



Department of  
**Health**

# Tennessee's Report on Healthcare-Associated Infections

January 1, 2021–December 31, 2021

Tennessee Department of Health | Report | September 2022



# Table of Contents

|  |            |
|--|------------|
| <b>Executive Summary</b> .....   | <u>1</u>   |
| <b>Background</b> .....  | <u>8</u>   |
| <b>Methods</b> .....   | <u>9</u>   |
| <b>Central Line-Associated Bloodstream Infections (CLABSI)</b> .....   | <u>15</u>  |
| <i>Adult and Pediatric Critical Care Units</i> .....   | <u>17</u>  |
| <i>Neonatal Critical Care Units</i> .....  | <u>25</u>  |
| <i>Adult and Pediatric Medical, Surgical, and Medical/Surgical Wards</i> .....   | <u>32</u>  |
| <i>Long-term Acute Care Hospitals</i> .....  | <u>33</u>  |
| <b>Catheter-Associated Urinary Tract Infections (CAUTI)</b> .....  | <u>47</u>  |
| <i>Adult and Pediatric Critical Care Units</i> .....   | <u>49</u>  |
| <i>Adult and Pediatric Medical, Surgical, and Medical/Surgical Wards</i> .....   | <u>56</u>  |
| <i>Long-term Acute Care Hospitals</i> .....  | <u>40</u>  |
| <i>Inpatient Rehabilitation Facilities</i> .....   | <u>70</u>  |
| <b>Surgical Site Infections (SSI)</b> .....  | <u>77</u>  |
| <i>Coronary Artery Bypass Graft Procedures</i> .....   | <u>79</u>  |
| <i>Colon Procedures</i> .....  | <u>85</u>  |
| <i>Abdominal Hysterectomy Procedures</i> .....   | <u>91</u>  |
| <b>Methicillin-Resistant <i>Staphylococcus aureus</i> (MRSA) Bacteremia Laboratory-Identified (LabID) Events</b> ..... | <u>98</u>  |
| <i>Acute Care Hospitals</i> .....  | <u>100</u> |
| <i>Inpatient Rehabilitation Facility</i> .....   | <u>104</u> |
| <i>Long-term Acute Care Hospitals</i> .....  | <u>107</u> |
| <b>C. difficile Infection (CDI) Laboratory-Identified (LabID) Events</b> .....   | <u>111</u> |
| <i>Acute Care Hospitals</i> .....  | <u>113</u> |
| <i>Long-term Acute Care Hospitals</i> .....  | <u>117</u> |
| <i>Inpatient Rehabilitation Facility</i> .....   | <u>121</u> |
| <b>Healthcare Personnel Influenza Vaccination</b> .....  | <u>126</u> |
| <i>Acute Care Hospitals</i> .....  | <u>128</u> |
| <i>Long-term Acute Care Hospitals</i> .....  | <u>131</u> |
| <i>Inpatient Rehabilitation Facilities</i> .....   | <u>133</u> |
| <b>Antimicrobial Stewardship</b> .....   | <u>136</u> |
| <b>Appendices</b> .....  | <u>138</u> |
| <i>Appendix A. Definitions</i> .....   | <u>139</u> |
| <i>Appendix B. Acronyms</i> .....  | <u>146</u> |

# Executive Summary

This report provides state-level HAI data, including central line-associated bloodstream infections (CLABSIs), catheter-associated urinary tract infections (CAUTIs), ventilator-associated events (VAEs), surgical site infections (SSIs), methicillin-resistant *Staphylococcus aureus* (MRSA) bloodstream events, and *Clostridioides difficile* (*C. difficile*) events for the year of 2021. Data is further broken down by facility type to include acute care hospitals (ACHs), inpatient rehabilitation facilities (IRFs) and long-term acute care hospitals (LTACs). Both the state of Tennessee and the U.S.'s HAI incidence increased in 2021. This increase was partially attributed to the effect of COVID-19. Significant increases were noted nationally in CLABSI, CAUTI, VAE, and MRSA bacteremia. Nationally and at the state-level, declines in *C. difficile* infections were noted.

## Key Findings ([Table 1](#))

### Acute Care Hospitals

- In 2021, there were 19%\* more central line-associated bloodstream infections (CLABSI) in Tennessee's adult and pediatric intensive care units (ICUs) and 38%\* fewer CLABSI in adult and pediatric wards than predicted based on national 2015 data. 27% of facilities had an SIR significantly above the national baseline whereas 8% of facilities had as SIR below baseline. Overall, Tennessee ICUs performed worse in terms of CLABSIs than in 2020 but the wards SIR remained stable.
- In 2021, there were 24%\* fewer catheter-associated urinary tract infections (CAUTI) in Tennessee's adult and pediatric ICUs and 23%\* fewer CAUTI in adult and pediatric wards than predicted based on national 2015 data. 4% of adult and pediatric ICUs had an SIR significantly worse than national baseline, whereas 8% had an SIR significantly better than baseline. Overall, Tennessee's CAUTI SIR increased slightly from 2020.
- In 2021, there were 35%\* fewer surgical site infections (SSI) following colon surgeries in Tennessee Acute Care Hospitals than predicted based on national 2015 data. 2021 also saw 14% fewer SSI following Coronary Artery Bypass Graft (CABG) surgeries in Tennessee Acute Care Hospitals than predicted based on national 2015 data. Also based on national 2015 data, Tennessee Acute Care Hospitals recorded 14% fewer Abdominal Hysterectomy SSI in both 2019 and 2020.
- Continuing the pattern detailed in our previous report, methicillin-resistant *Staphylococcus aureus* (MRSA) bloodstream infections in Tennessee Acute Care Hospitals exceeded the

---

\* Indicates that the stated figure is significantly different than predicted based on the 95% Confidence Interval calculations.

expected occurrences in 2021 with 23%\* more MRSA infections in Acute Care Hospitals in 2021.

- In 2021, there were 66%\* fewer *Clostridioides difficile* Infections (CDI) as predicted in Tennessee Acute Care Hospitals in 2021.

## Inpatient Rehabilitation Facilities (IRF)

- In 2021, there were 68%\* fewer *Clostridioides difficile* Infections (CDI) as predicted in Tennessee IRF compared to national 2015 data.

## Long-Term Acute Care (LTAC) Hospitals

- In 2021, central line-associated bloodstream infections (CLABSI) in LTAC facilities occurred as predicted based on national 2015 data.
- In 2021, there were 47%\* fewer catheter-associated urinary tract infections (CAUTI) in Tennessee's LTAC than predicted based on national 2015 data.
- In 2021, there were 29% more methicillin-resistant *Staphylococcus aureus* (MRSA) bloodstream infections in Tennessee LTAC facilities than predicted as modeled on national 2015 data.
- 2021 saw fewer *Clostridioides difficile* Infections (CDI) than predicted in Tennessee LTAC facilities with 67%\* fewer than predicted on national 2015 data.

## Pathogens

- In 2021, there were 1,147 device-associated (DA) isolates from all locations, with the 5 most common pathogens being *Escherichia coli* (20%), *Enterococcus spp.* (17%), coagulase-negative *Staphylococcus spp.* (12%), *Candida spp.* and other yeasts (11%), *Pseudomonas aeruginosa* (9%) ([Figure 1](#)).
- Of the 192 DA *Enterococcus spp.* isolates, 48 (25%) were vancomycin-resistant. Of the 70 DA *Staphylococcus aureus* isolates, 30 (41.67%) were methicillin-resistant ([Table 2](#)).
- In 2021, there were 587 SSI isolates, with the 5 most common pathogens being *E. coli* (21%), *Enterococcus spp.* (19%), *Staphylococcus aureus* (9%), *Candida spp.* and other yeasts (6%), and *Klebsiella spp.* (6%) ([Figure 2](#)).
- Of the 109 SSI *Enterococcus spp.* isolates, 11 (10.09%) were vancomycin-resistant. Of the 52 SSI *Staphylococcus aureus* isolates, 6 (11.54%) were methicillin-resistant ([Table 3](#)).

---

\* Indicates that the stated figure is significantly different than predicted based on the 95% Confidence Interval calculations.

**Table 1: Tennessee Standardized Infection Ratios (SIRs) and Distribution of Facility-specific SIRs for Central Line-Associated Bloodstream Infection (CLABSI), Catheter-Associated Urinary Tract Infection (CAUTI), Surgical Site Infection (SSI) and Laboratory-Identified (LabID) Methicillin-Resistant Staphylococcus aureus (MRSA) and C. difficile Infection (CDI) Events, 01/01/2021 - 12/31/2021**

| HAI    | Unit/Type                    | No. of Facilities | Device Days/<br>Procedures<br>Performed/<br>Patient Days | No. of Infections |        | Standardized Infection Ratio (SIR) and 95% CI |       |       | Distribution of Facility-specific SIRs | No. of Facs with SIR Sig. <1.0 |     | No. of Facs with SIR Sig. >1.0 |     |
|--------|------------------------------|-------------------|--|-------------------|--------|---|-------|-------|--|--------------------------------|-----|--------------------------------|-----|
|        |                              |                   |  | Obs.              | Pred.  | SIR   | Lower | Upper | No. of Facs with ≥1 Pred. Infection    | N                              | %   | N                              | %   |
| CLABSI | Adult/Pediatric ICUs         | 79                | 258,499  | 315               | 265.14 | 1.19  | 1.06  | 1.33  | 48                                     | 4                              | 8%  | 13                             | 27% |
|        | Adult/Pediatric Wards        | 96                | 233,394  | 124               | 203.10 | 0.61  | 0.51  | 0.73  | 38                                     | 3                              | 8%  | 1                              | 3%  |
|        | Long-term Acute Care         | 9                 | 26,006   | 30                | 30.24  | 0.99  | 0.68  | 1.40  | 8                                      | 0                              | 0%  | 1                              | 13% |
|        | Neonatal ICUs                | 22                | 42,897   | 40                | 61.43  | 0.65  | 0.47  | 0.88  | 11                                     | 1                              | 9%  | 1                              | 9%  |
| CAUTI  | Adult/Pediatric ICUs         | 79                | 306,317  | 312               | 409.60 | 0.76  | 0.68  | 0.85  | 47                                     | 8                              | 17% | 2                              | 4%  |
|        | Adult/Pediatric Wards        | 96                | 233,431  | 162               | 209.79 | 0.77  | 0.66  | 0.90  | 42                                     | 3                              | 7%  | 2                              | 5%  |
|        | Long-term Acute Care         | 9                 | 25,849   | 25                | 47.30  | 0.53  | 0.35  | 0.77  | 8                                      | 2                              | 25% | 0                              | 0%  |
| SSI    | Coronary Artery Bypass Graft | 27                | 6,102  | 44                | 50.97  | 0.86  | 0.64  | 1.15  | 15                                     | 1                              | 7%  | 3                              | 20% |
|        | Colon Surgery                | 89                | 8,141  | 143               | 219.21 | 0.65  | 0.55  | 0.77  | 41                                     | 5                              | 12% | 0                              | 0%  |
|        | Abdominal Hysterectomy       | 89                | 6,552  | 39                | 45.53  | 0.86  | 0.62  | 1.16  | 13                                     | 0                              | 0%  | 0                              | 0%  |
| MRSA   | Acute Care Hospitals         | 100               | 4,053,591  | 444               | 297.20 | 1.49  | 1.36  | 1.64  | 49                                     | 1                              | 2%  | 10                             | 20% |
|        | Long-Term Acute Care         | 8                 | 89,370   | 14                | 19.84  | 0.71  | 0.40  | 1.16  | 7                                      | 0                              | 0%  | 0                              | 0%  |
|        | Inpatient Rehabilitation     | 27                | 230,434  | 3                 | 4.38   | 0.69  | 0.17  | 1.86  | .                                      | .                              | .   | .                              | .   |
| CDI    | Acute Care Hospitals         | 100               | 3,706,960  | 622               | 1893.1 | 0.33  | 0.30  | 0.36  | 81                                     | 52                             | 64% | 1                              | 1%  |
|        | Long-Term Acute Care         | 9                 | 89,370   | 25                | 90.55  | 0.28  | 0.18  | 0.40  | 8                                      | 6                              | 75% | 0                              | 0%  |
|        | Inpatient Rehabilitation     | 27                | 230,434  | 32                | 99.59  | 0.32  | 0.22  | 0.45  | 23                                     | 7                              | 30% | 0                              | 0%  |

Data reported as of May 18, 2022

Adult/Pediatric ICUs exclude burn and trauma units for CLABSI

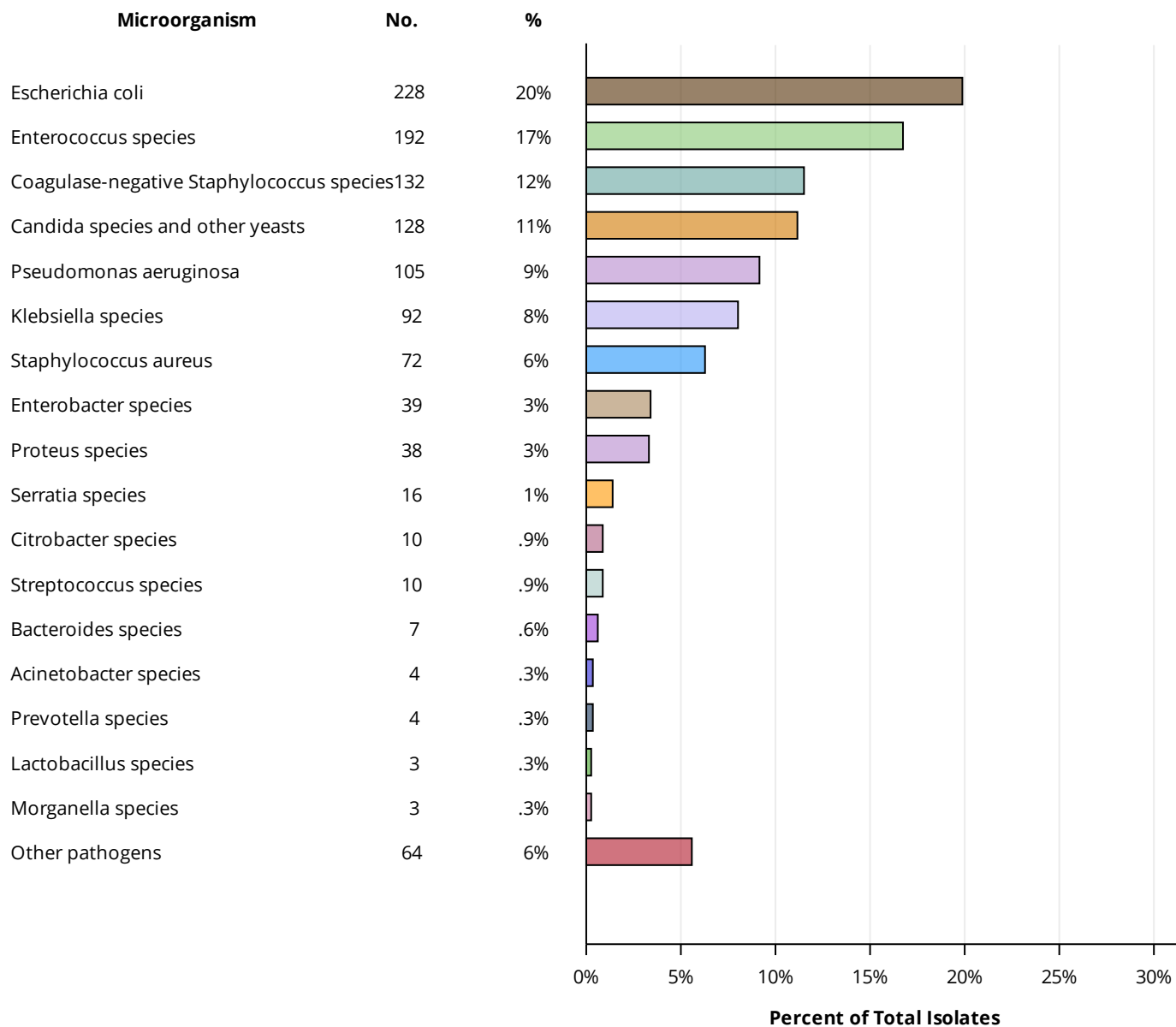
Adult Complex Admission/Readmission SIRs are presented for surgical site infections (SSI)

Green highlighting indicates an SIR significantly LOWER than the 2015 national baseline

Red highlighting indicates an SIR significantly HIGHER than the 2015 national baseline

**Figure 1: Microorganisms Identified in Catheter-Associated Urinary Tract (CAUTIs) and Central Line-Associated Blood Stream Infections (CLABSIs) in All Settings, Tennessee, 01/01/2021 - 12/31/2021**

**Number of isolates=1147; Number of events=1035**



Data reported as of May 18, 2022

For other pathogens identified, see individual infection types and settings.

**Table 2: Resistant Microorganisms Identified in Catheter Associated Urinary Tract Infections (CAUTIs) and Central Line-Associated Blood Stream Infections (CLABSIs) in All Settings, Tennessee, 01/01/2021 - 12/31/2021**

| State     | Year | Microorganism          | Number of Isolates |           | Percentage of Resistant Isolates |                                   |
|-----------|------|------------------------|--------------------|-----------|----------------------------------|-----------------------------------|
|           |      |                        | Total              | Resistant | By Microorganism                 | By Total Number of CAUTI Isolates |
| Tennessee | 2021 | Escherichia coli       | 228                | 2         | 0.88%*                           | 0.17%*                            |
|           |      | Enterococcus species   | 192                | 48        | 25%**                            | 4.18%**                           |
|           |      | Pseudomonas aeruginosa | 105                | 7         | 6.67%*                           | 0.61%*                            |
|           |      | Klebsiella species     | 92                 | 0         | 0%*                              | 0%*                               |
|           |      | Staphylococcus aureus  | 72                 | 30        | 41.67%***                        | 2.62%***                          |
|           |      | Enterobacter species   | 39                 | 2         | 5.13%*                           | 0.17%*                            |

Data reported as of May 18, 2022

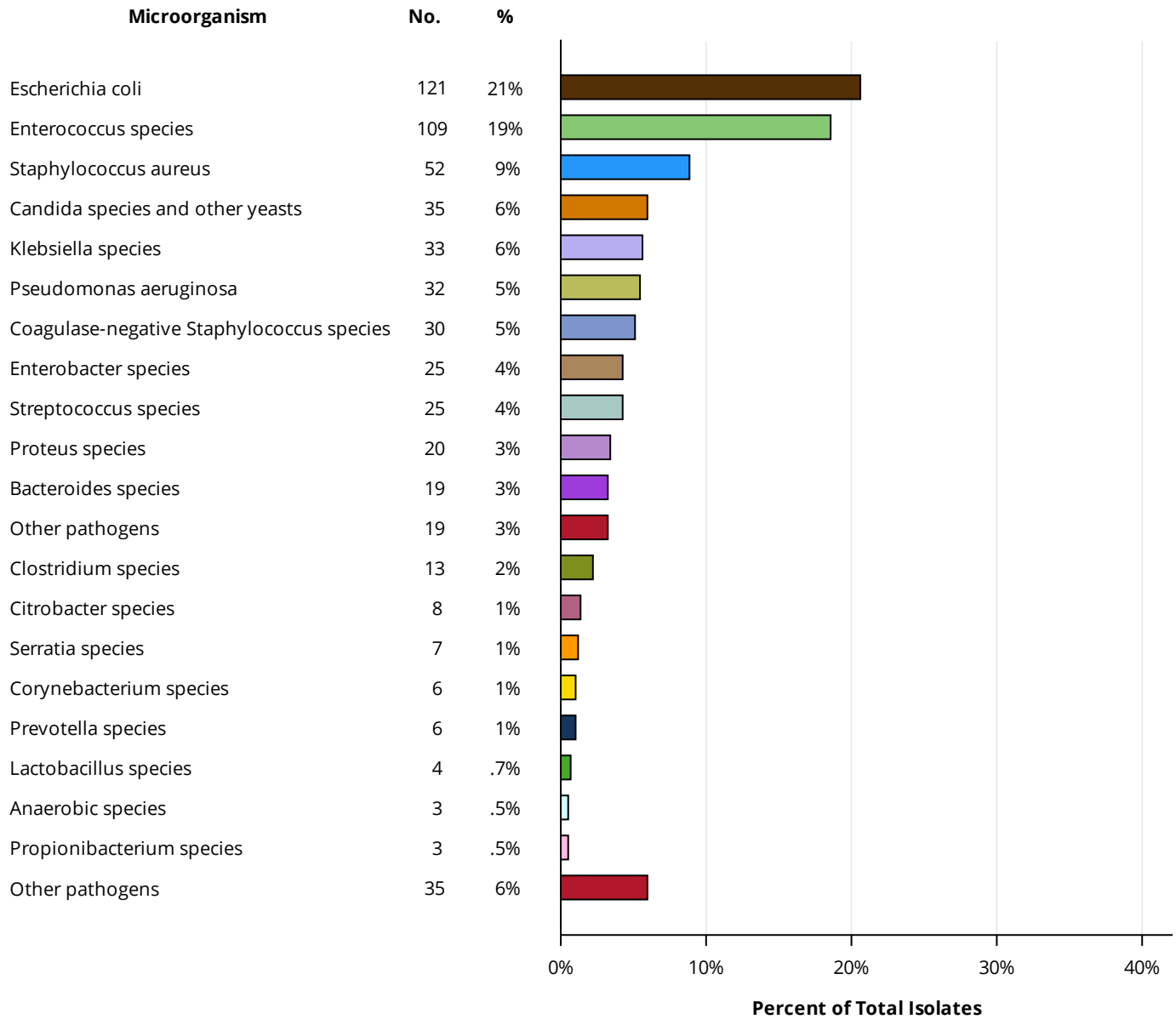
\* = Carbapenem-resistant

\*\* = Vancomycin-resistant

\*\*\* = Methicillin-resistant

**Figure 2: Microorganisms Identified from Surgical Site Infections (SSIs) all procedures, Tennessee, 01/01/2021 - 12/31/2021**

**Number of isolates=587; Number of events=574**



Data reported as of May 18, 2022  
 See individual procedure reports for other pathogen species.



**Table 3: Resistant Microorganisms Identified in Surgical Site Infections (SSI), all procedures, Tennessee, 01/01/2021 - 12/31/2021**

| State     | Year | Microorganism          | Number of Isolates |           | Percentage of Resistant Isolates |  |
|-----------|------|------------------------|--------------------|-----------|----------------------------------|--|
|           |      |                        | Total              | Resistant | By Microorganism                 | By Total Number of Procedure-specific Isolates |
| Tennessee | 2021 | Escherichia coli       | 121                | 3         | 2.48%*                           | 4.05%*   |
|           |      | Enterococcus species   | 109                | 11        | 10.09%**                         | 14.86%**                                       |
|           |      | Staphylococcus aureus  | 52                 | 6         | 11.54%***                        | 8.11%***                                       |
|           |      | Klebsiella species     | 33                 | 0         | 0%*                              | 0%*  |
|           |      | Pseudomonas aeruginosa | 32                 | 1         | 3.13%*                           | 1.35%*   |
|           |      | Enterobacter species   | 25                 | 3         | 12%*                             | 4.05%*   |

Data reported as of May 18, 2022

\* = Carbapenem-resistant

\*\* = Vancomycin-resistant

\*\*\* = Methicillin-resistant

# Tennessee's Report on Healthcare-Associated Infections

## Background

Healthcare-associated infections (HAIs) are a major public health problem. The Centers for Disease Control and Prevention (CDC) released a report in 2009 estimating the annual medical costs for U.S. hospitals from HAIs to be between \$35.7 billion and \$45 billion,<sup>1</sup> though the emotional, physical, and personal costs associated with HAIs are beyond quantification. The CDC estimated there were over 600,000 HAIs in 2015 alone in the United States, with an estimated 10% of these resulting in death.<sup>2</sup> Approximately 1 out of every 31 patients admitted to a hospital, and 1 out of every 43 nursing home residents, has an HAI.<sup>3</sup> Although positive improvement has been seen in many HAI-related outcomes in Tennessee, some HAI burden measures have proven remarkably stubborn to improve. A continued focus on reducing the number of HAIs amongst patients will significantly improve the health of Tennesseans and positively impact the wider Tennessee community.

*In 2015, there were over 600,000 estimated HAI events in the United States*

In December 2006, the Tennessee Legislature passed Senate Bill 2978 and the Governor signed the Public Acts, Public Chapter 904 (PC904) requiring some healthcare facilities to report selected HAIs to the Tennessee Department of Health (TDH). The legislation required use of CDC's National Healthcare Safety Network (NHSN) for reporting, a secure internet-based surveillance system maintained by the Centers for Disease Control and Prevention (CDC). Tennessee state requirements complement Centers for Medicare and Medicaid Services (CMS) mandated HAI reporting requirements which have been in effect since January 2011.

The following report summarizes the TDH's Healthcare-Associated Infection reporting activities from January 2021 through December 2021.

---

<sup>1</sup> Magill SS, et al. 2014. Op Cit

<sup>2</sup> Scott, RD. The direct medical costs of healthcare-associated infections in US hospitals and the benefits of prevention. 2009; 1-16.

<sup>3</sup> <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7978499/>

## Methods

### Healthcare-Associated Infections Reporting Requirements in Tennessee

Acute care hospitals (ACHs), regardless of average daily census (ADC) but excluding Critical Access Hospitals (CAHs) are required to report data related to central line-associated bloodstream infections (CLABSI) in adult and pediatric intensive care units, including burn and trauma intensive care units (ICUs, also called “critical care units), Neonatal ICUs (NICUs), and adult and pediatric medical, surgical, and combined medical/surgical wards to the Tennessee Department of Health (TDH) via the National Healthcare Safety Network (NHSN). ACHs must report catheter-associated urinary tract infections (CAUTI) from adult and pediatric ICUs, as well as adult and pediatric medical, surgical, and combined medical/surgical wards. Surgical site infections (SSI) following coronary artery bypass grafts (CBGB/C), colon procedures (COLO), and abdominal hysterectomies (HYST) are also required reporting for ACHs. Two Laboratory-Identified events (LabID), methicillin-resistant *Staphylococcus aureus* (MRSA) and *Clostridioides difficile* (CDI) are required reporting and are broken up into two categories: facility-wide inpatient locations and 24-hour observations and emergency departments. In addition to these HAI reporting requirements, ACHs are also required to report healthcare personnel influenza vaccination data to TDH via NHSN.

Long-term acute care hospitals (LTACHs) are required, for all inpatient locations, to report data related to CLABSIs, CAUTIs, and Ventilator-associated events (VAE). Like ACHs, LTACHs are also required to report LabID MRSA and CDI events, for the same two categories, facility-wide inpatient locations and 24-hour observation/emergency departments. LTACHs also must report data on healthcare personnel influenza vaccination.

Inpatient rehabilitation facilities (IRFs) are required to report data related to CAUTIs for all inpatient locations. They must also report LabID MRSA and CDI events for all facility-wide inpatient locations and for 24-hour observation and emergency department locations. IRFs must also report data on healthcare personnel influenza vaccination.

Outpatient Hemodialysis facilities must report data related to dialysis events, consisting of signs of infections at the site of vascular access, positive blood cultures, and initiation of intravenous antimicrobials. Additionally, they must also report data on healthcare personnel influenza vaccination.

Ambulatory surgery centers and inpatient psychiatric facilities are required to report data related to healthcare personnel influenza vaccination.

## Tennessee Reporting Facilities

Characteristics of acute care hospitals reporting HAI data to TDH from January 2021-December 2021 are displayed below (Table 4). Facilities are stratified by medical school affiliation (as defined by NHSN) and bed size, with data being gathered from the 2021 NHSN Annual Facility Survey.

| <b>Table 4. Characteristics of Tennessee Acute Care Hospitals, January-December 2021</b> |                      |         |
|--|----------------------|---------|
|  | Number of Facilities | Percent |
| <b>Medical School Affiliation</b>  |                      |         |
| Major teaching   | 24                   | 38.71%  |
| Graduate teaching  | 15                   | 24.19%  |
| Undergraduate teaching   | 23                   | 37.10%  |
| None   | 36                   | 36.73%  |
| <b>Number of Beds</b>  |                      |         |
| <50 beds   | 17                   | 17.35%  |
| 50-99 beds   | 26                   | 26.53%  |
| 100-399 beds   | 42                   | 42.86%  |
| ≥400 beds  | 13                   | 13.27%  |

## Accuracy of Reporting & Exemptions

TDH staff monitored the timeliness, completeness, and accuracy of aggregate healthcare reports. The Centers for Medicare & Medicaid Services (CMS) announced in March 2020 that due to the COVID-19 pandemic, it was granting blanket exceptions from quality reporting programs for the period Q4 2019 – Q2 2020 inclusive. The exception had the potential to impact the fidelity of some prior data in this report, with 6 Acute Care Hospitals electing not to report in Q2 2020. Given the intention of the CMS exception, the facilities electing not to report are not highlighted specifically. Outside of the CMS exception, no facilities were missing data through the reporting period.

### ***Data reported to NHSN are validated using several methods:***

***Point-of-entry checks:*** NHSN is a web-based data reporting and submission program that includes validation routines for many data elements, thus reducing common data entry errors. Hospitals can enter, view, edit, and analyze their data at any time.

***Quarterly checks for internal consistency:*** Each quarter, TDH staff download CLABSI, CAUTI, SSI, and LabID (MRSA/CDI) data from NHSN and verify completeness with a computerized data validation program. Data that are missing, unusual, inconsistent, or duplicative are identified and investigated through email and/or telephone communication with hospital staff. Hospitals are given the opportunity to verify and/or correct the data.

## Risk Adjustment

Risk adjustment is a statistical technique that allows hospitals to be compared fairly by accounting for differences in patient populations in terms of illness severity and other factors that may affect the risk of developing a HAI. For example, a hospital that performs many complex procedures on very sick patients would be expected to have a higher infection rate than a hospital that performs more routine procedures on healthier patients. Therefore, before comparing the infection rates of hospitals, it is important to adjust for the number and proportion of high- and low-risk patients by calculating a statistically 'expected' or predicted number of infections. Different risk adjustment methods are used for different types of HAIs.

### ***CLABSI, CAUTI, MRSA, and CDI Risk Model***

Risk adjustment for calculation of predicted events for CLABSI, CAUTI, MRSA, and CDI is done using a negative binomial regression model, as shown below:

$$\log(\lambda) = \alpha + \beta_1 X_1 + \beta_2 X_2 + \dots + \beta_i X_i, \text{ where:}$$

$\alpha$  = Intercept

$\beta_i$  = Parameter Estimate

$X_i$  = Value of Risk Factor (Categorical variables: 1 if present, 0 if not present)

$i$  = Number of Predictors

These models utilize summary data to estimate incidence in that summarized population (e.g., CAUTIs in a NICU). Using factors found to be significantly associated with HAI incidence, such as inpatient location, facility bed size, and medical school affiliation, an equation is generated for each are of interest, from facility to individual unit, which gives the predicted number of HAIs to occur for that period.

### SSI Risk Model

Risk adjustment for calculation of predicted events for SSIs is done using a logistic regression model, as shown below:

$$\text{logit}(\hat{p}) = \alpha + \beta_1 X_1 + \beta_2 X_2 + \dots + \beta_i X_i, \text{ where:}$$

$\alpha$  = Intercept  
 $\beta_i$  = Parameter Estimate  
 $X_i$  = Value of Risk Factor (Categorical variables= 1 if present, 0 if not present. Refer to "Variable Coding" column in Table 1 above.)  
 $i$  = Number of Predictors

These models are used when each exposure has the opportunity for a single outcome (e.g., an SSI after a CABG procedure). For each procedure completed, using a set of factors found to be significant predictors of SSIs, a numerical risk is assigned to that procedure. The total sum of the risk of infections from a set of procedures, is equal to the total number of predicted infections for that set of procedures.

### 2015 Re-baseline

The 2015 re-baseline updated both the source of aggregate data and the risk adjustment methodology used to create the original baselines. Before 2015, the baselines, or reference points, varied among the different HAI measures (e.g., several infections had different baselines). In previous Tennessee HAI reports, the number of predicted infections was estimated based on those original baselines. In this report, the number of predicted infections is an estimate based on infections reported to NHSN by participating facilities nationwide during the 2015 national baseline. Therefore, the data in this report are not comparable with previous Tennessee HAI reports before 2015. Moving forward, HAI prevention progress for 2015 and subsequent years will be measured in comparison to infection data from 2015.

## Standardized Infection Ratio Overview (with Confidence Intervals)

The SIR is identical in concept to a standardized mortality ratio and is an indirect standardization method for summarizing the HAI experience across any number of stratified groups of data. The SIR is calculated by dividing the number of observed infections by the number of statistically predicted infections based on the NHSN standard population and appropriate patient and facility-level risk adjustment:

$$\text{SIR} = \frac{\text{Observed HAIs}}{\text{Predicted HAIs}}$$

- An SIR of 1.0 means the observed number of infections is equal to the number of predicted infections.
- An SIR greater than 1.0 means there were more infections than predicted. For example, if a facility has a CLABSI SIR=1.5, they experienced 50% more CLABSIs than predicted.
- An SIR less than 1.0 means there were fewer infections than predicted. For example, if a facility has a CLABSI SIR=0.8, they experienced 20% fewer CLABSIs than predicted.

This report uses the 95% confidence interval to describe statistical significance when reporting the SIR. Consistent with CDC/NHSN methodology, exact mid-p confidence intervals are used when observed and expected numbers of events are less than or equal to 100; otherwise, the Byar approximation method is used.<sup>4</sup> Statistical analyses were performed, and tables and figures were created using SAS version 9.4.

---

<sup>4</sup> <http://www.cdc.gov/nhsn/sas/SIRcomp.sas>

# Central Line-Associated Bloodstream Infections (CLABSI)



## ***Central Line-Associated Bloodstream Infections (CLABSIs)***

A central line or central venous catheter is a flexible tube that is inserted in a patient's blood vessel and terminates at, or close to, the heart or one of the large vessels near the heart such as the aorta, superior/inferior vena cava, subclavian veins, femoral veins, or other great vessels.<sup>5</sup> For NHSN reporting, there are three main types of central lines: permanent central lines, temporary central lines, and umbilical catheters (for neonates). A central line can be used for infusion of medication, liquid nutrition, and fluids as well as being utilized for blood draws or hemodynamic management. If a central line is not inserted and cared for correctly, it can lead to dangerous bloodstream infections, known as central line-associated bloodstream infections (CLABSIs). Healthcare facilities can prevent CLABSIs by following appropriate infection prevention recommendations when placing and maintaining a central line, and by removing a central line as soon as it is no longer medically necessary.<sup>6</sup>

### **Reporting Requirements**

Since January 2008, acute care hospitals (ACHs) in Tennessee have been required to report CLABSI data from adult and pediatric intensive care units (ICUs, also called "Critical Care Units") to the Tennessee Department of Health (TDH). Hospitals with an average daily census, the average number of inpatients receiving services on a given day in a 12-month period, less than 25 were exempt from this requirement until January 2012. Neonatal ICUs in Tennessee have been reporting CLABSI data since July 2008. Burn ICUs, Trauma ICUs, and long-term acute care (LTAC) hospitals began reporting CLABSI data in July 2010. ACHs began reporting CLABSI from adult and pediatric medical, surgical, and medical/surgical wards in April 2014.

To comply with these reporting requirements, facilities are required to follow the NHSN CLABSI Surveillance protocol, which is updated each year with CLABSI surveillance definitions and reporting instructions. Facilities must report the number of central line and patient days for each applicable location each month to NHSN. They are also required to report any bloodstream infections which meet the NHSN surveillance definition of a CLABSI in required locations. The 2022 CLABSI Surveillance protocol contains no major changes from the previous year's version.

### **Surveillance Definitions & Changes**

NHSN defines the date of event (DOE) as the date that the first element that is used to meet an NHSN site-specific infection criterion occurs for the first time within the Infection Window Period (IWP). It defines the IWP as a 7-day window set by the first positive diagnostic test used as one element to meet the criterion.

---

<sup>5</sup> CLABSI Surveillance Protocol ([https://www.cdc.gov/nhsn/PDFs/pscManual/4PSC\\_CLABSCurrent.pdf](https://www.cdc.gov/nhsn/PDFs/pscManual/4PSC_CLABSCurrent.pdf))

<sup>6</sup> Patient Guide to CLABSI ([https://www.cdc.gov/hai/pdfs/bsi/BSI\\_tagged.pdf](https://www.cdc.gov/hai/pdfs/bsi/BSI_tagged.pdf))

NHSN defines a CLABSI for its surveillance purposes, as a laboratory confirmed bloodstream infection (LCBI) where an eligible bloodstream infection organism is identified, and an eligible central line is present on the LCBI date of event, or the day before. An eligible central line is one that has been in place for > 2 consecutive calendar days following the first access of the central line, and an eligible BSI organism is any organism not included on the excluded organism list. This must occur during the current admission and the patient must be in an inpatient location. Additionally, all elements necessary to meet the criterion for CLABSI must occur during the Infection Window Period.

In 2021, NHSN updated the CLABSI surveillance protocol to include more specific guidance on specific types of laboratory-testing for LCBIs (non-culture-based testing) as well as clarification on an exclusion based in a patient diagnosis of Epidermolysis bullosa (EB) to only include the genetic forms of EB in pediatric populations.

## Facility-Specific Data Thresholds

To ensure fair and accurate reporting of facility specific CLABSI standardized infection ratios (SIRs), TDH has adopted the NHSN minimum thresholds for reporting. To report a facility-specific CLABSI SIR, the statistically predicted number of infections must be at least 1.0.

## CLABSI Risk Adjustment

We use the SIR as a summary measure to compare CLABSI data for facilities in TN to the national benchmark from a baseline period. CDC uses HAI data collected nationally in 2015 to create the SIR baselines, which includes updates to both the source of aggregate data and the risk adjustment methodology used to calculate the number of predicted events. Before 2015, the period used to establish the baseline, or reference points, varied amongst the different HAI types. Thus, in TN HAI reports before 2015, the number of predicted infections was estimated based on a baseline that was created using data prior to 2015. The data in this report, therefore, are not comparable to pre-2015 HAI reports, as they are based on different baselines.

The CLABSI SIR is calculated by dividing the total number of CLABSI events (the observed events) by the predicted\* number of CLABSI (expected events). This predicted number, which can also be understood as a projection, is calculated using a negative binomial regression model. It is adjusted for each facility using variables found to be significant predictors of HAI incidence. Some of those variables include facility type, location, bed size, and medical school affiliation for ACHs. Additionally in acute care NICU locations, birthweight is adjusted for. In LTACHs, the average length of stay, hospital location, facility bed size, and proportion of admissions on a ventilator and hemodialysis are adjusted for. Additional details can be found in the [NHSN Guide to the SIR](#).<sup>7</sup>

---

\* "Predicted" is used throughout the report as a synonym for the standard statistical term "expected."

<sup>7</sup> <https://www.cdc.gov/nhsn/pdfs/ps-analysis-resources/nhsn-sir-guide.pdf>

# CLABSIs in Adult & Pediatric Critical Care Units

Total number of hospitals reporting from January-December 2021: 79

## **SIRs by Quarter (Figure 3)**

- The overall CLABSI SIR for acute care hospitals in Tennessee increased from 0.76 (95% CI: 0.62, 0.917) in Q1-2021 to 1.04 (95% CI: 0.84, 1.22) in Q4-2021. The latter half of 2021 saw statistically higher SIR's than both the HHS goal (0.5) and national baseline (1.0). The CLABSI SIR for ICUs in 2021 reached a high of 1.43 (95% CI: 1.2, 1.72) in Q3-2021. This is also the highest SIR value seen in Tennessee since the 2015 baseline. In 2021, Tennessee ICUs failed to achieve the 2020 U.S. Department of Health and Human Services' [National Action Plan to Prevent Healthcare-Associated Infections](#) prevention target of SIR=0.50.

## **Key Percentiles for Tennessee SIRs (Table 5, Table 6, Figure 4)**

- Including burn and trauma ICUs, the overall SIR across all reporting adult and pediatric ICUs in Tennessee from January-December 2021 was not significantly different than the national SIR of 1 (SIR=1.11; 95% CI: 0.99, 1.23).
- Excluding burn and trauma ICUs, the overall SIR across all reporting adult and pediatric ICUs in Tennessee from January-December 2021 was statistically significantly higher than the national SIR of 1 (SIR=1.19; 95% CI: 1.06, 1.33).
- In 2021, 48 facilities had >1 predicted infection (and thus a calculated SIR). Of those 48 facilities, 13 (27%) were significantly better than the national baseline (SIR=1.0), 4 (8%) were significantly worse, and the remaining 31 (65%) were not significantly different.

## **SIRs by Unit Type (Figure 5)**

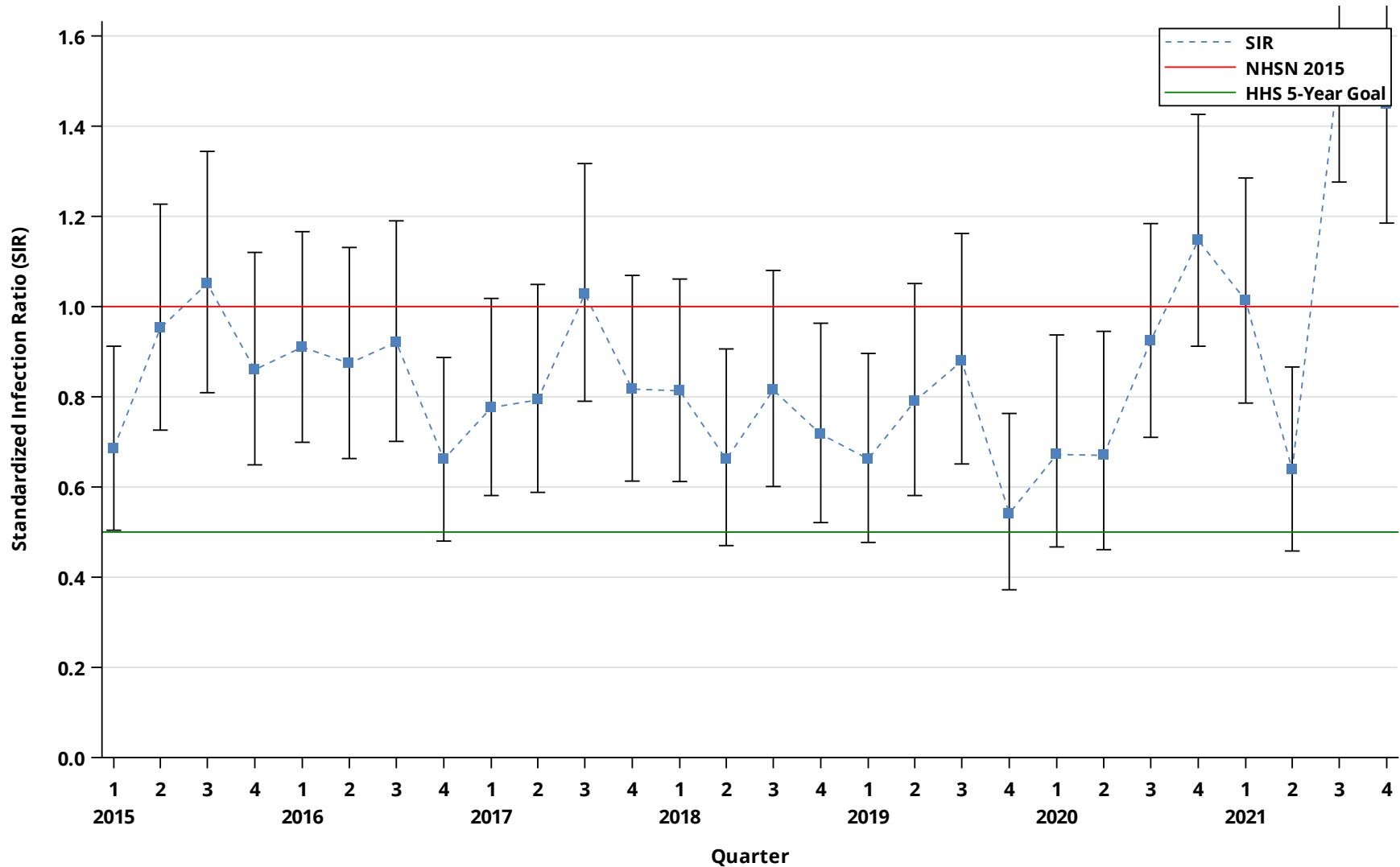
- In 2021, no unit type had a statistically higher yearly CLABSI SIR indicating that no unit type had more CLABSIs than expected. Reporting from Tennessee's Burn and Trauma Critical Care units demonstrated significantly lower CLABSI SIR results in 2021 with an SIR of 0.25 (95% CI: 0.06, 0.692) and 0.68 (95% CI: 0.52, 0.87) respectively.

## **Microorganisms Associated with CLABSIs in Adult and Pediatric ICUs (Figure 6, Figure 7)**

- Among the 356 isolates from 325 CLABSIs in 2021, the most common pathogens were *Candida* species and other yeasts (28%), coagulase-negative *Staphylococcus* species (25%), and *Enterococcus* species (17%). These three organisms were also the most common pathogens in 2017-2020.
- Of the 61 *Enterococcus spp.* Isolates, 20 of these isolates (32.79%) were vancomycin-resistant. Vancomycin-resistant *Enterococcus* species represented 5.62% of all CLABSI isolates.

- Of the 24 *Staphylococcus aureus* isolates, 10 (41.67%) were methicillin-resistant. Methicillin-resistant *S. aureus* represented 2.81% of all CLABSI isolates.
- Of the 15 *Pseudomonas aeruginosa* isolates, 3 (20%) were carbapenem -resistant. Carbapenem-resistant *P. aeruginosa* represented 0.84% of all CLABSI isolates.

