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July 19, 2017

VIA OVERNIGHT DELIVERY

RECEIVED
JUL 20 2017
HEALTH FACILITIES &
SERVICES REVIEW BOARD

Mr. Michael Constantino
Illinois Health Facilities & Services Review Board
525 West Jefferson Street
Second Floor
Springfield, IL 62761

Re: Project #17-019, SwedishAmerican Hospital, Rockford
Additional Response to Request for Additional Information

Dear Mr. Constantino:

This letter provides the remaining additional information requested in your letter dated May 1, 2017 to Ms. Jedediah Cantrell pertaining to Project #17-019 SwedishAmerican Hospital.

a. *Corrected Project Costs and Sources of Funds Schedule (Application ("Appl.") at 70.):*

The original project Cost and Sources of Fund Schedule had mathematical errors and minor allocation errors that resulted in the table not footing to the totals. Those errors are corrected in the schedule included as Attachment 1.

b. *Itemization of project costs (Appl. at 80.):*

An itemization of Project Costs with additional detail including allocation of preplanning costs among space programming and pre-schematic planning is included as Attachment 2. Regarding a list of movable equipment, please note that, at this stage of project development, equipment costs are based on department square footages per industry standards similar to the manner in which equipment costs were developed for other projects at similar stages of development, for example, MercyHealth (Project 15-039) and OSF Saint Anthony (Project 15-021).

c. *Itemization by department (Appl. at 82.):*

A revised itemization of department costs and square footages that identifies the non-receivable departments involved is included as Attachment 3.

d. *Deterioration of facilities (Appl. at 122.):*

The areas to be modernized include spaces that have had no significant improvements in over 55 years. SwedishAmerican's hospital facility is in compliance with IDPH licensing and CMMS regulations, as well as Joint Commission requirements, and therefore, have not been cited by these organizations for facility deficiencies pertaining to the modernization. Documentation supporting the modernization is included as Attachment 4 and pertain to industry studies and articles related to evidence-based design which stems from the recognition that the physical environment can have a measurable influence on patient satisfaction, privacy, infection control and outcomes, including conversion of multiple occupancy rooms to single occupancy, which is an important part of this project. The documentation includes the following:

- *Patients and Their Families Weigh in on Evidence-Based Hospital Design*, Critical Care Nurse, Vol. 32, No. 1, February 2012
- *Better Space, Better Health*, Building Operating Management, May 2006
- *Better Health From Better Design,* Building Operating Management, Jan. 2005
- *Factors Affecting Patient Satisfaction And Healthcare Quality,* International Journal of Health Care Quality Assurance, Vol. 22, No. 4, 2009
- *Designing Patient Rooms to Facilitate Patient-Centered Care,* Proceedings of the 2013 Industrial and Systems Engineering Research Conference, Michelle Jahn, B.S., A. Joy Rivera-Rodriguez, Ph.D.
- *Evidence of an Evolution,* Modern Healthcare, March 26, 2007
- *NICU Redesign from Open Ward to Private Rooms: a longitudinal study of parent and staff perceptions,* Journal of Perinatology, 466-469, 2013

e. *Service Demand-Expansion of AMI:*

The project proposes to add 10 AMI beds to the hospital's existing 32-bed unit. There is currently a need for 11 AMI beds in Planning Area 01 and the project is consistent with this need. The AMI Review Criteria directs that applicants document projected service demand through either referral letters or population projections, and the applicants documented the latter based on projections utilized in connection with the projected bed need for the Planning Area. This methodology conforms to the AMI criteria for Projected Service Demand, and would appear more reliable and authoritative than alternative methodologies not utilized by the State for similar purposes.

f. *Certification letter (Appl. at 96-97.):*

The Certification letters on pages 73 and 74 of the Exemption Application inadvertently referred to a change of ownership application. The template used for those certifications had been from a previous change of ownership application (#E-051-14) and that reference should have been stricken from the certification in the present project. Corrected certifications letters are included in Attachment 5.

g. *Clinical implications that the medical staff has decided upon that require a peer review (Appl. at 131.):*

A listing of categories and complications that trigger cases to be reviewed is included as Attachment 6.

h. *Floor layout for the cardiac cath labs (Appl. at 135.):*

A readable copy of the cardiac cath lab floor layout is included as Attachment 7.

i. *Please explain the gift of $1,000,000 that is being used to fund a portion of the project:*

Once the project has been approved, SwedishAmerican intends to engage in various fund raising projects to solicit donations designated for the proposed project. Based upon prior capital projects and related fund raising activities, $1 million is a reasonable amount anticipated for the proposed project.

j. *Please provide the expected terms and conditions of the bonds used to fund the project:*

Currently, the applicants intend to go to market for the bond financing in the Fall of 2018 and the terms and conditions of the bonds, such as whether variable or fixed financing, have not yet been determined. As the applicants are A rated and include UW Health, favorable financing terms are anticipated.

k. *Please provide a readable schematic and narrative of the location of the department/services that are being modernized at the hospital:*

A narrative of the location of the departments and services being modernized and readable schematics are included as Attachment 8.

l. *As part of the surgery modernization there is no discussion/information for the six (6) gastro procedure rooms (1) pain management room and one (1) minor procedure room. Are these rooms being modernized? If so please provide a narrative of this modernization:*

The gastro procedure rooms, pain management room and minor procedure room are not included in this modernization.

m. *Name change of University Health Care, Inc.:*

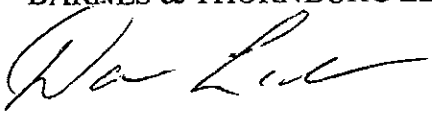
Your letter requests an explanation of the following statement from the applicants' financial statements: *"On January 1, 2015, Regional Division, Inc. f/k/a University Health Care, Inc. (RDI) became the sole member of the [SwedishAmerican Health Corporation System."* Pursuant to Projects #E-051-14 and E-050-14, University Health Care, Inc. (whose corporate members are University of Wisconsin Hospitals and Clinics Authority and University of Wisconsin Foundation, Inc.) became the sole corporate member of SwedishAmerican Health System. The two changes of ownership exemptions were approved by the Review Board on December 16, 2014 and the transaction closed effective January 1, 2015, as indicated in the applicants' financial statements and in the applicants' Notice of Project Completion to the Review Board dated January 8, 2015. Subsequently, University Health Care, Inc. changed its name to Regional Division, Inc. (see attached name-change filing with the Wisconsin Department of Financial Institutions.) All ownership interests in SwedishAmerican Health System and Regional Division, Inc. f/k/a University Health Care Inc. remain the same as approved by the Review Board in Exemptions #E-050-14 and #E-051-14 and there has been no change in any ownership interest of these entities or of the licensed facilities SwedishAmerican Hospital and SwedishAmerican Medical Center/Belvidere.

In addition to the above, a revised Facility Bed Capacity table that reflects the approval of SwedishAmerican Hospital's exemption application on June 7, 2017 (#E-019-17) for 10-bed NICU is included as Attachment 9.

Please contact me if you have any questions regarding the above.

Very truly yours,

BARNES & THORNBURG LLP



Daniel J. Lawler

DJL:dp
Enclosures

Project Costs and Sources of Funds

Complete the following table listing all costs (refer to Part 1120.110) associated with the project. When a project or any component of a project is to be accomplished by lease, donation, gift, or other means, the fair market or dollar value (refer to Part 1130.140) of the component must be included in the estimated project cost. If the project contains non-reviewable components that are not related to the provision of health care, complete the second column of the table below. Note, the use and sources of funds must be equal.

Project Costs and Sources of Funds			
USE OF FUNDS	**CLINICAL**	**NONCLINICAL**	**TOTAL**
Preplanning Costs	$75,000	$15,000	$90,000
Site Survey and Soil Investigation			
Site Preparation			
Off Site Work			
New Construction Contracts	$35,184,274	$14,851,828	$50,036,102
Modernization Contracts	$25,390,551		$25,390,551
Contingencies	$10,827,524	$2,438,222	$13,265,746
Architectural/Engineering Fees	$4,837,012	$1,097,191	$5,934,203
Consulting and Other Fees	$250,000		$250,000
Movable or Other Equipment (not in construction contracts)	$18,697,226	$5,047,077	$23,744,303
Bond Issuance Expense (project related)	$952,616	$243,493	$1,187,019
Net Interest Expense During Construction (project related)	$6,684,550	$1,645,450	$8,330,000
Fair Market Value of Leased Space or Equipment			
Other Costs To Be Capitalized			
Acquisition of Building or Other Property (excluding land)			
TOTAL USES OF FUNDS	$102,898,755	$25,329,260	$128,228,014
SOURCE OF FUNDS	**CLINICAL**	**NONCLINICAL**	**TOTAL**
Cash and Securities	$5,684,550	$1,645,450	$7,330,000
Pledges			
Gifts and Bequests	$1,000,000		$1,000,000
Bond Issues (project related)	$96,214,204	$23,683,810	$119,898,014
Mortgages			
Leases (fair market value)			
Governmental Appropriations			
Grants			
Other Funds and Sources			
TOTAL SOURCES OF FUNDS	$102,898,755	$25,329,260	$128,228,014

NOTE: ITEMIZATION OF EACH LINE ITEM MUST BE PROVIDED AT ATTACHMENT 7, IN NUMERIC SEQUENTIAL ORDER AFTER THE LAST PAGE OF THE APPLICATION FORM.

ATTACHMENT 1

SwedishAmerican Hospital: Itemization of Project Costs

Items	Cost	Line Item Total
Pre-Planning		**$90,000**
Space Programming	$30,000	
Pre-Schematic Planning	$60,000	
New Construction Contracts		**$50,036,102**
Women's & Childrens Paviliton	$43,821,805	
Cath/EP IR Addition	$6,214,297	
Moderization Contracts		**$25,390,551**
Surgery Renovation	$13,889,772	
Emergeny Depatment Renovation	$3,761,325	
Nursing Unit Renovations	$7,739,454	
Contingencies	$13,265,747	**$13,265,747**
Architect/Engineering Fees		**$5,934,203**
Architect/Engineering Basic Services	$5,747,203	
Sepcialty Consultant Services	$187,000	
Consulting and Other Fees		**$250,000**
CDN Application Fee	$100,000	
CON Consulting and Legal Fees	$150,000	
Movable/Other Equipment		**$23,744,302**
Clinics 1st Floor	$2,872,817	
Labor & Delivery/C-Section 2nd Floor	$4,309,655	
NICU 3rd Floor	$1,000,000	
Post Partum 4th Floor	$3,065,683	
Cath/EP IR Addition	$5,446,387	
Moderization Areas	$7,049,760	
Bond Issuance Expense	$1,187,109	**$1,187,109**
Net Interest Expense	$8,330,000	**$8,330,000**
TOTAL PROJECT COSTS	**$128,228,014**	**$128,228,014**

ATTACHMENT 2

Project Cost Space Requirements							
	Project Cost	Gross Square Feet		Amout of Proposed Total GSF that Is:			
Department		Existing	Proposed	New Construction	Remodeled	As Is	Vacated Space
Reviewable/Clinical							
Pediatric Clinics	$ 11,511,832	-	25,750	25,750		-	0
LDR	$ 14,205,602	18,302	21,330	21,330		-	0
C-section	$ 4,341,463	Inc. in LDR	5,400	5,400		-	0
Post Partum	$ 13,538,511	15,265	21,330	21,330		-	0
NICU/SCN	$ 10,865,709	2,539	21,330	21,330		-	0
Pediatric Inpatient	$ 3,903,509	10,250	10,250		10,250	-	0
Invasive Cath/Angiography	$ 8,389,301	17,257	12,000	12,000		-	0
PACU	$ 3,011,318	4,400	4,660		4,660	-	0
Surgery	$ 6,224,641	26,647	12,859		12,859	12,000	0
Prep/Recovery	$ 1,755,130	9,242	3,600		3,600	-	0
Central Sterile Processing	$ 7,760,104	9,091	14,800		14,800	-	0
Emergency	$ 6,919,885	24,220	17,175		17,175	16,000	0
Acute Mental Illness	$ 2,000,000	25,748	5,250		5,250	25,748	0
Inpatient Medical/Surgical	$ 10,648,010	-	27,960		27,960	-	0
Other Non-Reviewable*	$ 13,635,890		19,690	19,690			
Total Clinical	$ 118,710,905	162,961	223,384	126,830	96,554	53,748	

*Other Non Renewable includes building entrance, lobby, public circulation, conference center and mechanical & electrical space.

ATTACHMENT 3

Feature

Patients and Their Families Weigh in on Evidence-Based Hospital Design

Kathleen Trochelman, RN, MSN
Nancy Albert, RN, PhD, CCNS, CCRN, NE-BC
Jacqueline Spence, RN
Terri Murray, RN, BSN
Ellen Slifcak, RN, BA

BACKGROUND In 2 landmark publications, the Institute of Medicine reported on significant deficiencies in our current health care system. In response, an area of research examining the role of the physical environment in influencing outcomes for patients and staff gained momentum. The concept of evidence-based design has evolved, and the development of structural guidelines for new hospital construction was instituted by the American Institute of Architects in 2006.

OBJECTIVE To determine perceptions of patients and their families of evidence-based design features in a new heart center.

METHODS Hospitalized patients and their families, most of whom were in intensive care and step-down units, were surveyed and data from the Hospital Consumer Assessment of Healthcare Providers and Systems were reviewed to determine perceptions of evidence-based design features incorporated into a new heart center and to assess patients' satisfaction with the environment.

RESULTS Responses were reviewed and categorized descriptively. Five general environment topics of focus emerged: privacy, space, noise, light, and overall atmosphere. Characteristics perceived as being dissatisfying and satisfying are discussed.

CONCLUSIONS Critical care nurses must be aware of the current need to recognize how much the physical environment influences care delivery and take steps to maximize patients' safety, satisfaction, and quality of care. (*Critical Care Nurse*. 2012; 32[1]:e1-e11)

CE Continuing Education

This article has been designated for CE credit. A closed-book, multiple-choice examination follows this article, which tests your knowledge of the following objectives:

1. Discuss the concept of evidence-based design in health care environments
2. Identify evidence-based design features associated with improved patient care
3. Recognize the role of physical environment in influencing patient outcomes

©2012 American Association of Critical-Care Nurses doi: 10.4037/ccn2012785

Evidence-based practice assumes critical appraisal of current practice and integration of new research findings, expert opinion when research is lacking, and patients' perceptions and desires. In recent years, evidence-based design (EBD) has become a more pronounced guiding principle in health care. The concept of EBD is to design and build health care facilities founded on research or the best available information, ensuring that the relatively permanent physical environment facilitates the delivery of quality care, thereby improving patients' outcomes and safety.[2]

Review of the Literature on EBD in Critical and Acute Care

Substantial support exists for the view that a health care structure itself affects quality of care, patients' safety and satisfaction, as well as staff satisfaction and service efficacy.[3] In a report to the Center for Health Design funded by the Robert Wood Johnson Foundation, Ulrich and associates[4] identified more than 600 studies that link hospital design with clinical outcomes. Table 1 provides key references related to patients' outcomes after acute hospitalization on medical-surgical or intensive care units. Authors identified several design standards that should be universally adopted: use of single-bed rooms in almost all situations, natural light and views of nature, navigation or "wayfinding" systems for

ATTACHMENT 4

Table 1 Evidence-based design features and effects

Feature	Effect
Single bed rooms	Reduced nosocomial infections[5-11] Reduced medication errors[12,13] Reduced patients' falls[12] Improved privacy, confidentiality, communication[14-16] Improved satisfaction of patients[17-19] Reduced noise/improved sleep[20-25] Improved family visitation, social support[26,27]
Natural light	Reduced depression/agitation[28,29] Reduced length of stay[30,31] Improved sleep[32] Reduced analgesic use[33]
Wayfinding	Improved satisfaction/reduces stress[34,35]
Views of nature	Reduced stress/pain[36-40]
Unit layout	Improved efficiency[41-44]

outpatients and visitors, and unit layouts that reduce staff walking time, thereby increasing time for patient care. Single rooms were associated with lower rates of nosocomial infection, fewer medication errors, decreased noise, greater privacy for patients, improved social support by patients' families and significant others, improved communication between patients and staff, and an overall increase in patients' satisfaction with care.[5-26] Natural light in patient care areas reduced agitation in elderly patients, decreased length of stay, lessened the need for pain medication, and reduced depression.[27-33] Researchers[34] reported that the cost of an inefficient system for navigation in a major regional hospital was more than $220 000 per year or $448 per bed. Much of this cost involved 4500 hours of hospital staff other than information staff giving directions. Views of nature from patients' rooms and during procedures reduced stress and pain,[35,36] and redesigned nursing units improved work efficiency.[37]

In 1999 and 2001, the Institute of Medicine reported on numerous deficiencies in the existing health care system in 2 landmark reports. The first report "To Err Is Human" exposed the incidence of preventable medical errors.[38] Contributing factors included the decentralized and fragmented nature of our delivery system and lack of attention to error prevention by health care organizations and health care providers. Most often, however, errors were caused by ineffective systems, processes, and conditions. In "Crossing the Quality Chasm: A New Health System for the 21st Century,"[40] it was further reported that the current health care delivery system was not patient-centered, and was in fact ineffective, inefficient, untimely, and inequitable.

Evidence-based design addresses a number of deficiencies in the health care delivery system.[41] For example, patient-centeredness refers to the recognition of patients' preferences and values. In relation to physical environment, patient-centered designs include variable acuity rooms that allow patients to be cared for with fewer transfers, single-bed rooms, accommodations for family members, and access to information. Ineffectiveness refers to underuse and overuse of tests and other necessary services. In relation to physical environment, effectiveness can be enhanced by ensuring adequate lighting, multiple unit workstations, and noise reduction. Efficiency is addressed through the use of rooms for patients and unit layouts that are standardized. Timeliness of care is influenced by the size and shape of patient units. Equity can be addressed by assessing and planning for current and projected population demographics and their needs early in the design process.[41]

Rashid[42] examined intensive care units (ICUs) built between 1993 and 2003 and considered to be best-practice units by the Society

Authors

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of Critical Care Medicine, the American Association of Critical-Care Nurses, and the American Institute of Architects. Although characteristics supported by EBD were found, most units lacked consistent design solutions for improving outcomes for patients and staff. Family presence was restricted, and waiting areas were located outside the unit. Layout issues and mixed-use areas contributed to staffing and safety problems. Although the design of some units was not optimal, newer ICUs had best-practice design features such as private rooms, free-standing beds with access from all sides, hand-washing sinks, improved waste disposal facilities, and natural light to facilitate vision and circadian rhythm stability.[43,44]

Research on EBD is evolving. Hospital administrators and architects may use some characteristics that match EBD recommendations but not use others because of physical and/or budgetary restrictions. Therefore, it is important to assess both positive and negative outcomes of unit design to help identify the most beneficial elements. It is well recognized that patients' satisfaction is a valuable indicator in evaluating quality of care. The purpose of this survey was to examine responses of patients and their families to EBD features incorporated in a new heart center.

EBD Features of New Heart Center

The Cleveland Clinic, a large Midwest tertiary-care medical center in Cleveland, Ohio, opened a 395-bed heart and vascular hospital in October 2008 on the main campus of its system, with all beds providing ICU or telemetry/intermediate care services. In the planning phase, many aspects of EBD were considered. All rooms for patients were designed for single-bed use. Other EBD features include expansive windows, pullout futons supporting unrestricted family presence at the bedside, footwalls containing a large, easy-to-see flat screen television (Figure 1), large private bathrooms, headwalls with recessed space to stow medical equipment out of sight, and additional storage for patients and staff hidden behind room walls (Figure 2). Bathroom lights are motion sensitive. The shower area is spacious and entered by crossing a very low step. Patients can enter the shower by using a wheelchair or walker if necessary. In addition to a main nursing station, nursing units have auxiliary workstations. Nursing units also have multiple clean and dirty utility rooms and medication and supply rooms designed to decrease staff walking time and noise. ICU rooms have large multiposition lounge chairs and bedside toilet/sink units that appear as a seat when not being used for elimination needs (Figures 3 and 4).

Figure 1 Patient's room: window size, chairs, television, artwork, and futon.

The large bright main entrance of the stand-alone building was designed to facilitate patient flow and navigating through the building. Information desks are clearly visible, and numerous trained and highly visible "Red Coat" volunteers are strategically positioned and available to assist patients, patients' families, and health care workers. Directories are located outside elevators on each floor. Lounge areas are spacious with large windows, multiple seat groupings partitioned for privacy, multiple large-screen televisions, refrigerators, and a staffed information desk to facilitate communication between families and health care teams. A rooftop glass-walled observatory provides a scenic respite for patients, their families, and staff.

When patients were moved from old to new hospital rooms, a rare opportunity existed to assess the

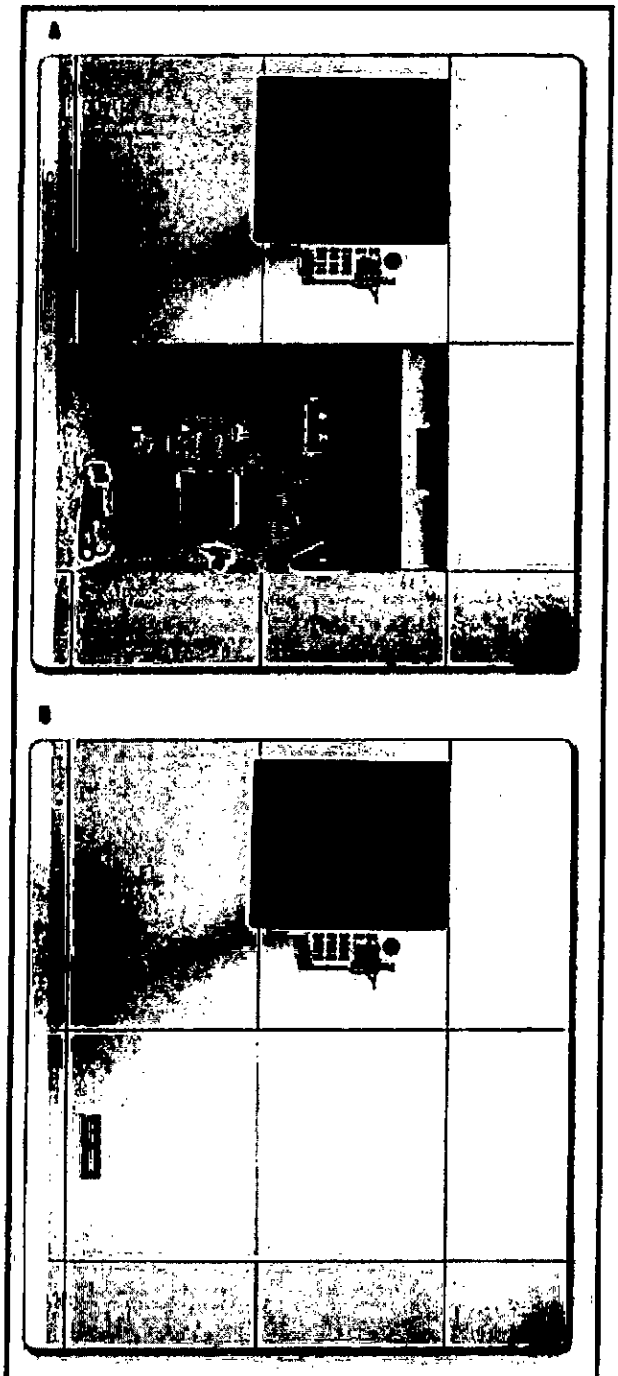

Figure 2 Headwall with out-of-sight equipment storage, (A) opened and (B) closed.

perceptions of patients and their families of the differences between the old and new environments of care. The goal was to determine what aspects of the physical environment were perceived as improved, unchanged, or worsened in order to anticipate the care needs of future patients and their families and enhance satisfaction with the physical environment.

