Hospital Inpatient Quality Measures
and Healthcare Facility Design

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Carl Hartman, MD is the Medical Director for Sentara Heart Hospital. Dr. Hartman is a graduate of the SUNY School of Medicine and received post-graduate training at Duke University. He is board certified in Internal Medicine and Cardiology.
Objectives

1. Recognize the role of the built environment and facility design in hospital inpatient quality measures.
2. Assess those elements of a facility design that, if modified, could improve reported hospital inpatient quality metrics.
3. Summarize all of the currently reported hospital inpatient quality measures that are impacted by hospital design.
4. Distinguish between quality metrics that are partially explained by hospital design from those that are independent of hospital design.
Outline

• Brief History of Inpatient Quality Measures
• Built Environment
• Health Behavior Theory (and the Built Environment)
• Hospital Design and Quality
• Hospital Accreditation and the Built Environment
• Inpatient Quality Metric Reporting
• Value-Based Purchasing and Quality
• Cardiac Inpatient Quality
Quality Timeline

2000

2001

2003-10
To Err is Human

- Institute of Medicine (2000)
  - At least 44,000 Americans die each year as a result of a medical error (may be as high as 98,000).
  - Total cost between $17 and $29 billion (lost income, lost productivity, disability and healthcare costs).

### Leading Cause of Death in United States

<table>
<thead>
<tr>
<th>Rank</th>
<th>Cause</th>
<th>Deaths</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Heart Disease</td>
<td>652,091</td>
</tr>
<tr>
<td>2</td>
<td>Cancer</td>
<td>599,312</td>
</tr>
<tr>
<td>3</td>
<td>Stroke</td>
<td>143,679</td>
</tr>
<tr>
<td>4</td>
<td>Chronic Lower Respiratory Disease</td>
<td>130,933</td>
</tr>
<tr>
<td>5</td>
<td>Accidents (unintentional injuries)</td>
<td>117,809</td>
</tr>
</tbody>
</table>

- Preventable Medical Errors: 98,000
Crossing the Quality Chasm

• Institute of Medicine (2001)
  – Establish a New Environment for Care
    • Focus and align the environment toward the six aims for improvement.
      – Safe, effective, patient-centered, timely, efficient, equitable
    • Provide, where possible, assets and encouragement for positive change.
  – Align Payment Policies with Quality Improvement
Built Environment
Built Environment
Built Environment
Bronfenbrenner Ecological Model
Exposure Pathways (air, land, water)

Fig. 6-2. Site Conceptual Model—Exposure Pathway Schematic

Source: www.atsdr.cdc.gov
Environmental Exposures

• Source
  – Point source (furnace)
  – Non-point source (allergens)

• Transport mechanism
  – Air
  – Water
  – Land (soil)
  – Vector (insects, clothes, shoes)

• Exposure route
  – Inhalation, absorption (dermal), indigestion
Root Causes of Medical Errors
*(adding the human element to the built environment)*

- **Latent errors**
  - Errors that result from underlying system failures
    - Technical
      - External
      - Design
      - Construction
      - Material
    - Organizational
      - External
      - Protocols/procedures
      - Transfer of knowledge
      - Management priorities
      - Culture

- **Active errors**
  - Errors of failures that result from human behavior
    - Knowledge-based
    - Rule-based
      - Qualifications
      - Coordination
      - Verification
      - Intervention
      - Monitoring
    - Skill-based
      - Slip (highly developed skills)
      - Trip
    - Other
      - Patient
FIGURE 1. Social determinants of health and environmental health promotion. The model was developed for an article by AJ Schultz and ME Northridge.®
Control of Built Environment Risks

- Occupational hygiene hierarchy of controls
  - Engineering controls
    - Built environment (healthcare facility design)
    - Negative pressure rooms
  - Work Practices
    - Time-out (healthcare facility operations)
  - Administrative Controls
    - Employee training (healthcare facility management)
  - Personal Protective Equipment
    - Droplet precaution PPE
Healthcare Built Environment and Outcomes

