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Leveraging Lean to Become Best-In-Class Lab Performer: How We Built a New Core Lab While Integrating Lab Operations and Helping Staff Embrace a New Culture

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October 8th, 2018

Carolinas HealthCare System Laboratory Scope of Services

CHS laboratory network provides testing services to acute care facilities (metro), Physician Practices both CHS and Non CHS (outreach), and free standing Emergency Departments.

Testing locations

- 12 Acute Care Hospitals
- 6 Free Standing ED Laboratories

Phlebotomy Services

- 19 Patient Services Centers (Locations for outpatient blood draws)
- 16 physician practices
- 21 skilled nursing facilities

Reference Laboratory Testing

- 2,978 providers located in 938 medical practices

Laboratory Departments

1) Hematology
2) Chemistry/Toxicology
3) Microbiology
4) Histology/Cytology
5) Blood Bank
6) Cytogenetics
7) Molecular Diagnostics
8) HLA Transplant
9) Coagulation

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Background (2012)

The success of CHS overall and the Laboratory Outreach program have resulted in significant volume growth, which has created numerous operational challenges.

- CMC laboratory currently serves as an acute care lab and as the core lab for CHS Metro hospitals.
- The department has experienced 50% growth over the past five years.
- The volume of routine tests from physician offices has reached a level where the acute care needs of the CMC campus are being adversely affected.
- Growth has also resulted in testing being spread across five locations, presenting challenges to quality and efficiency.
- Lab functions at CMC and CMC-Mercy are rapidly outgrowing their facilities.

Cost of Benchmark Core Labs

	Tests (millions)	Capital Investment (millions)	Capital $/Test	Difference
CHS	3.0	$17	$5.7	---
System A	3.5	$29	$8.3	46%
System B	3.8	$44	$11.6	104%
System C	1.8	$75	$42.0	637%

Core Lab's Theory

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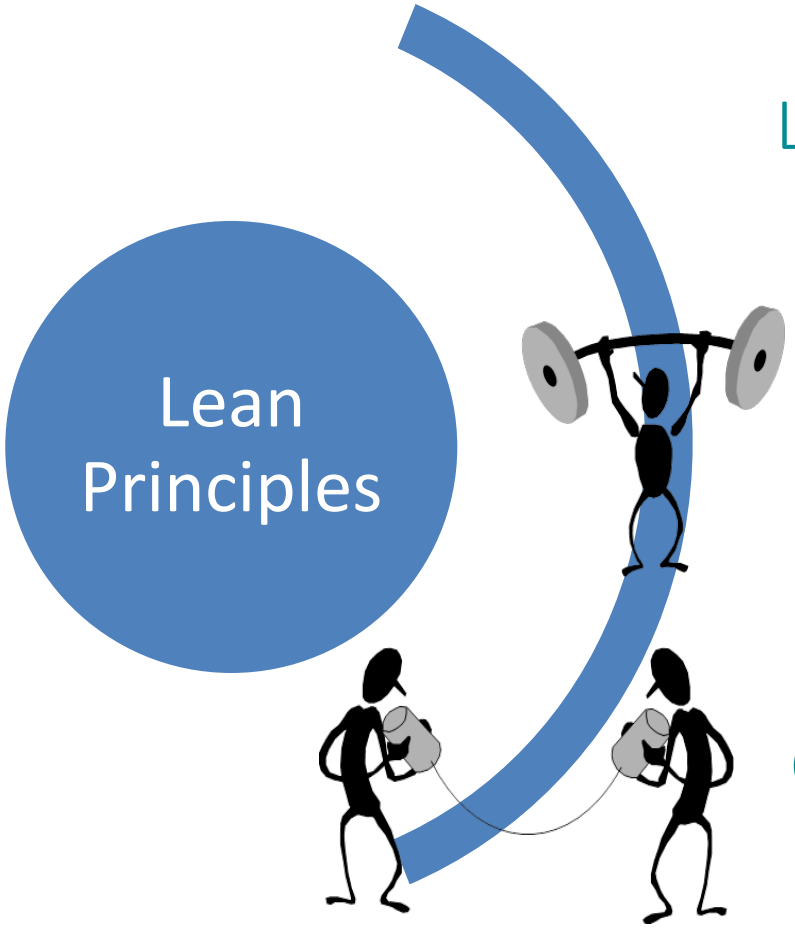
Design Process



Listening

Empowering

Communicating

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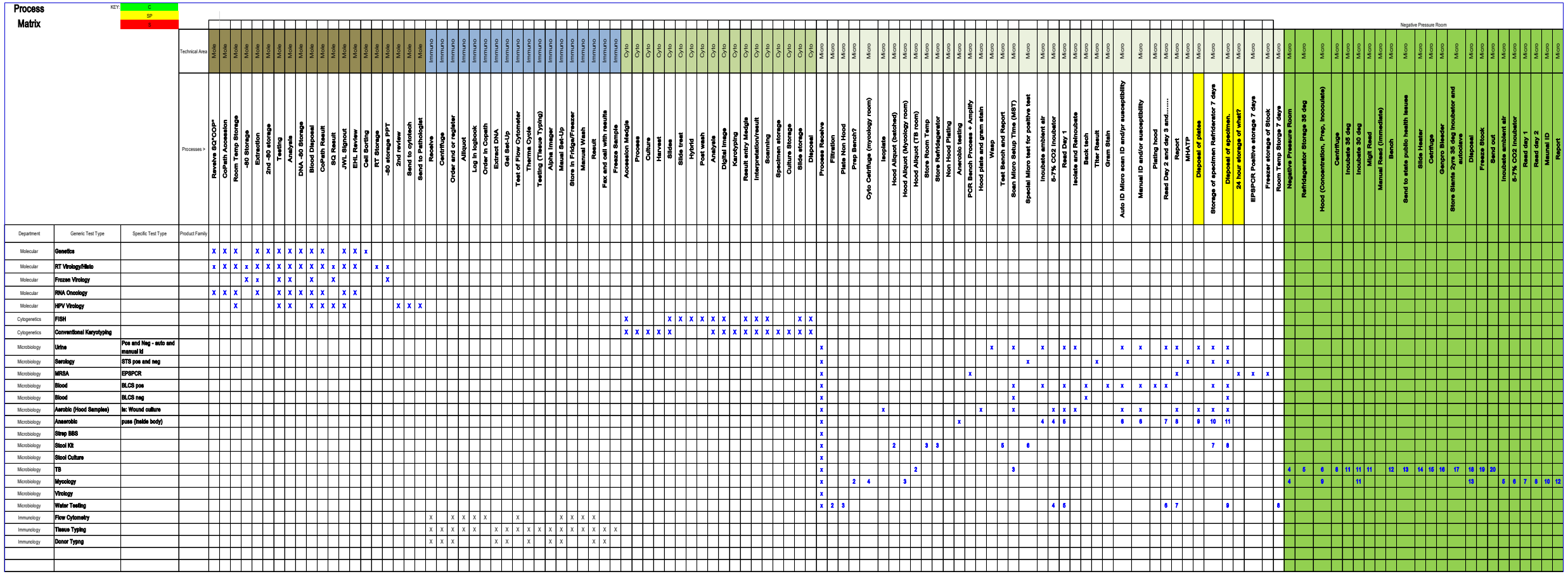
3P Process Utilized

What is 3P?

