Update on Healthcare-Associated Infections and Antimicrobial Resistance

Shelley Magill, MD, PhD
Captain, U.S. Public Health Service
Division of Healthcare Quality Promotion
Centers for Disease Control and Prevention

IDWeek
October 13, 2023

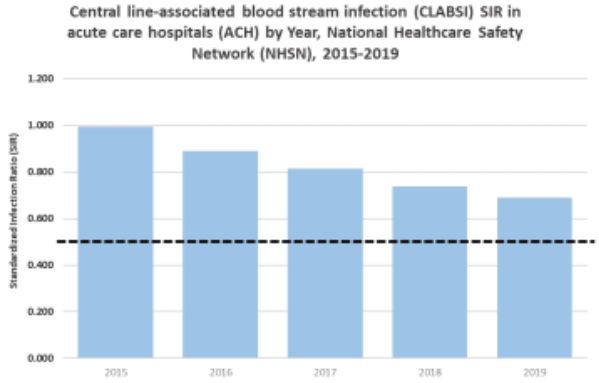
- Nothing to disclose
- Many thanks to all DHQP colleagues who provided data and slides for this presentation!
- The findings and conclusions in this presentation are those of the presenter and do not necessarily represent the official position of the Centers for Disease Control and Prevention

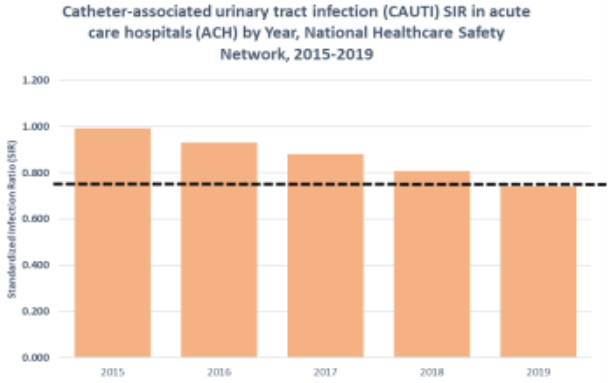
Overview

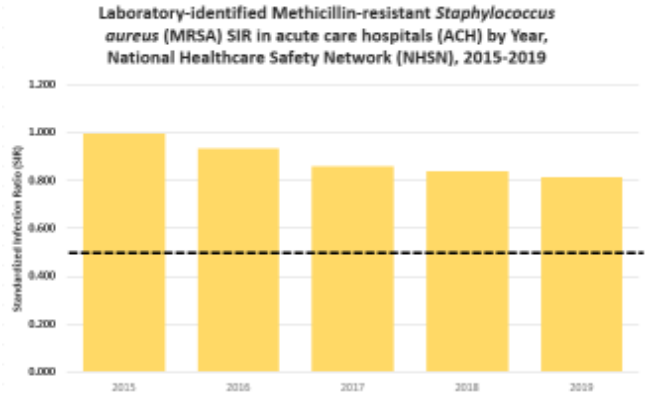
- Where we've been
  - Healthcare-associated infections (HAIs) and antimicrobial resistance (AR) before the pandemic
  - Impact of the pandemic
- Getting back on track
  - What do more recent HAI and AR data tell us?
- What's new and what's to come?

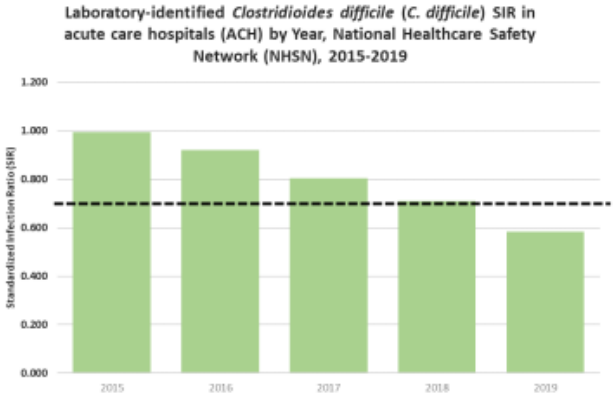
HAIs and AR in the United States before the COVID-19 pandemic

2019: HAIs Near or Meeting U.S. Department of Health and Human Services (HHS) Targets









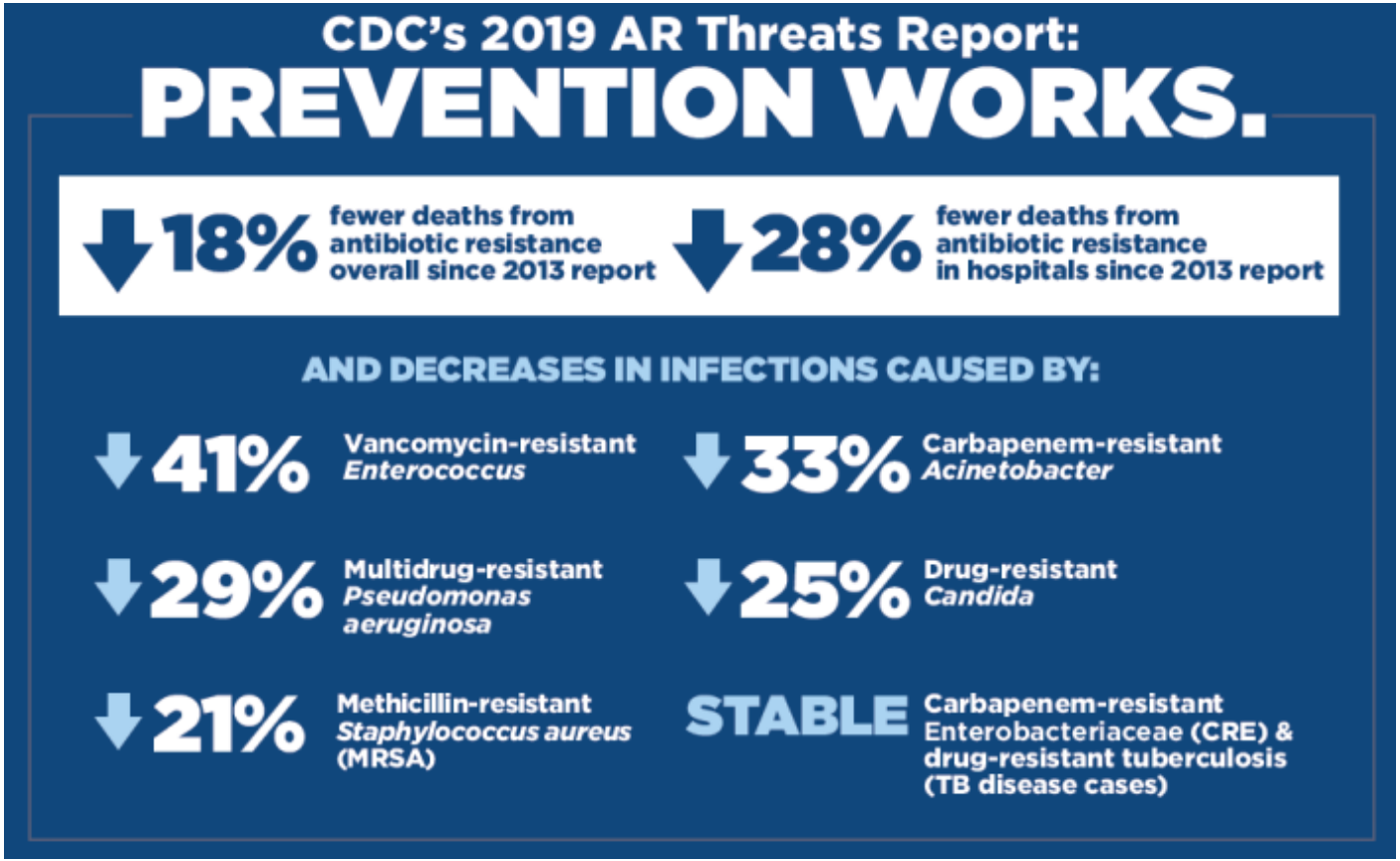
HHS target

Slide courtesy of Maggie Dudeck, MPH.

HHS National HAI Targets and Metrics. https://www.hhs.gov/oidp/topics/health-care-associated-infections/targets-metrics/index.html

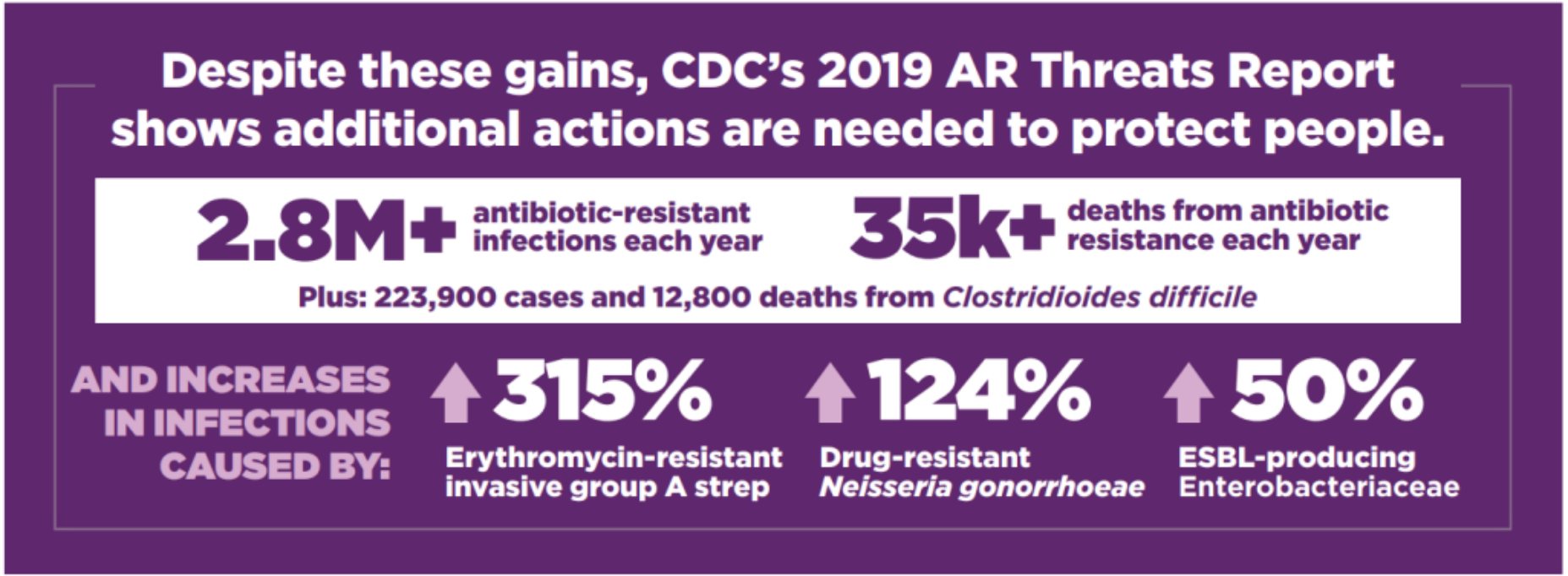
Data source: CDC. National and State HAI Progress Reports. https://www.cdc.gov/nhsn/datastat/progress-report.html

