Antimicrobial Stewardship Considerations during the COVID-19 Pandemic

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Disclosure

- I have no actual or potential conflicts of interest to disclose in relation to this presentation.

Objectives

1. Recognize antimicrobial stewardship strategies that can be applied during the COVID-19 pandemic response.
2. Describe the incidence and time course of bacterial co-infections in patients with COVID-19.
3. Explain antimicrobial stewardship interventions that should be performed for patients with COVID-19.

I. Antimicrobial Stewardship Strategies in COVID-19 Response

COVID-19 Adds to Antimicrobial Resistance

10 million deaths by 2050 = $100 trillion

- New infectious disease state
- Unnecessary antibiotics
- Healthcare-associated infections
- MDROs
- Fear
- Media

"Need for a strong antimicrobials **pipeline** has been further amplified by **the COVID-19 crisis**, highlighting the **urgent need** for increased public health preparedness."

Antimicrobials Working Group. Accessed August 5, 2021.
Getahun H, et al. *Bull World Health Organ.* 2020;98:442.

Pharmacy Challenges with COVID-19

Patient Surges

Medication Delivery

Old & New Medications

- Emergency Use Authorization
- Compassionate Use
- Off-label use

Drug Shortages

Nursing Coordination

Ethical Considerations

Solution: Antimicrobial Stewardship

- interventions to **improve** & **measure** the appropriate use of antibiotics by promoting the **optimal** antibiotic regimen including **dosing**, **duration**, & **route**

- Goals:
  - outcomes
  - resistance
  - side effects
  - costs

"precious non-renewable resource"

Barlam TF, et al. *Clin Infect Dis*. 2016;62:e51-e77.
Getahun H, et al. *Bull World Health Organ.* 2020;98:442.
The Society for Healthcare Epidemiology of America. Accessed August 5, 2021.

World Health Organization (WHO)

"address gaps in research to ensure that **antimicrobial stewardship** activities become an integral part of the pandemic response and beyond."

"**antimicrobial stewardship** activities should be integrated into the pandemic response across the broader health system."

Getahun H, et al. *Bull World Health Organ.* 2020;98:442.

CDC: 7 Core Elements of Antimicrobial Stewardship

1. Leadership Commitment	IT* support, resources
2. Accountability	reporting structure
3. Drug Expertise	drug shortages, formulary
4. Action	guideline, pre-authorization
5. Tracking	CDI^, broad-spectrum antibiotics
6. Reporting	inventory, antibiotic trends
7. Education	guidelines, resources

*IT= Information Technology
^CDI= *C. difficile* Infection

Barlam TF, et al. *Clin Infect Dis*. 2016;62:e51-e77.

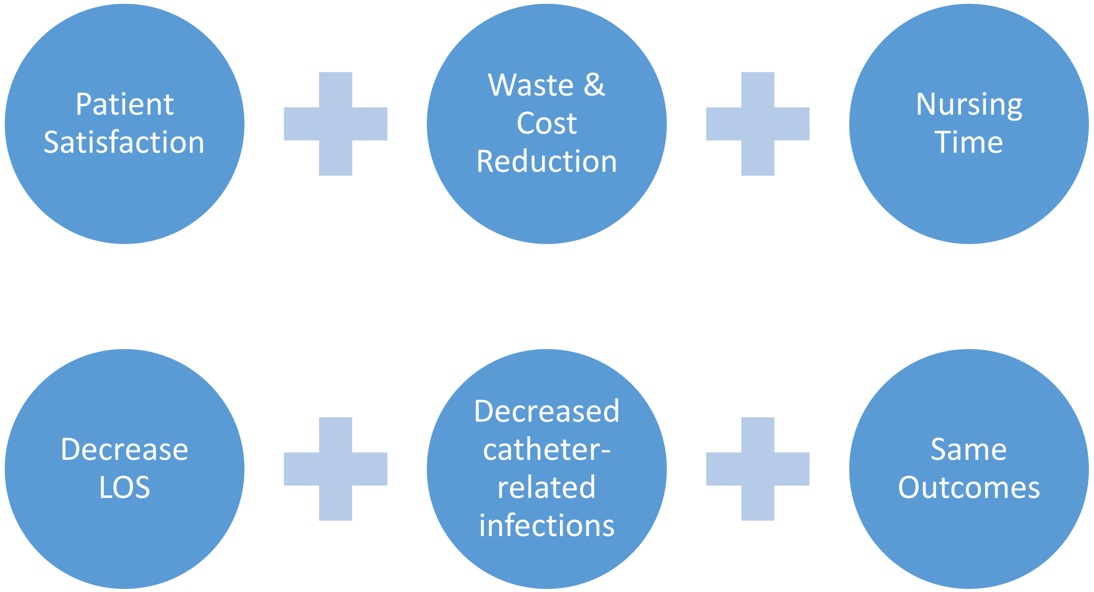
“Low Hanging Fruit” of Antimicrobial Stewardship

- IV to PO Conversion
- Medication Batching
- Therapeutic Substitutions
- Pre-authorization

among others…….

Goff DA, et al. *Clin Infect Dis*. 2012;55: 87-592.

IV to PO Conversion



Goff DA, et al. *Clin Infect Dis*. 2012;55: 87-592.

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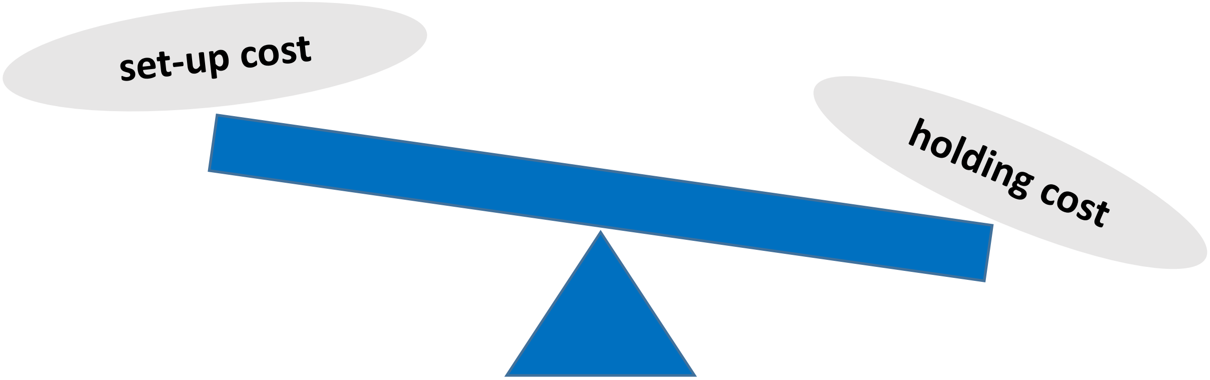
Medication Batching



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- Standard timing: preparation, administration
- ex. daptomycin batching --- 370 vials saved over 4 months ($83,991)

Goff DA, et al. *Clin Infect Dis*. 2012;55: 87-592.

Therapeutic Substitutions

PRE-COVID-19

Therapeutic Equivalence

- Statins
- Inhalers
- Antiretrovirals

COVID-19

Long Acting Agents

- Metoprolol succinate
- Ertapenem

Less Monitoring

- Enoxaparin
- Daptomycin

Consolidate dosing schedules!

Goff DA, et al. *Clin Infect Dis*. 2012;55: 87-592.
Earl G, et al. *Remington*. 2020;50:849-876.

Pre-authorization

Pre-authorization → Medication Order

High cost	fidaxomicin	baricitinib
Short supply	acyclovir	remdesivir
Limited data	cefiderocol	EUA drugs
Toxicity	foscarnet	hydroxychloroquine

Predominantly drug-driven

Goff DA, et al. *Clin Infect Dis*. 2012;55: 87-592.

