Delaware

Healthcare-Associated Infections

2013 First Quarter Cumulative Report

(April 1, 2012 – March 31, 2013)

Prepared by the Delaware Division of Public Health

HEALTHCARE-ASSOCIATED INFECTIONS

Health-care associated infections (HAI) are caused by a wide variety of bacteria, fungi, and viruses during the course of receiving medical care. These pathogens are acquired during the course of medical care in a hospital or other healthcare facility and are not present prior to the patient's admission to the facility [1]. As established in the "Hospital Infections Disclosure Act" [2] and outlined in the Communicable Disease regulations, healthcare facilities required to report and HAIs required to be reported in Delaware are consistent with those required by the Centers for Medicare and Medicaid Services (CMS). Currently, acute care hospitals, outpatient dialysis centers, and long-term acute care hospitals are required to report. This report provides a summary of the HAI data reported by acute care hospitals, which are required to report the following 3 infections:

1. **Catheter-Associated Urinary Tract Infections (CAUTI)**
   A urinary tract infection (UTI) is an infection involving any part of the urinary system including the urethra, bladder, ureters, and kidney. Urinary catheters are tubes inserted into the bladder through the urethra to drain urine. One out of four hospitalized patients receives urinary catheters during their hospital stay.

2. **Central Line-Associated Bloodstream Infections (CLABSI)**
   A "central line" or "central catheter" is a tube that is placed into a patient's large vein or artery, usually in the neck, chest, arm, or groin. The catheter is often used as a device to draw blood, to give fluids, or to administer medications and may not be removed for several weeks. A bloodstream infection can occur when bacteria or other germs travel down a "central line" and enter the blood. CLABSI is a laboratory confirmed bloodstream infection in a patient with a central line at the time of (or within 48 hours prior to) the onset of symptoms, and in whom the bloodstream infection is not related to an infection from another site.

3. **Surgical Site Infections (SSI)**
   A surgical site infection 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 involving the skin only while others are more serious and can involve tissues under the skin, organs, or implanted material.

REPORTING HAIs IN DELAWARE

All hospitals in Delaware report HAIs using the National Healthcare Safety Network (NHSN). The NHSN is a secure, internet-based surveillance system managed by the Centers for Disease Control and Prevention (CDC) that is available for use by all types of healthcare facilities in the United States, including acute care hospitals, long term acute care hospitals, psychiatric hospitals, rehabilitation hospitals, outpatient dialysis centers, and ambulatory surgery centers. CLABSI and CAUTI infections occurring in adult, pediatric, and neonatal intensive care units (ICUs) are reported by infection preventionists at acute care hospitals in Delaware and are included in this report. SSIs, specifically infections resulting from surgical procedures of colon surgery and hysterectomy, are reported by infection preventionists at acute care hospitals in Delaware and are included in this report.

What statistics are used to report HAIs?
Standardized infection ratios and confidence intervals.

Standardized Infection Ratio (SIR)
The standardized infection ratio (SIR) is a summary measure used to assess the magnitude of HAI rates in a hospital of interest. Specifically, the SIR is the infection rate observed in the hospital of interest (i.e. observed) divided by the infection rate in a standard population (i.e. expected). The infection rate in the ***standard population*** is derived from historical data reported to the NHSN by similar healthcare facilities in the United States and standardized by patient care location, hospital affiliation with a medical school, and bed size of the patient care location. For SSI, the SIR includes standardization for procedure type, length of surgery, type of surgical wound, and the patient's physical condition.

Interpretation of the Standardized Infection Ratio (SIR)

- A **ratio of less than 1** means the hospital's HAI rate was lower than the HAI rate of the standard population.
- A **ratio of 1** means that the hospital's HAI rate was similar to the HAI rate of the standard population.
- A **ratio of more than 1** means that the hospital's HAI rate was higher than the HAI rate of the standard population.

The SIR is not calculated when the "expected" number of infections is less than 1, which is usually due to small numbers of devices or procedures. Please note that the "expected" number of HAIs does not mean that one would expect to get an infection when hospitalized; rather it reflects the anticipated number of infections based on the frequency of infections previously reported to the NHSN.

Notably, the infection rate of a hospital may change from year to year, which may lead to considerable annual variation in the SIR, particularly for a small hospital. For example, if one HAI were diagnosed in a small hospital for 2009 and three diagnosed in 2010, the SIR for that hospital might change dramatically. Such dramatic variation is less likely to affect the SIRs in larger hospitals. Nonetheless, the overall HAI rate for Delaware may fluctuate as a result of the relatively few hospitals that contribute HAI data compared to states with more or larger hospitals.

