Why Do Flow?  
The Cincinnati Children’s Hospital Journey

Frederick C. Ryckman, MD
Professor of Surgery / Transplantation – Retired; Sr. Vice President – Medical Operations, Cincinnati Children’s Hospital, University of Cincinnati
fcryckman1@gmail.com

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Nothing to Disclose

• I have no relevant financial or nonfinancial relationship(s) within the services described, reviewed, evaluated or compared in this presentation.
Who am I

- 40 years clinical practice
  - Pediatric Surgery : Transplantation : ECMO
- Surgical Director Transplantation : ECMO
  - Multi-Disciplinary Teams
  - Evidence Based Care
- Sr. Vice President – Medical Operations
  - Interim COO
- Peri-Operative Services Director
- Operational Leader – Flow and Capacity
- Clinical Director – Pediatric Surgery, ACGME Fellowship
What Do Patients “Hire” Us to Provide
What do they call “Value”

- Make the Right Diagnosis
- Deliver the Correct Therapy / Treatment
- Prevent Complications or Errors in Care
- Deliver Safe Care regardless of the Inherent Risks
- Get Me Home, Keep me at Home
- Respect my needs
- Give me my Money’s Worth

Outcomes
Safety
Patient / Family Experience
Value

This is all FLOW management –
it is essential for SAFETY, PATIENT / FAMILY EXPERIENCE
and QUALITY DELIVERY

“Flow” is a Safety Initiative

- Getting the “Rights” Right
  - Right Diagnosis and Treatment
  - Right Patient in Right Bed – Location
  - Right Nursing Staff and Staffing Expertise
  - Disease Specific Expertise
  - Equipment Expertise

Best Care Model

- Requires ability to “Predict” future needs, and manage present
capacity and control variability
- Operations Management techniques to understand and manage variability
  are the key to success
Value Equation for Healthcare

\[
\text{Value} = \frac{(\text{Outcomes} + \text{Patient Experience}) \times \text{Appropriateness}}{\text{Cost} + \text{“Hassle Factor”}}
\]

Aims of Flow – Linkage to safety

Impact of delayed transfer of critically ill patients from the emergency department to the intensive care unit


- 50,322 patients – delayed > 6 hours (1,036) vs no delay < 6 hours (49,286)
- Primary Outcome – Mortality
  - ICU Mortality – 10.7% delayed vs 8.4% no delay – p<0.01
  - In-hospital Mortality – 17.4% delayed vs. 12.9% no delay - p<0.001
- Secondary Outcome – Hospital Length of Stay
  - 7 days delayed vs. 6 days no delay – p<0.001
- Conclusion – Delay in ICU transfer led to increased Mortality and LOS
Aims of Flow – Linkage to safety

Association of delay of urgent or emergency surgery with mortality and use of health care resources


- 15,160 non cardiac surgery patients
- “Delay” – booking to OR entry > institutional accepted wait times – 5 levels
- 2,820 patients (18.6%) experienced a delay
- Results:
  - Mortality – 4.9% delayed vs 3.2% no delay – OR=1.59
  - Propensity Matched Mortality – OR 1.56
  - Increased LOS (2.6 days) and Cost ($3,335) as well

Table 2: Reasons for delay in access (n=1109)

<table>
<thead>
<tr>
<th>Reason</th>
<th>No. (% of patients)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Availability of personnel</td>
<td>352 (31.7)</td>
</tr>
<tr>
<td>Anesthesiologist</td>
<td>42</td>
</tr>
<tr>
<td>Nurse</td>
<td>5</td>
</tr>
<tr>
<td>Surgeon</td>
<td>305</td>
</tr>
<tr>
<td>Availability of physical resources</td>
<td>347 (31.3)</td>
</tr>
<tr>
<td>Operating room</td>
<td>138</td>
</tr>
<tr>
<td>Postanesthesia care unit</td>
<td>11</td>
</tr>
<tr>
<td>Equipment</td>
<td>14</td>
</tr>
<tr>
<td>Multifactorial delay</td>
<td>409 (41.4)</td>
</tr>
<tr>
<td>Surprised by higher priority case</td>
<td>459</td>
</tr>
<tr>
<td>Patient specific delay</td>
<td>361 (33.6)</td>
</tr>
<tr>
<td>Medically complex or decompensated patient</td>
<td>151</td>
</tr>
</tbody>
</table>

CBDI: Patient Flow and Safety

- 56 beds in CBDI 6/13
- 68 beds in CBDI 2/14
- 80 beds in CBDI 4/14
- 360 new oncology patients per year
- 100-110 bone marrow transplants per year
CBDI: Patient Inflow and Safety