2019: Data Show AR Prevention Success



https://www.cdc.gov/drugresistance/pdf/threats-report/2019-ar-threats-report-508.pdf

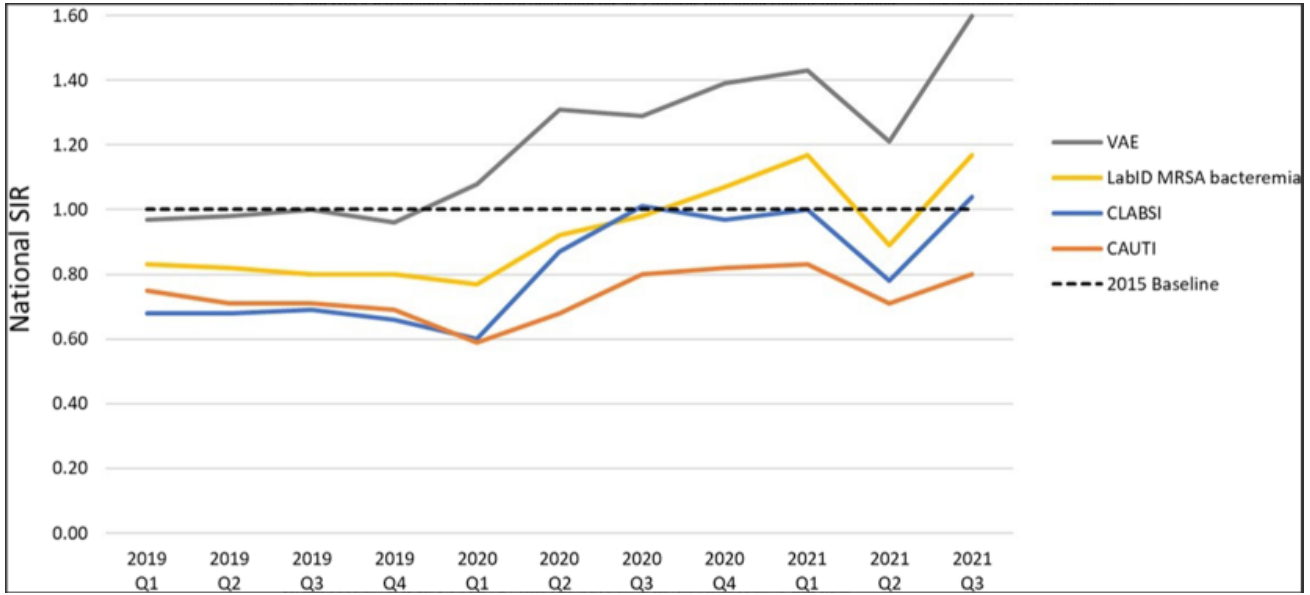
2019: Despite Progress, High Burden of AR



https://www.cdc.gov/drugresistance/pdf/threats-report/2019-ar-threats-report-508.pdf

Impact of the COVID-19 pandemic on HAIs and AR

Quarterly National Standardized Infection Ratios (SIRs) for Selected HAI Types, 2019 Q1–2021 Q3



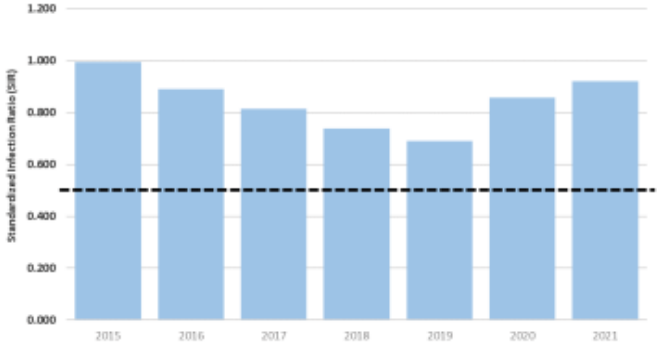
- **149% increase** in the number of VAEs reported in 2021 Q3 than in 2019 Q3, from same set of hospitals
- Elevated HAI incidence during periods of high COVID-19 hospitalizations (2021 Q1 & 2021 Q3)

Slide courtesy of Surveillance Branch, DHQP, CDC

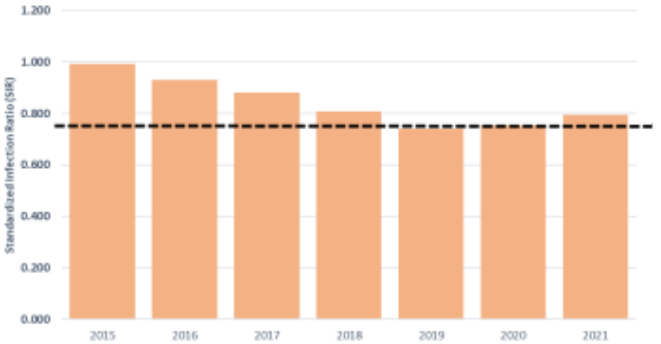
Lastinger LM, et al. *Infection Control & Hospital Epidemiology*. 2022:1-5. doi:10.1017/ice.2022.116

2020–2021: Changes in SIRs for Selected HAI Types

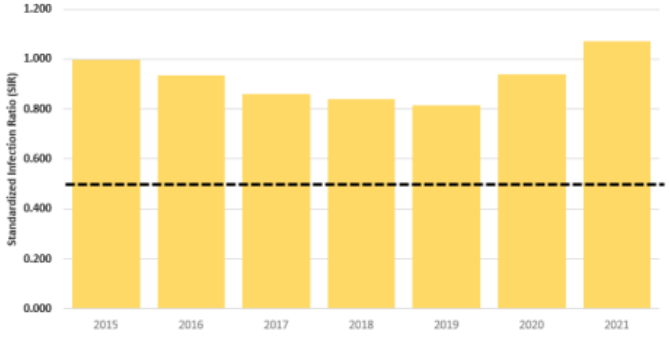
Central line-associated blood stream infection (CLABSI) SIR in acute care hospitals (ACH) by Year, National Healthcare Safety Network (NHSN), 2015-2021



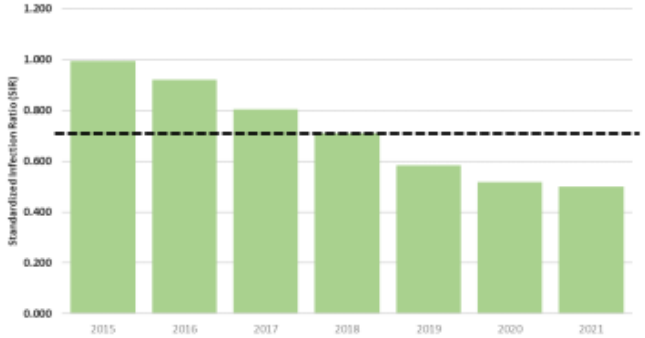
Catheter-associated urinary tract infection (CAUTI) SIR in acute care hospitals (ACH) by Year, National Healthcare Safety Network, 2015-2021



Laboratory-identified Methicillin-resistant *Staphylococcus aureus* (MRSA) SIR in acute care hospitals (ACH) by Year, National Healthcare Safety Network (NHSN), 2015-2021



Laboratory-identified *Clostridioides difficile* (*C. difficile*) SIR in acute care hospitals (ACH) by Year, National Healthcare Safety Network (NHSN), 2015-2021



HHS target

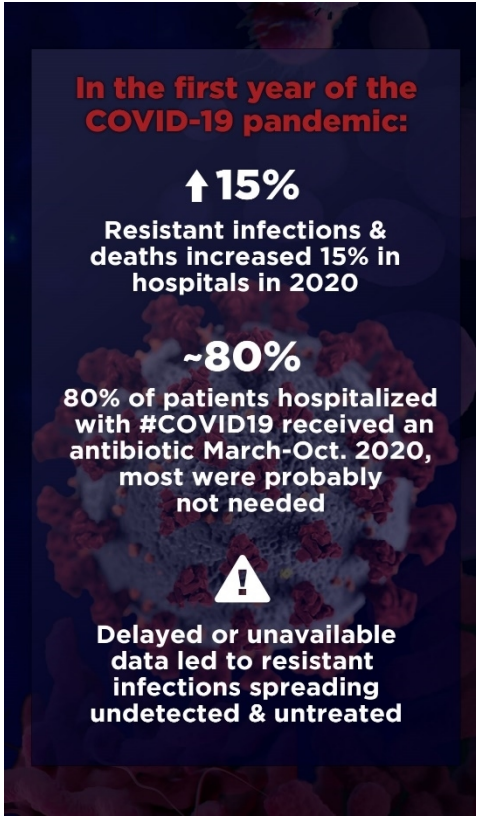
Slide courtesy of Maggie Dudeck, MPH.

Data source: CDC. National and State HAI Progress Reports. https://www.cdc.gov/nhsn/datastat/progress-report.html

Impact of COVID-19 Pandemic on AR

Recent prevention successes in hospitals **were reversed by the pandemic:**

- **Resistant hospital-onset infections and deaths both increased at least 15%** during the first year of the pandemic.
- **More than 29,400 people died from AR infections** commonly associated with healthcare during the first year of the pandemic.
  - Of these, **nearly 40% of the people** got the infection while they were in the hospital.
- The burden of resistance is likely much higher, but the pandemic caused **data gaps**.



CDC. COVID-19: U.S. Impact on Antimicrobial Resistance, Special Report 2022. Atlanta, GA: U.S. Department of Health and Human Services, CDC; 2022. https://www.cdc.gov/drugresistance/covid19.html

AR Pathogens During the COVID-19 Pandemic

Because of pandemic impacts, 2020 data are delayed or unavailable for 9 of the 18 antimicrobial resistance threats.

