Automation of Lean Processes Enables High Volume Throughput

April Gamache
Vice President, Business Services; General Manager, Quebec
LifeLabs, Toronto, Canada

Lab Quality Confab
Atlanta, Georgia
Sept 29, 2009

1

LifeLabs

- A Canadian diagnostic testing organization; nearly 50 years in the industry.
- The largest diagnostic laboratory in Canada, operating primarily in British Columbia, Ontario and Quebec.
- Employ more than 3,000 professionally-trained staff.
- Each year, provides more than 50 million laboratory tests to over 10 million patients and nearly 20,000 physicians.
- Community based laboratory testing, providing service to outpatients, homebound patients, long-term care facilities and other partnerships to support patients in the community (e.g. hospitals, public health, etc.).

2

The Challenge:

- Double-digit growth in test volumes driven by our aging population and changing patient profile.
- Increasing pressures on government funding.
- Increasing costs, industry and supplier consolidation, capital and space constraints.
- Scarce skills challenge.
- EHS risk increase with increasing volumes (eg. Repetitive Strain Injuries (RSI's))

3

The Objective:

Decrease cost, increase capacity and improve quality by consolidating six Chemistry testing platform types into one highly automated platform nationally (11 labs; ~60% of total volume).

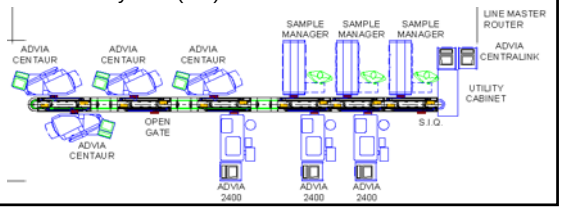
- Improved throughput and TAT, while addressing downtime risk on aging legacy platforms.
- Reduction in tubes drawn per patient.
- Reduction in FTE through automation and tube consolidation.
- Improved EH&S through decreased exposure and reduction in RSI's through automation of decapping, loading, unloading and recapping activities.
- Incremental capacity to meet future growth; further scalable capacity available.
- De-risk supply issues.
- Improved workflow using Lean Six Sigma methodologies in process and layout design.
- Reinforcement of National standards.
- Error reduction / mistake proofing through built-in quality checks.

4

The Solution:

Decrease cost, increase capacity and improve quality by consolidating six Chemistry testing platforms into one highly automated platform nationally (11 labs).

- Improved throughput and TAT.
- Reduction in tubes drawn per patient.
- Reduction in FTE through consolidation of platforms and tubes, as well as increased “walk away” capability and reduction in effort associated with automation.
- Leveraged capital investment, while offering scalable capacity.
- Sample management solutions to reduce RSI and exposure risks.
- Open system which allowed introduction of 3rd party materials in the event of lot failures.
- Scalable solution allowed placement at all sites.
- Error reduction / mistake proofing through built-in quality checks (eg. Clot detection and liquid level sense capabilities).
- Effective integration w/LifeLabs Lab Information System (LIS).



5

Our Approach:

Design through Lean Six Sigma; Integrated project management approach including, but not limited to:

- Mapping optimal flows (materials, people, documents, etc) prior to finalizing design – challenged internally and externally.
- Establishing joint and integrated professional project management with Siemens Medical Solutions, the Supplier.
- Fully leveraged SMEs.
- A focus on training and service support.
- Robust validation processes.

6

Problem Statement:

- On implementation, throughput at our largest lab in Toronto was only achieving 76% of target.
  - Our first two site implementations in BC, went live without issue, although much less complex in both volume, test menu and degree of automation.
  - The Toronto site processed ~13 Million tests annually.
  - Workflow was inconsistent in processing demand – sporadic bottlenecks, inconsistent process cycle times.
  - Excessive unplanned downtime.
  - Inconsistent planned downtime.
  - Throughput and therefore capacity was much lower than expected

Expectations:	
Target Tube Throughput:	925-950 tubes/hr
Target Track Operation:	23.5 hrs/workday
Instrument Operation Time:	20-21 hrs/day

Equipment Performance	**% of Expectation**
Total System Tube Throughput:	76 – 84%
Automation Components:	80 – 94%
Chemistry Instruments:	90 – 95%
Immunoassay Instruments:	90 – 95%

- The Impact:
  - Quality risk due to specimen backlogs and increased TAT.
  - Inability to consistently deliver to the customer.
  - Significant increased costs required to process tests and ensure quality – e.g. overtime, validation, transportation and opportunity costs associated with delay of further implementation.

