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-19 testing and identify AR outbreaks
- Data collection systems, like the National Healthcare Safety Network, **gather COVID-19 and AR/AU 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:

$558+ million

across all 50 state and several local health departments for detection/prevention

CDC has invested

$160+ million

in 100+ institutions to investigate AR innovations across One Health

Key Takeaways: AR Infections

- Healthcare infection control is critical to fight AR and COVID-19.
  - No clear evidence that patients with COVID-19 are more susceptible to bacterial/fungal infections—similar frequency as patients with influenza-like illness (ILI). However, sporadic outbreaks of AR infections in COVID-19 units & higher rates of hospital-onset infections are being reported.
  - COVID-19 can create a perfect storm for AR infections in healthcare settings: increased length of stay, increased number of patients, staffing shortages, sick patients, antibiotic use, challenges implementing infection prevention and control.
- Some preliminary analyses have identified increases in hospital-onset resistant infections (e.g., MRSA) and potential changes for community-onset infections.
  - Given the significant changes in healthcare utilizations and, possibly, lab testing (due to supply issues) during the pandemic, additional analyses are needed to assess the net impacts on AR threat pathogens.
- Findings highlight continued importance of healthcare infection control as one of the foremost tools needed to address emerging infectious diseases.

AR Pathogen Outbreaks and COVID-19

- CDC and public health partners responded to 20 outbreaks of AR pathogens in COVID-19 treatment and observation units since April 2020
- 2 MMWRs about outbreaks from Urgent Threats in hospitals during COVID-19 surges

New Jersey: 34 cases of carbapenem-resistant *Acinetobacter baumannii* attributed to changes in infection prevention and control practices[1]

Florida: 39 cases of *Candida auris* attributed to unconventional PPE practices and environmental contamination[2]

- Outbreaks resolve after surge but long-term impact on spread of AR pathogens in a region is uncertain

[1]Perez S, Innes GK, Walters MS, et al. Increase in Hospital-Acquired Carbapenem-Resistant *Acinetobacter baumannii* Infection and Colonization in an Acute Care Hospital During a Surge in COVID-19 Admissions — New Jersey, February–July 2020. MMWR Morb Mortal Wkly Rep 2020;69:1827–1831.
[2]Prestel C, Anderson E, Forsberg K, et al. *Candida auris* Outbreak in a COVID-19 Specialty Care Unit — Florida, July–August 2020. MMWR Morb Mortal Wkly Rep 2020; 70;56–57.

Key Takeaways: Antibiotic Use

- **Hospitals:** Lots of variability.
  - Overall increases in some agents (azithromycin/ceftriaxone). No national increases in broad spectrum agents; some facilities have seen shifting.
  - Decreases in overall prescribing vary; facilities with more COVID-19 cases had higher rates of prescribing on average for azithromycin/ ceftriaxone.
- **Outpatient:** Significant drop in antibiotic prescribing.
  - Drop appears related to decrease in healthcare utilization; however, antibiotic use has remained lower than pre-pandemic levels even as healthcare utilization has risen.
- **Nursing Homes:** Spikes in use.
  - Spikes were greatest early in the pandemic and subsequent increases were lower.

About Data Shown Today

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

Hospital data reflect:

- Infection data from **150+ hospitals and 14,000 hospital discharges**
- Antibiotic use data from **1,400+ hospitals & 4+ million hospital discharges**
- **2 data systems:** CDC's National Healthcare Safety Network and Premier Healthcare Database

Outpatient data reflect:

- National estimates extrapolated from **92% of retail prescriptions** (IQVIA data)

Nursing home data reflect:

- Pharmacy info based on PharMerica data from **1,900 U.S. nursing homes**

AR Pathogens & SARS-CoV-2 in Hospitalized Patients

Patient Discharge Data: Flu & COVID-19

	Patients with Influenza-Like Illness (Jan-March 2019)	Patients with COVID-19 (Jan-October 2020)
Median length of stay	5.88 days	8.20 days
Discharges with bacterial/fungal culture	55.8%	56.7%
Discharges with an AR-positive culture with a susceptibility result	12.4%	9.1%

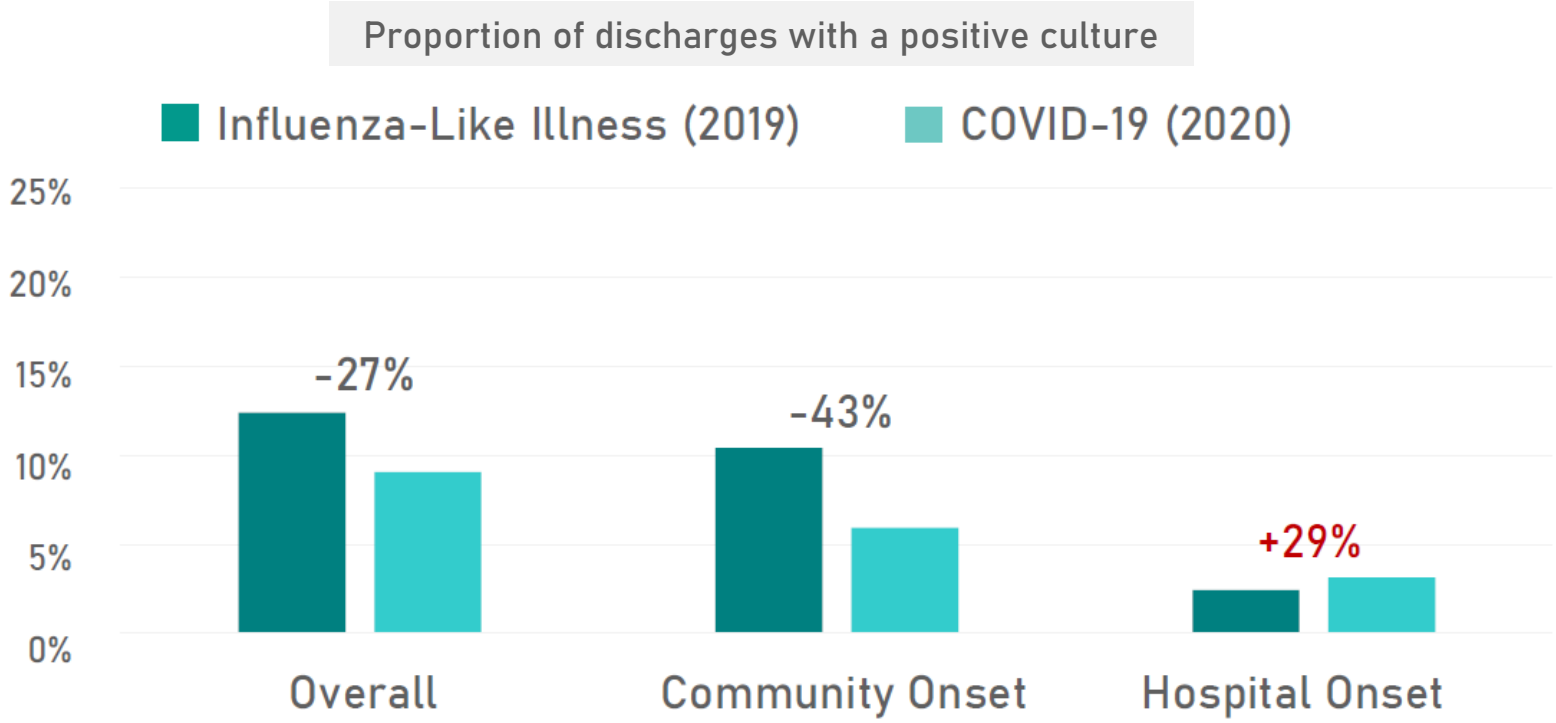
Source: Premier Healthcare Database

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–October 2020 or ICD-10-CM code of B97.29 (suspected) with a discharge date March–April 2020, and admission dates February–April 2020

