Antimicrobial Stewardship Collaborative of South Carolina

Ground Lost: Healthcare associated infections and antimicrobial resistance during the COVID-19 pandemic

PAMELA BAILEY, DO, MPH

Disclosures

- I have no relevant disclosures or conflicts of interest.

OBJECTIVES

- Define healthcare associated infections (HAIs)
- Recognize the deteriorating state of HAIs during COVID-19 pandemic
- Review prevention strategies for HAIs
- Review worsening antimicrobial resistance trends during the COVID-19 pandemic

HEALTHCARE ASSOCIATED INFECTIONS (HAIs): THE BASICS

HOSPITAL (HEALTHCARE) ACQUIRED INFECTIONS (HAIS)

- 1999: *To Err is Human* (IOM)
- 2003: First states mandate reporting of HAIs
- 2005: CMS began to identify high cost/high frequency conditions
- 2008: CMS stopped reimbursements related to costs for "reasonable preventable conditions"
  - Central line associated bloodstream infection (CLABSI), catheter associated urinary tract infection (CAUTI), and surgical infections (SSI) included
- 2009: National Healthcare Safety Network (NHSN) evolved out of prior NNIS; AHRQ set targets
- 2010: Patient Protection and Affordable Care Act links CMS payments through Hospital-Acquired Condition Reduction Program (HACRP), penalizing hospitals with high rates of HAIs

2010-PRESENT: GETTING TO ZERO?

- 2010: SHEA, IDSA, PIDS, APIC all call for "elimination of HAIs"
- 2016: AHRQ updates new targets (*National Action Plan to Prevent Health Care-Associated Infections: Road Map to Elimination)* for 2015-2020 that were "ambitious but achievable":
  - 50% reduction in CLABSI
  - 25% reduction in CAUTI
  - 50% reduction in invasive MRSA and hospital onset MRSA
  - 30% reduction in surgical site infections (SSI)
  - 30% decrease in *C. difficile* hospitalization

WHY DOES THIS MATTER?

- According to the CDC, approximately 1 in 31 patients in the US contracts at least one infection in association with their hospital care every day.
- This was approximately 3% of hospitalized patients in 2015 (which equates to ~687,000 HAIs)
  - 16% lower than 2011
  - There are racial and ethnic disparities in HAIs: Compared with white patients, the age, gender, and comorbidity-adjusted odds ratios of occurrence of HAIs were 1.1 (95% CI, 0.99-1.23), 1.3 (95% CI, 1.15-1.53), 1.4 (95% CI, 1.07-1.75), and 0.7 (95% CI, 0.40- 1.12) for black, Hispanic, Asian, and a combined group of Native Hawaiian/Pacific Islander compared to other patients, respectively
- **10-70% HAIs are preventable**
  - **65-70% of catheter associated UTI (CAUTI) and central line associated bloodstream infection (CLABSI) may be preventable**
  - **55% of ventilator associated pneumonia (VAP)**

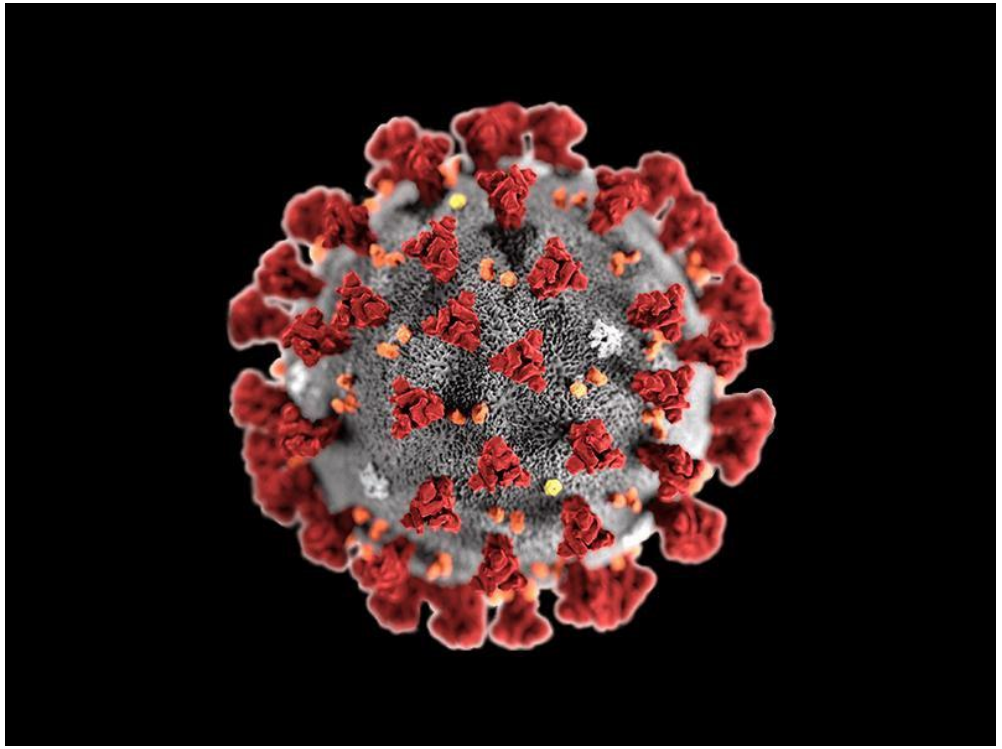
Bakullari A et al. Racial and Ethnic Disparities in Healthcare-Associated Infections in the United States, 2009-2011. ICHE. 2014; 35 (S3): S10-S16.
Umscheid CA, Mitchell MD, Doshi JA, et al. Estimating the proportion of healthcare-associated infections that are reasonably preventable and the related mortality and costs. ICHE. 2011:32:101–114.
https://www.cdc.gov/hai/data/portal/progress-report.html

LET'S TALK MONEY

- 2012: Mathematical simulation predicting each:
- CLABSI to cost $45,814 (95% CI, $30,919-$65,245)
- VAP at $40,144 (95% CI, $36,286-$44,220)
- SSI at $20,785 (95% CI, $18,902-$22,667)
- *C. difficile* infection at $11,285 (95% CI, $9,118-$13,574)
- CAUTI at $896 (95% CI, $603-$1,189)
- The total annual costs for the 5 major infections were **$9.8 billion** (95% CI, $8.3-$11.5 billion), with SSI contributing the most to overall costs (33.7% of the total), followed by VAP (31.6%), CLABSI (18.9%), *C. difficile* infections (15.4%), and CAUTI (<1%).

Umscheid CA, Mitchell MD, Doshi JA, et al. Estimating the proportion of healthcare-associated infections that are reasonably preventable and the related mortality and costs. Infect Control Hosp Epidemiol. 2011:32:101–114.

COVID-19 PANDEMIC



COVID-19 and the potential long-term impact on antimicrobial resistance

- *Societal focus on the threat from this emerging infectious disease has driven a heightened awareness of the importance of personal hygiene, particularly hand hygiene, environmental contamination and increased use of personal protective equipment (PPE). However, the pandemic is also likely to require the relaxing of measures that prevent the spread of MDR organisms (MDRO), such as screening, isolation in single rooms and antimicrobial stewardship.*
- *On one hand, the increased focus on hand hygiene, attempts to limit patient contact and social distancing may lead to reductions in healthcare-associated transmission of disease. On the other hand, the prioritized allocation of isolation rooms to COVID-19 patients, cohorting and/or management in open bays of patients colonized with carbapenemase-producing Enterobacteriaceae (CPE)/VRE/MRSA/Clostridioides difficile and the inevitable higher workload of healthcare workers may potentially lead to a greater number of hospital transmissions.*

Rawson TM et al. Journal of Antimicrobial Chemotherapy. 2020; 75(7): 1681-1684.

THE IMPACT OF COVID-19 ON HEALTHCARE ASSOCIATED INFECTIONS IN 2020

- Compared national and state level standardized infection ratios (SIRs) for each quarter in 2020, compared to those from 2019 for acute care hospitals
  - Percent change [2020 SIR – 2019 SIR/2019 SIR x100]
- Used NHSN data from 2019 and 2020
  - CLABSI, CAUTI, VAEs, some SSIs, MRSA, *C. diff* (CDI)
- Also analyzed device utilization
- Significant increases in the national SIRs were noted for CLABSI (largest), CAUTI, VAE, MRSA bacteremia
- Significant increases in VAE incidence and ventilator utilization were seen across all 4 quarters of 2020

Weiner-Lastinger LM, Pattabiraman V, Konnor RY, Patel PR, Wong E, Xu SY, et al. The impact of coronavirus disease 2019 (COVID-19) on healthcare-associated infections in 2020: A summary of data reported to the National Healthcare Safety Network. Infection Control & Hospital Epidemiology 2021;:1–14.

OVERALL DATA

	2020 Q1	2020 Q2	2020 Q3	2020 Q4
CLABSI	↓ −11.8%	↑ 27.9%	↑ 46.4%	↑ 47.0%
CAUTI	↓ −21.3%	No Change[1]	↑ 12.7%	↑ 18.8%
VAE	↑ 11.3%	↑ 33.7%	↑ 29.0%	↑ 44.8%
SSI: Colon surgery	↓ −9.1%	No Change[1]	↓ −6.9%	↓ −8.3%
SSI: Abdominal hysterectomy	↓ −16.0%	No Change[1]	No Change[1]	↓ −13.1%
Laboratory-identified MRSA bacteremia	↓ −7.2%	↑ 12.2%	↑ 22.5%	↑ 33.8%
Laboratory-identified CDI	↓ −17.5%	↓ −10.3%	↓ −8.8%	↓ −5.5%

Fig. 1. Changes in the 2020 national healthcare-associated infection (HAI) standardized infection ratios (SIRs) for acute-care hospitals, compared to respective 2019 quarters. Note. CLABSI, central-line-associated bloodstream infection; CAUTI, catheter-associated urinary tract infection; VAE, ventilator-associated event; SSI, surgical site infection; MRSA, methicillin-resistant *Staphylococcus aureus*; CDI, *Clostridioides difficile* infection. Interpretation: Unless otherwise noted, the results of the significance tests comparing consecutive annual pairs of quarterly SIRs are based on a 2-tailed test $P \leq .05$; however, the directional percentage change is based on the relative change in magnitude. An arrow pointing down, and a negative percentage change value, indicate that the 2020 SIR is lower than the 2019 SIR for the same quarter. An arrow pointing up, and a positive percentage change value, indicate that the 2020 SIR is higher than the 2019 SIR for the same quarter. Note. 1. "No change" signifies that the change in SIR was not statistically significant.