**Figure 3: Standardized Infection Ratios (SIR) for Central Line-Associated Bloodstream Infections (CLABSIs) for Adult and Pediatric Intensive Care Units (ICUs) by Quarter, Excluding Burn and Trauma ICUs, Tennessee, 01/01/2015–12/31/2021 [Reference standard: National Healthcare Safety Network (NHSN), 2015]**



Data Reported as of May 18, 2022

**Table 5: Central Line-Associated Bloodstream Infection (CLABSI) Standardized Infection Ratios (SIRs) in Adult and Pediatric Intensive Care Units (ICUs) by Reporting Year, Including Burn and Trauma Units, Tennessee, 01/01/2015 - 12/31/2021**

| STATE     | YEAR | No. | CL DAYS | No. of INFECTIONS |        | SIR AND 95% CONFIDENCE INTERVAL |             |             |
|-----------|------|-----|---------|-------------------|--------|---------------------------------|-------------|-------------|
|           |      |     |         | OBS               | PRED   | SIR                             | LOWER LIMIT | UPPER LIMIT |
| Tennessee | 2021 | 79  | 273,798 | 325               | 294.02 | 1.11                            | 0.99        | 1.23        |
|           | 2020 | 81  | 232,630 | 208               | 252.37 | 0.82                            | 0.72        | 0.94        |
|           | 2019 | 82  | 229,057 | 177               | 252.46 | 0.70                            | 0.60        | 0.81        |
|           | 2018 | 87  | 238,440 | 193               | 261.08 | 0.74                            | 0.64        | 0.85        |
|           | 2017 | 86  | 249,094 | 235               | 270.88 | 0.87                            | 0.76        | 0.98        |
|           | 2016 | 86  | 258,118 | 251               | 280.33 | 0.90                            | 0.79        | 1.01        |
|           | 2015 | 85  | 252,922 | 248               | 271.05 | 0.92                            | 0.81        | 1.03        |

**Table 6: Central Line-Associated Bloodstream Infection (CLABSI) Standardized Infection Ratios (SIRs) in Adult and Pediatric Intensive Care Units (ICUs) by Reporting Year, Excluding Burn and Trauma Units, Tennessee, 01/01/2015 - 12/31/2021**

| STATE     | YEAR | No. | CL DAYS | No. of INFECTIONS |        | SIR AND 95% CONFIDENCE INTERVAL |             |             |
|-----------|------|-----|---------|-------------------|--------|---------------------------------|-------------|-------------|
|           |      |     |         | OBS               | PRED   | SIR                             | LOWER LIMIT | UPPER LIMIT |
| Tennessee | 2021 | 79  | 258,499 | 315               | 265.14 | 1.19                            | 1.06        | 1.33        |
|           | 2020 | 81  | 217,034 | 198               | 223.32 | 0.89                            | 0.77        | 1.02        |
|           | 2019 | 82  | 213,656 | 159               | 222.33 | 0.72                            | 0.61        | 0.83        |
|           | 2018 | 87  | 221,722 | 173               | 229.60 | 0.75                            | 0.65        | 0.87        |
|           | 2017 | 86  | 232,541 | 204               | 239.68 | 0.85                            | 0.74        | 0.97        |
|           | 2016 | 86  | 240,678 | 209               | 248.42 | 0.84                            | 0.73        | 0.96        |
|           | 2015 | 85  | 236,863 | 212               | 240.57 | 0.88                            | 0.77        | 1.01        |

Data reported as of May 18, 2022

No. = number of facilities; CL Days = central line days; OBS = observed number of CLABSI

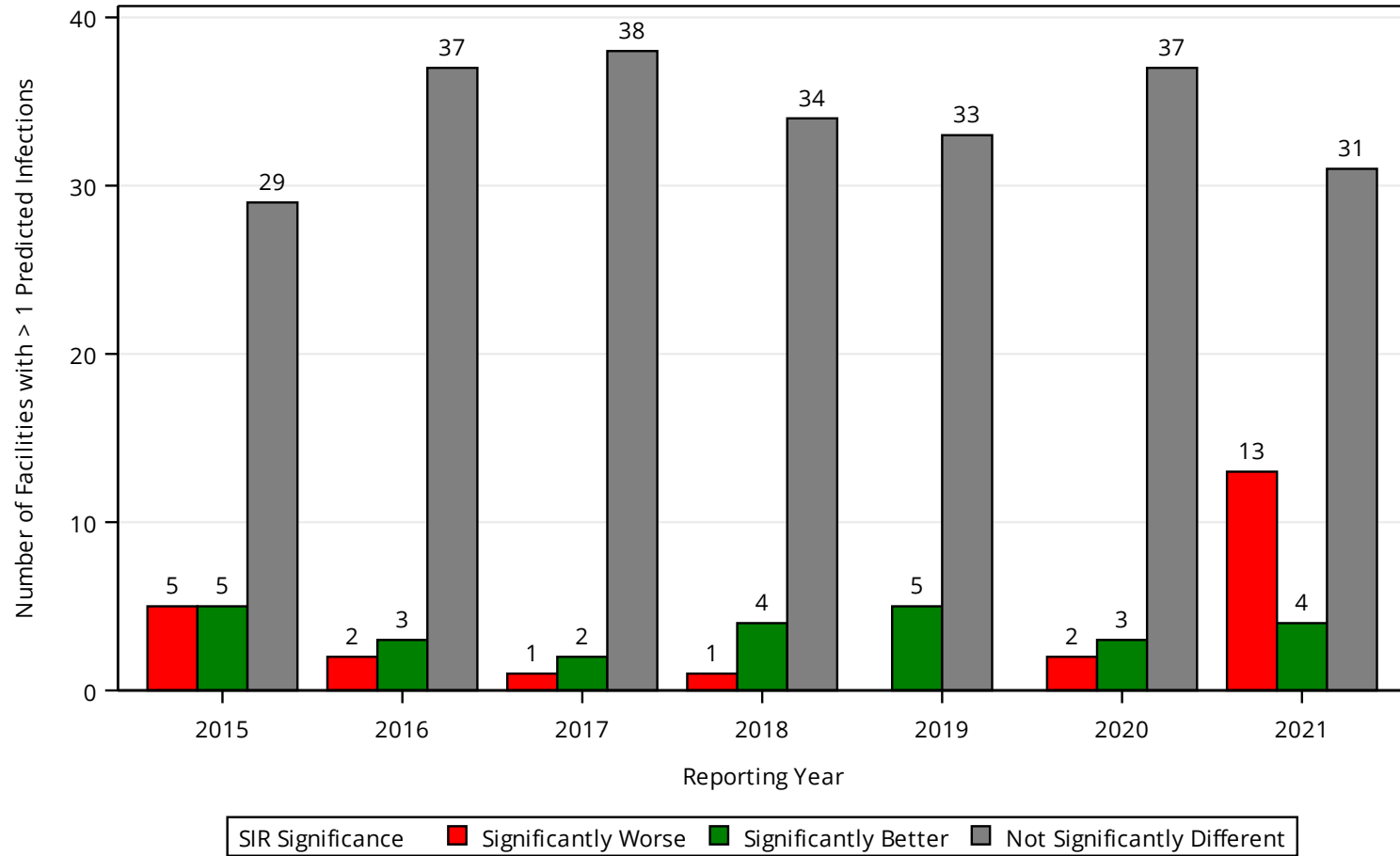
PRED = statistically 'predicted' number of CLABSI; SIR = standardized infection ratio (observed/predicted number of CLABSI)

Key percentiles include facilities with at least 1 predicted infection

Red highlighting indicates SIR for reporting period is significantly higher than national 2015 SIR of 1.0

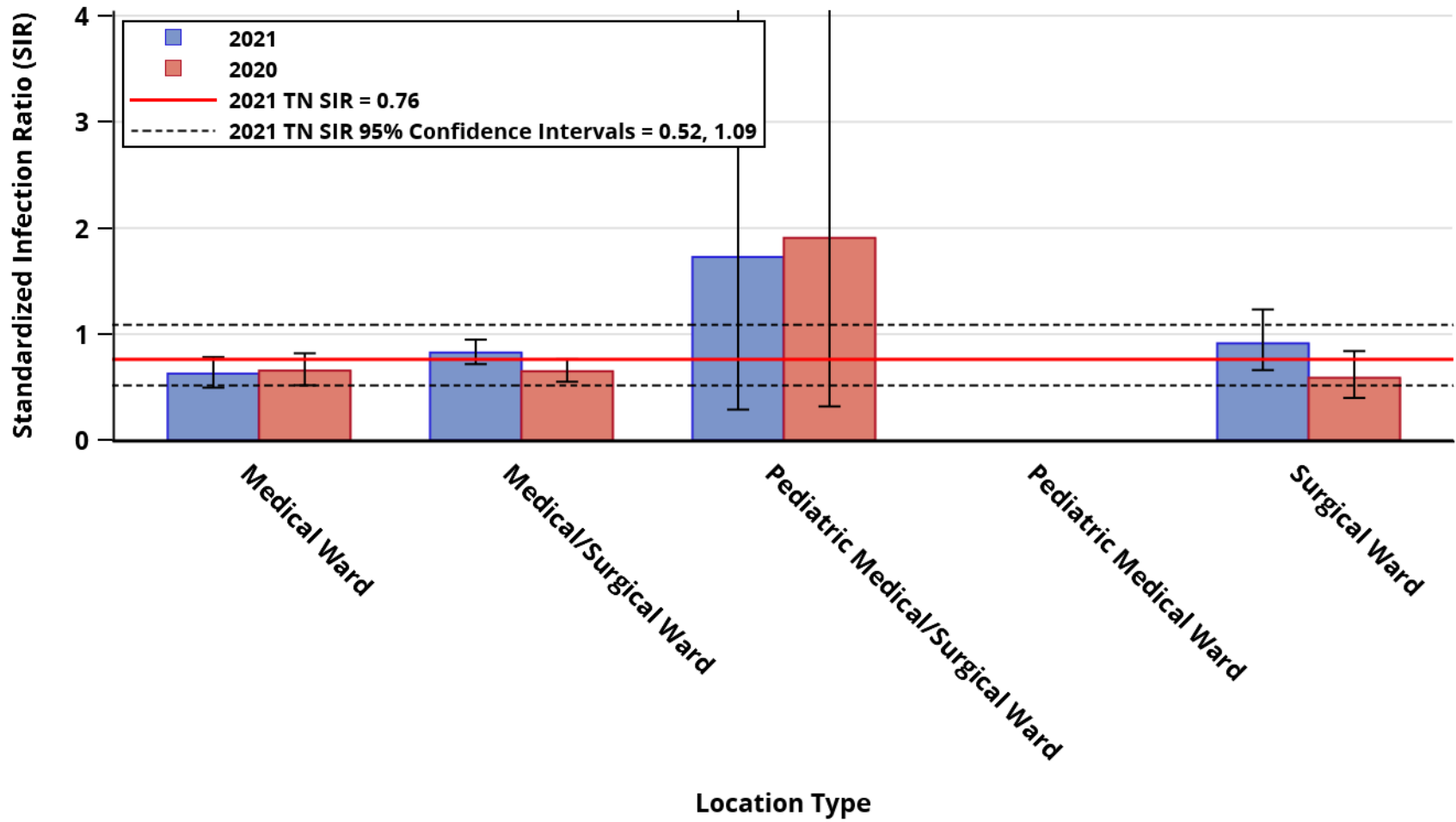
Green highlighting indicates SIR for reporting period is significantly lower than national 2015 SIR of 1.0

**Figure 4: Number of Facility SIRs with More than 1 Predicted Central Line-Associated Bloodstream Infection (CLABSI) Events in Adult and Pediatric Intensive Care Unit (ICUs) by Reporting Year, Including Burn and Trauma Units, Tennessee, 2015-2021**



Data reported as of May 18, 2022

Figure 5: Standardized Infection Ratios (SIRs) for Central Line-Associated Bloodstream Infections (CLABSIs) by Intensive Care Unit (ICU) Type, Tennessee, 2020 [Reference standard: National Healthcare Safety Network (NHSN), 2015]

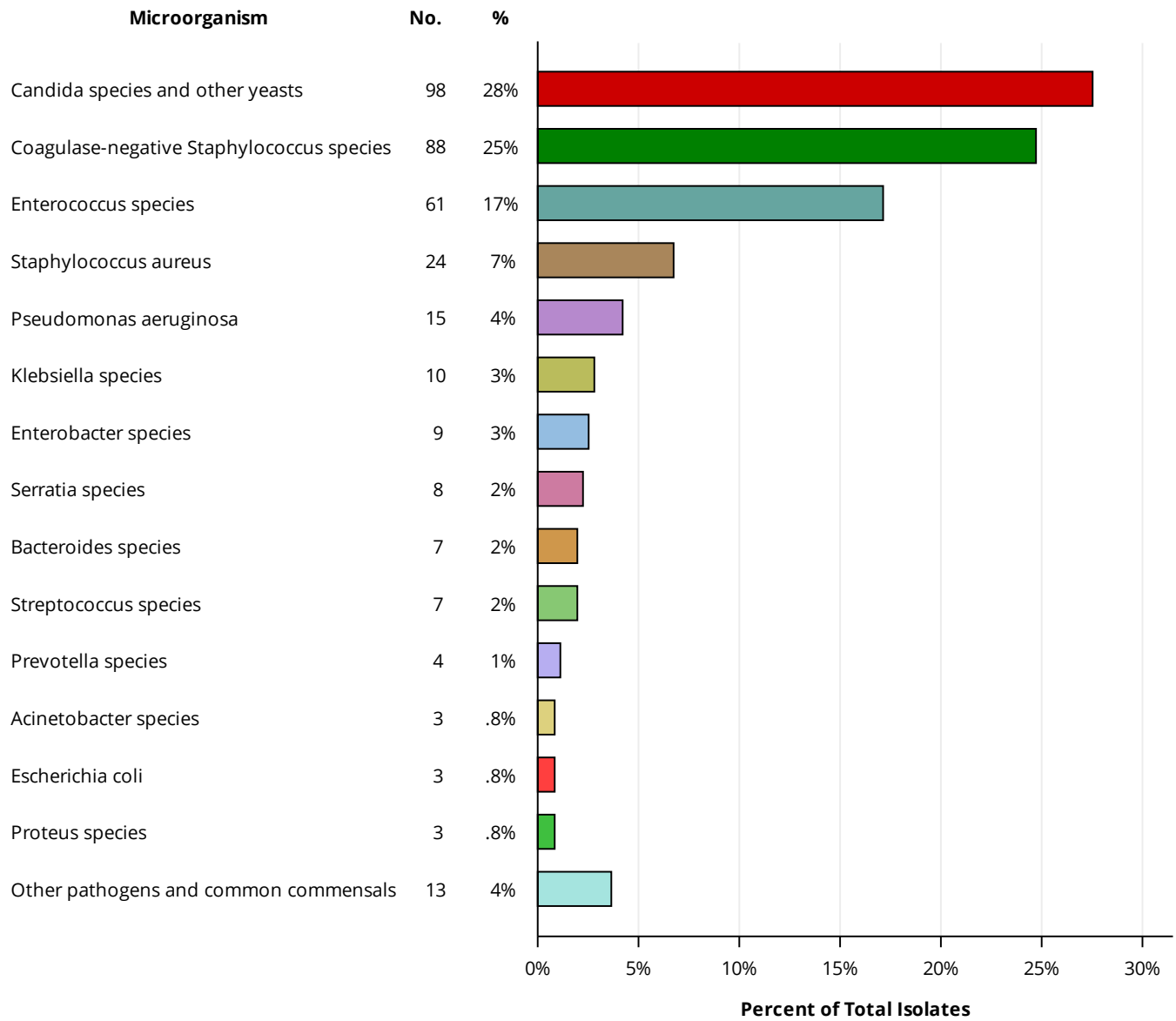


Data Reported as of May 18, 2022



**Figure 6: Microorganisms Identified in Central Line-Associated Bloodstream Infections (CLABSIs) in Adult and Pediatric Intensive Care Units, Tennessee, 01/01/2021 - 12/31/2021**

**Number of isolates=356; Number of events=325**



Data reported as of May 18, 2022

Other common commensals = Bacillus spp.

Other pathogens =Achromobacter spp., Actinomyces spp., Anaerobic spp., Eggerthella spp., Lactobacillus spp., Leuconostoc spp., Morganella spp., Other Staphylococcus spp., Rothia spp., Stenotrophomonas spp., Veillonella spp.

**Table 7: Resistant Microorganisms Identified in Central-Line Associated Bloodstream Infections (CLABSIs) in Adult and Pediatric Intensive Care Units, Tennessee, 01/01/2021 - 12/31/2021**

| State     | Year | Microorganism          | Number of Isolates |           | Percentage of Resistant Isolates |                                    |
|-----------|------|------------------------|--------------------|-----------|----------------------------------|------------------------------------|
|           |      |                        | Total              | Resistant | By Microorganism                 | By Total Number of CLABSI Isolates |
| Tennessee | 2021 | Enterococcus species   | 61                 | 20        | 32.79%**                         | 5.62%**                            |
|           |      | Staphylococcus aureus  | 24                 | 10        | 41.67%***                        | 2.81%***                           |
|           |      | Pseudomonas aeruginosa | 15                 | 3         | 20%*                             | 0.84%*                             |
|           |      | Klebsiella species     | 10                 | 0         | 0%*                              | 0%*                                |
|           |      | Enterobacter species   | 9                  | 0         | 0%*                              | 0%*                                |
|           |      | Escherichia coli       | 3                  | 0         | 0%*                              | 0%*                                |

Data reported as of May 18, 2022

\* = Carbapenem-resistant

\*\* = Vancomycin-resistant

\*\*\* = Methicillin-resistant

# CLABSIs in Neonatal Critical Care Units

**Total number of neonatal ICUs (NICUs) reporting from January-December 2021: 24**

## **SIRs by Quarter (Figure 7)**

- The overall CLABSI SIR in Tennessee NICUs increased each quarter from Q1-2021 (SIR=0.46, 95% CI: 0.19, 0.96) to Q4-2021 (SIR=0.72, 95% CI: 0.39, 1.24). Q1 was the only quarter significantly lower than the 2015 national baseline. Q1 was the only quarter that met the U.S. Department of Health and Human Services' [National Action Plan to Prevent Healthcare-Associated Infections](#)<sup>8</sup> 2020 prevention target of SIR=0.50 though not statistically significantly below this goal.

## **Key Percentiles for Tennessee SIRs (Table 8, Figure 8)**

- The overall SIR across all reporting NICUs in Tennessee from January-December 2021 was statistically significantly lower than the national SIR of 1 (SIR=0.65; 95% CI: 0.47, 0.88). (Table 8)
- In 2021, there were 11 facilities reporting CLABSIs for neonatal ICUs with predicted infections greater than 1. One of these facilities was significantly better than baseline, one was significantly worse, and the remaining nine were not significantly different. (Figure 8)

## **CLABSI SIRs by Unit Type (Figure 9)**

- Neither Tennessee CLABSI SIR in combination level II/III NICUs nor the Level III NICUs were statistically significantly different than 2015 national SIR of 1 across 2021.

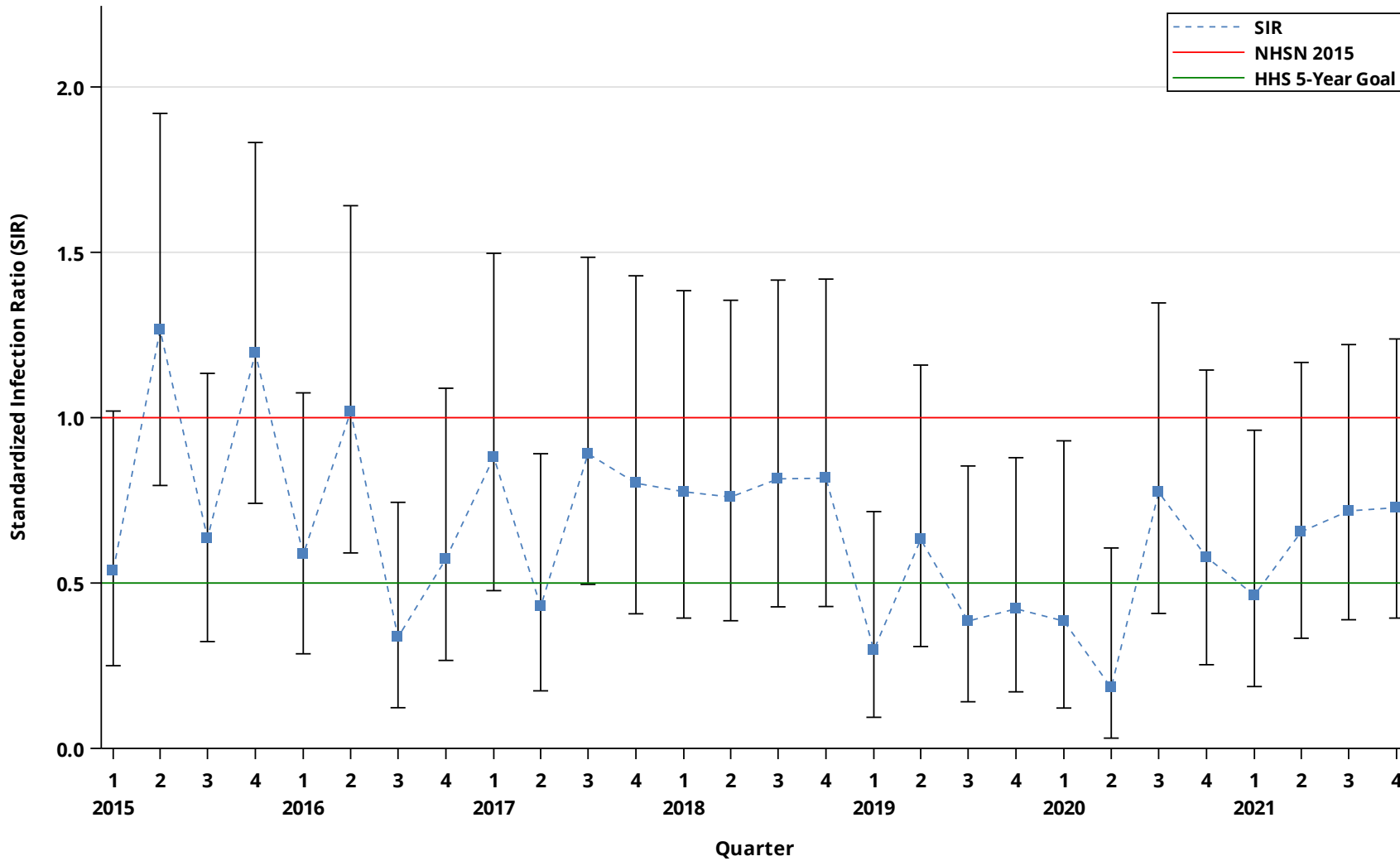
## **Microorganisms Associated with CLABSIs in Neonatal ICUs (Figure 10, Table 9)**

- Among the 43 pathogens isolated from 40 NICU CLABSIs in 2021, the most common pathogens were and *Staphylococcus aureus* (33%), coagulase-negative *Staphylococcus* species (26%), *Enterococcus* species (9%), (17%). Methicillin-Resistant *S. aureus* (MRSA) accounted for 10% of total positive isolates.
- Of the 14 *Staphylococcus aureus* isolates, 7 (50%) were methicillin-resistant. Methicillin-Resistant *S. aureus* (MRSA) accounted for 16.28% of total positive isolates.

---

<sup>8</sup> <http://www.hhs.gov/ash/initiatives/hai/actionplan/>

**Figure 7: Standardized Infection Ratios (SIR) for Central Line-Associated Bloodstream Infections (CLABSIs) for Neonatal Intensive Care Units (NICUs) by Quarter, Tennessee, 01/01/2015–12/31/2021 [Reference standard: National Healthcare Safety Network (NHSN), 2015]**



Data Reported as of May 18, 2022

**Table 8: Central Line-Associated Bloodstream Infection (CLABSI) Standardized Infection Ratios (SIRs) in Neonatal Intensive Care Units (NICUs) by Reporting Year, Tennessee, 01/01/2015 - 12/31/2021**

| STATE     | YEAR | No. | CL DAYS | No. of INFECTIONS |       | SIR AND 95% CONFIDENCE INTERVAL |             |             |
|-----------|------|-----|---------|-------------------|-------|---------------------------------|-------------|-------------|
|           |      |     |         | OBS               | PRED  | SIR                             | LOWER LIMIT | UPPER LIMIT |
| Tennessee | 2021 | 22  | 42,897  | 40                | 61.43 | 0.65                            | 0.47        | 0.88        |
|           | 2020 | 22  | 33,647  | 24                | 47.58 | 0.50                            | 0.33        | 0.74        |
|           | 2019 | 24  | 39,098  | 24                | 54.91 | 0.44                            | 0.29        | 0.64        |
|           | 2018 | 25  | 38,502  | 42                | 53.00 | 0.79                            | 0.58        | 1.06        |
|           | 2017 | 25  | 39,086  | 41                | 54.69 | 0.75                            | 0.55        | 1.01        |
|           | 2016 | 25  | 41,703  | 37                | 58.97 | 0.63                            | 0.45        | 0.86        |
|           | 2015 | 25  | 45,076  | 57                | 62.31 | 0.92                            | 0.70        | 1.18        |

Data reported as of May 18, 2022

No. = number of facilities; CL Days = central line days; OBS = observed number of CLABSI

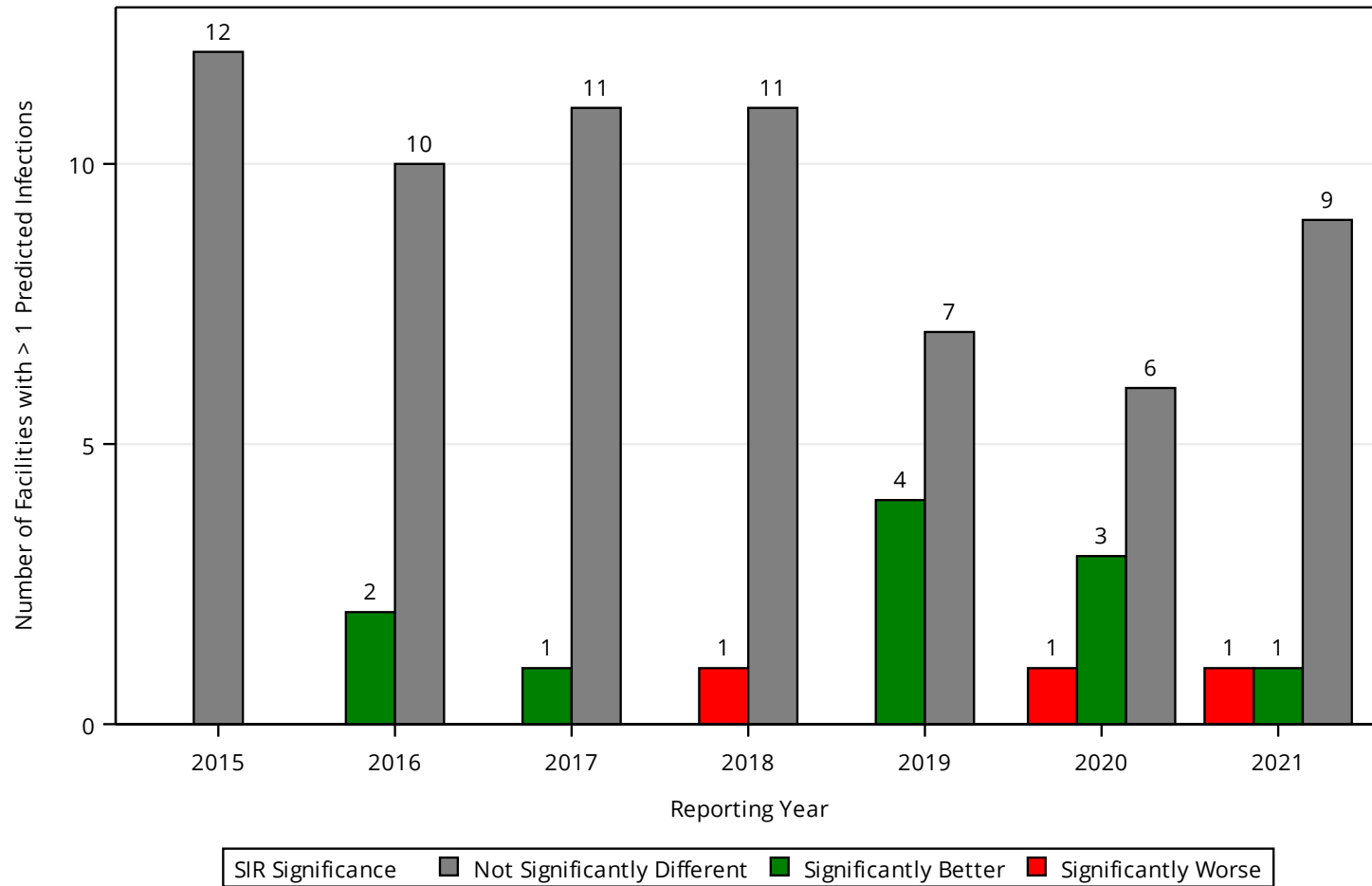
PRED = statistically 'predicted' number of CLABSI; SIR = standardized infection ratio (observed/predicted number of CLABSI)

Key percentiles include facilities with at least 1 predicted infection

Red highlighting indicates SIR for reporting period is significantly higher than national 2015 SIR of 1.0

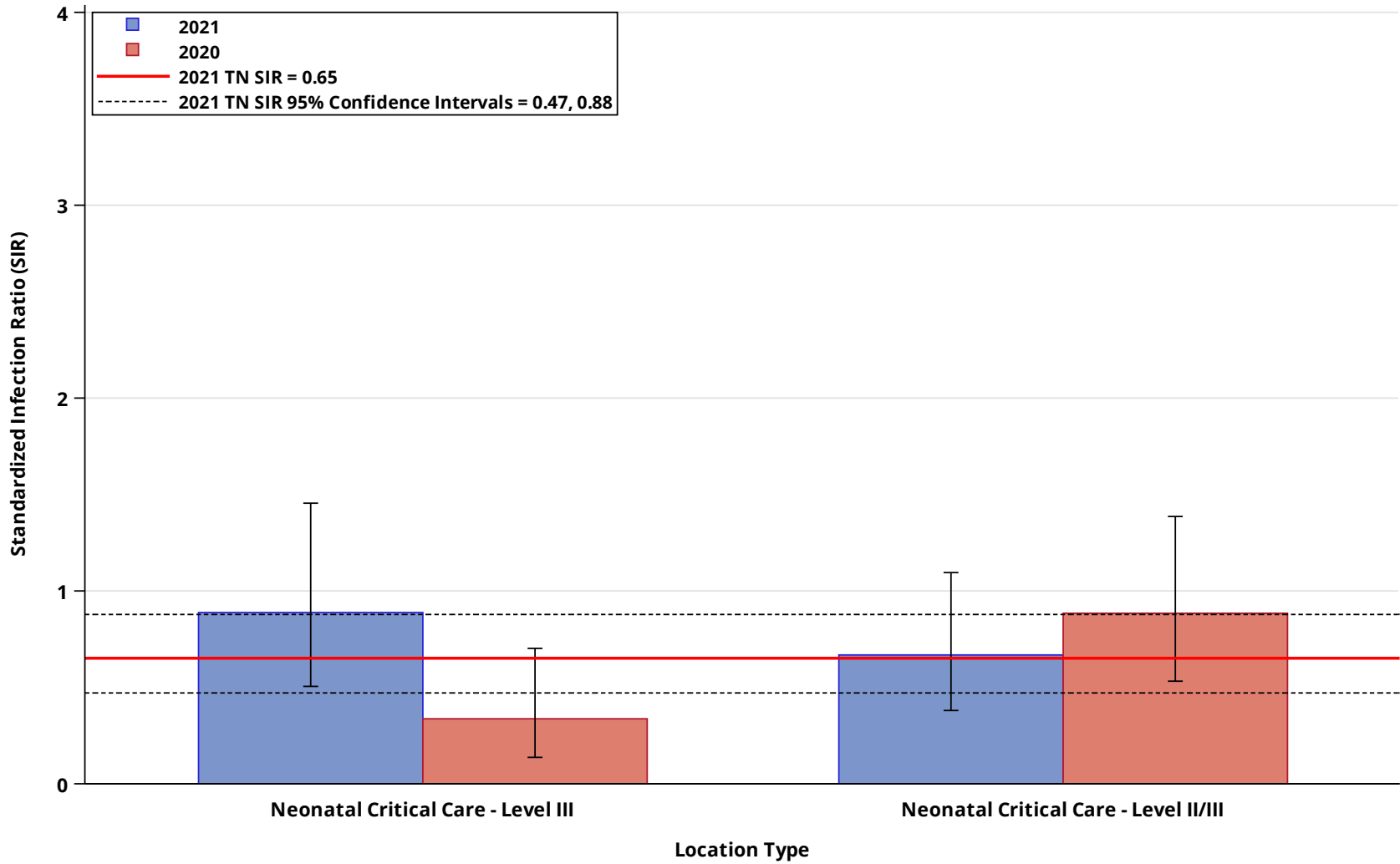
Green highlighting indicates SIR for reporting period is significantly lower than national 2015 SIR of 1.0

**Figure 8: Number of Facility SIRs with More than 1 Predicted Central Line-Associated Bloodstream Infection (CLABSI) Events in Neonatal Intensive Care Units (NICUs) by Reporting Year.**



Data reported as of May 18, 2022

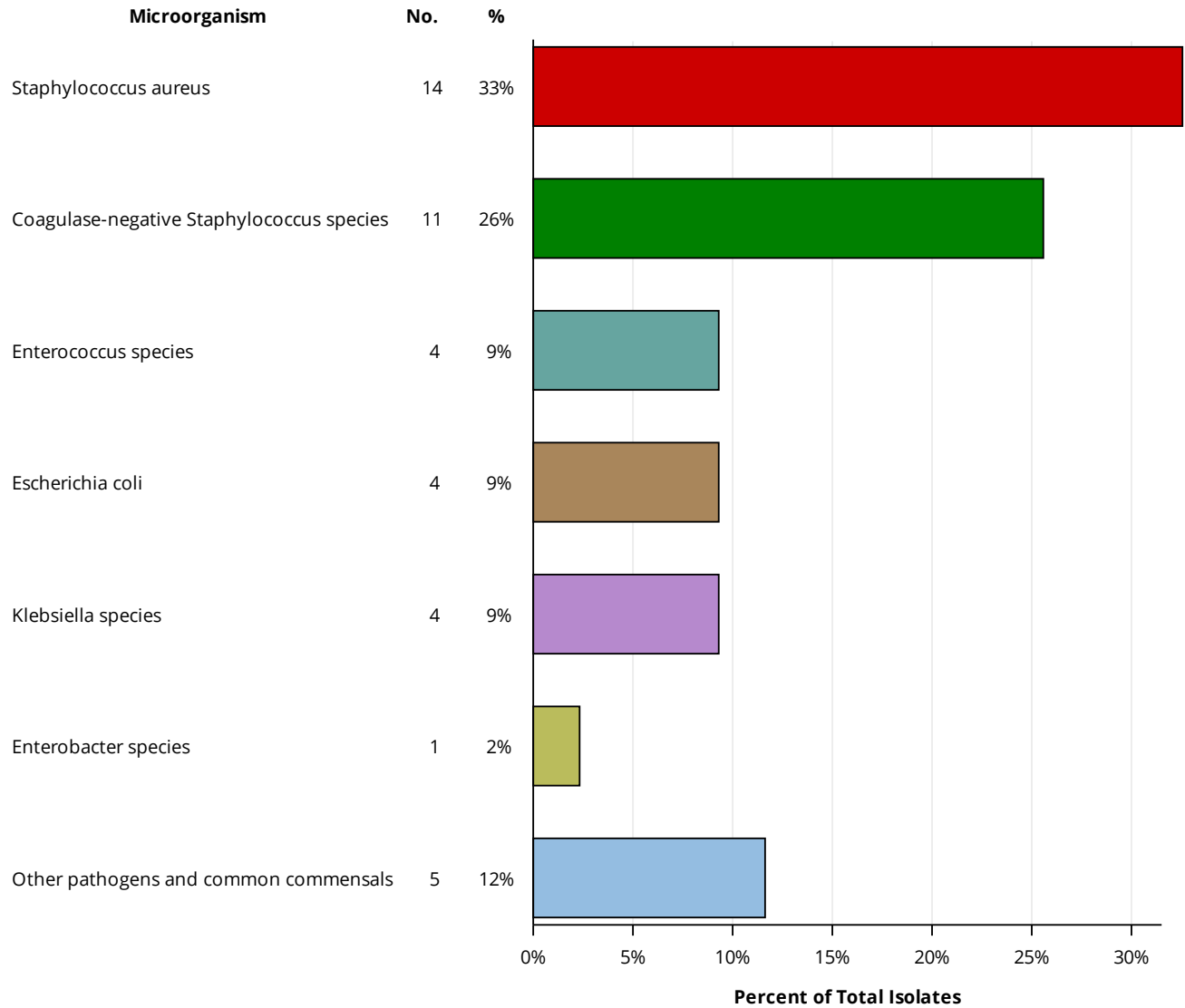
**Figure 9: Standardized Infection Ratios (SIRs) for Central Line-Associated Bloodstream Infections (CLABSIs) by Neonatal Intensive Care Unit (NICU) Type, Tennessee, 2021 [Reference standard: National Healthcare Safety Network (NHSN), 2015]**



Data Reported as of May 18, 2022

**Figure 10: Microorganisms Identified in Central Line-Associated Bloodstream Infections (CLABSIs) in Neonatal Intensive Care Units, Tennessee, 01/01/2021 - 12/31/2021**

**Number of isolates=43; Number of events=40**



Data reported as of May 18, 2022

Other common commensals = Bacillus spp.

Other pathogens =Achromobacter spp., Actinomyces spp., Anaerobic spp., Eggerthella spp., Lactobacillus spp., Leuconostoc spp., Morganella spp., Other Staphylococcus spp., Rothia spp., Stenotrophomonas spp., Veillonella spp.



**Table 9: Resistant Microorganisms Identified in Central-Line Associated Bloodstream Infections (CLABSIs) in Neonatal Intensive Care Units, Tennessee, 01/01/2021 - 12/31/2021**

| State     | Year | Microorganism         | Number of Isolates |           | Percentage of Resistant Isolates |                                    |
|-----------|------|-----------------------|--------------------|-----------|----------------------------------|------------------------------------|
|           |      |                       | Total              | Resistant | By Microorganism                 | By Total Number of CLABSI Isolates |
| Tennessee | 2021 | Staphylococcus aureus | 14                 | 7         | 50%***                           | 16.28%***                          |
|           |      | Enterococcus species  | 4                  | 0         | 0%**                             | 0%**                               |
|           |      | Escherichia coli      | 4                  | 0         | 0%*                              | 0%*                                |
|           |      | Klebsiella species    | 4                  | 0         | 0%*                              | 0%*                                |
|           |      | Enterobacter species  | 1                  | 1         | 100%*                            | 2.33%*                             |

Data reported as of May 18, 2022

\* = Carbapenem-resistant

\*\* = Vancomycin-resistant

\*\*\* = Methicillin-resistant

# CLABSIs in Adult/Pediatric Medical, Surgical, and Medical/Surgical Wards:

**Total number of hospitals reporting from January-December 2021: 96**

## **SIRs by Quarter ([Figure 11](#))**

- The overall CLABSI wards SIR in Tennessee increased from 0.57 (95% CI: 0.39, 0.81) in Q1-2021 to 0.69 in Q4-2021. During each quarter of 2021, Tennessee wards maintained a significantly lower than expected CLABSI (SIR=1) but failed to meet the HHS prevention target of 0.5.

## **Key Percentiles for Tennessee SIRs ([Table 10](#), [Figure 12](#))**

- The overall CLABSI SIR across all reporting adult and pediatric medical, surgical, and medical/surgical wards in Tennessee from January-December 2021 was statistically significantly lower than the national SIR of 1 (SIR=0.61; 95% CI: 0.43, 0.63). This SIR indicates that the number of CLABSIs in wards was 39% lower than predicted, compared to national 2015 NHSN data.
- In 2021, 38 facilities had greater than 1 predicted infection (and thus an SIR calculated). Of those 38 facilities, 3 (7%) were significantly better than the national baseline (SIR=1), 1 was significantly worse (2.6%), and the remaining 34 (89%) were not significantly different.

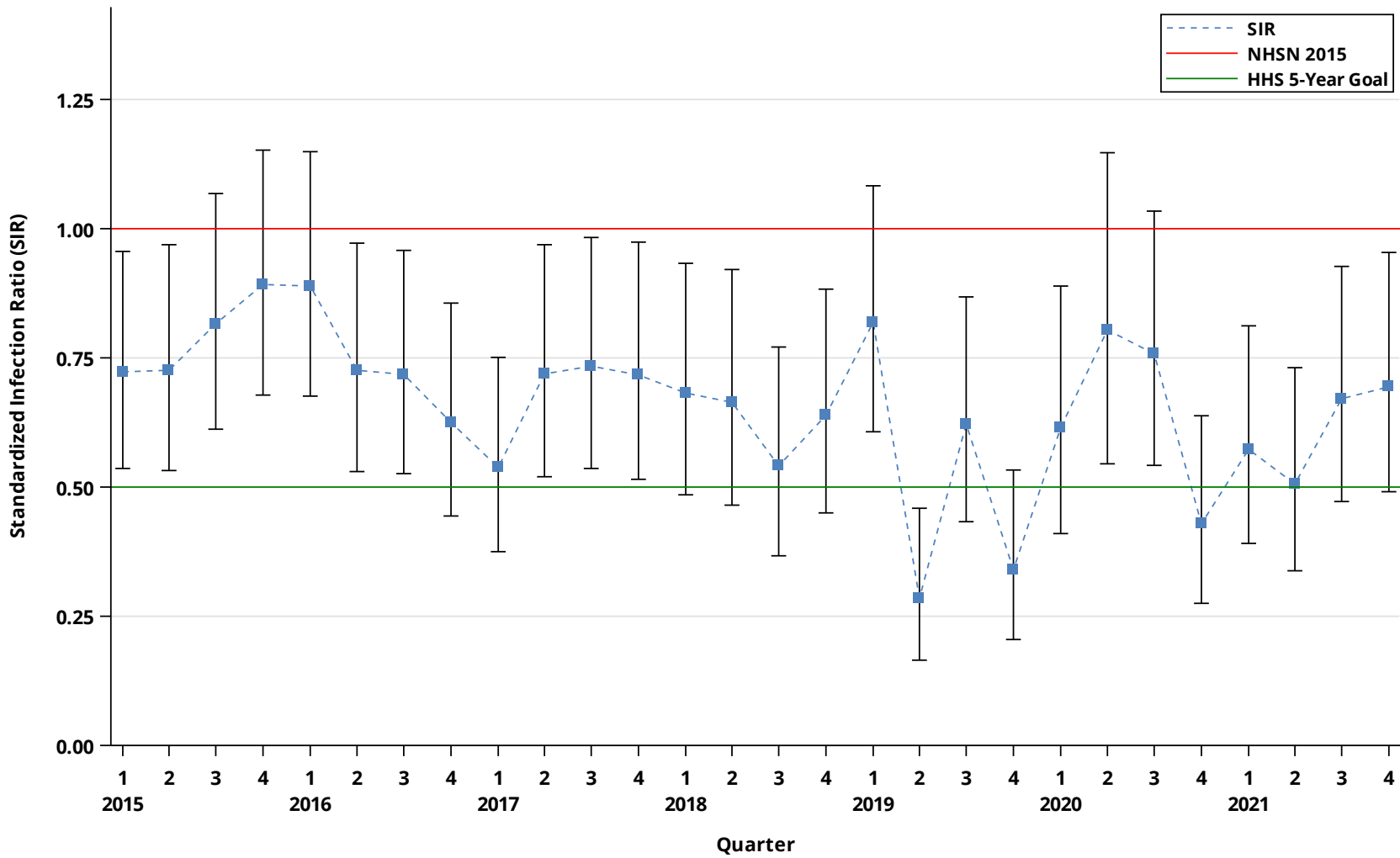
## **SIR by Unit Type ([Figure 13](#))**

- In 2021, no individual unit type recorded a statistically higher CLABSI SIR than predicted from the 2015 baseline.
- In 2021, Tennessee's medical wards and combination medical/surgical wards had statistically lower CLABSI SIRs than the national baseline (SIR=1). Tennessee's medical wards had a CLABSI SIR of 0.69 while the combination medical/surgical wards had CLABSI SIR of 0.54.

**Microorganisms Associated with CLABSIs in Adult and Pediatric Medical, Surgical, and Medical/Surgical Wards (Figure 14, Table 11)**

- Among the 136 pathogens isolated from 124 CLABSIs in 2021, the most common pathogens were *Staphylococcus aureus* (18%), coagulase-negative *Staphylococcus* species (18%), *Candida* species and other yeasts (18%), and *Enterococcus* species (9%).
- Of the 25 *Staphylococcus aureus* isolates, 9 (36%) were methicillin-resistant. Methicillin-Resistant *S. aureus* (MRSA) accounted for 6.6% of all CLABSI adult and pediatric ward isolates.
- Of the 12 *Enterococcus* species isolates, 3 (25%) were vancomycin-resistant. Vancomycin-resistant *Enterococcus* (VRE) accounted for 3% of CLABSI isolates.
- Of the 7 *Pseudomonas aeruginosa* isolates, 1 (14.29%) was carbapenem-resistant. Carbapenem-resistant *Pseudomonas aeruginosa* accounted for 0.74% of all CLABSI isolates.

