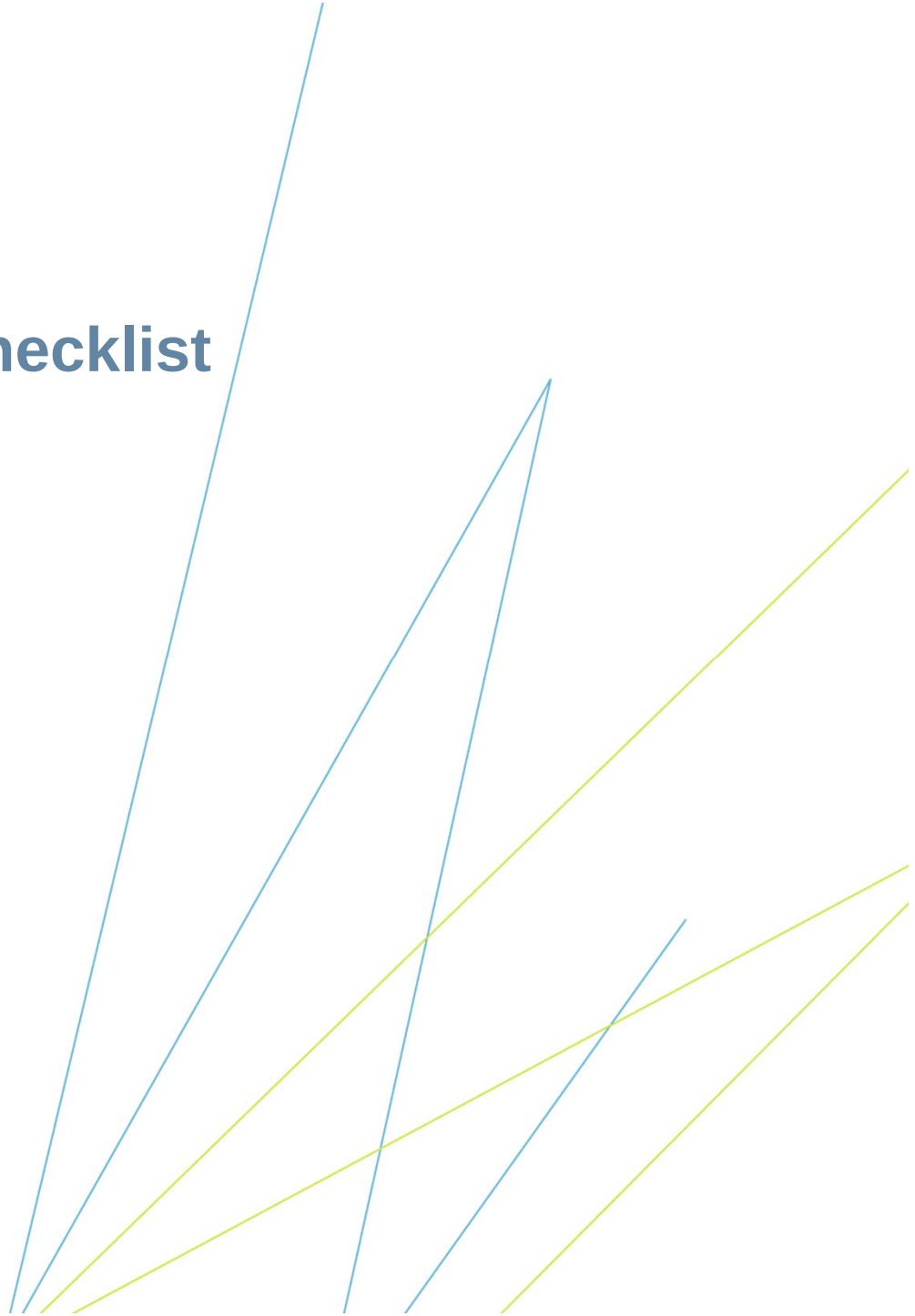
World-Class Facility Checklist

FY11 Overview



Document Overview

Purpose

- Recommend minimum mandatory strategies for FY12 World-Class checklist

Contents of Presentation

1. Approach
2. Recommended Minimum Mandatory Strategies for FY12 Checklist
3. Supporting research and information on recommended minimum mandatory strategies

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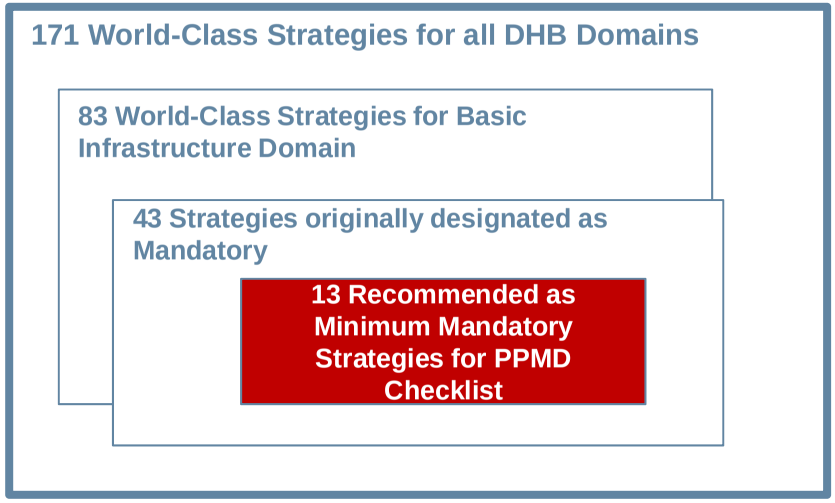
Recommended Minimum Mandatory Strategies

- Approach – Streamlining the Checklist
  - Identify strategies oriented to Facility Planning
  - Cull for strategies with most support in research community
  - Include strategies that were Service priorities (based on MHS Survey)
  - Remove strategies that are now criteria, standards, or part of a template

- Recommendation
  - 13 minimum mandatory strategies for the FY12 checklist
  - Continued investigation into promising strategies
  - Lifecycle cost/benefits need to be factored into use of the strategies – POE, inclusion of metrics into satisfaction surveys, design / construction costs



List of Recommended Strategies for the FY12 Checklist

Architectural Strategies		**Metric**	**Applicable Facility Type**
1	Provide acuity-convertible rooms (ability to convert room through minor modifications among ICU to step-down to acute). (18)	*100% compliance with FGI minimum specifications as shown in Diagrams 18.1 and 18.2*	*Medical Centers and Community Hospitals*
2	Optimize size and position of patient room windows to provide exterior views for patient from bed. (22)	*100% compliance with specification in Figure 22.1 with exceptions noted*	*Medical Centers and Community Hospitals*
3	Provide appropriately controlled natural light in all spaces occupied by patients, families and staff for more than 4 hours per day. (24)	*100% compliance with exceptions noted.*	*All Facility Types*
4	Separate front of house (front stage) from back of house (back stage) movement and activities whenever possible. (85)	*Improvement in responses to a specific patient and staff satisfaction survey question (to be identified).*	*Medical Centers and Community Hospitals*
5	Reduce or eliminate sources of noise: other patients, equipment 'clatter', loud conversations at nurse stations. (125)	*Proof that there is a maximum use of sound absorption materials and there are appropriate quiet zones in inpatient areas.*	*Medical Centers and Community Hospitals*
6	Provide clear spatial organization and visual cues for effective wayfinding. (139)	*Improvement in responses to a specific patient and staff satisfaction survey question regarding clarity and ease of wayfinding.*	*Hospitals, Medical and Dental Clinics, and Blood Donor Centers*
7	Provide visual and physical access to nature, including healing gardens as appropriate. (153)	*Improvement in responses to a specific patient and staff satisfaction survey question regarding access and views of nature.*	*Hospitals and Medical Clinics*
8	Maximize the simplicity and minimize the number of steps, and effort needed to approach, arrive, drop off, park, enter, and find one's destination. (2020)	*Simulation modeling required to show compliance of design with strategy.*	*Hospitals, Medical and Dental Clinics,and Blood Donor Centers*
Architectural and Interior Design Strategies		**Metric**	**Applicable Facility Type**
9	Provide patient and family comfort and control over the environment in the patient room. (55)	*100% compliance in patient rooms with exceptions noted.*	*Medical Centers and Community Hospitals*

	Architectural and Interior Design Strategies	Metric	Applicable Facility Type
10	Design patient room with family zone to support family involvement in care delivery (2001)	*100% compliance with specifications shown in Diagram 2001.1*	*Medical Centers and Community Hospitals*
	Interior Design Strategies	**Metric**	**Applicable Facility Type**
11	Provide positive distractions in all clinical and public spaces. (81)	*Improvement in responses to a specific patient satisfaction survey question (to be identified).*	*Hospitals, Medical and Dental Clinics, and Blood Donor Centers*
12	Create a therapeutic interior to create a healing environment. (154)	*Improvement in responses to a specific patient and staff satisfaction survey questions focused on the character of the physical environment overall and specific elements such as art, lighting, interior finishes and furnishings.*	*Hospitals and Medical Clinics*
	Technology/Communications Strategies	**Metric**	**Applicable Facility Type**
13	Provide the infrastructure to support the interoperability and usability among all information technology platforms. (56)	*Interoperability of critical administrative and clinical information systems within the facility as defined by the leadership.*	*All Facility Types*

Strategy Profile Example

Strategy - 1 FY2012 Strategies

1. Provide acuity-convertible rooms (ability to convert room through minor modifications among ICU to step-down to acute). (ID: 18)

Design inpatient rooms of consistent size and general configuration using adaptable service, gas columns or headwalls that support conversion for other acuity or specialty use through minor renovation within existing boundary walls. Conversion should not require partition relocation.

★★★ LIMITED DIRECT EVIDENCE

DHB Domain: Basic Infrastructure **Lifecycle:** Requirements Planning

TMASurvey Result:

Principles Supported:

4 Improve operational effectiveness

8 Design for maximum flexibility, standardization & growth

Core Dimensions Supported

15 Standardization

16 Adaptability, flexibility and future planning

Research Summary:

Acuity-convertible rooms are
This permits changing acuity
appropriately positioned to f
levels and/or patient popula
floor areas and services (e.g.

Metrics and Evaluation Approaches

1. Metric:

100% compliance with FGI minimum specifications as shown in Diagrams 18.1 and 18.2

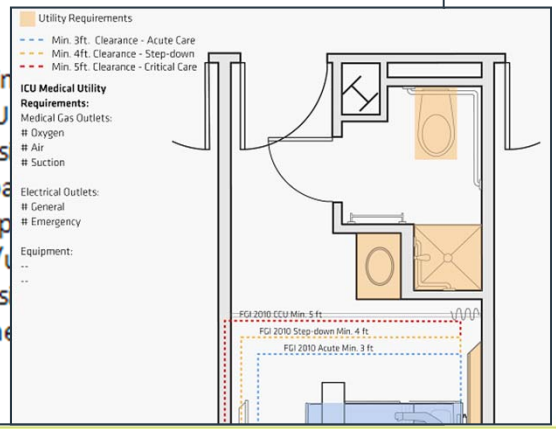
2. Design Review Considerations:

Plan review to confirm Facilities Institute Guideline [FGI] minir
bed for all applicable uses including acute, step down, and ICU
- Design team to submit diagrams for review in S3-4 submiss

boundaries around the bed and utility requirements for ICU pa
- Plan review of scaled diagrams to demonstrate a range of p

transfers, minor procedures and code scenarios for all acuity/u
- Design team to submit diagrams for review in S3-4 submiss

staffing, equipment, and patient care scenarios such as routine
etc. [See reference diagram. 18.2]



- Profiles include:
  - Evaluation
  - Research
  - References
  - Metrics
  - Descriptions

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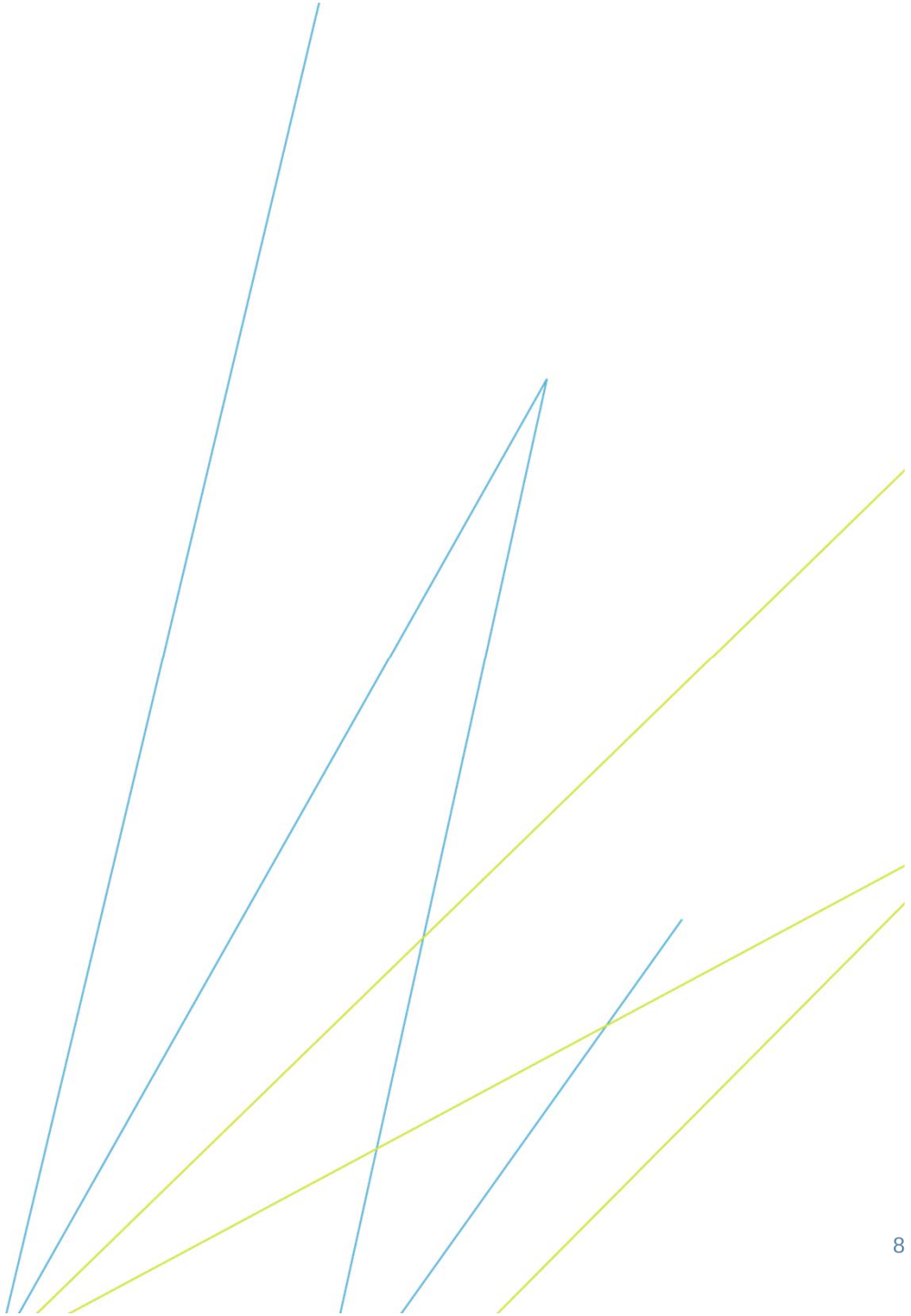
Way Forward

- Develop Policy
- Modify on-line checklist to include Strategy Profiles
- Begin to develop costs / benefits for strategies
- Develop maintenance program
  - Coordination with UFC / Criteria work groups
  - Linkages with innovative organizations to keep up-to-date on world-class strategies

Back-up



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World-Class Facilities

MHS MILITARY HEALTH SYSTEM | U.S. Department of Defense

MHS World-Class Facilities Checklist

The strategies included in this checklist are required for MHS Facilities. A strategy is applicable based on the type of facility. It may or may not be applicable to a specific project. Additional information on the value of all strategies and their relationship to the MHS principles can be found on: www.MHSWorldclassfacilities.org

Checklist Author: _____ **Checklist Date:** _____

1391 Project Name: _____ **Facility Type:** _____

Type of Project: **New Construction** ☐ **Replacement** ☐ **Addition** ☐ **Alteration** ☐ **Addition/Alteration** ☐

Project Information (e.g., brief description about the project):

Contact Information (email/telephone): _____

Instructions: Strategies marked with "X" are initially required. However, not all strategies apply to all types of facilities. The user may "unselect" a mandatory strategy and provide a reason in the comment section of the checklist. The strategies in the checklist are associated with two of the DHB Domains: Basic Infrastructure. There are strategies for all domains (See www.mhsworldclassfacilities.org).

World-Class Facilities
MHS MILITARY HEALTH SYSTEM | U.S. Department of Defense

MHS World-Class Facilities Checklist (V2,2011)

1.0 BASIC INFRASTRUCTURE	2.0 LEADERSHIP AND CULTURE	3.0 PROCESS OF CARE STANDARDS	4.0 PERFORMANCE OUTCOMES	5.0 KNOWLEDGE MANAGEMENT	6.0 COMMUNITY AND SOCIAL RESPONSIBILITY

X	**1. Provide acuity-convertible rooms (ability to convert room through minor modifications among ICU to step-down to acute). (18)** **Metric:** *100% compliance with FGI minimum specifications as shown in Diagrams 18.1 and 18.2*	**Applies to:** **Comment:**	Medical Centers and Community Hospitals
X	**2. Optimize size and position of patient room windows to provide exterior views for patient from bed. (22)** **Metric:** *100% compliance with specification in Figure 22.1 with exceptions noted*	**Applies to:** **Comment:**	Medical Centers and Community Hospitals
X	**3. Provide appropriately controlled natural light in all spaces occupied by patients, families and staff for more than 4 hours per day. (24)** **Metric:** *100% compliance with exceptions noted.*	**Applies to:** **Comment:**	All Facility Types
X	**4. Separate front of house (front stage) from back of house (back stage) movement and activities whenever possible. (85)** **Metric:** *Improvement in responses to a specific patient and staff satisfaction survey question (to be identified).*	**Applies to:** **Comment:**	Medical Centers and Community Hospitals
X	**5. Reduce or eliminate sources of noise: other patients, equipment 'clatter', loud conversations at nurse stations. (125)** **Metric:** *Proof that there is a maximum use of sound absorption materials and there are appropriate quiet zones in inpatient areas.*	**Applies to:** **Comment:**	Medical Centers and Community Hospitals

Instructions: Strategies marked with "X" are initially required. However, not all strategies apply to all types of facilities. The user may "unselect" a mandatory strategy and provide a reason in the comment section of the checklist. The strategies in the checklist are associated with two of the DHB Domains: Basic Infrastructure. There are strategies for all domains (See www.mhsworldclassfacilities.org).

MHS World-Class Facilities Checklist (V2,2011)

X	**6. Provide clear spatial organization and visual cues for effective wayfinding. (139)**	**Applies to:**	Hospitals, Medical and Dental Clinics, and Blood Donor Centers
	Metric: *Improvement in responses to a specific patient and staff satisfaction survey question regarding clarity and ease of wayfinding.*	**Comment:**	
X	**7. Provide visual and physical access to nature, including healing gardens as appropriate. (153)**	**Applies to:**	Hospitals and Medical Clinics
	Metric: *Improvement in responses to a specific patient and staff satisfaction survey question regarding access and views of nature.*	**Comment:**	
X	**8. Maximize the simplicity and minimize the number of steps, and effort needed to approach, arrive, drop off, park, enter, and find one's destination. (2020)**	**Applies to:**	Hospitals, Medical and Dental Clinics,and Blood Donor Centers
	Metric: *Simulation modeling required to show compliance of design with strategy.*	**Comment:**	
X	**9. Provide patient and family comfort and control over the environment in the patient room. (55)**	**Applies to:**	Medical Centers and Community Hospitals
	Metric: *100% compliance in patient rooms with exceptions noted.*	**Comment:**	
X	**10. Design patient room with family zone to support family involvement in care delivery (2001)**	**Applies to:**	Medical Centers and Community Hospitals
	Metric: *100% compliance with specifications shown in Diagram 2001.1*	**Comment:**	

Instructions: Strategies marked with "X" are initially required. However, not all strategies apply to all types of facilities. The user may "unselect" a mandatory strategy and provide a reason in the comment section of the checklist. The strategies in the checklist are associated with two of the DHB Domains: Basic Infrastructure. There are strategies for all domains (See www.mhsworldclassfacilities.org).

MHS World-Class Facilities Checklist (V2,2011)

X	**11. Provide the infrastructure to support the interoperability and usability among all information technology platforms. (56)** **Metric:** *Interoperability of critical administrative and clinical information systems within the facility as defined by the leadership.*	**Applies to:** **Comment:**	All Facility Types
X	**12. Provide positive distractions in all clinical and public spaces. (81)** **Metric:** *Improvement in responses to a specific patient satisfaction survey question (to be identified).*	**Applies to:** **Comment:**	Hospitals, Medical and Dental Clinics, and Blood Donor Centers
X	**13. Create a therapeutic interior to create a healing environment. (154)** **Metric:** *Improvement in responses to a specific patient and staff satisfaction survey questions focused on the character of the physical environment overall and specific elements such as art, lighting, interior finishes and furnishings.*	**Applies to:** **Comment:**	Hospitals and Medical Clinics

Instructions: Strategies marked with "X" are initially required. However, not all strategies apply to all types of facilities. The user may "unselect" a mandatory strategy and provide a reason in the comment section of the checklist. The strategies in the checklist are associated with two of the DHB Domains: Basic Infrastructure. There are strategies for all domains (See www.mhsworldclassfacilities.org).

World-Class Facilities

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Research Profiles for MHS Mandatory Facility Planning Strategies

1. Provide acuity-convertible rooms (ability to convert room through minor modifications among ICU to step-down to acute). (ID: 18)

Design inpatient rooms of consistent size and general configuration using adaptable service, gas columns or headwalls that support conversion for other acuity or specialty use through minor renovation within existing boundary walls. Conversion should not require partition relocation.

LIMITED DIRECT EVIDENCE

DHB Domain: Basic Infrastructure **Lifecycle:** Requirements Planning

TMASurvey Result:

Principles Supported:

4 Improve operational effectiveness

8 Design for maximum flexibility, standardization & growth

Core Dimensions Supported

15 Standardization

16 Adaptability, flexibility and future planning

Research Summary:

Acuity-convertible rooms are rooms built so they can be efficiently converted for more than one acuity level. This permits changing acuity assignments for entire nursing units, individual rooms or groups of rooms appropriately positioned to function as swing beds/rooms between two adjoining units of differing acuity levels and/or patient populations. Acuity-convertible rooms and units must be sized and built with the proper floor areas and services (e.g., mechanical, electrical, and plumbing) to be able to house changing patient care technologies without needing to relocate/reconstruct walls and primary building systems within the building floor plate or envelope.

Acuity-convertible rooms are believed to preserve flexibility in utilization of inpatient units. A review of literature identified modular design and a warehouse approach as the two primary means of designing for acuity-convertibility. Three additional expert opinion articles describe ways acuity-convertible rooms can improve health care delivery. Select case studies also indicate measures (e.g., floor areas, services per patient room) that have been successful at hospitals undertaking acuity-convertibility.

