The Laboratory’s Role In Reducing Time To Antibiotics in Febrile Neutropenic Patients.

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The Center for Cancer and Blood Disorders

Children’s Hospital Colorado
Learning Objectives

1. Describe how the laboratory partnered with an internal multi-disciplinary clinical team to improve patient flow and exceed a national quality measure for oncology centers
2. Describe the five key phases used to guide this improvement project team from discovery to control
3. Identify key change management approach to enable the project’s success and sustainability
NATIONALLY RANKED

As one of the Best Children's Hospitals by the *U.S. News and World Report* for more than 20 years
As a private, non-profit pediatric hospital, OUR MISSION is to improve the health of children through the provision of high-quality, coordinated programs of patient care, research, education, and advocacy.

HOW?

• PATIENT CARE
• RESEARCH
• EDUCATION
• ADVOCACY
We see more, treat more, and heal more kids than any other hospital in our SEVEN-STATE REGION

- Colorado
- Kansas
- Montana
- Nebraska
- New Mexico
- South Dakota
- Wyoming
WE ARE COLORADO’S ONLY LICENSED SPECIALTY HOSPITAL

EXCLUSIVELY FOR CHILDREN

- Level I Pediatric Trauma Center (only one in Colorado)
- 479 licensed beds
- 17,593 inpatient admissions
- 19,775 total surgeries
- 106,293 days of patient care
- 6.0 days for length of stay
- 543,476 outpatient visits
- 163,647 emergency department visits
- Treat patients from all 50 states and 27 countries
- 16 locations throughout Colorado

- Over 125 unique services for kids
- 1,288+ outreach clinics in 16 specialties in 24 cities across 3 states
- 1,073 telehealth visits in 22 specialties in 15 cities across 4 states
- 6,030 employees
- 2,078 medical staff
- 225 residents and fellows
- 2,646 volunteers
- Level IV Neonatal Intensive Care Unit (NICU)

All statistics from 2015 audit.
Department of Pathology and Laboratory Medicine

- Full service laboratory with over 200 employees
- 17 departments including...
- 3 Locations
- Teaching facility for Clinical Laboratory Science students, Pathology residents and fellows
Center for Cancer and Blood Disorders

• Rated top 10 in nation by both US News and World Report® and Parents® magazines

• Treat children, adolescents and young adults from birth through mid-20s with cancer and non-malignant blood disorders

• 12 departments including...

• ~300 new cancer & ~80 new BMT patients per year

• Teaching facility for medical students/residents & fellows.
Fever in patients with neutropenia may quickly become a medical emergency.

National best practice standards assert that patients who present with febrile neutropenia should receive intravenous antibiotics within 1-hour of triage.
Burning Platform...

U.S. News and World Report Ranking:

**Question:** Does your institution track the time to antibiotic delivery?

**Question:** If yes, what percentage of these patients received intravenous treatment antibiotics within 1 hour of initial triage?

...ranking not the driver!
Project Summary

• In 2012, interdisciplinary group was formed to review our Time to Antibiotic (TTA) performance:
  – Oncologists/BMT and ED Providers
  – Oncology Nurses
  – Clinical Informatics
  – Laboratory Specialists
  – Process Improvement Specialist

• Formal quality & process improvement methodology (DMAIC)
Definitions

Patient Population:
Oncology patients with central line presenting to the clinic or ED

Fever:
Any single temperature over 101ºF (38.3º C) or any two temperatures over 100.5ºF (38.0º C) in a 24 hr period at least 2 hours apart

Neutropenia:
Absolute Neutrophil Count (ANC) – Less than 500 cells/µL

TAT for Complete Blood Count (CBC):
45 minutes from receipt of specimen in laboratory to the time CBC resulted
Children’s Colorado: The Overall Approach to Quality Improvement

- Six Sigma
- Lean
- The Model for Improvement - PDSA -
- Leading Change
- DMAIC
Process Improvement

DMAIC Methodology

**Define Phase**
- Define the problem statement
- Develop project charter
- Map high-level process
- Define “customer” requirements - understand “voice of the customer”

**Measure Phase**
- Establish Data Collection Plan
- Collect baseline data
- Create a frequency diagram and Pareto analysis
- Map detailed process

**Analyze Phase**
- Focus the problem statement based on data
- Explore potential root causes
- Analyze and prioritize potential root causes
- Quantify cause and effect relationships

**Improve Phase**
- Create possible solutions for root causes
- Select solutions
- Develop improvement plan
- Pilot plan
- Implement plan
- Measure results
- Evaluate benefits

**Control Phase**
- Document standard practices
- Train teams
- Monitor performance
- Communicate learnings
- Implement process control system via Control Plan and project closure
Example Implementation Timeline

<table>
<thead>
<tr>
<th>Define</th>
<th>Measure</th>
<th>Analyze</th>
<th>Improve</th>
<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jan</td>
<td>Feb</td>
<td>Mar</td>
<td>Apr</td>
<td>May</td>
</tr>
</tbody>
</table>
## Change Begins with Effective Teams, Roles & Responsibilities