People, Preparation, Process

3P is an event to develop and define a Lean equipment and supply chain logistics system before the start of implementation

Design/Planning Phase: Process Matrix Molecular



Molecular/Microbiology

Objective

Identify opportunities to share common resources in the Lab in order to improve quality and improve patient care

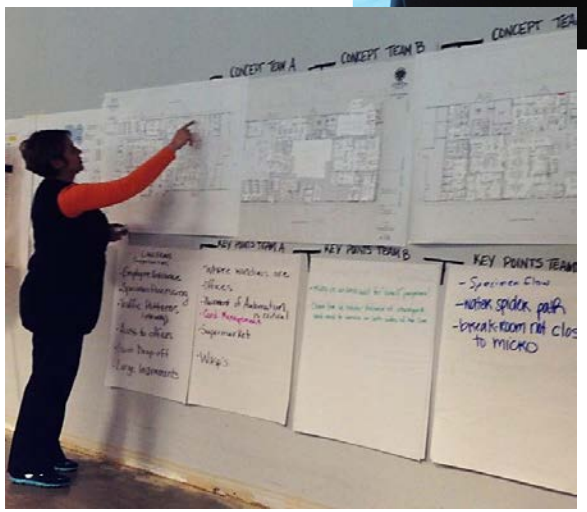
Potential shared resources For Micro, Molecular, Cytogenetics and Immunology

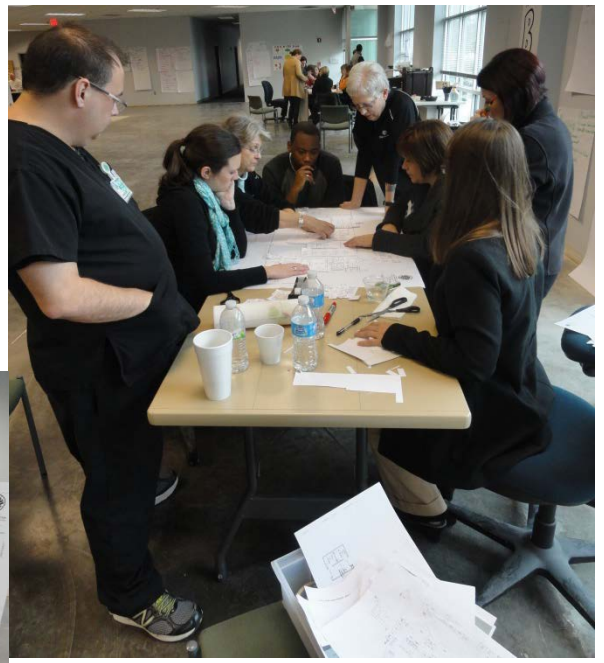
Pre Analytical	Analytical	Post Analytical
• Pre-Amplification • Isolation • -80 deg storage • RT storage	• Dark Room • Nitrogen • CO2 • Benches • QC • 2-8 Deg Storage • Amplification • PCR Setup	• Waste • RT Storage • -80 Deg Storage • Post Amplification

Specimen Families

Molecular	Frozen Virology
Molecular	Molecular Oncology
Molecular	HPV Virology
Molecular	Genetics
Molecular	RT Virology/Histo
Cytogenetics	FISH
Cytogenetics	Conventional Karyotyping
Immunology	Flow Cytometry
Immunology	Tissue Typing
Immunology	Donor Typing
Microbiology	Urine
Microbiology	Serology
Microbiology	MRSA
Microbiology	Blood
Microbiology	Blood
Microbiology	Aerobic (Hood Samples)
Microbiology	Anaerobic
Microbiology	Strep BBS
Microbiology	Stool Kit
Microbiology	Stool Culture
Microbiology	TB
Microbiology	Mycology
Microbiology	Virology
Microbiology	Water Testing

Ideas in Motion!





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Finally Making Sure the Space is Right!

