Intersection of LEAN and the LIS

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Agenda

• Manufacturing Mindset
  – LEAN Principles in the Lab

• Six Sigma Methodology
  – Role of LIS in DMAIC

• LEAN Redesign at Florida Hospital
  – Focus Areas and Tools Used
  – Process and Software Utilized

• Results
  – Improvement metrics
  – Controls in place
  – Advice for those just embarking on LEAN in the Lab
Laboratory Medicine faces production pressure

- Increase in lab tests with age and aging population are leading to expected increase in number of tests performed per year (increasing demand)
- Coincides with a decrease in the number of technologists in the field – average med tech age is +50 and retirements expected. Meanwhile, less techs coming on board (decreasing supply)
- Labs will be tasked with managing workforce shortages while growing business and maintaining TAT
- Efficient processes and automation are needed to meet the demand with less resources

A Robust Workflow Excellence Solution is Key to Ensuring Reliable Collection and Management of Lab Data

- Utilization of lab tests increases dramatically for 65+ year old people
- 80 million baby boomers today are rapidly advancing into this age cohort
- The U.S. is graduating 30% fewer lab practitioners than 10 years ago and 50% fewer than 20 years ago
- Shortage of medical lab personnel demonstrates an urgent need for continued improvement in workflow automation
- Rising U.S. healthcare costs continue to put pressure on hospitals to:
  - Maximize efficiency by increasing adoption of automation
  - Improve the quality of care in order to hold down overall healthcare costs
An efficient laboratory workflow is critical

Clinical Workflow?
Or "manufacturing" workflow that delivers a clinical product?
• High volume environment
• Quality must be maintained
  • High degree of accuracy required
  • Repeatable process desired

Manufacturing Mentality
• LEAN
  – Identify and reduce waste
  – Eliminate non-value added activities
  – Improve responsiveness to the customer, adding value
  – Reengineering labs to optimize workflow

• SIX SIGMA
  – Methodology of Continuous Improvement
  – Reduce Cost of Poor Quality
  – Elimination of Defects
  – Minimize Variation
  – DMAIC: Define, measure, analyze, improve, control
**When to do a workflow Assessment**

- Considering
  - Work force reductions
  - Issues with TAT, ED
  - Issues with lost, missing or delayed samples
  - Implementing or removing an automated line
  - New hospital adding on
  - Collection Management systems
  - Growing Outreach

**LEAN Principles**

- **Reduce Waste**
  - Eliminate Non-value added activities

- **Reduce Variability**
  - Demand fluctuations

- **Reduce inflexibility in labor pool**
  - Cross-train, plan shifts to peak demand

- **Instill performance management**
  - Real time operational metrics

- **Involve all levels of organization**
  - Waste-aware workforce with visibility to metrics
Typical Sources of Waste

- Waiting (Idle and process time)
- Overproduction (Resolving low priority as quickly as high priority)
- Defects (Waste)
- Not Using Talent (Mismatched skill sets and activities)
- Transportation (Sample movement)
- Inventory (Unused people capacity)
- Motion (Lack of standard protocols)
- Extra Processing (Lack of automation)

Performance Management

- Identify Trends and Proactively Address
- Data driven decisions
  - Increase organizational transparency
  - Increase patient safety
- Accurate diagnostic KPI tracking
- Real-time alerts
Engage all levels of the organization

- Share the data
- React real time
- Share successes

Sunquest Diagnostic Intelligence Whiteboard

Continuous Improvement in the Lab

Six Sigma Methodology: DMAIC
Define, measure, analyze, improve, control
Define

- Orders placed by physician
  - Nurse/Tech enters chart and requisition
- Nurse/Tech goes to patient bedside: Patient manually identified No Positive Patient ID
  - Nurse/Tech collects patient sample
- Specimen is labeled with track lane (WLB)
  - Nurse/Tech enters tracking number and collect time on label
  - Specimen manually released to H2L
    - Collector Info and/or other test results
  - Specimen sent to H2L
- Resulted

Sample sent to H2L

Determine which HID to run sample

Measure

- Average TAT per test (mins)
- Specimen Collects
  - Number of specimen collects per day
  - Time spent relabeling
  - Number of labeling errors
  - Number and cost of adverse events due to mislabeling
- Processing
  - Time spent receiving
  - Time spent routing specimens in the lab - per specimen (mins)
- Add-ons
  - # of add-ons needed per day
  - Time spent looking for existing specimen (mins)
  - # of misplaced specimens per day
  - Time spent looking for specimens (mins)
Analyze

Non-value added
Opportunity for error
Wasted time

Implement changes

- **Integrated Collection Manager**
  - Print instrument-ready labels at bedside
  - Receive immediate alert on hand-held for add-on orders

- **Lab Automation**
  - Integrate Robotic Lines to automatically receive and process

- **Specimen Routing Tracking**
  - LIS determines HID, lab and spot to route the sample
  - Track the location of any specimen at any time anywhere in the lab or enterprise

- **Advanced Accessioning**
  - Enable system to use a foreign barcode for outside samples
**Improve - New Process**

- **Efficiencies**
  - Handling an outside specimen reduced from 5 minutes to 1 minute.
  - 50,000 outside samples a month = annual benefit over one million dollars.

- **Quality**
  - LIS tracking functionality reduced misplaced specimens from 10 a day to 0.
  - Eliminated 25 minutes per misplaced specimen previously required to find them.

- **Turn Around Time**
  - Route optimization resulted in 30% reduction in turnaround times for lab tests.
  - Added over 40% more capacity as a result, while actually reducing FTE.

