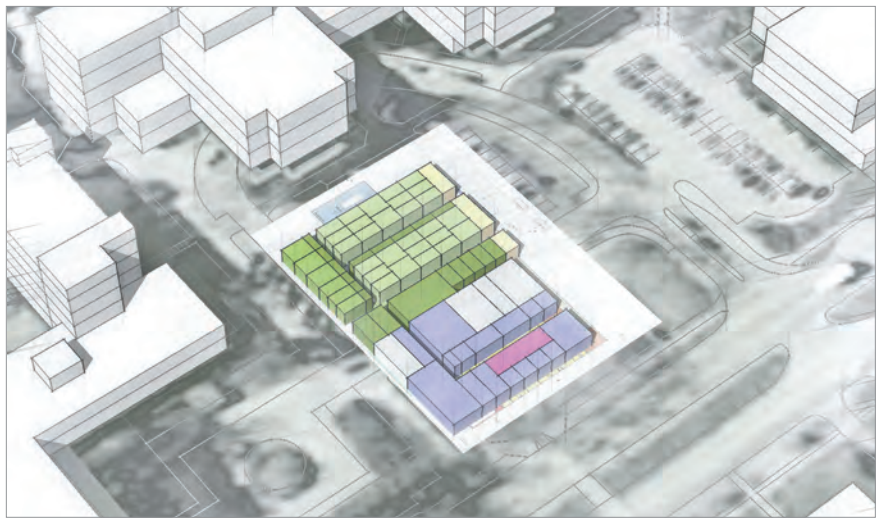


Figure 2: Diagram of Clinic Box

different needs of research labs and healthcare environments should not undermine the best that both worlds can offer.

In its purest form, translational means "bringing all parties together" which, as design practitioners quickly recognize, requires the blended discussion of parties that seldom share the same conference room table. As architects specializing in either research labs or healthcare, an inherent challenge stems from the "poles apart" mentalities involved in designing space for two disparate uses. Architects associated with research buildings are typically accustomed to designing for a generic population that allows any and all researchers to function as research grants change over time, whereas clinical architects customize a standard module to ensure designs meet the specific needs of a patient specialty while allowing any and all practitioners to function in the module despite future medical evolutions. Both designs achieve flexibility, yet both are arrived at by engaging users differently. Translational medicine design requires thinking simultaneously about different user processes while discovering the common features of flexibility and efficiency that will benefit both.

From the perspective of healthcare administrators and/or principal investigators, the facility systems can be a challenge with potential for no-one-wins conflicts. Standalone hospitals and research facilities typically have precise structural grids and mechanical systems that do not align when in a single structure. Even the diverse building codes associated with each facility type can create conflicts when a single building is desired.

The Centre for Brain Health addressed these potentially conflicting architectural differences by first challenging the design assumption that a single-building volume is the most efficient and economical. The project literally split the program into two boxes separating the disciplines, each with a structural and mechanical system appropriate for the respective lab or clinic needs; these boxes then rotate and interlock such that the slender lab box is suspended above half of the very broad clinic box.

The clinic box is divided by an atrium bifurcating staff zones separate from patient zones, with the later free from lab system constraints. By rotating the research labs' three upper floors away from the patient zones, each service has the appropriate structural grid and mechanical service; the portion of the two floors directly under the research labs are configured as clinic staff support spaces, which tolerate the lab grid and simultaneously offers a pure clinic-staff to research-staff vertical zone.

Figure 3: Five-Story Atrium

Once conflicts between architectural systems are addressed, the clients' contradictory operational needs must be considered. This may entail vastly different hours of operation and carry over into the overall arrangement of public versus private spaces. Research facilities often feature discrete, staff-only entries as well as back-of-house access for research animals or autopsy samples whereas, conversely, clinical environments usually encourage open space and a sense of entrance/arrival, fostering clinician and patient interaction as well as visitor engagement.

The Centre for Brain Health's two program boxes interlock with a five-story atrium as the connective tissue literally joining all building activities so patients and researchers can meet by chance "in a single space for mutual benefit," says David Martin, AIA, the project designer and principal for the London office of Anshen+Allen, now a part of Stantec Architecture.

Ultimately, translational medicine facilities must seek ways to create visual and physical opportunities for collaboration, and atriums have proven to be an inherent architectural motif for this new building typology. Atriums allow visual access into and from research labs so that both research investigator and patient can benefit from seeing each other; atriums also foster physical opportunities for interacting on a random basis and exchanging either new findings or new care paths.

Motivating Patients

Atriums, as a building concept, bring diverse parties together, but in translational medicine a strong design concept that succeeds at "chance meetings for patient and staff" does not guarantee that those patients will participate in research. It takes more than a random interaction or chance encounter to motivate patients to participate in finding their cure. Even having unlimited research funds available will still result in little research if there are no patients upon which studies can be conducted. In order for patients to feel motivated—motivated enough to give time, donate tissue or organs, and risk not receiving a miracle drug—they must first have felt cared for, and that means the architectural environment must meet their physical and emotional needs.

The needs of neuro-psychiatric patients are wholly unique. Patients with neurological diseases most often have movement disorders ranging from the simple need to rest or the contradictory inability to start walking only to then be unable to stop walking as their rhythm is literally off balance. Patients with psychiatric

Figure 4: Public Atrium

Figure 5: Detweiller Gallery

disorders need shielding from overstimulation but simultaneously need to visually scan all that the environment may pose for them. Lack of spatial clarity stresses both patient populations for different reasons: neurological patients are easily distracted because their focus is on the physical effort it takes to navigate even simple environments, while psychiatric patients are easily confused because their focus is on the mental effort it takes to navigate unfamiliar environments.

And atriums can be either over stimulating or ineffective for the distracted or confused neuro-psychiatric patient population. To support the Centre for Brain Health's patient population, the atrium was modified from a five-story space to step down as a two-story space over the clinic waiting areas; patients don't feel overwhelmed and are still connected to the scientists on upper levels as the atrium steps up into the research floors.

For any patient population connecting atriums can be a social challenge; the complexities of mixing clinics' very ill patients and distracted families with casual and carefree research assistants who are likely to be young adults in

T-shirts or lab coats is a challenge made even greater when aiming for an encounter between patient and researcher. For the Centre for Brain Health, Interior Architect Lynn Befu utilized the multi-stepped atrium as an opportunity to address the differing ambience of two dissimilar environments—lab versus exam, staff versus patient; she fashioned an interior with smooth "calming" materials for the clinic seen from the entry on the right, and textured "engaging" materials for the lab seen from the entry on the left. This right-side/left-side treatment subtly and respectfully references the neuro-psychiatric patients' often right-brain, left-brain entanglement, in addition to cueing all who enter which zone is their destination.

All patient populations should be greeted with entry cues that identify discrete patient zones from staff zones. The Centre for Brain Health furthers this concept with the previously noted geometric rotation that allows for two separate but integrated structural grids throughout both sides of the clinic floor; one grid creates a "clinic core," where patients receive care, while the other grid creates a "collaboration core," where staff can gather in private. The clinic core is rotated free of the research labs to foster exam room efficiency, while the collaboration core housing open staff workstations is aligned directly under the research labs to encourage vertical connectivity between clinicians and researchers. Separating the staff workstations in the "collaboration core" creates an "off-stage" environment protecting the patient from unintended research activities.

Grouping the primary patient destination spaces into a compact "clinic core" sets up three therapeutic needs important to the neurological and psychiatric patient population:

Single point of entry and exit. Multiple entries can be extremely taxing for patients with limited physical and/or mental resources. A typical clinic floor arrangement laid out in a large "U" configuration where patients enter on one end and exit on another end can create a potential obstacle for confusion as well as a longer path for both patient and staff. Creating a clinic entry that is also the clinic exit eases the mental stress of way finding by reinforcing the exit as the same way you entered.