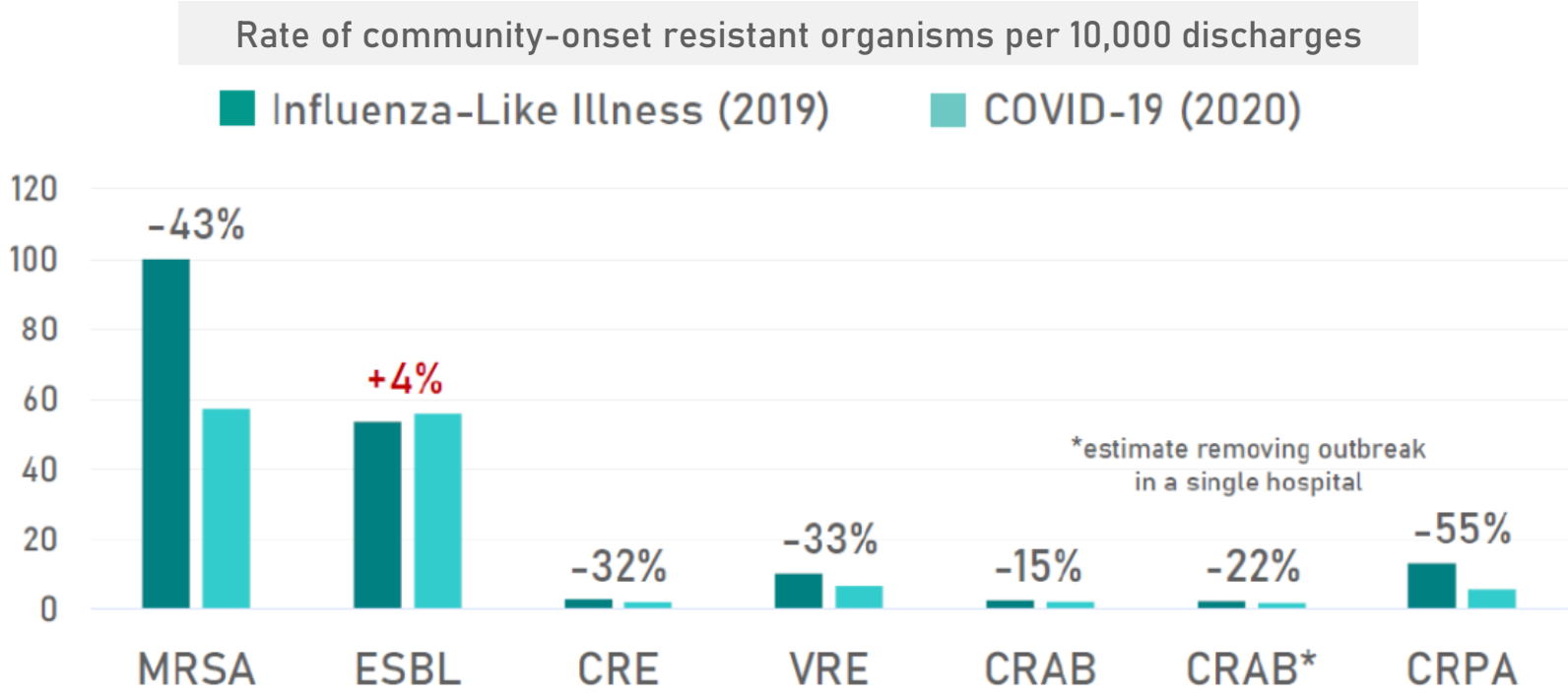
Data collected January 10, 2021

Frequency of Positive Cultures from Patients with COVID-19 and ILI



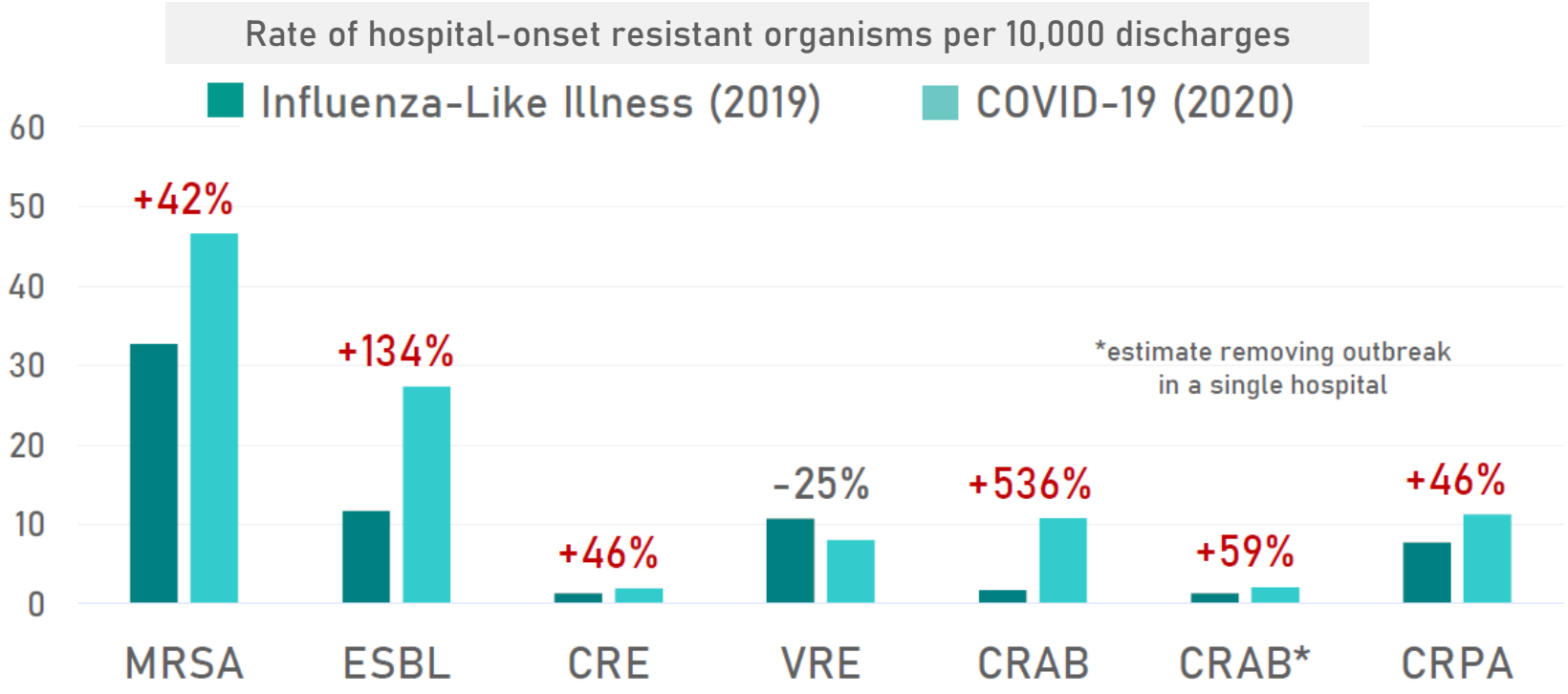
Source: Premier Healthcare Database

AR Pathogens in Hospitalized Patients:
Community-Onset Infections Only



Source: Premier Healthcare Database

AR Pathogens in Hospitalized Patients:
Hospital-Onset Infections Only



Source: Premier Healthcare Database

Increase in Healthcare-Onset MRSA Bacteremia SIR in 2020: Quarter 2

	2019 Q2	2020 Q2	Difference in Pooled Values (2020-2019) N (%)
# Hospitals	3,039	3,039	
# Hospitals with ≥ 1 HO event	890	882	-8 (-0.9%)
HO MRSA Events	1,690	1,704	14 (0.8%)
# Predicted HO MRSA	2,064.55	1,813.43	-251.12 (-12.2%)
Patient Days	32,937,724	28,058,539	-4,879,185 (-14.8%)
> Inpatient HO MRSA Rate	5.1	6.1	0.9 (18.4%)
SIR	0.82	0.94	0.12 (14.8%)
Inpatient CO MRSA Events	4,119	3,737	-382 (-9.3%)
Admissions	7,719,330	6,368,916	-1,350,414 (-17.5%)
> Inpatient CO MRSA Rate	5.3	5.9	0.5 (10.0%)
Outpatient MRSA Events	10,615	10,463	-152 (-1.4%)
Outpatient Encounters	28,792,424	19,056,924	-9,735,500 (-33.8%)
> Outpatient MRSA Rate	3.7	5.5	1.8 (48.9%)

Source: National Healthcare Safety Network (NHSN)

Larger Increases in Healthcare-Onset MRSA Bacteremia in 2020: Quarter 3

	2019 Q3	2020 Q3	Difference in Pooled Values (2020-2019) N (%)
# Hospitals	3,157	3,157	
# Hospitals with ≥ 1 HO event	929	1,082	153 (16.5%)
HO MRSA Events	1,873	2,364	491 (26.2%)
# Predicted HO MRSA	2,339.17	2,359.80	20.63 (0.9%)
Patient Days	37,062,230	36,285,640	-776,590 (-2.1%)
> Inpatient HO MRSA Rate	5.1	6.5	1.5 (28.9%)
SIR	0.80	1.00	0.20 (25.1%)
Inpatient CO MRSA Events	4,620	4,399	-221 (-4.8%)
Admissions	8,747,884	8,157,200	-590,684 (-6.8%)
> Inpatient CO MRSA Rate	5.3	5.4	0.1 (2.1%)
Outpatient MRSA Events	12,277	12,919	642 (5.2%)
Outpatient Encounters	31,896,130	25,779,810	-6,116,320 (-19.2%)
> Outpatient MRSA Rate	3.8	5.0	1.2 (30.2%)