Design Implications:

Acuity-convertibility is employed to avoid pre-mature obsolescence of health care facilities. Acuity-convertibility can be implemented at a range of scales, from overall hospital structure and configuration to unit layout to room design. It is important to plan in advance for acuity convertible rooms.. Though no empirical research has indicated appropriate floor areas and services, several case studies indicate key metrics to support acuity-convertibility:

For acuity-convertible rooms, recommendations for minimum floor areas include the following:

- About 300 ft2 configured as a 14 by 21 foot room (Eagle, 2005);
- Whatever size meets current applicable requirements for critical care (Pressler, 2006). According to AIA 2006 guidelines, this is 200 ft2 of clear floor area (excluding bathrooms/toilets and vestibules) and must include a 13-ft headwall (AIA, 2006).
- Nursing station schemes including both decentralized and centralized nursing stations have been used in flexible hospital designs (Eagle, 2006). They may facilitate changes to nurse-patient ratios as the acuity level of patients served changes.
- Potential need for growth in size of ancillary space should planned for (no dimensions or specifics provided) (Pressler, 2006)

For acuity-convertible and flexible buildings, infrastructure recommendations include:

- Design a 20-30% surplus of HVAC, wiring, and ICT (Valen & Larsen, 2006) to accommodate future technology changes.
- For mechanical, electrical and plumbing (MEP) include duplicate or multiple parts (Gupta & Marshall, 2005) to support future expansion of the building.

Metrics and Evaluation Approaches

1. Metric:

100% compliance with FGI minimum specifications as shown in Diagrams 18.1 and 18.2

2. Design Review Considerations:

Plan review to confirm Facilities Institute Guideline [FGI] minimum clearance and utility requirements at/around bed for all applicable uses including acute, step down, and ICU utilization.

- Design team to submit diagrams for review in S3-4 submission documents to indicate FGI required clearance boundaries around the bed and utility requirements for ICU patients. [See reference diagram 18.1]
- Plan review of scaled diagrams to demonstrate a range of patient care scenarios including routine bedside care, transfers, minor procedures and code scenarios for all acuity/uses.
- Design team to submit diagrams for review in S3-4 submission documents to indicate a cross section of potenti staffing, equipment, and patient care scenarios such as routine acute care, routine intensive care, code response, etc. [See reference diagram. 18.2]

3. Potential Mockup/Prototype/Simulations:

Human factors usability simulation study conducted in room mock-up or design prototype on number of people, task time, error rate and effort needed to accommodate all care scenarios for planned range of acuity levels

4. Proposed POE Information Collection Options:

Archival Take-off

- Identify size and layout of key standardized rooms, with FGI clearance requirement.

Walk Through

- Confirm size and layout of patient rooms (number and location). Provide room signs to identify patient rooms which are acuity adaptable.
- Confirm room that are easily adaptable to service or technological changes over time including…
- Confirm different types of care services, changes in work processes; changes or upgrades in technology and equipment.

Photo Documentation

- Document room layout

Staff Survey/Interview Questions [satisfaction with]:

- Size and layout of the patient room to promote safe care delivery
- Layout of the patient room for patient care tasks
- Productive use of room / space
- Ability to modify layout of room to accommodate different types of patient care

5. Post Occupancy – Focused Research Options:

Cost of room renovation and modification over life of facility

- Frequency of changes in uses for different patient acuity populations.
- Human factors usability study conducted in actual rooms on number of people, task time, error rate and effort needed to accommodate all care scenarios for planned range of acuity levels

Strategy 18: *Acuity Convertible Rooms*

Provide acuity-convertible rooms (ability to convert room through minor modifications among ICU to step-down to acute).

Patient Bed

Utility Requirements

Min. 3ft. Clearance - Acute Care

Min. 4ft. Clearance - Step-down

Min. 5ft. Clearance - Critical Care

ICU Medical Utility Requirements:

Medical Gas Outlets:
Oxygen
Air
Suction

Electrical Outlets:
General
Emergency

Equipment:
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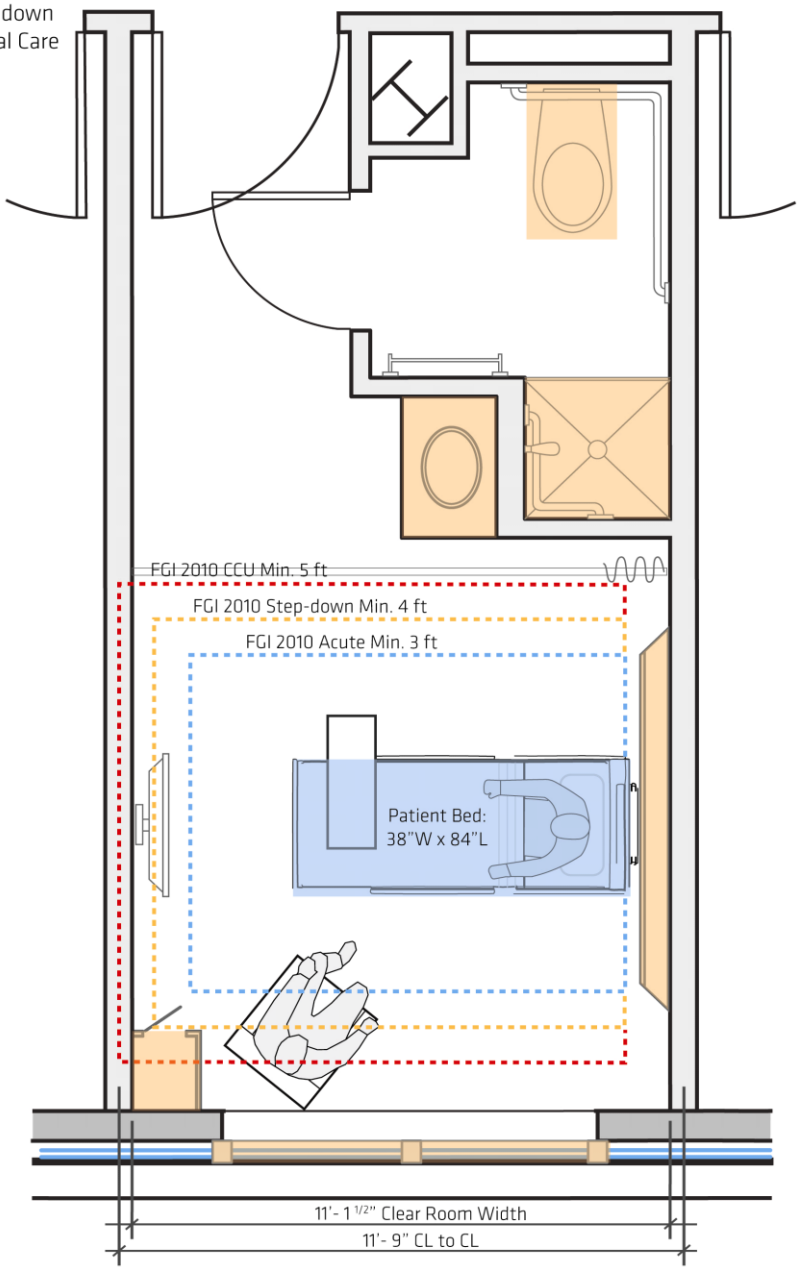

Figure 18.1

Strategy 18: *Acuity Convertible Rooms*

Provide acuity-convertible rooms (ability to convert room through minor modifications among ICU to step-down to acute).

- - - Min. 3ft. Clearance - Acute Care
- - - Min. 4ft. Clearance - Step-down
- - - Min. 5ft. Clearance - Critical Care

ICU Medical Utility Requirements:

Medical Gas Outlets:
Oxygen
Air
Suction

Electrical Outlets:
General
Emergency

Equipment Used in Code Situation:
Crash Cart

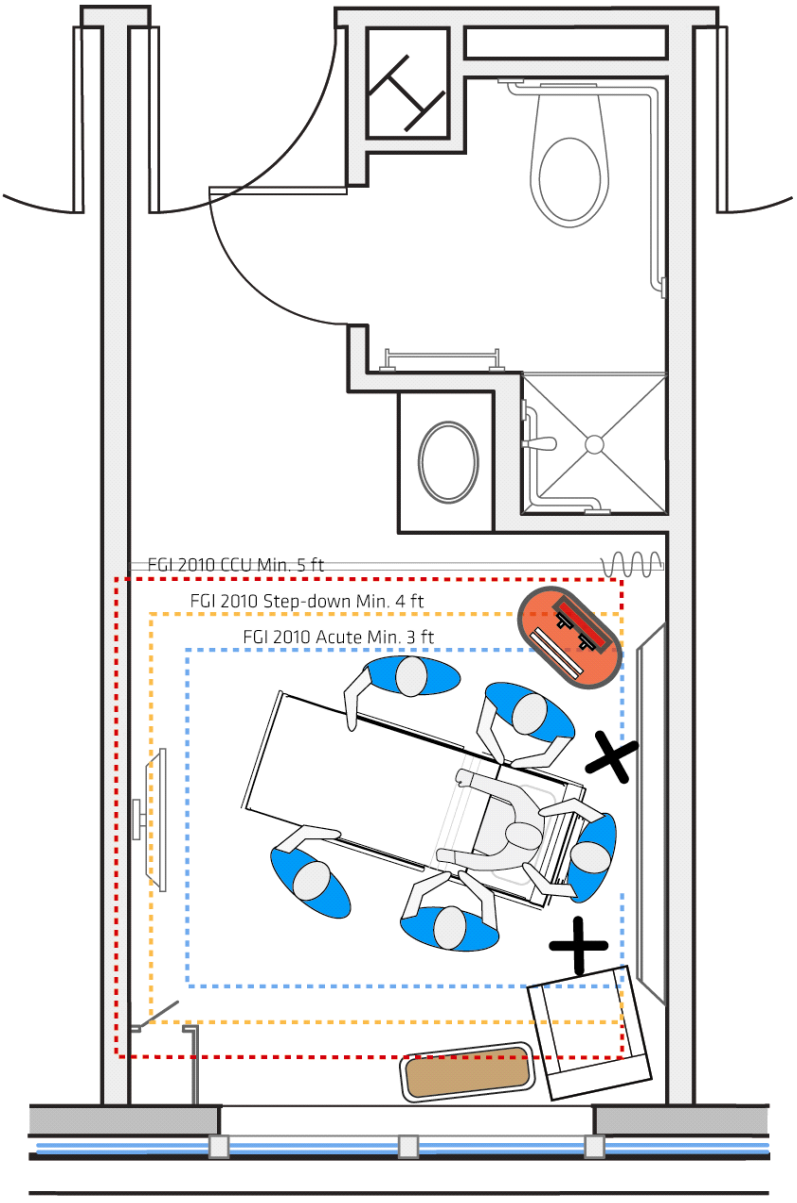

Figure 18.2 Patient Code Scenario

References:

2010 *American Society for Healthcare Engineering of the American Hospital Association (2010). Guidelines for Design and Construction of Health Care Facilities. The Facility Guidelines Institute: Dallas, TX.*

Case studies and expert opinions provided rules of thumb for designing for acuity-convertibility which have not been empirically tested (see design implications) (AIA, 2006; FGI, 2010; Eagle, 2005; Gupta & Marshall, 2005; Pressler, 2006; Valen & Larsen, 2006).

Guideline http://www.fgiguidelines.org/2010guidelines.html

2010 *Bartley, J. M., Olmsted, R. N., & Haas, J. (2010). Current views of health care design and construction: Practical implications for safer, cleaner environments. American Journal of Infection Control, 38(5, Supplement 1), S1-S12.*

Infection preventionists (IP) play an increasingly important role in preventing health care-associated infection in the physical environment associated with new construction or renovation of health care facilities. The Guidelines for Design and Construction of Hospital and Healthcare Facilities, 2010, formerly known as "AIA Guidelines" was the origin of the "infection control risk assessment" now required by multiple agencies. These Guidelines represent minimum US health care standards and provide guidance on best practices (Bartley, J.M., et al, 2010).

Peer reviewed / Empirical http://www.sciencedirect.com/science/article/B6W9M-50829M1-2/2/5d18b6fc46f8d5137b5e397cd8f6e135

2010 *Carthey, J., Chow, V., Jung, Y.-MM., & Mills, J. (2010). Achieving Flexibility and Adaptability in Healthcare Facilities—Findings from a Systematic Literature Review. In Barlow, J. (Ed.), Proceedings HaCIRIC International Conference 2010: Better Healthcare Through Better Infrastructure, 106-120.*

The literature review reveals that various sources measure and define the ability of a facility to accommodate change with multiple metrics and time constraints which clouds the very definition of 'flexibility and adaptability.' The general consensus is that healthcare facilities must design for and implement 'flexibility and adaptability' in order to reach full, long term potential. (Carthey et al, 2010)

Peer Reviewed http://www.haciric.org/static/doc/events/HaCIRIC10_Conference_Proceedings.pdf

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2006 *American Institute of Architects (2006). Guidelines for Design & Construction of Health Care Facilities. AIA/Facility Guidelines Institute: Dallas, TX.*

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Guideline http://www.fgiguidelines.org/guidelines.html?bcsi_scan_5256054E5687F970=0&bcsi_scan_filename=guidelines.html

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2006 *Eagle, A. (2006). The future is now. Flexibility and expandability drive hospital project. Health Facilities Management, 19(4), 14-20.*

Case studies and expert opinions provided rules of thumb for designing for acuity-convertibility which have not been empirically tested (see design implications) (AIA, 2006; FGI, 2010; Eagle, 2005; Gupta & Marshall, 2005; Pressler, 2006; Valen & Larsen, 2006).

Background http://www.hfmmagazine.com/hfmmagazine_app/jsp/articledisplay.jsp?dcrpath=HFMMAGAZINE/PubsNewsArticleGen/data/2006April/0604HFM_FEA_CoverStory&domain=HFMMAGAZINE

2006 *Pressler, G. R. (2006). Born to flex: Flexible design as a function of cost and time. Health Facilities Management, 19(6), 53-54.*

Case studies and expert opinions provided rules of thumb for designing for acuity-convertibility which have not been empirically tested (see design implications) (AIA, 2006; FGI, 2010; Eagle, 2005; Gupta & Marshall, 2005; Pressler, 2006; Valen & Larsen, 2006).

Background http://www.ncbi.nlm.nih.gov/pubmed/16929722

2006 *Valen, M. S., & Larssen, A.-K. (2006). Adaptability of Hospitals: Capability of Handling Physical Changes. Paper presented at the Trondheim International Symposium: Changing User Demands on Buildings - Needs for Lifecycle Planning and Management, Trondhei*

Case studies and expert opinions provided rules of thumb for designing for acuity-convertibility which have not been empirically tested (see design implications) (AIA, 2006; FGI, 2010; Eagle, 2005; Gupta & Marshall, 2005; Pressler, 2006; Valen & Larsen, 2006).

Background http://www.docstoc.com/docs/71540082/01_55_F_valen

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2005 *Gupta, R., & Marshall, D. (2005). Technology Transfusion. Consulting - Specifying Engineer, 38(1), 30-35.*

Case studies and expert opinions provided rules of thumb for designing for acuity-convertibility which have not been empirically tested (see design implications) (AIA, 2006; FGI, 2010; Eagle, 2005; Gupta & Marshall, 2005; Pressler, 2006; Valen & Larsen, 2006).

Background http://www.csemag.com/search/search-single-display/technology-transfusion/41e30fcef5.html

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2. Optimize size and position of patient room windows to provide exterior views for patient from bed. (ID: 22)

Provide large windows in patient rooms with exterior views. Locate windows so that patients can have good sight lines and broad view angles to the window from their upright position in bed.

SUFFICIENT DIRECT EVIDENCE

DHB Domain: Basic Infrastructure **Lifecycle:** Design / Construction Execution

TMASurvey Result:

Principles Supported:

2 Achieve world-class quality and safety

3 Create a positive work environment

Core Dimensions Supported

10 Access to daylight, nature and respite areas

Research Summary:

There is evidence to support that a view of nature (created by maximizing window size) from a patient room can have the positive effects on pain control, quality of sleep by regulating circadian rhythm, and ultimately reducing length of stay. The evidence also indicates that increased levels of natural light in hospital settings (to which maximized window dimensions contribute) lead to better patient outcomes and staff satisfaction. There is no known research that specifically addresses the size and position of the window relative to the patient.

Design Implications:

Designs should provide patients with exposure to views of nature and bright natural light. Providing a window in the patient room is considered the best method to achieve it. Often the patient's view from the window is obscured by the bathroom (outboard) or equipment placement in the room. Efforts should be made to minimize these impediments to the view of the window from the head of the patient bed.

Metrics and Evaluation Approaches

1. Metric:

100% compliance with specification in Figure 22.1 with exceptions noted

2. Design Review Considerations:

Plan review of physical measures of sight lines, angle of view and visible window area from patient in upright position in bed. Minimum standards for vertical and horizontal angle of view and visible window area to be determined [example: patient to be able to view a minimum of 25 SF of unobstructed window area sitting upright in bed within a 60 degree view angle in plan from forward view and side view between two and eight feet above the floor.

- Design team to submit plan diagram of room at S3-4 submission[s] illustrating sight lines, angle of view and visible window area [see reference figure 22.1]

3. Potential Mockup/Prototype/Simulations:

Window view study conducted in room mock-up or design prototype to determine available and comfortable view from patient in bed to and through window.

4. Proposed POE Information Collection Options:

Archival Take-off

- Identify [height, width, area and sill height] of windows in patient care areas the provide access to daylight and views

Walk Through:

- Confirm size of windows in patient care areas
- Confirm types of views [nature of not] in patient care areas
- Confirm typical window size and [placement and location] in patient care areas

Photo Documentation:

- Document typical patient room window and view outside from bed

Staff Survey/Interview Questions [satisfaction with]:

- Views to nature from patient in bed

5. Post Occupancy – Focused Research Options:

In depth patient/family/staff satisfaction surveys with questions focused on views from bed for patient.

- Patient stress measures in patient rooms with access to nature views compared to rooms without views to nature.
- Patient pain levels, need for pain medication and length of stay in spaces with access to nature views compared to rooms without views to nature.

Strategy 22: *Patient Room Window View*

Optimize size and position of patient room windows to provide exterior views for patient from bed.

Potential Daylight Exposure

Potential Views to Nature

Windows

Patient View Range

Target Viewable Window Area:
~25 sq.ft.

Sill Height: 34 1/2"
Head Height: 95 1/2"

As Built Window Area:
90"x61"= ~38 sq.ft.

Actual Window Area within Target Site Lines:
33"x61"= ~14 sq.ft.

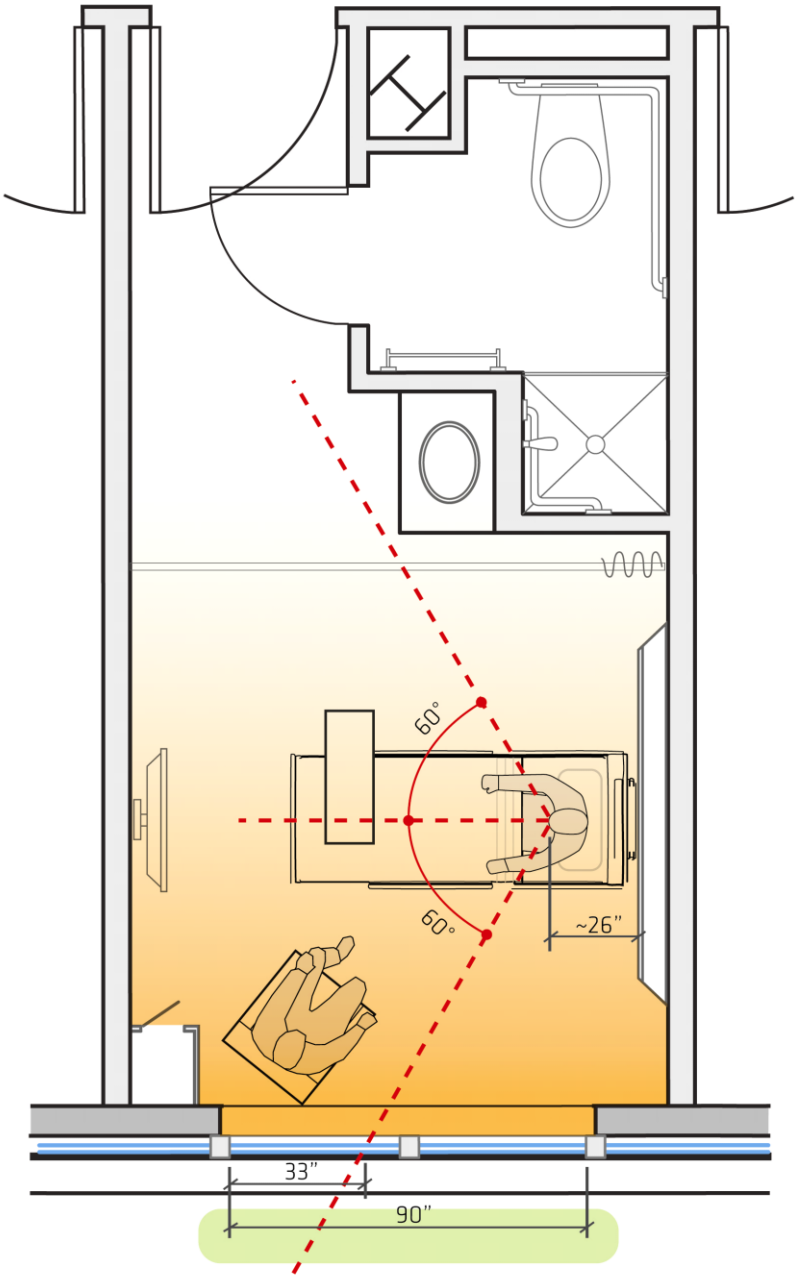

Figure 22.1

References:

2006 *Dijkstra, K., M. Pieterse, et al. (2006). "Physical environmental stimuli that turn healthcare facilities into healing environments through psychologically mediated effects: systematic review." Journal of Advanced Nursing 56(2): 166-181.*

A natural view from a patient room window has positive the effects on delirium, sleep quality and the length of stay (Dijkstra, et. al. 2006).

Peer reviewed / Empirical http://web.ebscohost.com.www.library.gatech.edu:2048/ehost/detail?vid=1&hid=106&sid=6a97237e-07be-4860-9635-e60021ec9336%40sessionmgr115&bdata=JnNpdGU9ZWhvc3QtbGl2ZQ%3d%3d

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2006 *Joseph, A. (2006). Impacts of Light on Outcomes in Healthcare Settings. The Center for Health Design. Issue Paper #2.*

Light impacts human health and performance by enabling performance of visual tasks, controlling the body's circadian system, affecting mood and perception, and by enabling critical chemical reactions in the body. (Joseph, 2006)

Background http://www.healthdesign.org/chd/research/impact-light-outcomes-healthcare-settings

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2002 *Harris, P. B., McBride, G., Ross, C., & Curtis, L. (2002). A place to heal: Environmental sources of satisfaction among hospital patients. Journal of Applied Social Psychology, 32(6), 1276-1299.*

In Harris' patient satisfaction surveys, patients enjoy a view to the outside through a large window with an unobstructed view. Views of nature produce higher levels of relaxation compared with views of urban scenes. Patients prefer rooms with views of nature (Harris, et. al. 2002).