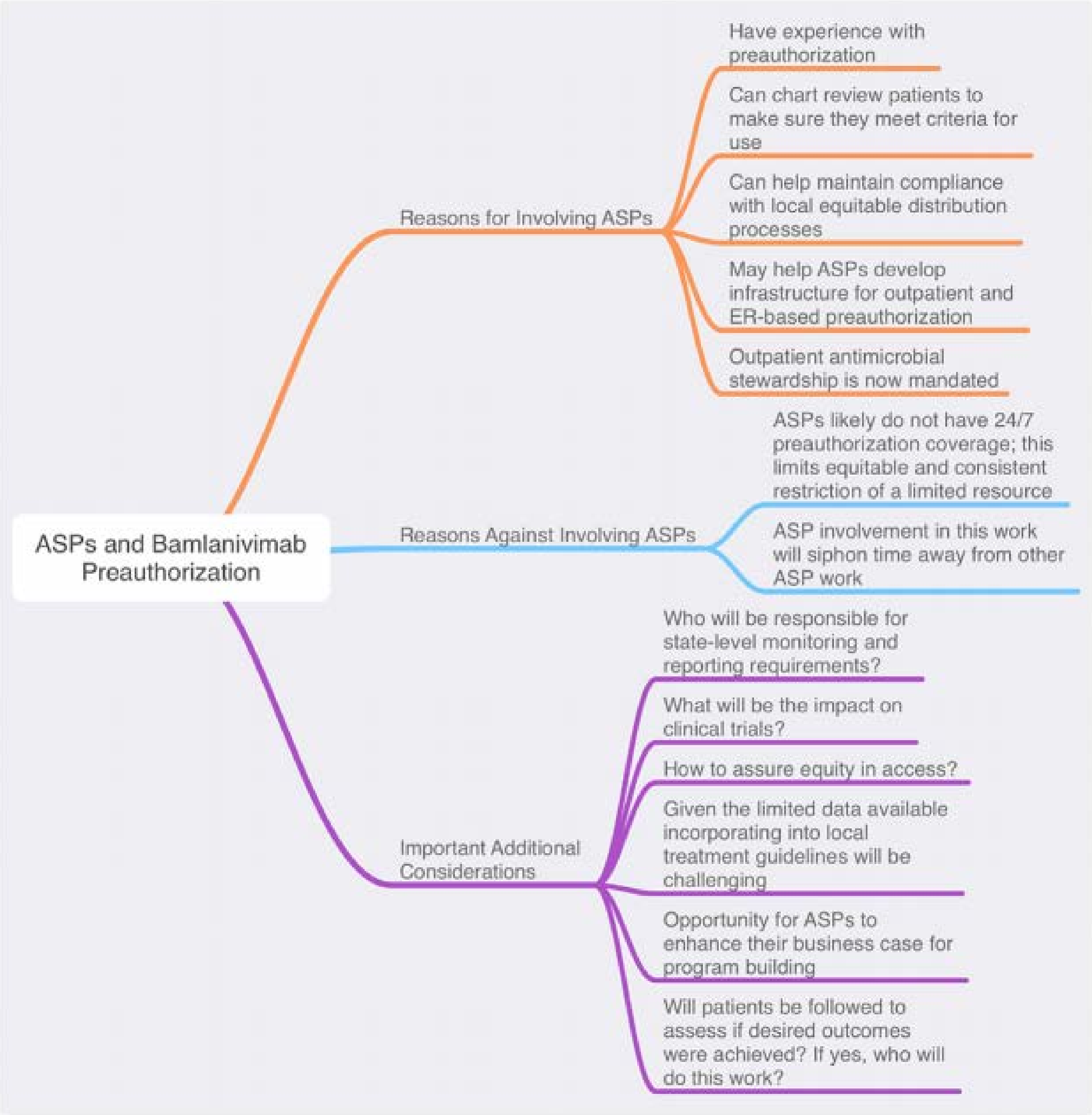


Image used with permission by: Patel PK, et al. *Infect Control Hosp Epidemiol. 2020*:1-3.

Prospective Audit & Feedback (PAF)

Medication Order

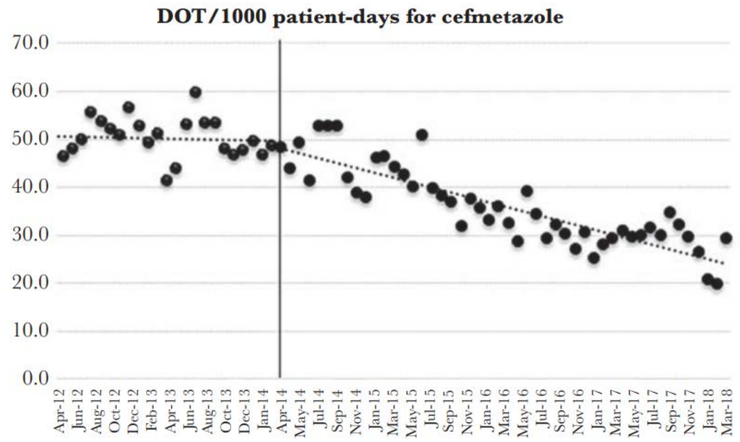
PAF

More customizable targets

- Disease state
- Lab result
- Drug

Image removed due to copyright. Please refer to:

Liew YX, et al. *Int J Antimicrob Agents. 2015;*45:168-173.
https://www.sciencedirect.com/science/article/abs/pii/S0924857914003537?via%3Dihub



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Honda H, et al. *Open Forum Infect Dis. 2018;5:*ofy314.

Forrest GN, et al. *Clin Infect Dis. 2014;*59:S122-S133.

PAF with IT Support

Table 1. Antimicrobial Stewardship COVID-19 Rule Logic

Name	Criteria	Display
ASP COVID-19 rule 1: negative SARS-COV-2 PCR w/ active drug order (inpatients only)	• IF negative COVID-19 PCR in last 7 days **AND** • IF active order for 1 of the following: • Chloroquine • Darunavir/ritonavir • Hydroxychloroquine • Lopinavir/ritonavir • Nitazoxanide • Remdesivir • Ribavirin • Sarilumab • Tocilizumab • Lenzilumab • IVIg • THEN fire alert	**Rule Text** • Rule name • COVID-19 medication that triggered flag • SARS-COV-2 test result, date, and time
ASP COVID-19 rule 2: positive SARS-COV-2 PCR or pending lab w/ active drug order (inpatients only)	• IF positive COVID-19 PCR in last 7 days **OR** • IF pending COVID-19 PCR in last 7 days **AND** • IF active order for 1 of the following: • Chloroquine • Darunavir/ritonavir • Hydroxychloroquine • Lopinavir/ritonavir • Nitazoxanide • Remdesivir • Ribavirin • Sarilumab • Tocilizumab • Lenzilumab • IVIg • THEN fire alert	**Rule Text** • Rule name • COVID-19 medication that triggered flag • SARS-COV-2 test result, date, and time

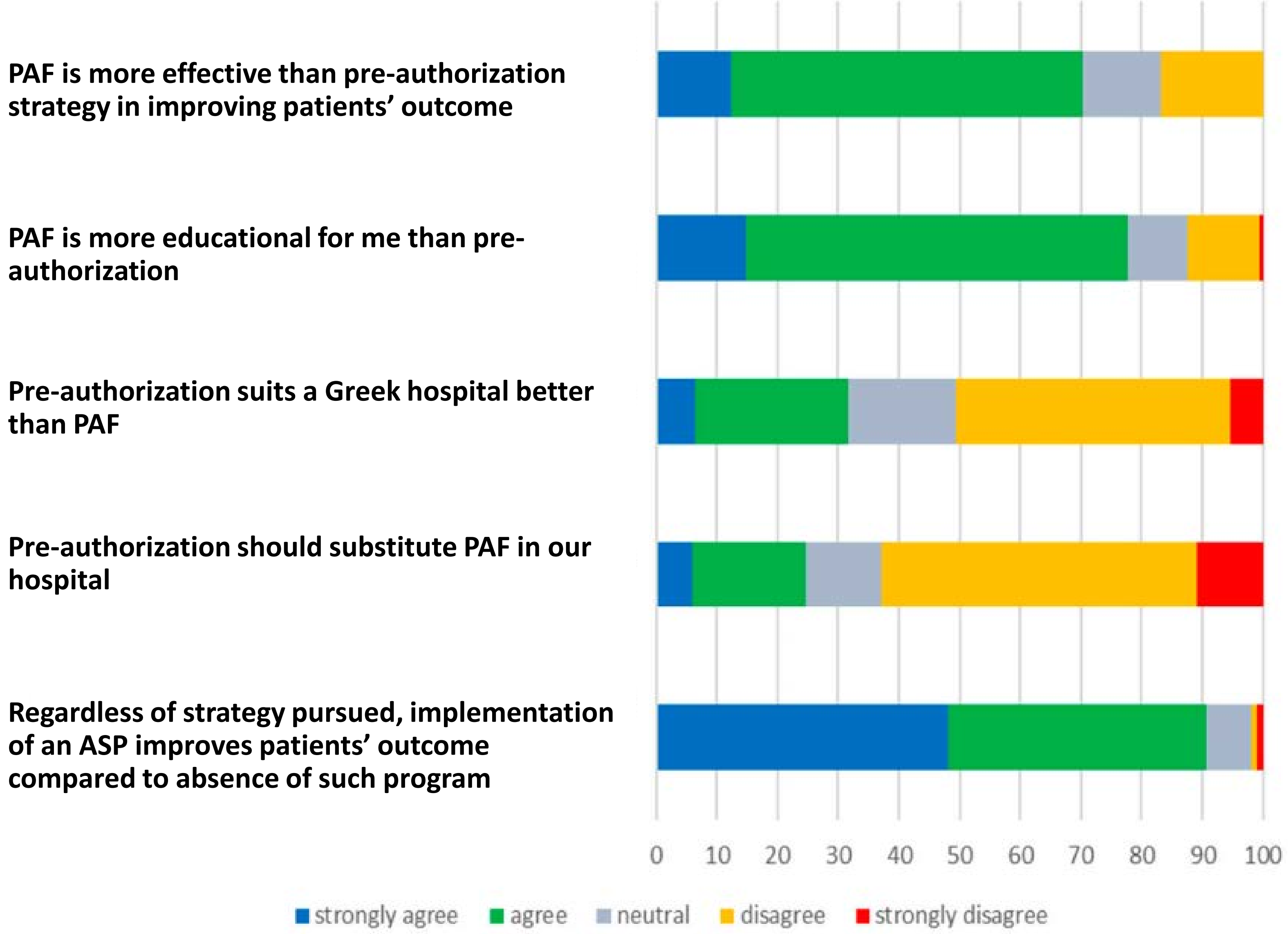
Image used with permission by: Stevens RW, et al. *Infect Control Hosp Epidemiol*. 2020;41:1108-1110.

Mazdeyasna H, et al. *Curr Infect Dis Rep. 2020;*22:1-6.

