Improving Healthcare through Building Design Innovations: An Evidence-Based Approach

Xiaobo Quan, PhD, EDAC
Center for Health Design
Concord, CA
IMPACT OF BUILDING DESIGN ON HEALTHCARE

Healthcare environment has a fundamental impact on patients, patients’ families, physicians, nurses, pharmacists, technologists and other staff members as well as healthcare organizations

- Patient safety
- Staff safety
- Quality of care
- Work efficiency
- Sustainability
- Financial viability
IMPACT OF BUILDING DESIGN ON HEALTHCARE

Patient and staff safety

Adjacencies/department
- Adjacency of ED to diagnostic services
- Medication distribution system

Unit configuration & layout
- Designated medication safety zone
- Decentralized nurse workstation

Room configuration & layout
- Single rooms
- Patient room layout
- Bathroom layout

Ventilation and air-conditioning system
- HEPA filtration
- Ventilation system

Acoustic environment
- Sound-absorbing ceiling tiles

FF&E
- Sinks/gel dispensers,
- Handwashing reminders
- Water disinfection
- Ceiling lifts

Interior Material
- Easy-to-clean surface materials

Healthcare-associated infections

Medical errors

Patient falls

Staff back injuries
IMPACT OF BUILDING DESIGN ON HEALTHCARE

Quality of care & work efficiency

- **Building location/site optimization**
  - Gardens, Building location, Parking

- **Adjacencies/department**
  - Adjacency of ED to diagnostic services
  - Medication distribution system

- **Unit configuration & layout**
  - Decentralized nurse workstation
  - Supplies located close to patient rooms

- **Room configuration & layout**
  - Single rooms, Patient room layout,
    - Bathroom layout

- **Building envelope**
  - Window view, insulation

- **Ventilation/air-conditioning system**
  - HEPA filtration
  - Ventilation system

- **Acoustic environment**
  - Sound-absorbing ceiling tiles

- **FF&E**
  - Artworks, Music, Amenities, Wireless technology

- **Interior Material**
  - Homelike materials

- **Patient stress**
- **Patient satisfaction**
- **Patient comfort**
- **Patient waiting**
- **Patient sleep quality**
- **Staff travel distance**
- **Flow time/throughput**
- **Job satisfaction**
Healthcare organizational outcomes

- Environmental impact / sustainability

- The Business Case – Return on investment of building design
  
  - Healthcare organization’s operating cost >>> capital investment
  
  - Improvements in building design can be paid off quickly
    - Reduced adverse events
    - Increased work efficiency
    - Shorter length of stay
    - Higher market share, etc.

(Rybkowski, UC Berkeley)
How can we improve healthcare environment through building design and innovations?

Many healthcare organizations have achieved improvements in healthcare outcomes by incorporating evidence-based design innovations in their building construction projects.
A growing body of research on how building design impacts healthcare outcomes

(Rubin, Owens, & Golden, 1998; R. S Ulrich, C. Zimring, X. Quan, A. Joseph, & Choudhary, 2004; Roger Ulrich et al., 2008)
What is evidence-based design (EBD)?

Clarifying some common misconception

- EBD is not prescriptive and does not provide a standard design solution to fit all situations.
- EBD is not static but ever evolving as the body of research grows.

From: http://www.cochrane.org/about-us/evidence-based-health-care
EVIDENCE-BASED DESIGN IS THE PROCESS OF BASING DECISIONS ABOUT THE BUILT ENVIRONMENT ON CREDIBLE RESEARCH TO ACHIEVE THE BEST POSSIBLE OUTCOMES
EVIDENCE-BASED DESIGN

EBD: 8-Step Process

The Evidence-Based Design Process

OCCUPANCY
- Measure Post Occupancy Performance Results

ORGANIZATIONAL READINESS
- Define EBD Goals & Objectives

PRE-DESIGN
- Find Sources for Relevant Evidence
- Critically Interpret Relevant Evidence