Confidence Interval (CI):
In addition to computing an SIR estimate, we also attempt to understand uncertainty of this SIR estimate by looking at its **confidence interval or confidence limits** (i.e. endpoints of the confidence interval)**.** A confidence interval is a range of values that accounts for random error in the estimation of the SIR [3]. The width of the confidence interval depends on the amount of random variability in the data-collection process. We typically calculate 95% confidence intervals (95% CI), an arbitrary level that specifies the degree of compatibility between the limits of the interval and the data [3]. Wider confidence intervals imply greater imprecision (e.g. a CI of 1.3 – 2.6 is more precise than a CI of 1.3–10.3), and thus the more uncertain we are when interpreting the SIR estimate [4].

Imprecision should not be interpreted as statistical significance. It is possible to have imprecise CIs that are above or below 1.0 and that do not include 1 (e.g. a CI of 0.8 – 1.5 is more precise than a CI of 1.5–10.3, yet the second CI is "statistically significant" because it does not include 1). Likewise, it is possible to have precise CIs that include 1 and are not statistically significant. Furthermore, statistical significance is not an indication of the validity of the SIR; it is a function of sample size (or total number of device days or procedures) and thus does not tell us whether the SIR reported is a valid estimate based on quality data.

More on interpreting CIs and precision

Interpreting a confidence interval by whether it includes 1 (for relative measures such as an SIR) is no different from interpreting results with a P-value dichotomy (i.e. P less than or greater than 0.05), an approach that has been categorically refuted as having any clinical relevance. To illustrate, an SIR=1.03 with 95% CI of 1.01 - 1.05 is statistically significant but clinically irrelevant (i.e. only a 3% relative excess of infections compared to the standard population). In contrast, an SIR=3.0 with 95% CI of 0.95 - 6.0 would be deemed not statistically significant despite a point estimate suggestive of a 300% relative excess of infections compared to the standard population. The caveat is that the second SIR estimate is less precise, which is dependent on sample size and number of events. Now compare that SIR to a third SIR=3.0 with 95% CI of 1.1 - 12. Although seemingly "significant," this estimate is more imprecise than the second SIR, as determined by the confidence limit ratio (CLR=Upper Limit / Lower Limit). The CLR for the second estimate is approximately 6, whereas the CLR for the third estimate is 12. The smaller the CLR the more precise the point estimate. A common misinterpretation is that an "imprecise" or "wide" confidence interval includes 1.0, but precision has nothing to do with the inclusion of the null value. The CLRs suggest that the second estimate may be more reliable than the third estimate.

Finally, a frequently lost issue is that the CI merely conveys random variance without accounting for variance related to bias from selection, confounding (unmeasured or residual), misclassification, and sparse-data, which are pervasive. If accounted in analyses, these systematic errors would stretch the CLR to uninterpretable widths. Consequently, interpreting a CI is not straightforward and may be easily misleading if it is suggested that SIRs be interpreted as a function of the CI including 1.

Healthcare-associated infections in Delaware

Data are compiled on a quarterly basis and shared with stakeholders (i.e. hospital infection control practitioners, hospital administrators, the Healthcare-associated Infections Advisory Committee, the public, and many others) on the Delaware Division of Public Health's Healthcare-Associated Infections Web site (http://dhss.delaware.gov/dph/epi/haihomepage.html). Because there are small numbers of procedures performed and devices used that are monitored for HAIs during a 3-month period (i.e. quarter), quarterly reports are cumulative and include data for the past year. For example, the fourth quarter report for 2012 includes HAI data from January through the end of December. Additionally, the first quarter report of 2013 will include HAI data from April 2012 through March 2013. The number of device days (i.e. central line and catheter) and inpatient procedures (colon surgery and hysterectomy) are used in the estimation of SIRs; smaller numbers of procedures or devices can result in imprecise SIR estimates. The number of device days and inpatient surgical procedures for each healthcare facility are presented in Table 1 and Figure 1.

