Strategies to Achieve System-Wide Hospital Flow:

*Delivering the Right Care, in the Right Place, at the Right Time*

Pat Rutherford
Session Objectives

After this session, participants will be able to:

- Understand the conceptual framework for system optimization to ensure patient access and flow in acute care hospitals
- Utilize an approach for “sense-making” regarding various strategies for managing hospital operations and improving patient flow throughout the hospital
- Identify high leverage interventions for creating a sustainable system for hospital flow, so that patients receive the right care, in the right place, at the right time
Don Berwick’s Reflections on Patient Flow

“Not long after safety leapt to the top, I became aware of a second “sleeping giant” of a problem in care – “flow”….Tom Nolan (API, IHI) asserted that “flow through the system” was an issue in some ways every bit as crucial and challenging as “safety”, and that, like safety, the issue of flow had somehow become cut off in healthcare from the fundamental sciences that, correctly employed, could help break healthcare free of some costly fetters. The problem of flow in healthcare may not have the charisma of safety, but it has everything else: it is big (indeed gigantic!), pervasive, interesting, and highly remediable.” pp. x, xi

-- Donald M. Berwick, MD, MPP, FRCP, President Emeritus and Senior Fellow, Institute for Healthcare Improvement
Don Berwick’s Reflections on Patient Flow

“As in the world of patient safety, the intellectual challenges in the sciences of flow proved to be of two major types – to master the complex theories and approaches that had matured in other industries and academic disciplines far from healthcare, and, at the same time, to adapt and invent new theories helpful in special contexts of healthcare systems.” p.xi

“Will flow ever acquire the patina of charisma that fuels today’s work on patient safety? I doubt it….But whether so honored or not, the problem of flow is every bit as consequential for the health of our systems and the well-being of our patients.” p.xii

-- Donald M. Berwick, MD, MPP, FRCP, President Emeritus and Senior Fellow, Institute for Healthcare Improvement
Hospital Flow: Impact on Patient Safety

Patient Story

Last March, I went to the ED at a nearby hospital because I was experiencing severe head pain, extreme vertigo, some numbness on my left side, and was rather confused. I got there around 7PM, and I was seen for in an exam room the first time around midnight. Since I suffer from migraines, they assumed that’s what was going on (regardless of me telling them that it was very different than my usual episodes). I was sitting there for so long because the place was filled with people and there were only 2 nurses in the ED. It was close to 4:30AM when I finally saw a physician, who said there’s really not much they can do for me. He said it would be best to go home and rest in my own bed, since the hospital was way too crowded for me to stay. So I went home.

I woke up around 9AM and felt like things were getting worse. I spoke to my friend who is a PA at another ED in Boston, and she told me to go back immediately and request imaging. I did. However, it was a fight to get neurological tests done. Pushing and pushing they finally agreed. I had suffered a vertebral artery dissection and a massive blood clot had formed near the tear. From that, I experienced a Transient Ischemic Attack that could have been a stroke. When they saw that, they apologized for sending me home because of the back up the night earlier. I wound up in the Neuro Unit for more than a week, and it took over six months to recover.
Hospital Flow: Impact on Patient Experience

The patient journey through hospital systems

Please note: The purpose of this diagram is to demonstrate the large number of systems that a patient could pass through on their healthcare journey.

The patient experience is a direct result of how the different hospital systems interact and the way staff work within these systems to provide patient care.
Hospital Flow: Impact on Healthcare Costs

MGH continues to grapple with patient overcrowding

Five years after expansion, problem returns

Massachusetts General Hospital is struggling with an overcrowded emergency department less than five years after it sought to fix the problem with a $500 million expansion.

Boston Globe article (March 2016)
Before the public, payers, policymakers and donors get on the hook — again — for more staff and more extraordinarily expensive capital expenditures, let’s ask these questions first.

- What’s the mix and volume of patients presenting at the emergency department?
- What portion of discharges occur on time, and of the rest, how long are they delayed?
- From when a patient first presents in the ED, what’s the lag until that patient is examined and treatment begins, the time from “door to doc?”
Addressing vexing issues of timely access and patient flow throughout the hospital is essential to ensure safe, high quality, patient-centered care. Delays in treatment and failure to provide the right care, in the right place, at the right time, puts patients at risk for potential harm and sub-optimal care.

