

# Patient-Population Based Design:

## A Wellness Approach for Designing Healthcare Environments



**Sharon E. Woodworth, AIA ACHA**

Healthcare Principal

Perkins+Will

**Edited by: Kalpana Kuttaiah**

## Author Contact Information

Sharon E. Woodworth, BSN, MArch,  
Assist. Professor UCSF - MS-HAIL Program  
2 Koret Way, Room N505, Box 0608  
San Francisco CA 94143-0608  
415-860-9486  
[Sharon.Woodworth@ucsf.edu](mailto:Sharon.Woodworth@ucsf.edu)

Sharon E. Woodworth, AIA ACHA  
Perkins+Will Healthcare Principal  
2 Bryant Street, Suite 300  
San Francisco CA 94105  
415-856-3000  
[sharon.woodworth@perkinswill.com](mailto:sharon.woodworth@perkinswill.com)

## Author Biography

Sharon Woodworth brings over twenty years of experience driving change in healthcare operations through architectural design. After careers in nursing and journalism, Ms. Woodworth received her master's degree in architecture, practicing with Anshen+Allen and Perkins+Will; she is also an Assistant Professor at UCSF teaching "Environmental Systems Leadership." Her designs embrace diverse cultural perspectives from the United Kingdom to the Philippines and continuum of care issues from pediatrics to senior living. She recognizes the value of research-based initiatives and on a personal level is able to translate ideas into form for client and team so that ultimately the end user benefits.

## Conceptual Background

Consider two questions:

1] Where on the continuum does health end and disease begin?

2] How healthy can a diseased individual be?

I believe our healthcare environments should begin with these questions in mind to specifically address how we as designers can design from a perspective of wellness rather than illness.

Modern healthcare environments are typically designed with an illness perspective, focusing on spaces that function to support diagnosis and treatment of an ailment rather than a wellness perspective, which identifies environmental factors maximizing wellness for that ailment. When designing healthcare spaces to foster wellness it is crucial to first understand the particular patient illness being served and then determine the fundamental needs for that patient population. In other words, the designer must understand more than what supports wellness for the general population; the designer must fully understand the disease being served and then translate what wellness would look like for the patient population with that particular illness in order to potentially impact the individual's wellbeing. This is a process referred to as Patient-Population Based Design, which begins with a needs assessment outlining the patient's clinical diagnosis, the environmental goals that are therapeutic for that illness, and the environmental features that would foster independence from the disease or ailment.

## Objective

Wellness by definition is complete physical, mental, and social well-being, not merely the absence of disease.<sup>1</sup> The objective of Patient-Population Based Design is to create a universal process for wellness-based design in healthcare settings as this process will increase the likelihood that healthcare environments will be designed to foster health rather than emphasize illness.

1. (World Health Organization, 2006)

Specific to the case study presented in this paper, there is a clear need for studies that examine patient participation in clinical research, but the objective of a wellness-based setting is to allow less-well patients to consider research dilemmas and prepare them for time sacrificed, tissue or organs donated, and risk missing a miracle drug or treatment. For translational medicine research facilities, a wellness-based setting should reinforce patients' trust that researchers and clinicians are committed to the patient's care regardless of the outcome.

## Method

The method used in Patient-Population Based Design begins with a needs-assessment matrix detailing the four fields of: clinical diagnosis, clinical presentation, environmental goals, and environmental features, which are then cross referenced with the specific patient illness being served as determined by the institution or healthcare provider. A sample needs-assessment matrix is shown in Figure 1 with the four fields noted on the left and the patient populations across the top; the three populations exhibited here, dementia, psychosocial, and complex medical, are three of six distinct patient populations from a specific long-term care institution serving residents in an inpatient setting.

*Figure 1: Sample Needs Assessment Matrix, Sharon E. Woodworth*

For any healthcare provider or institution, the process for developing a needs-assessment matrix requires that the clinical diagnosis and clinical presentation fields be developed by clinicians specializing in the patient populations being served; the environmental goals and environmental features are then developed by the architectural team through a review of the literature, evidence-based documentation, and anecdotal but proven experience.