Number of New Relapsed/Refractory Oncology Patients

Months
- Number of New Relapsed/Refractory Oncology Patients per Month
- Median

Average Daily Census in the CBDI

Active Phase 1 Patients in the CBDI

July_11 (n=1247)
Aug_11 (n=1094)
Sept_11 (n=1122)
Oct_11 (n=1238)
Nov_11 (n=1295)
Dec_11 (n=1380)
Jan_12 (n=1526)
Feb_12 (n=1362)
Mar_12 (n=1434)
Apr_12 (n=1550)
May_12 (n=1352)
Jun_12 (n=1410)
Jul_12 (n=1501)
Aug_12 (n=1415)
Sep_12 (n=1240)
Oct_12 (n=1280)
Nov_12 (n=1058)
Dec_12 (n=1136)
Jan_13 (n=1228)
Feb_13 (n=1081)
Mar_13 (n=1234)
Apr_13 (n=1314)
May_13 (n=1368)
June_13 (n=1246)
Jul_13 (n=1695)
Aug_13 (n=1652)
Sep_13 (n=1456)
Oct_13 (n=1606)
Nov_13 (n=1473)
Dec_13 (n=1414)
Jan_14 (n=1553)
Feb_14 (n=1426)
Mar_14 (n=1774)
Apr_14 (n=2157)
May_14 (n=2222)

Primary BSI Rate per 1000 line days

CBDI: Unit Stress and CA-BSI

Primary BSI Rate in CCHMC CBDI (July 2011-May 2014)

- Monthly Primary BSI Rate
- Median BSI rate
- Control Limits
Staffing and Environment - Mortality

Nurse Staffing and Hospital Mortality

- Tertiary Medical Center – 197,691 patients, 176,696 RN shifts, 43 hospital units

- Relationship between nurse staffing and patient turnover
  - Risk of Death ↑ 2-3 % for each below target shift
  - Risk of Death ↑ 4-7 % for every high turnover shift
    - Admissions, discharges, and transfers
  - Risk of Death ↑ 12 % for each below target shift
  - Risk of Death ↑ 15 % for every high turnover shift

- Independent Variables when considering risks


Critical Care Nursing and Outcomes

- Two Studies – Characteristics of Critical Care Nursing and Pediatric Cardiac Surgery Mortality
  - 2009-10 – 38 Children’s Hospitals – Risk Adjusted
  - 29 Children’s Hospitals – 15,463 patients – STS Database

Conclusion: Experience Matters

<table>
<thead>
<tr>
<th>In Hospital Mortality</th>
<th>O.R. for each 10% change</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 2 Years Experience</td>
<td>1.12</td>
<td>P&lt;0.001</td>
</tr>
<tr>
<td>&gt; 11 Years Experience</td>
<td>0.89</td>
<td>P=0.04</td>
</tr>
<tr>
<td>&gt; 16 Years Experience</td>
<td>0.82</td>
<td>P=0.06</td>
</tr>
<tr>
<td>% RN BSN or higher</td>
<td>0.91</td>
<td>P=0.02</td>
</tr>
</tbody>
</table>

Flow Failures and Flow Delays

**Delay**
- Wait 2 hours
- Go to Correct Destination

**Divert**
- Leave Now
- Go to Atlanta
- Maybe get to Florida

**Flow Delay**
- Right Location
- Risk – Treatment while delayed
- Right’s Right

**Flow Failures and Flow Delays**

- **Flow Failure** - Flow related event puts a patient in a position where they may suffer a serious safety event due to lack of resources or the correct care team
  - Risk – Very High
  - Incorrect location to receive correct care

- **Flow Delay** – Event where a patient is held in a site an inappropriate length of time, resulting in waste of their time and a delay in care progression
  - Risk – Moderate and time / site related
Critical Flow Failure – System Wide Function

Monthly Critical Flow Failures

Flow System Failure | Delay Failures
--- | ---
“Holds” in the ED | 
Patients staying overnight in the PACU | 
Times PICU bed not immediately available for Urgent Use | 
Delayed or canceled surgery because of bed capacity | 
Patients who remain in an ICU bed longer than medically necessary because an appropriate bed is not available | 

Placement Failures
Psychiatry patients placed anywhere outside of their primary unit | 
Hem/Onc/BMT patients placed anywhere outside of their primary unit | 
Transplant patients not on A4N | 
Ventilated patients who are admitted to the ICU because a bed is not available on TCC | 

System Wide Patient Flow Delay Measure

Composite Measure
Delay Definition
PACU > 20 Min
ICU to floor > 2 Hr
ER to Adm > 1 Hr

Percent of Patients Delayed (includes ED, PACU, and PICU*)

