

Understanding and Using Measures for Healthcare Associated Infections (HAI)

Healthcare-associated infections (HAIs) are among the top causes of unnecessary illnesses and deaths in the United States. HAIs are infections that patients get while staying in a hospital or other healthcare facility – infections that the patients did not have before being admitted. They account for approximately 1.7 million infections and almost 100,000 deaths annually¹. In a 2013 article, researchers analyzed the costs and financial impact of the 5 major HAIs seen in adult inpatients. Central line-associated bloodstream infections, catheter-associated urinary tract infections, surgical site infections, ventilator-associated pneumonia and clostridium difficile costs the U.S. health system \$9.8 billion each year.² HAIs result in extra days of hospitalizations and higher health care costs. The estimated financial impact of HAIs is between \$28 billion to \$33 billion a year³.

HAIs and patient safety are major public health issues that require collaborations of government and the health care industry. Reducing HAIs is a priority for the State and for New Jersey hospitals. Signed in 2007, Public Reporting Legislation (PL of 2007, C 196) requires hospitals to report HAI data to the State Department of Health for public reporting in the Hospital Performance Report.

This section of the report shows how well New Jersey hospitals are providing safe patient care by comparing hospital's HAI experience with the national experience. It gives hospitals information to help reduce HAIs and improve patient safety.

The HAI measures are calculated differently than the recommended care and PSI measures. The HAIs are not reported as scores or simple percentages; they are reported as **Standardized Infection Ratios (SIR)**. More detailed explanations on SIR are provided below. Hospitals that performed better than the national experience have lower ratios. **Lower ratios are better because they suggest fewer infections.** The label “L” in the tables identifies the better performing hospitals. **Unlike recommended care measures and similar to PSIs, a lower ratio is better.**

What HAIs are in this year's report?

This year's report focuses on the following HAIs; Surgical Site Infections (SSIs) following Coronary Artery Bypass Graft (CABG), Abdominal Hysterectomy, Knee Arthroplasty and Colon surgery procedures, Central Line-Associated Bloodstream Infections (CLABSIs), and Catheter-Associated Urinary Tract Infections (CAUTIs).

Where do the data come from?

New Jersey acute care hospitals are required to report SSI, CLABSI, and CAUTI infections to the National Healthcare Safety Network (NHSN), a healthcare-associated infection surveillance and tracking system developed by the Centers

for Disease Control and Prevention (CDC).

This report contains CLABSI, CAUTI and SSI data submitted to NHSN by New Jersey hospitals in 2015. Hospitals were provided the opportunity to verify the accuracy of their data. The data in this report have not been independently audited and validated.

What is Risk-Adjustment?

Some hospitals treat sicker or older patients than others. Sicker patients in the hospitals' Intensive Care Units (ICUs) are more likely to develop hospital-acquired infections. Hospitals affiliated with a medical school generally treat sicker patients than most hospitals. Also, not all hospitals have the same types of ICUs. For example, patients in burn units or trauma units are more at risk of acquiring infections. These differences make it difficult to fairly compare hospital's HAI experience.

The CDC uses a statistical method called "risk-adjustment" that standardizes the differences across hospitals and allows all hospitals to be measured more fairly. This method 'adjusts' for risk-factors that most often affect the risks of developing infections, such as type of ICUs, number of ICU beds, and hospitals affiliated with a medical school. This risk adjustment methodology was used on the New Jersey data to "even out the playing field".

How are HAIs measured and what do the measures mean?

The Standardized Infection Ratio (SIR) is used to measure HAIs. The SIR is a summary measure developed by CDC to track HAIs at a national, state, local or hospital level over time. The hospital SIR is the total number of "observed" or actual events, also called infections, divided by the total number of "expected" events, which is derived from the national baseline experience. More detailed explanations of the "observed" and "expected" number of events, as well as the SIR are provided below.

The hospital SIRs are compared to the national experience, which is a baseline SIR of 1.0. The results are summarized under the column, National Comparison. This column classifies the hospitals' performances by a L as "Lower than Expected", a S as "Similar to Expected", or a H as "Higher than Expected".

