

Brief Report: Quarterly National HAI Incidence in 2022

This report was prepared by members of the National Healthcare Safety Network (NHSN) Acute Care Analytics Team within the Surveillance Branch, Division of Healthcare Quality Promotion, National Center for Emerging and Zoonotic Infectious Diseases, Centers for Disease Control and Prevention.

Suggested citation: Brief report: Quarterly national HAI incidence in 2022. Centers for Disease Control and Prevention website. <https://www.cdc.gov/nhsn/pdfs/datastat/Quarterly-SIRs-Brief-Report.pdf>. Published September 2024.

I. Background

During the first two years of the COVID-19 pandemic, the National Healthcare Safety Network (NHSN) team at CDC monitored national standardized infection ratios (SIRs) on a quarterly schedule to assess the impact of the pandemic on the incidence of healthcare-associated infections (HAIs). These analyses demonstrated large increases in the incidence of most HAIs reported to NHSN during 2020 and 2021^{1,2}.

The *2022 National and State HAI Progress Report*³ (referred to as *HAI Progress Report*) was published in December 2023 and provided a summarized picture of HAI incidence for the 2022 calendar year. In this report, the CDC NHSN team noted that the incidence of methicillin-resistant *Staphylococcus aureus* (MRSA) bacteremia laboratory-identified (LabID) events (MRSA bacteremia) in acute care hospitals (ACH) measured annually did not reflect the dramatic and abrupt shift in incidence that occurred throughout the year. A quarterly assessment of SIRs for MRSA bacteremia provides greater understanding and context for the annual, summarized incidence and allows for a more accurate comparison of the incidence of MRSA bacteremia in 2022 and the pre-pandemic period. This brief report describes the results of the quarterly assessment.

Quarterly assessments of HAI incidence in 2022 were also performed for other HAIs, and these results are included in the Appendix of this report. However, for all infection types except MRSA bacteremia, the conclusions made from the 2022 annual SIRs published in the *HAI Progress Report* regarding whether national incidence had returned to pre-pandemic levels are consistent with the conclusions made from the quarterly analysis ([Table 1](#)). Thus, the primary purpose of this paper is to supplement the MRSA bacteremia data presented in the *2022 HAI Progress Report* by providing quarterly results and additional explanation around the national incidence of MRSA bacteremia.

II. Methods

Annual national SIRs for MRSA bacteremia from 2019 – 2022 were compiled using previously published *HAI Progress Reports*³⁻⁶; the annual SIRs are also available from CDC's [Antimicrobial Resistance & Patient Safety Portal](#) (PSP). A mid-P Exact test was used to determine whether the 2022 annual SIR was



statistically different from the annual SIRs in 2019 – 2021; a p-value ≤ 0.05 was considered statistically significant.

Quarterly national SIRs for all HAIs were calculated for 2022 and compared to the corresponding pre-pandemic quarter from 2019 using previously published methods^{1,2}. Comparisons were performed using hospitals that reported complete data in both quarters of the comparison; percent change and p-values were calculated as previously described^{1,2}. The SIRs represent the final data reported to NHSN for that quarter, as each set of quarterly data used in this report were frozen after the applicable Centers for Medicare and Medicaid Services (CMS) Inpatient Prospective Payment System (IPPS) reporting deadline for the respective quarters⁷. Almost all ACHs participate in the CMS IPPS, and thus these results are considered nationally representative.

The SIRs in this report were calculated using regression models that were constructed from the 2015 national baseline data. More information about the SIR can be found in NHSN's Guide to the SIR⁸.

III. Findings

The national MRSA bacteremia SIR for ACHs in 2022 was 0.90. There were 9,830 observed healthcare-onset (HO) MRSA bacteremia events and 10,878.37 predicted events for the entire calendar year³. While this represents a significant decrease in the incidence of HO MRSA bacteremia compared to the 2020 and 2021 SIRs, the 2022 annual SIR remains higher than the pre-pandemic SIR of 0.82 in 2019 ([Table 2](#)).