Combination of Strategies

- AM: review remdesivir report
- Identify toxicities, discharges, other discontinuations
- 1600: all remdesivir compounding
- Less waste, more usable drug for patients
- Change co-infected patients to ceftriaxone, daptomycin, etc. when applicable
- Nurse can enter room and hang remdesivir with antibiotic once daily

Physician Perspectives on Strategies by Stewardship Program Implemented During COVID-19



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	Pre-authorization	PAF
Advantages	• Initiation/empiric therapy • Direct control • Quick mechanism	• Definitive therapy • Prescriber autonomy → relationships • Hindsight/more data • Flexible
Disadvantages	• Resources: around the clock? • Limited lasting effects • Durations	• Resources: IT vs. computer surveillance • Compliance voluntary • Starting from behind

Adapted from: Goff DA, et al. *Clin Infect Dis*. 2012;55: 87-592.

Antibiotic "Time-Outs"

- Through prospective audit & feedback or electronic alerts

Image removed due to copyright. Refer to:

Wolfe JR, et al. *Infect Control Hosp Epidemiol. 2019;*40:1287-1289.
https://www.cambridge.org/core/journals/infection-control-and-hospital-epidemiology/article/impact-of-an-automated-antibiotic-timeout-alert-on-the-deescalation-of-broadspectrum-antibiotics-at-a-large-community-teaching-hospital/4CA0D7799D84CFF5D15C3EBE8F599392#

Education

- Use in combination
- High frequency
- Multi-disciplinary
- Promote guidelines, workflows

Weak recommendation, low quality evidence

Barlam TF, et al. *Clin Infect Dis*. 2016;62:e51-e77.

Which of the following drugs would be most appropriate for management via pre-authorization?

A. COVID-19 vaccine
B. IV tocilizumab
C. PO dexamethasone
D. IV ondansetron

Summary

Image removed from handout due to copyright. Refer to:

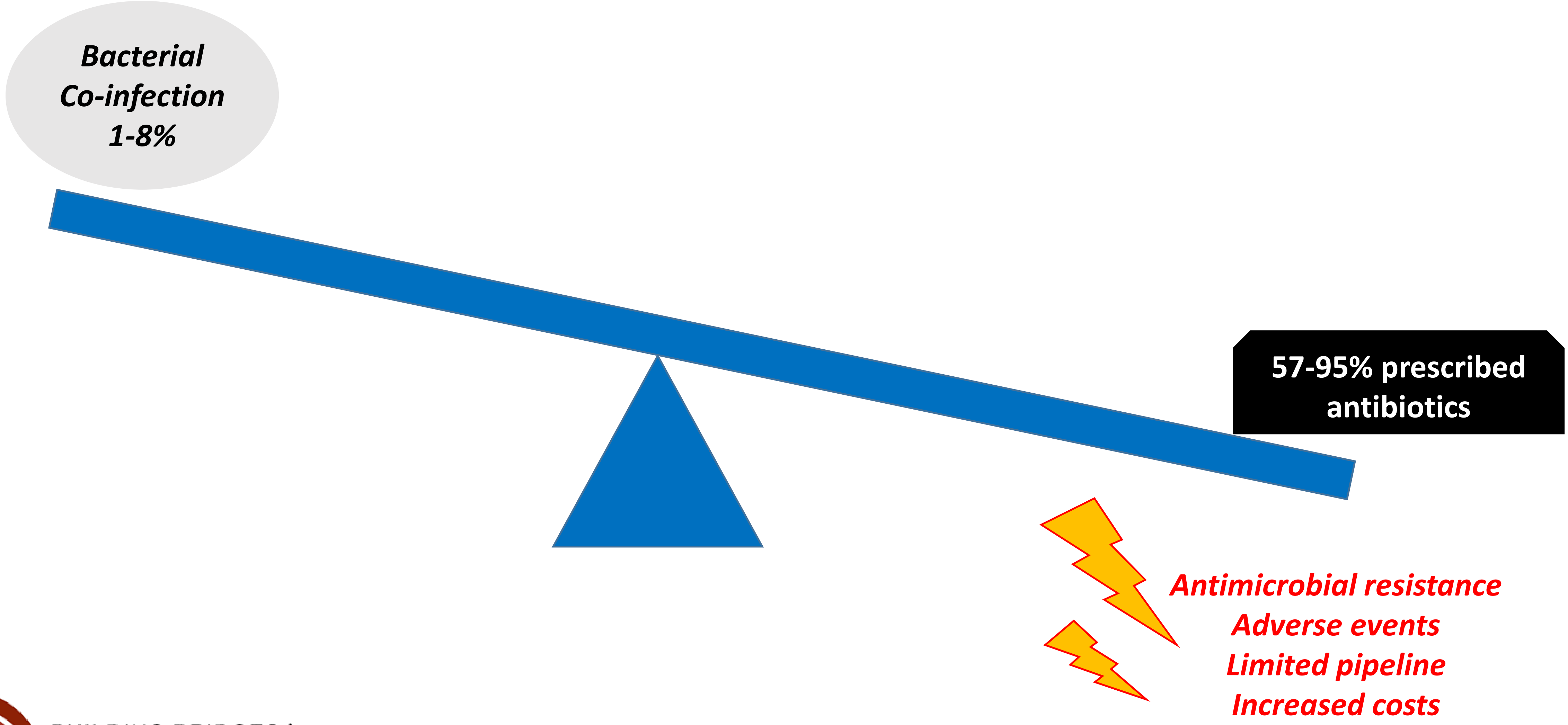
Moehring RW, et al. *Current Infect Dis Rep.* 2012;14:592-600. https://link.springer.com/content/pdf/10.1007/s11908-012-0289-x.pdf

II. Bacterial Co-infection in COVID-19

Co-infection Considerations

- Frequency of empiric antimicrobials
- Incidence
- Primary co-infection vs. secondary infection
  - Risk factors
  - Common pathogens
- Diagnostic criteria

Balance Needed



Martin AJ, et al. *J Pharm Pract.* 2021: online preprint.

International “Snapshot” of Antibiotic Use 2020

166 prescribers (50% ID)
23 countries

29% do not routinely prescribe antibiotics

Reason for antibiotics

-clinical presentation
-inflammatory markers
-radiology findings
*piperacillin/tazobactam most common

Coverage

-atypical
-*S. aureus*
-*Pseudomonas*

Mean duration (days)

All countries: 7.12

Guidelines for antibiotics in COVID-19: ~62%

Beović B, et al. *J Antimicrob Chemother.* 2020;75:3386-3390.

Co-infection in Familiar Viruses

	Influenza	SARS/MERS-CoV
Most Common Bacterial Respiratory Pathogens	1. *S. pneumoniae* 2. *S. aureus* 3. *H. influenzae* 4. *S. pyogenes*	Primary: atypical/community-acquired pneumonia (CAP) organisms Secondary: nosocomial pathogens
Bacterial Co-infection	~20%	~10-30% co-infection
Outcomes	↑ morbidity & mortality	Higher levels of care
Co-infection Guideline Recommendations	Community-acquired Pneumonia (CAP): administer antibiotics to adults with clinical and radiographically diagnosed CAP who test positive for influenza (strong recommendation, low quality of evidence)	n/a WHO refers to national guidelines for antibiotic management

Joseph C, et al. *Influenza Other Respir Viruses.* 2013;7:105-113.
Klein EY, et al. *Influenza Other Respir Viruses.* 2016;10:394-403.
Langford BJ, et al. *Clin Microbiol Infect.* 2020;26:1622-1629.
Metlay JP, et al. *Am J Respir Crit Care Med*. 2019;200:e45-e67.
Saad M, et al. *Int J Infect Dis.* 2014;29:301-306.

Limitations on Co-infection Reporting

- COVID-19: largely early 2020 data
- Difficult to group or compare reports
- Differing definitions
  - ex. community-acquired, co-infection
  - timing
- Inconsistent diagnostics

Challenges Specific to Bacterial Pneumonia in COVID-19

- COVID-19 similarities to bacterial pneumonia
- Colonization
- Low pathogen yield, often empiric
- Abnormal inflammatory markers in COVID-19 (ex. CRP)
- Limited procedures/testing, staffing

Under- vs. over-reported?

Feldman C, et al. *Pneumonia.* 2021;13:1-15.
Lansbury L, et al. *J Infect*. 2020;81:266-275.
Musher DM. *Am J Respir Crit Care Med.* 2021; online preprint.
Rawson TM, et al. *Clin Infect Dis.* 2020;71:2459-2468.