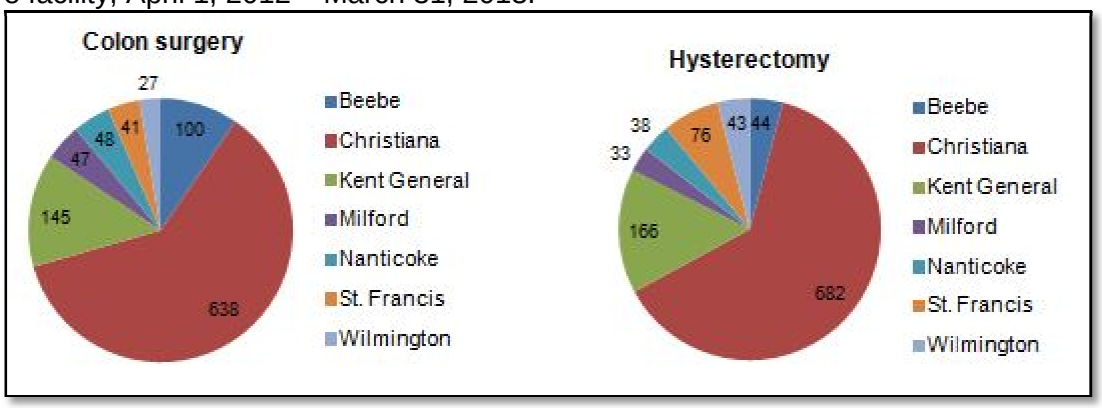
Table 1. Number of device days and inpatient surgical procedures by healthcare facility, April 1, 2012 – March 31, 2013.

	Device days		Inpatient[a] procedures	
Hospital	**Central Line**	**Catheter**	**Colon**	**Hysterectomy**
Statewide	29,186	23,812	1,046	1,082
A.I. Dupont	6,551	1,413	---[b]	---[b]
Beebe	2,884	2,950	100	44
Christiana	12,871	11,212	638	682
Kent General	2,848	3,438	145	166
Milford	902	831	47	33
Nanticoke	1,389	1,542	48	38
St. Francis	1,062	1,201	41	76
Wilmington	679	1,225	27	43
Median (IQR)[c]	2,119 (982-4,718)	1,478 (1,213-3,194)	48(41-145)	44 (38-166)

[a.] Inpatient procedure= A procedure that is performed on a patient whose date of admission the healthcare facility and the date of discharge are different calendar days and takes place during an operation.
[b.] Procedures not routinely performed at this hospital.
[c.] IQR= Interquartile range is a measure of spread of the data representing the middle 50% of device days or procedures; the lower end of the range is the 25th percentile and the higher end of the range is the 75th percentile. The IQR is less affected by extreme values than other measures of data dispersion (e.g. a large number of colon surgeries are performed at Christiana and the IQR is less affected by this more extreme number of procedures compared to other healthcare facilities in Delaware).