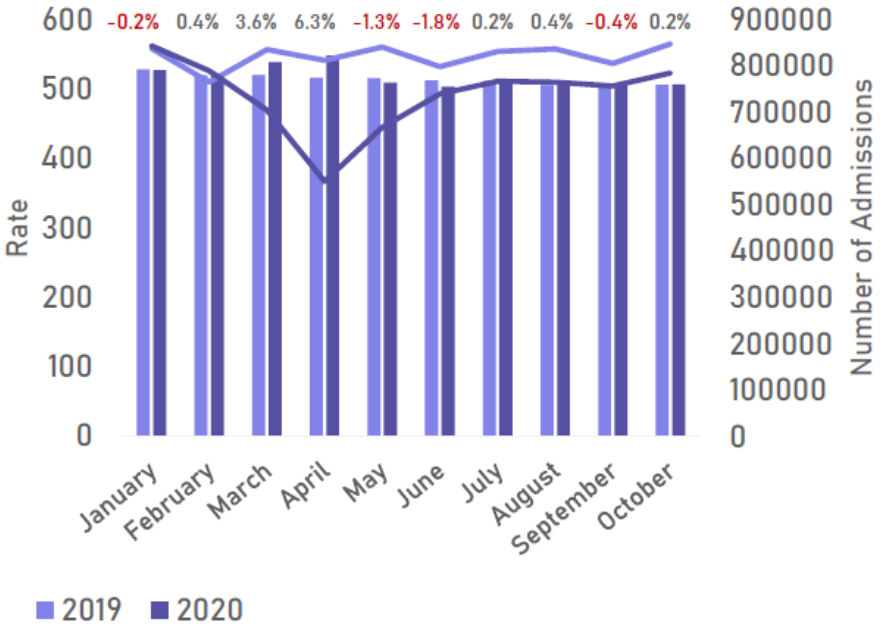
Source: National Healthcare Safety Network (NHSN)

Antibiotic Use During the COVID-19 Pandemic – Hospitals

Aggregate Hospital Antibiotic Use: All Antibiotics

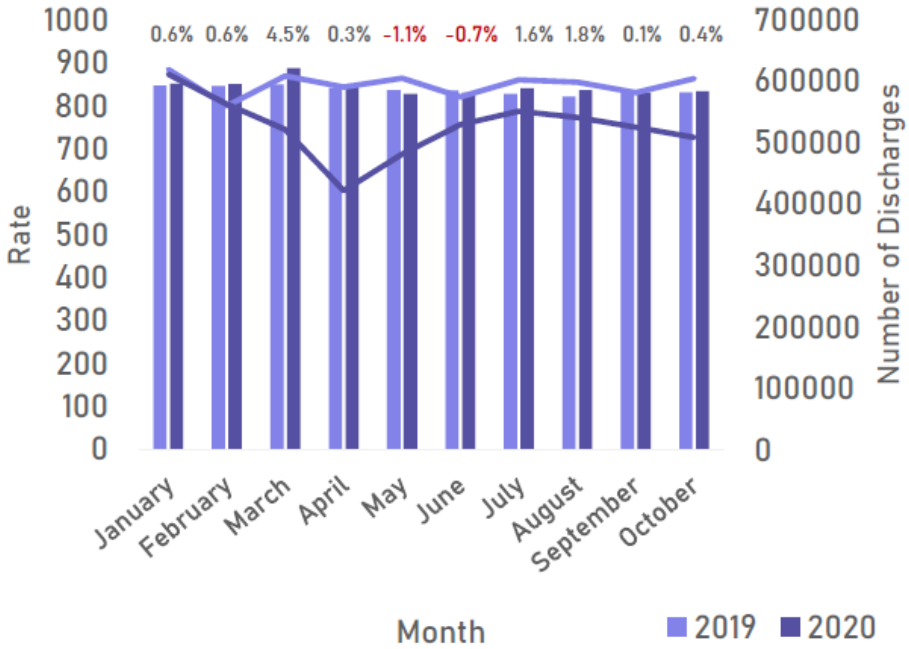
National Healthcare Safety Network (710 hospitals)

Days of Therapy per 1,000 Days Present – All Antibacterial Agents



Premier Healthcare Database (716 hospitals)

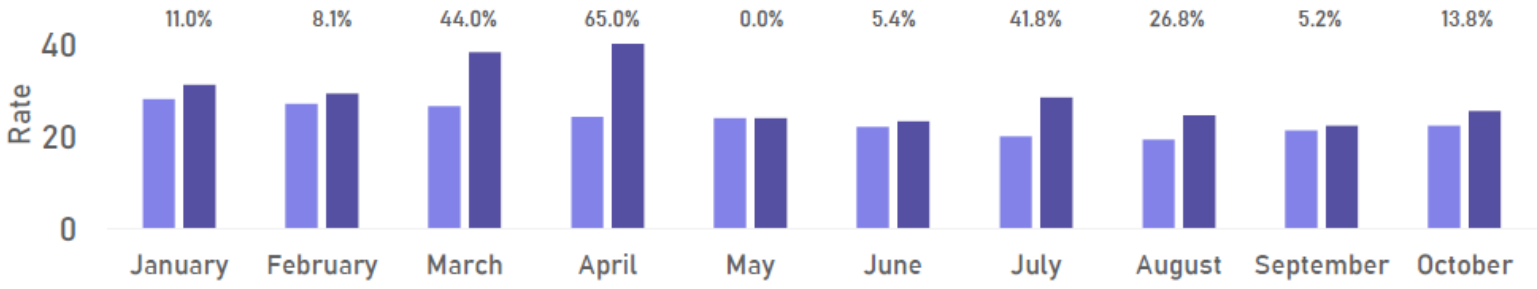
Days of Therapy per 1,000 patient days – All Antibacterial Agents



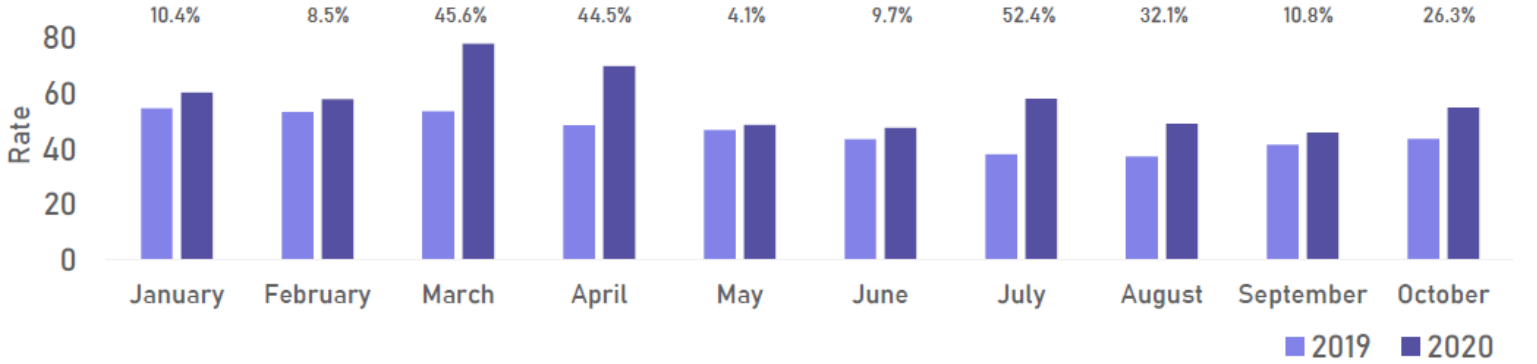
Note: NHSN AU days present denominator counts any portion of a day when a patient was hospitalized and thus is larger than the Premier patient day denominator, which counts 24-hour periods.
% indicates percent difference in pooled mean rate by year.

