Impact of the Pandemic on Microbiology Laboratories and Antimicrobial Stewardship Diagnostics

Lisa L Steed, PhD, D(ABMM)
Director, Diagnostic Microbiology

May 21, 2021
Objectives

• Identify our responses to supply shortages affecting both specimen collection and culture-based and PCR-based testing and the changes in testing demand over time.

• Describe the effects on patient care of staffing issues created by repurposing staff to perform COVID-19 testing and self-quarantine due to exposure.

• Identify the continued impact of elevated blood culture contamination rates and increasing incidence of antibiotic-resistant organisms on patient care.
Disclosures

- Magnolia Medical Technologies: Speaker’s Bureau
Medical University of South Carolina

- MUSC Health University Medical Center
  - Approx 800-bed tertiary/quaternary care hospital
  - 80,000 annual ED visits; Level 1 trauma center
  - Daily census 700 inpatients
    - Shawn Jenkins Children’s Hospital and Pearl Tourville Women’s Pavilion
    - National Cancer Institute designation for Hollings Cancer Center
    - Heart & Vascular Center
    - Joint Commission Certified Comprehensive Stroke Center

- ANCC Magnet Recognition Program®
Medical University of South Carolina

- Regional Health Network:
  - MUSC Health Florence Medical Center
  - MUSC Health Lancaster Medical Center
  - MUSC Health Marion Medical Center
  - MUSC Health Chester Medical Center
Objectives

• Identify our responses to supply shortages affecting both specimen collection and culture-based and PCR-based testing and the changes in testing demand over time.
Focus on COVID-19

### COVID-19 PCR testing capability
7/8/20

<table>
<thead>
<tr>
<th>Lab Platform</th>
<th>Go-live Date</th>
<th>Current daily capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abbott m2000 (3)</td>
<td>3.23.2020</td>
<td>1034</td>
</tr>
<tr>
<td>Abbott Alinity m (1)</td>
<td>6.12.2020</td>
<td>450+</td>
</tr>
<tr>
<td>Cepheid GeneXpert (1)</td>
<td>4.13.2020</td>
<td>30-40/day (vendor allocation)</td>
</tr>
<tr>
<td>Cepheid Infinity</td>
<td>TBD</td>
<td></td>
</tr>
<tr>
<td>ABI Quant Studio</td>
<td>~7.10.2020</td>
<td>300+</td>
</tr>
<tr>
<td>Hologic Panther</td>
<td>TBD</td>
<td></td>
</tr>
<tr>
<td>Hamilton Processor</td>
<td>TBD</td>
<td></td>
</tr>
<tr>
<td>Biofire</td>
<td>6.1.2020</td>
<td>Depleted supplies</td>
</tr>
<tr>
<td>Abbott ID Now (Marion ED)</td>
<td>5.26.2020</td>
<td></td>
</tr>
</tbody>
</table>

### COVID-19 testing platforms – System
4/14/21

<table>
<thead>
<tr>
<th>Lab Platform</th>
<th>Go-live Date</th>
<th>Current daily capacity</th>
<th>Divisions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abbott m2000 (3) - PCR</td>
<td>3.23.2020</td>
<td>300-500</td>
<td>Chs</td>
</tr>
<tr>
<td>Abbott Alinity m (2) - PCR</td>
<td>6.12.2020 &amp; 9.2020</td>
<td>800-1200</td>
<td>Chs</td>
</tr>
<tr>
<td>Cepheid Infinity Quad PCR</td>
<td>4.13.2020</td>
<td>Depleted supplies</td>
<td>Single test no longer in use</td>
</tr>
<tr>
<td>ABI Quant Studio - PCR</td>
<td>9.2020</td>
<td>33 (RHN 9th/acute hosp)</td>
<td>Chs</td>
</tr>
<tr>
<td>Hologic Panther - PCR</td>
<td>12.2020</td>
<td>300</td>
<td>Chs, 9th CSB Lab</td>
</tr>
<tr>
<td>Illumina - NGS</td>
<td>12.21.2020</td>
<td>Depleted supplies</td>
<td>No longer in use</td>
</tr>
</tbody>
</table>