Methods

This project was exempt from the oversight of the institutional review board under the federal exemption category 2, as this project was intended to be a quality assessment of the perceptions of patients and their families related to environment of care.

Data collection was guided by asking patients and their family members, when present, to respond to the following open-ended questions: (1) What have you noticed that is different in this environment compared with the old unit? (2) Do these differences affect you and if so, how? (3) What improvements are still needed? (4) Has the care you've received changed since coming to the new building? (5) Is there anything else about the new building we should know? Data collection was anonymous and confidential. Participants' responses did not place them at risk because data were not used in patient care or shared with nursing staff. Further, follow-up questions were not elicited to determine respondents' meaning or to gain additional insights.

Questions were developed by 2 clinical nurse specialists and 2 nurse managers and were intended to be broad in scope and to elicit personal descriptive responses. Using a convenience sample of patients and family members who were awake and alert, 1 nurse and 1 patient service associate transcribed verbal responses after providing the rationale for data collection. All patients and their families were interviewed within 1 week of the move from their old to their new room. Five general environmental topics emerged: privacy, space, noise, light, and overall atmosphere or "feel."

In addition to data collected from interviews, relevant data on patients' satisfaction from the Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS) and Press Ganey surveys were examined. The nationally used HCAHPS and Press Ganey surveys are valid, reliable, and standardized, and HCAHPS results are publicly reported.[45] The HCAHPS survey asks discharged patients 27 questions about their hospital stay; however, we assessed only data related to environment of care, as noted in results reported in Figure 5. The Press Ganey survey asks additional

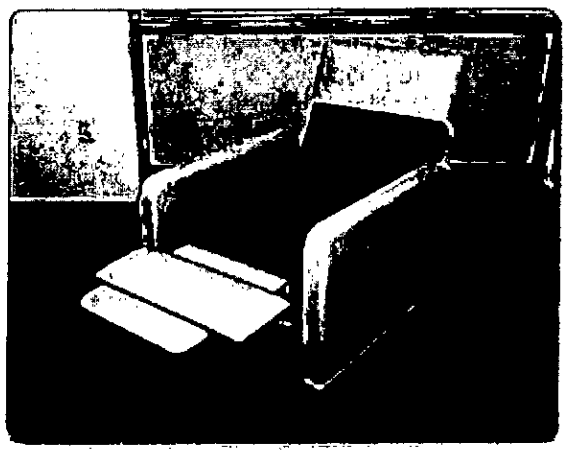

Figure 3 Chair for patient in intensive care unit.

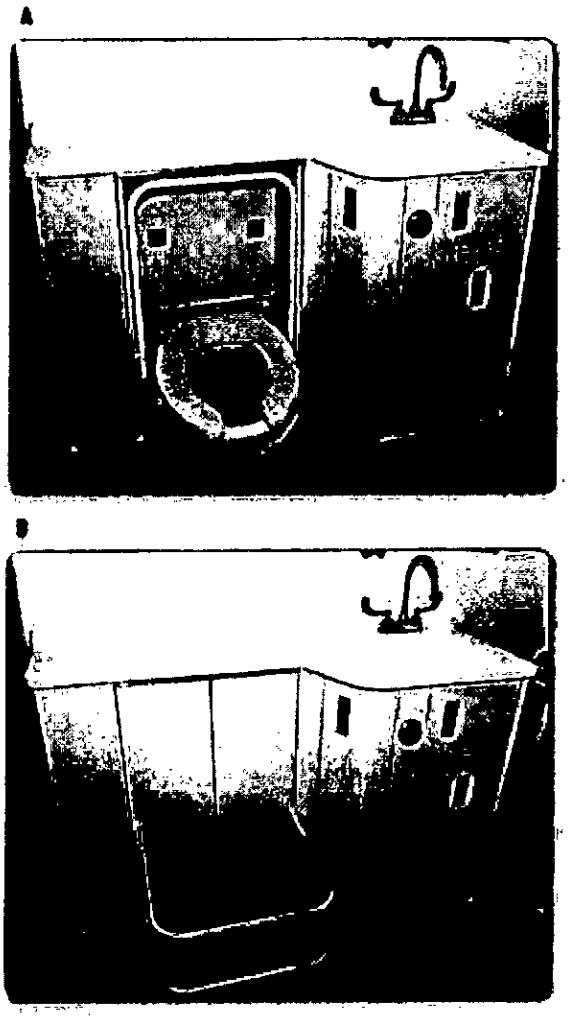

Figure 4 Intensive care unit sink/toilet, (A) opened and (B) closed.

questions about admission, room, meals, nurses, physicians, visitors and family, personnel issues, tests and treatments, and overall assessment using a Likert-like scale with 5 points, from 1 (very poor) to 5 (very good). As with the HCAHPS survey, we assessed only the data related to the patient's experience with the room (pleasantness, décor, and temperature) and the comfort of patients' visitors and family with accommodations because these data reflected the goals of the project.

The HCAHPS and Press Ganey surveys are administered by Press Ganey to a random sample of adult patients across medical conditions between 48 hours and 6 weeks after discharge from the hospital. Per requirements, patients are surveyed throughout every month of the year. Data for this report were provided by a member of the hospital's Quality Practice and Safety Institute. Data collection on the nursing units of the old heart center occurred from January through September 2008. Data from the new heart center were collected during the same time frame 1 year later, from January through October 2009. Data on patients' satisfaction represented responses from patients on four 36-bed telemetry units before the move and six 24-bed telemetry units after the move. Interview responses were reviewed verbatim and categorized descriptively on the basis of the care themes raised by the patients and their family members.

Results

The old heart center had 244 beds consisting of 28 coronary care and heart failure ICU beds, 108 cardiothoracic surgical telemetry beds, and 108 cardiac medical telemetry beds. The new heart center has 395 beds consisting of 34 coronary care and heart failure ICU beds, 76 cardiothoracic ICU beds, and 285 telemetry beds. Cardiothoracic surgery ICU patients were not included because the length of stay in that environment is usually less than 24 hours. Patients were not moved on 1 day; rather moves from the old to new environment occurred on consecutive Saturdays during a 4-week period. Based on a 90% occupancy in the old facility on the days that patients were moved, and assuming an additional 10% of patients moved would not meet eligibility criteria to be interviewed, our sample of 103

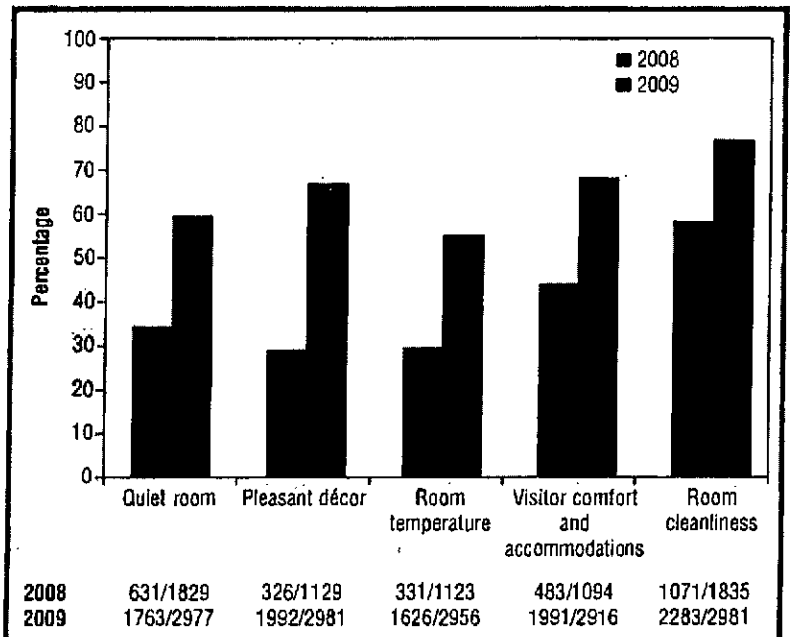

Figure 5 Hospital Consumer Assessment of Healthcare Providers and Systems "always" or "very good" scores before (April-September 2008) and after (January-October 2009) change in environment. Rating options for quiet and cleanliness were *never, sometimes, usually,* and *always*; rating options for all other factors were *very poor, poor, fair, good,* and *very good.* Data on the quiet and cleanliness factors were provided from January through September 2008.

hospitalized patients and families who participated represented 62.7% of the available population. No other participant descriptors were collected.

Characteristics Eliciting Satisfaction With the New Physical Environment

Patients and their families overwhelmingly reported being pleased with the overall room design (Table 2). When responding to the first 2 questions of the survey ("What have you noticed that is different in this environment compared to the old unit" and "Do these differences affect you and if so, how?"), nearly a third of patients commented on having a private room.

Some stated they did not have to worry about "bothering anyone" or invading their roommate's privacy. A female patient stated "I get up earlier than most people; now I don't have to worry about disturbing my roommate . . . I can watch TV in the morning." Others stated, "Privacy is big", and "The private room is a blessing." Patients reported that it was easier to talk with their family members and that they could rest or sleep when they wanted. Patients also commented on being able to adjust the room thermostat to their comfort level.

Patients and their families reported that the new rooms were quieter, more spacious, less confining, less cluttered, and allowed more family visitation. One elderly man commented, "I can get up so much easier, there is nothing to bump my feet on." A female patient stated that she felt "less confined; [it is] easier to maneuver." Others stated that they felt more independent and were less stressed about getting up to go to the bathroom. The large bathroom with motion-sensitive lighting was also a positive feature. Some patients were pleased that they could "get a chair in there to wash" and that it was easier to maneuver in the low-step shower. The addition of a futon was appreciated by patients and their family members. Family members stated that they were very pleased that they had a place to rest or sleep in the patient's room. Large windows elicited nearly unanimous approval. Comments included "I can see better," "beautiful windows," "the big windows are lovely," "nice view," "lots of light," "happy for the view," "big windows are more cheerful," and "don't need to use the lights."

The overall atmosphere was described by patients as being less like a hospital and more like home or a hotel. Most patients reported

Table 2 Satisfying design features of patients' rooms (N = 91)

Satisfying features	% of patients commenting on the feature
Privacy of room; no roommate	31.9
Room size	29.7
Bathroom	26.4
Reduced noise	23.1
Television	23.1
Window size/view	19.8
Lighting	16.5
Storage	5.5
White walls	4.4
Television control; artwork; and electrical outlets	1.1 (each)

Table 3 Dissatisfying design features of patients' rooms (N = 91)

Dissatisfying features	% of patients commenting on the feature
Television control	16.5
Chairs	12.1
Noise	9.9
Clock placement and face (no numbers on face)	5.5
Bathroom	4.4
Signage	4.4
Television	3.3
White walls	3.3
Lighting	2.2
Private room; room size; window size or view; artwork, storage; and electrical outlets	1.1 (each)

that they felt happier, less anxious, more relaxed, less stressed, more comfortable, and more independent. Families also reported that they felt more relaxed, more comfortable, and happy that the room could accommodate overnight visitors.

Characteristics Eliciting Dissatisfaction With the New Physical Environment

Because patients had spent time in an older semiprivate room before being transferred to the new heart center environment, they were able to compare elements of the environment in the old and new space that were unchanged, prompted dissatisfaction, or needed to be improved (Table 3). Light controls for the room were an issue for some. Patients reported dissatisfaction with the fact that they could not access all light controls in the room while in bed. One patient was concerned about unlabeled red wall switches, asking "what happens if I bump them?" One female patient was concerned that the bathroom was a little farther away. One man suggested that an extra handicap bar by the toilet would have been helpful. Although the large-screen television was well received, a number of patients reported that the controls were difficult to use and allowed the user to scroll through the channels only in 1 direction. One patient stated that Internet access and a bedside keyboard would have been very desirable. A numberless clock positioned at the side of the bed was reported to be difficult to see and read. A wall calendar, a small refrigerator, and hand cleaner for family members were requested by a few patients.

Although the rooms themselves were quieter, hallway noise continued to be a problem. The size and design of patients' chairs was a concern for many (see chair in Figure 1). A streamlined office-style chair with open arms had been selected by the designers. Patients reported that they did not feel comfortable sitting in them. Comments included that they were "unfriendly . . . can't sit up in them," "my wires and gown get caught," "not enough padding on arms," "no foot rest," "[I'm] worried about sitting in those chairs," and "don't want to get out of bed—don't like the chairs."

Finding their way around remained an issue for many visitors. The "Red Coat" volunteers were lauded for their assistance but others reported that the facility was difficult to navigate, that more directories were needed, and that it was too much walking.

Nursing Care Changes With a Change in Environment

When asked "Has the care you've received changed since coming to the new building?" patients and their families overwhelming reported being very pleased with the care in both the old and new heart centers. Some noted that in the new rooms, nurses "move[d] in and out more smoothly," were "more attentive," and were "more responsive, in better spirits."

Patients' Satisfaction With a Change in Environment

In addition to face-to-face surveys, HCAHPS data were examined before and after hospital opening for changes in cardiac patients' perceptions of their hospital experience. Improvements were noted in every area of environment of care when old and new facility experience responses were compared (Figure 5). For example, when asked how often the area around the room was quiet at night, patients reported it was "always" quiet 59.2% of the time in 2009 compared with 34.5% of the time in the old heart renter. When asked about the pleasantness of room décor, patients reported "very often" 66.8% of the time in the new environment of care compared with 28.9% in the old heart center environment.

Discussion

Design decisions made today may affect care delivery for decades. With the current unprecedented surge in hospital construction, it is imperative that environmental characteristics influencing the well-being of patients, visitors, and staff be identified and incorporated in

Table 4 Nursing implications for evidence-based design

- Be aware of the influence of the physical environment on patients, patients' families, and staff
- Arrange for private rooms whenever available
- Be aware and, if possible, remedy factors affecting physical privacy and communication privacy of patients and their family members
- Encourage and facilitate family visitation in or near patients' room
- Provide patients with control over lighting, temperature, and television, radio, or other controls
- Minimize noise
- Enhance natural lighting and views of nature by opening window curtains/blinds whenever possible
- Ensure safe walkways in patient rooms and bathrooms by removing/moving medical equipment or other impediments
- Have patients provide feedback on comfort of chairs, pillows, blankets, and other supplies or equipment that can be updated for comfort and support. For example, assess chair features for patients with multiple intravenous catheters, telemetry wires, or other entangling attachments
- Consider how much of your time is spent walking (gathering supplies, accessing computers, etc) and how this can be lessened
- Participate in committees planning changes in the design of nursing units

future hospital designs. Based on the Institute of Medicine's findings regarding effects associated with environment-of-care design features, hospitals built in the 1950s to 1970s are outdated and inadequate in meeting today's health care demands[46] and have significant safety issues and inefficiencies. In reports from the Pebble Project, a research initiative of the Center for Health Design, patients' outcomes improved when EBD concepts were implemented.[2] Topics specific to patient safety, such as medication errors, infection, pressure ulcer development, cognition, and falls, were not raised by patients when answering questions nor were those topics assessed objectively or through review of quality data. Structural elements of EBD that were most often vocalized as satisfiers were private rooms, larger private bathrooms, and large windows with a view. These same structural EBD features could enhance patients' safety in relation to falls and cognition.

Satisfaction of patients and their families with the hospital experience was enhanced when EBD elements were incorporated in the structural plan. Casscells et al[47] found that patients and their families strongly endorsed private rooms, space in the patient's room for family members to stay overnight, lighting and temperature controls, and means for maintaining awareness of the outside world through television, books, and papers. In our quality assessment, quality scores based on HCAHPS and Press Ganey data improved in the new heart center environment, reflecting enhanced patient and family satisfaction.

Knowledge gained from patients and their family members can be applied by nurses working in new or older critical care, intermediate, and telemetry care areas. Although many design elements were perceived as improvements, some features of the new heart center were not optimal. Overall functional status and timely discharge may be affected if bedside chairs are uncomfortable or do not offer support features needed to encourage use. Because early mobility and general activity are critical in avoiding functional decline,[48] lessons learned about the comfort of chairs (and other furniture) could help determine if furniture choices facilitate mobility.

Availability of an easy-to-see television can improve sensory stimulation and help patients remain oriented and aware of local and national events outside of the hospital. In addition, the television is an educational feature if used to provide patients with new knowledge about their illness or plan of care. Thus, an ability to use controls independently may affect knowledge, emotions, and space-time orientation as well as provide entertainment. Finally, in our study, the inability to control room lighting was dissatisfying. Lighting can affect circadian rhythm and sleep patterns.[49,50] Ensuring a patient's ability to control lighting independently may be a factor in achieving optimal sleep and recovery. Offering patients meaningful sources of sensory stimulation and a sense of control of the environment can help maintain patients' orientation, promote normal sleep patterns, and improve satisfaction with care. Table 4 provides a list of EBD considerations that can apply to new, remodeled, or current environments of care.

Evidence-based design is cost-effective. In an analysis of 1-time capital expense compared with reasonable operational savings, increased market share, and philanthropic donations, Sadler et al[51] indicated that initial additional

capital costs would be recovered in 2 to 3 years. In another in-depth analysis, Berry et al[52] demonstrated that estimated savings and revenue increases generated from a building constructed according to EBD guidelines would result in nearly recapturing the additional investment in the first year. Ultimately, construction costs associated with EBD can be balanced by a short time to break-even. Because our occupancy rate was historically high for heart center services (consistently >95%), occupancy rate comparisons were not conducted.

In 2006, the American Institute of Architects developed guidelines for new hospital construction that were based, in part, on EBD data. These guidelines are currently used by 42 states and the US federal government.[53] Not only does EBD create a visually appealing environment of care, but EBD has been associated with improved clinical outcomes, including aspects of patient safety, and directly addresses many deficiencies identified by the Institute of Medicine. Patients' independence and safety, control over the environment, and overall satisfaction with care provided during a hospital stay can be improved with EBD. Interventions that aid in reducing dissatisfying aspects of the environment may enhance patients' care and further improve clinical outcomes, safety, and satisfaction with the hospital experience. CCN

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Financial Disclosures
None reported.

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CE Test Test ID C1213: Patients and Their Families Weigh in on Evidence-Based Hospital Design

Learning objectives: 1. Discuss the concept of evidence-based design in health care environments 2. Identify evidence-based design features associated with improved patient care 3. Recognize the role of physical environment in influencing patient outcomes

1. Which of the following is an effect of single (private) hospital rooms?
a. Reduced nosocomial infections
b. Increased patient falls
c. Decreased communication between patients and staff
d. Reduced social support

2. Which of the following is associated with natural light in patient care areas?
a. Increased agitation in older adults
b. Increased analgesic use
c. Increased length of stay
d. Reduced depression

3. Which of the following design standards is primarily associated with decreased stress and pain during procedures?
a. Single-bed rooms
b. Views of nature
c. Natural light
d. Unit layout

4. In relation to physical environment, what can enhance patient-centered *effectiveness*?
a. Family member accommodations
b. Minimizing laboratory draws
c. Noise reduction
d. Variable acuity rooms

5. Standardized unit layouts primarily address patient-centeredness by which of the following?
a. Providing service effectiveness
b. Being efficient
c. Displaying equity
d. Demonstrating timeliness

6. What deficiency in health care delivery can be addressed by assessing and planning for current and projected population demographies and their needs early in the design process?
a. Untimeliness
b. Inequities
c. Inefficiencies
d. Ineffectiveness

7. In addition to overall atmosphere, privacy, and space, what other general environment topics of focus emerged in this survey?
a. Family presence and emergency preparedness
b. Communication and infection control
c. Music and art
d. Noise and light

8. Compared with 34.5% of the time in the old heart center, how often did patients report it was "always" quiet at night in 2009?
a. 39.2% c. 59.2%
b. 49.2% d. 69.2%

9. What is correct about evidence-based design in health care?
a. Overall hospital size is an important aspect of evidence-based design.
b. The effects of evidence-based design are geared toward patient, not staff, satisfaction.
c. Evidence-based design addresses deficiencies identified by the Institute of Medicine.
d. Evidence-based design is a component of national, hospital patient satisfaction scores.

10. What design feature did patients in this survey perceive as the most satisfying?
a. Room size
b. Large bathroom
c. Reduced noise
d. Private room

11. What design feature did patients in this survey perceive as the most dissatisfying?
a. Remote television control
b. Comfort of chairs
c. Lighting options
d. Clock face design

12. What nursing intervention best reflects application of evidence-based design data?
a. Open window curtains and blinds whenever possible
b. Arrange for semi-private rooms whenever available
c. Adjust the television controls for patients
d. Control room lighting for patients

Test answers: Mark only one box for your answer to each question. You may photocopy this form.

1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.
☐ a	☐ a	☐ a	☐ a	☐ a	☐ a	☐ a	☐ a	☐ a	☐ a	☐ a	☐ a
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☐ c	☐ c	☐ c	☐ c	☐ c	☐ c	☐ c	☐ c	☐ c	☐ c	☐ c	☐ c
☐ d	☐ d	☐ d	☐ d	☐ d	☐ d	☐ d	☐ d	☐ d	☐ d	☐ d	☐ d

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pg. 45

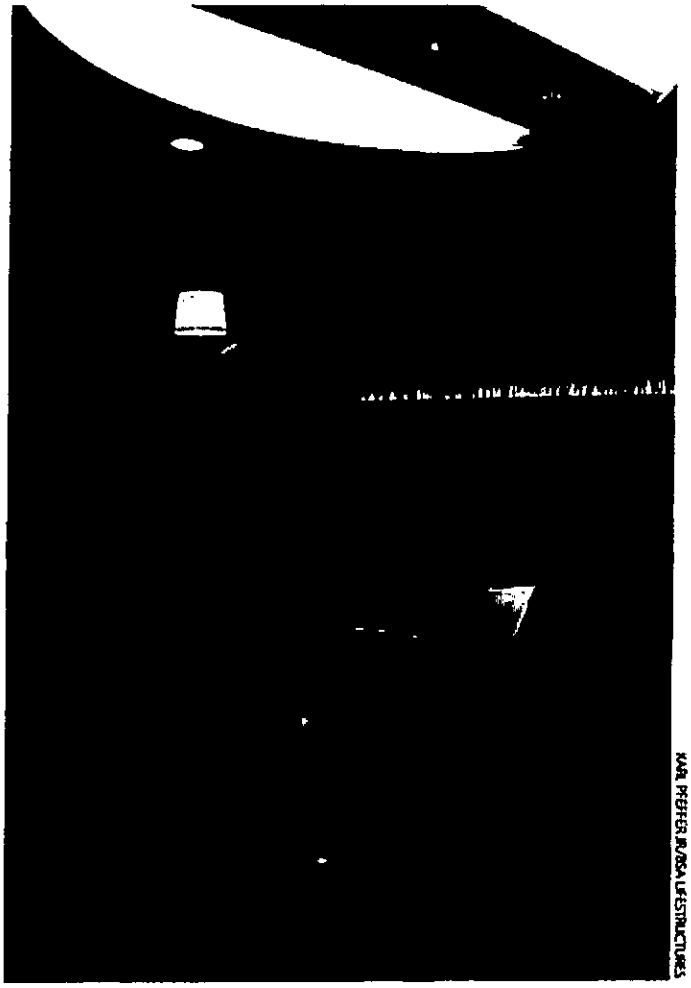
Better Space, Better Health

Health care company uses evidence-based design in an effort to **IMPROVE PATIENT OUTCOMES AND FACILITY PERFORMANCE**

A massive change in health care is occurring as hospitals reinvent themselves to cater to the medical needs of aging baby boomers. Hospitals are building new facilities that deliver clinical excellence, improve patient safety, and accommodate patient- and family-focused care. They are moving to a private room model. And they're considering facility design as a way to help brand themselves as the preferred hospitals in their markets.