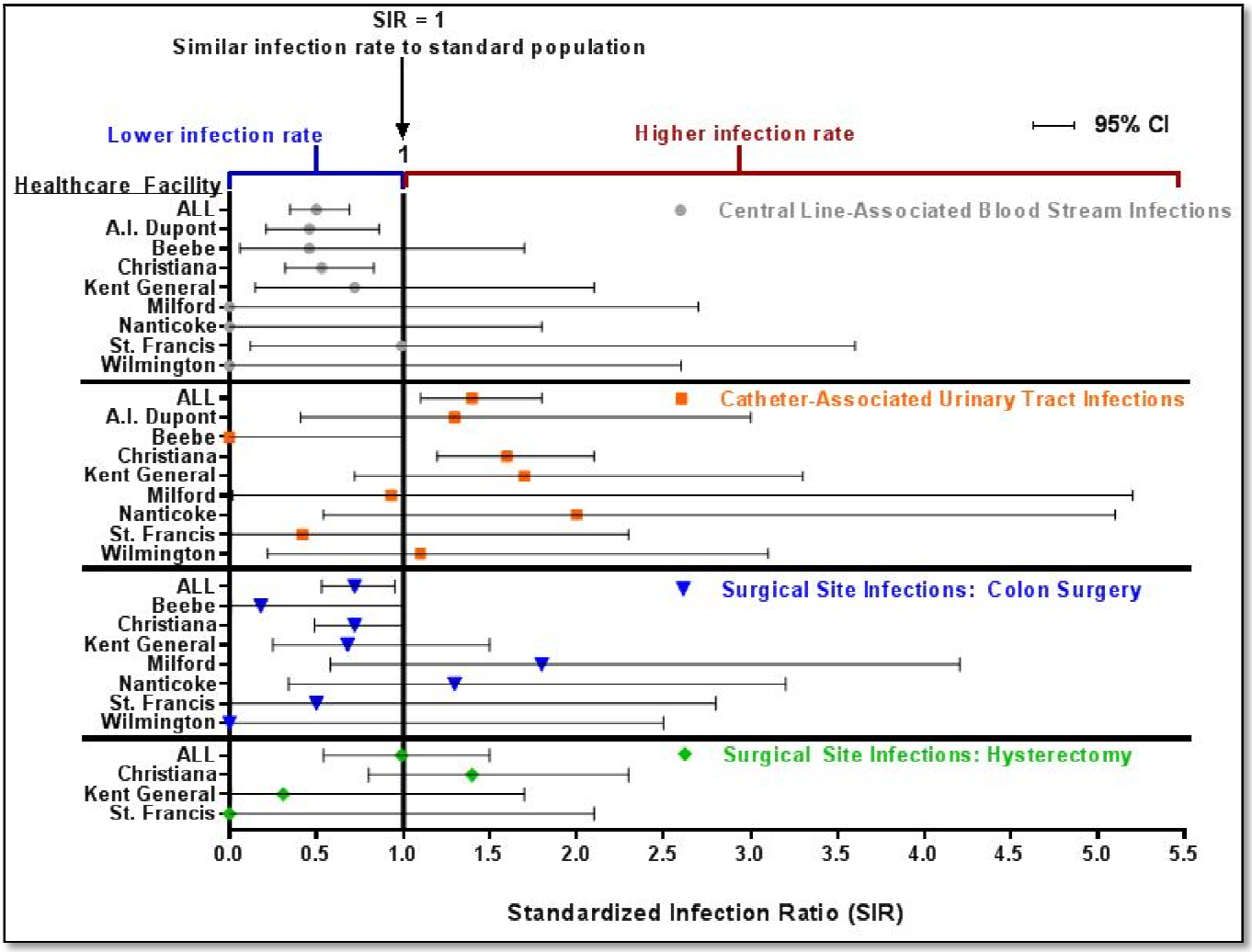
The pie chart below depicts the number and the relative proportion of inpatient only (Figure 1) colon surgeries and inpatient hysterectomies performed at each healthcare facility. There were 1,046 inpatient colon surgeries and 1,082 inpatient hysterectomies performed between April 1, 2012 and March 31, 2013. More than half of these procedures were performed at Christiana. A smaller proportion of inpatient colon surgeries and hysterectomies were performed at other healthcare facilities in Delaware. The numbers reported below do not necessarily reflect the total number of hysterectomies or colon surgeries at these acute care hospitals; only those that are classified as inpatient procedures.

Figure 1. Number of inpatient surgical procedures (colon surgeries and abdominal hysterectomies) by healthcare facility, April 1, 2012 – March 31, 2013.



The number and SIR of HAIs for hospitals in Delaware are presented in Figure 2 and Table 2. The SIRs in this report are estimated for a 12-month period from April 1, 2012 to March 31, 2013. Quarterly SIR estimates for a 3-month period are not reported because small numbers preclude estimation of SIRs for hospitals with smaller numbers of devices or procedures.

Figure 2. Device- and procedure-related healthcare-associated infections (HAIs) from all intensive care units (ICUs) and acute care hospitals, respectively, reported as standardized infection ratios (SIRs) for hospitals participating in the National Healthcare Safety Network (NHSN) in Delaware, April 1, 2012 – March 31, 2013.



Interpretation of Figure 1: Facilities were not included in this figure when SIRs were not calculated because the Expected number was less than 1 (see Table 1). The symbols in the figure represent the value of the SIR that is estimated using data reported by the hospitals participating in the NHSN and the standard population calculated by CDC. The width of the confidence interval provides an indication of the precision of the SIRs; the wider the confidence interval, the less precise the estimate and the less certain we are regarding the compatibility of the reported data with the estimated SIR. The confidence interval is also affected by factors such as the number of facilities reporting data from the relevant patient care locations and the number of device days or operative procedures that were reported. SIRs estimated for smaller hospitals with fewer device days or observed and/or expected number of infections will be less precise compared to larger hospitals with more device days and observed and/or expected number of infections. Imprecision should not be interpreted as statistical significance. Furthermore, statistical significance is not an indication of the validity of the SIR; it is a function of sample size (or total number of device days or procedures) and thus does not tell us whether the SIR reported is a valid estimate based on quality data. For SIR estimates of HAIs in Delaware, a Confidence Limit Ratio (CLR= Upper Limit/Lower Limit) of greater than or equal to 5.0 is considered to be relatively imprecise.