Desired Direction

Quarter

Weighted % of Patients Delayed  Median  Goal
Health Care Delivery System Transformation
Strategic Improvement Priorities and System Level Measures

System Level Measures

1. Adverse drug events (ADE) per 1,000 doses
2. Nosocomial infection rates: Bloodstream infection rate
3. Surgical site infection rate
4. VAP infection rates
5. Safe Practices
6. Serious Safety Events
7. Functional Health Status
8. Touch Time for Providers
9. Employee Satisfaction
10. Staffing Effectiveness
11. Physician Satisfaction
12. Voluntary staff turnover rate
13. Accident rate for staff with Work days lost

Risk Adjusted Cost per Discharge

Organizing For Transformation

1. Board Oversight
2. Senior Leadership Focus
3. System-Wide Priorities
4. Operational Excellence Teams
5. Division/Microsystem-Based Priorities
6. Individual System Performance Data

Board Chair – We Own Safety (Flow)
Ownership of Mission Goals and Integration of Safety: Flow
Front-Line Leaders Leading Skilled Experienced Leaders MD:RN Diad + Assoc. Leads Always “On-Stage” Focus on Process Execution
Feedback on Process and Outcome Success

Institute for Healthcare Improvement
Leadership Design – O.R. Smoothing Project

LEADERSHIP GROUP
CEO / CFO Active Support
MD Surgery:Anesthesia / RN Nursing Director
ROLE - LEAD

WORKING GROUP
Multi – Disciplinary Surgical / Proceduralists
Nursing – Anesthesia – Administration - Data Support / Quality Improvement Teams
ROLE – SET PRIORITIES – IMPLEMENT - MONITOR PERFORMANCE

CASE STRATIFICATION
Clinically Established Urgency Based

TIME GOALS
Patient Access Determined by Clinical Need

CLINICAL CRITERIA
Optimize Access - Maximum Patient Safety

Hospital Flow - Challenge of Team
Multiple Sites – All Interactive / Interdependent

Families
Nursing
Patients
Medical Staff
Housestaff
ED
Out Patients
OR
In Patients
ICU
IHI Theory on Flow

Outcomes

Primary Drivers

Secondary Drivers

Specific Change Ideas

Shape or Reduce Demand

• 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

Match Capacity and Demand

• Relocate care in ICUs in accordance with patients EOL wishes
• Relocate care in Med/Surg units to community-based care settings
• Relocate low acuity care in EDs to community-based care settings
• Decrease demand for hospital beds through following appropriate care
• Decrease variation in surgical scheduling

Redesign the System

• Oversite system for hospital-wide operations to optimize patient flow
• Real-time demand and capacity management processes
• Flex capacity to meet hourly, daily and seasonal variations in demand
• Early recognition for high census and surge planning

IHI Theory on Flow

Working Premise – Surgical Care

• No patient wants compromises in their care if they are the one having surgery – elective or emergent
• Surgeons want to deliver great, careful and safe care for their patients

• We regularly structure care in the OR around efficient and revenue enhancing scheduling of elective cases and block time
• Delayed urgent case scheduling leads to increased risk of complications and poor outcome
Surgical Streams of Care

- **Urgent / Emergent Surgery**
  - Predictable and Measurable – Natural Variation
  - Possible to Model
  - Can be managed within the System with resource allocation
  - Delay ➔ Increased risk and worse outcomes

- **Elective Surgery**
  - Unpredictable – Whim of Surgical Schedule
  - High variability over time
  - Delay ➔ Case specific risk

- **Initial Design around Urgent Needs**
  - Goal – No urgent cases in Block Time
  - Allocate “Block” for Urgent Needs

Traditional Block

- Reactive System
- Urgent Emergent Cases placed within Block Time
- Elective Case Plan disrupted, prolonged waiting time for elective patients
- Inefficient (Unsafe) Access for Urgent Cases
- Push complex Elective Cases into the evening or at night when resources were limited
- Overtime
- Wrong Team in OR

\[ \text{Not Ideal} \]
### Scheduling Guidelines – A to E

#### GUIDELINES FOR SURGICAL CASE GROUPING DIAGNOSES/PROCEDURES

**(guideline only: medical judgment required)**

**Acute Life and Death Emergencies**

<table>
<thead>
<tr>
<th>A &lt; 30 Minutes</th>
<th>C &lt; 4 Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acute airway emergency (upper airway obstruction)</td>
<td>Access with urgency</td>
</tr>
<tr>
<td>Cardiac surgery postop bleeding with tamponade</td>
<td>Access with urgency (non-urgent diagnostic L&amp;B: fast branch, non-symptomatic foreign body)</td>
</tr>
<tr>
<td>Cardiorespiratory decompensation (severe)</td>
<td>Appendicectomy with siopued progression</td>
</tr>
<tr>
<td>Liver transplant postoperative emergency</td>
<td>Blunt abdominal trauma</td>
</tr>
<tr>
<td>Malrotation with volvulus</td>
<td>Cardiac catheterization</td>
</tr>
<tr>
<td>Massive bleeding</td>
<td>Cerebrovascular accident</td>
</tr>
<tr>
<td>Multiple Trauma unstable or OR: resuscitation</td>
<td>Cesarean section</td>
</tr>
</tbody>
</table>

