“Role of Diagnostic Stewardship during a Public Health Emergency: COVID-19”
PACCARB, September 2020

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Outline

1. Diagnostics: critical to public health
2. COVID-19 and AMR: insights from the hospital setting
3. Executive Summary
Diagnostics support surveillance, uncovering trends that can help inform clinician practice

If there is 3-drug resistance, your options for treatment are limited*

“What has happened in the past?”

Different Trends may help inform different local and state level public health policies

“What is feasible in the future?”

* “The prevalence of Enterobacteriaceae resistant to all major classes of oral antibiotics from outpatient urine cultures in the United States and effect on clinical outcomes,” Presented 2018 ID week


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Insights on hospital Length of Stay (LOS) & Mortality

Diagnostic tests inform hospital care:

COVID+ patients (vs COVID -) have*:

• Higher mortality (both ICU and non-ICU areas)
• Longer length of stay
• Higher rate % needing ICU care
• Optimizing resources
  • Medication management
  • Vaccine stores
• Risk stratification**

<table>
<thead>
<tr>
<th></th>
<th>Admit</th>
<th>Col. %</th>
<th>ER Admit</th>
<th>AVG. LOS</th>
<th>ICU Admits</th>
<th>Avg. ICU LOS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Negative</td>
<td>131,123</td>
<td>87.0%</td>
<td>47.6%</td>
<td>5.4</td>
<td>17.5%</td>
<td>3.9</td>
</tr>
<tr>
<td>Positive</td>
<td>19,675</td>
<td>13.0%</td>
<td>57.0%</td>
<td>9.3</td>
<td>24.3%</td>
<td>8.1</td>
</tr>
<tr>
<td>Grand Total</td>
<td>150,798</td>
<td>100.0%</td>
<td>48.8%</td>
<td>5.9</td>
<td>18.4%</td>
<td>4.7</td>
</tr>
</tbody>
</table>


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<table>
<thead>
<tr>
<th></th>
<th>ICU Admission</th>
<th>No ICU Admission</th>
</tr>
</thead>
<tbody>
<tr>
<td>Expired %</td>
<td>38.20%</td>
<td>10.90%</td>
</tr>
<tr>
<td>Expired %</td>
<td>13.00%</td>
<td>1.80%</td>
</tr>
</tbody>
</table>
Decline in hospitalizations and ED visits* reflected in decreased utilization of non-COVID testing

Sources:

** Commercial laboratory testing summarized from LabCorp and Quest SEC filings: Labcorp and Quest

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# Diagnostics and stewardship: antibiotics use

<table>
<thead>
<tr>
<th>COVID+</th>
<th>COVID-</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length of Stay</td>
<td>8.7 days</td>
</tr>
<tr>
<td>% in ICU</td>
<td>24%</td>
</tr>
<tr>
<td>Culture+</td>
<td>20.9%</td>
</tr>
<tr>
<td>Antibiotic Use</td>
<td>68%</td>
</tr>
</tbody>
</table>

- COVID+ and COVID negative patients: same bacterial/fungal culture positive rate
- 22% more antibiotic use (key agents: 3rd, 4th gen. cephalosporins, vancomycin, macrolides)

More antibiotic use drives **antibiotic resistance**

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Diagnostics enable clinician action

- Definitive therapy; eases **drug shortages**
- Less time on **broad** antimicrobial drugs
- Less time on **unnecessary** antibiotics

