“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

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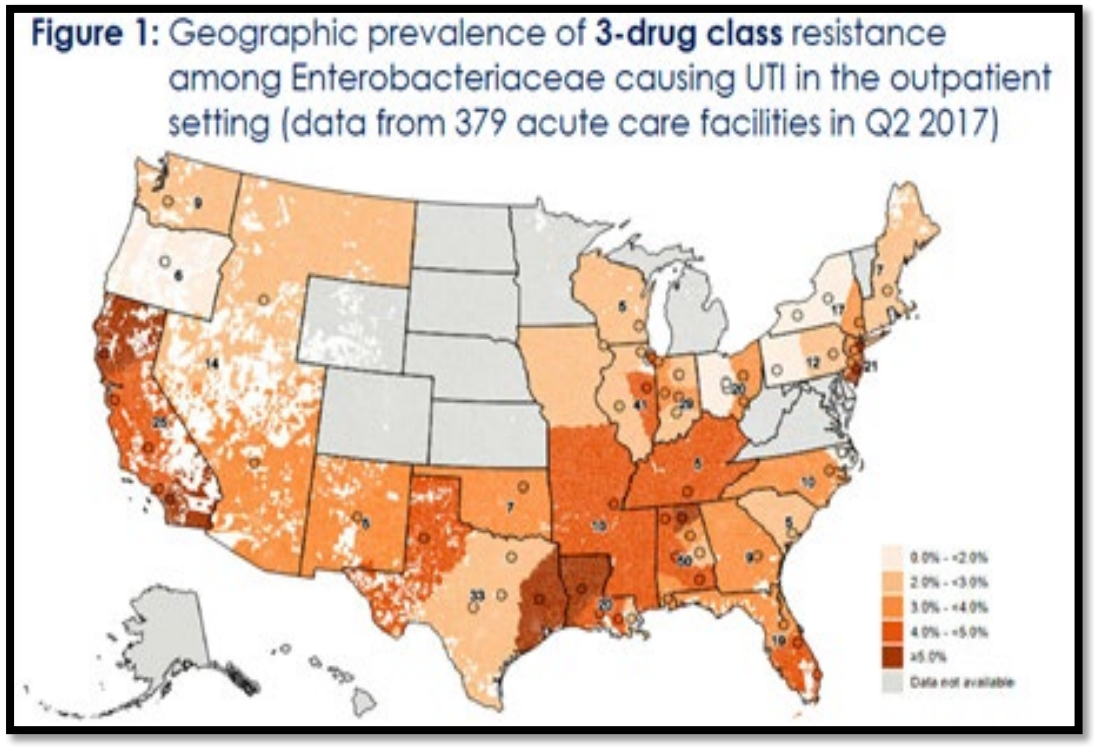
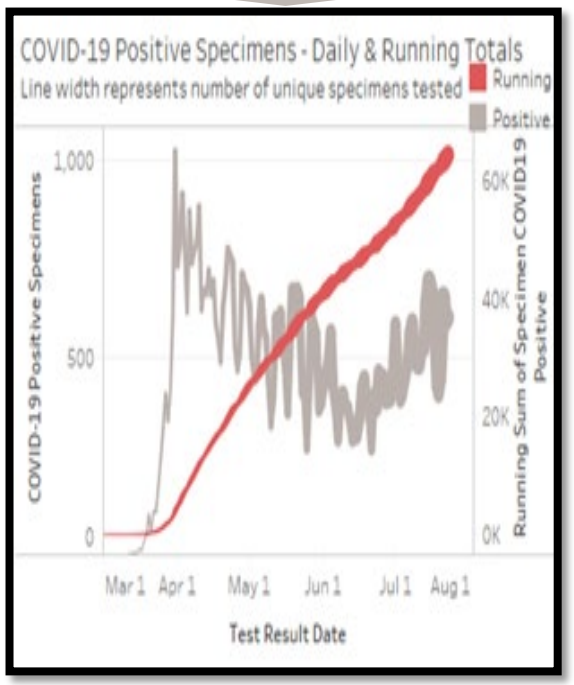
Diagnostics support surveillance, uncovering trends that can help inform clinician practice



