Supporting Antimicrobial Stewardship:

Combining Effective Microbiology Workflow Solutions, New Automation, and Rapid Tests to Boost Productivity, Cut Costs and Shorten Time to Diagnosis and Start of Therapy

April 30, 2019
Connecting the Dots from MBA to Microbiology

• Six Sigma trained at GE Capital in the 1990’s
• Trained in Lean manufacturing in the 2000’s
• Began consulting in 2006, with a focus on healthcare
• Partnered with bioMérieux in 2009

Thanks to the partnership between ttec and bioMérieux, I have been in over 125 microbiology labs.
Microbiology – 2009 vs 2019

Lab of 2009

- Automation:
  - Plate streaking (mostly manual)
  - Blood cultures automated incubation and detection of positive/negative
  - ID & AST in 24 hours
  - Some introduction of same-day testing (C. diff, Strep A testing…)
- Overnight batching
- Work assigned by bench & Tech
- Significant bench testing
- Pos Urine TAT consistently ~42-48 hours
- Pos Blood TAT consistently ~42-48 hours (after alert); ~60-72 hours from Time in lab

Lab of 2019

- Automation:
  - Plate streaking with auto-incubation
  - Ability to read images not plates
  - Quicker BC positive detection (and auto-load)
  - Direct from sample PCR
  - MALDI-TOF 30 minute organism ID
  - AST in 8-24 hours
  - Overnight batching
- Work assigned by bench & Tech
- Less bench testing
- Pos Urine TAT consistently ~42-48 hours (?)
- Pos Blood TAT consistently ~42-48 hours (after alert); ~60-72 hours from Time in lab
Why is Automation Not Affecting TAT?

• "We’ve always done it this way”
• If there is a 2nd shift – “Our 2nd shift people are too busy”
• We can’t find people to work non-traditional shifts
• Lab Leadership more focused on cost rather than value (Micro is getting more expensive – it’s not just about the 20 cent plates or the 2 cent slides)

Maybe we should look at process in addition to automation
Time-Based Strategy

Every process has non-value added activities that can be eliminated or reduced using Lean Six Sigma principles.

The key is to reduce business processes and effort to “core value”
Time-Based Strategy

Current State Process

Traditional Focus Of Process Improvement

Agile Focus On Reducing Non Value Added Activity

Wasted Time and Activity
Core Process Value

Agile companies focus on eliminating non value added activities to make larger, lasting improvements in lead time.
Strapping new technology on old processes will not propel you in the right direction
How Arrival Patterns SHOULD Drive Workflow

This is a typical pattern for when Blood Cultures arrive; in this lab 31% arrive during day shift hours
How Arrival Patterns SHOULD Drive Workflow

Assuming ~16 hours to alert, 18 hours of incubation, and ~12 hours to AST, only 45% of Blood Cultures alert positive on 1st shift; only 31% of those requiring AST are ready to Final
What Really Happens in the Lab

Overnight batching adds unnecessary waiting to Time to Result
## What Really Happens to the Patient

The timing of results affects 1) the treatment a patient receives, and 2) the length of stay for the patient.

<table>
<thead>
<tr>
<th>Clinician</th>
<th>Initial diagnosis; labs ordered: broad spectrum of treatment begun</th>
<th>Change treatment based on Prelim; Patient not showing improvement</th>
<th>Receive susceptibility; focused treatment begins; patient released after 1-2 more days</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hour 0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hour 24</td>
<td></td>
<td></td>
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<tr>
<td>Hour 48</td>
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<tr>
<td>Hour 72</td>
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<td></td>
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<tr>
<td>Hour 96</td>
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</tbody>
</table>

**Steps:**
- **Collection/Transportation**
- **Incubation (BC)**
- **Gram Stain**
- **Preliminary Results: ID**
- **Susceptibility testing**
Understanding Antimicrobial Stewardship

Unnecessary Antibiotics: 30-50% of antibiotics are deemed unnecessary\(^4\)

Emergence of Resistance: over 2M illnesses per year\(^1\)

Patient Risk: Antibiotics increase the risk of *C. difficile* infection\(^3,5\)

Deaths: 23,000/year, estimated 10 million deaths by 2050 associated with resistance\(^6\)

$4-5$ Billion Spent: annual cost of caused by antibiotic-resistance organisms\(^7\)

Global Risk: Antibiotics increase is a serious public health threat\(^1\)

How Should Labs Adapt Processes to Automation?

- Focus on the patient outcomes first – prioritize
- Chart the optimal path from the time the culture is received until the final result
- Understand where human intervention is necessary
- Staff to ensure capacity matches need for intervention
- Switch from daily bench reading to small batched readings

Target continuous results as opposed to batched results
Optimal Patient Timeline

**Clinician**

<table>
<thead>
<tr>
<th>Time</th>
<th>Action Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hour 0</td>
<td>Initial diagnosis; labs ordered: broad spectrum of treatment begun</td>
</tr>
<tr>
<td>Hour 12</td>
<td>Modify treatment based on Confirmed ID</td>
</tr>
<tr>
<td>Hour 24</td>
<td>Receive susceptibility; refine treatment (if necessary)</td>
</tr>
</tbody>
</table>

Collection/Transportation
Incubation (BC)
Gram Stain + Confirmed ID
Incubation
Susceptibility testing

Get to the right treatment sooner; minimize LOS; improve patient outcomes
How Do We Bring it All Together?

- Micro – Reach out to Pharmacy and MD's to understand "cutoffs" (e.g. MD rounds at 7am? – maximize results out before 7am)
- Pharmacy and Clinicians – Spend time in Micro and become familiar with the people and their process and technology
  - Learn what’s possible, and incorporate these possibilities into your treatment
  - Improvement efforts should focus on entire patient-centered value stream – not in individual silos
Thanks