Poorly managed patient flow in hospital settings also adds to the already taxing burden on clinicians and accelerates burnout. Improved timely access to appropriate care and hospital flow are critical levers to increase value, for patients, clinicians and health care systems.
Problem Statement for Hospital Flow (2)

Many health care professionals today realize that diversions and long waits and delays in the emergency department (ED) are a hospital-wide issue, not just an emergency department issue. The waits are often the result of emergency department beds being occupied by patients waiting for admission to the hospital.

Lack of inpatient capacity also results in patients being “boarded” in the post-anesthesia care unit (PACU) and often managed on “off service” units. Unfortunately, understanding the problem is one thing, but actually improving hospital-wide patient flow is another.
Effects of High Utilization and Variability in Demand

When the Emergency Department is overcrowded –

- Patients may be diverted to other hospitals (external diversion)
- Patients leave without being seen
- Patients with acute illnesses experience delays in treatment
- Physicians, nurses and staff are overloaded (which often leads to medical errors and burnout of clinicians and staff)
- Throughput is decreased
Adoption of Effective Interventions

### EXHIBIT 2

**Emergency Department (ED) And Hospital Crowding Interventions Implemented By US Hospitals, 2007-10**

<table>
<thead>
<tr>
<th>Hospitals adopting intervention</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>INTERVENTIONS AT THE EMERGENCY DEPARTMENT LEVEL</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bedside registration***</td>
<td>66.3%</td>
<td>72.3%</td>
<td>76.6%</td>
<td>79.2%</td>
</tr>
<tr>
<td>Electronic dashboard***</td>
<td>35.2</td>
<td>40.8</td>
<td>35.7</td>
<td>51.9</td>
</tr>
<tr>
<td>Computer-assisted triage</td>
<td>40.1</td>
<td>46.6</td>
<td>41.2</td>
<td>49.3</td>
</tr>
<tr>
<td>Zone nursing</td>
<td>35.3</td>
<td>37.6</td>
<td>36.5</td>
<td>44.6</td>
</tr>
<tr>
<td>Fast track</td>
<td>33.9</td>
<td>35.0</td>
<td>30.9</td>
<td>39.7</td>
</tr>
<tr>
<td>Increased no. of ED treatment spaces</td>
<td>24.2</td>
<td>28.0</td>
<td>26.7</td>
<td>23.6</td>
</tr>
<tr>
<td>Physical expansion of ED</td>
<td>195</td>
<td>22.4</td>
<td>227</td>
<td>23.1</td>
</tr>
<tr>
<td>ED observation unit****</td>
<td>35.7</td>
<td>32.2</td>
<td>11.6</td>
<td>21.1</td>
</tr>
<tr>
<td>RFID tracking***</td>
<td>9.8</td>
<td>11.8</td>
<td>8.0</td>
<td>20.7</td>
</tr>
<tr>
<td><strong>Mean no. of ED-level interventions</strong></td>
<td><strong>3.00</strong></td>
<td><strong>3.27</strong></td>
<td><strong>2.90</strong></td>
<td><strong>3.53</strong></td>
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<tr>
<td><strong>INTERVENTIONS AT THE HOSPITAL LEVEL</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bed census availability*****</td>
<td>66.1%</td>
<td>70.4%</td>
<td>76.5%</td>
<td>83.4%</td>
</tr>
<tr>
<td>Avoid elective admissions during diversion*</td>
<td>71.9</td>
<td>68.7</td>
<td>71.2</td>
<td>79.2</td>
</tr>
<tr>
<td>Pooled nursing****</td>
<td>33.2</td>
<td>44.8</td>
<td>43.6</td>
<td>60.0</td>
</tr>
<tr>
<td>Bed czar</td>
<td>505</td>
<td>58.2</td>
<td>56.6</td>
<td>59.2</td>
</tr>
<tr>
<td>Full-capacity protocol*****</td>
<td>21.0</td>
<td>27.1</td>
<td>35.5</td>
<td>45.6</td>
</tr>
<tr>
<td>Board patients in inpatient hallways**</td>
<td>148</td>
<td>17.5</td>
<td>17.0</td>
<td>23.8</td>
</tr>
<tr>
<td>Separate operating room for ED cases</td>
<td>37</td>
<td>3.3</td>
<td>1.6</td>
<td>4.8</td>
</tr>
<tr>
<td>Surgical schedule smoothing</td>
<td>39</td>
<td>3.4</td>
<td>4.7</td>
<td>4.6</td>
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<tr>
<td><strong>Mean no. of hospital-level interventions</strong>****</td>
<td><strong>2.21</strong></td>
<td><strong>2.56</strong></td>
<td><strong>2.64</strong></td>
<td><strong>3.02</strong></td>
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<tr>
<td><strong>INTERVENTIONS AT BOTH LEVELS</strong></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean no.****</td>
<td>5.21</td>
<td>5.83</td>
<td>5.54</td>
<td>6.55</td>
</tr>
</tbody>
</table>