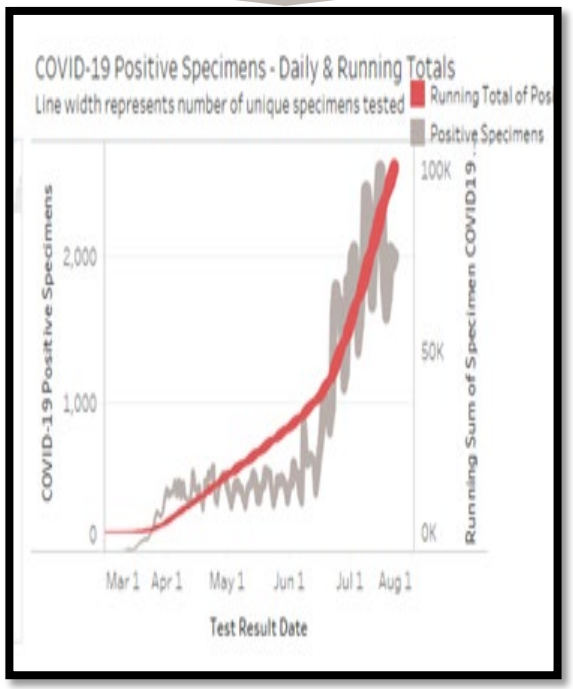
If there is 3-drug resistance, your options for treatment are limited*

"What has happened in the past?"

Overall decrease with later small increase**



Sudden steep increase



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
- **BD insights newsletter, https://www.bd.com/en-us/clinical-excellence/covid-19-insights-analytics/bd-insights-issue-2

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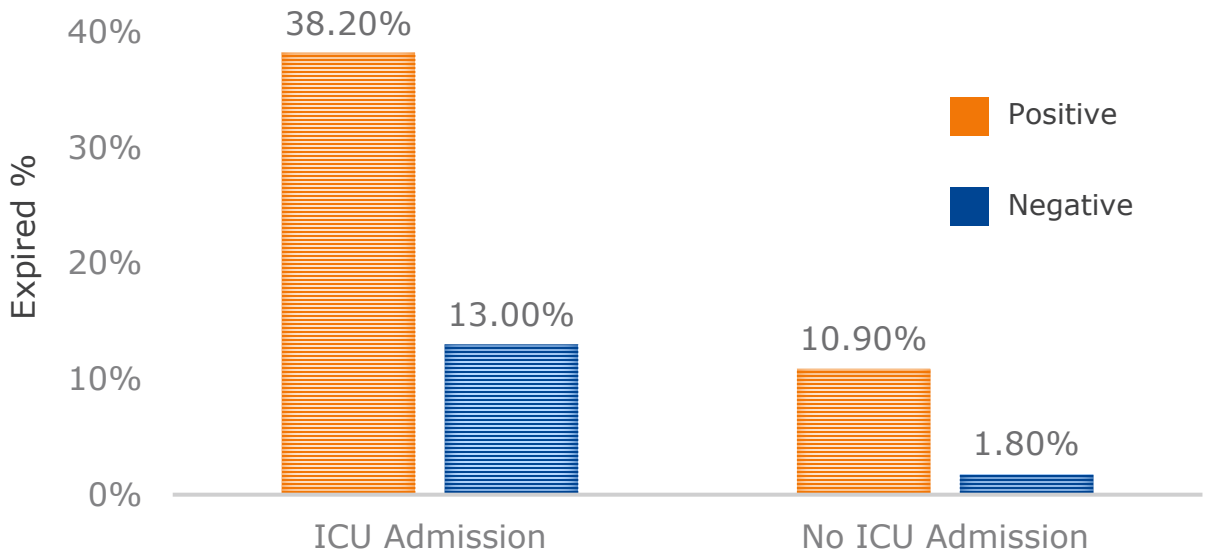
Insights on hospital Length of Stay (LOS) & Mortality

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**

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



*Source: BD insights Research & Analytics, https://www.bd.com/en-us/clinical-excellence/covid-19-insights-analytics
** "Hospitalization and Mortality among Black Patients and White Patients with Covid-19", Price-Haywood et. al, June 25, 2020, N Engl J Med 2020; 382:2534-2543. DOI: 10.1056/NEJMsa2011686