Weiner-Lastinger LM, Pattabiraman V, Konnor RY, Patel PR, Wong E, Xu SY, et al. The impact of coronavirus disease 2019 (COVID-19) on healthcare-associated infections in 2020: A summary of data reported to the National Healthcare Safety Network
Infection Control & Hospital Epidemiology 2021;1–14

IT'S NOT ALL BAD NEWS…

- CDI SIRs went down!
- Possibly related to increased focus on hand hygiene, environmental cleaning, patient isolation, and use of PPE
- Marked decline in outpatient antimicrobial prescribing may also have contributed to fewer CDI

- SSIs went down as well, not statistically significant
- # of procedures also went down

Weiner-Lastinger LM, Pattabiraman V, Konnor RY, Patel PR, Wong E, Xu SY, et al. The impact of coronavirus disease 2019 (COVID-19) on healthcare-associated infections in 2020: A summary of data reported to the National Healthcare Safety Network. Infection Control & Hospital Epidemiology 2021;:1 14.

DISCUSSION

- Note significant improvement prior to 2020 in HAI rates, as seen in the Q1 2020 data
- CLABSI and MRSA bacteremia climbed in Q2 2020, then in Q3 and Q4 significant increases in CLABSI, CAUTI, VAE, MRSA bacteremia SIRS
- Theories: longer LOS, additional comorbidities, higher patient acuity, longer duration of device use
- Highest increase in CLABSI, concern for likely decrease in adherence to CL insertion and maintenance practices
- VAEs due to severity of illness of COVID patients
  - # of patients requiring ventilation, ventilator utilization, and average duration of ventilation

Weiner-Lastinger LM, Pattabiraman V, Konnor RY, Patel PR, Wong E, Xu SY, et al. The impact of coronavirus disease 2019 (COVID-19) on healthcare-associated infections in 2020: A summary of data reported to the National Healthcare Safety Network. Infection Control & Hospital Epidemiology 2021;:1–14.

COMMENTARY

- Increased ICU admissions
  - Increased device utilization="sicker" patients
- Does not apply to just COVID patients (but does, in some cases):
  - Hospital with >10% COVID patients had 2.4x more CLABSI than those with <5%
  - COVID patients had >5x more CLABSI than those without COVID
    - likely fewer nursing/patient interactions due to PPE/isolation
      - Less likely to adhere to known infection prevention practices, more novel interventions
    - CLABSI ~18 days into hospitalization, indicating longer hospitalizations for COVID patients
      - Increased proportion of *E. faecalis*, coagulase negative *Staphylococci* in 2020 compared to 2019
  - MRSA events may be related to intravascular device infections, HAP/VAP in COVID patients

Fakih MG, et al. (2021). Coronavirus disease 2019 (COVID-19) pandemic, central-line–associated bloodstream infection (CLABSI), and catheter-associated urinary tract infection (CAUTI): The urgent need to refocus on hardwiring prevention efforts. Infection Control & Hospital Epidemiology.
Fakih MG, et al. (2021). Is it time for us to account for the impact of coronavirus disease 2019 (COVID-19) on healthcare-associated infections? Infection Control & Hospital Epidemiology.
Weiner-Lastinger LM et al. (2022). Pathogens attribute to central line associated bloodstream infections in US acute care hospitals during the first year of the COVID-19 pandemic. Infection Control & Hospital Epidemiology.

2020-2021 data from NYC

Variable	Total No.	Catheters in COVID-19 Patients (n=185) No. (%)	Catheters in Patients Without COVID-19 (n=238) No. (%)	*P* Value
Type of catheter				
Short term	247	153 (83)	94 (39)	<.001
Dialysis	98	27 (14)	71 (30)	.003
Peripherally inserted	69	5 (3)	64 (27)	<.001
Chemo port	4	0 (0)	4 (2)	.14
Umbilical	5	0 (0)	5 (2)	.07
Location of catheter				
Brachial	62	5 (3)	57 (24)	<.001
Femoral	69	36 (19)	33 (14)	.14
Jugular	220	109 (59)	111 (47)	.01
Subclavian	67	35 (19)	32 (13)	.41
Umbilical	5	0 (0)	5 (2)	.07

Variable	Hospital Size	Jan–Jun 2019	Jul–Dec 2019	Jan–Jun 2020	Jul–Dec 2020	Jan–Jun 2021
CLABSIs						
No. of CLABSIs in COVID-19 patients	Large	31	33	155 (119)	54 (5)	65 (26)
	Small	9	9	23 (11)	7 (0)	24 (16)
Rate (per 1000 catheter days)	Large	1.45±0.45	1.27±0.63	4.57±1.23	2.15±1.08	1.86±1.36
	Small	0.61±0.55[a]	0.42±0.41[a]	1.14±1.39[a]	0.47±0.46[a]	1.26±0.7
Rate (per 10000 patient days)	Large	1.25±0.24	1.31±0.76	7.67±2.79	2.41±1.75	2.48±2.24
	Small	0.61±0.53[a]	0.44±0.44	1.64±1.78[a]	0.53±0.51	1.46±1.38
Standardized infection ratio	Large	1.32±0.40	1.13±0.51	3.36±1.11	1.84±0.88	1.41±0.91
	Small	0.61±0.55	0.42±0.41[a]	1.21±1.58[a]	0.47±0.44[a]	0.97±0.71
CAUTIs						
No. of CAUTIs in COVID-19 patients	Large	25	31	69 (43)	56 (5)	69 (24)
	Small	14	17	30 (11)	19 (1)	34 (14)
Rate (per 1,000 catheter days)	Large	1.13±0.43	1.34±1.33	2.08±0.77	2.26±1.59	2.21±1.36
	Small	0.98±0.50	0.73±0.79	1.11±1.15	1.39±0.60	1.75±0.99
Rate (per 10,000 patient days)	Large	0.97±0.36	1.89±1.19	3.69±2.04	2.44±1.73	2.67±1.70
	Small	0.90±0.55	0.80±0.95	1.88±2.02	1.45±0.82	2.27±1.54
Standardized infection ratio	Large	0.81±0.32	0.94±0.90	1.28±0.36	1.50±0.96	1.53±0.85
	Small	0.86±0.53	0.60±0.63	0.73±0.65	1.18±0.56	1.33±0.65

Samaroo-Campbell J et al. *Antimicrobial Stewardship and Hospital Epidemiology.* 2022.

OTHER CONTRIBUTING ISSUES

Nbcboston.com

- In March-July 2020:
- 29% hospitals reports shortages of health care workers:
  - 372 hospitals with nursing shortages, 250 with respiratory therapy, 217 with environmental services, 138 with physicians, 125 with pharmacists
  - Possible causes: baseline shortages, HCW quarantine, HCW with family responsibilities
  - Increased reliance on acute care hospitals, increased critical care capacity
- 11% reported having "no on-hand supply for at least one day" of PPE:
  - Eye protection 125 hospitals, gowns 103, ventilator supplies 101, N95 80, surgical masks 64, gloves 64
  - Possible causes: inadequate reserves, interrupted supply chains

Rosenthal VD et al. The impact of COVID-19 on healthcare-associated infections in intensive care units in low and middle income countries: International Nosocomial Infection Control Consortium (INICC) findings. International Journal of Infectious Diseases. 2022 Feb 24.
Wu H et al. Hospital capacities and shortages of healthcare resources among US hospitals during the coronavirus disease 2019 (COVID-19) pandemic, National Healthcare Safety Network (NHSN), March 27–July 14, 2020. ICHE 2021;1–4.