Peer reviewed / Empirical http://onlinelibrary.wiley.com/doi/10.1111/j.1559-1816.2002.tb01436.x/abstract

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1998 *Beauchemin, K., & Hays, P. (1998). Dying in the dark: sunshine, gender and outcomes in myocardial infarction. Journal of the Royal Society of Medicine, 91(7), 352-354.*

According to a study, mortality was higher in rooms designated as "dark" versus "bright" rooms. There was a shorter length of stay in bright rooms. Women were more affected by natural light than men, staying one day less in bright rooms than in the dark rooms (Beauchemin & Hays, 1998).

Peer reviewed / Empirical http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1296806/

1996 *Beauchemin, K. M., and Hays, P. (1996). Sunny hospital rooms expedite recovery from severe and refractory depressions. Journal of Affective Disorders, 40(1-2), 49-51.*

According to a study of patients in brightly lit rooms stayed an average of 16.9 days, whereas those in dimly lit rooms stayed 19.5 days. The difference appeared more marked in males (Beauchemin, et. al. 1996).

Peer reviewed / Empirical http://www.sciencedirect.com/science?_ob=ArticleURL&_udi=B6T2X-3W317G9-8&_user=10&_coverDate=09%2F09%2F1996&_rdoc=1&_fmt=high&_orig=search&_origin=search&_sort=d&_docanchor=&view=c&_searchStrId=1455942065&_rerunOrigin=scholar.google&_acct=C000050221&_vers

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1984 *Urlich, R. (1984). View from a window may influence recovery from surgery. Science, 223,420-444.*

Inpatient rooms with views of nature reduce patients' stress, recovery time, and amount of pain medication (Ulrich, 1984).

Peer reviewed / Empirical http://www.sciencemag.org/cgi/content/abstract/sci;224/4647/420

3. Provide appropriately controlled natural light in all spaces occupied by patients, families and staff for more than 4 hours per day. (ID: 24)

In all areas occupied by patients and staff for more than 4 hours per day during daytime hours, provide windows, clerestory, skylights with control devices to adjust direct and indirect daylighting into the space.

SUFFICIENT DIRECT EVIDENCE

DHB Domain: Basic Infrastructure **Lifecycle:** Requirements Planning

TMASurvey Result:

Principles Supported:

- **2** Achieve world-class quality and safety
- **3** Create a positive work environment
- **4** Improve operational effectiveness

Core Dimensions Supported

- **7** Safe and effective work environment for clinical staff
- **10** Access to daylight, nature and respite areas
- **11** Indoor environmental quality (ambient)

Research Summary:

There is strong evidence demonstrating that exposure to natural light is correlated with improved moods, reduction of pain and stress, higher satisfaction among patients and staff, and shorter lengths of stay for patients. The mood of depressed patients has been improved in hospital rooms with bright natural light. Brighter light in patient rooms has also been found to result in positive outcomes for patients recovering from surgery, heart attacks and affective disorders. Daylight is necessary to regulate circadian rhythms, and as such exposure to daylight during certain times of the day can improve nighttime sleep. Staff exposure to daylight has also been demonstrated to improve the satisfaction and performance of staff that work over night.

Design Implications:

Designs should provide patients and staff with exposure to bright natural light during part of the day. Units with patient populations that experience pain and /or are at high risk of depression should be placed in areas of the building with the highest levels of natural light. The timing, duration and intensity of natural light exposure are all important and should be considered during design.

Metrics and Evaluation Approaches

1. Metric:

100% compliance with exceptions noted.

2. Design Review Considerations:

Plan review for the location, placement and size of direct and indirect daylighting features such as windows, clerestory windows, skylights and control devices to adjust the quality and amount of daylight. (Shading control devices at skylight and clerestory are optional).

- Design team to provide plan diagram at S3-4 review illustrating spaces occupied more than 4 hours per day and those with access to daylight [see example figure 24.1]
- Design team to provide window to floor area ratio calculations at S3-S4 review.
- Design team to submit calculations on percent of area within the daylight zone d (15-20 feet along the building perimeter) or twice the window head height (2h=d) at S3-S4 review.
- Design team to create and submit simulation model of projected daylight levels in critical spaces (such as patier rooms, nurse stations, nurse/staff work areas…) with access to daylight at S3-S4 review.

4. Proposed POE Information Collection Options:

Archival Take-off

- Identify [windows and] skylights that provide access to daylight in public, staff and patient care areas.

Walk Through

- Confirm location of [windows and] skylights that provide access to daylight in public, staff and patient care area
- Confirm staff respite area features [including daylighting]
- Confirm size [orientation and placement] of windows in typical patient care area

Photo Documentation

- Document typical windows and view outside

Survey/Interview Questions [satisfaction with]:

- Access to daylight in areas where patients receive care
- Access to daylight in staff work areas

5. Post Occupancy – Focused Research Options:

In depth patient/family/staff satisfaction surveys with questions focused on daylight availability, quality and contr

- Measure daylight light levels in occupied locations (E outside lux = 100%, E center of the room lux = X%)
- Measure lighting energy consumption/savings in spaces with daylight compared to spaces in facilities without daylight
- Patient and staff stress measures in spaces with access to daylight compared to spaces in facilities without daylight
- Patient pain levels, need for pain medication and length of stay in spaces with access to daylight compared to spaces in facilities without daylight

Strategy 24: *Daylight*

Provide appropriately controlled natural light in all spaces occupied by patients, families and staff for more than 4 hours per day.

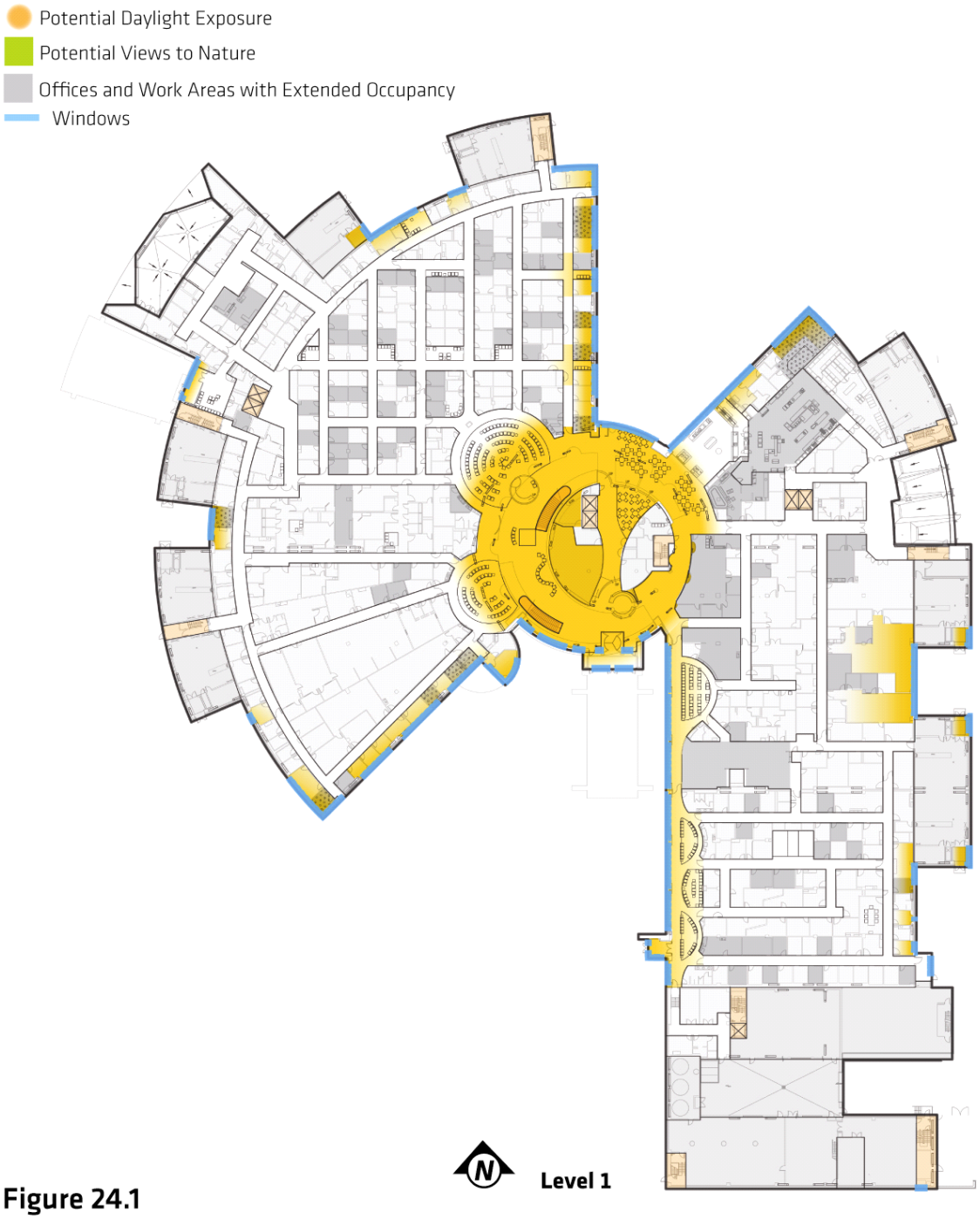

Figure 24.1

References:

2010 *Alzoubi, H., Al-Rqaibat, S. a., & Bataineh, R. F. (2010). Pre-versus post-occupancy evaluation of daylight quality in hospitals. [doi: DOI: 10.1016/j.buildenv.2010.05.027]. Building and Environment, 45(12), 2652-2665.*

The purpose of this study is to examine the effect of space occupancy on indoor daylight quality in hospitals (Alzoubi, H., et al, 2010)

Peer reviewed / Empirical http://knowledgecenter.iida.org/AssetDetails.aspx?assetGuid=ac12a35b-bbaf-4556-a6da-72e0e4c08543&BackToPage=search.aspx

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2006 *Joseph, A. (2006). Impacts of Light on Outcomes in Healthcare Settings. The Center for Health Design. Issue Paper #2.*

Light impacts human health and performance by enabling performance of visual tasks, controlling the body's circadian system, affecting mood and perception, and by enabling critical chemical reactions in the body. (Joseph, 2006)

Background http://www.healthdesign.org/chd/research/impact-light-outcomes-healthcare-settings

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2005 *Alimoglu, M. K., & Donmez, L. (2005). Daylight exposure and the other predictors of burnout among nurses in a University Hospital. International Journal of Nursing Studies, 42(5), 549-555.*

A survey of 141 nurses in Turkey found that nurses who were exposed to a total of 3 hours or more of daylight (during personal time and at work) were less stressed and reported higher levels of job satisfaction. However they were not able to directly connect daylight exposure with a reduction in job burnout, as they had intended. (Alimoglu and Donmez 2005). Daylight exposure of at least 3 hours a day decreased stress among staff and increased job satisfaction (Alimoglu & Donmez, 2005).

Peer reviewed / Empirical http://www.journalofnursingstudies.com/article/S0020-7489(04)00156-7/abstract

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2005 *Walch, J. M., Rabin, B. S., Day, R., Williams, J. N., Choi, K., & Kang, J. D. (2005). The effect of sunlight on post-operative analgesic medication usage: A prospective study of spinal surgery patients. Psychosomatic Medicine, 67(1), 156-163.*

Eighty-nine post-surgical patients were randomly assigned to two types of patient rooms: bright and dim rooms based on measured natural light levels. Patients in the bright rooms used 22% less analgesic medicines per hour and reported lower levels of stress and pain (Walch, et. al. 2005).

Peer reviewed / Empirical http://www.psychosomaticmedicine.org/cgi/content/abstract/67/1/156

2003 *Boyce, P., Hunter, C., & Howlett, O. (2003). The benefits of daylight through windows. Troy, NY: Rensselaer Polytechnic Institute.*

Study demonstrates that lighting is both a psychological and physiological boost to healing.

Peer Reviewed http://www.usp.br/fau/cursos/graduacao/arq_urbanismo/disciplinas/aut0213/Arquivos_Anteriores/Publicacoes_e_Referencias_Eletronicas/The_Benefits_Of_Daylight_Through_Windows.pdf

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1998 *Beauchemin, K., & Hays, P. (1998). Dying in the dark: sunshine, gender and outcomes in myocardial infarction. Journal of the Royal Society of Medicine, 91(7), 352-354.*

According to a study, mortality was higher in rooms designated as “dark” versus “bright” rooms. There was a shorter length of stay in bright rooms. Women were more affected by natural light than men, staying one day less in bright rooms than in the dark rooms (Beauchemin & Hays, 1998).

Peer reviewed / Empirical http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1296806/

1996 *Beauchemin, K. M., and Hays, P. (1996). Sunny hospital rooms expedite recovery from severe and refractory depressions. Journal of Affective Disorders, 40(1-2), 49-51.*

According to a study of patients in brightly lit rooms stayed an average of 16.9 days, whereas those in dimly lit rooms stayed 19.5 days. The difference appeared more marked in males (Beauchemin, et. al. 1996).

Peer reviewed / Empirical http://www.sciencedirect.com/science?_ob=ArticleURL&_udi=B6T2X-3W317G9-8&_user=10&_coverDate=09%2F09%2F1996&_rdoc=1&_fmt=high&_orig=search&_origin=search&_sort=d&_docanchor=&view=c&_searchStrId=1455942065&_rerunOrigin=scholar.google&_acct=C000050221&_vers

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4. Separate front of house (front stage) from back of house (back stage) movement and activities whenever possible. (ID: 85)

Separate the traffic flow and activity patterns of visitors (public) and flows of patient care areas (mixed), from staff work areas (private), whenever possible to prevent transmission of contamination, infection and noise.

GENERAL EVIDENCE

DHB Domain: Basic Infrastructure **Lifecycle:** Design / Construction Execution

TMASurvey Result:

Principles Supported:

2 Achieve world-class quality and safety
4 Improve operational effectiveness

Core Dimensions Supported

5 Safe environment for patients
14 Process optimization and workflow

Research Summary:

There is no direct published evidence for separating front of house and back of house activities, but indirect published evidence supports the strategy. According to expert opinion, regulating the flow of visitors, patients and staff plays a central role in preventing disease transmission in healthcare facilities. There is positive correlation between number of people present and microbial contamination in an area.

Design Implications:

Experts suggest that healthcare design should minimize traffic flow in areas where patient care and instrument processing take place. Such areas include: procedure areas (where patients are examined and undergo treatment), surgical units (where major and minor operations are performed), and work areas (where instruments and supplies are processed).

Another potential benefit is the separation of informal and formal staff communication from visitors and patients and the inadvertent violation of HIPAA patient privacy regulations. Patient dignity and privacy can also be better protected when inpatient holding areas and transport is separated from public movement in corridors, elevators and elevator lobbies.

Metrics and Evaluation Approaches

1. Metric:

Improvement in responses to a specific patient and staff satisfaction survey question (to be identified).

2. Design Review Considerations:

Plan review for separation of public [outpatient/visitor] from private [inpatient, supplies, soiled goods, and staff] circulation areas within diagnostic and treatment departments and between all patient care departments. Check for separated public from inpatient, staff and service elevators, elevator lobbies and corridors in clinical and diagnostic treatment areas.

- Design team to submit plans coded, showing circulation paths of all (visitors, outpatients, inpatients, clinical staff, admin staff, service staff..), showing different zones: front stage vs. back stage, clean vs. dirty, private vs. public to indicate proposed public, mixed and private [back-of-the-house] pathways at S3-4 review.

3. Potential Mockup/Prototype/Simulations:

- Simulation model of inpatient, supplies, soiled goods, outpatient/public and staff movement flows within diagnostic and treatment departments to identify potential conflicts
- Simulation model of inpatient, supplies, soiled/waste, outpatient/public and staff movement flows between patient care departments to identify potential conflicts
- Simulation model required also for outpatient medical and surgical clinics.

4. Proposed POE Information Collection Options:

Archival Take-off

- Identify the location and type of circulation pathways in and between departments: front and back of house (public), mixed (patient care areas) and private (staff work areas and offices)

Walk Through

- Confirm the location and type of circulation pathways in and between departments: front and back of house (public), mixed (patient care areas) and private (staff work areas and offices)

Photo Documentation

- Document the character of circulation pathways in and between departments: front and back of house (public), mixed (patient care areas) and private (staff work areas and offices)

Staff Survey/Interview Questions [open ended]:

- Do you feel like the workflow between departments is efficient? if yes, what works well, if no, how could it be improved?

5. Post Occupancy – Focused Research Options:

- RFID tracking studies of inpatients, staff, equipment and materials to identify actual movement paths and conflict with public areas and pathways.
- Net to gross studies to evaluate the impact on net to gross ratios in hospitals with increased and minimized separation of front of the house and back of the house circulation

References:

2003 *Tietjen, L., Bossemeyer, D., & McIntosh, N. (2003). Traffic flow and activity patterns. Infection prevention: Guidelines for healthcare facilities with limited resources. Baltimore, Md.: JHPIEGO Corp.*

This book section offers an expert opinion on regulating traffic flow and activity patterns in healthcare settings. Regulating the flow of visitors, patients, and staff plays a central role in preventing disease transmission in healthcare facilities. Because the number of microorganisms in a designated area tends to be related to the number of people present and their activity, microbial contamination is expected—and found—to be high in areas such as waiting rooms and places where soiled surgical instruments and other equipments are initially processed. An important objective of infection prevention is to minimize the level of microbial contamination in areas where patient care and instrument processing take place. Such areas include procedure areas, surgical units, and work areas. (Tietjen, Bossemeyer, & McIntosh, 2003)

Expert Opinion http://www.reproline.jhu.edu/english/4morerh/4ip/IP_manual/15_TrafficFlow.pdf

5. Reduce or eliminate sources of noise: other patients, equipment 'clatter', loud conversations at nurse stations. (ID: 125)

Apply solutions to reduce or eliminate sources of noise such as: sound absorption finishes and materials for floors, walls and ceilings, high STC partitions, duct attenuation, vibration isolators for mechanical equipment, etc

SUFFICIENT DIRECT EVIDENCE

DHB Domain: Basic Infrastructure **Lifecycle:** Facility Activation & Operations

TMASurvey Result:

Principles Supported:

1. Provide patient and family-centered care
2. Achieve world-class quality and safety
3. Create a positive work environment
4. Improve operational effectiveness

Core Dimensions Supported

2. Patient and family privacy, comfort and control
7. Safe and effective work environment for clinical staff
11. Indoor environmental quality (ambient)

Research Summary:

There is strong evidence demonstrating that noise is a major significant environmental stressor causing sleep deprivation, low levels of satisfaction and decreased productivity, and that the soundscape within healthcare environments should be improved through either elimination or relocation of excessive noise sources and/or utilizing materials with sound absorbing qualities. Several studies (out of many) point out that noise accounts for only a small portion of arousals and awakenings and suggest that other elements also need to be investigated in the pathogenesis of sleep fragmentation.

Design Implications:

The noise studies conducted in healthcare settings suggest four major interventions to be considered. First is the identification and elimination/relocation of noise sources (pneumatic tubes, bedrails moving up and down, trolleys, telephones, ice machines, etc…) in healthcare settings. Second, the body of research strongly recommends avoiding hard and sound-reflecting, instead of sound-absorbing; this creates poor acoustic conditions in healthcare settings. Third, research suggests utilizing single-bedrooms and avoiding open bays since much noise originates from other patients. And fourth, the research demonstrates that staff behavior modifications can significantly reduce noise in patient-care areas.

Metrics and Evaluation Approaches

1. Metric:

Proof that there is a maximum use of sound absorption materials and there are appropriate quiet zones in inpatient areas.

2. Design Review Considerations:

Conduct plan and specification review for appropriate use, location and specification of acoustical materials in ceilings and other surfaces to absorb/dampen the transmission of noise generated in nurse stations and other clinical work areas.

• Design team to submit plans and specifications at S3-4 review that identifies the location and type of acoustical materials at nurse stations including Sound Transmission Class [STC] ratings for enclosing walls and ceilings, and Noise Reduction Coefficient [NRC] for floor, wall and ceiling surface finish materials.

Conduct equipment specification review for determine if equipment alarm and background noise level [dB] specifications are within acceptable ranges as determined by the MHS.

• Appropriate consultant and/or vendor to provide specifications for equipment to be located at nurse stations and associated staff work areas that identifies alarm and background dB levels prior to final specification/selection of equipment.

4. Proposed POE Information Collection Options:

Staff survey/interview with questions related to [satisfaction with]:

- Perceived noise levels and distraction at nurse stations

Patient survey/interview with questions related to [satisfaction with]:

- Perceived noise levels and distraction at patient care spaces adjoining nurse stations

5. Post Occupancy – Focused Research Options:

- Sound measurements in nurse stations and in patient rooms near nurse stations and other clinical support areas.
- Observational studies of work/conversation activities and patterns at nurse stations
- In depth staff surveys on perceived noise levels and distraction at nurse stations
- In depth patient/family surveys on perceived noise levels in patient care spaces adjoining nurse stations
- Studies on medication, communication and patient information entry/retrieval error rates

References:

2010 *Liu, W. F. (2010). The impact of a noise reduction quality improvement project upon sound levels in the open-unit-design neonatal intensive care unit. Journal of Perinatology, 30(7), 489-496.*

An empirical study conducted in two neonatal intensive care units report that using primarily human behavior noise reduction strategies, that the two units were unable to demonstrate measurable improvements in sound levels within the occupied open-unit-design neonatal intensive care unit (Liu, 2010).

Peer reviewed / Empirical http://www.ncbi.nlm.nih.gov/pubmed?term=Liu%2C%20W.%20F.%20(2010).%20The%20impact%20of%20a%20noise%20reduction%20quality%20improvement%20project%20upon%20sound%20levels%20in%20the%20open-unit-design%20neonatal%20intensive%20care%20unit.%20Journal%20of%20P

2010 *Ryherd, E., & Zimring, C. (2010). Too noisy to heal: using advances in hospital acoustics to bridge the gap between architecture, engineering, and medicine. Healthcare Design, 10(11), 60-68.*

A review article (Ryherd & Zimring, 2010) highlights the body of noise studies conducted in healthcare environments. The authors emphasize adverse effects of noise including negative psychological and physiological reactions in patients and staff (Busch-Vishniac, et al., 2005; Ryherd, et al., 2008a; Ryherd, et al., 2008b), reduced sleep (Topf, et al., 1996; Freedman, et al., 2001; Gabor, et al., 2003; Parthasarathy & Tobin, 2004), a cardiovascular response (Baker, 1992; Baker, et al., 1993), an extended hospital stay (Fiffe & Rappaport, 1976), the need for increased pain medication (Minkley, 1968), burnout for staff (Topf & Dillon, 1988), hearing loss (Holmes, et al., 1996; Willett, 1991), decreased mental efficiency (Murthy, et al., 1995), decreased short-term memory (Murthy, et al., 1995), and difficulties discerning what others are saying (Busch-Vishniac, et al., 2005).

Peer reviewed / Empirical http://www.healthcaredesignmagazine.com/ME2/dirmod.asp?sid=&nm=&type=Publishing&mod=Publications%3A%3AArticle&mid=8F3A7027421841978F18BE895F87F791&tier=4&id=D7843F9592994CBEBA65FDACACC710DC

2009 *Joseph, A., Keller, A., & Gulwadi, G. (2009). Improving the Patient Experience: Best Practices for Safety-Net Clinic Redesign. The Center for Health Design report for California Healthcare Foundation. Concord, CA: The Center for Health Design.*

A background discussion reports negative association of noise with patient satisfaction (Joseph, et al., 2009).

