

Combining Lean with Automation and Maldi-TOF in Microbiology: How We Cut TAT, Boosted Staff Productivity, Reduced Costs and Helped Improve Patient Care

Lab Quality Confab

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Objectives:

- Understand the rationale for introducing total lab automation into the Microbiology Department
- Understand how unique technologies are improving performance in Microbiology
- How does automation affect the clinical, operational and economic performance of Microbiology
- Determine the changes necessary to successfully implement total lab automation in Microbiology

Our Mission – to preserve and improve human life



About NorthShore University HealthSystem

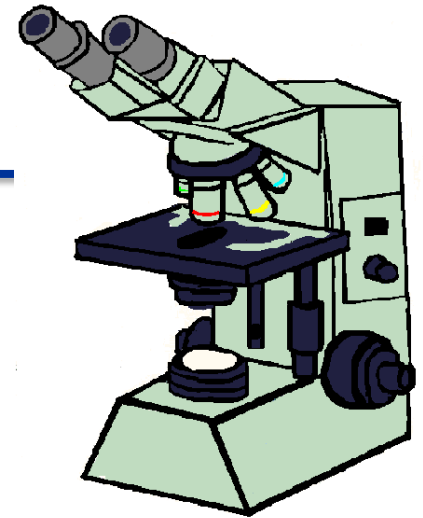
- Headquartered in Evanston, Illinois
- Comprehensive, fully integrated healthcare delivery system serving the Chicago region
- Four Hospitals: Evanston, Glenbrook, Highland Park and Skokie
 - Total of ~800 beds
- Employs about 10,000 people
- Approximately 2,400 affiliated physicians with nearly 900 belonging to the NorthShore Medical Group, a multispecialty group practice with 100+ office locations.

About NSUHS

- Principal teaching affiliate for the University of Chicago Pritzker School of Medicine
- Leading clinical programs:
 - Kellogg Cancer Center
 - NorthShore Neurological Institute
 - NorthShore Orthopaedic Institute
 - NorthShore Cardiovascular Institute
 - High-Risk Maternity
- NorthShore Research Institute
 - Focuses on clinical and translational research
 - Leadership in clinical trials and medical informatics

Microbiology at NSUHS

- Centralized at Evanston Hospital
- Full-service Microbiology
- Performs ~300,000 billable tests/year
- First Kiestra TLA in the U.S.!



Why Automate Now???

- Aging Workforce
 - At decision time NSUHS Micro had 30 FTEs w/9.1 who were ≥ 60 YO
That is 30% of our staff!
- Knowing we would like to pursue automation:
 - Starting 2013 as staff left we weren't given permission to fill most vacancies.
 - From 9/2013 to present we reduced staffing by 6.0 FTEs through attrition
- Current Staffing
 - 20 Full-time (1.0 – 0.8)
 - 2 Part-time (0.5)
 - 7 Resource

Why Automate Now???

FTEs Lost	
Date vacated	FTE
Sept 2013	-1.0
Jan 2014	-0.2
June 2014	-1.0
Oct 2014	-1.0
Dec 2014	-1.0
Dec 2014	-0.8
Mar 2015	-1.0
August 2015	-0.8
August 2015	-0.3
August 2015	-1.0
TOTAL	-8.1

FTEs Gained			
Original FTE	FTE increase	New FTE	Effective Date
0.5	0.3	0.8	Dec 2014
0.5	0.3	0.8	Apr 2015
0.5	0.3	0.8	Apr 2015
0.3	0.2	0.5	Apr 2015
	1.0		Jul 2015
TOTAL	2.1		

Net Decrease in FTEs = 6.0

Why Automate Now???

- Fewer MLS programs
- Fewer skilled Microbiologists
- TLA is the perfect companion to MALDI-TOF to further decrease TAT and increase productivity



NorthShore Impetus to Automate

It was a Perfect Storm!



NorthShore Impetus to Automate

- New Department Chairperson in 2012
- Lab due for a complete renovation
 - Capital \$\$\$\$ available
- Support from Hospital Administration
- TLA would allow for increased volume without the need for more space or personnel

Decisions, decisions ...

- First look at Kiestra in early 2011
 - Fact finding
- Presentations by the two major players late 1st quarter/early 2nd quarter of 2013
- Decision made by looking at throughput, flexibility, plans for future modules, reputation in marketplace
 - Ability to streak five plates at the same time
 - Rolling bead technology provides superior isolation of colonies
 - Can hold up to 24 different types of plated media

NorthShore Microbiology before TLA



NS Micro Ready for TLA



Finally – A new Lab!