**Emergent, but not immediately life threatening**

<table>
<thead>
<tr>
<th>B &lt; 2 Hours</th>
<th>D &lt; 8 Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acute shunt malfunction</td>
<td>Abscess drainage</td>
</tr>
<tr>
<td>Acute spinal cord compression</td>
<td>Appendicectomy/obstructive</td>
</tr>
<tr>
<td>Bladder rupture</td>
<td>Caecostomy</td>
</tr>
<tr>
<td>Bowel perforation, traumatic</td>
<td>Cubital ligament repair</td>
</tr>
<tr>
<td>Cardiac congenital emergencies: hemodynamic or pulmonary instabilities</td>
<td>Dental intervention</td>
</tr>
<tr>
<td>Coma</td>
<td>Drainage</td>
</tr>
<tr>
<td>Compartment syndrome</td>
<td>ECMO cannulation</td>
</tr>
<tr>
<td>ECMO</td>
<td>Embolization for acute hemorrhage</td>
</tr>
<tr>
<td>Embolized areas with tracheoesophageal fistula</td>
<td>Embolization for delayed hemorrhage</td>
</tr>
<tr>
<td>Gastric/peptic perforation with air leak</td>
<td>Endoscopic intubation (confirmed intubation)</td>
</tr>
<tr>
<td>Heart, heart-lung transplant, liver transplant,</td>
<td>Laparoscopy</td>
</tr>
<tr>
<td>Incarcerated hernia</td>
<td>Liver transplant (ORGAN AVAILABLE)</td>
</tr>
<tr>
<td>Intestinal obstruction with suspected vascular compromise</td>
<td>Liver transplant with suspected thrombosis</td>
</tr>
<tr>
<td>Intussusception</td>
<td>Liver transplant with graft failure</td>
</tr>
<tr>
<td>Ischemic intestinal or compartment syndrome</td>
<td>Liver transplant with suspected vascular compromise</td>
</tr>
<tr>
<td>Liver/Multivisceral/SI transplant (when organ available)</td>
<td>Liver transplant with suspected vascular compromise</td>
</tr>
<tr>
<td>Liver transplant</td>
<td>Liver transplant with suspected vascular compromise</td>
</tr>
<tr>
<td>Nephrostomy tube placement in patient with acute kidney injury</td>
<td>Liver transplant with suspected vascular compromise</td>
</tr>
<tr>
<td>Obstructed kidney (stones) with sepsis</td>
<td>Liver transplant with suspected vascular compromise</td>
</tr>
<tr>
<td>Older child with bowel obstruction</td>
<td>Liver transplant with suspected vascular compromise</td>
</tr>
<tr>
<td>PICC placement where patient has no access but needs fluids/medications urgently</td>
<td>Liver transplant with suspected vascular compromise</td>
</tr>
<tr>
<td>Progressive shunt malfunction</td>
<td>Liver transplant with suspected vascular compromise</td>
</tr>
<tr>
<td>Traumatic dislocation-hip</td>
<td>Liver transplant with suspected vascular compromise</td>
</tr>
<tr>
<td>Unstable neurological condition</td>
<td>Liver transplant with suspected vascular compromise</td>
</tr>
</tbody>
</table>

**Semi-Urgent**

<table>
<thead>
<tr>
<th>E &lt; 24 Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Needs to be done that day, but does not require the manipulation of the elective schedule, pyeloscopy</td>
</tr>
<tr>
<td>Biopsy</td>
</tr>
<tr>
<td>Closed reduction</td>
</tr>
<tr>
<td>Carotid arteriography</td>
</tr>
<tr>
<td>Carotid endarterectomy</td>
</tr>
<tr>
<td>Closed fracture grade III</td>
</tr>
<tr>
<td>Open reduction of fracture</td>
</tr>
<tr>
<td>PCI placement has other IV access</td>
</tr>
<tr>
<td>Transplantation of pancreas or liver</td>
</tr>
<tr>
<td>Vascular repair of aorta or other vascular access</td>
</tr>
</tbody>
</table>

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**Block with Urgent Access Assured**

