Why Do Flow?
The Cincinnati Children’s Hospital Journey

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Nothing to Disclose
Nothing to Disclose

- I have no relevant financial or nonfinancial relationship(s) within the services described, reviewed, evaluated or compared in this presentation.
<table>
<thead>
<tr>
<th>Cincinnati Children’s Hospital</th>
</tr>
</thead>
<tbody>
<tr>
<td>550 Bed Medical Center</td>
</tr>
<tr>
<td>Admissions/Year – 30,848</td>
</tr>
<tr>
<td>Outpatient Visits 1.02 M</td>
</tr>
<tr>
<td>Surgical Procedures – 32,000 cases</td>
</tr>
<tr>
<td>20 OR’s, 2 IR suites, Hybrid Cath</td>
</tr>
<tr>
<td>8 OR Outpatient Surgery Center</td>
</tr>
<tr>
<td>1.4 M sq. ft. Research Space</td>
</tr>
<tr>
<td>15,000 Employees</td>
</tr>
</tbody>
</table>
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

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

- 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

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 (2.6days) and Cost ($3,335) as well

<table>
<thead>
<tr>
<th>Reason</th>
<th>No. (%) of patients</th>
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<tbody>
<tr>
<td>Availability of personnel</td>
<td>352 (31.7)</td>
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<tr>
<td>Anesthesiologist</td>
<td>42</td>
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<tr>
<td>Nurse</td>
<td>5</td>
</tr>
<tr>
<td>Surgeon</td>
<td>305</td>
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<tr>
<td>Availability of physical resources</td>
<td>147 (13.3)</td>
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<tr>
<td>Operating room</td>
<td>122</td>
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<tr>
<td>Postanesthesia care unit</td>
<td>11</td>
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<tr>
<td>Equipment</td>
<td>14</td>
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<tr>
<td>Multifactorial delay</td>
<td>459 (41.4)</td>
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<tr>
<td>Bumped by higher priority case</td>
<td>459</td>
</tr>
<tr>
<td>Patient-specific delay</td>
<td>151 (13.6)</td>
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<tr>
<td>Medically complex or decompensated patient</td>
<td>151</td>
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</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

Average Daily Census in the CBDI

Active Phase 1 Patients in the CBDI
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>
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<tbody>
<tr>
<td>&lt; 2 Years Experience</td>
<td>1.12</td>
<td>P&lt;0.001</td>
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<tr>
<td>&gt; 11 Years Experience</td>
<td>0.89</td>
<td>P=0.04</td>
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<tr>
<td>&gt; 16 Years Experience</td>
<td>0.82</td>
<td>P=0.06</td>
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<tr>
<td>% RN BSN or higher</td>
<td>0.91</td>
<td>P=0.02</td>
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Flow Failures and Flow Delays

<table>
<thead>
<tr>
<th>Flight</th>
<th>Time</th>
<th>Status</th>
<th>Gate</th>
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<tbody>
<tr>
<td>ATLANTA</td>
<td>2.31p</td>
<td>DELAYED</td>
<td>B3</td>
</tr>
<tr>
<td>NEW YORK</td>
<td>2.34p</td>
<td>DELAYED</td>
<td>C12</td>
</tr>
<tr>
<td>BOSTON</td>
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<td>CANCELLED</td>
<td>C14</td>
</tr>
<tr>
<td>LONDON</td>
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<td>NEWARK</td>
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<td>DELAYED</td>
<td>B9</td>
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<tr>
<td>LOS ANGELES</td>
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<td>VANCOUVER</td>
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<tr>
<td>MIAMI</td>
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<td>B11</td>
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<tr>
<td>NEWARK</td>
<td>2.53p</td>
<td>DELAYED</td>
<td>C6</td>
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<tr>
<td>CHICAGO</td>
<td>2.56p</td>
<td>CANCELLED</td>
<td>B3</td>
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<tr>
<td>SEATTLE</td>
<td>3.02p</td>
<td>DELAYED</td>
<td>C17</td>
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<tr>
<td>MONTREAL</td>
<td>3.06p</td>
<td>CANCELLED</td>
<td>A10</td>
</tr>
<tr>
<td>DETROIT</td>
<td>3.07p</td>
<td>DELAYED</td>
<td>C5</td>
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Delay
- Wait 2 hours
- Go to Correct Destination
- Delayed
  - Right Location
  - Risk – Treatment while delayed
  - Right’s Right

Divert
- Leave Now
- Go to Atlanta
- Maybe get to Florida
- Wrong Destination
- Need to Transfer
- Risk – Don’t Arrive
- Right’s Wrong
- Flow Failure
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