Peer reviewed / Empirical http://www.chcf.org/publications/2009/03/improving-the-patient-experience-best-practices-for-safetynet-clinic-redesign

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2009 *Pelton, H., Ryherd, E., & Martin, M. (2009). Acoustical design of a burn acute care unit for enhanced patient comfort. Noise Control Engineering Journal, 57(1), 32-41.*

An empirical study presents the acoustical remodel of a Burn Acute Care Unit. Researchers report the gains after acoustical installations (The L1 values for typical patient distress sounds as measured in adjacent spaces were reduced from 88 dBA before remodel to 55~58 dBA after the remodel). It is reported that the treatment enhanced privacy and acoustical comfort within the remodeled facility as well as to patient rooms throughout the ward (Pelton, et al., 2009).

Peer reviewed / Empirical http://dialnet.unirioja.es/servlet/articulo?codigo=3061124

2008 *Ryherd, E., Waye, K. P., & Ljungkvist, L. (2008). Characterizing noise and perceived work environment in a neurological intensive care unit. Journal of the Acoustical Society of America, 123(2), 747-756.*

A review article (Ryherd & Zimring, 2010) highlights the body of noise studies conducted in healthcare environments. The authors emphasize adverse effects of noise including negative psychological and physiological reactions in patients and staff (Busch-Vishniac, et al., 2005; Ryherd, et al., 2008a; Ryherd, et al., 2008b), reduced sleep (Topf, et al., 1996; Freedman, et al., 2001; Gabor, et al., 2003; Parthasarathy & Tobin, 2004), a cardiovascular response (Baker, 1992; Baker, et al., 1993), an extended hospital stay (Fiffe & Rappaport, 1976), the need for increased pain medication (Minkley, 1968), burnout for staff (Topf & Dillon, 1988), hearing loss (Holmes, et al., 1996; Willett, 1991), decreased mental efficiency (Murthy, et al., 1995), decreased short-term memory (Murthy, et al., 1995), and difficulties discerning what others are saying (Busch-Vishniac, et al., 2005).

Peer reviewed / Empirical http://www.ncbi.nlm.nih.gov/pubmed/18247879

2008 *Ryherd, E., West, J., Busch-Vishniac, I., & Waye, K. P. (2008). Evaluating the hospital soundscape. Acoustics Today, 4(4), 22-29.*

Environments where decisions are made affecting health and survival and where patients reside should promote thinking, communication, good patient care and restfulness for the patients. This article summarizes what is known about the hospital soundscape and its impacts and describes ongoing work for improvement. (Ryherd, E., et al, 2008)

Peer reviewed / Empirical http://asadl.org/at/resource/1/atcodk/v4/i4/p22_s1?isAuthorized=no

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2007 *Joseph, A., & Ulrich, R. (2007). Sound control for improved outcomes in healthcare settings. Issue Paper #4. . Concord, CA: The Center for Health Design.*

A review article emphasizes the impacts of excessive noise levels and recommends that noise levels can be effectively reduced by providing single-patient bedrooms, installing high-performance sound-absorbing acoustical ceiling tiles, and removing or reducing loud noise sources on hospital units (Joseph & Ulrich, 2007).

Peer reviewed / Empirical http://www.healthdesign.org/sites/default/files/Sound%20Control.pdf

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2007 *MacLeod, M., Dunn, J., Busch-Vishniac, I., & West, J. (2007). Quieting Weinberg 5C: A case study in hospital noise control. Journal of the Acoustical Society of America, 121, 3501-3508.*

An empirical study conducted in a hematological cancer unit discusses the impact of noise-control installation. Researchers report that the noise on the unit was immediately reduced by 5 dB(A), and that surveys of staff and patients before and after the treatment indicated a change from viewing the unit as very noisy to a view of the unit as relatively quiet (MacLeod, et al., 2007)

Peer reviewed / Empirical http://www.ncbi.nlm.nih.gov/pubmed/17552702

2006 *Joseph, A. (2006). The Role of the Physical and Social Environment in Promoting Health, Safety and Effectiveness in the Healthcare Workplace. Issue Paper #3. Concord, CA: The Center for Health Design.*

A review article on the impact of lifts on staff injury in healthcare settings show substantial benefit (Joseph, 2006).

Expert Opinion http://www.healthdesign.org/chd/research/role-physical-and-social-environment-promoting-health-safety-and-effectiveness-healthca?page=8

2006 *Philbin, M. K., & Evans, J. B. (2006). Standards for the acoustic environment of the newborn ICU. Journal of Perinatology, 26(S3), 27-30.*

Recommended standards for the acoustic environment of the newborn intensive care unit (NICU) have become more protective over time based on research about the deleterious effects of noise and distraction on infants and adults, and on experience in successfully designing and building quiet hospital nurseries. (Philbin, M.K., & Evans, J.B., 2006)

Peer Reviewed /Expert Opinion http://www.nature.com/jp/journal/v26/n3s/full/7211585a.html

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2005 *Blomkvist, V., Eriksen, C., Theorell, T., Ulrich, R., et al. (2005). Acoustics and psychosocial environment in intensive coronary care. Occupational and Environmental Medicine, 62(3,e.1), 1-8.*

In an empirical study conducted in a coronary critical care unit (CCU), psychosocial work environment data from start and end of each individual shift were obtained from three shifts (morning, afternoon, and night) for a one-week baseline period and for two four-week periods during which either sound reflecting or sound absorbing tiles were installed. Researchers conclude that important gains (Reverberation times and speech intelligibility) in the psychosocial work environment of healthcare can be achieved by improving room acoustics (Blomkvist et. al., 2005)

Peer reviewed / Empirical http://oem.bmj.com/content/62/3/e1.abstract

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2005 *Busch-Vishniac, I., West, J., Barnhill, C., Hunter, T., et al. (2005). Noise levels in Johns Hopkins Hospital. Journal of the Acoustical Society of America, 118(6), 3629-1645.*

A review article (Ryherd & Zimring, 2010) highlights the body of noise studies conducted in healthcare environments. The authors emphasize adverse effects of noise including negative psychological and physiological reactions in patients and staff (Busch-Vishniac, et al., 2005; Ryherd, et al., 2008a; Ryherd, et al., 2008b), reduced sleep (Topf, et al., 1996; Freedman, et al., 2001; Gabor, et al., 2003; Parthasarathy & Tobin, 2004), a cardiovascular response (Baker, 1992; Baker, et al., 1993), an extended hospital stay (Fiffe & Rappaport, 1976), the need for increased pain medication (Minkley, 1968), burnout for staff (Topf & Dillon, 1988), hearing loss (Holmes, et al., 1996; Willett, 1991), decreased mental efficiency (Murthy, et al., 1995), decreased short-term memory (Murthy, et al., 1995), and difficulties discerning what others are saying (Busch-Vishniac, et al., 2005).

Peer reviewed / Empirical http://www.ncbi.nlm.nih.gov/pubmed/16419808

2005 *Hagerman, J., Rasmanis, G., Blomkvist, V., Ulrich, R., et al. (2005). Influence of intensive coronary care acoustics on the quality of care and physiological state of patients. International Journal of Cardiology, 98(2), 267-270.*

An empirical study investigated the possible role of room acoustics on patients with coronary artery disease. Researchers state that there were significant differences between good and bad acoustics with regard to pulse amplitude in the acute myocardial infarction and unstable angina pectoris groups, with lower values during the good acoustics period during the night (Hagerman, et al., 2005).

Peer reviewed / Empirical http://www.internationaljournalofcardiology.com/article/S0167-5273(04)00066-X/abstract

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2005 *Nelson, C., West, T., & Goodman, C. (2005). The Hospital Built Environment: What Role Might Funders of Health Services Research Play? Rockville, MD: Agency for Healthcare Research and Quality, Publication Number 05-0106-EF.*

An expert opinion paper, referring to the body of existing studies, emphasizes the reduction of environmental stressors, such as noise, that negatively affect patient outcomes and staff performance (Nelson, et al., 2005).

Peer reviewed / Empirical http://www.ahrq.gov/qual/hospbuilt/

2004 *Dubbs, D. (2004). Design and Operation Solutions to Hospital Noise: Sound Effects. Health Facilities Management, September, 15-18.*

An expert opinion article state that hospitals often have worst-case acoustical conditions. The author points out noise-reduction strategies including the use of high-performance acoustical ceiling tiles, fixing or replacing squeaky wheels and better furnishing solutions (Dubbs, 2004)

Expert opinion http://www.hfmmagazine.com/hfmmagazine_app/jsp/articledisplay.jsp?dcrpath=HFMMAGAZINE/PubsNewsArticleGen/data/0409HFM_FEA_Cover_Story

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2004 *Parthasarathy, S., & Tobin, M. (2004). Sleep in the intensive care unit. Intensive Care Medicine, 30(2), 197-206.*

An empirical study conducted in an ICU reports that about 20% of arousals and awakenings are related to noise. Sleep disruption can induce sympathetic activation and elevation of blood pressure, which may contribute to patient morbidity. Measure to improve quanttiy and quality of sleep include mode of mechanical ventilation, decreasing noise, and sedative agents (Parthasarathy & Tobin, 2006).

Peer reviewed / Empirical http://www.springerlink.com/content/u3q365481m144gl3/

2003 *Gabor, J., Cooper, A., Crombach, S., Lee, B., et al. (2003). Contribution of the intensive care unit environment to sleep disruption in mechanically ventilated patients and healthy subjects. American Journal of Respiratory and Critical Care Medicine, 167(5), 708-715.*

An empirical study characterized potentially disruptive ICU noise stimuli and patient-care activities and determined their relative contributions to sleep disruption. Researchers state that subjects slept relatively well in the typically loud ICU environment and experienced a quantitative, but not qualitative, improvement in sleep in a noise-reduced, single-patient ICU room; and that noise and patient-care activities account for less than 30% of arousals and awakenings (Gabor, et al., 2003).

Peer reviewed / Empirical http://ajrccm.atsjournals.org/cgi/content/abstract/167/5/708

2003 *Morrison, W., Haas, E., Shaffner, D., Garrett, E., et al. (2003). Noise stress and annoyance in a pediatric intensive care unit. Critical Care Medicine, 31, 35-37.*

An empirical study measured hospital noise and tried to determine whether noise can be correlated with nursing stress measured by questionnaire, salivary amylase, and heart rate. The study was conducted with 11 nurses in a tertiary care center pediatric intensive care unit. Noise was shown to correlate with several measures of stress including tachycardia and annoyance ratings (Morrison, et al., 2003).

Peer reviewed / Empirical http://www.ncbi.nlm.nih.gov/pubmed/12545003

2002 *Allaouchiche, B., Duflo, F., Debon, R., Bergeret, A., et al. (2002). Noise in the postanaesthesia care unit. British Journal of Anesthesia, 88(3), 369-373.*

A British empirical article studying the postanaesthesia care unit (PACU) studied the sources and intensity of noise in the PACU and assessed its effect on patients' comfort. They determined that even though sound levels exceeded the internationally recommended intensity, it did not cause discomfort. (Allaouchiche et al, 2002).

Peer reviewed / Empirical http://www.ncbi.nlm.nih.gov/pubmed/11990268

2002 *Philbin, M. K., & Gray, L. (2002). Changing levels of quiet in an intensive care nursery. Journal of Perinatology, 22(6), 455-460.*

This study looked at the relative effects of operational (staff and equipment generated) and facility (building generated) noise on the acoustic environment of a level III nursery. Researchers conclude that staff behavior as well as the acoustical characteristics of the facility determines the levels of noise and quiet in an intensive care nursery (Philbin & Gray, 2002).

Peer reviewed / Empirical http://www.ncbi.nlm.nih.gov/pubmed/12168122

2001 *Berg, S. (2001). Impact of reduced reverberation time on sound-induced arousals during sleep. Sleep, 24, 289-292.*

The effect of reducing reverberation time was studied in 12 subjects during sleep. EEG-arousals following specific sound stimuli were significantly reduced ($p<0.007$) when reverberation time was reduced with sound-absorbing ceiling-tiles. On average reverberation was reduced 0.124 seconds at similar sound levels. It is proposed that increased sound absorption, i.e. reduced reverberation time, by contributing to a better acoustic environment may reduce sound-induced sleep fragmentation. (Berg, S. , 2001)

Peer reviewed / Empirical http://www.ncbi.nlm.nih.gov/pubmed/11322711

2001 *Freedman, N., Gazendam, J., Levan, L., Pack, A., et al. (2001). Abnormal sleep/wake cycles and the effect of environmental noise on sleep disruption in the intensive care unit. American Journal of Respiratory and Critical Care Medicine, 163(2), 451-457.*

An empirical research studied 22 (20 mechanically ventilated) medical intensive care unit (ICU) patients and environmental noise measurements. Authors state that ICU patients are qualitatively, but not necessarily quantitatively, sleep deprived; and although environmental noise is in part responsible for sleep-wake abnormalities, it is not responsible for the majority of the sleep fragmentation and may therefore not be as disruptive to sleep as the previous literature suggests (Freedman, et al., 2001).

Peer reviewed / Empirical http://ajrccm.atsjournals.org/cgi/content/abstract/163/2/451

2000 *Evans, J. B., & Philbin, M. K. (2000). Facility and operations planning for quiet hospital nurseries. Journal of Perinatology, 20(8 Pt2), 105-112.*

An expert opinion article discusses architectural design and construction and recommends criteria for achieving quiet nursery environments. Authors recommend that designs for new construction or facility renovation should incorporate vibration and noise control methods appropriate to the occupants and activities of the proposed space (Evans & Philbin, 2000).

Peer Reviewed /Expert Opinion http://www.nature.com/jp/journal/v20/n1s/abs/7200437a.html

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2000 *Thomas, K. A., & Martin, P. A. (2000). NICU sound environment and the potential problems for caregivers. Journal of Perinatology, 20(8 Pt2), 94-99.*

A review article emphasizes that findings from other research of responses to sound suggest that a variety of physiological and behavioral responses may occur in response to the NICU sound environment, and that the sound intensity of the NICU may interfere with ccommunication and job performance (Thomas & Martin, 2000).

Peer reviewed / Empirical http://www.nature.com/jp/journal/v20/n1s/abs/7200435a.html

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1998 *Kahn, M. D., Cook, T. E., Carlisle, C. C., Nelson, D. L., et al. (1998). Identification and Modification of Environmental Noise in an ICU Setting. Journal of the Acoustical Society of America, 118, 3629-3645.*

An empirical study reports the sound peak measurements conducted in an ICU unit. Researchers report that many of the noises causing sound peaks (TV and talking accounted for %49) are amenable to behavior modification and that it is possible to reduce the noise levels significantly through a program of behavior modification (Kahn, et al., 1998).

Peer reviewed / Empirical http://chestjournal.chestpubs.org/content/114/2/535.full.pdf

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1998 *Robertson, A., Cooper-Peel, C., & Vos, P. (1998). Peak noise distribution in the neonatal intensive care nursery. Journal of Perinatology, 18(5), 361-364.*

Research demonstrates the intensity, incidence, and periodicity of short duration sounds in the intensive care nursery. Short duration sounds are known to affect the infant's physiological and behavioral states and should be addressed in future recommendations for sound control and reduction strategies (Robertson et. al., 1998).

Peer reviewed / Empirical http://www.ncbi.nlm.nih.gov/pubmed/9766412

1997 *Committee on Environmental Health (1997). Noise: a hazard for the fetus and newborn. Pediatrics, 100(4), 724-727.*

Noise is ubiquitous in our environment. High intensities of noise have been associated with numerous health effects in adults, including noise-induced hearing loss and high blood pressure. The intent of this statement is to provide pediatricians and others with information on the potential health effects of noise on the fetus and newborn. The information presented supports a number of recommendations for both pediatric practice and government policy. (Committee on Environmental Health, 1997),

Peer Reviewed /Expert Opinion http://aappolicy.aappublications.org/cgi/content/full/pediatrics;100/4/724

1997 *Cureton-Lane, R. A., & Fontaine, D. K. (1997). Sleep in the pediatric ICU: an empirical investigation. American Journal of Critical Care, 6(1), 56-63.*

An empirical study observes the sleep of children in a pediatric ICU and determines the relationship of noise, light, contact with caregivers, parental presence, and severity of illness to the sleep obtained by children in a pediatric ICU during a 10-hour night. Researchers report that the patterns of sleep were seriously disturbed due to noise, light, and contact with caregivers (Cureton-Lane & Fontaine, 1997).

Peer reviewed / Empirical http://ajcc.aacnjournals.org/content/6/1/56.short

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1996 *Corser, N. C. (1996). Sleep of 1- and 2-year-old children in intensive care. Issues in Comprehensive Pediatric Nursing, 19(1), 17-31.*

Study conducted in a PICU negatively correlated external environmental stimuli of light, noise, and caregiver activity with sleep state. Researchers state that physiologic and psychologic changes associated with sleep disturbance decrease the ability of a critically ill child to adapt to hospitalization and thus hamper recovery (Corser, 1996).

Peer reviewed / Empirical http://www.ncbi.nlm.nih.gov/pubmed/8920497

1996 *Holmes, G. B., Goodman, H. K., Hang, D., & McCorvey, V. (1996). Noise levels of orthopedic instruments and their potential health risks. Orthopedics, 19(1), 35-37.*

An empirical study conducted a noise level survey on selected orthopedic equipment alongside the audiometric tests conducted on staff (n=5). Audiometric measurements indicated that, in the absence of other risk factors for hearing loss, there was an association between the presence of NIHL (noise-induced hearing loss) and the years of exposure (Holmes, et al., 1996).

Peer reviewed / Empirical http://www.ncbi.nlm.nih.gov/pubmed/8771111

1996 *McLaughlin, A., McLaughlin, B., Elliott, J., & Campalani, G. (1996). Noise levels in a cardiac surgical intensive care unit: a preliminary study conducted in secret. Intensive and Critical Care Nursing, 12(4), 226-230.*

The aim of this study was to record the noise levels within the cardiac surgical intensive care unit (CSICU) environment in secret. The study revealed that noise in the CSICU was above the recommended levels for patients and staff well-being. Future studies will be designed to establish a correlation between sound levels and events. (McLaughlin, A., et al, 1996)

Peer reviewed / Empirical http://www.ncbi.nlm.nih.gov/pubmed/8932018

1996 *Topf, M., Bookman, M., & Arand, D. (1996). Effects of critical care unit noise on the subjective quality of sleep. Journal of Advanced Nursing, 24, 545-551.*

An empirical study conducted in a critical care unit (CCU, n=60) reports that CCU sound levels impact negatively on self-reports of the subjective quality of sleep following exposure to this stressor (Topf, et al., 1996).

Peer reviewed / Empirical http://www.ncbi.nlm.nih.gov/pubmed/8876415

1995 *De Paul, D., & Chambers, S. E. (1995). Environmental noise in the neonatal intensive care unit: implications for nursing practice. The Journal of Perinatal and Neonatal Nursing, 8(4), 71-76.*

Environmental stimuli may cause sensory overload in premature infants, leading to stress and alterations in development. Noise levels generated from selected caregiving activities (eg, placing formula at bedside table, closing drawers, and discarding plastic equipment in trash cans) surpassed 52 dB, the sound level of light traffic. Caregiving activities continue to contribute to the environmental noise in the NICU. Nurses must be aware of the noise levels generated by specific caretaking activities and attempt to reduce the noise level in the NICU. (De Paul, D. & Chambers, S.E., 1995)

Peer reviewed / Empirical http://journals.lww.com/jpnnjournal/Abstract/1995/03000/Environmental_noise_in_the_neonatal_intensive_care.9.aspx

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1995 *Murthy, V., Malhotra, S., Bala, I., & Raghunathan, M. (1995). Detrimental effects of noise on anaesthetists. Canadian Journal of Anesthesia, 42(7), 608-611.*

An empirical study measured noise levels in operating rooms alongside the investigation of two cognitive functions, mental efficiency and short-term memory. Researchers state that operating room noise reduced the mental efficiency and short-term memory of anesthesia residents (Murthy, et al., 1995).

Peer reviewed / Empirical http://www.springerlink.com/content/b026mj3n98560385/

1995 *Southwell, M. T., & Wistow, G. (1995). Sleep in Hospitals at Night - Are Patients Needs Being Met? Journal of Advanced Nursing, 21(6), 1101-1109.*

The findings of a study on the hospital in-patient night show that many patients do not consider that they have sufficient sleep in hospital at night; that discomfort, worries and pain may contribute to their wakefulness; that the sleep of many is disrupted by a variety of sources of disturbances; that ward lights are dimmed for the night for no longer than required by the average, healthy person; and that patients continue to be woken early in the morning. (Southwell, M.T., & Wistow, G., 1995)

Peer reviewed / Empirical http://www.ncbi.nlm.nih.gov/pubmed/7665774

1994 *Couper, R. T., Hendy, K., Lloyd, N., Gray, N., et al. (1994). Traffic and noise in children's wards. Medical Journal of Australia, 160(6), 338-341.*

An empirical study investigated noise levels in pediatric open bay areas. Authors state that, due to visits, open bay areas generate high traffic volumes and coincident noise and that consideration should be given to either modifying or abolishing open bay areas (Couper, et al., 1994).

Peer reviewed / Empirical http://www.ncbi.nlm.nih.gov/pubmed/8133817

1993 *Baker, C., Garvin, B., Kennedy, C., & Polivka, B. (1993). The effect of environmental sound and communication on CCU patients' heart rate and blood pressure. Research in Nursing and Health, 16(6), 415-421.*

The effects of high ambient stressors (equipment sounds) and social stressors (conversation) on heart rate (HR) and blood pressure (BP) were examined in 20 coronary care patients. High ambient stressors did not affect HR for these subjects. BP did not significantly change during any of the sound conditions. Further research is needed to delineate cardiovascular effects of specific social stressors. (Baker, C., et al, 1993)

Peer reviewed / Empirical http://www.ncbi.nlm.nih.gov/pubmed/8248568

1992 *Baker, C. (1992). Discomfort to environmental noise: Heart rate responses of SICU patients. Critical Care Nursing Quarterly, 15(2), 75-90.*

An empirical study investigated the effect of noise on the heart rate of 28 surgical ICU patients. Based on continuous heart-rate measurements, the researcher reports that the noise increased heart rate in 68% patients and decreased it in 11% (Baker, 1992).

Peer reviewed / Empirical http://www.ncbi.nlm.nih.gov/pubmed/1628246

1992 *Yinnon, A. M., Ilan, Y., Tadmor, B., Altarescu, G., & Hershko, C. (1992). Quality of Sleep in the Medical Department. British Journal of Clinical Practice, 46(2), 88-91.*

An empirical research reports the quality of sleep in 134 patients admitted to two medical departments and an intensive coronary care unit Researchers state that of the reasons specified for impaired quality of sleep, the most important were noise made by other patients or by the medical staff (47%), and the patient's own disease (30%) (Yinnon, et al., 1992).

Peer reviewed / Empirical http://www.ncbi.nlm.nih.gov/pubmed/1457316

1988 *Topf, M. (1988). Noise-induced occupational stress and health in critical care nurses. Hospital Topics, 66, 30-34.*

In this empirical study they found that for 100 critical care nurses, noise-induced stress was positively related to burnout. (Topf,M, 1988)

Peer reviewed / Empirical http://www.ncbi.nlm.nih.gov/pubmed/10288383

1988 *Topf, M., & Dillon, E. (1988). Noise-induced stress as a predictor of burnout in critical care nurses. Heart and Lung, 17, 247-250.*

An empirical study reports that noise-induced occupational stress was positively related to burnout (n=100 critical care nurses). The researcher states that there are exceptionally high levels of noise in critical care units (Topf, 1988; Topf & Dillon, 1988).