Short and simple corridors. Racetrack corridors that loop back create pathways that are disorienting and often longer than the neuro-psychiatric population can tolerate. Ideally, clinics should be compressed to only patient-destination rooms located off of one, short corridor; from this primary corridor patients then need only turn left or right to access exam and treatment rooms. The simple "left or right" decision point eases mental stress, and the shorter path acknowledges patients who have difficulty walking any distance.

Stopping & starting opportunities. Corridors can be hazardous traffic zones for neuro-psychiatric patients, some of whom travel at different speeds while others are disturbed by perceived congestion. Programming a wider primary corridor to include alcoves for either staff touch-down zones, patient sub-waiting areas, or simple benches for anyone allow the tired patient to rest or the overstimulated patient to take a break; the Parkinson's patient will use any sort of visual cue from a mark on the floor to a small waiting nook to pace himself, the Multiple Sclerosis patient will use that nook as a place to rest, and the psychiatric patient will take advantage of a brief moment of "escape" as he or she pulls away from the traffic.

The Centre for Brain Health's clinic core achieves all of these attributes to support their particular patient population, which in turn sends the message that they are cared for; then and only then will the patient be receptive to considering participation in neuro-psychiatric research. Cynader's objective to have 100% patient participation in research is a highly optimistic but potentially attainable vision; as a benchmark, patient participation in research has been known to range from as low as 2 percent based on a 2007 study of U.S. cancer clinical trials, to as high as 67 percent according to a 2007 study of Canadians volunteering for randomized, controlled trials (1) (2). Participation in research is always a patient dilemma. For the neurological patient, he or

All patient populations should be greeted with entry cues that identify discrete patient zones from staff zones.

Figure 6: Staff-Only Collaboration Core

she may feel "untreated" in a controlled study, and donating brain tissue post-mortem requires sensitive ethical considerations; clinical trials for cancer patients carry similar risks as there is always a chance a new treatment may be ineffective or worse than their current treatment. Architecturally, for patients of any clinical diagnosis, the environment must first meet the specific needs of that patient population; a supportive setting allows them to consider these dilemmas and prepares them to participate in research fully motivated and committed to a helping find a cure.

Beyond meeting the patient's particular physical and emotional needs, translational medicine facilities must also seek ways to offer patients a "preview" of spaces they might encounter, thus allowing them an opportunity to anticipate what is ahead. Providing interior windows or glazed panes into spaces wherever appropriate eases the unknown for patients and families, and in some instances, simultaneously allows the staff to monitor patient needs.

Transparency, either through the use of interior glazing or open visual sightlines, furthers the design goal of allowing the scientist to be seen and the patient to view research in action, but as an interior motif transparency is a fundamental element ensuring a positive patient experience in translational medicine facilities.

Sustaining Environments

For a neuroscience facility, utilizing transparency to experience a two-way connection is symbolic of the healthy brain's functioning where synapses connect right-brain thoughts to left-brain actions. The Centre for Brain Health was inspired by the idea of an intact brain synapse: "There is a therapeutic gain when there is a sense [that patients] are part of something bigger than themselves… The whole point was to institute a dynamic where more academic researchers, who typically have little interaction with patients, are put into direct contact with doctors and patients," says Martin.

And with both interior and exterior transparency, the potential for heat buildup can be extreme. The Centre's large glass atrium was the focus of energy-saving strategies. Mandated to construct the building to LEED Gold standards, heat recovery in the atrium was maximized by running exhaust air through a manifold and reusing the heat to pre-temper incoming air. While the exhaust requirements of the research areas ruled out a natural-ventilation strategy, separate zone systems for each area to maximize energy savings were created. "Some research areas need 10 to 12 air changes an hour, but the patient areas have a much lower draw, around four air changes an hour," Martin says. "Only 60 percent of the building needs to be at a higher rate, so the building systems were designed for the populations within them, rather than the lowest common denominator."

The upper-level lab floors are full-height glass walls incorporating insulated clear glass panels with interior materials that are highly visible above the tree line, and when illuminated in the early evening, highlight the translational research mission of the Centre. In keeping with the campus' broader goals for environmental sustainability, the lab design incorporates solar shading. Extensive high-performance glazing "puts science on display" to patients and public, while light-colored block walls enclose clinical areas to maintain patient privacy; both treatments offer a continual balance of patient needs, transparency between science and care, and sustainability of resources.

With or without the clinical component common to translational medicine, lab facilities benefit society as a whole when resources are conserved. Research labs' energy consumption per square foot exceeds hospitals' energy consumption by a factor of two; labs also use disproportionate amounts of water and have a substantial waste stream, some of it toxic. With these concerns in mind, the Centre for Brain Health also has reflective surfaces for both roof and landscape, automatic lighting controls, and a gray water-harvesting system; the Centre will be 50 to 60 percent more energy efficient than a baseline building, and half of the savings will be achieved through air-side heat recovery.

In addition to architectural sustainability, carbon footprint reductions were also considered; the project was a collaboration between teams in two cities—San Francisco and Vancouver—and the design took place in both cities simultaneously. From San Francisco, an IBM laptop tablet was utilized to draw ideas in PowerPoint that the Vancouver clinicians could then manipulate through their pointer; this back-and-forth, drawing and pointing, resulted in a dynamic, on-the-spot discovery of what would work for this patient population without either party having to board a plane every week.

Targeting a June 2013 completion and LEED Gold certification, the project is currently under construction. It is not a simple box—it is instead a place in which patients with severe mobility and psychological needs will feel comforted and cared for—enough to motivate their giving back to those who cared for them, to those who seek a cure for brain health.

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Opportunities for Sustainable Design in Skilled-Nursing Culture Change

By Sara Mae Martens, AIA, LEED AP

The skilled-nursing industry is undergoing a great evolution, renovating and re-organizing in a national movement known as "culture change."

Abstract

The skilled-nursing industry is undergoing a great evolution, renovating and re-organizing in a national movement known as "culture change." Values of culture change include providing more choice, dignity, respect, self-determination, and purposeful living for residents. The building industry as a whole is undergoing a similar evolution in sustainability—focusing on energy efficiency, cleaner interior air quality, and healthier urban environments. Most hospital administrators indicated that they generally perceive evidence-based design as synergistic with eco-effective design (Shepley et al. 2009). This should make sense intuitively—that a natural building would in fact *feel* better than a "conventional" building. Do sustainable buildings generate better healthcare outcomes? What would an environment look like that seamlessly integrates both culture change goals and sustainable design goals into an elegant home for healing and wellness?

Culture change provides an opportunity for architects to discuss environmental sustainability concerns that dovetail with the therapeutic goals driving the culture change movement. Our clients need to know that there are opportunities to incorporate sustainable design into their new environments in a way that reinforces the underlying values of culture change. This paper draws on the available research to examine how sustainable design strategies and culture change strategies overlap in long-term healthcare facilities. Five design strategies are discussed in depth: daylighting, therapeutic gardens, family and community, households, and safe materials—in relation to both their therapeutic and sustainable potential.

Article

"We can create places that devour and destroy the environment and that in turn destroy us. Or we can do the opposite—create places that help us to live in harmony with the environment and sustain our health."
—Esther M. Sternberg, MD
(Sternberg 2009)

The skilled-nursing industry is undergoing a great evolution, renovating and re-organizing in a national movement known as "culture change." Ideally, elderly and those with chronic medical conditions who reside in skilled-nursing facilities should be able to live well, with dignity, outside of traditional institutional medical facilities. Just because a person needs regular medical care, on a monthly, daily, or weekly basis does not need to mean they are "sick." Culture change is a progression from institutional or traditional models of care to more individualized, consumer-directed practices that embrace choice and autonomy for care providers and recipients (Frampton 2010: xiii). Values of culture change include providing more choice, dignity, respect, self-determination, and purposeful living for residents. Most facilities implement programs that give residents more choices and more control over their daily schedule. Most buildings undergo some kind of physical renovation to transform existing sterile, institutional spaces into decentralized, home-like environments. Renovated facilities usually have smaller units, refreshed residential style interiors, and amenities like kitchens, laundry rooms, or game rooms that are available to residents 24 hours a day.