The matrix has been designed as a generic tool capable of generating specific results for any patient population, and using this tool ensures having a universal process applicable to a variety of settings. Prior to this process, environments for age-based populations (such as pediatrics or senior care) were subconsciously or intuitively modified to be child or elderly “friendly” designs, but the formal, conscious process proposed here is intended to create a universal process with a wellness perspective in healthcare settings. Also note that the universal process inherent in Patient-Population Based Design allows for customization to meet specific needs while remaining flexible for other populations, which differs from “accessibility” design where a high standard is set to accommodate individuals with varying abilities but can unintentionally restrict options for some patient populations. The end-objective of a universal, patient-based process that can be generalized to a variety of settings is to have a process that increases the likelihood that healthcare environments will be designed to foster health rather than emphasize illness.

Figure 1

**SAMPLE NEEDS-ASSESSMENT MATRIX**

	<b>DEMENTIA</b>	<b>PSYCHOLOGICAL</b>	<b>COMPLEX MEDICAL</b>
<b>CLINICAL DIAGNOSES</b>	<ul style="list-style-type: none"> <li>Alzheimer's Disease</li> <li>Multi-Infarct Dementia (MID)</li> <li>Short-term memory impairment</li> <li>Judgment impairment due to perception problems (such as left/right neglect)</li> <li>Impulse control due to an unmet need or anxiety (such as wandering)</li> </ul>	<ul style="list-style-type: none"> <li>Spinal cord injury</li> <li>Multiple sclerosis</li> <li>Substance abuse</li> <li>Delusional presentations</li> <li>Depression</li> <li>Judgment impairment or impulse control due to behavioral problems (such as acting out)</li> </ul>	<ul style="list-style-type: none"> <li>Mild retardation</li> <li>Spinal cord injury</li> <li>Cerebral vascular accident (CVA)</li> <li>Continuous Dialysis (CAPD)</li> <li>Diabetes</li> <li>Wound care</li> <li>Huntington's</li> </ul>
<b>CLINICAL PRESENTATION</b>	<p>Unable to manage self-care at home or in community settings due to progressive dementia or non-progressive cognitive impairments.</p> <p>Indefinite length of stay</p>	<p>Complex psychosocial problems often due to a medical diagnosis. Rehabilitation is the ultimate goal for this population. Goals of treatment include lessening of symptom severity, improvement in ability to relate to others, improvement in ability to perform activities of daily living, and reduction of specific target behaviors that impact the resident's ability to interact safely and socially in another environment.</p> <p>Varied length of stay</p>	<p>Multiple medical problems with concomitant psychosocial issues. Most residents are alert, oriented and able to communicate. However, despite being cognitively intact, many have significant social or behavioral issues. Unlike the Psychosocial population whose therapeutic goal is rehabilitation back into the community, the Complex Medical residents' behavioral goal is to restore social interactions for maximum independence in a group setting.</p> <p>Indefinite length of stay</p>
<b>ENVIRONMENTAL GOALS</b>	<p>Dependent upon environment for a therapeutic setting with the goal of safety and security.</p>	<p>Like Dementia residents, Psychosocial residents are also dependent upon their environment as a therapeutic setting but the goal is clarification of the environment as opposed to comfort and predictability of the environment.</p>	<p>Due to the psychosocial component of Complex residents' care, their environmental needs are similar to the Psychosocial residents' needs with an additional requirement to accommodate medical care.</p>
<b>ENVIRONMENTAL FEATURES</b>	<ul style="list-style-type: none"> <li>Cueing opportunities (such as which room is their bedroom, where is the toilet room, etc.) provide important visual "clues".</li> <li>Personalization of rooms (such as "memory cabinets", picture rails, etc.) helps reclaim a sense of self-identity, maximizes attention span, and reinforces directional cueing</li> <li>Stimulation control (such as private bedrooms, small-group dining rooms, etc.) help minimize intake overload.</li> <li>Stimulation outlets (such as indoor/outdoor wandering paths, come-and-go activities, etc.) allow release of anxiety and agitation.</li> <li>Security issues (such as protection from aggressive residents, non-axial entries and exits, etc.) increases feelings of security and improves emotional well-being.</li> <li>Creative resolution of paradoxes (such as need for stimulation but problems of over stimulation, need for predictability versus value of prompting curiosity, etc.).</li> <li>High spatial/storage needs to accommodate bulky assistive devices unique to the declining dementia resident (such as "ultimate walkers".)</li> </ul>	<ul style="list-style-type: none"> <li>Orientation to place (such as wayfinding) helps the resident adjust to the environment.</li> <li>Personalization of rooms (such as private rooms) helps reclaim a sense of self-identity as well as reduce territorial issues.</li> <li>Behavior control (such as small-group dining rooms, time-out rooms, etc.) helps modify inappropriate actions.</li> <li>Behavior outlets (such as access to the outdoors, vigorous activities, etc.)</li> <li>Range of security issues (such as protecting frail residents from psychosocial residents, observation of the residents for behavior control, etc.)</li> <li>Rehabilitation opportunities (such as cooking &amp;/or housekeeping, self-medication, group therapy, egalitarian rooms, etc.)</li> <li>Average spatial/storage needs associated with skilled care residents.</li> </ul>	<ul style="list-style-type: none"> <li>Orientation to place (such as wayfinding) helps the resident adjust to the environment.</li> <li>Personalization of rooms (such as private rooms) helps reclaim a sense of self-identity as well as reduce territorial issues.</li> <li>Behavior control (such as small-group dining rooms, time-out rooms, etc.) helps modify inappropriate actions.</li> <li>Behavior outlets (such as access to the outdoors, varied activities, etc.)</li> <li>Range of security issues (such as protecting the frail from psycho-social residents, observation of residents for behavior control, etc.)</li> <li>High spatial/storage needs to accommodate numerous assistive devices unique to the medically-dependent Complex Medical resident, which are often bulky and high maintenance (such as Vail beds, Broda chairs, PVC toilet frames, power wheelchairs that need re-charging, etc.)</li> </ul>

