STATE-SPECIFIC SUPPLEMENT TO THE NATIONAL HEALTHCARE-ASSOCIATED INFECTION STANDARDIZED INFECTION RATIO REPORT: JULY 2009 THROUGH DECEMBER 2009

The National Healthcare Safety Network (NHSN) is a public health surveillance system that the Centers for Disease Control and Prevention's (CDC) Division of Healthcare Quality Promotion (DHQP) maintains and supports as a mainstay of its healthcare-associated infection (HAI) prevention program. Central line-associated bloodstream infections (CLABSIs) are one of the HAI types most frequently reported to NHSN. In 2010, CDC analyzed and reported state-specific summary CLABSI data for January – June 2009; this first report provided an initial set of measurements for evaluating the impact of federal investments in state HAI programs that began in September 2009, specifically American Recovery and Reinvestment Act (Recovery Act) funds administered by CDC, and to help states set or reassess priorities for their HAI surveillance and prevention efforts.

This report supplements the Second National HAI Standardized Infection Ratio (SIR) Report and provides state-specific summary CLABSI data for July through December 2009 and compares them to state-specific summary CLABSI data for January through June 2009 for states with mandates for reporting CLABSIs through NHSN.[1] This supplement includes specialty care locations including long-term acute care (LTAC) locations (both freestanding and hospital-within a hospital) in the state-specific calculations.

Methods

NHSN Data Reported

Detailed methodology for CLABSI case finding and reporting through NHSN are summarized elsewhere.[2] For the state-specific aggregation of HAI data, state-specific SIRs reported are limited to states in

which any type of mandate for reporting CLABSIs to NHSN was in place as of December 31, 2009. The calculations include data from all reporting locations within these hospitals except locations designated for treatment of hematology/oncology or transplant (either bone marrow or solid organ) patients. These locations are excluded because reporting from them was infrequent from 2006 through 2009. Further work is needed to confirm the accurate categorization of these locations by reporting facilities before they can be included in subsequent reports.

Calculation of SIRs

The same referent period used in the first report was also utilized for this report. This referent period was derived from national-level HAI data from NHSN from January 2006 through December 2008; these data were used to estimate the predicted number of HAIs in the observed-to-predicted ratios that comprise the SIRs.[3] The SIRs represent comparisons of observed HAI occurrence during each distinct reporting period with the predicted occurrence based on the referent period rates of infections adjusting for key covariates. Illustrative examples of how an SIR is calculated are provided elsewhere.[1] In this report, the CLABSI SIRs are adjusted for patient case-mix by taking into account hospital affiliation with a medical school as well as the type and bed-size of patient care locations.

First, state-specific SIRs were calculated from all reporting locations in all reporting facilities in each state. Second, facility-specific SIRs were calculated for each summary measure. However, if a facility's predicted number of HAIs (e.g., CLABSIs) was <1.0, a facility-specific SIR was not calculated. This report considered calculations of a facility-specific SIR to be unreliable when so few (i.e., < 1.0) HAIs would be predicted from the data reported by the facility to NHSN.

Serial Comparison of SIRs

Whether prevention success changed or was sustained was assessed by comparing CLABSI SIRs between two sequential six-month periods in 2009 for each of 17 states with a CLABSI mandate in place as of June 30, 2009, as well as for all locations in all states (i.e., CLABSI reported from all locations from 50 states, the District of Columbia, and Puerto Rico). First, the SIRs were compared regardless of whether the locations reported continuously throughout 2009, and these comparisons were summarized as a percentage change in SIR ($[SIR_{T1} - SIR_{T2}/SIR_{T1}] \times 100$) between the six-month periods. A second comparison, again summarized as a percentage change in SIR for each state with a CLABSI reporting mandate, or the nation, was restricted to hospital locations from which any CLABSI data were reported during both six-month time periods. These locations are referred to as continuously reporting locations. A conditional binomial test was performed to assess statistically significant changes in the pairs of sequential SIRs (two-sided P-value $\leq .05$). If the change was not statistically significant, it was reported as "no change." Prevention success can be measured as sustained (similar SIRs between reporting periods), accelerated (SIRs sequentially decreasing), or slowing of progress (SIRs sequentially increasing toward or above 1.0).