• Rubin et al. (1998)*
  – Noise/music
  – Air Quality
  – Exposure to Daylight and Sunlight

• Ulrich^:
  – Noise
  – Natural Light/Windows (versus no windows)
  – Private rooms
  – Flooring materials
  – Furniture arrangements


^Source: Roger Ulrich Effects of Healthcare Environmental Design on Medical Outcomes
Evolution of Hospital Design
Evolution of Hygiene
Evolution of the Hospital Room
Evolution of Reimbursement

$ DRG VBP
Centers for Medicare & Medicaid Services

• CMS Conditions of Participation for Hospitals
  – 42 CFR Part 482
    • 42 CFR 482.41 – Physical Environment
      “The condition of the physical plant and the overall hospital environment must be developed and maintained in such a manner that the safety and well-being of patients are assured.”
      (The Joint Commission & DNV)

• Value-Based Purchasing
  (Medicare Payment Holdbacks)

• Hospital Inpatient Quality Reporting Program
  (Medicare Incentives)
§482.41 Condition of participation: Physical environment.

The hospital must be constructed, arranged, and maintained to ensure the safety of the patient, and to provide facilities for diagnosis and treatment and for special hospital services appropriate to the needs of the community.

(a) Standard: Buildings. The condition of the physical plant and the overall hospital environment must be developed and maintained in such a manner that the safety and well-being of patients are assured.

(b) Professional staff. The hospital staff must be able to provide medical and surgical care on an inpatient basis and to give patients the necessary care and services that they require.

(c) Equipment and supplies. The hospital must have adequate equipment and supplies to provide adequate care to patients.

(d) Medication. The hospital must have adequate medication to provide adequate care to patients.

(e) Fire prevention. The hospital must have adequate fire prevention and fire protection systems to provide adequate care to patients.

(f) Infection control. The hospital must have adequate infection control measures to prevent the spread of infection to patients.

(g) Nutrition. The hospital must have adequate nutrition services to provide adequate care to patients.

(h) Physical environment. The hospital must have an adequate physical environment to provide adequate care to patients.

(i) Environmental health. The hospital must have adequate environmental health services to provide adequate care to patients.

(j) Emergency services. The hospital must have adequate emergency services to provide adequate care to patients.

(k) Clinical laboratory. The hospital must have adequate clinical laboratory services to provide adequate care to patients.

(l) Dental services. The hospital must have adequate dental services to provide adequate care to patients.

(m) Radiology. The hospital must have adequate radiology services to provide adequate care to patients.

(n) Pharmacy. The hospital must have adequate pharmacy services to provide adequate care to patients.

(o) Pathology. The hospital must have adequate pathology services to provide adequate care to patients.

(p) Blood bank. The hospital must have adequate blood bank services to provide adequate care to patients.

(q) Laboratory services. The hospital must have adequate laboratory services to provide adequate care to patients.

(r) Surgical services. The hospital must have adequate surgical services to provide adequate care to patients.

(s) Anesthesia services. The hospital must have adequate anesthesia services to provide adequate care to patients.

(t) Operating rooms. The hospital must have adequate operating rooms to provide adequate care to patients.

(u) Operating rooms supplies. The hospital must have adequate operating room supplies to provide adequate care to patients.

(v) Laboratory equipment. The hospital must have adequate laboratory equipment to provide adequate care to patients.

(w) Laboratory supplies. The hospital must have adequate laboratory supplies to provide adequate care to patients.

(x) Microbiological services. The hospital must have adequate microbiological services to provide adequate care to patients.

(y) Immunization services. The hospital must have adequate immunization services to provide adequate care to patients.

(z) Drug therapy. The hospital must have adequate drug therapy services to provide adequate care to patients.