HEALTH

WHY HEALTH-CARE WORKERS ARE QUITTING IN DROVES

About one in five health-care workers has left their job since the pandemic started. This is their story—and the story of those left behind.

https://www.theatlantic.com/health/archive/2021/11/the-mass-exodus-of-americas-health-care-workers/620713/

- *"The year 2020 marked an unprecedented time for hospitals, many of which were faced with extraordinary circumstances of increased patient caseload, staffing challenges, and other operational changes that limited the implementation and effectiveness of standard infection prevention practices. A regular review of HAI surveillance data is critical for hospitals to identify gaps in prevention and address any observed increases in HAIs. Infection prevention staff should continue to reinforce infection prevention practices in their facilities, and consider the importance of building resiliency in their programs to withstand future public health emergencies."*

Not just a US problem…

- HAIs and other markers worsened in resource-limited countries: CLABSI, VAP/VAEs, mortality rates in ICU, average LOS
- 7 low/middle income countries (LMIC) January 2019-May 2020
  - India, Mongolia, Jordan, Lebanon, Palestine, Egypt, Turkey
- Used NHSN definitions

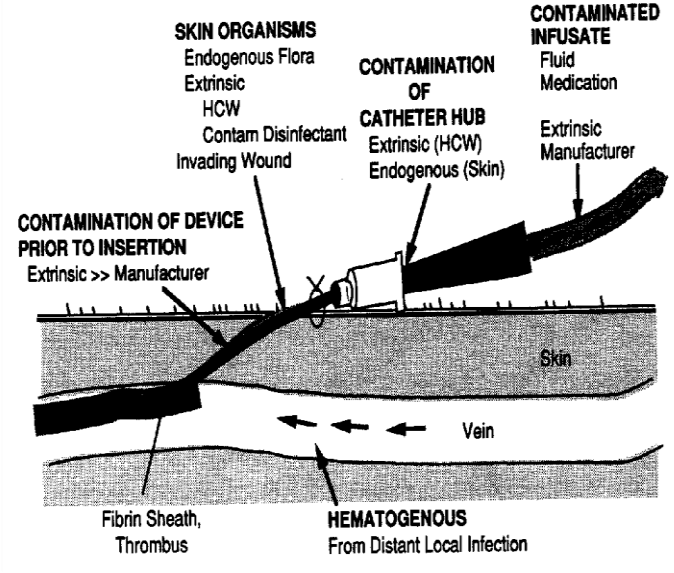
Rosenthal VD et al. The impact of COVID-19 on healthcare-associated infections in intensive care units in low and middle income countries: International Nosocomial Infection Control Consortium (INICC) findings. International Journal of Infectious Diseases. 2022 Feb 24.

SO WHAT CAN I DO ABOUT THIS?

CLABSI

- >150 million 'intravascular devices' purchased yearly to administer IV fluids, meds, blood products, parenteral nutrition, to monitor hemodynamic status, and to provide hemodialysis

- 90% of blood stream infections in the US are related to vascular access devices



Mermel LA, Allon M, Bouza E, Craven DE, Flynn P, O'Grady NP, Raad II, Rijnders BJ, Sherertz RJ, Warren DK. Clinical practice guidelines for the diagnosis and management of intravascular catheter-related infection: 2009 Update by the Infectious Diseases Society of America. Clinical infectious diseases. 2009 Jul 1;49(1):1-45.

RISK FACTORS FOR CLABSI

- Site of insertion
- Multiple lumen catheters
- Total parenteral nutrition and/or lipids
- Low nurse to patient ratio
- Infection elsewhere
- Colonization of catheter
- Duration of catheter (>72 hours)

- Inexperience of personnel inserting the central device
- Use of stopcocks

- *Risk of infection varies depending on device, the type of catheter, its intended use, experience of the person inserting the catheter, the frequency with which the catheter is accessed, the duration of catheter placement, and use of proven prevention strategies*

https://www.ahrq.gov/hai/clabsi-tools/appendix-3.html#sl1
Merrer, et al. *JAMA*. 2001;286:700-7

Checklists:
Hand hygiene
Barrier precautions
Chlorhexidine
Access to device/dressing

Recommend daily audits for need

Start to get into details:
Antimicrobial catheters/dressings
Hubs

Checklist for Prevention of Central Line Associated Blood Stream Infections

Based on 2011 CDC guideline for prevention of intravascular catheter-associated bloodstream infections:
https://www.cdc.gov/infectioncontrol/guidelines/bsi/index.html
Strategies to Prevent Central Line–Associated Bloodstream Infections in Acute Care Hospitals: 2014 Update
http://www.jstor.org/stable/10.1086/676533

For Clinicians:

Follow proper insertion practices

- ☐ Perform hand hygiene before insertion.
- ☐ Adhere to aseptic technique.
- ☐ Use maximal sterile barrier precautions (i.e., mask, cap, gown, sterile gloves, and sterile full body drape).
- ☐ Choose the best insertion site to minimize infections and noninfectious complications based on individual patient characteristics.
  - Avoid femoral site in obese adult patients.
- ☐ Prepare the insertion site with >0.5% chlorhexidine with alcohol.
- ☐ Place a sterile gauze dressing or a sterile, transparent, semipermeable dressing over the insertion site.
- ☐ For patients 18 years of age or older, use a chlorhexidine impregnated dressing with an FDA cleared label that specifies a clinical indication for reducing CLABSI for short term non-tunneled catheters unless the facility is demonstrating success at preventing CLABSI with baseline prevention practices.

Handle and maintain central lines appropriately

- ☐ Comply with hand hygiene requirements.
- ☐ Bathe ICU patients over 2 months of age with a chlorhexidine preparation on a daily basis.
- ☐ Scrub the access port or hub with friction immediately prior to each use with an appropriate antiseptic (chlorhexidine, povidone iodine, an iodophor, or 70% alcohol).
- ☐ Use only sterile devices to access catheters.
- ☐ Immediately replace dressings that are wet, soiled, or dislodged.
- ☐ Perform routine dressing changes using aseptic technique with clean or sterile gloves.
  - Change gauze dressings at least every two days or semipermeable dressings at least every seven days.
  - For patients 18 years of age or older, use a chlorhexidine impregnated dressing with an FDA cleared label that specifies a clinical indication for reducing CLABSI for short-term non-tunneled catheters unless the facility is demonstrating success at preventing CLABSI with baseline prevention practices.
- ☐ Change administrations sets for continuous infusions no more frequently than every 4 days, but at least every 7 days.
  - If blood or blood products or fat emulsions are administered change tubing every 24 hours.
  - If propofol is administered, change tubing every 6-12 hours or when the vial is changed.

Promptly remove unnecessary central lines

- ☐ Perform daily audits to assess whether each central line is still needed.

For Healthcare Organizations:

- ☐ Educate healthcare personnel about indications for central lines, proper procedures for insertion and maintenance, and appropriate infection prevention measures.
- ☐ Designate personnel who demonstrate competency for the insertion and maintenance of central lines.
- ☐ Periodically assess knowledge of and adherence to guidelines for all personnel involved in the insertion and maintenance of central lines.
- ☐ Provide a checklist to clinicians to ensure adherence to aseptic insertion practices.
- ☐ Reeducate personnel at regular intervals about central line insertion, handling and maintenance, and whenever related policies, procedures, supplies, or equipment changes.
- ☐ Empower staff to stop non-emergent insertion if proper procedures are not followed.
- ☐ Ensure efficient access to supplies for central line insertion and maintenance (i.e. create a bundle with all needed supplies).
- ☐ Use hospital-specific or collaborative-based performance measures to ensure compliance with recommended practices.

Supplemental strategies for consideration:

- ☐ Antimicrobial/Antiseptic impregnated catheters
- ☐ Antiseptic impregnated caps for access ports

Barrier precautions:
Sterile gown **securely fastened**
Face mask, cap, sterile gloves
Cover patient completely with drape

https://www.cdc.gov/hai/pdfs/bsi/checklist-for-CLABSI.pdf

WHAT CAN YOU DO?

- Follow the checklist
- Hand hygiene
- Assess need for central line **daily**
  - **Know if your patient has a CVC**
    - 21% of physicians were unaware of their patient's CVC
    - Teaching attendings (25.8%) and hospitalists (30.5%) were more frequently unaware than interns (25.8%) and residents (16.4%) (p=0.014)
    - Critical care physicians (12.6%) were more aware than general medicine (26.2%) (p=0.003)
    - Specialty services (22.5%) were more frequently aware than general medicine teaching services (26.2%)
- Be aware of risk factors for assessing if your patient has CLABSI
- Be aware of guidelines for removing CVC and treating CLABSI

Chopra V, Govindan S, Kuhn L, Ratz D, Sweis RF, Melin N, Thompson R, Tolan A, Barron J, Saint S. Do clinicians know which of their patients have central venous catheters? A multicenter observational study. Annals of internal medicine. 2014 Oct 21;161(8):562-7.

PROMPT REMOVAL

- Be aware of inappropriate usage/presence and monitor for ongoing need
  - Beware the ‘idle catheter’
    - 21% of patients transferred out of ICU with CVC, and 26.2% went idle after transfer
    - 50% of patients with CVC had at least 1 day of no use, 25% with at least 2 days and up to 4 days of no use
- Nurse-driven protocol for catheter removal?
  - Regardless, better communication
- Daily audits
- Utilization of midline…or even a PIV?

Burdeu G, Currey J, Pilcher D. Idle central venous catheter-days pose infection risk for patients after discharge from intensive care. American journal of infection control. 2014 Apr 1;42(4):453-5.
Beville AS, Heipel D, Vanhoozer G, Bailey P. Reducing Central Line Associated Bloodstream Infections (CLABSIs) by Reducing Central Line Days. Current Infectious Disease Reports. 2021 Dec;23(12):1-7.