Table 2. Device- and procedure-related healthcare-associated infections (HAIs) from all intensive care units (ICUs) and acute care hospitals, respectively, reported as standardized infection ratios (SIRs) for hospitals participating in the National Healthcare Safety Network (NHSN) in Delaware, April 1, 2012 – March 31, 2013.

Central Line-Associated Bloodstream Infections (CLABSI) in ICUs						
Hospital	**Number of infections**		**SIR**	**95% CL[a]**		**Interpretation[b]**
	Observed	**Expected**		**Lower[c]**	**Upper**	Data collected by the hospital are more compatible with an infection rate lower/higher/similar to the standard population[d].
ALL	35	70.6	**0.50[e]**	0.35	0.69	Lower
A.I. Dupont	9	19.7	**0.46**	0.21	0.86	Lower
Beebe	2	4.3	0.46	0.06	1.7	Lower but estimates may be statistically unreliable
Christiana	19	35.6	**0.53**	0.32	0.83	Lower
Kent General	3	4.2	0.72	0.15	2.1	Lower but estimates may be statistically unreliable
Milford	0	1.4	0	---	2.7	Lower but estimates may be statistically unreliable
Nanticoke	0	2.1	0	---	1.8	Lower but estimates may be statistically unreliable
St. Francis	2	2.0	0.99	0.12	3.6	Similar but estimates may be statistically unreliable
Wilmington	0	1.4	0	---	2.6	Lower but estimates may be statistically unreliable
Catheter-Associated Urinary Tract Infections (CAUTI) in ICUs						
	Number of Infections		**SIR**	**95% CL[a]**		**Interpretation[b]**
	Observed	**Expected**		**Lower[c]**	**Upper**	Data collected by the hospital are more compatible with an infection rate lower/higher/similar to the standard population[d].
ALL	72	51.5	**1.4**	1.1	1.8	Modestly higher
A.I. Dupont	5	4.0	1.3	0.41	3.0	Modestly higher but estimates may be statistically unreliable
Beebe	0	3.5	0	---	1.0	Lower but estimates may be statistically unreliable
Christiana	50	30.9	**1.6**	1.2	2.1	Higher
Kent General	8	4.8	1.7	0.72	3.3	Higher but estimates may be statistically unreliable
Milford	1	1.1	0.93	0.02	5.2	Lower but estimates may be statistically unreliable
Nanticoke	4	2.0	2.0	0.54	5.1	Higher but estimates may be statistically unreliable
St. Francis	1	2.4	0.42	0.01	2.3	Lower but estimates may be statistically unreliable
Wilmington	3	2.8	1.1	0.22	3.1	Lower but estimates may be statistically unreliable
Surgical Site Infections (SSI)[f]						
Combined SIR estimates for Colon Surgeries and Hysterectomies						
	Number of Infections		**SIR**	**95% CL[a]**		**Interpretation[b]**
	Observed	**Expected**		**Lower[c]**	**Upper**	Data collected by the hospital are more compatible with an infection rate lower/higher/similar to the standard population[d].
ALL[g]	67	85.5	**0.78**	0.61	0.99	Lower
Beebe	1	6.3	**0.16**	0	0.88	Lower but estimates may be statistically unreliable
Christiana	47	54.5	0.86	0.63	1.1	Lower