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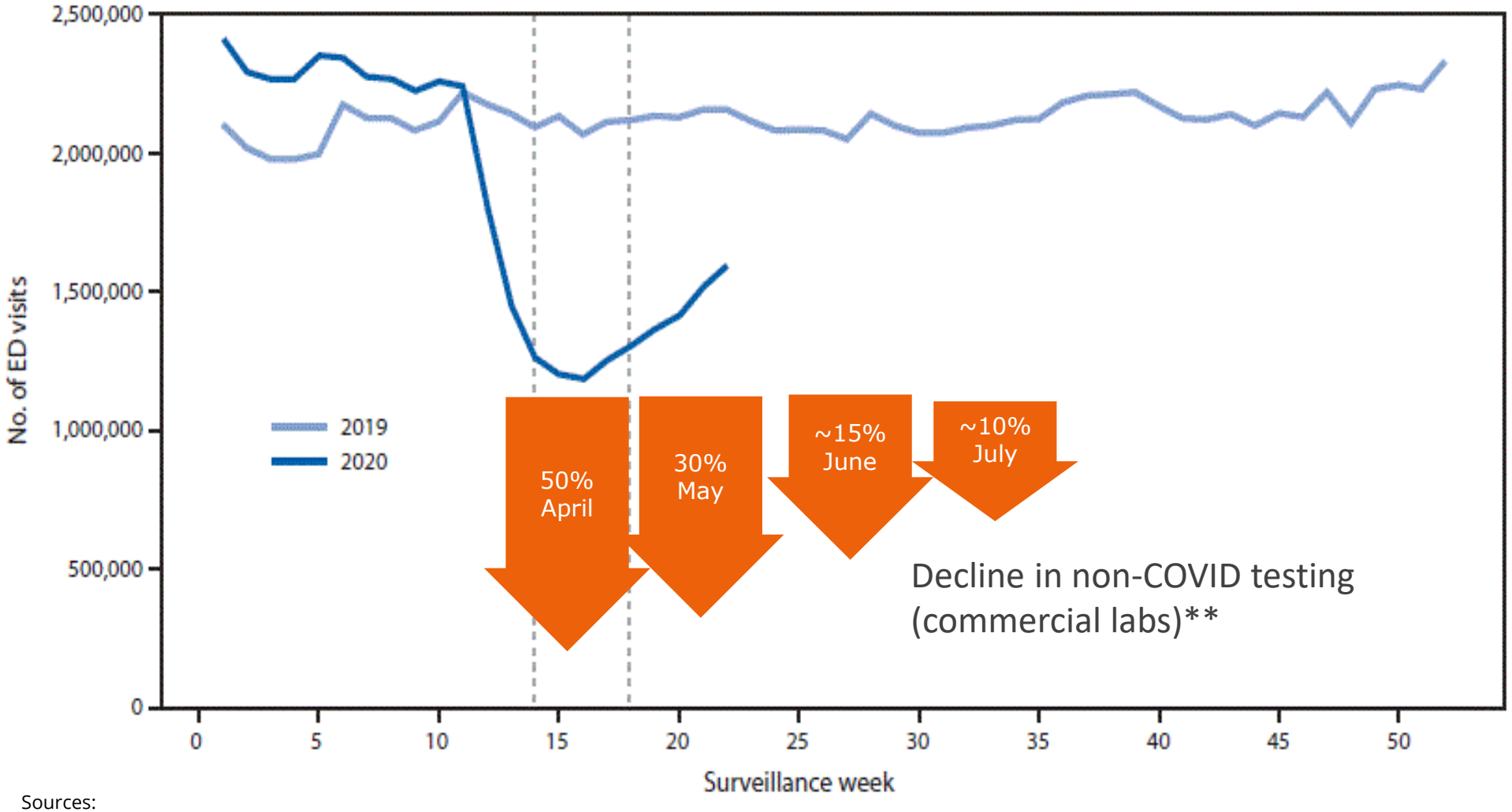
Decline in hospitalizations and ED visits* reflected in decreased utilization of non-COVID testing



Sources:

* CDC: Hartnett KP, Kite-Powell A, DeVies J, et al. Impact of the COVID-19 Pandemic on Emergency Department Visits — United States, January1, 2019–May 30, 2020. MMWR Morb Mortal Wkly Rep 2020;69:699–704. DOI: http://dx.doi.org/10.15585/mmwr.mm6923e1

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

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Diagnostics and stewardship: antibiotics use

	COVID+	COVID-
Length of Stay	8.7 days	5.1 days
% in ICU	24%	17%
Culture+	20.9%	21.4%
Antibiotic Use	68%	46%