Results

Eighteen states implemented a mandate for reporting of CLABSIs through NHSN before December 31, 2009; within these states 1,281 acute care facilities reported data from adult or pediatric non-NICU locations during June-December, 2009 (Table 1). This represents roughly 80% of the acute care facilities reporting data from such locations in all 50 States, Washington D.C., and Puerto Rico. Ten of the 18 states with a mandate had SIRs significantly less than 1.0, while only 2 had SIRs significantly higher than 1.0. The facility-specific SIRs, listed in Table 1 at key percentile distributions, illustrate two key points. In nine of the 18 states, the median facility-specific SIR was 0; this translates to half of all facilities in these states reporting zero CLABSIs during

the six month period. In seven of the states, the 10 percent of facilities reporting the highest facility-specific SIRs (90th percentile) reported SIRs >2.0 (i.e. twice as many CLABSIs as would have been expected during this time period).

Only 1 state, West Virginia, implemented their mandate for CLABSI reporting after June 2009 and therefore was not included in the serial SIR evaluation. Among the 17 states with a mandate in place before July 2009, there was no statistically significant change in CLABSI SIRs between two sequential six-month periods when evaluating all reporting locations within each of these states (Table 2). In all but one state, the stability in CLABSI SIRs persists across the two time periods regardless of whether all reporting locations are included (All Locations Reporting) or just those hospital locations that reported continuously throughout 2009 (Continuously Reporting Locations). In South Carolina, there was a significant decrease in the SIR calculated from data submitted by only continuously reporting locations; the SIR decreased from 1.18 (95% confidence interval, 1.01-1.36) to 0.88 (95% CI, 0.73-1.04) (P-value =.01). Similarly, the national CLABSI SIRs were similar between reporting periods, indicating sustained reductions compared to the referent period. This finding was confirmed when evaluating only the 1,442 continuously reporting locations (Table 2).

Discussion

The HAI data summarized in this report over two sequential six-month periods in 2009 show that the healthcare facilities reporting to NHSN during the entire year, considered as a group, reported fewer CLABSIs than predicted, taking into account the patient case-mix of patients and hospital locations included in each reporting period. CLABSI SIRs remained below 1.0 during 2009 nationally and in most states with CLABSI reporting mandates, without statistically significant changes in SIRs at the state or national levels across the two sequential reporting periods. This suggests that CLABSI prevention efforts have been widely effective and

sustained, albeit with opportunities for further improvement in some places. While these are encouraging findings, they do not represent a complete picture of the impact of the Recovery Act support for state HAI programs on extending gains in CLABSI prevention since the time period in this report covers only the first three months of a two-year federal-state initiative. Subsequent analyses are needed to fully evaluate such programmatic impact.

For each state, the change in the SIR point estimate for the sequential periods represents non-statistically significant differences in all comparisons except among continuously reporting locations in South Carolina, where there was a significant reduction in the SIR. Apart from this example, the inability to detect statistically significant differences in most states might be a result the relative infrequency of events expected to occur within the short time window of six months in any given state. This is one of the limitations in summarizing HAI experience of a state over a short time period (i.e., six months). There are many reasons for fluctuations in the state-specific values. One important note is that as state HAI programs accelerate validation efforts, their serial SIRs may paradoxically increase if substantial improvements in case-finding have occurred. State health departments can use facility-specific SIRs to help identify facilities with high SIRs, evaluate the circumstances related to the CLABSI occurrences, and assist them in improvement.

A major consideration for interpreting these data and future reports includes assessing the confidence in the validity of the data reported. Specific validation efforts have begun at the state level; there is a need for additional validation of HAI data reported to NHSN. Eleven of the 18 states with a mandate reported the completion of some validation studies of CLABSI data reported during July 2009 through December 2009; only 6 of these states conducted audits of medical records.[1] As a result of increased funding for HAI prevention, more state health departments have plans to launch more comprehensive validation studies over the next several

months; these will serve as an important step toward a more complete understanding of the HAI data reported to NHSN.