**Figure 11: Standardized Infection Ratios (SIR) for Central Line-Associated Bloodstream Infections (CLABSIs) for Adult and Pediatric Medical, Surgical, and Medical/Surgical Wards by Quarter, Tennessee, 01/01/2015–12/31/2021 [Reference standard: National Healthcare Safety Network (NHSN), 2015]**



Data Reported as of May 18, 2022

**Table 10: Central Line-Associated Bloodstream Infection (CLABSI) Standardized Infection Ratios (SIRs) in Adult and Pediatric Medical, Surgical, and Medical/Surgical Wards by Reporting Year, Tennessee, 01/01/2015 - 12/31/2021**

| STATE     | YEAR | No. | CL DAYS | No. of INFECTIONS |        | SIR AND 95% CONFIDENCE INTERVAL |             |             |
|-----------|------|-----|---------|-------------------|--------|---------------------------------|-------------|-------------|
|           |      |     |         | OBS               | PRED   | SIR                             | LOWER LIMIT | UPPER LIMIT |
| Tennessee | 2021 | 96  | 233,394 | 124               | 203.10 | 0.61                            | 0.51        | 0.73        |
|           | 2020 | 96  | 203,119 | 113               | 177.20 | 0.64                            | 0.53        | 0.76        |
|           | 2019 | 98  | 241,067 | 110               | 210.29 | 0.52                            | 0.43        | 0.63        |
|           | 2018 | 104 | 239,900 | 131               | 207.50 | 0.63                            | 0.53        | 0.75        |
|           | 2017 | 103 | 263,768 | 152               | 225.27 | 0.68                            | 0.57        | 0.79        |
|           | 2016 | 103 | 278,422 | 176               | 237.28 | 0.74                            | 0.64        | 0.86        |
|           | 2015 | 102 | 292,258 | 194               | 245.79 | 0.79                            | 0.68        | 0.91        |

Data reported as of May 18, 2022

No. = number of facilities; CL Days = central line days; OBS = observed number of CLABSI

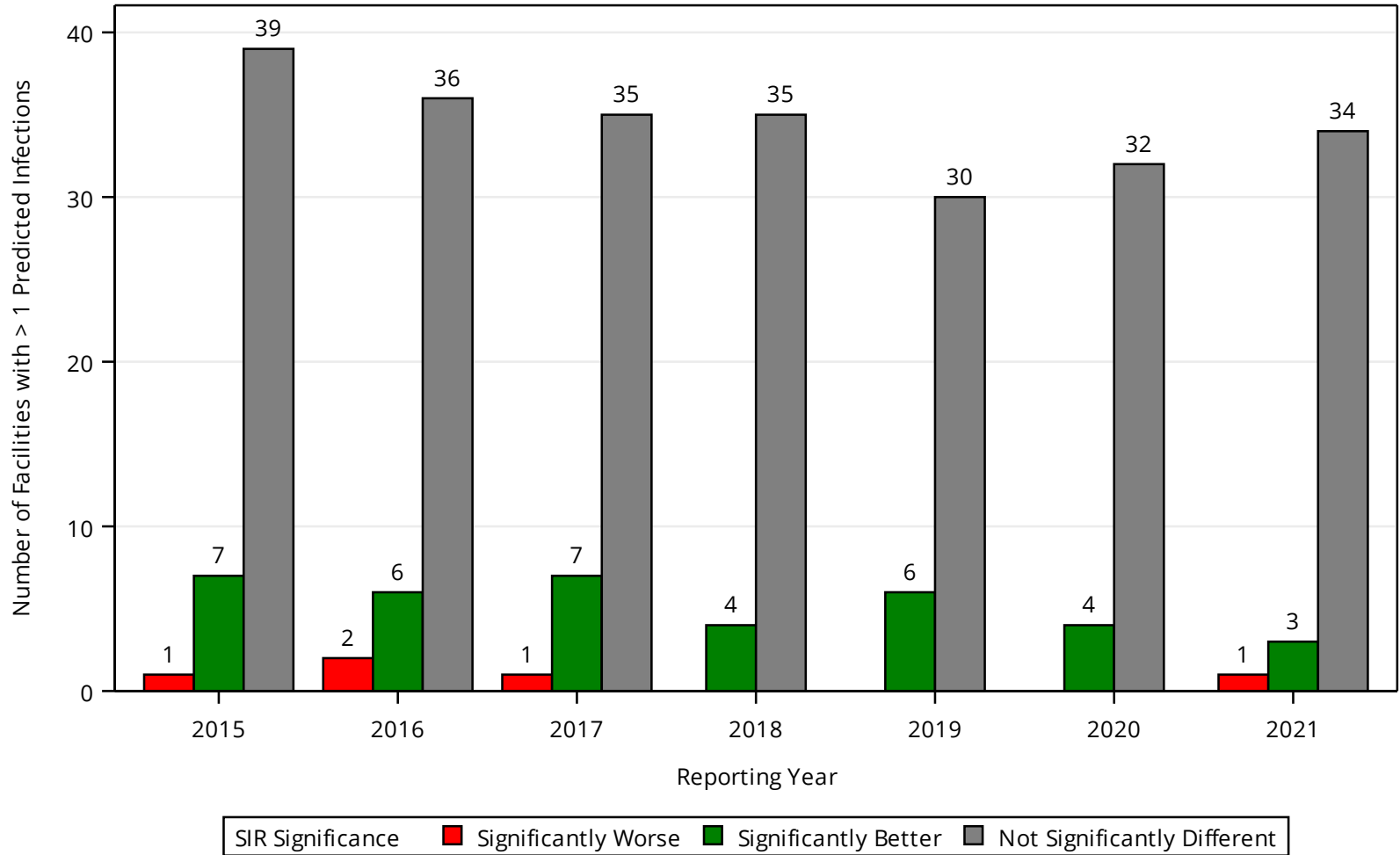
PRED = statistically 'predicted' number of CLABSI; SIR = standardized infection ratio (observed/predicted number of CLABSI)

Key percentiles include facilities with at least 1 predicted infection

Red highlighting indicates SIR for reporting period is significantly higher than national 2015 SIR of 1.0

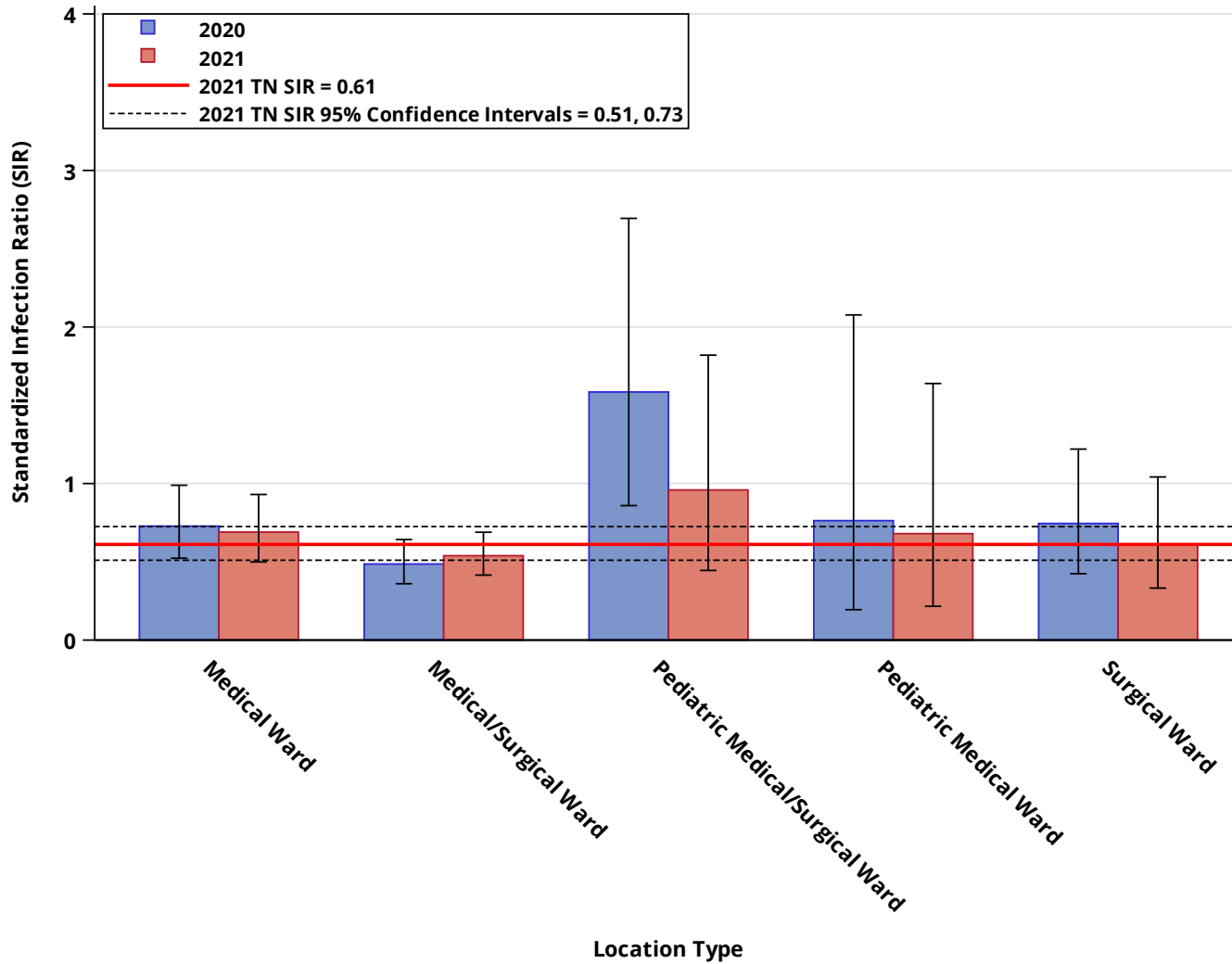
Green highlighting indicates SIR for reporting period is significantly lower than national 2015 SIR of 1.0

**Figure 12: Number of Facility SIRs with More than 1 Predicted Central Line-Associated Bloodstream Infection (CLABSI) Events in Adult and Pediatric Medical, Surgical, and Medical/Surgical Wards by Reporting Year, Including Burn and Trauma Units, Tennessee, 2015-2021.**



Data reported as of May 18, 2022

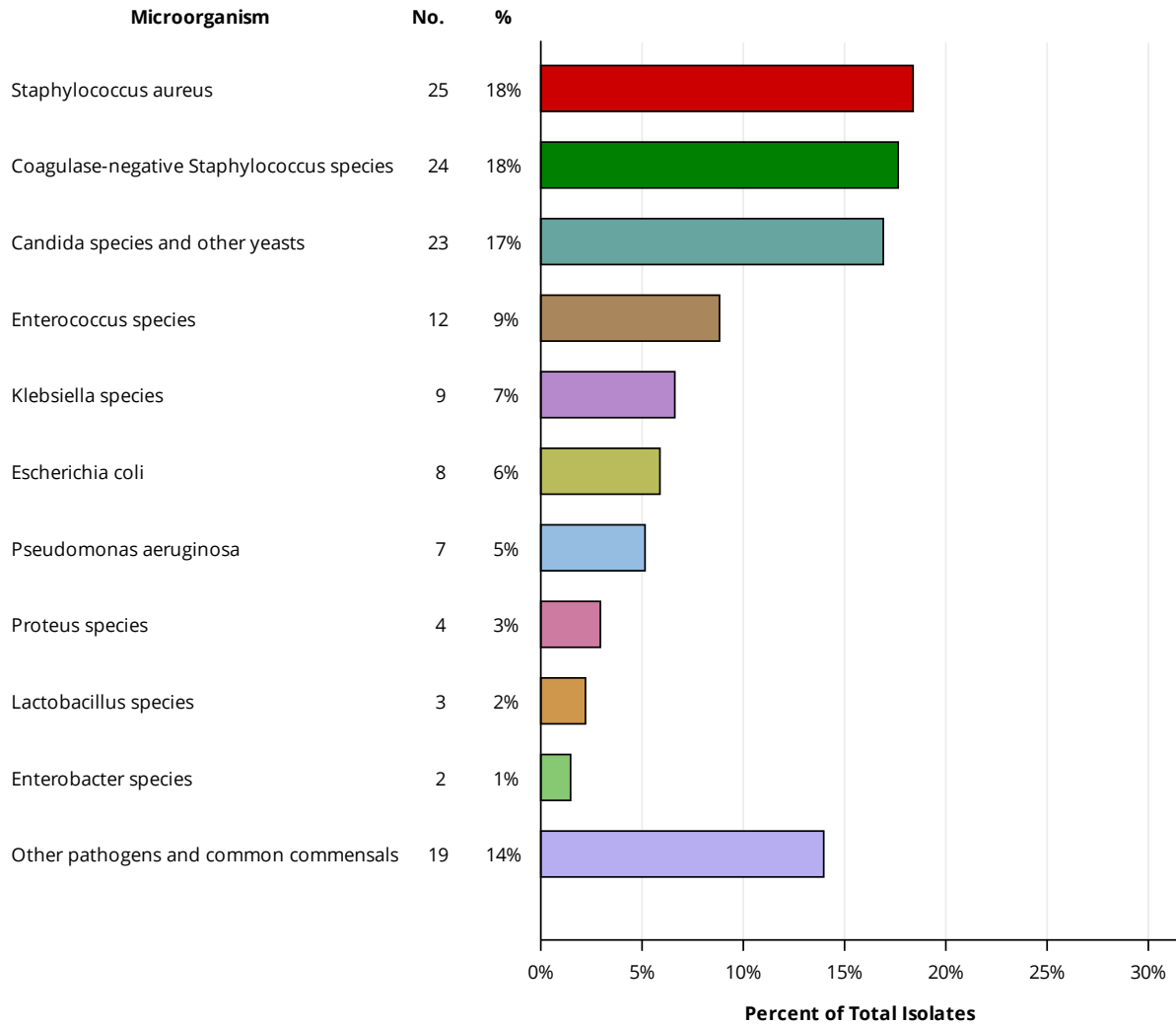
**Figure 13: Standardized Infection Ratios (SIRs) for Central Line-Associated Bloodstream Infections (CLABSIs) by Ward Location Type, Tennessee, 2021 [Reference standard: National Healthcare Safety Network (NHSN), 2015]**



Data Reported as of May 18, 2022

**Figure 14: Microorganisms Identified in Central Line-Associated Bloodstream Infections (CLABSIs) in Adult and Pediatric Wards, Tennessee, 01/01/2021 - 12/31/2021**

**Number of isolates=136; Number of events=124**



Data reported as of May 18, 2022

Other common commensals = Bacillus spp.

Other pathogens =Achromobacter spp., Actinomyces spp., Anaerobic spp., Eggerthella spp., Lactobacillus spp., Leuconostoc spp., Morganella spp., Other Staphylococcus spp., Rothia spp., Stenotrophomonas spp., Veillonella spp.



**Table 11: Resistant Microorganisms Identified in Central-Line Associated Bloodstream Infections (CLABSIs) in Adult and Pediatric Wards, Tennessee, 01/01/2021 - 12/31/2021**

| State     | Year | Microorganism          | Number of Isolates |           | Percentage of Resistant Isolates |                                    |
|-----------|------|------------------------|--------------------|-----------|----------------------------------|------------------------------------|
|           |      |                        | Total              | Resistant | By Microorganism                 | By Total Number of CLABSI Isolates |
| Tennessee | 2021 | Staphylococcus aureus  | 25                 | 9         | 36%***                           | 6.62%***                           |
|           |      | Enterococcus species   | 12                 | 3         | 25%**                            | 2.21%**                            |
|           |      | Klebsiella species     | 9                  | 0         | 0%*                              | 0%*                                |
|           |      | Escherichia coli       | 8                  | 0         | 0%*                              | 0%*                                |
|           |      | Pseudomonas aeruginosa | 7                  | 1         | 14.29%*                          | 0.74%*                             |
|           |      | Enterobacter species   | 2                  | 0         | 0%*                              | 0%*                                |

Data reported as of May 18, 2022

\* = Carbapenem-resistant

\*\* = Vancomycin-resistant

\*\*\* = Methicillin-resistant

## CLABSIs in Long-Term Acute Care (LTAC) Hospitals:

**Total number of facilities reporting from January-December 2021: 9**

### **SIRs by Quarter ([Figure 15](#))**

- In 2021, the overall CLABSI SIR for Tennessee LTACs was higher than baseline in Q1 (SIR=1.29; 95% CI: 0.63, 2.37) and Q4 (SIR=1.46; 95% CI: 0.77, 2.53) but lower than baseline in Q2 (SIR=0.63; 95% CI: 0.23, 1.4) and Q3 (SIR=0.64; 95% CI: 0.23, 1.41). No quarter significantly differed from the national baseline. Throughout 2021, Tennessee LTACs were above the U.S. Department of Health and Human Services' [National Action Plan to Prevent Healthcare-Associated Infections](#)<sup>9</sup> 2020 prevention target of SIR=0.50.

### **Key Percentiles for Tennessee SIRs ([Table 12](#), [Figure 16](#))**

- The overall CLABSI SIR across all reporting LTACs in Tennessee from January-December 2021 was not statistically significantly different from the national SIR of 1 (SIR=0.99; 95% CI: 0.68, 1.4).
- In 2021, there were 8 LTACs with a predicted number of infections greater than 1. None of these facilities were significantly better than baseline, and one was significantly worse.

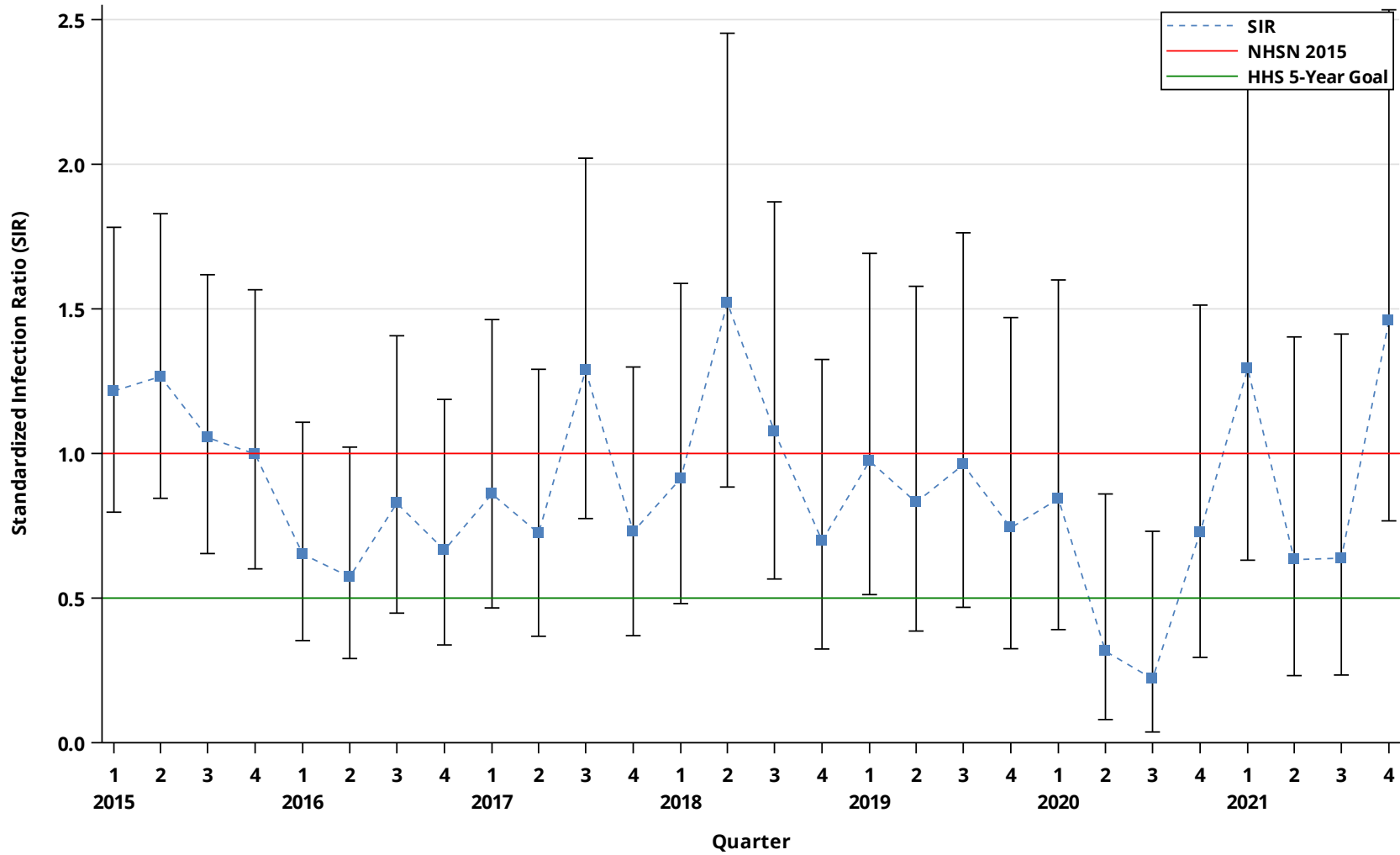
### **Microorganisms Associated with CLABSIs in LTACs ([Figure 17](#), [Table 13](#))**

- Among the 34 pathogens isolated from 30 LTAC CLABSIs in 2021, the most common pathogens were *Enterococcus spp.* (26%), *Candida* species (21%), and coagulase-negative *Staphylococcus spp.* (18%).
- Of the 9 *Enterococcus* species isolated from LTAC CLABSIs, 2 (22%) were vancomycin-resistant. Vancomycin-resistant *Enterococcus* species accounted for 5.9% of all total positive CLABSI isolates.

---

<sup>9</sup> <http://www.hhs.gov/ash/initiatives/hai/actionplan/>

**Figure 15: Standardized Infection Ratios (SIR) for Central Line-Associated Bloodstream Infections (CLABSIs) in Long-term Acute Care (LTAC) Facilities by Quarter, Tennessee, 01/01/2015–12/31/2021 [Reference standard: National Healthcare Safety Network (NHSN), 2015]**



Data Reported as of May 18, 2022

**Table 12: Central Line-Associated Bloodstream Infection (CLABSI) Standardized Infection Ratios (SIRs) in Long-term Acute Care (LTAC) Facilities by Reporting Year, Tennessee, 01/01/2015 - 12/31/2021**

| STATE     | YEAR | No. | CL DAYS | No. of INFECTIONS |       | SIR AND 95% CONFIDENCE INTERVAL |             |             |
|-----------|------|-----|---------|-------------------|-------|---------------------------------|-------------|-------------|
|           |      |     |         | OBS               | PRED  | SIR                             | LOWER LIMIT | UPPER LIMIT |
| Tennessee | 2021 | 9   | 26,006  | 30                | 30.24 | 0.99                            | 0.68        | 1.40        |
|           | 2020 | 9   | 29,706  | 19                | 36.27 | 0.52                            | 0.33        | 0.80        |
|           | 2019 | 8   | 34,032  | 35                | 39.71 | 0.88                            | 0.62        | 1.21        |
|           | 2018 | 9   | 39,286  | 45                | 43.58 | 1.03                            | 0.76        | 1.37        |
|           | 2017 | 9   | 44,308  | 49                | 54.67 | 0.90                            | 0.67        | 1.18        |
|           | 2016 | 10  | 53,159  | 44                | 65.38 | 0.67                            | 0.50        | 0.90        |
|           | 2015 | 10  | 64,625  | 86                | 75.30 | 1.14                            | 0.92        | 1.40        |

Data reported as of May 18, 2022

No. = number of facilities; CL Days = central line days; OBS = observed number of CLABSI

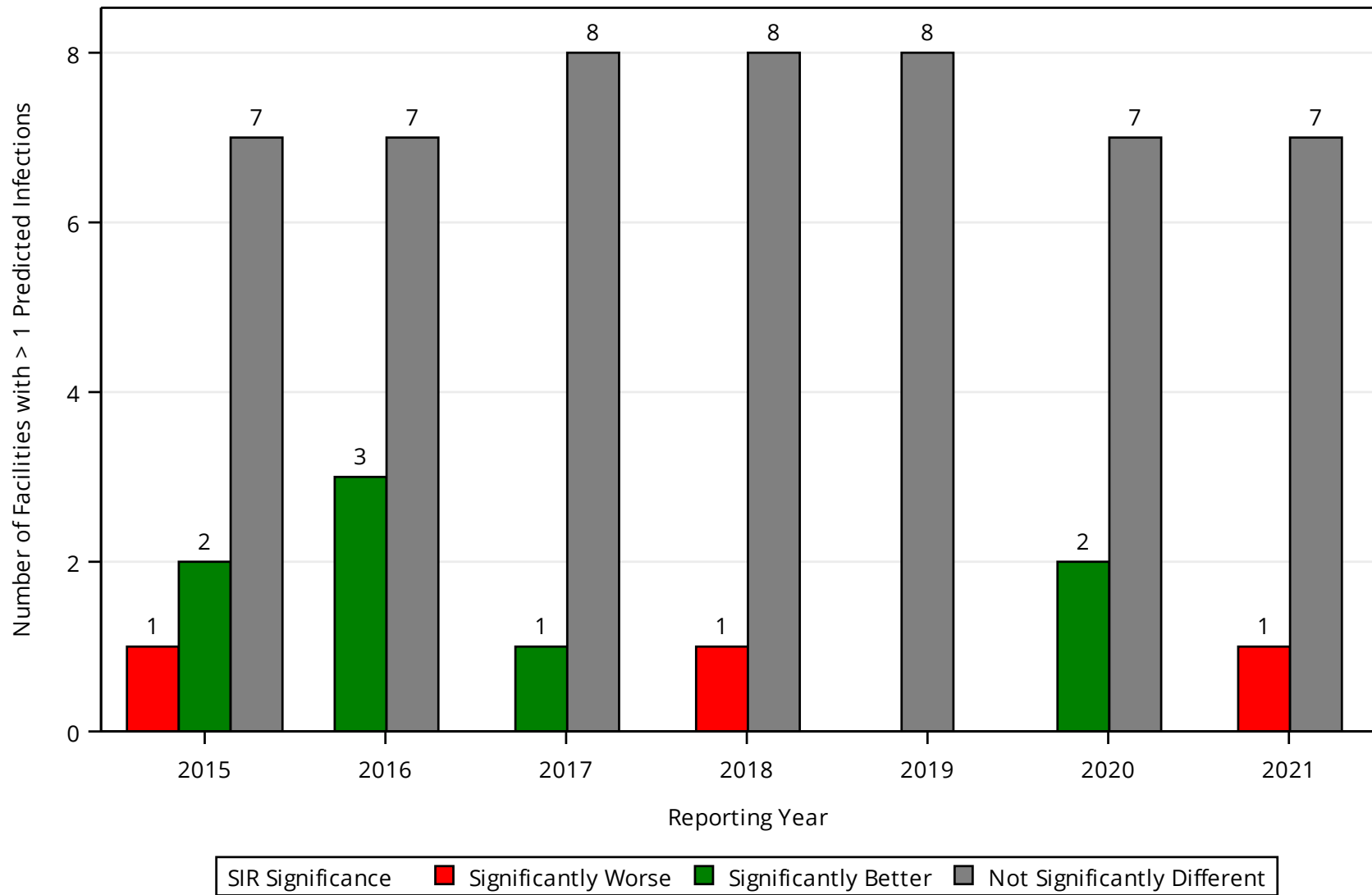
PRED = statistically 'predicted' number of CLABSI; SIR = standardized infection ratio (observed/predicted number of CLABSI)

Key percentiles include facilities with at least 1 predicted infection

Red highlighting indicates SIR for reporting period is significantly higher than national 2015 SIR of 1.0

Green highlighting indicates SIR for reporting period is significantly lower than national 2015 SIR of 1.0

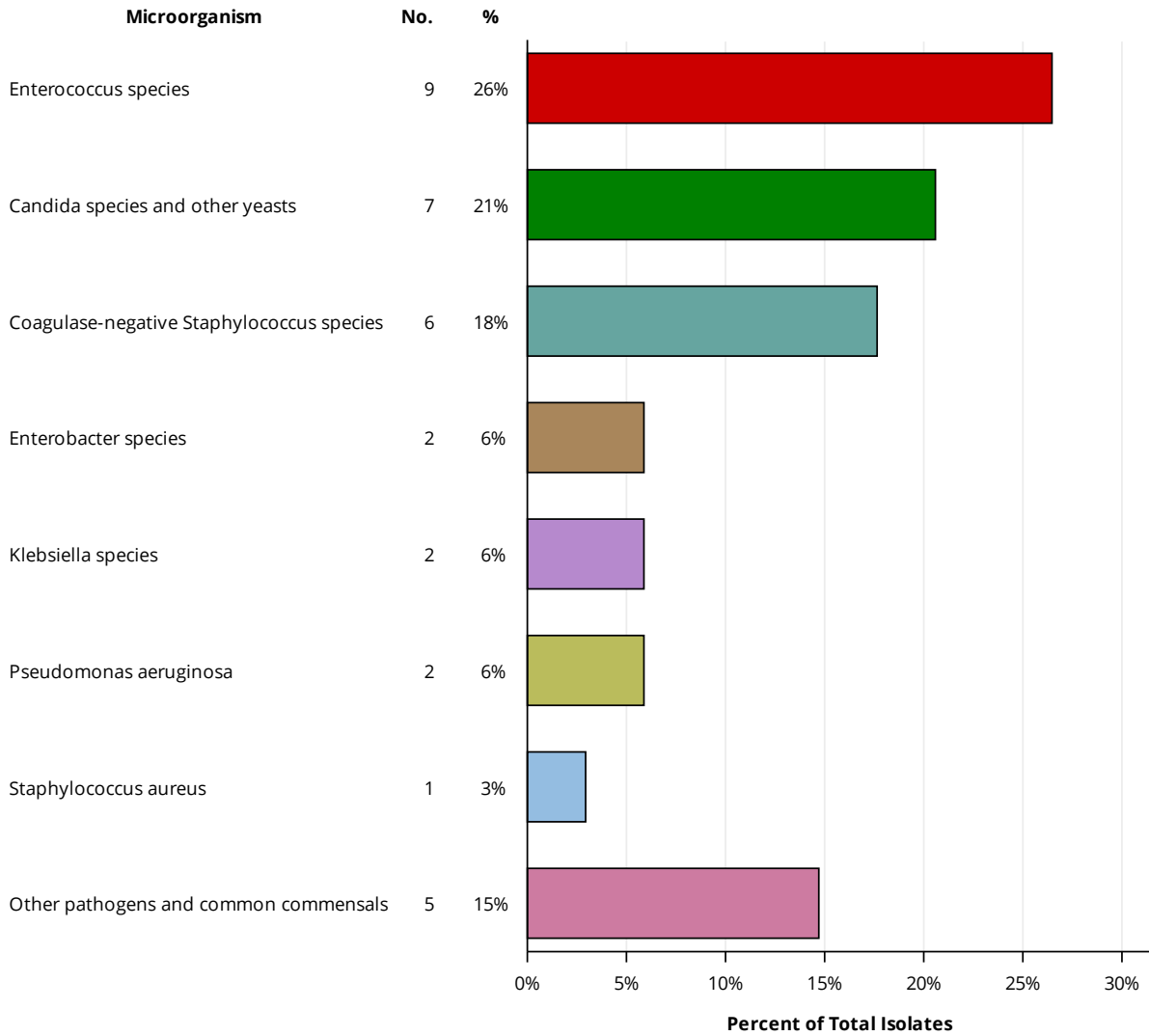
**Figure 16: Number of Facility SIRs with More than 1 Predicted Central Line-Associated Bloodstream Infection (CLABSI) Events in Long Term Acute Care Facilities by Reporting Year, 2015-2021.**



Data reported as of May 18, 2022

**Figure 17: Microorganisms Identified in Central Line-Associated Bloodstream Infections (CLABSIs) in Long-term Acute Care (LTAC) Facilities, Tennessee, 01/01/2021 - 12/31/2021**

**Number of isolates=34; Number of events=30**



Data reported as of May 18, 2022

Other common commensals = *Bacillus* spp.

Other pathogens = *Achromobacter* spp., *Actinomyces* spp., *Anaerobic* spp., *Eggerthella* spp., *Lactobacillus* spp., *Leuconostoc* spp., *Morganella* spp., *Other Staphylococcus* spp., *Rothia* spp., *Stenotrophomonas* spp., *Veillonella* spp.

**Table 13: Resistant Microorganisms Identified in Central-Line Associated Bloodstream Infections (CLABSIs) in Long-term Acute Care (LTAC) Facilities, Tennessee, 01/01/2021 - 12/31/2021**

| State     | Year | Microorganism          | Number of Isolates |           | Percentage of Resistant Isolates |                                    |
|-----------|------|------------------------|--------------------|-----------|----------------------------------|------------------------------------|
|           |      |                        | Total              | Resistant | By Microorganism                 | By Total Number of CLABSI Isolates |
| Tennessee | 2021 | Enterococcus species   | 9                  | 2         | 22.22%**                         | 5.88%**                            |
|           |      | Enterobacter species   | 2                  | 0         | 0%*                              | 0%*                                |
|           |      | Klebsiella species     | 2                  | 0         | 0%*                              | 0%*                                |
|           |      | Pseudomonas aeruginosa | 2                  | 0         | 0%*                              | 0%*                                |
|           |      | Staphylococcus aureus  | 1                  | 1         | 100%***                          | 2.94%***                           |

Data reported as of May 18, 2022

\* = Carbapenem-resistant

\*\* = Vancomycin-resistant

\*\*\* = Methicillin-resistant

# **Catheter-Associated Urinary Tract Infections (CAUTI)**



## ***Catheter-Associated Urinary Tract Infections (CAUTI)***

An indwelling urinary catheter, sometimes referred to as a Foley catheter, is a drainage tube that is inserted through the urethra into the urinary bladder and is left in place, connected to a closed collection system.<sup>10</sup> When pathogens enter the urinary tract through the catheter and lead to urinary tract infections (UTIs), these infections are called catheter-associated urinary tract infections (CAUTIs). Healthcare facilities can prevent CAUTIs by following appropriate infection prevention recommendations when inserting and maintaining indwelling urinary catheters, and by removing a urinary catheter as soon as it is no longer medically necessary.<sup>11</sup>

### **Reporting Requirements**

Tennessee acute care hospitals (ACHs) have been required to report CAUTI data in adult and pediatric ICUs to the Tennessee Department of Health (TDH) since January 2012. Long-term acute care (LTAC) hospitals and inpatient rehabilitation facilities (IRFs) began reporting CAUTI data in October 2012. ACHs began reporting CAUTI from adult and pediatric medical, surgical, and medical/surgical wards in July 2014.

To comply with these reporting requirements, facilities are required to follow the NHSN CAUTI Surveillance protocol,<sup>12</sup> which is updated each year with CAUTI surveillance definitions and reporting instructions. Facilities must report the number of urinary catheter and patient days for each applicable location to NHSN monthly. They are also required to report any urinary tract infections which meet the NHSN surveillance definition of a CAUTI in the required locations. There have been no major changes to the 2022 update of the CAUTI Surveillance protocol since its 2021 edition.

### **Surveillance Definitions & Changes**

NHSN defines the date of event as the date that the first element that is used to meet an NHSN site-specific infection criterion occurs for the first time within the Infection Window Period (IWP). It defines the IWP as a 7-day window set by the first positive diagnostic test used as one element to meet the criterion.

A CAUTI for NHSN's surveillance purposes, is a urinary tract infection where the patient has an eligible urinary catheter. An eligible urinary catheter is one that has been in place for > 2 consecutive calendar days on the date of event. This must occur during the current admission in an inpatient location, and an eligible urinary catheter must be in place on the date of event or the day before. Additionally, all elements necessary to meet the criterion for CAUTI must occur during the IWP.

---

<sup>10</sup> NHSN CAUTI Surveillance (<https://www.cdc.gov/nhsn/PDFs/pscManual/7pscCAUTIcurrent.pdf>)

<sup>11</sup> Patient Guide to CAUTIs ([https://www.cdc.gov/hai/pdfs/uti/CA-UTI\\_tagged.pdf](https://www.cdc.gov/hai/pdfs/uti/CA-UTI_tagged.pdf))

<sup>12</sup> NHSN Guide to SIR (<https://www.cdc.gov/nhsn/pdfs/ps-analysis-resources/nhsn-sir-guide.pdf>)

In 2021, NHSN updated the CAUTI surveillance protocol to include changes related to non-catheter-associated UTIs, and to update Urinary System Infection (USI) definitions. No major changes to CAUTI definitions were made.

## Facility-Specific Data Thresholds

To ensure fair and accurate reporting of facility specific standardized infection ratios (SIRs), TDH has adopted the NHSN minimum thresholds for reporting. To report a facility-specific SIR, the statistically predicted number of infections must be at least 1.0.

## CAUTI Risk Adjustment

We use the SIR as a summary measure to compare CAUTI data for facilities in TN to the national benchmark from a baseline period. CDC uses HAI data collected nationally in 2015 to create the SIR baselines, which includes updates to both the source of aggregate data and the risk adjustment methodology used to calculate the number of predicted events. Before 2015, the period used to establish the baseline, or reference points, varied amongst the different HAI types. Thus, in TN HAI reports before 2015, the number of predicted infections was estimated based on a baseline that was created using data prior to 2015. The data in this report, therefore, are not comparable to pre-2015 HAI reports, as they are based on different baselines.

The CAUTI SIR is calculated by dividing the total number of CAUTI events (the observed events) by the predicted\* number of CAUTI (expected events). This predicted number, which can also be understood as a projection, is calculated using a negative binomial regression model. It is adjusted for each facility using variables found to be significant predictors of HAI incidence. Some of those variables include facility type, location, bed size, and medical school affiliation for ACHs. Additionally in acute care NICU locations, birthweight is adjusted for. In LTACHs, the average length of stay, hospital location, facility bed size, and proportion of admissions on a ventilator and hemodialysis are adjusted for. Additional details can be found in the [NHSN Guide to the SIR](#).<sup>13</sup>

---

\* "Predicted" is used throughout the report as a synonym for the standard statistical term "expected."

<sup>13</sup> <https://www.cdc.gov/nhsn/pdfs/ps-analysis-resources/nhsn-sir-guide.pdf>

# CAUTIs in Adult & Pediatric Critical Care Units (ICUs):

**Total number of adult & pediatric ICUs reporting from January-December 2021: 79**

## **SIRs by Quarter ([Figure 18](#))**

- In all quarters of 2021, the overall CAUTI SIR in Tennessee adult and pediatric ICUs was lower than the predicted SIR of 1.0 based on the 2015 baseline. Q2 (SIR=0.62; 95% CI: 0.5, 0.76), Q3 (SIR=0.82; 95% CI: 0.62, 0.97), and Q4 (SIR=0.75; 95% CI: 0.62, 0.88) were statistically significantly lower than the baseline of 1. Q2 and Q4 were lower, albeit not significantly, than the U.S. Department of Health and Human Services' [National Action Plan to Prevent Healthcare-Associated Infections](#)<sup>14</sup> 2020 prevention target of SIR=0.75.

## **Key Percentiles for Tennessee SIRs ([Table 14](#), [Figure 19](#))**

- The overall CAUTI SIR across all reporting adult and pediatric ICUs in Tennessee from January-December 2021 was 0.76 (95% CI: 0.68, 0.85). This SIR indicates that the number of CAUTIs in ICUs was statistically significantly lower than the national sir of 1.
- In 2021, 48 facilities had greater than 1 predicted infection (and thus a calculated SIR). Of these 48 facilities, 9 (18.8%) facilities were significantly better than the national baseline (SIR=1) and 2 (4%) were significantly worse. The remaining 37 (77%) were not significantly different than baseline.

## **SIR by Unit Type ([Figure 20](#))**

- In 2021, CAUTI SIRs remained highest in the pediatric medical-surgical critical care locations (SIR=1.17; 95% CI=0.49, 2.2). No specific unit type had a significantly higher SIR than baseline (SIR=1), but neurologic critical care had an SIR significantly lower than baseline (SIR=0.37; 95% CI: 0.189, 0.663).

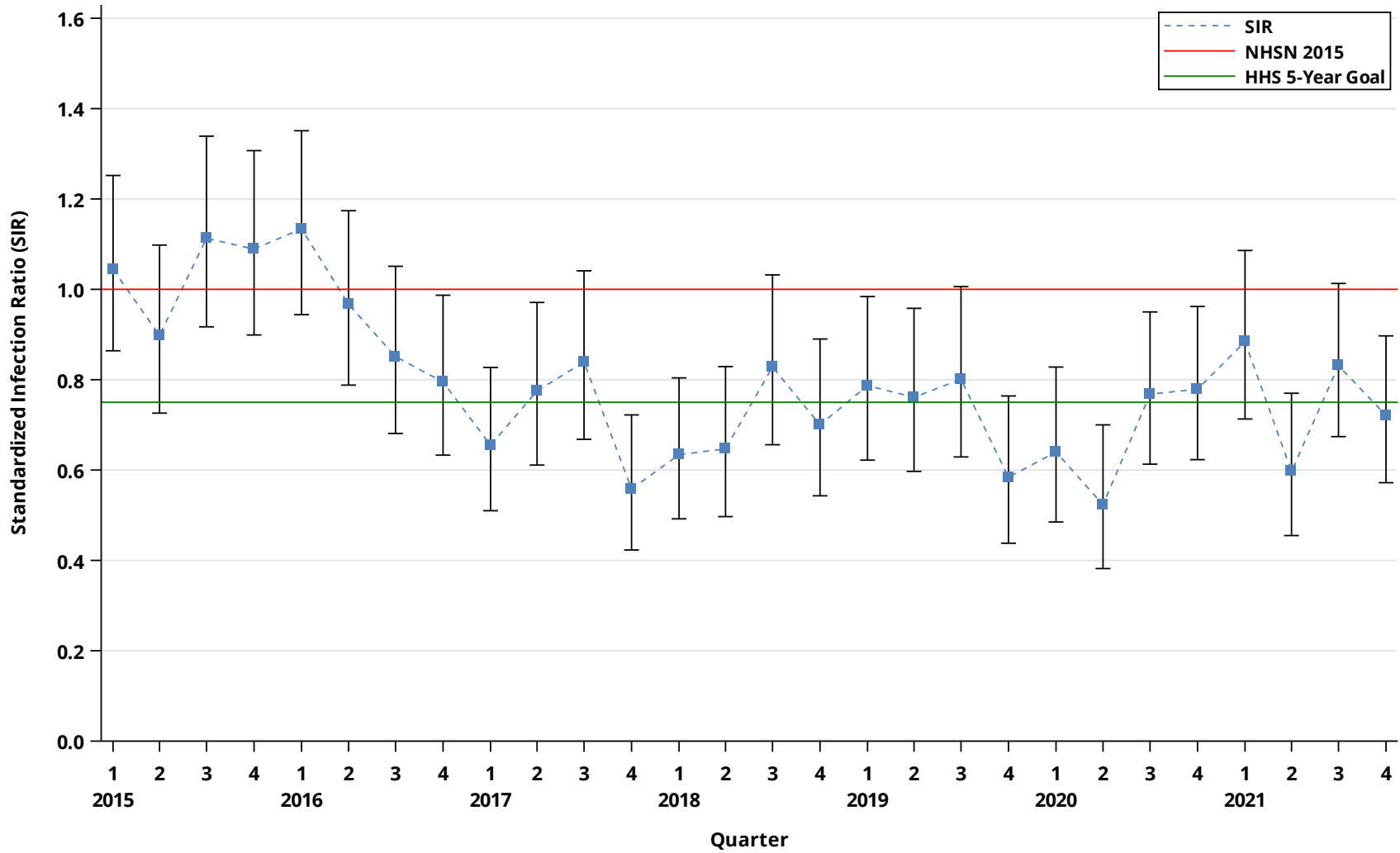
## **Microorganisms Associated with CAUTIs in Adult and Pediatric ICUs ([Figure 22](#), [Table 15](#))**

- Among the 346 pathogens isolated from 312 CAUTIs in 2021, the most common pathogens were *Escherichia coli* (37%), *Enterococcus* species (21%), and *Pseudomonas aeruginosa* (13%).
- Of the 70 *Enterococcus spp.* isolates, 11 (15.7%) were vancomycin-resistant. Vancomycin-resistant *Enterococcus spp.* represented 3.5% of total positive isolates.