The building industry as a whole is undergoing a similar evolution in sustainability—focusing on energy efficiency, cleaner interior air quality, and healthier urban environments. Quantifying and measuring sustainability is challenging. The most prevalent measure in the building industry today is the Leadership in Energy

and Environmental Design (LEED) rating system created by the United States Green Building Council. LEED rating systems are checklists developed by a collaboration of industry professionals, and are peer reviewed and pilot tested prior to being implemented. Buildings achieve a sustainability rating by earning a number of points from the checklist. LEED is by no means a perfect measure of sustainability, but it may be the most standard tool currently available. Architects must still strive for true sustainability beyond LEED—creating conditions "in which human and nature can exist in productive harmony, that permit fulfilling the social, economic and other requirements of present and future generations" (EPA).

Culture change provides an opportunity for architects to discuss environmental sustainability concerns that dovetail with the therapeutic goals driving the culture change movement. Our clients need to know that there are opportunities to incorporate sustainable design into their new environments in a way that reinforces the underlying values of culture change.

Some of these opportunities are straightforward; here are two examples:

Acoustics: Quieter environments with fewer unwanted background noises result in improved sleep and decreased agitation among residents (Joseph 2006: 3). Most LEED-certified buildings have increased levels of wall, floor and ceiling insulation in order to meet energy efficiency standards. This decreases the sound transfer between walls, floors, and ceilings, producing quieter indoor environments for the benefit of residents and staff.

Wayfinding: Buildings with floor plans in the shape of letters, such as L, H, or E are easier for elderly residents to navigate than buildings that are linear or thick, square shapes (Joseph 2006). These simply shaped buildings lend themselves to an orientation along an East-West axis. Such orientation facilitates daylighting and thereby uses less energy than buildings with deep, boxy floor plans. Letter-shaped buildings are easier to make sustainable and easier for residents to navigate—a real win-win.

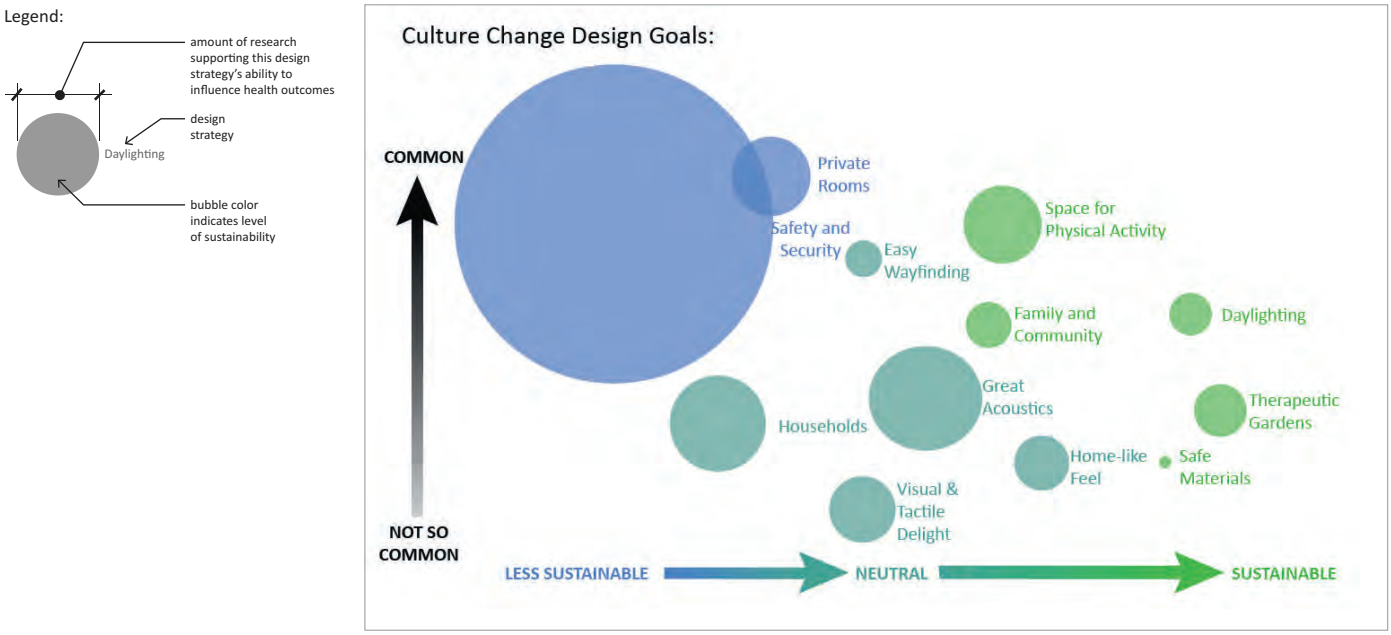
This paper draws on the available research to examine how sustainable design strategies and culture change strategies overlap in long-term healthcare facilities. Healthcare designers are now turning to evidence-based design (EBD) to inform more and more of the design process. EBD is "the process of basing decisions about the built environment on credible research to achieve the best possible outcomes" (Harris et al. 2008). Many of the design strategies implemented in culture change are supported by credible research. How does evidence-based design and culture change relate to sustainability? Most hospital administrators indicated that they generally perceive EBD as synergistic with eco-effective design (Shepley et al. 2009). This should make sense intuitively—that a natural building—one designed such that humans and nature exist in productive harmony—would in fact *feel* better than a "conventional" building. When asked to picture a place of healing, the majority of people imagine a space dominated with natural elements (Cooper Marcus and Barnes 1999). What evidence is there to support this notion? Do sustainable buildings generate better healthcare outcomes? What would an environment look like that seamlessly integrates both culture change goals and sustainable design goals into an elegant home for healing and wellness?

Culture change provides an opportunity for architects to discuss environmental sustainability concerns that dovetail with the therapeutic goals driving the culture change movement.

Based on a review of the literature, the design strategies presented in Figure 1 are the most widely recommended for improving health outcomes of residents in skilled-nursing facilities (Brawley 1997, Joseph 2006, Sloane 2002). Each bubble represents a relative estimate of the following: level of potential sustainability (x-axis), how often this feature occurs in current existing facilities (y-axis), and amount of research supporting each strategy (bubble size).

What does the level of potential sustainability mean? For instance, having "great acoustics" is fairly neutral as far as sustainability—a facility could be designed with great acoustics

Figure 1: Mapping therapeutic design strategies in terms of sustainability and rate of occurrence



by installing a ton of additional synthetic ceiling panels shipped in from overseas (not very sustainable), or by carefully configuring space in a shapes that reduce noise transfer, carefully overseeing the installation to ensure quality, and strategically installing a few ceiling panels made of recycled cotton to achieve the same result (very sustainable). The difference is having a knowledgeable design team that prioritizes sustainability. "Healing Gardens" is further on the right side of the scale because no matter how you detail it, any type of garden will be more sustainable than no garden. Private rooms is on the left side of the scale—because building new private rooms most likely means using more materials for construction and heating/cooling more air year after year—it's inherently less sustainable (although we may choose to build them anyway to achieve other goals).

Perfect data to quantify the measures in the above chart is not yet available, but the framework is a way to holistically visualize the factors that contribute to the improvement of these spaces and thus the figure is a heuristic for critical consideration.