- *Clostridioides difficile (C. diff)*
- Drug-resistant *Neisseria gonorrhoeae*
- Drug-resistant *Campylobacter*
- Drug-resistant nontyphoidal *Salmonella*
- Drug-resistant *Salmonella* serotype Typhi
- Drug-resistant *Shigella*
- Drug-resistant *Streptococcus pneumoniae*
- Erythromycin-resistant group A *Streptococcus*
- Clindamycin-resistant group B *Streptococcus*

Available data show an alarming increase in resistant infections starting during hospitalization, growing at least 15% from 2019 to 2020.

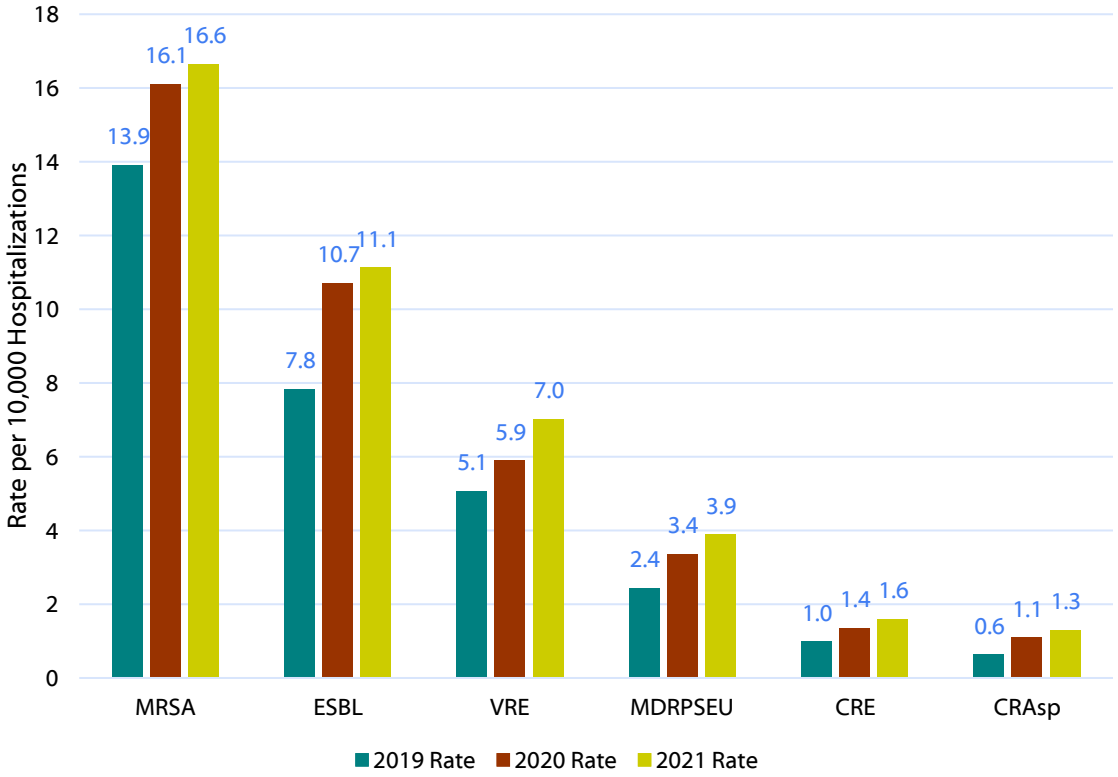
- Carbapenem-resistant *Acinetobacter* (↑78%)
- Antifungal-resistant *Candida auris* (↑60%)*
- Carbapenem-resistant Enterobacterales (↑35%)
- Antifungal-resistant *Candida* (↑26%)
- ESBL-producing Enterobacterales (↑32%)
- Vancomycin-resistant Enterococcus (↑14%)
- Multidrug-resistant *P. aeruginosa* (↑32%)
- Methicillin-resistant *Staphylococcus aureus* (↑13%)

**Candida auris* was not included in the hospital-onset rate calculation of 15%. See Data Table and Methods for more information on this pathogen.

CDC. COVID-19: U.S. Impact on Antimicrobial Resistance, Special Report 2022. Atlanta, GA: U.S. Department of Health and Human Services, CDC; 2022. https://www.cdc.gov/drugresistance/covid19.html

National Rates of Hospital-Onset AR Pathogens, 2019–2021

Poster 2455, Baggs J, et al. National Trends in the Rates of Drug-resistant Bacteria Commonly Associated with Healthcare in U.S. Acute Care Hospitals, 2019-2021 (Saturday, 10/14, 12:15 pm)



Are we getting back on track?

Ingredients for Success

- **Infrastructure and capacity** established pre-pandemic
  - Examples: State HAI/AR programs, AR Laboratory Network
- **Stronger connections between healthcare and public health**
  - State and local HAI/AR programs developed expertise in supporting facilities, especially nursing homes, with infection prevention and control
- **Stronger relationship with the Centers for Medicare & Medicaid Services**
  - Hospital and nursing home mandates for antibiotic stewardship programs
  - Antibiotic use and resistance surveillance measure mandated in recent Inpatient Prospective Payment System rule

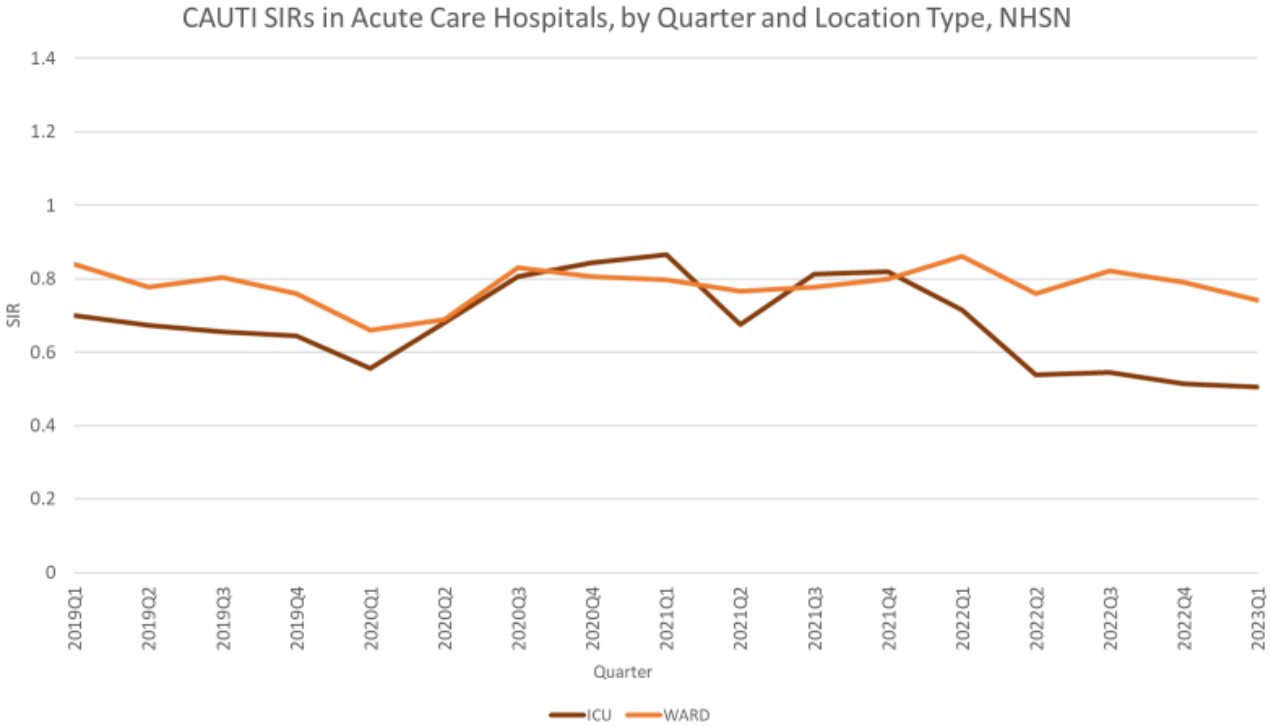
Changes in the 2022 National HAI Standardized Infection Ratios (SIRs) Compared to 2021

	Acute Care Hospitals (ACH)	Inpatient Rehab Facilities (IRF)	Long-term Acute Care Hospitals (LTACH)
CAUTI	↓ 12%	No change[1]	No change[1]
CLABSI	↓ 9%	No change[1]	No change[1]
VAE	↓ 19%		No change[1]
SSI-COLO	No change[1]		
SSI-HYST	No change[1]		
LabID MRSA bacteremia	↓ 16%	No change[1]	No change[1]
LabID CDI	↓ 3%	↓ 9%	No change[1]

Data represent all facilities with at least 1 month of in-plan data, and all location types for device-associated HAIs.
[1]"No change" signifies that the change in SIR was not statistically significant