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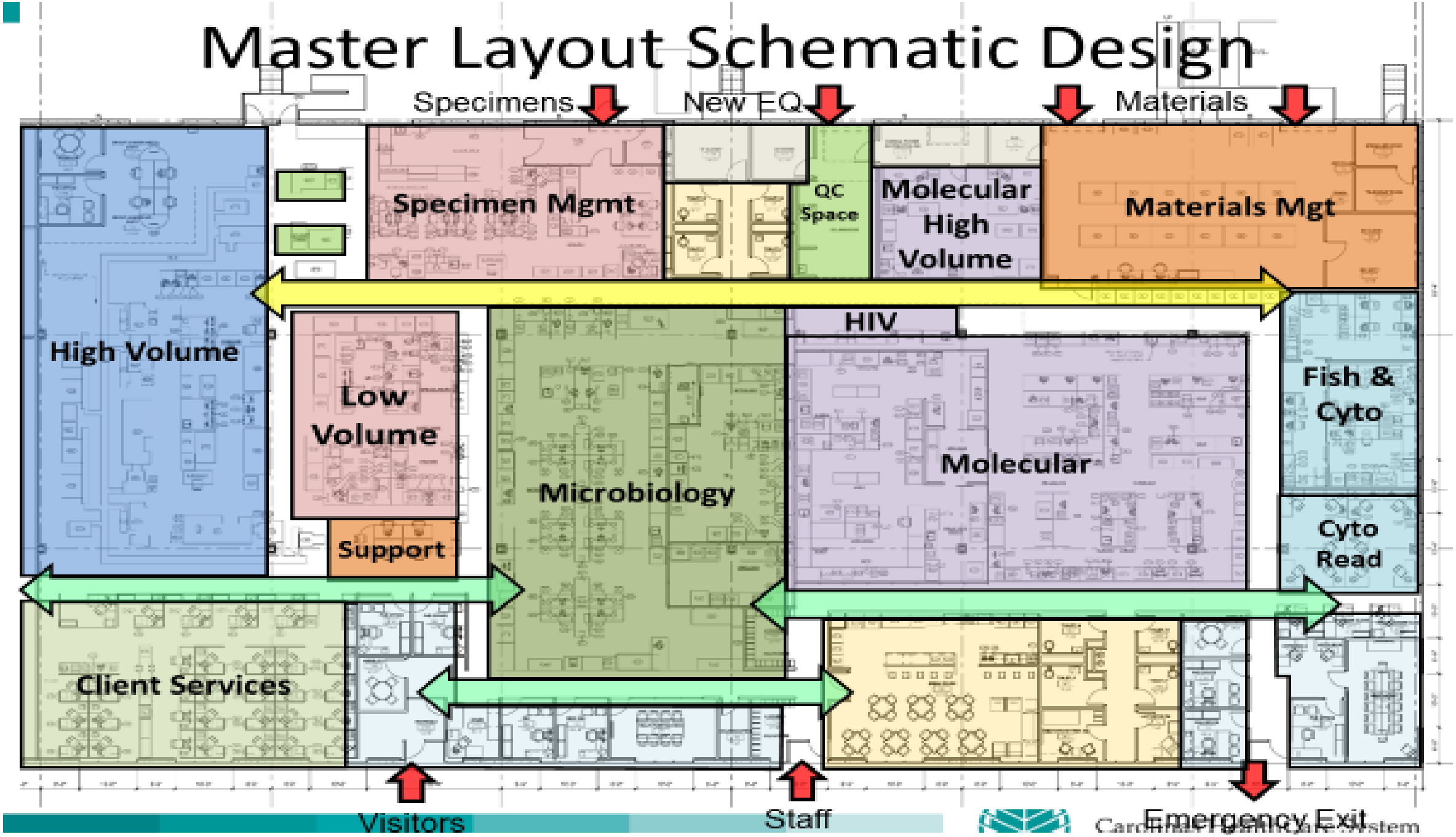
2013 Core Lab 3P Schedule

- 6/17 – 6/21 Molecular, Cytogenetics, Immunology
- 7/15 – 7/18 Receiving
- 7/29 – 8/2 Chem/Heme high volume
- 8/12 -8/16 Chem/Heme low volume, Serology, Blood Bank
- 9/9 – 9/13 Microbiology
- 10/14 – 10/18 Employee spaces, Leader areas
- 10/28 – 11/1 Waste Stream, Materials Management, Storage
- 11/11 – 11/15 Client Services, Logistics, Sales, Marketing
- 12/2 – 12/6 Core Lab Master Layout

Master Layout Schematic Design



Specimen Flow Distances

Flow	Before (feet)	After (feet)	% Improved
High Vol Chem / Heme	1189	210	82%
Low Vol Chem / Heme	1081	265	75%
Micro - Urine	1619	260	84%
Micro - Gram Stain	1008	205	80%
Molecular - CF	2652	327	88%
Immunology – PRA	2338	293	87%
Cytogenetics – Bone Marrow	2800	339	88%

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Recap of All 3P Events

9 Events

176 Days

39 Departments

103 Lab Teammates

138 CHS Teammates

1,976 Years of Experience

5,692 Hours of Design Time

Great Design!

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Lean Management Structure

October 2018

Our Concept for Core Lab

- Maximize quality, service, efficiency
- Maximize flow – specimens; materials; people; information; waste
- Eliminate Defects – specimens; orders; accurate results; on-time results
- To develop a culture of continuous Improvement

Our Challenge for Core Lab

- Implementing a management system to sustain continuous improvement
- Overcome current operational practice and thinking
- Leaders and teammates adopting the new way of thinking
- Building trust to facilitate open communication about opportunities to improve

Addressing the Challenge

- Our leadership model is derived from the approach used by Toyota Production Systems piloted in a clinical setting elsewhere
  - Directors
  - Group Leaders
  - Team Leaders
- Our model relies on team leadership to drive change
- The Team Leader plays a key role in our day-to-day operations
- The Group Leader supports the Team Leader

Our Operating System Elements

- People
  - Teammate Development
  - Standard Work
  - Team Structure
  - Staffing to Model
  - Leader Standard Work
  - Cross Training
- Process
  - Huddle
  - Andon
  - Visual Controls
- System
  - Problem Solving
  - Schedule
  - Audits
  - Point-of-Use Materials

Our Leadership Principles

- **Patients first, always**
- **Value is defined by the patient**
- Maintain **continuous flow** – level out the workload to the extent practical
- **Use visual controls** so that problems are easily seen
- Ensure **quality is right the first time** by stopping to fix problems
- **Go and see** yourself to thoroughly understand the situation
- **Implement technology judiciously**; automating a poor process is unlikely to result in improvement
- **Develop exceptional people** and teams through a relentless **focus on daily improvement**

Teammate Role

- Follow standard work without exception
- Pull the Andon immediately if unable to perform standard work
- Continuously identify ways to **improve processes**
- Participate actively in daily huddle
- Ensure safety and quality
- Daily upkeep of work area

Team Leader Role

- **Minimize process stops by solving problems**
- **Own, train, and develop standard work**
- **Audit standard work and processes daily for deviation from standard**
- **Lead real-time practical problem solving**
- Focus on safety through 5s and visual control audits
- **Own the training and development of teammates**
- Cover gaps for call ins, project time, personal needs, any unexpected team member absence
- **Develop staff skills in standard work and problem solving**
- Maintain 5s – Workplace organization
- Ensure shift-to-shift communication
- Understands the pulse of the team

Group Leader Role

- Performs basic administrative functions, including budget preparation and human resources duties such as hiring, performing evaluations and corrective action
- **Lead daily huddles**
- **Minimize process stops by solving issues**
- Ensure standard work audits are completed daily. Audit one process each week
- **Lead advanced practical problem solving to include A3**
- Focus on safety through 5s Gemba walks with team leaders
- **Develop staff skills in standard work and problem solving**
- Communicates to staff shift-to-shift about important process specific safety/quality issues