CAUTI

- Most common HAI worldwide
- Related to use of Foley catheters, much of which is inappropriate (LTCF)

- *CA-UTI in patients with indwelling urethral, indwelling suprapubic, or intermittent catheterization is defined by the presence of symptoms or signs compatible with UTI with no other identified source of infection along with 10^3 colony-forming units (cfu)/mL of ≥1 bacterial species in a single catheter urine specimen or in a midstream voided urine specimen from a patient whose urethral, suprapubic, or condom catheter has been removed within the previous 48 h*

https://www.ahrq.gov/hai/cauti-tools/guides/implguide-pt3.html

CRITICAL: APPROPRIATE USE OF INDWELLING URINARY CATHETERS

- Acute urinary retention or obstruction
- Accurate measurement of urinary output in critically ill patients
  - Hourly monitoring, NOT daily unless in very specific situations
- Perioperative use in selected surgeries
  - Prolonged procedures, urologic surgery, epidural anesthesia/analgesia
- Assistance with healing of stage III/IV perineal and sacral wounds in incontinent patients
- Hospice/comfort/palliative care (if desired)
- Required immobilization for trauma surgery
  - Thoracic/lumbar spinal injuries, pelvic fractures, acute hip fractures prior to surgical repair

https://www.ahrq.gov/hai/cauti-tools/guides/implguide-pt3.html

…INAPPROPRIATE USAGE

- Urine output monitoring that can be obtained by other means
- Incontinence without a sacral/perineal pressure sore
- Prolonged postoperative use
- Morbid obesity/immobility
- Confusion/dementia
- Patient/family request
- Attempting to reduce risk for falls (by minimizing need to get up to urinate)
- “bed rest”
- Attempting to prevent UTI in patients with fecal incontinence/diarrhea

https://www.ahrq.gov/hai/cauti-tools/guides/implguide-pt3.html

STEWARDSHIP

- Inadvertent increases in antimicrobial use in treating asymptomatic bacteriuria leads to antimicrobial resistance, *C. diff* infections, adverse drug events

- Diagnostic stewardship
- Device stewardship
- Antimicrobial stewardship

Nicolle LE, Gupta K, Bradley SF, Colgan R, DeMuri GP, Drekonja D, Eckert LO, Geerlings SE, Köves B, Hooton TM, Juthani-Mehta M. Clinical practice guideline for the management of asymptomatic bacteriuria: 2019 update by the Infectious Diseases Society of America. Clinical Infectious Diseases. 2019 May 2;68(10):e83-110.

Table 1.
Prevalence of Asymptomatic Bacteriuria Reported for Different Populations

Population	Prevalence, %	Reference
Children		
Boys	<1	[7]
Girls	1–2	[8–10]
Healthy women		
Premenopausal	1.0–5.0	[11]
Pregnant	1.9–9.5	[11]
Postmenopausal (age 50–70 y)	2.8–8.6	[11]
Persons with diabetes		
Women	10.8–16	[12]
Men	0.7–11	[12]
Elderly persons in the community (age ≥70 y)		
Women	10.8–16	[13]
Men	3.6–19	[13]
Elderly persons in a long-term care facility		
Women	25–50	[13]
Men	15–50	[13]
Persons with spinal cord injury		
Intermittent catheter use	23–69	[14]
Sphincterotomy/condom catheter	57	[15]
Persons with kidney transplant		
First month posttransplant	23–24	[16, 17]
1 mo–1 y post-transplant	10–17	[16]
>1 y post-transplant	2–9	[16]
Persons with indwelling catheter use		
Short-term	3%–5%/day catheter	[18]
Long-term	100	[19]

VAP/VAE

- Consensus definition?!
  - I will use the 2016 IDSA/ATS guidelines
  - Clinical, radiographic, microbiological criteria
  - ~10-20% of ventilated patients develop VAP
    - 20-50% all cause mortality, but morbidity??
      - 10% attributable mortality
      - Longer ventilation by 7.6-11.5 days
      - Longer LOS by 11.5-13.1 days
- Respiratory cultures
- Upper vs lower respiratory tract

Kalil AC, Metersky ML, Klompas M, Muscedere J, Sweeney DA, Palmer LB, Napolitano LM, O'Grady NP, Bartlett JG, Carratalà J, El Solh AA. Management of adults with hospital-acquired and ventilator-associated pneumonia: 2016 clinical practice guidelines by the Infectious Diseases Society of America and the American Thoracic Society. Clinical Infectious Diseases. 2016 Sep 1;63(5):e61-111.

TABLE 2. Summary of Recommendations for Preventing Ventilator-Associated Pneumonia (VAP) in Adult Patients

Recommendation	Rationale	Intervention	Quality of evidence
Basic practices	Good evidence that the intervention decreases the average duration of mechanical ventilation, length of stay, mortality, and/or costs; benefits likely outweigh risks	Use noninvasive positive pressure ventilation in selected populations[57,58]	High
		Manage patients without sedation whenever possible[46,61]	Moderate
		Interrupt sedation daily[62]	High
		Assess readiness to extubate daily[47,66-68]	High
		Perform spontaneous breathing trials with sedatives turned off[48]	High
		Facilitate early mobility[49,70-75,78]	Moderate
		Utilize endotracheal tubes with subglottic secretion drainage ports for patients expected to require greater than 48 or 72 hours of mechanical ventilation[50]	Moderate
		Change the ventilator circuit only if visibly soiled or malfunctioning[88-91]	High
		Elevate the head of the bed to 30°–45°[84-86]	Low[a]
Special approaches	Good evidence that the intervention improves outcomes but insufficient data available on possible risks	Selective oral or digestive decontamination[93-96]	High[b]
	May lower VAP rates but insufficient data to determine impact on duration of mechanical ventilation, length of stay, or mortality	Regular oral care with chlorhexidine[98,101-104]	Moderate
		Prophylactic probiotics[111-114]	Moderate
		Ultrathin polyurethane endotracheal tube cuffs[120,121]	Low
		Automated control of endotracheal tube cuff pressure[122,123]	Low
		Saline instillation before tracheal suctioning[124]	Low
		Mechanical tooth brushing[125,126]	Low
Generally not recommended	Lowers VAP rates but ample data suggest no impact on duration of mechanical ventilation, length of stay, or mortality	Silver-coated endotracheal tubes[127]	Moderate
		Kinetic beds[128]	Moderate
		Prone positioning[87,129-134,c]	Moderate
	No impact on VAP rates, average duration of mechanical ventilation, length of stay, or mortality[c]	Stress ulcer prophylaxis[135,136]	Moderate
		Early tracheotomy[137]	High
		Monitoring residual gastric volumes[138]	Moderate
		Early parenteral nutrition[139]	Moderate
No recommendation	No impact on VAP rates or other patient outcomes, unclear impact on costs	Closed/in-line endotracheal suctioning[141-143]	Moderate

Klompas et al. Strategies to Prevent Ventilator-Associated Pneumonia in Acute Care Hospitals: 2014 update. Infect Control Hosp Epid. 2014: 35 (8): 915-936.

SSI: SURGICAL SITE INFECTION

- Number of surgical cases continues to rise in the US
- More complex comorbidities

Berríos-Torres SI, Umscheid CA, Bratzler DW, Leas B, Stone EC, Kelz RR, Reinke CE, Morgan S, Solomkin JS, Mazuski JE, Dellinger EP. Centers for disease control and prevention guideline for the prevention of surgical site infection, 2017. JAMA surgery. 2017 Aug 1;152(8):784-91.

FACTORS TO CONSIDER

- Patient factors
  - Comorbid conditions, colonization, hyperglycemia, tobacco use
- Procedural factors
  - OR traffic, breaks in sterile technique, operating room ventilation
- Proceduralist factors
  - Surgical technique, improper application of skin antisepsis

Berríos-Torres SI, Umscheid CA, Bratzler DW, Leas B, Stone EC, Kelz RR, Reinke CE, Morgan S, Solomkin JS, Mazuski JE, Dellinger EP. CDC guideline for the prevention of surgical site infection, 2017. JAMA surgery. 2017 Aug 1;152(8):784-91.

RECOMMENDATIONS

- Shower/bathe (full body) with soap or antiseptic agents on at least the night before the operative day
- Antimicrobial prophylaxis only when indicated by clinical guidelines, timed appropriately
  - Do not administer additional agents even in the presence of a drain
- Skin prep in the OR should be alcohol-based agent
- Do not apply topical antimicrobials to a surgical incision
- Glycemic control <200mg/dL
- Normothermia
- FiO2 should be maintained appropriately
- Do not withhold blood products

Berríos-Torres SI, Umscheid CA, Bratzler DW, Leas B, Stone EC, Kelz RR, Reinke CE, Morgan S, Solomkin JS, Mazuski JE, Dellinger EP. Centers for disease control and prevention guideline for the prevention of surgical site infection, 2017. JAMA surgery. 2017 Aug 1;152(8):784-91.

OPTIMAL USE OF "RIGHT" DRUG

- Right drug, right dose, right time
- Allergy history!
  - Patients with a reported penicillin allergy had a 50% increased odds of SSI, attributable to the receipt of second-line perioperative antibiotics. Clarification of penicillin allergies as part of routine preoperative care may decrease SSI risk.

Blumenthal KG, Ryan EE, Li Y, Lee H, Kuhlen JL, Shenoy ES. The Impact of a Reported Penicillin Allergy on Surgical Site Infection Risk. *Clin Infect Dis*. 2018;66(3):329-336

C. DIFF

Burden of community-associated *Clostridioides difficile* infection in southeastern United States: a population-based study

January 2016-June 2016
>50% were CA-CDI
41% required hospitalization
$16,217,295 in hospitalization costs

- Traditionally thought to be in older adults, debilitated, hospitalized
- Now we do see community onset
  - Hospital acquired if in hospital >3 days when diagnosed
    - This is what's reportable and has penalties if rates increase

Antimicrobial Stewardship Collaborative of South Carolina

THINK ABOUT YOUR *C. DIFF* TEST (ORDERING)

- Do you know the signs/symptoms?
- >3 loose/watery stools in 24h
- Lower abdominal pain/cramping
- Low grade fever
- Elevated WBC
- Radiologic evidence

- Confounding factors: laxative use, tube feeds (started/changed rate)

- Risk factors:
- >65yo
- Recent: abx, chemo, hospitalization, PPI
- Previous h/o *C. diff*

THINK ABOUT YOUR *C. DIFF* TEST (LABORATORY)

- NAAT: very sensitive, low/moderate specificity
  - Detects toxin genes
  - Came to market in 2009
- Stool toxin test EIA: low sensitivity, moderate specificity
  - Detects toxin (enzyme)
- GDH (glutamate dehydrogenase): high sensitivity/low specificity
  - Detects antigen

ISOLATION PRECAUTIONS

HAND HYGIENE

- Most HAIs are transmitted on the hands of HCW
- Transient flora
- “bare below the elbows”

WHAT NOT TO WEAR

Hippocrates had a definite idea of what physicians should be—*"clean in person, well dressed, and anointed with sweet-smelling unguents."*

For generations, that's been business attire topped off with a white coat and maybe a few squirts of sweet-smelling hand sanitizer.

