The Intersection of Antibiotic Resistance (AR), Antibiotic Use (AU), and COVID-19
for the Presidential Advisory Council on Combating Antibiotic-Resistant Bacteria

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CDC AR Investments Support U.S. through Pandemic

- **500+ experts** in infection prevention and control, HAI, AR, laboratorians responding domestically
- **AR Lab Network in 50 states, several cities, territories** to provide COVID testing and identify AR outbreaks
- Data collection systems, like the National Healthcare Safety Network, **gather COVID-19 and AR data**
- CDC **antibiotic stewardship tools** for frontline workers
- Infection control **experts responding globally** to COVID-19
- Building on foundational innovations for AR **sewage surveillance** to detect COVID-19 in wastewater
- **Leverage antibiotic stockpile** for continuity of TB treatment due to drug shortages

**CDC funding 2016-2020:**

$373M+ across 59 state & local health departments for detection/prevention

**Nearly $115M** to 100+ institutions for innovations, therapeutics and diagnostics
Key Takeaways

- Healthcare infection control is critical to fighting AR and SARS-CoV-2 infections
  - No clear evidence that COVID-19 patients are more susceptible to bacterial/fungal infections—similar frequency as patients with influenza-like illness (ILI). **However, we are seeing sporadic outbreaks of AR infections in COVID units & higher rates of hospital onset infections**
  - COVID-19 creates perfect storm for AR infections in healthcare settings: length of stay, crowding, sick patients, antibiotic use, infection control issues

- Antibiotic use fluctuated, appears stable but remains too high
  - Hospitals: Spiked in early 2020 but flattened as pandemic continued
  - Outpatient, nursing homes: Significant drops from previous years

- Highlights continued importance of infection control and antibiotic stewardship—both are dependent on the resiliency of these programs
About Data Shown Today

Preliminary data provide the largest snapshot to date about relative burden of AR infections & antibiotic use in U.S. COVID-19 patients.

Inpatient data reflect:
- Infection data from **150+ hospitals and 14,000 hospital discharges**
- Antibiotic use data from **1,100+ hospitals & 2+ million hospital discharges**
- **2 data systems:** National Healthcare Safety Network and Premier Healthcare Database

Outpatient data reflect:
- National estimates based on IQVIA data from **92% of retail prescriptions**

Nursing home data reflect:
- Pharmacy info based on PharMerica data from **1,900 U.S. nursing homes**
Comparison of Flu & COVID-19 Discharges

<table>
<thead>
<tr>
<th></th>
<th>Patients with Influenza-Like Illness (Jan-March 2019)</th>
<th>Patients with COVID-19 (Jan-June 2020)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean length of stay</td>
<td>5.88 days</td>
<td>8.44 days</td>
</tr>
<tr>
<td>Discharges with bacterial/fungal culture</td>
<td>55.8%</td>
<td>65.1%</td>
</tr>
<tr>
<td>Discharges with a positive culture with a susceptibility result</td>
<td>12.4%</td>
<td>11.9%</td>
</tr>
</tbody>
</table>

**Influenza-Like Illness Definition:** A hospitalization with a discharge during January 1, 2019-March 30, 2019, and any of the following ICD-10-CM codes: B97.89, H66.9, H66.90, H66.91, H66.92, H66.93, J00, J01.9, J01.90, J06.9, J09.X, J10.X, J11.X, J12.89, J12.9, J18, J18.1, J18.8, J18.9, J20.9, J40, R05, R50.9

**COVID-19 Definition:** An ICD-10-CM code of U07.1 (confirmed) with a discharge date April–June 2020 or ICD-10-CM code of B97.29 (suspected) with a discharge date March–June, 2020, and admission dates January–June 2020

Data collected August 24, 2020

Preliminary unpublished analysis, please do not reproduce without permission
Cultures from Patients with COVID-19 and ILI Grew Organisms at Similar Frequency

Proportion of discharges with a positive culture

- **Overall**:
  - Influenza-Like Illness (2019): -4%
  - COVID-19 (2020): +53%

- **CO**:
  - Influenza-Like Illness (2019): -17%
  - COVID-19 (2020): +53%

- **HO**:
  - Influenza-Like Illness (2019): 0%
  - COVID-19 (2020): 0%
Antibiotic-Resistant Pathogens in Hospitalized Patients: Overall

Rate of resistant organisms per 10,000 discharges


- MRSA: -7%
- ESBL: +43%
- CRE: -22%
- VRE: +16%
- CRAB: -21%

Preliminary unpublished analysis, please do not reproduce without permission
Specimen Types: Overall

Proportion of discharges


MRSA

Respiratory: 40%  Blood: 20%  Urine: 10%

ESBL

Respiratory: 80%  Blood: 20%  Urine: 10%
Antibiotic-Resistant Pathogens in Hospitalized Patients: Community-Onset