New Lab



New Lab



NS TLA Timeline

- System delivered late July 2014
- Installation/vendor testing and validation August 2014
- Key User and staff training September & October 2014
- Clinical validation of TLA with urine specimens November 2014
- Go-live with urines December 15, 2014



NS TLA Timeline

- Stool cultures added May 2015
- MDRO screens added June 2015
- GBS screens added August 2015
- Throat, genital, wound, and positive blood cultures added September 2015
- Inoqua+ installed February 2016
 - Remaining Bacteriology specimen types requiring semi-automated processing added.

February 2016 – BacT is Totally Automated!



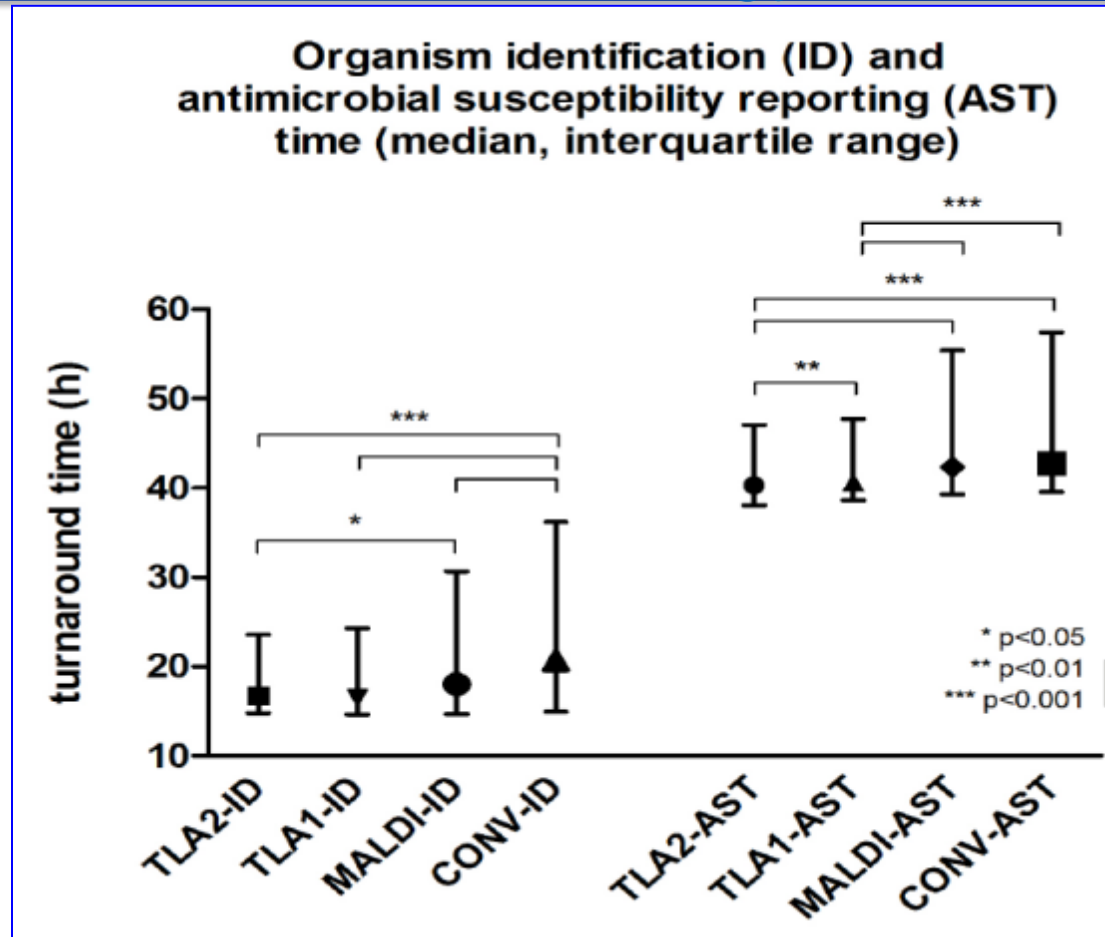
Improving Performance in Microbiology

- New Technologies
 - MALDI-TOF
 - » Improved TAT for organism identification
 - » Decreased reagent costs
 - » Decreased QC in age of IQCP
 - Plug-and-Play PCR assays
 - » Organism ID/resistance mechanisms direct from positive blood cultures
 - » Toxigenic *C. difficile*
 - » MRSA screening
 - » Respiratory viruses
 - TLA
 - » Automated plating
 - » “Smart” incubators: Plates remain incubated instead of sitting on the counter until the technologist is ready to read them
 - » HD imaging of cultures: Can visualize all plates from a culture on one screen at the same time