**Control**

- **Specimen Management**
  - Pre-planning instructions for specimen processing and routing.
  - Business Intelligence and Analytics.
LEAN at Florida Hospital

Improved Process and Turn Around Times

Florida Hospital Orlando

- Part of a 7 hospital system in Central Florida
- FH Orlando >1,000 beds
- Core Lab
- Specialty Laboratories: Micro, Histology, Serology, Infectious Disease, Molecular Diagnostics
Lean Journey – Why?

- Unacceptable TAT’s
  - Major Chemistry, Order to Collect 70 – 80 minutes
  - Hematology, 50 – 60 minutes
- Separate laboratories for Processing, Hematology and Chemistry
- Label driven process in phlebotomy

Lean Journey – Areas of Focus

- IP Stat TAT
  - Processing
  - Chemistry
  - Hematology
  - Blood Collection
AM Lab Completion (Orlando)

ED TAT Collect to Result
Orlando

IP Stat TAT Order to Result
Orlando
Lean Journey – Tools

- Process Flow Mapping (Order to Machine)
  - Phlebotomy
  - Processing
- Spaghetti diagrams
- Video Taping – Product
- 5S and standard workstation
- Standard Work
Lean Journey – Tools

- **LEAN**
  - Identify and reduce waste
  - Eliminate non-value added activities
  - Improve responsiveness to the customer, adding value
  - Reengineering labs to optimize workflow

- **SIX SIGMA**
  - Methodology of Continuous Improvement
  - Reduce Cost of Poor Quality
  - Elimination of Defects
  - Minimize Variation
  - **DMAIC**: Define, measure, analyze, improve, control
Lean Journey – Focus

• Phlebotomy
   – Reduce waste in wait time process
   – Keep phlebotomist on the floor and eliminate Transport delays (people and label processes)

• Solutions
   – Electronic collection System
   – Real time information to phlebotomist, eliminate walking to lab to get labels/orders
   – Maximize tube system to deliver sample
   – Utilize Single piece Work Flow

Positive
Patient ID
Bedside
Label Printing
Single piece workflow example

Last work completed in 30 minutes

First work completed in 3 minutes

Results – Stat TAT
Results – Productivity

![FHO Phlebotomy Productivity Graph]

Results - Errors

![Specimen Collection Label Errors Graph]
Lean Journey – Focus

• Processing
  – Reduce Waste, motion and “tube wait time”
  – Accelerate tube processing and loading of analyzers.
  – Not in scope: Instrumentation
  – Auto-verification already being utilized

• Solutions
  – Move Processing to Central area
  – Remove walls and create core lab to contain Processing, Chemistry and Hematology
  – Staff to meet workload demand
### Travel Distance

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<tr>
<th></th>
<th>Before</th>
<th>After</th>
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<tr>
<td>Chem</td>
<td>154</td>
<td>22</td>
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<td>Hem</td>
<td>105</td>
<td>21</td>
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<tr>
<td>Micro</td>
<td>235</td>
<td>30</td>
<td>87%</td>
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<tr>
<td>Serology</td>
<td>179</td>
<td>80</td>
<td>55%</td>
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### Original Layout

- Hematology
- Chemistry
- Receiving Phlebotomy
- Serology

### New Layout

- Automated Cell for Chemistry
- Main Lab Cell for Hematology
- Receiving
- Chemistry
- Hematology
- Send-out/PKU
- Manual Chemistry
- Phlebotomy
- Bone Marrow
- Serology

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Additional tools needed

• Collection Manager
  – Keep phlebotomist on floors
  – To receive or not?
• Real time feedback
  – Daily reports
    • AM TAT
    • STAT IP TAT
    • ED TAT

• Close but not quite there

Additional Tools & Tasks

• Enhanced front end automation
  – Tecan FE500 to Beckman power processor
• Container tracking and post analytical storage tracking
• Real time monitoring
• Utilizing automation to receive samples
  – Collection managers already have collector and collection time
  – Visual Clues
New Tools

- Enhanced Autoverification
  - Normal Values
  - Non critical values
  - Criteria based
    - Instrument flags
    - Delta failures

- Automated Storage
  - Real time location information

New Tools, New Processes

- Automated Storage
  - Real time location information
  - Automated Retrieval and rerun capabilities
## 2011 Scorecard

### Laboratory - Orlando

#### TEAM

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<td>Overall Separation</td>
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<td>12.1%</td>
<td>11.7%</td>
<td>11.4%</td>
<td>13.9%</td>
<td>13.8%</td>
<td>12.5%</td>
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<td>Stat FAP Results Received (avg Min)</td>
<td>29</td>
<td>27.7</td>
<td>28.9</td>
<td>28.9</td>
<td>28.7</td>
<td>28.2</td>
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<td>24.9</td>
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<td>Stat FAP Completion by 45 Min</td>
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<td>Stat FAP Complete in 15 Min</td>
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<td>Brain Attack Lab TAT (order to result in 45 min)</td>
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<td>80%</td>
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<td>IP STAT TAT (order to result in 120 minutes)</td>
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<td>First Look Productivity Index</td>
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<td>103.7%</td>
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<td>Campus Blood Culture Contamination Rate</td>
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**If I had to do it again...**

- Do a piece at a time in rapid succession
  - Maybe??
  - Is big bang a better way?
- Chose tools based on the desired new processes
- Continue to leverage automation and reduce hands on time and chances for error
Florida Hospital Orlando Laboratory

Innovation for better patient care

Robotic Specimen Delivery

Pre and post analytical Automation with chemistry analysis
First Integrated system in the US

4th Generation Automated Blood Bank Testing
First in US

DNA Sequencing
Detecting bone marrow transplant chimerism

Electronic Positive Patient.ID