<table>
<thead>
<tr>
<th>Delay Failures</th>
</tr>
</thead>
<tbody>
<tr>
<td>“Holds” in the ED</td>
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<tr>
<td>Patients staying overnight in the PACU</td>
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<tr>
<td>Times PICU bed not immediately available for Urgent Use</td>
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<tr>
<td>Delayed or canceled surgery because of bed capacity</td>
</tr>
<tr>
<td>Patients who remain in an ICU bed longer than medically necessary because an appropriate bed is not available</td>
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</table>

Placement Failures

<table>
<thead>
<tr>
<th>_placement_failures</th>
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</thead>
<tbody>
<tr>
<td>Psychiatry patients placed anywhere outside of their primary unit</td>
</tr>
<tr>
<td>Hem/Onc/BMT patients placed anywhere outside of their primary unit</td>
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<tr>
<td>Transplant patients not on A4N</td>
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<tr>
<td>Ventilated patients who are admitted to the ICU because a bed is not available on TCC</td>
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System Wide Patient Flow Delay Measure

Composite Measure
Delay Definition
PACU > 20 Min
ICU to floor > 2 Hr
ER to Adm > 1 Hr
Health Care Delivery System Transformation
Strategic Improvement Priorities and System Level Measures

**System Level Measures**

**ACCESS**
- 3rd Next available appointment

**FLOW**
- Flow Failures
  - Adverse drug events (ADE) per 1,000 doses
- Patient Delays
  - Nosocomial infection rates: Bloodstream infection rate
  - Surgical site infection rate
- Discharge Prediction and Execution
  - Growth Prediction
    - Infection rates: VAP
  - Resource Prediction
    - Safe Practices
    - Serious Safety Events

**PATIENT SAFETY**
- Codes outside the ICU rate/1000 days
- Standardized PICU Mortality Ratio – Expected/Actual
- % use of Evidence-Based Care for eligible patients
- Functional Health Status

**CLINICAL EXCELLENCE**
- Touch Time for Providers
- Employee Satisfaction
- Staffing Effectiveness
- Physician Satisfaction
- Voluntary staff turnover rate
- Accident rate for staff with Work days lost

**REDUCE HASSLES**
- Overall Rating: Patient Experience

**TEAM WELLBEING**

**FAMILY CENTERED CARE**

**Risk Adjusted Cost per Discharge**
Organizing For Transformation

- 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

Board Oversight

Senior Leadership Focus

System-Wide Priorities

Operational Excellence Teams

Division/Microsystem-Based Priorities

Individual System Performance Data
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

E D

Out Patients

I C U

In Patients

O R
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

Redesign the System
- 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 delivering appropriate care
- Decrease demand for hospital beds by reducing hospital acquired conditions
- Decrease variation in surgical scheduling
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Shape or Reduce Demand
- Decrease variation in surgical scheduling
- 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

Match Capacity and Demand
- Improve efficiencies and throughput in the OR, ED, ICUs and Med/Surg Units
- Service Line Optimization (frail elders, SNF residents, stroke patients, etc.)
- Reducing unnecessary variations in care and managing LOS “outliers”
- Assess seasonal variations and changes in demand patterns and proactively plan for variations
- Daily flow planning huddles (improve predictions to synchronize admissions, discharges and discharges)
- Real-time demand and capacity problem-solving (managing constraints and bottlenecks)
- Planning capacity to meet predicted demand patterns
- High census protocols to expedite admissions from the ED and manage surgical schedules.

Primary Drivers
- Decrease overutilization of hospital services
- Optimize patient placement to insure the right care, in the right place, at the right time
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Secondary Drivers
- Decrease demand for hospital beds by reducing hospital acquired conditions
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Specific Change Ideas
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
6. Enroll patients in community-based mental health services
7. Paramedics & EMTs triaging & treating patients at home
8. Greater use of clinical pathways and evidence-based medicine
9. Care management for vulnerable/high risk patient populations
10. Decrease complications/harm (HAPU, CAUTI, SSI, falls with harm) and subsequent LOS
11. Redesign surgical schedules to create an predictable flow of patients to downstream ICUs and inpatient units

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IHI Theory on Flow

Outcomes
- Decrease overutilization of hospital services
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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 as needed
- Elective Case Plan disrupted, prolonged waiting time for elective patients
- Inefficient (Unsafe) Access for Urgent Cases
- Push complex Elective Cases into the late hours
  - Overtime
  - Wrong Team in OR

Not Ideal
## Scheduling Guidelines – A to E

### GUIDELINES FOR SURGICAL CASE GROUPING DIAGNOSES/PROCEDURES

*(guideline only: medical judgment required)*

#### Acute Life and Death Emergencies

**A < 30 Minutes**
- Airway emergency (upper airway obstruction)
- Cardiac surgery postop bleeding with tamponade
- Cardiorespiratory decompensation (severe)
- Liver transplant postoperative emergency
- Malrotation with volvulus
- Massive bleeding
- Mediastinal injury
- Multiple Trauma-unstable or O.R. resuscitation
- Neurosurgical condition w/imminent herniation