Benefits of Our Structure

- Provides for **daily** coaching and mentoring of teammates by Team Leaders
- **Daily** confirmation that standardized work is being followed
- Enhances teammate development and training – **all shifts**
- **Develops trust** and results in high performing teams
- Provides a high level of support for teammates
- Improves problem solving – teammates participate in **real-time problem solving**
- **Drives** the cultural and organizational requirement to sustain Continuous Improvement

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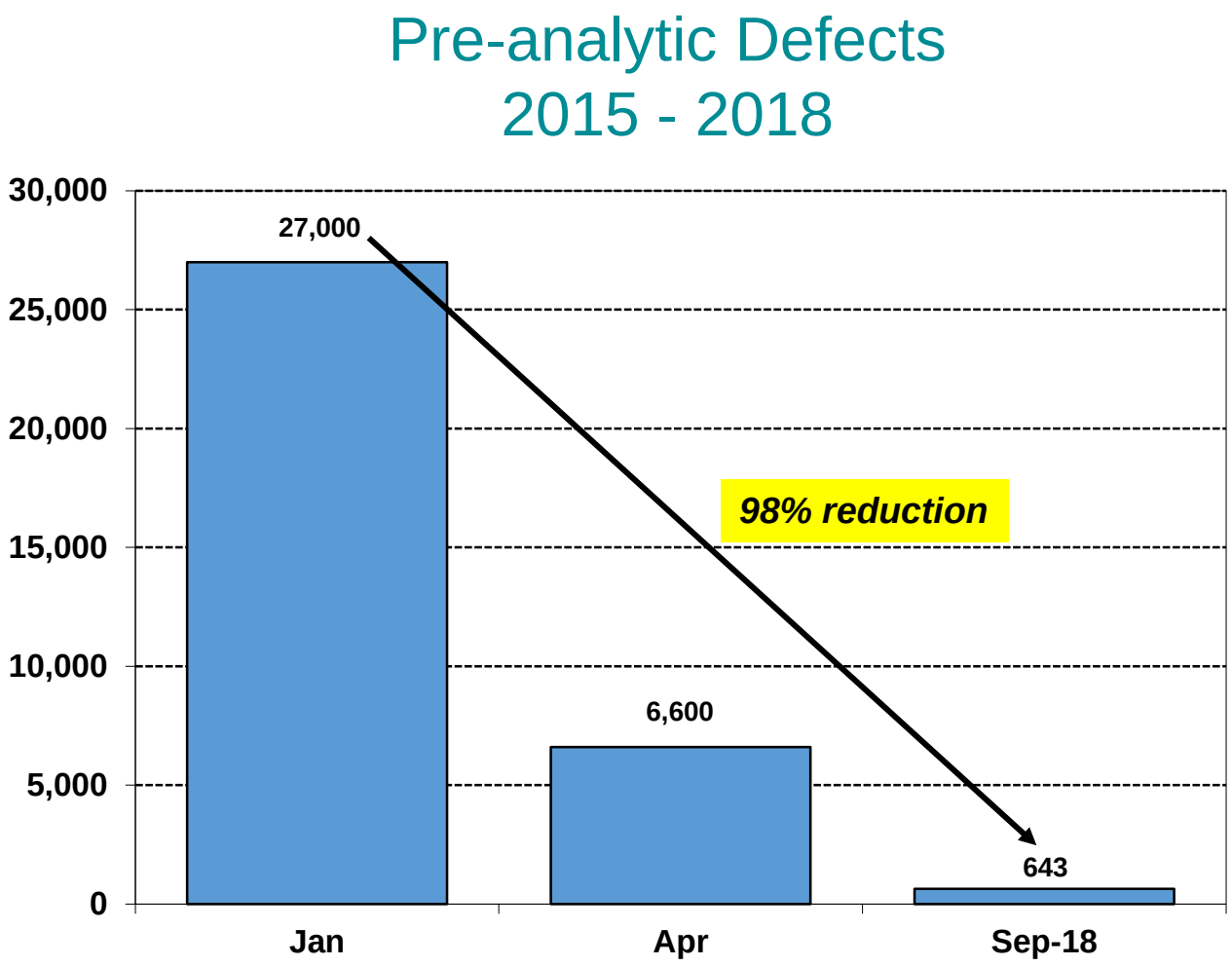
Highlights of Outcomes

Turnaround Time Improvements

	Jan. 2015	Jul. 2017	Reduction (days)	Improvement
Microbiology - Collect to Result (days)				
Urine cultures	1.76	1.40	(0.36)	20.5%
Blood cultures	4.60	2.40	(2.20)	47.8%
Fluid cultures	5.79	3.90	(1.89)	32.6%
Spinal fluid cultures	5.74	1.50	(4.24)	73.9%