- Predictive system
- Urgent Cases in Defined Rooms with Scheduled Teams
- Resources needed can be modeled
- Care based on Urgency / Medical Need
B-E Case Access - % Successful

Month | % Successful
--- | ---
Jul 2006 (n=3) | 60%
Sep 2006 (n=6) | 65%
Nov 2006 (n=16) | 70%
Jan 2007 (n=6) | 65%
Mar 2007 (n=7) | 70%
May 2007 (n=6) | 65%
Jul 2007 (n=7) | 70%
Sep 2007 (n=3) | 60%
Nov 2007 (n=1) | 60%
Jan 2008 (n=3) | 60%
Mar 2008 (n=3) | 60%
May 2008 (n=7) | 70%
Jul 2008 (n=0) | 50%
Sep 2008 (n=0) | 50%
Nov 2008 (n=2) | 60%
Jan 2009 (n=2) | 60%
Mar 2009 (n=2) | 60%
May 2009 (n=4) | 80%
Jul 2009 (n=2) | 60%
Sep 2009 (n=5) | 80%
Nov 2009 (n=1) | 60%
Jan 2010 (n=2) | 60%
Mar 2010 (n=0) | 50%
May 2010 (n=1) | 60%
Jul 2010 (n=2) | 60%
Sep 2010 (n=4) | 80%
Nov 2010 (n=2) | 60%
Jan 2011 (n=1) | 60%
Mar 2011 (n=2) | 60%
May 2011 (n=1) | 60%
Jul 2011 (n=0) | 50%
Sep 2011 (n=0) | 50%
Nov 2011 (n=3) | 80%
Jan 2012 (n=2) | 60%
Mar 2012 (n=2) | 60%
May 2012 (n=2) | 60%
Jul 2012 (n=3) | 80%
Sep 2012 (n=4) | 80%
Nov 2012 (n=3) | 80%
Jan 2013 (n=4) | 80%
Mar 2013 (n=4) | 80%
May 2013 (n=1) | 60%
Jul 2013 (n=2) | 60%
Sep 2013 (n=3) | 80%
Nov 2013 (n=2) | 80%
Jan 2014 (n=3) | 80%
Mar 2014 (n=3) | 80%
May 2014 (n=2) | 80%
Jul 2014 (n=0) | 50%
Sep 2014 (n=0) | 50%
Nov 2014 (n=0) | 50%
Jan 2015 (n=0) | 50%
Mar 2015 (n=3) | 80%
May 2015 (n=1) | 60%
Jul 2015 (n=6) | 90%
Sep 2015 (n=7) | 100%
Nov 2015 (n=0) | 50%
Jan 2016 (n=1) | 60%
Mar 2016 (n=5) | 80%

Average Wait Time (Minutes)

Month | Average Wait Time (Minutes)
--- | ---
Jul 2006 | 30
Sep 2006 | 30
Nov 2006 | 30
Jan 2007 | 30
Mar 2007 | 30
May 2007 | 30
Jul 2007 | 30
Sep 2007 | 30
Nov 2007 | 30
Jan 2008 | 30
Mar 2008 | 30
May 2008 | 30
Jul 2008 | 30
Sep 2008 | 30
Nov 2008 | 30
Jan 2009 | 30
Mar 2009 | 30
May 2009 | 30
Jul 2009 | 30
Sep 2009 | 30
Nov 2009 | 30
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Nov 2012 | 30
Jan 2013 | 30
Mar 2013 | 30
May 2013 | 30
Jul 2013 | 30
Sep 2013 | 30
Nov 2013 | 30
Jan 2014 | 30
Mar 2014 | 30
May 2014 | 30
Jul 2014 | 30
Sep 2014 | 30
Nov 2014 | 30
Jan 2015 | 30
Mar 2015 | 30
May 2015 | 30
Jul 2015 | 30
Sep 2015 | 30
Nov 2015 | 30
Jan 2016 | 30

Source: CPM/EPIC
Last Updated 4/6/2016 by A. Anneken, James M. Anderson Center for Health Systems Excellence
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

1. Redesign surgical schedules to improve throughput and to improve smooth flow of patients to downstream ICUs and inpatient units
2. Separate scheduled and unscheduled flows in the OR
3. ED efficiency changes to decrease LOS
4. Decrease LOS in ICUs (timely consults, tests and procedures)
5. Decrease LOS on Med/Surg Units (case management for patients with complex medical and social needs)
6. Advance planning for transfers to community-based care settings
7. Cooperative agreements with rehab facilities, SNFs and nursing homes

Reduce unnecessary variations in care and managing "outliers"