## Research Theories

While this paper is not a formal research study, various classic and current studies have been influential for the concept of Patient-Population Based Design. The first use of this design process was for a long-term care facility in need of a residential (as opposed to institutional) ambiance with a rehabilitation focus, therefore the Competence-Press Model by Lawton and Nahemow (1973) helped shape the concept of the need for stress (press) in the environment as a positive challenge contributing to an individual's rehabilitation (competence); remarkably, adaptive behavior and personal satisfaction are the products of a balance between competence and press. Another early reading by Carpman, Grant and Simmons (1986), provided the classic perspective on the significance of easy wayfinding, in particular:

*"The close proximity of common destinations, availability of visual clues that provide landmarks (such as windows, plants, artwork, changes in floor covering), easily understood terminology, clear floor and room numbering systems, availability of well-trained staff for giving directions, and the signage system should all work together as an integrated system".<sup>2</sup>*

*2. (Carpman, Grant & Simmons, 1986, p. 58)*

As different healthcare settings and different patient populations emerged as candidates for this design process, further readings influenced the concept of Patient-Population Based Design. In addition to the predecessor theories above, two theories: Antonovsky's Sense of Coherence (SOC) (1993) and Dilani's cognitive map theory (a concept based on the research of Tolman (1948), Golledge (1998) and others), were key to the patient population for this article's case study, and these concepts are discussed in detail in the section below. For reader's further interest, one of the most challenging patient populations to design for are patients with a psychiatric condition; for this population, Dr. Jan Golembiewski, on the faculty of Built Environment at the University of New South Wales, is developing a wealth of new material that spans both neuroscience and architecture for this demanding patient population.<sup>3</sup>

*3. (Golembiewski, 2013)*

## Results

To date, Patient-Population Based Design has been employed in a range of facilities, as diverse as acute to long-term care. An example in acute care concerns a major medical center serving two million people as the designated trauma center, burn center, and spinal cord injury center. This facility is currently under construction and was designed based on the unique population needs for traumatic brain injury (TBI) and spinal cord injury (SCI) patients; Patient-Population Based Design was used to support the decision to convert all 280 beds to meet the same criteria as the 64-licensed rehab beds for TBI and SCI patients. An example in long-term care concerns a 1,200-bed inpatient facility designed for the unique population needs that spanned acute, skilled, rehab, dementia, and hospice patients; this new facility with patient rooms customized to meet these specific needs yet flexible enough to meet other patients' needs has been in operation for four years, and in 2014, more patients were rehabilitated and discharged back into the community for the first time in its 150-year history where previously they were expected to live the remainder of their life in this institution. This paper presents the use of Patient-Population Based Design in an outpatient setting, further reinforcing the validity of this universal process for a wellness-based approach to healthcare design.

## Case Study

The case presented is a newly constructed translational medicine facility combining research labs with patient clinics dedicated to serving severe neurological and psychiatric diseases. The Centre for Brain Health at the University of British Columbia in Vancouver, 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 serving the full range of neuro-psychiatric diseases 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 and psychiatric disorders are among the greatest challenges in healthcare architecture, made even more so when the driving vision for this institution was to maximize patient research.