Peer reviewed / Empirical http://www.ncbi.nlm.nih.gov/pubmed/3417467

1985 *Hilton, B. A. (1985). Noise in acute patient care areas. Research in Nursing and Health, 8(3), 283-291.*

An empirical study reported that continuous high noise levels were found in the larger hospital's open heart recovery room and intensive care units, lower levels in the smaller hospital's intensive care units and varying levels in the general ward areas (Hilton, 1985).

Peer reviewed / Empirical http://www.ncbi.nlm.nih.gov/pubmed/3852363

1976 *Fife, D., & Rappaport, E. (1976). Noise and hospital stay. American Journal of Public Health, 66(7), 680-681.*

In an empirical study, length of hospital stay for simple cataract surgery was compared retrospectively for a period of construction noise and for two similar periods without construction noise. Researchers state that hospital stay was significantly longer during the period of construction (Fife & Rappaport, 1976).

Peer reviewed / Empirical http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1653406/pdf/amjph00494-0050.pdf

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1968 *Minckley, B. (1968). A study of noise and its relationship to patient discomfort in the recovery room. Nursing Research, 17, 247-250.*

An empirical study conducted in ten-bed recovery room supported the hypothesis that; the patients' subjective sensations pain in the immediate post-operative period would be increased at times when noise levels were high; and that noise in the external environment represents an increased irritant to the patient who is already experiencing post-operative pain; and that if this were true, more pain medication would be given patients per capita at times of high noise levels than at times of low noise levels (Minckley, 1968).

Peer reviewed / Empirical http://journals.lww.com/nursingresearchonline/Citation/1968/05000/A_Study_of_Noise_and_Its_Relationship_To_Patient.18.aspx

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6. Provide clear spatial organization and visual cues for effective wayfinding. (ID: 139)

Create floor plans with logical functional organization and simple circulation routes. Indicate departmental transitions through the use of visible architectural, interior design features (such as landmarks, special elements at major intersections, uses of colors, themes on walls, floors, ceilings…) and easy-to-locate signage as visual cues to help visitors, patients and staff navigate through the building easily. In addition, utilize graphic communication (audible communication, tactile elements, etc.) to ensure a positive way-finding experience for special-needs users.

SUFFICIENT DIRECT EVIDENCE

DHB Domain: Basic Infrastructure **Lifecycle:** Design / Construction Execution

TMASurvey Result:

Principles Supported:

1 Provide patient and family-centered care

Core Dimensions Supported

1 Physical access and wayfinding

Research Summary:

There is much research on way finding in various settings, including healthcare. Research shows that poor way finding increases healthcare costs (Carpman, Grant, & Simmons, 1985) and produces stress and negative health outcomes (Evans, 1998; Nelson-Shulman, 1983). Good way finding is supported by clear spatial configurations, spatial landmarks, and spatial differentiation (i.e., simple corridors, central atrium systems, asymmetrical layouts with repetitive units, perpendicular intersecting hallways, visual access to destination, and clear contours and distinctive surfaces) in addition to well-designed signage and legible room numbers. Clear spatial organization and cues for way finding have been shown to reduce sources of stress and improve satisfaction (Nelson-Shulman, 1983) and health outcomes (Rooke, Tzortzopoulos, Koskela, & Rooke, 2009).

Design Implications:

Wayfinding is not just about better signage or colored lines on floors (Ulrich et al., 2008). Rather, wayfinding is the process of using spatial and environmental information to find our way in the built environment (Brandon, 2008). Wayfinding is essentially a problem-solving process. Designers can employ a variety of strategies to assist in wayfinding, including carefully designed signs, visible cues (Carpman and Grant, 1993; Nelson-Sulman, 1983, Wright, Hull, & Lickorish, 1993), clear plan configuration, and legible physical settings. Plan configuration may be the most influential factor influencing wayfinding, followed by spatial landmarks, spatial differentiation, and finally signage and room numbers (Weisman 1979, 1981). Design strategies for improved wayfinding include the following: 1) simple corridors, 2) central atrium systems, 3) asymmetrical layouts with repetitive units, 4) perpendicular intersecting hallways, 5) visual access to destinations, and 6) clear contours and distinctive surfaces.

Metrics and Evaluation Approaches

1. Metric:

Improvement in responses to a specific patient and staff satisfaction survey question regarding clarity and ease of wayfinding.

2. Design Review Considerations:

Schematic design document review to assess spatial organization, view and daylight cues of circulation elements for clarity and hierarchy of paths, nodes, visible landmarks, and departmental districts/boundaries. Other methods to provide clear spatial organization and effective way-finding are colors, patterns or themes used on floors, wall, ceiling finishes of spaces, and clearly marked entrances with architectural features, or volumes of spaces.

- Design team to submit plan, building sections and renderings of major circulation pathways at S3-4 review.
- Design team to submit plan, elevations, renderings, and interior finishes of spaces at S3-4 review.
- Design team to submit 3 dimension of exterior view of entrances, entry lobby, and/or major spaces along paths

Plan/specification/shop drawing review of signage location and design.

- Design team to submit signage design and specification documents at S3-4 review
- Design team to submit overall wayfinding plan demonstrating clairity and hierarchy of paths, nodes, visible landmarks, and departmental districts / boundaries.

3. Potential Mockup/Prototype/Simulations:

Develop virtual model review to assess spatial organization, view and daylight cues of circulation elements for clarity and hierarchy of paths, nodes, visible landmarks, and departmental districts/boundaries.

4. Proposed POE Information Collection Options:

Archival Take-off

- Identify main entry points into facility
- Identify arrival sequence to clinical departments (park/drop off, entry, reception, wait, exam, exit)
- Identify circulation pathways throughout facility (public, mixed and private)

Walk Through

- Confirm main entry points into facility
- Confirm arrival sequence to clinical departments (park/drop off, entry, reception, wait)
- Confirm circulation pathways throughout facility (public, mixed and private)
- Confirm visual cues, signage, landmarks or obstacles from arrival to clinical destination - check-in

Photo Documentation

- Document main entry points into facility
- Document arrival sequence to clinical departments (park/drop off, entry, reception, wait)
- Document circulation pathways throughout facility (public, mixed and private)
- Document visual cues, signage, landmarks or obstacles from arrival to clinical destination - check-in

Staff Survey/Interview Questions [satisfaction with]:

- Locating parking close to the facility
- Clarity and visibility of signage throughout the facility
- Finding your way to your appointment or destination

5. Post Occupancy – Focused Research Options:

Conduct patient, visitor, staff analysis on image-ability and legibility based on the work of Kevin Lynch and others.

References:

2009 *Rooke, C. N., Tzortzopoulos, P., Koskela, L. J., & Rooke, J. A. (2009). Wayfinding: embedding knowledge in hospital environments. Paper presented at the HaCIRIC 2009: Improving Healthcare Infrastructures Through Innovation, Brighton, UK.*

A case study at a local HNS Foundation Trust found that easy wayfinding using simple architectural and graphic organizing principles not only reduces patient stress and anxiety but can lead to improved health (Rooke, Tzortzopoulos, Koskela, & Rooke, 2009).

Peer reviewed / Empirical http://usir.salford.ac.uk/3411/1/2009_Wayfinding.pdf

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2008 *Brandon, K. (2008) Wayfinding. Retrieved from http://www.kellybrandondesign.com/IGDWayfinding.html*

Wayfinding is not just about better signage or colored lines on floors (Ulrich et al., 2008). Rather, wayfinding is the process of using spatial and environmental information to find our way in the built environment (Brandon, 2008). Wayfinding is essentially a problem-solving process. Designers can employ a variety of strategies to assist in wayfinding, including carefully designed signs, visible cues (Carpman and Grant, 1993; Nelson-Sulman, 1983, Wright, Hull, & Lickorish, 1993), clear plan configuration, and legible physical settings. Plan configuration may be the most influential factor influencing wayfinding, followed by spatial landmarks, spatial differentiation, and finally signage and room numbers (Weisman 1979, 1981). Design strategies for improved wayfinding include the following: 1) simple corridors, 2) central atrium systems, 3) asymmetrical layouts with repetitive units, 4) perpendicular intersecting hallways, 5) visual access to destinations, and 6) clear contours and distinctive surfaces.

Expert Opinion http://www.kellybrandondesign.com/IGDWayfinding.html

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2008 *Ulrich, R. S., Zimring, C., Zhu, X. M., DuBose, J., Seo, H. B., Choi, Y. S., et al. (2008). A Review of the Research Literature on Evidence-Based Healthcare Design. Herd-Health Environments Research & Design Journal, 1(3), 61-125.*

Wayfinding is not just about better signage or colored lines on floors (Ulrich et al., 2008). Rather, wayfinding is the process of using spatial and environmental information to find our way in the built environment (Brandon, 2008). Wayfinding is essentially a problem-solving process. Designers can employ a variety of strategies to assist in wayfinding, including carefully designed signs, visible cues (Carpman and Grant, 1993; Nelson-Sulman, 1983, Wright, Hull, & Lickorish, 1993), clear plan configuration, and legible physical settings. Plan configuration may be the most influential factor influencing wayfinding, followed by spatial landmarks, spatial differentiation, and finally signage and room numbers (Weisman 1979, 1981). Design strategies for improved wayfinding include the following: 1) simple corridors, 2) central atrium systems, 3) asymmetrical layouts with repetitive units, 4) perpendicular intersecting hallways, 5) visual access to destinations, and 6) clear contours and distinctive surfaces.

Peer reviewed / Empirical http://smartech.gatech.edu/handle/1853/25676

2004 *Baskaya, A., Wilson, C., & Ozcan, Y. Z. (2004). Wayfinding in an unfamiliar environment - Different spatial settings of two polyclinics. Environment and Behavior, 36(6), 839-867.*

An asymmetrical layout with repetitive units along one side of a linear corridor was associated with better wayfinding outcomes than a symmetrical layout with repetitive units that were undifferentiated. Wayfinding in a symmetrical layout with repetitive units can be improved by landmarks or other strategies to aid in place recognition (Baskaya, Wilson, & Ozcan, 2004).

Peer reviewed / Empirical http://eab.sagepub.com/content/36/6/839.abstract

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2004 *Werner. S., and Schindler, L. E (2004) The role of spatial reference frames in architecture: Misalignment impairs way-finding performance. Environment and Behavior, 36 (4), 461-482*

It is generally recognized that the spatial structure of a building is an important factor in way-finding performance. However, surprisingly little research has related way-finding performance directly to topological and geometrical properties of spatial environments. In this study, the authors provide empirical evidence that way-finding performance and the ability of people to orient themselves in their environment depends partly on geometrical relations between different parts of the space (Werner, S. & Schindler, L.E., 2004)

Peer reviewed / Empirical http://eab.sagepub.com/content/36/4/461.abstract

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2001 *Carpman, J., and Grant, M. (2001). Design that cares. San Francisco: Jossey-Bass Inc.*

The stress related to wayfinding problems in complex hospital environments has been associated with elevated blood pressure, headaches, increased physical exertion, and fatigue (Carpman & Grant, 2001).

Peer reviewed / Empirical http://www.healthdesign.org/chd/research/wayfinding-design-understanding?page=6

2000 *Dogu, U., & Erkip, F. (2000). Spatial factors affecting wayfinding and orientation: A case study in a shopping mall. Environment and Behavior, 32, 731-755.*

This case study conducted in Turkey examines the factors that affect wayfinding behavior of individuals in a shopping mall and explains how their behaviors are influenced by factors such as building configuration, visual accessibility, circulation systems, and signage (Dogu, r. & Erkip, F., 2000).

Peer reviewed / Empirical http://eab.sagepub.com/content/32/6/731.abstract

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2000 *Murakoshi, S.,&Kawai, M. (2000). Use of knowledge and heuristics for wayfinding in an artificial environment. Environment and Behavior, 32, 756-774.*

The purpose of this study was to explore wayfinding behavior in an unfamiliar environment. The participants were 24 university freshmen. Their verbal explanations of their choices revealed that using route scenes, schema-like knowledge, environmental constraints, and information-seeking heuristics enabled them to find their way in the artificial environment (Murakoshi, S. & Kawai, M., 2000).

Peer reviewed / Empirical http://eab.sagepub.com/content/32/6/756

1998 *Evans, G.W. (1998).When buildings don't work: The role of architecture in human health. Journal of Environmental Psychology, 18, 85-94.*

Wayfinding is not just about better signage or colored lines on floors (Ulrich et al., 2008). Rather, wayfinding is the process of using spatial and environmental information to find our way in the built environment (Brandon, 2008). Wayfinding is essentially a problem-solving process. Designers can employ a variety of strategies to assist in wayfinding, including carefully designed signs, visible cues (Carpman and Grant, 1993; Nelson-Sulman, 1983, Wright, Hull, & Lickorish, 1993), clear plan configuration, and legible physical settings. Plan configuration may be the most influential factor influencing wayfinding, followed by spatial landmarks, spatial differentiation, and finally signage and room numbers (Weisman 1979, 1981). Design strategies for improved wayfinding include the following: 1) simple corridors, 2) central atrium systems, 3) asymmetrical layouts with repetitive units, 4) perpendicular intersecting hallways, 5) visual access to destinations, and 6) clear contours and distinctive surfaces.

Peer reviewed / Empirical http://www.ingentaconnect.com/content/ap/ps/1998/00000018/00000001/art00089

1997 *Brown, B., Wright, H., & Brown, C. (1997). A post-occupancy evaluation of wayfinding in a pediatric hospital: Research findings and implications for instruction. Journal of Architectural and Planning Research, 14(1), 35-51.*

A post occupancy evaluation in a new pediatric hospital identified wayfinding problems with radial floor layouts (Brown, Wright, and Brown, 1997).

Peer reviewed / Empirical http://content.lib.utah.edu/cdm4/document.php?CISOROOT=/ir-main&CISOPTR=18099

1993 *Carpman, J. R., & Grant, M. A. (1993). Design that cares: Planning health facilities for patients and visitors (2nd ed.). Chicago: American Hospital Publishing, Inc.*

Wayfinding is not just about better signage or colored lines on floors (Ulrich et al., 2008). Rather, wayfinding is the process of using spatial and environmental information to find our way in the built environment (Brandon, 2008). Wayfinding is essentially a problem-solving process. Designers can employ a variety of strategies to assist in wayfinding, including carefully designed signs, visible cues (Carpman and Grant, 1993; Nelson-Sulman, 1983, Wright, Hull, & Lickorish, 1993), clear plan configuration, and legible physical settings. Plan configuration may be the most influential factor influencing wayfinding, followed by spatial landmarks, spatial differentiation, and finally signage and room numbers (Weisman 1979, 1981). Design strategies for improved wayfinding include the following: 1) simple corridors, 2) central atrium systems, 3) asymmetrical layouts with repetitive units, 4) perpendicular intersecting hallways, 5) visual access to destinations, and 6) clear contours and distinctive surfaces.

Peer reviewed / Empirical http://www.pohly.com/books/designthat.html

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1993 *Wright, P., Hull, A. J., & Lickorish, A. (1993). Navigating in a hospital outpatients' department: The merits of maps and wall signs. Journal of Architectural and Planning Research, 10(1), 76-89.*

Wayfinding is not just about better signage or colored lines on floors (Ulrich et al., 2008). Rather, wayfinding is the process of using spatial and environmental information to find our way in the built environment (Brandon, 2008). Wayfinding is essentially a problem-solving process. Designers can employ a variety of strategies to assist in wayfinding, including carefully designed signs, visible cues (Carpman and Grant, 1993; Nelson-Sulman, 1983, Wright, Hull, & Lickorish, 1993), clear plan configuration, and legible physical settings. Plan configuration may be the most influential factor influencing wayfinding, followed by spatial landmarks, spatial differentiation, and finally signage and room numbers (Weisman 1979, 1981). Design strategies for improved wayfinding include the following: 1) simple corridors, 2) central atrium systems, 3) asymmetrical layouts with repetitive units, 4) perpendicular intersecting hallways, 5) visual access to destinations, and 6) clear contours and distinctive surfaces.

Peer Reviewed http://www.mrc-cbu.cam.ac.uk/bibliography/articles/2686/

1990 *Peponis, J., Zimring, C., & Choi, Y. K. (1990). Finding the building in way finding. Environment and Behavior, 22(5), 555-590.*

This article uses a limited example to demonstrate that studies of wayfinding and spatial learning can benefit from a more rigorous analytic description of building layout and exploration paths that exhibit their own pattern. In at least one case, search patterns are strongly shaped according to the degree of integration of each space and each choice node of the circulation system within the overall layout. Given this overriding trend, we formulate the idea of a search structure whereby the intelligible properties of layouts interact with navigation rules to produce characteristic patterns of exploration (Peponis, J. et al, 1990)

Peer reviewed / Empirical http://eab.sagepub.com/content/22/5/555.short

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1985 *Carpman, J., Grant, M. A., & Simmons, D. A. (1985). Hospital design and wayfinding: A video simulation study. Environment and Behavior, 17(3), 296-314.*

The study conducted a video simulation study to assess the driving turning behavior of 100 visitors to a new hospital. The results showed that the presence of the entrance to the deck from the drop-off circle did make a significant difference in reported turning behavior. 37% of the respondents said that they would turn into the drop circle when they could see the entry to the garage, ignoring the signs. (Carpman, 1985)

Peer reviewed / Empirical http://eab.sagepub.com/content/17/3/296.abstract

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1983 *Nelson-Shulman, Y. (1983). Information and Environmental Stress: Report of a Hospital Intervention. Journal of Environmental Systems, 13(4), 303-316.*

An experimental study found that patients who encountered wayfinding cues (welcome signage, a hospital information booklet, a patient letter, and orientation aids) upon reaching the admitting area were more self-reliant and made fewer demands on staff. In contrast, uninformed patients rated the hospital less favorably and had elevated heart rates (Nelson-Shulman, 1983).

Peer reviewed / Empirical http://baywood.metapress.com/app/home/contribution.asp?referrer=parent&backto=issue,2,7;journal,76,127;linkingpublicationresults,1:300323,1

1983 *Wener, R., & Kaminoff, R. (1983). Improving environmental information: Effects of signs on perceived crowding and behavior. Environment and Behavior, 15, 3-20.*

The presence of signs that identified locations and described registration procedures was associated with significantly reduced perceived crowding, discomfort, anger, and confusion as well as the amount of time spent to complete a registration process in the crowded lobby of a correctional facility (Wener and Kaminoff, 1983).

Peer reviewed / Empirical http://eab.sagepub.com/content/15/1/3.abstract

7. Provide visual and physical access to nature, including healing gardens as appropriate. (ID: 153)

Provide window views to nature, landscape and accessible outdoor spaces such as healing gardens, courtyards, and indoor atriums with natural landscaping.

SUFFICIENT DIRECT EVIDENCE

DHB Domain: Basic Infrastructure **Lifecycle:** Design / Construction Execution

TMASurvey Result:

Principles Supported:

1 Provide patient and family-centered care
2 Achieve world-class quality and safety
3 Create a positive work environment

Core Dimensions Supported

2 Patient and family privacy, comfort and control
6 Health maintenance/healthy practices (optimal health outcomes)
10 Access to daylight, nature and respite areas

Research Summary:

There is a strong evidence to support the value of nature for both patients and staff. Access to nature can reduce patient ratings of pain, bring down anxiety, relieve stress and control mood swings. Healing gardens and large windows to nature influence the length of patient's hospital stays. Access to nature can also reduce staff stress and fatigue and increase effectiveness in delivering care, and improve overall health care quality.

Research strongly supports the use of healing gardens on medical campuses. There are varieties of conditions affected by the access to and use of healing gardens. Stress relief can be targeted directly by the use of healing gardens. In addition, mood and amount of pain can be improved. The design of the garden should address patient control, noise, and circulation.

Design Implications:

Patients and staff need access to nature through large windows and gardens. It is not only enough to provide large size windows but the view needs to be of nature. Garden respite areas are also valued by patients, family and staff and serve to reduce stress and encourage healing and productivity.

The use of a healing garden as a "pass through" space is discussed in the literature. If the healing garden is in a central area, such as a contained courtyard, it is more likely to be used by patients, visitors, and staff. The healing garden should be designed to encourage a peaceful, tranquil space, not for large groups of people to use.

Considerations should be made for white noise and sounds provided by water features. Plant selection should be harmonious, but with contrast. Design of healing gardens should reflect a pattern and rhythm to propel users through the space.

Metrics and Evaluation Approaches

1. Metric:

Improvement in responses to a specific patient and staff satisfaction survey question regarding access and views o nature.

2. Design Review Considerations:

Floor area and/or wall areas in corridors, public areas, patient care spaces, offices and staff work areas having windows with unobstructed views of natural living elements outside, as well as landscape plans adjacent to those interior spaces.
Floor area and/or wall areas, 3 dimension views of corridors, public areas, patient care spaces, offices and staff work areas having unobstructed views of natural living elements inside.
Floor area and/or wall areas in corridors, public areas, patient care spaces, offices and staff work areas having direct physical access to natural living elements outside.
Healing gardens, interior landscaping features.
Design team to submit annotated plans and/or diagrams at S3-4 review identifying the above criteria for views and access to nature.

4. Proposed POE Information Collection Options:

Archival Take-off
- Identify the location and size of windows and skylights with views to nature.
- Identify the location of doors that provide access to nature
- Identify the location of interior nature elements or features [water, planting areas, sunrooms] in atria, lobbies, waiting rooms, corridors and other interior spaces.
- Identify the location of exterior nature elements or features [water, planting areas, healing gardens].

Walk Through
- Confirm the location and size of windows and skylights with views to nature.
- Confirm the location of doors that provide access to nature
- Confirm the location of interior nature elements or features [water, planting areas, sun rooms in atria, lobbies, waiting rooms and other interior spaces.
- Confirm the location of exterior nature elements or features [water, planting areas, healing gardens].

Photo Documentation
- Document windows and skylights with views to nature.
- Document doors that provide access to nature
- Document interior nature elements or features [water, planting areas, sunrooms] in atria, lobbies, waiting rooms, corridors and other interior spaces.
- Document exterior nature elements or features [water, planting areas, healing gardens]

Staff Survey/Interview Questions [satisfaction with]:
- Views to nature from rooms where patients receive care
- Views to nature from patient bed
- Access to daylighting in areas where patients receive care
- Physical access to nature (e.g. courtyards, balconies, gardens) in public areas

5. Post Occupancy – Focused Research Options:

In-depth patient, family and staff satisfaction surveys with questions pertaining to patient/staff interactions and access/views to nature.
Staff productivity, stress and turnover rates compared to facilities with limited access to nature.

References:

2008 *Naderi, J. R., & Shin, W. H. (2008). Humane Design for Hospital Landscapes: A Case Study in Landscape Architecture of a Healing Garden for Nurses. Herd-Health Environments Research & Design Journal, 2(1), 82-119.*

Sixty-one nurses participated in a survey of the pre-design stage of a garden for a hospital. Preferences for contact with nature and privacy were significant among the staff. Included private table-and-chair places for one or two people and features that would encourage a contemplative pedestrian walk along existing shortcuts. To encourage the benefits of the typical staff's very short exposure to the garden, archetypal landscape features-thresholds, contemplative paths, garden benches, a symbolic creek, and sacred springs-were arranged. (Naderi, 2008).