<table>
<thead>
<tr>
<th>Role</th>
<th>Responsibilities</th>
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<tbody>
<tr>
<td><strong>Sponsor or Champion</strong></td>
<td>• Sets direction/ deliverables / expected results</td>
</tr>
<tr>
<td></td>
<td>• Assigns resources and removes barriers required for success</td>
</tr>
<tr>
<td></td>
<td>• Supports the team through the continual interface with the team leader</td>
</tr>
<tr>
<td><strong>Team Leader/ Process Owner</strong></td>
<td>• Accountable for results</td>
</tr>
<tr>
<td></td>
<td>• Leads implementation and sustainability</td>
</tr>
<tr>
<td><strong>Team Member(s)</strong></td>
<td>• Empowered to make decisions</td>
</tr>
<tr>
<td></td>
<td>• Responsible for implementing actions</td>
</tr>
<tr>
<td></td>
<td>• Based on complementary expertise &amp; skills, not availability</td>
</tr>
<tr>
<td><strong>Coach/ Facilitator</strong></td>
<td>• Process expert and methodology coach for the team</td>
</tr>
</tbody>
</table>
Project Title: CCBD Time To Antibiotics  JUNE 2012

Background:
Fever in patients with neutropenia is a medical emergency. While there has been no study comparing outcomes such as mortality, morbidity, rate of MSSOs in different times of antibiotic delivery, it has become a national standard to deliver IV antibiotics within 1 hour of “check-in to the facility.”

Problem Statement:
There is no standard work for prompt delivery of IV antibiotics in CCBD. The Neuro/Oncology Program delivers IV antibiotics to all febrile patients, regardless of ANC. Solid Tumor and Leukemia Programs treat only neutropenic patients, so the turnaround time (TAT) of our CBCs is one of our delays. TAT for stat CBC is 45-60 min. Pharmacy has recently determined that they will no longer allow antibiotics in the CCBD pyxis, so an additional amount of time will come into antibiotic delivery.

Project AIMS (goal statements)
Global aim: 100% of CCBD cancer patients with fever and neutropenia will have IV antibiotics delivered within 59 minutes of check-in by December 2012.
CCBD SMART aim: 50% of CCBD cancer patients with fever and neutropenia will have IV antibiotics delivered within 59 minutes of check-in by September 2012.

Scope of Project:
- Process Start: First set of vitals in E.D., CCBD Inpatient, CCBD outpatient.
- Process Stop: Start of first dose of IV antibiotics.

Boundaries of Project:
- In: All CCBD oncology and BMT patients, including those at NOC sites.
- Out: Febrile Sickle Cell patients (temporarily)

Operational Definitions:
Fever: 38.3 degrees centigrade
First vitals: In E.D., vitals in triage. In clinic, first vitals by MA.
Neutropenia: ANC < 500.

Team Members
Sponsors: (Approver) Joanne Hilden, Ellen Servetar
Clinical Champions: Joanne Hilden, Jammie Reichel, Karen Walton
Process Owner: (Driver) Joanne Hilden
Core Team Members: (Consulted)
  - CPI Coach: Becky Coughlin
Extended Team Members:
  - Nick Foreman, John Craddock, Laine Santamaria, Nancy King,
  - Melissa Bojan, Doug Graham, Jean Weigel, Grant Crooks, Lindsey Hoffman, Jen Salstrom, Lisa Reaves, E.D. MD TBD
  - Whitney Smith, Gabrielle Pearl

Resources:
Whitney Smith and lab team: creation of “CBC Machine Diff” test to shorten CBC TAT
Laine Santamaria as clinical leader

Key Measures

<table>
<thead>
<tr>
<th>Key Measures</th>
<th>Definitions</th>
<th>Baseline</th>
<th>Goal</th>
<th>Progress (incl. date)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outcome</td>
<td>Time to ABX in E.D. from check into start</td>
<td>Median 154 min</td>
<td>59 min</td>
<td></td>
</tr>
<tr>
<td>Process</td>
<td>Time from pt arrival to order of ABX</td>
<td>Not yet measured</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Balancing</td>
<td>Length of stay for P/N</td>
<td>Not yet measured</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Financial</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Milestones/Tasks

<table>
<thead>
<tr>
<th>Milestones/Tasks</th>
<th>Owner</th>
<th>Due Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Process Mapping in the different CCBD Programs</td>
<td>Becky Coughlin, Laine Santamaria, Lindsey Hoffman</td>
<td>June 20</td>
</tr>
<tr>
<td>Creation of CBC Machine Diff test</td>
<td>Whitney Smith</td>
<td>June 20</td>
</tr>
<tr>
<td>Collection of baseline data</td>
<td>Mike Rannie, Michelle Finnerty, Nancy King</td>
<td>June 4</td>
</tr>
<tr>
<td>Creation of method for ongoing data collection</td>
<td>Mike, Michelle, Nancy</td>
<td></td>
</tr>
<tr>
<td>1st PDSA for initiation of ABX in CCBD</td>
<td></td>
<td>June 20</td>
</tr>
<tr>
<td>1st PDSA for initiation of ASX in E.D.</td>
<td></td>
<td>Aug 20</td>
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Strong feelings about “appropriateness” of giving or not giving dose of abx to non-neutropenic pts despite lack of data either way. Resistance to adoption of 1 hour standard despite it being nat’l standard Lack of education on the issue Lack of experience with rapid cycle PDSAs
High Level Process Map
Baseline