Gonzalo Bearman, M.D., M.P.H., associate hospital epidemiologist and professor of medicine at the VCU Medical Center, says that traditional physician dress may play a role in transmission of pathogens in the inpatient setting.

Bearman was lead author of an expert guidance paper published earlier this year by the Society for Healthcare Epidemiology of America (SHEA), a professional group whose mission is to prevent and control infections in the medical workplace. In the paper, he talks about the bacteria that can live on clothing, jewelry and everyday objects. These objects are not washed or decontaminated between patient encounters and may serve as vectors of transmission. His work and SHEA's guidelines for provider clothing have been cited in publications such as *The New York Times* and *USA Today*.

Bearman stresses that SHEA's guidance statement on health care professional attire is for the acute-care or inpatient setting, not necessarily for physicians in lower-risk, ambulatory settings.

And while there's no concrete proof that losing the white coat will result in increased patient safety, it's part of myriad measures hospitals are taking to minimize germs.

So consider hanging up the white coat and rolling up your sleeves next time you take care of a hospitalized patient. "It's just common sense," says Bearman. – *Lisa Crutchfield*

Photography by Kevin Schindler

DON'T WEAR **THAT**

DON'T MAKE IT A STAPH-OSCOPE
If you're not disinfecting that stethoscope between patients, consider not using it.

WATCH IT
Your wristwatch and other jewelry can harbor germs. Remove them during inpatient care.

ENOUGH WITH THE CUFF
Those French cuffs and fancy cufflinks look debonair, but Bearman's SHEA guidelines recommend Bare Below the Elbows (BBE) to reduce the spread of germs.

KEEP IT CLEAN
Think you know how to do laundry? SHEA recommends that any apparel worn at the bedside that comes in contact with the patient or patient environment should be laundered after daily use, using hot water followed by a cycle in the dryer.

WEAR **THIS**

DON'T BE TIED DOWN
When was the last time you cleaned your necktie? You probably don't want to know what's growing there. If you must wear a tie, be sure that it is either tucked in or fastened so that it won't come in direct contact with the patient or patient care environment.

GERM MAGNETS
The healthcare environment is teeming with pathogens. Where's your cell phone been?

FREE YOUR FOREARMS
Bare Below the Elbows (BBE) makes hand hygiene to the levels of the wrists and forearms easier and reduces the risk of spreading pathogens in the hospital.

TAKE IT OFF
SHEA suggests removing the infrequently laundered white coat during patient visits to reduce the spread of germs from direct patient contact with the apparel.

WHITE WASH
According to SHEA, facilities that mandate or strongly recommend use of a white coat for professional appearance should institute one or more of the following measures:

Providers should have two or more white coats available and have access to a convenient and economical means to launder white coats (such as on-site laundering at no cost or low cost).

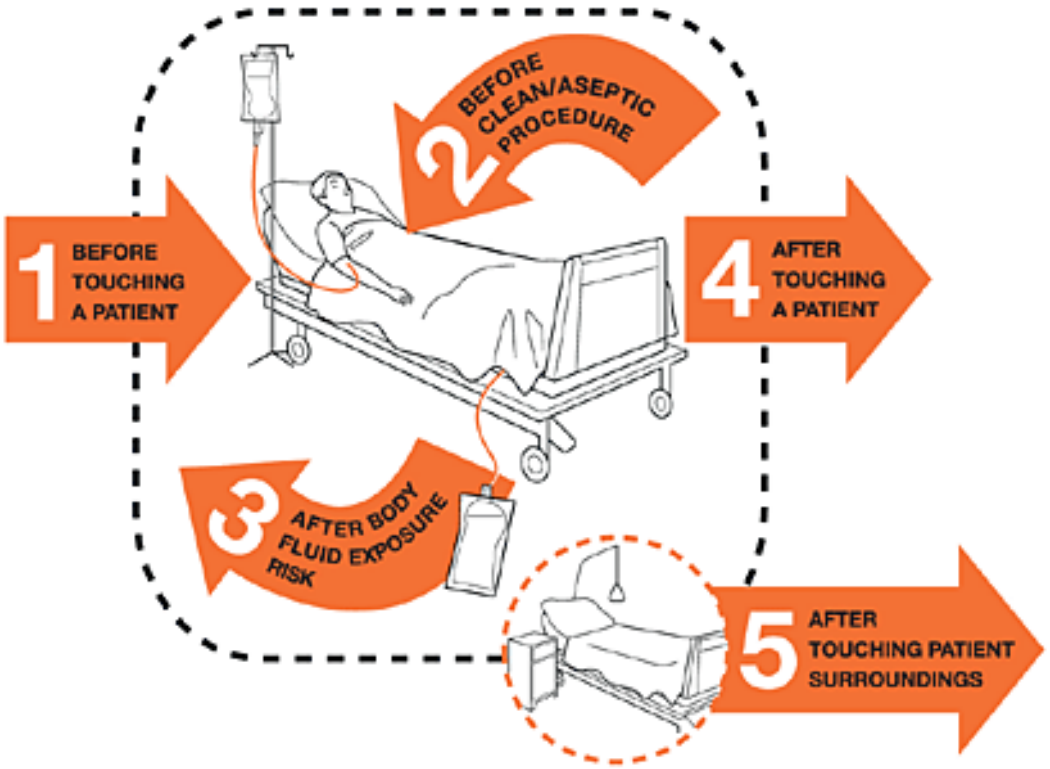
Institutions should provide coat hooks that would allow providers to remove their white coat prior to contact with patients or a patient's immediate environment.

BADGE OF DISTINCTION
Patients like providers to be easily recognizable, but that doesn't have to mean a white coat. Name badges that include your title in large letters make it easy for patients to know who you are.

VEST DRESSED
Bearman and colleagues at the VCU Medical Center often wear sleeveless vests in lieu of white coats. The vests feature many convenient pockets, and as they are sleeveless, they allow for a BBE approach to inpatient care. Also, they look uniform-like and professional. The concept, says Bearman, is gaining traction quickly.

START AT THE BOTTOM
Footwear should always have closed toes, low heels, and be non-slip and puncture-resistant.

HAND HYGIENE (WHO)



- 1. Wet hands
- 2. Obtain soap
- 3. Lather for 10-15 seconds
- 4. Rinse hands
- 5. Turn off faucet handles with paper towel.

Songs from the 90s' you can sing while washing your hands

These verses last for about 20 seconds or more.

BARBIE GIRL

I'm a Barbie girl in a Barbie world
Life in plastic, it's fantastic
You can brush my hair, undress me everywhere
Imagination, life is your creation
Come on, Barbie, let's go party!
I'm a Barbie girl in a Barbie world

MACARENA

Dale a tu cuerpo alegría Macarena
Que tu cuerpo pa' darle alegría
y cosa buena Dale a tu cuerpo
alegría, Macarena Hey Macarena
(aight, uh)
(Repeat x 1)

GANGSTA'S PARADISE

As I walk through the valley of the shadow of death
I take a look at my life and realize there's nothin' left'
Cause I've been blastin' and laughin' so long that
even my momma thinks that my mind is gone
But I ain't never crossed a man that didn't deserve it
Me be treated like a punk, you know that's unheard of
You better watch how you talkin' and where you walkin

HIT ME BABY ONE MORE TIME

My loneliness is killing me (and I)
I must confess I still believe (still believe)
When I'm not with you I lose my mind
Give me a sign
Hit me, baby, one more time

WANNABE

Yo, I'll tell you what I want,
what I really, really want
So tell me what you want,
what you really, really want
I'll tell you what I want,
what I really, really want
So tell me what you want,
what you really, really want
I wanna, (ha) I wanna, (ha) I wanna, (ha) I wanna, (ha)I wanna really,
really, really wanna zigazig ah
If you want my future, forget my past
If you wanna get with me, better make it fast

I WANT IT THAT WAY

Tell me why
Ain't nothin' but a heartache
Tell me why
Ain't nothin' but a mistake
Tell me why
I never want to hear you say
I want it that way

mothership

https://www.reddit.com/r/China_Flu/comments/feepa0/songs_from_the_90s_you_can_sing_while_washing/

- 1. "Love On Top," by Beyoncé
- 2. "Truth Hurts," by Lizzo
- 3. "Jolene," by Dolly Parton
- 4. "Somewhere Over the Rainbow," from the Wizard of Oz
- 5. "The Sound of Music," from The Sound of Music
- 6. "My Shot," from Hamilton
- 7. "Hands Clean," by Alanis Morisette
- 8. "Karma Chameleon," by Culture Club
- 9. "Stayin' Alive," by The BeeGees (also a favorite song for performing CPR)
- 10. "Toxic," by Britney Spears
- 11. "Livin' On a Prayer," by Bon Jovi
- 12. "No Scrubs," by TLC
- 13. "Raspberry Beret," by Prince
- 14. "Landslide," by Fleetwood Mac
- 15. "Love Shack" by The B-52's

https://www.today.com/health/songs-sing-while-washing-hands-coronavirus-hand-washing-songs-t175755

