

NEW JERSEY 2010 HOSPITAL PERFORMANCE REPORT
TECHNICAL REPORT: METHODOLOGY
CENTRAL LINE-ASSOCIATED BLOODSTREAM INFECTIONS

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CENTRAL LINE-ASSOCIATED BLOODSTREAM INFECTIONS

A. Background: Healthcare-Associated Infections

Healthcare-Associated Infections (HAIs) are defined as infections acquired by patients while being treated in a healthcare setting. Healthcare settings include acute-care and specialty care hospitals, outpatient clinics, nursing homes, rehabilitation facilities and ambulatory surgery centers. HAIs contribute significantly to morbidity and mortality in the United States. They account for approximately 1.7 million infections and 99,000 deaths annually¹. The estimated financial impact of HAIs is between \$28 billion to \$33 billion a year².

There are a number of causes of HAIs which include medical devices (i.e. catheters, implants, ventilators), surgical procedure complications, the overuse of antibiotics and improper hand hygiene. Approximately 75 percent of HAIs can be attributed to four infection categories:

1. [Surgical site infections](#);
2. [Central line-associated bloodstream infections](#);
3. [Ventilator-associated pneumonia](#), and;
4. [Catheter-associated urinary tract infections](#).

Two additional major contributors to HAIs are:

5. [Clostridium difficile](#), and;
6. [Methicillin-resistant Staphylococcus aureus \(MRSA\)](#)³.

The most common healthcare-associated infections are urinary tract infections (32 percent), followed by surgical site infections (22 percent), pneumonias (15 percent), and bloodstream infections (14 percent)⁴.

B. HAI Surveillance in New Jersey

Reducing preventable HAIs has become a priority for New Jersey hospitals, healthcare providers, state legislators and healthcare policy professionals. Signed in 2007, the public reporting legislation (PL of 2007, C 196) requires hospitals to report HAI data to the State Department of Health and Senior Services and for the data to be published in the Hospital Performance Report.

Beginning January 1, 2009, all acute-care hospitals along with one specialty care hospital in New Jersey began submitting the following HAI data to the New Jersey Department of Health and Senior Services:

- Central Line-Associated Bloodstream Infections (CLABSIs) in adult, pediatric and neonatal critical care units.
- Surgical Site Infections following Abdominal Hysterectomies.
- Surgical Site Infections following Coronary Artery Bypass Graft procedures.

In 2010, two additional HAIs were added to the surveillance efforts:

- Catheter-Associated Urinary Tract Infections in all adult critical care units.
- Surgical Site Infections following Knee Prosthesis.

C. Source of Healthcare-Associated Infection Data

The Centers for Disease Control and Prevention's (CDC) Division of Healthcare Quality Promotion (DHQP) implemented a public health surveillance system known as the National Healthcare Safety Network (NHSN) in 2005. The American Recovery and Reinvestment Act (ARRA) of 2009 provided the funding necessary to expand HAI surveillance and prevention efforts on both the national and state level. As a result, the NHSN system is used by various types of health care facilities in all 50 states, Washington, D.C. and Puerto Rico to monitor patient safety, healthcare personnel safety and biovigilance. Currently, more than 3000 hospitals use the NHSN system and 22 states have mandates which require hospitals to report Healthcare-Associated Infections using NHSN⁴. The NHSN system is a secure, internet-based system and its use is voluntary. The 71 acute care hospitals as well as one specialty care hospital in New Jersey use the NHSN system to report and survey HAIs.

This initial report focuses on the type of HAIs that is the deadliest and most costly to treat, Central Line-Associated Bloodstream Infections (CLABSIs). It is estimated that CLABSIs cost \$2.7 billion a year in the United States². CLABSIs are primary bloodstream infections which occur when bacteria or other germ travel down a "central line", such as catheter, and enter the blood. If you develop a catheter-associated bloodstream infection, you may become ill with fevers and chills or the skin around the catheter may become sore and red. CLABSIs can be prevented through proper management of the central line.