Effects of High Utilization and Variability in Demand (2)

- When hospital census is high –
  - Patients are “boarded” in the ED, waiting to be admitted to a hospital bed
  - Patients have overnight stays in the Post-op Recovery Rooms
  - Patients are admitted to alternative units or ICUs (internal diversions or “off-service patients”)
  - Patients may experience delays in treatment or delays or cancelations of surgery
  - Physicians, nurses and staff are overloaded (which often leads to medical errors and burnout of clinicians and staff)
  - Throughput is decreased (there are delays in transferring patients to appropriate units based on their clinical conditions and in discharging patients)
Most hospitals are engaged in individual projects throughout the hospital to improve efficiencies and flow, but few have hospital-wide oversight systems to manage overall operations and patient flow throughout the hospital; there is a need for system-wide metrics to assess and manage patient flow at the macro whole-system level and in microsystems (OR, ED, ICUs, Med/Surg Units).

Most hospitals are engaged in multiple efforts to improve flow, but few have shown quantitative results; need to develop performance targets to dramatically improve hospital operations and flow.

Few hospitals seem to be linking the “shaping demand” concept of decreasing overutilization of hospital services as a concurrent strategy to improve patient flow through the hospital [decreasing readmissions; proactive palliative care; reducing admissions for patient with complex needs; reducing low acuity ED visits; managing artificial variability in surgical scheduling].
Hospital Flow: Key Learning To-Date (2)

- There is a definitive need to simplify, standardize and sequence various matching capacity and demand strategies (variability management and daily real-time capacity and demand strategies)

- Current problems of patient flow in hospitals cannot be solved solely by efforts within the walls of the hospital (need partnerships with primary care, urgent care centers, specialty practices, mental health services, community-based care services, SNFs and nursing homes);

- Demonstrating a ROI for the systems moving to value-based payment models (or ACOs) should help to build will for improvement; avoiding capital expenditures is another incentive
Creating Value for Patients

“Value should always be defined around the customer, and in a well-functioning health care system, the creation of value for patients should determine the rewards for all other actors in the system. Since value depends on results, not inputs, value in health care is measured by the outcomes achieved, not the volume of services delivered, and shifting focus from volume to value is a central challenge. Nor is value measured by the process of care used; process measurement and improvement are important tactics but are no substitutes for measuring outcomes and costs. Since value is defined as out.”
What are your performance goals?

- Decrease overutilization of hospital services?
  - Relocate care to more appropriate care settings
  - Reducing delays in treatment, surgery, transfers, discharge, etc.?
  - Decreasing related medical errors and harm to patients?
  - Manage LOS “outliers”?

- Optimize patient placement to insure the right care, in the right place, at the right time?
  - Decrease external diversions?
  - Decrease internal diversions (“off-service” patients)?

- Maintain adequate staffing levels to maintain quality and safety?

- Increase clinician and staff satisfaction with hospital operations?

- Demonstrate a ROI for the hospital or the health system?
  - Is your goal to have a high utilization of your hospital resources (procedures, beds and staff)? What is the right goal?
  - What are the quality and safety balancing measures?
  - When do you consider adding more bed capacity?
Hospital Occupancy Rates in MA (2012)

A hospital’s average occupancy rate measures the percent of the hospital’s inpatient staffed beds that have been occupied over the course of a year. Statewide, the median acute hospital occupancy rate is equal to the national average—both at 65%. However, both the academic medical center and teaching hospital cohorts have higher occupancy rates than other cohorts, as shown in Table 4:

<table>
<thead>
<tr>
<th>Cohort</th>
<th>FY2012 Occupancy Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Academic Medical Centers</td>
<td>84%</td>
</tr>
<tr>
<td>Teaching</td>
<td>74%</td>
</tr>
<tr>
<td>Community</td>
<td>62%</td>
</tr>
<tr>
<td>Community-DSH</td>
<td>61%</td>
</tr>
<tr>
<td>Specialty*</td>
<td>64%</td>
</tr>
</tbody>
</table>