### COVID-19 Antibody testing
7/8/20

<table>
<thead>
<tr>
<th>Lab Platform</th>
<th>Go-Live Date</th>
<th>Current daily capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abbott Architect (rapid access)</td>
<td>4.27.2020 (6.10.2020)</td>
<td>1500</td>
</tr>
<tr>
<td>Abbott Alinity i</td>
<td>6.12.2020</td>
<td>2500-7700</td>
</tr>
<tr>
<td>CCT lab (confirm pos)</td>
<td>5.18.2020</td>
<td>-</td>
</tr>
</tbody>
</table>

Data provided by Frederick S Nolte, PhD, D(ABMM), F(AAM), Director, Molecular Pathology, MUSC Health
Help from outside the lab

- Infection Control agreed to suspend the universal MRSA and focused VRE surveillance testing
Clinical Microbiology Supply Shortage Collection (CMSSC) tool

• Non-COVID-19 shortages for the week of Jan. 8-15, 2021:
  • 35.1% of labs have a shortage of supplies for the molecular detection of sexually transmitted infections.
  • 47.5% of labs have a shortage of supplies for detection of routine bacteria (including the bacteria causing strep throat, pneumonia, bronchitis and urinary tract infections).
  • 29.4% of labs have a shortage of supplies for mycobacteria testing (including supplies for tuberculosis (TB) and pulmonary nontuberculous mycobacterial disease testing).
  • 8.8% of labs have a shortage of supplies for routine parasite testing.
  • 19.4% of labs have a shortage of supplies for routine fungal testing.
Clinical Microbiology Supply Shortage Collection (CMSSC) tool

<table>
<thead>
<tr>
<th>Week Of</th>
<th>Bacteria</th>
<th>Fungi</th>
<th>Myco</th>
<th>Parasite</th>
<th>STI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sep 11, 2020</td>
<td>94.0%</td>
<td>47.0%</td>
<td>14.0%</td>
<td>0.0%</td>
<td>88.9%</td>
</tr>
<tr>
<td>Sep 17, 2020</td>
<td>80.0%</td>
<td>58.0%</td>
<td>13.0%</td>
<td>9.0%</td>
<td>67.5%</td>
</tr>
<tr>
<td>Sep 24, 2020</td>
<td>67.0%</td>
<td>53.0%</td>
<td>21.0%</td>
<td>8.0%</td>
<td>77.8%</td>
</tr>
<tr>
<td>Oct 01, 2020</td>
<td>64.0%</td>
<td>33.0%</td>
<td>17.0%</td>
<td>0.0%</td>
<td>72.7%</td>
</tr>
<tr>
<td>Oct 08, 2020</td>
<td>67.0%</td>
<td>50.0%</td>
<td>19.0%</td>
<td>5.0%</td>
<td>69.6%</td>
</tr>
<tr>
<td>Oct 15, 2020</td>
<td>53.0%</td>
<td>39.0%</td>
<td>23.0%</td>
<td>8.0%</td>
<td>53.8%</td>
</tr>
<tr>
<td>Oct 22, 2020</td>
<td>47.0%</td>
<td>50.0%</td>
<td>15.0%</td>
<td>0.0%</td>
<td>57.1%</td>
</tr>
<tr>
<td>Nov 10, 2020</td>
<td>56.0%</td>
<td>12.0%</td>
<td>27.0%</td>
<td>14.0%</td>
<td>65.8%</td>
</tr>
<tr>
<td>Nov 20, 2020</td>
<td>39.0%</td>
<td>5.0%</td>
<td>35.0%</td>
<td>18.0%</td>
<td>70.0%</td>
</tr>
<tr>
<td>Dec 02, 2020</td>
<td>51.0%</td>
<td>29.0%</td>
<td>39.0%</td>
<td>16.0%</td>
<td>46.0%</td>
</tr>
<tr>
<td>Dec 09, 2020</td>
<td>58.0%</td>
<td>21.0%</td>
<td>26.0%</td>
<td>11.0%</td>
<td>59.0%</td>
</tr>
<tr>
<td>Jan 08, 2021</td>
<td>48.0%</td>
<td>19.0%</td>
<td>29.0%</td>
<td>9.0%</td>
<td>35.0%</td>
</tr>
</tbody>
</table>
Media and supply shortages

- Backordered media
  - Blood agar plates
  - Mueller Hinton plates—validated *P. aeruginosa* on Phoenix panels
- Expired media
  - Specialty media—inoculated QC when specimen set up
- E test strips
- GI PCR panels
Objectives

• Identify our responses to supply shortages affecting both specimen collection and culture-based and PCR-based testing and the changes in testing demand over time.