Kent General	7	12.0	0.58	0.23	1.2	Lower
Milford	6	3.4	1.8	0.65	3.9	Higher but estimates may be statistically unreliable
Nanticoke	4	3.8	1.1	0.29	2.7	Modestly higher but estimates may be statistically unreliable
St. Francis	1	3.8	0.26	0.01	1.5	Lower but estimates may be statistically unreliable
Wilmington	1	2.2	0.46	0.02	2.3	Lower but estimates may be statistically unreliable
Colon Surgery						
	Number of Infections		**SIR**	**95% CL[a]**		**Interpretation[b]**
	Observed	**Expected**		**Lower[c]**	**Upper**	Data collected by the hospital are more compatible with an infection rate lower/higher/similar to the standard population[d].
ALL[g]	48	66.6	**0.72**	0.53	0.95	Lower
Beebe	1	5.5	0.18	0.01	1.0	Lower but estimates may be statistically unreliable
Christiana	31	43.1	0.72	0.49	1.0	Lower
Kent General	6	8.8	0.68	0.25	1.5	Lower but estimates may be statistically unreliable
Milford	5	2.8	1.8	0.58	4.2	Higher but estimates may be statistically unreliable
Nanticoke	4	3.2	1.3	0.34	3.2	Modestly higher but estimates may be statistically unreliable
St. Francis	1	2.0	0.50	0.01	2.8	Lower but estimates may be statistically unreliable
Wilmington	0	1.5	0	---	2.5	Lower but estimates may be statistically unreliable
Hysterectomy						
	Number of Infections		**SIR**	**95% CL[a]**		**Interpretation[b]**
	Observed	**Expected**		**Lower[c]**	**Upper**	Data collected by the hospital are more compatible with an infection rate lower/higher/similar to the standard population[d].
ALL[g]	19	18.9	0.99	0.54	1.5	Similar
Beebe	0	0.79	---	---	---	Numbers too low to calculate SIR[h]
Christiana	16	11.5	1.4	0.80	2.3	Modestly higher
Kent General	1	3.3	0.31	0.01	1.7	Lower but estimates may be statistically unreliable
Milford	1	0.60	---	---	---	Numbers too low to calculate SIR[h]
Nanticoke	0	0.61	---	---	---	Numbers too low to calculate SIR[h]
St. Francis	0	1.8	0	---	2.1	Lower but estimates may be statistically unreliable
Wilmington	1	0.69	---	---	---	Numbers too low to calculate SIR[h]

a. CL=Confidence Limits are the endpoints of the confidence interval, which is a range of values that accounts for random error in the estimation of the SIR.

b. Interpretation of the Standardized Infection Ratio (SIR): A **ratio of less than 1** means the hospital's HAI rate was lower than the standard population; A **ratio of 1** means that the hospital's HAI rate was similar to the standard population; A **ratio of more than 1** means that the hospital's number of reported HAIs was higher than the standard population. Small numbers of devices or procedures contribute to imprecision (wide confidence intervals). Wider confidence intervals imply greater imprecision (e.g. a CI of 1.3 – 2.6 is more precise than a CI of 1.3– 10.3), and thus the more uncertain we are when interpreting the second SIR estimate's CI. Imprecision should not be interpreted as statistical significance. Furthermore, statistical significance is not an indication of the validity of the SIR; it is a function of sample size (or total number of device days or procedures) and thus does not tell us whether the SIR reported is a valid estimate based on quality data. For SIR estimates of HAIs in Delaware, a Confidence Limit Ratio (CLR= Upper Limit/Lower Limit) of greater than or equal to 5.0 is considered to be relatively imprecise.

c. Lower= Lower bound of 95% Confidence Interval only calculated if Observed is greater than 0.

d. The standard population is derived from historical data reported to the NHSN by similar healthcare facilities in the United States.
e. Bolded estimates are "statistically significant".
f. Surgical site infections include colon surgery and hysterectomy (abdominal approach with uterine removal).
g. AI Dupont is not included in the statewide SIR estimate for SSIs because colon surgeries and hysterectomies are not procedures routinely performed at this hospital (i.e. pediatric population).
h. Numbers too low to calculate SIR= SIR values are only calculated if the Expected number is greater than or equal to 1.

Summary of HAI SIRs in Delaware hospitals

Below is a summary of HAI data for Delaware hospitals presented by infection type. As detailed in the National HAI report, "SIRs are not intended to serve as comprehensive and conclusive HAI measures for all uses and users of HAI data. More specific data at the state and healthcare facility levels are needed to target specific HAI problems and monitor impact of prevention programs" [5].

HAI SIRs for DELAWARE

Intensive Care Units
CLABSI: Lower (0.50, 0.35-0.69)
CAUTI: Modestly higher (1.4, 1.1-1.8)

Acute Care Hospitals
SSI Colon Surgery: Lower (0.72, 0.53-0.95)
SSI Hysterectomy: Similar (0.99, 0.54-1.5)

Central Line-associated Bloodstream Infections (CLABSI)

The standardized infection ratio of CLABSIs for Delaware was lower than the standard population (SIR= 0.50, 95% CL: 0.35, 0.69) and ranged from 0 (95% CL: ---, 2.7) to 0.99 (95% CL: 0.12, 3.6). SIRs for AI Dupont and Christiana were lower than the standard population with estimates that were more statistically reliable and precise because of a relatively large number of device days compared with the hospitals that had a small number of device days. Small numbers of devices for 6 hospitals (Beebe, Kent General, Milford, Nanticoke, St. Francis, and Wilmington) contributed to imprecise SIR estimates making it difficult to interpret these estimates accurately.