Peer reviewed / Empirical http://www.highbeam.com/doc/1P3-1703542301.html

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2008 *Ottosson, J., & Grahn, P. (2008). The role of natural settings in crisis rehabilitation: How does the level of crisis influence the response to experiences of nature with regard to measures of rehabilitation? Landscape Research, 33(1), 51-70.*

The results from a survey of 547 people showed that experiencing nature has a more powerful influence on the rehabilitation potential of people greatly affected by a crisis; taking a walk also has an influence, although not of equal importance; the social factor has more influence on the rehabilitation potential of people affected by a crisis to a low/moderate degree. During stays in natural settings, an interaction takes place between sensory stimulation, emotions and logical thought. (Ottosson. 2008).

Peer reviewed / Empirical http://www.agnesvandenberg.nl/crisis.pdf

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2005 *Sherman, S. A., Varni, J. W., Ulrich, R. S., & Malcarne, V. L. (2005). Post-occupancy evaluation of healing gardens in a pediatric cancer center. Landscape and Urban Planning, 73(2-3), 167-183.*

A study of 1,400 patients, visitors and staff at pediatric cancer center found, among other findings, that emotional distress and pain were lower for all groups when in the gardens than when inside the hospital. (Sherman, 2005)

Peer reviewed / Empirical http://www.sciencedirect.com/science?_ob=ArticleURL&_udi=B6V91-4F60NDR-2&_user=10&_coverDate=10%2F15%2F2005&_rdoc=1&_fmt=high&_orig=search&_origin=search&_sort=d&_docanchor=&view=c&_searchStrId=1582261290&_rerunOrigin=scholar.google&_act=C000050221&_vers

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2004 *Altimier, L. B. (2004). Healing environments: for patients and providers. Newborn & Infant Nursing Reviews, 4(2), 89-92.*

This review paper suggests that healing environments in hospitals can make a difference in how quickly a patient recovers. Research has shown that patients do experience a positive outcome in an environment that incorporates natural light, elements of nature, soothing colors, meaningful and varying stimuli, peaceful sounds, pleasant views, and a sense of beauty. (Altimier, 2004)

Peer Reviewed /Expert Opinion http://www.nainr.com/article/S1527-3369(04)00045-5/abstract

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2004 *Ulrich, R., Zimring, C., Quan, W., and Joseph, A. (2004). The Role of the Physical Environment in the Hospital of the 21st Century: A Once-In-A-Lifetime Opportunity. The Center for Health Design.*

This review paper suggests that mounting scientific evidence has shown that exposing patients to nature can produce substantial and clinically important alleviation of pain. According to distraction theory, pain requires considerable conscious attention. However, if patients become diverted by or engrossed in a pleasant distraction such as a nature view, they have less attention to direct to their pain, and the experienced pain therefore will diminish (Ulrich, et al., 2004).

Expert Opinion http://www.rwjf.org/files/publications/other/RoleofthePhysicalEnvironment.pdf

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2003 *Bowers, D.A. (2003). Incorporating restorative experiential qualities and key landscape attributes to enhance the restorative experience in healing gardens within health care settings. Unpublished master's action research project, Washington State University, Pullman, WA.*

There is a goal of enclosure of gardens in health care facilities. This will contain the peacefulness of the garden, and block out unwanted noise, especially in urban spaces. Enclosure can lead to the enhancement of positive stimulation or positive distraction. Enclosure also enhances sensory stimulation, which aids the user in controlling distractions. When water is included in a garden, it aids restoration due to the life sustaining properties in water. Still water with subtle movement is perceived as tranquil, and the sound of water is white noise that can disguise nearby noise. The spatial configuration of a garden should be easy to understand, with patterns and rhythm. Use plants that respond to the changing of seasons, and provide a harmonious contrast (Bowers, 2003).

Peer Reviewed / Background https://research.wsulibs.wsu.edu:8443/xmlui/bitstream/handle/2376/104/d_bowers_050703.pdf?sequence=1

2003 *Devlin, A. S., & Arneill, A. B. (2003). Health Care Environments and Patient Outcomes. Environment and Behavior, 35(5), 665-694.*

A literature review from Connecticut College identified several studies which confirmed the significance of art and natural views, as well as that views of nature have a stronger effect than art, and that views of nature reduce blood pressure and increase muscle relaxation, and can facilitate reactions to stress in as few as 5 minutes. (Devlin, 2003)

Background http://eab.sagepub.com/content/35/5/665.abstract

2002 *Davis, B.E. (2002). Healing the whole person: a post occupancy evaluation of the rooftop therapy park at Frot Sasnders Regional Medical Center. Knoxville, Tennessee. Unpublished master's action research project, Louisiana State University, Baton Rouge, LA.*

A case study was done at a rehabilitation center which provided surveys from patients and staff on the use and features of a healing garden in regard to physical therapy. Due to many hardscape features, it seems more like a landscape than a garden. An elevator from the attached hospital is used to access the garden in this case, but other methods of approach should be investigated. Centralizing a garden park will allow busy staff to use it, even if simply passing through. Regional and cultural aspects should be integrated into garden design (Davis, 2002).

Peer Reviewed / Background http://etd.lsu.edu/docs/available/etd-1207101-182907/unrestricted/Davis_thesis.pdf

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2001 *Whitehouse, S., Seid, M., Jacobs, J. R., Mehlenback, R. S., Varni, J. W., Ensberg, M. J., & Cooper-Marcus, C. (2001). Evaluating a children's hospital garden environment: Utilization and consumer satisfaction. Journal of Environmental Psychology, 21(3),*

A post occupancy evaluation conducted at a children's hospital found that adult garden users reported a more positive affect after visiting the garden (Whitehouse, et al, 2001).

Peer reviewed / Empirical http://www.ingentaconnect.com/content/ap/ps/2001/00000021/00000003/art00224

2001 *Whitehouse, S., Varni, J. W., Seid, M., Cooper-Marcus, C., Ensberg, M. J., & Jacobs, J. R. (2001). Evaluating a children's hospital garden environment: Utilization and consumer satisfaction. Journal of Environmental Psychology, 21(3), 301-314.*

The Leichtag Family Healing Garden at Children's Hospital and Health Center, San Diego was evaluated with a Post-Occupancy Evaluation (POE). Results from behavioral observations, surveys, and interviews indicated a number of benefits of the garden. The garden was perceived as a place of restoration and healing, and use was accompanied by increased consumer satisfaction. However, the garden was not utilized as often or as effectively as intended. Children, parents and many staff members recommended changes for the garden, such as the inclusion of more trees and greenery, and more interactive `things for kids to do'. In addition, the majority of family members surveyed throughout the hospital did not know about the garden. (Whitehouse, et al., 2001)

Peer reviewed / Empirical http://www.sciencedirect.com/science?_ob=ArticleURL&_udi=B6WJ8-45817SK-8&_user=10&_coverDate=09%2F30%2F2001&_rdoc=1&_fmt=high&_orig=search&_origin=search&_sort=d&_docanchor=&view=c&_searchStrId=1457010283&_rerunOrigin=google&_acct=C000050221&_version=1&_u

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2000 *Zeisel, J. (2000). Environmental design effects on Alzheimer symptoms in long term care residences. World Hospitals and Health Services, 36(3), 27-31*

In an expert opinion article, healing gardens were identified as a means to reduce the sense of confinement on an Alzheimer's unit (Zeisel, 2000).

Peer reviewed / Empirical http://www.ncbi.nlm.nih.gov/pubmed/11276941

1999 *Ulrich, R. S. (1999). Healing gardens: therapeutic benefits and design recommendations. Danvers: John Wiley & Sons.*

Stress in a hospital is a problem for patients, family, and other visitors, which directly affects health outcomes. Healing gardens offer a sense of control, social support, physical movement, and access to nature and positive distractions (Ulrich, 1999).

Background http://books.google.com/books?hl=en&lr=&id=YRY1WejQok8C&oi=fnd&pg=PA27&dq=effects+of+gardens+on+health+outcomes:+theory+and+research&ots=y8xYw5JLu5&sig=ioGLDw703JA2_pm02P01csqMYZA

1984 *Ulrich, R. S. (1984). View through a window may influence recovery from surgery. Science. 224 (4647), 420-1.*

In a retrospective chart review, postoperative patients with a view to a window had a shorter length of stay, took fewer pain medications and had more positive nursing notes than similar patients with a view to a brick wall (Ulrich, 1984).

Peer reviewed / Empirical http://www.ncbi.nlm.nih.gov/pubmed/6143402

1981 *Ulrich, R. S. (1981). Natural versus urban scenes: Some psychophysiological effects. Environment & Behavior, 13(5), 523-556.*

This study investigated psychological effects of viewing nature scenes vs. urban scenes. There was a consistent pattern for nature, especially water, to have more positive influences on emotional states. A salient finding was that water, and to a lesser extent vegetation views, held attention and interest more effectively than the urban scenes. Implications of the findings for theory development in environmental aesthetics are discussed (Ulrich, R.S., 1981).

Peer reviewed / Empirical http://eab.sagepub.com/content/13/5/523.short

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8. Maximize the simplicity and minimize the number of steps, and effort needed to approach, arrive, drop off, park, enter, and find one's destination. (ID: 2020)

Travel paths from arrival on site and parking to key clinic and inpatient areas to be short, direct, clear, and simple to help patients get to their destinations effortlessly, thus reducing stress.

LIMITED DIRECT EVIDENCE

DHB Domain: Basic Infrastructure **Lifecycle:** Design / Construction Execution

TMASurvey Result:

Principles Supported:

1 Provide patient and family-centered care

Core Dimensions Supported

1 Physical access and wayfinding

Research Summary:

Limited research supports value of parking and the ease of building access by patients and staff. Both the signs and visual access to the destinations influences how people initially enter the hospital. Some research suggests that visual environmental cues outweigh the verbal cues available on signs for a significant percentage of the sample (Carpman 1985, Tang 2009). For example, being able to see a parking deck entrance seemed to draw people to use it, despite signs directing them elsewhere (Carpman 1985).

Design Implications:

The first priority for clear wayfinding should be to create simple approach, access and movement pathways with visually distinctive and legible physical and spatial cues. Signs and visual environmental cues that lead to the hospital especially to and from the parking lot, must be considered carefully because they are the patient's first point of contact with the hospital (Ulrich,2008).

Metrics and Evaluation Approaches

1. Metric:

Simulation modeling required to show compliance of design with strategy.

2. Design Review Considerations:

Plan review and mapping analysis that identifies the number and sequence of distinct path elements from arrival on site and parking to key clinic and inpatient areas for path complexity, distance, decision points, spatial cues and landmarks, directional information, etc.

- Design team to submit annotated plan diagram[s] at S3-4 review with path sequence, distances, and critical decision nodes such as entry points, waiting areas, elevator lobbies, corridor intersections, check-in/reception, other information points and landmarks. [see reference diagram 2020.1]
- Design team can submit lighting plans of travel paths if lighting is used to help directing and clarifying travel paths.
- Design team can submit annotated plan diagram[s] at S3-4 review showing clearly marked entrances and drop-off areas with signage, architectural features
- Design team can submit annotated parking plan diagram[s] at S3-4 review showing marked lanes, signage, lighting which clarify path leading to main building entrances

3. Potential Mockup/Prototype/Simulations:

Virtual reality and/or simulation study of critical arrival and movement sequences.

4. Proposed POE Information Collection Options:

Archival Take-off

- Identify main entry points and departmental/clinical service area entry
- Identify circulation pathways for public, patients, staff and services to each department/clinical service area
- Identify front and back of house circulation
- Identify decision points, travel distance and time to departmental reception points from main entry
- Identify arrival sequence to departments – location on parking/drop-off, entry, reception, wait, patient care and exit

Walk Through

- Confirm main entry points to facility and departments/clinical service area
- Confirm circulation pathways for public, patients, staff, and services to each department/clinical service area
- Confirm front and back of house circulation
- Confirm presence of escorts or concierge services and main entry
- Confirm decision points, travel distance and time to departmental reception points from main entry
- Confirm arrival sequence to departments – location on parking/drop-off, entry, reception, wait, patient care and exit
- Document visual cues and landmarks or obstacles on path from main entry to department reception points

Photo Documentation

- Document arrival drive, main entry drop-off, information desk, arrival lobby/atrium, admissions area, corridors, vertical circulation elements, corridor intersections, landmarks, wayfinding cues.
- Document visual cues and landmarks or obstacles on path from main entry to department reception points

Survey/Interview Questions [satisfaction with]:

- Locating parking close to the facility
- Accessing facility from parking
- Distance to travel to destination from drop-off or entrance

5. Post Occupancy – Focused Research Options:

Study of patients, visitors and staff way finding based on the work of Kevin Lynch on legibility of the physical environment documented in The Image of the City.

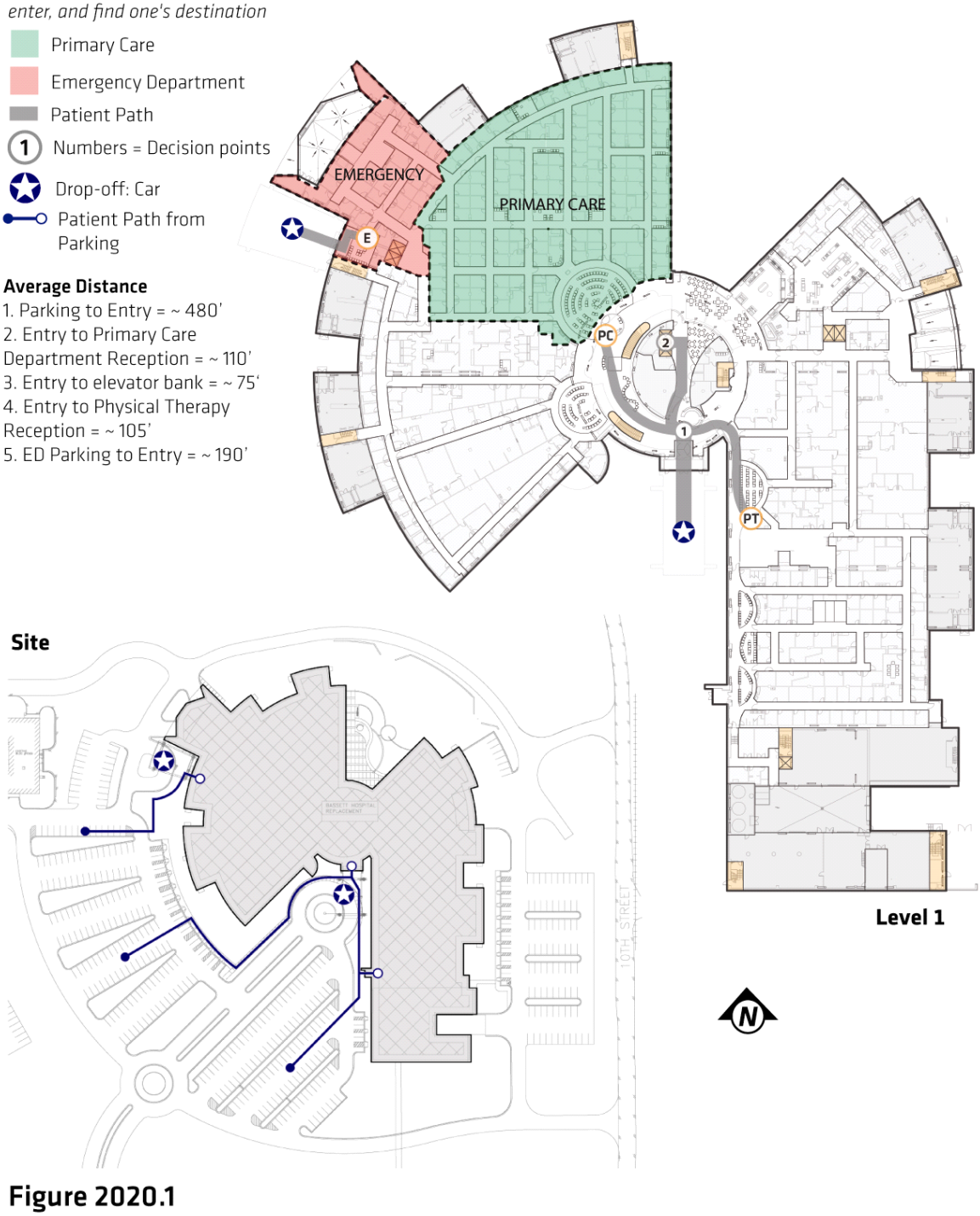

Figure 2020.1

References:

2009 *Tang, C. H., Wu, W. T., & Lin, C. Y. (2009). Using virtual reality to determine how emergency signs facilitate way-finding. Applied Ergonomics, 40(4), 722-730.*

In this study, virtual reality was used to compare wayfinding behavior in three scenarios - one without emergency signs, another with an old-version emergency sign, and the third with a new-version emergency sign with 107 subjects. These findings indicate that signs do help way-finding greatly. In addition, when faced with both an emergency direction sign and an exit door, almost half of the subjects (42% of the participants) were chosen to take the door instead of following the direction posted on the sign. (Tang, 2009)

Peer reviewed / Empirical http://www.ncbi.nlm.nih.gov/pubmed/18708182

2008 *Ulrich, R.S. et al, (2008). A Review of the Research Literature on Evidence Based Healthcare Design. Herd-Health Environments Research & Design Journal, 1(3), 61-125.*

A review article discussed the topic of wayfinding and accessibility to hospitals. Signs and cues that lead to the hospital, especially to the parking lot, must be considered carefully because they are the patient's first point of contact with the hospital. (Ulrich,2008)

Peer Reviewed /Expert Opinion http://smartech.gatech.edu/xmlui/handle/1853/25676

1985 *Carpman, J., Grant, M. A., & Simmons, D. A. (1985). Hospital design and wayfinding: A video simulation study. Environment and Behavior, 17(3), 296-314.*

The study conducted a video simulation study to assess the driving turning behavior of 100 visitors to a new hospital. The results showed that the presence of the entrance to the deck from the drop-off circle did make a significant difference in reported turning behavior. 37% of the respondents said that they would turn into the drop circle when they could see the entry to the garage, ignoring the signs. (Carpman, 1985)

Peer reviewed / Empirical http://eab.sagepub.com/content/17/3/296.abstract

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9. Provide patient and family comfort and control over the environment in the patient room. (ID: 55)

Provide means for patients to control the room temperature, lighting (including window shades), TV, and other environmental amenities provided from their bed.

INDIRECT SUPPORTING EVIDENCE

DHB Domain: Basic Infrastructure **Lifecycle:** Design / Construction Execution

TMASurvey Result: Top 2 and 3 items for both AD and FM (control of lighting, control of room temperature). Internet access was also frequently mentioned.

Principles Supported:

1 Provide patient and family-centered care

Core Dimensions Supported

2 Patient and family privacy, comfort and control

Research Summary:

Limited evidence supports the optimization of patient and family comfort and control in the patient room and other spaces. Studies suggest (but do not empirically demonstrate) that increased patient and family control over the environment can (expert opinion) improve patient outcomes, including reduced stress, depression and lengths of stay.

Design Implications:

It is important to provide the bed-ridden patient with controls at the bedside for lighting, entertainment, HVAC, window shades, etc.), in addition to the standard nurse call and tv remote control. Wireless and telephone access or both patient and family are both critical ways that the patient and family can maintain control over their environment. Another way to control the environment, especially in long-term patients, is to provide ways for patients and families to personalize the room. Consideration can also be given to providing opportunities for the patient to order food when hungry, rather than on a hospital schedule.

Metrics and Evaluation Approaches

1. Metric:

100% compliance in patient rooms with exceptions noted.

2. Design Review Considerations:

Plan review for easy patient and family access to controls for natural and artificial lighting, thermal comfort, acoustical privacy and/or sound levels, and information in the patient room.
Plan review for adequate space for programmed patient/family activities, furniture arrangement, storage of personal items, etc. in the patient room.

- Design team to submit labeled plan of patient room at S3-S4 review that indicate the location and layout of the following items within reach of patient in bed and/or family members in family or general access areas to include: movable furnishings for use by patient and family, built in furnishings and millwork for use by patients and family, cubicle curtain and door position, thermostat, window covering controls, light switches, A/V controls, telephone, internet access points and controls. [See reference figure 55.1]

3. Potential Mockup/Prototype/Simulations:

Provide a mock-up or prototype that allows the usability evaluation of location and layout of the following items within reach of patient in bed and/or family members in the family or general access areas to include: movable furnishings for use by patient and family, built in furnishings and millwork for use by patients and family, thermostat, window covering controls, light switches, A/V, telephone and internet access points.

4. Proposed POE Information Collection Options:

Archival Take-off

- Identify location and layout of single patient rooms
- Identify the location and type of privacy accommodations in patient rooms - door or curtain
- Identify the location and type of patient/family controlled attributes in room (light, HVAC, entertainment, remote controls, other);

Walk Through

- Confirm the location and type of patient/family controlled attributes in room (light, HVAC, entertainment, remote controls, other);
- Confirm the location and type of privacy accommodations in patient rooms - door or curtain

Photo Documentation

- Document the layout of single patient rooms
- Document the location and type of privacy accommodations in patient rooms - door or curtain
- Document the location and type of patient/family controlled attributes in room (light, HVAC, entertainment, remote controls, other);

Staff Survey/Interview Questions [satisfaction with]:

- Ability to control environmental conditions, e.g. temperature, in rooms where patients receive care

Staff Survey/Interview open ended questions:

- Is there sufficient privacy in the patient care area (both visual and auditory)? Please explain.
- Do the patients and families in the facility have adequate control over the environmental conditions such as temperature and lighting? If no, what could be done to improve this?

5. Post Occupancy – Focused Research Options:

Patient stress, length of stay and outcome measures

- Patient/family satisfaction survey
- Sensor monitoring of environmental conditions such as temperature, lighting, acoustics, etc.