Aggregate Hospital Antibiotic Use: Azithromycin

National Healthcare Safety Network (710 hospitals)
Days of Therapy per 1,000 Days Present – Azithromycin



Premier Healthcare Database (716 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.
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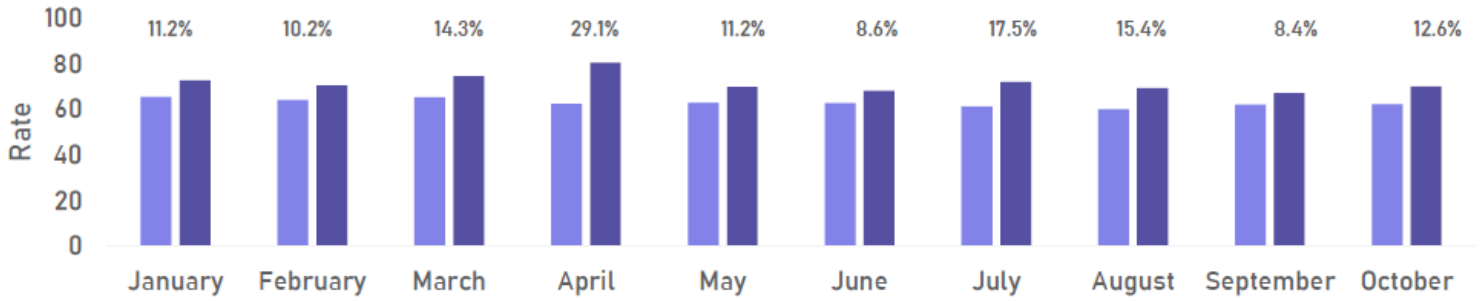
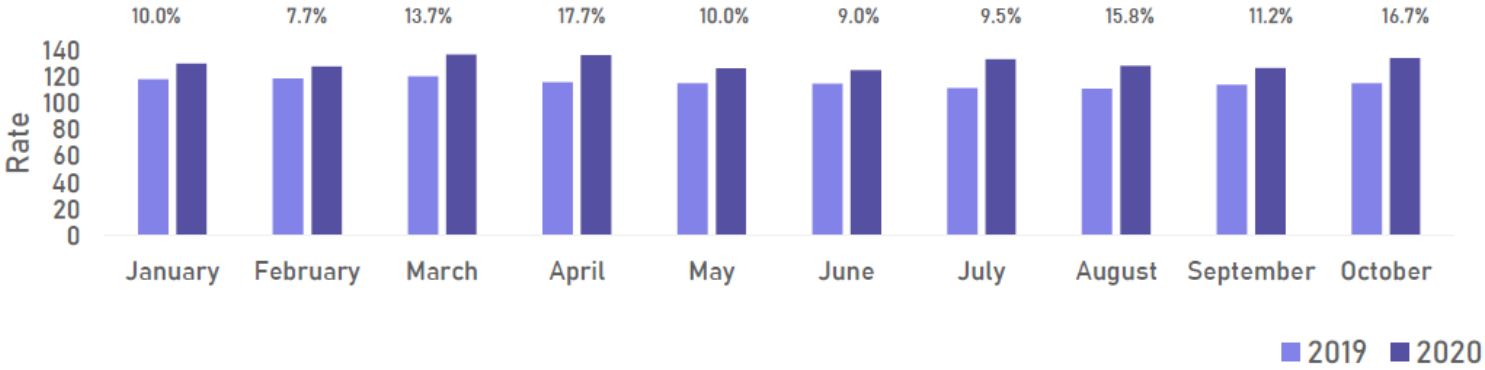
Aggregate Hospital Antibiotic Use: Ceftriaxone

National Healthcare Safety Network (710 hospitals)
Days of Therapy per 1,000 Days Present – Ceftriaxone



Premier Healthcare Database (716 hospitals)
Days of Therapy per 1,000 patient days– Ceftriaxone



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.
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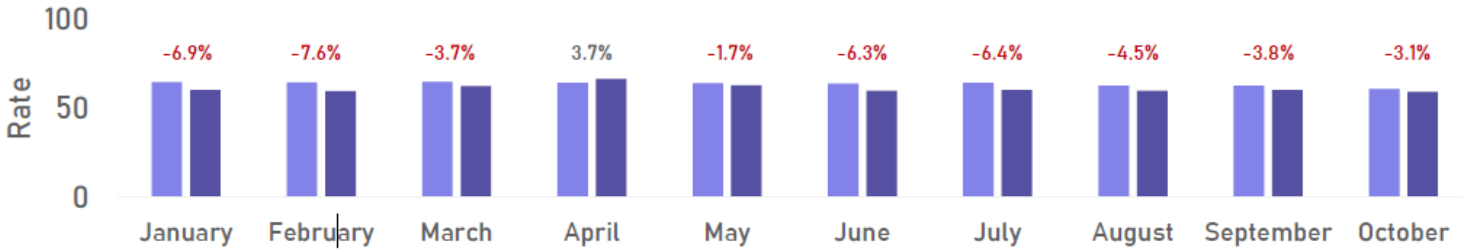
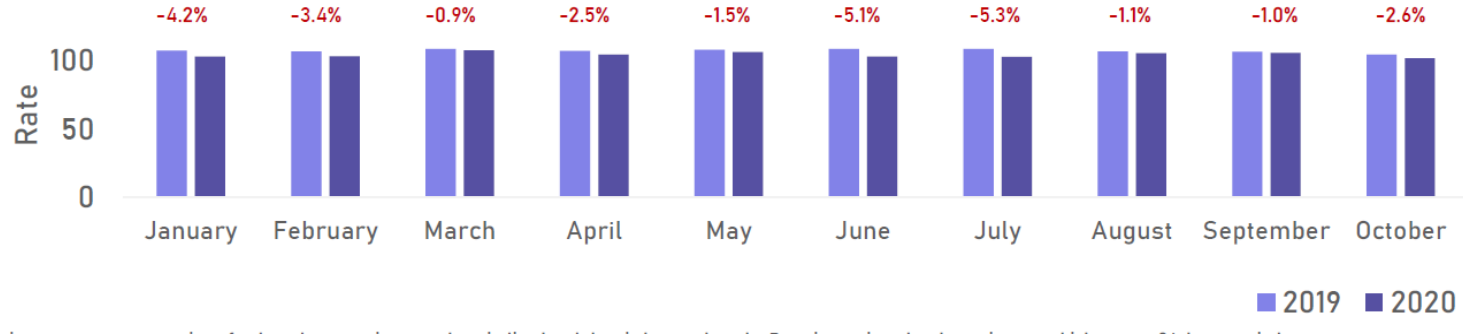
Aggregate Hospital Antibiotic Use: Piperacillin-Tazobactam

National Healthcare Safety Network (710 hospitals)
Days of Therapy per 1,000 Days Present – Piperacillin-Tazobactam



Premier Healthcare Database (716 hospitals)
Days of Therapy per 1,000 patient days– Piperacillin-Tazobactam



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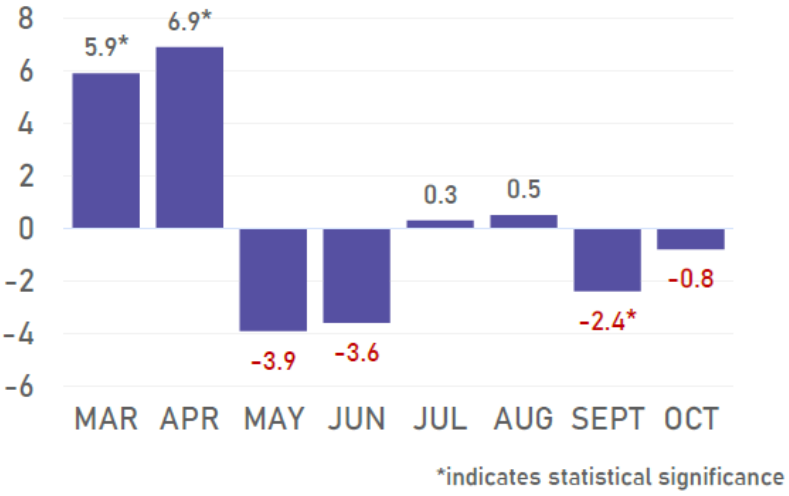
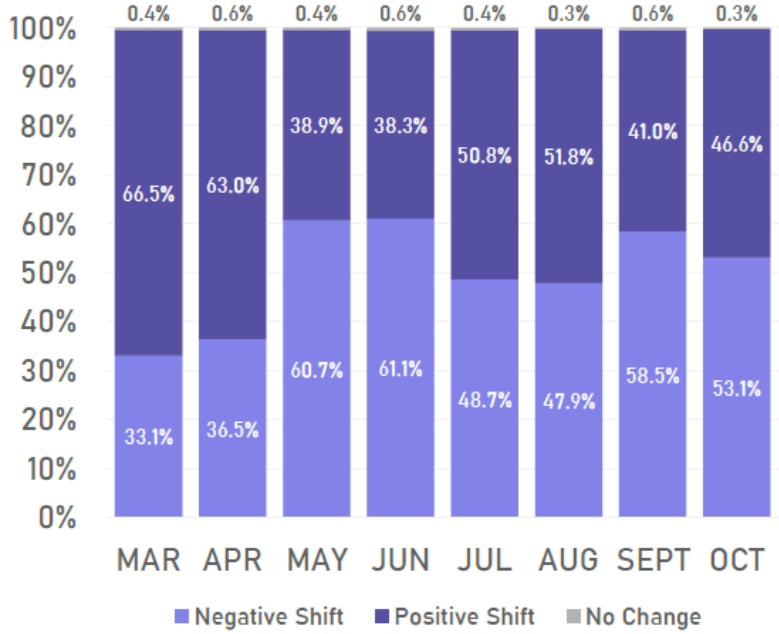
Hospital-Level Antibiotic Use: Azithromycin

