Making the Connection: Linking Building Design to Healthcare Outcomes

Assessing the Impact of Environmental Strategies on Outcomes in Healthcare Facilities

Presented by:
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"As the healthcare industry’s environmental footprint negatively affects the environment, these environmental impacts may in turn affect human health, and human health issues further increase the need for healthcare services."
- Roberts and Guenther (2006)
THE NEED

Need for standard metrics and tools for measuring the affects of sustainable healthcare design strategies on patient, staff and environmental outcomes

Need for benchmarking and comparison for continuous improvement

This project: Grant from USGBC (2008-2010) to develop An open source searchable database to assess the impact of environmental strategies on outcomes in healthcare facilities.
PROJECT FOCUS

Identify COMMON METRICS
Healthcare Specific - Performance & Outcomes

Create a STANDARD PROTOCOL
For Data Collection

BENCHMARK
Design Strategy Effectiveness
<table>
<thead>
<tr>
<th>Objectives</th>
<th>Multiple Methods Used</th>
</tr>
</thead>
</table>
| **1** Develop Framework | Deep Dive Activity  
Selection Criteria Identification  
Advisory Council  
Focus Area Identification  
Literature review |
| **2** Define Metrics   | Literature Review  
Industry Scan of Standard Metrics  
Advisory Council/ Focus Groups |
| **3** Develop Protocols| Advisory Council/ Focus groups  
Tool Exploration/ Development  
Database Development  
Field Data Collection  
Interface Development |
| **4** Promote Evaluation | Field Data Collection  
Web Interface Development  
Data Analysis |
To develop a robust framework for understanding the relationship between environmental design strategies that potentially promotes patient, worker and environmental safety in hospitals with actual outcomes in these areas.
Conceptual frameworks were developed for each of the 8 topic areas to understand the relationships between groups of variables:

- Design strategies, environmental quality, patient outcomes, worker outcomes, and environmental safety outcomes.
To identify and clearly define standard existing metrics that should be tracked across multiple healthcare organizations to understand the relationship between environmental design strategies and outcomes.
LITERATURE ANALYSIS

• Information on measurement tools and metrics of sustainable design extracted from a subset of the 300+ articles, publications and case studies.
  • reference information
  • research type
  • building type
  • focus area
  • variable names
  • variable types (independent, dependent, or confounding)
  • metrics (how to measure variables)
  • measurement tools
  • relationships found between variables
  • other findings
  • descriptions about research subjects

• Result
  • 36 design variables
  • 30 outcome variables
Design Categories
1. Daylighting
2. Ventilation, thermal comfort and indoor air quality
3. Building envelope
4. Auditory environment
5. Fixture selection
6. Interior materials selection

Outcome Categories
1. Conservation of limited resources
2. Healthcare associated infections
3. Productivity
4. Staff outcomes
5. Economic impact
6. Patient perception of service
To develop standard protocols for collecting data on environmental design strategies and outcomes from healthcare organizations.
DATA TO BE COLLECTED VIA ONLINE QUESTIONNAIRES

USGBC Environmental Safety Survey

1. **Environmental design strategies incorporated in healthcare facilities**

2. **Perceptions of environmental qualities**

3. **Healthcare outcomes**
Building Envelope

Building envelope is the interface between the building indoor environment and the outside air including building facades and the building roof. Depends on different climate, envelope strategies for air-tightness, insulation, daylighting, glazing choices, natural ventilation, can effectively energy demand and enhance occupant health and productivity. In this section, please provide information around the building envelope design strategies implemented in this building project.

Note: Envelope design strategies for daylighting and ventilation are covered in previous topics not be repeated in this section.

What were your project team's key design goals for this facility are design of the building envelope? Please check all that apply.

- Reduce heat loss/gain
- Reduce energy consumption
- Reduce pollutant concentration/contamination
- Design for longevity
- Support patient and staff satisfaction
- Support patient well-being
- Support staff productivity
- Other (please specify)

What design standards or metrics did you design toward to achieve goals for this building project?

Please check the predominant exterior wall material.

- Masonry (brick, stone, or concrete block)
- Sliding or shingles
- Metal panels
- Concrete panels
- Glass
- Other (please specify)

Please enter the % of wall area that window glass occupies.

Please indicate the characteristics of your building envelope below. Please check all that apply.

- Insulating glass (i.e. 2 or more panes)
- Tinted glass
- Reflective glass
- High performance glass (low-e glass)
- Exterior window shades
- Integral window blinds
- Interior window blinds
- Operable windows
- Curtain wall
- Steel framed in-fill
- Solid concrete or masonry
- Other (please specify)

Please indicate if you have incorporated the following design strategies into this building project. If your design strategy is related to but different from the ones below, please write in the actual strategy in the 'modify text' box.