4. "My Shot" from *Hamilton*

Listen here: 00:00-00:21

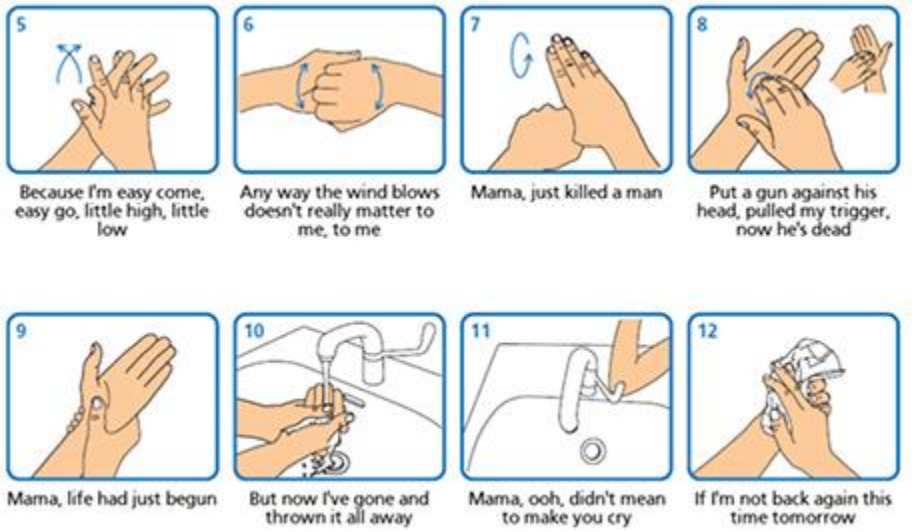
I am not throwing away my shot
I am not throwing away my shot
Hey yo, I'm just like my country
I'm young, scrappy, and hungry
And I'm not throwing away my shot
I'mma get scholarship to King's College
I probably shouldn't brag, but dag, I amaze and astonish
The problem is I got a lot of brains, but no polish
I gotta holler just to be heard
With every word I drop knowledge

https://www.playbill.com/article/9-broadway-songs-that-last-the-20-seconds-you-need-to-wash-your-hands-of-coronavirus

"Jolene, Jolene, Jolene, Jolene, I'm begging of you please don't take my man. Jolene, Jolene, Jolene, Jolene. Please don't take him just because you can."

Triage nurse Phillip Flavin goes for a line from Queen three times: "We will, we will rock you (rock you)." Sometimes, he says, he changes it to "We will, we will wash you."

https://www.npr.org/sections/goatsandsoda/2020/03/17/814221111/my-hand-washing-song-readers-offer-lyrics-for-a-20-second-scrub



https://www.crc.ie/20-second-hand-washing/

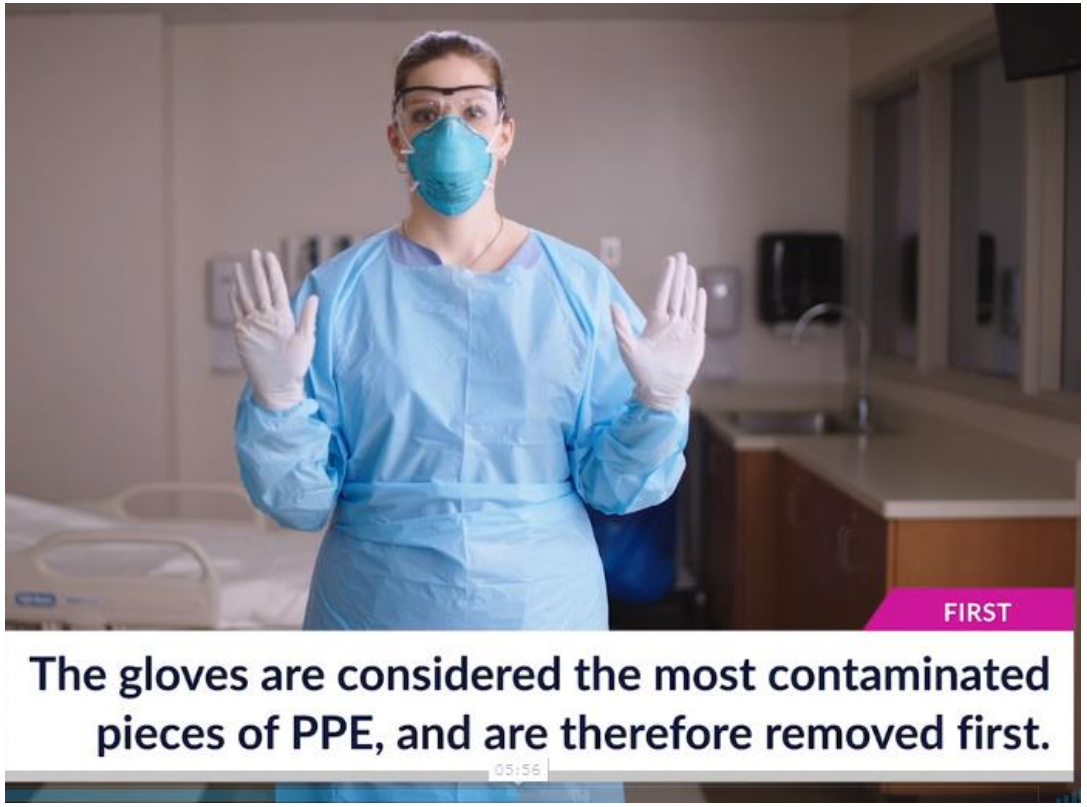
MODES OF TRANSMISSION

- Contact transmission
  - Direct: blood/body fluids, mites…
  - Indirect: touching the environment (fomites) then touching the patient, patient care devices (stethoscopes), shared toys, surgical instruments
- Droplet
  - Larger droplets
  - Do not remain suspended, drop to the ground (within 3ft)
- Airborne
  - Droplet nuclei <5µm
  - Remain suspended, travel long distances

Siegel JD, Rhinehart E, Jackson M, Chiarello L, and the Healthcare Infection Control Practices Advisory Committee, 2007 Guideline for Isolation Precautions: Preventing Transmission of Infectious Agents in Healthcare Setting. https://www.cdc.gov/infectioncontrol/guidelines/isolation/index.html

PRECAUTIONS—BE THOUGHTFUL!

- ALWAYS perform hand hygiene prior to donning gown
- READ the sign if you aren't sure
- Be conscientious in donning/doffing
  - >90% make errors in doffing
- Use the isolation equipment instead of your own stethoscope



https://vimeo.com/439273381

Phan LT et al. Personal protective equipment doffing practices of healthcare workers. J of occupational and environmental hygiene. 2019;16(8):575-81.

"PRESENTEEISM"

- Cost >>>>> absenteeism but difficult to quantify
  - 35-97% prevalence in healthcare
  - Nearly 60% medical residents admit to working while ill, and were more likely to come in if later in training
- Medical students, residents, and attendings survey
- Attendings were most likely to work (despite acknowledging that working through ILI posed a risk to others) AND considered the risk of transmitting that infection to the others lower than the students, house staff
- Reasons to stay home: feeling too unwell to perform duties, concern over infecting others, having obvious symptoms
- Medical students: difficulty in getting doctor's note
- Surgeons: worried about rescheduled in OR (impact on others)

When asked if they believed in the legitimacy of a colleague's sick day, medical students and residents were significantly less likely than [attendings] to agree (45% vs 49% vs 79%, p<0.001). Residents were also more likely than medical students or [attendings] to feel annoyed when a colleague was absent because of illness (22% vs 11% vs 6%, p<0.001).

Rantanen I, Tuominen R. Relative magnitude of presenteeism and absenteeism and work-related factors affecting them among health care professionals. *Int Arch Occ Env Hea* 2011;84:225–230.
Collins JJ, Baase CM, Sharda CE, *et al.* The assessment of chronic health conditions on work performance, absence, and total economic impact for employers. *J Occup Environ Med* 2005;47:547–557.
Jena AB, Baldwin DC, Daugherty SR, Meltzer DO, Arora VM. Presenteeism among resident physicians. *JAMA* 2010;304:1166–1168.
Letvak SA, Ruhm CJ, Gupta SN. Nurses' presenteeism and its effects on self-reported quality of care and costs. *Am J Nurs* 2012;112:30–38.
Widera E, Chang A, Chen HL. Presenteeism: a public health hazard. *J Gen Intern Med* 2010;25:1244–1247.
Ward A, Caro J, Bassinet L, Housset B, O'Brien JA, Guiso N. Health and economic consequences of an outbreak of pertussis among healthcare workers in a hospital in France. *Infect Control Hosp Epidemiol* 2005;26:288–292.
Albrich WC, Harbarth S. Healthcare workers: source, vector, or victim of MRSA? *Lancet Infect Dis* 2008;8:289–301.
Chiu S, Black CL, Yue X, *et al.* Working with influenza-like illness: presenteeism among US health care personnel during the 2014–2015 influenza season. *Am J Infect Control* 2017;45:1254–1258.

Gudgeon P, Wells DA, Baerlocher MO, Detsky AS. Do you come to work with a respiratory tract infection? Occup Environ Med. 2009;66(6):424.
Bergstrom G et al. Sickness presenteeism today, sickness absenteeism tomorrow? A prospective study on sickness presenteeism and future sickness absenteeism. J Occup Environ Med. 2009; 51(6):629-638.

PRESENTEEISM

Causes:

1. organizational (organizational policies, culture, disciplinary action)
2. job characteristics (lack of cover, professionalism, job demand)
3. personal reasons (burden on colleagues, perception, financial concerns)

Fixes:

1. positive working culture
2. paid sick leave

Webster. A systematic review of infectious illness presenteeism: prevalence, reasons, and risk factors. BMC Public Health. 2019 (19): 799.