---

<sup>14</sup> <http://www.hhs.gov/ash/initiatives/hai/actionplan/>

**Figure 18: Standardized Infection Ratios (SIR) for Catheter-Associated Urinary Tract Infections (CAUTIs) for Adult and Pediatric Intensive Care Units (ICUs) by Quarter, Tennessee, 01/01/2015–12/31/2021 [Reference standard: National Healthcare Safety Network (NHSN), 2015]**



Data Reported as of May 18, 2022

**Table 14: Catheter-Associated Urinary Tract Infection (CAUTI) Standardized Infection Ratios (SIRs) in Adult and Pediatric Intensive Care Units (ICUs) by Reporting Year, Tennessee, 01/01/2015 - 12/31/2021**

|           |      |     |         | No. of INFECTIONS |        |      | SIR AND 95% CONFIDENCE INTERVAL |             |
|-----------|------|-----|---------|-------------------|--------|------|---------------------------------|-------------|
| STATE     | YEAR | No. | UC Days | OBS               | PRED   | SIR  | LOWER LIMIT                     | UPPER LIMIT |
| Tennessee | 2021 | 79  | 306,317 | 312               | 409.60 | 0.76 | 0.68                            | 0.85        |
|           | 2020 | 81  | 270,156 | 258               | 374.27 | 0.69 | 0.61                            | 0.78        |
|           | 2019 | 82  | 257,209 | 262               | 356.37 | 0.74 | 0.65                            | 0.83        |
|           | 2018 | 87  | 275,613 | 261               | 372.64 | 0.70 | 0.62                            | 0.79        |
|           | 2017 | 86  | 288,025 | 270               | 383.55 | 0.70 | 0.62                            | 0.79        |
|           | 2016 | 86  | 299,126 | 377               | 400.69 | 0.94 | 0.85                            | 1.04        |
|           | 2015 | 85  | 302,913 | 419               | 404.68 | 1.04 | 0.94                            | 1.14        |

Data reported as of May 18, 2022

No. = number of facilities; UC Days = urinary catheter days; OBS = observed number of CAUTI

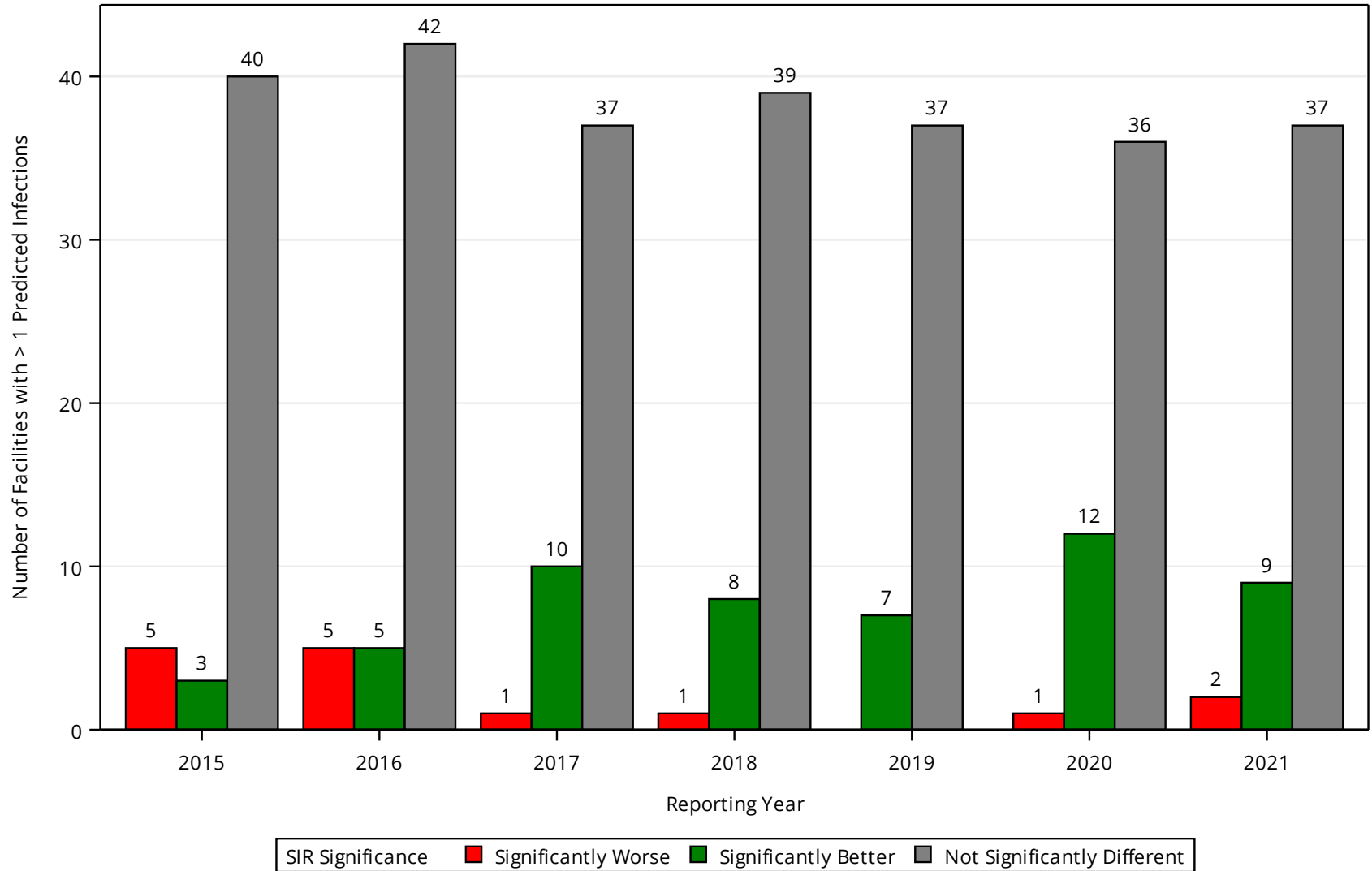
PRED = statistically 'predicted' number of CAUTI; SIR = standardized infection ratio (observed/predicted number of CAUTI)

Key percentiles include facilities with at least 1 predicted infection

Red highlighting indicates SIR for reporting period is significantly higher than national 2015 SIR of 1.0

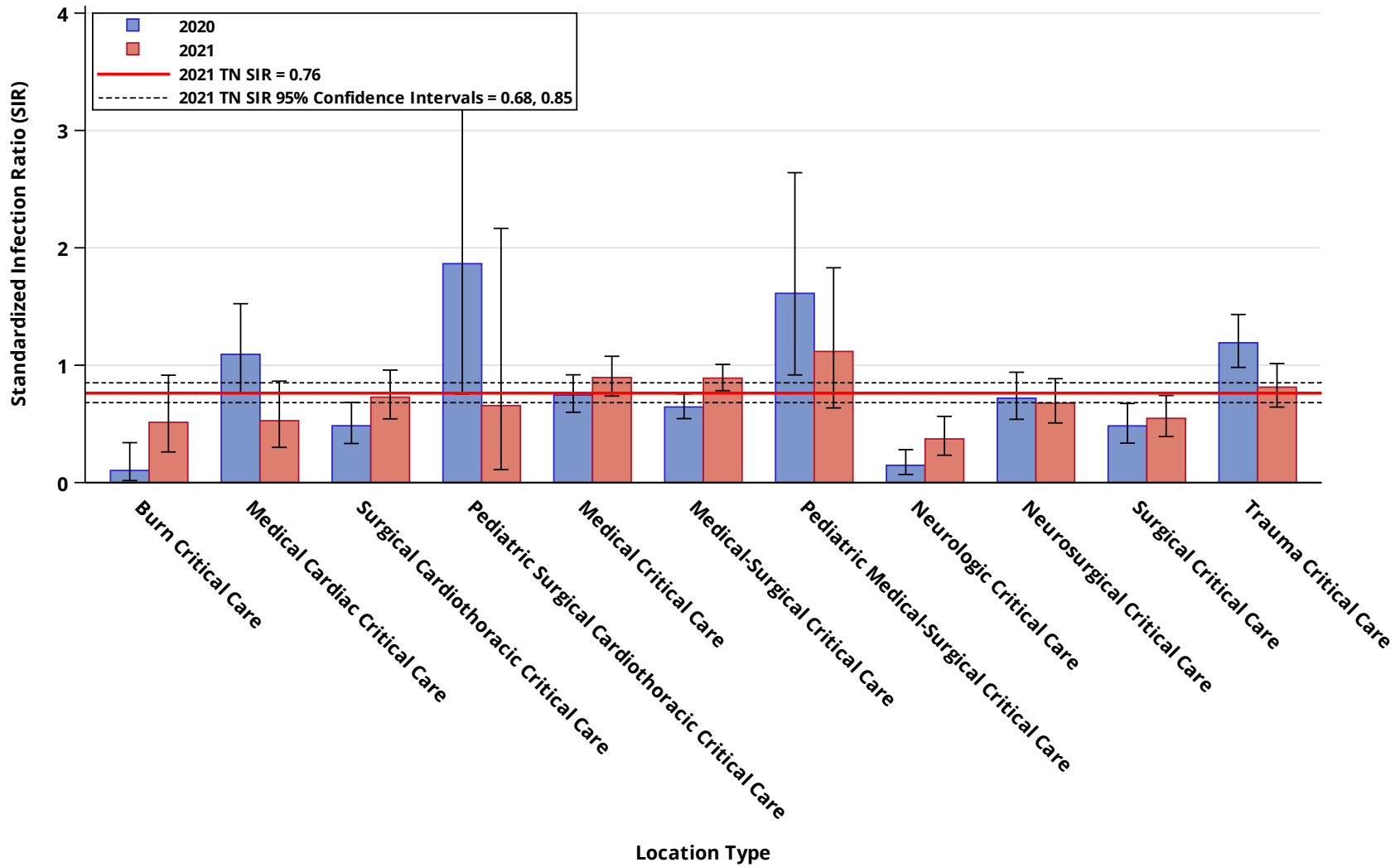
Green highlighting indicates SIR for reporting period is significantly lower than national 2015 SIR of 1.0

**Figure 19: Number of Facility SIRs with More than 1 Predicted Catheter-Associated Urinary Tract Infection (CAUTI) Events in Adult and Pediatric Intensive Care Units (ICUs) by Reporting Year, Tennessee, 2015-2021**



Data reported as of May 18, 2022

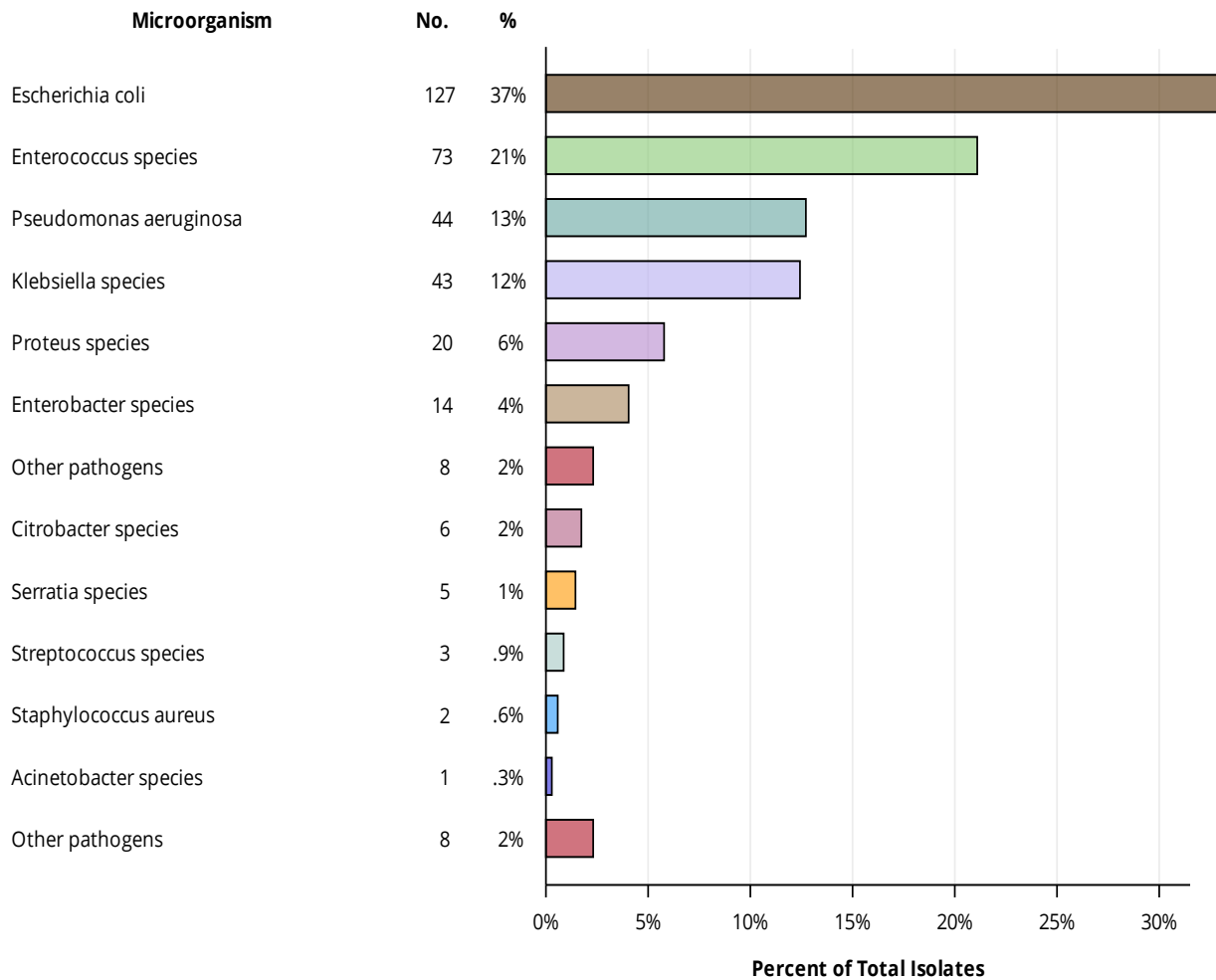
**Figure 20: Standardized Infection Ratios (SIRs) for Catheter-Associated Urinary Tract Infections (CAUTIs) by Intensive Care Unit (ICU) Type, Tennessee, 2021 [Reference standard: National Healthcare Safety Network (NHSN), 2015]**



Data Reported as of May 18, 2022

**Figure 21: Microorganisms Identified in Catheter-Associated Urinary Tract (CAUTIs) in Adult and Pediatric Intensive Care Units, Tennessee, 01/01/2021 - 12/31/2021**

**Number of isolates=346; Number of events=312**



Data reported as of May 18, 2022

Other pathogens = Aerococcus spp., Citrobacter spp., Coagulase-negative spp., Diphtheroids spp., Lactobacillus spp., Morganella spp., Providencia spp., Pseudomonas spp., Raoultella spp., Serratia spp.



**Table 15: Resistant Microorganisms Identified in Catheter Associated Urinary Tract Infections (CAUTIs) in Adult and Pediatric Intensive Care Units, Tennessee, 01/01/2021 - 12/31/2021**

| State     | Year | Microorganism          | Number of Isolates |           | Percentage of Resistant Isolates |                                   |
|-----------|------|------------------------|--------------------|-----------|----------------------------------|-----------------------------------|
|           |      |                        | Total              | Resistant | By Microorganism                 | By Total Number of CAUTI Isolates |
| Tennessee | 2021 | Escherichia coli       | 121                | 0         | 0%*                              | 0%*                               |
|           |      | Enterococcus species   | 70                 | 11        | 15.71%**                         | 3.33%**                           |
|           |      | Klebsiella species     | 41                 | 0         | 0%*                              | 0%*                               |
|           |      | Pseudomonas aeruginosa | 41                 | 0         | 0%*                              | 0%*                               |
|           |      | Enterobacter species   | 13                 | 0         | 0%*                              | 0%*                               |
|           |      | Staphylococcus aureus  | 2                  | 0         | 0%***                            | 0%***                             |

Data reported as of May 18, 2022

\* = Carbapenem-resistant

\*\* = Vancomycin-resistant

\*\*\* = Methicillin-resistant

# CAUTIs in Adult & Pediatric Medical, Surgical, and Medical/Surgical Wards:

**Total number of hospitals reporting from January-December 2021: 96**

## **SIRs by Quarter ([Figure 23](#))**

- From Q1-2021 through Q4-2021, the overall CAUTI SIR in Tennessee medical, surgical, and medical/surgical wards remained relatively stable between 0.67 and 0.82. Q2-2021 was the only quarter with an SIR significantly lower than 1 (SIR=0.67, 95% CI: 0.469, 0.922) and the only quarter that met the U.S. Department of Health and Human Services' [National Action Plan to Prevent Healthcare-Associated Infections](#)<sup>15</sup> 2020 prevention target of SIR=0.75.

## **Key Percentiles for Tennessee SIRs ([Table 16](#), [Figure 24](#))**

- The overall CAUTI SIR across all reporting adult and pediatric medical, surgical, and medical/surgical wards in Tennessee was statistically significantly lower than the national SIR in 2021 (SIR=0.77; 95% CI: 0.66, 0.9). This SIR indicates that the number of CAUTIs in adult and pediatric medical, surgical, and medical/surgical wards was 23% lower than predicted in 2021.
- In 2021, there were 43 facilities that had greater than 1 infection and thus a calculated SIR. Of these 43 facilities, 4 (9%) had an SIR significantly better than the national baseline of 1, 2 (5%) had an SIR significantly worse than 1, and the remaining 37 (86%) were not significantly different than 1.

## **SIR by Unit Type ([Figure 25](#))**

- In 2021, Tennessee CAUTI SIRs were significantly lower than the 2015 baseline SIR in adult medical and medical/surgical ward locations. The SIR for pediatric medical/surgical wards was higher, albeit not significantly, than baseline.

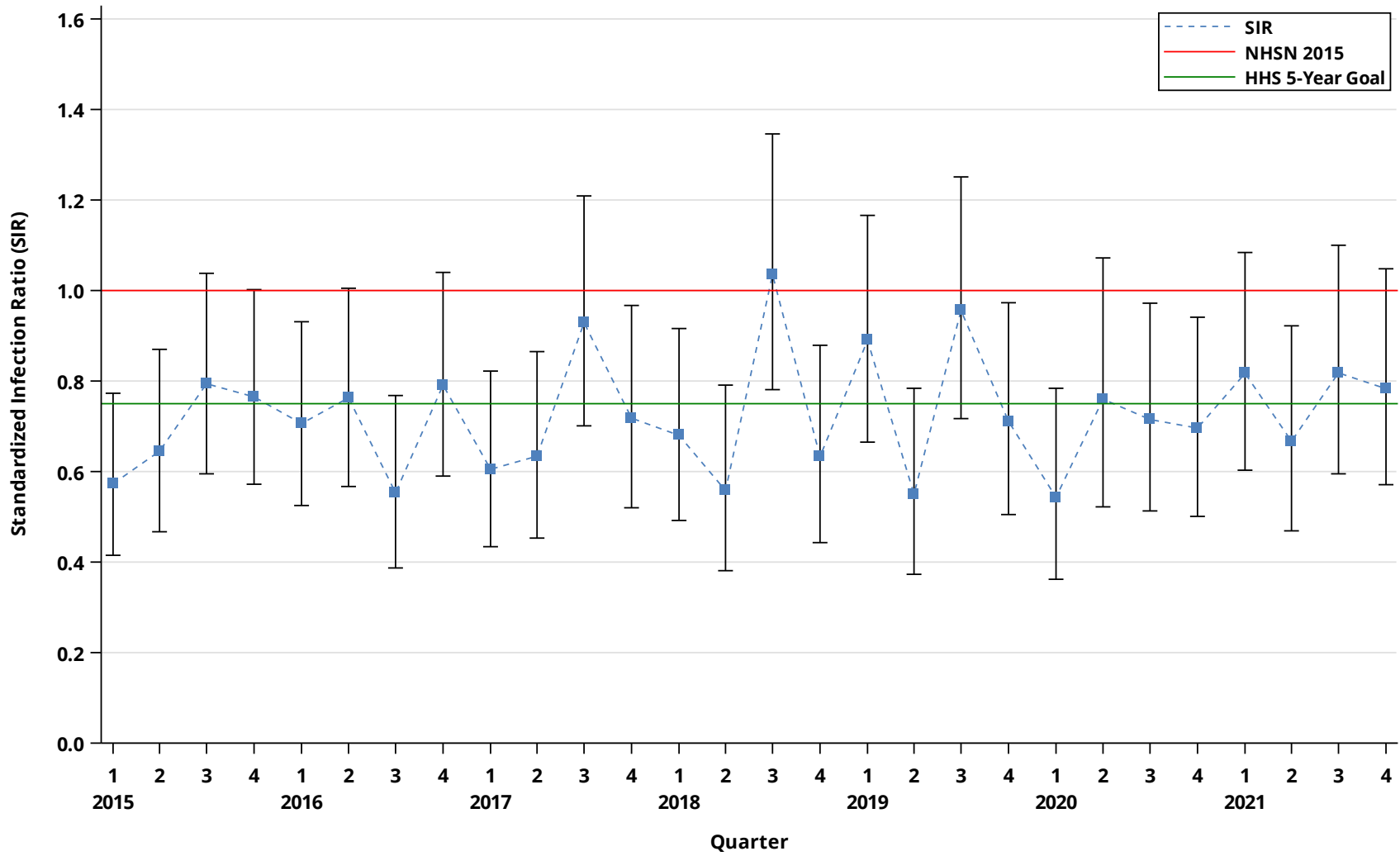
---

<sup>15</sup> <http://www.hhs.gov/ash/initiatives/hai/actionplan/>

**Microorganisms Associated with CAUTIs in Adult and Pediatric Medical, Surgical, and Medical/Surgical Wards (Figure 26, Table 17)**

- Among the 184 pathogens isolated from 162 CAUTIs in 2021, the most common pathogens were *Escherichia coli* (35%), *Enterococcus spp.* (16%), and *Pseudomonas aeruginosa* (15%).
- Of the 64 positive *E. coli* isolates, 2 (3.13%) were carbapenem-resistant. Carbapenem resistant *E. coli* represented 1.1% of total positive isolates.
- Of the 29 positive *Enterococcus spp.* isolates, 9 (31.03%) were vancomycin-resistant. Vancomycin-resistant *Enterococcus spp.* represented 4.97% of total positive isolates.
- Of the 28 positive *Pseudomonas aeruginosa* isolates, 1 (3.57%) were carbapenem-resistant. Carbapenem-resistant *Pseudomonas aeruginosa* represented 0.55% of total positive isolates.
- Of the 5 positive *Staphylococcus aureus* isolates, 2 (40%) were methicillin-resistant. MRSA represented 1.1% of all total positive isolates.

Figure 22: Standardized Infection Ratios (SIR) for Catheter-Associated Urinary Tract Infections (CAUTIs) for Adult and Pediatric Medical, Surgical, and Medical/Surgical Wards by Quarter, Tennessee, 01/01/2015–12/31/2021 [Reference standard: National Healthcare Safety Network (NHSN), 2015]



Data Reported as of May 18, 2022

**Table 16: Catheter-Associated Urinary Tract Infection (CAUTI) Standardized Infection Ratios (SIRs) in Adult and Pediatric Medical, Surgical, and Medical/Surgical Wards by Reporting Year, Tennessee, 01/01/2017 - 12/31/2021**

| STATE     | YEAR | No. | UC Days | No. of INFECTIONS |        | SIR AND 95% CONFIDENCE INTERVAL |             |             |
|-----------|------|-----|---------|-------------------|--------|---------------------------------|-------------|-------------|
|           |      |     |         | OBS               | PRED   | SIR                             | LOWER LIMIT | UPPER LIMIT |
| Tennessee | 2021 | 96  | 233,431 | 162               | 209.79 | 0.77                            | 0.66        | 0.90        |
|           | 2020 | 96  | 211,787 | 133               | 196.55 | 0.68                            | 0.57        | 0.80        |
|           | 2019 | 98  | 227,078 | 163               | 208.94 | 0.78                            | 0.67        | 0.91        |
|           | 2018 | 104 | 238,264 | 154               | 213.24 | 0.72                            | 0.62        | 0.84        |
|           | 2017 | 103 | 259,432 | 167               | 232.86 | 0.72                            | 0.61        | 0.83        |
|           | 2016 | 103 | 280,000 | 175               | 248.54 | 0.70                            | 0.61        | 0.81        |
|           | 2015 | 102 | 298,663 | 179               | 258.91 | 0.69                            | 0.60        | 0.80        |

Data reported as of May 18, 2022

No. = number of facilities; UC Days = urinary catheter days; OBS = observed number of CAUTI

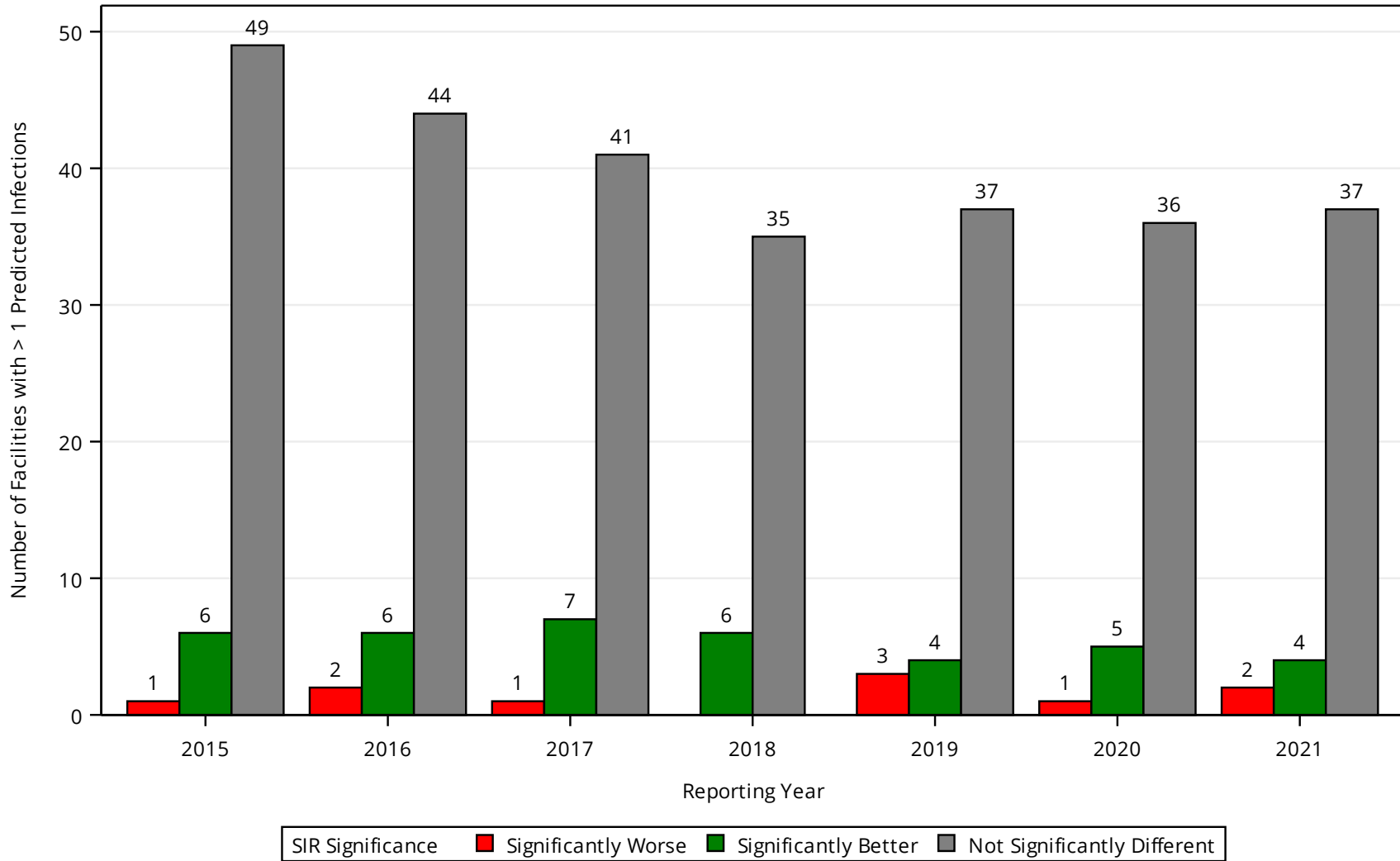
PRED = statistically 'predicted' number of CAUTI; SIR = standardized infection ratio (observed/predicted number of CAUTI)

Key percentiles include facilities with at least 1 predicted infection

Red highlighting indicates SIR for reporting period is significantly higher than national SIR of 1.0

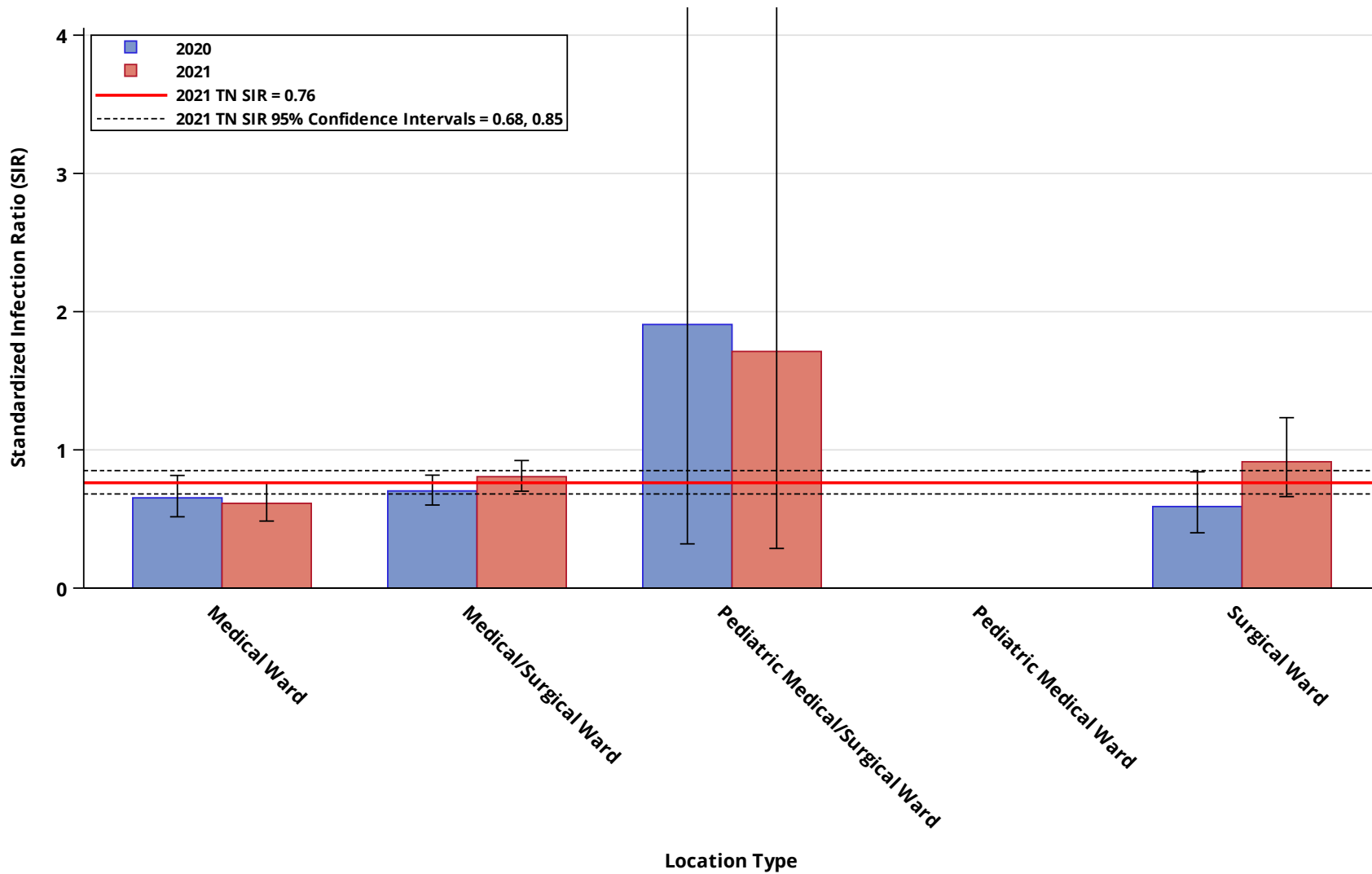
Green highlighting indicates SIR for reporting period is significantly lower than national SIR of 1.0

**Figure 23: Number of Facility SIRs with More than 1 Predicted Catheter-Associated Urinary Tract Infection (CAUTI) Events in Adult and Pediatric Medical, Surgical, and Medical/Surgical Wards by Reporting Year, Tennessee, 2015-2021**



Data reported as of May 18, 2022

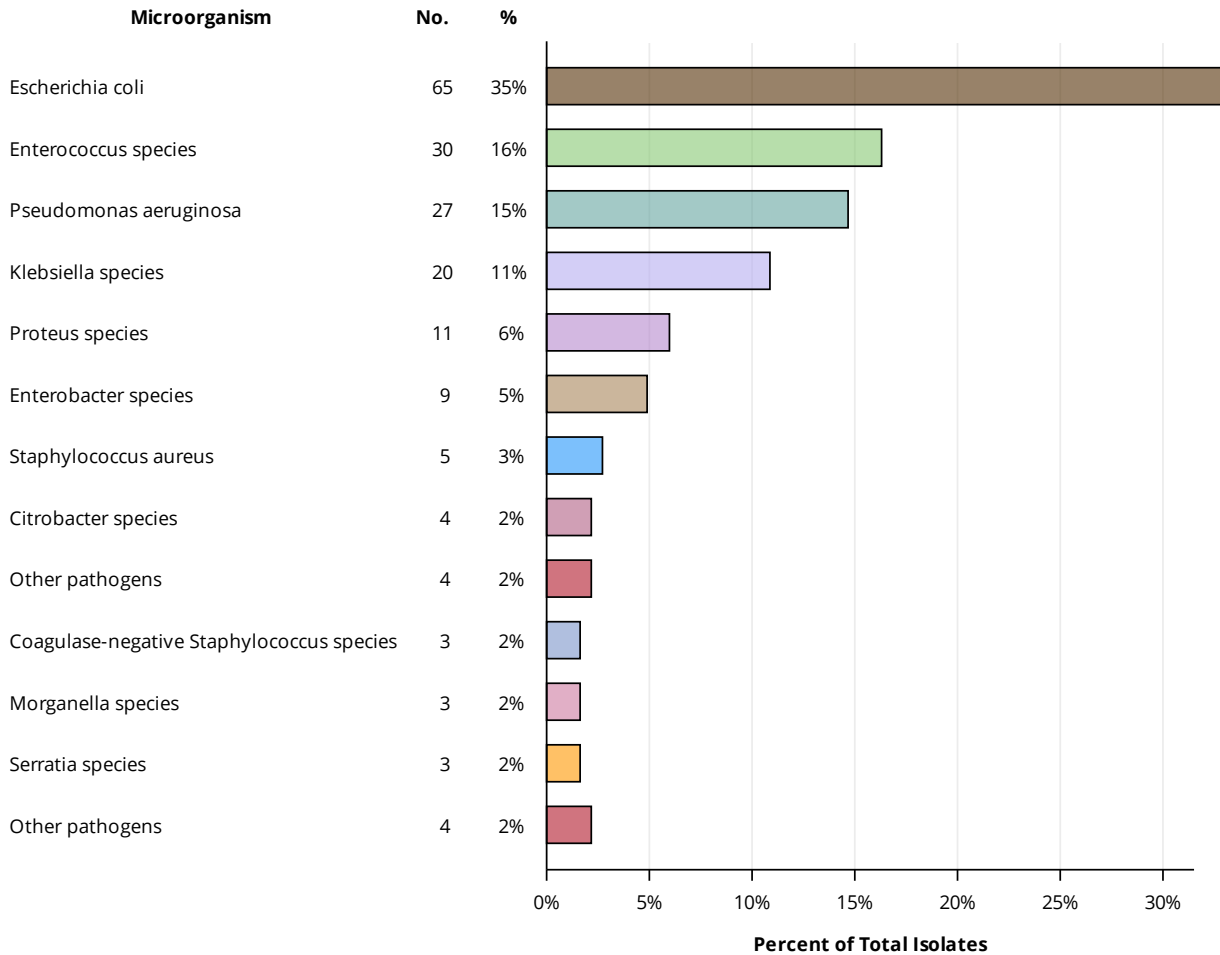
**Figure 24: Standardized Infection Ratios (SIRs) for Catheter-Associated Urinary Tract Infections (CAUTIs) by Ward Location Type, Tennessee, 2021**  
 [Reference standard: National Healthcare Safety Network (NHSN), 2015]



Data Reported as of May 18, 2022

**Figure 25: Microorganisms Identified in Catheter-Associated Urinary Tract (CAUTIs) in Adult and Pediatric Wards, Tennessee, 01/01/2021 - 12/31/2021**

**Number of isolates=184; Number of events=162**



Data reported as of May 18, 2022

Other pathogens =Aerococcus spp., Citrobacter spp., Coagulase-negative spp., Diphtheroids spp., Lactobacillus spp., Morganella spp., Providencia spp., Pseudomonas spp., Raoultella spp., Serratia spp.



**Table 17: Resistant Microorganisms Identified in Catheter Associated Urinary Tract Infections (CAUTIs) in Adult and Pediatric Wards, Tennessee, 01/01/2021 - 12/31/2021**

| State     | Year | Microorganism          | Number of Isolates |           | Percentage of Resistant Isolates |                                   |
|-----------|------|------------------------|--------------------|-----------|----------------------------------|-----------------------------------|
|           |      |                        | Total              | Resistant | By Microorganism                 | By Total Number of CAUTI Isolates |
| Tennessee | 2021 | Escherichia coli       | 64                 | 2         | 3.13%*                           | 1.1%*                             |
|           |      | Enterococcus species   | 29                 | 9         | 31.03%**                         | 4.97%**                           |
|           |      | Pseudomonas aeruginosa | 28                 | 1         | 3.57%*                           | 0.55%*                            |
|           |      | Klebsiella species     | 20                 | 0         | 0%*                              | 0%*                               |
|           |      | Enterobacter species   | 8                  | 0         | 0%*                              | 0%*                               |
|           |      | Staphylococcus aureus  | 5                  | 2         | 40%***                           | 1.1%***                           |

Data reported as of May 18, 2022

\* = Carbapenem-resistant

\*\* = Vancomycin-resistant

\*\*\* = Methicillin-resistant

# CAUTIs in Long-Term Acute Care (LTAC) Hospitals:

**Total number of facilities reporting from January-December 2021: 9**

## **SIRs by Quarter ([Figure 27](#))**

- From Q1-Q4 2021, the overall CAUTI SIR for Tennessee LTACs remained relatively stable around an SIR of 0.6 except for Q2-2021 where a decreased SIR of 0.32 was observed. Q2-2021 was significantly lower than the national baseline of 1. In all quarters the reporting period, Tennessee LTACs achieved the U.S. Department of Health and Human Services' prevention target of SIR=0.75 but were not significantly lower than the target.

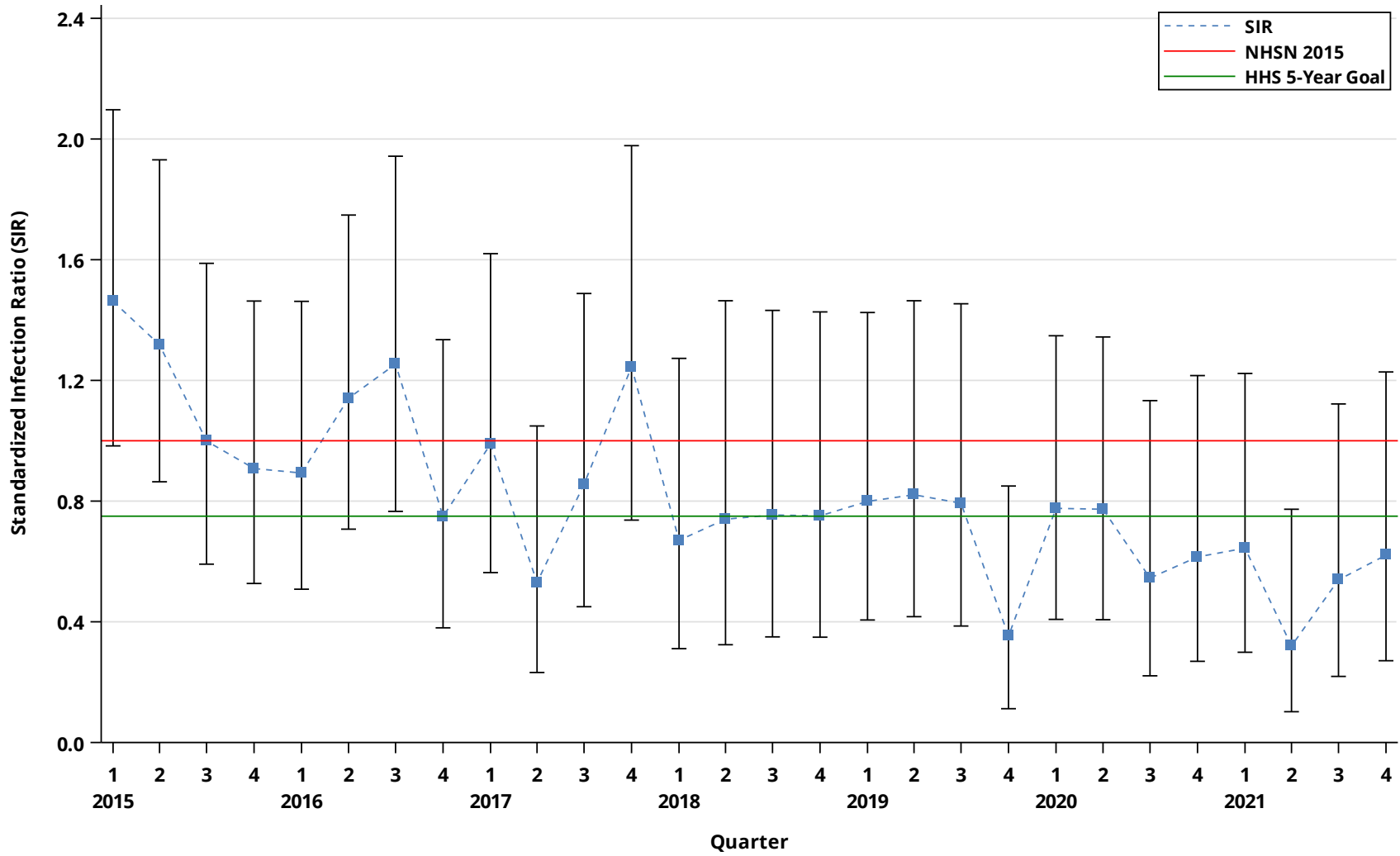
## **Key Percentiles for Tennessee SIRs ([Table 18](#), [Figure 28](#))**

- The overall CAUTI SIR across all reporting LTACs in Tennessee was statistically significantly lower than the national SIR of 1 in 2021 with an SIR of 0.53 (95% CI: 0.35, 0.77).
- In 2021, there were 9 LTAC facilities that had greater than 1 predicted infection, and thus an SIR was calculated. Of these 9 facilities, 3 (33%) were significantly better than the national baseline of 1, 6 (66%) were not significantly different, and none were significantly worse.

## **Microorganisms Associated with CAUTIs in LTACs ([Figure 29](#), [Table 19](#))**

- Among the 29 pathogens isolated from 25 LTAC CAUTIs in 2021, the most common pathogens were *Escherichia coli* (31%), *Pseudomonas aeruginosa* (24%), and *Enterococcus* species (10%).
- Of the 7 *Pseudomonas aeruginosa* isolates, 2 (28.6%) were vancomycin-resistant. Vancomycin-resistant *Pseudomonas aeruginosa* represented 6.9% of total positive isolates.
- The single *Staphylococcus aureus* isolate was methicillin-resistant (100%). MRSA represented 3.45% of all total positive isolates.

**Figure 26: Standardized Infection Ratios (SIR) for Catheter-Associated Urinary Tract Infections (CAUTIs) in Long-term Acute Care (LTAC) Facilities by Quarter, Tennessee, 01/01/2015–12/31/2021 [Reference standard: National Healthcare Safety Network (NHSN), 2015]**



Data Reported as of May 18, 2022

**Table 18: Catheter-Associated Urinary Tract Infection (CAUTI) Standardized Infection Ratios (SIRs) in Long-term Acute Care (LTAC) Facilities by Year, Tennessee, 01/01/2017 - 12/31/2021**

| STATE     | YEAR | No. | UC Days | No. of INFECTIONS |       | SIR AND 95% CONFIDENCE INTERVAL |             |             |
|-----------|------|-----|---------|-------------------|-------|---------------------------------|-------------|-------------|
|           |      |     |         | OBS               | PRED  | SIR                             | LOWER LIMIT | UPPER LIMIT |
| Tennessee | 2021 | 9   | 25,849  | 25                | 47.30 | 0.53                            | 0.35        | 0.77        |
|           | 2020 | 9   | 28,221  | 35                | 50.81 | 0.69                            | 0.49        | 0.95        |
|           | 2019 | 8   | 26,890  | 33                | 47.39 | 0.70                            | 0.49        | 0.97        |
|           | 2018 | 9   | 28,858  | 31                | 42.66 | 0.73                            | 0.50        | 1.02        |
|           | 2017 | 9   | 33,994  | 48                | 53.06 | 0.91                            | 0.67        | 1.19        |
|           | 2016 | 10  | 37,565  | 61                | 60.05 | 1.02                            | 0.78        | 1.30        |
|           | 2015 | 10  | 42,292  | 82                | 69.23 | 1.19                            | 0.95        | 1.46        |

Data reported as of May 18, 2022

No. = number of facilities; UC Days = urinary catheter days; OBS = observed number of CAUTI

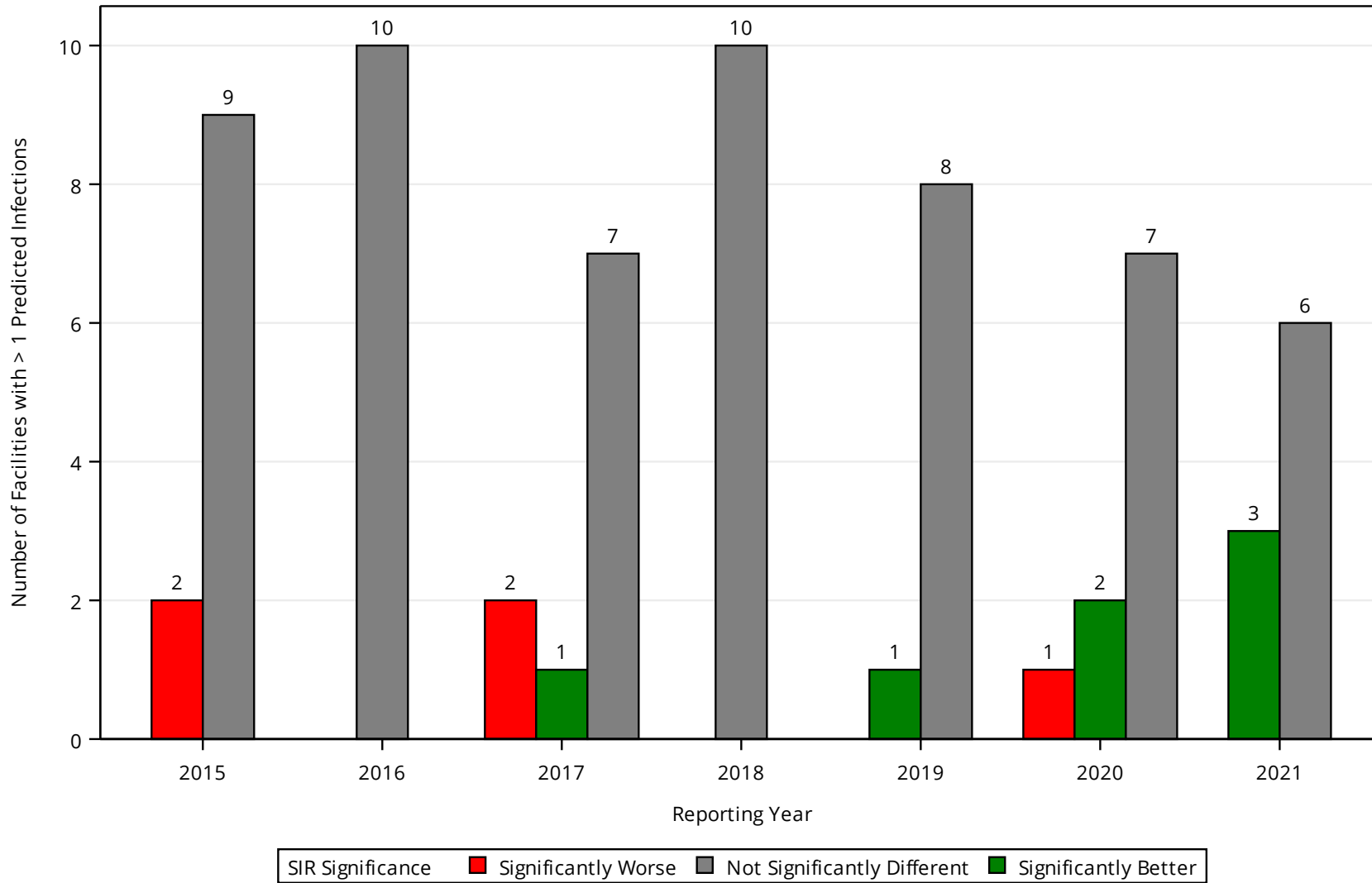
PRED = statistically 'predicted' number of CAUTI; SIR = standardized infection ratio (observed/predicted number of CAUTI)

Key percentiles include facilities with at least 1 predicted infection

Red highlighting indicates SIR for reporting period is significantly higher than national 2015 SIR of 1.0

Green highlighting indicates SIR for reporting period is significantly lower than national 2015 SIR of 1.0

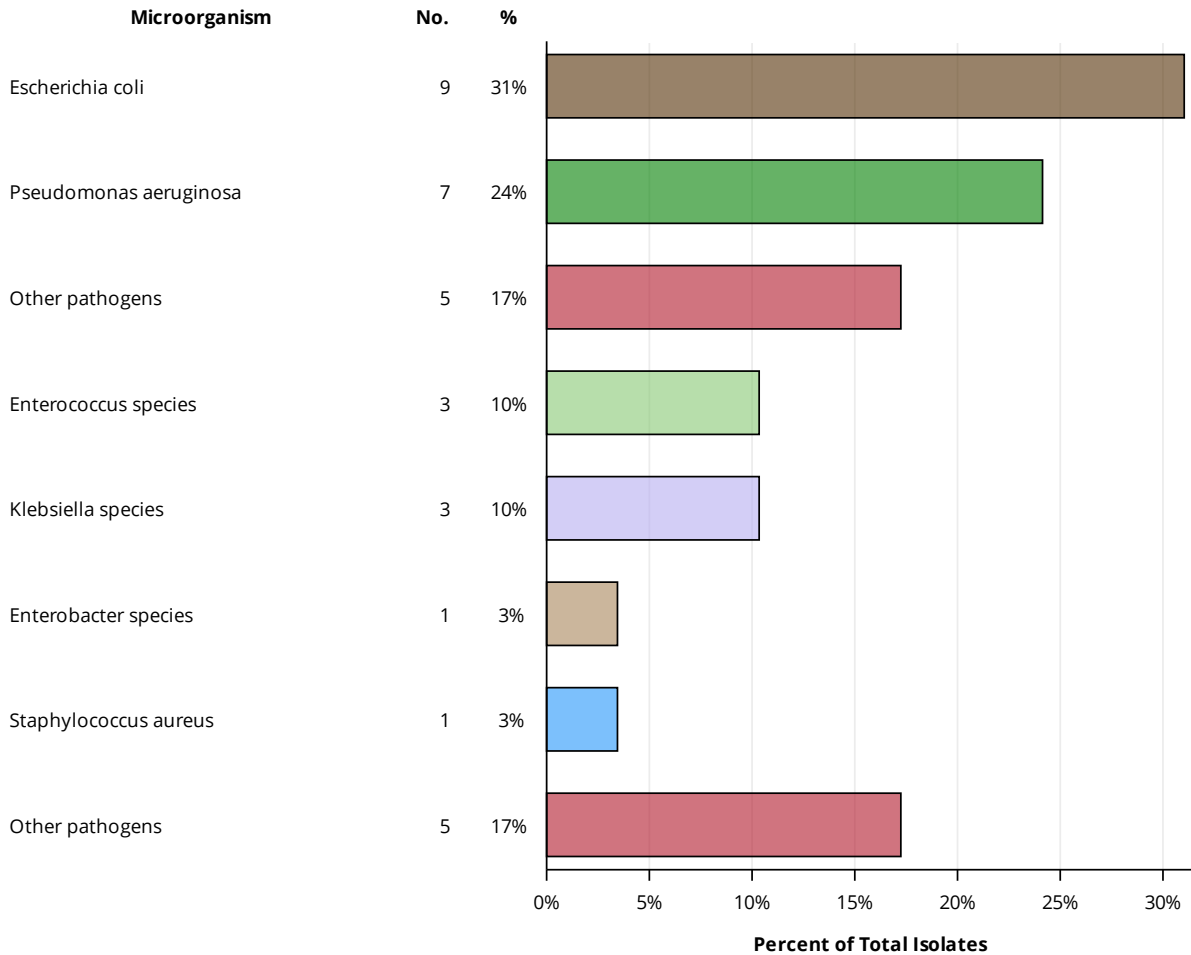
**Figure 27: Number of Facility SIRs with More than 1 Predicted Catheter-Associated Urinary Tract Infection (CAUTI) Events in Long Term Acute Care (LTAC) Facilities by Reporting Year, 2015-2021**



Data reported as of May 18, 2022

**Figure 28: Microorganisms Identified in Catheter-Associated Urinary Tract (CAUTIs) in Long-term Acute Care (LTAC) Facilities, Tennessee, 01/01/2021 - 12/31/2021**

**Number of isolates=29; Number of events=25**



Data reported as of May 18, 2022

Other pathogens =Aerococcus spp., Citrobacter spp., Coagulase-negative spp., Diphtheroids spp., Lactobacillus spp., Morganella spp., Providencia spp., Pseudomonas spp., Raoultella spp., Serratia spp.