One strategic tool that some hospitals are using is data-driven, evidence-based design. Evidence-based design looks at ways facility design can improve patient outcomes and operational performance.

Lakeland Regional Health System, a nonprofit, community-owned health care system, has embraced evidence-based design and used it as a major focus in the design of a new 118-room inpatient replacement tower on its St. Joseph, Mich., campus. Lakeland had two major objectives: to create a truly community-focused facility — one that is seen as the hospital of choice in



KARL PFEFFER JR/OSA LIFESTRUCTURES

A mock-up of patient rooms that are part of Lakeland Regional Health System's new 118-room patient pavilion shows the added space, window views and storage space that are part of the room's design.

BY MONTE HOOVER AND ROBERT SCHOECK

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the region — and to design environments based on the latest evidence-based design research, to improve outcomes and to raise patient, staff, physician and visitor satisfaction.

In the traditional programming phase, administrators and medical staff outline facility goals. These are often expressed in such items as number of beds, the size of the emergency department, types of medical specialties to accommodate, size of surgical suites, types of procedure rooms, size of patient rooms, and equipment needs. It is a functional list of physical and practice requirements in a new medical facility.

Evidence-based design adds an overlay of results-oriented objectives specified by the hospital. These objectives might be to reduce medical errors, increase staff satisfaction, reduce noise levels, minimize patient transfers, improve patient privacy or increase patient satisfaction.

Lakeland and the design team identified 53 metrics vital to the goal of creating the hospital of choice for its community. Data and statistics were gathered on Lakeland's existing performance in these areas — and they will continue to be gathered until the new pavilion is finished. Once the

DESIGN EFFECTIVENESS MEASURED, MONITORED

Lakeland Regional Health System is undergoing an examination.

BSA Lifestructures, the project's architecture and engineering firm, is submitting final drawings of the 140,000-square-foot, 118-room patient pavilion to Lakeland facility executives this month. Included with the prints is a book indicating what steps the firm took to meet 15 facility design criteria set out by Lakeland's facility department at the beginning of the project.

Having such data is Lakeland's first move toward verifying that the patient pavilion, which is set to open in a little more than two years, is contributing to patient wellness and promoting healing.

Kastner

"We expect all of the outcomes we identified to be met," says Russell Furst, manager of biomedical engineering.

Lakeland facility executives identified 53 measures that will be monitored to gauge the facility's performance. The performance measures, also known as metrics, for the hospital's patient pavilion include those directly related to the design of the facility, such as the size of rooms, windows and storage areas, and those that are related to both design and operations, such as the number of patient falls, infection rates, and noise levels in and around rooms.

With the final drawings complete, Lakeland can begin sizing up how well its evidence-based design approach worked in achieving specific goals as gauged by facility metrics. The metrics that depend upon operations will be evaluated for one year after the pavilion opens before conclusions are drawn about the performance, Furst says.

"I think there is a certain amount of variability that you have to let time account for when you move into a new facility," he says.

The project architect has developed a toolbox of 77 metric benchmarks based on research, data averages collected from previous projects and best-of-class industry standards. These are grouped into four areas: facility design, operational improvements, satisfaction (quality) and research. Lakeland selected its metrics from that toolbox of choices.

The metrics identified for the patient pavilion were based on studies of health care facilities indicating that patients heal faster if they are placed in a more comforting environment. While doctors will argue both sides, says Mike Kastner, director of building services and construction management, it makes sense that patients have better attitudes if they're given access to outside views through windows and if daylight is allowed to enter the room.

Lakeland will also examine its performance on the widely used Press Ganey survey of patients to determine how well the new facility performs. On that survey, the hospital will be looking for improvements in such measures as satisfactory room temperature, pleasantness of room décor and the promptness with which nurses respond to patient calls.

While most of those measures will depend on operational procedures, the design of the new patient pavilion will have a certain amount of influence. For instance, one of the design criteria was to reduce the distance between nurse work stations and between equipment storage areas and patient rooms.

Lakeland's effort to monitor facility performance dates back a few years when the organization's chief executive officer led an effort to create healing environments at the health system's facilities, says Kastner. The health system developed a master plan in 2000 and has spent $60 million in upgrading sites since.

Kastner says the CEO's commitment to developing a master plan with patient and staff satisfaction in mind made it easier to build the new facility using an evidence-based design approach and to incorporate performance measures.

"Whenever you have a top-down approach it's easier to sell than working bottom-up," he says.

Kastner estimates the premium on using an evidence-based design approach at 3 percent. Reviewing costs of similar health care facilities set the budget for the project. Lakeland wanted to be neither the highest nor the lowest-spending hospital on a cost per square foot basis.

"We decided this was the right thing to do and the cost would be spread out over 30 years," he says. "It's a lot more cost-effective to take these steps in a new building than during a renovation."

— Mike Lobash, executive editor

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facility is operational, performance data will be compared with the old facility's data to evaluate the success of evidence-based design.

Hospitals look to improve patient, visitor, physician and staff satisfaction, as well as patient safety and clinical outcomes. These were key goals for Lakeland as well. But Lakeland believed that using evidence-based design would give it the opportunity to go beyond what other hospitals achieve, giving the hospital a competitive advantage in the community.

The design of patient rooms was seen as a critical factor in achieving patient safety and satisfaction. All rooms will be private, reflecting a nationwide trend. (The Facilities Guidelines Institute, in conjunction with the AIA/Academy of Architecture for Health, issued new standards last month that call for all future patient facilities to be designed with private rooms.) Studies have shown that private rooms can decrease infection rates by up to 45 percent and can produce a significant increase in patient satisfaction.

The new rooms will be 305 square feet, an increase of 140 percent compared to the space that a patient has in the current double-patient configura-

MARY BETH HANKE/RSA LIFESTRUCTURES AND MARCGATTI INTERIORS

Visitor comfort is a significant factor in the design of Lakeland's new patient pavilion. In addition to nearly doubling the amount of space for family members in patient rooms, the new pavilion contains family retreat areas with fireplaces, lounges and kitchenettes.

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tion (total of 220 square feet). Rooms also will receive more natural light, have operable windows, overlook natural settings, provide easier access to room controls, and include amenities such as shelves for cards and flowers, moveable chairs, and tables. Space in the family zone will increase by 170 percent and include a sleep sofa for overnight stays. In addition, the new tower will include family retreat areas with fireplaces, lounges and kitchenettes.

As part of the design process, a full-scale concept patient room was built, with all equipment (non-operable) and furniture. Staff, physicians, community members and former patients were asked for feedback. Many adjustments were suggested. For example, feedback led to rethinking and relocating lighting and lighting controls. Lighting controls that are highly used by staff were located by the entry door, with night lights on the bottom and overall room lights on the top. In addition, moving a task lighting fixture 6 inches made a significant difference for the patient. The level of control that patients have over their room, such as lighting, temperature, window treatments and call buttons, is a considerable factor in patient satisfaction.

MEASUREMENTS OF SUCCESS

Here is a sampling of the metrics Lakeland Regional Health System is using to determine how well its new patient pavilion performs:

PEOPLE
- Associate satisfaction
- Doctor satisfaction
- Workplace injuries

SERVICE
- Internal patient transfers
- Pleasantness of room decor
- Room cleanliness
- Room temperature
- Nurse promptness
- Comfort of visitors
- Noise in and around room

QUALITY
- Infection rate
- Length of stay
- Patient falls

FACILITY
- Nurse travel distances
- Distance from patient bed to toilet
- Overall patient room size
- Overall unit size
- Construction cost per square foot
- Noise level on nursing units
- Square footage of patient room

IMPACT ON STAFF

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travel distance from the nurse's station to the furthest patient room from 84 feet to 33 feet, a reduction of 255 percent. The percentage of staff work area per bed will be increased by 148 percent, equipment storage areas will increase by 149 percent, and access to medications and supplies will be more convenient. The new facility will also contain a staff retreat area, separate from staff lounges, where staff can catch some quiet time, recharge and enjoy scenic views.

A centralized distribution system, serviced by its own materials elevator within the core, will be used for all supplies, dietary needs and equipment, avoiding use of patient or visitor elevators. One additional design change locates patient and visitor elevators at opposite ends of each floor. The goal is to improve patient privacy, reduce infections and alleviate congestion.

Results-oriented objectives, including reduced medical errors, fewer patient transfers and increased patient satisfaction, are THE MEASURES OF A DESIGN'S SUCCESS

Evidence-based design requires commitment. The hospital should identify an individual to champion the effort, both during the project process and afterwards, to help collect information. Time should be built into the schedule for research activities such as focus groups, surveys and measurements and documentation of existing facilities. At the end of the process, the additional time and effort pays off in better results, efficiencies that save money and time, and a documented return on the investment.

Evidence-based design is an effective tool in more than just health care design. It works for areas like higher education, which aims to improve learning, and in research, to improve discovery. The process allows administrators and users to understand and express priorities — what is really important from an outcome and capital investment point of view — and provides a way to track the success of their decisions and the designs. BW

Monte Hoover, AIA, and Robert Schoeck, AIA, are principals with BSA LifeStructures Inc., an architecture and engineering firm with offices in Indianapolis and Chicago.

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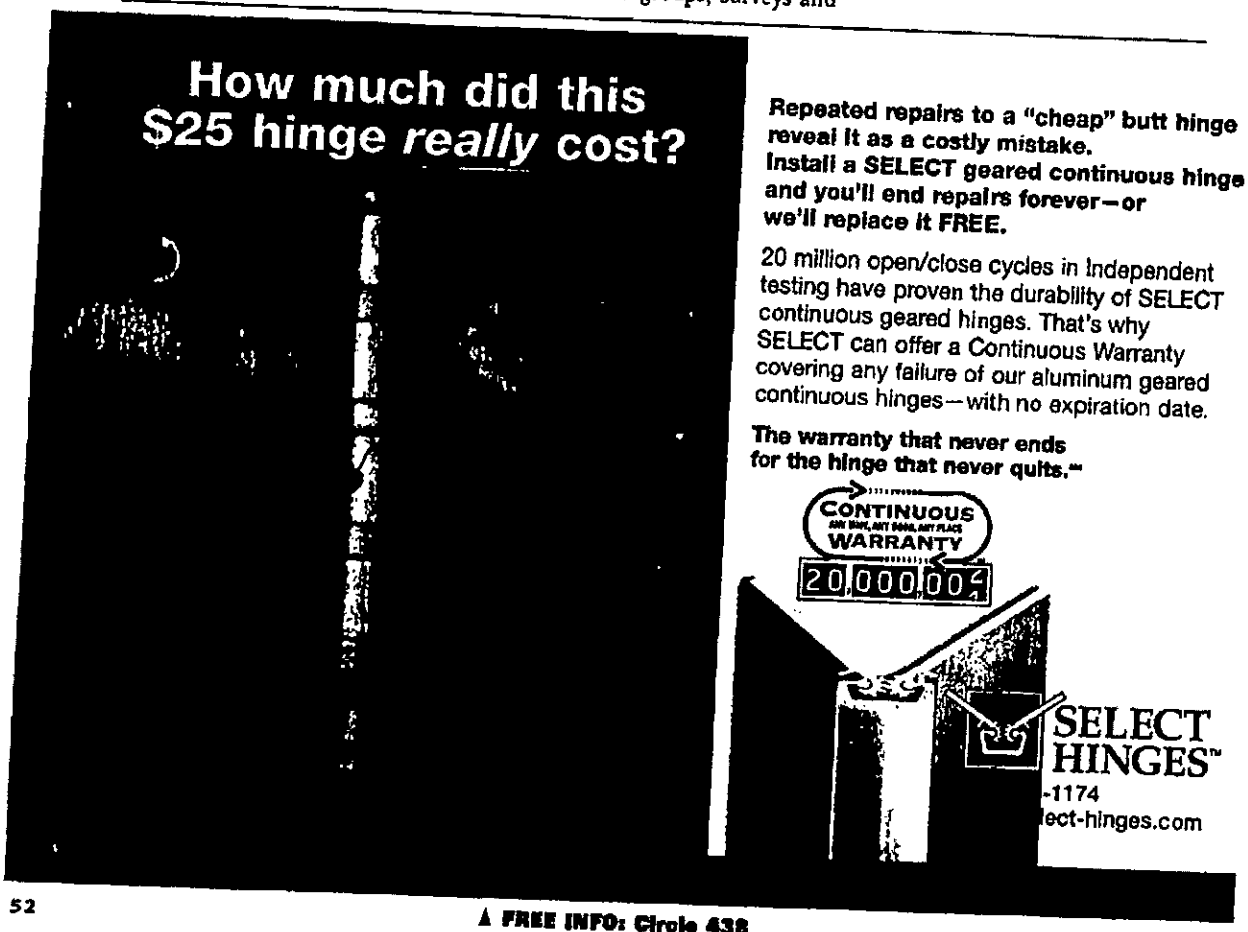

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Abstract

Clearly, evidence-based design is gaining ground, and more rigorous studies will soon be completed. As the body of data grows, advocates for evidence-based design contend that facility and real estate professionals will be compelled to evaluate and apply it. "Now that we know there is research, there's an obligation to use it in the same way that we expect an aircraft engineer to use the best research," says Hamilton. "It's a moral issue and a patient safety issue."

Full text

Listen

Advocates of EVIDENCE-BASED DESIGN say, 'Yes'. A new generation of hospitals is putting the theory to the test

Probably the most famous description of the impact of buildings on people came not from an architect or a researcher studying workplace performance, but from a politician, British Prime Minister Winston Churchill: "First we shape our buildings; thereafter, they shape us."

No segment of the facilities market has taken that observation more to heart than health care facilities. Today, the concept of evidence-based design is drawing interest because it moves beyond the general idea that the physical environment affects occupants: It seeks to gauge the impact of specific designs on productivity, employee and patient morale, and patient outcome.

Evidence-based design stems from the recognition that the physical environment can have a measurable influence on our well-being, especially in health care. "A properly designed environment is part of the course of care," says O. Kirk Hamilton, founding principal with Watkins Hamilton Ross Architects in Houston and associate professor with the Center for Health Systems and Design at Texas A&M University.

Parrish Medical Center, Titusville, Fla., incorporates elements of evidence-based design, such as locating nursing stations in alcoves in the patient wings. The center, which opened in 2002, has received high marks for patient satisfaction.

Under the banner of evidencebased design, a growing number of facility executives, architects and designers are applying rigorous, peerreviewed studies of the facilities impact on patient outcomes. Evidence-based design is "the critical thinking of the architect, working together with an informed client, to make design interpretations on the basis of reliable evidence from research," says Hamilton.

Today, experts are completing studies to determine how different aspects of a facility - such as décor, the placement of sinks and bathrooms, or the use of overhead pages - affect patients' health. The effects are measured by looking at statistics such as the rate of nosocomial infections - those that patients acquire while in the hospital - or the number of medication errors and the length of patient stays. Improving these measures should translate into an overall enhancement of patients' well-being.

This approach differs from the traditional mindset of many designers and architects, says Rosalyn Cama, president of Cama Inc. and board chair of the Center for Health Design in Concord, Calif. Most architects are guided by principles of good design, as well as their own knowledge and intuition, but they also have to comply with codes and regulations, she says. They rarely have done true, academic research that shows when the environment puts patients at harm and when it helps them.

That's changing. In 2000, a handful of health care organizations, working with the Center for Health Design, launched the Pebble Project. Member organizations examine the impact of the health care facilities they're constructing. The goal of each research initiative is a report that shows - in a manner that can be replicated by others - whether the money spent on the facility did achieve intended results. For instance, a study might evaluate whether making all patient rooms private lowers the rate of nosocomial infections.

Why "Pebble Project?" A pebble thrown into a pond creates ripples across the water, says Cama. The 24 hospitals now participating in the project hope to create ripples that will dramatically change the way health care facilities are designed and operated.

The Pebble Project organizations hope that evidence-based design helps accomplish three objectives: promote healing; recruit and retain employees; and reduce operating costs, Cama says.

To achieve those aims, the starting point is for facility executives and architects to identify project goals, says Mike Kastner, director of building services and construction management with Lakeland Regional Health Systems, St. Joseph, Mich.

New patient rooms at Saint Alphonsus Regional Medical Center, Boise, Idaho, use healing architectural design principles that enhance privacy, comfort, communication and safety. Patients in the new rooms ranked their sleep a 7.3, compared with 4.9 in traditional rooms.

For instance, the goal may be reducing patient falls, which often occur when a patient tries to reach the bathroom at night. Disoriented and tired, the patient may trip and fall.

An architect taking an evidence-based-design approach might start with the knowledge that a facility similar in size to the one being designed will experience 20 falls annually. The goal might be to reduce that number to five. One approach is to place the patients' beds nearer to the bathroom and keep a night light on, says Kastner. Once the facility is in operation, the architect and health care organization would document how the design influenced the number of falls by patients.

WHAT IT'S NOT

Evidence-based design can mean different things to different people, so identifying its general parameters is important. For starters, evidence-based design doesn't mean simply spending money on lavish amenities. "It's nice to have a nice lobby, but can you say it's having an influence on making people well?" asks John Balzer, vice president of facility planning and development with Froedtert & Community Health System, Milwaukee, a member of the Pebble Project.

In addition, evidence-based design is about more than trying to reduce the stress patients experience while they're in the hospital, although that's certainly an important subset of the discipline. However, the field is more expansive, with such goals as reducing medication errors and the length of the average hospital stay.

Finally, evidence-based design means not using a cookbook approach to building design. Because every facility is built within a specific set of requirements and constraints, each requires a tailored approach. The goal is for architects and facility executives to intelligently adopt or adapt the research that's been done and apply it to the project they're working on.

Health care organizations around the country are doing just that.

Bronson Methodist Hospital in Kalamazoo, Mich., built a 287-bed replacement facility that opened in 2000. All patient rooms are private. Today, the rate of hospital-acquired infections is 11 percent lower than it was in the old facility, says Sue Reinohl, vice president, business development. A single infection can add more than a week to a hospital stay.

Froedtert & Community Health System added a new 118-bed, inpatient facility, says Balzer. The new break rooms contain windows - the first time the organization has provided windows in staff areas. "The windows were reserved for the public, while the staff got the back of the house."

Froedtert's nursing vacancy rate is about 4 percent. The national average is about three times that. Although it would be difficult to prove that windows alone have helped Froedtert retain nurses, they are one tool in the box. "We feel strongly enough about this that we will take one patient room (on a wing) out of service to use the windows for the staff," says Balzer.

Saint Alphonsus is currently building a nine-story tower using evidence-based design. The new tower will house critical care and operating facilities.

In Michigan, Lakeland Regional Health Systems is building a 142-bed addition to its facility, which houses 250 beds. The new facility will incorporate several principles from evidence-based design. For instance, patient-room toilets will be located to minimize falls, and supply stations will be near nurse stations to reduce the distances nurses must walk each shift.

Once the building is complete, Kastner and his colleagues will study more than 30 metrics, including the length of patient stays, the number of patient transfers and nurses' promptness in responding it to call buttons.

Parrish Medical Center in Titusville, Fla., which opened in 2002, incorporates several elements identified as being critical to a healing environment by the Center for Health Design, says George Mikitarian, president and chief executive officer.

For instance, to ensure quiet patient areas, Parrish has nearly eliminated public address pages. Parrish also has done away with the traditional nurses' station. Instead, nurses work from alcoves that are located within patient wings and equipped with computers, phones and storage space. This puts nurses closer to patients and reduces the time needed to answer calls.

The design appears to be winning over patients. In January 2003, respondents to a patient satisfaction survey ranked 12 of 16 areas higher than 90 percent.

The management team at St. Alphonsus Regional Medical Center in Boise, Idaho, is adding a nine-story tower that is being constructed using evidence-based design, says vice president Susan Gibson.

St. Alphonsus also created a prototype floor with 40 rooms designed using evidence-based design in its current facility and has monitored differences between these and older rooms, says Gibson. For instance, the renovated rooms feature materials and finishes with high sound-absorbency ratings. Patients in the new wing ranked the quality of their sleep a 7.3. That compares to a 4.9 ranking by patients in traditional rooms.

OBSTACLES REMAIN

Applying evidence-based design is not without challenges.

One is the dearth of architects experienced in the discipline. "A lot understand the words and concepts, but not many have designed buildings based on it," says Kastner.

Cost is another significant challenge. Many facilities that incorporate evidence-based design principles require a larger initial investment. Private rooms, for instance, are more expensive to build than shared rooms, although they can lower the rate of nosocomial infections.

As a result, facility executives trying to make the case for evidencebased design often need to calculate both the initial construction cost and the cost to operate the facility over several years. Savings from lower rates of nosocomial infections, fewer medication errors or more efficient staff processes can allow an organization to recoup the higher investment.

One notable study on the tradeoff between the higher initial cost and lower ongoing costs associated with evidence-based design is known as "The Fable Hospital" study. "The Business case for Better Buildings," as the study is formally known, was published in Frontiers of Health Care Management.

The research team analyzed studies on evidence-based design currently under way to determine likely construction cost increases when a hospital uses evidence-based design. They compared that with the estimated change in ongoing operating expenses. The name of the fictitious, 300-bed health care facility is Fable Hospital.

The researchers found that constructing a hospital using evidencebased design concepts added approximately $12 million to construction costs. For instance, all patient rooms are private, have larger bathrooms with double doors and feature sinks placed near the doorway to encourage caregivers to wash their hands.

Within a year, anticipated operational savings more than compensated for the extra investment. For example, patient falls can cost about $10,000 each. Nationally, the median rate of falls is 3.5 per 1,000 patient days. The study estimated that this number would drop by 90 percent as a result of locating beds closer to the bathroom, using a monitoring system that alerts nurses when a patient is out of bed, and putting double doors on bathrooms. The result at Fable was an estimated savings of $2.5 million annually. And that total doesn't include any reduction in litigation costs due to the reduced number of falls.

Another challenge with evidence-based design is the need to compromise when two goals collide. For instance, the nursing staff at Saint Alphonsus wanted hard-surface flooring in work areas because spills are common. Carpet would require more frequent cleaning, which would interrupt the nurses as they did their jobs.

"You can't compromise efficiency by having someone come in and clean the floors," Gibson says. "But from an aesthetic and noise point of view, we would prefer carpet."

A new 118-bed, in-patient facility, built by Froedtert & Community Health System, Milwaukee, includes an employee break room with windows.

To reach the dual goals of efficiency and noise reduction, Gibson and her staff are pairing hard-surface flooring with ceiling tile that's very high in sound absorbency.

It's important to note that not all evidence-based design principles boost costs. For instance, ceiling tiles that absorb sounds and reduce noise levels can cost about the same as materials that are less sound-absorbent. However, sound-absorbent tiles can create a quieter environment and dramatically boost patient satisfaction.

Finally, another challenge, albeit one which will dissipate over time, is the fact that much of the hard, rigorous research on evidence-based design is just now being done. As a result, it can be difficult to find existing studies that stand up to questioning.

"In a lot of what's been described as evidence-based design, the evidence is not as strong as one would like; it's more anecdotal," says Tom Heller, vice president of facility services with Oakland, Calif.-based Kaiser Permanente.