National Healthcare Safety Network (710 hospitals)

Median shifts in prescribing when a hospital is compared to itself and normalized to January 2020 – Azithromycin



Percent of facilities with a positive increase in antibiotic use, normalized to January 2020 – Azithromycin



NHSN·AU
NATIONAL HEALTHCARE SAFETY NETWORK
ANTIMICROBIAL USE OPTION

Hospital-Level Antibiotic Use: Piperacillin-Tazobactam

National Healthcare Safety Network (710 hospitals)

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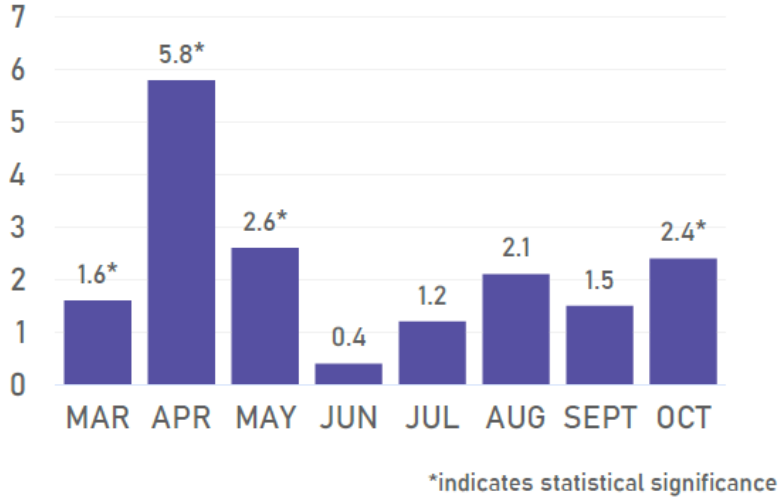

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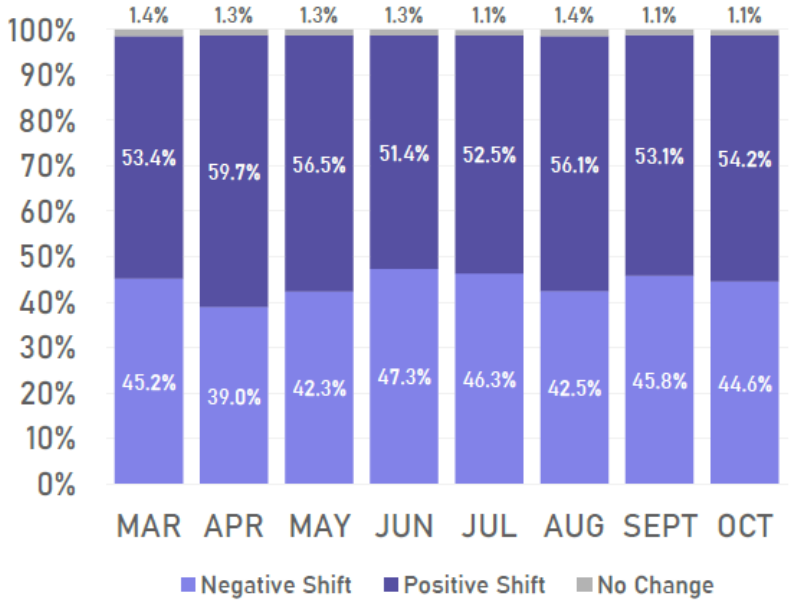

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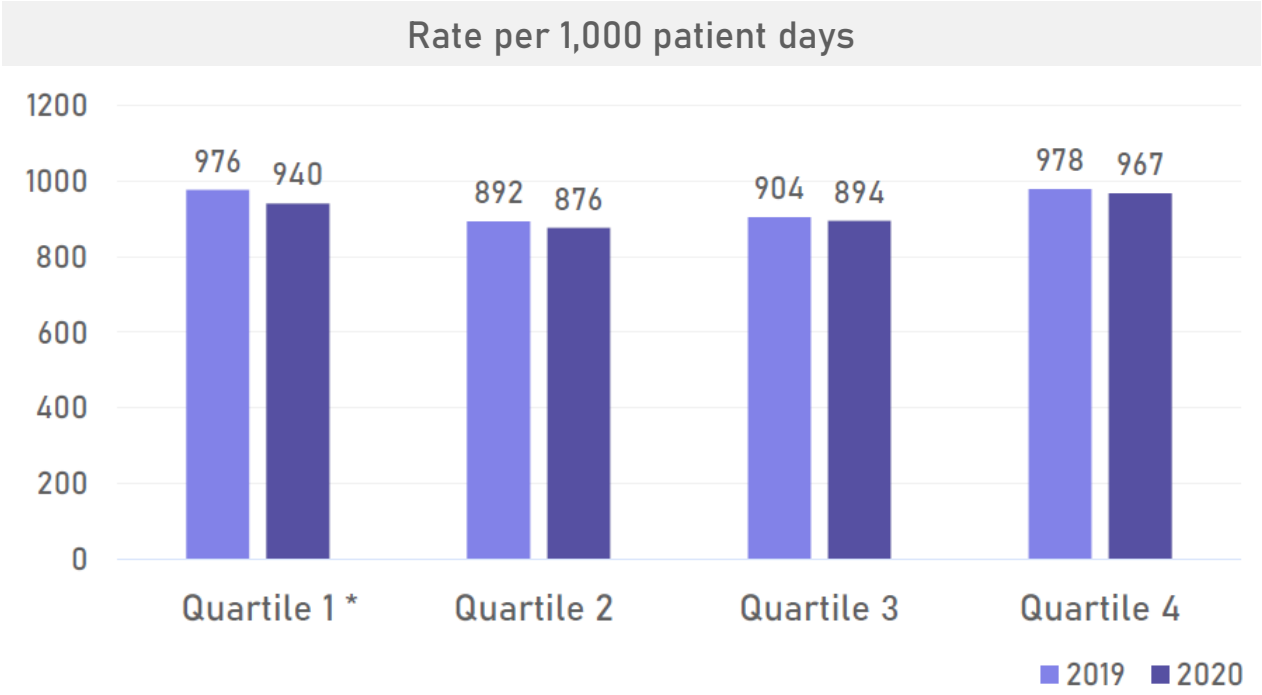
NATIONAL HEALTHCARE SAFETY NETWORK
ANTIMICROBIAL USE OPTION

Hospital Antibiotic Use: All Antibiotics

Based on COVID-19 Burden – Premier Data

Premier Healthcare Database (716 hospitals)

Median Total Antibiotic Use during March-October per 1,000 patient days by COVID-19 Hospital Burden



Hospitals were categorized into quartiles by COVID-19 burden based on the rate of COVID-19 cases per 10,000 discharges for each hospital and month.