Upon further analyses of quarterly NHSN data, we found that the 2022 annual MRSA bacteremia SIR was heavily influenced by the data reported during the first quarter (Q1) of the year. The observed SIR for 2022 Q1 was 1.09, which is significantly higher than the pre-pandemic 2019 Q1 SIR of 0.84 ($p < 0.0001$). This increase in incidence during 2022 Q1 is consistent with the surge in COVID-19 hospital admissions seen at the beginning of 2022⁹. However, starting in 2022 Q2, the SIR for MRSA bacteremia dropped to 0.84 and remained consistently low at 0.84 for the remaining quarters of the year ([Table 3](#)). The quarterly MRSA bacteremia SIRs from 2022 Q2 – Q4 are not statistically different from the corresponding pre-pandemic SIRs from 2019 Q2 – Q4 (0.80-0.82). The lower MRSA bacteremia incidence observed during 2022 Q2 – Q4 was driven by a decrease in the number of reported HO MRSA bacteremia events (i.e., the numerator of the SIR), which dropped from 2,977 events (2022 Q1) to 2,163 events (2022 Q2), nationally. No substantial changes were observed in other factors associated with MRSA incidence (and reflected in the SIR) during each quarter of 2022, such as total patient days or the prevalence rate of community-onset MRSA bacteremia.

IV. Conclusion

In conclusion, the annual 2022 SIR for MRSA bacteremia was influenced by the high incidence that occurred during a single quarter, 2022 Q1, and does not fully reflect the reduced national incidence that occurred in 2022 Q2 – Q4. The change in MRSA bacteremia incidence between 2022 Q1 to 2022 Q2 mirrors the trend in COVID hospitalizations during the same time, which suggests that the measure is sensitive to significant events such as surges in COVID hospitalizations⁹. Findings from review of the quarterly MRSA bacteremia data show that the 2022 Q2, Q3, and Q4 SIRs are not significantly different compared to pre-pandemic SIRs from 2019 ([Table 3](#)). Thus, we can conclude that by the end of 2022, the national incidence of MRSA bacteremia was not significantly different than the 2019 pre-pandemic levels. The CDC team will continue to monitor national SIRs on a regular schedule to detect any changes in national HAI incidence and results will continue to be published on CDC's website and within the [PSP](#).

V. Data Tables

Table 1. Comparison of National 2022 vs 2019 SIRs for Acute Care Hospitals, as published in the *National and State HAI Progress Reports*, by HAI

HAI Type	2022 HAI Progress Report ³				2019 HAI Progress Report ⁶ (pre-pandemic)				Direction of Change, 2022 vs 2019*	P-value: 2022 vs. 2019 SIR
	Number of Hospitals	Number Observed	Number Predicted	National SIR ³	Number of Hospitals	Number Observed	Number Predicted	National SIR ⁶		
CLABSI	3,728	23,389	27,993.69	0.84	3,602	18,009	26,148.99	0.69	↑	<0.0001
CAUTI	3,780	20,237	29,055.17	0.70	3,678	19,398	26,182.61	0.74	↓	<0.0001
VAE	1,874	32,631	27,472.92	1.19	2,028	24,724	25,566.34	0.97	↑	<0.0001
Colon Surgery SSI	3,052	7,355	8,574.09	0.86	3,108	7,256	8,482.25	0.86	No change	0.8665
Abdominal Hysterectomy SSI	2,789	1,695	1,782.01	0.95	2,925	2,157	2,202.64	0.98	No change	0.3697
MRSA bacteremia	3,723	9,830	10,878.37	0.90	3,698	8,131	9,952.62	0.82	↑	<0.0001
<i>C. difficile</i>	3,722	42,601	88,078.90	0.48	3,702	54,282	93,184.43	0.58	↓	<0.0001

*Direction of change is shown for only those comparisons where there is a statistically significant difference between the 2022 SIR and the corresponding 2019 (pre-pandemic) SIR

Table 2. National Annual MRSA bacteremia SIRs for Acute Care Hospitals[†], 2019 – 2022, as published in the *National and State HAI Progress Reports*³⁻⁶

Year	Number of Hospitals	Number Observed	Number Predicted	National SIR	P-value*
2019	3,698	8,131	9,952.62	0.82	<0.0001
2020	3,658	8,775	9,328.83	0.94	0.0063
2021	3,681	11,605	10,850.79	1.07	<0.0001
2022	3,723	9,830	10,878.37	0.90	--

*P-value compares each annual SIR to the 2022 national SIR

[†]The annual SIRs are also available from CDC's Antimicrobial Resistance & Patient Safety Portal (<https://arpsp.cdc.gov/profile/nhsn/mrsa>).