**B < 2 Hours**
- Acute shunt malfunction
- Acute spinal cord compression
- Bladder rupture
- Bowel perforation, traumatic
- Cardiac congenital emergencies hemodynamic or pulmonary instabilities
- Compartment syndrome
- Donor harvest
- ECMO cannulation
- Ectopic pregnancy
- Embolization for acute hemorrhage
- Esophageal atresia with tracheoesophageal fistula
- Gastrochisis/omphalocoele
- Heart, heart/lung, lung, liver and intestinal transplants
- Incarcerated hernias
- Intestinal obstruction with suspected vascular compromise
- Intussusception-irreducible
- Ischemic limb/cold extremity (compromised arterial flow)
- Liver/Multivisceral/SI Transplant (when organ available)
- Liver transplant with suspected thrombosis
- Newborn bowel obstruction
- Open globe
- Orbital abscess
- Pacemaker insertion for complete heart block
- Replant fingers
- Replant hand or arm
- Spontaneous abortion

**C < 4 Hours**
- Abscess with sepsis
- Airway (non-urgent diagnostic L&B, flex bronch, non-symptomatic foreign body)
- Appendicitis-with sepsis/rapid progression
- Biliary obstruction non-drainable
- Cardiac ventricular assist device intervention
- Cerebral angiogram for intracranial hemorrhage
- Chest tube placement in patient w/unstable vital signs, increased work of breathing and decreased O2 saturation
- Contaminated Wounds-Multiple Trauma
- Diagnostic/therapeutic airway intervention
- Hepatic angiogram w/suspected vascular thrombus
- Hip Dislocation
- Intestinal Obstruction-no suspected vascular compromise
- Kidney transplant (ORGAN AVAILABLE)
- Liver laparotomy
- Massive soft tissue injury
- Nephrostomy tube placement in patient w/sepsis
- Obstructed kidney (stones) w/sepsis
- Older child with bowel obstruction
- PICC placement where patient has no access but needs fluids/medications urgently
- Progressive shunt malfunction
- Traumatic dislocation-hip
- Unstable neurosurgical condition

**D < 8 Hours**
- Abscess drainage
- Appendicitis-stable/elective
- Caustic ingestion
- Chest tube in patient w/stable vital signs
- Chronic airway foreign bodies
- Closure abdomen-liver transplant
- Coarctation repair in newborn
- Esophageal foreign body without airway symptoms
- GJ tube/NJ tube placement with no other nutrition access
- Hematuria with clot retention
- I & D abscess without sepsis
- Joint aspiration or bone biopsy prior to starting antibiotic therapy
- Kidney transplant (ORGAN NOT YET AVAILABLE)
- Liver/Multivisceral/SI Transplant (ORGAN NOT YET AVAILABLE)

**E < 24 Hours**
- Needs to be done that day, but does not require the manipulation of the elective schedule, pyloromyotomy
- Broviac
- Closed reduction
- Eyelid/canalicular lacerations
- Facial nerve decompression
- Femoral neck fracture
- Liver biopsy
- Mastoidectomy
- Open fracture grade I/II
- Open reduction of fracture
- PICC placement-has other IV access
- Retinopathy of prematurity treatment
- Unstable slipped capital femoral epiphysis
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

% of "B-E" Cases performed within 15% of their acceptable timeframe

- % Cases
- Center Line
- Control Limits

OR Renovation
1 Add-On Room Closed
“A” Case Access Times – Target 30 Minutes

Average Wait Time (Minutes)

<table>
<thead>
<tr>
<th>Month</th>
<th>Wait Time (Minutes)</th>
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</tr>
<tr>
<td>September 2006 (n=6)</td>
<td>240</td>
</tr>
<tr>
<td>November 2006 (n=16)</td>
<td>210</td>
</tr>
<tr>
<td>January 2007 (n=6)</td>
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</tr>
<tr>
<td>March 2007 (n=7)</td>
<td>150</td>
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<tr>
<td>May 2007 (n=6)</td>
<td>120</td>
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<td>March 2008 (n=3)</td>
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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

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

Redesign the System
- Redesign surgical schedules to create a predictable flow of patients to downstream ICUs and inpatient units

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 delivering appropriate care
- Decrease demand for hospital beds by reducing hospital acquired conditions
- Decrease variation in surgical scheduling
- 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 (frail elders, SNF residents, stroke patients, etc.)
- Reducing unnecessary variations in care and managing LOS “outliers”

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
6. Enroll patients in community-based mental health services
7. Paramedics & EMTs triaging & treating patients at home
8. Greater use of clinical pathways and evidence-based medicine
9. Care management for vulnerable/high risk patient populations
10. Decrease complications/harm (HAPU, CAUTI, SSI, falls with harm) and subsequent LOS
11. Redesign surgical schedules to create an predictable flow of patients to downstream ICUs and inpatient units