Rate of community-onset resistant organisms per 10,000 discharges

- Influenza-Like Illness (2019)
- COVID-19 (2020)

<table>
<thead>
<tr>
<th>Pathogen</th>
<th>ILI 2019 Rate</th>
<th>COVID-19 Rate</th>
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<tbody>
<tr>
<td>MRSA</td>
<td>-28%</td>
<td></td>
</tr>
<tr>
<td>ESBL</td>
<td>+15%</td>
<td></td>
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<tr>
<td>CRE</td>
<td>-27%</td>
<td></td>
</tr>
<tr>
<td>VRE</td>
<td>-21%</td>
<td></td>
</tr>
<tr>
<td>CRAB</td>
<td>-16%</td>
<td></td>
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<tr>
<td>CRPA</td>
<td>-58%</td>
<td></td>
</tr>
</tbody>
</table>

Preliminary unpublished analysis, please do not reproduce without permission
Antibiotic-Resistant Pathogens in Hospitalized Patients: Hospital-onset

Rate of hospital-onset resistant organisms per 10,000 discharges


MRSA  +57%  +56%
ESBL  +176%  +23%
CRE  +56%  -23%
VRE  +62%  -23%
CRAB  +42%  +62%
CRPA

Length of stay may contribute to the higher frequency of some pathogens in patients with COVID-19.

Preliminary unpublished analysis, please do not reproduce without permission.
Hospital Antibiotic Use: All Antibiotics

National Healthcare Safety Network (649 hospitals)
Days of Therapy per 1,000 Days Present - All Antibiotics

-1%  -2%  +2%  +5%  -3%  -3%
Jan  Feb  Mar  Apr  May  Jun

Premier Healthcare Database (516 hospitals)
Days of Therapy per 1,000 Patient Days - All Antibiotics

+1%  +1%  +5%  +2%  -2%  -2%
Jan  Feb  Mar  Apr  May  Jun

Note: NHSN AU days present denominator counts any portion of a day when a patient was hospitalized and thus is larger than the Premier patient day denominator, which counts 24-hour periods. Preliminary unpublished analysis, please do not reproduce.

Note: 25% drop in hospitalizations for March-June of 2020 vs 2019
Hospital Antibiotic Use: Ceftriaxone

National Healthcare Safety Network (649 hospitals)
Days of Therapy per 1,000 Days Present - Ceftriaxone

- Jan: +10%
- Feb: +9%
- Mar: +10%
- Apr: +22%
- May: +9%
- Jun: +6%

Premier Healthcare Database (516 hospitals)
Days of Therapy per 1,000 Patient Days - Ceftriaxone

- Jan: +10%
- Feb: +8%
- Mar: +15%
- Apr: +22%
- May: +12%
- Jun: +14%

Note: NHSN AU days present denominator counts any portion of a day when a patient was hospitalized and thus is larger than the Premier patient day denominator, which counts 24-hour periods. Preliminary unpublished analysis, please do not reproduce.
Note: 25% drop in hospitalizations for March-June of 2020 vs 2019
Hospital Antibiotic Use: Azithromycin

National Healthcare Safety Network (649 hospitals)
Days of Therapy per 1,000 Days Present - Azithromycin

Premier Healthcare Database (516 hospitals)
Days of Therapy per 1,000 Patient Days - Azithromycin

Note: NHSN AU days present denominator counts any portion of a day when a patient was hospitalized and thus is larger than the Premier patient day denominator, which counts 24-hour periods. Preliminary unpublished analysis, please do not reproduce.

Note: 25% drop in hospitalizations for March-June of 2020 vs 2019
Hospital Antibiotic Use: Vancomycin

National Healthcare Safety Network (649 hospitals)
Days of Therapy per 1,000 Days Present - Vancomycin

<table>
<thead>
<tr>
<th>Month</th>
<th>2019</th>
<th>2020</th>
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<tbody>
<tr>
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<td>-5%</td>
<td></td>
</tr>
<tr>
<td>Feb</td>
<td>-4%</td>
<td></td>
</tr>
<tr>
<td>Mar</td>
<td>+0.4%</td>
<td></td>
</tr>
<tr>
<td>Apr</td>
<td>+3%</td>
<td></td>
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<tr>
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<td>-3%</td>
<td></td>
</tr>
<tr>
<td>Jun</td>
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Premier Healthcare Database (516 hospitals)
Days of Therapy per 1,000 Patient Days - Vancomycin

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</tr>
<tr>
<td>Apr</td>
<td>-7%</td>
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</tr>
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Note: 25% drop in hospitalizations for March-June of 2020 vs 2019
Hospital Antibiotic Use: Piperacillin/Tazobactam