A national average occupancy of 78% applies to hospitals with 1,000 beds in the USA.
Average Occupancy Rates (at hospital or unit levels) and the Day-to-Day Realities of Managing Patient Flow
Queuing Theory

- Systems serving unscheduled (uncontrolled) arrivals behave in a characteristic fashion.
- When (patient) inflow and service times are random, their response to increasing utilization is non-linear.
- As utilization rises above 80-85%, waits and rejections increase exponentially.

At high levels of utilization small changes can lead to big improvements…
Lessons from Queuing Theory

\[ y = 0.0003e^{7.8221x} \]

\[ R^2 = 0.5294 \]
Smaller hospitals and units have to run at lower average occupancy. This explains the observed higher nursing cost per bed day in smaller wards and the lower average occupancy observed to be associated with the smaller specialty bed pools.

The figure of 3% turn-away was considered to be a pragmatic compromise between operational efficiency and the capital cost issues applicable to the UK but comes at the cost of not being able to guarantee waiting time targets.

‘turn-away’ - a measure of the chaos, difficulty and effort implied in running the hospital, i.e. ambulances diverted elsewhere, patients held on trolleys in the emergency department, medical patients in surgical beds, cancelled operations, managers and clinicians hastily re-arranging schedules, bed management meetings and general operational complexity.

Hospital Occupancy Rates

- Based on AHA data, overall nationwide hospital inpatient occupancy was 67.8% (AHA 1991–2011); range was from 33.6% to 74%)

- Once managed efficiently, US hospitals, on average, could achieve an 80–90 percent bed occupancy rate—without adding beds at capital costs of approximately $1 million per bed.

- As a result of “smoothing” the scheduling of elective surgeries, improving discharge efficiencies and other interventions to improve flow at CCHMC, the hospital’s quality of care improved even as the occupancy rate grew from 76 percent to 91 percent. Hospital officials also report improved overall safety for patients and reduction in stress on the doctors and nurses who treat them.

Complexity and Simplicity

For the simplicity that lies this side of complexity, I would not give a fig, but for the simplicity that lies on the other side of complexity, I would give my life. (Oliver Wendell Holmes)

…Simplicity often lies on the other side of complexity, so for any problem, the more you can zoom out and embrace complexity, the better chance you have of zooming in on the simple details that matter most. (Eric Berlow)
Complexity and Simplicity

If you can't explain it simply, you don't understand it well enough.

- Albert Einstein

Everything should be made as simple as possible, but not simpler.

- Albert Einstein
**Strategies**

1. **Shape the Demand** (reduce bed days; reduce ED visits; smooth elective surgeries and downstream bed utilization)

2. **Match Capacity to Demand** (reduce delays in moving patients to appropriate units throughout hospital; ensure patients are admitted to the appropriate unit)

3. **Redesign the System** (increase throughput; reduce bed days, manage LOS outliers, and reduce delays and waiting times)
Strategies to Achieve System-Wide Hospital Flow

Outcomes

• Decrease overutilization of hospital services
• Optimize patient placement to insure the right care, in the right place, at the right time
• Increase clinician and staff satisfaction
• Demonstrate a ROI for the systems moving to bundled payment arrangements

Strategies

Will

Ideas

Execution

Primary Drivers

- Strategic Priority and Aligned Incentives
- Mutuality between Physicians and Hospital Executives
- Integrated Health Care Systems and/or ACOs
- Avoidance of Capital Expenditures
- Positive ROI and Financial Viability
- Shape the Demand
- Match Capacity and Demand
- Redesign the System
- Utilization of Hospital-wide Metrics to Guide Learning Within and Across Projects for Achieving Results
- Accountable Executive Leadership Providing Oversight of System-Level Performance
- Data Analytics to Provide Real-time Capacity and Demand Management and Forecasting
- Micro-system Quality Improvement Capability and Empowerment
### Managing Complex Change