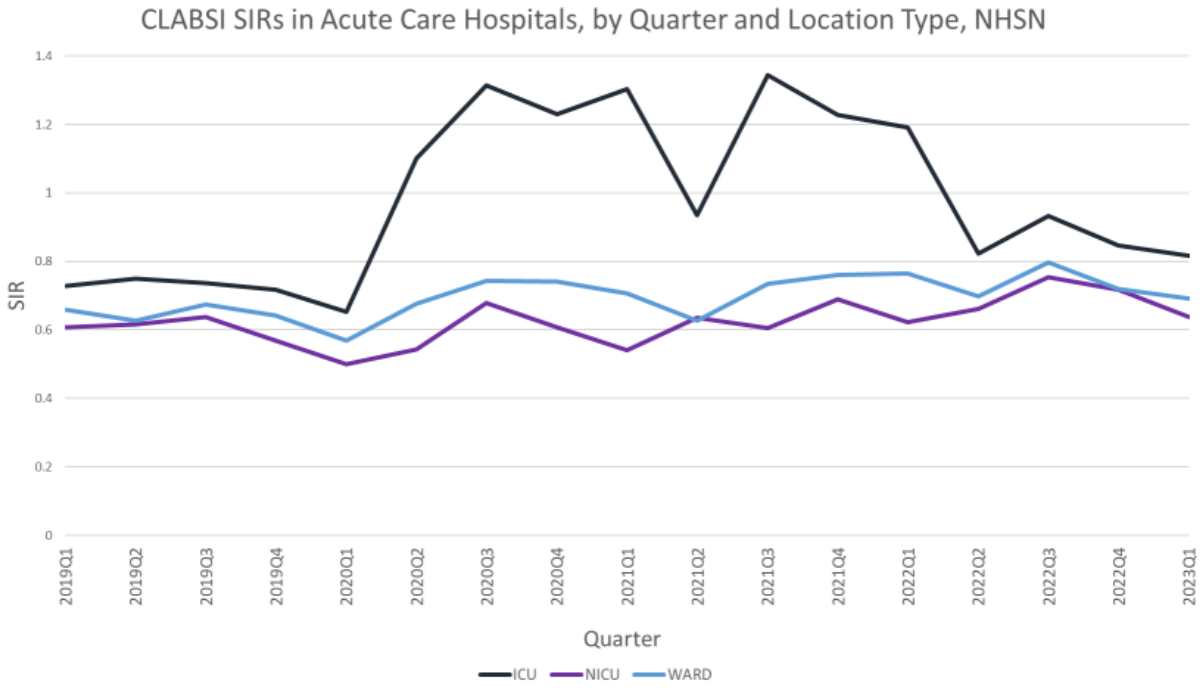
Slide courtesy of the NHSN Acute Care Analytics Team, including Karen Jones and Maggie Dudeck, Surveillance Branch, DHQP, CDC.
2022 National and State HAI Progress Report. *Publication pending.*

Quarterly CAUTI SIRs in Acute Care Hospitals – by Location Type



Slide courtesy of the NHSN Acute Care Analytics Team, including Karen Jones and Maggie Dudeck, Surveillance Branch, DHQP, CDC. NHSN. Unpublished data. *Disclaimer: The chart and data table display quarterly SIR point estimates which do not constitute a statistical trend analysis.*

Quarterly CLABSI SIRs in Acute Care Hospitals – by Location Type

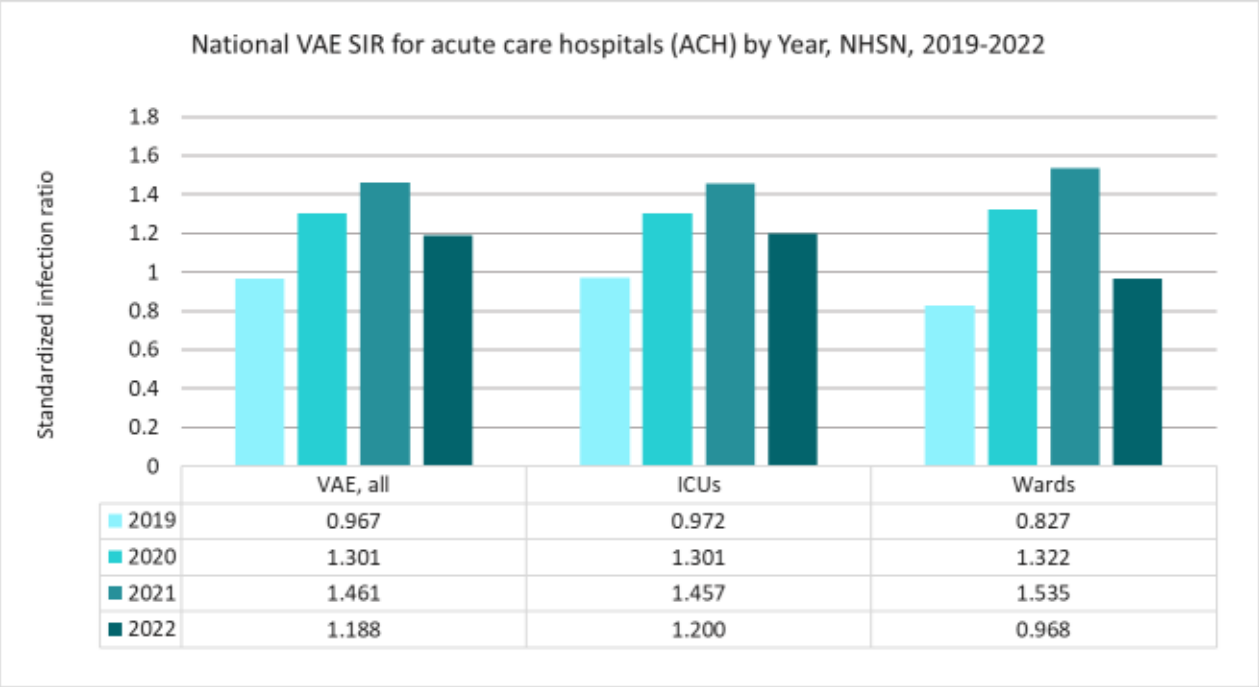


Slide courtesy of the NHSN Acute Care Analytics Team, including Karen Jones and Maggie Dudeck, Surveillance Branch, DHQP, CDC. NHSN. Unpublished data. *Disclaimer: The chart displays quarterly SIR point estimates which do not constitute a statistical trend analysis.*

2022 VAE SIRs Compared to 2021 – Acute Care Hospitals

- Compared to 2021, we observed a 19% decrease* in the overall 2022 VAE SIR
- Decrease* in ICUs (18%) and Wards (37%)

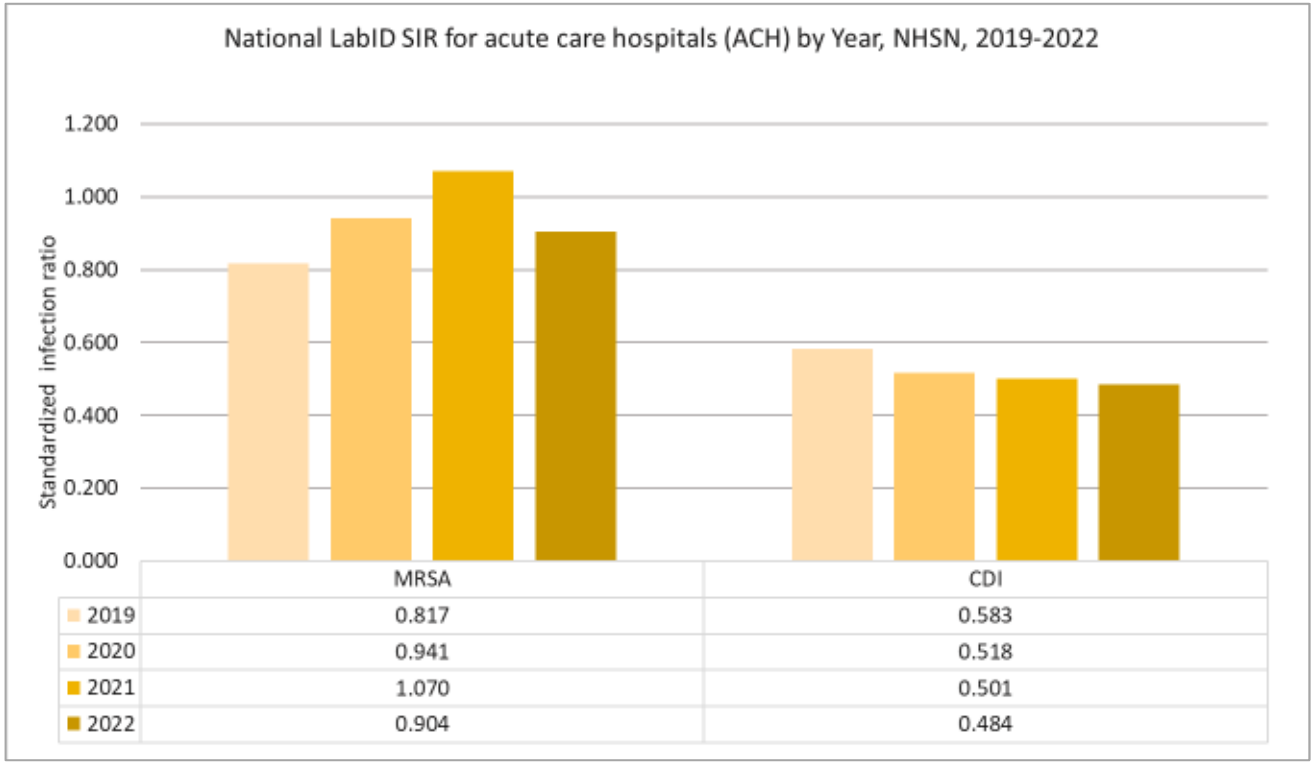
*Direction of Change in SIRs (Increases/Decrease/No Change) using percent change is based on statistical significance, p-value <0.05



	VAE, all	ICUs	Wards
2019	0.967	0.972	0.827
2020	1.301	1.301	1.322
2021	1.461	1.457	1.535
2022	1.188	1.200	0.968

Slide courtesy of the NHSN Acute Care Analytics Team, including Karen Jones and Maggie Dudeck, Surveillance Branch, DHQP, CDC. NHSN. CDC. 2022 National and State HAI Progress Report. *Publication pending.*