Table 3. National Quarterly MRSA bacteremia SIRs for Acute Care Hospitals in 2022, Compared to Pre-Pandemic Time Period, for Consistent Reporters*

Quarter	Number of Hospitals	2022			2019 (pre-pandemic)			Percent Change [†]	P-value
		Number Observed	Number Predicted	SIR	Number Observed	Number Predicted	SIR		
Q1	3,456	2,977	2,730.12	1.09	2,092	2,502.70	0.84	30.4	<0.0001
Q2	3,452	2,163	2,566.89	0.84	2,009	2,455.62	0.82	No Change	0.3404
Q3	3,463	2,242	2,672.76	0.84	1,983	2,456.79	0.81	No Change	0.2117
Q4	3,437	2,310	2,735.37	0.84	1,978	2,464.05	0.80	No Change	0.0978

*Acute care hospitals that reported complete HAI surveillance data for both quarters in the comparison

[†]Percent change is shown for only those comparisons where a statistically significant difference exists. Percent change is calculated as: $[(2022 \text{ SIR} - 2019 \text{ SIR}) / 2019 \text{ SIR}] * 100$

VI. References

1. Weiner-Lastinger, L, Pattabiraman, V, Konnor, RY, 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. *Infect Control Hosp Epidemiol* 2022;43:12–25.
2. Lastinger LM, Alvarez CR, Kofman A, et al. Continued increases in the incidence of healthcare-associated infection (HAI) during the second year of the coronavirus disease 2019 (COVID-19) pandemic. *Infection Control & Hospital Epidemiology*. 2023;44(6):997-1001.
3. 2022 National and State Healthcare-Associated Infections Progress Report. Centers for Disease Control and Prevention website. <https://www.cdc.gov/hai/data/portal/progress-report.html>. Updated December 2023. Accessed December 19, 2023.
4. 2021 National and State Healthcare-Associated Infections Progress Report. Centers for Disease Control and Prevention website. <https://www.cdc.gov/hai/data/archive/2021-HAI-progress-report.html>. Updated November 2023. Accessed December 19, 2023.
5. 2020 National and State Healthcare-Associated Infections Progress Report. Centers for Disease Control and Prevention website. <https://www.cdc.gov/hai/data/archive/2020-HAI-progress-report.html>. Updated October 2021. Accessed December 19, 2023.
6. 2019 National and State Healthcare-Associated Infections Progress Report. Centers for Disease Control and Prevention website. <https://www.cdc.gov/hai/data/archive/2019-HAI-progress-report.html>. Updated October 2021. Accessed December 19, 2023.
7. Hospital Inpatient Quality Reporting Program. Centers for Medicare & Medicaid Services website. <https://www.cms.gov/medicare/quality/initiatives/hospital-quality-initiative/inpatient-reporting-program>. Updated September 2023. Accessed December 19, 2023.
8. The NHSN standardized infection ratio (SIR): a guide to the SIR. Centers for Disease Control and Prevention website. <https://www.cdc.gov/nhsn/pdfs/ps-analysis-resources/nhsn-sir-guide.pdf>. Updated April 2022. Accessed December 19, 2023.
9. Weekly United States COVID-19 Hospitalization Metrics by Jurisdiction – ARCHIVED. Centers for Disease Control and Prevention. https://data.cdc.gov/Public-Health-Surveillance/Weekly-United-States-COVID-19-Hospitalization-Metr/7dk4-g6vg/about_data. Accessed July 2, 2024.

Appendix

A. National Quarterly Central Line-Associated Bloodstream Infection (CLABSI) SIRs for Acute Care Hospitals in 2022, Compared to Pre-Pandemic Time Period, for Consistent Reporters*

Quarter	Number of Hospitals	2022			2019 (pre-pandemic)			Percent Change [†]	P-value
		Number Observed	Number Predicted	SIR	Number Observed	Number Predicted	SIR		
Q1	3,347	4,241	4,386.00	0.97	2,836	4,123.81	0.69	40.6	<0.0001
Q2	3,345	3,005	3,935.14	0.76	2,706	3,967.59	0.68	12.0	<0.0001
Q3	3,354	3,447	4,014.56	0.86	2,752	3,905.93	0.71	22.9	<0.0001
Q4	3,325	3,176	4,110.31	0.77	2,648	3,942.71	0.67	15.0	<0.0001

B. National Quarterly Catheter-Associated Urinary Tract Infection (CAUTI) SIRs for Acute Care Hospitals in 2022, Compared to Pre-Pandemic Time Period, for Consistent Reporters*