<table>
<thead>
<tr>
<th>Vision</th>
<th>Skills</th>
<th>Incentives</th>
<th>Resources</th>
<th>Action Plan</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- Vision + Skills + Incentives + Resources + Action Plan = Change
- Vision + Skills + Incentives + Resources + Action Plan = Confusion
- Vision + Skills + Incentives + Resources + Action Plan = Anxiety
- Vision + Skills + Incentives + Resources + Action Plan = Resistance
- Vision + Skills + Incentives + Resources + Action Plan = Frustration
- Vision + Skills + Incentives + Resources + Action Plan = False Starts

Driver Diagram: Ideas to Improve Hospital Flow

Outcomes
- Decrease overutilization of hospital services
- Optimize patient placement to insure the right care, in the right place, at the right time
- Increase clinician and staff satisfaction
- Demonstrate a ROI for the systems moving to bundled payment arrangements

Primary Drivers
- Shape or Reduce Demand
- Match Capacity and Demand
- Redesign the System

Secondary Drivers
- S1 Relocate care in ICUs in accordance with patients EOL wishes
- S2 Decrease demand for Med/Surg beds by preventing avoidable readmissions
- S3 Relocate low-acuity care in EDs to community-based care settings
- S4 Decrease artificial variation in surgical scheduling
- S5 Decrease demand for hospital beds by reducing hospital acquired conditions
- S6 Reduce ED visits & hospital admissions through delivering appropriate care
- S7 Oversight system for hospital-wide operations to optimize patient flow
- S8 Real-time demand and capacity management processes
- S9 Flex capacity to meet hourly, daily and seasonal variations in demand
- S10 Early recognition for high census and surge planning
- S11 Improve efficiencies and throughput in the OR, ED, ICUs and Med/Surg Units
- S12 Improve efficiencies & coordination of discharge processes
- S13 Service Line Optimization (frail elders, SNF residents, stroke patients, etc.)
- S14 Reducing unnecessary variations in care and managing LOS “outliers”

Specific Change Ideas
- C1 Reliably identify EOL wishes and proactively create and execute advanced illness plans
- C1 Development of palliative care programs (hospital-based and community-based)
- C2 Reduce readmissions for high risk populations
- C3 Extended hours in primary care practices
- C3 Develop partnerships with Urgent Care and Retail Clinics
- C3 Enroll patients in community-based mental health services
- C3 Paramedics & EMTs triaging & treating patients at home
- C4 Separate scheduled and unscheduled flows in the OR
- C4 Redesign surgical schedules to create an predictable flow of patients to downstream ICUs and inpatient units
- C5 Decrease complications/harm (HAPU, CAUTI, SSI, falls with harm) and subsequent LOS
- C6 Reliably use of clinical pathways and evidence-based medicine
- C7 Assess seasonal variations and changes in demand patterns and proactively plan for variations
- C8 Daily flow planning huddles (improve predictions to synchronize admissions, discharges and discharges)
- C8 Real-time demand and capacity problem-solving (managing constraints and bottlenecks)
- C9 Planning capacity to meet predicted demand patterns
- C10 High census protocols to expedite admissions from the ED and manage surgical schedules.
- C11 Increase OR throughput through efficiency changes
- C11 ED efficiency changes to decrease LOS
- C11 Decrease LOS in ICUs (timely consults, tests and procedures)
- C11 Decrease LOS on Med/Surg Units (case management for patients with complex medical and social needs)
- C12 Initiate final discharge preparations when the patient is clinically ready for discharge
- C13 Care management for vulnerable/high risk patient populations
- C14 Advance planning for transfers to community-based care settings
- C14 Cooperative agreements with rehab facilities, SNFs and nursing homes
# Draft Hospital Flow Metrics

## Hospital Macro

- **Average Occupancy Rate**
- **Readmissions within 1 week of discharge**
- **Readmissions within 30 days after discharge**
- **Patient experience (HCAHPS measures related to waits & delays)**
- **Clinician and staff satisfaction related to workload (ex. NDNQI)**
- **Number of “off-service” patients**
- **Number of HACs (ex. falls with injury, VAPs, etc.)**

## Emergency Department

- **ED diversions**
  - # of diversions
  - hours per month
- **Patients who “left without being seen”**
- **Visits per day**
- **Average length of stay**
  - for patients who are discharged
  - for patients who are admitted
- **Door to provider time**
- **Time from decision to admit to transfer to inpatient unit**
- **Number of “ED boarders” waiting to be admitted to a hospital bed**
- **Time from decision to have emergency surgery to OR**
- **Percentage of ESI level 4 & 5 patients (low acuity)**
- **Percentage of patients who were admitted**
- **Readmissions within 1 week of discharge**
- **Readmissions within 30 days after discharge**
- **Patient experience (HCAHPS measures related to waits & delays)**
- **Clinician and staff satisfaction related to workload (ex. NDNQI)**
- **Number of “off-service” patients**
- **Number of HACs (ex. falls with injury, VAPs, etc.)**
## Draft Hospital Flow Metrics