**Table 19: Resistant Microorganisms Identified in Catheter Associated Urinary Tract Infections (CAUTIs) in Long Term Acute Care, Tennessee, 01/01/2021 - 12/31/2021**

| State     | Year | Microorganism          | Number of Isolates |           | Percentage of Resistant Isolates |                                   |
|-----------|------|------------------------|--------------------|-----------|----------------------------------|-----------------------------------|
|           |      |                        | Total              | Resistant | By Microorganism                 | By Total Number of CAUTI Isolates |
| Tennessee | 2021 | Escherichia coli       | 9                  | 0         | 0%*                              | 0%*                               |
|           |      | Pseudomonas aeruginosa | 7                  | 2         | 28.57%*                          | 6.9%*                             |
|           |      | Enterococcus species   | 3                  | 1         | 33.33%**                         | 3.45%**                           |
|           |      | Klebsiella species     | 3                  | 0         | 0%*                              | 0%*                               |
|           |      | Enterobacter species   | 1                  | 0         | 0%*                              | 0%*                               |
|           |      | Staphylococcus aureus  | 1                  | 1         | 100%***                          | 3.45%***                          |

Data reported as of May 18, 2022

\* = Carbapenem-resistant

\*\* = Vancomycin-resistant

\*\*\* = Methicillin-resistant

## CAUTIs in Inpatient Rehabilitation Facilities (IRFs):

**Total number of facilities reporting from January-December 2021: 26**

**SIRs by Quarter ([Figure 30](#))**

- In Q1-Q42021, the overall CAUTI SIR for Tennessee inpatient rehabilitation facilities (IRFs) ranged from 0.51 in Q4 to 1.08 in Q2. No quarter in 2021 was significantly below the national baseline SIR of 1, and no quarter achieved the U.S. Department of Health and Human Services' [National Action Plan to Prevent Healthcare-Associated Infections](#)<sup>16</sup> prevention target of SIR=0.75.

**Key Percentiles for Tennessee SIRs ([Table 20](#), [Figure 31](#))**

- The overall CAUTI SIR across all reporting IRFs in Tennessee for the 2021 was 0.72 (95% CI: 0.43, 1.15), which is the lowest it has been during any reporting year since 2015. The 2021 SIR was not significantly lower than 1.
- In 2021, there were 10 facilities that had greater than 1 predicted infection, and thus an SIR was calculated. No facility was significantly different than the national baseline of 1.

**Microorganisms Associated with CAUTIs in IRFs ([Figure 32](#), [Table 21](#))**

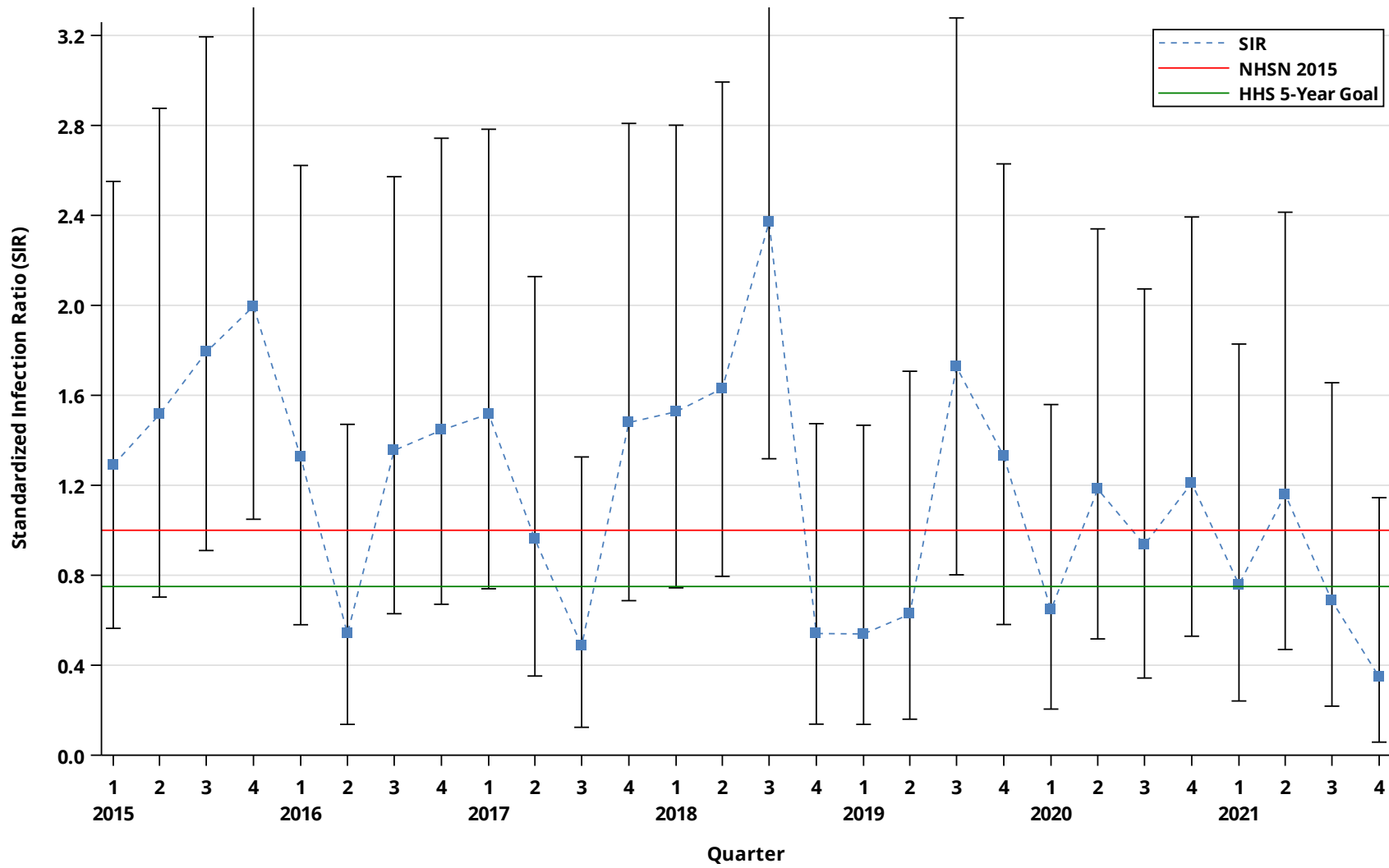
- Among the 19 pathogens isolated from 17 IRF CAUTIs in 2021, the most common pathogens were Escherichia coli (63%) and Pseudomonas aeruginosa (16%).
- There were no resistant *E. coli* isolates for IRF CAUTIs in 2021.

---

<sup>16</sup> <http://www.hhs.gov/ash/initiatives/hai/actionplan/>



**Figure 29: Standardized Infection Ratios (SIR) for Catheter-Associated Urinary Tract Infections (CAUTIs) in Inpatient Rehabilitation Facilities (IRF) by Quarter, Tennessee, 01/01/2015–12/31/2021 [Reference standard: National Healthcare Safety Network (NHSN), 2015]**



Data Reported as of May 18, 2022

**Table 20: Key Percentiles for Facility-Specific Catheter-Associated Urinary Tract Infection (CAUTI) Standardized Infection Ratios (SIRs) in Inpatient Rehabilitation Facilities (IRF) Facilities by Year, Tennessee, 01/01/2017 - 12/31/2021**

| STATE     | YEAR | No. | UC Days | No. of INFECTIONS |       | SIR AND 95% CONFIDENCE INTERVAL |             |             |
|-----------|------|-----|---------|-------------------|-------|---------------------------------|-------------|-------------|
|           |      |     |         | OBS               | PRED  | SIR                             | LOWER LIMIT | UPPER LIMIT |
| Tennessee | 2021 | 26  | 14,851  | 16                | 22.05 | 0.73                            | 0.43        | 1.15        |
|           | 2020 | 27  | 15,330  | 23                | 23.24 | 0.99                            | 0.64        | 1.46        |
|           | 2019 | 27  | 12,487  | 21                | 20.25 | 1.04                            | 0.66        | 1.56        |
|           | 2018 | 29  | 13,677  | 34                | 22.44 | 1.52                            | 1.07        | 2.09        |
|           | 2017 | 29  | 12,864  | 25                | 22.71 | 1.10                            | 0.73        | 1.60        |
|           | 2016 | 29  | 12,908  | 26                | 22.28 | 1.17                            | 0.78        | 1.69        |
|           | 2015 | 28  | 13,211  | 36                | 21.80 | 1.65                            | 1.17        | 2.26        |

Data reported as of May 18, 2022

No. = number of facilities; UC Days = urinary catheter days; OBS = observed number of CAUTI

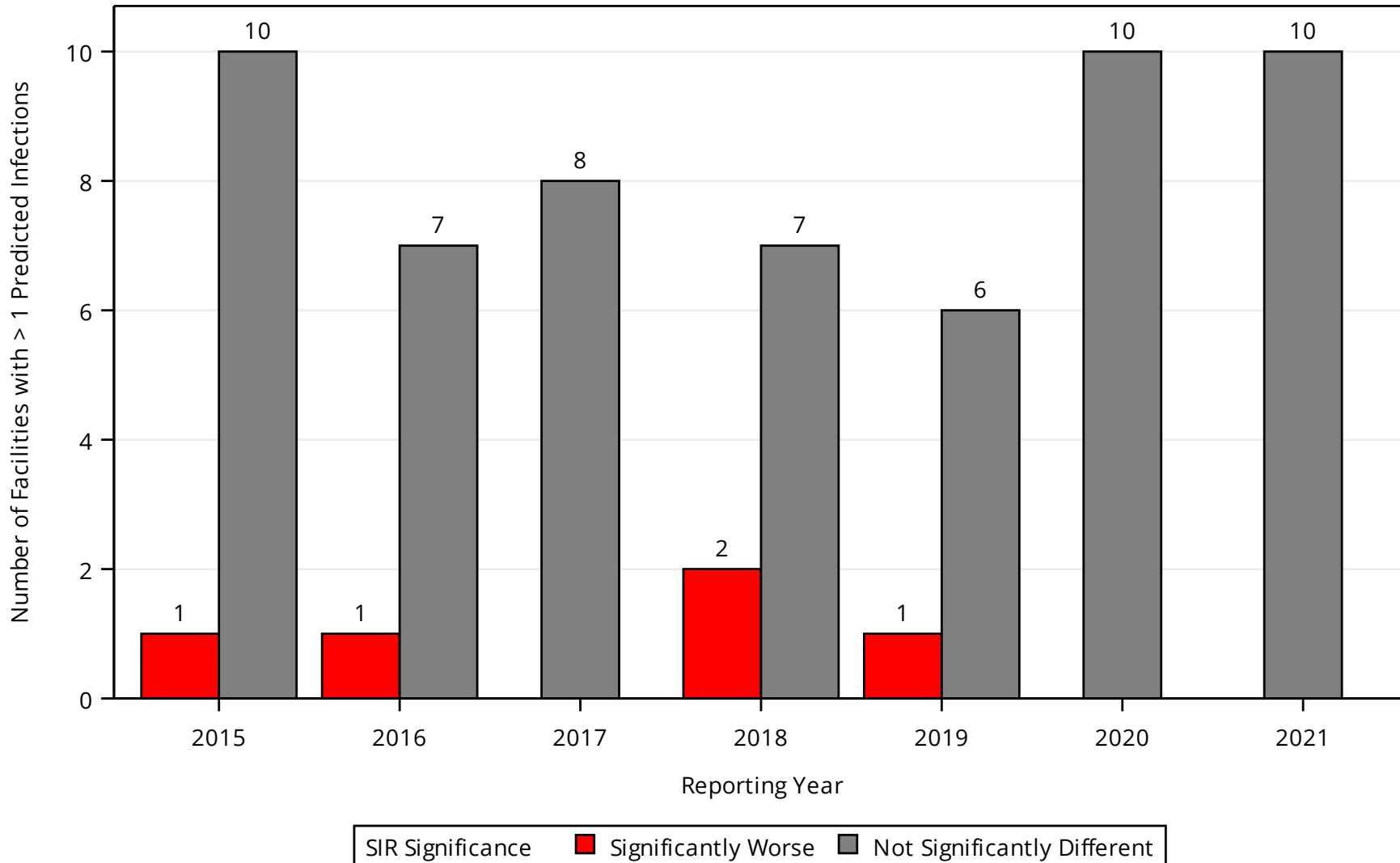
PRED = statistically 'predicted' number of CAUTI; SIR = standardized infection ratio (observed/predicted number of CAUTI)

Key percentiles include facilities with at least 1 predicted infection

Red highlighting indicates SIR for reporting period is significantly higher than national 2015 SIR of 1.0

Green highlighting indicates SIR for reporting period is significantly lower than national 2015 SIR of 1.0

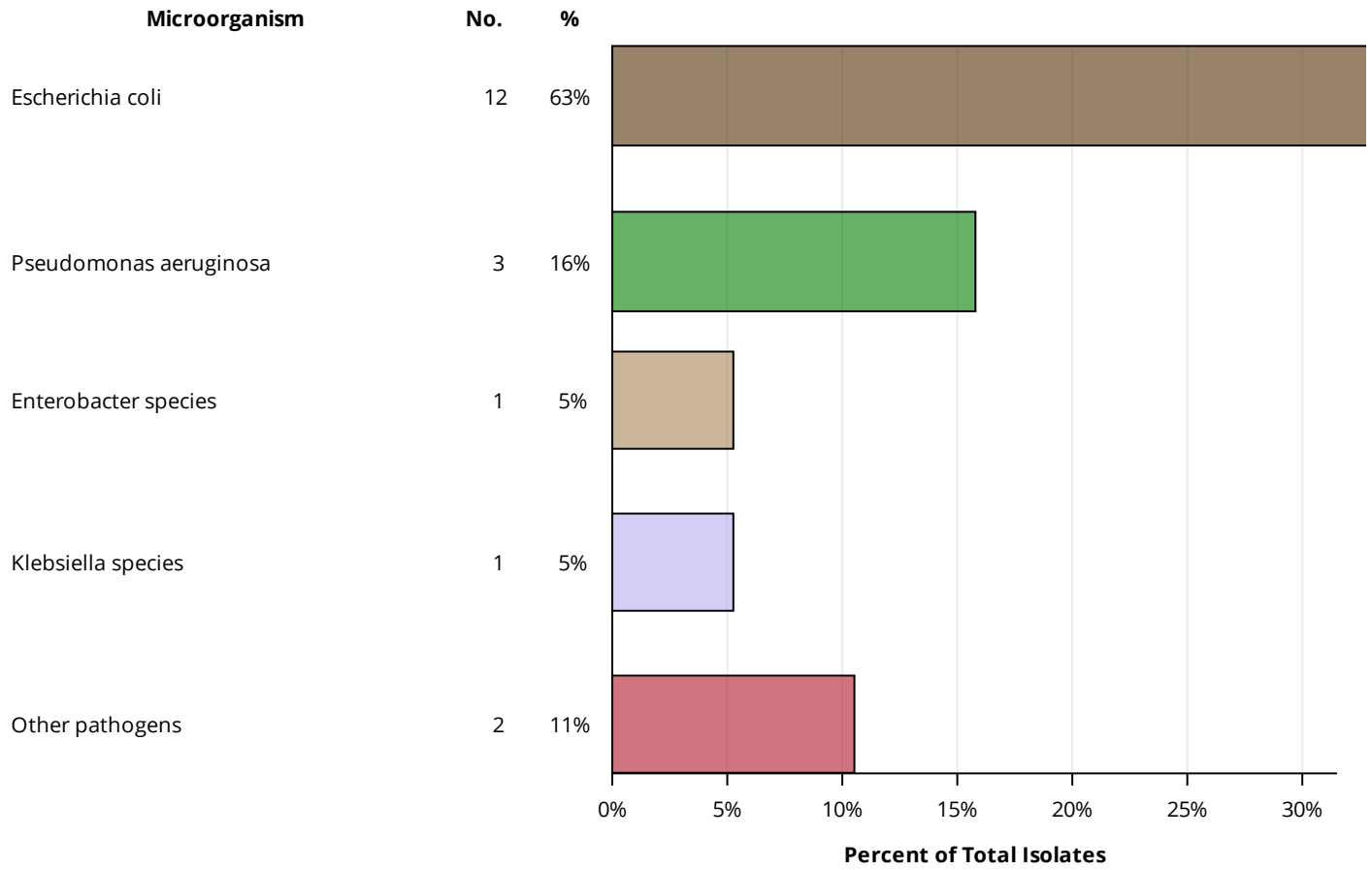
**Figure 30: Number of Facility SIRs with More than 1 Predicted Catheter-Associated Urinary Tract Infection (CAUTI) Events in Inpatient Rehabilitation Facilities (IRF) by Reporting Year, Tennessee, 2015-2021**



Data reported as of May 18, 2022

**Figure 31: Microorganisms Identified in Catheter-Associated Urinary Tract (CAUTIs) in Inpatient Rehabilitation Facilities (IRF), Tennessee, 01/01/2021 - 12/31/2021**

**Number of isolates=19; Number of events=17**



Data reported as of May 18, 2022

**Table 21: Resistant Microorganisms Identified in Catheter Associated Urinary Tract Infections (CAUTIs) in Inpatient Rehabilitation Facilities, Tennessee, 01/01/2021 - 12/31/2021**

| State     | Year | Microorganism          | Number of Isolates |           | Percentage of Resistant Isolates |                                   |
|-----------|------|------------------------|--------------------|-----------|----------------------------------|-----------------------------------|
|           |      |                        | Total              | Resistant | By Microorganism                 | By Total Number of CAUTI Isolates |
| Tennessee | 2021 | Escherichia coli       | 11                 | 0         | 0%*                              | 0%*                               |
|           |      | Pseudomonas aeruginosa | 3                  | 0         | 0%*                              | 0%*                               |
|           |      | Enterobacter species   | 1                  | 0         | 0%*                              | 0%*                               |
|           |      | Klebsiella species     | 1                  | 0         | 0%*                              | 0%*                               |

Data reported as of May 18, 2022

\* = Carbapenem-resistant

\*\* = Vancomycin-resistant

\*\*\* = Methicillin-resistant

# Surgical Site Infections (SSI)

## ***Surgical Site Infections***

A surgical site infection (SSI) is an infection that occurs after surgery in the part of the body where the surgery took place. Surgical site infections can sometimes be superficial infections only involving the skin, while others can be more serious and involve deeper tissues, organs, or implanted materials. Healthcare facilities can prevent SSIs by following appropriate infection prevention recommendations before, during, and after surgery.<sup>17</sup>

### **Reporting Requirements**

Tennessee acute care hospitals (ACHs) have been required to report SSIs following coronary artery bypass graft procedures (CBGB/C) since January 2008. SSIs following colon procedures (COLO) and those following abdominal hysterectomies (HYST) have been required reporting for ACHs in Tennessee since January 2012.

To comply with these reporting requirements, facilities are required to follow the NHSN SSI Surveillance protocol,<sup>18</sup> which is updated each year with SSI surveillance definitions and reporting instructions. Facilities must report each required surgical procedure that is performed every month to NHSN. They are also required to report any surgical site infections which meet NHSN surveillance definition of an SSI following required procedures.

### **Surveillance Definitions & Changes**

NHSN defines SSIs as those infections occurring after an NHSN Operative Procedure that meets one or more criteria listed in the SSI Surveillance Protocol. An NHSN Operative Procedure is any procedure that is included in ICD-10-PCS an/or CPT NHSN operative procedure code mapping that takes place during an operation where at least one incision is made through the skin, or reoperation via an incision left open during a prior operative procedure. This must all take place in an operating room, which is defined as a patient care area that met the Facilities Guidelines Institute's (FGI) or American Institute of Architects' (AIA) criteria for an operating room after construction or renovation.

In 2021, NHSN clarified that only NHSN Operative Procedures are eligible for SSI surveillance, but that infections following other procedures can still be investigated as HAIs. Additionally, patient-reported signs or symptoms within an SSI surveillance period became eligible to fulfill SSI criteria provided they were documented in the medical records by a healthcare professional.

### **Facility-Specific Data Thresholds**

To ensure fair and accurate reporting of facility-specific SSI standardized infection ratios (SIRs), TDH has adopted the NHSN minimum thresholds for reporting. To report a facility-specific SIR, there

---

<sup>17</sup> Patient Guide to SSI ([https://www.cdc.gov/HAI/pdfs/ssi/SSI\\_tagged.pdf](https://www.cdc.gov/HAI/pdfs/ssi/SSI_tagged.pdf))

<sup>18</sup> NHSN SSI Surveillance protocol (<https://www.cdc.gov/nhsn/PDFs/pscManual/9pscSSICurrent.pdf>)

must be a minimum of 20 procedures performed for a reporting period, and the statistically predicted number of infections must be at least 1.0.

### **SSI Risk Adjustment**

For individuals undergoing surgical procedures, risk adjustment is calculated through logistic regression models which use national NHSN baseline data from 2015 to represent a standard population. With this method, risk factors are procedure-specific, and each risk factor's contribution varies according to its magnitude of association with risk of SSI. For this report, SSI SIRs are generated utilizing data reported into NHSN, and come in two forms: All SSI SIR and Complex Admission/Readmission (Complex A/R) SIRs.



# Coronary Artery Bypass Graft Procedures (CBGB/C):

**Total number of facilities reporting from January-December 2021: 27**

**SIRs by Quarter ([Figure 33](#))**

- In 2021, the All-Adult CABG SSI SIR increased from 0.62 in Q1 to 1.37 in Q4. The Complex Admission/Readmission SSI SIR increased also from 0.67 in Q1 to 1.07 in Q4, after declining slightly in Q2 to 0.64. The U.S. Department of Health and Human Services' SIR prevention target for 2020 is an SIR=0.70. In Q1, both the All-CABG and the Complex A/R SIRs met the prevention target, but both SIRs rose above the prevention target, remaining elevated for the rest of 2021.

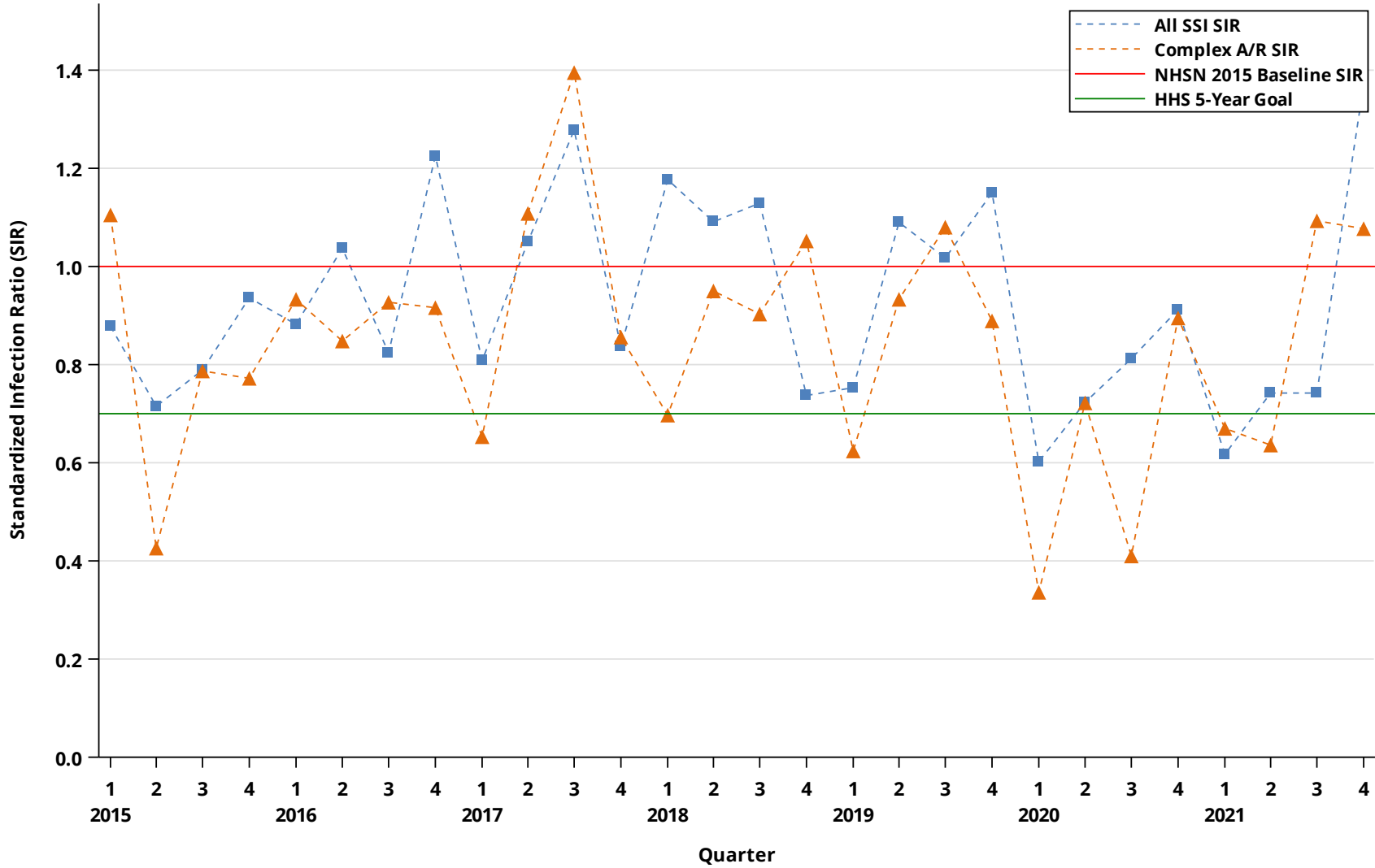
**Key Percentiles for Tennessee SIRs ([Table 22](#))**

- The overall SIR across All-Adult CABG SSIs reported in Tennessee from January-December 2021 was not significantly different than the national SIR of 1 (SIR=0.86; 95% CI: 0.69, 1.06).
- The overall SIR across Complex A/R CABG SSIs reported in Tennessee from January-December 2021 was not significantly different than the national SIR of 1 (SIR=0.86; 95% CI: 0.64, 1.15).

**Infection Sites, Pathogens, and Detection ([Figure 34](#), [Figure 35](#), [Figure 36](#), [Table 23](#))**

- In 2021 amongst 105 CBGB/C SSI events, the majority (39%) were superficial primary SSIs, while Organ/Space and Deep Primary SSIs rounded out the top three types with 26% and 20% respectively. Secondary SSIs were split into superficial and deep, making up 11% and 4% of the total CBGB/C SSIs in 2021. Amongst those 105 SSI events, 65% were detected upon readmission, 19% were detected upon first admission, and 16% detected upon discharge.
- In 2021, 89 isolates from SSIs were submitted to the Tennessee State Public Health Lab (TPHL), with a quarter of isolates growing *S. aureus*. The next most common organisms were Coagulase-negative Staphylococcus species (16%) and Enterobacter species (10%). Methicillin-resistant *S. aureus* (MRSA) isolates accounted for 9% of all isolates for the year, and one-third of all *S. aureus* isolates were methicillin-resistant. 6% of all isolates were *P. aeruginosa*, with 20% of all *P. aeruginosa* isolates exhibiting resistant to carbapenems.

**Figure 32: Coronary Artery Bypass Graft (CBGB/C) All and Complex Admission/Readmission Surgical Site Infection (SSI) Standardized Infection Ratios (SIRs) by Quarter, Tennessee, 01/01/2015–12/31/2021 [Reference standard: National Healthcare Safety Network (NHSN), 2015]**



Data Reported as of May 18, 2022

**Table 22: Coronary Artery Bypass Graft (CBGB/C) All and Complex Admission/Readmission (AR) Surgical Site Infection (SSI) Standardized Infection Ratios (SIRs) by Reporting Year, Tennessee, 01/01/2017 - 12/31/2021**

|           |                |      |     |            | No. of INFECTIONS |           | SIR AND 95% CONFIDENCE INTERVAL |             |             |
|-----------|----------------|------|-----|------------|-------------------|-----------|---------------------------------|-------------|-------------|
| STATE     | SIR TYPE       | YEAR | No. | PROCEDURES | OBSERVED          | PREDICTED | SIR                             | LOWER LIMIT | UPPER LIMIT |
| Tennessee | All Procedures | 2021 | 27  | 6,102      | 88                | 102.26    | 0.86                            | 0.69        | 1.06        |
|           |                | 2020 | 25  | 5,457      | 70                | 91.35     | 0.77                            | 0.60        | 0.96        |
|           |                | 2019 | 26  | 6,473      | 101               | 100.82    | 1.00                            | 0.82        | 1.21        |
|           |                | 2018 | 28  | 6,600      | 105               | 101.25    | 1.04                            | 0.85        | 1.25        |
|           |                | 2017 | 29  | 6,848      | 103               | 104.04    | 0.99                            | 0.81        | 1.20        |
|           |                | 2016 | 30  | 6,942      | 103               | 104.33    | 0.99                            | 0.81        | 1.19        |
|           |                | 2015 | 31  | 6,826      | 82                | 99.15     | 0.83                            | 0.66        | 1.02        |
|           | Complex A/R    | 2021 | 27  | 6,102      | 44                | 50.97     | 0.86                            | 0.64        | 1.15        |
|           |                | 2020 | 25  | 5,457      | 27                | 46.11     | 0.59                            | 0.39        | 0.84        |
|           |                | 2019 | 26  | 6,473      | 45                | 51.00     | 0.88                            | 0.65        | 1.17        |
|           |                | 2018 | 28  | 6,600      | 46                | 51.20     | 0.90                            | 0.67        | 1.19        |
|           |                | 2017 | 29  | 6,848      | 53                | 53.08     | 1.00                            | 0.76        | 1.30        |
|           |                | 2016 | 30  | 6,942      | 48                | 53.05     | 0.91                            | 0.68        | 1.19        |
|           |                | 2015 | 31  | 6,826      | 40                | 52.43     | 0.76                            | 0.55        | 1.03        |

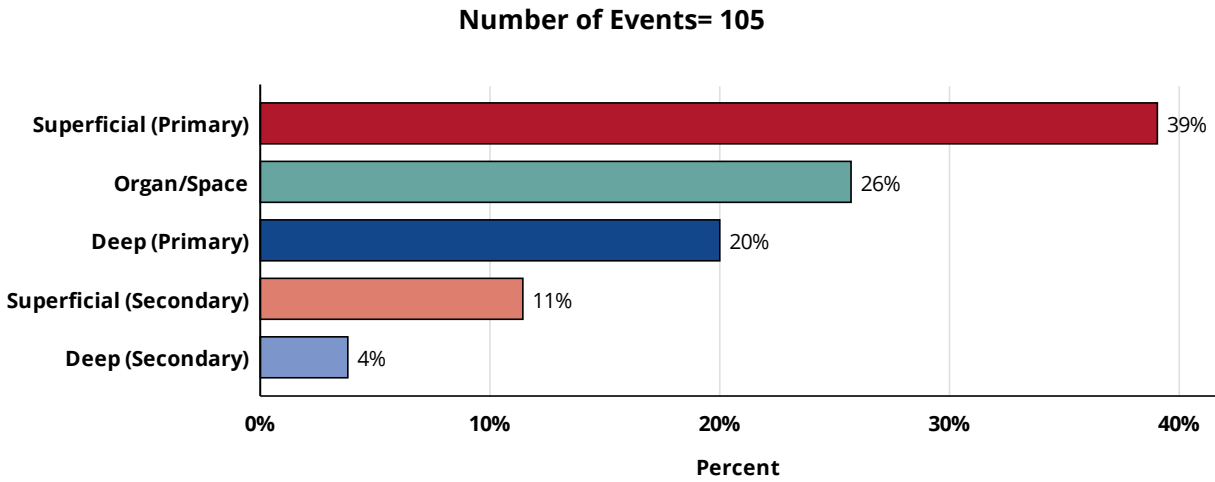
Data reported as of May 18, 2022

No. = number of facilities reporting

Red highlighting indicates SIR for reporting period is significantly higher than 2015 national SIR of 1.0

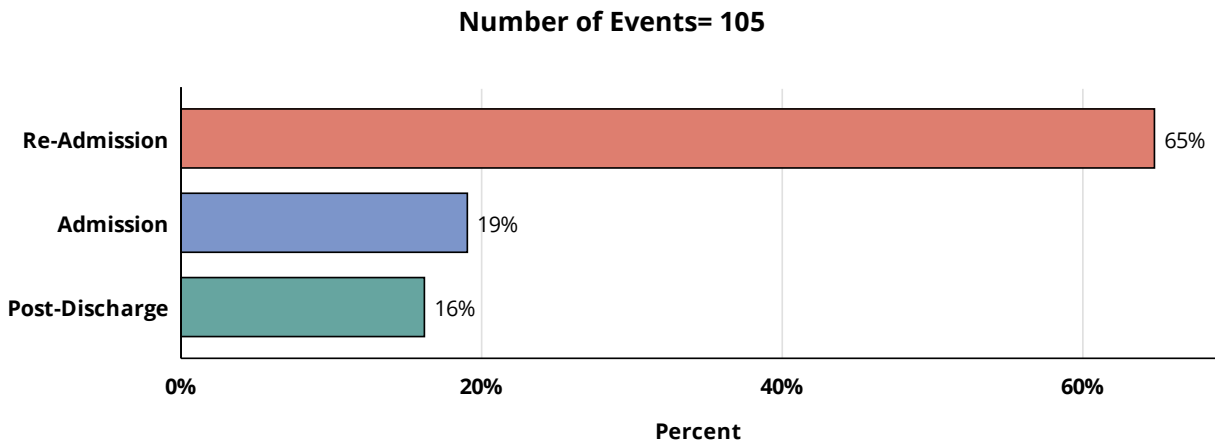
Green highlighting indicates SIR for reporting period is significantly lower than 2015 national SIR of 1.0

**Figure 33: Coronary Artery Bypass Graft (CBGB/C) Surgical Site Infections by Site, Tennessee, 01/01/2021–12/31/2021**



*Data Reported as of May 18, 2022*

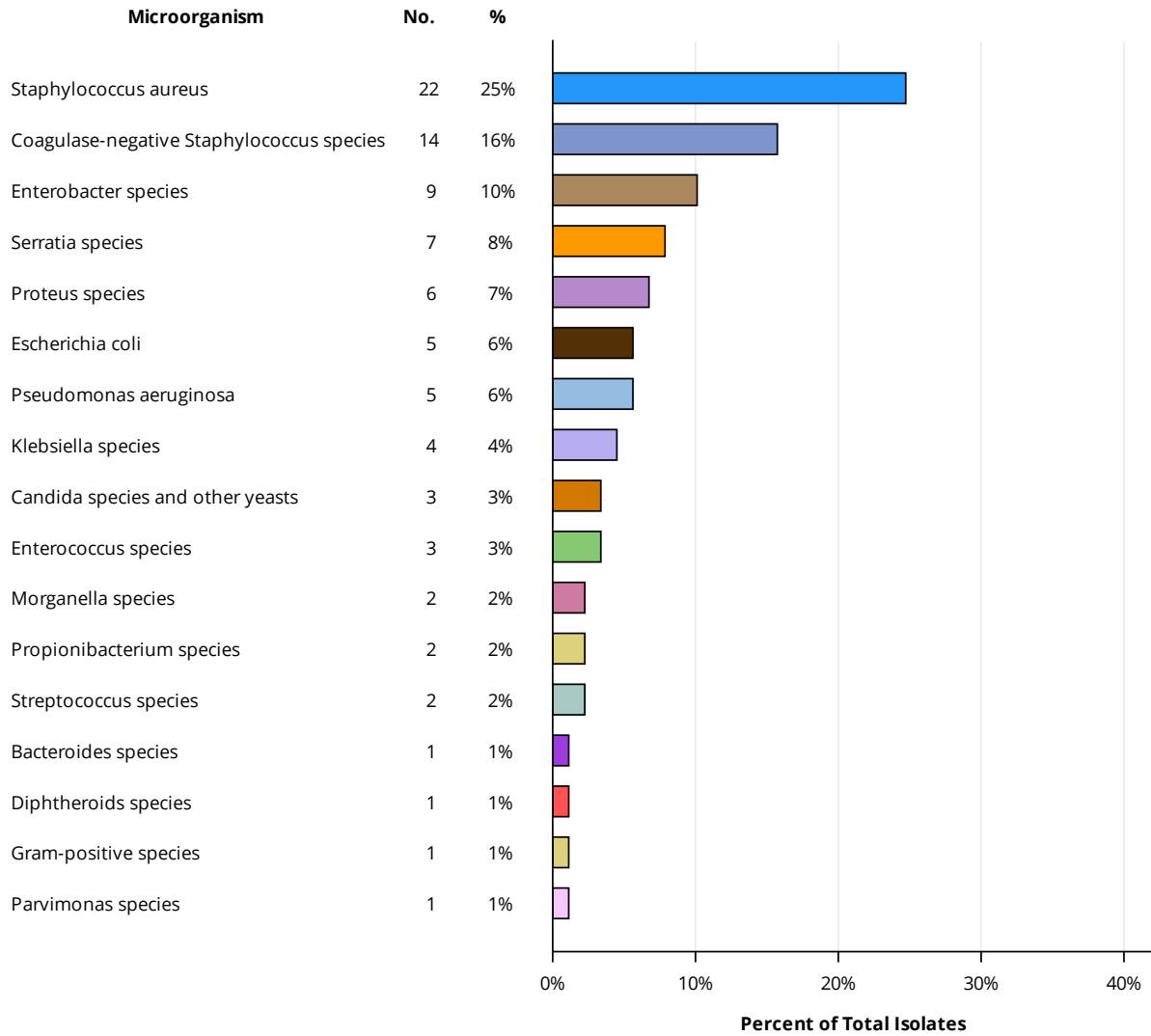
**Figure 34: Coronary Artery Bypass Graft (CBGB/C) Surgical Site Infections Detection, Tennessee, 01/01/2021–12/31/2021**



*Data Reported as of May 18, 2022*

**Figure 35: Microorganisms Identified from Surgical Site Infections (SSI) following Coronary Artery Bypass Graft (CBGB/C) Procedures, Tennessee, 01/01/2021 - 12/31/2021**

**Number of isolates=89; Number of events=105**



Data reported as of May 18, 2022

**Table 23: Resistant Microorganisms Identified in Surgical Site Infections (SSI) following Coronary Artery Bypass Graft (CBGB/C) Procedures, Tennessee, 01/01/2021 - 12/31/2021**

| State     | Year | Microorganism          | Number of Isolates |           | Percentage of Resistant Isolates |  |
|-----------|------|------------------------|--------------------|-----------|----------------------------------|--|
|           |      |                        | Total              | Resistant | By Microorganism                 | By Total Number of Procedure-specific Isolates |
| Tennessee | 2021 | Staphylococcus aureus  | 22                 | 8         | 36.36%***                        | 8.99%***                                       |
|           |      | Enterobacter species   | 9                  | 0         | 0%*                              | 0%*  |
|           |      | Escherichia coli       | 5                  | 0         | 0%*                              | 0%*  |
|           |      | Pseudomonas aeruginosa | 5                  | 1         | 20%*                             | 1.12%*   |
|           |      | Klebsiella species     | 4                  | 0         | 0%*                              | 0%*  |
|           |      | Enterococcus species   | 3                  | 0         | 0%**                             | 0%**   |

Data reported as of May 18, 2022

\* = Carbapenem-resistant

\*\* = Vancomycin-resistant

\*\*\* = Methicillin-resistant

## Colon (COLO) Procedures:

**Total number of facilities reporting from January – December 2021: 89**

### **SIRs by Quarter ([Figure 37](#))**

- In 2021, the All-Adult COLO SSI SIR declined from 0.59 in Q1 to 0.46 in Q4. The SIR peaked in Q2, climbing to 0.74 before declining in the last two quarters of the year. The Complex Admission/Readmission SSI SIR followed a similar pattern, increasing from 0.62 in Q1 to 0.78 in Q2, before declining to reach 0.53 by Q4. Both SIRs remained, with the exception of the peaks in Q2 SIRs, below the HHS prevention target SIR of 0.70.

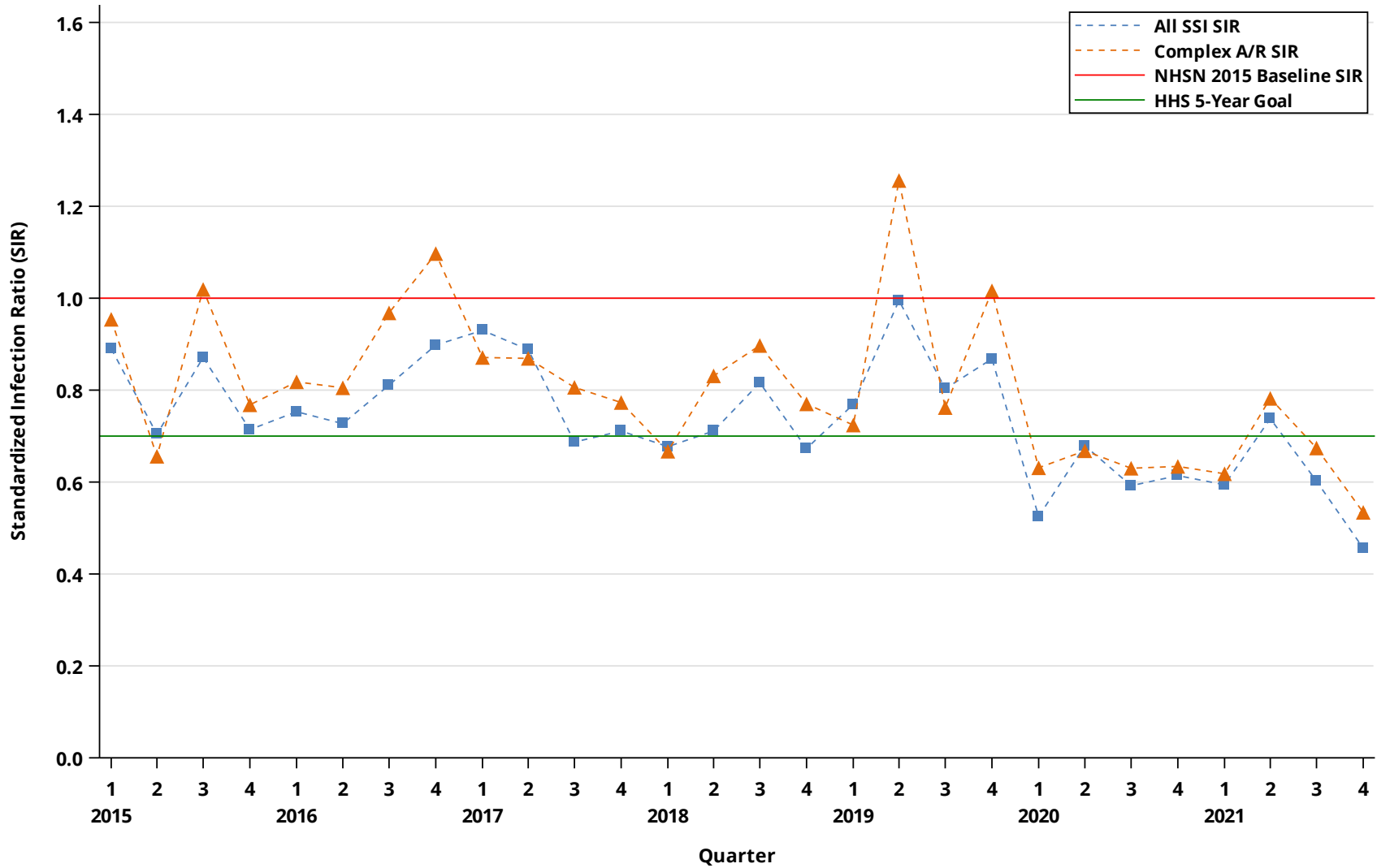
### **Key Percentiles for Tennessee SIRs ([Table 24](#))**

- The overall SIR across All-Adult COLO SSIs reported in Tennessee from January-December 2021 was significantly less than the national SIR of 1 (SIR=0.60; 95% CI: 0.53, 0.68).
- The overall SIR across Complex A/R COLO SSIs reported in Tennessee from January-December 2021 was significantly less than the national SIR of 1 (SIR=0.65; 95% CI: 0.55, 0.77).