The serial SIRs should not be used to derive any absolute ranking of states; rather, they should serve as a marker for success or failure of current prevention efforts within facilities reporting in any given state. Given the lack of statistical significance in the observed difference in serial SIRs within any given state, comparing SIRs over longer observation periods may be more useful as a marker for successful prevention efforts. The influx of facilities reporting to NHSN for the first time as a result of the requirement by the Center for Medicare and Medicaid Services (CMS) for hospitals participating in the CMS Hospital Inpatient Quality Reporting Program to use NHSN to report CLABSIs among adult, pediatric, and neonatal ICUs, presents new opportunities and challenges for summarizing the CLABSI experience across all states. More comprehensive national coverage of CLABSIs among patients in intensive care unit locations will be available. However, in smaller hospitals that are just beginning to report to NHSN, the predicted number of CLABSIs may be too low to yield meaningful results at the hospital level. Subsequent CLABSI analyses and reports may be more useful if they are completed at wider time intervals.

Conclusion

This report presents state-specific and national summary statistics for CLABSIs, including serial SIRs for two sequential six-month time periods in 2009. Prevention success at the state and national level has been sustained between these sequential reporting periods. However, measurable improvement in the CLABSI SIR between sequential reporting periods was not evident at either the state or national level. These serial comparisons provide an improved means for monitoring the impact of interventions and indicate the successes of state-based and national HAI reduction efforts and point to additional prevention opportunities. Ongoing

interactions between state and federal public health agencies and their partners in the healthcare sector will be vital to sustaining and extending HAI surveillance and prevention. CDC will continue to report SIRs at the state and national levels as measures of progress toward the HHS HAI Action Plan targets.

Table 1. State-specific Standardized Infection Ratios (SIRs)and facility-specific percentiles using HAI data reported from non-NICU Locations¶ from all NHSN facilities reporting during July 2009 – December 2009, for States using NHSN to comply with a legislative mandate* to report HAIs to the State Health Department (reported as of September 2010):

Central Line-associated Bloodstream Infections (CLABSI)

State	No. of Facilities Reporting	No. of Infections		SIR	95% CI for SIR		Facility-specific SIRs at Key Percentiles ‡				
		Observed	Predicted		Lower	Upper	10%	25%	Median (50%)	75%	90%
Colorado	59	104	133.74	0.77	0.63	0.94	0.00	0.00	0.00	0.78	1.60
Connecticut	30	66	65.50	1.01	0.78	1.28	0.00	0.00	0.79	1.52	2.76
Delaware	8	17	30.32	0.56	0.33	0.90	.	.	.	.	.
Illinois	147	307	363.84	0.84	0.75	0.94	0.00	0.00	0.00	1.03	1.85
Maryland	47	232	167.04	1.39	1.21	1.58	0.00	0.00	1.14	1.99	2.80
Massachusetts	68	137	207.64	0.66	0.55	0.78	0.00	0.00	0.00	0.69	2.04
New Hampshire	22	14	20.52	0.68	0.41	1.06	0.00	0.00	0.00	0.00	0.73
New Jersey	72	152	222.34	0.68	0.58	0.80	0.00	0.00	0.40	0.94	1.88
New York	179	612	594.14	1.03	0.95	1.11	0.00	0.00	0.78	1.49	2.35
Oklahoma	50	61	111.13	0.55	0.42	0.70	0.00	0.00	0.00	0.56	1.72
Oregon	46	51	82.53	0.62	0.46	0.81	0.00	0.00	0.00	0.64	1.33
Pennsylvania	226	877	1294.54	0.67	0.63	0.72	0.00	0.00	0.32	0.96	1.90
South Carolina	70	299	278.92	1.07	0.95	1.20	0.00	0.00	0.23	1.28	2.31
Tennessee	77	320	262.94	1.22	1.09	1.36	0.00	0.00	0.18	1.04	2.04
Vermont	8	8	11.12	0.72	0.36	1.30	.	.	.	.	.
Virginia	75	151	187.63	0.80	0.68	0.94	0.00	0.00	0.00	0.96	1.73
Washington	63	104	169.82	0.61	0.50	0.74	0.00	0.00	0.00	0.72	1.20
West Virginia	34	52	63.33	0.82	0.61	1.08	0.00	0.00	0.00	0.71	2.11
All U.S.	1,603	4,967	6,005.00	0.83	0.80	0.85	0.00	0.00	0.32	1.05	1.99