7

Lean Six Sigma Applied

An immediate team was formed between LifeLabs and Siemens to attack the problem.

- A global team of subject matter experts in all areas of platform performance were assembled, including, but not limited to:
  - LifeLabs' Lean Six Sigma Team
  - International workflow experts with platform experience of this scale (Top 10 in the world).
  - IT experts to mine data from Platform and LIS systems.
  - Executive level commitment from both organizations to quickly mobilize scarce resources.
  - Capitalize on the knowledge of the team working the line.

Immediately executed the DMAIC process, by

- Defining the overall problem.
- Defining appropriately scoped work streams.
- Enabling with the best expertise.
- Instituting measurement systems.
- Prioritization of streams based on level of improvement.
- Overall program management to understand the cause/effect relationship and interaction of various streams toward achievement of required performance.

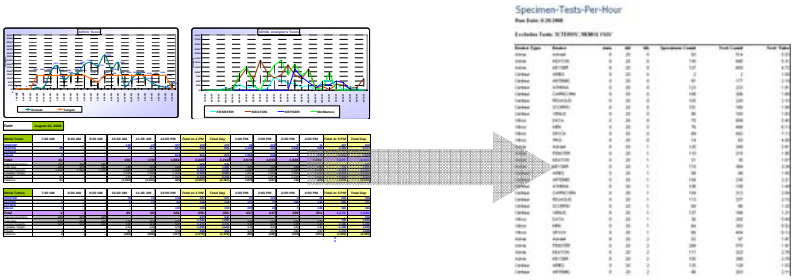
Lean Six Sigma applied across organizations requires:

- Shared objectives
- Resisting the urge to "blamestorm".
- Honestly engaging
- Learning and improving together.

8

Establish Daily Production Reports

- High volume labs can learn from manufacturing best practices.
  - Tracking and understanding throughput by hour by machine.
  - Establishing target performance and analysis of variances.
  - Understanding “entitlement” – best achieved performance.
  - Automating data collection to encourage analysis vs collection efforts and ensure sustainability of control systems.
  - The ability to “drill down” on throughput data



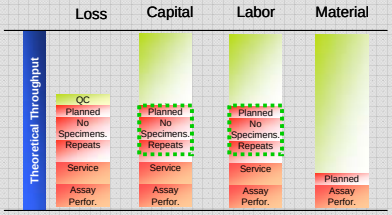
9

“See” the Backlog

- Specimens Received vs Specimens Processed
  - By test and by tube
  - By day, by hour
- Inventory Visibility - By Location and Type

10

Understand Throughput Losses



- Identify the losses
- Brainstorm cause/effect relationships
- Subjective followed by objective prioritization.

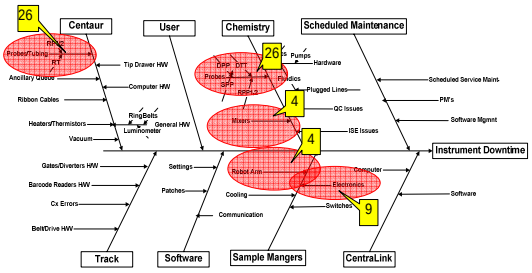
Service Tracking Report Tuesday, August 19, 2008

Count of Issue Date	Total
Total	21

Average of TSC minutes	Total
Total	12.19

Count of Issue Date	
TSC minutes	Total
0	4
N/A	5
Grand Total	9

Count of Issue Date	
FSR on Schedule	Total
FSR on site	10
Solved by J.L.	1
TSC on Phone	1
Unknown	2
Yes	7
Grand Total	21



Measure, Analyze and Reduce Losses

Reduce Repeat Testing

- Enable tracking of tube re-testing (i.e. other than clinical repeats).
- Analyze root cause of repeats through system and user assigned reason codes.