2022 MRSA and CDI SIRs Compared to 2021 – Acute Care Hospitals



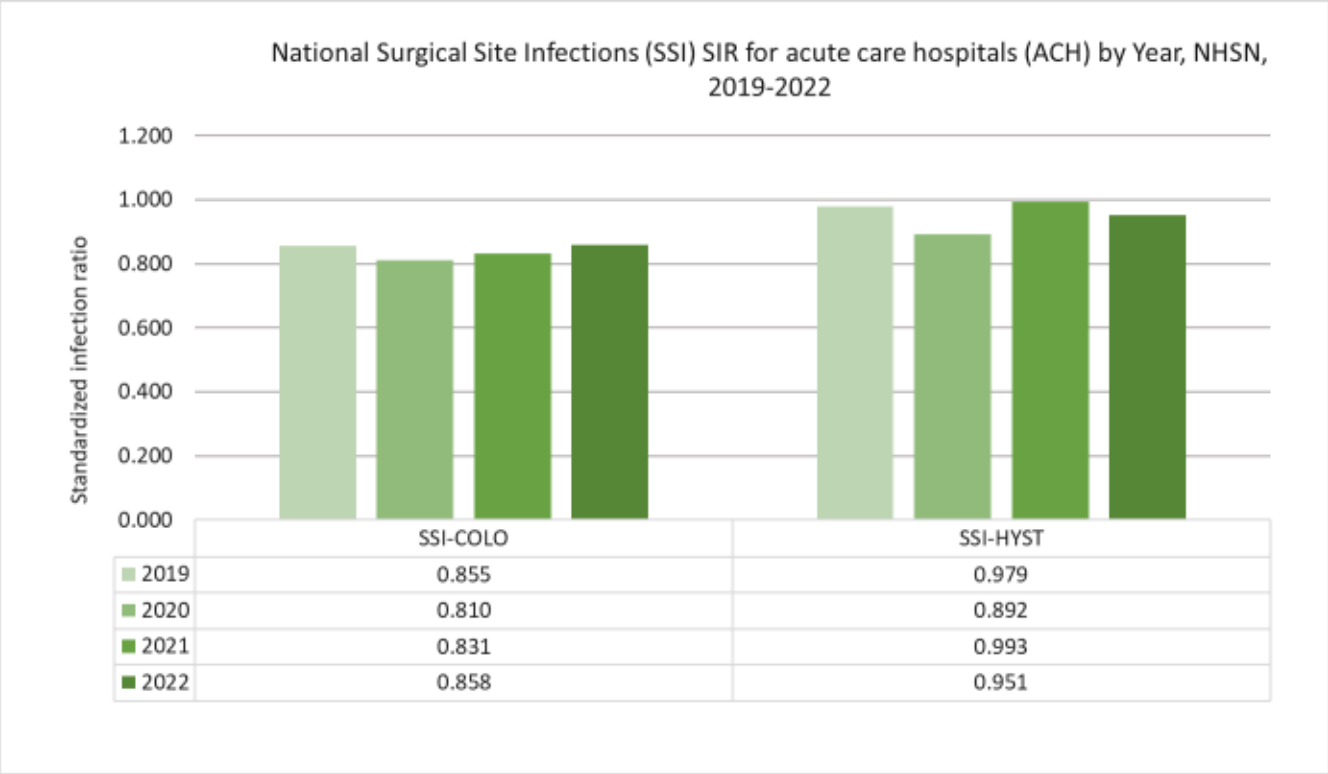
	MRSA	CDI
2019	0.817	0.583
2020	0.941	0.518
2021	1.070	0.501
2022	0.904	0.484

- After increase, progress made in the reduction of MRSA, 16% decrease*
- 3% decrease* in CDI SIR between 2022 and 2021

*Direction of Change in SIRs (Increases/Decrease/No Change) using percent change is based on statistical significance, p-value <0.05

Slide courtesy of the NHSN Acute Care Analytics Team, including Karen Jones and Maggie Dudeck, Surveillance Branch, DHQP, CDC. NHSN. CDC. 2022 National and State HAI Progress Report. *Publication pending.*

2022 COLO and HYST SSI SIRs Compared to 2021 – Acute Care Hospitals



	SSI-COLO	SSI-HYST
2019	0.855	0.979
2020	0.810	0.892
2021	0.831	0.993
2022	0.858	0.951

- No significant changes in 2022 colon surgery (COLO) SSI and abdominal hysterectomy (HYST) SSI SIRs

*Direction of Change in SIRs (Increases/Decrease/No Change) using percent change is based on statistical significance, p-value <0.05

Slide courtesy of the NHSN Acute Care Analytics Team, including Karen Jones and Maggie Dudeck, Surveillance Branch, DHQP, CDC. NHSN. CDC. 2022 National and State HAI Progress Report. *Publication pending.*

Conclusions from NHSN Data

- Significant decreases in CAUTI, CLABSI, VAE, MRSA bacteremia, and CDI SIRs in 2022 compared to 2021 in acute care settings
  - COVID-related challenges improving
  - Some HAIs have returned to pre-pandemic SIRs
  - Reductions particularly notable for CAUTI, CLABSI, and VAE SIRs in ICUs
- Findings support the need for hospitals to continue to reinforce infection prevention protocols, review HAI surveillance data regularly to identify areas that need improvement, plus address any gaps in prevention practices
- Coming soon! 2022 National and State HAI Progress Report will be available at https://www.cdc.gov/hai/data/portal/progress-report.html and in CDC's Antibiotic Resistance & Patient Safety Portal (AR&PSP) at https://arpsp.cdc.gov/

Information courtesy of the NHSN Acute Care Analytics Team, including Karen Jones and Maggie Dudeck, Surveillance Branch, DHQP, CDC.
NHSN. CDC. 2022 National and State HAI Progress Report. *Publication pending.*

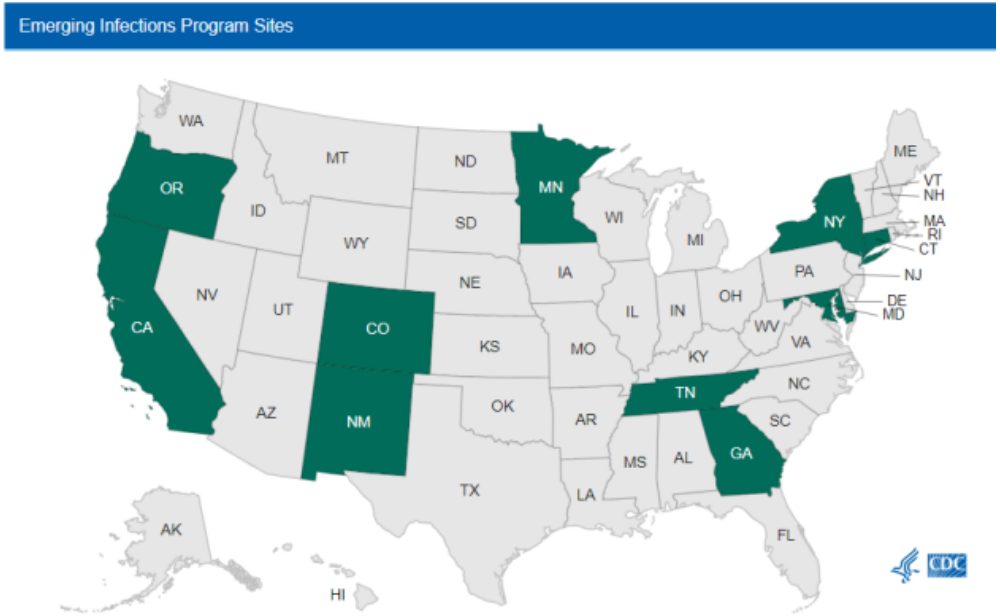
Emerging Infections Program Healthcare-Associated Infections – Community Interface Activity (EIP HAIC)

Slides and data provided by the Office of Surveillance and Epidemiology, Epidemiology Research and Innovations Branch (ERIB), DHQP, CDC

For more information: https://www.cdc.gov/hai/eip/index.html

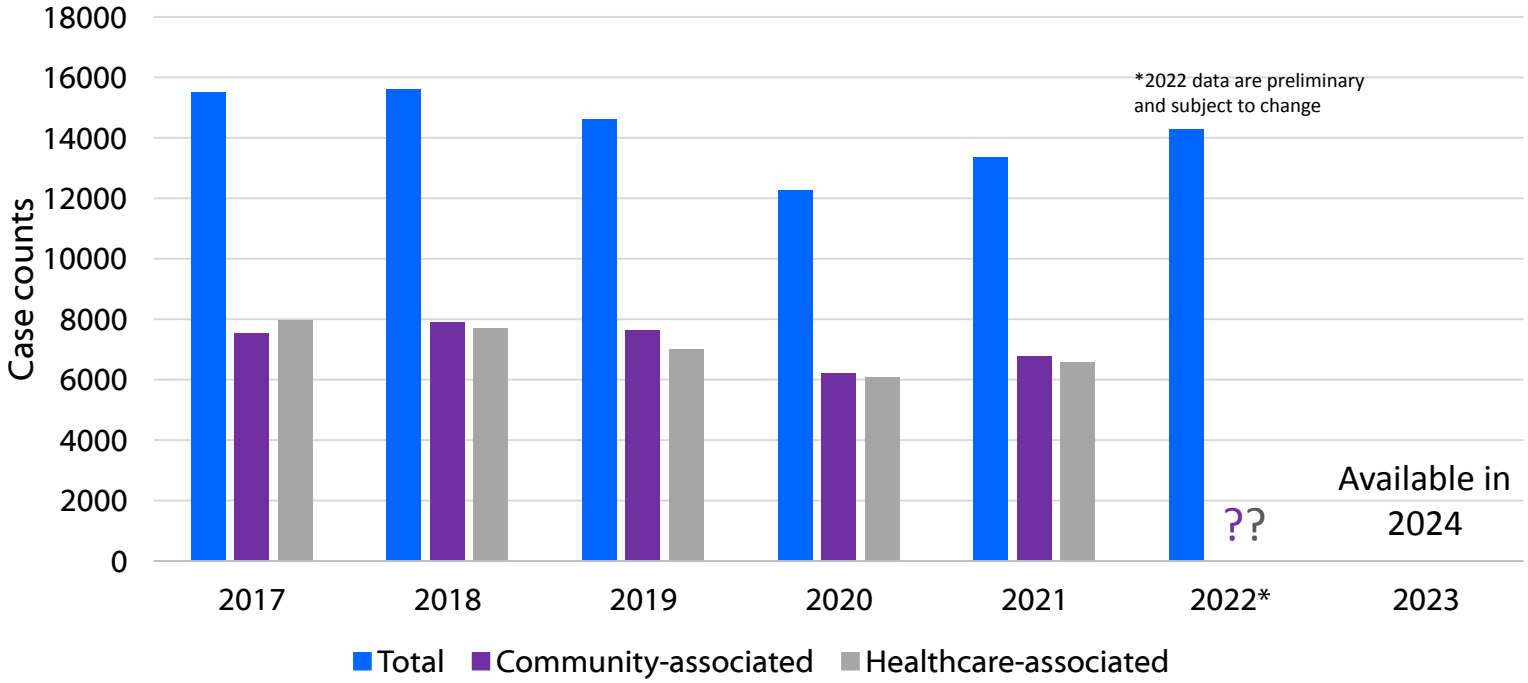
CDC's Emerging Infections Program: Network for Population-Based Surveillance and Special Studies