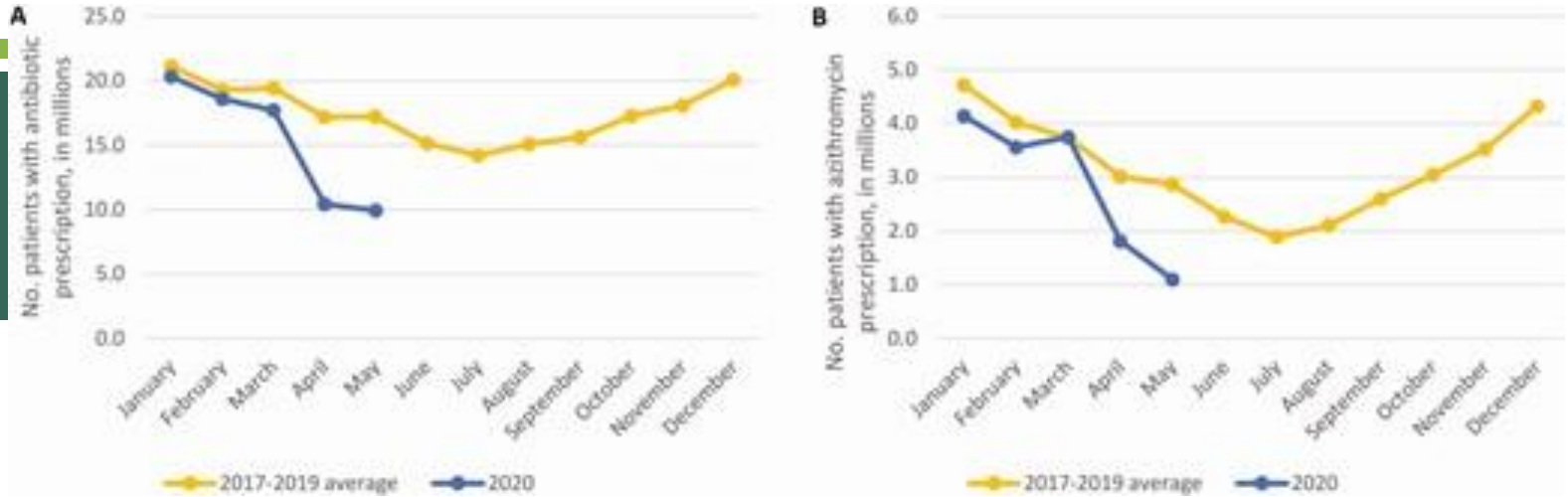
Antimicrobial resistance

AMR remains urgent public health threat

- MRSA, ESBL, CR-Enterobacterales, *Acinetobacter baumannii*, *Pseudomonas aeruginosa*
- Current understanding of AMR on mortality and healthcare costs is still modeling data/estimates
- Need comprehensive federal policy response to appropriate resource AS research, innovation
  - Surveillance, stewardship, innovation, diagnostics, research, infection prevention, workforce, global coordination
- COVID-19 pandemic disrupted AS activities with furloughing/eliminating AS staff
- 85-95% antibiotics are prescribed in outpatient setting without significant oversight

Fowler VG, Jezek A, Spivak ES. CID. 2022; 74(6): 1107-1111.

Outpatient prescribing



- Decrease AU in outpatient settings
- Compared to historic trends from January-May 2017-2020
  - Utilized database that access 92% of outpatient prescribing pharmacies
- Absolute # decreased from 20.3million to 9.9million, exceeding seasonally expected decreases
- April 2020: -39%; May 2020: -42%
- Azithromycin increased initially, then decreased
  - New York (37% higher in 2020 than 2017–2019 average), New Jersey (32%), Florida (16%), Oklahoma (7%), Louisiana (6%), Georgia (5%), Alabama (5%), Texas (3%), Mississippi (3%), Arkansas (2%), and Idaho (1%)
- "Beyond expected" decreases seen in respiratory infections, dentistry, and surgical prophylaxis
  - observed in prescribing by primary care, advanced practice providers, and select subspecialty and surgical providers

King LM et al. CID. 2021.

High rates of antimicrobial utilization

- Early reports: >70% received antibiotics, ~15% received antifungal (China, 2020)
  - Brazil: 85% received IV antibiotics, Peru: 70% azithro/ceftriaxone, with 33% prior to hospitalization
- Estimated than >50% of COVID-19 patients received antibiotics, as high as 95%-100% in some studies
- Why?
  - Cough/fever/radiologic infiltrates concerning for bacterial infection, therefore add empiric coverage
  - Anxiety/uncertainty regarding COVID-19 (1918 influenza pandemic was so deadly due to bacterial pneumonias)
  - Lack of anti**viral** therapies driving anti**biotic** use, particularly in the critically ill
  - Co-infection possibilities
    - Data emerged ~8% co-infected, and later studies showed even smaller #
    - Subsequent superinfections: VAP ~31%

Lai CC et al. International Journal of Antimicrobial Agents. 2021: 106324.
Ghosh et al. Journal of Infection and Public Health. 2021; 14(5): 555-560.

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journal homepage: www.elsevier.com/locate/ijantimicag

Antimicrobial Stewardship Collaborative of South Carolina

Change in Antimicrobial Use During COVID-19 Pandemic in South Carolina Hospitals: A Multicenter Observational Cohort Study

Hana R. Winders[a,b], Pamela Bailey[c,d,*], Joseph Kohn[b], Carmen M. Faulkner-Fennell[e], Sara Utley[f], Evan Lantz[g], Lloyd Sarbacker[h], Julie Ann Justo[a,b], P. Brandon Bookstaver[a,b], Sharon Weissman[c,d], Hannah Ruegner[a,i], Majdi N. Al-Hasan[c,d]

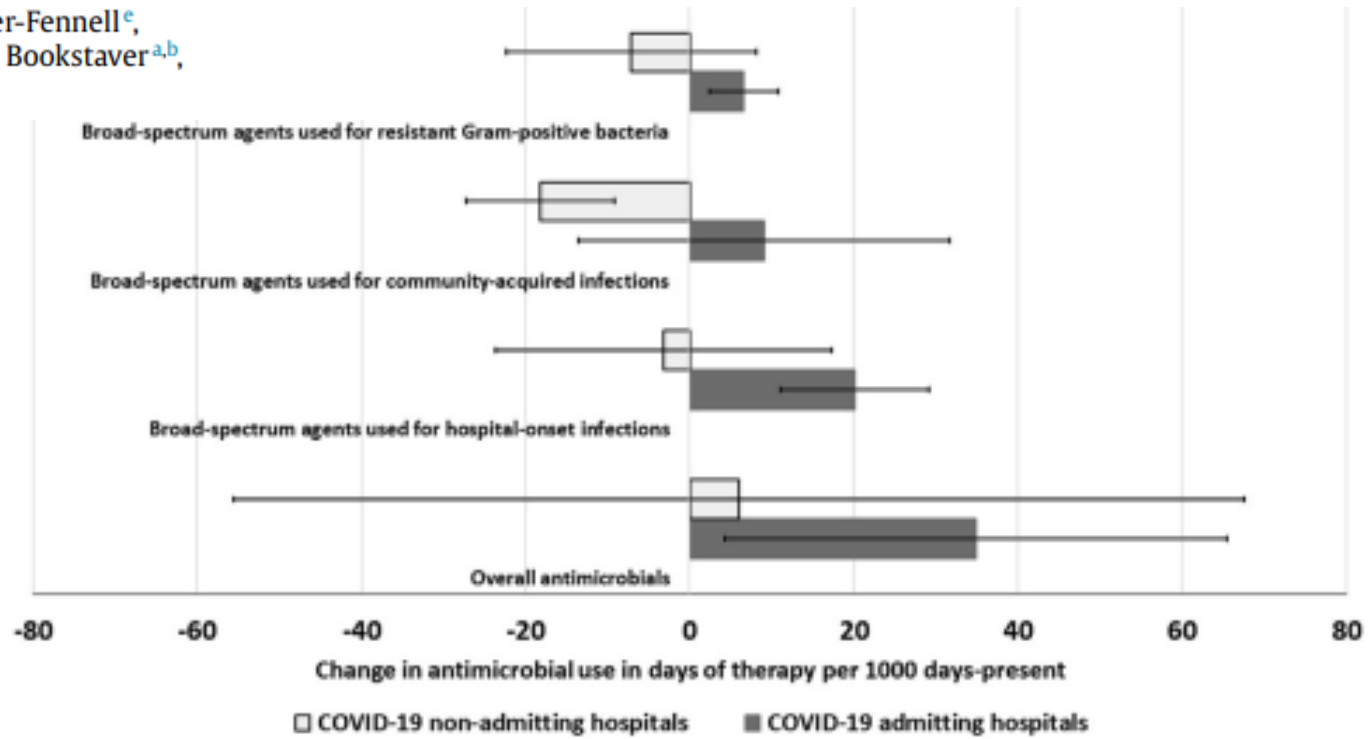


Figure 1. Mean change in antimicrobial use in March–June 2020 compared with March–June 2019. Error bars indicate 95% confidence intervals

Additional issues contributing to (inappropriate) antimicrobial use

- Many COVID-19+ patients are from congregate living facilities
  - May already be colonized with MDROs therefore will drive broad spectrum empiric antimicrobial use (AU)
- Significant increase in ICU patients, with increased AU will drive selection pressure for AMR
  - Long term effects: ? Increased structural lung disease with subsequent infections/colonization
- Many early COVID epicenters are also MDR epicenters (China, India, Mexico)
  - Note role for OneHealth/community transmission of the MDROs
  - Disruption of governance, sanitation/water safety, public health efforts
  - Disruption of supply chains: those that manufacture/produce antimicrobials leading to shortages→suboptimal concentrations, overly broad agents
- Driving resistance in other infections: using TB-active agents driving subsequent MDR TB in patients
- Misinformation about treatment/prevention (prophylaxis) of infections
  - Azithromycin, ivermectin
  - 2020, Australia: 44% survey respondents thought antibiotics could treat/prevent COVID-19