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### Physical Environment

- **PE.1 Facility**
  - The condition of the physical plant and the overall hospital environment must be developed and maintained in such a manner that the safety and well-being of patients, visitors, and staff are assured.
• Physical Environment
  – PE.1 Facility
  – PE.2 Life Safety Management System
  – PE.3 Safety Management System
  – PE.4 Security Management System
  – PE.5 Hazardous Material Management System
  – PE.6 Emergency Management System
  – PE.7 Medical Equipment Management System
  – PE.8 Utility Management System
The Joint Commission

• National Patient Safety Goals
  – Improve the accuracy of patient identification
  – Improve the effectiveness of communication among caregivers
  – Improve the safety of using medications
  – Reduce the risk of health care-associated infections
  – Accurately and completely reconcile medication across the continuum of care
  – Reduce the risk of patient harm resulting from falls
  – Prevent health care-associated pressure ulcers
  – The organization identifies safety risks inherent in its patient population

• Environment of Care
  – Standard EC.01.01.01 – EC.04.01.05
  – EC.01.01.01
    • The hospital plans activities to minimize risks in the environment of care.
CMS
Core Measures
(chart abstraction)

Medicare
(claims data)
(AHRQ)

HCAHPS

NDNQI
Nurse Indicators

STS
Society of Thoracic Surgeons

ACC/NCDR
National Cardiovascular Disease Registry

CDC
National Healthcare Safety Network

*Publicly Reported Quality
Agency for Healthcare Research and Quality

• Patient Safety Indicators (PSI) that may be partially explained by hospital design:
  
  – Pressure Ulcer Rate (PSI #03)
  – Central Venous Catheter-Related Blood Stream Infection Rate (PSI #07)
  – Postoperative Hip Fracture Rate (PSI #8)
Agency for Healthcare Research and Quality

• Inpatient Quality Indicators (IQI) that may be partially explained by hospital design:
  
  – Acute Myocardial Infarction (AMI) Mortality Rate (IQI #15)
  – Acute Stroke Mortality Rate (IQI #17)
  – Percutaneous Coronary Intervention (PCI) Mortality Rate (IQI #30)
  – Acute Myocardial Infarction (AMI) Mortality Rate, Without Transfer Cases (IQI #32)
Hospital Value Based Purchasing

  - Origin of Hospital Inpatient Quality Reporting Program
  - Reduced annual payment update by 0.4% to non-participating hospitals or hospitals that failed to meet criteria for reporting.
  - Increased reduction to 2%
- Patient Protection and Affordable Care Act (Pub. L. 111-148)
  - Authorized 1st national Hospital Value Based Purchasing Pay-for-Performance program.
  - Effective FY2013 for discharges on or after October 1, 2012.
October 1, 2012

• Value-Based Purchasing
  – Funded by DRG percentage 1.0% FY2013
    • Equivalent to $850 million
    • Increases 0.25% each year up to 2.0% in 2017
  – Process Measures
    • 70% Clinical Process of Care Measures
      – National Benchmark – mean performance for top 10%
      – National Threshold – 50th percentile for all
        » Below National Threshold = 0
        » Between benchmark and threshold = 1-9
    • 30% Patient Satisfaction (HCAHPS)
FY2013 Value-Based Purchasing

• Clinical Process of Care Measures (n=12)
  – Heart Attack (n=2)
  – Heart Failure (n=1)
  – Pneumonia (n=2)
  – Surgical Care Improvement Program (n=7)

• Patient Experience of Care Measures (n=8)
  – HCAHPS
    Nurse Communication  Doctor Communication
    Responsiveness of Hospital Staff  Pain Management
    Communication about Medications  Cleanliness and Quietness
    Discharge Information  Overall Rating
FY2013 Value-Based Purchasing

• Clinical Process of Care Measures (n=12)
  – Heart Attack (n=2)
  – Heart Failure (n=1)
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  – HCAHPS
    Nurse Communication
    Responsiveness of Hospital Staff
    Communication about Medications
    Discharge Information
    Doctor Communication
    Pain Management
    Cleanliness and Quietness
    Overall Rating
## FY2013 Value-Based Purchasing