For instance, there's little rigorous research showing that the color of patient rooms or the presence of music can influence healing, says John Koulelsis, director of planning and design with Kaiser. "You can say that seems to make sense, but there's little hard science."

On the other hand, data is accumulating in other areas, such as the impact of different materials, like low-VOC paints, on patients, says Heller. "Our approach is to continually scan what's being said and done, and weed through to find what's real."

Clearly, evidence-based design is gaining ground, and more rigorous studies will soon be completed. As the body of data grows, advocates for evidence-based design contend that facility and real estate professionals will be compelled to evaluate and apply it. "Now that we know there is research, there's an obligation to use it in the same way that we expect an aircraft engineer to use the best research," says Hamilton. "It's a moral issue and a patient safety issue."

BY KAREN KROLL, CONTRIBUTING EDITOR

Karen Kroll, a contributing editor to Building Operating Management, is a freelance writer who has written extensively about real estate and facility issues.

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Factors affecting patient satisfaction and healthcare quality

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Abstract

Purpose – The aim of this paper is to build a comprehensive conceptual model to understand and measure variables affecting patient satisfaction-based healthcare quality.

Design/methodology/approach – A total of 24 articles from international journals were systematically reviewed for factors determining patient satisfaction and healthcare quality.

Findings – Patient satisfaction is a multi-dimensional healthcare construct affected by many variables. Healthcare quality affects patient satisfaction, which in turn influences positive patient behaviours such as loyalty. Patient satisfaction and healthcare service quality, though difficult to measure, can be operationalized using a multi-disciplinary approach that combines patient inputs as well as expert judgement.

Research limitations/implications – The paper develops a conceptual model that needs to be confirmed empirically. Also, most research pertains to developed countries. Findings are presented that may not be generalized to developing nations, which may be quite different culturally.

Practical implications – The paper has direct implications for health service providers. They are encouraged to regularly monitor healthcare quality and accordingly initiate service delivery improvements to maintain high levels of patient satisfaction.

Originality/value – The paper collates and examines recent healthcare quality study findings. It presents a comprehensive, conceptual model encompassing research work and a holistic view of various aspects affecting patient satisfaction and healthcare quality. Although a large amount of healthcare quality research has been done, each studying a particular service, this paper comprehensively brings together various research findings.

Keywords Health services, Quality management, Customer satisfaction, Performance monitoring

Paper type Literature review

Introduction

Studies confirm that high quality services are directly linked to increased market share, profits and savings (Devlin and Dong, 1994). Generally, service quality is also recognized as a corporate marketing and financial performance driver (Buttle, 1996). Specifically, patients' quality perceptions have been shown to account for 17-27 percent of variation in a hospital's financial measures such as earnings, net revenue and asset returns (Nelson *et al.*, 1992). Moreover, negative word of mouth can cost hospitals $6,000-$400,000 in lost revenues over one patient's lifetime (Strasser *et al.*, 1995).

Health service's nature and value

Like quality in most services, healthcare quality is difficult to measure owing to inherent intangibility, heterogeneity and inseparability features (Conway and Willcocks, 1997). Butler *et al.* (1996) reiterate Zeithaml (1981, pp. 186-190) that patients participating in production, performance and quality evaluations are affected

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by their actions, moods and cooperativeness. Healthcare is dynamic – considerable customer changes have taken place and competition is increasing (Gilbert *et al.*, 1992). Consequently, healthcare quality evaluations raise problems owing to service size, complexity, specialization and expertise within healthcare organizations (Eiriz and Figueiredo, 2005).

Generally, purchases can be categorized as having search, experiential and credence properties (Nelson, 1974). Specifically, healthcare is by nature a credence purchase (Butler *et al.*, 1996). Patients may be unable to assess medical service technical quality accurately; hence, functional quality is usually the primary determinant. Also, healthcare quality is more difficult to define than other services such as financial or tourism mainly because it is the customer himself/herself and the quality of his/her life being evaluated (Eiriz and Figueiredu, 2005). Some authors suggest that healthcare quality can be assessed by taking into account observer, i.e. friends and family perceptions. Moreover, these observer groups represent potential future customers – major influencers of patient healthcare choices (Strasser *et al.*, 1995).

Patient satisfaction and its dimensions

Cure is a fundamental health service expectation (Conway and Willcocks, 1997). Specifically, patient satisfaction is defined as an evaluation of distinct healthcare dimensions (Linder-Pelz, 1982). It may be considered as one of the desired outcomes of care and so patient satisfaction information should be indispensable to quality assessments for designing and managing healthcare (Turner and Pol, 1995). Patient satisfaction enhances hospital image, which in turn translates into increased service use and market share (Andaleeb, 1988). Satisfied customers are likely to exhibit favourable behavioural intentions, which are beneficial to the healthcare provider's long-term success. Customers tend to express intentions in positive ways such as praising and preferring the company over others, increasing their purchase volumes or paying a premium (Zeithaml and Bitner, 2000, pp. 176-181).

Patient satisfaction is predicted by factors relating to caring, empathy, reliability and responsiveness (Tucker and Adams, 2001). Ware *et al.* (1978) identified dimensions affecting patient evaluations, including physician conduct, service availability, continuity, confidence, efficiency and outcomes. Other dimensions have been introduced to capture patients' healthcare evaluations (Fowdar, 2005), including:

- core services;
- customization;
- professional credibility;
- competence; and
- communications.

Human involvement in the service situation with emotions approaching love for the patient and positive patient outcomes such as pain relief, life saving and dealing with anger or disappointment with life after medical interventions (Bowers *et al.*, 1994) are also included in the literature. Woodside *et al.* (1989) identified other primary patient satisfaction determinants:

- admissions;
- discharge;

- nursing care;
- food;
- housekeeping; and
- technical services.

Patients' perceptions, notably about physician communication skills are also significant satisfaction determinants. Two dimensions in Butler *et al.*'s (1996) study explained 66 percent of the variance in patients' service quality perceptions:

(1) facility quality; and

(2) staff performance.

Access refers to health service availability (service is available when it is required), and is operationally defined as the number of patient-physician contacts (Turner and Pol, 1995), waiting times, convenience and availability associated with healthcare experiences (Tucker, 2002). Communication is the degree to which the patient is heard, kept informed through understandable terms, afforded social interaction and time during consultation and provided psychological and non-technical information (Tucker, 2002). If communication is good, which includes information from the service provider to the patient on the type of care he or she will receive, thereby alleviating uncertainty that increases his or her awareness and sensitivity about what to expect, then patient satisfaction is higher (Andaleeb, 1988).

Outcomes are defined as the change in physical health status directly attributable to the healthcare experience and efforts. Service quality, therefore, is the degree to which care was humane and competent (Tucker, 2002). If the service provider's competence is perceived high then levels of satisfaction also increase. Competence strongly influences patients' service quality assessments (Andaleeb, 1988). Staff demeanour also has a significant impact on customer satisfaction. The manner in which staff interacts with the patient and staff sensitivity to the patient's personal experience seems to be important (Andaleeb, 1988).

Studies show that if hospital costs are perceived high then patient satisfaction is lower (Andaleeb, 1988). If physical facilities, including: cleanliness; modern equipment; and the general feeling that the hospital is in a good physical condition, are well perceived then patient satisfaction increases (Andaleeb, 1988). Many dimensions discussed so far come close to factors determined by Parasuraman *et al.* (1988):

- reliability (competence);
- responsiveness (communication);
- tangibles (physical facilities); and
- empathy (staff demeanour).

Through factor analysis, Tucker and Adams (2001) reduced these variables to two primary dimensions thought to affect patient evaluations:

(1) *Provider performance* – found to be the most significant in patient evaluations, associated with interpersonal relations and patient-caregiver interactions.

(2) *Access* – variables related to the patient's ability to gain care and the impediments to that process.

The effect of specific service encounters on cumulative patient satisfaction
Owing to the nature of different services it becomes necessary to differentiate between overall customer satisfaction and transaction specific satisfaction; i.e. specific service encounter (Bitner and Hubbert, 1994, pp. 72-94). Multiple service satisfaction leads to an overall level of customer satisfaction (Bitner and Hubbert, 1994, pp. 72-94). Boshoff and Gray (2004) found that satisfaction with specific service dimensions such as nursing staff, fees and meals were found to exert positive influence on cumulative patient satisfaction – the strongest being satisfaction with nursing staff. However, satisfaction with administration, reception and television services were rejected as things that influence customer satisfaction (Boshoff and Gray, 2004).

Different health care options: patient expectation and satisfaction levels
Gilbert *et al.* (1992) compared patient expectations of three different health provider options:

(1) emergency rooms;
(2) private physician; and
(3) walk-in clinics.

Expectation and performance questions covered several attributes:

(1) time spent with the physician;
(2) the way diagnosis, treatment and care were explained;
(3) physician and staff friendliness; and
(4) amount of information provided.

There was also two instrumental attributes:

(1) cost; and
(2) physician competence.

The study showed that expectations were not equal for all three health service providers. For walk-in-clinic patrons, the most important influence on expectations was staff friendliness and cost. For private physician patients, they were friendliness and time spent with the customer, treatment explanations and competence. Customers said emergency rooms were the least attractive. The most important influence were physician friendliness, competence, amount of time spent with the customer and the amount of information provided. Both private physician and emergency room patrons placed walk-in rooms as the referent for their expectations. Staff friendliness, cost and the amount of time the physician spent with them were found to be the three most important considerations/discriminators. With low expectations, emergency rooms generated higher than expected satisfaction levels. The only group where what was received was exactly as what was expected was walk-in patrons. In the case of private physicians, the performance fell short of expectations, thus generating dissatisfaction.

Healthcare value chain: various actor roles and links that shape patient satisfaction and healthcare quality
According to Pitta and Laric (2004), healthcare delivery value can be described using elements that precede service delivery. The value chain includes five groups:

(1) payers – government, employer and individuals;
(2) fiscal intermediaries – insurers;
(3) providers – hospitals, hospital systems and alternate site facilities;
(4) purchasers; and
(5) producers.

Their study elaborates how links are created from the simplest, direct physician-patient to more complex and elaborate networks, which include other players such as employers, insurers, retailers, diagnosis systems and alternate medical service providers. Healthcare value chains also carry a large amount of patient information, which patients may feel a perceived risk in disclosing. The study shows how each of these links and players create positive or negative patient experiences. All value chain entities are important for service success and any one can harm image. As in all services, the customer tends to blame the contact organization when there is a problem (the hospital, in this case). Authors suggest that hospital managers can increase perceived value for the customer by handling the bulk of behind-the-scenes detail, providing clear and appropriate patient information and showing care and concern (Pitta and Laric, 2004).

Role of hospital rooms in shoping patient perceptions and satisfactions
The physical setting in which services are delivered has been found to influence customer service performance evaluations, including customer satisfaction (Bitner, 1990, 1992; Parasuraman *et al.*, 1985, 1988). In the healthcare literature, a common finding is that physical facilities are a component of patient healthcare evaluations (Woodside *et al.*, 1989). Swan *et al.*'s (2003) recent study showed that room appearance affects patient perceptions and satisfaction. Their study compared patients' evaluations of rooms that ranged in quality. Healthcare dimensions affected by room appearance are:

- physician skill and expertise;
- physician and nurse courtesy (answering questions, listening to concerns);
- food (overall satisfaction, receiving what was ordered, temperature);
- general hospital evaluations;
- intentions to use the hospital again; and
- recommending the hospital to others.

On all these dimensions, patients staying in appealing rooms gave more positive evaluations than those in typical rooms. However, regarding nurse behaviour (answering calls, explaining illness, treatment and home care) no significant differences were found between room types.

Effect of diagnosis on patient perceptions and expectations
Silvestro (2005) studied patient perceptions in one NHS breast cancer screening unit and found that screened and diagnosed patient perceptions differed. Screened patients' ratings were slightly lower than diagnosed patients' evaluations, which reflected the diagnosed patients' heightened sensitivity to service levels. Integrity (transparency

and instilling patient confidence) was another factor emerging as important for patients. Communication and competence emerged as important quality factors among screened patients. In the diagnosed patient's case, the four most important service quality factors were: reliability; integrity; functionality and comfort. Also, the diagnosed patients' perceptions were generally slightly lower than screened patients'. In general, screened patients' perceptions were positive. However, diagnosed patients' perceptions (with the exception of courtesy) were poor leading to a negative gap for every factor. Patients were most dissatisfied with:

- care;
- comfort;
- responsiveness; and
- privacy (undressing during the screening process and that conversation with staff were overheard).

Privacy's importance has been recognized in previous studies (Silvestro, 2005).

Effect of socio-demographic characteristics on patient perceptions

Socio-demographic variables showing positive association with patient satisfaction include:

- age;
- education;
- health status;
- race;
- marital status; and
- social class.

However, Tucker (2002) states that unclear, contradictory and inconclusive relationships exist between:

- satisfaction and gender;
- race;
- marital status; and
- social class.

Individual factors positively associated with patient satisfaction are health status and education. Younger, less educated, lower ranking, married, poorer health and high-service use were associated with lower satisfaction (Tucker, 2002). Another study found that the patient's health quality assessment appeared to change with the introduction of patient's socio-demographic characteristics. However, the effect produced only a 1 percent variation (Tucker and Adams, 2001). Butler *et al.* (1996) found gender and age significantly predicted patients' quality perceptions, but on only one dimension – facilities. Females valued this dimension more than males. Perceived facility-related quality was found to be better for older than younger respondents (Butler *et al.*, 1996). Earlier studies showed satisfaction differences between health service users and observers (Strasser *et al.*, 1995). However, Butler *et al.* (1996) found no

significant differences in health quality perceptions between users and observers (friends and families of patient). A significant difference, on the other hand, was found on facility quality dimension – where users criticised the hospital's tangible characteristics more than observers (Butler *et al.*, 1996).

Earlier work also suggests that patient's expectations and priorities vary among countries and are highly related to cultural background and to the healthcare system (Eiriz and Figueiredu, 2005). Income was the only socio-demographic characteristic found to have an influence on patient satisfaction (Mummalaneni and Gopalakrishna, 1995); this study included socio-demographic characteristics such as age, gender, occupation, employment status, education and income. It revealed that only income influenced patient satisfaction; upper income customers appeared more concerned with personal health delivery such as answers they receive to medical queries, waiting time for appointments and medical care. Lower income consumers, on the other hand, were more concerned with costs and overall physical facilities, indicating value orientation.

Healthcare quality and satisfaction

Patient determined quality literature inconclusively predicts the direction of satisfaction and quality from the patient's perspective (Tucker and Adams, 2001). Quality is positively correlated with satisfaction; however, the direction and strength of the predictive relationship between quality and satisfaction remains unclear. Some authors believe that complex healthcare services and the patient's lack of technical knowledge to assess them should incorporate broader healthcare quality measures, including financial performance, logistics, professional and technical competence (Eiriz and Figueiredo, 2005). Quality is a judgmental concept (Turner and Pol, 1995) and operational quality definitions, as we have seen, are based on values, perceptions and attitudes (Taylor and Cronin, 1994). The implication thus is to develop quality measures based on expert judgement, specifically insightful customers and respected practitioners (Turner and Pol, 1995). Consequently, healthcare quality can be categorized in three ways (Donabedian, 1986):

(1) *Technical aspects* – how well clinicians diagnose and treat problems.

(2) *Interpersonal component* – provider responsiveness, friendliness and attentiveness.

(3) *Amenities* – health care facility appeal and comfort.

Individual healthcare quality measures include (Donabedian, 1986):

- *Structure* – the medical delivery system's fixed characteristics such as staff number, types, qualifications and facilities.
- *Process* – what is done to and for the patient such as treatment.
- *Outcomes* – changes in the patients' current and future health attributed to antecedent medical care.

Measuring healthcare quality

Some believe healthcare quality should be studied from the patient's perspective. Patients provide valid and unique information about the quality of care (Ware and Stewart, 1992, p. 3, 291, 373). Another school believes that patient satisfaction rather than health status is the primary healthcare measure. This line of research focuses

primarily on the attitude towards service performance by confirming/disconfirming expectations (Taylor and Cronin, 1994). The SERVQUAL instrument has been empirically evaluated and found to be reliable and valid for hospital use (Babakus and Mangold, 1992). Generally, the tool and adapted versions are suitable for measuring patient satisfaction (Sohail, 2003; Parasuraman *et al.*, 1988, 1991). However, some authors question its applicability for healthcare (Butler *et al.*, 1996). Consequently, in some studies, the tool has been modified by dropping irrelevant or adding relevant dimensions (Fowdar, 2005; Sohail, 2003). It is generally felt that SERVQUAL should be adapted as required (Parasuraman *et al.*, 1988).

Accreditation-based approaches

The Health Plan Employer Data and Information Set (HEDIS) coordinated by the National Committee for Quality Assurance in the US involves self-reporting surveys. It attempts to standardize managed care delivery, quality and cost-effectiveness evaluation. The Medical Treatment Effectiveness Programme (MEDEP) concentrates on medical effectiveness research. It focuses on identifying procedures and treatments that improve care quality, clinical outcomes and patients' quality of life. It involves four components:

(1) data collection and development;
(2) patient outcomes and clinical effectiveness research;
(3) developing and disseminating guidelines; and
(4) assimilating research findings guidelines.

However, accreditation limitations include:

- the absence of standards weighting criteria;
- fixation on goals that repress investigation into related areas or side-effects;
- review teams' managerial bias; and
- processes that obstruct input from the institution's most severe critics.

The 1992 American Medical Association's review process also uses various approaches but is limited by differences in peer review assessments (Turner and Pol, 1995).

Multi-dimensional approaches

More complex conceptual models to understand and measure patient satisfaction and healthcare quality include Turner and Pol's (1995) multidimensional approach to measuring healthcare quality, representing experts and other stakeholder judgements. The authors incorporated Donabedian's (1986) and Ware and Stewart's (1992, p. 3, 291, 373) patient satisfaction perspective in a model for measuring service quality including two more care dimensions: access and personnel. Additionally, the model incorporates contexts in which quality is measured, thereby providing an explanation for the level at which outcome or degrees of satisfaction are measured. Within each quality dimensions, these contexts affect how different components are weighted. The authors suggested two contexts – micro and macro. Macro includes delivery modes (where care is delivered), "providership" (the mechanism through which care is delivered such as managed care, fee-for-service, insured care) and technology. Micro context factors

are those accounting for individual differences such as values, beliefs and maladies, etc. Furthermore, each quality dimension comprises general and specific construct/measurement. General context such as inpatient versus outpatient service is also considered. The researchers measured quality dimensions including access, personnel, clinical outcome and patient satisfaction. Thus, the model brings out patient satisfaction as a multi-dimensional concept needing to be operationalized and considered under the relevanl contexts (Turner and Pol, 1995). Second, Tucker and Adams' (2001) integrative patient evaluation model shows how caring, empathy, reliability, responsiveness, access, communication and outcome dimensions predict satisfaction and quality as moderated by the patients' socio-demographic characteristics. Third, Conway and Willcocks' (1997) integrated model applies service quality to healthcare settings. It incorporates influencing factors such as:

- patient knowledge and experience;
- perceived risk/pain/distress level;
- affiliated parties' experience;
- provider information;
- provider image;
- affiliated parties' information;
- patient preference;
- patient personality; and
- socio-economic factors with measurement issues (reliability, responsiveness, tangibles, assurance, empathy, information, access, redress and representation).

For each, the degree of confirmation/disconfirmation is incorporated with expectations and service-quality gaps (Parasuraman *et al.*, 1985) to arrive at patient satisfaction levels.

Healthcare service satisfaction and loyalty

Previous studies show a positive relationship between service quality and customer satisfaction (Loveman, 1998; Heskett *et al.*, 1997, pp. 236-257). Customer loyalty is both an attitude and a shopping behaviour (Dick and Basu, 1994). In the context of healthcare, a study found nurse empathy, assurance and tangibles affected loyalty positively. Security's impact on loyalty was, however, found to be negative; that is too much security reduced loyalty. Satisfaction with meals, fees and television services were also found to positively affect loyalty (Boshoff and Gray, 2004).

Physician role and patient behaviour

Ross *et al.* (1982) found patients in large multi-speciality organizations were more satisfied with physicians who fit an expected demographic norm (middle-aged, white men from higher socio-economic groups). Also, a greater match between role expectations and physician behaviour meant more satisfied respondents (Ditto *et al.*, 1995). There is a clear relationship between medical care satisfaction and patient compliance; when patients are dissatisfied with medical advice they are less likely to cooperate. Ditto *et al.* (1995) argue that it is healthcare's socio-emotional component rather than the physician's perceived competence or intelligence that seems to be most

important in determining patient satisfaction with their physician, and consequently their adherence to treatment regimens. According to the authors, patients encounter two physician types – authoritarian and egalitarian. The former is defined as one where the physician assumes the role of an expert and primary decision maker. The patient expecting such a role places great faith in the physician's abilities, anticipating the physician will provide clear-cut treatment. The egalitarian belief, on the other hand, is defined as one where the patient expects the physician to make treatment recommendations, discuss options and allow the patient to participate in treatment decisions (Ditto *et al.*, 1995). Subjects expressing authoritarian beliefs about physician roles tend to show greater healthcare utilization by visiting medical professionals more often. Beliefs about physicians were unrelated to age, gender, marital status, race or education. Authoritarian role expectations were also found to be significantly associated with longer physician-patient relationships. Authoritarian expectation subjects reported poorer health status than egalitarian ones. Physicians presenting treatment in an egalitarian style were perceived as significantly more competent and inspired greater confidence in both themselves and their prescriptions than did authoritarian physicians. Respondents were less likely to seek a second opinion after an egalitarian prescription. Both authoritarian and egalitarian subjects were more satisfied with the egalitarian physicians than the authoritarian ones (Ditto *et al.*, 1995). This finding, however, seems to contradict earlier studies showing that if there was a greater similarity between the physician's behaviour with the expected role then patient satisfaction would be greater. Authoritarian belief patients also responded as being more satisfied with egalitarian style. Consequently, patient compliance too would be greater for egalitarian than authoritarian physicians even for an authoritarian belief patient. Further research needs to be carried out to address these contradictions.

Lovdal and Peerson (1989) found that doctors' and other medical personnel's behaviour were central determinants of patients' attitudes about a hospital as a whole. They also confirmed earlier studies that affective role physicians were more likely to generate satisfaction among respondents than instrumental types. Patients look for behaviour that is supportive, friendly, caring, helpful and attentive. Ware *et al.* (1978) show that physicians' affective behaviour is seen to be more satisfying to patients. The authors state that consumers appear to take for granted that doctors are well trained and highly skilled. What consumers do not seem to take for granted, on the other hand, is the degree to which doctors' exhibit friendly, caring behaviour. In terms of patient perceptions, respondents had less favourable opinions about doctors' affective as opposed to instrumental behaviour (Lovdal and Peerson, 1989, p. 40).

Trust in the context of healthcare

There has been an increased awareness, via media reporting, of harm associated with healthcare errors. With this came an increased concern amongst policy makers, hospital administrators and professionals about patient safety. Hall (2005) explains that those who trust have an expectation that the trusted person will behave with goodwill towards them and with competence in the domain in which he or she is trusted (or in caring for that with which he or she is entrusted). Patient safety concerns

may lead customers to stop using a particular hospital's services owing to negative word-of-mouth. Basic principles outlined in healthcare studies include:

- Trusting patients are vigilant, i.e. trust is not simply a vague hope or thinking optimistically; health service providers must keep patients alert to errors in the course of their care. Some checking by the patient is appropriate even when there is trust particularly when honest mistakes are possible, which may be easily spotted and corrected.
- Patients may continue to trust even if harmed.
- Healthcare provider's trust in their patients may positively affect healthcare experience and outcomes.