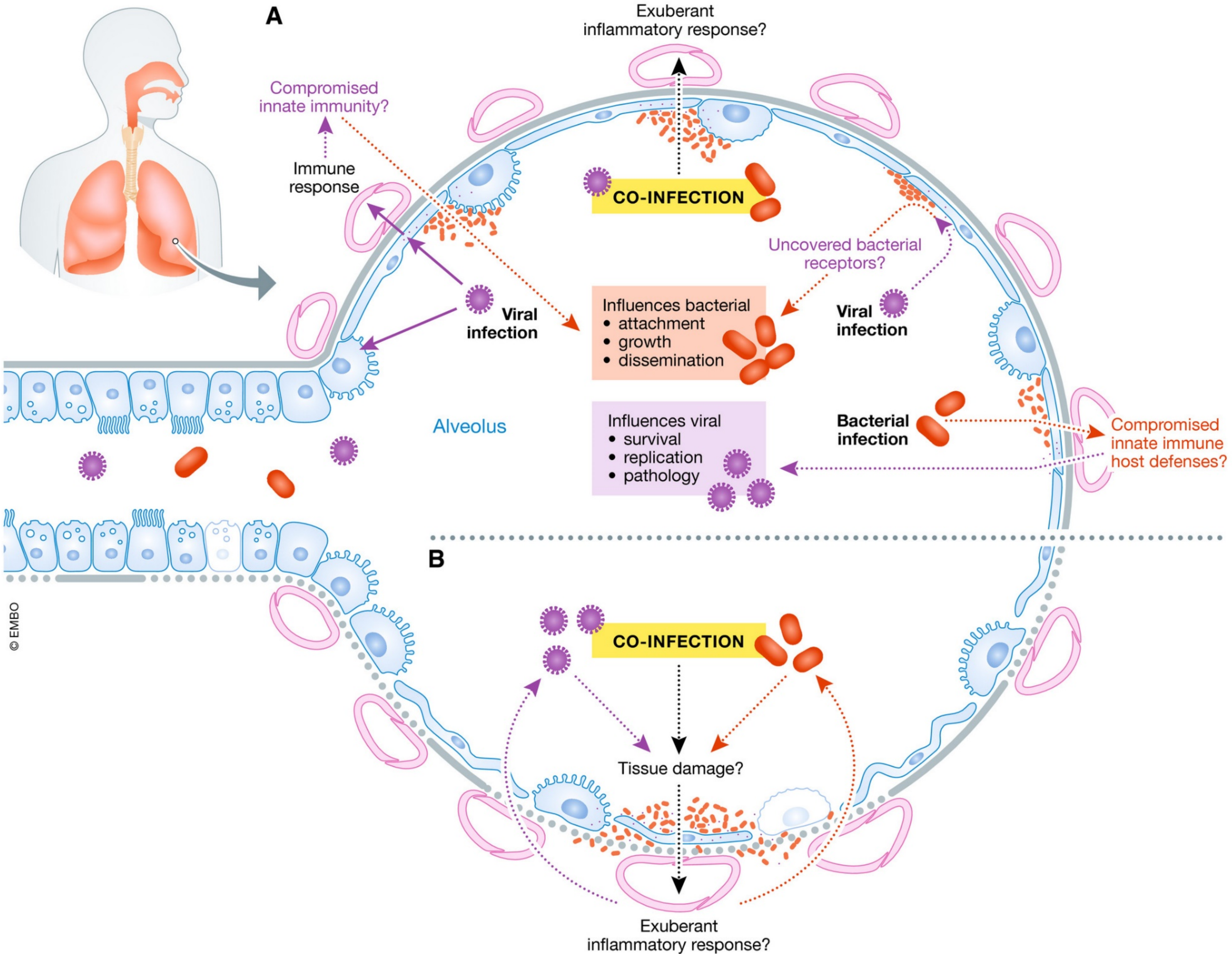


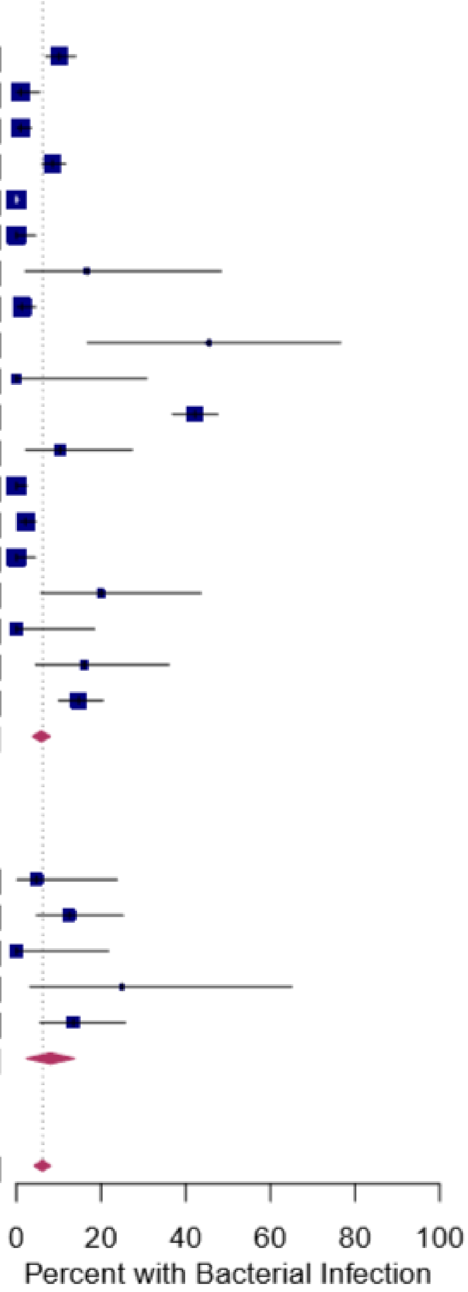
Image used with permission by: Bengoechea JA, et al. *EMBO Mol Med*. 2020;12:e12560.

Pooled Analyses of Co-infection

	Rawson (May 2020)	Langford (July 2020)
Methods	Review of 9 studies • 806 patients	Meta analysis of 24 studies • 3,338 patients
Co-infection	8%	6.9% • 3.5% co-infection • 14.3% secondary infection
Empiric Antibiotics	72%	71.8%
Pathogens Identified	*Limited:* *few atypical pathogens*	*Limited: pathogen data from 14% of patients* *Most common: Mycoplasma species, H. influenzae, & P. aeruginosa*
WARNING	*Co-infection may be misrepresented*	

Langford BJ, et al. *Clin Microbiol Infect*. 2020;26:1622-1629.
Rawson TM, et al. *Clin Infect Dis*. 2020;71:2459-2468.

Study	Patients	% Infected	95% C.I.
Severity = All Patients			
Cai Q, 2020	298	10.1	[6.9; 14.1]
Chen N, 2020	99	1.0	[0.0; 5.5]
Chen T, 2020	203	1.0	[0.1; 3.5]
Feng Y, 2020	410	8.5	[6.0; 11.7]
Lian J, 2020	788	0.0	[0.0; 0.5]
Liu W, 2020	78	0.0	[0.0; 4.6]
Liu Y, 2020	12	16.7	[2.1; 48.4]
Mo P, 2020	155	1.3	[0.2; 4.6]
Pongpirul W, 2020	11	45.5	[16.7; 76.6]
Tan Y, 2020	10	0.0	[0.0; 30.8]
Wang L, 2020	339	42.2	[36.9; 47.6]
Wang Z, 2020	29	10.3	[2.2; 27.4]
Wu C, 2020	148	0.0	[0.0; 2.5]
Wu J, 2020	280	2.1	[0.8; 4.6]
Wu J, 2020	80	0.0	[0.0; 4.5]
Xia W, 2020	20	20.0	[5.7; 43.7]
Young B, 2020	18	0.0	[0.0; 18.5]
Zheng F, 2020	25	16.0	[4.5; 36.1]
Zhou F, 2020	191	14.7	[10.0; 20.5]
Percent with Bacterial Infection		5.9	[3.8; 8.0]
Heterogeneity: $I^2 = 95\%$, $\tau^2 = 0.0014$, $\chi^2_{18} = 383.26$ ($p < 0.01$)			
Severity = Critically Ill Only			
Arentz M, 2020	21	4.8	[0.1; 23.8]
Barrasa H, 2020	48	12.5	[4.7; 25.2]
Bhatraju P, 2020	15	0.0	[0.0; 21.8]
Ling L, 2020	8	25.0	[3.2; 65.1]
Yang X, 2020	52	13.5	[5.6; 25.8]
Percent with Bacterial Infection		8.1	[2.3; 13.8]
Heterogeneity: $I^2 = 45\%$, $\tau^2 = 0.0014$, $\chi^2_{4} = 7.3$ ($p = 0.12$)			
Percent with Bacterial Infection		**6.1**	**[4.2; 8.1]**
Heterogeneity: $I^2 = 94\%$, $\tau^2 = 0.0014$, $\chi^2_{23} = 401.39$ ($p < 0.01$)			
Residual heterogeneity: $I^2 = 94\%$, $\chi^2_{22} = 390.57$ ($p < 0.01$)			



36 European ICUs

568 SARS-CoV-2

482 influenza

Antibiotics on ICU admission ~89%

1°

10% bacterial identification

34% bacterial identification

OR 0.21 (95% CI 0.15 to 0.33)
Adj OR 0.23 (95% CI 0.16 to 0.33)

2°

58% GPC
11% *Pseudomonas*
9% *H. influenzae*

Mostly
S. aureus &
S. pneumoniae

72% GPC
6% *Pseudomonas*
11% *H. influenzae*

28-day mortality vs. no bacteria
16% (95% CI 2.2 to 29.7)

28-day mortality vs. no bacteria
2.5% (95% CI -6.1 to 11)

Adapted from: Rouze A, et al. *Am J Respir Criti Care Med.* 2021; online preprint.

Early Antibiotics in Critically Ill COVID-19 Patients

Outcome (n= 48)	Antibiotics (n= 19)	No Antibiotics (n= 29)	
mortality	5 (26%)	7 (24%)	p=0.86
VAP	14 (74%)	19 (66%)	p=0.55
CRBSI	5 (26%)	7 (24%)	p=0.86
UTI	2 (11%)	8 (28%)	p=0.28

50% steroids in ICU
10% tocilizumab

Buetti N, et al. *J Infect*. 2020;81:e148–e149.