This report focuses on CLABSI events that occurred in adult and pediatric critical/intensive care units (CCUs or ICUs) from all 71 acute care hospitals as well as one specialty hospital in New Jersey. The data in this report are from 2009.

D. Standardized Infection Ratio

This report presents composite statistics summarizing CLABSI data at the hospital level. The CLABSI data are summarized using the Standardized Infection Ratio (SIR), a

statistic used to measure relative difference in HAI occurrence during a reporting period compared to a common reference period (i.e. standard population).

What is a Standardized Infection Ratio (SIR)?

The Standardized Infection Ratio (SIR) is a summary measure developed by CDC to be used to track HAIs at a national, state, local or hospital level over time. The SIR adjusts for the fact that each hospital treats different types of patients. In CLABSI context, the SIR compares the actual number of CLABSI events reported by a hospital with the national baseline experience, adjusting for several risk factors that have been found to be significantly associated with differences in infection incidence^{5,7}.

How is the SIR Calculated?

The SIR is calculated by applying the risk-adjustment method developed by CDC to the 2009 New Jersey data. Calculating the SIR is similar to the Standardized Mortality Ratio (SMR), a summary statistic frequently used in public health.

It is defined as the number of observed infections divided by the number of expected infections. The formula below depicts the calculation:

$$\text{SIR} = \frac{\text{Observed Infections}}{\text{Expected Infections}}$$

This table provides an example of how a hospital's CLABSI data from four different locations can be summarized into a single risk-adjusted summary statistic, i.e., the SIR.

Type of ICU Location	Observed Number of CLABSI Events	Central Line-days	CLABSI Rate (per 1000 central-days)	NHSN Rate (per 1000 central-days)	Expected Number of CLABSI Events
Medical cardiac	2	380	5.26	2.0	0.76
Medical	1	257	3.89	2.6	0.67
Med/Surgical	3	627	4.78	4.5	0.94
Neurosurgical	2	712	2.81	2.5	1.78
<i>Total</i>	<i>8</i>	<i>1976</i>	<i>4.05</i>	<i>---</i>	<i>4.15</i>
Overall CLABSI SIR = Observed/Expected = 8/4.15 = 1.93					

The “observed” number of CLABSI events are the number of CLABSI events that occurred in an ICU or CCU in a hospital. The greater the total number of days that patients have central lines inserted (central line-days), the more CLABSI events are likely to occur.

The “expected” number of CLABSI events for an ICU or CCU is calculated by multiplying the total count of central line-days in the ICU or CCU by the NHSN rate and

dividing by 1000. The NHSN rate is based on 2006-2008 NHSN aggregate data. CLABSI rates were stratified by type of patient care locations and, in some cases, also by type of hospital or bed size of the patient-care locations^{5, 6}. The expected numbers of CLABSI events from all adult and pediatric ICUs and CCUs in a hospital are then summarized and used as the denominator for the overall SIR for the hospital.

The “expected” number of CLABSI events shows the number of CLABSI events that would have occurred if the hospital’s performance had been the same as the national experience.

Following the NHSN methodology, the SIRs are calculated only if the number of expected CLABSI events is ≥ 1 . When the number of expected CLABSI events is < 1 , based on the NHSN aggregate rates, the central line-day count in the hospital is too low to calculate a precise SIR and comparative statistics⁷.

How to interpret the SIR?

In trying to determine a hospital’s performance, it is important to account for the fact that some differences occur simply due to chance or random variation. As shown in table 1, 95% confidence intervals are used to determine whether a hospital’s SIR is statistically significantly higher or lower than 1.0.

A hospital’s SIR is statistically significantly lower than 1.0 if its 95% confidence interval falls completely below 1.0. The hospital is listed as “Lower than Expected”. This means fewer CLABSI events were observed than expected, adjusting for differences in the types of patients treated. 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. The hospital is listed as “Higher than Expected”. This means more CLABSI events were observed than expected, adjusting for differences in the types of patients treated. 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 listed as “Similar to Expected”. This means similar number of CLABSI events were observed as expected, adjusting for differences in the types of patients treated. The hospital performed similar to the national baseline experience.