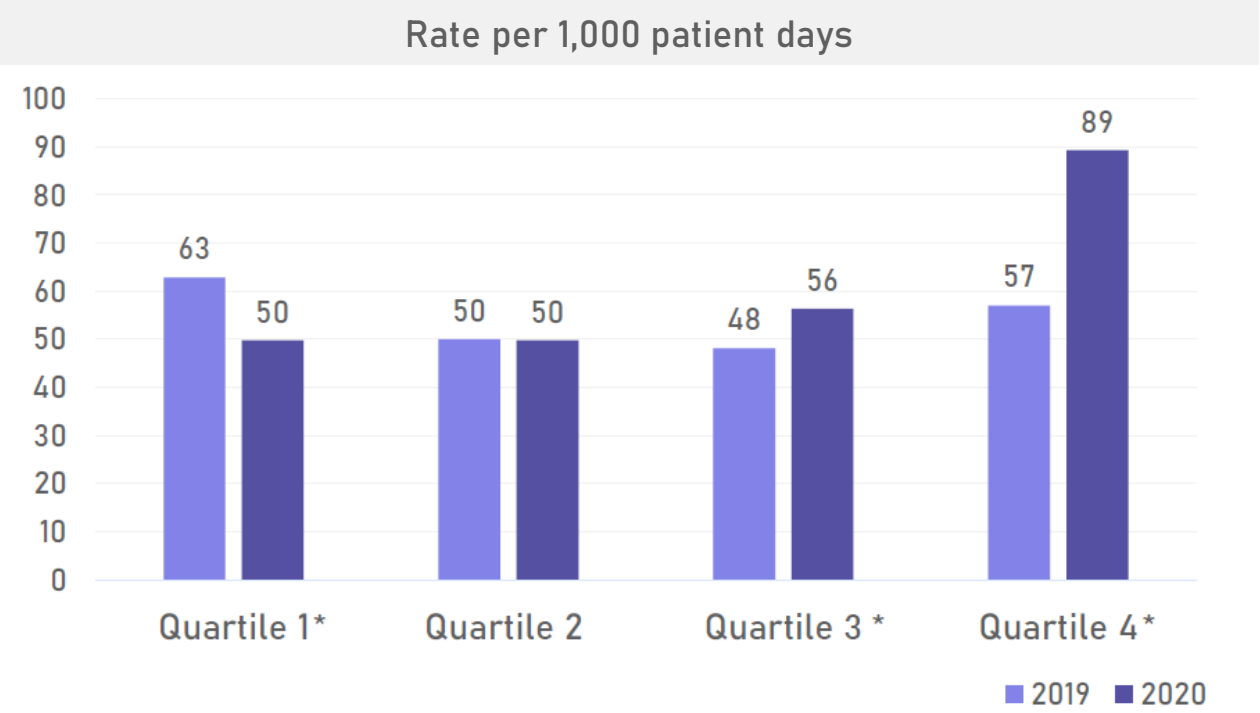
*indicates statistical significance

Hospital Antibiotic Use: Azithromycin

Based on COVID-19 Burden – Premier Data

Premier Healthcare Database (716 hospitals)

Median Azithromycin Use per 1,000 patient days by COVID-19 Hospital Burden



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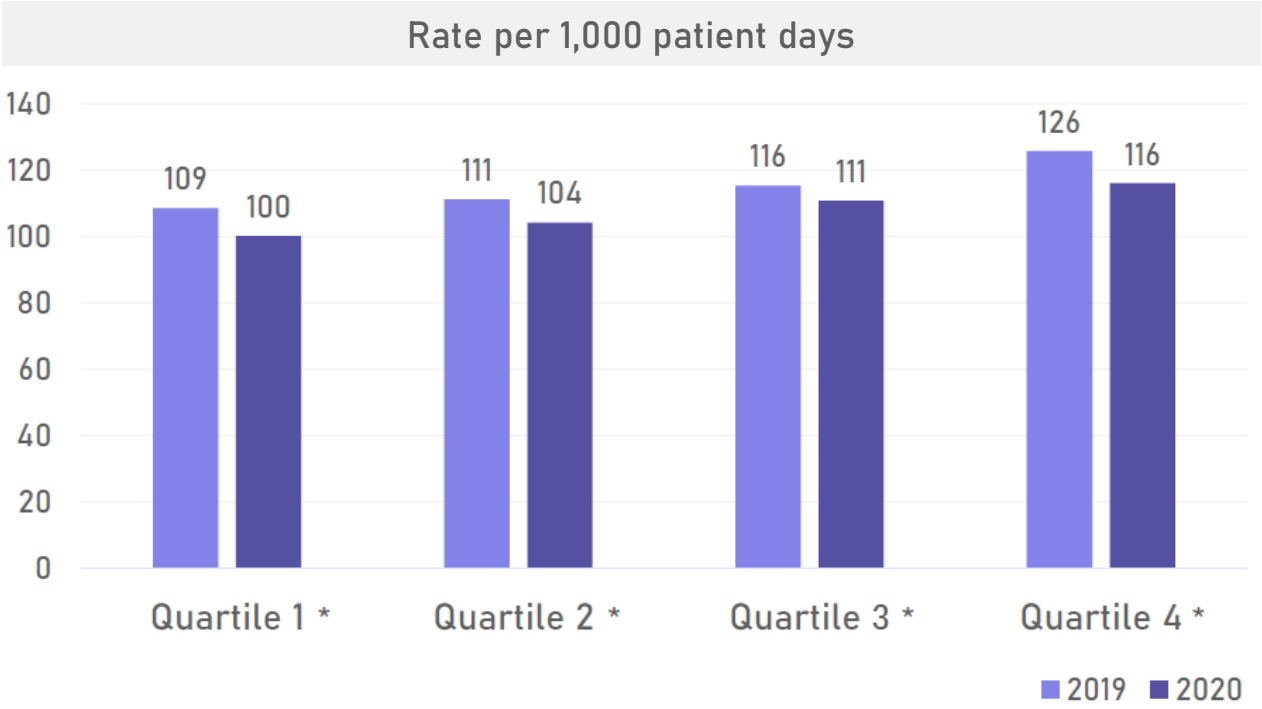
*indicates statistical significance

Hospital Antibiotic Use: Piperacillin-Tazobactam
Based on COVID-19 Burden – Premier Data

Premier Healthcare Database (716 hospitals)

Median Piperacillin-Tazobactam Use per 1,000 patient days by COVID-19 Hospital Burden



Hospitals were categorized into quartiles by COVID-19 burden based on the rate of COVID-19 cases per 10,000 discharges for each hospital and month.

*indicates statistical significance

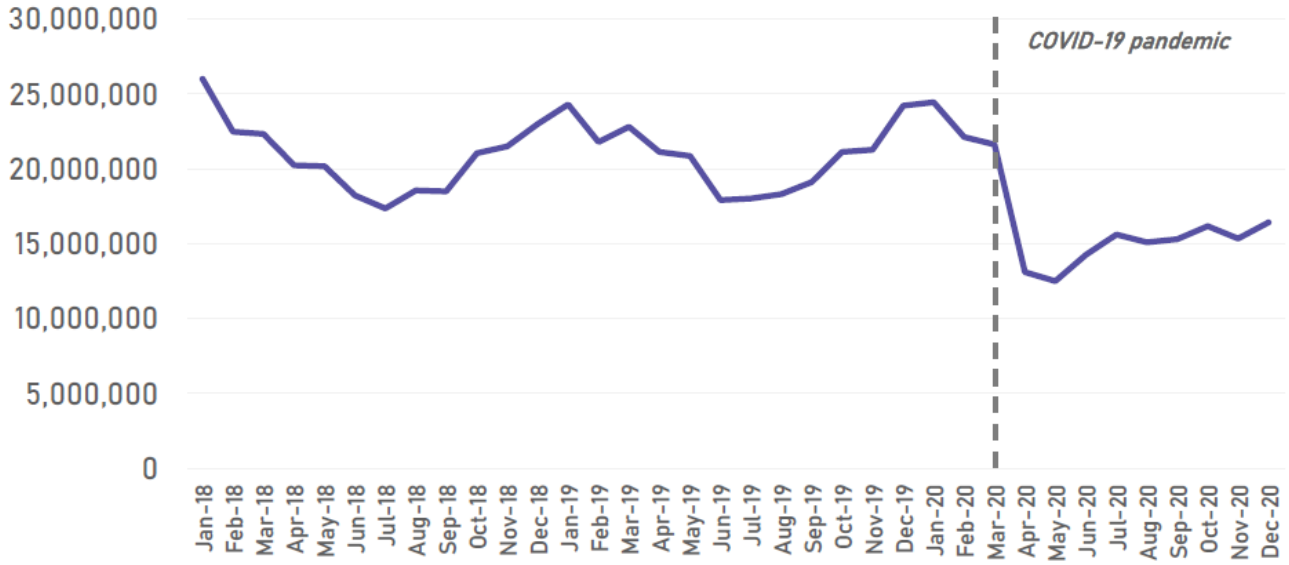
Antibiotic Use During the COVID-19 Pandemic – Outpatient