Risk Factors for Co-infection

	Incidence of Co-infection	Community-acquired Risk Factors	Hospital-associated Risk Factors
Petty LA, et al.	6.4% (141/2,205) • 3% community-acquired • 3.4% hospital-associated	• Day 1 admission to ICU • Admission from LTCF	• Median 8 days • Fever • Higher respiratory support
Vaughn VM, et al.	3.5% (59/1,705)	• Older age • Lower BMI • Mod-severe kidney disease • SNF • ICU admission • Leukocytosis	n/a
Conclusion	Consistent at <10%	Hold antibiotics at admission for non-ICU patients	Signs & symptoms of bacterial infection, timing

Petty LA, et al. *Infect Control Hosp Epidemiol*. 2021;1-10. Online preprint.
Vaughn VM, et al. *Clin Infect Dis*. 2021;72:e533-e541.

USA: Primary Co-infection at Admission

- 1,016 patients; 5 Johns Hopkins hospitals

Type of Co-infection	# of Patients (%)
Viral/atypical respiratory infection	2 (0.2)
Bacterial respiratory infection	
By any definition	497 (49)
Proven	1
Probable	11
Possible	483
Fungal Infection	
Fungal respiratory infection	0
Endemic mycoses	0
Bloodstream infection	20 (2)
Urinary tract infection	30 (3)
Clostridioides difficile colitis	2 (0.2)

71% received antibiotics

0.3% proven infection

1.1% probable infection

Proven/probable/possible bCAP more likely admitted to ICU vs. no co-infection (33% vs. 16% vs. 7%; P< .01)

Adapted from: Karaba SM, et al. *Open Forum Infect Dis*. 2021;8:ofaa578.

Bacterial Pneumonia Management Remains the Same

CAP
Duration:
5 days

HAP/VAP
Duration:
7 days

Obtain cultures!
De-escalate!
Discontinue!

Other Uncommon Co-infecting Pathogens

- Viral
  - Enterovirus/Rhinovirus
  - Influenza less common
  - Risk factor: older age

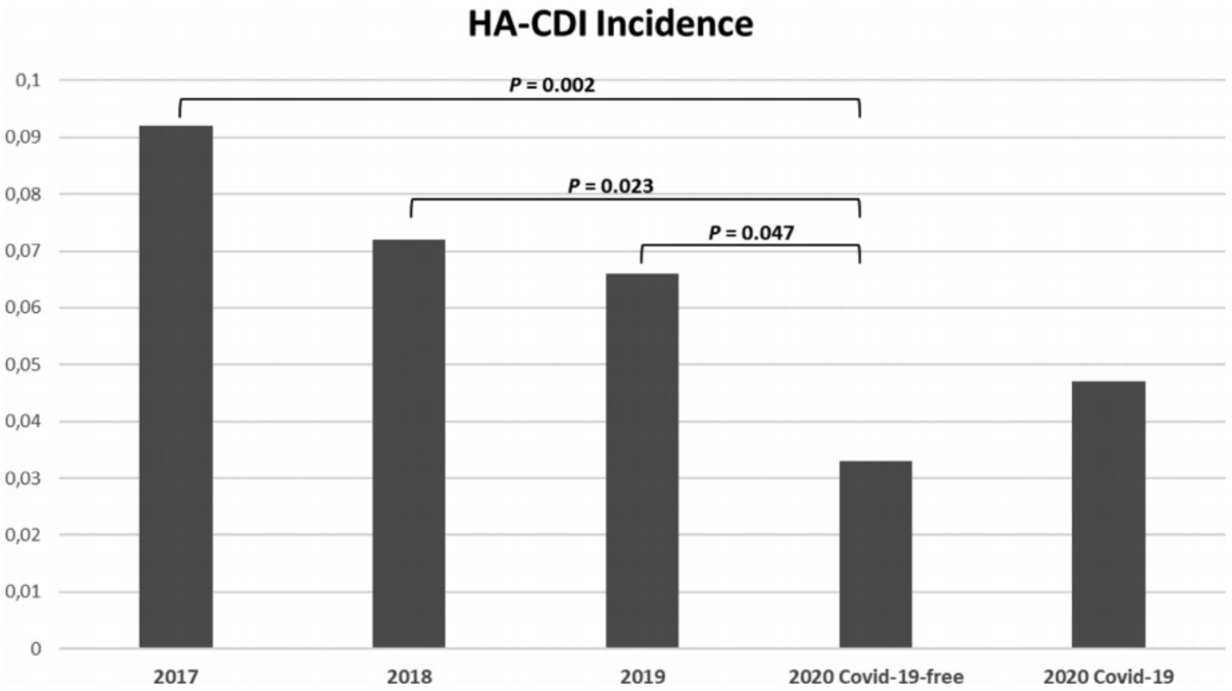
- Fungal
  - COVID-19-associated pulmonary aspergillosis (CAPA)
  - Candidiasis
  - Risk Factors: immunosuppression, corticosteroids

Fekkar A, et al. *Am J Resp Crit.* 2021;203:307-317.
Xi C, et al. *Appl Microbiol Biotechnol.* 2020;104:7777-7785.

Other Pathogens: *Clostridioides difficile* Infections (CDI)

- Incidence lower than pre-COVID-19:
  - Infection control techniques
  - Less surgeries

- Unknowns:
  - Healthcare vs. community-acquired
  - Antibiotics vs. no antibiotics



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Hazel K, et al. *Infect Control Hosp Epidemiol.* 2021:1-2. Online preprint.
Luo Y, et al. *Infect Control Hosp Epidemiol.* 2020:1-2. Online preprint.

Secondary Infection

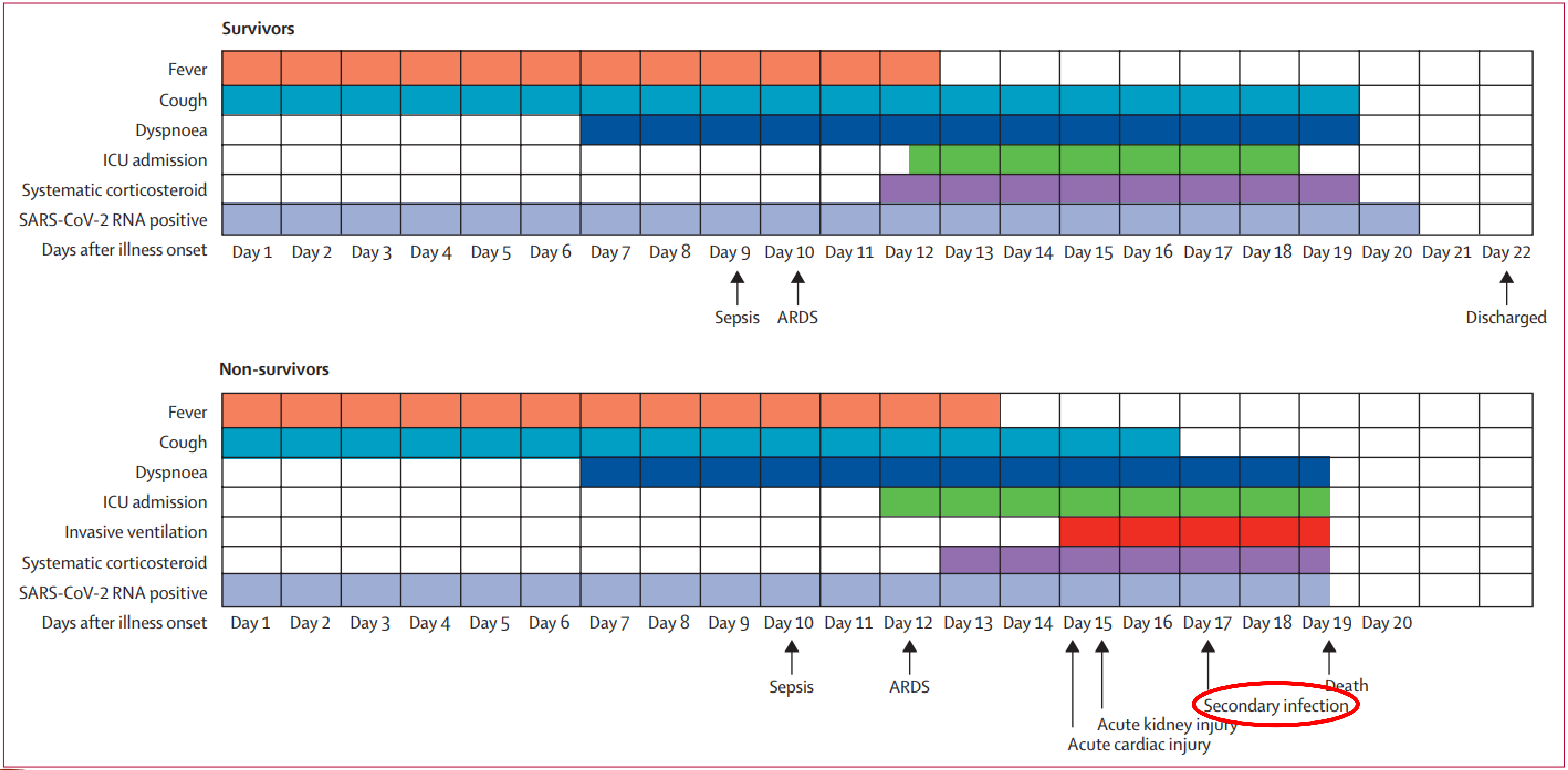


Image used with permission by: Zhou F, et al. *Lancet*. 2020;395:1054–1062.

Bacterial Co-infection Clues in Pneumonia

Respiratory Setting Trends	• Nursing • Respiratory therapy
Sputum Gram stains	• ↑ sensitivity, specificity • # bacteria/organisms • Microbiology lab!
Primary vs. Secondary Infections	• ex. day of hospitalization • central line, Foley catheter • antibiogram

Musher DM. *Am J Respir Crit Care Med.* 2021; online preprint.