In examining the table, some SIRs may appear lower than others but are considered “Similar to Expected”, while other SIRs may appear higher but the National Comparisons indicate “Lower than Expected”. This reflects the fact that ratios calculated from hospitals with higher counts of central line-days are more statistically stable. For instance, Meadowlands Hospital Medical Center’s SIR is 0.00 and its National Comparison is “Similar to Expected” while Jersey Shore University Medical Center’s SIR

is 0.52 and its National Comparison is “Lower than Expected”. This is because Jersey Shore University Medical Center had a much higher count of central line-days. Jersey Shore University Medical Center reported a total of 8,960 central line-days, while Meadowlands Hospital Medical Center reported a total of 994 central line-days. As a result, while we have high statistical certainty that Jersey Shore University Medical Center’s SIR of 0.52 is lower than 1.0, we cannot conclude with the same statistical certainty that Meadowlands Hospital Medical Center’s SIR is lower than 1.0.

When using this report, it is important to remember that the data in Table 1 are designed to show whether a hospital’s SIR is statistically significantly above, below or the same as the national baseline. Thus, it is more important to view the confidence intervals in relation to the national baseline SIR of 1.0 than it is to make hospital-to-hospital comparisons.

Following the NHSN methodology, when the CLABSI count is 0, the lower bound of the 95% Confidence Interval will not be calculated⁷.

E. Data Limitations

Please keep in mind some of the following issues before making conclusions about a hospital. Even though hospitals reviewed and verified the data used in this report, the data have not been audited by an independent source. However, an official audit of the data is underway for next year’s report.

In addition, the risk-adjustment method may not fully capture how sick patients are in certain hospitals and locations. For example, the medical intensive care unit patients in one hospital might be intrinsically at greater risk for HAI compared to the medical intensive care unit patients from the national experience. Therefore, it is important to use caution when interpreting hospital HAI data.

Table 1. Central Line-Associated Bloodstream Infections (CLABSIs) in 2009, New Jersey

Hospital Name	Observed Number of CLABSIs (O)	Expected Number of CLABSIs (E)	SIR = O/E	National Comparison (1)*	Number of Central Line-days	95% Confidence Interval***
AtlantiCare Regional Medical Center-City	9	6.84	1.32	Similar to Expected	2,474	(0.60, 2.50)
AtlantiCare Regional Medical Center-Mainland	5	8.26	0.61	Similar to Expected	5,014	(0.20, 1.41)
Bayonne Medical Center	2	1.78	1.13	Similar to Expected	888	(0.14, 4.07)
Bayshore Community Hospital	1	3.26	0.31	Similar to Expected	2,174	(0.01, 1.71)
Bergen Regional Medical Center	0	1.10	0.00	Similar to Expected	579	(---, 3.35)
Cape Regional Medical Center	1	2.42	0.41	Similar to Expected	1,612	(0.01, 2.30)
Capital Health System at Fuld	13	6.16	2.11	Higher than Expected	4,108	(1.12, 3.61)
Capital Health System at Mercer	5	3.09	1.62	Similar to Expected	2,062	(0.52, 3.77)
CentraState Medical Center	1	2.76	0.36	Similar to Expected	1,455	(0.01, 2.02)
Chilton Memorial Hospital	1	0.47	2.12	Similar to Expected**	315	(0.05, 11.79)
Christ Hospital	2	3.18	0.63	Similar to Expected	2,121	(0.08, 2.27)
Clara Maass Medical Center	4	11.80	0.34	Lower than Expected	5,875	(0.09, 0.87)
Community Medical Center	2	3.43	0.58	Similar to Expected	1,490	(0.07, 2.11)
Cooper Hospital/University Medical Center	3	25.19	0.12	Lower than Expected	9,660	(0.02, 0.35)
Deborah Heart and Lung Center	3	5.38	0.56	Similar to Expected	2,529	(0.11, 1.63)
East Orange General Hospital	0	4.17	0.00	Lower than Expected	2,782	(---, 0.88)
Englewood Hospital and Medical Center	0	5.43	0.00	Lower than Expected	2,947	(---, 0.68)
Hackensack University Medical Center	36	19.74	1.82	Higher than Expected	9,487	(1.28, 2.53)
Hackettstown Regional Medical Center	0	1.01	0.00	Similar to Expected	673	(---, 3.65)
Hoboken University Medical Center	0	2.07	0.00	Similar to Expected	984	(---, 1.79)
Holy Name Hospital	4	3.04	1.32	Similar to Expected	2,026	(0.36, 3.37)
Hunterdon Medical Center	2	3.74	0.54	Similar to Expected	1,779	(0.06, 1.93)
JFK Medical Center	20	15.54	1.29	Similar to Expected	8,830	(0.79, 1.99)
Jersey City Medical Center	2	8.97	0.22	Lower than Expected	4,346	(0.03, 0.81)