The success of Patient-Population Based Design was crucial in this case study because the client's objective was to strive for 100% patient participation in clinical research. [As a benchmark for this high expectation, patient participation in research is known to range from as low as 2% based on a 2007 study of US cancer clinical trials, to as high as 67% according to a 2007 study of Canadians volunteering for randomized, controlled trials.](#)<sup>4</sup> Notably, even if research funds are unlimited, little research will be done if there are no patients upon which studies can be conducted; therefore, patient participation is critical. Research participation is always a patient dilemma and especially so for the neurological patient, as he or 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. For patients of any clinical diagnosis, before they can commit to clinical research they must first have felt cared for—and that means the architectural environment must meet their physical and emotional needs. This is an issue of patient comfort and trust.

4. (Cornell University, 2007; Jones, et al., 2007)

While it may seem obvious that the built environment is important for patients' sense of confidence with their care, little research exists to corroborate how the physical environment may be essential to facilitating patient commitment in research. Carpman, Grant and Jones (1989) highlighted a seemingly unrelated article concerning Boston City Hall that noted visitors' disorientation with wayfinding may surface as generalized hostility toward the organization, alluding to the relationship between environmental discomfort and distrust. Lawton and colleagues in a later study found that residential well-being has considerable bearing on psychological well-being, alluding to how an elderly person's sense of comfort in their environment leads to their ease of mind—comfort equals confidence.<sup>5</sup>

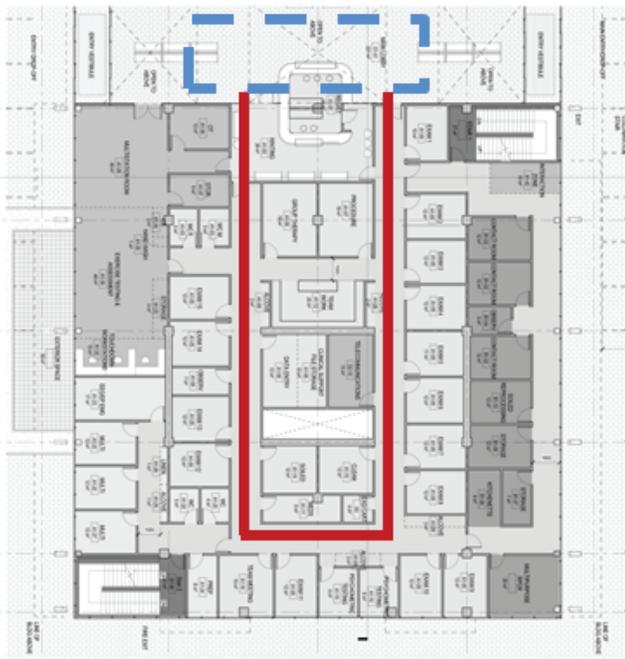
5. (Lawton, et al., 1989)

This case study is ideal for exhibiting the universal potential for Patient-Population Based Design because the needs of neuro-psychiatric patients are frequently contradictory. For example: patients with neurological diseases most often have opposing movement disorders such as the simple need to stop and rest while others have difficulty starting and stopping altogether; patients with psychiatric 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, such as neurological patients distracted by the physical effort navigating even simple environments, while psychiatric patients become easily confused due to the mental effort navigating unfamiliar settings. Developing a matrix of environmental needs for this range of patients highlights features that support both populations while calling attention to features that exacerbate either patient's condition. While Patient-Population Based Design hones in on specific patient needs, the objective is a facility design that is not narrowly customized to one single patient population but instead is flexible enough to support a variety of patient needs.

Before and after floor plans illustrate how Patient-Population Based Design thinking was utilized to support the neuro-psychiatric patient population while remaining functional for the general patient population. The Pre-Design diagram [see Figure 2] shows the preliminary clinic layout as a loop corridor with doors at both ends of the loop and a single waiting zone. The Final Design diagram [see Figure 3] shows the patient-based clinic layout with a single primary corridor, only one option for both entry and exit, and internal clinic sub-waiting in addition to the main waiting zone.

Figure 2-3:  
Anshen + Allen

Figure 2:  
Pre-Design Clinic Plan



- Waiting
- Clinic Corridor

Figure 3:  
Final Design Clinic Plan



- Waiting
- Clinic Corridor

The final clinic floor plan represents an entirely different building footprint; the building was completely reconfigured to efficiently maximize the research labs above without inefficiently penetrating the clinic spaces below with stairwells and duct shafts. In the final clinic layout, three critical design parameters were established:

- Single clinic entry and exit;
- Redundant pathway;
- Break points.