Procalcitonin (PCT) in COVID-19

- Critically ill COVID-19 patients?
- Vaughn, et al: community-onset bacterial co-infection

PCT >0.5ng/mL	PCT ≤0.1ng/mL
Positive predictive value 9.3%	Negative predictive value 98.3%

- Crotty, et al: bacterial respiratory co-infection

PCT >0.25ng/mL	PCT >0.5ng/mL
Sensitivity 73.9% Specificity 65.2%	Sensitivity 43.5% Specificity 81.3%,

- Possible role in antibiotic discontinuation and secondary infections

Crotty MP, et al. *medRxiv*. 2020: online preprint.
Vaughn VM, et al. *Clin Infect Dis*. 2021;72:e533-e541.

TA is a 48 yo F with a PMH of anxiety and hyperlipidemia who presented to the ED last night with SOB, cough, anosmia, and muscle aches. Her O2 saturations were 90% on room air and she was started on 2L nasal cannula. Upon admission to the general medicine floor, she was started on remdesivir and dexamethasone. Overnight she spiked a fever to 101^{o}F and the covering physician ordered a one time dose of piperacillin/tazobactam.

- WBC 5.9 K/uL
- Procalcitonin 0.1 mcg/L
- Serum creatinine: 0.8 mg/dL

- Chest X-ray: mild patchy perihilar & peripheral airspace opacities
- Microbiology: blood cultures pending

Which of the following statements is most appropriate for the pharmacist to discuss with the ordering provider?

A. Patient is at risk of a secondary nosocomial infection so meropenem should be started ASAP.

B. The likelihood of bacterial co-infection is low so consider monitoring off antibiotics.

C. Procalcitonin is < 0.5 mcg/L so order piperacillin/tazobactam for 6 more days to treat bacterial pneumonia co-infection.

D. Add vancomycin to piperacillin/tazobactam to cover for resistant *S. pneumoniae*.

Guideline Recommendations

COIVD-19 Guideline	Recommendation
Surviving Sepsis, March 2020	Empiric antimicrobials over no antimicrobials in mechanically ventilated patients with
WHO, Jan 2021	Severe: clinical judgement for antibiotics, attempt de-escalation daily
NIH, April 2021	“antimicrobial stewardship is critical”
NICE	Antibiotics for suspected bacterial infection but know risks and de-escalate rapidly
IDSA, June 2021	Review of controversy in literature
IDSA Real Time Learning Network	Pre-existing antimicrobial stewardship infrastructures for guidelines

Alhazzani W, et al. *Intensive Care Med.* 2020;46:854-887.
World Health Organization. Accessed August 10, 2021.
National Institutes of Health. Accessed August 10, 2021.
National Institute for Health and Care Excellence. Accessed August 10, 2021.
Bhimraj A, et al. Infectious Diseases Society of America 2021; Version 4.4.1.
COVID-19 Real-Time Learning Network. Accessed August 10, 2021.

COVID-19 vs. Influenza

	COVID-19	vs. Flu
Most Common Bacterial Respiratory Pathogens	*?* *CAP organisms* *S. aureus*	=
Bacterial Co-infection	1-10%	↓
Outcomes	↑ mortality	=
Co-infection Guideline Recommendations	n/a Weak, brief summaries across multiple guidelines	↓

Co-infection Summary

- Low incidence of bacterial co-infection in COVID-19
- Distinction between co-infection and secondary infection
- Inconsistencies in reporting
- Pharmacists play an important role

III. Other Longitudinal Interventions to Enhance Care of Patients with COVID-19


Medication use evaluation
Medication safety initiative
Drug shortage strategy
Tracking
Cost savings initiative
Research or quality project
Formulary decision

Tracking & Reporting

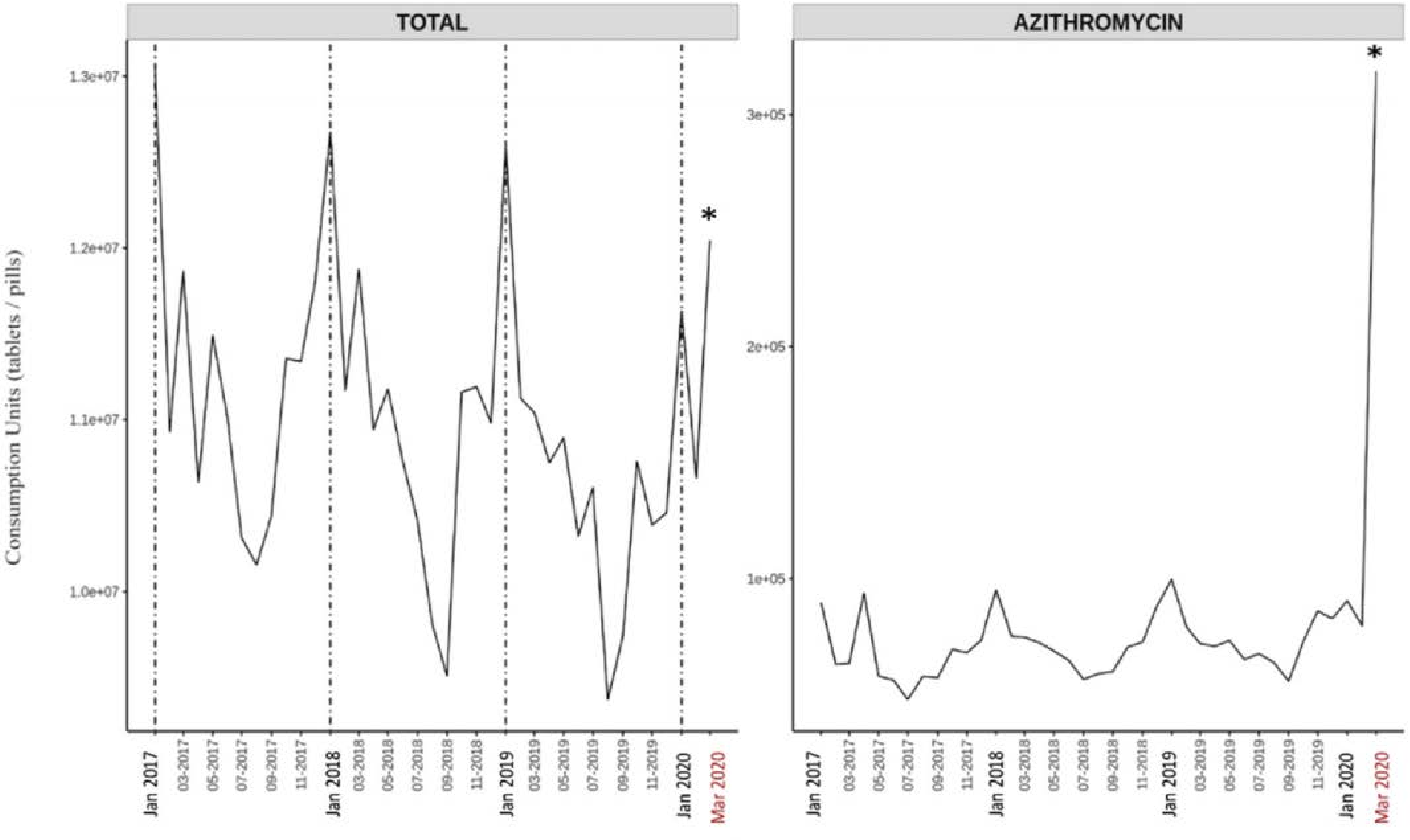
- Antibiogram
- Antimicrobial Utilization
  - Interventions
  - Opportunities for improvement
- Track by:
  - Institution vs. ward vs. prescriber/service
  - Drug, class, disease state