Found:

- Inter and Intra system IT communication errors.
- Pre-analytical improvements (eg. Collection, label placement, etc.).
- Repeat Algorithm updates.
- Further needs to mirror test menus across analyzers and interaction with QC activities.

Measure, Analyze and Reduce Losses

Reduce and Control Planned QC

- Create, Document and Train Standard Work
- Publish Standards
- Document Actual Performance
- Analyze cause of variances
- Continually improve toward consistency and reduction.

Found:

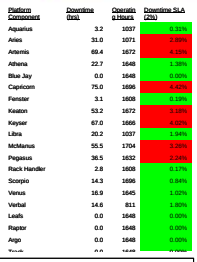
- Need for staggered schedules
- Hidden factories / non-standard work
- Procedural improvements
- Measured = managed
- Contributed to broader education on relationship to throughput.

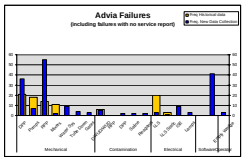
13

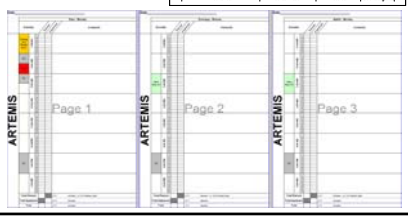
Measure, Analyze and Reduce Losses

Reduce Unplanned Downtime

- Ensure clear definitions of downtime
  - Planned and unplanned
  - Measurement system method and compliance
- Measure performance by component
  - Overall system
  - Sub-systems
- Assess root cause and corrective action
- Ensure clear report and communication
  - Performance;
  - Action Plans;
  - Escalation Protocols
- Institute Control Plans
  - Mistake proof where possible
  - Entire value stream!
  - Identify leading indicators
  - PM's tied to cycles vs time





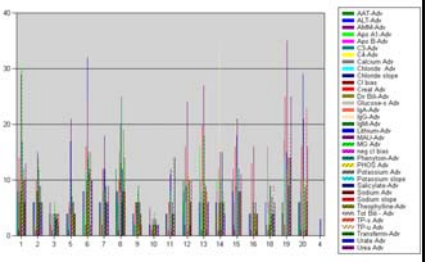


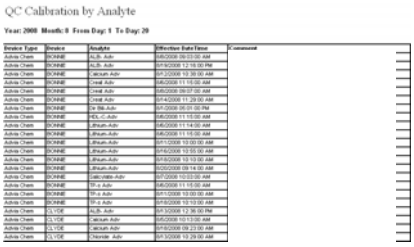
14

Measure, Analyze and Reduce Losses

Improving Assay Performance

- Measure and calibration data
- Identify root cause of calibration issues
- Education on Production Management
  - Analyzers are no longer independent
  - Operator decisions impact the entire system
  - Understanding Queuing Theory
  - Understanding Theory of Constraints
- Systematically identify leading downtime indicators



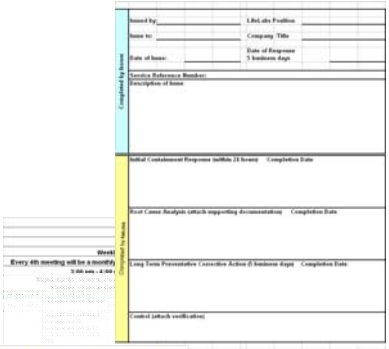


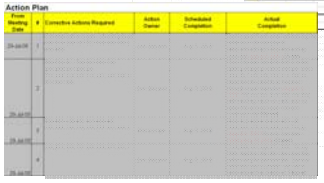
QC Calibration by Analyte

15

Control and Continually Improve Performance

- Formalize Failure / Root Cause Reporting and Establish accountabilities for Corrective Action.
- Formal performance review meetings w/key stakeholders
- Shift:Shift Communications
- Clear Action Logs
- Clear Accountabilities tied to performance management