Strategy 55: *Patient/Family Comfort and Control*

Plan review for easy patient and family access to controls for natural and artificial lighting, thermal comfort, acoustical privacy and/or sound levels, and information in the patient room

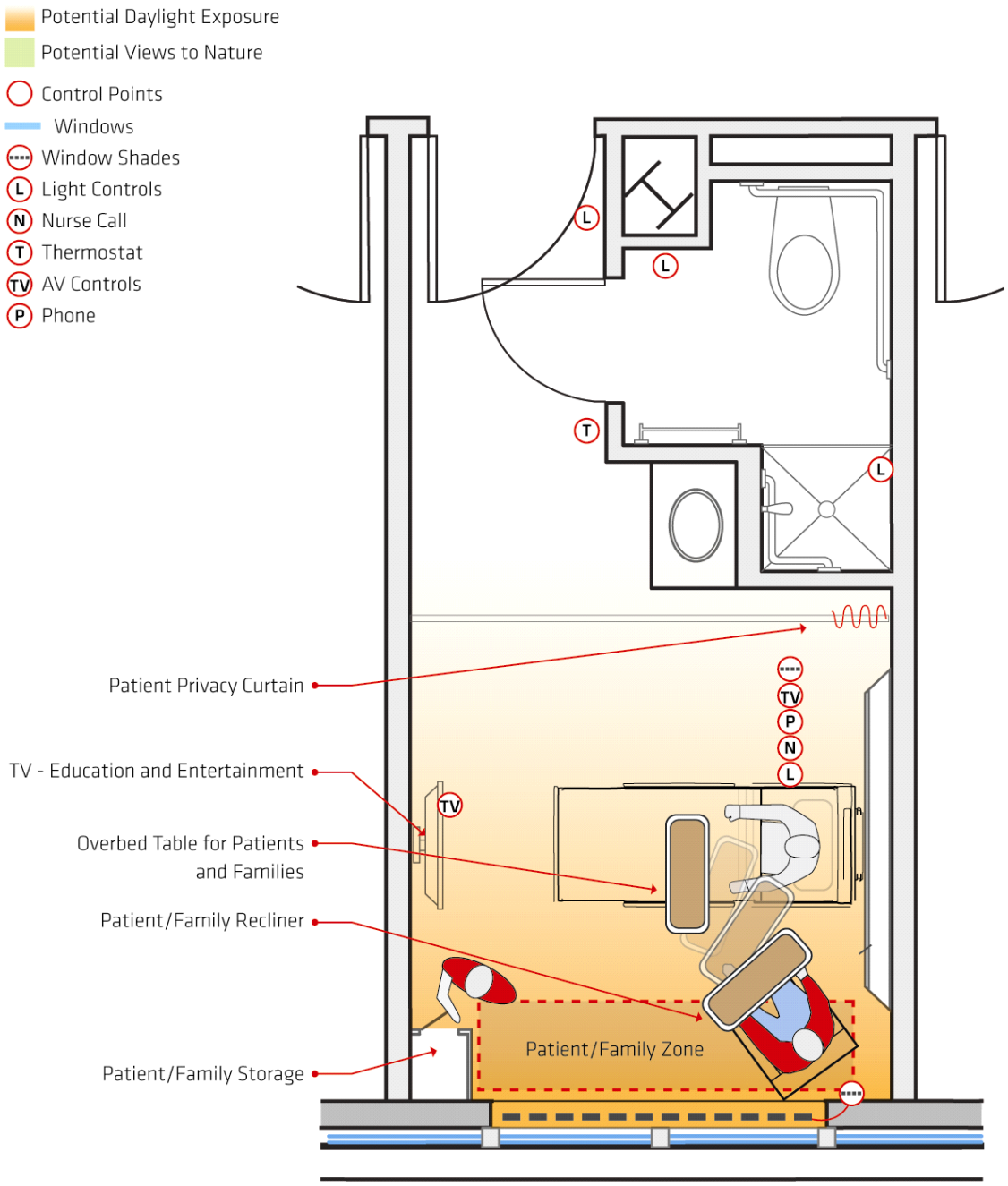

Figure 55.1

References:

2010 *Altringer, B. (2010). The emotional experience of patient care: a case for innovation in health care design. J Health Serv Res Policy, 15(3), 174-177.*

A review of the literature in healthcare facility design and psychology concludes that the evidence supports design interventions resulting in improvements in patient and staff experience of care, as well as reduction in patient stress, and in some cases, patient outcomes. (Altringer, 2010)

Peer Reviewed /Expert Opinion http://jhsrp.rsmjournals.com/cgi/content/abstract/15/3/174

2009 *Samuels, O. (2009). Redesigning the neuro critical care unit to enhance family participation and improve outcomes. Cleveland Clinic Journal Of Medicine, 76 Suppl 2, S70-S74.*

To support family involvement, a neurological intensive care unit provided family zone in patient room, kids' room, lockers and showers, and family quiet room (Samuels, 2009).

Peer Reviewed /Expert Opinion http://www.ccjm.org/content/76/Suppl_2/S70.abstract

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2007 *Press Ganey, Inc. (2007). Hospital pulse report: Patient perspectives on American health care.*

Press Ganey Associates,Inc., the health care industry's leading provider of measurement andimprovement services, unveils the 2007 Hospital Pulse Report: Perspectiveson American Health Care at the 2007 World Health Care Congress inWashington, DC.

Empirical http://www2.prnewswire.com/cgi-bin/stories.pl?ACCT=104&STORY=/www/story/04-24-2007/0004572157&EDATE=

2005 *Douglas, C. H., & Douglas, M. R. (2005). Patient-centred improvements in health-care built environments: perspectives and design indicators. [Article]. Health Expectations, 8(3), 264-276.*

Through questionnaires, autographic interviews, and focus groups, an NHS study in England showed that patients perceived sustainable healthcare environments to be supportive of their health and recovery. Additionally, they preferred residential designs which supported normal lifestyles and family centered care, and were supportive of accessibility and transition. (Douglas & Douglas, 2005)

Peer Reviewed /Expert Opinion http://onlinelibrary.wiley.com/doi/10.1111/j.1369-7625.2005.00336.x/abstract

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10. Design patient room with family zone to support family involvement in care delivery (ID: 2001)

Provide dedicated space for family members that includes amenities for their respite and communication such as a comfortable sleeping chair, visitor chair(s), desk, individually controlled lighting and access to technology (wireless internet, TV, phone).

LIMITED DIRECT EVIDENCE

DHB Domain: Basic Infrastructure **Lifecycle:** Design / Construction Execution

TMASurvey Result: Number 1 item for both AD and FM

Principles Supported:

1 Provide patient and family-centered care

Core Dimensions Supported

3 Patient and family Involvement in Care Decisions

Research Summary:

Empirical research has not examined the relationship of family presence or involvement with room type or design. In addition, we are aware of several unpublished studies that are under development and examine effects of family space in patient rooms. Current studies suggest that private rooms are better than multi-occupancy rooms in supporting and accommodating family members and visitors.

Design Implications:

Private rooms and designated space for families are expected to promote family involvement in care and improve patient and family satisfaction. Patient rooms and other areas can be designed with certain patient and family centered care model such as the Relationship –Based Care Model in mind to encourage family involvement and improve satisfaction.

Metrics and Evaluation Approaches

1. Metric:

100% compliance with specifications shown in Diagram 2001.1

2. Design Review Considerations:

Plan review for adequate space, furnishings and room features for at least 3 family members to stand or sit, and one family member to sleep in the room outside of necessary clinical care zone around all sides of the patient bed. Also review the location and type of family amenities provided in the room.

- Design team to submit at the S3-4 review plans/diagram[s] to scale illustrating and annotating the ability of room to accommodate three visitors seated or standing around the bed, and accommodations for one family member to sleep overnight outside of the patient care zone around the bed. Also illustrate the location and type o amenities designed for family accommodation in the room. [Refer to Figure 2001 as example]

3. Potential Mockup/Prototype/Simulations:

Human factors usability simulation study conducted in room mock-up or design prototype on ability to accommodate family members without increasing the number of care providers, task time, error rate and effort needed to accommodate critical care scenarios for planned range of acuity levels

4. Proposed POE Information Collection Options:

Archival Take-off
- Identify patient zone and family zone in patient room
- Identify family amenities (furnishings, controls)

Walk Through
- Confirm patient zone and family zone in patient rooms
- Confirm the location and type of family amenities

Photo Documentation
- Document the patient zone and family zone in patient rooms
- Document the location and type of family amenities

Staff Survey/Interview Questions [satisfaction with]:
- Ability to move around patient care room
- Ability for patients to be involved in the delivery of care
- Layout of the patient room to accommodate family during day visits
- Layout of the patient room to accommodate family during overnight stays
- Layout of patient room to promote communication between staff and patients/families
- Comfort of family accommodations in rooms

5. Post Occupancy – Focused Research Options:

In-depth Patient/Family/Staff surveys with questions related to accommodations for family and family involvemen in care delivery.
- Accommodations for family and family involvement in care delivery.
- Accommodations for overnight rooming in by family members
- Accommodations for visitation in the patient room
- Conflicts between family accommodations/visitation/rooming-in and patient care delivery
- Measures of utilization of family amenities and overnight stays in patient rooms

Strategy 2001: *Patient Room Family Accommodations*

Design patient room with family zone to support family involvement in care delivery.

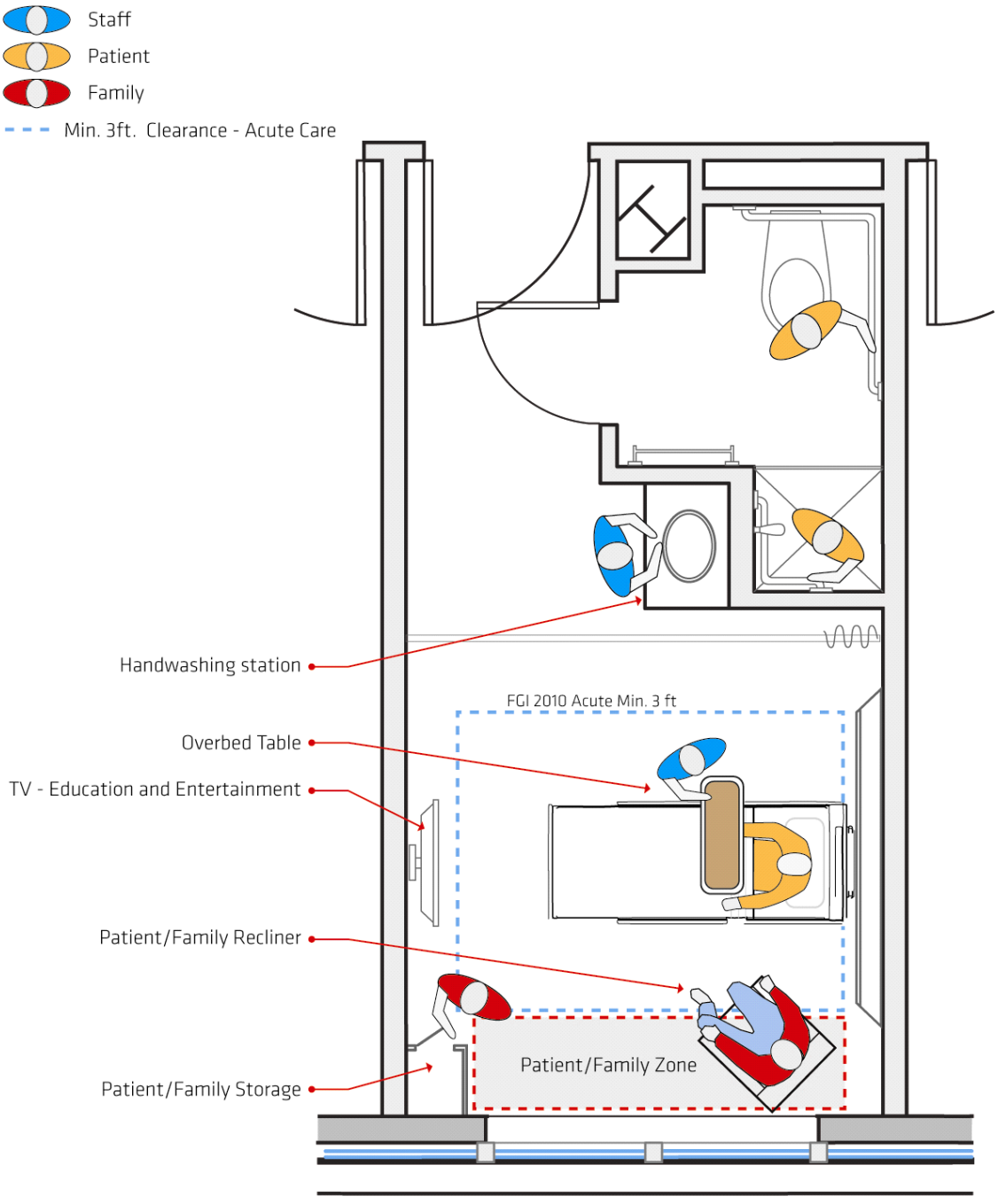

Figure 2001.1

References:

2010 *Annonio, D., Graham, J., & Ross, R. (2010). Using an Acuity-Adaptable Unit for Urological Services. Urologic Nursing, 30(4), 223-251.*

With proper accommodation and amenities for family members in patient room, the Relationship-Based Care Model might be implemented with patient and family as the center core for care surrounded by the multidisciplinary team of nursing, medicine, and ancillary staff. In fact, the unit with such model and setting had better patient satisfaction score (Annonio, 2010).

Peer Reviewed /Expert Opinion http://www.ncbi.nlm.nih.gov/pubmed/20949806

2009 *Samuels, O. (2009). Redesigning the neuro critical care unit to enhance family participation and improve outcomes. Cleveland Clinic Journal Of Medicine, 76 Suppl 2, S70-S74.*

To support family involvement, a neurological intensive care unit provided family zone in patient room, kids' room, lockers and showers, and family quiet room (Samuels, 2009).

Peer Reviewed /Expert Opinion http://www.ccjm.org/content/76/Suppl_2/S70.abstract

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2006 *Chaudhury, H., Mahmood, A., & Valente, M. (2006). Nurses' perception of single-occupancy versus multi occupancy rooms in acute care environments: an exploratory comparative assessment. Applied Nursing Research: ANR, 19(3), 118-125.*

In survey of 77 nurses in the states of Washington and Oregon, 51% of nurses mentioned that private rooms are helpful for family space (Chaudhury, 2006).

Peer reviewed / Empirical http://www.nursingconsult.com/das/journal/view/230078968-2/N/16370908?issn=08971897&_returnURL=http://linkinghub.elsevier.com/retrieve/pii/S0897189706000462?showall=true&ja=541976&ANCHOR=text&PAGE=1.html

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2005 *Chaudhury, H., Mahmood, A., & Valente, M. (2005). Advantages and disadvantages of single- versus multiple-occupancy rooms in acute care environments: A Review and Analysis of the Literature, Environment & Behavior.*

Private rooms compared to multi-occupancy rooms are easier to provide family members and visitors with a comfortable and quiet placeto wait and to stay overnight, a place to be alone, and a place with access to patient information (Chaudhury, 2005)

Peer Reviewed /Expert Opinion http://eab.sagepub.com/content/41/6/755.short

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1987 *Sallstrom, C., Sandman, P. O., & Norberg, A. (1987). Relatives' experience of the terminal care of long-term geriatric patients in open-plan rooms. Scandinavian Journal of Caring Science, 1(3-4), 133-140.*

Patient and family in multi-occupancy rooms might experience restrictions in their interactions and more likely to have limited visiting hours (Sallstrom, 1987).

Peer Reviewed /Expert Opinion http://www.ncbi.nlm.nih.gov/pubmed/3128852

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11. Provide positive distractions in all clinical and public spaces. (ID: 81)

In all public spaces (lobby, waiting area, cafeteria, ..) and clinical spaces (patient rooms, exam rooms,..), provide positive distractions such as artwork, windows with views to nature, reading material, technology (televisions, wireless network,..), and seating arrangements that provide quiet respite to improve the quality of the waiting and healing experience.

SUFFICIENT DIRECT EVIDENCE

DHB Domain: Basic Infrastructure **Lifecycle:** Design / Construction Execution

TMASurvey Result:

Principles Supported:

1 Provide patient and family-centered care

Core Dimensions Supported

4 Therapeutic and comfortable interiors

Research Summary:

There is strong evidence demonstrating positive distraction is correlated with reduced stress for both patients and staff, and shorter lengths of stay. The two specific areas of positive distraction which have been researched and shown to be significant are views of nature (alone and with nature sounds) and artwork. One of the first evidence-based design studies was done by Roger Ulrich demonstrating that patients with views of nature utilized less pain medication and had a more positive demeanor. Subsequent studies have added the reduction in stress and length of stay as an additional benefit. Artwork can also be beneficial, however studies have suggested that modern or jarring representations can have a negative effect and should be avoided.

Design Implications:

Designs should provide patients and staff with positive distractions in the form of views to nature and positive artwork throughout the clinical and public spaces. Nature views seem to have a beneficial effect across a variety of populations. Artwork should be carefully selected to be calming and relatively soothing. Nature themes in art are a logical, stress-reducing, choice.

Metrics and Evaluation Approaches

1. Metric:

Improvement in responses to a specific patient satisfaction survey question (to be identified).

2. Design Review Considerations:

Confirm proximity and easy access from all clinical and public spaces to visual and physical connections to exterior and/or interior nature features, appropriate places/settings for visual art installations, opportunities for live music and performance, spaces for quiet reflection, food, etc.

- Design team to submit plans indicating visual and physical access to positive distractions as appropriate and identified above from all clinical and public spaces at S3-4 review.

4. Proposed POE Information Collection Options:

Archival Take-off

- Identify the location and type views of nature and other positive distractions

Walk Through

- Confirm the location and type of works of art and other positive distractions

Photo Documentation

- Document the type of views and access to nature, works of art and other positive distractions

Staff Survey/Interview Questions [satisfaction with]:

- Positive visual distractions, e.g. views to nature, artwork

5. Post Occupancy – Focused Research Options:

- Controlled studies on patient need for pain medication and measures of stress in clinical spaces - compared wit hospitals with fewer positive distractions.
- Controlled studies on staff turnover, burnout and stress - compared with hospitals with fewer positive distractions.

References:

2010 *Cusack, P., Lankston, L., & Isles, C. Impact of visual art in patient waiting rooms: survey of patients attending a transplant clinic in Dumfries. JRSM Short Reports, 1(6).*

In a renal transplant clinic in Dumfries, Scotland, 39 waiting room patients responded positively to the artwork, and expressed a preference for nature scenes and paintings of animals (84%) versus abstract paintings (27%) or portraits (24%). (Cusack, 2010)

Peer reviewed / Empirical http://shortreports.rsmjournals.com/content/1/6/52.abstract

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2009 *Kline, G. A. (2009). Does A View of Nature Promote Relief From Acute Pain? Journal of Holistic Nursing, 27(3), 159-166.*

A review of four studies which had evaluated natural views and sounds as distracting stimuli in response to acute pain situations, found that each study measured statistically significant results showing a relief from acute pain for both natural views and for natural sounds. Additionally, each of the studies also showed that the combination of natural sights and sounds for positive distraction was greater than either one individually. (Kline, 2009)

Background http://jhn.sagepub.com/content/27/3/159.abstract

2007 *Suter, E., & Baylin, D. (2007). Choosing art as a complement to healing. Applied Nursing Research, 20(1), 32-38.*

A study of 37 oncology patients allowed to self-select art, concluded that art improved the patient's quality of life by facilitating interaction with patients & visitors and providing a positive distraction (Suter, 2007)

Peer reviewed / Empirical http://www.appliednursingresearch.org/article/S0897-1897(06)00129-7/abstract

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2006 *Lohr, V. I., & Pearson-Mims, C. H. (2006). Responses to Scenes with Spreading, Rounded, and Conical Tree Forms. Environment and Behavior, 38(5), 667-688.*

In academic study of 206 participants, participants viewing images of trees were found to have statistically significantly more positive emotions, then those participants who viewed images of inanimate objects. Additionally they found participants had a small preference for spreading trees, as opposed to trees with conical or round shaped canopies. (Lohr, 2006)

Peer reviewed / Empirical http://eab.sagepub.com/content/38/5/667.abstract

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2006 *Shepley, M. M. (2006). The role of positive distraction in neonatal intensive care unit settings. [Article]. Journal of Perinatology, 26, S34-S37.*

A literature review regarding positive distraction and stress in the neonatal intensive care unit revealed that several factors in the physical environment can contribute to positive distraction and reduce stress, among the most significant: nature, art, and music. (Shepley, 2006)

Empirical http://www.nature.com/jp/journal/v26/n3s/full/7211584a.html

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2004 *Park, S.-H., Mattson, R.H. and Kim, E. (2004). PAIN TOLERANCE EFFECTS OF ORNAMENTAL PLANTS IN A SIMULATED HOSPITAL PATIENT ROOM. Paper presented at the ISHS Acta Horticulturae 639: XXVI International Horticultural Congress: Expanding Roles for Horticulture in Improving Human Well-Being and Life Quality*

In a simulated Hospital patient room, 90 female university students showed an increased pain tolerance time, as well as lowered electrodermal activities in the presence of ornamental plants. The effect for flowering plants was greater than that for foliage only plants. (Park, 2004)

Peer Reviewed / Background http://www.actahort.org/books/639/639_31.htm

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2003 *Devlin, A. S., & Arneill, A. B. (2003). Health Care Environments and Patient Outcomes. Environment and Behavior, 35(5), 665-694.*

A literature review from Connecticut College identified several studies which confirmed the significance of art and natural views, as well as that views of nature have a stronger effect than art, and that views of nature reduce blood pressure and increase muscle relaxation, and can facilitate reactions to stress in as few as 5 minutes. (Devlin, 2003)

Background http://eab.sagepub.com/content/35/5/665.abstract

2003 *Diette, G. B., Lechtzin, N., Haponik, E., Devrotes, A. and Rubin, H.R. (2003). Distraction therapy with nature sights and sounds reduces pain during flexible bronchoscopy: A complementary approach to routine analgesia. Chest 123(3): 941-948.*

Distraction therapy with nature sights and sounds significantly reduces pain in patients undergoing Flexible Bronchospy. (Diette, 2003)

Peer reviewed / Empirical http://chestjournal.chestpubs.org/content/123/3/941.full

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2003 *Diette, G. B., Lechtzin, N., Haponik, E., Devrotes, A. and Rubin, H.R. (2003). Distraction therapy with nature sights and sounds reduces pain during flexible bronchoscopy: A complementary approach to routine analgesia. Chest, 123(3), 941-948.*

This study focused on 80 adult patients undergoing bronchoscopy with conscious sedation. Their findings sugguest that distraction therapy with nature sights and sounds significantly reduces pain in patients undergoing FB. Although the precise mechanism of this beneficial effect requires further investigation, clinicians should consider this nonintrusive strategy in addition to standard analgesic medications in patients undergoing painful, invasive procedures (Diette, G.B. et al, 2003).

Peer reviewed / Empirical http://chestjournal.chestpubs.org/content/123/3/941.abstract

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2003 *Diette, G. B., Lechtzin, N., Haponik, E., Devrotes, A., & Rubin, H. R. (2003). Distraction Therapy With Nature Sights and Sounds Reduces Pain During Flexible Bronchoscopy*. Chest, 123(3), 941-948.*

In a randomized controlled trial involving 80 adult patients at a teaching hospital in Baltimore Maryland, patients receiving natural sights and sounds were found to have produced a significant reduction in patient pain during a flexible bronchoscopy. (Deitte, 2003)

Peer reviewed / Empirical http://chestjournal.chestpubs.org/content/123/3/941.abstract

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1991 *Ulrich, R. S. (1991). Effects of interior design on wellness: Theory and recent scientific research. Journal of Health Care Interior Design, 3, 97-109.*

Research suggests that healthcare environments will support coping with stress and promote wellness if they are designed to foster: 1. sense of control, 2. access to social support, and 3. access to positive distractions. Further, environments should not expose patients to negative distractions The most effective positive distractions include visual images, such as happy, laughing or caring faces, animals, and natural elements such as trees, plants, and water. It was also noted that patients preferred representational pictures over abstract works (Ulrich, 1991).

Peer Reviewed /Expert Opinion http://www.majorhospitalfoundation.org/pdfs/Effects%20of%20Interior%20Design%20on%20Wellness.pdf

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1981 *Ulrich, R. S. (1981). Natural versus urban scenes: Some psychophysiological effects. Environment & Behavior, 13(5), 523-556.*

This study investigated psychological effects of viewing nature scenes vs. urban scenes. There was a consistent pattern for nature, especially water, to have more positive influences on emotional states. A salient finding was that water, and to a lesser extent vegetation views, held attention and interest more effectively than the urban scenes. Implications of the findings for theory development in environmental aesthetics are discussed (Ulrich, R.S., 1981).

Peer reviewed / Empirical http://eab.sagepub.com/content/13/5/523.short

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12. Create a therapeutic interior to create a healing environment. (ID: 154)

Create therapeutic interiors by: controlling negative distractions such as noise and odors; providing non-institutional interior lighting, finishes, details and furnishings, and providing access to nature, art, and music.