To improve the health and sustainability of skilled-nursing facilities, we must find ways to inflate all these bubbles and move them to the upper right-hand corner. Increased research will inflate the bubbles; this in turn will help convince owners to incorporate these strategies into new or renovated facilities, which will float them to the top of the chart. Architects need to be educated in principles of sustainability so they can design solutions that move the items from the left to the right, while taking into account safety and economic realities.

This paper discusses five of the above design strategies in depth: daylighting, therapeutic gardens, family and community, household, and safe materials—in relation to both their therapeutic and sustainable potential—and shows how the bubbles can be inflated and moved.

Daylighting

"Good lighting should be thought of as the silent partner in caregiving."
—Elizabeth Brawley and Eunice Noell-Waggoner
(Brawley 2008)

Daylighting is the practice of designing a building such that sunlight and ambient daylight illuminate the spaces instead of electric fixtures. Daylighting significantly reduces energy use and promotes healing (Shepley et

al. 2009). Sunlight is essential for good health; it provides us with vitamin D, reinforces circadian rhythms, prevents depression, and helps to regulate sleep and wake cycles. It's been proven that light exposure during the day improves sleep at night for long-term care residents (Joseph 2006). Most elderly do not receive enough exposure to light for optimum circadian rhythm (Brawley 1997:75).

A successfully day-lit building will tend to have both high and low windows and skylights and shading devices designed to optimize the quality and quantity of light in the interior spaces throughout the day and year. Elderly residents are more affected by glare; so much of the sunlight in a long-term care facility would need to be diffused by the use of sheer curtains, light shelves, deepened window openings, or other window treatments. Victor Regnier, FAIA, recommends French balconies, picture windows with low sills and bay windows in assisted living facilities so residents can fully enjoy views as well as daylight (Regnier 1994: 64). The latest survey by the U.S. Energy Information Administration reports that only 9 percent of healthcare buildings have skylights (USEIA 2003: table B11). LEED for healthcare awards points for buildings that have daylight and views provided to 90 percent of the spaces in the interior and for providing outdoor places of respite, both of which support therapeutic needs of long-term care residences.

Therapeutic Gardens

"In the twenty-first century, the healing garden will be seen as an essential, intrinsic component of every healthcare setting"
—Clare Cooper Marcus
(Cooper Marcus 1995)

Much has been written and studied about healing gardens in healthcare environments, but the most convincing piece of evidence is the one that we already understand instinctively—when we imagine a place of healing, it is a most often a place dominated by nature. This intuitive notion is widespread among different cultures. Studies show that spending time in natural settings with plants, mountains, lakes, streams, or ocean breezes has a calming, stress-reducing effect—particularly by increasing perceived control (Cooper Marcus and Barnes 1999). Although the trends in healthcare architecture in the last 20-30 years have been focused on the clinical, sterile environments that characterize our hospitals, this tide is turning as more and more healthcare professionals are looking to incorporate gardens and other natural elements into their facilities.

Gardens and open space are critical for sustainability. Sustainably designed landscaped areas reduce the urban heat island effect, infiltrate storm water on site, recharge the aquifer, reduce water pollution, reduce water use, require less maintenance, and support local wildlife.

Healing gardens should have the following qualities:

1. Sense of control and access to privacy—options within the garden for exposure or privacy

2. Social support—space to sit and chat

3. Physical movement and exercise—safe accessible paths for walking, spaces designed specifically for games or sports or gardening

4. Natural distractions—lots of plants, flowers, flowing water, sounds of wildlife (Ulrich 1999)

Keith Diaz Moore's research into gardens for those with dementia identified the following characteristics of gardens that are particularly restorative:

Being away
Contrast between the space you were before and where you are now.

Fascination
Elements with patterns, variation, visual intrigue. Natural environments are inherently fascinating.

Figure 2: Neighborhood
Skilled-nursing facilities can be designed to fit in existing neighborhoods providing easier access for families, residents and those living nearby

Extent
An experience that engages a substantial portion of one's mind; that engages multiple senses.

Compatibility
Providing the necessary resources for what one wants to do (also referred to as "fit"). Resources include physical components like safe paving, seating, easily accessible bathrooms, and spatial qualities like being easy to navigate (Diaz Moore 2007).

Family and Community

"They would be qualified to be institutionalized or moved to a nursing home, and because there is public transit service or also some meal service, they can stay in their homes."
—Jill Hough, Director of the Small Urban and Rural Transit Center in Fargo, North Dakota (Albright 2012)

The LEED rating system rewards buildings that are connected with the surrounding community. Credits are awarded for building on infill sites, building at densities high enough to support successful public transportation, and choosing a site within walking distance of parks and services.

The literature on housing for the elderly stresses that maintaining connections to friends and family is beneficial to one's health and sense of well-being. Patients who have a social support network have improved recovery time and survival rate in acute care settings (Cooper Marcus 1999: 43). Care facilities designed to provide for more family involvement are associated with improved clinical outcomes (Rashid 2010). Convenience to family and friends is the second most common deciding factor when it comes to selecting a home for an elderly family member (Regnier 1994). Locating skilled-nursing in close proximity to public transportation, work centers, and retail centers makes it easier for friends and family to visit and sustain social support for residents (Cantor 1975). Integrating the facility into the existing city or town enables easy access via foot, train, bus, and bike, and decreases the amount of materials needed for infrastructure.

Sustainable buildings get big points for being built at higher densities that strengthen the viability of public transportation and other

city services, and reduce the need for new infrastructure. Eventually most older adults lose the ability to drive, but those in denser cities with successful public transportation can remain at home and continue living vibrant independent lives without a car. Seniors in towns and cities take more trips outside the home than those in the suburbs, regardless of health condition or socioeconomic status (Lynott 2009). It's been shown that older adults who can no longer drive are more likely to end up in a skilled-nursing facility regardless of their medical need to be in such a care environment (Freeman 2006). More than half of non-drivers over the age of 65 stay home because they lack transportation options, making fewer shopping trips, social trips, or trips to the doctor (Bedney 2010).

There are certain neighborhoods that naturally tend to have higher numbers of older independent residents. Usually these are walkable neighborhoods, with easy access to needed services and enjoyable social activities. Groups have started identifying these communities as "NORC's"—naturally occurring retirement communities and are putting in place programs to enhance the advantages these neighborhoods already have. This means providing supplemental services such as meal delivery, transportation, housekeeping, exercise classes, recreation, and social events, as well as organizing volunteers to provide these services; essentially the program is simply a framework that organizes older residents in a community helping out other older residents in the community (Bedney 2010). If there was a weekly community meal down the street, your grandmother would be able to walk there and get a nutritious meal, have an interesting conversation, and see a doctor, but if that same community meal was a drive away in a gated community it would require twice as much effort to get there and she would be much more likely to just stay at home alone. If skilled-nursing facilities were designed in such a way as to fit comfortably into existing neighborhoods, these organizations could share space, staff, and other resources, and provide needed services to independent community members at home at a lower cost. When an independently living community member needs the additional help of a skilled-nursing facility, they can move in and remain a part of the same neighborhood with the same social network of caregivers and friends.

Design is what makes the difference here. While there are problems that arise from having a skilled-nursing facility in close proximity to loud buses and dangerously fast skateboarders in the city, these problems can be successfully mitigated through thoughtful design. Building a skilled-nursing facility on a green field on the edge of town with a large secure fence around it will solve some of these problems, but it creates health problems (depression, abandonment, dependency) and environmental problems. Designers need a vision for future successful urban skilled-nursing facilities that provide services not just to residents, but also to elders at home in the adjacent neighborhood. The building must be thoughtfully located and designed to provide safe, healthy, and quiet spaces for residents while being connected to the community and (of course) achieving net zero energy.

Care facilities designed to provide for more family involvement are associated with improved clinical outcomes (Rashid 2010).