National Outpatient Antibiotic Prescription Trends

December 2020

32% year-over-year decrease
7% month-over-month increase ***(compared with 14% MOM increase in Dec 2019)***

Number of antibiotic prescriptions dispensed from retail pharmacies



Source: IQVIA National Prescription Audit Last update: January 19, 2021

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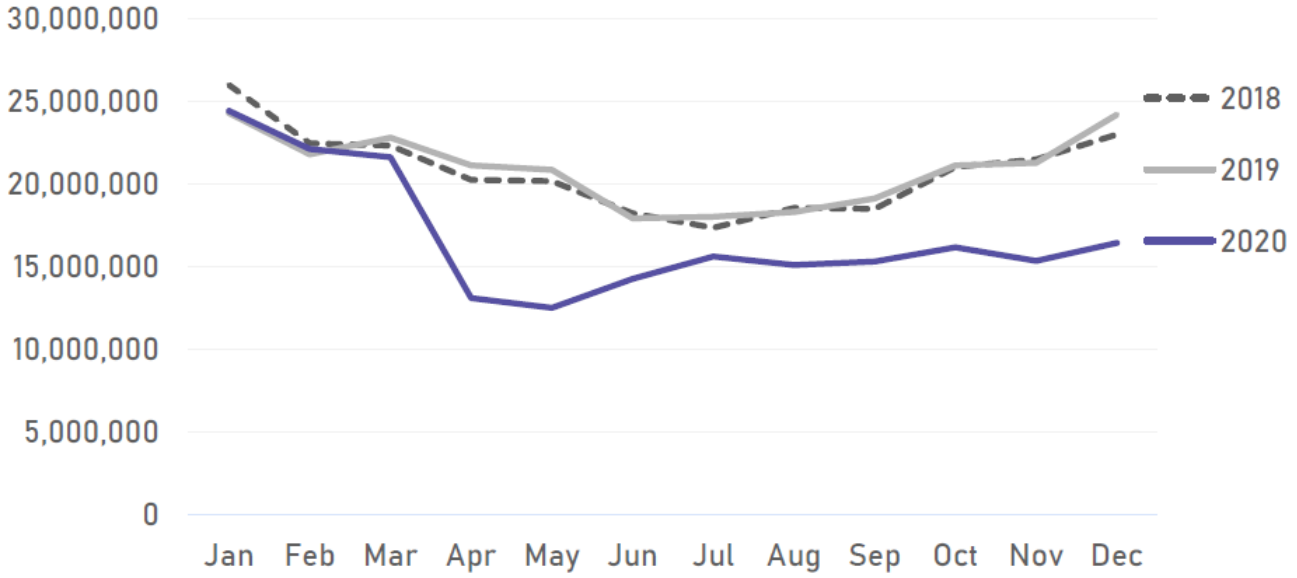


Source: IQVIA National Prescription Audit Last update: January 19, 2021

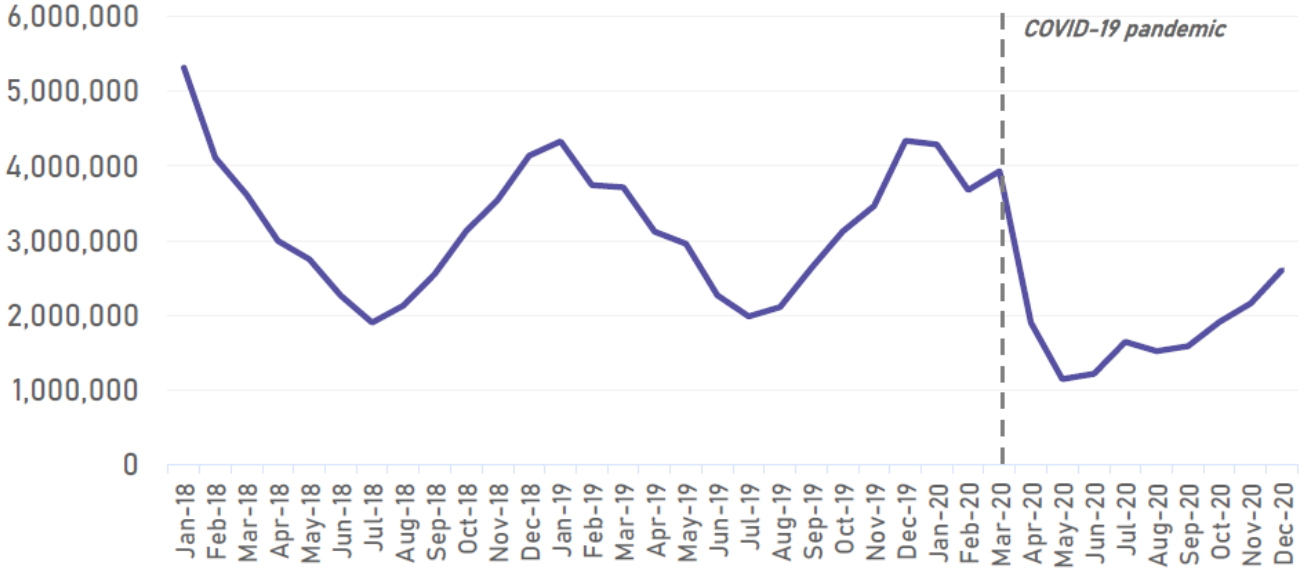
National Outpatient Antibiotic Prescription Trends: Azithromycin