Entwistle and Quick's (2006, p. 411) study reviews patient safety developments and suggests avenues for further research:

> We have suggested, in principle, trust can be understood in such a way that it is well placed, morally appropriate and compatible with current understandings of safety problems in health care.

Factors responsible for HMO customer switching behaviour

Rising healthcare consumerism is changing the traditional physician-patient relationship into a provider-consumer one. By taking a consumerist stance, patients are now more inclined to ask questions, contribute to decision making, "shop" for doctors, sample healthcare providers and switch services if they experience dissatisfaction. Service industry brand switching behaviour is influenced by price, inconvenience, core service failures, inadequate employee responses to service failures, competitive issues, ethical problems and involuntary factors. Of the few studies that focus on patient switching behaviour, one found that dissatisfaction with emergency access increases the probability of switching healthcare providers (Ho *et al.*, 1998). This factor includes attributes such as emergency care procedures, getting care without appointment and a 24-hour phone consultation. Individual factors such as marital status and education also determine switching behaviour. People with higher education are more health conscious and more aware of their consumer rights – they are more inclined to challenge medical advice and ask questions. The study provides healthcare managers an opportunity to make improvements such as better emergency care, installing a 24-hour phone consultation, etc. (Ho *et al.*, 1998).

Distance and hospital use

Earlier studies examined the effect of distance on patients' health service use. Goodman *et al.* (1997) found that specific service use is increased by availability. The authors examined the relationships between distance from home, primary care physician and hospitalization rates. Previous work showed that rural citizens are more likely to be hospitalized than urban residents. Hospital use was found to be well reflected as a function of discharge rates – showing a U-shaped curve between discharge rates and distance. However, in the case of children, the relationship was seen to be step-wise with discharge rates decreasing with increasing distance. The study did not indicate that hospitalizing more people residing close to hospitals was associated with higher illness rates. Rather, the results indicate that adults with poor

health tend to live closer to hospitals. A similar relationship was found among children with chronic illnesses who moved closer to medical facilities. Living further from the hospital was associated with lower hospital rates in metropolitan as well as no-metropolitan areas, affluent as well as poor populations. Proximity influences the likelihood of patients' contacting the healthcare service and the means they use or the rate at which physicians recommend (and patients accept) hospitalization for conditions where there is substantial uncertainty about its need (Goodman *et al.*, 1997, p. 1149).

Understanding hospital staff perceptions of patient priorities and perceptions

Apart from understanding patient satisfaction dimensions, Silvestro (2005) argues it is beneficial for managers to understand staff perceptions regarding patient expectations and perceptions. Such an examination helps us to understand if there are gaps between the two and to take measures to close them through training, for example. In a healthcare service study, the author focused on extending the use of a tool based on SERVQUAL (Parasuraman *et al*, 1988) to measure staff perceptions of patient priorities with a view to identify those staff who best understood the patient's perspective. This, the author felt, can be applied to identify functional differences and thus allow opportunities for intra-organizational learning. The study involved staff from different functional areas (nursing, management and radiology) and found that differences in staff understanding patient priorities and perceptions did indeed emerge. Apart from intra-organizational learning, such an analysis can also lead to recognizing and rewarding high levels of services with positive effects on staff morale and esteem (Silvestro, 2005).

Conclusions

Figure 1 proposes a comprehensive model that encompasses issues discussed in this article. The model shows how patient and health providers create and affect health service quality. Patient involvement is an inherent feature in healthcare services whereby he or she influences outcome quality through compliance, describing the right symptoms and physically undergoing treatment. Health service quality perceptions are antecedents to patient satisfaction, which in turn decide whether patients are loyal to healthcare providers. Patient loyalty results in positive behaviours such as recommending health services to friends and relatives, compliance and higher service use thus positively impacting profitability. Mederating factors that affect patient satisfaction are outlined.

Healthcare services are difficult to evaluate as credence values are high. There is a debate about how healthcare should be evaluated. While some authors feel patient perceptions are valuable healthcare quality indicators, others contend that health service quality should be evaluated by experts. The SERVQUAL instrument is used in many patient satisfaction studies and has been found appropriate in healthcare settings, but needs to be modified to suit specific environments. Dimensions that determine patient satisfaction have been identified, including:

- health care output;
- access;
- caring;

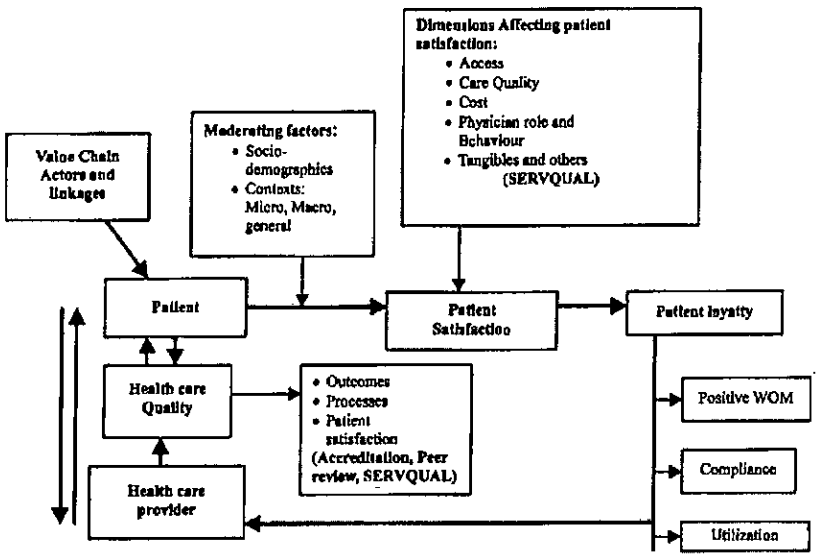

Figure 1.
A comprehensive model to understand healthcare services

Note: Bracketed phrases explain how particular concepts can be measured

- communication; and
- tangibles.

These are close to general service quality dimensions like reliability, responsiveness, empathy, assurance and tangibles.

Healthcare experiences can be understood by studying value systems comprising various actors and links. Each has the capacity to create a positive or negative patient experience. Hospital room appearance and comfort also play a significant role in determining patient perceptions, which seem also to be moderated by socio-demographic factors though some authors contend that these play contradictory, no or miniscule roles. Physician studies show that different role expectations give rise to different patient satisfaction, perception, care take-up and other compliance behaviour. Trust has been studied in the context of health with care errors reported in the media. However, material reviewed points out that healthcare trust requires further research. Several researchers developed conceptual models to measure health services and one suggests that patient satisfaction is a multi-dimensional concept that should be studied by operationalizing it within its context. Consequently, a conceptual model to understand and measure patient satisfaction and care quality in health care services is proposed by the author. Measuring healthcare quality can help healthcare managers to effectively set control mechanism and initiate improvement programmes. This article, by reviewing published research, found that patient satisfaction and healthcare quality are fundamental to improving health service performance and image.

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Designing Patient Rooms to Facilitate Patient-Centered Care

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Abstract

The design of the patient room plays an essential role in the overall design of healthcare facilities. The physical environment of patient rooms can greatly impact patient safety and quality of care. For example, environmental factors such as lighting, noise, and air quality can affect how healthcare providers complete tasks and how quickly patients recover. Understanding these factors and their influence on providing a safe, healing environment for patients can advance the concept of patient-centered care. This is an important topic in healthcare because studies show that patient-centered care improves disease-related outcomes, quality of life, and patient satisfaction while simultaneously decreasing readmission rates. Researchers have studied how communication, teamwork and other social phenomena influence patient-centered care, while the physical design of the patient room has received less attention. The patient room is important to consider because it impacts the patient care process, in addition to being economically sound for the healthcare industry. This paper presents a review of literature that examines different physical environment features applicable to patient recovery rooms in hospital settings that influence the patient-centered care (e.g. lighting). This study concludes with suggestions for re-design of the physical environment of patient recovery rooms in order to facilitate patient-centered care.

Keywords
Healthcare, Human Factors, Patient Room Redesign, Patient-centered Care

1. Introduction
Patient-centered care is a concept where health care is individualized by addressing the patient's and his/her family's needs and satisfaction as a priority, as opposed to only focusing on the patient's treatment [1]. Moreover, patient-centered care is designed to encourage patients and their families to become active participants in their health care and management through education about the patient's condition [1]. The current and future challenges in health care related to safety, quality, cost, and accessibility are daunting [2]. It is imperative for health care practitioners (HCPs) to embrace patient-centered care in order to advance high quality, safe, health care practices that meet patients' and their family members' health care expectations.

The physical design of the patient room is one way to support patient-centered care by making small environmental changes that facilitate a safe, healing environment, which supports the patient's psychological needs and increases satisfaction for both the patient and their family. According to Epstein *et al.* [3], patient-centered care may also improve disease-related outcomes, chronic disease control, and quality of life, while simultaneously decreasing patient readmission rates and patient anxiety and depression. Hospital facility design is the first step in preparing a solid foundation for a patient-centered environment because it provides the framework for how HCPs' work is structured which influences how patient care is provided [1]. For example, the layout of the unit can greatly influence HCPs' ability to work as a team; a circular layout of patient rooms with the nursing station in the middle, promotes teamwork; while long separated hallways with no communal nursing station can hinder it. Teamwork can help to quickly meet the needs of patients (i.e., if one nurse is busy with another patient, a second nurse can help attend to his/her other patient), enhancing patient-centered care. New hospitals have the opportunity to build their units from the ground up to positively influence patient-centered care; however, many times they do not take advantage of this. Both new and existing hospitals are unfortunately not always built to be "safe by design" [5]. This review of the literature demonstrates the importance of considering the design of the physical environment while

minimizing the effects of latent conditions to enhance patient-centered care. It pays particular attention to patient recovery rooms in hospital settings.

2. Dimensions of the Physical Environment

Research shows that various factors in the physical environment may have an impact on the overall health and well being of patients [6]. Understanding the implications of these factors will help improve healthcare design applications [5]. There are several studies that highlight the dimensions of the physical environment [7,8], but Harris *et al.* [9] most notably highlighted architectural features, interior design, and ambient characteristics as the three main aspects of the physical environment within a hospital setting. Architectural features relate to the aspects of the environment that are relatively permanent, such as hospital layouts or the shape of a patient room. Furnishings, non-medical equipment, and artwork are some examples of interior design features, which are defined as less permanent facets of the hospital design and layout. Lastly, ambient characteristics include lighting, noise, odors, air quality and temperature. According to Evans *et al.* [10] when these environmental conditions are extreme or uncontrollable, they can adversely affect patient stress levels, and stress has physiological repercussions that potentially can affect a patient's recovery and satisfaction [1, 5]. In the following sections the three aforementioned aspects of the physical environment of hospital settings, and specifically within the patient recovery room, will be discussed in detail and their effects on patient-centered care and patient safety will be noted.

3. Architectural Features

3.1. Spatial Layout

A literature review conducted by Dijkstra *et al.* [11] discussed the effects of changes in spatial layout on patient health and well-being (e.g. quality of sleep) and concluded that most of the research had inconsistent outcomes. The types of spatial layouts compared were: a bay ward layout, which is a group of at least four beds that are parallel with both the external wall and the corridor; and a Nightingale ward, which is one long, open room with only curtains surrounding each bed [7]. The Nightingale layout had higher complaints of noise compared to the bay ward layout study, but the patients' did not report significantly different sleep satisfaction scores. Patients may have perceived a noisier and less private experience in the Nightingale layout due to the pre-conceived notion that curtained areas were less soundproof than solid wall material [12]. Pattison *et al.* [7] concluded that even though 48 (75%) of the patients studied preferred the bay ward layout over the Nightingale layout, the Nightingale layout was actually better for patients' knowing their nurse whereabouts and improved nurse-patient communication, which is an essential part of patient-centered care [12]. Even though the evidence did not suggest significantly different outcomes with the various ward style options, the obvious perception differences of the patients with respect to noise and privacy are worth noting.

There is also significant research on the advantages and disadvantages of individual patient rooms versus multi-bed room designs. Individual room designs were first proposed for Neonatal Intensive Care Unit (NICU) applications when research showed that infants could have adverse effects to environmental factors, such as noise and bright lighting [13], which could hamper infants' recovery process. The separate rooms allowed infants to receive appropriate individualized care for their specific needs, extra privacy for families, and a chance for families to create a "home away from home". Yet these perks came at the expense of an increased workload for NICU nurses, decreased teamwork efforts, and decreased visibility of patients [14]. Although patient-centered care is important, as it has been shown to increase the quality and safety of care [1], it is also crucial to consider the unintended consequences of redesign. For example, it does not make sense to push the idea of patient-centered care at the expense of the HCPs. The goal of redesigning spatial layouts of patient rooms should jointly optimize both patient and worker satisfaction. One way to do this is to adapt the idea of an individual patient room for increased privacy and patient-centered care as was done in the NICU with an oval cluster of faux individual rooms, which could optimize delivery of care while maintaining individual patient spaces. In hospital settings, space is costly and individual rooms may not be an economically feasible option.

3.2. Individual Room Design

The structure of each individual patient room is intrinsically linked to the structure of the intensive care unit (ICU) as a whole. According to Pati *et al.*, [8] one of the key elements to consider in an individual patient room design is the configuration of the bathroom unit and ease of bathroom access for the patient. The bathroom configuration could potentially affect the workflow of the HCP in addition to the safety of the patient. With geriatric patients, it is

necessary to consider minimizing the risks of patient falls and its consequences. This particular study did not find enough empirical evidence to suggest a particular configuration as a standardized recommendation, but it highlighted key considerations: patient visibility from HCP workstations, ease of patient transport from bed to bathroom, and to consider, above all else, the overall safety of the patient.

The designers of the individual patient room should also consider other physical attributes related to safety, for example bed clearances, adequate floor space, HCP access to supplies, or adaptable beds and headwalls. Clearance concerns are the most often encountered issue in space requirements of patient recovery rooms. Designers should consider adequate space in the layout plans for medical equipment to ensure safe operator use, safety for the patient, and fire code regulations [6]. Due to the dynamic nature of healthcare, room designs may also be flexible and adaptable for individual patient needs. Gallant *et al.* [15] recommends that individual room designs should have the capability to adapt and adjust in order to serve different patient needs and requirements with minimal remodeling. This method helps minimize costs in the long run by reducing excessive patient transfers and allowing a patient to stay with the same HCP longer, which supports a continued HCP-patient relationship and enhances patient-centered care. Current research shows that this innovative idea is difficult to implement with the shortage of nurses and economic difficulties in health care, but it is an important concept that may be useful in the future [15].

3.3. Windows

The Society of Critical Care Medicine (SCCM) suggests an adjustable window in each ICU room to minimize disruptions in circadian rhythm cycles [16]. Keep *et al.* [17] surveyed discharged ICU patients to determine the effects of rooms with and without windows. In general, they found that patients treated in ICU rooms with wiadows, as opposed to no windows, experienced less sleep issues and suffered less from hallucinations and delusions. Wilson *et al.* [11, 18] confirmed Keep *et al.'s* study by conducting a post-surgery survey with patients and found that the windowless patients experienced higher rates of delirium reactions after surgery. A simple window could have a positive affect on a patient's sleep rhythms and minimize hallucination, and this affect could lead to quicker recovery rates and increased patient satisfaction.

Not only is the presence or absence of a window important, but several studies have also shown that the view can impact patient outcomes as well. Ulrich *et al.* [19] compared recovery outcomes of surgical patients in the ICU that had a wall view and surgical patients in the ICU with a tree view. The patients with the natural view of the tree tended to have shorter hospital stays, took fewer pain medications, and had slightly lower scores for minor post-surgery difficulties. A window overlooking nature may be refreshing and therapeutic for ICU patients [20], because windows, through visual access to the outdoors, help patients deal with stimulus deprivation [21].

4. Interior Design Features

4.1. Flora in patient rooms

The impact of flora in the patient room on patient-centered care has not received a lot of attention from researchers. However, one study in particular found that the presence of foliage and flowering plaats in patient rooms had an effect on perceived patient pain. In a horticulture therapy experiment by Park *et al.*, [22] patients were placed in rooms with flowering plants and foliage, foliage plants only, or no plants. The study concluded that patients who had flowering plants and foliage and foliage plants only in their rooms had lower self-rated scores for intensity of pain, increased scores for tolerance to pain, and overall lower levels of distress than patients without plants in their patient room. By adding flora in a patient room, the goals of patient-centered care are supported because the patient's lower levels of distress and pain may lead to a more comfortable and satisfied patient.

4.2. Artwork

Artwork may be beneficial in patient recovery rooms for the patient, the patient's family, and HCPs involved in the patient's care. In general, artwork that is symbolic of nature or natural settings is recommended over other forms of artwork. Ulrich *et al.* [19] discovered that when patients see images of garden scenes, trees, water, or foliage for even as little as five minutes, patients can have significant drops in their blood pressure and muscle tension. Research suggests that pictures and artwork featuring geometric designs or abstract art should be avoided in patient room design [23]. ICU patients can suffer from delirium and this style of art could have a negative effect on the patient [24]. Bold designs in upholstery and window curtains along with over the top artwork and eccentric furnishings should not be considered in the interior design of the patient room. Although color will be discussed in

more detail below, the concept of color schemes can be applied to appropriate artwork and decoration decisions in the patient rooms as well.

Patients in the ICU are often under high levels of stress and anxiety in their post-operative recovery. Early in the facility design process, designers may want to consider implementing positive distractions to help improve patient satisfaction levels during recovery. For example, bed-ridden patients view the ceiling most often during their stay in the ICU and images can be incorporated into the design of the ceiling to create a pleasant deviation from the usual monotony of ceiling tiles and ceiling-mounted medical equipment [24].

4.3. Furniture and Amenities

In order to create a more patient-centered environment, designers can also select furniture options that allow for personalization, comfort, and a family-oriented atmosphere. For example, Thompson *et al.* [24] suggest having a whiteboard and/or a tack-board to allow families to decorate the patient's room and create a healing environment. Horizontal surfaces (e.g. side tables) are encouraged for placement of personal items the patient may receive during their stay (e.g. cards, flowers, etc.) [24]. Clocks and calendars are also recommended to help families and HCPs monitor the patient [24]. Several hospitals are moving towards a more, "hotel-like" model and featuring amenities such as wireless Internet, video games, television, and storable cots for family members to stay overnight [25], which facilitates increased familial involvement in the patient's care. At the University of Arkansas for Medical Sciences in Little Rock, patient focus is a priority and rooms are now large enough to allow family members to stay and work overnight, if necessary. The patient rooms are each equipped with the technology to support PlayStation video games and wireless Internet [25].

Additionally, St. Joseph's Community Hospital of West Bend, near Milwaukee, Wisconsin created and tested several mock patient room designs based on safety design principles of the patient room. In this study, researchers created a designated "family area" and "caregiver area" to encourage family members to stay with patients without impeding the workflow of the HCPs. This family area included a foldout bed/couch, a desk, Internet and technology resources and a closet for family members' personal belongings [26]. This new design also helped keep family members informed of their loved one's status and patient care plans. As both patients and family members are informed, they can participate and become partners in care with HCPs improving the quality of care and potentially reducing errors [26].

5. Ambient Features

5.1. Noise

As technology evolves, the amount of medical equipment in hospitals increases, as does the overall noise level. Noise levels in healthcare and recovery settings, like ICUs, are a heavily researched area. From alarms [27] to interruptions [28] to music [29], each of these has a significant impact on patient care. Noise from alarms can be significantly stressful and irritating to patients in the ICU [30]. Sleeplessness in patients can occur from hospital noise, resulting in increased alertness and changes in sleep patterns, which ultimately can have a negative affect on the healing process [31]. Dracup *et al.* [32] noted that the ICU psychosis syndrome, where patients withdraw from interpersonal relationships and become delusional, could be an outcome from excessive noise and sleep deprivation in the ICU. Whalen *et al.* believes noise in the ICU, can lead to psychological and physiological stress responses [33], which can affect a patient's ability to recover [1]. In order to cope with alarms and noise in the ICU, Whalen *et al.* [33] suggest involving the patient and patient's family in learning what the alarms mean and how to cope with them, so they do not panic when one goes off unexpectedly, and they perceive them as less disturbing. Adding sound to the environment in attempts to positively distract patients generally showed inconclusive results. However, preventative measures and positive distraction efforts seemed to have a positive impact on patient outcomes. In a patient room study by St. Joseph's hospital, researchers found that no overhead paging, quiet floor coverings, insulation between patient rooms, special sound-absorbent ceiling tiles, and "quiet" technology and equipment all significantly reduced noise and contributed to higher patient satisfaction [26]. Hagerman *et al.* [34] also focused on reducing sound through absorbent ceiling tiles. The results of this study showed the patients in rooms with poor acoustics had higher re-admittance rates for hospitalization and worse attitudes compared to the patients in the good acoustic rooms.

5. 2. Lighting

Natural lighting can greatly improve patient outcomes. Research has shown that natural sunlight could have an effect on improving moods, reducing mortality rates in cancer patients, and potentially reducing hospital stays for patients who experienced myocardial infarction [35]. In a study of pain medication conducted by Walch *et al.* [35], researchers found that patients that were located on a brightly lit side of a hospital consistently used less pain-relieving medications, in all age ranges. With access to increased natural lighting, patients also reported significantly less stress and marginally less pain when healing post spinal surgery [35]. Furthermore, another study found that depressed patients had shorter visits when they stayed in sunny rooms as opposed to dull rooms [36].

Artificial lighting research with respect to a patient-centered care is still in its infancy. There are multitudes of lighting recommendations for hospital patient rooms that pertain to visual task performance of HCPs (e.g., polarized lighting in a surgical room [37]). Additionally, some studies have focused on how artificial lighting impacts only patients' circadian rhythm without examining other variables [16]. Due to recent technological advances, hospitals can now use automated lighting features to match illumination with natural day/night patterns, which may result in less fragmented sleep for patients [38].

5.3. Odor

The sense of smell is a powerful tool that is deeply connected with human memories [39]. In a hospital setting, medicinal odors can elicit strong responses from patients; even the basic "antiseptic" or "clean hospital smell" can produce anxiety issues and an increased heart rate in patients [40]. With the combination of offensive odors from various bodily fluids and any related unpleasant memories, patients could react negatively leading to lower levels of comfort and patient satisfaction.

Unfortunately, maintaining high levels of sanitation and minimizing negative effects of odor may be difficult to achieve. There is not a great deal of research in olfactory responses of patients, however, Malkin *et al.* [41] discussed two ways to attempt to control stress-producing smells in patient recovery room settings. One key idea is to provide excellent air quality and ventilation to continually filter in fresh air and reduce odors that may be present. Another strategy mentioned was to remove the noxious smell from the ICU as quickly as possible, and replace it with a stronger, more pleasant odor through cleaning products or air fresheners.

5. 4. Air Quality

Air quality relates to the movement, cleanliness, and humidity of air in the environment. Drafts are often considered one of the most annoying environmental factors in the workplace, and people tend to he most sensitive to excessive air movement around the head, neck and shoulders regions [6, 42]. In the context of the patient recovery room, designers may consider selecting air ventilation systems that reduce the speed and intensity of the airflow. Additionally, the placement of the air ventilation system should be selected carefully as to not cause excessive drafts in the direction of the patient, especially the patient's head region. In one study, researchers used an unconventional approach of incorporating theatrical fog to determine airflow patterns in an isolation room in the ICU. The fog acted as a visual confirmation of how the air moved through the patient room and gave design insight for improving the air exchange in isolation environments [43]. Designers may also familiarize themselves with the construction and environmental standards listed by the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) for interactions of people, medical devices, and air-handling systems in a critical care environment [44]. These standards help designers ensure that air-handling systems are filtering the air properly, without contributing or disseminating airborne contaminants.