Households

"I do not want to die here because it's so ugly."
—Michael Graves
(Perman 2006)

Culture change empowers residents and staff so that the decision making is done at the household level rather than the institutional level (Zigmond 2009). This means adopting a framework for decision making that can take into account the individual needs of particular residents, at a particular time, in a particular place. Sustainable design thinking is similar. True sustainability requires the careful consideration of the particular characteristics of each site, community, and microclimate, and tailoring the building design to fit (and adapt in the future) to those particular circumstances. No culture change facility will be exactly like another; similarly no sustainable building will be exactly like another. This underlying mindset is truly the most synergistic and will enable facilities to adopt sustainable

technologies that are most effective for their particular circumstance.

It is recommended that designers create a home-like ambiance—an environment that is familiar and comfortable for the residents. Homes tend to feature smaller social spaces designed for specific activities, rather than larger multipurpose rooms (Diaz Moore 2007). Furniture should be arranged in smaller groups to facilitate socialization among elderly (Diaz Moore, Geboy and Weisman, 2006; Joseph 2006). People feel more comfortable in smaller groups, but this is especially important for elderly residents with hearing and mobility loss. One of the difficulties of using locally reclaimed, reused, local materials is that there is often a limited selection and limited quantity of items. As a designer you have to work with what is available; you may not have control over the exact material, exact color, etc. A series of several smaller spaces rather than a few large spaces gives a designer more flexibility to incorporate sustainable materials without compromising overall design quality. In other words, a patchwork of sustainable finishes may not be perceived as appropriate in a high-performance heart surgery center—where a feeling of slick scientific accuracy and dependability is desired. In long-term care facility a patchwork of materials and textures can be designed to be beautiful, appropriate, modern, and beneficial to helping residents find their way and feel connected to the community they came from.

The other thing that makes a house a home is that it is socially comfortable. We know how to act, what to do, what to talk about in each room of a house. Skilled-nursing facilities can be designed to encourage this natural socialization by providing views in places that generate conversation among residents, residents and family, and residents and staff. This means not just views, but views of places where something interesting is happening: seasons are changing—people are talking and living—birds are eating—plants are growing (Joseph 2006). It is commonly observed that residents tend to congregate where there are things to watch, whether out the window, the nursing station, the facility entry, or one another (Cooper Marcus 1999: 395). Native plants in and around the facility will earn LEED points. They change with the seasons and interact with local flora and fauna in a way that helps to reinforce a sense of the seasons, which can be easily lost when one spends most of their time indoors. Reused local furniture and materials often come with a familiar story that can enrich, interest, and entertain residents and visitors alike—for example, reusing the seats from the old movie

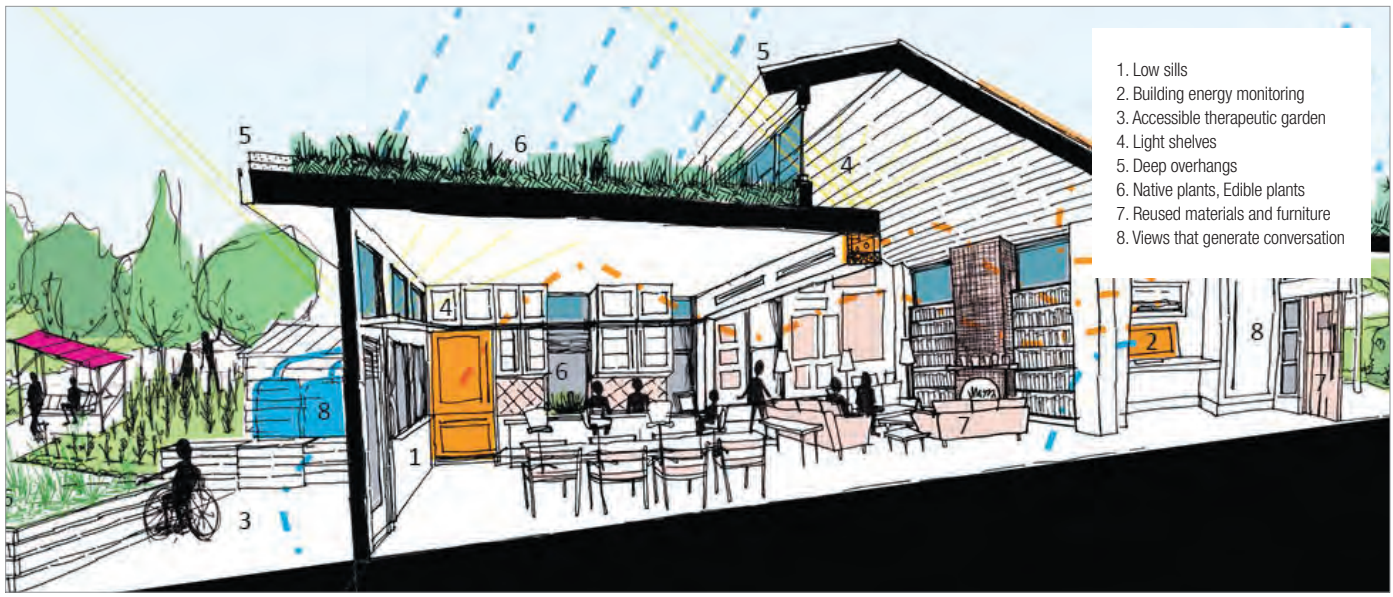
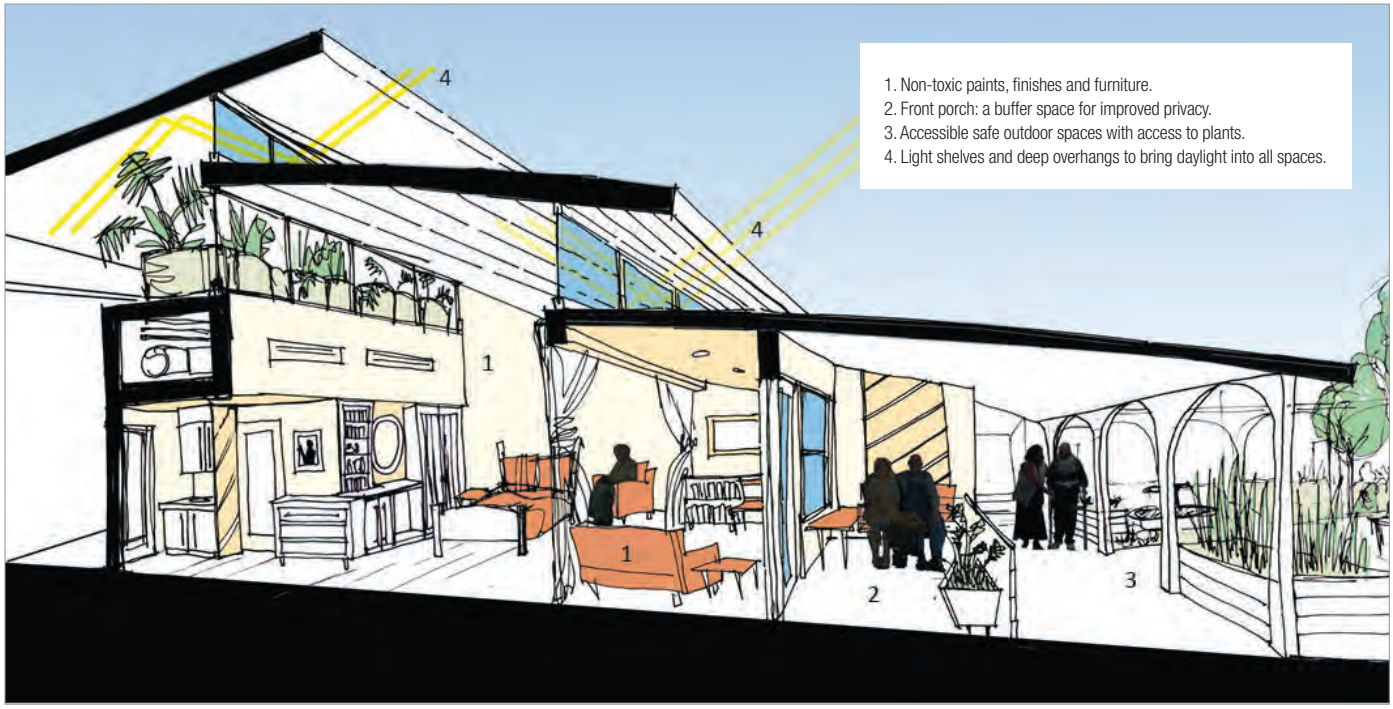


Figure 3: Hearth
Entry, kitchen, dining, garden and living room space serving 10 to 15 residents



theater in town or reusing old benches from the city park in the garden.