- Network of state health departments and academic partners established in 1995
- Assess public health impact and evaluate approaches to prevention and control of emerging infectious diseases
- Core EIP work is **active, population- and laboratory-based infection surveillance with isolate collection**
  - Surveillance area varies by pathogen; up to 45 million persons
  - Basis for epidemiological and laboratory analyses, special projects



https://www.cdc.gov/ncezid/dpei/eip/index.html

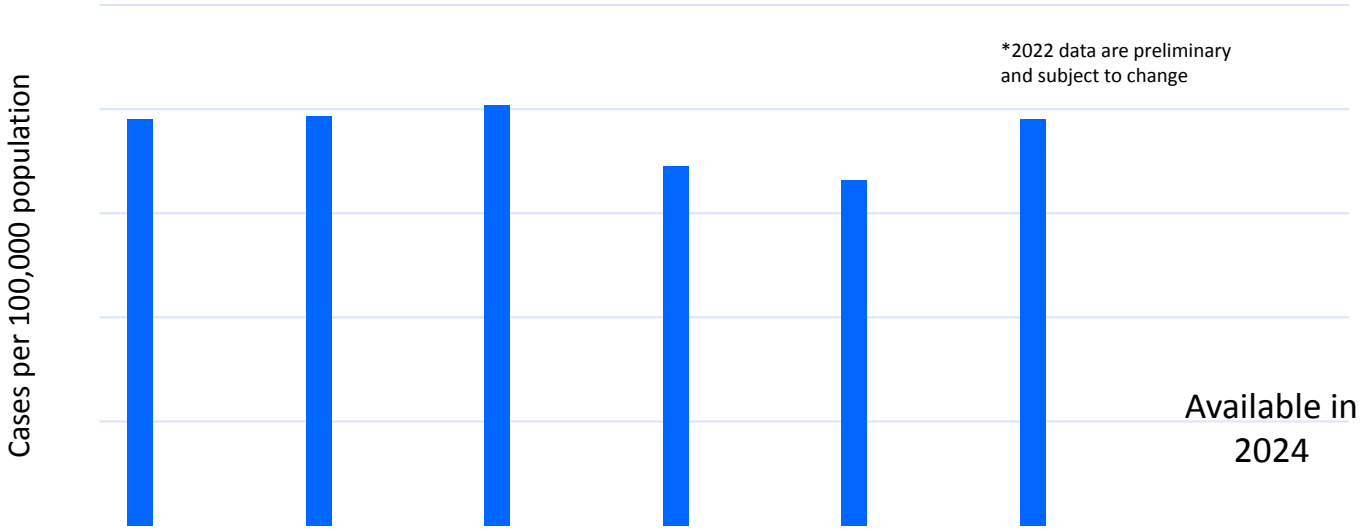
Clostridioides difficile Infections in 10 EIP Sites, 2017–2022



Data source: https://www.cdc.gov/hai/eip/cdiff-tracking.html

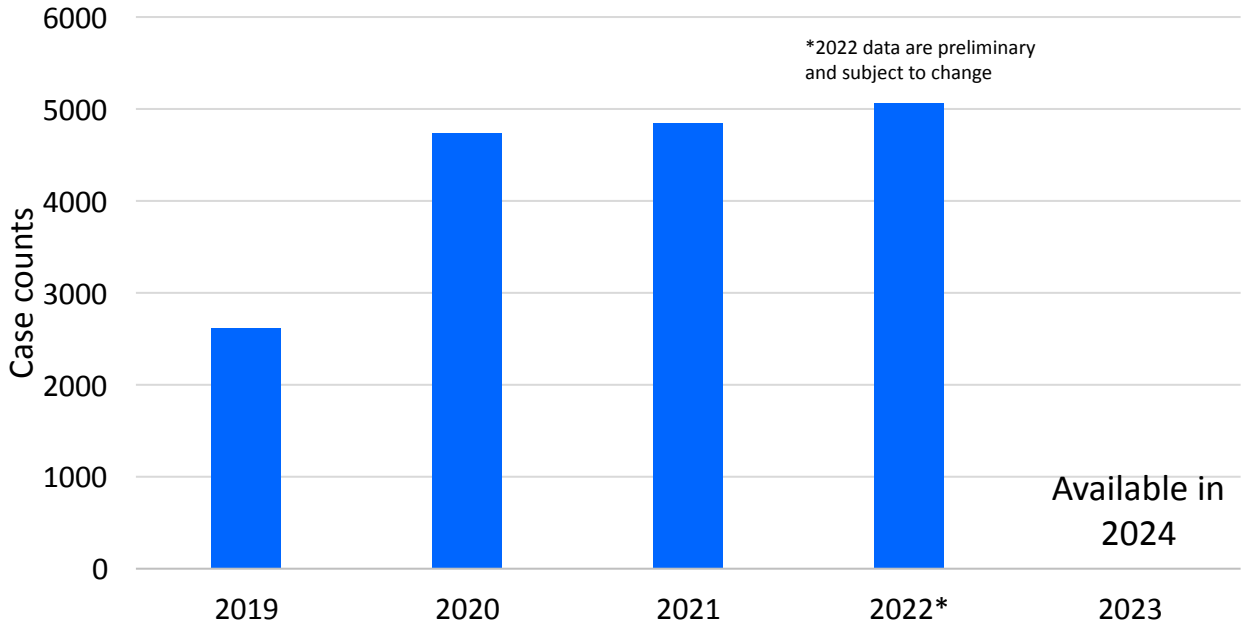
Data from 2022 provided by the Office of Surveillance and Epidemiology, ERIB, DHQP, CDC; they are preliminary and subject to change.

Invasive Methicillin-Resistant *Staphylococcus aureus* (MRSA) Infection Incidence, Four EIP Sites, 2017–2022



More information available at: https://www.cdc.gov/hai/eip/saureus.html .
Data provided by the Office of Surveillance and Epidemiology, ERIB, DHQP, CDC; they are preliminary and subject to change.

ESBL-Producing Enterobacterales from Sterile Body Sites or Urine, Six EIP Sites, 2019–2022



ESBL = extended spectrum beta lactamase. More information available at: https://www.cdc.gov/hai/eip/mugsi.html. Case counts shown may differ slightly from online annual reports due to data updates after annual report data were finalized.
Data provided by the Office of Surveillance and Epidemiology, ERIB, DHQP, CDC; they are preliminary and subject to change.

Summary of EIP HAIC Data*

- Since 2020, rebound in:
  - CDI cases in 2021 and 2022
  - Invasive MRSA infection incidence in 2022
- Continued increases in ESBL-producing Enterobacterales case counts through 2022

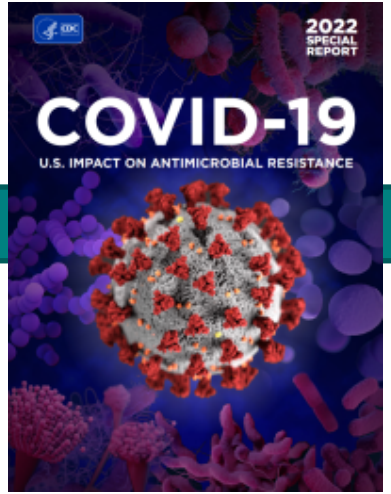
*Important considerations: population-based surveillance (rather than facility-based), preliminary 2022 data, small numbers of participating sites and sizes of populations under surveillance, and differences in changes over time based on epidemiological classifications of cases

What’s new / what’s to come …

Selected Recent and Future Developments

- December 2022 update, “Interim Guidance for a Public Health Response to Contain Novel or Targeted Multidrug-resistant Organisms (MDROs),” https://www.cdc.gov/hai/mdro-guides/containment-strategy.html
- 2022 NHSN HAI Progress Report
- NHSN HAI Pathogens and AR Report, 2018–2021: https://www.cdc.gov/nhsn/hai-report/index.html
- NHSN rebaseline process to update the national baseline data used to calculate HAI SIRs (https://www.cdc.gov/nhsn/2022rebaseline/)
- NHSN Antimicrobial Resistance Option, https://www.cdc.gov/nhsn/psc/aur/index.html
  - New Standardized Resistant Infection Ratio (SRIR) and pathogen-specific SIR (pSIR) reports

CDC Antimicrobial Resistance Threats Report



Next report in development, release date TBD

2023 EIP Hospital Prevalence Survey of HAIs and Antimicrobial Use (AU)

- Complements data reported to NHSN
  - Full spectrum of HAIs across hospital inpatient locations
  - Two previous full-scale surveys conducted in hospitals in 10 EIP sites, 2011 and 2015
- Provides snapshot of all hospital HAIs and AU and changes over time
  - National HAI burden estimation
  - Most common infections and pathogens
  - Most common antimicrobials and indications
  - Assessment of the quality of antimicrobial prescribing for selected hospital prescribing scenarios

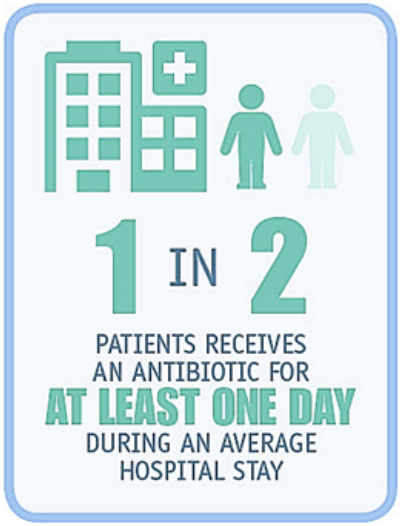
More information available at: https://www.cdc.gov/hai/eip/antibiotic-use.html.

Key HAI Results of Previous EIP Hospital Surveys

	2011	2015
Hospitals and Patients	183 hospitals 11,282 patients	199 (including 148 that participated in 2011) 12,299 patients
Patients with HAIs	4.0% of patients (95% confidence interval: 3.7 – 4.4%) *1 in 25 patients on any given day*	3.2% of patients (95% confidence interval 2.9 – 3.5%) *1 in 31 patients on any given day*
Annual U.S. HAI Burden	648,000 patients with HAIs 721,800 total HAIs	633,300 patients with HAIs 687,200 total HAIs
Most Common Infections	#1 – Surgical site infections and pneumonia (tie) #3 – Gastrointestinal infections	#1 – Pneumonia #2 – Gastrointestinal infections #3 – Surgical site infections
Most Common Pathogens	#1 – *Clostridioides difficile* #2 – *Staphylococcus aureus* #3 – *Klebsiella pneumoniae/oxytoca*	#1 – *Clostridioides difficile* #2 – *Staphylococcus aureus* #3 – *Escherichia coli*

Slide courtesy of Nora Chea, Office of Surveillance and Epidemiology, ERIB, DHQP, CDC.
Magill SS, et al. https://www.nejm.org/doi/full/10.1056/NEJMoa1306801; Magill SS, et al. https://www.nejm.org/doi/full/10.1056/NEJMoa1801550. More information available at: https://www.cdc.gov/hai/eip/antibiotic-use.html.