Hospital Name	Observed Number of CLABSIs (O)	Expected Number of CLABSIs (E)	SIR = O/E	National Comparison (1)*	Number of Central Line-days	95% Confidence Interval***
Jersey Shore University Medical Center	9	17.24	0.52	Lower than Expected	8,960	(0.24, 0.99)
Kennedy Mem. Hospitals UMC-Cherry Hill	1	3.55	0.28	Similar to Expected	1,553	(0.01, 1.57)
Kennedy Mem. Hospitals UMC-Stratford	2	1.99	1.00	Similar to Expected	949	(0.12, 3.63)
Kennedy Mem. Hospitals UMC-Wash. Twp.	1	5.05	0.20	Similar to Expected	2,069	(0.01, 1.10)
Kimball Medical Center	1	2.21	0.45	Similar to Expected	1,473	(0.01, 2.52)
Lourdes Medical Center of Burlington County	6	1.85	3.25	Higher than Expected	1,231	(1.19, 7.07)
Meadowlands Hospital Medical Center	0	1.49	0.00	Similar to Expected	994	(---, 2.47)
Memorial Hospital of Salem County	1	0.52	1.94	Similar to Expected**	344	(0.05, 10.80)
Monmouth Medical Center	3	4.11	0.73	Similar to Expected	1,927	(0.15, 2.14)
Morristown Memorial Hospital	3	13.43	0.22	Lower than Expected	5,606	(0.05, 0.65)
Mountainside Hospital	2	5.94	0.34	Similar to Expected	2,864	(0.04, 1.22)
Newark Beth Israel Medical Center	14	20.90	0.67	Similar to Expected	10,703	(0.37, 1.12)
Newton Memorial Hospital	0	1.33	0.00	Similar to Expected	889	(---, 2.77)
Ocean Medical Center	4	3.52	1.14	Similar to Expected	2,347	(0.31, 2.91)
Our Lady of Lourdes Medical Center	4	12.48	0.32	Lower than Expected	8,014	(0.09, 0.82)
Overlook Hospital	9	11.19	0.80	Similar to Expected	6,142	(0.37, 1.53)
Palisades Medical Center of New York	2	1.45	1.38	Similar to Expected	964	(0.17, 5.00)
RWJ University Hospital at Hamilton	2	4.84	0.41	Similar to Expected	3,229	(0.05, 1.49)
RWJ University Hospital at Rahway	0	4.06	0.00	Lower than Expected	2,211	(---, 0.91)
Raritan Bay Medical Center-Old Bridge	3	2.13	1.41	Similar to Expected	1,423	(0.29, 4.11)
Raritan Bay Medical Center-Perth Amboy	2	5.26	0.38	Similar to Expected	3,096	(0.05, 1.37)
Riverview Medical Center	10	2.59	3.87	Higher than Expected	1,724	(1.85, 7.11)
Robert Wood Johnson University Hospital	35	33.51	1.04	Similar to Expected	13,307	(0.73, 1.45)
Shore Memorial Hospital	0	3.09	0.00	Similar to Expected	2,062	(---, 1.19)
Somerset Medical Center	6	4.83	1.24	Similar to Expected	2,503	(0.46, 2.70)
South Jersey Healthcare Regional Medical Center	2	3.50	0.57	Similar to Expected	1,753	(0.07, 2.06)
South Jersey Hospital-Elmer	0	0.88	0.00	Similar to Expected**	464	(---, 4.18)
Southern Ocean County Hospital	0	1.85	0.00	Similar to Expected	976	(---, 1.99)