Some Outcomes of Our Structure



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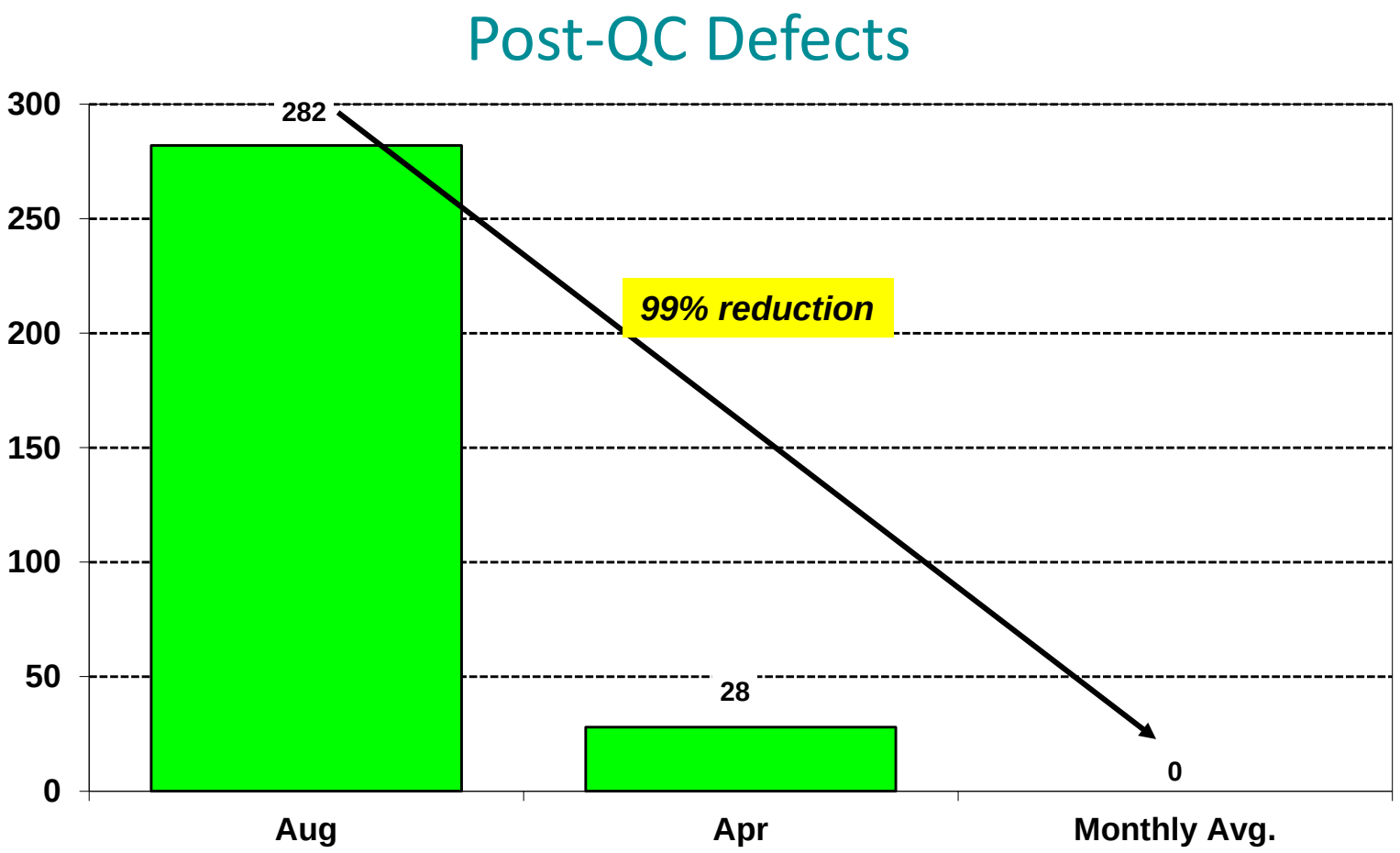
Specimen Management Defect Reductions



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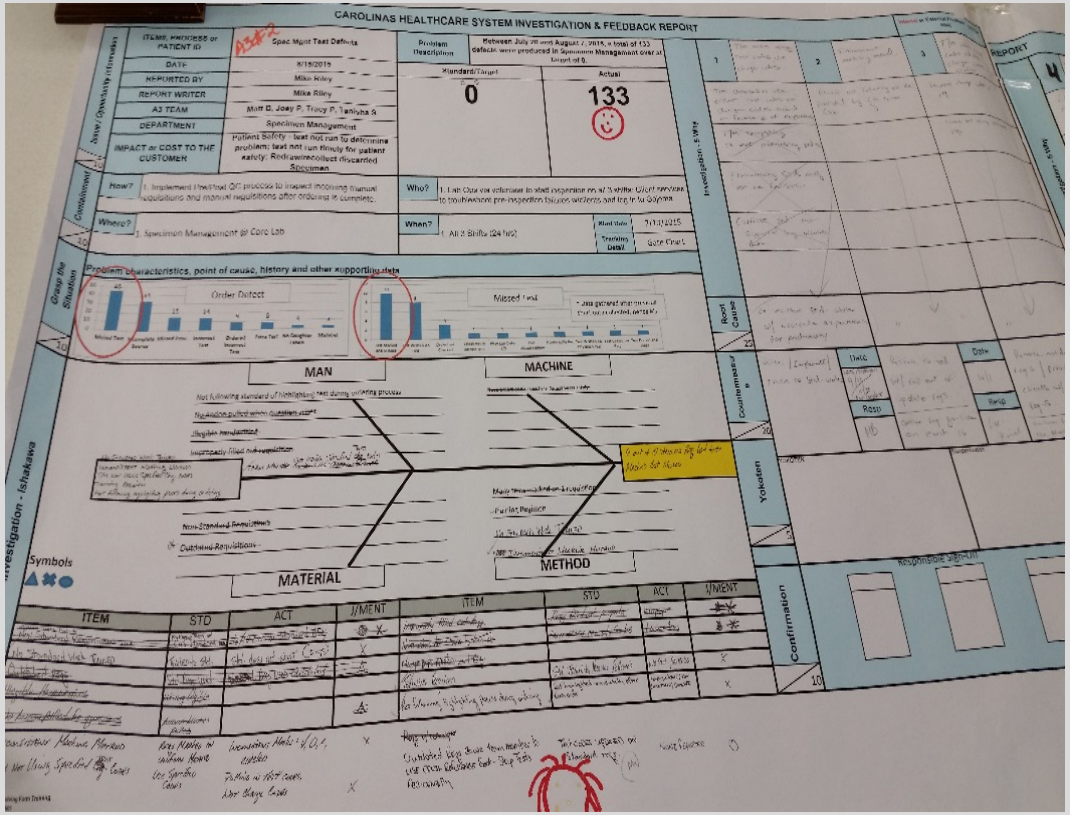
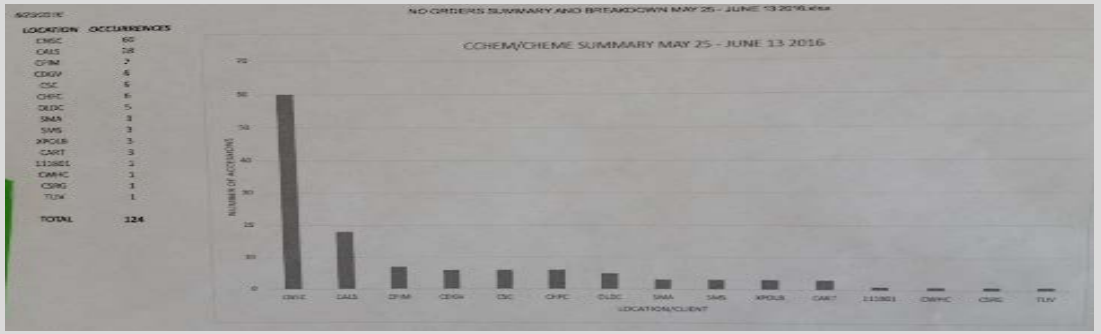
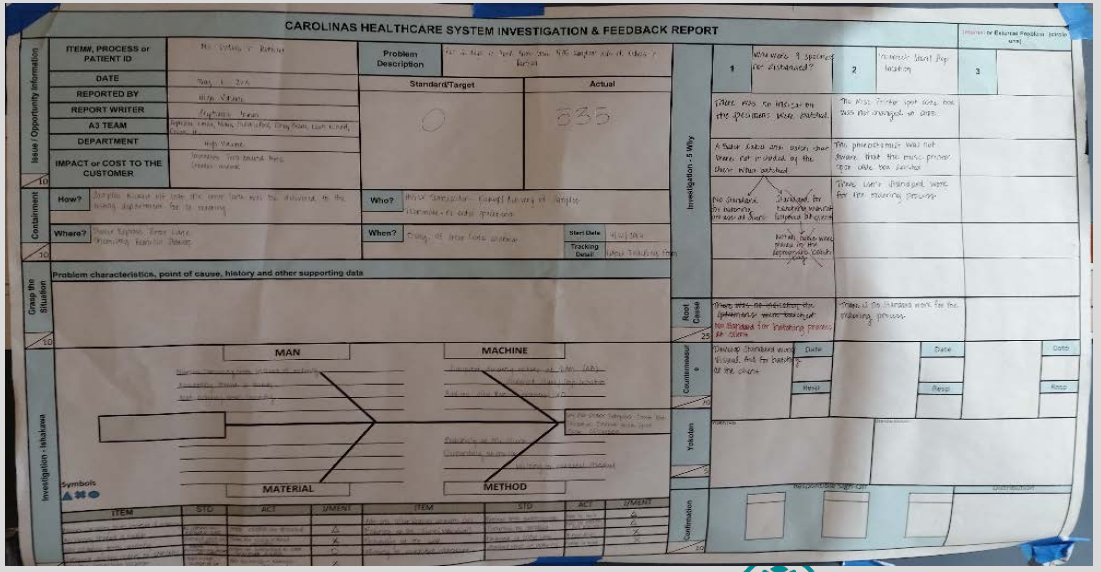
Practical Problem Solving