The building's sustainable features could provide positive relevant activities or entertainment for residents. Green design features such as green roofs, on-site energy generation systems, healing gardens, and greywater collection could be great conversation pieces because they are relevant to daily life and change on a daily basis. Residents may find joy in monitoring the rainwater collection barrels as they talk about the weather; it is something common and timely to talk about. The maintenance and monitoring of the natural processes occurring in a sustainable facility could be an activity of interest to residents and provide another sense of control over their surroundings. Keith Diaz Moore's research identified a need for "extent"—activities and simulation that have depth, that change with the seasons, that are timely (Diaz Moore 2007). Many of these systems now have sophisticated monitoring systems that could take talking about the weather to a higher level—akin to tracking baseball statistics. The future may see on-site energy production elevated to the level of a local sport; building maintenance teams could compete with one another to produce the most energy on site. This requires daily responsibilities of monitoring building energy use and production that are important but not physically demanding and could be an enjoyable pursuit for some residents. Through technology, the monitoring of green building features could be the job of a resident, a low-impact activity that an able-minded resident could enjoy.

Safe Materials

"Consult your nose – if it stinks, don't use it."
Material Rules at transparency.perkinswill.com

It should go without saying that healthcare environments should be places of healing and peace, and should be free from harmful toxins, but most interior environments are full of toxic materials yielding very poor indoor air quality. Common paints, sealants, and finishes emit volatile organic compounds. Cheap pressed-wood products contain formaldehyde. These toxicants create poor indoor air quality that is associated with higher instances of asthma, respiratory illnesses, reproductive

Figure 4: Living Quarters
Private rooms include bathroom, nurses counter, ample storage, space for reading/study, space for guests and access to a secure courtyard

disorders, developmental disorders, and cancer, especially for those with compromised health who spend the majority of their time indoors (Vittori 2002). Healthcare professionals should be concerned with the indoor air quality of each healthcare space, and the impact on public health that results from the extraction, manufacture and transportation, and disposal of these materials. There are many great resources to help identify toxic products and viable alternatives including the following:

- www.noharm.org
- www.transparency.perkinswill.com
- www.practicegreenhealth.org
- www.healthybuilding.net

Finding alternatives to these toxic materials can be cost effective, sustainable and beautiful.

Conclusion

The design of long-term care facilities significantly affects the health and well-being of older adults (Lawton 1986). As one loses physical and mental functions, an appropriately designed home can enable one to continue living life to the fullest. As our life spans continue to increase, there will be greater numbers of people living with a need for part-time medical care, and we need to design better environments to meet this demand. Before culture change, skilled-nursing facilities followed acute care medical model architecture—they were institutional and sterile—meant to reinforce the expectation that you are ill and could expect to be cured in this place by scientific technology. For those with conditions that cannot be cured (such as old age) this expectation is downright unhealthy. Culture change is beginning to create a new architectural style for healthcare facilities for people who are well and need some medical assistance on a daily basis. These new environments are designed to uplift the spirit, and reinforce the idea that one can live well within whatever physical limits life has dealt you. This type of architecture more easily lends itself to sustainability, having more in common with multi-family housing (a sector that has made great strides in sustainability) than acute care medical facilities.

Incorporating sustainable design principles into all our future buildings will be mandatory for human survival on this planet. As architects we should know this by now; our clients may or may not. It is our responsibility to guide them through the transition to truly sustainable design, and we can make it less painful if we emphasize the ways in which sustainable features support our clients' therapeutic goals. The culture change movement is an opportunity to incorporate new ideas into skilled-nursing design, and sustainability needs to be one of them. By using the research and ideas in this paper we can honor our aging population with spaces that are healthy, uplifting, sustainable, and dignified.

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Evolution of the ED

By James Harrell, FAIA, FACHA, LEEP AP and Angela Mazzi, AIA, ACHA, EDAC

Abstract

Alleviating crowding and minimizing length of stay continue to be major issues in the Emergency Department (ED). However, when intake and flow in the ED are examined, it is clear that the issue is multi-faceted; it will take a combination of improving proximities, changing the care paradigm, and making operational changes to improve the conditions. There have been numerous studies related to operational performance of the ED and the design of the room itself; however, few delve into the issue of the relationship of staff to patient from a design point of view. This study examines ED design from the point of view of staff delivery of care, using several case studies. The case studies represent the evolution of a design concept, where data learned through post-occupancy evaluation was then applied to the subsequent design. What resulted was the "Ribbon" ED concept, which focuses on improving efficiency and flow through a decentralized design that can easily flex based on patient load while minimizing the staff needed to care for patients. The improvement factors achieved in this concept can be combined with other operational and design improvements for other areas of the ED to produce a concept that can be customized to future ED design based upon size and volume targets.

Article

Introduction

Emergency Department (ED) design is driven by maximum volumes to be expected. However, for a significant part of each day, the number of patients presenting is just a fraction of the peak. During these periods, staffing is at a minimum. Generally, volume increases incrementally, and ideally, staffing keeps pace with this change. During low census times, there are frequent occurrences when several more patients arrive than staff has planned for. Many times these patients can be managed by the minimum staff, if they [staff] can visualize the patients in their rooms. However, many ED's are planned in such a way that when an additional patient arrives, a staff member must be added in order to see and care for them. These instances drive up costs of care, as there becomes an inefficient ratio of staff to patient.

Traditional ED's process patients in a linear manner, moving from registration to exam, evaluation, diagnostics/treatment, and admission/discharge. This involves lengthy waits on the part of patients at each point in the process and creates hectic conditions for staff as they move in and out of each room multiple times in uneven cycles based on patients' varying needs.

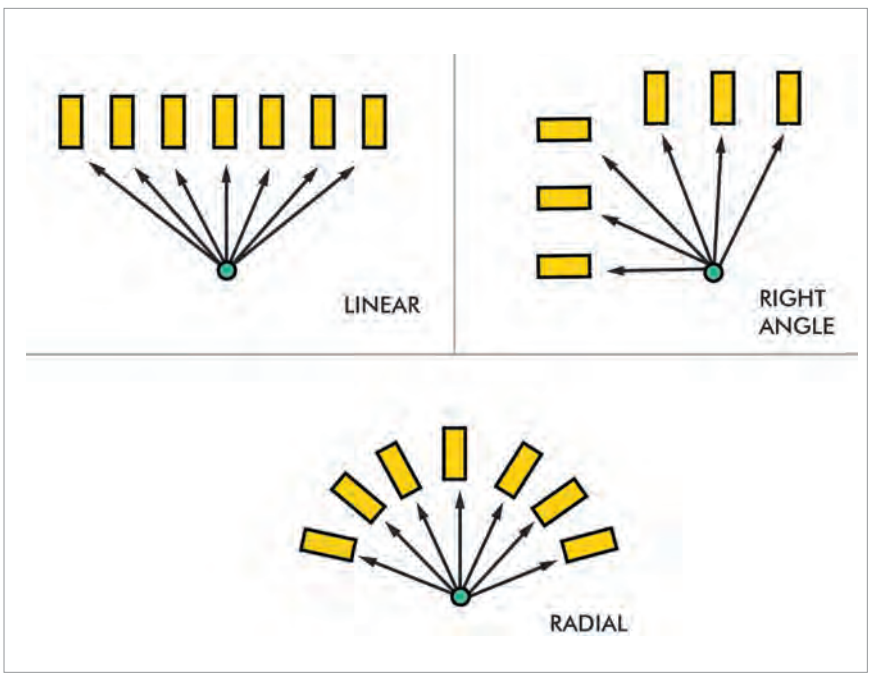

Figure 1: Linear layouts restrict visibility. Creating a right angle can improve on this, but can create awkward spaces. A radial layout allows all rooms to be visualized, and all staff to be proximal with no wasted space.