Please indicate any other design strategies related to the building envelope that you have incorporated into this building project that are not listed above.
INTERFACE WITH FACILITIES TO COLLECT DATA

**Timeline:** January to June 2010

**Who:** 30 healthcare facilities and their project’s architecture firms invited:
- Facilities that recently completed a major renovation or new construction project and were occupied for at least six months
- Both inpatient and outpatient facilities included

**How:** Administrators at each organization contacted through phone and email

**What:** Results of the data collection would appear on the RIPPLE database
To promote evaluation and comparison of performance outcomes between different healthcare organizations.
ANALYSIS PLAN

Analysis:
• Evaluate commonly adopted design strategies found within the study sites
• Benchmark patient, staff and environmental outcomes
• Develop a plan for categorical analyses to examine the links between certain design variables and outcome variables

Result:
• Analysis framework sets the foundations for comparing the relationship between design strategies and outcomes in different areas
• Benchmarking of outcomes data possible
WEB INTERFACE

• Develop the information architecture needed to support desired comparative scenarios

• Develop detailed user-interface wireframes

• Two tracks for accessing information:
  • LEARN
  • COMPARE
FINDINGS: FACILITY GENERAL INFORMATION

- Data collection was completed in **five** occupied facilities during the Spring and Summer of 2010

<table>
<thead>
<tr>
<th>Facility</th>
<th>Project Type</th>
<th>Size</th>
<th>Urban Context</th>
<th>Acuity Level</th>
<th>Occupant Satisfaction Survey Response Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Facility One</td>
<td>New Addition</td>
<td>645 bed</td>
<td>Suburban</td>
<td>Acute Care</td>
<td><strong>41%</strong></td>
</tr>
<tr>
<td>Facility Two</td>
<td>New Facility</td>
<td>94 bed</td>
<td>Suburban</td>
<td>Acute Care</td>
<td><strong>38%</strong></td>
</tr>
<tr>
<td>Facility Three</td>
<td>New Patient Tower, Diagnostic/Treatment, Renovation</td>
<td>563 bed</td>
<td>Suburban</td>
<td>Acute Care</td>
<td><strong>34%</strong></td>
</tr>
<tr>
<td>Facility Four</td>
<td>New Patient Tower</td>
<td>381 bed</td>
<td>Urban</td>
<td>Acute Care Medical Surgical</td>
<td><strong>48%</strong></td>
</tr>
<tr>
<td>Facility Five</td>
<td>New Addition and Renovation</td>
<td>N/A</td>
<td>Suburban</td>
<td>Outpatient</td>
<td><strong>16%</strong></td>
</tr>
</tbody>
</table>
DUBLIN METHODIST HOSPITAL

Facility size: 94-bed general acute care community hospital located in suburban Dublin, OH.
Completed/Occupied: January 2008

Design Strategies

• Accessible roof gardens
• Nature photograph
• Carpets and sound-absorbing ceiling tiles in nursing units, family space in patient rooms
• Large operable windows, natural light accessible to majority of spaces
Outcome Summary

- 92% of staff satisfied with the overall building performance
- 83% of patients satisfied with healthcare service
- Environmental aspects that were perceived positively include: thermal comfort and building envelope
CROSS FACILITY COMPARISON, DAYLIGHTING EXAMPLE

<table>
<thead>
<tr>
<th>Outcome Measure</th>
<th>Series 1</th>
<th>Series 2</th>
<th>Series 3</th>
<th>Series 4</th>
<th>Series 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>% of respondents that felt that the building was energy efficient</td>
<td>89%</td>
<td>61%</td>
<td>74%</td>
<td>82%</td>
<td>71%</td>
</tr>
<tr>
<td>% of respondents satisfied that natural light enhances their ability to get their job done</td>
<td>86%</td>
<td>76%</td>
<td>89%</td>
<td>83%</td>
<td>84%</td>
</tr>
<tr>
<td>% of respondents satisfied with the visual comfort of natural daylight</td>
<td>86%</td>
<td>76%</td>
<td>89%</td>
<td>89%</td>
<td>84%</td>
</tr>
<tr>
<td>% of respondents satisfied with the amount of natural daylight in building</td>
<td>90%</td>
<td>71%</td>
<td>97%</td>
<td>94%</td>
<td>83%</td>
</tr>
<tr>
<td>% of respondents satisfied with the amount of natural daylight in nursing stations, offices or other supplemental areas</td>
<td>71%</td>
<td>55%</td>
<td>86%</td>
<td>76%</td>
<td>59%</td>
</tr>
<tr>
<td>% of respondents satisfied with the amount of natural daylight in patient rooms</td>
<td>64%</td>
<td>83%</td>
<td>92%</td>
<td>100%</td>
<td>93%</td>
</tr>
<tr>
<td>Average Voluntary Nurse Turnover Rate</td>
<td>5%</td>
<td>10.79%</td>
<td>5%</td>
<td>3%</td>
<td>5.77%</td>
</tr>
<tr>
<td>Pain management (% of patients who reported their pain was &quot;Always&quot; well controlled)</td>
<td>Not applicable</td>
<td>67%</td>
<td>71%</td>
<td>67%</td>
<td>Not reported</td>
</tr>
</tbody>
</table>
RELATIONSHIPS YET TO BE EXPLORED

The potential for research and education is clear

- Large scale data collection made possible
- Initial trends of links between design and outcomes observed
- Database as design decision support tool in the future

Future analysis

- Continuous benchmarking
- Categorical analyses of satisfaction and outcomes data with presence or absence of various design strategies
- Explore links between design and outcomes – those identified in literature & new and critical links
LESSONS LEARNED

• Lack of response from some sites
• Qualification to participate
• Performance & outcomes data more challenging to collect
• Aggregated facility data vs. individual building data
• Information from multiple personnel
• Data format
NEXT STEPS

• Pebble Projects invited to contribute to RIPPLE

• Facilities currently providing data invited to submit their data annually

• Launch and maintain RIPPLE, add additional facilities to the database.

• Future development of ‘patient safety’ and ‘worker safety and effectiveness’

• Identify strategies at the intersection of the three safeties