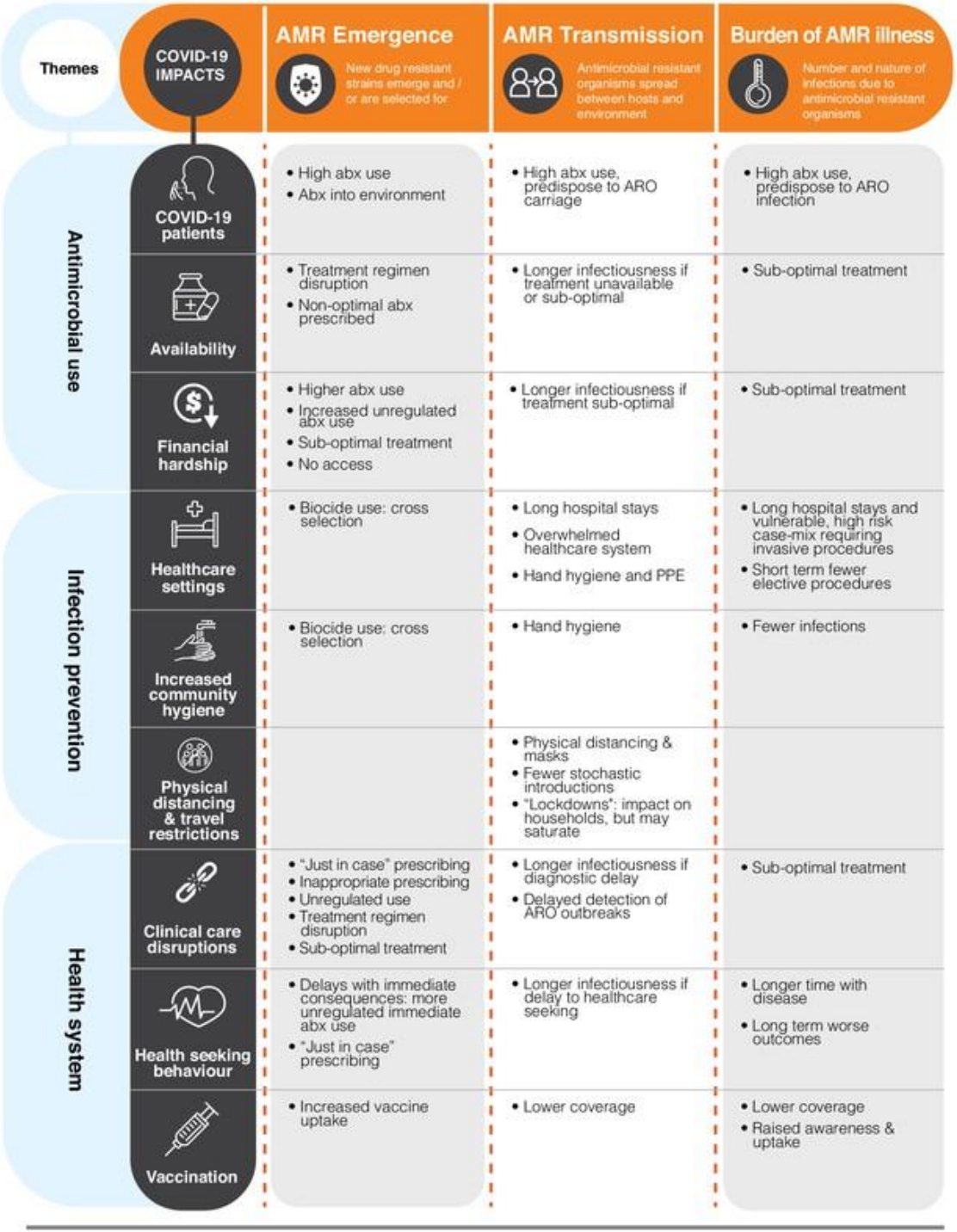
Clancy et al. JAC. 2020; 2(3).
Arshad M, Khan M. BMJ. 2020; 371:m4501.
Knight et al. eLife. 2021;10:e64139.

Increased antimicrobial resistance during the COVID-19 pandemic

- Carbapenem-resistant Enterobacterales colonization increase from 6.7% in 2019 to 50% in 2020
  - Related to 4-5 HCW with prolonged contact with 1 patient, 32 new HCW, high intensity of care required
- In China, secondary infections in 102 COVID-19 patients: *Acinetobacter baumannii* (35.8%), *Klebsiella pneumoniae* (30.8%), *Stenotrophomonas maltophilia* (6.3%)
  - Carbapenem resistance noted in 91% of the *Acinetobacter*, 75.5% of the *Klebsiella*
- In France, multiple cohorts of COVID-19 patients with bacterial co-infections were resistant to 3rd gen ceph
  - ICU patients frequently had MDR *A. baumannii*, MRSA
- Outbreaks of NDM: *Enterobacter cloacae* (NYC) and *E. coli* (France)
- Fungal reports: coinfection MRSA/*Morganella*/echinocandin resistant *C. glabrata; C. auris*; azole resistant *Aspergillus fumigatus*

Lai CC et al. International Journal of Antimicrobial Agents. 2021: 106324.

Responses to COVID-19:
The interplay of interventions (themes) affect different dimensions of change



Knight et al. eLife. 2021;10:e64139

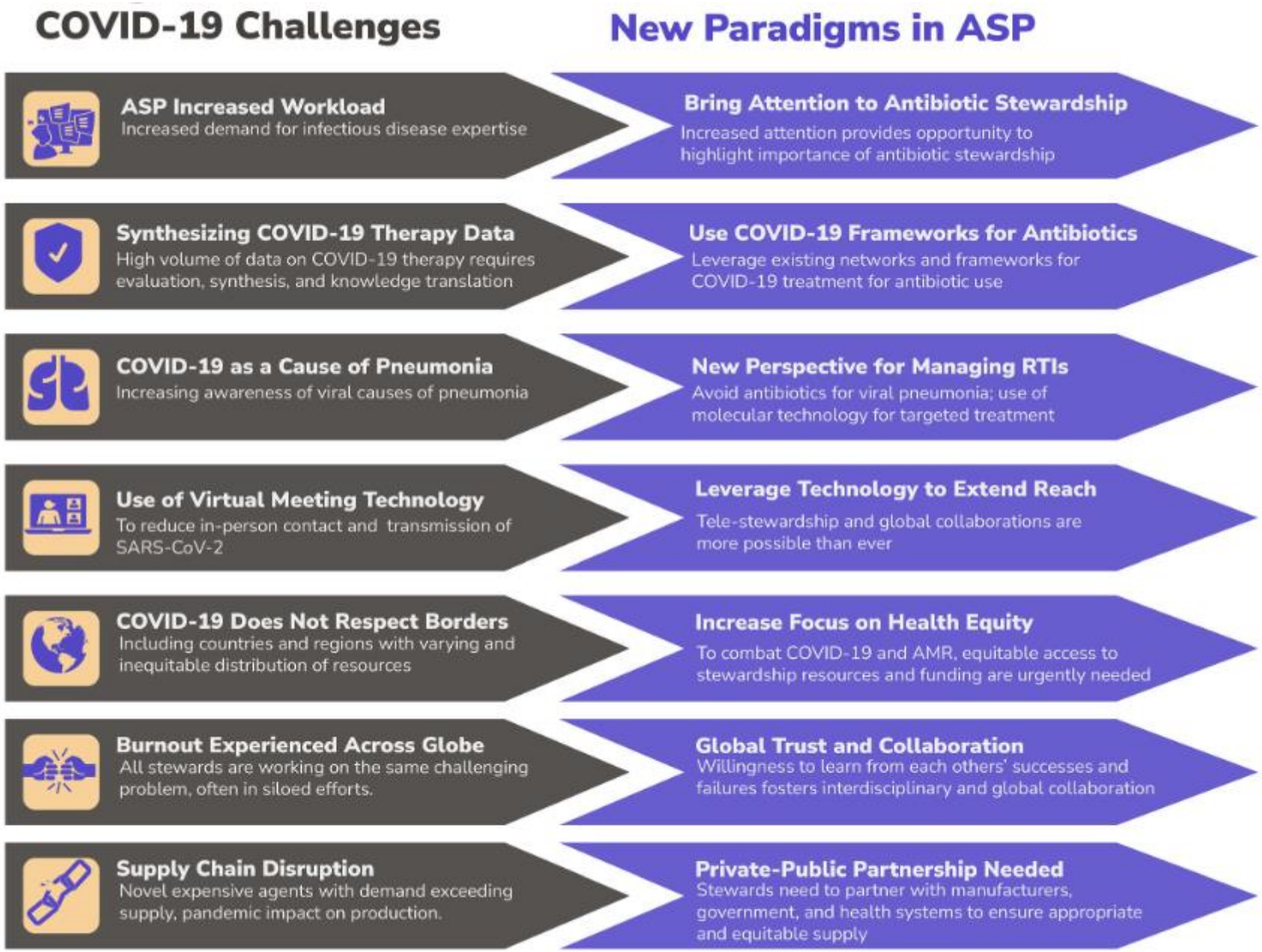


FIGURE 1 New paradigms in antimicrobial stewardship during COVID-19. ASP antimicrobial stewardship programs

Goff DA et al. J Am Coll Clin Pharm. 2022.

Questions?

Antimicrobial Stewardship Collaborative of South Carolina

Pamela Bailey, DO, MPH: pamela.bailey@uscmed.sc.edu
@dr_pbailey
ASC-SC: asc-sc@dhec.sc.gov
@ASC-SCarolina