Humidity, a measure of the amount of moisture present in the air, also impacts air quality in patient rooms. Lower humidity levels can cause dryer eyes, noses, throats, and skin in patients and HCPs [6, 42]. Although there is not a specific, recommended humidity level for hospitals, humidity can still impact patient safety and errors, thus affecting the quality of patient care. The materials the medical devices are comprised of may behave differently under extreme humidity and temperature levels and certain components of the devices, such as adhesives, could degrade or warp significantly [6]. An ideal patient room might have controls available to adjust the humidity levels based on patient preference and medical device requirements for optimal performance.

5.5. Temperature

Similar to humidity, critical care and recovery environments require appropriate ambient temperature levels in order to have optimal device performance, and to control airborne infections and the spread of disease. Moreover, temperature can impact HCP perfonnance as well as patient sleep and comfort levels during recovery. Cold temperatures and its impact on HCP performance is often ignored and overlooked in research [6]. For hospitals to comply with occupational safety regulations fnr bloodborne pathogens and OSHA laws, HCPs must have increased personal protection materials (e.g. gowns) and hence temperatures in surgery and ICUs tend to be lowered to accommodate the extra material [6]. However, when cold temperatures are extreme, they can cause HCPs to shiver, have reduced tactile sensitivity and manual dexterity [6, 45], which could affect patient safety.

In concordance with the patient-centered care practices, Thompson *et al.* [24] recommend controls for each patient room to adjust the temperature as desired. Wenham *et al.* [46] also found that lower ambient temperatures usually decrease a patient's amount and quality of sleep, while higher temperatures tended to promote sleep. In addition, Matthews *et al.* [47] discovered that a lack of sleep is a considerable stressor that can potentially affect patient recovery rates or even survival.

5.6. Color

Colby *et al.* [48] noted that blue hues tend to have a calming affect on patients under sedation, causing patients to perceive a more relaxing atmosphere. In a study of children and design professionals on pediatric patient room design,, both groups preferred blue and green colors, where white was the least preferred color [49]. Blue and green are often found in nature scenes and could have a soothing psychological, as previously noted by Ulrich *et al.* [19]. A "horizon line" is also highly recommended in patient recovery rooms [50]. Horizon lines should be located at waist height and extend around an entire room in order to mimic the natural horizon that people see outdoors [50]. The horizon line also may subliminally create a calm, balanced setting and reinforce the natural design elements in the room (e.g. nature artwork, blue/green hues).

6. Conclusion

Without economic support in health care, it is very difficult to implement high quality designs to advance patient-centered care. In addition, there is a lack of construction of brand new facilities; many hospitals are merely remodeled as needed. Therefore, in order to achieve a patient-centered care environment, it is essential to consider the main elements of design that can be implemented in cost effective ways to pre-existing structures.

Adapting architectural features is difficult in existing hospitals because these features are largely permanent. It is recommended that windows be installed in patient rooms, since the research shows that both natural lighting and natural views can have positive effects on patient outcomes [19]. In the event that a patient wards underwent significant architectural changes, it would be pertinent for the design team to consider the costs and benefits of individual patient rooms, or other ways to create patient recovery rooms more individualized for each patient's needs.

Plants, artwork, color schemes, and furniture are inexpensive and easily implemented interior features in the patient recovery room design. Plants and foliage should be added to patient rooms and designers should use natural artwork of scenery, gardens, trees, etc. For color schemes, blue and greens tones can create a calming atmosphere, while abstract art and bold designs should be avoided. Hospitals are moving more towards a "hotel-feel" with amenities that encourage family involvement in patient care, such as furniture (e.g. a hideaway bed or a work desk) to accommodate a family member staying overnight or Internet access.

Ambient features can be hard to monitor and control in a dynamic, fast-paced environment of hospitals and individual patient rooms. Excess noise and light should be minimized during night hours to help patients with higher quality sleep and lower stress levels. Noise from alarms and technology should be avoided whenever possible [27]. Automated features for lights are also nice to align patient room illumination patients' circadian rhythms. Odors can be tricky to identify and eliminate in medical environments. Mild air fresheners and cleaning supplies should be available in each patient room to allow patients to eliminate noxious odors with pleasant fragrances as needed. Drafts and rapid air movement should be avoided in the patient room, especially with drafts in the direction of the patient's head and shoulders, because excessive air to this region may cause increased patient discomfort. Temperature and humidity can affect medical devices when they are at extreme levels. It is important to note the recommended levels for the medical devices in patient recovery settings, like the ICU, so as to optimize the

technologies' performance and avoid degradation of materials. Lastly, Temperature levels can affect patient sleep and recovery, and it is recommended to have individual controls for each patient to adjust as necessary. In patient-centered care, it is important to maintain the delicate balance between medical device shelf life, and patient and HCP comfort levels.

There is a great need for more research in the design of health care facilities. The literature suggests many general guidelines and inferences, but there are not as many controlled clinical trials to support these notions. Several researchers found inconclusive results and noted that they did not consider factors (e.g. age) that could have skewed their experimental design [18, 22]. It is also difficult for hospitals to implement and test these suggestions due to the lack of resources (e.g., time, manpower, and capital). Nevertheless, an understanding of the key design elements for patient recovery rooms is essential for developing evidence-based research, which will ultimately further patient-centered care efforts in health care.

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Abstract

More than $39 billion worth of healthcare construction projects broke ground in 2006 --about 33% higher than the total in the previous year, according to Modern Healthcare's 28th annual Construction & Design Survey. This ongoing new construction has led to the push for more evidence-based design in recent years. St. Vincent Hospital South Tower, a $42 million project that opened last year with 90 beds, employed evidence-based design to help better-utilize natural light, as well as focusing on the textures and colors inside the facility to provide a more nurturing environment. Boca Raton Community Hospital will feature nurses' stations closer to rooms and softer floors to reduce fatigue. At Sentara Williamsburg Regional Medical Center, decentralized nurses' stations are situated between each pair of rooms, providing caregivers more of a bird's-eye view through large windows. To minimize noise, all nurses carry small, hand-held paging devices to eliminate the distractions of an overhead paging system.

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Headnote
Our annual construction survey indicates the building boom continues-with research-based design playing a key role

Architects and designers are still putting the finishing design touches on the new Boca Raton Community Hospital, a 530-bed teaching facility that will rise from a 38-acre site in the heart of the wealthy resort community in South Florida. But this replacement hospital is not just another in a succession of new acute-care facilities that have popped up across the country, designers insist. In fact, they say, the 1.2 million-square-foot facility will be "the world's safest hospital" when it opens in about four years.

Among the features: Each of the large private rooms-more than 300 square feet in size-will be completely standardized, with equipment, supplies and bathroom located in precisely the same place. The rooms will all be "same-handed," meaning that beds are oriented against the same wall in every room, allowing caregivers to approach the right side of every patient-a technique taught in medical school. In addition to this standardized bed orientation, patient rooms feature identical placement of oxygen and medical equipment, which avoids potential confusion and speeds up care, designers say.

Nurse's stations will be decentralized, handwashing stations will be repositioned for maximum exposure and noise will be greatly reduced by softer flooring and upgraded insulation between the walls.

It may sound basic or intuitive, but these features-now standard at many new hospitalsare all just part of the relatively recent trend in "evidence-based design," which relies on solid research to help guide the hospital blueprints created by architects, designers and contractors.

"Everybody's talking about evidence-based design," says Joseph Sprague, a senior vice president and principal at Dallas-based HKS, one of the nation's leading healthcare-architecture firms. "Most everybody now wants to have some data that goes into design and really supports outcomes. For instance, if you do this, can you reduce infections? If you do this, can you reduce stress? Everybody's working to incorporate evidence-based design to produce positive outcomes-such as increased patient safety and staff efficiency."

This movement, experts say, marks a new phase in the evolution of a Healthcare building boom that began shortly after the turn of the century. It continued in full swing last year, according to Modern Healthcare's 28th annual Construction & Design Survey-based on 2006 information-which includes data from 186 development companies, general contractors, design-build outfits, architectural companies and construction-management firms. The number of firms taking part in the survey jumped from 167 in 2005, an increase that led to sizeable spikes in all construction categories compared with last year's survey.

Still growing strong

More than $39 billion worth of healthcare construction projects broke ground in 2006-about 33% higher than the total in the previous year. The total projected costs of healthcare facilities in the design phase in 2006 rose about 34% to nearly $75 billion from about $56 billion in 2005. The survey also found that about $24.7 billion in projects were completed during the 2006 calendar year, a 19% increase from 2005.

What's more, the feverish pace of healthcare construction in all sectors is expected to continue for several years, experts say, as many hospitals and health systems continue to take advantage of favorable interest rates to replace aging infrastructure and prepare for the expected wave of future business from aging baby boomers. Yet the real crunch from that cohort isn't expected to hit for several years.

"We're not even seeing the wave of impact from the baby boomers-yet," says Richard Galling, president and chief operating officer of Hammes Co., Brookfield, Wk, the nation's largest healthcare development firm whose total dollar volume jumped by about 38% last year to more than $900 million. "I think this surge in construction will last for at least a few more years. I think what we're seeing now is the tip of the iceberg."

This ongoing new construction-this year's survey includes 144 new acute-care hospitals completed in 2006 at a total cost of about $4.7 billion-has led to the push for more evidence-based design in recent years, observers say.

For instance, St Vincent Hospital South Tower in Birmingham, Ala., a $42 million project that opened last year with 90 beds, employed evidence-based design to help betterutilize natural light, as well as focusing on the textures and colors inside the facility to provide a more nurturing environment, says Todd Robinson, a principal and senior designer at Earl Swensson Associates, an architectural firm based in Nashville.

The typical patient rooms in the new facility include a foldout bed and a computer workstation. The nursing stations on each wing, which are designed in a V-shape configuration, feature an atrium that receives abundant natural light as well.

"Studies have shown that natural light serves as a healer and that patients get better quicker," Robinson says. "It creates much more positive results in care."

Not too long ago, the design of hospitals often sprung almost entirely from the intuition, creativity and personality of architects who drew up the building plans, according to Sprague and other architects.

"Architects have always used evidence and science and research to inform design," says Roger Ulrich, professor of architecture at Texas A&M University and a faculty fellow of the Center for Health Systems and Design, an interdisciplinary center in the university's colleges of architecture and medicine. "What's new is the really extensive implementation of research these days. Insofar as possible, people are trying to look toward research to better ground their intuition and problem-solving as designers with the goal of improving outcomes in a wide range of areas-everything from patient safety, reducing nursing turnover, patient satisfaction, shortening stays, enhancing financial performance."

The move to evidence-based design also has been fostered by the Center for Health Design, a research and advocacy organization in Concord, Calif., whose mission is improving the quality of Healthcare through better design and architecture. The center's Pebble Project, which kicked off in 2000 at the San Diego Children's Hospital and Health Center, is based on the supposition that small strides in these areas will eventually lead to a "wave" of change that will transform Healthcare. Several dozen hospitals are now involved in the trendsetting initiative that serves as a parallel to the growing emphasis on evidence-based medicine in clinical settings.

Ulrich was a leader of a joint project between Texas A&M and the Georgia Institute of Technology in Atlanta that identified 700 studies of how architecture and design affect the delivery of care in acute-care hospitals. In an essay in the December 2006 issue of the Lancet, an authoritative British medical journal, Ulrich outlined some key areas of research, including studies that show hospital noise levels are far too high and that floor layouts should be designed to reduce staff fatigue and increase the time for care.

In favor of single rooms

Research also reinforced a near-unanimous decision among hospital designers that single rooms are easier to clean and can reduce infections. In a report for the Center for Health Design about two months ago, Ulrich determined that studies show high ambient noise levels have serious effects ranging from sleep loss and elevated blood pressure among patients to burnout and emotional exhaustion among staff.

Yet hospital noise levels have been rising steadily since the '60s, and dozens of published studies over the past 45 years show that hospitals are not complying with even the most basic noise levels established by the World Health Organization. Sound-absorbing tiles, single-bed rooms and private discussion areas are just three immediate ways to help reduce noise levels and improve outcomes, according to the center's report.

Some of these steps, particularly the trend toward single-bed rooms, can add to the cost of construction, but hospitals are likely to recoup the extra expense in a short time, Ulrich says. Single rooms in most new hospitals, including those in St Vincent, which average about 313 square feet in size, have grown larger to accommodate another comparatively recent trend: allowing families to stay with patients and help manage their care and recovery. The 347 square feet of space in each room at the new Boca Raton Community Hospital will include the toilet and a subalcove and nursing station adjacent to the room that measures about 45 square feet and includes storage and a charting area.

Evidence-based upgrades such as this extra room add just over 5% to initial construction costs, according to a peer-reviewed analysis, Ulrich says, but estimates of savings and revenue gains indicated that these one-time costs would be recaptured in just a year, and would provide a boost to the bottom line every year thereafter, he estimates.

Hospitals, Ulrich wrote in his report, "should seize the opportunity to invest in evidencebased improvements as a long-term means of improving the financial health of their institutions, and most importantly the well-being and safety of their patients and staff."

Boca Raton Community Hospital, among the many projects still in the preliminary stage of design, is a teaching facility that sprung from an affiliation between former 380-bed Boca Raton Community Hospital and the University of Miami Miller School of Medicine at Florida Atlantic University in Boca Raton. The hospital, located on Florida Atlantic's Boca Raton campus, is just one of scores of examples of embryonic healthcare construction projects built on a firm foundation of evidence-based design. In addition to room standardization, the hospital will feature nurses' stations doser to rooms and softer floors to reduce fatigue. The hospital also will have far more insulation over a larger section of headwalls to improve acoustics.

"I think what we're seeing is a living lab," says Dan Noble, a senior vice president, principal and director of design at HKS. There's this idea that, intuitively, you think it'd be a better idea to have standardized rooms and decentralized nurses stations. Even before there was a body of evidence, we thought that Now, we have studies that help in the way we design hospitals."

He says he is a big proponent of same-handed rooms as opposed to the once-standard mirrorreverse design, where beds and other equipment are oriented against opposite walk He says considerable evidence points to improved safety when "everything is standardized and your layout is exactly the same."

Echoing Ulrich, Noble says the costlier additions are well worth the price. Even though he says he gets "pushback" from both contractors and hospital executives, the updated elements will ultimately save money. "Contractors seem to think this costs more money," he says. "But, logically, if you're doing things like standardizing rooms, it should cost less in the long run."

In addition to the "world's safest" hospital in Boca Raton, another big architectural firmnot to be outdone in the hyperbolic world of hospital construction-has designed what officials call the "state of the future" acute-care facility. At least that's the assessment of HDR, a large architectural firm in Omaha, Neb., that designed 110-bed Sentara Williamsburg (Va.) Regional Medical Center, a $76.3 million facility that opened in September 2006.

Like the Boca Raton project, Sentara features all-private patient rooms that are standard in shape, size and configuration. They are all acuityadaptable, which reduces or eliminates the need to move patients as their conditions change. Handwashing sinks are located just inside the doors near the patient bedside and alcohol-rub dispensers are placed in the corridors. Decentralized nurses' stations are situated between each pair or rooms, providing caregivers more of a bird's-eye view through large windows.

"Studies show that nurses (with decentralized stations) are spending more time in the patient rooms rather than traversing back and forth," says Sheik Elijah-Barnwell, a vice president and senior project designer at HDR.

In his essay on evidence-based design, Ulrich notes that "conventional floor layouts feature corridors organized around a central nursing station, which has traditionally served as a hub where medications, charts and other supplies are located." In this design, he writes, "nurses spend much of their time walking up and down halls engaged in wasteful activity, such as fetching supplies." It also contributes to fatigue and a reduction in time spent dealing with patients.

"By contrast," he adds, "floor layouts with decentralized nurse charting or observation stations and supplies dispersed to be dose to patients' rooms cut staff time spent walking and fetching and greatly increase time for observation and care of patients," which can help reduce falls by fostering direct observation of vulnerable individuals.

To minimize noise, all nurses carry small, hand-held paging devices to eliminate the distractions of an overhead paging system. Support spaces and supply areas are located in a central area to cut down noise and disruptions in the patient corridor, speeding up the process for caregivers in need of supplies.

For his part, Robinson, the Earl Swensson architect, tends to downplay evidence-based design as a new or emerging building block of hospital construction. Even without research studies to guide them, he says, hospital planners have long used some form of evidence-based design without giving it a trendy new name.

"Evidence-based design (as a concept) is fairly new, but evidence-based design is really something that people have been doing for a long time," Robinson says. "When pu go through and do research on results of what has been effective in the past, that's something all good designers do-and we've all been doing that for years. Evidence-based design is very important It's important to have some type of evidence as to why something works or doesn't work But I predict that in the not-too-distant future, therell be another newer buzzword out mere."

Sidebar
St. Vincent Hospital South Tower, Birmingham, Ala., which opened last year, makes abundant use of natural light, which architects say serves as a highly effective healer.

Charts on the following pages that rank the companies participating in this year's Construction & Design Survey include the top 20 only (if fewer than 20 companies responded in a category, the full ranking is presented). For the complete rankings in all categories and an alphabetical list of survey respondents, please visit the Databank section of modernhealthcare.com.

Sidebar
How we did it

A total of 186 respondents participated in Modern Healthcare's 28th annual Construction and Design Survey, up about 11% from 167 last year. This year's total includes 107 architecture firms, 25 development firms, 26 construction management companies, 18 general contractors and 11 design/build firms. (One firm responded to two categories). Invitations and reminders were sent out and the questionnaire was universally accessible online from Nov. 6, 2006, through Jan. 29.

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ORIGINAL ARTICLE

NICU redesign from open ward to private room: a longitudinal study of parent and staff perceptions

JR Swanson[1,2], C Peters[1] and BH Lee[1,2]

OBJECTIVE: Assess the attitudes and perceptions of parents and healthcare providers regarding the neonatal intensive care unit (NICU) environment while transitioning from an open ward (OW) to private-room (PR) NICU.
STUDY DESIGN: Parents and staff were surveyed 6 months before and 1 and 8 months after moving from OW to PR in a Level III NICU in 2009. Questions were scored on a 0 to 10 scale in areas of teamwork, communication, development, facility, safety and privacy.
RESULTS: In OW, parents and medical staff were satisfied with the teamwork. After 1 month in the PR, advanced practitioners reported higher scores whereas nurses reported declines in teamwork and safety but gains in other areas. Advanced practitioners' scores did not vary between surveys in the PR. Nurses were initially satisfied with the PR, but by 8 months, the scores declined. Parental satisfaction scores were consistently higher than medical staff in both settings.
CONCLUSIONS: Parental satisfaction is likely due to focus on their infant rather than facilities. In the PR, lower nursing scores are likely due to decreased interaction with peers. Research is needed to ensure that improvements gained from a PR NICU are meaningfully consistent.

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Keywords: intensive care unit; family-centered care; neonate; NICU design

INTRODUCTION

The concept of a private-room neonatal intensive care unit (NICU) design was first proposed nearly 20 years ago.[1] Since then, the development of private-room (PR) NICUs as opposed to the traditional 'open-ward' (OW) unit has seen a growing trend. Open ward NICU design limits privacy and conversation and can be intimidating and overwhelming for families; OWs also poorly limit environmental distractions and may lead to over stimulation of the infant and family.[2] This environment can affect family perceptions on the delivery of care, amount of attention devoted to their infant as well as the relationships they form with nursing, advanced practitioners and other families.[3,4] A PR NICU design, touted for optimal development of the vulnerable patient population, also presents challenges in logistics, operational changes and staff culture with the physical changes that occur in transitioning from the OW design.[5]

These conflicting issues between NICU designs afford an opportunity to evaluate the potential effects transitioning from one style type to the other. However, the literature evaluating these effects is limited. Domanico *et al.*[6] demonstrated that parents of NICU patients had different views of NICU design compared to health care staff. Parents who only experienced one of the designs felt staff performance was similar in both and that except for noise disturbance, the physical facilities were comfortable and adequate. The authors found that nursing staff preferred the OW design whereas neonatologists favored the PR layout. Others have found varying results in staff and family perceptions of the design dilemma.[7–12] In a separate paper, Domanico *et al.*[13] also showed that the PR design was more conducive to family-centered care and breast-feeding success than their previous OW design. It has also been postulated that a PR NICU design may improve infant neurobehavioral development at discharge through a variety of mechanisms, including decreased sound levels from neighboring equipment.[14–16]

The purpose of this study was to examine the effects of transitioning from an OW NICU design to a PR NICU design on advanced practitioners (neonatologists, nurse practitioners, physician assistants), nursing staff and parents in several categories across three different epochs of the transition (pre-, post- and 8 months post transition). It was hypothesized that the PR NICU design would be preferred to the OW design across all categories and that this preference would be sustained.

METHODS

An observational crossover cohort study design was used to assess the perceptions of study subjects to an OW NICU design compared with a PR NICU (PR) design at a single hospital site. In February 2009, the NICU service at Morristown Medical Center, Morristown, NJ, moved from an OW (9200 ft^2; 42 bed spaces; 219 ft^2 per bed space) to a PR design (17 855 ft^2; 34 rooms, 54 bed spaces in 34 rooms; 330 ft^2/bed space). Approval from the institutional review board was obtained prior to the study. Individual consent was assumed with the return of the survey.

The perceptions of the study subjects were assessed with an anonymous written questionnaire at three time points: 6 months prior to the OW to PR move (OW epoch), 1 month after the OW to PR move (transitional epoch) and 8 months after the OW to PR move (PR epoch). We decided *a priori* to resurvey parents and staff 8 months after the move to the PR NICU. Our intent was to survey the staff after several cycles of infant turnover (the hospital length of stay for the smallest infants ranges from 60 to 90 days in our NICU) to ensure validity of the data and to evaluate sustainability of perceptions of the nursing and advanced practitioner staff.

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The study population consisted of three defined study groups: parents of NICU patients, NICU nurses and advanced practice (AP) NICU providers (neonatologists, neonatal nurse practitioners and neonatal physician assistants). The questionnaire was a closed-ended survey of 22 questions that queried perceptions in six general categories: Team, defined as the sense of being part of the healthcare team; communication, defined as the ease with which one could contact/communicate with others; development, defined as the subjective sense of a neurodevelopmentally appropriate environment; facility, defined as the appeal of the physical environment; safety, defined as the sense of patient safety; and privacy, defined as the sense of family privacy. Questionnaire responses were based on a 10-point response scale, with 0 being the lowest and 10 being the highest end of the queried dimension. The questionnaire was modeled from a survey developed by the Picker Institute, an independent not-for-profit organization dedicated to advancing the principles of patient-centered care.

Questionnaires were provided to study subjects with an unmarked envelope with instructions to return the sealed, completed questionnaire to a designated collection site. The same questionnaire was administered to nurses and AP subjects during all three epochs. For parents, the questionnaire was administered only during the OW and PR epochs. This was decided *a priori*, given that parents from a transitional epoch would compose a singular unique cohort whose experiences, although interesting, would not directly relate to the study objectives.

Responses from returned surveys were recorded in a computerized database. Normality of data was assumed for questionnaire responses. Data were summarized with means and standard deviations; one-way analysis of variance with Tukey's honestly significant difference (HSD) *post-hoc* testing or Student's *t*-test were used, as appropriate, for comparisons of groups within a given epoch and within each study group. A *P*-value <0.05 was considered statistically significant. SPSS 15.0 for Windows software (Chicago, IL, USA) was used for statistical analyses.