How these three design elements maximize the environment for both neurologically impaired patients as well as patients with psychiatric conditions is summarized in Figure 4.

**Figure 4**

<b>CENTRE FOR BRAIN HEALTH</b>	<b>POPULATION</b>	
	<b>NEUROLOGICAL</b>	<b>PSYCHIATRIC</b>
<b>SINGLE CLINIC ENTRY EXIT</b>	Same way in and out is physically more manageable with less seek-and-find wasted movement due to its predictability;	Same way in and out is emotionally more manageable with less unknowns and requires less thought due to its predictability;
<b>REDUNDANT PATHWAY</b>	<p>Single shorter corridor is physically more manageable with less seek-and-find wasted movement due to its predictability;</p> <p>Single decision point (one turn off corridor) is physically more manageable with less seek-and-find wasted movement due to its simplicity;</p>	<p>Single corridor is emotionally more manageable with less unknowns and requires less thought due to its predictability and visibility;</p> <p>Single decision point (one turn off corridor) is emotionally more manageable with less thought due to its memorability;</p>
<b>BREAK POINTS</b>	<p>Sub-waiting alcoves offer stopping points for rest of physical movement;</p> <p>Sub-waiting alcoves offer landmarks from which to mark physical progress.</p>	<p>Sub-waiting alcoves offer escape points to pull away from corridor traffic;</p> <p>Sub-waiting alcoves offer landmarks from which to gauge mental effort.</p>

Figure 4:  
Sharon E. Woodworth

These three design parameters for the Centre for Brain Health each address the unique day-long clinic visits experienced by both patient populations, who typically cycle in and out of waiting and clinic exam rooms between various procedures or consultations. General design parameters not specific to this case study, but to be anticipated for any facility serving neurologic and/or psychiatric patients are summarized in Figure 5. Overall, the environment should support physical (movement) and mental (cognitive) needs. Intuitively we might assume that patients with neurological ailments have a weakened sense of space with safety as a primary concern, therefore design parameters should focus on things they touch; patients with psychiatric conditions have a vulnerable sense of self with composure as a primary concern, therefore design parameters should focus on things they see. For reference see: Paterson and Zangwill's 1944 article regarding brain lesions and space; Davidson and Straus', 1992 article on psychiatric conditions and sense of self; and Cooney and Gazzaniga's 2003 article on neurological disorders.

A review of the literature reinforced and influenced the environmental parameters that would be ideal for neuro-psychiatric patients. One concept put forward by Antonovsky (1993) states that individuals with numerous emotional resources, referred to as a high SOC, were more confident and therefore better able to adapt to stressful situations.<sup>1</sup> Patient-Population Based Design assumes that patients may have a high SOC, and offers them an environment with choices to meet their physical and mental needs when in a stressful situation; more importantly, for patients who do not have a high SOC, the patient-population designed environment offers supportive features appropriate for several levels of coping ability.

The concept of cognitive maps put forward by Dilani (2001, 2005) stresses that landmarks in buildings are closely related to the perception of stress and can serve as reference points for easier orientation. In the Centre for Brain Health, the sub-waiting alcoves are distinct elements creating a cognitive map that fosters the neurological patient's need for rest and reassures the psychiatric patient's need for escape, thereby reinforcing the well-being of both populations.

Beyond the concern for Patient-Population Based Design, two concepts in the final clinic layout were specific to maximizing overall clinic efficiency for the Centre for Brain Health: clinic pods and dual-purpose exam rooms. First, the total 18-exam room clinic was re-configured into three, self-contained pods each comprising six exam rooms, two support rooms, and a touch-down space for staff and sub-waiting alcove for patients. This clinic pod concept simplified the patients' experience by reducing his or her exposure down to a smaller number of rooms, while increasing the staff's efficiency through in-the-pod access to support rooms and work space. Second, the exam room functions either for an exam-table neurological assessment or for a group-seating psychiatric consultation. This dual-purpose exam room concept was achieved by fixing only the door and sink location with all other items being movable, allowing the clinic to flex from neuro to psychiatric services as needed.