**National Healthcare Safety Network (649 hospitals)**
Days of Therapy per 1,000 Days Present Piperacillin/Tazobactam

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<td>-5%</td>
<td>-5%</td>
<td>0%</td>
</tr>
<tr>
<td>Apr</td>
<td>+4%</td>
<td>+4%</td>
<td>0%</td>
</tr>
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<td>-2%</td>
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<td>0%</td>
</tr>
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Days of Therapy per 1,000 Patient Days Piperacillin/Tazobactam

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<tr>
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<td>-0.35%</td>
<td>-0.35%</td>
<td>0%</td>
</tr>
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<td>-2%</td>
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<td>0%</td>
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Note: 25% drop in hospitalizations for March-June of 2020 vs 2019.
Decrease in Nursing Home Antibiotic Dispense Rates

- Long-term care pharmacy prescription dispense data from over 1,900 nursing homes
- Overall, antibiotic use rates decreased 16% during January-June 2020, compared with 9% decrease in 2019
- Antibiotic use declined more than expected for seasonal declines

![Graph showing decrease in antibiotic use rates](image)

Residents with antibiotic dispensed per 1,000 residents serviced

- Preliminary unpublished analysis, please do not reproduce without permission
Higher Rates of Antibiotics Commonly Used for Respiratory Infections in Nursing Homes

- **Antibiotics higher** in April 2020 than 2019
  - Azithromycin
  - Ceftriaxone
  - Doxycycline

- **Antibiotics lower** in April 2020 than 2019
  - Levofloxacin
  - Amoxicillin

**Percent change in prescription rate from 2019**

- Azithromycin, +150%
- Ceftriaxone, +43%
- Doxycycline, +6%
- Levofloxacin, -19%
- Amoxicillin, -25%

Preliminary unpublished analysis, please do not reproduce without permission.
Emergency department visits declined 41%-64% during January-April 2020\(^1\) and 42% year over year\(^2\).

A convenience sample of 50,000+ outpatient providers shows visits down 60% by the end of March compared with its first week but have rebounded.\(^3\)

Outpatient Antibiotic Prescriptions Down

- National estimates projected from a sample covering 92% of all retail prescriptions
- Largest beyond seasonally-expected decreases in penicillins (mostly amoxicillin), then macrolides, cephalosporins, and beta-lactam agents
- Azithromycin prescribing in NY & NJ higher than seasonally-expected in March & April

Patients with antibiotic prescriptions dispensed from retail pharmacies for **all antibiotics decreased 42%** May 2019-May 2020

Patients with **azithromycin prescriptions decreased 62%** during May 2019-May 2020

Preliminary unpublished analysis, please do not reproduce without permission
Other Impacts from COVID-19

- Antibiotic drug shortages, with specific challenges for TB, STD
- Potential increased risk for MDR transmission and drop in surveillance cultures creates challenges for MDRO outbreak identification and response
- Closure of STD clinics, limited healthcare access during the pandemic might create long-term health issues
- Significant declines in AR data reporting & lab surveillance as staff are redirected
- Increased use of immune support could increase risks (e.g., steroids and new therapeutics)
More AR & COVID-19 Studies Coming from CDC

- Academic collaborations to better understand COVID-19 & secondary infections
- **International collaborations** to explore bacterial/fungal infections in COVID-19 patients in South America and Asia
- Deeper dive on **fungal infections** & COVID-19
- Evaluating **antibiotic use data** in COVID-19 patients in low- to middle-income countries
- Publications & additional studies from preliminary data presented today including ongoing work on the increasing risk of ESBLs
Future Implications for AR & COVID-19

- Continued emphasis of healthcare infection prevention and control in infectious disease transmission cannot be overestimated
  - Spread of pathogens can be contained and outbreaks can be prevented but we must ensure ongoing robust infection control training, continuity of PPE supply, support for frontline healthcare providers

- Support greater resiliency in antibiotic resistance and antibiotic use programs in healthcare and state/local health departments
  - Without resiliency, critical work will not happen as new threats emerge

- Continued gathering and analysis of AR and AU data from multiple sources like presented today is critically important as it allows resilience when some systems are impacted and provides a fuller picture of impact.
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Amy Webb
Hannah Wolford
Hsiu Wu

For more information, contact CDC
1-800-CDC-INFO (232-4636)

The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention.
Key Takeaways

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  - No clear evidence that COVID-19 patients are more susceptible to bacterial/fungal infections—similar frequency as patients with influenza-like illness (ILI). However, we are seeing sporadic outbreaks of AR infections in COVID units & higher rates of hospital onset infections
  - COVID-19 creates perfect storm for AR infections in healthcare settings: length of stay, crowding, sick patients, antibiotic use, infection control issues

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  - Hospitals: Spiked in early 2020 but flattened as pandemic continued
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