- 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

Diagnostics enable clinician action

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

Category	SARS-CoV-2 + (n=17,075)	SARS-CoV-2 - (n=124,979)	Total SARS-CoV-2 Tested (n=142,054)
% Male	9,053 (53%)	58,114 (46%)	67,167(47%)
Age (mean (SD); median years)	61.7 ± 18.0 (63)	58.5 ± 20.9 (62)	58.9 ± 20.6 (62)
Overall LOS (mean (SD); median days)	8.7 ± 12.9 (6)	5.1 ± 9.0 (3)	5.5 ± 9.6 (3)
ICU Admissions, n (%)	4,034 (24%)	20,969 (17%)	25,003 (18%)
ICU LOS (mean (SD); median days)	7.9 ± 8.5 (5.0)	3.8 ± 6.2 (2.0)	4.5 ± 6.8 (2.2)
Admissions with culture positive	3487 (20.9%)	24539 (21.4%)	28026 (21.3%)
Admissions Prescribed Antimicrobials* (duration ≥ 24 hours; n (%))	11,681 (68%)	56,809 (46%)	68,490 (48%)
Culture Positive Hospital LOS (mean (SD); median days)	13.8 ± 16.1 (9)	8.3 ± 11.8 (5)	9.0 ± 12.6 (6)
Admission to Abx Start (mean (SD); median hours)	9.2 ± 51.9 (0)	9.9 ± 50.8 (0)	9.8 ± 51.0 (0)
3rd/4th Gen Cephalosporins	8,643 (74%)	33,750 (59%)	42,393 (62%)
Glycopeptides	3,630 (31%)	21,719 (38%)	25,349 (37%)
Macrolides	8,036 (69%)	16,264 (29%)	24,300 (35%)
β-lactam/β-lactamase inhibitors	3,175 (27%)	19,073 (34%)	22,248 (32%)
Fluoroquinolones	1,277 (11%)	9,689 (17%)	10,966 (16%)
1st/2nd Gen Cephalosporins	560 (5%)	8,705 (15%)	9,265 (14%)
Tetracyclines	2,386 (20%)	6,386 (11%)	8,772 (13%)
Carbapenems	1,083 (9%)	5,025 (9%)	6,108 (9%)
Antifungals	658 (6%)	4,229 (7%)	4,887 (7%)
Anti-influenza agents	933 (8%)	998 (2%)	1,931 (3%)
Top Abx Prescribed as a % of Discharges Prescribed an Abx*			

*EPIDEMIOLOGY OF ANTIMICROBIAL USE AMONG SARS-COV-2 POSITIVE AND NEGATIVE ADMISSIONS IN THE US: A MULTICENTER EVALUATION, ID week 2020

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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

Pathogen Type	SARS-COV-2 Positive	SARS-COV-2 Negative	Total
Total Pathogens*^	6,057	48,051	54,108
Culture Positive Hospital LOS (mean (SD); median)	13.8 ± 16.1 (9)	8.3 ± 11.8 (5)	9.0 ± 12.6 (6)
Culture Negative Hospital LOS (mean (SD); median)	7.5 ± 11.7 (5)	4.6 ± 8.4 (3)	4.9 ± 8.9 (3)
Gram-positive	1,832 (30.2%)	14,992 (31.2%)	16,824 (31.1%)
S. aureus	746 (40.7%)	6,710 (44.8%)	7,456
Enterococcus spp.	575 (31.4%)	4,024 (26.8%)	4,599
S. pneumoniae	99 (5.4%)	546 (3.6%)	645
Gram-negative	2,423 (40.0%)	18,421 (38.3%)	20,844 (38.5%)
Enterobacteriales	1,860 (76.8%)	14,128 (76.7%)	15,988
P. aeruginosa	**410 (16.9%)**	**2,481 (13.5%)**	2,891
A. baumannii spp.	27 (1.1%)	162 (0.9%)	189
Fungi/mold	**470 (7.8%)**	**2,378 (4.9%)**	2,848 (5.3%)
Candida spp.	365 (77.7%)	1,657 (69.7%)	2,022
Aspergillus spp.	6 (1.3%)	121 (5%)	127
Non-COVID-19 Virus	547 (9.0%)	5,421 (11.3%)	5,968 (11.0%)