A3 completed to problem-solve specimen management defects; defects reduced 95% 1st year and additional 49% 2nd year.



A3 completed to problem-solve no orders in Remisol; reduced by 50%





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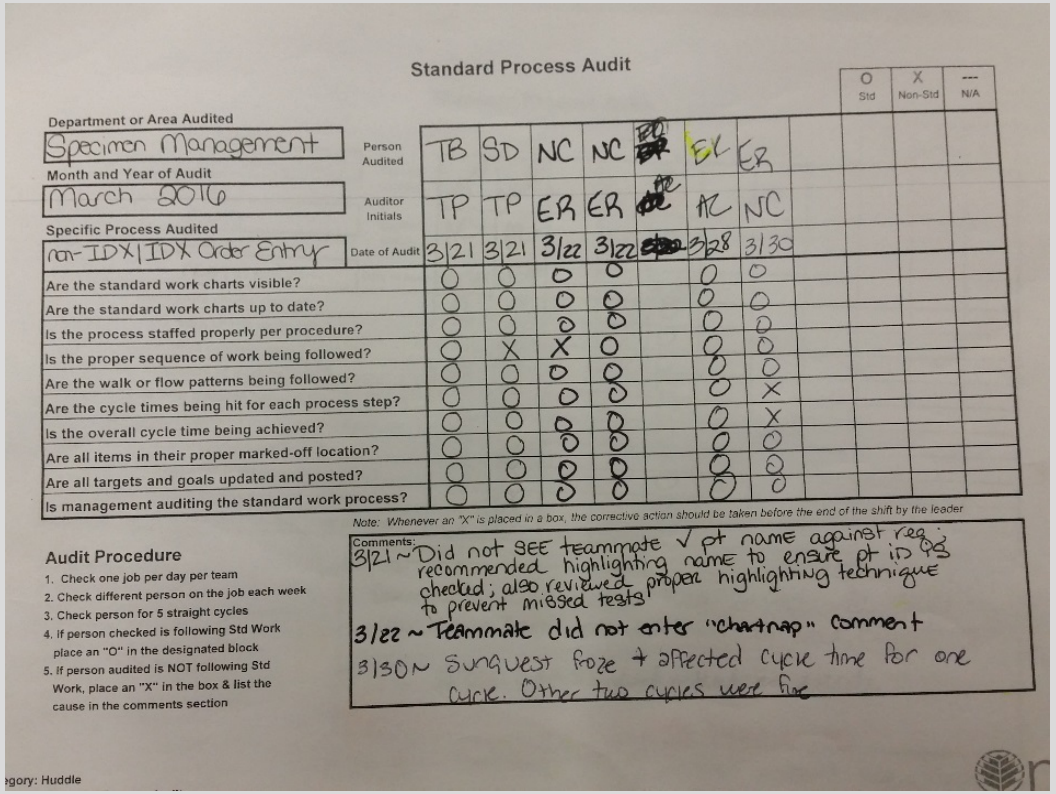
Quality & Sustainment

Process audits are done weekly each shift to ensure that we continue to follow the standard work or SOP and to identify gaps in process and correct to ensure better quality.

For each defect that occurs, we perform a 5-Why problem-solving to try to solve the root cause of what caused the issue.



Standard Process Audit

O Std | X Non-Std | --- N/A

Department or Area Audited: Specimen Management
Month and Year of Audit: March 2016
Specific Process Audited: non-IDX/IDX Order Entry

	Person Audited	TB	SD	NC	NC		EL	ER
	Auditor Initials	TP	TP	ER	ER		AC	NC
	Date of Audit	3/21	3/21	3/22	3/22		3/28	3/30
Are the standard work charts visible?		O	O	O	O		O	O
Are the standard work charts up to date?		O	O	O	O		O	O
Is the process staffed properly per procedure?		O	O	O	O		O	O
Is the proper sequence of work being followed?		O	X	X	O		O	O
Are the walk or flow patterns being followed?		O	O	O	O		O	O
Are the cycle times being hit for each process step?		O	O	O	O		O	X
Is the overall cycle time being achieved?		O	O	O	O		O	X
Are all items in their proper marked-off location?		O	O	O	O		O	O
Are all targets and goals updated and posted?		O	O	O	O		O	O
Is management auditing the standard work process?		O	O	O	O		O	O