Quarter	Number of Hospitals	2022			2019 (pre-pandemic)			Percent Change [†]	P-value
		Number Observed	Number Predicted	SIR	Number Observed	Number Predicted	SIR		
Q1	3,341	3,839	5,010.47	0.77	3,484	4,677.80	0.75	No Change	0.2260
Q2	3,340	2,711	4,360.06	0.62	3,143	4,417.92	0.71	-12.5	<0.0001
Q3	3,350	2,917	4,448.21	0.66	3,007	4,253.03	0.71	-7.2	0.0038
Q4	3,317	2,846	4,636.44	0.61	3,013	4,365.51	0.69	-11.0	<0.0001

C. National Quarterly Ventilator-Associated Event (VAE) SIRs for Acute Care Hospitals in 2022, Compared to Pre-Pandemic Time Period, for Consistent Reporters*

Quarter	Number of Hospitals	2022			2019 (pre-pandemic)			Percent Change [†]	P-value
		Number Observed	Number Predicted	SIR	Number Observed	Number Predicted	SIR		
Q1	1,359	9,045	6,462.74	1.40	4,902	5,090.25	0.96	45.4	<0.0001
Q2	1,320	5,047	4,766.35	1.06	4,529	4,679.09	0.97	9.4	<0.0001
Q3	1,300	5,172	4,800.70	1.08	4,455	4,446.30	1.00	7.5	0.0004
Q4	1,307	5,587	5,211.21	1.07	4,653	4,723.67	0.99	8.8	<0.0001

D. National Quarterly Colon Surgery Surgical Site Infection (SSI) SIRs for Acute Care Hospitals in 2022, Compared to Pre-Pandemic Time Period, for Consistent Reporters*

Quarter	Number of Hospitals	2022			2019 (pre-pandemic)			Percent Change [†]	P-value
		Number Observed	Number Predicted	SIR	Number Observed	Number Predicted	SIR		
Q1	2,739	1,755	2,047.87	0.86	1,803	2,082.14	0.87	No Change	0.7568
Q2	2,737	1,858	2,151.78	0.86	1,834	2,116.93	0.87	No Change	0.9195
Q3	2,724	1,837	2,135.73	0.86	1,854	2,129.73	0.87	No Change	0.7149
Q4	2,703	1,763	2,103.69	0.84	1,760	2,109.16	0.83	No Change	0.8985

E. National Quarterly Abdominal Hysterectomy Surgical Site Infection (SSI) SIRs for Acute Care Hospitals in 2022, Compared to Pre-Pandemic Time Period, for Consistent Reporters*

Quarter	Number of Hospitals	2022			2019 (pre-pandemic)			Percent Change [†]	P-value
		Number Observed	Number Predicted	SIR	Number Observed	Number Predicted	SIR		
Q1	2,382	334	402.63	0.83	473	504.29	0.94	No Change	0.0852
Q2	2,398	475	451.16	1.05	540	551.57	0.98	No Change	0.2481
Q3	2,371	432	434.68	0.99	570	539.62	1.06	No Change	0.3395
Q4	2,368	417	452.75	0.92	568	574.57	0.99	No Change	0.2726

F. National Quarterly *C. difficile* Laboratory-Identified Event SIRs for Acute Care Hospitals in 2022, Compared to Pre-Pandemic Time Period, for Consistent Reporters*

Quarter	Number of Hospitals	2022			2019 (pre-pandemic)			Percent Change [†]	P-value
		Number Observed	Number Predicted	SIR	Number Observed	Number Predicted	SIR		
Q1	3,455	11,263	22,144.98	0.51	15,087	24,028.68	0.63	-18.9	<0.0001
Q2	3,454	10,231	21,488.22	0.48	13,430	23,107.30	0.58	-18.1	<0.0001
Q3	3,462	10,373	21,636.37	0.48	12,903	22,756.63	0.57	-15.5	<0.0001
Q4	3,437	10,216	21,815.99	0.47	12,439	22,521.68	0.55	-15.2	<0.0001

Footnotes for all Appendix tables:

*Acute care hospitals that reported complete HAI surveillance data for both quarters in the comparison

[†]Percent change is shown for only those comparisons where a statistically significant difference exists, demonstrated by a p-value ≤ 0.05. Percent change is calculated as: [(2022 SIR – 2019 SIR) / 2019 SIR] * 100.