*"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

**CDC 2019 Antibiotic Threats Report, https://www.cdc.gov/drugresistance/pdf/threats-report/2019-ar-threats-report-508.pdf

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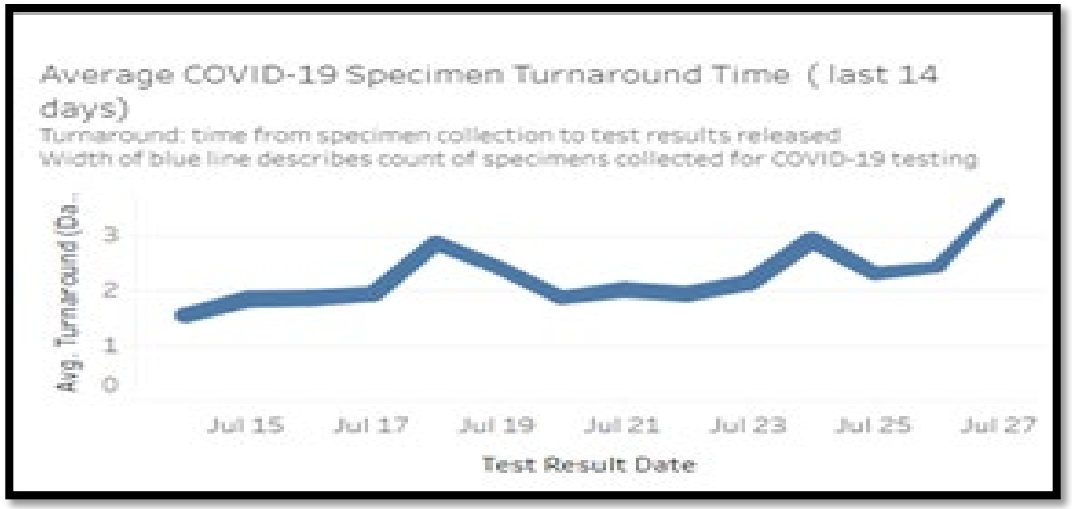
Diagnostics in a public health crisis: Every cold/flu season strains healthcare systems

TAT for SARS-CoV-2 Tests*:

Without flu

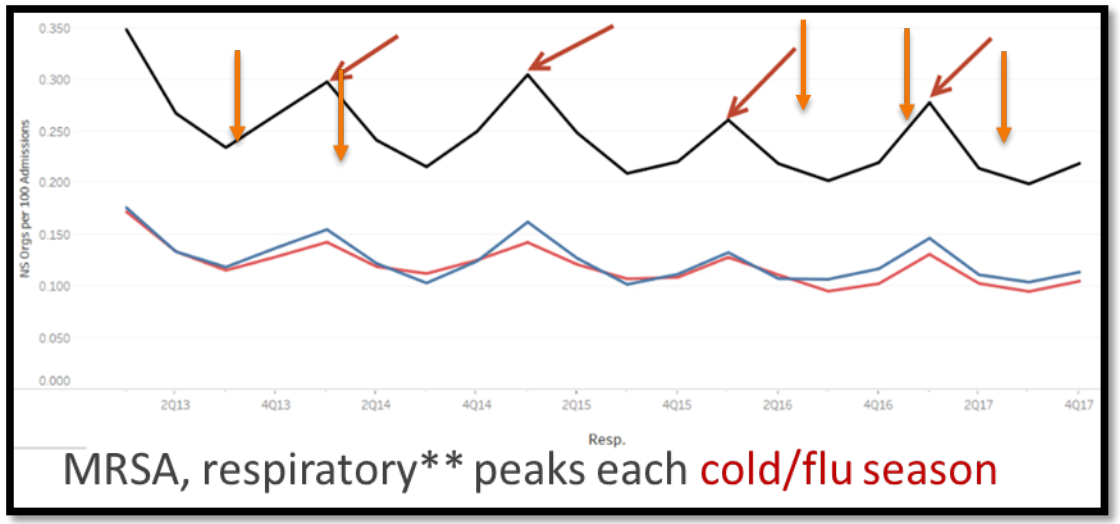
1.5 to 6 days

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



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?



MRSA, respiratory** peaks each cold/flu season

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

* Source: BD insights Research & Analytics, https://www.bd.com/en-us/clinical-excellence/covid-19-insights-analytics
**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

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.

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