• Describe the effects on patient care of staffing issues created by repurposing staff to perform COVID-19 testing and self-quarantine due to exposure.
Staffing shortages

- Repurposed staff
- New Hires
- Staff that left MUSC
- Staff that left Micro for another section of the Lab
- Database coordinator focused on Beaker conversion
- Quarantined staff
- Traveler techs
Staffing Shortages

• Not just at MUSC—a general clinical microbiology & molecular laboratory workforce shortage
  • 2015 survey: % employees anticipated to retire in the next 5 years: chemistry 23.6%, hematology 19.51%, microbiology 19.48%, blood bank 19.19%
    • Average age of a laboratorian is early 50s
  • Hospitals don’t understand the return on investment of the lab
    • Who were the heroes of COVID-19?
  • Medical lab scientist & medical technologist programs closing or have closed
    • Difficulty in finding labs that will accept trainees for clinical rotations
Objectives

• Identify our responses to supply shortages affecting both specimen collection and culture-based and PCR-based testing and the changes in testing demand over time.

• Describe the effects on patient care of staffing issues created by repurposing staff to perform COVID-19 testing and self-quarantine due to exposure.

• Identify the continued impact of elevated blood culture contamination rates and increasing incidence of antibiotic-resistant organisms on patient care.
Blood culture contamination rates

False Positive Blood Culture Rates (%), FY 2008-2021

- Phlebotomy Contamination Rate
- Total Nursing Contamination Rate
- Line Contamination Rate
- Nursing Peripheral Contamination Rate
Blood culture contamination rates

Blood culture contamination rates

**False Positive Blood Culture Rates (%), FY 2008-2021**

- Red line: Phlebotomy Contamination Rate
- Green line: Total Nursing Contamination Rate
- Purple line: Line Contamination Rate
- Blue line: Nursing Peripheral Contamination Rate

**% FPBC for Phlebotomy vs Nursing Service, Jan 2020 - Mar 2021**

- Green line: Total Nursing Contamination Rate
- Purple line: Line Contamination Rate
- Blue line: Nursing Peripheral Contamination Rate
- Red line: Phlebotomy Contamination Rate
Blood culture contamination rates

% FPBC After SteriPath Intervention--Adult ED

- with SteriPath
- without SteriPath
- overall contam rate
- acceptable % FPBC (<= 3%)

SteriPath
Blood culture contamination rates

“overall institutional contamination rates of \( \leq 1.0\% \) are now achievable, and therefore, consideration should be given to the establishment of a new universal threshold value of \( \leq 1.0\% \)”

“in settings in which overall contamination rates rise above 1%...objective, stepwise quality improvement programs designed to improve patient care and reduce unnecessary costs [should] be implemented”

Meropenem = R *P. aeruginosa*

- **# CRPA**
  - Calendar year 2019 = 36
  - Calendar year 2020 = 35
  - Jan-Mar 2021 = 41

- **# pts with CRPA (no duplicates)**
  - Calendar year 2019 = 32
  - Calendar year 2020 = 32
  - Jan-Mar 2021 = 24

Data, graphs, & analysis provided by Bryan Raux, PharmD, BCPS, BCIDP, MUSC Infectious Diseases/ Antimicrobial Stewardship
Meropenem = R *P. aeruginosa*

- Testing/treatment options:
  - Ceftolozane/tazobactam (C/T)
  - Ceftazidime/avibactam (CZA)
  - Meropenem/vaborbactam
  - Imipenem/cilastin/relebactam
  - Cefiderocol
  - Colistin
Questions?

“In an increasingly complex world, sometimes old questions require new answers.”