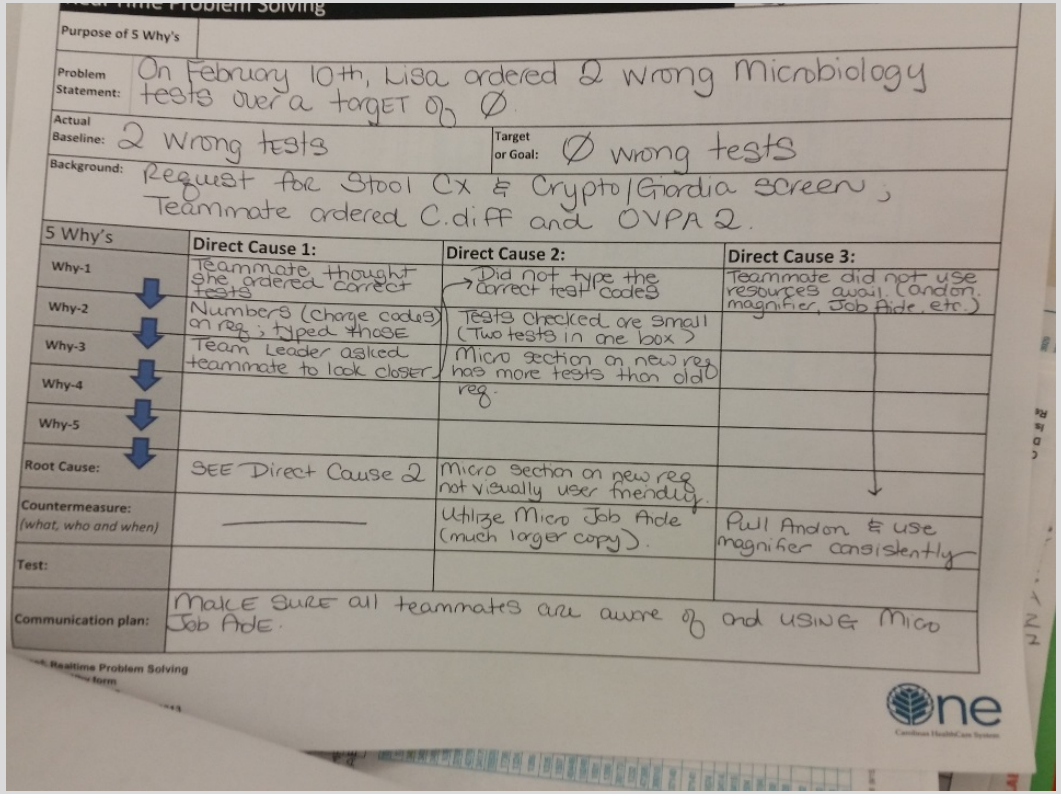
Note: Whenever an "X" is placed in a box, the corrective action should be taken before the end of the shift by the leader

Audit Procedure

1. Check one job per day per team
2. Check different person on the job each week
3. Check person for 5 straight cycles
4. If person checked is following Std Work place an "O" in the designated block
5. If person audited is NOT following Std Work, place an "X" in the box & list the cause in the comments section

Comments:
3/21 ~ Did not see teammate √ pt name against req; recommended highlighting name to ensure pt ID'd & checked; also reviewed proper highlighting technique to prevent missed tests
3/22 ~ Teammate did not enter "chartnap" comment
3/30 ~ Suggest froze + affected cycle time for one cycle. Other two cycles were fine

gory: Huddle



Purpose of 5 Why's

Problem Statement: On February 10th, Lisa ordered 2 wrong Microbiology tests over a target of Ø.

Actual Baseline: 2 wrong tests | Target or Goal: Ø wrong tests

Background: Request for Stool Cx & Crypto/Giardia screen; Teammate ordered C.diff and OVPA 2.

5 Why's	Direct Cause 1:	Direct Cause 2:	Direct Cause 3:
Why-1	Teammate thought she ordered correct tests	Did not type the correct test codes	Teammate did not use resources avail. (andon, magnifier, Job Aide, etc.)
Why-2	Numbers (charge codes) on req; typed those	Tests checked are small (Two tests in one box)	
Why-3	Team Leader asked teammate to look closer	Micro section on new req has more tests than old req.	
Why-4			
Why-5			
Root Cause:	SEE Direct Cause 2	Micro section on new req not visually user friendly.	
Countermeasure: (what, who and when)	———	Utilize Micro Job Aide (much larger copy).	Pull Andon & use magnifier consistently
Test:			
Communication plan:	MAKE SURE all teammates are aware of and USING Micro Job Aide.		

Realtime Problem Solving

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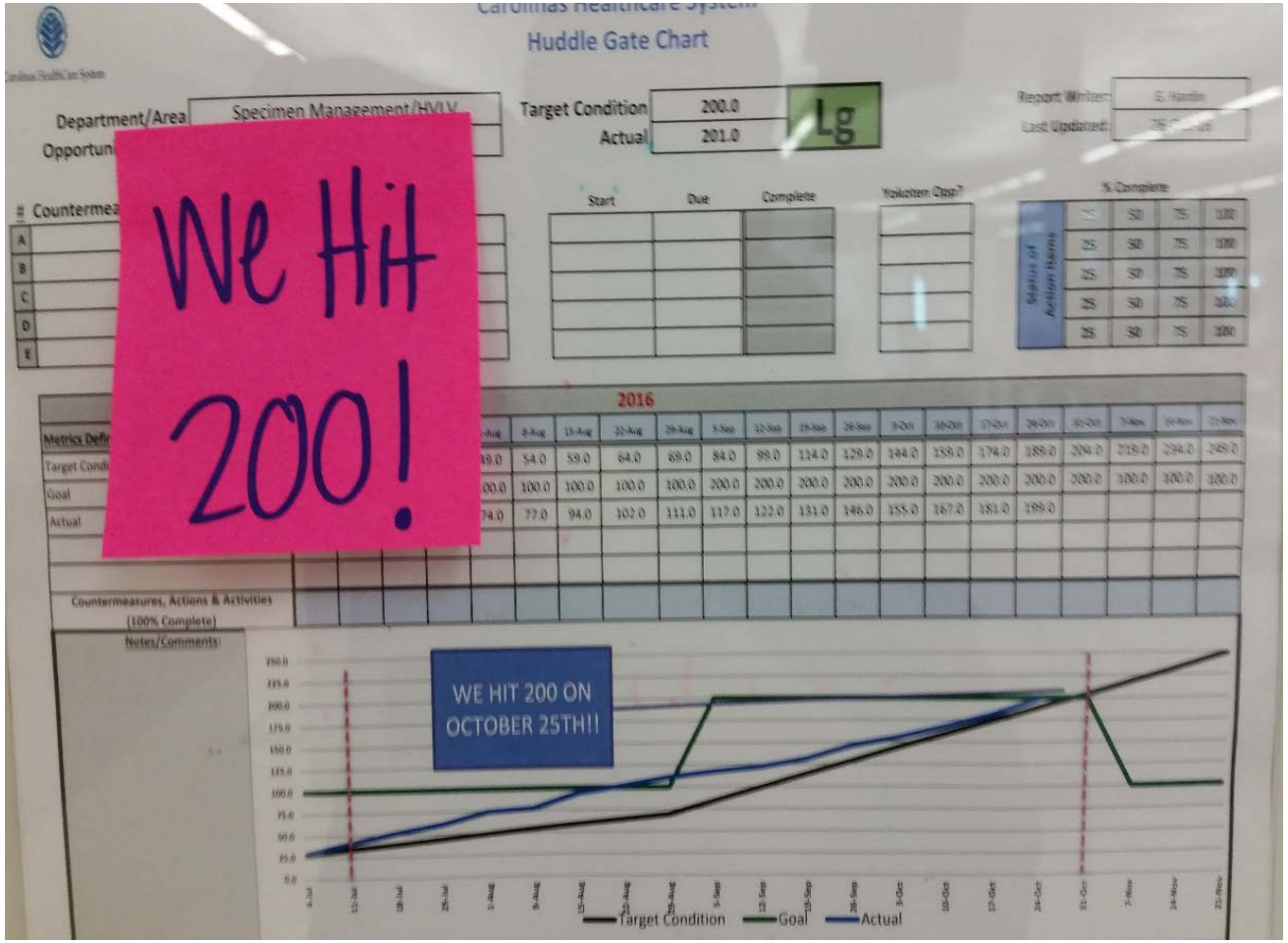
Continuous Improvement