Increased clinician and staff satisfaction

Demonstrate a ROI for the systems moving to bundled payment arrangements

1. Reduce readmissions for high risk populations
2. Extended hours in primary care practices
3. Urgent Care and Retail Clinics
4. EdM patients in community-based mental health services
5. Palliative care & EHRs for hospice and patients at home
6. Greater use of clinical pathways and evidence-based medicine
7. Care management for vulnerable/high risk patient populations
8. Decrease complications/harm (MHI, UTI, SSI, falls with harm) and subsequent LOS
9. Redesign surgical schedules to create an predictable flow of patients to downstream ICUs and inpatient units

1. Proactive advanced illness planning
2. Development of palliative care programs (hospital-based and community-based)
3. Reduce readmissions for high risk populations
4. Extended hours in primary care practices
5. Urgent Care and Retail Clinics
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10. Decrease complications/harm (MHI, UTI, SSI, falls with harm) and subsequent LOS

1. Assess seasonal variations and changes in demand patterns and proactively plan for variations
2. Daily flow planning huddles (improve predictions to synchronize admissions, discharges and discharges)
3. Real-time demand and capacity problem-solving (managing constraints and bottlenecks)
4. Placing capacity to meet predicted demand patterns
5. High census protocols to expedite admissions from the ED and manage surgical schedules

1. Redesign surgical schedules to improve throughput and to improve smooth flow of patients to downstream ICUs and inpatient units
2. Separate scheduled and unscheduled flows in the OR
3. ED efficiency changes to decrease LOS
4. Decrease LOS in ICUs (timely consults, tests and procedures)
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7. Cooperative agreements with rehab facilities, SNFs and nursing homes

IHI Theory on Flow

Outcomes  Primary Drivers  Secondary Drivers  Specific Change Ideas

Shape or Reduce Demand

- 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

Reroute care in ICUs in accordance with patients’ LOS windows
Relocate care to Med/Surg units to community-based care settings
Relocate low-acuity care in EDs to community-based settings
Decrease demand for hospital beds through following appropriate care
Decrease demand for hospital beds by reducing hospital acquired conditions
Decrease variation in surgical scheduling

Match Capacity and Demand

- Oversight system for hospital-wide operations to optimize patient flow
- Real-time demand and capacity management processes
- Flex capacity to meet hourly, daily and seasonal variations in demand
- Early recognition for high census and surge planning

Improve efficiencies and throughput in the OR, ED, ICUs and Med/Surg units
Service Line Optimization (trauma, SICU, medical, stroke patients, etc.)
Reducing unnecessary variations in care and managing "outliers"

Oversight system for hospital-wide operations to optimize patient flow
Real-time demand and capacity management processes
Flex capacity to meet hourly, daily and seasonal variations in demand
Early recognition for high census and surge planning

1. Redesign surgical schedules to improve throughput and to improve smooth flow of patients to downstream ICUs and inpatient units
2. Separate scheduled and unscheduled flows in the OR
3. ED efficiency changes to decrease LOS
4. Decrease LOS in ICUs (timely consults, tests and procedures)
5. Decrease LOS on Med/Surg Units (case management for patients with complex medical and social needs)
6. Advance planning for transfers to community-based care settings
7. Cooperative agreements with rehab facilities, SNFs and nursing homes

ICU Daily Elective Census

Prior to ICU Model for Smoothing

Number of Patients in ICU Beds

- ICU Daily Elective Patient Census
- Center Line - Mean
- Control Limits
ICU Bed Availability – ICU Scheduling

Case Statistics by Category

<table>
<thead>
<tr>
<th>Category</th>
<th>Total PICU Days</th>
<th>Case Count</th>
<th>ALOS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Short</td>
<td>224.47</td>
<td>177 (61%)</td>
<td>1.27 (27%)</td>
</tr>
<tr>
<td>Medium</td>
<td>304.74</td>
<td>82 (28%)</td>
<td>3.72 (37%)</td>
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<tr>
<td>Long</td>
<td>302.56</td>
<td>31 (11%)</td>
<td>9.76 (36%)</td>
</tr>
<tr>
<td>Grand Total</td>
<td>831.78</td>
<td>290</td>
<td>2.87</td>
</tr>
</tbody>
</table>

Short: 61% cases, 27% days
Medium: 28% cases, 37% days
Long: 11% cases, 36% days

ICU Admission Model – Elective Cases

Short Stay Cases – Access Cap
# Cases on Schedule / Day

Long Stay Cases
Fixed # Beds

Short: 61% cases, 27% days
Medium: 28% cases, 37% days
Long: 11% cases, 36% days
Daily Critical Flow Failures

1. **Delayed or Canceled Surgery Due to Bed Capacity**
2. **PICU Bed Not Available for Urgent Use**
3. **Patients who Utilize an ICU bed b/c an Appropriate Bed is Not Available**
4. **Psychiatry Patients Placed Outside of their Primary Unit**

Timeline for DC when Medically Ready

- Criteria established at admission
- Nurse at bedside notifies service when Medical discharge criteria are met
- Discharge from floor in < 2 hours
- Review Length of Stay and Re-Admissions as balancing measures

Not about Speed – Now about Efficiency
Results - DC when Medically Ready

Inter-Disciplinary Teams

You may be the smartest person in the room, but…
You are not smarter than the collective wisdom of the room!