December 2020

40% year-over-year decrease

21% month-over-month increase ***(compared with 25% MOM increase in Nov 2019)***

Number of azithromycin prescriptions dispensed from retail pharmacies

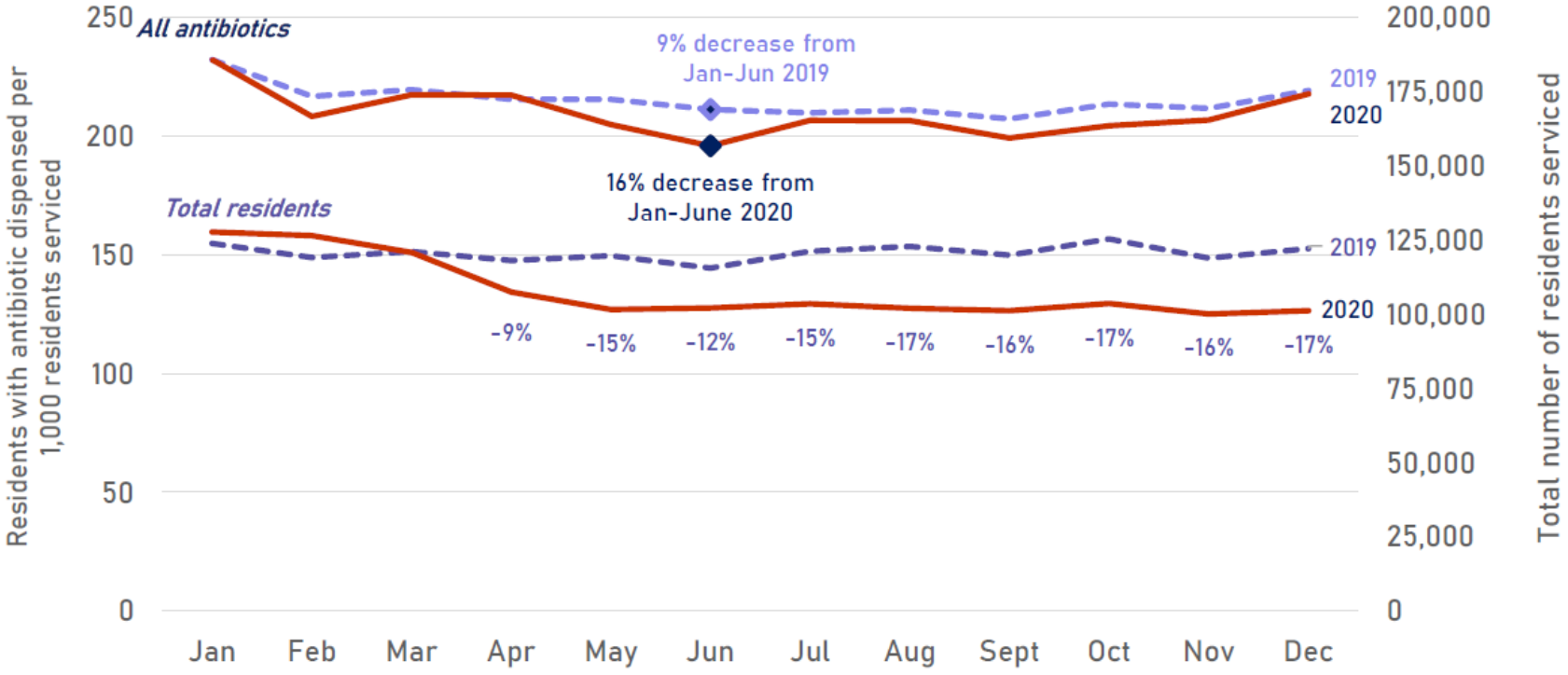


Source: IQVIA National Prescription Audit Last update: January 19, 2021

Antibiotic Use During the COVID-19 Pandemic – Nursing Homes

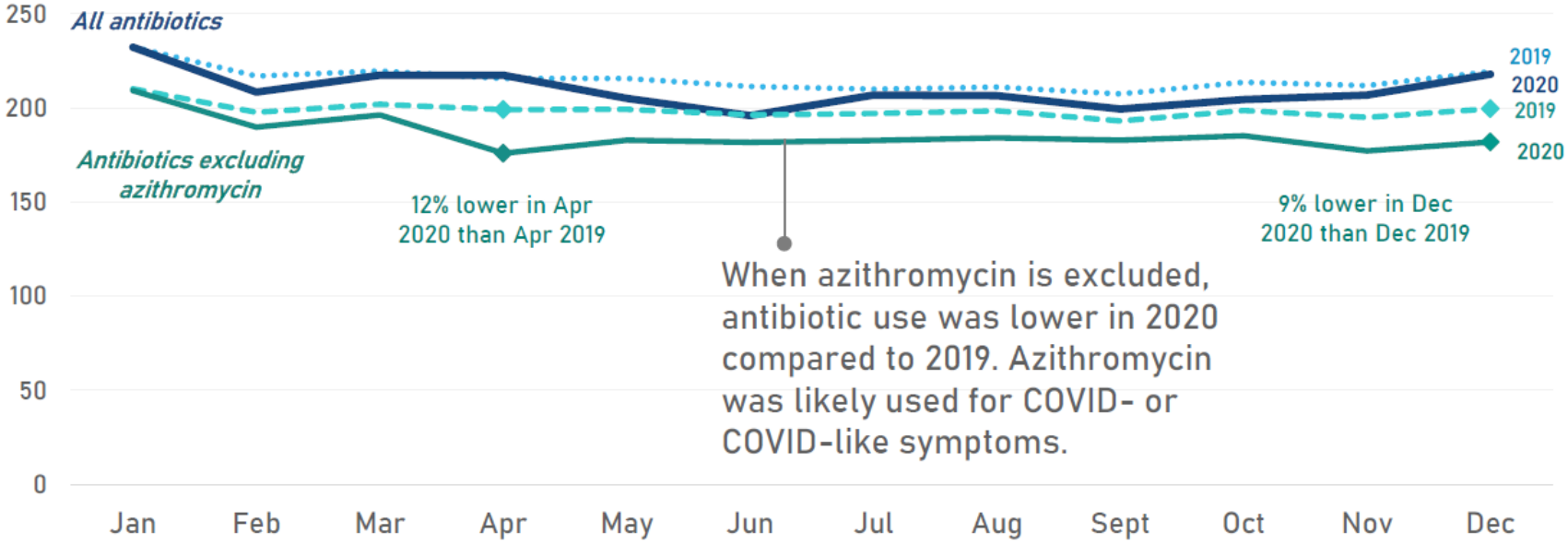
Nursing Home Antibiotic Dispensing Rates

Residents with antibiotic dispensed and total residents serviced, 2019 vs. 2020



Nursing Home Antibiotic Dispensing Rates

Residents with antibiotic dispensed per 1,000 residents serviced – Excluding Azithromycin



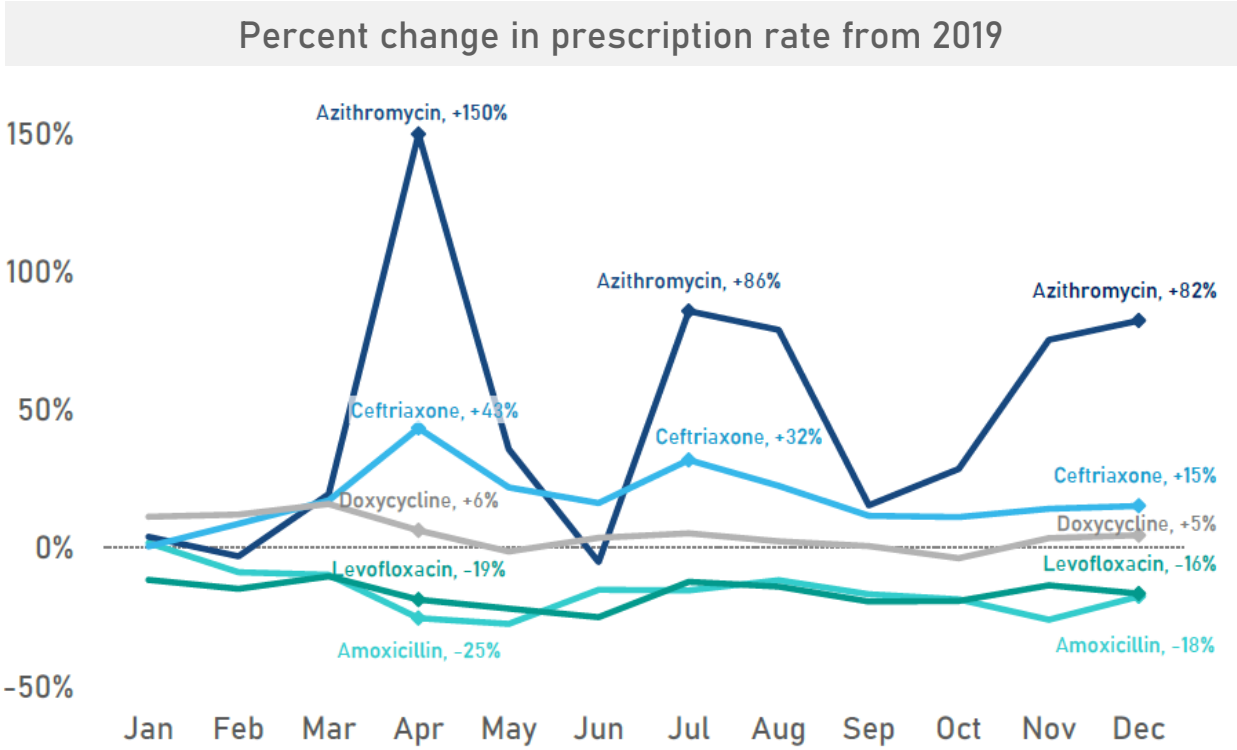
Higher Rates of Antibiotics Commonly Used for Respiratory Infections in Nursing Homes

Antibiotics higher in 2020 than 2019

- Azithromycin
- Ceftriaxone
- Doxycycline

Antibiotics lower in 2020 than 2019

- Levofloxacin
- Amoxicillin



More AR & COVID-19 Studies Coming from CDC

- Academic and healthcare collaborations to better understand COVID-19 and the impacts on AR/AU, some examples:
  - University of Pennsylvania
  - Washington University School of Medicine
  - Cook County Health, Rush University, and Northwestern Medicine
- Deeper dive on ***C. auris*** and COVID-19 in Orange County and Chicago
- International collaborations to explore bacterial/fungal infections and antibiotic use in patients with COVID-19 in South America and Asia
- Publications & additional studies from preliminary data presented today

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 those 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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Alex Kallen
Laura King
Jennifer Lind
Maribeth Lovegrove
Natalie McCarthy
Melinda Neuhauser
Erin O'Leary
Lindsay Parnell
Sujan Reddy
Rebecca Roberts
Ashley Rose
Nadine Shehab
Alicia Shugart
Dawn Sievert
Minn Soe
Sharon Tsay
Maroya Walters
Amy Webb
Hannah Wolford
Hsiu Wu

For more information, contact CDC
1-800-CDC-INFO (232-4636)
TTY: 1-888-232-6348 www.cdc.gov

Find More Info on CDC's Efforts to Combat AR

CDC's AR Investment Map shows global-, state- and city-specific fact sheets showing how CDC invested $118+ million in 2020 AR activities—plus a new AR & COVID-19 investment overview: https://ARinvestments.cdc.gov.