<table>
<thead>
<tr>
<th>#</th>
<th>Start</th>
<th>Stop</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Check-in</td>
<td>Specimen Received</td>
<td>57 min</td>
</tr>
<tr>
<td>2</td>
<td>Specimen Received</td>
<td>ANC Resulted</td>
<td>43 min</td>
</tr>
<tr>
<td>3</td>
<td>ANC Resulted</td>
<td>Order Released</td>
<td>63 min</td>
</tr>
<tr>
<td>4</td>
<td>Order Released</td>
<td>Abx Administered</td>
<td>34 min</td>
</tr>
</tbody>
</table>

**TOTAL** 197 min
One Obvious Challenge:

Complete Blood Count (CBC)

- TAT of 45 min and average TAT 43 min (Final ANC result)
- Only left 17 minutes for all of clinic processes

Laboratory’s Goal:

- Decrease TAT for ANC from 43 minutes to less than 18 minutes
To Accomplish Laboratory Goal:

What if....

Developed Modified CBC?

- CBC – Sepsis
  - WBC, RBC, Hgb, Hct, Indices, Platelets, “Preliminary” ANC (Automated ANC)

Process changes required

- CBC Sepsis specimen and requisition flagged with purple sticker
- Requisition would indicate phone number to call result
- Preliminary ANC would be called immediately upon resulting
Laboratory Concern...

Releasing abnormal CBC before slide review
To help alleviate the concern....

Perform Study
“Preliminary” ANC Verification Study

Analytical precision study

2 normal patient samples, 10 repetitions each looking at the ANC

- Coefficient of Variation 0.04% and 0.06%

Correlation study (retrospective)

122 CBC results (5 days)
Compared Automated ANC to final reported ANC
19 out of 122 (15.6%) ANC results changed after slide review
Analyzed data at antibiotic administration decision point of 500 cells/µL
- 1 of 8 (13%) ANC results changed after slide review (510 cells/µL → 590 cells/µL)

Conclusion – minimal risk!
### Baseline Data (1/2012-6/2012)

<table>
<thead>
<tr>
<th>TTA (N)</th>
<th>TTA (minutes) - From fever to antibiotics administered</th>
<th>CBCs ordered (N)</th>
<th>TAT (minutes) – Specimen receipt in laboratory to result</th>
</tr>
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<tbody>
<tr>
<td>72</td>
<td>111.3</td>
<td>44</td>
<td>43.0</td>
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</table>

### Post Improvement Data (12/2012-5/2014)

<table>
<thead>
<tr>
<th>TTA (N)</th>
<th>TTA (minutes) - From fever to antibiotics administered</th>
<th>*CBCs ordered (N)</th>
<th>TAT (minutes) – Specimen receipt in laboratory to result</th>
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<tbody>
<tr>
<td>179</td>
<td>42.2</td>
<td>96</td>
<td>12.0</td>
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</table>

*CBC Sepsis
Laboratory Control

Monthly analysis of ANC turn-around times

Specimens delayed in Laboratory triage and log in areas
Specimens with Low WBC caused delay

Continuous improvements:

Retrain specimen processing staff
Revise CBC Sepsis SOP
Summary

- Use of lean/six sigma methodology resulted in sustained reduction in TTA delivery process
- Project - QI interventions & change management both significantly improved our TTA from 52% to 95% within 60 minutes*
- Today - Improved process is capable of delivering antibiotics in <60 min ≥95% of the time

Conclusion

• MUST have all key process stakeholders at the table!
• Recognized Laboratory’s contribution to improving the overall TTA process
• The overall TTA project showed achieving TTA <60 minutes significantly reduced the need for ICU consultation or admission in this population.

  ○ Worthy of continued study regarding clinical & financial outcomes
Acknowledgements

**THANK YOU!**

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<thead>
<tr>
<th>Joanne Hilden, MD</th>
<th>Jennifer Salstrom, MD, PhD</th>
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<tr>
<td>Brian Greffe, MD</td>
<td>Kevin Carney, MD</td>
</tr>
<tr>
<td>Kathy Pool, MSN, CPNP</td>
<td>Camille Mediavilla, BSN</td>
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<tr>
<td>Jennifer Olson, RN</td>
<td>Sara Gibbens</td>
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<tr>
<td>Tyler Winkler, MT, SH (ASCP)</td>
<td>Dawn Law, MBA</td>
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