A hospital has performed better than the national baseline if the National Comparison column is marked with a L. These hospitals appear better because they had fewer infections than what was predicted based on the national experience. Hospitals labeled with a H had more infections than what the national experience predicted. Those hospitals that performed the same as the national experience are labeled with a S.

According to CDC's risk adjustment methodology, the SIR for the national baseline is 1.0. To interpret a hospital's SIR, compare the SIR to 1.0, the national

baseline SIR. This approach compares a hospital's actual performance to what would have occurred if the hospital performed the same as the national baseline experience.

To learn more about the risk-adjustment method and how SIRs are calculated, see the technical report at www.nj.gov/health/hpr.

What are Central Line-Associated Bloodstream Infections (CLABSIs)?

CLABSIs are primary bloodstream infections that are associated with the presence of a central vascular catheter. A central line is a tube that is placed into a patient's large vein, usually in the neck, chest, arm or groin. The line is used to give fluids and medication, withdraw blood, and monitor the patient's condition. A bloodstream infection can occur when microorganisms such as bacteria and fungi enter, attach and multiply on the tubing or in fluid administered through the tubing and then enters the blood.

If you develop a central line-associated bloodstream infection, you may become ill with fevers and chills or the skin around the central line may become sore and red. CLABSIs can be prevented through proper management of the central line. The costs of a CLABSI in 2012 U.S. dollars averaged \$45,814. ² It is estimated that CLABSIs cost \$2.7 billion a year in the United States. According to the federal Centers for Disease Control and Prevention (CDC), approximately 250,000 CLABSIs occur annually with an estimated death rate of 12% to 25% for each CLABSI⁴.

What CLABSI data are included in this report?

CLABSIs are monitored in many inpatient locations within the hospital. This report includes CLABSI events that occurred in adult, pediatric critical/intensive care units and neonatal intensive care units (ICUs and NICUs) in each of the 70 acute care and one specialty care hospitals in New Jersey during 2015. The data were verified for accuracy by each hospital.

What are the CLABSI results for New Jersey for 2015?

There were more than 500,000 central-line days reported to NHSN by New Jersey acute care hospitals in 2015. The formula below provides the Statewide observed, expected and SIR for CLABSIs:

$$\begin{aligned} \text{Observed CLABSIs} &= 542 \\ \text{Expected CLABSIs} &= 843.58 \\ \text{SIR} &= \text{Observed/Expected} = 0.64 \end{aligned}$$

The SIR of 0.64 indicates that CLABSIs for New Jersey were 36% fewer than expected based on the national data. The difference is statistically significant. This means the central-line infections in New Jersey were lower than the central-line infections seen nationally.

In the ICUs in New Jersey, the SIR is as follows:

Observed ICU CLABSIs=506
Expected ICU CLABSIs=777.08
SIR=Observed/Expected=0.65

The SIR of 0.65 indicates that ICU CLABSIs for New Jersey were 35% fewer than expected based on the national data. The difference is statistically significant. Central-line infections in New Jersey were lower than the central-line infections seen nationally.

There are 24 acute care hospitals in New Jersey which have Neonatal Intensive Care Units (NICUs). The SIR for NICU is as follows:

Observed NICU CLABSIs=36
Expected NICU CLABSIs=66.50
SIR=Observed/Expected=0.54

The SIR of 0.54 indicates that NICU CLABSIs for New Jersey were 46% fewer than expected based on the national data. The difference is statistically significant; NICU CLABSIs in New Jersey were lower than NICU CLABSIs seen nationally.

What are Catheter-Associated Urinary Tract Infections (CAUTIs)?

Catheter-Associated Urinary Tract Infections (CAUTI) are the most commonly reported healthcare-associated infection in acute care hospitals. A catheter is a drainage tube that is inserted into the bladder. The catheter is left in place and is connected to a closed collection device.