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. Planning 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)
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

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<th>Category</th>
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**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
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

Surgery

Medical
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

Residents

Nurses

Attending

Core Team

Information Gathering

Inpatient Team
Drs. and Nurses
Pharmacy,
Social Worker,
Resp. Therapist
Dietitian

Pre-Rounds
Held in a Private
Space

Synthesis, Decision Making
Teaching

Family Centered
Rounds
Inpatient Team
Family
Patient

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

YEAR 2: Probability of a Full Unit at X Beds
YEAR 5: Probability of a Full Unit at X Beds
YEAR 7: Probability of Full Unit at X Beds

Cincinnati Children’s
changing the outcome together
# The “What if” Analysis

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

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<th>Forecast Time Frame</th>
<th>Probability of Full Unit</th>
<th>PICU Beds</th>
<th>CICU Beds</th>
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POPULATION: Unscheduled Medical/Surgical, BMT, ENT Airway ICU Elective Cases, Heart Institute Patients
Analytics to Forecast Growth Implications

Forecasted System - CY 2009+5%

Bed Needs for BMT Patients - Probability of a Full "BMT Unit"

50 Replications - Mean Probability

"BMT UNIT" BED CAPACITY
- Probability of Full Unit at X Beds

BMT PICU Bed Needs

50 Replications - Mean Probability

PICU BED CAPACITY PLANNED FOR BMT PATIENTS
- Probability of Full Unit at X Beds

Cincinnati Children's
changing the outcome together

Institute for Healthcare Improvement
Analytics to Forecast Growth Implications

Heart Institute
Cardiomyopathy Non-Surgical Admissions by Fiscal Year*

Forecasted Growth
y = 11.5x + 75.5
R² = 0.4999

*Includes admissions related to cath procedures. Excludes admissions associated with transplant patients.
Understanding Capacity Needs & Variability for New/Growth Programs

YEAR 1-10 Forecasted Lung Post Transplant Floor Bed Needs - Mid-Range/Most Likely

Lung Transplant Program
Outpatient Demand for Growth Scenarios

PFT: Bronchoscopy
Outpatient Visits

Year 1  Year 3  Year 5  Year 7  Year 10
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

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
**Staffing Prediction – Proactive Planning**

---

**Weekly Census Prediction Report**

Last Exec: 11/20/2017 4:53:40 AM

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Census Prediction Model

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<td>Predicted Overflow</td>
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<td>3 (A6C)</td>
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<tr>
<td>Predicted Unit</td>
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- Available bed capacity
- Midnight census
- Scheduled admissions
- Predicted admissions
- Predicted discharges
- Predicted demand (census + adm – disch)
- Predicted overflow placement
Census Prediction Accuracy - ICU

B5CC (PICU) (Actual vs Pred)

B6HI (CICU) (Actual vs Pred)
Census Prediction Accuracy – Med Surg

A8NS (Actual vs Pred)

A3N (Actual vs Pred)
# Staffing Tool - AcuShift

## State of Unit

| Unit: RMT | Date: 1/23/2017 | Shift: Day 2 |

### Schedule

<table>
<thead>
<tr>
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### Comments

#### Reasons & Mitigations

### Sign Off (Psych Only)

#### Unit Assessment

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<th>Night 2</th>
<th>Day 1</th>
<th>Day 2</th>
<th>Evening</th>
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<th>Night 1</th>
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<td>Orange</td>
<td>Red</td>
<td>Green</td>
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### Acuity

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### Psych Obs. Levels

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<td>11 At All Times</td>
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<td>Location</td>
<td>Unit Population</td>
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<tr>
<td>A3N Surgery</td>
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<td>A3S TCC</td>
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<td>A4C1 Rehab</td>
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<td>A4N Transplant/Surgery</td>
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<td>A4S GI/Colonrectal</td>
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<tr>
<td>ASC Hem/Onc</td>
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<td>AS5 BMT</td>
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<td>A6N Adol. Medicine</td>
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<td>A6S Child Medicine</td>
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<td>A7C1 Complex Pulmonary</td>
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**Total** 474 78.3% 371.0 376.3 101.4% 79.4% 2919.7 10.0% 2448.8 8.0% 78 2.5% 1.4% 0.5% 1.9%

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

NICU Parents/Guardians, please tell us how your day was today
1. I felt very supported by NICU staff today
2. I felt somewhat supported by NICU staff today
3. I felt I needed more support from NICU staff today

I felt very supported by NICU staff today
I felt somewhat supported by NICU staff today
I felt I needed more support from NICU staff today

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  Pt. Transport  Facilities  Security  Housekeeping  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 !