<table>
<thead>
<tr>
<th>Category</th>
<th>SARS-CoV-2+ (n=17,075)</th>
<th>SARS-CoV-2- (n=124,979)</th>
<th>Total SARS-CoV-2 Tested (n=142,054)</th>
</tr>
</thead>
<tbody>
<tr>
<td>% Male</td>
<td>9,053 (53%)</td>
<td>58,114 (46%)</td>
<td>67,167 (47%)</td>
</tr>
<tr>
<td>Age (mean (SD); median years)</td>
<td>61.7 ± 18.0 (63)</td>
<td>58.5 ± 20.9 (62)</td>
<td>58.9 ± 20.6 (62)</td>
</tr>
<tr>
<td>Overall LOS (mean (SD); median days)</td>
<td>8.7 ± 12.9 (6)</td>
<td>5.1 ± 9.0 (3)</td>
<td>5.5 ± 9.6 (3)</td>
</tr>
<tr>
<td>ICU Admissions, n (%)</td>
<td>4,034 (24%)</td>
<td>20,969 (17%)</td>
<td>25,003 (18%)</td>
</tr>
<tr>
<td>ICU LOS (mean (SD); median days)</td>
<td>7.9 ± 8.5 (5.0)</td>
<td>3.8 ± 6.2 (2.0)</td>
<td>4.5 ± 6.8 (2.2)</td>
</tr>
<tr>
<td>Admissions Prescribed Antimicrobials* (duration ≥ 24 hours; n (%))</td>
<td>11,681 (68%)</td>
<td>56,809 (46%)</td>
<td>68,490 (48%)</td>
</tr>
<tr>
<td>Culture Positive Hospital LOS (mean (SD); median days)</td>
<td>13.8 ± 16.1 (9)</td>
<td>8.3 ± 11.8 (5)</td>
<td>9.0 ± 12.6 (6)</td>
</tr>
<tr>
<td>Admission to Abx Start (mean (SD); median hours)</td>
<td>9.2 ± 51.9 (0)</td>
<td>9.9 ± 50.8 (0)</td>
<td>9.8 ± 51.0 (0)</td>
</tr>
<tr>
<td>3rd/4th Gen Cephalosporins</td>
<td>8,643 (74%)</td>
<td>33,750 (59%)</td>
<td>42,393 (62%)</td>
</tr>
<tr>
<td>Glycopeptides</td>
<td>3,630 (31%)</td>
<td>21,719 (38%)</td>
<td>25,349 (37%)</td>
</tr>
<tr>
<td>Macrolides</td>
<td>8,036 (69%)</td>
<td>16,264 (29%)</td>
<td>24,300 (35%)</td>
</tr>
<tr>
<td>β-lactam/β-lactamase inhibitors</td>
<td>3,175 (27%)</td>
<td>19,073 (34%)</td>
<td>22,248 (32%)</td>
</tr>
<tr>
<td>Fluoroquinolones</td>
<td>1,277 (11%)</td>
<td>9,689 (17%)</td>
<td>10,966 (16%)</td>
</tr>
<tr>
<td>1st/2nd Gen Cephalosporins</td>
<td>560 (5%)</td>
<td>8,705 (15%)</td>
<td>9,265 (14%)</td>
</tr>
<tr>
<td>Tetracyclines</td>
<td>2,386 (20%)</td>
<td>6,386 (11%)</td>
<td>8,772 (13%)</td>
</tr>
<tr>
<td>Carbenems</td>
<td>1,083 (9%)</td>
<td>5,025 (9%)</td>
<td>6,108 (9%)</td>
</tr>
<tr>
<td>Antifungals</td>
<td>658 (6%)</td>
<td>4,229 (7%)</td>
<td>4,887 (7%)</td>
</tr>
<tr>
<td>Anti-Influenza agents</td>
<td>933 (8%)</td>
<td>998 (2%)</td>
<td>1,931 (3%)</td>
</tr>
</tbody>
</table>

*EPIDEMIOLOGY OF ANTIMICROBIAL USE AMONG SARSCOV-2 POSITIVE AND NEGATIVE ADMISSIONS IN THE US: A MULTICENTER EVALUATION, ID week 2020*
Diagnostics and stewardship: a deeper dive

COVID-19+ Patients*:

- High rate of Staph aureus culture positive
- Greater Pseudomonas vs COVID-
- Greater Candida vs COVID-

Why does this matter?

Staph aureus, Pseudomonas, and Candida all have multidrug resistant strains and often lead to poor outcomes**

How can diagnostics help?

Diagnostics enable clinician action:

- Differentiating multi drug resistant vs sensitive
- Definitive therapy faster may = better outcomes
- Less broad/unnecessary antibiotics may help AMR
- Innovation: Point of care, faster TAT helps facilitate

**COMPARISON OF THE EPIDEMIOLOGY AND PATHOGENS CULTURED FROM PATIENTS HOSPITALIZED WITH SARS-COV-2 POSITIVE VERSUS SARS-COV-2 NEGATIVE IN THE US: A MULTICENTER EVALUATION*, ID week 2020

Diagnostics in a public health crisis:  
Every cold/flu season strains healthcare systems

**Surge Capacity during Cold/Flu Season:**
- Resistant infections peak during cold/flu season without COVID**
- Resources are lower; “pandemic pay”/back to work
- Cold + Flu + COVID = larger potential for confusion
  - How will you distinguish fever and cough?

**Triaging patients and prioritizing resources with diagnostics will be crucial for hospital bed availability**

TAT for SARS-CoV-2 Tests*:
- Without flu: 1.5 to 6 days

* What will happen to TAT during the 2020 cold/flu season?

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**on file BD Insights Research and Analytics
Executive Summary
Diagnostic tests during a pandemic: value to clinicians, patients and challenges

Diagnostics enable identification & surveillance that can inform clinicians, policy makers and businesses.

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Diagnostic result TAT (turn around time) has been an issue for SARS-CoV-2 tests. This will be crucial for surge capacity cold/flu season. We need a ramp up strategy for microbiology diagnostics.

In-hospital mortality in COVID-19 positive patients is higher than COVID-19 test negative comparators.

Antibiotic (over)use and AMR risk: COVID-19+ patients were on key antibiotics 68% vs 46% in the COVID-19 negative cohort, even though they both had the same bacterial/fungal culture + rate (21%).

Challenges:
1. TAT for COVID-19 tests
2. POC diagnostics: a path to patient care improvement & AMR mitigation
3. Stockpile strategy for flu/pandemics
4. Education and allocation of resources strategy of appropriate diagnostics deployment and use. Crucial in surge capacity situations.