<table>
<thead>
<tr>
<th>Clinical Process of Care Measures – FY2013</th>
<th>Base</th>
<th>Goal</th>
</tr>
</thead>
<tbody>
<tr>
<td>AMI-7a Fibrinolytic therapy received within 30 minutes of hospital arrival</td>
<td>0.6548</td>
<td>0.9191</td>
</tr>
<tr>
<td>AMI-8a Primary PCI within 90 minutes of hospital arrival</td>
<td>0.9186</td>
<td>1.0</td>
</tr>
<tr>
<td>HF-1 Discharge instructions</td>
<td>0.9077</td>
<td>1.0</td>
</tr>
<tr>
<td>PN-3b Blood cultures performed in the ER prior to initial antibiotic received in hospital</td>
<td>0.9643</td>
<td>1.0</td>
</tr>
<tr>
<td>PN-6 Initial antibiotic selection for community-acquired pneumonia in immunocompetent patient</td>
<td>0.9277</td>
<td>0.9958</td>
</tr>
<tr>
<td>SCIP-Inf-1 Prophylactic Antibiotic Received Within One Hour Prior to Surgical Incision</td>
<td>0.9735</td>
<td>0.9998</td>
</tr>
<tr>
<td>SCIP-Inf-2 Prophylactic Antibiotic Selection for Surgical Patients</td>
<td>0.9766</td>
<td>1.0</td>
</tr>
<tr>
<td>SCIP-Inf-3 Prophylactic Antibiotics Discontinued Within 24 Hours After Surgery End Time</td>
<td>0.9507</td>
<td>0.9968</td>
</tr>
<tr>
<td>SCIP-Inf-4 Cardiac Surgery Patients with Controlled 6:00 a.m. Postoperative Serum Glucose</td>
<td>0.9428</td>
<td>0.9963</td>
</tr>
<tr>
<td>SCIP-VTE-1 Surgery Patients with Recommended Venous Thromboembolism Prophylaxis Ordered</td>
<td>0.9500</td>
<td>1.0</td>
</tr>
<tr>
<td>SCIP-VTE-2 Surgery Patients Who Received Appropriate Venous Thromboembolism Prophylaxis Within 24 Hours Prior to Surgery to 24 Hours After Surgery</td>
<td>0.9307</td>
<td>0.9985</td>
</tr>
<tr>
<td>SCIP-Card-2 Surgery Patients on a Beta Blocker Prior to Arrival That Received a Beta Blocker During the Perioperative Period.</td>
<td>0.9399</td>
<td>1.0</td>
</tr>
</tbody>
</table>
## FY2013 Value-Based Purchasing

<table>
<thead>
<tr>
<th>Clinical Process of Care Measures – FY2013</th>
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<th>Goal</th>
</tr>
</thead>
<tbody>
<tr>
<td>HCAHPS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Communication with Nurses</td>
<td>75.18%</td>
<td>84.70%</td>
</tr>
<tr>
<td>Communication with Doctors</td>
<td>79.42%</td>
<td>88.95%</td>
</tr>
<tr>
<td>Responsiveness of Hospital Staff</td>
<td>61.82%</td>
<td>77.69%</td>
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<tr>
<td>Pain Management</td>
<td>68.75%</td>
<td>77.90%</td>
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<tr>
<td>Communication About Medicines</td>
<td>59.28%</td>
<td>70.42%</td>
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<tr>
<td>Cleanliness and Quietness of Hospital Environment</td>
<td>62.80%</td>
<td>77.64%</td>
</tr>
<tr>
<td>Discharge Information</td>
<td>81.93%</td>
<td>89.09%</td>
</tr>
<tr>
<td>Overall Rating of Hospital</td>
<td>66.02%</td>
<td>82.52%</td>
</tr>
</tbody>
</table>
FY2013 Value-Based Purchasing