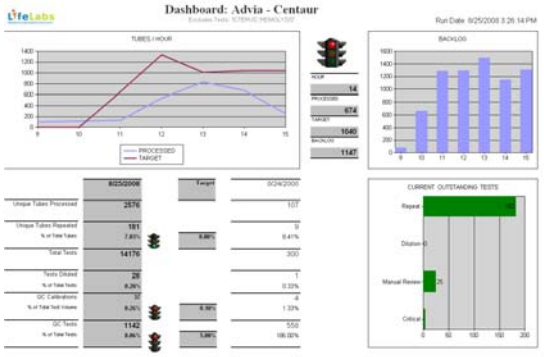




16

Make Performance Visible!

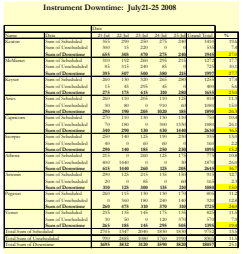
- Chemistry In-Lab Dashboard
  - Wall-Mounted Screens in Lab Display the Most Critical Key Indicators

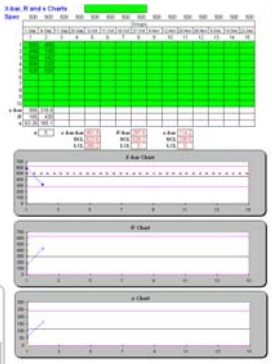


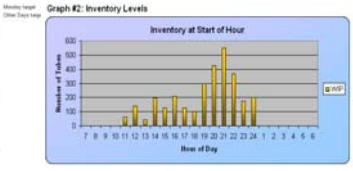
17

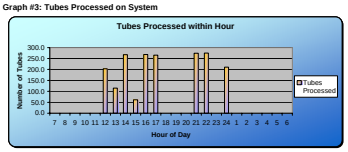
Make Performance Visible!

- Clear, Simple and easily accessible summary reporting





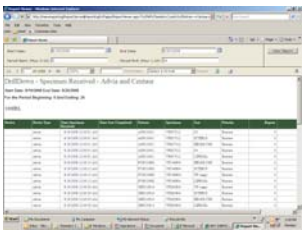
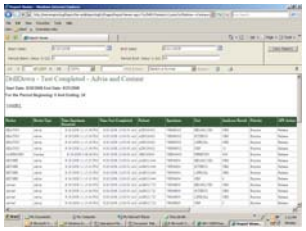
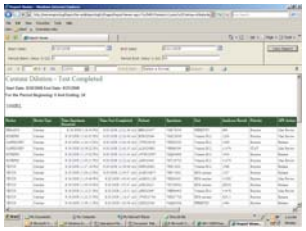
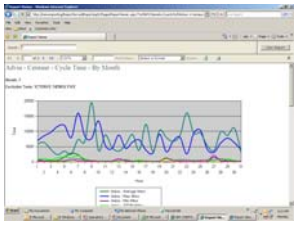




18

Make Performance Visible!

- Analytical Reporting with Drill Down Capability

19

Ongoing Capacity Assessment

- Consider:
  - Observed, not theoretical performance (i.e. actual throughput, downtime considered, etc,)
  - Growth needs
  - Entitlement

20

Clear Process Ownership for the "System"

- Education on ownership and action to be taken when indicators are "red".
- Establish ongoing accountability for process and document control

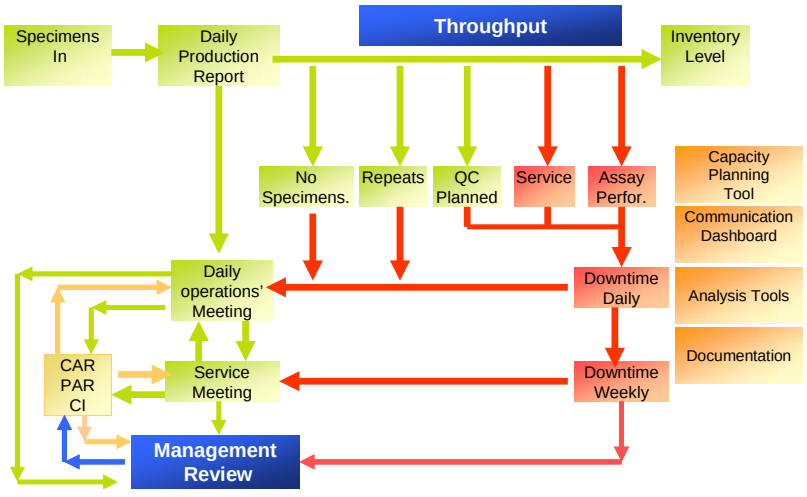
Reporting Summary for Chemistry Dashboard