Teammates in specimen management and high/low volume Chemistry and Hematology have accomplished over 200 continuous improvement activities in a 4 month period! The activities have improved safety, quality, delivery and cost for our patients and physicians! Additionally, they have built more cohesive, engaged teams.



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Visual Management

Using visual management to ensure specimens route where they need to go timely and to ensure the right specimens are placed in the appropriate storage conditions.

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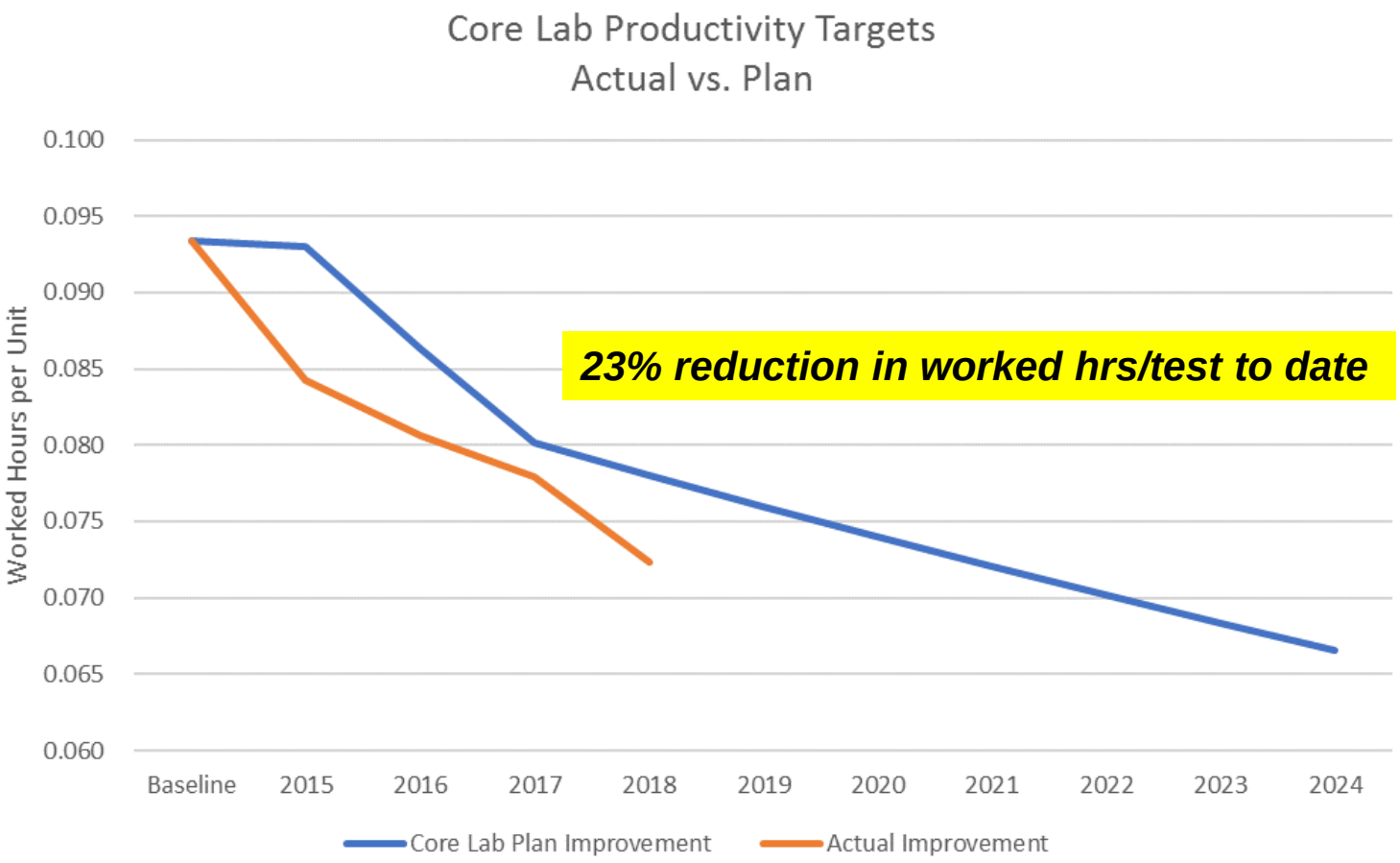
Productivity Gains



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Summary

- A system of continuous improvement is important
- Continuous Improvement structure is the foundation for our continued success
- Leadership provides the day-to-day structure and focus
- Team Leaders are key to our success
- Teammate’s continual engagement in the improvement process is essential

Questions

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