Hospital Name	Observed Number of CLABSIs (O)	Expected Number of CLABSIs (E)	SIR = O/E	National Comparison (1)*	Number of Central Line-days	95% Confidence Interval***
St. Barnabas Medical Center	12	20.95	0.57	Similar to Expected	8,226	(0.30, 1.00)
St. Clare's Hospital-Denville	0	1.50	0.00	Similar to Expected	999	(---, 2.46)
St. Clare's Hospital-Dover	0	0.97	0.00	Similar to Expected**	649	(---, 3.79)
St. Clare's Hospital-Sussex	0	0.04	0.00	Similar to Expected**	28	(---, 87.83)
St. Francis Medical Center	1	3.46	0.29	Similar to Expected	2,193	(0.01, 1.61)
St. Joseph's Hospital and Medical Center	12	11.99	1.00	Similar to Expected	4,784	(0.52, 1.75)
St. Joseph's Wayne Hospital	0	3.29	0.00	Similar to Expected	2,196	(---, 1.12)
St. Mary's Hospital (Passaic)	4	5.25	0.76	Similar to Expected	3,502	(0.21, 1.95)
St. Michael's Medical Center	10	10.94	0.91	Similar to Expected	5,261	(0.44, 1.68)
St. Peter's University Hospital	6	9.50	0.63	Similar to Expected	4,262	(0.23, 1.37)
Trinitas Hospital	6	5.30	1.13	Similar to Expected	3,536	(0.42, 2.46)
UMDNJ-University Hospital	6	18.18	0.33	Lower than Expected	7,422	(0.12, 0.72)
Underwood-Memorial Hospital	0	3.33	0.00	Similar to Expected	2,223	(---, 1.11)
University Medical Center at Princeton	3	1.96	1.53	Similar to Expected	1,227	(0.32, 4.48)
Valley Hospital	19	9.86	1.93	Higher than Expected	6,116	(1.16, 3.01)
Virtua-Memorial Hospital Burlington County	4	6.53	0.61	Similar to Expected	4,352	(0.17, 1.57)
Virtua-West Jersey Hospital Berlin	0	1.68	0.00	Similar to Expected	1,121	(---, 2.19)
Virtua-West Jersey Hospital Marlton	4	3.48	1.15	Similar to Expected	2,318	(0.31, 2.95)
Virtua-West Jersey Hospital Voorhees	3	4.73	0.63	Similar to Expected	3,206	(0.13, 1.85)
Warren Hospital	0	1.80	0.00	Similar to Expected	1,202	(---, 2.05)
Statewide	328	448.36	0.73	Lower than Expected	230,810	(0.65, 0.82)

Source: New Jersey Healthcare-Associated Infections, 2009, submitted through the National Healthcare Safety Network (NHSN).

* Each hospital is compared to the National Ratio=1. The National Ratio is derived using NHSN data from 2006-2008 (AJIC, December 2009).

** This hospital's expected number of CLABSIs is less than 1.0 due to low count of central line-days. Interpret data with caution.

*** The lower bound of the 95% confidence interval is not calculated when the observed number of CLABSIs is 0.

Notes: SIR = Standardized Infection Ratio defined as Observed / Expected; Observed = Number of CLABSIs reported by each hospital for 2009.

Expected = Number of CLABSIs predicted using the model fitted from the NHSN data from 2006-2008. This data set will serve as the baseline/benchmark for all future reports.

Hospital is listed as "Lower than Expected" if the 95% confidence interval of the SIR is below 1.0, "Similar to Expected" if the confidence interval includes 1.0, "Higher than Expected" if the confidence interval is above 1.0. The greater the number of central line-days, the narrower the confidence interval is.

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