### Critical Care Units
- Average Census
- Average Length of Stay
- Number of “LOS outliers” per month
- Number of decedents spending 7 or more days in the ICU in the last 6 months of life
- Number of ICU diversions due to lack of capacity (# of “off-service patients”)
- Nursing Overtime
- Number of HACs
- Delays in Transferring Patients to Med/Surg Units

### Med/Surg Units
- Average Census
- Average Length of Stay
- Number of “LOS outliers” per month
- Nursing Overtime
- Number of HACs
- Median discharge time (or discharge profile)

### Operating Rooms
- Number of emergency cases by day
- Number of scheduled cases by day
- Percentage of OR utilization
- Number of changes from schedule for Elective Surgical Cases
- Actual and Scheduled Start Times for Elective Surgical Cases
- Nursing Overtime
  - OR
  - PACU
- Number of overnight PACU patients
Shape or Reduce Demand

S1 Relocate care in ICUs and Medical and Surgical Units in accordance with patients EOL wishes

S2 Decrease demand for Med/Surg beds by preventing avoidable readmissions

S3 Relocate low-acuity care in EDs to community-based care settings

S4 Decrease artificial variation in surgical scheduling

S5 Decrease demand for hospital beds by reducing harm and hospital acquired conditions

S6 Reduce demand for ED visits and hospital admissions through delivering appropriate care

Delivering safe and reliable evidence-based care
The Conversation Continuum

End of Life Wishes

Healthy
Living with Chronic Illness
Approaching End of Life

Expressed
Spoken
Documented

Respected
Accessed
Implemented
Strategies to Reduce Readmissions

- Rehospitalizations are frequent, costly, and actionable for improvement.
- Focus on addressing the medical and social needs patients and family caregivers, not penalties.
- The IHI approach acts on multiple levels – engaging hospitals and community providers, communities, and state leaders in pursuit of a common aim to reduce avoidable rehospitalizations.
- Working to reduce rehospitalizations focuses on improved communication and coordination over time and across settings:
  - With patients and family caregivers;
  - Between clinical providers;
  - Between the medical and social services (e.g. aging services, etc.)
- Working to reduce rehospitalizations is one part of a comprehensive strategy to promote patient-centered care and appropriate utilization of health care resources.
## Emergency Severity Index (ESI) and Patient Acuity

<table>
<thead>
<tr>
<th>Degree of Acuity</th>
<th>Level of Acuity</th>
<th>Patient Condition/Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>High</strong></td>
<td><strong>LEVEL 1 EMERGENT</strong></td>
<td>Patients in this category require immediate attention with maximal utilization of resources to prevent loss of life, limb, or eyesight.</td>
</tr>
<tr>
<td></td>
<td><strong>LEVEL 2 URGENT</strong></td>
<td>Patients in this category should be seen by a physician because of high risk for rapid deterioration, loss of life, limb, or eyesight if treatment or interventions are delayed.</td>
</tr>
<tr>
<td><strong>Medium</strong></td>
<td><strong>LEVEL 3 ACUTE</strong></td>
<td>Patients who develop a sudden illness or injury within 24-48 hours. Symptoms and risk factors for serious disease do not indicate a likelihood of rapid deterioration in the near future.</td>
</tr>
<tr>
<td><strong>Low</strong></td>
<td><strong>LEVEL 4 ROUTINE</strong></td>
<td>Patients with chronic complaints, medical maintenance, or medical conditions posing no threat to loss of life, limb, or eyesight.</td>
</tr>
<tr>
<td></td>
<td><strong>LEVEL 5 ROUTINE</strong></td>
<td>Patients in this category are currently stable and require no resources such as labs or x-ray.</td>
</tr>
</tbody>
</table>
Managing and Reducing Variability in Surgical Scheduling

**Natural Variability** (Clinical Variability, Flow Variability, Professional Variability)
- Random
- Can not be eliminated (or even reduced)
- Must be optimally managed’

**Artificial Variability**
- Non-random
- Non-predictable (driven by unknown individual priorities)
- Should not be managed, must be identified and eliminated
Separate Flows for Elective and Non-Elective Surgical Cases

Mayo Clinic Florida

- Surgical volume and surgical minutes increased by 4% and 5%, respectively;
- Prime time use increased by 5%;
- Overtime staffing decreased by 27%;
- Day-to-day variability decreased by 20%;
- The number of elective schedule same day changes decreased by 70%;
- Staff turnover rate decreased by 41%. Net operating income and margin improved by 38% and 28%, respectively.