Antimicrobial Use in EIP Hospital Surveys, 2015 vs. 2011



Antimicrobial Use*

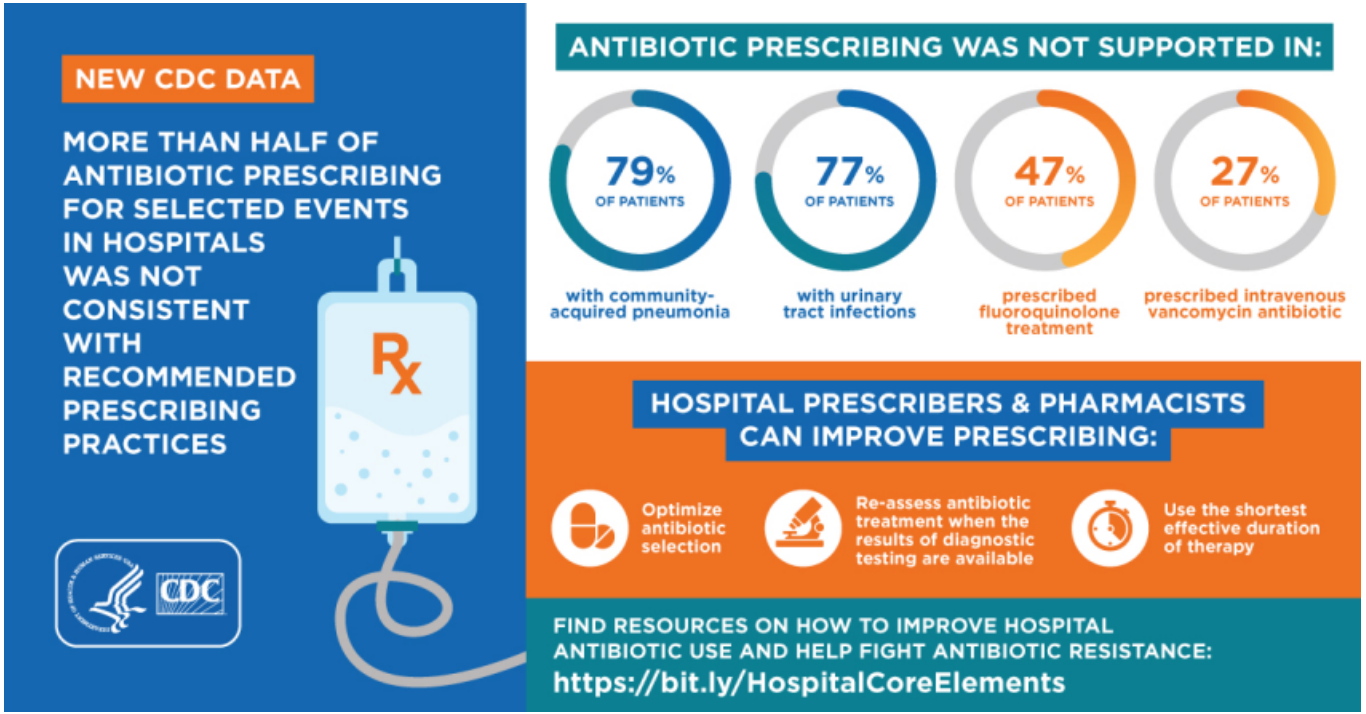
Lower percentage of patients on **fluoroquinolones** in 2015 compared with 2011.

Higher percentage of patients on **cephalosporins** and **carbapenems** in 2015 compared with 2011.

*In 148 hospitals participating in the 2011 and 2015 surveys.

Slide courtesy of Nora Chea, Office of Surveillance and Epidemiology, ERIB, DHQP, CDC.
Magill SS, et al. https://jamanetwork.com/journals/jama/fullarticle/1911328; Magill SS, et al. https://academic.oup.com/cid/article/72/10/1784/5855453?login=true .
More information available at: https://www.cdc.gov/hai/eip/antibiotic-use.html

Quality of Antimicrobial Prescribing in EIP Hospital Survey, 2015



Slide courtesy of Nora Chea, Office of Surveillance and Epidemiology, ERIB, DHQP, CDC.
Magill SS, et al. https://jamanetwork.com/journals/jamanetworkopen/fullarticle/2777635.
More information available at: https://www.cdc.gov/hai/eip/antibiotic-use.html.

Status of 2023 EIP Hospital Survey

- Total of 216 participating hospitals across 10 EIP sites as of September 25, 2023
- Data collection and entry underway in all sites, with completion goal by end of December 2023
- Anticipate availability of results in 2024

Information courtesy of Nora Chea, Office of Surveillance and Epidemiology, ERIB, DHQP, CDC.
Magill SS, et al. https://jamanetwork.com/journals/jamanetworkopen/fullarticle/2777635.
More information available at: https://www.cdc.gov/hai/eip/antibiotic-use.html.

Acknowledgments:

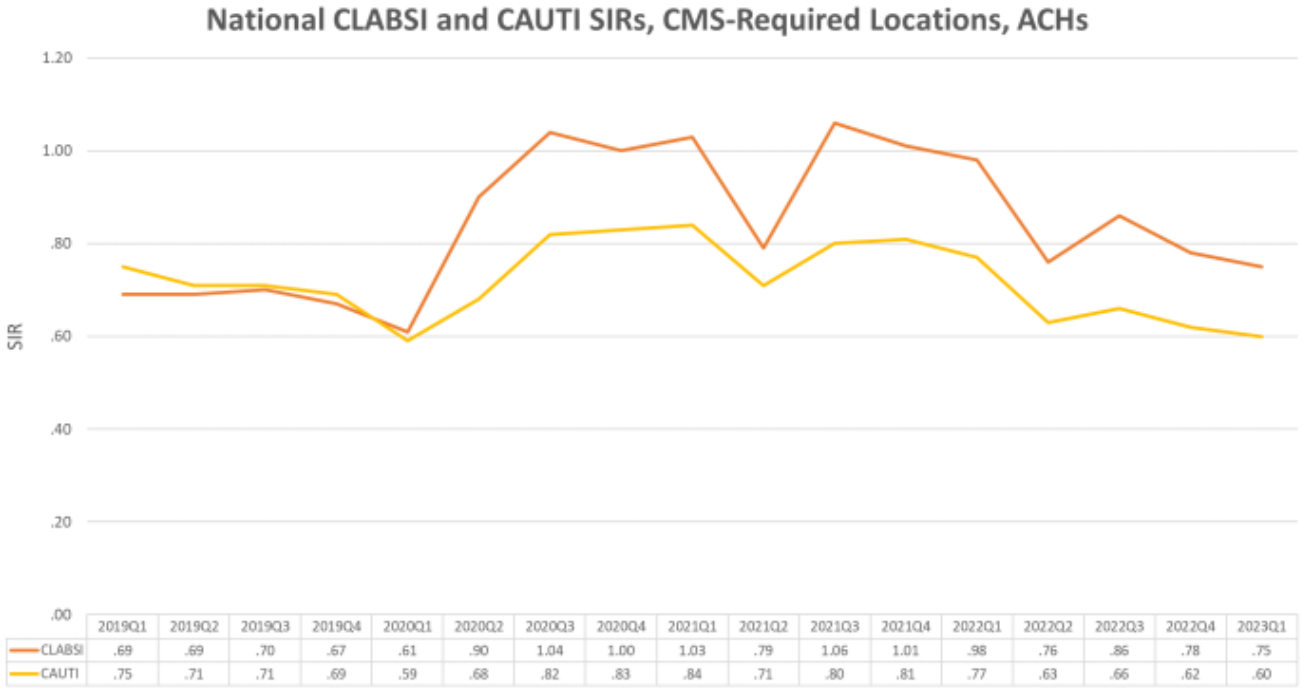
- Surveillance Branch colleagues, including Maggie Dudeck, Karen Jones, Prachi Patel, Vaishnavi Pattabiraman, Sunny Xu, Susan Knoll, Rebecca Konnor, Carlos Alvarez, Benjamin O'Connell, Amanda Gillespie, JaKeiia Bedgood, Lindsey Lastinger, Hsiu Wu, Andrea Benin
- ERIB colleagues, including Isaac See, Holly Biggs, Kelly Jackson, Lauren Korhonen, Alice Guh, Julian Grass, Nora Chea, Rebecca Alkis-Ramirez, Cheri Grigg
- Many other DHQP colleagues, including James Baggs, Kate Ayres
- EIP site colleagues
- Facilities and staff participating in EIP and NHSN activities

Thank you!

fxe9@cdc.gov

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

By 2022 Quarter 2, CAUTIs were below 2019 pre-pandemic levels; slower progress in reducing CLABSI