More than 30 percent of infections in acute care hospitals are reported as CAUTIs.⁶ As with other HAIs, CAUTIs are also associated with increased morbidity, mortality, length of stay and hospital costs. It is estimated that more than 449,000 CAUTIs occur annually and patient hospital costs range from \$862 to \$1,007 per incident.³ CAUTIs are also associated with more than 13,000 deaths annually.⁶

What CAUTI data are included in this report?

CAUTIs are monitored in many inpatient locations within the hospital. **This report focuses on CAUTI events that occurred in adult critical/intensive care units (CCUs or ICUs)** in each of the 70 acute care hospitals and one specialty care hospital in New Jersey during 2015. It is important to note that the CAUTI data in this report were verified for accuracy by each hospital but were not audited.

What are the CAUTI results for New Jersey for 2015?

There were over 530,000 catheter days reported to NHSN by New Jersey hospitals in 2015. The formula below provides the Statewide observed, expected and SIR for CAUTIs:

Observed CAUTIs=680
Expected CAUTIs=987.96
SIR=Observed/Expected=0.69

The SIR of 0.69 indicates that CAUTIs for New Jersey were 31% lower than the expected national data. The difference is statistically significant. This means the catheter-associated urinary tract infections in New Jersey were lower than the catheter-associated urinary tract infections seen nationally.

What are Surgical Site Infections?

A surgical site infection (SSI) is an infection that occurs in the area of the body where the surgery took place. The SSI can be superficial, meaning it's on the skin. It can also be serious and affect layers under the skin, organs and/or implants. The infection is reported if it develops within 30-90 days of the procedure.

According to a recent survey, SSIs were the second most common HAI in 2011, accounting for an estimated 24 percent of all HAI hospitalizations.⁸ Associated costs to treat an inpatient with a SSI are between \$11,874 - \$34,670 per infection.² One article notes that more than 750,000 SSIs occur each year in the United States which results in an additional 2.5 million hospital days which leads to more than \$1 billion in unnecessary costs.⁷

What Surgical Site Infections are in this report?

The surgical site infections included in this report are from 2015. The infections reported were inpatient procedures and Deep Incisional Primary and Organ/Space SSIs that were identified during admission or readmission to the same facility.

This year's report includes SSI data from Coronary Artery Bypass Graft (CABG) procedures, Abdominal Hysterectomy procedures, Knee Arthroplasty procedures and Colon surgery procedures. It is important to note that only 18 of the 71 acute care hospitals are licensed as Open Heart Surgery hospitals and are able to perform CABG surgery. The surgical site infection data for 2015 were verified for accuracy by each hospital but were not audited.

What are the SSI results for New Jersey hospitals for 2015?

A total of 4,849 **CABG procedures** were reported in NHSN by the 18 Open Heart Surgery Hospitals in New Jersey. The formula below provides the Statewide observed, expected and SIR for CABGs:

Observed CABG infections=51
Expected CABG infections=60.10
SIR=Observed/Expected=0.85

The SIR of 0.85 indicates that the observed CABG infections were 15% fewer than expected based on the national data. The difference is not statistically significant which means the CABG infections in New Jersey were similar to the CABG infections seen nationally.

A total of 7,202 **Abdominal Hysterectomy (HYST)** procedures were reported in NHSN by the hospitals in New Jersey who perform the procedure. The formula below provides the Statewide observed, expected and SIR for abdominal hysterectomies:

Observed HYST infections=52
Expected HYST infections=54.06
SIR=Observed / Expected =0.96

The SIR of 0.96 indicates that the observed abdominal hysterectomy infections were 4% less than expected based on the national data. However, the difference is not statistically significant which means the abdominal hysterectomy infections in New Jersey were similar to those seen nationally.

A total of 16,300 **Knee Arthroplasty (KPRO)** procedures were reported in NHSN by hospitals in New Jersey who perform the procedure. The formula below provides the Statewide observed, the expected and the SIR for knee arthroplasties:

Observed KPRO infections=64
Expected KPRO infections=103.92
SIR=Observed/Expected=0.62

The SIR of 0.62 indicates that the observed knee arthroplasty infections were 38% less than expected based on the national data. The difference is statistically significant which means the knee arthroplasty infections in New Jersey were lower than those seen nationally.