Improving Performance and Quality in Microbiology

- TLA + MALDI-TOF
 - TAT for cultures is decreased
 - » More robust culture growth earlier because incubators aren't opened and closed
 - » First images for urine cultures taken at 10 hours
 - » First images for throat cultures taken at 12 hours
 - » First images for wound and sputum cultures taken at 15 hours
 - » First images for stool cultures taken at 16 hours
 - » First images for genital cultures taken at 18 hours
 - » MALDI-TOF for ID – minutes versus hours/days for final ID
 - » Better/consistent streaking = better isolation of colonies = decreased TAT for ID/Sens and fewer subcultures

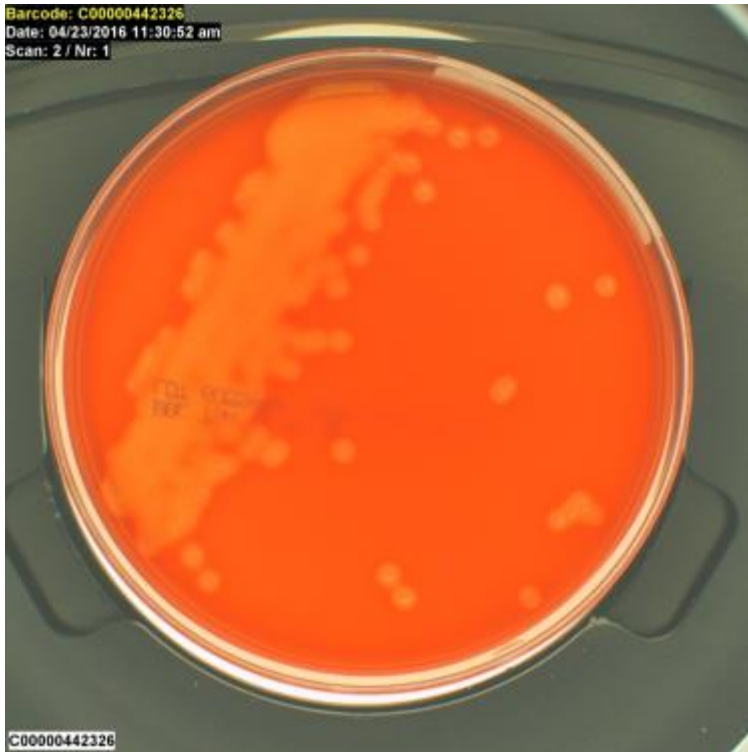
Improving Performance and Quality in Microbiology