RESULTS

A total of 248 surveys were completed during the study period: 42 (17%) from APs, 55 (22%) from parents and 151 (61%) from nurses. During the OW epoch, 15 surveys were from APs, 33 from parents and 42 from nurses. During the transitional epoch, 15 surveys were from APs and 58 from nurses. During the PR epoch, 12 surveys were from APs, 22 from parents and 51 from nurses. APs returned 78% of surveys handed out, nurses returned 68% and parents returned 56%.

Among neonatal nurses, only three categories in the OW had mean responses >7: safety (8.5 ± 1.3), team (8.1 ± 1.1) and communication (7.6 ± 1.0). Low mean scores were given for development (6.4 ± 1.2), facility (5.4 ± 1.7) and privacy (4.3 ± 2.1). One month after moving into the PR (transitional epoch), nursing perceptions improved for development, facility and privacy (*P*-value <0.05). However, there was a statistically significant decrease in nursing perception of team. After 8 months in the PR, the improvements in nursing perceptions of development, facility and privacy persisted (*P*-value <0.05, compared with OW) and the nursing sense of team increased to a mean score that was no longer statistically different than that in the OW. Interestingly, there were no significant changes in nursing perceptions of communication or safety throughout the study periods (Figure 1a).

Among advanced neonatal practice providers (AP), only three categories in the OW had mean responses >7, similar to nursing perceptions: team (8.3 ± 1.0); safety (7.8 ± 1.5) and communication (7.5 ± 1.2). Low mean scores were given for development (5.4 ± 1.6), privacy (4.8 ± 2.4) and facility (4.5 ± 2.0). In the transitional epoch, 1 month after moving into the PR, similar to that observed with nursing, AP perceptions improved for development, facility and privacy (*P*-value <0.05). After 8 months in the PR, the improvements in AP perceptions of development, facility and privacy persisted (*P*-value <0.05, compared to OW NICU). There were no significant changes in AP perceptions of team, communication or safety throughout the study periods (Figure 1b).

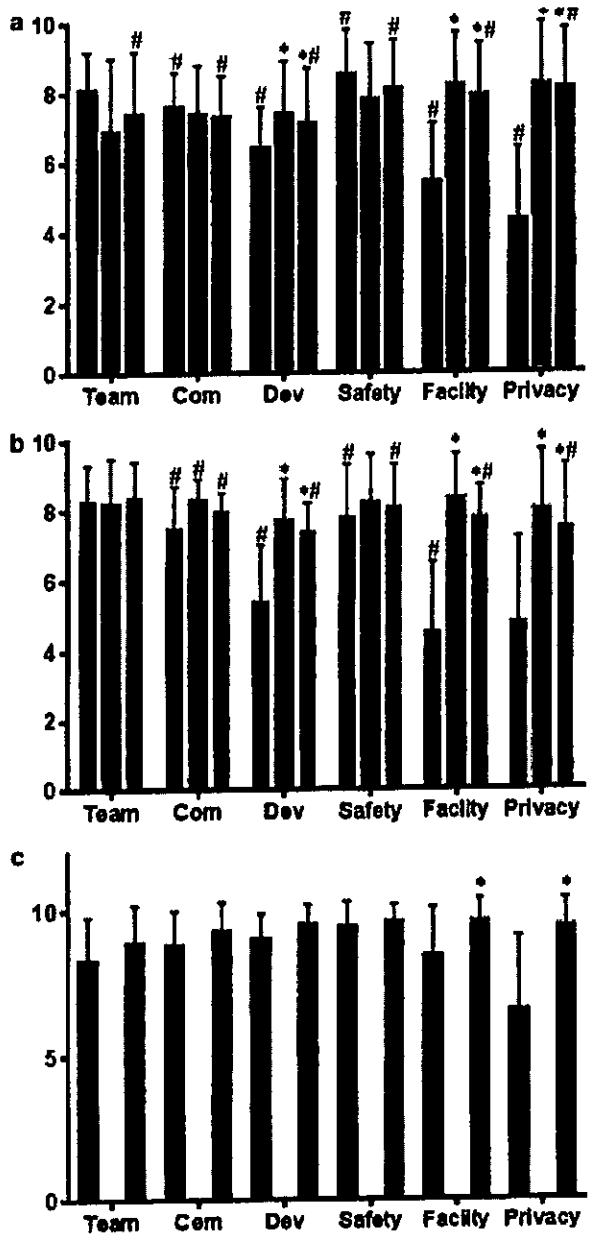

Figure 1. Survey responses from NICU nurses (a), advanced practitioners (b) and parents (c). Columns represent mean values ± s.d. of survey responses from nurses (a), advanced practitioners (b) and parents (c) during the open ward (■), transitional (■), and private room (■) epochs. Responses were on a scale of 0 to 10. *$P<0.05$ within group (one-way ANOVA with Tukey HSD post-hoc testing using parent baseline or Student's *t*-test as appropriate). #$P<0.05$ within epoch (one-way ANOVA with Tukey HSD post-hoc testing using parent baseline or Student's *t*-test as appropriate). For development during open ward, all groups were statistically different from each other.

In the OW, parents were more satisfied than nurses or AP providers with safety, development, communication and facility and more satisfied than nurses with privacy (*P*-value <0.05) (Figure 1c). In the OW, there were no perceptual differences between nurses and APs in any category other than development,

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with APs giving statistically significant lower mean scores. Nurses, parents and APs had similar high perceptions of team in the OW. In the transitional phase, APs perceived a higher degree of team and communication than nurses (P-value <0.05); there were no other differences between these two groups during this epoch.

In the PR, parents continued to report statistically significant higher degrees of satisfaction than nurses or AP providers with safety, facility, development, communication and privacy and higher scores for team than nurses (Figure 1c).

There were no statistically significant differences in survey responses among parents when controlling for duration of NICU hospitalization or NICU daily census, among AP providers when controlling for physician versus nonphysician status, or among nurses when controlling for shift (day versus night) or years of experience.

DISCUSSION

The results of our prospective survey study provide new information on parent, staff and practitioner attitudes on moving from an OW NICU to a PR NICU, a growing trend in the USA. Aside from the lengthy decision making process and resources required to pursue a PR NICU design, care should also be given to monitor staff and family attitudes both before and after the transition to ensure that support and facilities are appropriate for everyone affected. Our study demonstrated several issues that should be addressed or considered before transitioning from an OW to PR NICU design.

Parent perceptions

Overall scores from parents were universally high except for privacy in the OW. Although there were statistically significant improvements between OW and PR in the categories of communication, development and facility, the scores were high in both NICU designs. Of note, parents perceived developmental care and the facilities to be of a higher caliber than the NICU staff regardless of setting. Other studies have shown similar findings.[6,7] In contrast, Domanico *et al.*[17] found that 59% parents who were experienced to both types of NICU design favored the PR design compared with the OW. It is a well-known phenomenon that there are perception disparities between parents and NICU staff in what is important in the care of their infant. It could be assumed the consistently high scores found in our study in both NICU environments is a function of the focus of families on their infant rather than on the environmental or facility.

A concern of our social services department was the possibility that PRs would prevent families from developing relationships with other NICU families. Preparations to implement social activities were made to offset this potential void including 'family dinner night' and sibling social events located in our NICU lounge. Parent surveys, however, revealed this was a perceived possible change that did not come to fruition. Developing relationships with other families remained strong in parent survey results. One reason for this unexpected result may be increased visitation. Visitation allows for more contact with families in other areas of the NICU and hospital (lounge, cafeteria, etc.). Pineda *et al.*[11] showed that parents of infants in their PR NICU spent significantly more time visiting than those in the open-ward NICU, from an average of 19 to 32 h per week. This increase persisted over the first four weeks of hospitalization but was no longer significantly increased from week 5 until discharge. We did not change our visitation policy and although we did not collect any of this data, we did not see an increase in visitation.

Nursing staff and advanced practitioner perceptions

There were noteworthy perceptions of the nursing staff based on the survey results. The sense of teamwork decreased significantly in the transition epoch and was lower than parents or advanced practitioners perceived it. Although teamwork improved 8 months after the move, scores were still lower than the two other study groups. The fact that the scores were no longer significantly different likely reflects nursing staff feeling more comfortable with their new surroundings, accepting changes to workflow issues such as daily rounds and being more comfortable to no longer having advanced practitioners easily visible.

Nursing communication scores were also unchanged between epochs and were significantly lower than both parents and advanced practitioner scores. Previous studies have demonstrated conflicting results on this phenomenon.[6,8,18] As part of the move to the PR, a communications system was installed (Vocera, San Jose, CA, USA) that allowed immediate transmission of vital sign alarms to a nurse in a separate room. This has been shown to improve nursing workflow as well as communication in a previous study.[19] Nursing perceptions of teamwork and communication are likely due to the feeling of being more isolated from coworkers, a larger facility spreading nursing staff out and more dependence on electronic communication in the PR compared with the OW.

Neonatologists, neonatal nurse practitioners and neonatal physician assistants perceived the PR to be more developmentally appropriate, safer, more private and more environmentally appealing than the OW. Like the nursing staff, their scores were lower than parent scores in every category except teamwork. Other than as mentioned above in the categories of teamwork and communication, their scores were similar to that of nursing staff perceptions. The manner in which this group functions within the NICU could account for the static scores in both teamwork and communication compared with the nursing staff. In either NICU design, this group rounds on all patients thereby automatically giving them the knowledge of all patients regardless of location. They are also made aware of any other situation or event such as admissions, discharges and changes in clinical status that other members of the healthcare team may not be as aware of in the PR design. Statistical analyses of the various types of advanced practitioners were not done due to staff number limitations.

Evaluating the possibility of pursuing a PR design requires a lengthy decision process and securement of resources. The aesthetic appeal, potential to foster family-centered care and increased customer satisfaction must be balanced with the overall impact to all parties. Consideration must be taken into account for finances, the need for equipment and storage changes, supportive technology, work flow processes, ancillary services and the culture within the NICU.

These considerations can pose barriers that must be overcome to successfully transition to a PR setting.[20] Our survey did not reveal an increase in customer satisfaction (that is, a significant increase in survey scores across all six categories) that was an expected benefit of the PR design, although not the primary reason for the transition. Family response seemed to view all categories similarly in both NICU settings. Length of stay (data not shown) did not seem to influence this result. This seems to suggest that the family focuses on their infant rather than on the environmental surroundings. Other factors that could account for this response include the continued use of family-centered care principles that were already in place in the OW, the ability to be present during daily rounds and involvement in their infant's care and no significant changes in the medical or nursing care given to their infant. All of these factors have been shown to be a driver of parent satisfaction, whereas the physical environment has a very small role.[21,22]

The impact of the new unit fell with greatest intensity on the nursing staff. This impact was universal, regardless of the years of experience in NICU care, years of employment in our NICU or shift worked. The geographical limitation on visibility of their peers and the entire patient care area could result in a feeling of being isolated and prevent nurses from having comprehensive

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knowledge of unit activities. These perceptions likely contribute to feelings of decreased communication and a lack of teamwork. Although nursing staff had these negative perceptions, there was no change in staff turnover after the move to the PR setting. A great deal of support, new communication venues and utilization of staff input may decrease these perceptions over time.

CONCLUSION

Parents had consistently high scores in all categories in both OW and PR epochs. Nurses and APs found significant improvement in development, safety and facility, which was sustained. Nursing staff, however, felt that teamwork initially was poor, although 8 months post transition, this feeling was no longer statistically significant. The amenities, physical environment, privacy and developmentally appropriate environment of a PR are undoubtedly a worthwhile endeavor. A cautionary tale is the expectation that the change will foster an improved perception of family-centered care and customer satisfaction. The authors suggest a thorough investigation that includes ability to meet targeted goals and expectations before embarking on a significant change in NICU design.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

ACKNOWLEDGEMENTS

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CERTIFICATION AND AUTHORIZATION
of
UNIVERSITY OF WISCONSIN HOSPITALS AND CLINICS AUTHORITY

The undersigned representative of University of Wisconsin Hospitals and Clinics Authority in connection with application submitted herewith hereby states as follows:

I certify that no adverse action has been taken against University of Wisconsin Hospitals and Clinics Authority by the federal government, licensing or certifying bodies, or any other agency of the State of Illinois against any health care facility owned or operated by University of Wisconsin Hospitals and Clinics Authority, directly or indirectly, within three years preceding the filing of this application.

I authorize the Illinois Health Facilities and Services Review Board and the Illinois Department of Public Health (IDPH) access to any documents pertaining to University of Wisconsin Hospitals and Clinics Authority necessary to verify the information submitted with this application, including, but not limited to official records of IDPH or other Illinois agencies; the licensing or certification records of other states, when applicable; and the records of nationally recognized accreditation organizations.

Name: Ronald T. Sliwinski
Title: SVP & Chief of Hospital Division

Subscribed and sworn to
this 8th day of May, 2017

KRISTINA M. GORMAN
NOTARY
PUBLIC
STATE OF WISCONSIN

ATTACHMENT 5

CERTIFICATION AND AUTHORIZATION
of
SWEDISHAMERICAN HEALTH SYSTEM and SWEDISHAMERICAN HOSPITAL

The undersigned representative of SwedishAmerican Health System and SwedishAmerican Hospital in connection with the application submitted herewith hereby states as follows:

I certify that no adverse action has been taken against SwedishAmerican Health System and SwedishAmerican Hospital by the federal government, licensing or certifying bodies, or any other agency of the State of Illinois against any health care facility owned or operated by SwedishAmerican Health System and SwedishAmerican Hospital, directly or indirectly, within three years preceding the filing of this application.

I authorize the Illinois Health Facilities and Services Review Board and the Illinois Department of Public Health (IDPH) access to any documents pertaining to University of Wisconsin Hospitals and Clinics Authority necessary to verify the information submitted with this application, including, but not limited to official records of IDPH or other Illinois agencies; the licensing or certification records of other states, when applicable; and the records of nationally recognized accreditation organizations.

Name: William R. Gorski, M.D.
Title: CEO, SwedishAmerican Hospital and SwedishAmerican Health System

GINA BOETTCHER
OFFICIAL SEAL
Notary Public - State of Illinois
My Commission Expires
September 30, 2017

Gina Boettcher

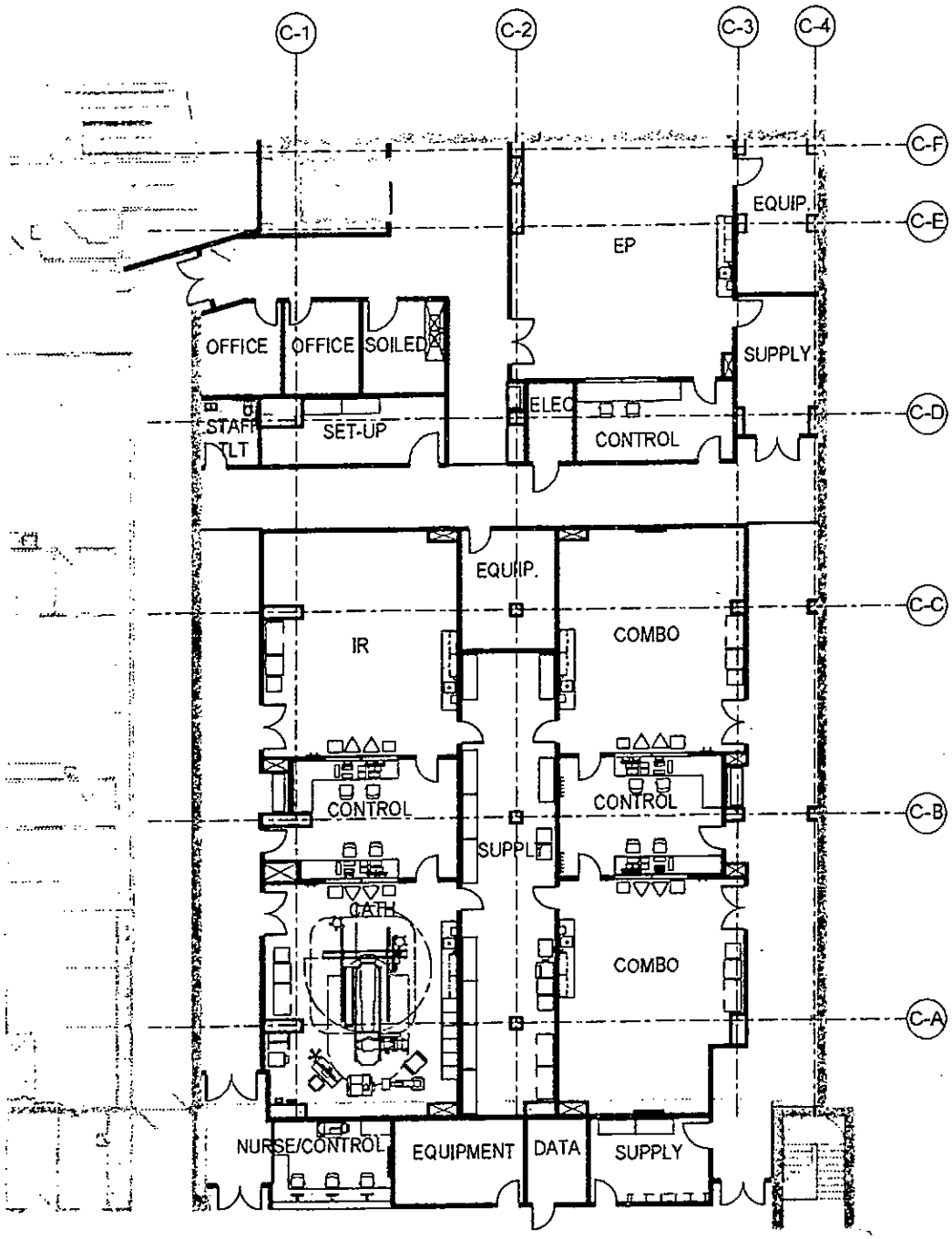
Subscribed and sworn to
this 5th day of May, 2017

Complications List

Category	Complication
Cardiac Rhythm	Arrhythmia (NOS)
	Asystole
	Atrial fibrillation
	Atrial flutter
	Bradycardia
	Second degree AV block
	Supraventricular Tachycardia
	Third degree AV block
	Ventricular fibrillation
	Ventricular standstill
	Ventricular tachycardia
Acute Anatomy	Acute closure
	Dissections
	Extravaasation
	Intervention Unsuccessful
	PCI during lab visit
	Perforation
	Periprocedural MI
Allergic Reaction	Adverse drug reaction
	Anaphylaxis
	Contrast reaction (major)
	Contrast reaction (minor)
	Hypersensitivity (unspecified)
	Hypotension
	Urticaria
Cardiovascular	Cardiogenic shock
	Congestive heart failure
	Hypotension
	Pericardial effusion
	Tamponade
	Vasovagal reaction
Access Site	Access perforation, extravasation
	Bleeding (unspecified)
	Cholesterol emboli
	Closure device unsuccessful
	Dissection of access site
	Embolization
	External bleeding
	Peripheral emboli
	Retroperitoneal bleeding
	Vessel occlusion of access site
Neurologic	Cerebrovascular accident

ATTACHMENT 6

	TIA
Patient to Surgery	Emergency vascular surgery
	Immediate CABG
	Subsequent CABG
Radiation	Rad dose over 10,000 mGy
Respiratory	Pneumothorax
	Pulmonary emboli
	Respiratory failure/distress
Device Complication	Aborted case due to patient anatomy
	Balloon rupture
	Closure device unsuccessful
	Equipment failure
	Insufficient supplies to finish case
	Device missed target area
Post Cath Complications	AV fistula of access site
	Congestive heart failure
	Hematoma bleeding
	No distal pulse at access site
	Pseudoaneurysm of access site
	Renal failure
	TIA
Death	Cardiac death
	Death (unspecified)
	Death due to infection
	Death due to pulmonary complication
	Death due to renal complication
	Death due to valvular complication
	Death due to vascular complication
	Neurologic death



ATTACHMENT 7

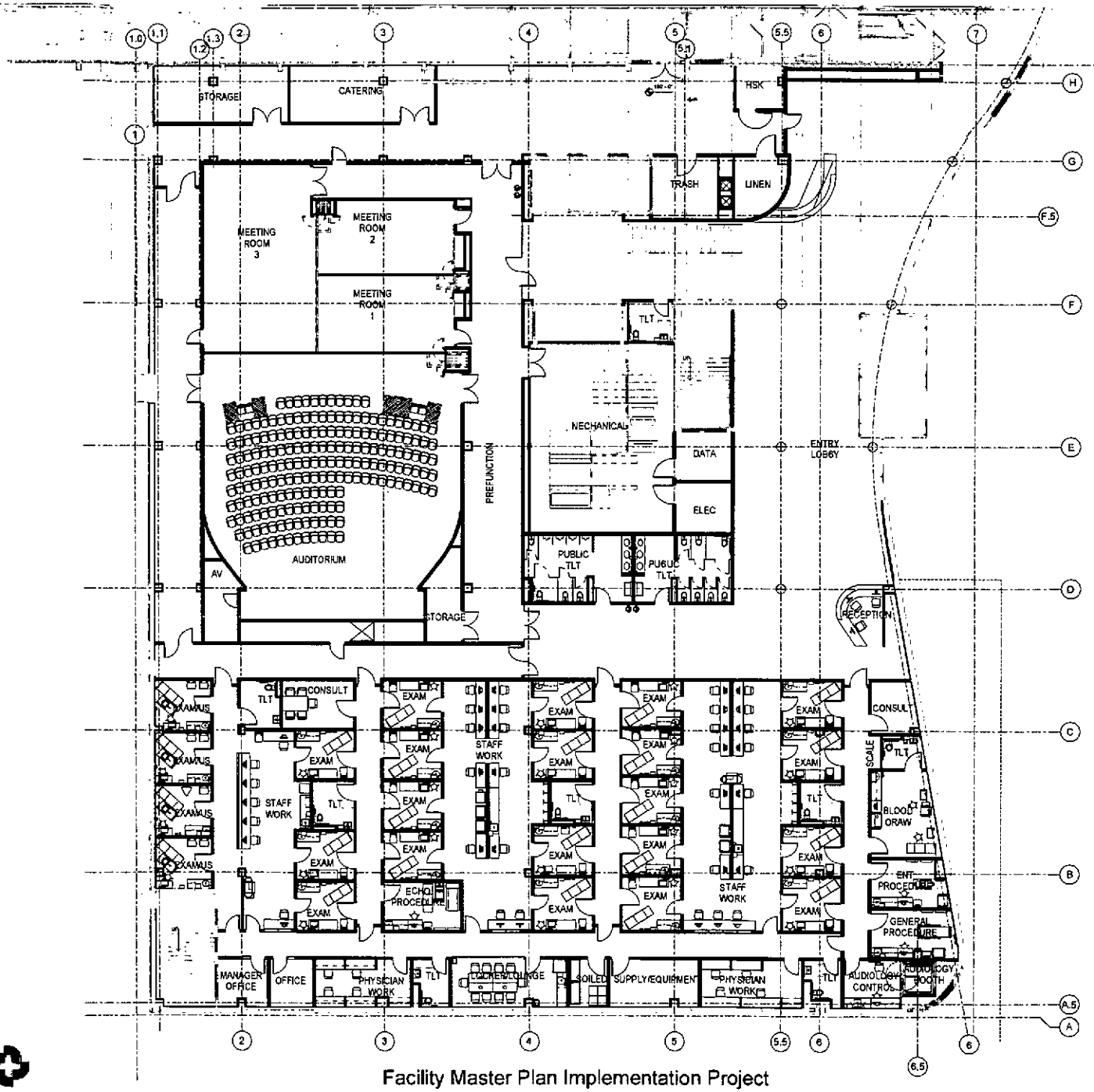
NARRATIVE AND SCHEMATICS OF DEPARTMENTS AND SERVICES

The first floor of the new women's and children's tower will include pediatric specialty and maternal fetal medicine outpatient clinics, conference rooms, lobby and common staff and public areas. (*See* attached Schematic labelled *Clinics & Auditorium.*) The second floor will include a 14-bed labor and delivery and antepartum inpatient unit with 2 cesarean-section procedure rooms, common areas and a connector to the existing hospital building. (*See* attached Schematic labelled *Labor & Delivery.*) The third floor will include the Nursery unit, common areas and a connector to the existing hospital building. (*See* attached Schematic labelled *Pediatrics.*) The fourth floor will include a 20-bed mother/baby inpatient unit and common areas. (*See* attached Schematic labelled *Mother/Baby.*)

Additional new construction of a one-story 12,000 gsf extension to the existing facility will provide a replacement for the existing Cath Labs and Angiography suites. (*See* attached Schematic labelled *CATH/EP/IR.*) This will provide space in the existing facility to modernize and expand Surgery which then, in a phased sequence, will in turn provide space for the expansion of the Emergency Department. Other renovations are proposed to modernize, renovate and expand the current instrument processing area to support surgery along with a renovation of the prep/recovery area to accommodate the growth of surgery.