A total of 8,045 **Colon (COLO) procedures** were reported in NHSN by hospitals in New Jersey who performed the procedure. The formula below provides the Statewide observed, the expected and the SIR for colon procedures:

Observed COLO infections=206
Expected COLO infections=247.96
SIR=Observed/Expected=0.83

The SIR of 0.83 indicates that the observed colon infections were 17% less than expected based on the national data. The difference is statistically significant. This means that the colon infections in New Jersey were lower than the colon infections seen nationally.

The **Overall SSI SIR** accounts for all surgeries that were reported in New Jersey in 2015; CABG, Abdominal Hysterectomy, Knee Arthroplasty and Colon surgeries. There were more than 36,000 surgeries reported in NHSN by New Jersey hospitals. The formula below provides the Statewide observed, the expected and SIR for the Overall SSIs:

Observed SSIs=373
Expected SSIs=465.75
SIR=Observed/Expected=0.80

The SIR of 0.80 indicates that the Overall SSIs for New Jersey were 20% fewer than expected based on the national data. The difference is statistically significant. This means the surgical site infections in New Jersey were lower than surgical site infections seen nationally.

What is “National Comparison”?

In addition to displaying the “observed” and “expected” numbers of events and the SIRs, the tables include a column labeled “National Comparison”. This column classifies the hospitals’ performances as “L” which is Lower than expected, “S” which is Similar to expected, or “H” which is Higher than expected.

A hospital performed better than the national baseline if the National Comparison has L or Lower than Expected, as indicated in the table.

In trying to determine a hospital’s performance, it is important to account for the fact that some differences occur simply due to chance. Although not shown in the table, 95% confidence intervals are used to determine how statistically certain is the conclusion that a hospital’s SIR is higher or lower than 1.0. For more details, refer to the HAI Technical Report at www.nj.gov/health/hpr.

A hospital’s SIR is statistically significantly lower than 1.0 if its 95% confidence interval falls completely below 1.0. The hospital is noted with a L in the National Comparison column. This means that fewer HAI events were observed than expected, adjusting for differences in the types of patients treated. Since the

comparison is to the national baseline data, the hospital performed better than the national baseline experience.

A hospital's SIR is statistically significantly higher than 1.0 if its 95% confidence interval falls completely above 1.0. In this case, the hospital is noted with a H in the National Comparison column. This means that more HAI events were observed than expected, adjusting for differences in the types of patients treated and that the hospital performed worse than the national baseline experience.

A hospital's SIR is not statistically different from 1.0 if its 95% confidence interval includes 1.0. The hospital is noted with a capital S in the National Comparison column. This means that adjusting for difference in the types of patients treated, the hospital's performance on preventing HAI events was similar to the national baseline experience.

Can we make conclusions about a hospital's performance in preventing HAIs based on this data?

Please keep in mind the following before making conclusions about a hospital:

Even though hospitals reviewed and verified accuracy of the data used in this report, the data have not been audited by an independent agency.

It is also important to note that a hospital which performed lower than the National Comparison, does not necessarily mean the hospital is better but that they may need to improve their HAI surveillance protocols. Conversely, a hospital which performed higher than the National Comparison is not necessarily a poor performer. This hospital could have better infection surveillance and detection processes instituted throughout their facility.

In addition, the risk-adjustment method may not fully capture how sick patients are in certain hospitals and locations. The sicker the patients are, the more likely a hospital is to have a higher number of events. Therefore, it is important to use caution when interpreting the hospital infection data.

References

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- ⁴ Centers for Disease Control and Prevention: Slides for the **American Recovery and Reinvestment Act Epidemiology and Laboratory Capacity (ELC) for Infectious Disease Program, Healthcare-Associated Infections (HAIs) Grantee Meeting** October 19-20, 2009, presented by *Katherine Allen-Bridson* http://www.cdc.gov/hai/recoveryAct/PDF/Oct09/11-145_Bridson_NHSN_CLABSI_Day2_Workshop1.pdf accessed April 10, 2015.
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