- NorthShore data (2012-2016) submitted for publication

Plate Images

Strep pyogenes in urine culture



Enterococcus faecalis in urine culture

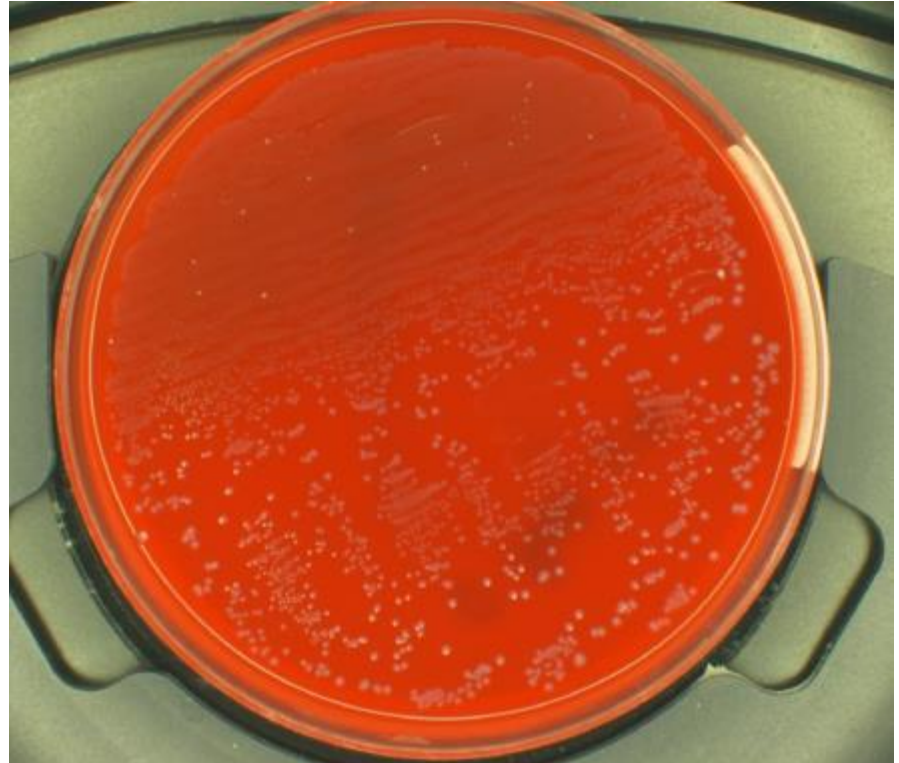


Plate Images

Lactose- & Non-lactose-fermenters in urine culture

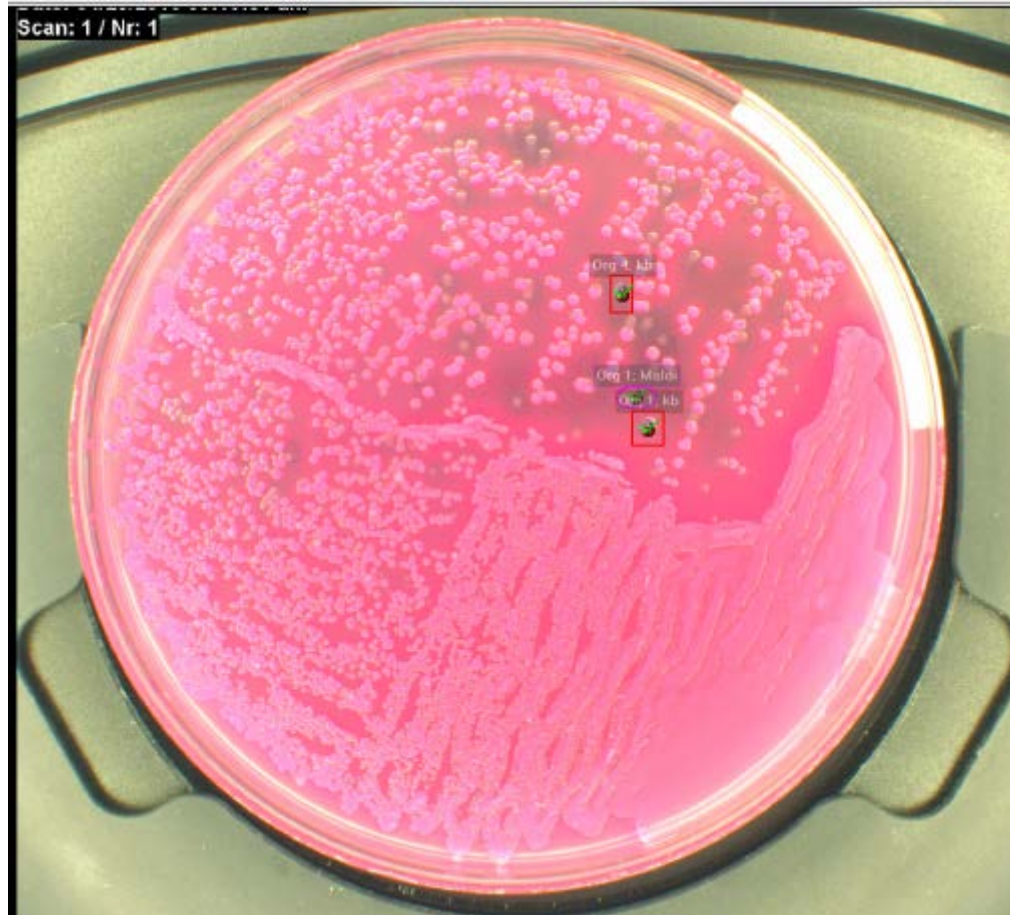
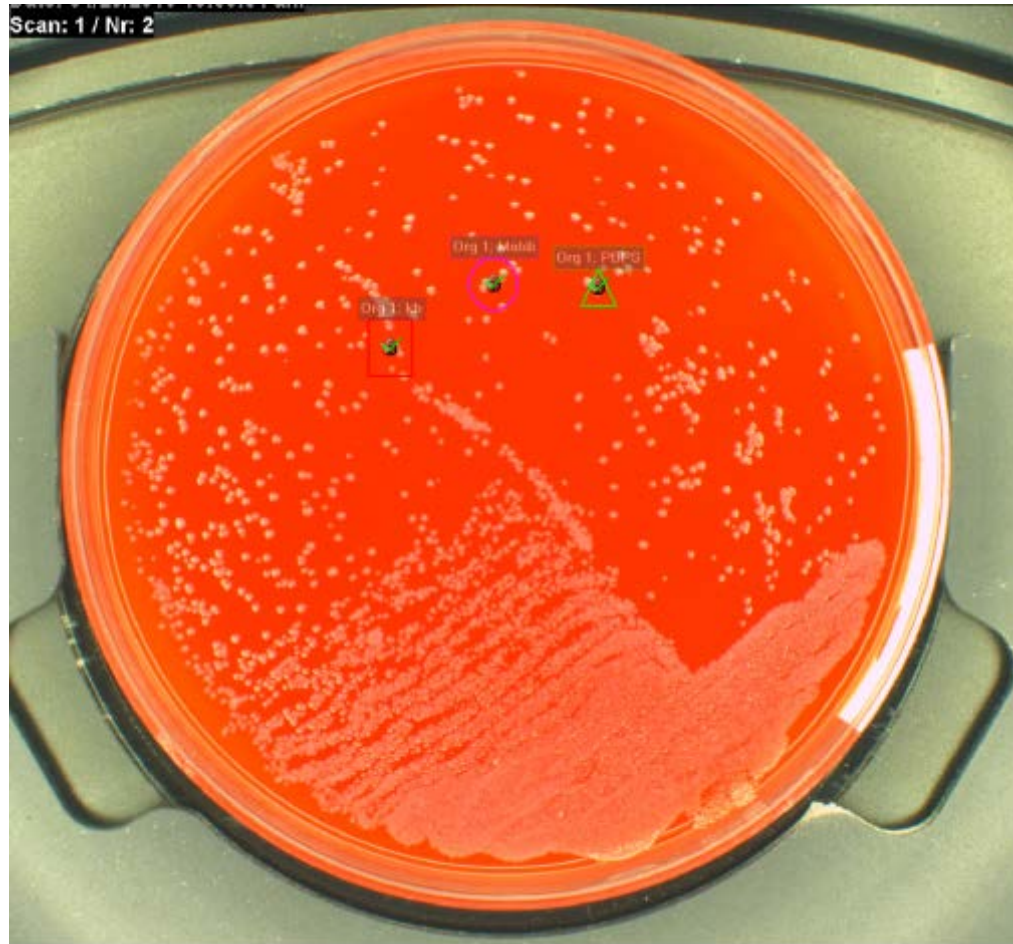