Area	*What to Look For*	*Question to Ask*	*Who Asks?*	*Method of Reporting*	*Frequency*	*Timeline to Implement*
Tubes/Hour Graph	Processed below Target	What are the events/reasons for low processing?				
Tubes/Hour Graph	Extensive Variation Above or Below Target	What are the events/reasons for variation (improvement or deterioration) of process?				
Tubes/Hour Graph	Not trending/moving with target	Why is the process not moving/trending with target?				
Backlog Graph	High/Low Backlog	Why is the backlog higher/lower than expected?				
Day to Day Metric Summary	Red/Yellow light on repeats	Why are the repeats higher than expected?	Captain ask operators	conversation and log review in Daily Log	At Shift Change	
Day to Day Metric Summary	Red/Yellow light on Calibrations	Why are the unplanned calibrations higher than expected?				
Day to Day Metric Summary	Red/Yellow light on number of QC Tests	Why are QC tests higher than expected?				

Control #	Document Name	Author	Owner /Position/ Organization	Document description and Comments	Latest Revision
	Service Tracking Log			Form for Service Tracking	Service Tracking Log
	CAR Form			Form for issuing corrective action response from Siemens (or others)	CAR Form
	Siemens LL Service Action Plan			Form for tracking the service issues and action plan to remediate	Siemens LL Service Action Plan
	PM Tracking Log			Form for PM tracking	PM Tracking Log

21

Understand the System



22

Sample Outcomes

- Completed 28 Projects in 3 Months

Focus Area	Actions
Service Related Downtime	• Improved inter-company service model (effectiveness of comm'n). • Improved incident reporting, analysis, trending and review processes throughout the value stream. • Revised PM protocol and schedule. • Parts supply planning throughout the value chain; local inventories. • Increased number and "system" knowledge of local service teams.
Load Balancing	• Optimized test menu mapping. • Multiple wedges for high volume chemistries. • Moved one instrument off-line; automated sorting (low test density; C/T variation) • Automated Sorting and reporting for rework. • Instrument operator procedure changes (care & feeding to improve throughput) • On & Off-line assay protocols. • Tie reagent change to maintenance schedules. • Reduce material lead time and improve line fill rates
QC and Maintenance Processes	• Stagger daily maintenance • More efficient maintenance protocols; Compliance to schedule
Information Technology	• Improved inter-system hand shakes • Pre-scanned information to improve tube identification
Increase Capacity	• Improved inter-system hand shakes • Install 4th Sample Manager • Change Track Operating Procedures to 23.5hrs • Increased track tube capacity • Developed Capacity Simulation Model
Knowledge Transfer - Local Service and User Expertise	• " System" training for employees and service personnel • Improved work instructions, continuous improvement process and ongoing training protocols

23

The Result:

- Now not only systematically measure quality and cost of testing processes, but apply that rigor in understanding our overall capacity and throughput.
- No longer implement "equipment", we take a systems approach - design, prepare and implement new "processes".
- Achieved our objectives
  - Improved throughput and TAT.
  - Less tubes drawn per patient.
  - Reduction in FTE through automation and tube consolidation.
  - Improved employee health and safety.
  - Incremental capacity with further scalable capacity available.
  - Strengthened supplier relationships, de-risked supply and improved lot management capabilities.
  - National standards.
  - Error reduction through mistake proofing and improved surveillance.
  - Improved workflow using Lean Six Sigma methodologies in process and layout design.

Next:

- Continue to measure, openly challenge, raise the bar and improve.

24