• **Cleanliness and Quietness**
  – Q: During this hospital stay, how often were your room and bathroom kept clean?
  – Q: During this hospital stay, how often was the area around your room quiet at night?
Sentara Heart Hospital
Quality Outcome Measures and Hospital Design

• Outline
  – Morbidity/Mortality
  – Safety
  – Infection
  – Patient Satisfaction
  – Early Readmission
Morbidity/Mortality Outcomes

• Quality Metrics Partially Explained by Hospital Design
  – Door-to-Balloon Time (D2B) (AMI-8a)
    • Transporting or receiving hospital
  – ED arrival at STEMI referral facility to Primary PCI at STEMI receiving facility (NCDR-19)

• Quality Metrics Independent of Hospital Design
  – Aspirin at discharge for AMI patients
## 90 Minute Door to Balloon Time (D2B)

<table>
<thead>
<tr>
<th>Time (min)</th>
<th>Adjusted mortality*</th>
</tr>
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<tbody>
<tr>
<td>15</td>
<td>2.9 (2.8-3.1)</td>
</tr>
<tr>
<td>30</td>
<td>3.0 (2.9-3.2)</td>
</tr>
<tr>
<td>60</td>
<td>3.5 (3.4-3.6)</td>
</tr>
<tr>
<td>90</td>
<td>4.3 (4.2-4.4)</td>
</tr>
<tr>
<td>120</td>
<td>5.6 (5.4-5.7)</td>
</tr>
<tr>
<td>180</td>
<td>8.4 (8.2-8.7)</td>
</tr>
<tr>
<td>240</td>
<td>10.3 (10.0-10.7)</td>
</tr>
</tbody>
</table>

Source: [www.theheart.org](http://www.theheart.org)
Door-to-Balloon Distance

Sentara Heart Hospital

- Distance 990 ft.
  - Time 4m 13s
  - Door(s) 4
  - Elevators 1

  - ER/Cath lab distance adds 3 minutes to D2B time.
  - Accounts for 5% of D2B time exceeding 90 min.
## E.R. to Cath Lab Distance

<table>
<thead>
<tr>
<th>Distance</th>
<th>Time</th>
<th>Door(s)</th>
<th>Elevators</th>
</tr>
</thead>
<tbody>
<tr>
<td>225 ft.</td>
<td>1m 5s</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>375 ft.</td>
<td>1m 45s</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>507 ft.</td>
<td>2m 55s</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>507 ft.</td>
<td>2m 55s</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>385 ft.</td>
<td>1m 42s</td>
<td>2</td>
<td>0</td>
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</table>
Safety

- Medication Errors
- Variability in Care
- Percentage High Acuity Beds
- National Database of Nursing Quality Indicators (NDNQI)
  - Falls (Inpatient Falls w/ Injury per 1000 Days)
  - Total Falls per 1000 Inpatient Days
  - Hospital Acquired Pressure Ulcers (Stage II and greater)
  - Hospital Acquired Pressure Ulcers (State III and greater)
  - Inpatient Out-of-Unit Codes per 1000 Discharges

Source: www.nursingquality.org
Infection

• Airflow
  – Negative pressure/isolation rooms
  – Outdoor fresh air intake location

• Washable finishes for floors, walls, and ceilings.

• Sinks
  – Infection control and prevention
Patient Satisfaction

• Quietness
  – High noise reduction coefficient (NRC) ceiling products
  – Proximity to noise source(s)
• Proximity to food service
• Emergency Department (ED) design
  – Computed Tomography Angiography (CTA)
• Light (daylight)
• Room design
• Flex space
• Post-discharge holding space
Expanding Hospital Role to Outpatient Environment

PCP
Primary Care

Specialty Clinic

Rehab

DME
Med Equip

Rx

Home
Outpatient Environment Impacting Hospital Quality Metrics

• 30 Day Readmission
  – Heart Failure
  – Acute Myocardial Infarction
  – Pneumonia

• Expanding hospital role & responsibility in outpatient care
  – Clinic space