Example Metrics

- DOT/1,000 patient days
- DDD
- Costs
- Orders

DOT= days of therapy
DDD= defined daily dose

Spain, March 2020



*** indicates statistical significance (a = 0.05)**

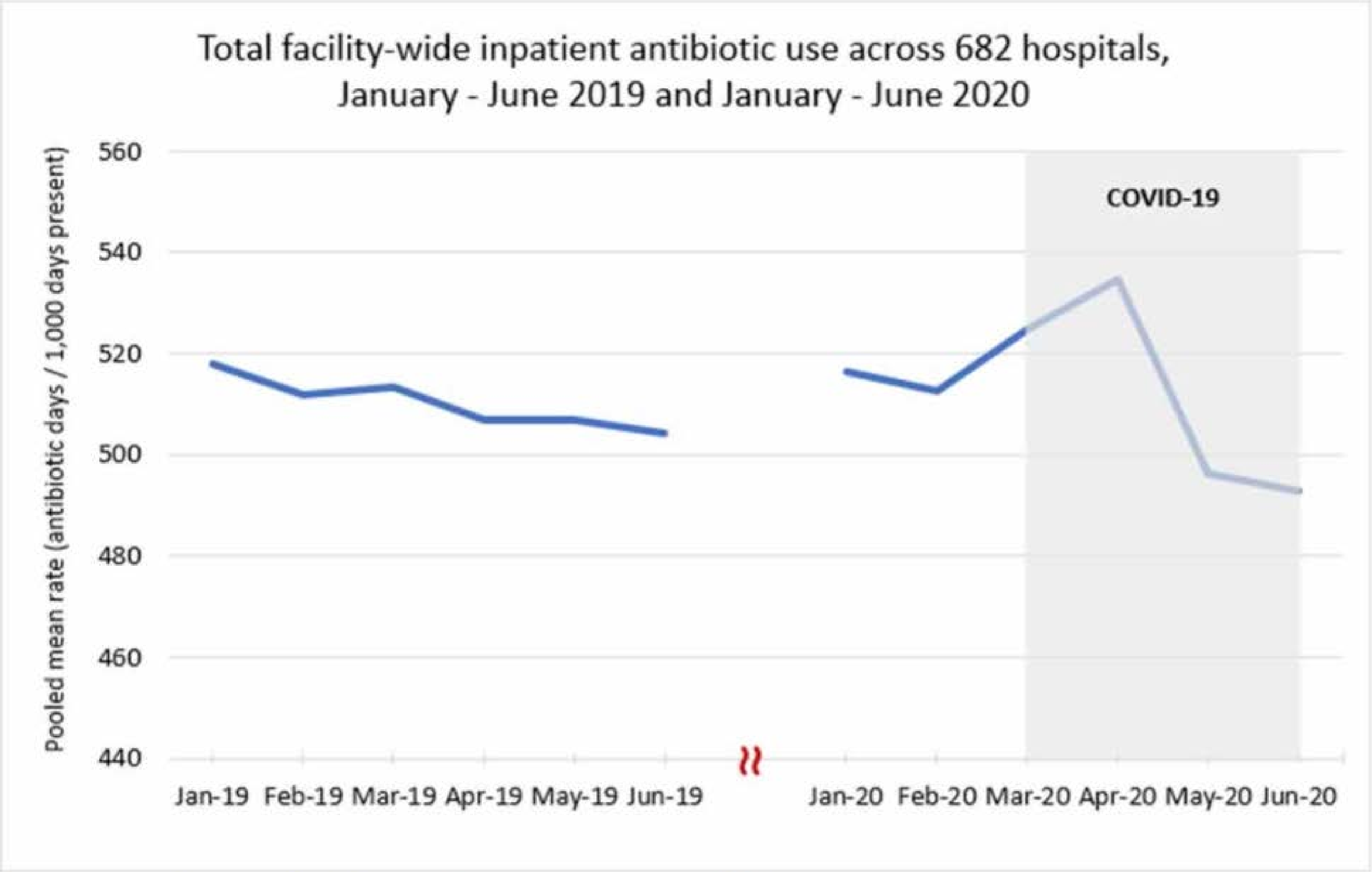
<u>Other Antibiotics</u>

1. ceftaroline (183%)
2. ceftolozane/tazobactam (103%)
3. ceftriaxone (204%)
4. colistin (145%)
5. doxycycline (517%)
6. linezolid (189%)

Image used with permission by: Gonzalez-Zorn B. *Clin Microbiol Infect.* 2020;27:646-647.

USA, CDC: Inpatient Antibiotic Prescribing

composite



Data Source: CDC National Healthcare Safety Network Antimicrobial Use Option

Centers for Disease Control and Prevention. Accessed August 10, 2021.

Standardized Antimicrobial Administration Ratio (SAAR)

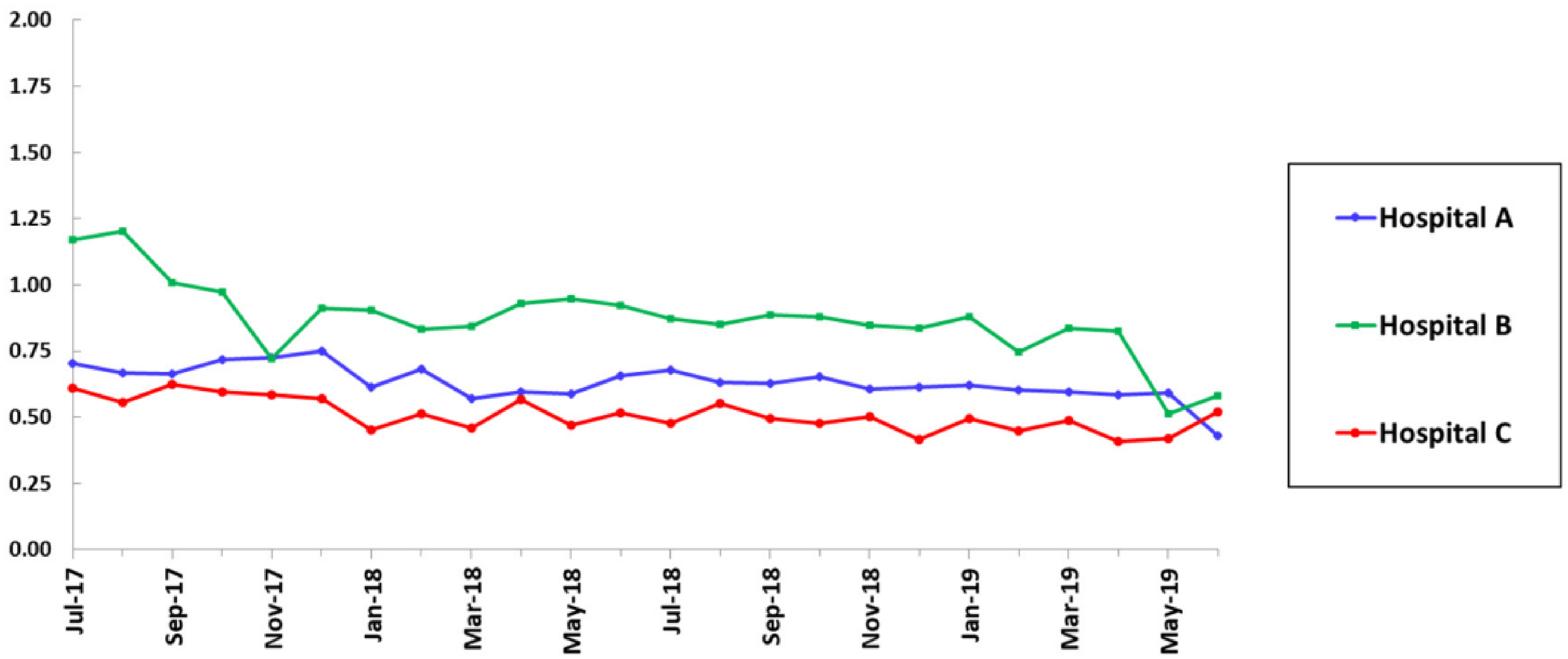
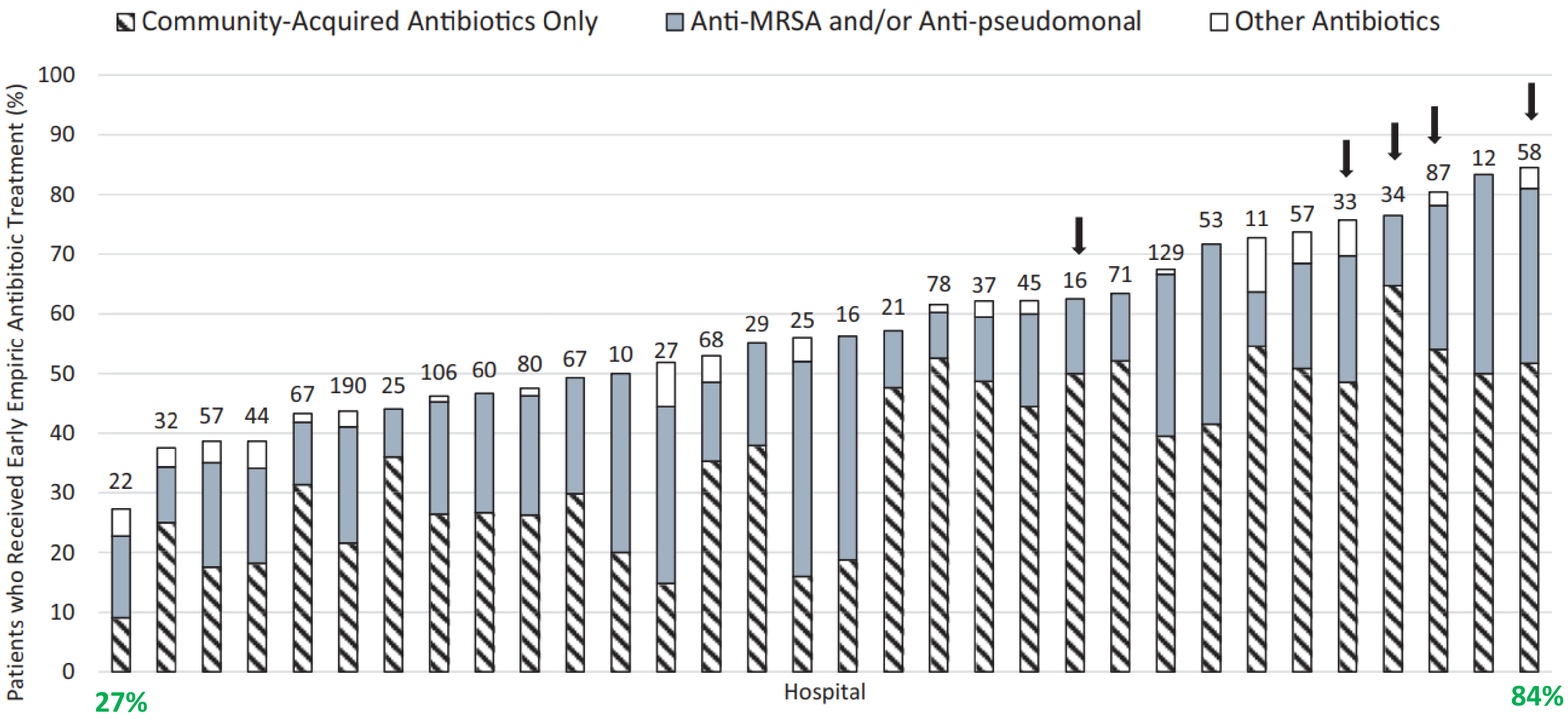


Figure 1. Standardized antimicrobial administration ratio (SAAR) trends for all antimicrobials used in adult intensive care units (ICUs), wards, step down units, and oncology units.