LIMITED DIRECT EVIDENCE

DHB Domain: Basic Infrastructure **Lifecycle:** Design / Construction Execution

TMASurvey Result:

Principles Supported:

1 Provide patient and family-centered care

Core Dimensions Supported

4 Therapeutic and comfortable interiors

Research Summary:

Limited evidence exists for the benefits of therapeutic interiors in general hospital settings. While there is a considerable amount of research on the effect of therapeutic environments on patient well-being and satisfaction, most articles focus on older people or people with dementia.

Design Implications:

Three main design strategies for creating therapeutic interiors are: 1) access to positive distractions including art, music, and other soothing design elements (such as: colors, pattern design on walls, glass,…); 2) providing a degree of control to users of the space (e.g., through small unit size or appropriate access to care staff); and 3) eliminating negative distractions.

Metrics and Evaluation Approaches

1. Metric:

Improvement in responses to a specific patient and staff satisfaction survey questions focused on the character of the physical environment overall and specific elements such as art, lighting, interior finishes and furnishings.

2. Design Review Considerations:

Plan and specification review to determine the provision of non-institutional interior lighting, finishes, details and furnishings, and spaces for the potential display of art.

- Design team to submit annotated facility and departmental plans at S3-4 review identifying the above criteria and elements designed to create a healing environment

4. Proposed POE Information Collection Options:

Archival Take-off

- Identify the location and nature of therapeutic interior finishes, furnishings and design features.
- Identify the location and nature of interior nature elements or features [water, planting areas, sunrooms] in atria, lobbies, waiting rooms, corridors and other interior spaces.

Walk Through

- Confirm the location and nature of therapeutic interior finishes, furnishings and design features.
- Confirm the location and nature of interior nature elements or features [water, planting areas, sunrooms] in atria, lobbies, waiting rooms, corridors and other interior spaces.

Photo Documentation

- Document the nature of therapeutic interior finishes, furnishings and design features.
- Document the nature of interior nature elements or features [water, planting areas, sunrooms] in atria, lobbies waiting rooms, corridors and other interior spaces.

Staff Survey/Interview Questions [satisfaction with]:

- Positive interior visual distractions
- No negative distractions
- Therapeutic feel of rooms where patients receive care

5. Post Occupancy – Focused Research Options:

Review for incorporation of therapeutic visual and/performing arts program[s].

- Patient, family staff satisfaction surveys with questions focused on the character of the physical environment overall and specific elements such as art, lighting, interior finishes and furnishings

References:

2010 *Smith, R. & Watkins, N. (2010) Therapeutic Environments. Therapeutic Environments Forum, AIA Academy of Architecture for Health.*

A healthcare environment is therapeutic when it does all of the following: supports clinical excellence in the treatment of the physical body; supports the psycho-social and spiritual needs of the patient, family, and staff; produces measurable positive effects on patients' clinical outcomes and staff effectiveness. In general, therapeutic environments have been proven to be cost-effective by improving patient outcomes, reducing length of stay, and by enhancing staff satisfaction, recruitment, and retention (Smith & Watkins, 2010).

Expert Opinion http://www.wbdg.org/resources/therapeutic.php

2006 *Karlin, B. E., & Zeiss, R. A. (2006). Best practices: Environmental and therapeutic issues in psychiatric hospital design: Toward best practices. Psychiatric Services, 57(10), 1376-1378.*

In a literature review of environmental and therapeutic issues in psychiatric hospital design, the authors suggested reducing the institutional feel of the facility and incorporating a homelike environment whenever possible. This type of atmosphere has been associated with enhanced emotional and intellectual well-being and improved patient behavior. Additionally, research has revealed that people preferred familiar rooms over decorative or stylish rooms. Upholstered furniture should be included whenever feasible (Karlin & Zeiss, 2006).

Peer Reviewed /Expert Opinion http://ps.psychiatryonline.org/cgi/content/full/ps;57/10/1376

2003 *Stern, A. L., MacRae, S., Gerteis, M., Harrison, T., Fowler, E., Edgman-Levitan, S., Walker, J., Ruga, W. (2003). Understanding the consumer perspective to improve design quality. Journal of Architectural and Planning Research, 20(1), 16-28.*

Through focus groups, patients and family members described quality of experience as improved in built environments that 1) facilitate connection to staff, 2) are conducive to well-being, 3) are convenient and accessible, 4) are caring for family, 5) protect confidentiality and privacy, 6) are considerate of impairments, 7) facilitate connection to the outside world, and 8) are safe and secure (Stern et al., 2003).

Peer reviewed / Empirical http://japr.homestead.com/files/STERN.pdf

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2000 *Day, K., Carreon, D., & Stump, C. (2000). The therapeutic design of environments for people with dementia: A review of the empirical research. Gerontologist, 40(4), 397-416.*

In a review on the therapeutic design of environments for people with dementia, the authors suggested providing small-size units, separating non-cognitively impaired residents from people with dementia, and moderating levels of environmental stimulation (Day, Carreon, & Stump, 2000).

Peer Reviewed /Expert Opinion http://www.ncbi.nlm.nih.gov/pubmed/10961029

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13. Provide the infrastructure to support the interoperability and usability among all information technology platforms. (ID: 56)

Provide the infrastructure to support the interfaces and interconnections between all information systems so that information can be shared between systems.

GENERAL EVIDENCE

DHB Domain: Basic Infrastructure **Lifecycle:** Design / Construction Execution

TMASurvey Result:

Principles Supported:

1 Provide patient and family-centered care
4 Improve operational effectiveness
8 Design for maximum flexibility, standardization & growth

Core Dimensions Supported

12 Access to essential/vital information and education
15 Standardization
16 Adaptability, flexibility and future planning

Research Summary:

Published evidence directly supports the strategy of providing infrastructure to support interoperability across all medical and information technology platforms, especially between DoD and VA. There is wide consensus on the increasing importance of interoperable technology in health care settings. However, it appears physical infrastructure impacting design has not been a focus of research thus far. Many articles on interoperability indicated that data structure, organizational issues, and work process issues are impediments to interoperability. However, there was no mention of the physical environment. Further, in these articles, "infrastructure" refers only to information technology organization and not to anything that comes under the purview of building design.

However, research does indicate emerging trends in interoperability. These include:
1. the rise of wireless technology, which has demonstrated positive impact on user satisfaction (Tseng, 2007), and
2. the increasing potential for ubiquitous computing in health care settings (Bardram, retrieved 12-17-2010).

Design Implications:

Good-sense measures should be taken to ensure there is flexibility and space, configured both horizontally, vertically and in closets, for telecommunications in healthcare designs (e.g., designing in a 20-30% surplus of wiring and Information and Computer Technologies (ICT)). Further, designers should investigate the space and wiring needs of Wireless Local Area Networks. Somewhat counter-intuitively, such wireless networks require both wired and wireless components. Designers should also investigate the potential for ubiquitous computing in hospitals. Ubiquitous computing is, by definition, about embedding computers in everyday objects, such as a computers integrated into hospital beds. Space requirements associated with ubiquitous computing may be no more than for typical settings, but this should be investigated on a case-by-case basis. In addition to mobility and interoperability, places to display data and share data are of particular importance in ubiquitous computing. Building in the potential for wireless and ubiquitous computing should be considered, even if the client is not ready to implement such technologies, as the client may decide to adopt such technologies at some future point in the lifecycle of the building.

Metrics and Evaluation Approaches

1. Metric:

Interoperability of critical administrative and clinical information systems within the facility as defined by the leadership.

2. Design Review Considerations:

Review plans and specifications submitted by design team to verify the scope, location and layout of data infrastructure [data ports, cable trays, wireless systems, IT closets, etc.] to accommodate integrated data systems throughout the facility.
[Note: compliance with this strategy will involve a rapidly evolving set of target specifications and needs to be established and updated by IT experts in the MHS or external consultants at the time of project scoping]

- Design team to submit architectural, electrical and IT/data plans and specifications at S3-6 phase[s]

4. Proposed POE Information Collection Options:

Archival Take-off
- Identify location and type of information access point or access to computers in patient care and staff work areas
- Identify range of access to wireless

Walk Through
- Confirm location and type of information access point or access to computers in patient care and staff work areas
- Confirm range of access to wireless

Photo Documentation
- Document location and type of information access point or access to computers in patient care and staff work areas

Staff Survey/Interview Questions [satisfaction with]:
- Care coordination with lab and ease in sending specimens and receiving labs results
- Care coordination with pharmacy department and ease in ordering and receiving medication
- Care coordination with imaging dept. and ease in ordering tests and accessing test results
- Compatibility of information systems
- Ease of retrieving patient medical information

Plus open ended question:
- Are there any aspects of accessing information that you would like to change or that you fell work exceptionally well? Please explain.

5. Post Occupancy – Focused Research Options:

- Usability and interoperability studies of platforms employed
- Studies of infrastructure cost compared to technology replacement cost over facility life
- Measures of interoperability over the life of the facility including the number and percentage of systems able to communicate and share data, and the number of discrete tasks required to input, share and retrieve data

References:

2010 *Bardram, J. E. (2010, December 17). Hospitals of the future – Ubiquitous computing support for medical work in hospitals. Retrieved from http://www.citeulike.org/user/argo/article/5428160*

Ubiquitous computing recognizes that computing technology has largely been developed for office work, which is far more sedentary and solitary than health care work. Research in ubiquitous computing seeks to develop new concepts, technologies and objects that better support interactions and work processes in hospitals. In addition to mobility and interoperability, ubiquitous computing requires places to share and display data. (Bardram, 2010)

Expert Opinion http://www.citeulike.org/user/argo/article/5428160

2010 *Igbowke, O. (2010, December 17). Wireless technology and healthcare. Retrieved from http://www.biohealthmatics.com/Articles/0000000016.aspx*

Wireless local area networks are increasingly used in health care settings and tasks (Ikbowke, retrieved 12-17-2010).

Background http://www.biohealthmatics.com/Articles/0000000016.aspx

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2010 *Johnson, N.B. (2010, October 15). VA, DoD work through struggles to make health information systems interoperable. Federal Times.*

The Veterans Affairs Department aims to be able to share its patients' electronic medical records with private-sector health care providers and the Defense Department by 2012. But most people tracking VA's efforts agree that progress is slow. VA and the Defense Department have struggled for years to create a common system that supports VA's mission of caring for veterans and DoD's mission of caring for the active-duty military.

Background http://www.federaltimes.com/article/20101015/DEPARTMENTS04/10150305/

2009 *Mosquera, M. (2009, July 29). VA-DoD must improve interoperability management. Government HealthIT.*

The Defense and Veterans Affairs departments have met some objectives for making their health IT systems interoperable by a Sept. 30 deadline, but are lagging in their efforts to establish interagency program management, GAO said in a July 28 report.

Background http://www.govhealthit.com/news/gao-va-dod-must-improve-interoperability-management

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2007 *Tseng, P.T.Y.,& Heui-huang, Chen (2007). Creating a new wireless business model of healthcare: The WiMAX Project in Hualien, Taiwan. In Proceedings of the IEEE Mobile WiMax Symposium, 138-43.*

Wireless technology was appreciated by users as part of the business model of healthcare in Hualien, Taiwan (Tseng & Chen, 2007).

Empirical http://ieeexplore.ieee.org/xpl/freeabs_all.jsp?arnumber=4156110

2006 *Valen, M. S., & Larssen, A.-K. (2006). Adaptability of Hospitals: Capability of Handling Physical Changes. Paper presented at the Trondheim International Symposium: Changing User Demands on Buildings - Needs for Lifecycle Planning and Management, Trondhei*

Case studies and expert opinions provided rules of thumb for designing for acuity-convertibility which have not been empirically tested (see design implications) (AIA, 2006; FGI, 2010; Eagle, 2005; Gupta & Marshall, 2005; Pressler, 2006; Valen & Larsen, 2006).

Background http://www.docstoc.com/docs/71540082/01_55_F_valen

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Strategy Framework Report:

MHS Principles and Core Dimensions

September 2011

Strategy Framework: MHS Principles and Core Dimensions

Principle 1: Provide patient and family-centered care

Provide healthcare that is focused on the patient and family, encouraging their ease of access and participation and collaboration in the care delivery process. The patient and family's cultural background, preferences and values are acknowledged and they are treated with dignity and respect leading to a positive and meaningful experience.

	Core Dimensions:	Areas of Interest for Evaluating Achievement of the Principle (Objective)
1	**Physical access and wayfinding**	Ease of physically moving through the healthcare facility and its environment; ease of understanding how to get to where it is necessary to go; minimization of effort to arrive at the destinatic minimization of confusion in finding the destination
2	**Patient and family privacy, comfort and control**	The patient and family have control over their environment; the environment is comfortable and supports their visitation needs a there is privacy for them and for their families with them.
3	**Patient and family Involvement in Care Decisions**	The facility environment and healthcare system positively affect ability of the family and patient's involvement in making knowledgeable health care decisions. The information is readily available; there are areas where private discussions can be hel
4	**Therapeutic and comfortable interiors**	The interior areas of the healthcare facilities are designed to incl therapeutic elements (such as atriums, respite areas) and to be comfortable to the users of the facility (patients, family, guests, staff). The design and placement of elements consi
9	**Personnel Satisfaction and Retention**	Focus on staff; responsibility to staff to ensure retention of high-quality, highly committed individuals with the capabilities and vi to deliver world-class health care.
12	**Access to essential/vital information and education**	Ensure available, accessible, timely and comprehensive informat on all topics relevant to healthcare and patient records. Institute flexible, multi-source ways and means to deliver the information
13	**Care options, availability, and timeliness**	The right type of care is locally available within reasonable time frame; Patients have the right type of services available within a reasonable timeframe and geographical limit.
22	**Social support**	The facility provides opportunities for patients and family to integrate/associate with other patient/families for support and communion, within the military community and the surrounding community.

Principle 2: Achieve world-class quality and safety

Foster high quality and safe care by continuously improving performance to prevent the occurrence of adverse events, such as patient falls, infection rates and medication errors.

	Core Dimensions:	Areas of Interest for Evaluating Achievement of the Principle (Objective)
5	**Safe environment for patients**	Institute practices that minimize the likelihood of the healthcare system causing harm to the patient (iatrogenic effects). Design a construct elements and features within the infrastructure to minimize opportunities for causing harm.
6	**Health maintenance/healthy practices (optimal health outcomes)**	Identify, design, construct and provide elements necessary for individuals to elect for maintaining (improving) their health with the healthcare facility such as hand-washing, healthy nutritional options, exercise stations, etc.
7	**Safe and effective work environment for clinical staff**	The work environment for clinical staff enables the performance effective/best practice clinical activities; the environment is protective of the health and welfare of the staff while performin their clinical activities. The infrastructure is designed
8	**High visibility, collaboration and effective communication**	Design and construct features and elements within the healthcar facility suitable and conducive to maintaining visual contact with patient. Design and construct features and elements that suppo optimal clinical collaboration and communication.
10	**Access to daylight, nature and respite areas**	Throughout the facility, daylight is available, nature is visible and accessible and peaceful areas that have components of nature a available.
11	**Indoor environmental quality (ambient)**	The light is daylight to a great extent; the air and water tasteless without unpleasant odors; the noise is muted; and together the elements of the environment do not unpleasantly distract the senses of the staff, families, patients or visitors.
21	**Multi-discipline collaboration on achieving world class health care**	Integrated, multi-disciplined areas of interest investing time and energy into resolving, investigating and determining best way possible to deliver world-class health care.
24	**Goal oriented organizational quality (professional competency and capability)**	Support achievement of all professional and organization quality standards; maintain highest levels of competencies among all disciplines supporting the medical delivery system.

Principle 3: Create a positive work environment

Create a positive work environment that optimizes team capabilities, collaboration and strong organizational leadership. Pleasant and safe working conditions are provided to improve staff satisfaction, avoid injury and mitigate worker fatigue. Effective communications are promoted among all employees and a culture of excellence is advanced.

	Core Dimensions:	Areas of Interest for Evaluating Achievement of the Principle (Objective)
8	**High visibility, collaboration and effective communication**	Design and construct features and elements within the healthca facility suitable and conducive to maintaining visual contact with patient. Design and construct features and elements that suppo optimal clinical collaboration and communication.
9	**Personnel Satisfaction and Retention**	Focus on staff; responsibility to staff to ensure retention of high-quality, highly committed individuals with the capabilities and vi to deliver world-class health care.
10	**Access to daylight, nature and respite areas**	Throughout the facility, daylight is available, nature is visible and accessible and peaceful areas that have components of nature a available.
11	**Indoor environmental quality (ambient)**	The light is daylight to a great extent; the air and water tasteless without unpleasant odors; the noise is muted; and together the elements of the environment do not unpleasantly distract the senses of the staff, families, patients or visitors.

Principle 4: Improve operational effectiveness

Plan and design for supporting highly efficient processes in the delivery of care. Efficiencies start with the right-sized functional work areas aligned with adjacencies that promote efficient work patterns and integrated service delivery. Adjacencies are designed to decrease staff and patient travel distances, while promoting optimal work flow and improved throughputs.

	Core Dimensions:	Areas of Interest for Evaluating Achievement of the Principle (Objective)
7	**Safe and effective work environment for clinical staff**	The work environment for clinical staff enables the performance effective/best practice clinical activities; the environment is protective of the health and welfare of the staff while performin their clinical activities. The infrastructure is designed
8	**High visibility, collaboration and effective communication**	Design and construct features and elements within the healthca facility suitable and conducive to maintaining visual contact with patient. Design and construct features and elements that suppo optimal clinical collaboration and communication.
12	**Access to essential/vital information and education**	Ensure available, accessible, timely and comprehensive informat on all topics relevant to healthcare and patient records. Institute flexible, multi-source ways and means to deliver the information
13	**Care options, availability, and timeliness**	The right type of care is locally available within reasonable time frame; Patients have the right type of services available within a reasonable timeframe and geographical limit.
14	**Process optimization and workflow**	System-wide workflow improvement from trash disposal to pharmaceuticals. The integrated view of processes and infrastructure innovation to optimize the functioning of the syste wide healthcare delivery process at a facility.
15	**Standardization**	Elements of design and construction are based on MHS-wide standards for the type of facility and space under consideration. This standardization is a key component in achieving efficiencies scale for the facility and for operations.
16	**Adaptability, flexibility and future planning**	Infrastructure designed and constructed to accommodate future requirements for growth or changing needs; infrastructure that c be modified, adapted, expanded, and repurposed with limited disruptions and minimized cost requirements due to initial plann

Principle 4: Improve operational effectiveness

Plan and design for supporting highly efficient processes in the delivery of care. Efficiencies start with the right-sized functional work areas aligned with adjacencies that promote efficient work patterns and integrated service delivery. Adjacencies are designed to decrease staff and patient travel distances, while promoting optimal work flow and improved throughputs.

17	**Building system performance and maintainability**	The facility and its component parts are designed and constructe for optimal performance (efficient, effective) and for maintainab (easy to maintain) and reliability (downtime is minimal); the infrastructure includes the building exterior, interior

Principle 5: Be sustainable with a high level of community responsibility

Demonstrate a population health focus by being involved in community improvement and preparedness projects. Deliver LEED certified projects that are sustainable for the health of the environment and occupants. Balance the needs of the community with the integrity of nature.

Core Dimensions:	Areas of Interest for Evaluating Achievement of the Principle (Objective)
18 **Efficient and environmentally responsible use of resources**	Conserve natural resources such as water, minerals; protect the environment through responsible selection of materials, disposa materials, and conversation of resources. Minimize use of non-reusable materials; increase use of reusable materials as ap
19 **Stewardship to the community ; collaboration with the community**	Dedication to the community -- in support of, collaboration with fully vested entity with the local community. Ensuring consisten timely, transparent communication on matters that impact the community -- soliciting feedback and interaction; flexibilit

Principle 6: Provide high value & be good stewards of taxpayer money

Ensure that each facility is planned, designed, constructed and operated in a manner that ensures the best value for the taxpayer while achieving world-class care for the patient. Provide executive leadership that is empowered with organizational and fiscal authority to provide high value at reasonable costs, demonstrating transparency of processes by making publicly available performance data and de-identified results of root cause analyses.

	Core Dimensions:	Areas of Interest for Evaluating Achievement of the Principle (Objective)
17	**Building system performance and maintainability**	The facility and its component parts are designed and constructe for optimal performance (efficient, effective) and for maintainab (easy to maintain) and reliability (downtime is minimal); the infrastructure includes the building exterior, interior
18	**Efficient and environmentally responsible use of resources**	Conserve natural resources such as water, minerals; protect the environment through responsible selection of materials, disposa materials, and conversation of resources. Minimize use of non-reusable materials; increase use of reusable materials as ap
20	**Cost effectiveness and reduction**	Focus on good fiscal management and responsibility to the taxpayer. Ensuring that the funding required for world-class facilities is not lost to unproductive activities; ensuring funding meets requirements for achieving goals in most efficient and cos

Principle 7: Be evidence and performance based

Routinely operationalizes evidence-based practices and processes in the delivery of care and the design of facilities. Provides access to the latest credible research and empirical evidence to inform decisions.

Core Dimensions:	Areas of Interest for Evaluating Achievement of the Principle (Objective)
21 **Multi-discipline collaboration on achieving world class health care**	Integrated, multi-disciplined areas of interest investing time and energy into resolving, investigating and determining best way possible to deliver world-class health care.
23 **Leadership: responsibility, innovation, andcontinuous process improvement -**	The MTF continually monitors quality with an established Quality Improvement Program, taking responsibility for errors, and partnering with Innovative organizations and the MHS to enhanc innovation within the MTF.
24 **Goal oriented organizational quality (professional competency and capability)**	Support achievement of all professional and organization quality standards; maintain highest levels of competencies among all disciplines supporting the medical delivery system.

Principle 8: Design for maximum flexibility, standardization & growth

Design modular and flexible building systems and utilities infrastructure, to easily adapt spaces to accommodate new and emerging technologies, medical practices ,or surge capacity needs.

	Core Dimensions:	Areas of Interest for Evaluating Achievement of the Principle (Objective)
15	**Standardization**	Elements of design and construction are based on MHS-wide standards for the type of facility and space under consideration. This standardization is a key component in achieving efficiencies scale for the facility and for operations.
16	**Adaptability, flexibility and future planning**	Infrastructure designed and constructed to accommodate future requirements for growth or changing needs; infrastructure that c be modified, adapted, expanded, and repurposed with limited disruptions and minimized cost requirements due to initial plann
17	**Building system performance and maintainability**	The facility and its component parts are designed and constructe for optimal performance (efficient, effective) and for maintainab (easy to maintain) and reliability (downtime is minimal); the infrastructure includes the building exterior, interior

Principle 9: Decision making based on best practices and innovation

Adopt a knowledge driven approach to healthcare delivery and facility design process. Focus on collaboration with government, academia, and the building community to ensure that world-class is inculcated in the MHS facility portfolio. Look for opportunities to identify and support innovation and research.

	Core Dimensions:	Areas of Interest for Evaluating Achievement of the Principle (Objective)
23	**Leadership: responsibility, innovation, andcontinuous process improvement -**	The MTF continually monitors quality with an established Quality Improvement Program, taking responsibility for errors, and partnering with Innovative organizations and the MHS to enhanc innovation within the MTF.
24	**Goal oriented organizational quality (professional competency and capability)**	Support achievement of all professional and organization quality standards; maintain highest levels of competencies among all disciplines supporting the medical delivery system.

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