- **Great team characteristics** –
  - Common and shared goal, ties that permit trust and foster mutual accountability
  - Each member brings specific and special knowledge and capabilities
  - Physician challenge – may have less knowledge than pharmacists, dietitians, social workers, respiratory therapists and nurses – yet are compelled to retain decision authority

- **Challenges**
  - Larger, highly dynamic teams – further challenged in AMC’s with residents, fellows, students
  - “Core” team must get regular input from “consultants” – communication challenge
  - Patients and families are included in rounding discussions – witness real-time complex problem solving may lead to anxiety and confusion
Process of Care

- Resident(s)
- Inpatient Team (Drs. and Nurses, Pharmacy, Social Worker, Resp.Therapist, Dietitian)
- Family Centered Rounds (Inpatient Team, Family, Patient)
- Nursing
- Attending
- Core Team

Information Gathering
- Pre-Rounds (Held in a Private Space)
- Synthesis, Decision Making, Teaching
- Rounds (Held in a Patients Room)
- Communicate, Execute, Coordinate

Analytics for Prediction of Present Bed Needs

YEAR 2-7 Forecasted Heart Institute Pediatric Floor Bed Needs - Mid-Range/Most Likely

Bed Needs for Pediatric Floor: Probability of a Full Unit
20 Replications of a 425 Period (60 Day Warmup) - Mean Probability

POPULATION: Heart Institute/Cardiac Patients

PEDiatric FLOOR BED CAPACITY

YEAR 2: Probability of a Full Unit at X Beds
YEAR 6: Probability of a Full Unit at X Beds
YEAR 7: Probability of a Full Unit at X Beds
The “What if” Analysis

Estimated number of beds required for given probability of the unit being full.

<table>
<thead>
<tr>
<th>Forecast Time Frame</th>
<th>Probability of Full Unit</th>
<th>PICU Beds</th>
<th>CICU Beds</th>
<th>ICU Bed Needs</th>
<th>Combined ICUs</th>
<th>Estimated Savings</th>
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<tbody>
<tr>
<td>Year 2</td>
<td>10%</td>
<td>34</td>
<td>27</td>
<td>61</td>
<td>56</td>
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<tr>
<td></td>
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<td>36</td>
<td>29</td>
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<td>7</td>
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<td>71</td>
<td>7</td>
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<tr>
<td>Year 7</td>
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<td>69</td>
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<td>76</td>
<td>68</td>
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<td>1%</td>
<td>42</td>
<td>39</td>
<td>81</td>
<td>71</td>
<td>10</td>
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</table>

POPULATION: Unscheduled Medical/Surgical, BMT, ENT Airway ICU Elective Cases, Heart Institute Patients

Analytics to Forecast Growth Implications

Forecasted System - CY 2000+5%
Bed Needs for BMT Patients - Probability of a Full "BMT Unit"
10 Replications - Mean Probability

Forecasted System - CY 2000+5%
BMT PICU Bed Needs
10 Replications - Mean Probability
Analytics to Forecast Growth Implications

Heart Institute
Cardiomyopathy Non-Surgical Admissions by Fiscal Year*

Forecasted Growth
\[ y = 11.5x + 75.5 \]
\[ R^2 = 0.4999 \]

*Includes admissions related to cath procedures. Excludes admissions associated with transplant patients.

Understanding Capacity Needs & Variability for New/Growth Programs

Lung Transplant Program
Outpatient Demand for Growth Scenarios

YEAR 1-3: Forecasted Lung Post Transplant Floor Bed Needs - Mid-Range/Most Likely

Lung Transplant Patients
The Value of Analytics

- Bed demand predictions facilitate staffing and overflow planning – right patient – right team
- ED admit predictions improved from 40% to 70% accuracy – resource allocation
- Encourages staff to more consistently predict and document estimated discharge date – helps guide bedside care system efficiency
- Uncovers scheduling issues for staffing and resources right team - efficiency and access
- One step source to determine where there is capacity real time response
Predicting Admissions