A number of ideas were introduced into the built environment to remedy this, from zoning the department based on acuity, to attempts to clustering staff in varying relationships with patient rooms, to creating satellite lab, imaging and other diagnostics embedded within the ED. Operational improvements such as bedside registration and triaging of patients directly from the waiting room has shown promise in getting critical patients treatment and eliminating assigning beds to less critical patients.

However, as patient volumes continue to increase, bottlenecks continue to occur because none of these solutions have solved the underlying problem of flow. Flow is influenced by two major factors: the ability to quickly assess, assign and register patients, and the ability to deliver treatment efficiently. This study examines the concept of flow in two parts, front end and back end. Front-end flow studied opportunities to streamline triage and the process registration. Back-end flow looked at a revolutionary new concept for organizing the ED by distributing staff and supplies to reflect the delivery of care model. It has evolved over the course of several consecutive projects, which evolved into the full expression of a new model: the "Ribbon" ED.

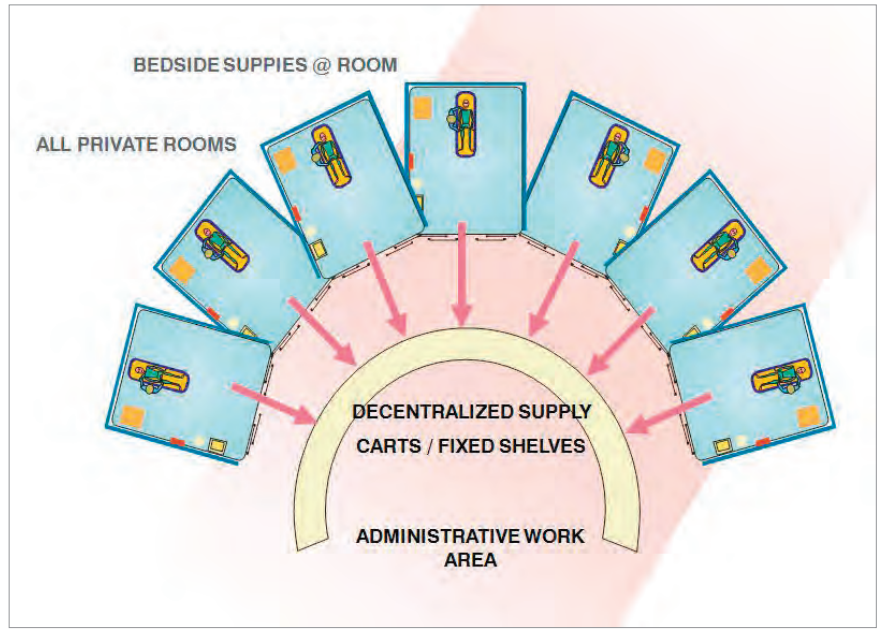

Figure 2: The Ribbon ED builds upon the concept of a radial layout by allowing a decentralized distribution of supplies and equipment.

Design Goals for Improving Staff Care Delivery:

1. Increase capacity of the department to minimize front-end waiting

2. Provide greater efficiency in care delivery to minimize throughput times

3. Increase patient satisfaction by improving the experience and environment

Research Hypothesis

The first bottleneck that occurs in the emergency department is tied to the ability to correctly assess a patient's condition and assign them to the proper area for care. Having every patient wait the same amount of time can lead to dire consequences, just as quickly assigning a patient to a room does not guarantee immediate attention by medical

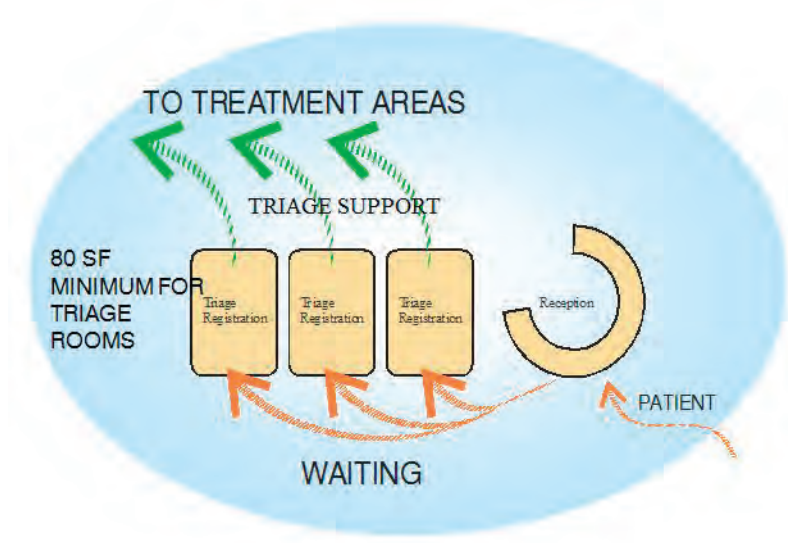

Figure 3: Ideal triage flow.

staff, thus leading to a bed being occupied by a non-critical patient, and further delays in treating other patients. The second bottleneck is related to the first, in terms of being able to efficiently deliver care. This study looked at the effectiveness of triage and in-room registration in correctly getting patients to the proper care setting. It also looked at some of the causes in delay of care related to being able to visualize patients and easily access supplies and equipment from the patient room.

The hypothesis driving the design is that there are four major concepts that impact flow in the ED:

1. Triage of patients directly from the waiting room. Since a majority of ED visits are non-critical, requiring only a quick examination and prescription of drugs or therapy, effective design of the triage space can quickly see and treat patients in the front end of the flow process and avoid them creating congestion in the back end by tying up bed space and additional staff time.

2. Bedside registration can occur immediately prior to or parallel with treatment to avoid delays in either the triage area or exam rooms.

3. Decentralized supplies allow the delivery of care to be more efficient by introducing concepts from Lean design.

4. A radial plan places staff work areas at the center, maximizing visualization of and access to treatment areas while minimizing walking.

Case Studies:
The first test of this theory was at University Hospital in Cincinnati, Ohio. Patients flow from a reception area directly into triage bays which are integrated into the urgent care center. The facility was modeled after research from critical care departments, indicating the importance of decentralized staffing. Designed for 65,000 visits per year, the plan comprises two pods of private exam rooms arrayed radially around a staff work area which accommodates the distributed placement of staff and supplies. The pods are separated by a central urgent care center on one side and trauma area on the other. While this concept did provide an improved patient experience and reduce staff travel around the department, it did not allow for easy flexing from one pod to another during non-peak times.

Designed for 65,000 visits per year, Strong Memorial Hospital in Rochester, NY, improved on the triage and radial decentralized concept. In this model, triage and registration are combined functions. Each treatment zone is organized radially around staff cores. Decentralized supplies are placed along the staff work counter, while restocks and infrequently used items are centralized. Private exam rooms feature bedside supplies with decentralized supply carts and fixed shelves arrayed around the staff work area. This improved upon the previous model, but centralized staff support areas continued to create an obstacle to true flexibility of staffing among pods.