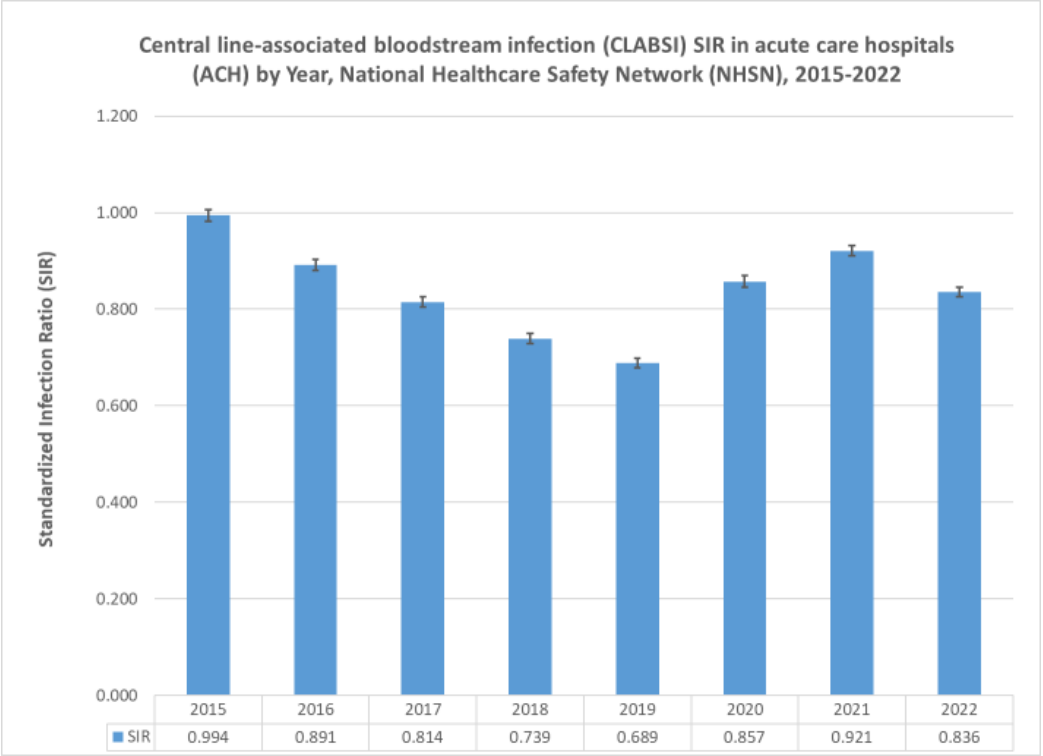
	2019Q1	2019Q2	2019Q3	2019Q4	2020Q1	2020Q2	2020Q3	2020Q4	2021Q1	2021Q2	2021Q3	2021Q4	2022Q1	2022Q2	2022Q3	2022Q4	2023Q1
CLABSI	.69	.69	.70	.67	.61	.90	1.04	1.00	1.03	.79	1.06	1.01	.98	.76	.86	.78	.75
CAUTI	.75	.71	.71	.69	.59	.68	.82	.83	.84	.71	.80	.81	.77	.63	.66	.62	.60

Slide courtesy of the NHSN Acute Care Analytics Team, including Karen Jones and Maggie Dudeck, Surveillance Branch, DHQP, CDC. NHSN. Unpublished data. *Disclaimer: The chart and data table display quarterly SIR point estimates which do not constitute a statistical trend analysis.*

Significant Changes in 2022 CLABSI SIRs Compared to 2021 – Acute Care Hospitals

- Compared to 2021, we observed a 9% decrease* in the overall 2022 CLABSI SIR
- 16% decrease* compared to 2015 (baseline)
- Hospital SIRs range from 0 to 2.149 (median: 0.756)

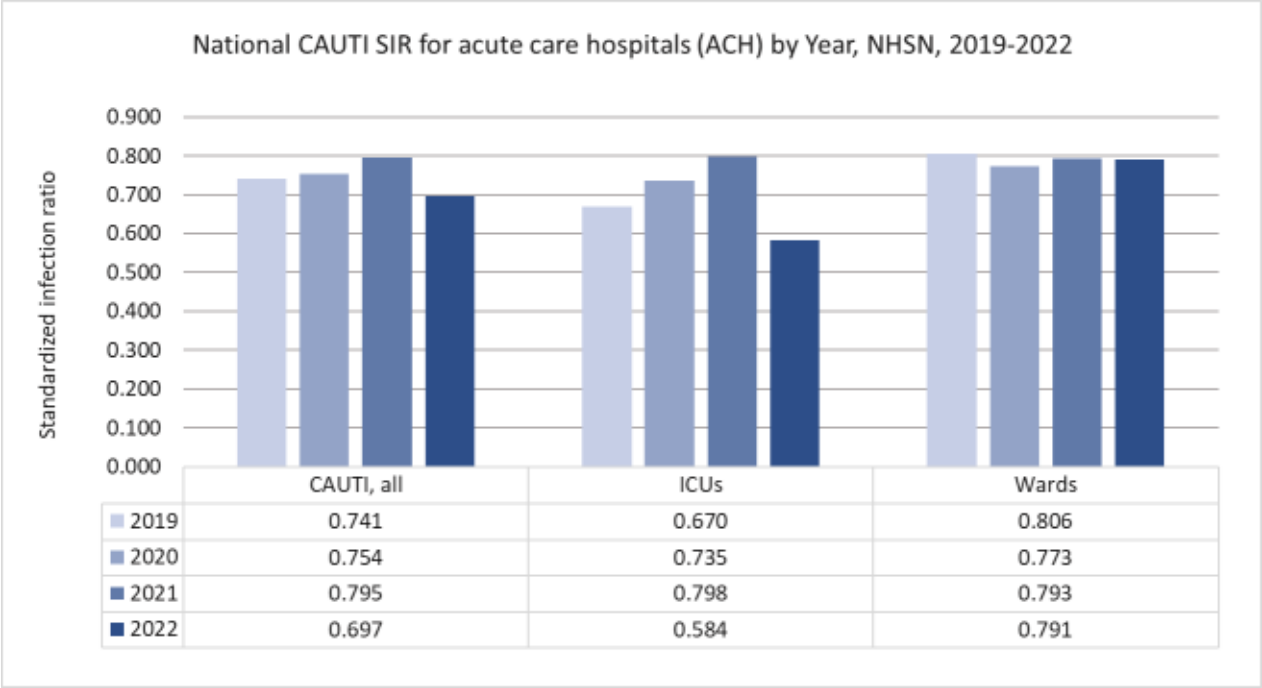
*Direction of Change in SIRs (Increases/Decrease/No Change) using percent change is based on statistical significance, p-value <0.05



Slide courtesy of the NHSN Acute Care Analytics Team, including Karen Jones and Maggie Dudeck, Surveillance Branch, DHQP, CDC. NHSN. CDC. 2022 National and State HAI Progress Report. *Publication pending.*

Significant Decreases 2022 CAUTI SIRs Compared to 2021 – Acute Care Hospitals

- Compared to 2021, we observed a 12% decrease* in the overall 2022 CAUTI SIR
- Largest decrease* in ICU (27%)



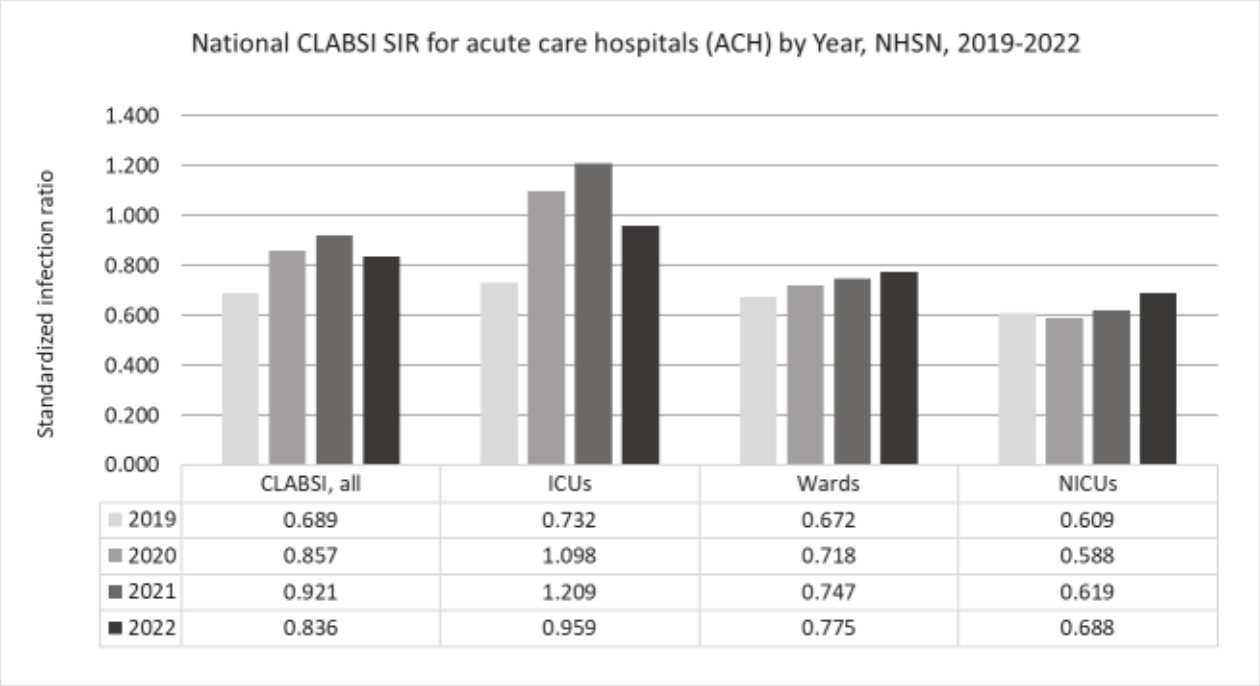
	CAUTI, all	ICUs	Wards
2019	0.741	0.670	0.806
2020	0.754	0.735	0.773
2021	0.795	0.798	0.793
2022	0.697	0.584	0.791

*Direction of Change in SIRs (Increases/Decrease/No Change) using percent change is based on statistical significance, p-value <0.05

CDC. 2022 National and State HAI Progress Report. *Publication pending.*

Significant Changes in 2022 CLABSI SIRs Compared to 2021 – Acute Care Hospitals

- Compared to 2021, we observed a 9% decrease* in the overall 2022 CLABSI SIR
- Largest change in ICU with 21% decrease*
- Slight increase* in Wards (4%)
- Largest increase* in NICU (11%)



	CLABSI, all	ICUs	Wards	NICUs
2019	0.689	0.732	0.672	0.609
2020	0.857	1.098	0.718	0.588
2021	0.921	1.209	0.747	0.619
2022	0.836	0.959	0.775	0.688

*Direction of Change in SIRs (Increases/Decrease/No Change) using percent change is based on statistical significance, p-value <0.05

CDC. 2022 National and State HAI Progress Report. *Publication pending.*

Other AR-Related Posters …

- Friday, 10/13, 12:15 pm
  - Poster 1428, Wolford H, et al. **The proportion of excess hospital-onset antibiotic-resistant infections attributable to patients diagnosed with COVID-19 in U.S. hospitals, 2019-2021**
- Saturday, 10/14, 12:15 pm
  - Poster 2472, McCarthy N, et al. **Hospital Onset Antibiotic Resistant Infections among Patients without COVID-19 Diagnosis in Pre-Pandemic and Pandemic Periods**