**Staffing Prediction – Proactive Planning**

**Weekly Census Prediction Report**

<table>
<thead>
<tr>
<th>Monday</th>
<th>PICU</th>
<th>HI</th>
<th>NEDU</th>
<th>Crp</th>
<th>TCC</th>
<th>GBK</th>
<th>Medical</th>
<th>Surgical</th>
<th>Liberty</th>
<th>Psychiatry</th>
<th>Other</th>
<th>DVF</th>
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<tr>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11/20/2017</td>
<td>53</td>
<td>25</td>
<td>19</td>
<td>17</td>
<td>57</td>
<td>6</td>
<td>24</td>
<td>21</td>
<td>23</td>
<td>9</td>
<td>33</td>
<td>18</td>
</tr>
</tbody>
</table>

**Predicted Admissions**

- **OR Elective Sleep Study EEG** Pulled from electronic medical records (EMR)
- **ED** ARIMA model with seasonality*
- **Other Admits** Linear exponential smoothing with seasonality*
- **OR Add-On** Historic 90th percentile
- **Direct Admits** Linear exponential smoothing with seasonality*

* Two seasonal indices:
  1. Day of week seasonality
  2. Holiday index
Census Prediction Model

- Available bed capacity
- Midnight census
- Scheduled admissions
- Predicted admissions
- Predicted discharges
- Predicted demand (census + adm – disch)
- Predicted overflow placement

Census Prediction Accuracy - ICU
Census Prediction Accuracy – Med Surg

Staffing Tool - AcuShift

Jackie Hausfeld, RN, William Vadonish, RN, et al. CCHMC Patient Services
## Microsystem Stress Report

### Week of: 1/8/2017 to 1/14/2017

<table>
<thead>
<tr>
<th>Location</th>
<th>Unit Population</th>
<th>Capacity</th>
<th>% Budgeted Occupancy</th>
<th>% Budgeted ADC</th>
<th>% Operational Hours of Float Staff</th>
<th>% Staffing Criteria</th>
<th>% Red Shifts</th>
<th>% Orange and Red Shifts</th>
<th>Status</th>
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</thead>
<tbody>
<tr>
<td>NICU</td>
<td>NICU</td>
<td>53</td>
<td>76.9%</td>
<td>76.9%</td>
<td>12/3/2017</td>
<td>Green</td>
<td>1.0%</td>
<td>0.0%</td>
<td>Green</td>
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<tr>
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<td>0.0%</td>
<td>Green</td>
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</tbody>
</table>

**Microsystem Stress Report**

Jackie Hausfeld, RN, William Vadonish, RN, et al.  CCHMC Patient Services

### NICU: Qualitative Pilot

**Family Stress**

Jackie Hausfeld, RN, William Vadonish, RN, et al.  CCHMC Patient Services
Hospital Wide System for Flow and Safety

3 Times - Every Day

Individual Room / Floor / System Predictions – Flow, Capacity and Safety

Floor Huddles  PeriOp Huddle  Outpt, Home, Psych  ED Huddle  ICU Huddles

Institutional Wide Bed Huddle – Flow and Capacity Management

Pharmacy  Security
Pt. Transport  Housekeeping
Facilities  P.F.E.

Institutional Daily Operations Brief

System Prediction – Mitigation Strategy

Flow and Patient Placement

Production Capacity, FY 2005

• Maximum inpatient capacity: 425 beds (“theoretical capacity”)
• Barriers resulted in daily “practical capacity” reached at ~ 325 patients
  • System failures: cancel surgery, deny admission
• Practical operational capacity was 76% of theoretical maximum capacity
Flow and Patient Placement

Production Capacity, FY 2017

- Inpatient capacity: 510 beds ("theoretical capacity")
- Twelve years of work on:
  - Smoothing scheduling
  - Discharge planning
  - Patient flow
  - Physical layout in key bottleneck areas
  - Re-examining patient cohorting for greater utilization
- Expanded "practical capacity" to a daily peak of 460 inpatients (90% of theoretical capacity)

What Has It Meant?

- Increased "Safe" Occupancy. (76 to 90%)
- Potential for 73 more inpatients/day within current bed capacity
- $354,000/day in potential additional net billing revenue from existing assets and staff ($129 million/year)
- Avoided construction of about 95 additional beds ($100+ million)
  - beds would have been required to meet today’s volume in our FY 2005 workflow system over the past 10 years – living within our capacity
Summary

Great management of Flow is:

An essential strategy to achieve Safety
An essential component of Patient Satisfaction
Frees resources and time for Staff Satisfaction and Retention
Increases your effective “capacity” to care for patients
A cornerstone of your business strategy – “Getting the Right’s Right”

Thanks!