### **Infection Sites, Pathogens, and Detection ([Figure 38](#), [Figure 39](#), [Figure 40](#), [Table 25](#))**

- Of the 366 COLO SSI events in 2021, over half (59%) were Organ/Space infections, 33% were superficial primary, and 8% were deep primary infections. Most infections were detected either upon admission (50%) or upon readmission (42%), with only 9% being detected after discharge. 424 isolates were submitted, with the majority of microorganisms represented by *E. coli* (25%). *S. aureus* made up 5% of submitted microorganisms, but of those *S. aureus* isolates, nearly three quarters (72.7%) were methicillin resistant, making MRSA isolates almost 4% of all COLO microorganisms documented. Enterococcus species made up 23% of isolates submitted, with 11% of Enterococcus species resistant to vancomycin. *P. aeruginosa* made up 6% of total isolates, with 16% of *P. aeruginosa* isolates displaying resistant to carbapenems.

Figure 36: Colon Surgery (COLO) All and Complex Admission/Readmission Surgical Site Infection (SSI) Standardized Infection Ratios (SIRs) by Quarter, Tennessee, 01/01/2015–12/31/2021 [Reference standard: National Healthcare Safety Network (NHSN), 2015]



Data Reported as of May 18, 2022



**Table 24: Colon Surgery (COLO) All and Complex Admission/Readmission (AR) Surgical Site Infection (SSI) Standardized Infection Ratios (SIRs) by Reporting Year, Tennessee, 01/01/2015 - 12/31/2021**

|           |                |      |     |            | No. of INFECTIONS |           | SIR AND 95% CONFIDENCE INTERVAL |             |             |
|-----------|----------------|------|-----|------------|-------------------|-----------|---------------------------------|-------------|-------------|
| STATE     | SIR TYPE       | YEAR | No. | PROCEDURES | OBSERVED          | PREDICTED | SIR                             | LOWER LIMIT | UPPER LIMIT |
| Tennessee | All Procedures | 2021 | 89  | 8,141      | 257               | 429.70    | 0.60                            | 0.53        | 0.68        |
|           |                | 2020 | 89  | 7,478      | 236               | 394.37    | 0.60                            | 0.53        | 0.68        |
|           |                | 2019 | 95  | 8,807      | 395               | 460.92    | 0.86                            | 0.78        | 0.95        |
|           |                | 2018 | 99  | 8,591      | 330               | 459.33    | 0.72                            | 0.64        | 0.80        |
|           |                | 2017 | 99  | 8,234      | 345               | 429.56    | 0.80                            | 0.72        | 0.89        |
|           |                | 2016 | 99  | 8,157      | 336               | 420.75    | 0.80                            | 0.72        | 0.89        |
|           |                | 2015 | 99  | 7,605      | 311               | 391.39    | 0.80                            | 0.71        | 0.89        |
|           | Complex A/R    | 2021 | 89  | 8,141      | 143               | 219.21    | 0.65                            | 0.55        | 0.77        |
|           |                | 2020 | 89  | 7,478      | 128               | 200.23    | 0.64                            | 0.54        | 0.76        |
|           |                | 2019 | 95  | 8,807      | 218               | 232.70    | 0.94                            | 0.82        | 1.07        |
|           |                | 2018 | 99  | 8,591      | 183               | 231.63    | 0.79                            | 0.68        | 0.91        |
|           |                | 2017 | 99  | 8,234      | 180               | 216.93    | 0.83                            | 0.72        | 0.96        |
|           |                | 2016 | 99  | 8,157      | 196               | 212.06    | 0.92                            | 0.80        | 1.06        |
|           |                | 2015 | 99  | 7,605      | 168               | 198.08    | 0.85                            | 0.73        | 0.98        |

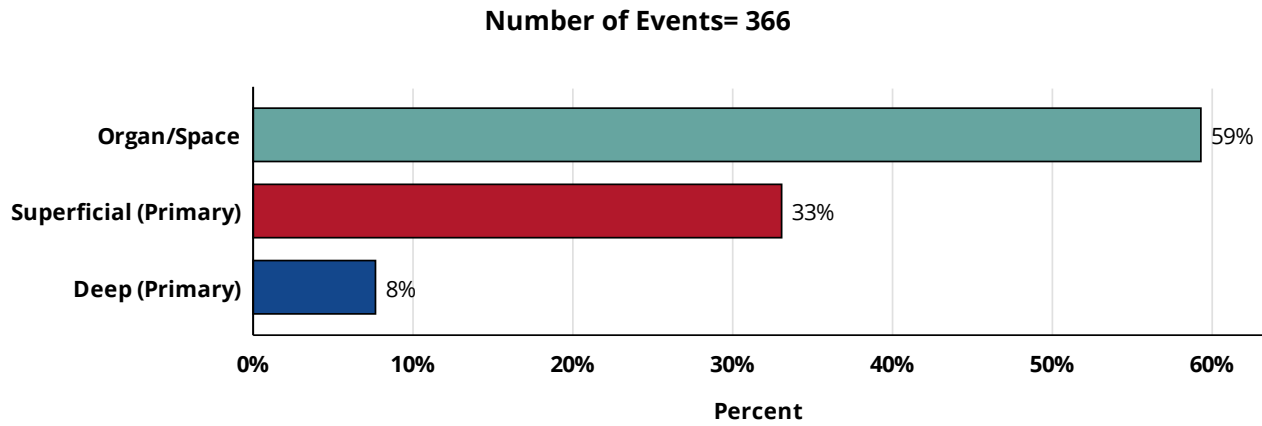
Data reported as of May 18, 2022

No. = number of facilities reporting

Red highlighting indicates SIR for reporting period is significantly higher than 2015 national SIR of 1.0

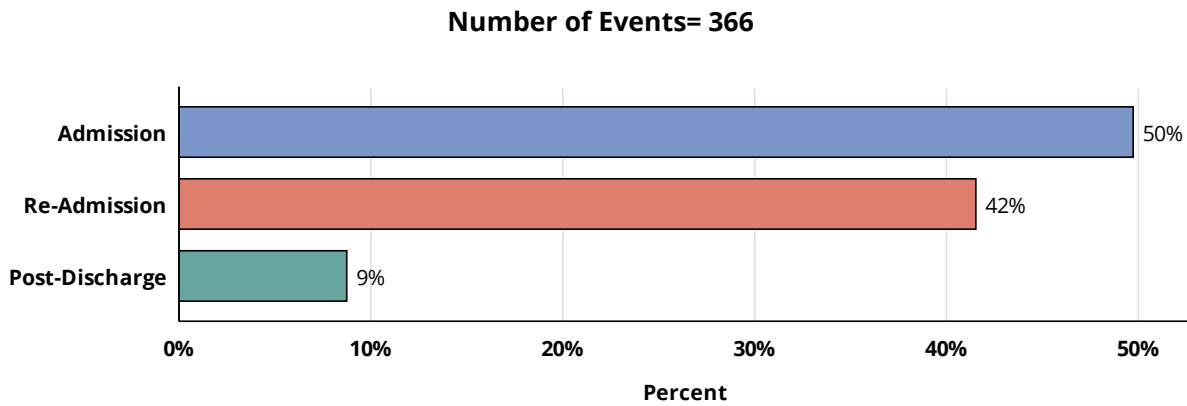
Green highlighting indicates SIR for reporting period is significantly lower than 2015 national SIR of 1.0

**Figure 37: Colon Surgery (COLO) Surgical Site Infections by Site, Tennessee, 01/01/2021–12/31/2021**



*Data Reported as of May 18, 2022*

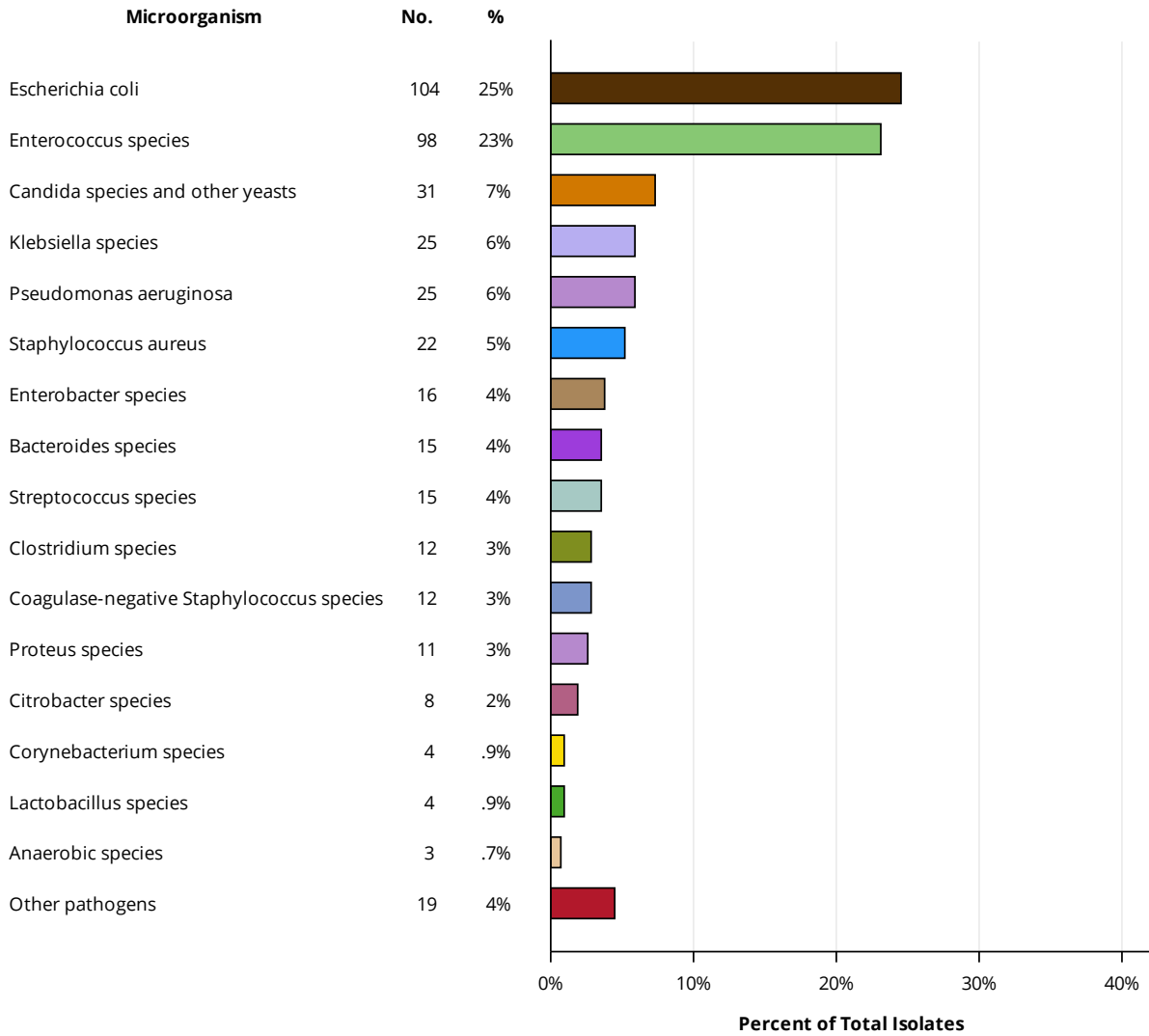
**Figure 38: Colon Surgery (COLO) Surgical Site Infections Detection, Tennessee, 01/01/2021–12/31/2021**



*Data Reported as of May 18, 2022*

**Figure 39: Microorganisms Identified from Surgical Site Infections (SSI) following Colon (COLO) Procedures, Tennessee, 01/01/2021 - 12/31/2021**

**Number of isolates=424; Number of events=366**



Data reported as of May 18, 2022

Other pathogens =Bacillus spp., Bifidobacterium spp., Eggerthella spp., Eubacterium spp., Fusobacterium spp., Gram-negative spp., Gram-positive spp., Haemophilus spp., Hafnia spp., Leuconostoc spp., Morganella spp., Parvimonas spp., Peptoniphilus spp., Providencia spp., Raoultella spp., Veillonella spp.

**Table 25: Resistant Microorganisms Identified in Surgical Site Infections (SSI) following Colon (COLO) Procedures, Tennessee, 01/01/2021 - 12/31/2021**

| State     | Year | Microorganism          | Number of Isolates |           | Percentage of Resistant Isolates |  |
|-----------|------|------------------------|--------------------|-----------|----------------------------------|--|
|           |      |                        | Total              | Resistant | By Microorganism                 | By Total Number of Procedure-specific Isolates |
| Tennessee | 2021 | Escherichia coli       | 104                | 3         | 2.88%*                           | 0.71%*   |
|           |      | Enterococcus species   | 98                 | 11        | 11.22%**                         | 2.59%**  |
|           |      | Klebsiella species     | 25                 | 0         | 0%*                              | 0%*  |
|           |      | Pseudomonas aeruginosa | 25                 | 4         | 16%*                             | 0.94%*   |
|           |      | Staphylococcus aureus  | 22                 | 16        | 72.73%***                        | 3.77%***                                       |
|           |      | Enterobacter species   | 16                 | 2         | 12.5%*                           | 0.47%*   |

Data reported as of May 18, 2022

\* = Carbapenem-resistant

\*\* = Vancomycin-resistant

\*\*\* = Methicillin-resistant

# Abdominal Hysterectomy (HYST) Procedures:

**Total number of facilities reporting from January – December 2021: 89**

## **SIRs by Quarter ([Figure 41](#))**

- In 2021 the All Adult HYST SSI SIR varied by quarter, starting at 0.58 in Q1, dipping to 0.53 in Q2 before climbing in the latter half of the year to end at 1.01 in Q4. The Complex Admission/Readmission HYST SSI SIR rose overall in 2021, beginning at 0.60 in Q1 and rising to 1.20 in Q4, dipping slightly in Q3 to 0.68. Both SIRs began below the HHS prevention benchmark of 0.7 but ended the year above the target, though near the national baseline.

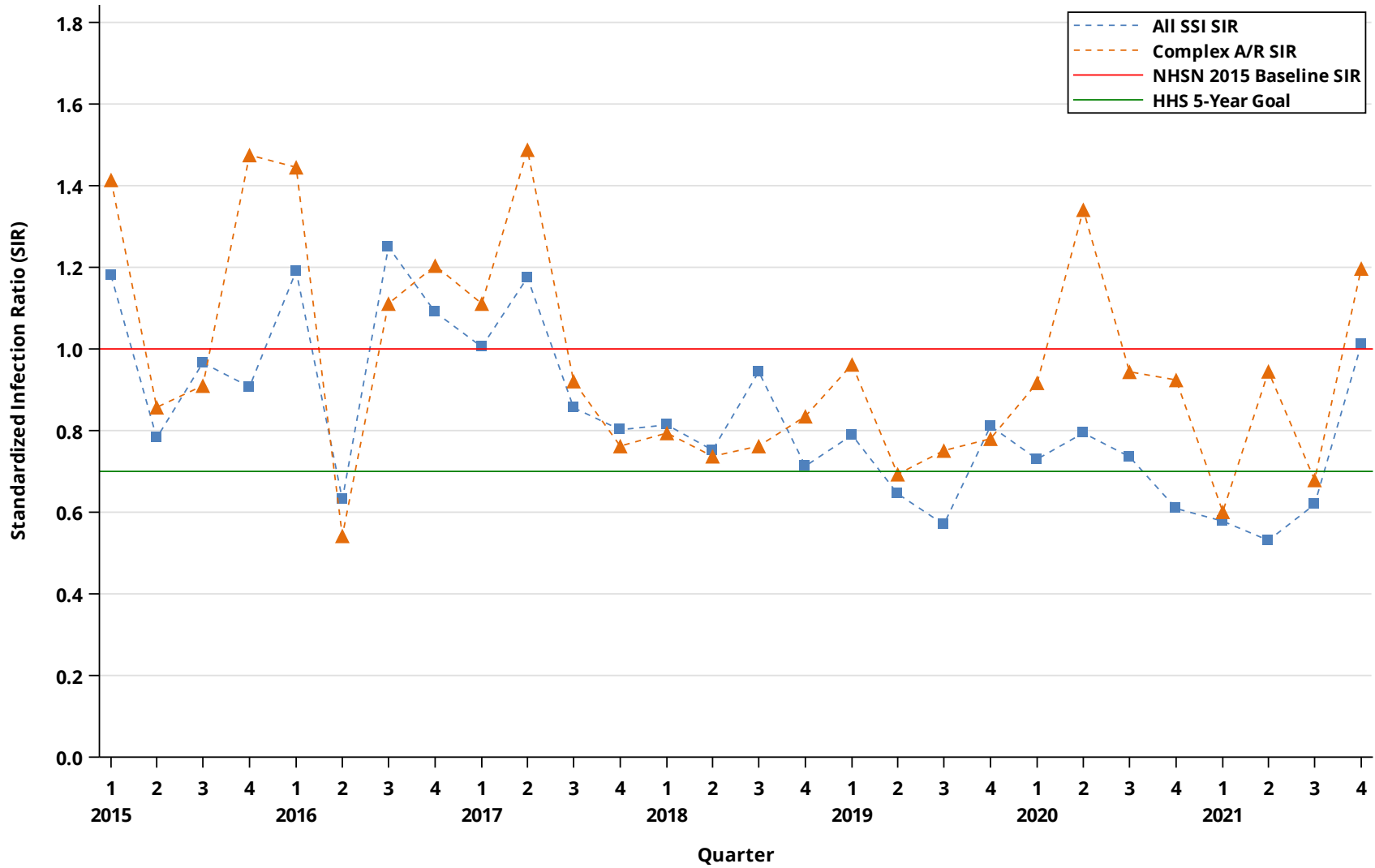
## **Key Percentiles for Tennessee SIRs ([Table 26](#))**

- The overall SIR across All-Adult HYST SSIs reported in Tennessee from January-December 2021 was significantly less than the national SIR of 1 (SIR=0.68; 95% CI: 0.54, 0.85).
- The overall SIR across Complex A/R CABG SSIs reported in Tennessee from January-December 2021 was not significantly different than the national SIR of 1 (SIR=0.86; 95% CI: 0.62, 1.16).

## **Infection Sites, Pathogens, and Detection ([Figure 42](#), [Figure 43](#), [Figure 44](#), [Table 27](#))**

- Of the 76 HYST SSI events, most were Organ/Space (61%). 34% were superficial primary infections, and only 5% were classified as deep primary infections. The large majority (78%) of infections were detected upon readmission. 18% were detected after discharge, and only 4% detected on initial admission. Of those HYST SSI events, five pathogens made up the majority of microorganism isolates submitted. *E. coli* constituted 16% of isolates while Enterococcus species, *S. aureus*, and Streptococcus species each made up 11% of isolates submitted. Three quarters of *S. aureus* isolates (75%) were methicillin resistant. *P. aeruginosa* isolates made up 3% of total HYST isolates, with half (50%) of those *P. aeruginosa* isolates displayed resistance to carbapenems.

**Figure 40: Abdominal Hysterectomy (HYST) All and Complex Admission/Readmission Surgical Site Infection (SSI) Standardized Infection Ratios (SIRs) by Quarter, Tennessee, 01/01/2015–12/31/2021 [Reference standard: National Healthcare Safety Network (NHSN), 2015]**



Data Reported as of May 18, 2022

**Table 26: Abdominal Hysterectomy (HYST) All and Complex Admission/Readmission (AR) Surgical Site Infection (SSI) Standardized Infection Ratios (SIRs) by Reporting Year, Tennessee, 01/01/2015 - 12/31/2021**

| STATE     | SIR TYPE       | YEAR | No. | PROCEDURES | No. of INFECTIONS |           | SIR AND 95% CONFIDENCE INTERVAL |             |             |
|-----------|----------------|------|-----|------------|-------------------|-----------|---------------------------------|-------------|-------------|
|           |                |      |     |            | OBSERVED          | PREDICTED | SIR                             | LOWER LIMIT | UPPER LIMIT |
| Tennessee | All Procedures | 2021 | 89  | 6,552      | 73                | 107.78    | 0.68                            | 0.54        | 0.85        |
|           |                | 2020 | 89  | 6,659      | 70                | 98.61     | 0.71                            | 0.56        | 0.89        |
|           |                | 2019 | 95  | 9,248      | 90                | 127.33    | 0.71                            | 0.57        | 0.87        |
|           |                | 2018 | 100 | 8,713      | 97                | 120.76    | 0.80                            | 0.66        | 0.98        |
|           |                | 2017 | 99  | 9,148      | 120               | 124.65    | 0.96                            | 0.80        | 1.15        |
|           |                | 2016 | 99  | 9,523      | 135               | 130.31    | 1.04                            | 0.87        | 1.22        |
|           |                | 2015 | 99  | 8,934      | 115               | 120.56    | 0.95                            | 0.79        | 1.14        |
|           | Complex A/R    | 2021 | 89  | 6,552      | 39                | 45.53     | 0.86                            | 0.62        | 1.16        |
|           |                | 2020 | 89  | 6,659      | 43                | 42.66     | 1.01                            | 0.74        | 1.35        |
|           |                | 2019 | 95  | 9,248      | 45                | 56.61     | 0.80                            | 0.59        | 1.05        |
|           |                | 2018 | 100 | 8,713      | 42                | 53.66     | 0.78                            | 0.57        | 1.05        |
|           |                | 2017 | 99  | 9,148      | 60                | 55.76     | 1.08                            | 0.83        | 1.38        |
|           |                | 2016 | 99  | 9,523      | 62                | 58.07     | 1.07                            | 0.83        | 1.36        |
|           |                | 2015 | 99  | 8,934      | 64                | 55.26     | 1.16                            | 0.90        | 1.47        |

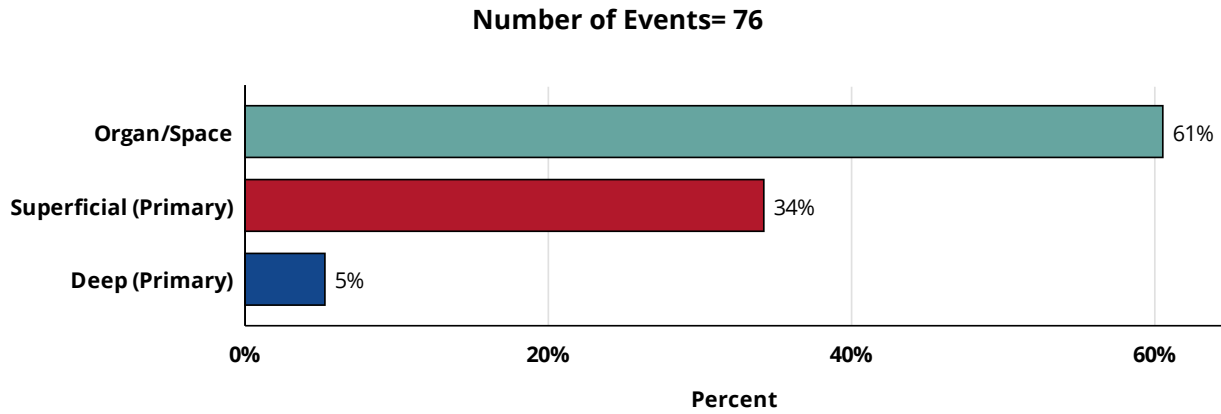
Data reported as of May 18, 2022

No. = number of facilities reporting

Red highlighting indicates SIR for reporting period is significantly higher than 2015 national SIR of 1.0

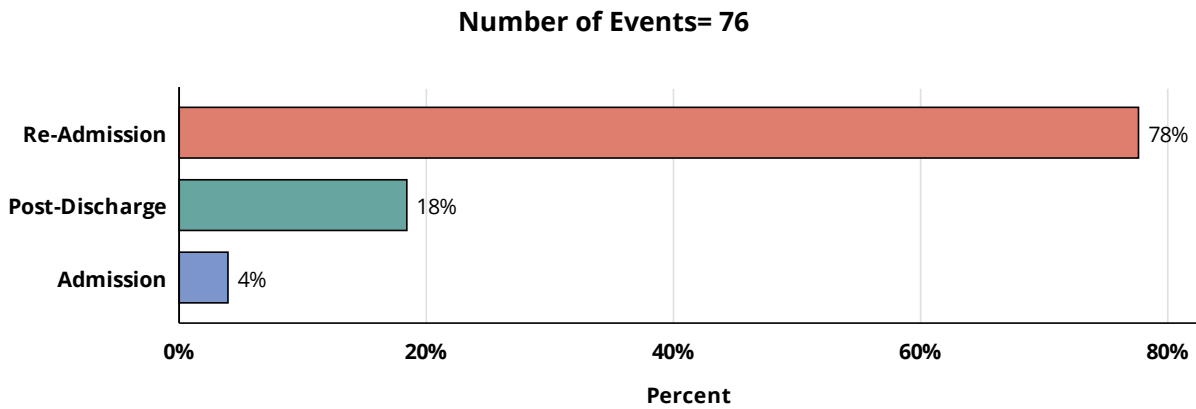
Green highlighting indicates SIR for reporting period is significantly lower than 2015 national SIR of 1.0

**Figure 41: Abdominal Hysterectomy (HYST) Surgical Site Infections by Site, Tennessee, 01/01/2021-12/31/2021**



*Data Reported as of May 18, 2022*

**Figure 42: Abdominal Hysterectomy (HYST) Surgical Site Infections Detection, Tennessee, 01/01/2021-12/31/2021**

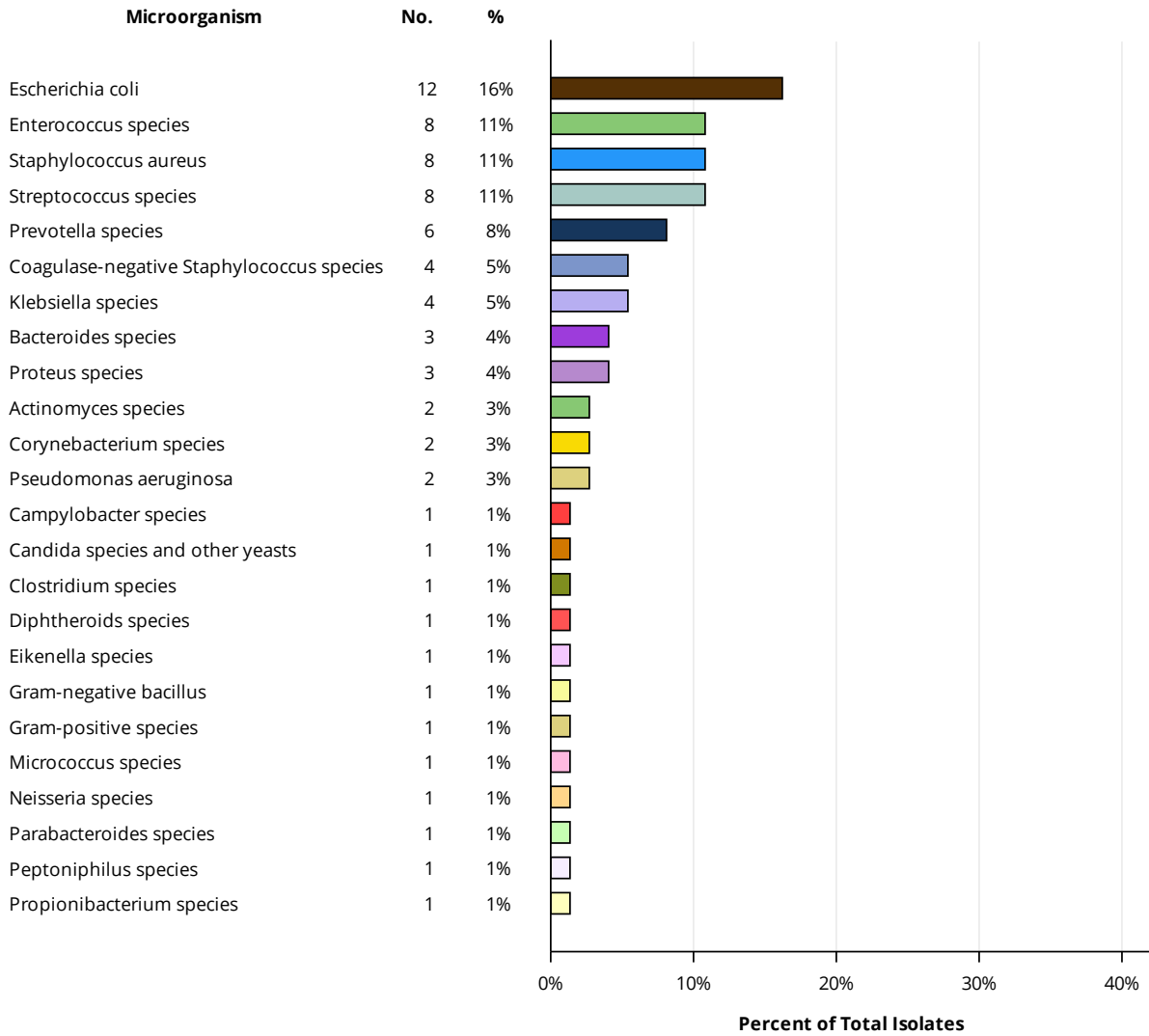


*Data Reported as of May 18, 2022*



**Figure 43: Microorganisms Identified from Surgical Site Infections (SSI) following Abdominal Hysterectomy (HYST) Procedures, Tennessee, 01/01/2021 - 12/31/2021**

**Number of isolates=74; Number of events=76**



Data reported as of May 18, 2022

**Table 27: Resistant Microorganisms Identified in Surgical Site Infections (SSI) following Abdominal Hysterectomy (HYST) Procedures, Tennessee, 01/01/2021 - 12/31/2021**

| State     | Year | Microorganism          | Number of Isolates |           | Percentage of Resistant Isolates |  |
|-----------|------|------------------------|--------------------|-----------|----------------------------------|--|
|           |      |                        | Total              | Resistant | By Microorganism                 | By Total Number of Procedure-specific Isolates |
| Tennessee | 2021 | Escherichia coli       | 12                 | 0         | 0%*                              | 0%*  |
|           |      | Enterococcus species   | 8                  | 0         | 0%**                             | 0%**   |
|           |      | Staphylococcus aureus  | 8                  | 6         | 75%***                           | 8.11%***                                       |
|           |      | Klebsiella species     | 4                  | 0         | 0%*                              | 0%*  |
|           |      | Pseudomonas aeruginosa | 2                  | 1         | 50%*                             | 1.35%*   |

Data reported as of May 18, 2022

\* = Carbapenem-resistant

\*\* = Vancomycin-resistant

\*\*\* = Methicillin-resistant

**Methicillin-Resistant *Staphylococcus aureus*  
(MRSA) Bacteremia Laboratory-Identified Event**

## ***Methicillin-Resistant Staphylococcus aureus (MRSA) Bacteremia***

Methicillin-Resistant *Staphylococcus aureus* (MRSA) is a type of *Staphylococcus* bacteria that is resistant to many antibiotics. MRSA can be spread via contaminated surfaces or equipment and on the hands of healthcare personnel. When MRSA enters the bloodstream, also known as MRSA bacteremia, it can cause severe and life-threatening bloodstream infections. Healthcare facilities can prevent MRSA infections by following infection prevention recommendations, including hand hygiene, environmental cleaning, and contact precautions to prevent the spread of MRSA in healthcare settings.<sup>19</sup>

### **Reporting Requirements**

Tennessee acute care hospitals (ACHs) have been required to report MRSA bacteremia LabID events to TDH since July 2010. This reporting for ACHs is split into two components: facility-wide inpatient locations and 24-hour observations with emergency departments). Long-term acute care (LTAC) hospitals have been required to report MRSA LabID events in the facility-wide inpatient locations since July 2010 as well. Inpatient rehabilitation facilities (IRFs) have been required to report MRSA LabID events in the facility-wide inpatient locations since 2015.

To comply with these reporting requirements, facilities are required to follow the NHSN Multidrug Resistant Organism & *Clostridioides difficile* Infection LabID Event Surveillance protocol,<sup>20</sup> which is updated yearly with MRSA LabID event surveillance definitions and reporting instructions. Facilities must report the total number of admissions and patient days (for all facility-wide inpatient locations), or patient encounters (for Emergency Department and/or 24-hour Observation locations) to NHSN monthly. They are also required to report any positive MRSA blood cultures which meet the NHSN surveillance definition of a MRSA bacteremia LabID event.

### **Surveillance Definitions & Changes**

NHSN defines a MRSA LabID event as a blood specimen obtained for clinical decision making, that tests positive for MRSA and is not a Duplicate multidrug resistant organism (MDRO) isolate. A duplicate isolate is any MDRO blood isolate from the same patient and location, following a previous MDRO blood isolate within 14 days across calendar months & readmission to the same location.

For 2021, NHSN updated some aspects of the Surveillance protocol related to organism definitions, clarifications of unit inclusion for facility reporting, and an antibiotic removal. There were no major updates to the MRSA LabID event surveillance.

---

<sup>19</sup> Patient Guide on MRSA ([https://www.cdc.gov/mrsa/pdf/SHEA-mrsa\\_tagged.pdf](https://www.cdc.gov/mrsa/pdf/SHEA-mrsa_tagged.pdf))

<sup>20</sup> NHSN Multidrug Resistant Organism & *Clostridioides difficile* Infection LabID Event Surveillance protocol ([https://www.cdc.gov/nhsn/PDFs/pscManual/12pscMDRO\\_CDADcurrent.pdf](https://www.cdc.gov/nhsn/PDFs/pscManual/12pscMDRO_CDADcurrent.pdf))

## Facility-Specific Data Thresholds

To ensure fair and accurate reporting of facility-specific healthcare facility-onset MRSA bacteremia LabID events standardized infection ratios (SIR), TDH has adopted the NHSN minimum threshold for reporting. To report a facility-specific SIR, the statistically predicted number of infections must be at least 1.0.

## MRSA LabID Risk Adjustment

We use the SIR as a summary measure to compare MRSA LabID event data for facilities in TN to the national benchmark from a baseline period.<sup>21</sup> CDC uses HAI data collected nationally in 2015 to create the SIR baselines, which includes updates to both the source of aggregate data and the risk adjustment methodology used to calculate the number of predicted events. Before 2015, the period used to establish the baseline, or reference points, varied amongst the different HAI types. Thus, in TN HAI reports before 2015, the number of predicted infections was estimated based on a baseline that was created using data prior to 2015. The data in this report, therefore, are not comparable to pre-2015 HAI reports, as they are based on different baselines.

Risk adjustment for healthcare facility-onset (HO) Methicillin-Resistant *Staphylococcus aureus* (MRSA) bacteremia is calculated by dividing the total number of MRSA LabID events (the observed events) by the predicted\* number of MRSA LabID events (expected events). This predicted number, which can also be understood as a projection, is calculated using negative binomial regression based on facility-level characteristics, including MRSA community-onset prevalence rate, average length of stay, medical school affiliation, facility type, ICU bed size, and outpatient community-onset prevalence rate. The negative binomial regression model is based on national NHSN data from 2015. Note that IRFs and LTACs utilize an intercept only model for MRSA risk adjustment. Additional details can be found in the [NHSN Guide to the SIR](#).<sup>22</sup>

---

<sup>21</sup> NHSN Guide to SIR (<https://www.cdc.gov/nhsn/pdfs/ps-analysis-resources/nhsn-sir-guide.pdf>)

\* "Predicted" is used throughout the report as a synonym for the standard statistical term "expected."

<sup>22</sup> <https://www.cdc.gov/nhsn/pdfs/ps-analysis-resources/nhsn-sir-guide.pdf>

## MRSA in Acute Care Hospitals (ACHs):

**Total number of facilities reporting from January-December 2021: 100**

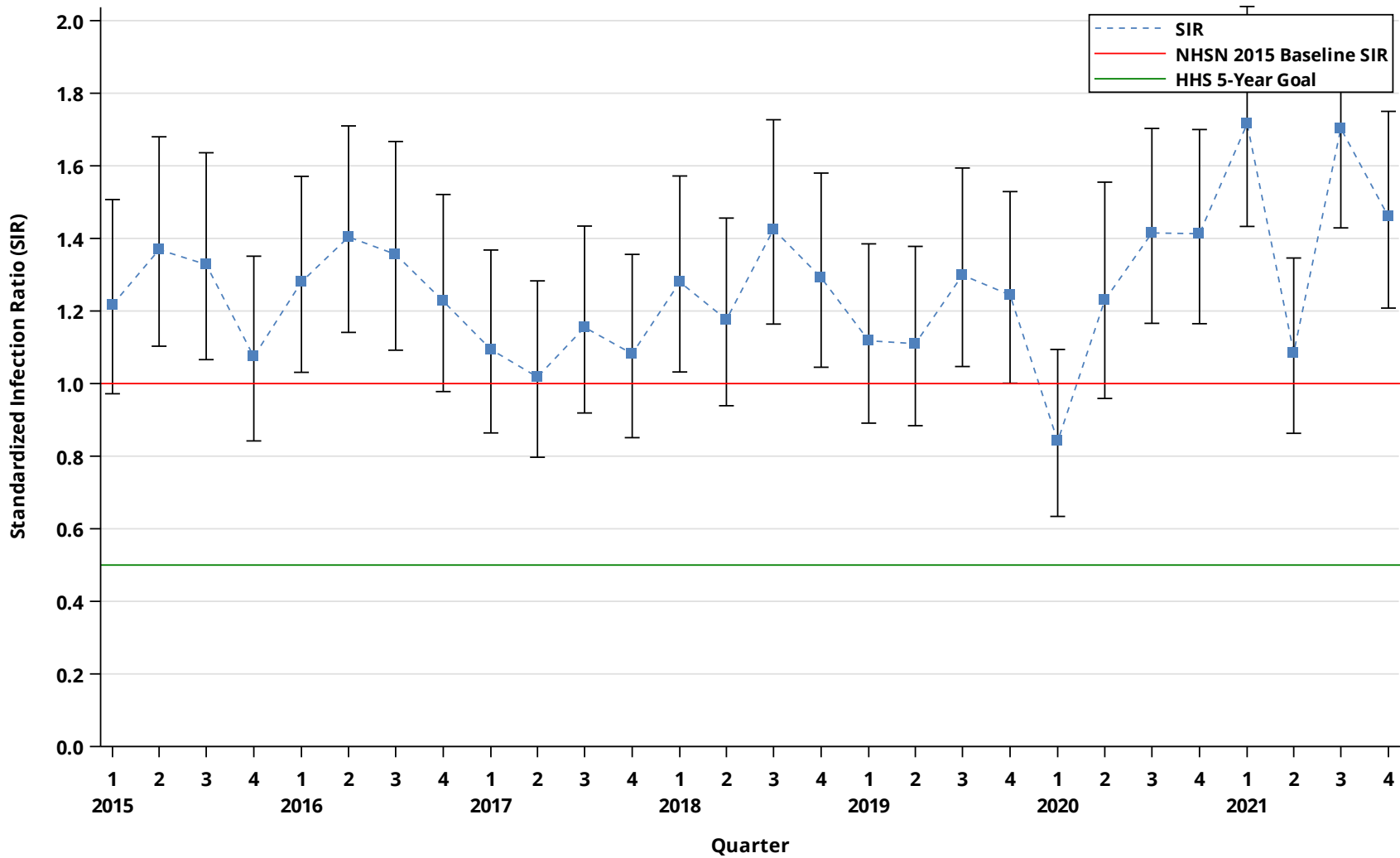
### **SIRs by Quarter ([Figure 45](#))**

- In 2021, the healthcare-onset MRSA LabID SIR for acute care hospitals increased overall from the previous year, though not linearly. Q1 and Q3 saw the highest SIRs at 1.72 and 1.70 respectively, with Q2 and Q4 having SIRs of 1.1 and 1.46, respectively. This continues the trend of increasing SIRs for ACHs since Q1 of 2020, with 5/8 quarters showing significantly higher SIRs than the national baseline. Only Q2 of 2021 had an SIR not significantly different than the national baseline, though still well above the HHS prevention target. Every quarterly SIR since 2015 has been significantly higher than the HHS prevention target of an SIR=0.5.

### **State and Facility SIRs ([Table 28](#), [Figure 46](#))**

- The overall SIR for 2021 was 1.49 (95% CI: 1.36, 1.64) which was significantly higher than the HHS target and national SIR. Of the 100 facilities reporting, 49 had at least 1 predicted infection, giving those facilities individual SIRs. Only 2.04% (1/49) of facilities had an SIR that was significantly lower than the national baseline, while 20.41% (10/49) of facilities had SIRs that were significantly higher than the national baseline. 77.55% (38/49) facilities had SIRs that were not significantly different from the national SIR.