Smooth the Flow of Electively Scheduled Surgical Cases

By applying variability methodology, queuing theory and the I/T/O model, hospitals can identify and eliminate many of the patient flow impediments caused by operational inefficiencies.

By smoothing the inherent peaks-and-valleys of patient flow, and eliminating the artificial variability that unnecessarily impair patient flow, hospitals can improve patient safety and quality while simultaneously reducing hospital waste and cost.

2006 IOM Report: *The Future of Emergency Care in the U.S. Health System (Hospital-Based Emergency Care: At the Breaking Point)*
Match Capacity Demand

S7 Oversight system for hospital-wide operations to optimize patient flow

S8 Flex capacity to meet hourly, daily and seasonal variations in demand

S9 Real-time demand and capacity management processes

S10 Early recognition for high census and surge planning
Flex Capacity to Meet Seasonal, Day of the Week and Hourly Variations in Demand

- Can you predict a surge in admissions for patients with medical conditions in the winter months?
  - Use seasonal flex units to manage increases in medical patients during the winter months
- Can you anticipate which units need more bed capacity? (which services consistently have a large number of “off-service patients”)
  - Use data analytics to quantify needs of each service
- Do you have a regular surge of activity mid-week with the hospital census regularly reaching >95% occupancy?
  - Smooth elective surgical schedules (particularly for patients who will require ICU care post-op)
Classic ED Patient Demand Patterns

**Emergency Department Admission Times: 1 Hour Increments**

- **FY2004 Q-1**: 154, 149, 120, 81, 79, 99, 153, 166, 269, 253, 277, 235, 307, 352, 299, 278, 211

**ED Hourly Census And Arrivals**

- **Average Hourly Census/Arrivals**
- **HR of Day**

**ED Hourly Lab/Radiology Orders**

- **Average Hourly Lab/Radiology Orders**
- **HR of Day**
RN Capacity for Predicted ED Demand

Aggregate Demand/RN Capacity

Projected Total RN Demand
Total RN Staffing
Admissions and Discharges

Hospital: hourly hospital inpatient admission and discharge profile, 1 Apr to 26 May 2013

Average daily hospital admissions and discharges (excl. elective LoS = 0 day stays in non-inpatient areas), n; by hour of day
Source: local unvalidated TrakCare extract, taken Jun 2013, note: results are intended for management information only
Redesign the System

S11 Improve efficiencies and throughput in the OR, ED, ICUs and Med/Surg Units

S12 Improve efficiencies & coordination of discharge processes

S13 Service Line Optimization (frail elders, SNF residents, stroke patients, etc.)

S14 Reducing unnecessary variations in care and managing LOS “outliers”
16-Bed MICU
We need more beds!

Emergency Center
- Reduced EC – ICU admit time
- Efficient

Wards
- Reduce admission delays
- Timely

Sepsis Management
- Stabilization
- Safe

Reliable weaning protocol
- Weaning
- Effective

VAP, CR-BSI bundles
- Complications
- Safe

End-of-Life
- Standardize family meetings
- Patient-centered

RRT team
- RRT to reduce floor codes

Ward Home Other facility

Bela Patel, MD and Khalid Almoosa, MD

Decreased Length of Stay
Focused on Geriatric Medicine Service:

- 33% of medicine patients over 75 with and increasing number over 90 years old; 50% were receiving specialized care/therapy; 50% awaiting discharge coordination
- Analysis of outlier hospital stays revealed multiple points when patients could have been discharged; 66% of frail elders arrived after 6PM and were not seen by geriatrician until the next morning (20% of patients had the diagnosis changed after being seen by the geriatrician)

Changes:

- Matched specialist capacity to patient demand
- Developed a Frailty Unit with specialized focus and teams
- Sped up discharge process and patients discharged when medically ready; home assessment for safety and support (saved up to two weeks); Continuous improvement teams continuously looking for additional ways to shorten hospital stays
Sheffield Teaching Hospitals NHS Trust

Figure SH8: Geriatric medicine bed occupancy rate and associated tests of change
(provided by Sheffield Teaching Hospitals NHS Trust)
Driver Diagram: Ideas to Improve Hospital Flow

Outcomes
- Decrease overutilization of hospital services
- Optimize patient placement to insure the right care, in the right place, at the right time
- Increase clinician and staff satisfaction
- Demonstrate a ROI for the systems moving to bundled payment arrangements

Primary Drivers
- Shape or Reduce Demand
- Match Capacity and Demand
- Redesign the System

Secondary Drivers
- S1 Relocate care in ICUs in accordance with patients EOL wishes
- S2 Decrease demand for Med/Surg beds by preventing avoidable readmissions
- S3 Relocate low-acuity care in EDs to community-based care settings
- S4 Decrease artificial variation in surgical scheduling
- S5 Decrease demand for hospital beds by reducing hospital acquired conditions
- S6 Reduce ED visits & hospital admissions through delivering appropriate care
- S7 Oversight system for hospital-wide operations to optimize patient flow
- S8 Real-time demand and capacity management processes
- S9 Flex capacity to meet hourly, daily and seasonal variations in demand
- S10 Early recognition for high census and surge planning
- S11 Improve efficiencies and throughput in the OR, ED, ICUs and Med/Surg Units
- S12 Improve efficiencies & coordination of discharge processes
- S13 Service Line Optimization (frail elders, SNF residents, stroke patients, etc.)
- S14 Reducing unnecessary variations in care and managing LOS “outliers”

Specific Change Ideas
- C1 Reliably identify EOL wishes and proactively create and execute advanced illness plans
- C1 Development of palliative care programs (hospital-based and community-based)
- C2 Reduce readmissions for high risk populations
- C3 Extended hours in primary care practices
- C3 Develop partnerships with Urgent Care and Retail Clinics
- C3 Enroll patients in community-based mental health services
- C3 Paramedics & EMTs triaging & treating patients at home
- C4 Separate scheduled and unscheduled flows in the OR
- C4 Redesign surgical schedules to create an predictable flow of patients to downstream ICUs and inpatient units
- C5 Decrease complications/harm (HAPU, CAUTI, SSI, falls with harm) and subsequent LOS
- C6 Reliably use of clinical pathways and evidence-based medicine
- C7 Assess seasonal variations and changes in demand patterns and proactively plan for variations
- C8 Daily flow planning huddles (improve predictions to synchronize admissions, discharges and discharges)
- C8 Real-time demand and capacity problem-solving (managing constraints and bottlenecks)
- C9 Planning capacity to meet predicted demand patterns
- C10 High census protocols to expedite admissions from the ED and manage surgical schedules.
- C11 Increase OR throughput through efficiency changes
- C11 ED efficiency changes to decrease LOS
- C11 Decrease LOS in ICUs (timely consults, tests and procedures)
- C11 Decrease LOS on Med/Surg Units (case management for patients with complex medical and social needs)
- C12 Initiate final discharge preparations when the patient is clinically ready for discharge
- C13 Care management for vulnerable/high risk patient populations
- C14 Advance planning for transfers to community-based care settings
- C14 Cooperative agreements with rehab facilities, SNFs and nursing homes
Strategies to Achieve System-Wide Hospital Flow

Outcomes

- Decrease overutilization of hospital services
- Optimize patient placement to insure the right care, in the right place, at the right time
- Increase clinician and staff satisfaction
- Demonstrate a ROI for the systems moving to bundled payment arrangements

Strategies

- Will
- Ideas
- Execution

Primary Drivers

- Strategic Priority and Aligned Incentives
- Mutuality between Physicians and Hospital Executives
- Integrated Health Care Systems and/or ACOs
- Avoidance of Capital Expenditures
- Positive ROI and Financial Viability
- Shape the Demand
- Match Capacity and Demand
- Redesign the System
- Utilization of Hospital-wide Metrics to Guide Learning Within and Across Projects for Achieving Results
- Accountable Executive Leadership Providing Oversight of System-Level Performance
- Data Analytics to Provide Real-time Capacity and Demand Management and Forecasting
- Micro-system Quality Improvement Capability and Empowerment