Plate Images

Staph aureus in a wound culture



Necessities for Successful Implementation

- Physical resources – Do we have enough space?
- Human resources
 - A strong and committed Key User Group
 - Validation of system
 - Training
 - Leadership dedicated to change management
- IT
 - Commitment from both Hospital and LIS teams
- Service
 - On-site and phone support from vendor

Necessities for Successful Implementation



Necessities for Successful Implementation

- **Ensure that your specimen collection devices are compatible with your TLA before implementation.**



Outcomes of Automation

- Easier to apply LEAN concepts
 - All workstations are configured the same
 - Protocols for culture reading and workup carried out uniformly
- Decreased TAT
- Improving antibiotic stewardship (MALDI & Verigene assays)
- Error reduction due to barcoding
- Reduced costs
 - Employee expense decreased 2.8% in FY14 (\$69,655); 4.3% in FY15 (\$103,046) and 0.4% in FY16 (\$9,371)
 - » NSUHS has given merit raises in each of these years with an average increase of 3%
 - Implementation of MALDI-TOF saved \$65,500 in reagent cost

Outcomes of Automation

Reagent Savings due to MALDI-TOF

	FY 13	FY 14
Reagent Cost	\$126,200	\$37,900
MALDI Reagent Cost		\$22,800
Total Reagent Savings		\$65,500

Outcomes of Automation

- Increased Productivity
 - Our data presented as a poster at Microbe 2016
 - » Analyzed # of tests and FTEs pre- and post-TLA
 - » 3.2% increase in tests with a 9.4% decrease in FTEs
 - » Tests/FTE increased 14%
- Continue to work with the BD Kiestra Lean Optimization Team to gain further efficiencies

Lessons Learned – What we did well

- Chose our Key User Group wisely
- Kept to our implementation timeline and added one specimen type at a time
- Keep lines of communication open – if a process isn't working as expected be open to suggestions for change
- Made change management a priority
- Did a thorough validation of first specimen source, then less rigorous for additional types

Lessons Learned – What we could have done better

- Ensure that your swab specimens are ESwabs prior to implementation
- All technologists trained to read cultures from all specimen sources
- Don't "Go Live" during the holidays

Thank you!

The Hard-working and
Dedicated Team at
NSUHS Microbiology

Team Microbiology!



Questions?



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