Image used with permission by: Shealy S, Kohn J, Yongue E, et al. *J Pharm Pract*. 2021;9:32.

Antibiotics in Michigan Hospitals



4,628 antibacterial days/1,000 patients

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Before & After Interventions

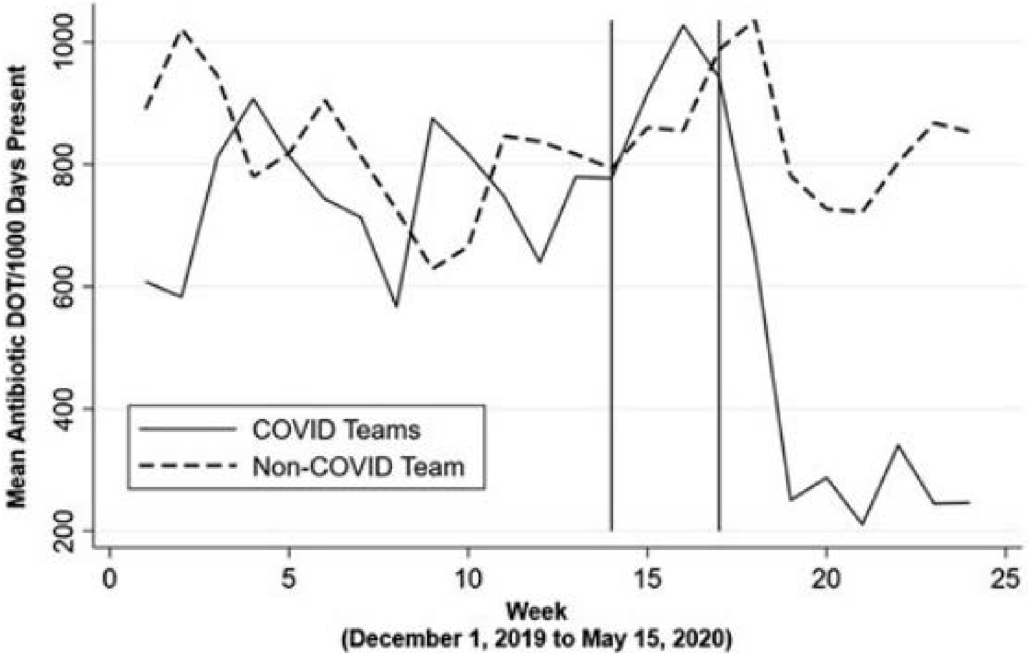

Image used with permission by: Staub MB, et al. *Infect Control Hosp Epidemiol. 2021;42:*810-816.

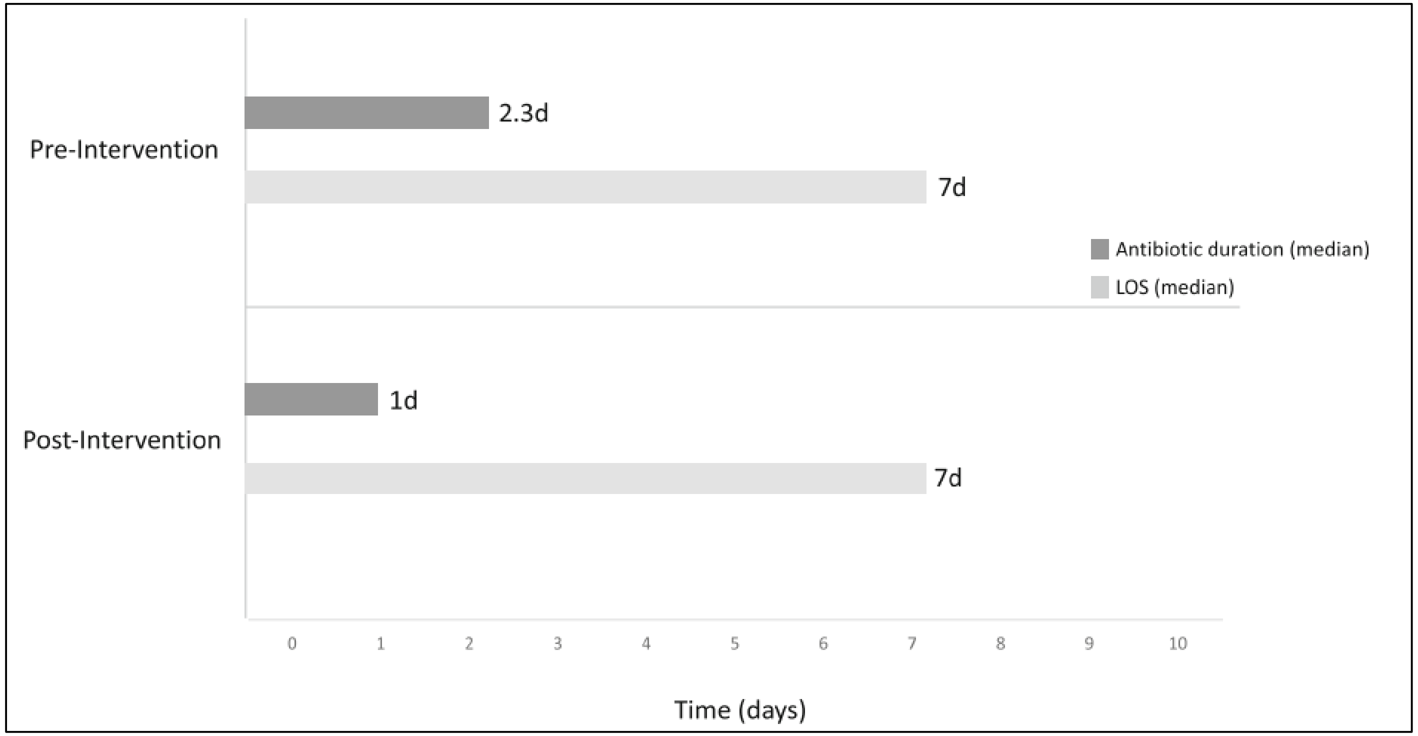

Image used with permission by: Pettit NN, et al. *BMC Infect* Dis. 2021;21:1-7.

Tracking Tocilizumab Administration

- Viral reactivation
- Live vaccines
- Contraindications
- Shortages

The FDA has issued Emergency Use Authorization for the emergency use of tocilizumab in the treatment of COVID-19.

The primary purpose of tracking antibiotic use during the COVID-19 era is to

A. reduce the rate of healthcare-associated *Clostridiodes difficile* (CDI).
B. fulfill hospital accreditation requirements.
C. report the highest antibiotic prescribers to leadership.
D. identify and compare usage trends before COVID-19.

Summary

- Antimicrobial Stewardship strategies are useful for the COVID-19 response.
- Balance antibiotic use with low rates of co-infection.
- Pharmacists play an important role in multidisciplinary COVID-19 treatment teams.
- Use tracking and reporting to find and evaluate areas of opportunity.
- More antimicrobial stewardship research needed!

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Antimicrobial Stewardship Considerations during the COVID-19 Pandemic

Assessment Questions

1. Which antimicrobials stewardship strategy applicable to COVID-19 requires the most IT support?
    a. Prospective audit & feedback
    b. Therapeutic substitution
    c. Pre-authorization
    d. Guideline creation

2. Defaulting all remdesivir maintenance dose administration times to 1500 is a component of which antimicrobial stewardship strategy?
    a. Batching
    b. Prospective audit and feedback
    c. Therapeutic substitution
    d. IV to PO conversion

3. What is the estimated incidence of bacterial co-infection in COVID-19?
    a. 0%
    b. 1-10%
    c. 15-20%
    d. >25%

4. Antimicrobial utilization reports by hospital floor is an example of which Core Element of Antimicrobial Stewardship?
    a. Pharmacy Expertise
    b. Action
    c. Tracking
    d. Education

Answer key: 1. a, 2. a, 3. B, 4. c

1. Prospective audit & feedback (PAF) requires the most IT support. This is a disadvantage of PAF compared to pre-authorization. Therapeutic substitution and guideline creation do not require IT support for implementation.
2. Creating drug-specific, standard administration times for certain medications to avoid waste is a characteristic of the batching strategy. Prospective audit and feedback, therapeutic substitution, and IV to PO conversions do not affect administration times at the ordering phase of medications.
3. The estimated incidence of bacterial co-infection in COVID-19 is 1-10%. This finding is from meta analyses from limited reports in COVID-19 since the identification of the virus. This statistic varies according to country or region and the inclusion of primary vs. secondary bacterial infections.
4. Antimicrobial utilization reports by hospital floor is an example of the "Tracking" Core Element of Antimicrobial Stewardship. These reports are used to generate various "Action" or "Education" strategies. "Pharmacy Expertise" is used to interpret these reports in collaboration with other members of the antimicrobial stewardship multidisciplinary team.