SwedishAmerican Hospital obtained approval on June 7, 2017 of its exemption application (E-019-17) to establish a 10-bed Neonatal Intensive Care Unit (NICU). The NICU will be established in the hospital's existing facility and is expected to be operational in 2018. Upon completion of the women's and children's patient tower, the NICU would be re-located to the new facility along with other obstetric and neonatal services. *See,* attached Schematic labelled *NICU.*)

Concurrently with the construction of the Women's and Children's Tower the existing Pediatric Unit will be renovated to provide modern all-private rooms for Pediatric patients. After the completion of the women's and children's tower the existing floor occupied for those services will be renovated as an adult medical/surgical all-private nursing unit which will allow the entire hospital to operate with an all-private patient room model.



SWEDISHAMERICAN

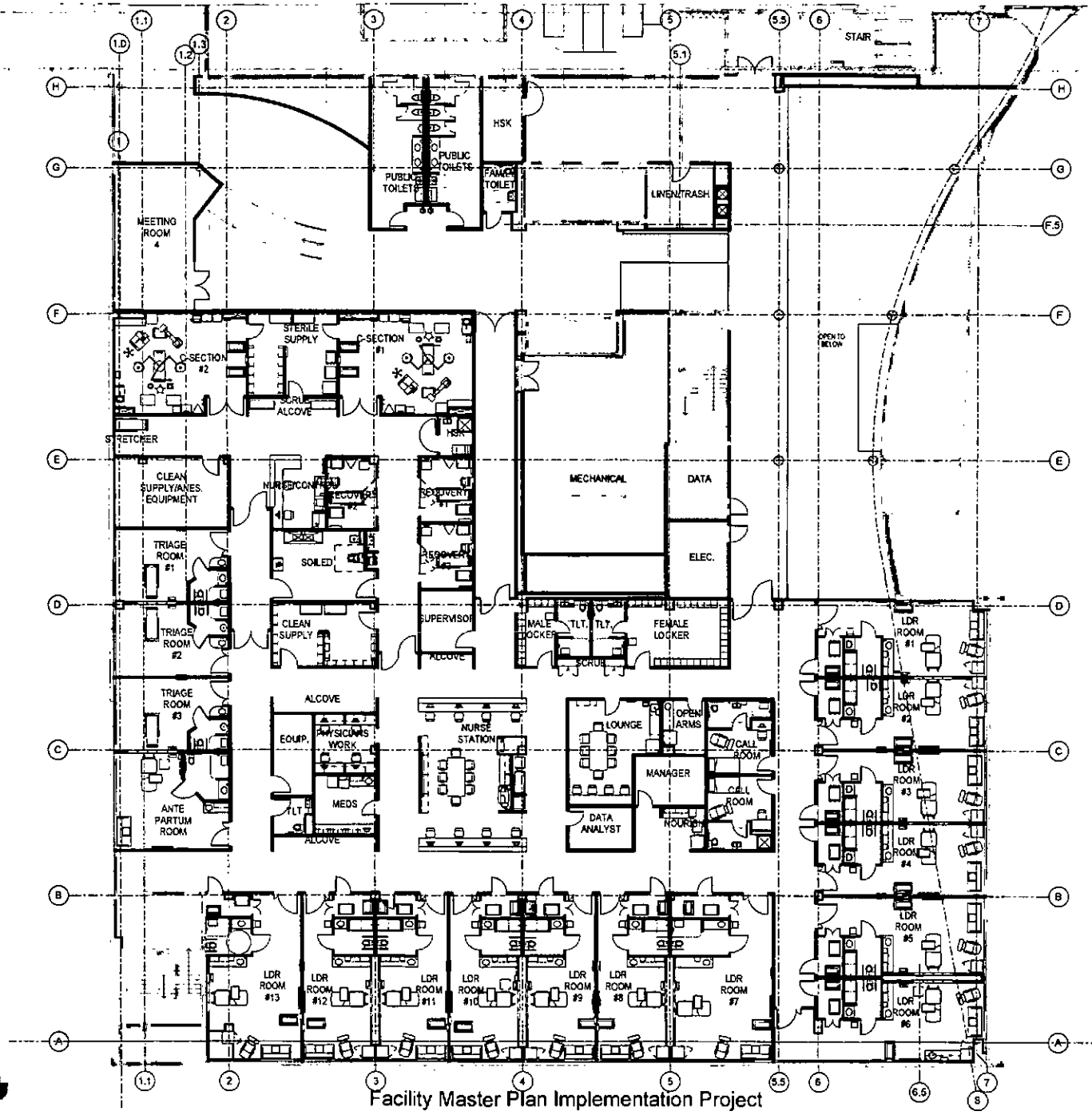
Facility Master Plan Implementation Project

CANNONDESIGN

SCALE 3/16" = 1'

Clinics & Auditorium

04/24/2017



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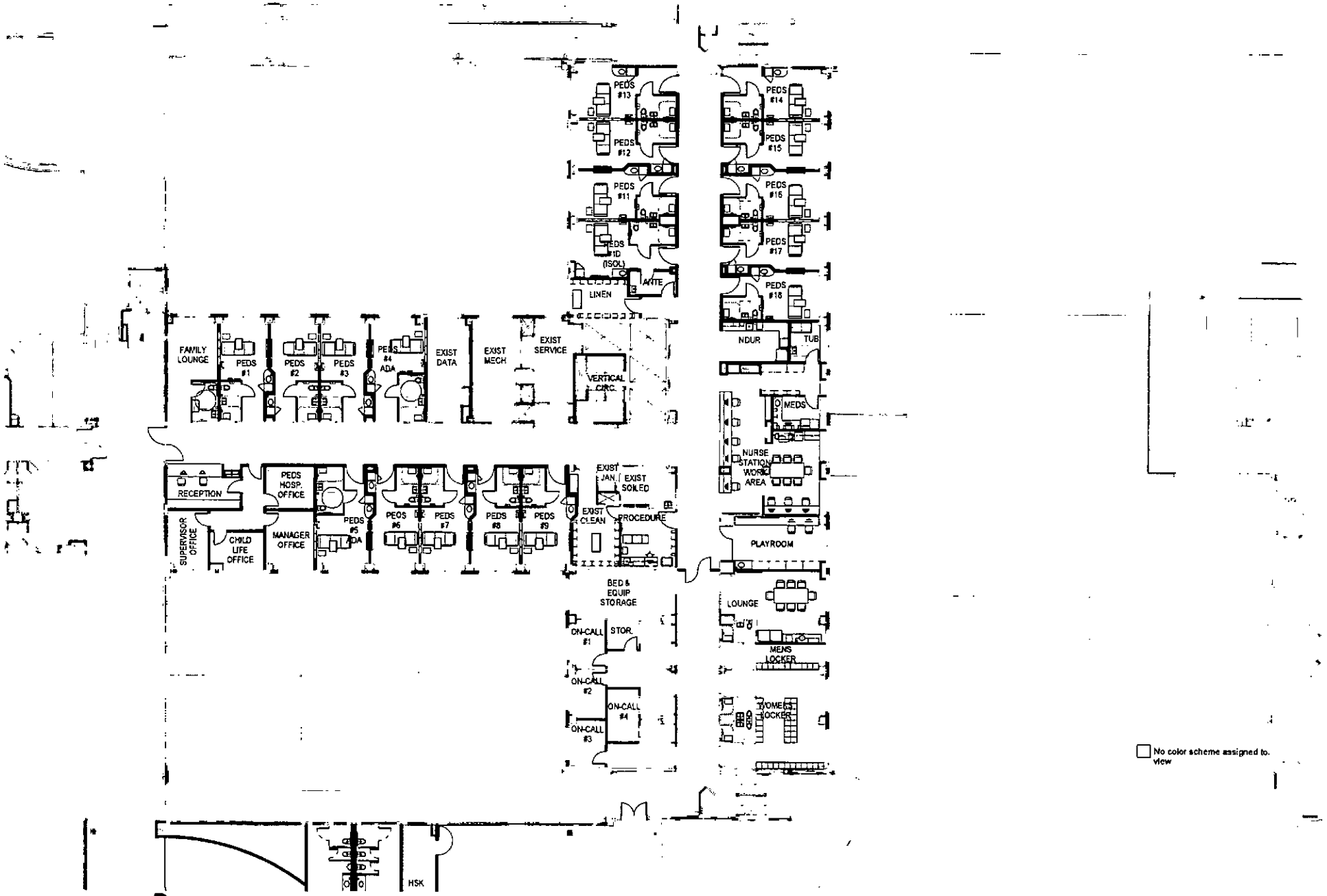
Facility Master Plan Implementation Project

CANNONDESIGN

SCALE 3/16" = 1'

Labor & Delivery

04/24/201T



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Facility Master Plan Implementation Project

CANNONDESIGN

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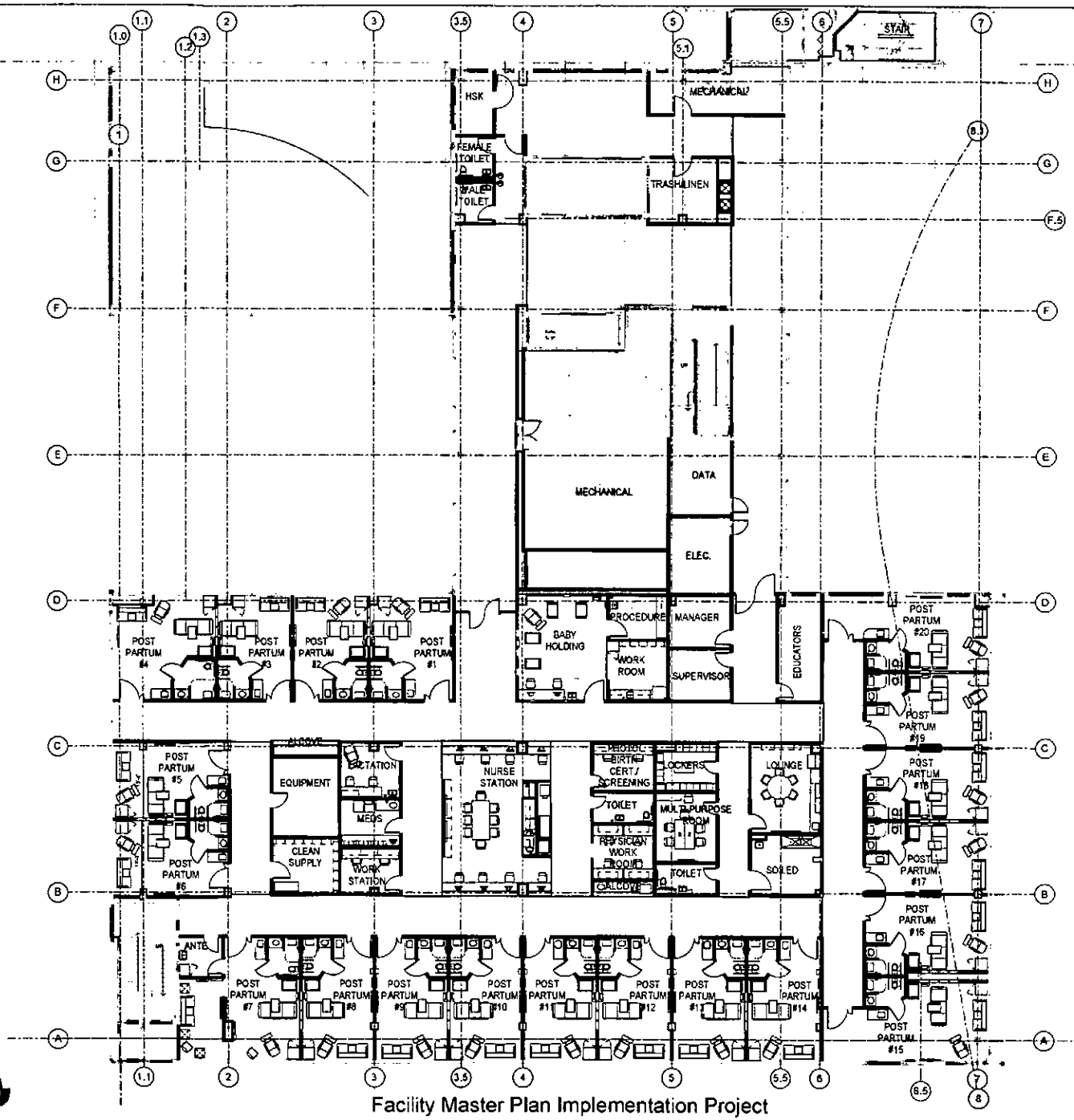
Pediatrics

04/24/17



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CANNONDESIGN

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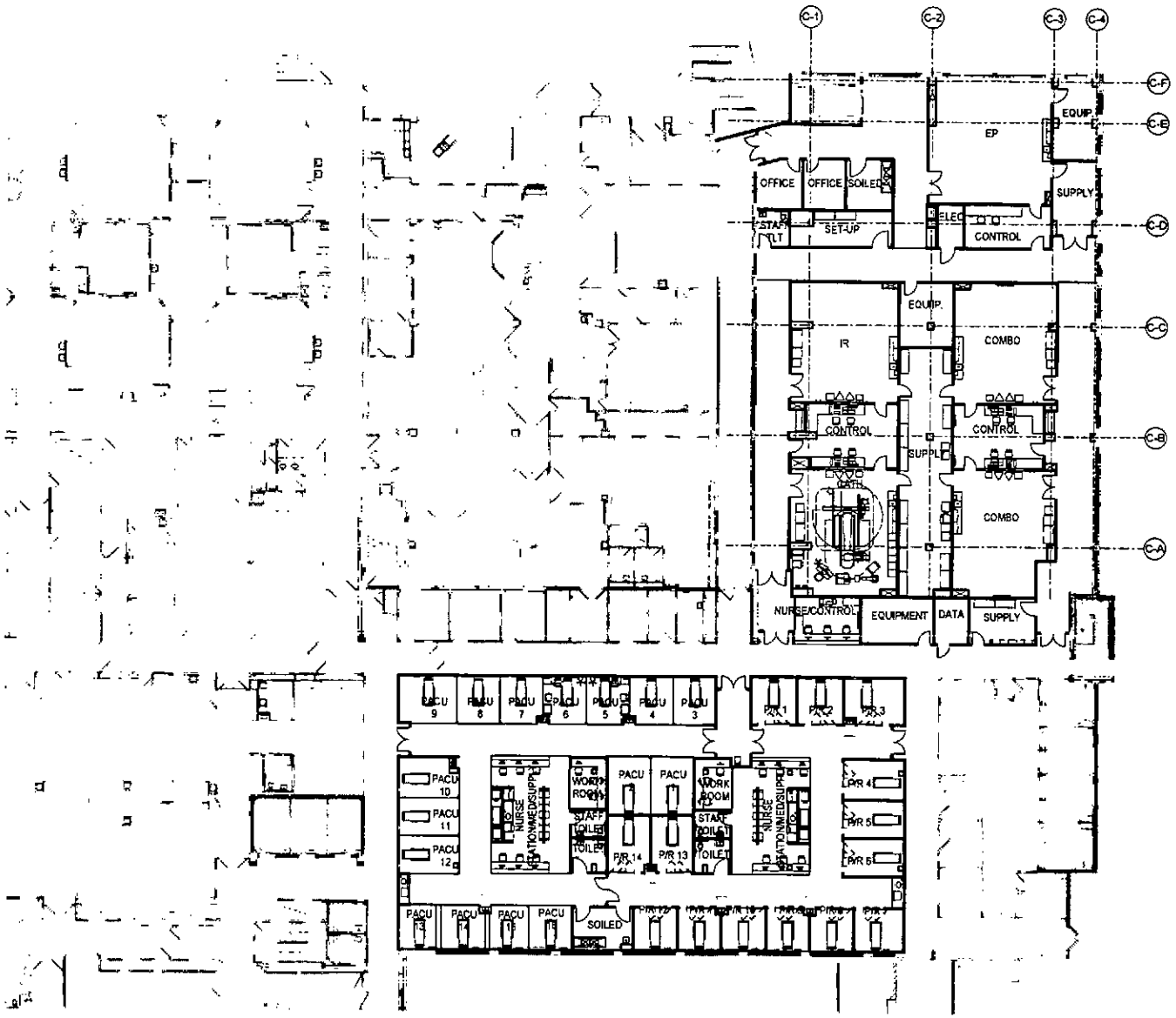
Mother/Baby

04/24/2017



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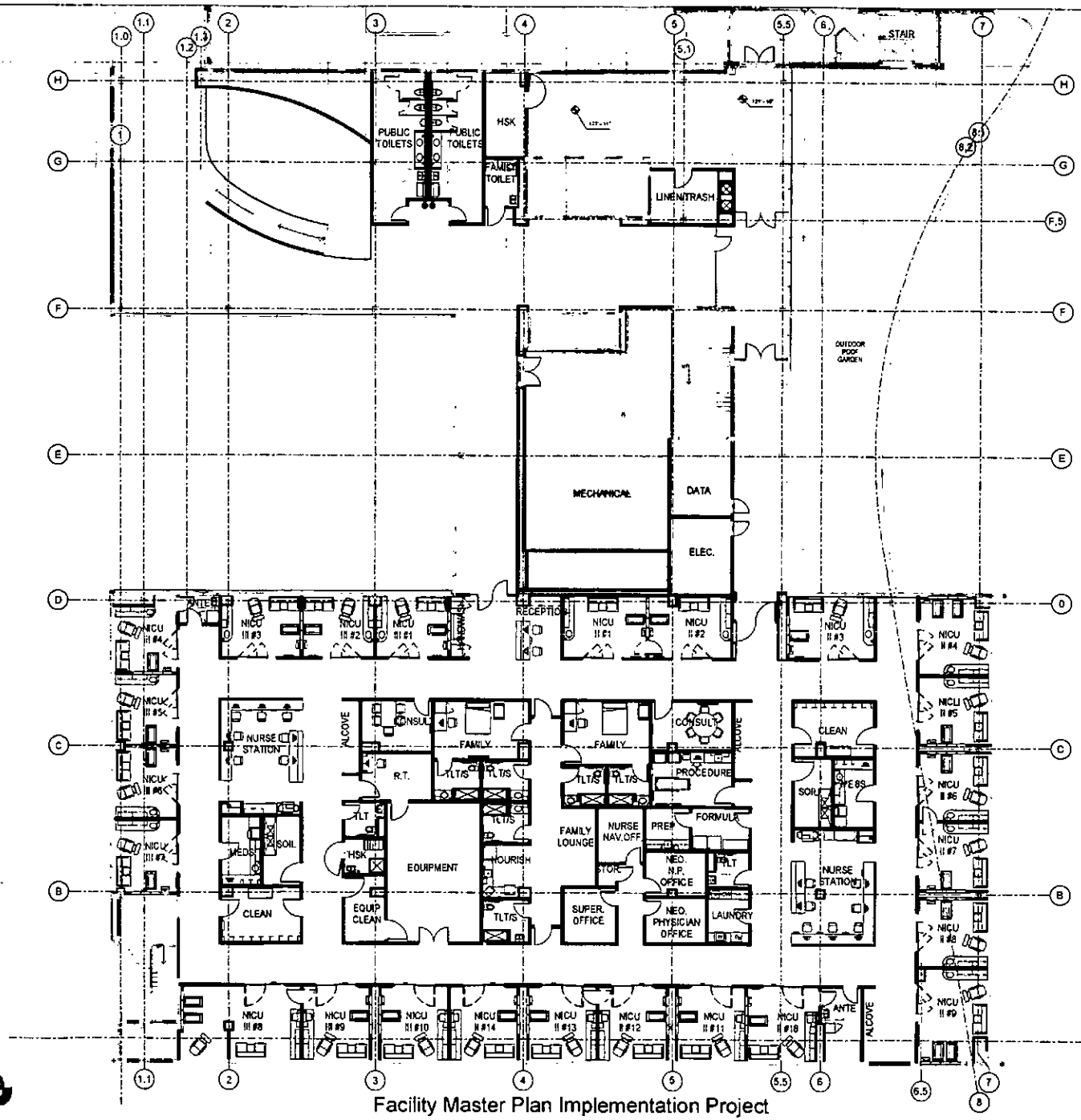
CATH/EP/IR

04/24/2017



SWEDISHAMERICAN

Facility Master Plan Implementation Project

CANNONDESIGN

SCALE 3/16" = 1'

NICU

04/24/2017

Facility Bed Capacity and Utilization

Complete the following chart, as applicable. Complete a separate chart for each facility that is a part of the project and insert the chart after this page. Provide the existing bed capacity and utilization data for the latest **Calendar Year for which data is available. Include observation days in the patient day totals for each bed service.** Any bed capacity discrepancy from the Inventory will result in the application being deemed **incomplete**.

FACILITY NAME: SwedishAmerican Hospital			**CITY:** Rockford, Illinois		
REPORTING PERIOD DATES:	**From:** July 1, 2015		**to:** June 30, 2016		
Category of Service	**Authorized Beds**	**Admissions**	**Patient Days**	**Bed Changes**	**Proposed Beds**
Medical/Surgical	209	10,342	47,170	-10	199
Obstetrics	34	2,520	4,431	0	34
Pediatrics	28	272	1,192	-10	18
Intensive Care	30	368	6,048	0	30
Comprehensive Physical Rehabilitation	0	0	0	0	0
Acute/Chronic Mental Illness	32	1,387	8,540	+10	42
Neonatal Intensive Care	10	New*	New*	0	10
General Long Term Care	0	0	0	0	0
Specialized Long Term Care	0	0	0	0	0
Long Term Acute Care	0	0	0	0	0
Other ((identify)	0	0	0	0	0
TOTALS:	343	14,889	67,352	-10	333

*NOTE: SwedishAmerican Hospital's exemption application for a new 10-bed NICU (E-019-17) was approved on June 7, 2017. The NICU Service will be set up in the existing facility, then relocated to the new patient tower as part of this project once the tower is completed.

ATTACHMENT 9