Marymount Hospital, part of the Cleveland Clinic Health System, offered an opportunity to explore the concept further for its 40,000 visits per year ED. Registration/triage were separated from the reception desk and staffed by a pivot nurse. Instead of being placed in detached central pods, staff work areas were clustered in a more amorphous shape that still creates zoning opportunities for the exam rooms but allows centralization of resources for staff and more staffing flexibilities, creating a continuous line of staff work and resources within sight of the patient; the true "Ribbon" concept is born.

This "Ribbon" concept is expressed at the design for University of Pittsburgh Mercy Hospital in Pittsburgh, Pa., where the concept of a supertrack is introduced. The supertrack is an evolution of the fast track concept for processing ESI level 5 patients, and begins to explore the concept of the triage as treatment idea more fully.

Figure 4: Radial layout concept introduced at University Hospital.

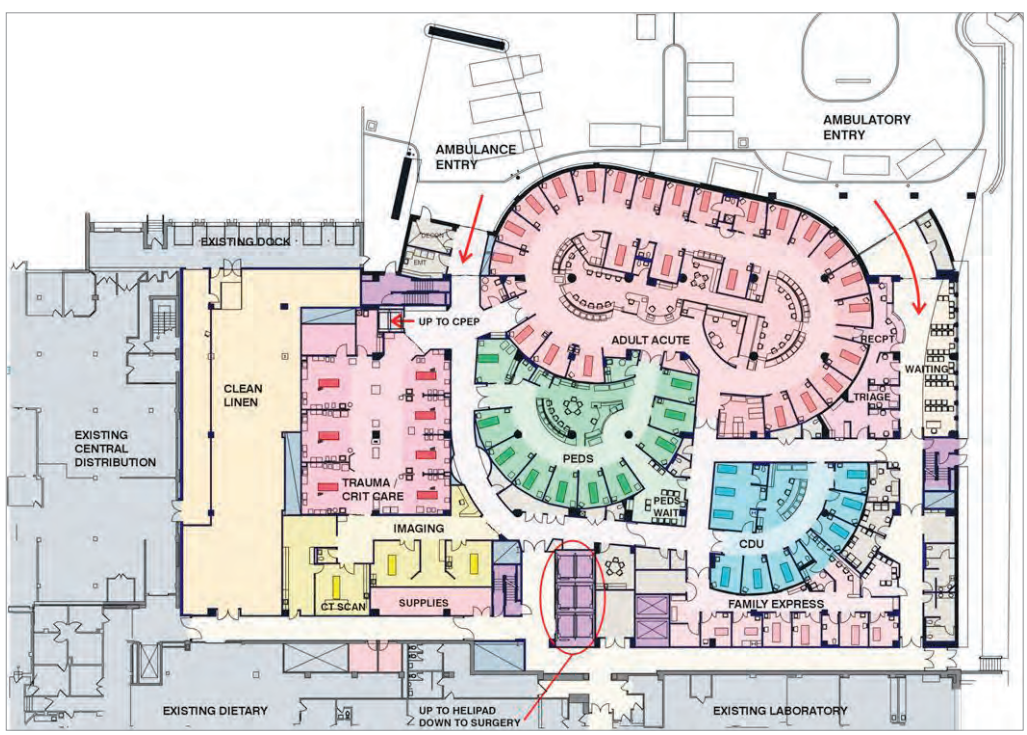

Figure 5: Concept is advanced with triage flow-through and decentralization of supplies.

Figure 6: Ribbon concept is fully expressed at Marymount Hospital.

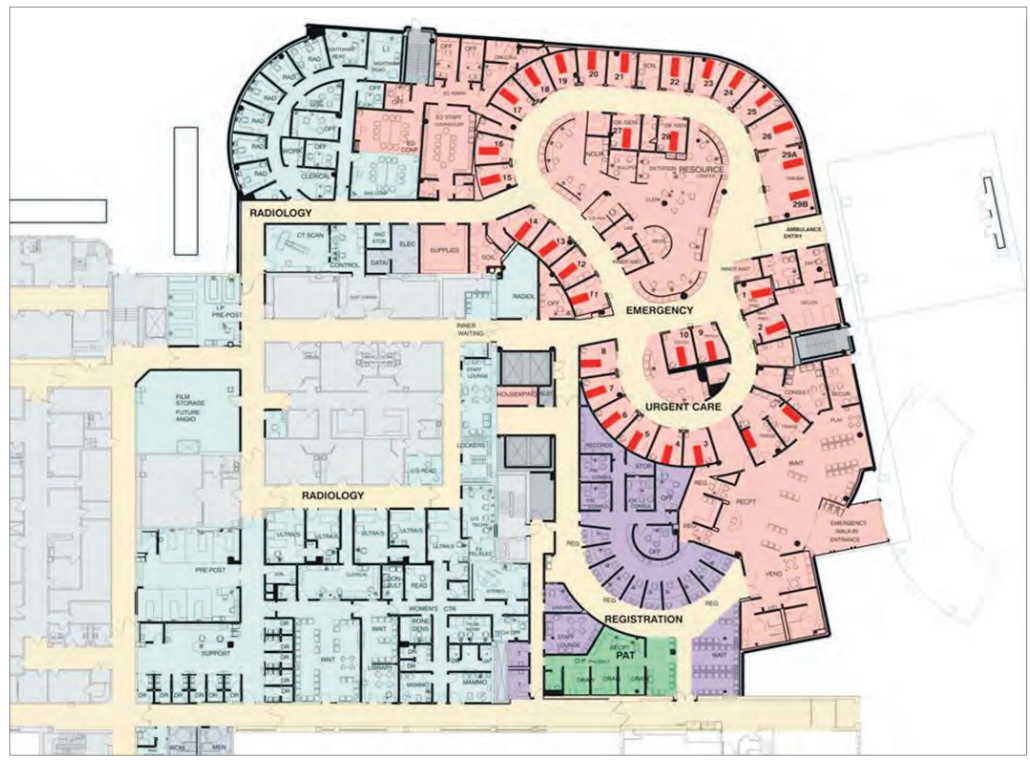

Figure 7: UPMC Advances the Ribbon concept with the supertrack.

Figure 8: The new ED for University Hospitals expands further upon the ribbon concept to function as a high-volume ED.

The most recent expression of the "Ribbon" ED concept is yet to be constructed, but will be an expansion of the original premise at University Hospital in Cincinnati. Designed for an expanded caseload of 100,000 visits per year, this design provides the highest degree of staffing flexibility, featuring double-sided exam rooms that can be staffed by one desk during peak times and another during non-peak times when the rooms are used for overflow.

Conclusion

The concept of a Ribbon ED evolved out of previous models for radial design and decentralization. It focuses on high performance by locating supply carts and equipment in an alcove facing into the corridor designed as part of the front of the nurse work area. The curvilinear design allows rooms to be arrayed in direct line of sight of the nurse work area and allows equipment to be distributed along the path so that it is never more than a few steps away from either staff work areas or the exam rooms. The number of walls that extend to the ceiling were minimized in order to increase visualization through the department and allow staff to zone and flex the space as needed. A supertrack concept keeps fewer ill patients who require more than cursory treatment out of exam rooms in order to keep rooms free for more critical patients and to decrease overall treatment times. The pivot nurse keeps the flow moving.

Operational data supports the "Ribbon" design for the ED. The "Ribbon," or continuous, closed-loop layout of exam rooms can keep operating costs in line by permitting minimal staffing. Decentralization of supplies and support can improve staff efficiency, and therefore improves patient care. Furthermore, open planned ED's promote and maximize visualization throughout, enhancing patient and staff safety.

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