DESIGN
- Create & Innovate EBD Concepts
- Develop a Hypothesis

CONSTRUCTION
- Collect Baseline Performance Measures
- Monitor Implementation of Design & Construction
A research initiative with healthcare organizations that are building new or renovating existing facilities

- Commit to using an EBD process, document and share their results

Started in 2000 with one hospital; more than 70 organizations have participated

http://www.healthdesign.org/pebble
EBD INNOVATIONS

All-single-room design
- 100% single rooms in patient care unit

Benefits

Reduce
- Hospital-acquired infection rates
- Noise
- Annoyances from roommates
- Patient and staff stress level
- Privacy breaches
- # of patient transfers
- Patient length of stay

Improve
- Sleep quality
- Communication between patients and staff
- Satisfaction of patients and families

Policy change:
All-single-room mandated in 2006 version of Guidelines for the Design and Construction of Health Care Facilities
All-single-room design
Example: Bronson Methodist Hospital, Kalamazoo, MI

Results

• 45% reduction in hospital-acquired infections in the new all-single-room units
• 11% reduction in overall infection rates
• Nursing turnover rates down to 4.7%.
• Occupancy rate increased to 87%.
• Overall patient satisfaction increased to 96.7%.
• Decreased patient transfers
• Better patient sleep quality
• Market share increased
• Employee satisfaction improved
Decentralized nurse workstation - brings nurses closer to the patients

Benefits

• Shorter travel distance in staff
• Quick response to patient calls
• Better monitoring of patient status

Challenges

• Staff feel isolated and lack of social support from other nurses
• Noise from workstations near patient rooms
Decentralized nurse workstation
Example: Dublin Methodist Hospital, Dublin, OH
Universal room/acuity-adaptable room
- Sufficient space and provision for equipment, medical gases, and power to accommodate any level of patient acuity

Benefits
- Reduce patient transport
- Reduce errors, extra staffing time, delays related to patient transport
- Increase staff productivity
- Increase satisfaction

Challenges
- Difficulties in assigning nurses
- Resistance from nurses
- Reimbursement regulations!

Clarian Methodist Hospital, Indianapolis, IN
Universal room/ acuity-adaptable room
Example: Dublin Methodist Hospital, Dublin, OH
Clarian Methodist Hospital, Indianapolis, IN
Positive distractions
- Pleasant environmental stimuli (nature view, artworks, music) to create a healing environment

Benefits
- Reduce patient stress/anxiety
- Provide a welcoming, homelike environment
- Improve patient satisfaction
- Reduce pain & pain medication
- Reduce length of stay
- Increase reimbursement
Positive distractions
Example: Imaging rooms, Lurie Children’s Hospital, Chicago, IL

EBD process
• Involvement of children advisory group in design

Innovative design feature
• Immersive environment
• Disguising the observation window
EBD - A multi-disciplinary approach

- Medicine
- Nursing
- Architecture
- Psychology
- Social science
- Engineering
- Policy
- Business operation, etc.

Building design innovation is only one part of the solution and should join forces with other elements such as operation and policy to achieve the goals of improving healthcare
POLICY IMPLICATIONS

Support healthcare design innovations from the perspective of policy-making

- Support the implementation of proven design concepts by accommodating and incorporating new design concepts in the regulations
- Support the evaluation of new design innovations
  - Relevant data often collected in different ways in different facilities → more reporting of standard metrics in recent years
  - Relevant data scattered in multiple departments even in one facility → Integrating design data and outcome data

Kaiser Permanente's Integrated Database Model
(Chong et al., 2008)
CONCLUSION

• As the healthcare industry moves towards more accountability and emphasizing quality of care, the design of the built environment becomes more important than ever.

• EBD provides an effective way of innovating building design and then evaluating and sharing the design innovations.

• The coordination of multiple disciplines including design, operation, policy and others, is the key to successfully improving healthcare.
Questions?