Catheter-Associated Urinary Tract Infections (CAUTI)

The standardized infection ratio of CAUTIs for Delaware was modestly higher than the standard population (SIR= 1.4, 95% CL: 1.1, 1.8) and ranged from 0 (95% CL: ---, 1.0) to 2.0 (95% CL: 0.54, 5.1). Small numbers of procedures or devices for nearly all hospitals contributed to imprecise SIR estimates making it difficult to interpret these estimates accurately.

Surgical Site Infections (SSI)

Colon Surgery

The standardized infection ratio of SSIs for colon surgery in Delaware was lower than the standard population (SIR= 0.72, 95% CL: 0.53, 0.95) and ranged from 0 (95% CL: ---, 2.5) to 1.8 (95% CL 0.58, 4.2). SIRs for SSI varied widely by hospital; some hospital with rates lower than the standard population and other hospitals with rates higher than the standard population. The SIR estimate was lower than the standard population for Christiana. Although SIRs for Beebe, Kent General, and St. Francis were lower than the standard population, they were imprecise and difficult to interpret. Additionally, SIRs for Nanticoke and Milford were modestly higher and higher, respectively, although small numbers of procedures performed at these hospitals resulted in imprecise SIR estimates that are difficult to interpret.

Hysterectomy

The standardized infection ratio of SSIs for hysterectomy in Delaware was similar to the standard population (SIR= 0.99, 95% CL: 0.54, 1.5). The SIR for 1 hospital (St. Francis) was 0 with wide confidence intervals making it difficult to interpret the estimate accurately. The SIR for Kent General was lower than the standard population but statistically unreliable given the relatively small number of hysterectomies performed (n=166). The SIR for Christiana was modestly higher than the standard

population (SIR= 1.4, 95% CL: 0.80, 2.3). SIRs for Beebe, Milford, Nanticoke, and Wilmington were not estimated because the expected number of infections was less than 1.

***Please note when interpreting SIRs**

Although some SIRs were reported as higher or lower than the standard population, the confidence intervals provide us with a sense of the uncertainty regarding these estimates making those estimates with wide confidence intervals difficult to interpret accurately. For hospitals with small numbers of procedures or devices, the SIR may change dramatically when comparing HAI rates for the same hospital between quarterly reports. For example, if zero HAIs were diagnosed in a small hospital for 2009 (e.g. Observed=0, Expected= 1.3; SIR= 0, 95% CL: ---, 2.9) and two diagnosed in 2010 (e.g. Observed=2, Expected= 1.3; SIR= 1.5, 95% CL: 0.26, 5.1), the SIR for that hospital might change dramatically, although we would still have uncertainty (wide confidence intervals) regarding the SIR.

What is Delaware doing to reduce the number of HAIs?

Delaware hospitals are working to reduce HAIs through prevention, surveillance (monitoring and detection), and response activities. To deliver better outcomes, they partner with the Delaware Division of Public Health, Centers for Medicare and Medicaid Services, Centers for Disease Control and Prevention, and regional quality improvement organizations such as Quality Insights of Delaware.

Delaware HAI prevention activities include but are not limited to:

1. Collaborating with local and regional partners to identify specific targets to reduce HAIs in Delaware healthcare facilities. Partners include state hospital associations, professional societies for infection control and healthcare epidemiology, academic organizations, laboratorians, networks of acute care hospitals, and long term care facilities.
2. Improving overall use of surveillance data to identify and prevent HAI outbreaks or transmission in healthcare settings.
3. Developing and disseminating provider and patient education materials.
4. Conducting validation studies to assess the quality of HAI data reported.
5. Providing consumers access to useful healthcare quality measures through quarterly reports.

Prevention of HAIs is of the utmost importance among healthcare and public health communities. Ongoing efforts to reduce the occurrence of HAIs occur routinely at hospitals and other healthcare facilities across Delaware.

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