¶ Data from all non-NICU locations: ICUs, wards, and LTACs

* Presence of mandate to report CLABSI to the state health department using NHSN in place as of December 31, 2009

‡ Facility-specific key percentiles were only calculated for states in which ≥20 facilities reported during the reporting period If a single facility's predicted number of HAIs (e.g., CLABSI) was <1.0, a facility-specific SIR was neither calculated nor included in the determinations of the distribution of facility-specific SIRs.

Table 2. Changes in State-specific Standardized Infection Ratios (SIRs) using non-NICU HAI data submitted from all facilities and locations reporting during January 2009 through June 2009, compared to that from all facilities and locations reporting during July 2009 through December 2009, and adjusted SIR calculated for continuous reporters* only, for States using NHSN to comply with a legislative mandate* to report HAIs to the State Health Department during both time periods° (reported as of September 2010):

Central Line-associated Bloodstream Infections (CLABSI)

	All Locations Reporting				Continuously Reporting Locations		
State°	SIR: Jan-Jun 2009	SIR: Jul-Dec 2009	Change in SIR	p-value	No. of Continuous Reporters *	Change in SIR‡	p-value‡
Colorado	0.68	0.77	No Change	0.44	50	No Change	0.81
Connecticut	0.94	1.01	No Change	0.74	30	No Change	0.94
Delaware	0.59	0.56	No Change	1.0	8	No Change	1.0
Illinois	0.90	0.84	No Change	0.43	136	No Change	0.67
Maryland	1.30	1.39	No Change	0.51	43	No Change	0.65
Massachusetts	0.59	0.66	No Change	0.37	65	No Change	0.40
New Hampshire	0.57	0.68	No Change	0.77	19	No Change	0.42
New Jersey	0.82	0.68	No Change	0.11	71	No Change	0.18
New York	0.99	1.03	No Change	0.50	175	No Change	0.52
Oklahoma	0.50	0.55	No Change	0.64	48	No Change	0.57
Oregon	0.61	0.62	No Change	1.0	35	No Change	1.0
Pennsylvania	0.70	0.67	No Change	0.61	195	No Change	0.18
South Carolina	1.16	1.07	No Change	0.44	63	- 0.30	0.01
Tennessee	1.15	1.22	No Change	0.49	66	No Change	0.26
Vermont	0.27	0.72	No Change	0.23	8	No Change	0.23
Virginia	0.83	0.80	No Change	0.82	74	No Change	0.80
Washington	0.58	0.61	No Change	0.77	60	No Change	0.83
All U.S.	0.82	0.83	No Change	0.73	1,442	No Change	0.95

* Continuous reporters include all facilities with at least one location that reported any data for CLABSI during both Jan-Jun 2009 and Jul-Dec 2009.

° Presence of mandate to report CLABSI to the state health department using NHSN in place as of June 30, 2009.

‡ Adjusted by limiting analysis to only continuous reporters, i.e., facility locations reporting for 1 month or more during Jan-Jun 2009 that also reported during Jul-Dec 2009.

□ Data from all non-NICU locations: ICUs, wards, and LTACs (except for January 2009 through June 2009, which only includes data from ICUs and wards)

References

1. Centers for Disease Control and Prevention. National Healthcare-Associated Infections Standardized Infection Ratio Report Using Data Reported to the National Healthcare Safety Network.
2. Centers for Disease Control and Prevention, National Healthcare Safety Network (NHSN). "Central Line-Associated Bloodstream Infection (CLABSI) Event: Guidelines and procedures for monitoring CLABSI." NHSN Patient Safety Component Manual. Accessed Feb 22 2011.
3. Edwards J, Peterson KD, Mu W, Banerjee S, Allen-Bridson K, Morrell G, et al. National Healthcare Safety Network (NHSN) report: data summary for 2006 through 2008, issued December 2009. Am J Infect Control. 2009 Dec;37(10):783-805. Accessed Feb 22 2011.