**Figure 44: Standardized Infection Ratio (SIR) for Healthcare-Onset Methicillin-resistant Staphylococcus aureus (MRSA) Bacteremia Laboratory-Identified (LabID) Events for Acute Care Hospitals by Quarter, Tennessee, 01/01/2015–12/31/2021 [Reference standard: National Healthcare Safety Network (NHSN), 2015]**



Data Reported as of May 18, 2022

**Table 28: Healthcare-Onset Methicillin-resistant Staphylococcus aureus (MRSA) Laboratory-Identified (LabID) Events Standardized Infection Ratio (SIR) in Acute Care Hospitals by Reporting Year, Tennessee, 01/01/2015 - 12/31/2021**

| STATE     | YEAR | No. | PATIENT DAYS | No. of INFECTIONS |           | SIR AND 95% CONFIDENCE INTERVAL |             |             |
|-----------|------|-----|--------------|-------------------|-----------|---------------------------------|-------------|-------------|
|           |      |     |              | OBSERVED          | PREDICTED | SIR                             | LOWER LIMIT | UPPER LIMIT |
| Tennessee | 2021 | 100 | 4,053,591    | 444               | 297.20    | 1.49                            | 1.36        | 1.64        |
|           | 2020 | 100 | 3,586,788    | 333               | 267.52    | 1.25                            | 1.12        | 1.38        |
|           | 2019 | 102 | 3,945,208    | 330               | 277.04    | 1.19                            | 1.07        | 1.33        |
|           | 2018 | 107 | 3,864,519    | 356               | 275.11    | 1.29                            | 1.17        | 1.43        |
|           | 2017 | 106 | 3,925,819    | 290               | 266.66    | 1.09                            | 0.97        | 1.22        |
|           | 2016 | 106 | 3,872,388    | 346               | 262.73    | 1.32                            | 1.18        | 1.46        |
|           | 2015 | 105 | 3,888,821    | 320               | 256.79    | 1.25                            | 1.12        | 1.39        |

Data reported as of May 18, 2022

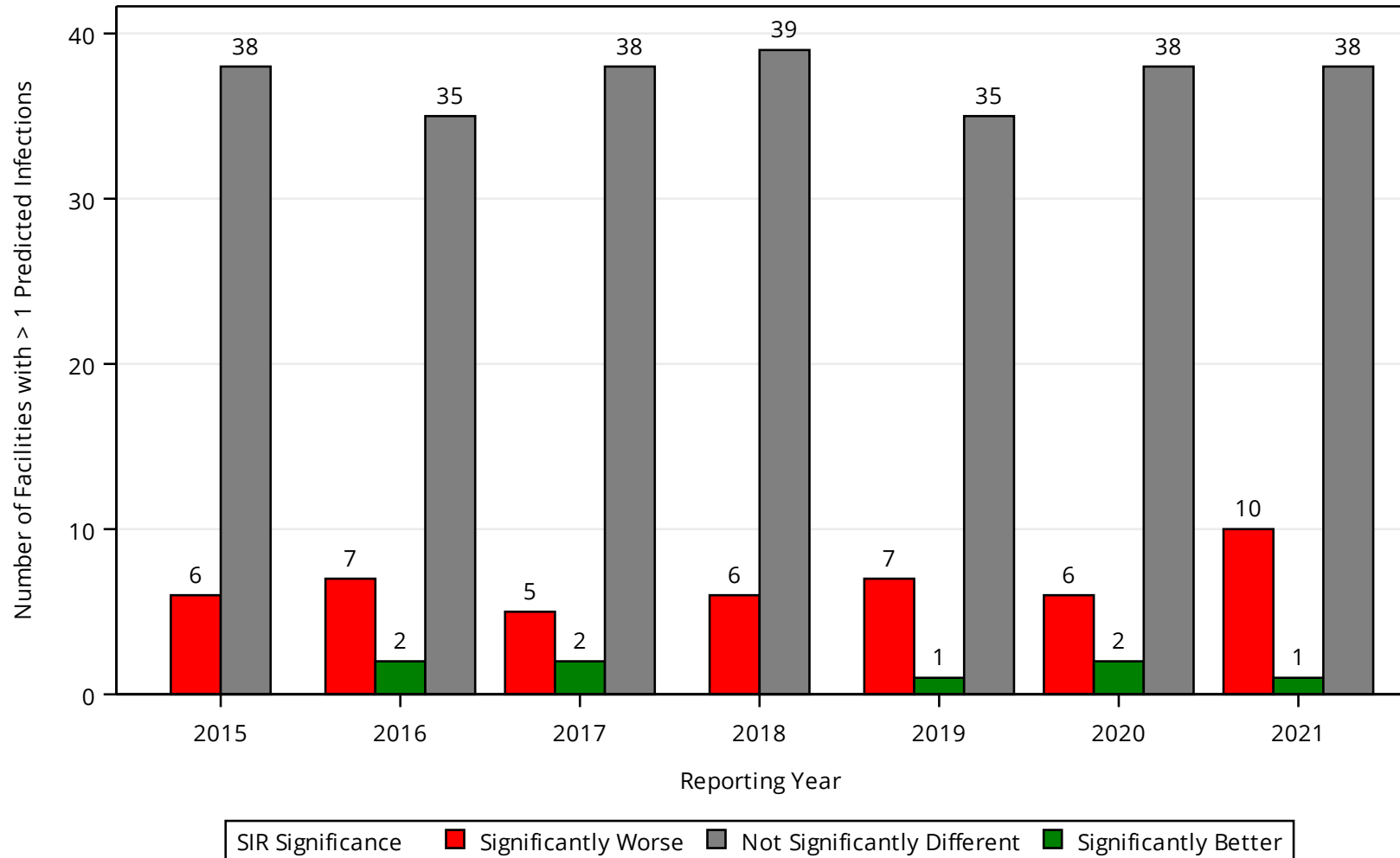
No. = number of facilities reporting

Red highlighting indicates SIR for reporting period is significantly higher than national 2015 SIR of 1.0

Green highlighting indicates SIR for reporting period is significantly lower than national 2015 SIR of 1.0



**Figure 45: Number of Facilities with more than 1 predicted Healthcare-Onset Methicillin-resistant Staphylococcus Aureus (MRSA) Laboratory-Identified (LabID) EVENT IN Acute Care Hospitals (ACH) by reporting year, Tennessee, 2015-2021**



Data reported as of May 18, 2022

## MRSA in Inpatient Rehabilitation Facilities (IRFs):

**Total number of facilities reporting from January – December 2021: 27**

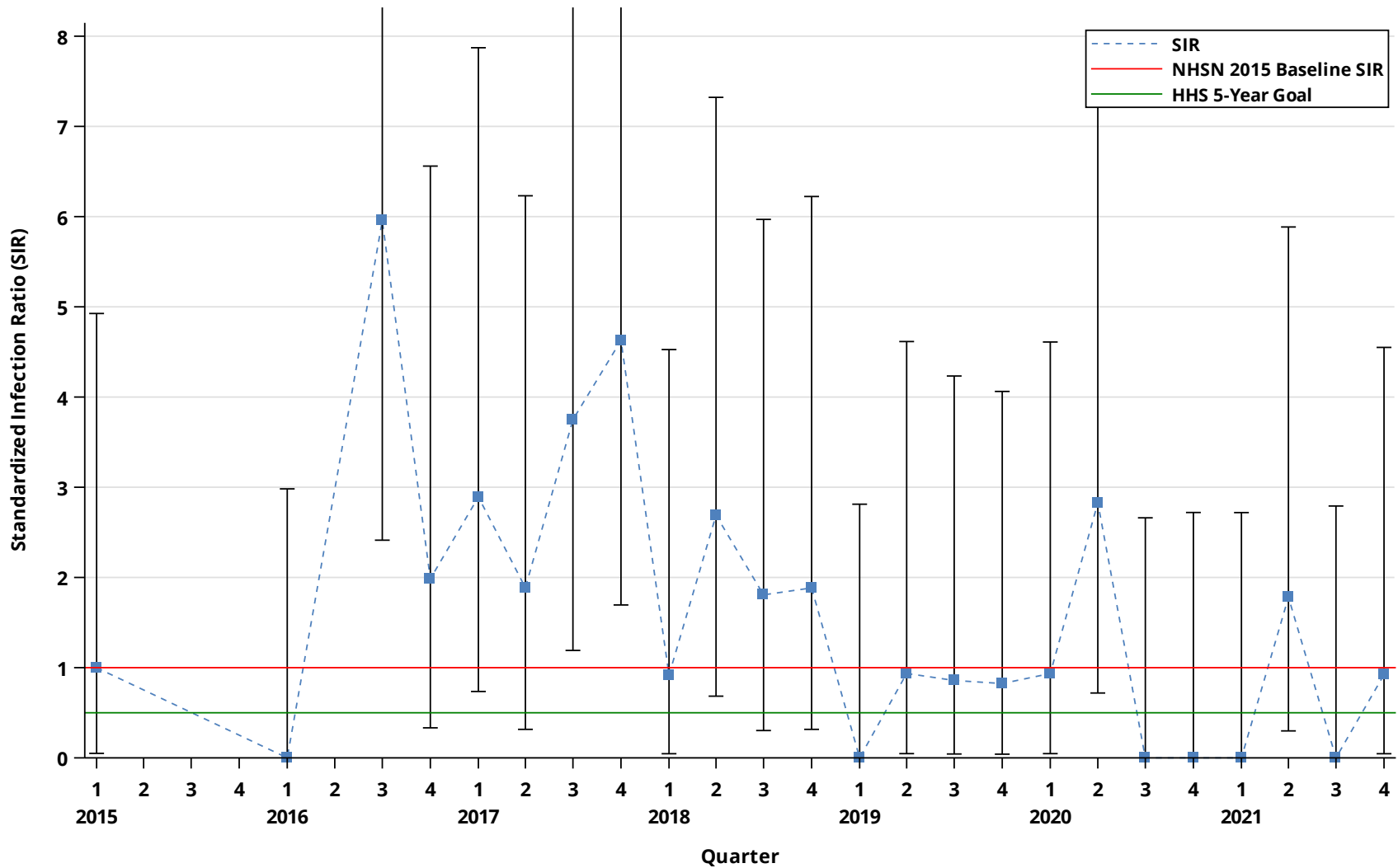
**SIRs by Quarter ([Figure 47](#))**

- In 2021, the healthcare-onset MRSA LabID SIR for inpatient rehabilitation fluctuated from 0 – 1.78, peaking in Q2. This continues a trend since 2018 of SIR values showing increases in Q2 followed by declines or plateaus. Notably, all values have wide confidence intervals that well overlap each other, indicating that these changes are likely not statistically significantly different from one another, nor from the national baseline of 1.0. Overall, quarterly SIRs were split evenly on their success with meeting the HHS prevention benchmark.

**State and Facility SIRs ([Table 29](#))**

- The overall SIR for 2021 was 0.69 (95% CI: 0.17, 1.86) which was not significantly different than the national SIR. Of the 27 facilities reporting, none had more than 1 predicted infection, and thus did not have facility-specific SIRs.

**Figure 46: Standardized Infection Ratio (SIR) for Healthcare-Onset Methicillin-resistant Staphylococcus aureus (MRSA) Bacteremia Laboratory-Identified (LabID) Events for Inpatient Rehabilitation Facilities (IRF) by Quarter, Tennessee, 01/01/2015–12/31/2021 [Reference standard: National Healthcare Safety Network (NHSN), 2015]**



Data Reported as of May 18, 2022

**Table 29: Healthcare-Onset Methicillin-resistant Staphylococcus aureus (MRSA) Laboratory-Identified (LabID)Events Standardized Infection Ratio (SIR) in Inpatient Rehabilitation Facilities (IRF) by Reporting Year, Tennessee, 01/01/2015 - 12/31/2021**

| STATE     | YEAR | No. | PATIENT DAYS | No. of INFECTIONS |           | SIR AND 95% CONFIDENCE INTERVAL |             |             |
|-----------|------|-----|--------------|-------------------|-----------|---------------------------------|-------------|-------------|
|           |      |     |              | OBSERVED          | PREDICTED | SIR                             | LOWER LIMIT | UPPER LIMIT |
| Tennessee | 2021 | 27  | 230,434      | 3                 | 4.38      | 0.69                            | 0.17        | 1.86        |
|           | 2020 | 27  | 229,182      | 4                 | 4.36      | 0.92                            | 0.29        | 2.21        |
|           | 2019 | 27  | 237,353      | 3                 | 4.51      | 0.67                            | 0.17        | 1.81        |
|           | 2018 | 29  | 230,014      | 8                 | 4.37      | 1.83                            | 0.85        | 3.47        |
|           | 2017 | 29  | 223,264      | 14                | 4.25      | 3.30                            | 1.88        | 5.40        |
|           | 2016 | 29  | 210,596      | 8                 | 4.00      | 2.00                            | 0.93        | 3.79        |
|           | 2015 | 29  | 205,183      | 8                 | 3.90      | 2.05                            | 0.95        | 3.89        |

Data reported as of May 18, 2022

No. = number of facilities reporting

Red highlighting indicates SIR for reporting period is significantly higher than national 2015 SIR of 1.0

Green highlighting indicates SIR for reporting period is significantly lower than national 2015 SIR of 1.0

## MRSA in Long-term Acute Care (LTAC) Hospitals:

**Total number of facilities reporting from January – December 2021: 8**

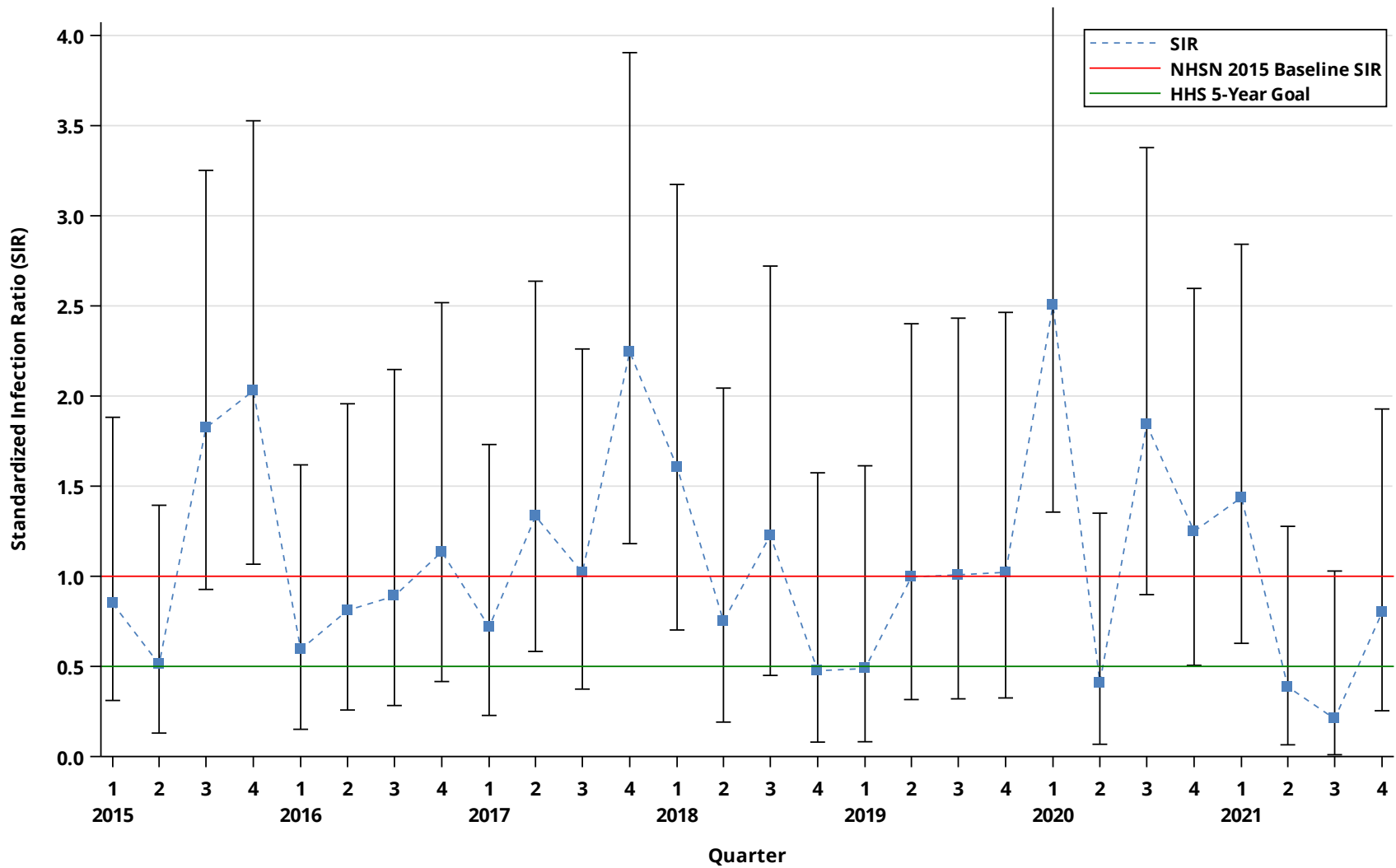
### **SIRs by Quarter ([Figure 48](#))**

- For 2021, the healthcare-onset MRSA LabID SIR for long-term acute care facilities declined from 1.44 in Q1 to 0.80 by Q4, with the lowest values in Q2 and Q3 of 0.39 and 0.21, respectively. Q2 and Q3 fell below the HHS prevention benchmark though not significantly, while Q1 and Q4 failed to meet the benchmark. No quarterly SIR for 2021 was statistically significantly different than the national baseline of 1.0.

### **State and Facility SIRs ([Table 30](#))**

- The overall state SIR for long-term acute care facilities in 2021 was 0.71 (95% CI: 0.40, 1.16), not significantly different than the national SIR. Out of the eight reporting facilities, none had SIRs with values significantly different than the national SIR of 1

**Figure 47: Standardized Infection Ratio (SIR) for Healthcare-Onset Methicillin-resistant Staphylococcus aureus (MRSA) Bacteremia Laboratory-Identified (LabID) Events for Long-term Acute Care (LTAC) Facilities by Quarter, Tennessee, 01/01/2015–12/31/2021**



Data Reported as of May 18, 2022

**Table 30: Healthcare-Onset Methicillin-resistant Staphylococcus aureus (MRSA) Laboratory-Identified (LabID) Events Standardized Infection Ratio (SIR) in Long-term Acute Care (LTAC) Facilities by Reporting Year, Tennessee, 01/01/2015 - 12/31/2021**

| STATE     | YEAR | No. | PATIENT DAYS | No. of INFECTIONS |           | SIR AND 95% CONFIDENCE INTERVAL |             |             |
|-----------|------|-----|--------------|-------------------|-----------|---------------------------------|-------------|-------------|
|           |      |     |              | OBSERVED          | PREDICTED | SIR                             | LOWER LIMIT | UPPER LIMIT |
| Tennessee | 2021 | 8   | 89,370       | 14                | 19.84     | 0.71                            | 0.40        | 1.16        |
|           | 2020 | 9   | 94,989       | 29                | 19.38     | 1.50                            | 1.02        | 2.12        |
|           | 2019 | 8   | 91,068       | 14                | 16.00     | 0.88                            | 0.50        | 1.43        |
|           | 2018 | 9   | 92,696       | 17                | 16.63     | 1.02                            | 0.62        | 1.60        |
|           | 2017 | 9   | 95,741       | 27                | 20.62     | 1.31                            | 0.88        | 1.88        |
|           | 2016 | 10  | 103,518      | 16                | 18.87     | 0.85                            | 0.50        | 1.35        |
|           | 2015 | 10  | 111,861      | 29                | 22.65     | 1.28                            | 0.87        | 1.82        |

Data reported as of May 18, 2022

No. = number of facilities reporting

Red highlighting indicates SIR for reporting period is significantly higher than national 2015 SIR of 1.0

Green highlighting indicates SIR for reporting period is significantly lower than national 2015 SIR of 1.0

*Clostridioides difficile* Infection (CDI)  
Laboratory-Identified Events



## ***Clostridioides difficile* Infection (CDI) Laboratory-Identified (LabID) Events**

*Clostridioides difficile* (*C. difficile*) is a bacterium that naturally resides in the bowels of some people without symptoms of infection. *C. difficile* is responsible for a spectrum of *C. difficile* infections (CDI), including gastrointestinal illness which can lead to severe complications including sepsis and death. CDI can occur when *C. difficile* spores are transferred to patients via the hands of healthcare personnel or other contaminated surfaces or items. Healthcare facilities can prevent CDI by using antibiotics wisely and following infection prevention recommendations, including hand hygiene, environmental cleaning, and contact precautions to prevent the spread of *C. difficile* in the healthcare setting.

### **Reporting Requirements**

Tennessee acute care hospitals (ACHs) have been required to report CDI LabID events to TDH since July 2010. This reporting for ACHs is split into two components: facility-wide inpatient locations and 24-hour observations with emergency departments). Long-term acute care (LTAC) hospitals have been required to report MRSA LabID events in the facility-wide inpatient locations since July 2010 as well. Inpatient rehabilitation facilities (IRFs) have been required to report MRSA LabID events in the facility-wide inpatient locations since 2015.

To comply with these reporting requirements, facilities are required to follow the [NHSN Multidrug-Resistant Organism & \*Clostridioides difficile\* Infection LabID Event Surveillance protocol](#)<sup>23</sup>, which is updated yearly with CDI LabID event surveillance definitions and reporting instructions. Facilities must report the total number of admissions and patient days (for all facility-wide inpatient locations), or patient encounters (for Emergency Department and/or 24-hour Observation locations) to NHSN monthly. They are also required to report any positive MRSA blood cultures which meet the NHSN surveillance definition of a MRSA bacteremia LabID event.

### **Surveillance Definitions & Changes**

NHSN defines a CDI LabID event as a specimen obtained for clinical decision making, that tests positive for CDI and is not a Duplicate multidrug resistant organism (MDRO) isolate. A duplicate isolate is any MDRO isolate that is not the first in the calendar month, per patient, per location, for CDIs. The only exception to this rule is for organisms isolated from unique blood sources. A MDRO isolate from blood in a patient with no prior positive blood cultures for the same MDRO, in the same location, in ≤ 14 days is considered a unique blood source.

---

<sup>23</sup> [https://www.cdc.gov/nhsn/PDFs/pscManual/12pscMDRO\\_CDADcurrent.pdf](https://www.cdc.gov/nhsn/PDFs/pscManual/12pscMDRO_CDADcurrent.pdf)

For 2021, NHSN updated some aspects of the Surveillance protocol related to organism definitions, clarifications of unit inclusion for facility reporting, and an antibiotic removal. There were no major updates to the CDI LabID event surveillance.

## Facility-Specific Data Thresholds

To ensure fair and accurate reporting of facility-specific healthcare facility-onset CDI LabID events standardized infection ratios (SIR), TDH has adopted the NHSN minimum thresholds for reporting. To report a facility-specific SIR, the statistically predicted number of infections must be at least 1.0.

## MRSA LabID Risk Adjustment

We use the SIR as a summary measure to compare MRSA LabID event data for facilities in TN to the national benchmark from a baseline period. CDC uses HAI data collected nationally in 2015 to create the SIR baselines, which includes updates to both the source of aggregate data and the risk adjustment methodology used to calculate the number of predicted events. Before 2015, the period used to establish the baseline, or reference points, varied amongst the different HAI types. Thus, in TN HAI reports before 2015, the number of predicted infections was estimated based on a baseline that was created using data prior to 2015. The data in this report, therefore, are not comparable to pre-2015 HAI reports, as they are based on different baselines.

Risk adjustment for healthcare facility-onset (HO) *C. difficile* is calculated by dividing the total number of CDI LabID events (the observed events) by the predicted\* number of CDI LabID events (expected events). This predicted number, which can also be understood as a projection, is calculated using negative binomial regression based on facility-level characteristics, including inpatient community-onset prevalence rate, CDI test type, medical school affiliation, facility type, ICU bed size, and outpatient reporting. The negative binomial regression model is based on national NHSN data from 2015. Note that IRFs and LTACs utilize an intercept only model for MRSA risk adjustment. Additional details can be found in the [NHSN Guide to the SIR](#).<sup>24</sup> Standardized infection ratios (SIRs) are displayed for LabID events in acute care hospitals beginning January 2015.

---

\* "Predicted" is used throughout the report as a synonym for the standard statistical term "expected."

<sup>24</sup> <https://www.cdc.gov/nhsn/pdfs/ps-analysis-resources/nhsn-sir-guide.pdf>

## CDI LabID Events in Acute Care Hospitals (ACHs):

**Total number of facilities reporting from January-December 2021: 100**

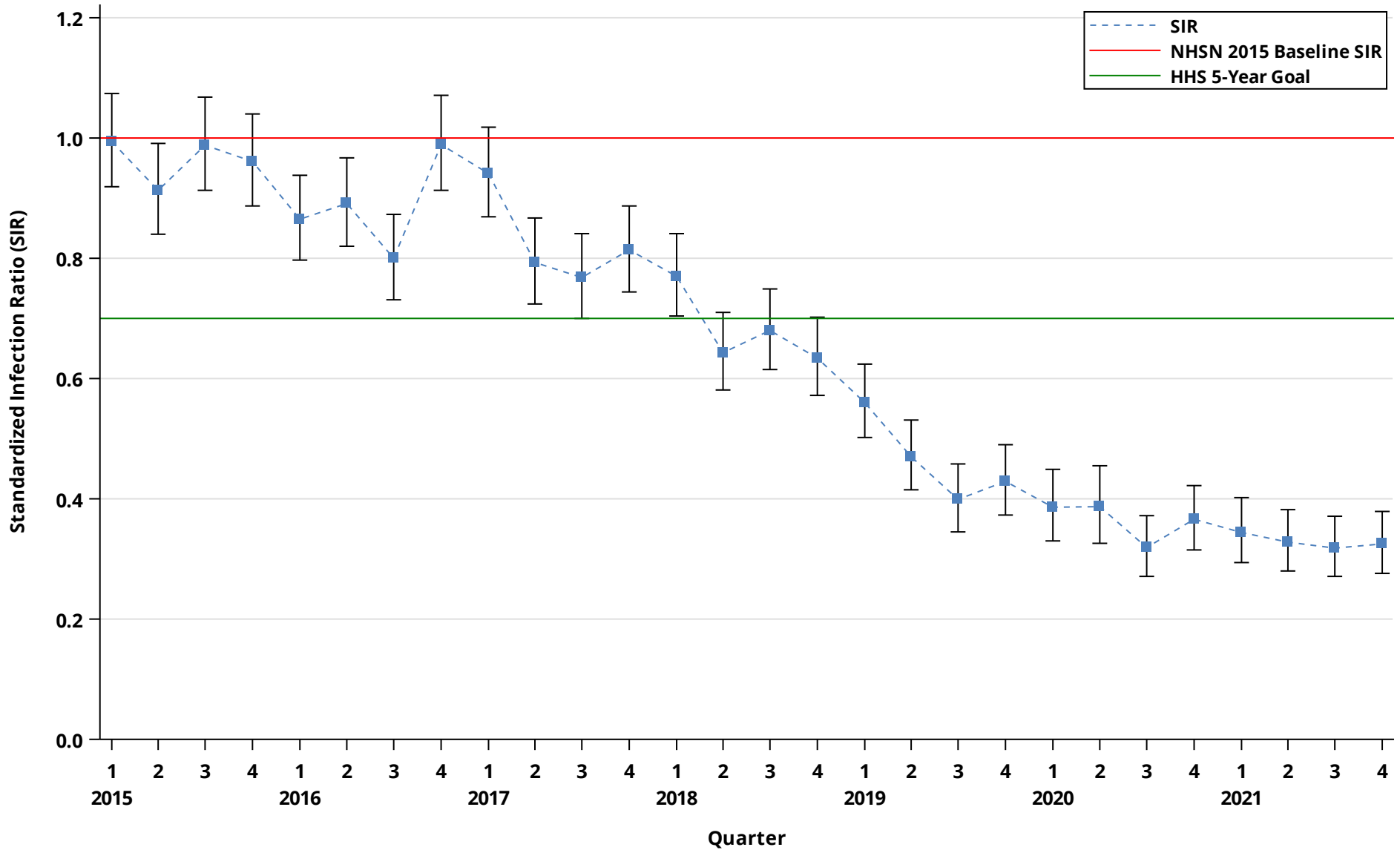
### **SIRs by Quarter ([Figure 49](#))**

- The healthcare-facility onset CDI LabID SIR for acute care hospitals remained relatively steady throughout 2021, showing a gradual, shallow decline from 0.34 in Q1 to 0.33 in Q4. The SIRs for each quarter of 2021 were significantly below both the national average and the U.S. Department of Health and Human Services' (HHS) prevention target of SIR=0.7. This decline continues a pattern from Q4 of 2016, with SIRs falling significantly below the national baseline (1.0) in Q1 of 2017 and again below the prevention target in Q1 of 2019.

### **State and Facility SIRs ([Table 31](#), [Figure 50](#))**

- The overall SIR for acute care hospitals in 2021 was 0.33 (95% CI: 0.30, 0.36) which was statistically significantly lower than both the national baseline, and the HHS target SIR. Of the 100 facilities reporting during 2021, 81 had at least 1 predicted infection, and thus had a facility-specific SIR. Since 2019, most facilities with facility-specific SIRs have had SIRs significantly better than national baseline. 64.20% (52/81) of those facility-specific SIRs were significantly lower than the national SIR, with only 1.23% (1/81) of facility-specific SIRs were significantly higher. The remaining 34.57% (28/81) of facilities had SIRs that were not significantly different from the national SIR.

Figure 48: Standardized Infection Ratio (SIR) for Healthcare-Onset *C. difficile* Infection (CDI) Laboratory-Identified (LabID) Events for Acute Care Hospitals by Quarter, Tennessee, 01/01/2015–12/31/2021 [Reference standard: National Healthcare Safety Network (NHSN), 2015]



Data Reported as of May 18, 2022

**Table 31: Healthcare-Onset C. difficile Infection (CDI) Laboratory-Identified (LabID) Events Standardized Infection Ratio (SIR) in Acute Care Hospitals by Reporting Year, Tennessee, 01/01/2015 - 12/31/2021**

| STATE     | YEAR | No. | PATIENT DAYS | No. of INFECTIONS |           | SIR AND 95% CONFIDENCE INTERVAL |             |             |
|-----------|------|-----|--------------|-------------------|-----------|---------------------------------|-------------|-------------|
|           |      |     |              | OBSERVED          | PREDICTED | SIR                             | LOWER LIMIT | UPPER LIMIT |
| Tennessee | 2021 | 100 | 3,706,960    | 622               | 1,893.09  | 0.33                            | 0.30        | 0.36        |
|           | 2020 | 100 | 3,285,666    | 637               | 1,759.70  | 0.36                            | 0.34        | 0.39        |
|           | 2019 | 102 | 3,609,751    | 975               | 2,078.01  | 0.47                            | 0.44        | 0.50        |
|           | 2018 | 106 | 3,508,689    | 1,625             | 2,377.86  | 0.68                            | 0.65        | 0.72        |
|           | 2017 | 105 | 3,560,671    | 2,050             | 2,466.22  | 0.83                            | 0.80        | 0.87        |
|           | 2016 | 105 | 3,500,718    | 2,245             | 2,535.00  | 0.89                            | 0.85        | 0.92        |
|           | 2015 | 105 | 3,510,281    | 2,431             | 2,520.44  | 0.97                            | 0.93        | 1.00        |

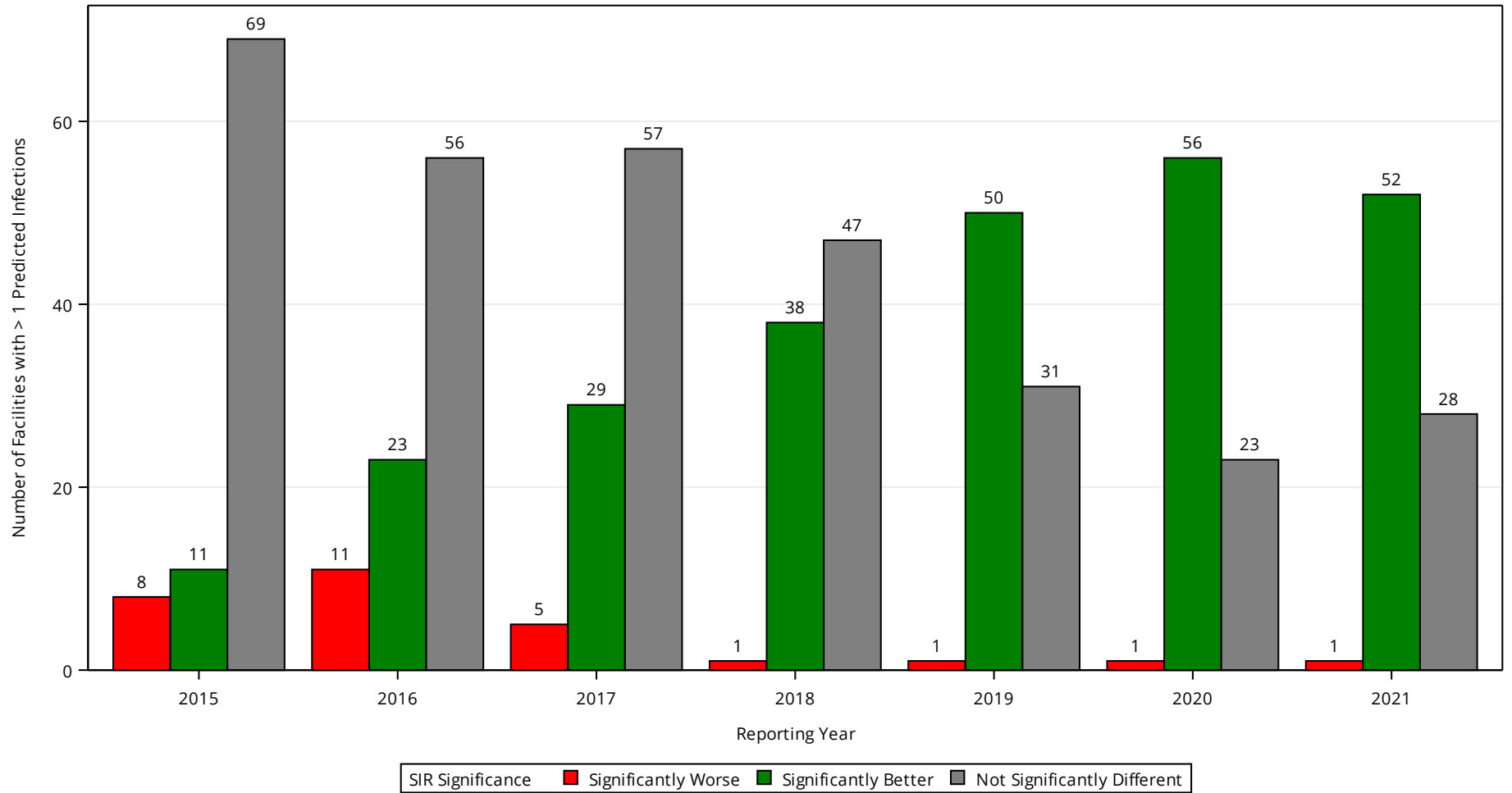
Data reported as of May 18, 2022

No. = number of facilities reporting

Red highlighting indicates SIR for reporting period is significantly higher than national 2015 SIR of 1.0

Green highlighting indicates SIR for reporting period is significantly lower than national 2015 SIR of 1.0

**Figure 49: Number of Facilities with more than 1 predicted Healthcare-Onset C. difficile Infection (CDI) Laboratory-Identified (LabID) Event in Acute Care Hospitals (ACHs) by Reporting Year, Tennessee, 2015-2021**



Data reported as of May 18, 2022

## CDI in Long Term Acute Care (LTAC) Hospitals:

**Total number of facilities reporting from January – December 2021: 9**

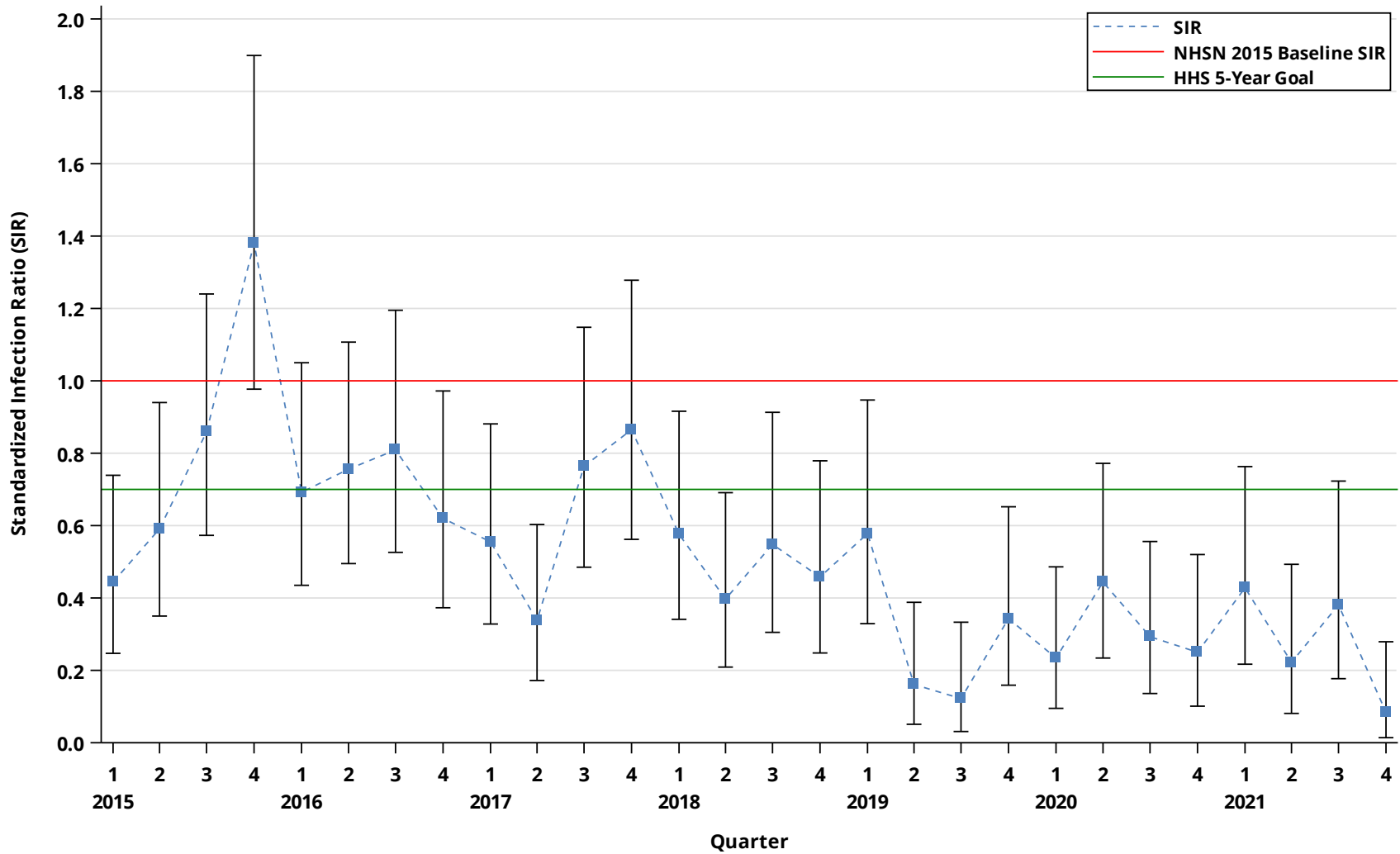
### **SIRs by Quarter ([Figure 51](#))**

- For 2021, the healthcare facility-onset CDI LabID SIR for long-term acute care facilities remained relatively stable from Q1 to Q3, with values ranging from 0.43 – 0.22, before declining to 0.08 in Q4. All quarterly SIRs remained below the HHS prevention target of SIR=0.70, though only Q2 and Q4 saw SIRs that were significantly lower than the prevention target. Quarterly SIRs for LTACs have remained below the national baseline consistently since Q1 of 2018 and intermittently since then, have also dipped significantly below the HHS prevention target.

### **State and Facility SIRs ([Table 32](#), [Figure 52](#))**

- The overall state SIR for long-term acute care facilities in 2021 was 0.28 (95% CI: 0.18, 0.40), significantly lower than the national SIR and HHS prevention target. Eight of the nine reporting facilities had at least 1 predicted infection. 75% (6/8) of those facilities with individual SIRs had values significantly lower than 1.0, while 25% (2/8) had values not significantly different than 1.0. Since 2018, more facilities have had statistically better SIRs than those facilities with SIRs not statistically different than the national baseline. No facilities have had statistically worse SIRs since the establishment of the national baseline in 2015.

**Figure 50: Standardized Infection Ratio (SIR) for Healthcare-Onset *C. difficile* Infection (CDI) Laboratory-Identified (LabID) Events for Long-Term Acute Care (LTAC) Facilities by Quarter, Tennessee, 01/01/2015–12/31/2021 [Reference standard: National Healthcare Safety Network (NHSN), 2015]**



Data Reported as of May 18, 2022



**Table 32: Healthcare-Onset C. difficile Infection (CDI) Laboratory-Identified (LabID) Events Standardized Infection Ratio (SIR) in Long-Term Acute Care (LTAC) Facilities by Reporting Year, Tennessee, 01/01/2015 - 12/31/2021**

|           |      |     |              | No. of INFECTIONS |           | SIR AND 95% CONFIDENCE INTERVAL |             |             |
|-----------|------|-----|--------------|-------------------|-----------|---------------------------------|-------------|-------------|
| STATE     | YEAR | No. | PATIENT DAYS | OBSERVED          | PREDICTED | SIR                             | LOWER LIMIT | UPPER LIMIT |
| Tennessee | 2021 | 9   | 89,370       | 25                | 90.55     | 0.28                            | 0.18        | 0.40        |
|           | 2020 | 9   | 94,989       | 31                | 101.75    | 0.31                            | 0.21        | 0.43        |
|           | 2019 | 9   | 91,787       | 29                | 96.93     | 0.30                            | 0.20        | 0.42        |
|           | 2018 | 9   | 92,696       | 52                | 105.37    | 0.49                            | 0.37        | 0.64        |
|           | 2017 | 9   | 95,741       | 70                | 112.49    | 0.62                            | 0.49        | 0.78        |
|           | 2016 | 9   | 99,255       | 84                | 116.51    | 0.72                            | 0.58        | 0.89        |
|           | 2015 | 9   | 100,528      | 90                | 111.99    | 0.80                            | 0.65        | 0.98        |

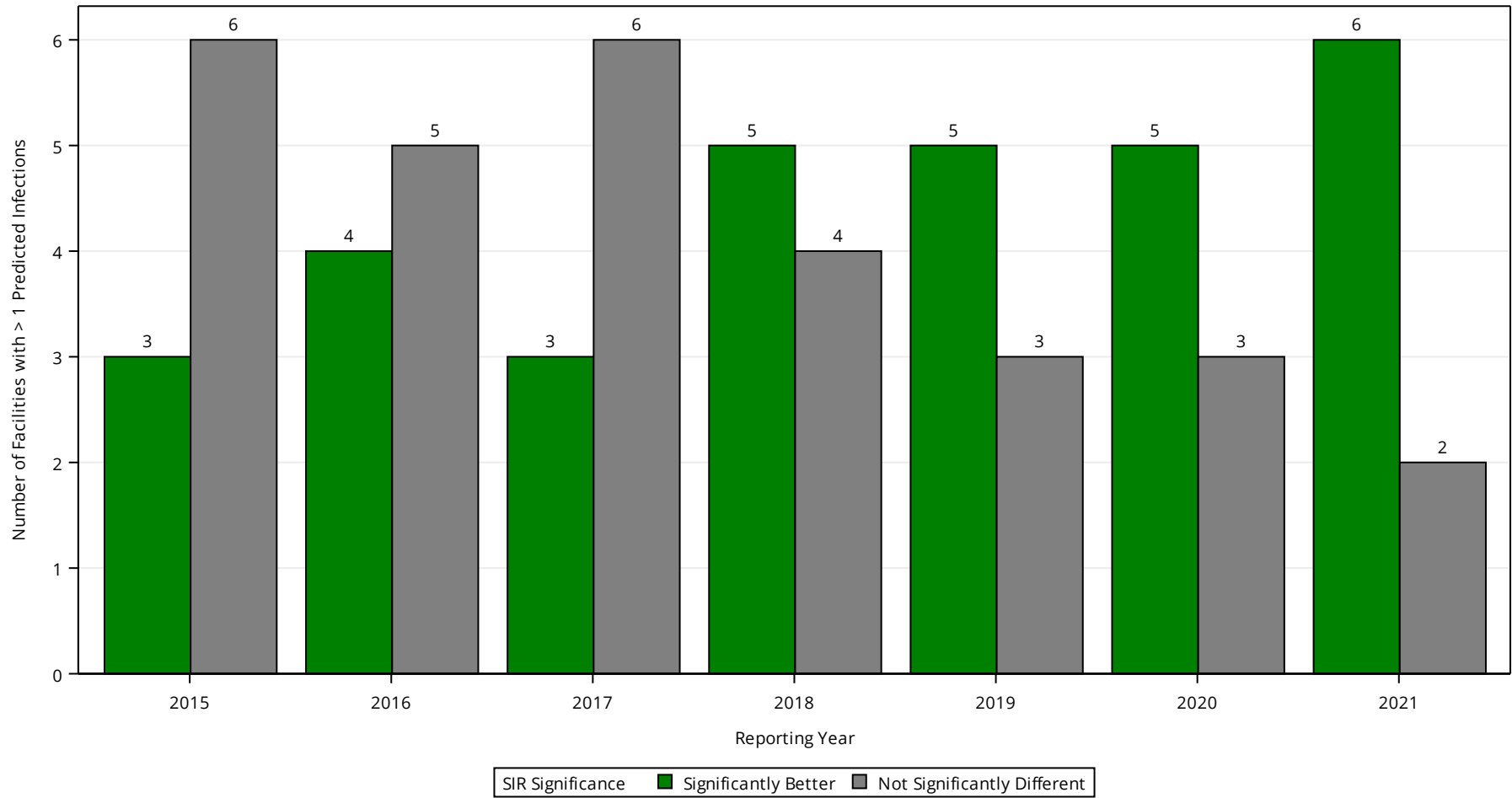
Data reported as of May 18, 2022

No. = number of facilities reporting

Red highlighting indicates SIR for reporting period is significantly higher than national 2015 SIR of 1.0

Green highlighting indicates SIR for reporting period is significantly lower than national 2015 SIR of 1.0

**Figure 51: Number of Facilities with more than 1 predicted Healthcare-Onset C. difficile Infection (CDI) Laboratory-Identified (LabID) Event in Long-term Acute Care (LTAC) Facilities by Reporting Year, Tennessee, 2015-2021**



Data reported as of May 18, 2022

## CDI in Inpatient Rehabilitation Facilities (IRFs):

**Total number of facilities reporting from January – December 2021: 27**

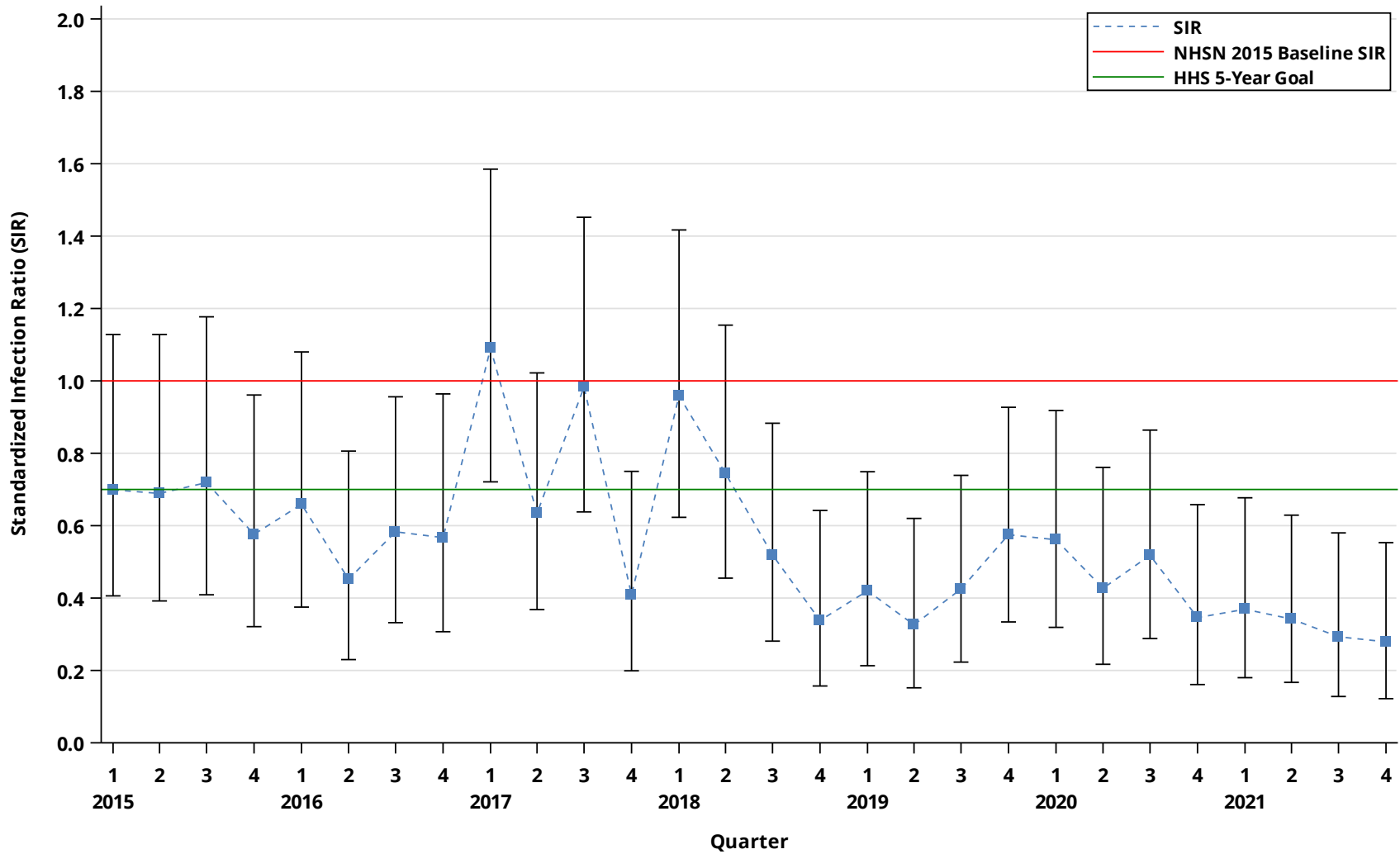
**SIRs by Quarter ([Figure 53](#))**

- In 2021, the healthcare facility-onset CDI LabID SIR for inpatient rehabilitation facilities remained relatively stable, with values ranging from 0.37 – 0.28. This continues the trend of a gradual decline from Q3 of 2020, and all quarterly SIRs for 2021 remained significantly below the HHS prevention target, the first such occurrence since the establishment of the national baseline.