Figure 5

NEURO-PSYCH POPULATION CONTINUUM		
GENERAL ENVIRONMENTAL NEEDS		
MOVEMENT	COGNITION	PSYCHOSIS
<ul style="list-style-type: none"> <li>• Pacing is key to their movement through the environment;</li> <li>• Focus on features that allow stopping &amp; starting, such as:               <ul style="list-style-type: none"> <li>Corridor ‘pull outs’ or niches;</li> <li>Deeper elevator / entry vestibules;</li> </ul> </li> <li>• Create a ‘new normal’ environment by acknowledging / celebrating differences / imbalance through asymmetry such as:               <ul style="list-style-type: none"> <li>Corridors lit from one side;</li> <li>Parallel planes treated differently;</li> </ul> </li> <li>• Predominately seated population, therefore:               <ul style="list-style-type: none"> <li>Assume low view angle with focus on floor more than ceiling (typical 60-degree cone of vision is from about 8 feet, 6 inches down to the floor);</li> <li>Consider wheelchair ‘rear view mirrors’ for backing out of elevators, exam rooms, etc.;</li> <li>Assume reach is limited regardless of front or side approach;</li> <li>Push plates needed throughout patient pathway.</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• Guide their (limited) thinking;</li> <li>• Focus on features that are touched more so than seen and offer simple decisions, such as:               <ul style="list-style-type: none"> <li>Bathroom stall swivel latches;</li> <li>Sliding doors where ever possible (5# limit).</li> </ul> </li> <li>• Therapeutic way finding, such as:               <ul style="list-style-type: none"> <li>Strong differentiation between left versus right;</li> <li>Shortest distance to meaningful space;</li> <li>Previewing of adjacent spaces through transparency will create visually open plans for orientation;</li> <li>Details that differentiate (asymmetrical color coding, staggered doors, etc.) will trigger individual cueing.</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• Limit choice &amp; decision-making;</li> <li>• Focus on features that are seen more so than touched and offer predictable cues, such as:               <ul style="list-style-type: none"> <li>Hand rail different color than wall;</li> <li>Small alcoves with 1 or 2 seats;</li> </ul> </li> <li>• Avoid creating paradoxes through predictable spaces that progress from small to large (alcove, sub-waiting, full waiting to lobby); each space will act as transition space and enhance their sense of control;</li> <li>• Stimulating spaces will over stimulate; smaller groups &amp; waiting rooms help minimize intake overload/over stimulation and reduce territoriality;</li> <li>• Simple decision points at meaningful spaces (a space they will use) reduces anxiety;</li> <li>• Behavior outlets (access to the outdoors, quiet rooms, time-out rooms, etc.) help dissipate or modify inappropriate actions.</li> </ul>

Figure 5:  
Sharon E. Woodworth

## Conclusion

This facility was open for only a few months at the time of this paper and the clinic portion was only partially open. During this early time, they have had numerous issues with doors, some of which have been resolved (acoustics) and some of which reflect departmental security (three doors for a newly-arrived patient to traverse from entry to waiting-room washroom.) These negative issues do not seem to have been caused by the floor plan reconfiguration. More importantly, the positive aspects of Patient-Population Based Design have yet to be proven or disproven. While, the outcome of this process for this facility is not known at this time, the process did inform the design; ideally, a post-occupancy evaluation conducted a full year or more after opening would greatly inform the validity of this process.

The primary intervention described in this paper focused solely on the spatial relationships without considering the other physical elements that were modified, such as access to daylight, sensitivity to color, and asymmetrical interior design elements, all of which were undertaken in order to have a significant, positive impact specific to this neuro-psychiatric patient population. This case study is limited in terms of in-depth research, but in the hope that Patient-Population Based Design gains acceptance, future research is highly recommended. Most importantly, the medical leadership of this case study focused on brain health over brain disease, with the aspiration that this be a benchmark facility of what a healthy built environment can be.

*"If adaptive coping is indeed the secret of movement toward the healthy end of the health ease/dis-ease continuum, then primary attention must be paid to what I had earlier called 'generalized resistance resources.' What came to concern me more and more, however, was a theoretical understanding of why such resources-wealth, ego strength, cultural stability, social support-promoted health. Or, to put it in other words, what did they have in common? I came to call the answer to this question the sense of coherence . . ."<sup>6</sup>*

6. (Antonovsky, A. pg. 725)

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**Sharon E. Woodworth, AIA ACHA**  
**Healthcare Principal**  
**Perkins+Will**

**Edited by: Kalpana Kuttaiah**