**State and Facility SIRs ([Table 33](#), [Figure 54](#))**

- The overall SIR for 2021 was 0.32 (95% CI: 0.22, 0.45) which was significantly lower than the national SIR and HHS prevention target. Of the 27 facilities reporting, 23 had at least 1 predicted infection and facility-specific SIR. 30.43% (7/23) of facilities had a significantly lower SIR, while the remaining 69.57% (16/23) of facilities had SIRs that were not significantly different from the national SIR. No facilities since 2019 have had SIRs statistically higher than the national baseline.

**Figure 52: Standardized Infection Ratio (SIR) for Healthcare-Onset C. difficile Infection (CDI) Laboratory-Identified (LabID) Events for Inpatient Rehabilitation Facilities (IRF) by Quarter, Tennessee, 01/01/2015–12/31/2021 [Reference standard: National Healthcare Safety Network (NHSN), 2015]**



Data Reported as of May 18, 2022

**Table 33: Healthcare-Onset C. difficile Infection (CDI) Laboratory-Identified (LabID) Events Standardized Infection Ratio (SIR) in Inpatient Rehabilitation Facilities (IRFs) by Reporting Year, Tennessee, 01/01/2015 - 12/31/2021**

|           |      |     |              | No. of INFECTIONS |           | SIR AND 95% CONFIDENCE INTERVAL |             |             |
|-----------|------|-----|--------------|-------------------|-----------|---------------------------------|-------------|-------------|
| STATE     | YEAR | No. | PATIENT DAYS | OBSERVED          | PREDICTED | SIR                             | LOWER LIMIT | UPPER LIMIT |
| Tennessee | 2021 | 27  | 230,434      | 32                | 99.59     | 0.32                            | 0.22        | 0.45        |
|           | 2020 | 27  | 229,182      | 45                | 96.55     | 0.47                            | 0.34        | 0.62        |
|           | 2019 | 27  | 237,353      | 44                | 100.29    | 0.44                            | 0.32        | 0.58        |
|           | 2018 | 28  | 223,082      | 61                | 94.93     | 0.64                            | 0.50        | 0.82        |
|           | 2017 | 28  | 216,048      | 72                | 92.03     | 0.78                            | 0.62        | 0.98        |
|           | 2016 | 28  | 205,642      | 50                | 88.50     | 0.57                            | 0.42        | 0.74        |
|           | 2015 | 27  | 200,362      | 56                | 83.81     | 0.67                            | 0.51        | 0.86        |

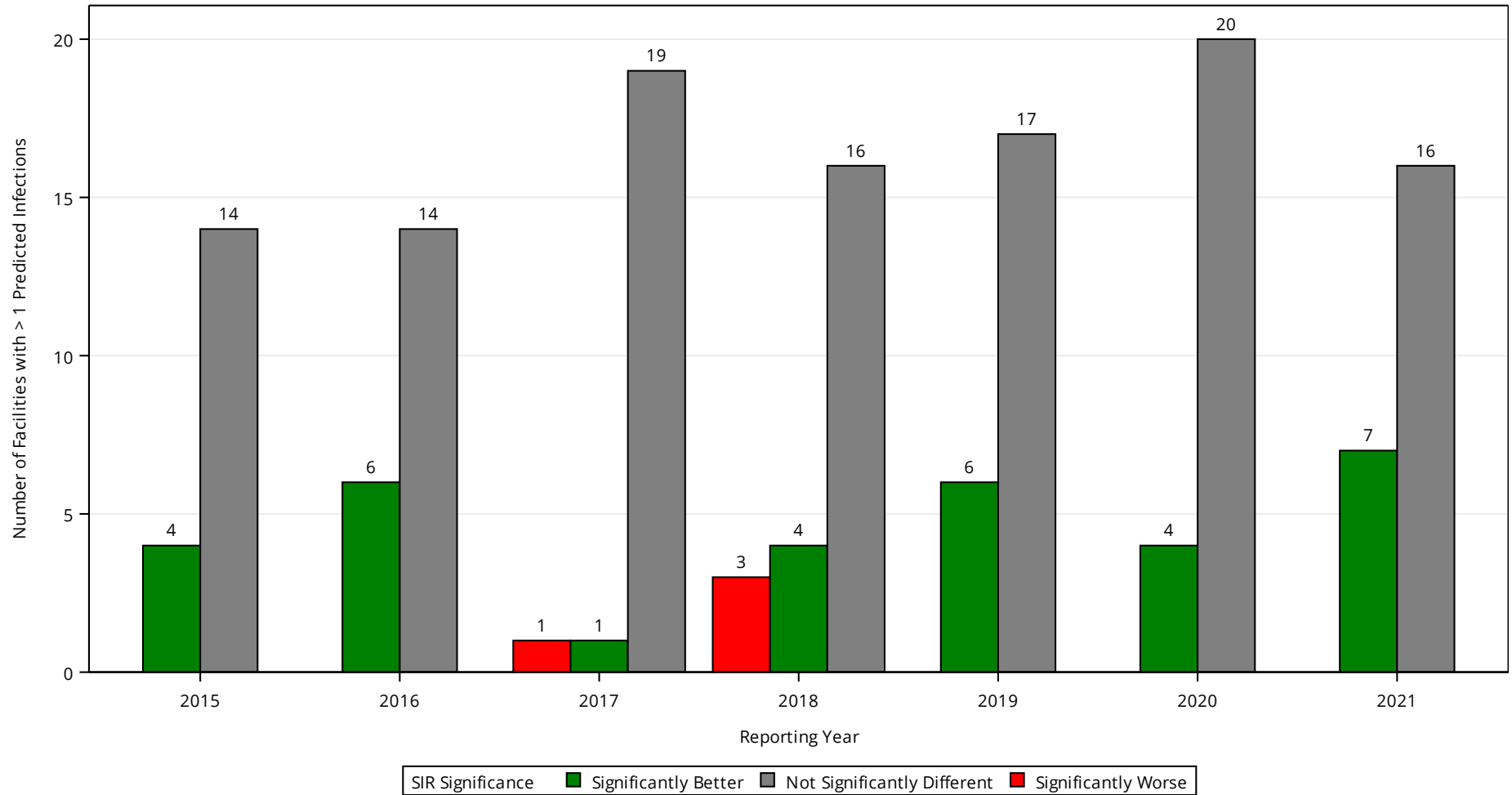
Data reported as of May 18, 2022

No. = number of facilities reporting

Red highlighting indicates SIR for reporting period is significantly higher than national 2015 SIR of 1.0

Green highlighting indicates SIR for reporting period is significantly lower than national 2015 SIR of 1.0

**Figure 53: Number of Facilities with more than 1 predicted Healthcare-Onset C. difficile Infection (CDI) Laboratory-Identified (LabID) Event in Inpatient Rehabilitation Facilities (IRFs) by Reporting Year, Tennessee, 2015-2021**



Data reported as of May 18, 2022

# Healthcare Personnel Influenza Vaccination

## ***Healthcare Personnel Influenza Vaccination***

Influenza can be a serious disease that can lead to hospitalization and sometimes even death. Older adults, pregnant women, and very young children, as well as people with certain long-term medical conditions, are at high risk of serious complications from the flu. The Centers for Disease Control and Prevention (CDC), the Advisory Committee on Immunization Practices (ACIP), and the Healthcare Infection Control Practices Advisory Committee (HICPAC) recommend that all U.S. healthcare workers, including those not directly involved in patient care, are vaccinated against influenza every year. By getting vaccinated, healthcare workers can help protect themselves, their families, and their patients, especially those who cannot receive influenza vaccination (see [Influenza Vaccination Information for Health Care Workers](#)).<sup>25</sup>

### **Reporting Requirements**

Healthcare personnel influenza summary data have been reportable to TDH from acute care hospitals beginning with the 2012-2013 influenza season. Long-term acute care (LTAC) hospitals and inpatient rehabilitation facilities (IRF) began reporting healthcare personnel influenza vaccination data to TDH in the 2014-2015 influenza season. Outpatient hemodialysis facilities and inpatient psychiatric facilities have been required to report healthcare worker influenza vaccination data since the 2015/2016 influenza season.

To comply with these reporting requirements, facilities are required to follow the [NHSN Healthcare Personnel Vaccination Module: Influenza Vaccination Summary Protocol](#),<sup>26</sup> which is regularly updated with reporting instructions. Facilities must report the number of healthcare personnel who were physically present in their facility for 1 working day or more during the reporting period (October 1 through March 31), stratified by personnel category (Employees, Licensed Independent Practitioners (LIPs), Adult Students/Trainees and Volunteers, and Other Contract Personnel (optional)). Facilities are required to report the number of personnel who:

- Received an influenza vaccination administered at the healthcare facility, or
- Reported in writing (paper or electronic) or provided documentation that influenza vaccination was received elsewhere, or
- Were determined to have a medical contraindication/condition of severe allergic reaction to eggs or other component(s) of the vaccination, or history of Guillain-Barré Syndrome (GBS) within 6 weeks after a previous influenza vaccination, or
- Were offered but declined influenza vaccination, or

---

<sup>25</sup> <https://www.cdc.gov/flu/professionals/vaccination/index.html>

<sup>26</sup> <http://www.cdc.gov/nhsn/PDFs/HPS-manual/vaccination/HPS-flu-vaccine-protocol.pdf>



- Had an unknown vaccination status or did not otherwise meet any of the definitions of the above-mentioned numerator categories.

## **Healthcare Personnel Influenza Vaccination Rates**

This report presents the percent of healthcare personnel in each personnel category (Employees, LIPs, and Adult Students/Trainees and Volunteers) and overall (personnel categories combined) who either received influenza vaccination at the healthcare facility or reported in writing (paper or electronic), or provided documentation, that influenza vaccination was received elsewhere. The denominator for this measure includes all healthcare personnel who were physically present in the facility at least 1 working day during the influenza season (October 1 – March 31), including healthcare personnel whose influenza vaccination status was unknown.

# Healthcare Personnel Influenza Vaccination in Acute Care Hospitals (ACHs):

**Total number of facilities reporting from October 2021 – March 2022: 98**

**Healthcare Personnel Influenza Vaccination Rates ([Table 34](#), [Figure 55](#))**

- The mean facility-specific overall healthcare personnel vaccination rate at Tennessee acute care hospitals was 77.0% for the 2021/2022 influenza season (October 2021-March 2022). This was a 7.7% reduction from the revised 2020/2021 mean facility-specific overall healthcare personnel vaccination rate of 84.7%.
- The median facility-specific overall healthcare personnel vaccination rate was 81.2%, indicating that half of all Tennessee acute care hospitals documented at least 81.2% of their healthcare personnel received influenza vaccination for the 2021/2022 influenza season. This was a decrease from the 87.1% rate observed during the 2020/2021 influenza season.
- The Tennessee 2021/2022 mean facility-specific influenza vaccination rates were the lowest for Licensed Independent Practitioners (69.9%) and the highest for students/trainees/volunteers (84.3%).

**Table 34: Healthcare Personnel Influenza Vaccination Rate and Key Percentiles by Healthcare Personnel Category by Influenza Season in Acute Care Facilities, Tennessee, 10/01/2020 - 03/31/2022**

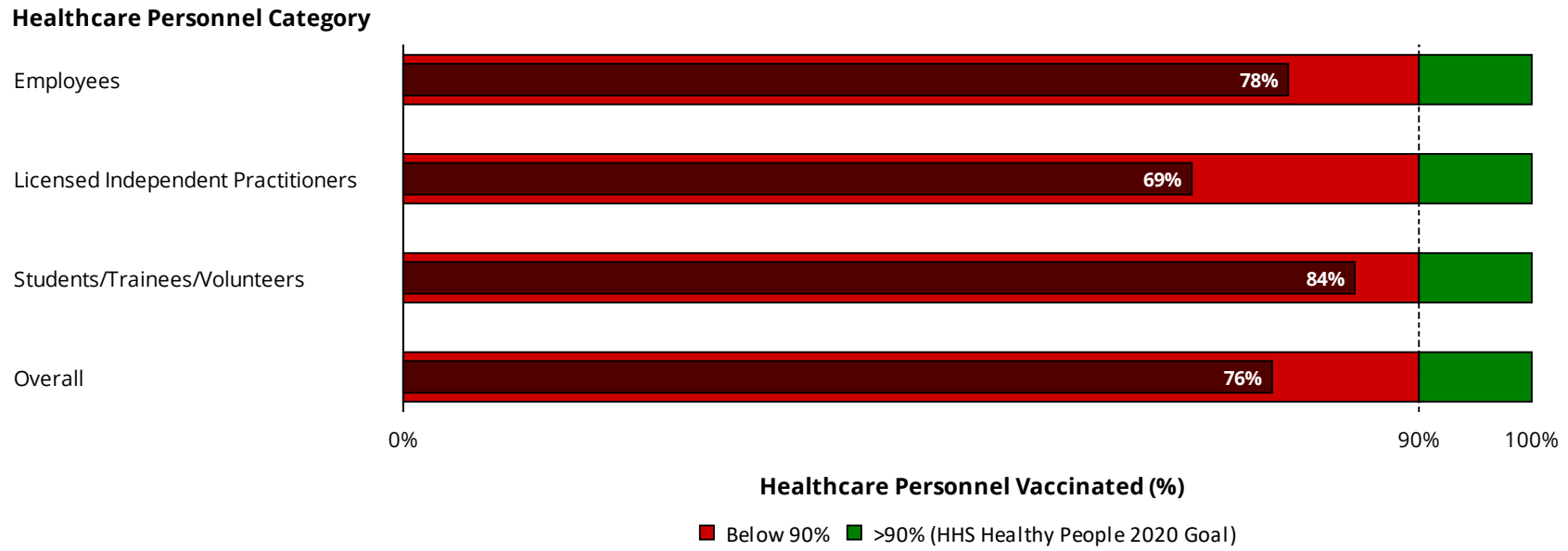
|           |            |                                    |           |                           | DISTRIBUTION OF HCP VACCINATION RATE |              |              |              |              |
|-----------|------------|------------------------------------|-----------|---------------------------|--------------------------------------|--------------|--------------|--------------|--------------|
| STATE     | FLU SEASON | HEALTHCARE PERSONNEL CATEGORY      | No.       | MEAN HCP VACCINATION RATE | 10%                                  | 25%          | 50%          | 75%          | 90%          |
| Tennessee | 2021/2022  | Employees                          | 98        | 78.4%                     | 49.2%                                | 67.7%        | 83.4%        | 94.8%        | 98.0%        |
|           |            | Licensed Independent Practitioners | 98        | 69.9%                     | 23.5%                                | 39.6%        | 80.0%        | 98.1%        | 99.6%        |
|           |            | Students/Trainees/Volunteers       | 98        | 84.3%                     | 18.4%                                | 86.7%        | 98.6%        | 100%         | 100%         |
|           |            | <b>Overall</b>                     | <b>98</b> | <b>77.0%</b>              | <b>41.3%</b>                         | <b>65.8%</b> | <b>81.2%</b> | <b>94.2%</b> | <b>97.9%</b> |
|           | 2020/2021  | Employees                          | 99        | 84.4%                     | 64.3%                                | 76.8%        | 85.3%        | 96.8%        | 99.0%        |
|           |            | Licensed Independent Practitioners | 99        | 80.7%                     | 50.0%                                | 63.2%        | 89.2%        | 98.0%        | 100%         |
|           |            | Students/Trainees/Volunteers       | 99        | 94.7%                     | 87.1%                                | 97.4%        | 99.9%        | 100%         | 100%         |
|           |            | <b>Overall</b>                     | <b>99</b> | <b>84.7%</b>              | <b>65.5%</b>                         | <b>78.5%</b> | <b>87.1%</b> | <b>96.4%</b> | <b>98.5%</b> |

Data reported as of June 28, 2022

No. = number of facilities reporting

HCP = Healthcare Personnel

**Figure 54: Healthcare Personnel Influenza Vaccination Rate by Healthcare Personnel Category in Acute Care Facilities, Tennessee, 2021/2022 Influenza Season, 10/01/2020 - 03/31/2022**



# Healthcare Personnel Influenza Vaccination in Long-term Acute Care (LTAC) Hospitals:

**Total number of facilities reporting from October 2021 – March 2022: 9**

**Healthcare Personnel Influenza Vaccination Rates ([Table 35](#))**

- The mean facility-specific overall healthcare personnel vaccination rate in Tennessee long-term acute care hospitals was 81.3% for the 2021/2022 influenza season (October 2021-March 2022). This was below the 2020/2021 influenza season (October 2020-March 2021) mean of 84.2%
- The median facility-specific overall healthcare personnel vaccination rate was 80.2%, indicating that half of all Tennessee long-term acute care hospitals documented at least 80.2% of their healthcare personnel received influenza vaccination for the 2021/2022 influenza season. The median facility-specific overall healthcare personnel vaccination rate was 88.3% for the 2020/2021 influenza season.
- The Tennessee 2021/2022 mean facility-specific influenza vaccination rates were the lowest for employees (82.9%) and the highest for students/trainees/volunteers (100.0%). There were decreases reported for the means among all employment types from the 2020/2021 influenza season except for students who were 100% vaccinated in 2021/2022.

**Table 35: Healthcare Personnel Influenza Vaccination Rate and Key Percentiles by Healthcare Personnel Category by Influenza Season in Long-Term Acute Care (LTAC) Facilities, Tennessee, 10/01/2020 - 03/31/2022**

|           |            |                                    |          |                           | DISTRIBUTION OF HCP VACCINATION RATE |              |              |              |             |
|-----------|------------|------------------------------------|----------|---------------------------|--------------------------------------|--------------|--------------|--------------|-------------|
| STATE     | FLU SEASON | HEALTHCARE PERSONNEL CATEGORY      | No.      | MEAN HCP VACCINATION RATE | 10%                                  | 25%          | 50%          | 75%          | 90%         |
| Tennessee | 2021/2022  | Employees                          | 9        | 81.3%                     | 53.8%                                | 70.3%        | 82.9%        | 94.9%        | 100%        |
|           |            | Licensed Independent Practitioners | 9        | 77.2%                     | 3.3%                                 | 73.2%        | 92.1%        | 96.4%        | 98.5%       |
|           |            | Students/Trainees/Volunteers       | 9        | 100%                      | 100%                                 | 100%         | 100%         | 100%         | 100%        |
|           |            | <b>Overall</b>                     | <b>9</b> | <b>81.3%</b>              | <b>58.7%</b>                         | <b>70.8%</b> | <b>80.2%</b> | <b>94.7%</b> | <b>100%</b> |
|           | 2020/2021  | Employees                          | 9        | 82.3%                     | 50.3%                                | 71.2%        | 84.9%        | 97.8%        | 100%        |
|           |            | Licensed Independent Practitioners | 9        | 88.6%                     | 45.5%                                | 89.6%        | 95.6%        | 98.8%        | 100%        |
|           |            | Students/Trainees/Volunteers       | 9        | 98.1%                     | 94.3%                                | 94.3%        | 100%         | 100%         | 100%        |
|           |            | <b>Overall</b>                     | <b>9</b> | <b>84.2%</b>              | <b>49.2%</b>                         | <b>76.1%</b> | <b>88.3%</b> | <b>97.7%</b> | <b>100%</b> |

Data reported as of June 28, 2022

No. = number of facilities reporting

HCP = Healthcare Personnel

# Healthcare Personnel Influenza Vaccination in Inpatient Rehabilitation Facilities (IRFs):

*Total number of facilities reporting from October 2021 – March 2022: 26*

*Healthcare Personnel Influenza Vaccination Rates ([Table 36](#))*

- The mean facility-specific overall healthcare personnel vaccination rate in Tennessee inpatient rehabilitation facilities was 76.1% for the 2021/2022 influenza season (October 2021-March 2022). This was a substantial decrease from the reported mean of 86.6% for the 2020/2021 influenza season.
- The median facility-specific overall healthcare personnel vaccination rate was 85.2%, indicating that half of all Tennessee inpatient rehabilitation facilities documented at least 85.2% of their healthcare personnel received influenza vaccination for the 2021/2022 influenza season. This was lower than the median facility-specific overall healthcare personnel vaccination rate of 88.1% for the 2020/2021 influenza season.
- The 2021/2022 mean facility-specific influenza vaccination rates were the lowest for employees (75.4%) and highest for licensed independent practitioners (89.0%).

**Table 36: Healthcare Personnel Influenza Vaccination Rate and Key Percentiles by Healthcare Personnel Category by Influenza Season in Inpatient Rehabilitation Facilities, Tennessee, 10/01/2020 - 03/31/2022**

|           |            |                                    |           |                           | DISTRIBUTION OF HCP VACCINATION RATE |              |              |              |              |
|-----------|------------|------------------------------------|-----------|---------------------------|--------------------------------------|--------------|--------------|--------------|--------------|
| STATE     | FLU SEASON | HEALTHCARE PERSONNEL CATEGORY      | No.       | MEAN HCP VACCINATION RATE | 10%                                  | 25%          | 50%          | 75%          | 90%          |
| Tennessee | 2021/2022  | Employees                          | 26        | 75.4%                     | 38.9%                                | 64.0%        | 85.7%        | 90.0%        | 96.0%        |
|           |            | Licensed Independent Practitioners | 26        | 89.0%                     | 63.2%                                | 86.2%        | 99.3%        | 100%         | 100%         |
|           |            | Students/Trainees/Volunteers       | 26        | 87.9%                     | 50.0%                                | 98.0%        | 100%         | 100%         | 100%         |
|           |            | <b>Overall</b>                     | <b>26</b> | <b>76.1%</b>              | <b>38.9%</b>                         | <b>60.0%</b> | <b>85.2%</b> | <b>91.8%</b> | <b>96.6%</b> |
|           | 2020/2021  | Employees                          | 26        | 85.8%                     | 71.2%                                | 81.6%        | 85.9%        | 94.1%        | 98.8%        |
|           |            | Licensed Independent Practitioners | 26        | 90.5%                     | 75.0%                                | 93.8%        | 100%         | 100%         | 100%         |
|           |            | Students/Trainees/Volunteers       | 26        | 92.4%                     | 94.7%                                | 100%         | 100%         | 100%         | 100%         |
|           |            | <b>Overall</b>                     | <b>26</b> | <b>86.6%</b>              | <b>72.0%</b>                         | <b>81.7%</b> | <b>88.1%</b> | <b>94.1%</b> | <b>98.4%</b> |

Data reported as of June 28, 2022

No. = number of facilities reporting

HCP = Healthcare Personnel



# Antimicrobial Use

## ***Antimicrobial Use***

Optimizing antibiotic use in acute care hospitals can help reduce adverse drug effects, treatment failures, antimicrobial resistance development, *Clostridioides difficile* infection, and hospital costs and length of stays. In 2014, CDC released the [Core Elements of Hospital Antibiotics Stewardship Programs](#)<sup>27</sup>. The Core Elements serve as a guide for hospitals in implementing successful stewardship programs. The key principle of antibiotic stewardship to improve antibiotic use is critical to effectively treat infections, protect patients from harm caused by unnecessary use, and combat antimicrobial resistance.

The Core Elements of Hospital Antibiotic Stewardship Programs was updated in 2019; the seven Core Elements include Hospital Leadership Commitment, Accountability, Pharmacy Expertise, Action, Tracking, Reporting, and Education. The updated document outlines specific recommendations and interventions for each element that may be adopted by institutions to improve their antibiotic use.

### **Reporting Requirements**

The CDC and the Tennessee Healthcare Associated Infections Program first began tracking adherence to the Core Elements in 2014. Information on national adherence can be found on the CDC's [Antibiotic Resistance and Patient Safety Portal](#)<sup>28</sup>. Adherence is assessed based on results from the National Healthcare Safety Network's (NHSN) [Patient Safety Annual Facility Survey](#)<sup>29</sup>. This survey is completed by the facility's NHSN Facility Administrator each year, with feedback from the accountable antibiotic stewardship leads. Achievement is obtained if at least one corresponding question for each Core Element is answered in the affirmative.

### ***Antimicrobial Stewardship Core Elements in ACHs and LTACs (Figure 55)***

- The Cluster Bar-chart shows the numbers of acute care and critical access hospitals meeting all Core Elements for years 2014–2021 in Tennessee. The comparison shows the gradual increase in facilities meeting all 7 Core Elements by year. In 2014, there were only 36 out of 113 participating facilities (32%) facilities who met all 7 Core Elements. Since then, consistent progress has been made in hospital antibiotic stewardship programs that have achieved all Core Elements. By 2019, 90% of facilities had achieved all 7 Core Elements and by 2021, >99% of facilities had done so.

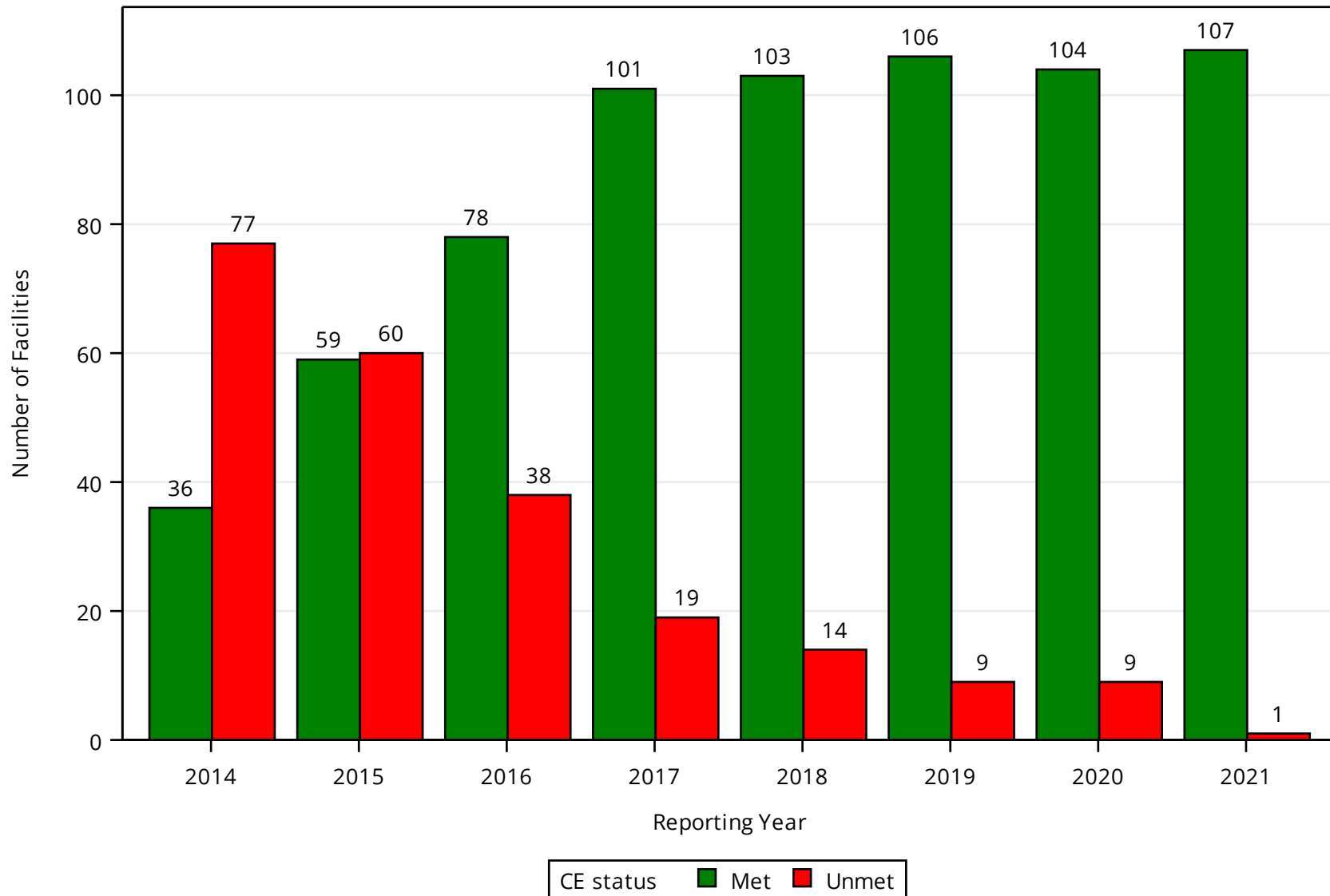
---

<sup>27</sup> <https://www.cdc.gov/antibiotic-use/healthcare/pdfs/hospital-core-elements-H.pdf>

<sup>28</sup> <https://arpsp.cdc.gov/profile/stewardship>

<sup>29</sup> [https://www.cdc.gov/nhsn/forms/57.103\\_pshospsurv\\_blank.pdf](https://www.cdc.gov/nhsn/forms/57.103_pshospsurv_blank.pdf)

Figure 55: Number of Facilities Meeting All 7 Core Elements by Reporting Year, Tennessee, 2014-2021



Data reported as of Aug 08, 2022

# Appendices

## Appendix A. Definitions

**Abdominal hysterectomy (HYST):** Hysterectomy performed through the abdomen; includes laparoscopic procedures.

**All Surgical Site Infection Standardized Infection Ratio (All SSI SIR):** (See Standardized Infection Ratio.) A standardized infection ratio calculated by NHSN for surgical site infections, which includes all inpatient and outpatient procedures and all primary SSIs identified during admission, readmission, or post-discharge surveillance, as defined in the NHSN Patient Safety Component Manual.

**ASA Score:** Assessment by the anesthesiologist of the patient's preoperative physical condition using the American Society of Anesthesiologists' (ASA) Classification of Physical Status. Patient is assigned one of the following which is used as one element of the SSI Basic Risk index:

- 1 -- Normally healthy patient
- 2 -- Patient with mild systemic disease
- 3 -- Patient with severe systemic disease that is not incapacitating
- 4 -- Patient with an incapacitating systemic disease that is a constant threat to life
- 5 -- Moribund patient who is not expected to survive for 24 hours with or without the operation

**Catheter-associated urinary tract infection (CAUTI):** When a patient develops a urinary tract infection while having a urinary catheter in place for more than 2 days consecutive dates on the date of event and was either: present for any portion of the calendar day on the date of event or removed the day before the event. the infection is considered a CAUTI (see [Patient Guide to CAUTI](#)<sup>1</sup>).

**CAUTI infection rate:** The total number of catheter-associated urinary tract infections divided by the number of urinary catheter-days, multiplied by 1,000.

**Central line:** A intravascular catheter that is inserted in a patient's blood vessel and terminates at or close to the heart or in one of the great vessels. A central line (or an umbilical line for newborns) can be used to give fluids, antibiotics, medical treatments such as chemotherapy, and/or liquid food. If a central line is inserted incorrectly or not cared for properly, it can lead to dangerous bloodstream infections (see [Patient Guide to CLABSI](#)<sup>2</sup>). Central lines are also sometimes called central venous lines or central venous catheters.

---

<sup>1</sup> [http://www.cdc.gov/hai/pdfs/uti/CA-UTI\\_tagged.pdf](http://www.cdc.gov/hai/pdfs/uti/CA-UTI_tagged.pdf)

<sup>2</sup> [http://www.cdc.gov/hai/pdfs/bsi/BSI\\_tagged.pdf](http://www.cdc.gov/hai/pdfs/bsi/BSI_tagged.pdf)

**Central line-associated bloodstream infection (CLABSI):** When a patient develops a bloodstream infection while having a central line in place for greater than two consecutive days following the first access of the central line, in an inpatient location and remain eligible for CLABSI events until the day after removal from the body or patient discharge, whichever comes first. the infection is considered a CLABSI (see [Patient Guide to CLABSI](#)<sup>3</sup>).

**Central line-days:** The total number of days a central line is in place for patients in a particular unit. The count is performed at the same time each day. Each patient with one or more central lines at the time the count is performed is counted as 1 central line day. In specialty care areas, central line-days are collected separately for permanent and temporary central lines (see “Central line” definition). If a patient has both a permanent and a temporary central line, the day is recorded as a temporary central line-day.

Example: 5 patients on the first day of the month had one or more central lines in place. Similarly, 5 patients on day two, 2 patients on day three, 5 patients on day four, 3 patients on day five, 4 patients on day six, and 4 patients on day seven had central lines in place. Adding the number of patients with central lines on days one through seven, we would have  $5 + 5 + 2 + 5 + 3 + 4 + 4 = 28$  central line-days for the first week. The number of central line-days for the month is the sum of the daily counts.

**Central line-associated bloodstream infection (CLABSI) rate:** This rate is the total number of central line-associated bloodstream infections divided by the number of central line-days, multiplied by 1,000.

**Central line utilization ratio:** See Device Utilization Ratio

***Clostridioides difficile:*** A bacterium that naturally resides in the bowels of some people without symptoms of infection. *Clostridioides difficile* (*C. difficile*) is responsible for a spectrum of *C. difficile* infections (CDI), including gastrointestinal illness which can lead to severe complications including sepsis and death. CDI can occur when *C. difficile* spores are transferred to patients via the hands of healthcare personnel or other contaminated surfaces or items ([Patient Guide to \*C. difficile\*](#)<sup>4</sup>).

**Colon surgery (COLO):** Procedure performed on the large intestine; does not include rectal operations.

**Community-onset (CO):** LabID event specimen collected as an outpatient or an inpatient less than or equal to 3 days after admission to the facility (i.e., days 1, 2, or 3 of admission).

---

<sup>3</sup> [http://www.cdc.gov/hai/pdfs/bsi/BSI\\_tagged.pdf](http://www.cdc.gov/hai/pdfs/bsi/BSI_tagged.pdf)

<sup>4</sup> [https://www.cdc.gov/hai/pdfs/cdiff/Cdiff\\_tagged-BW.pdf](https://www.cdc.gov/hai/pdfs/cdiff/Cdiff_tagged-BW.pdf)

**Community-onset healthcare facility-associated (CO-HCFA):** Community-onset (CO) LabID event specimen collected from an inpatient or an outpatient location from a patient who was discharged from the facility less than or equal to 28 days prior to the current date of stool specimen collection (*Clostridioides difficile* infection LabID events only). The previous discharge must have been from an inpatient location within the same facility (in other words, an outpatient visit does not qualify as “admitted”, and therefore is not used to set the timeline for CO-HCFA).

**Complex Admission/Readmission Standardized Infection Ratio (Complex A/R SIR):** (See Standardized Infection Ratio) A standardized infection ratio calculated by NHSN for surgical site infections, which only includes inpatient procedures, deep incisional primary and organ/space SSIs identified during admission or readmission to the reporting facility, as defined in the NHSN Patient Safety Component Manual.

**Confidence intervals:** Confidence intervals describe the reliability of a point estimate, such as a standardized infection ratio or infection rate. If TDH mentions a confidence interval of 95%, it means that the TDH has a high degree of confidence that the hospital’s precise infection rate (the point estimate) falls within the range given. In this report, the confidence interval is based on the number of infections observed and the number of central line-days accumulated during the specified period.

If two hospitals have different infection rates, but the confidence intervals for the two rates overlap, then it is reasonably possible that the true rates are the same.

**Coronary artery bypass graft with both chest and donor site incisions (CBGB):** Chest procedure to perform direct revascularization of the heart; includes obtaining suitable vein from donor site for grafting.

**Coronary artery bypasses graft with chest incision only (CBGC):** Chest procedure to perform direct vascularization of the heart using, for example, the internal mammary (thoracic) artery.

**Deep incisional SSI:** A surgical site infection that involves the deep soft tissues (e.g., fascial and muscle layers) of the incision and meets the NHSN criteria for a deep incisional SSI as described in the NHSN Patient Safety Manual. A deep incisional SSI can be either 1) *primary* – identified in the primary incision in a patient that had an operation with one or more incisions (e.g., chest incision in a CBGB) or 2) *secondary* – identified in the secondary incision in a patient that had an operation with more than one incision (e.g., donor site (leg) incision in a CBGB).

**Device Utilization (DU) Ratio:** This ratio is the number of device (central line or urinary catheter) days divided by the number of patient-days (see also: central line utilization ratio and urinary catheter utilization ratio).

**Healthcare-associated infection (HAI):** For an infection to be considered healthcare-associated, there must be no evidence that the infection was present or incubating at the time of hospital admission. A HAI may be confined to one area of the body (localized) or be spread throughout (systemic). It is the body’s adverse reaction to the presence of an infectious agent(s) or its toxin(s).

**Healthcare facility-onset (HO) for LabID events:** LabID event specimen collected more than 3 days after admission to the facility (i.e., on or after day 4).

**Hip prosthesis (HPRO):** In HPRO surgery (also called a “hip arthroplasty”), all or part of a diseased hip joint is removed and replaced with an artificial joint.

**Infection control/prevention processes:** These are routine measures that can be used in all healthcare settings to prevent infections. These steps or principles can be expanded to meet the needs of specialized types of hospitals. Examples include:

- Diligent hand hygiene.
- Use of personal protective equipment such as gloves, gowns, eye protection and/or masks when caring for patients in select situations to prevent the spread of infections.
- Use of an infection prevention checklist when inserting central lines. The list reminds healthcare workers to clean their hands thoroughly; clean the patient’s skin with the appropriate type of disinfectant before insertion; wear the recommended sterile gown, gloves, and mask; and place sterile barriers around the insertion site.
- Monitoring staff to ensure that they are following proper infection prevention procedures.

**Infection preventionists (IPs):** Health professionals with special training in infection prevention and monitoring.

**Intensive care unit (ICU) (also called a “critical care unit”):** ICUs are hospital units that provide intensive observation and treatment for patients either dealing with, or at risk of developing, life-threatening problems. Smaller hospitals typically care for both medical and surgical patients in a combined medical-surgical ICU. Larger hospitals often have separate ICUs for medical patients and surgical patients.

**Inpatient:** As defined by NHSN, a patient whose date of admission to the healthcare facility and the date of discharge are different calendar days

**Laboratory-identified (LabID) event:** A monitoring method for multidrug-resistant organisms which relies almost exclusively on data obtained from the laboratory. Surveillance is performed using the [NHSN MDRO/CDI Module Protocol](#)<sup>5</sup>.

**Long-Term Acute Care (LTAC) Hospitals:** LTACs provide evaluation, treatment, and management of patients suffering medically complex conditions, or who have suffered recent catastrophic illness or injury, and require an extended stay in an acute care environment.

---

<sup>5</sup> [http://www.cdc.gov/nhsn/PDFs/pscManual/12pscMDRO\\_CDADcurrent.pdf](http://www.cdc.gov/nhsn/PDFs/pscManual/12pscMDRO_CDADcurrent.pdf)



**Methicillin-Resistant *Staphylococcus aureus*:** Methicillin-Resistant *Staphylococcus aureus* (MRSA) is a type of *Staphylococcus* bacteria that is resistant to certain antibiotics including methicillin. MRSA can be spread via contaminated surfaces or equipment and on the hands of healthcare personnel. MRSA infections can be severe and life-threatening and treatment options are often limited and expensive (see [Patient Guide on MRSA](#)<sup>6</sup>).

**National Healthcare Safety Network (NHSN):** This is the online system that Tennessee hospitals must use to report HAI data to the Tennessee Department of Health. NHSN is a secure, internet-based surveillance (monitoring and reporting) system. Among other features, the network offers integrated patient and healthcare worker safety surveillance systems. NHSN is managed by CDC's Division of Healthcare Quality Promotion. In NHSN, hospitals submit information that is needed to calculate HAI rates and standardized infection ratios (SIRs). Hospitals must confer rights to TDH in order for TDH to collect data from NHSN and report the information to the public.

**NHSN Patient Safety Component Manual:** This manual contains standardized surveillance definitions and data collection methods that are essential for fair reporting of HAIs. Surveillance definitions are updated annually; [current protocols](#)<sup>7</sup> are available online.

**NHSN operative procedure:** A procedure that:

- Is performed in any inpatient facility and/or outpatient procedure department (HOPD) where the selected NHSN operative procedure (s) are performed.
- Takes place during an operation where at least one incision (including laparoscopic approach and cranial Burr holes) is made through the skin or mucous, or reoperation via an incision that was left open during a prior operative procedure.
- Is included in the [ICD-10-PCS](#) and/or [CPT](#) NHSN operative procedure code mapping

**Operation:** A single trip to the operating room (OR) where a surgeon makes at least one incision through the skin or mucous membrane, including laparoscopic approach and cranial Burr holes, incision may be closed by primary or non-primary closure before the patient leaves the OR.

**Organ/space SSI:** A surgical site infection that involves any part of the body, deeper than fascial/muscle layers that is opened or manipulated during the operative procedure (e.g., osteomyelitis).

**Outpatient:** As defined by NHSN, a patient whose date of admission to the healthcare facility and the date of discharge are the same calendar day.

---

<sup>6</sup> [http://www.cdc.gov/mrsa/pdf/SHEA-mrsa\\_tagged.pdf](http://www.cdc.gov/mrsa/pdf/SHEA-mrsa_tagged.pdf)

<sup>7</sup> <http://www.cdc.gov/nhsn/acute-care-hospital/index.html>

**Standardized infection ratio (SIR):** The SIR is a summary measure used to compare infection data from one population to data from a “standard” population. For HAI reports, the standard population comes from data reported from U.S. hospitals that report to NHSN. The SIR is calculated by dividing the observed number of infections by the predicted (or statistically expected) number of infections, which is calculated using data from the standard population. See Methods section for more information.

**Superficial incisional SSI:** A surgical site infection that involves only skin and soft tissue layers of the incision and meets the NHSN criteria for a superficial incisional SSI as described in the NHSN Patient Safety Manual. A incisional SSI can be either 1) *primary* – identified in the primary incision in a patient that had an operation with one or more incisions (e.g., chest incision in a CBGB) or 2) *secondary* – identified in the secondary incision in a patient that had an operation with more than one incision (e.g., donor site (leg) incision in a CBGB).

**Surgical Site Infection (SSI):** An infection found after an operation in the part of the body where the surgery was performed (see [Patient Guide to SSI](#)).<sup>8</sup>

**Surveillance:** The process of finding and documenting infections.

- Active surveillance: This includes, but is not limited to, active, patient-based, prospective surveillance by a trained infection preventionist (IP). The IP seeks out infections during a patient’s stay by screening a variety of data sources. The sources may include patient charts and laboratory, pharmacy, radiology/imaging, admission/discharge/transfer, and pathology databases. The complete definition of surveillance, including how to capture denominator data to calculate infection rates, is found in each module of the NHSN Patient Safety Component Manual ([here](#)<sup>9</sup>).
- Post-discharge surveillance: This is the process facilities use to seek out infections after patients have been discharged from the hospital. Post-discharge surveillance includes screening data sources such as re-admission and emergency department visit records.

**Urinary catheter:** A drainage tube that is inserted into the urinary bladder through the urethra, left in place, and connected to a closed collection system (including leg bags).

---

<sup>8</sup> [http://www.cdc.gov/HAI/pdfs/ssi/SSI\\_tagged.pdf](http://www.cdc.gov/HAI/pdfs/ssi/SSI_tagged.pdf)

<sup>9</sup> [https://www.cdc.gov/nhsn/pdfs/pscmanual/pccmanual\\_current.pdf](https://www.cdc.gov/nhsn/pdfs/pscmanual/pccmanual_current.pdf)

**Urinary catheter days:** The total number of days a urinary catheter is in place for patients in a particular unit. The count is performed at the same time each day. Each patient with urinary catheter in place at the time the count is performed is counted as one urinary catheter day.

Example: 5 patients on the first day of the month had a urinary catheter in place. Similarly, 5 patients on day two, 2 patients on day three, 5 patients on day four, 3 patients on day five, 4 patients on day six, and 4 patients on day seven had urinary catheters in place. Adding the number of patients with urinary catheters on days one through seven, we would have  $5 + 5 + 2 + 5 + 3 + 4 + 4 = 28$  urinary catheter-days for the first week. The number of urinary catheter days for the month is the sum of the daily counts.

**Urinary catheter utilization ratio:** See Device Utilization Ratio

**Validation:** Validation is the process of making sure that HAI data reported to NHSN are complete and accurate to:

- Assess the accuracy and quality of data submitted to NHSN
- Provide hospitals with information to help them correctly use the NHSN application
- Provide education to IPs and other hospital staff to improve data accuracy and quality, if necessary
- Teach IPs how to confirm the accuracy of written or electronic data they receive from hospital departments
- Look for unreported HAIs
- Assess selected infection control processes
- Make recommendations for improvements if data accuracy and/or quality issues are discovered

## **Appendix B. Acronyms**

A/R – admission/readmission  
ASA – American Society of Anesthesiologists  
CAUTI – catheter-associated urinary tract infection  
CABG – coronary artery bypass graft surgery, includes both CBGB and CBGB  
CBGB – coronary artery bypass graft surgery: both chest and donor site incisions  
CBGC – coronary artery bypass graft surgery: chest incision only  
CCU – critical care unit (used interchangeably with intensive care unit (ICU))  
CDC – Centers for Disease Control and Prevention  
CDI – *Clostridioides difficile* (*C. difficile*) infection  
CI – confidence interval  
CLD – central line-days  
CLABSI – central line-associated bloodstream infection  
CMS – Centers for Medicare and Medicaid Services  
CO – community onset  
COLO – colon surgery  
DD – device days  
DIP – deep incisional primary SSI  
DIS – deep incisional secondary SSI  
DU ratio – device utilization ratio  
HAI – healthcare-associated infection  
HO – healthcare facility onset  
HYST – abdominal hysterectomy  
IP – infection preventionist  
ICU – intensive care unit (use interchangeably with critical care unit (CCU))  
LTAC – long-term acute care  
MRSA – methicillin-resistant *Staphylococcus aureus*  
NHSN – National Healthcare Safety Network  
NICU – neonatal intensive care unit  
OR – operating room  
PROC – surgical procedures  
SIP – superficial incisional primary SSI  
SIR – standardized infection ratio  
SIS – superficial incisional secondary SSI  
SSI – surgical site infection  
TDH – Tennessee Department of Health  
UCD – urinary catheter days  
VRE – vancomycin-resistant *Enterococcus*