Dataset Dictionary:
Hospital-Acquired Infection Data

October 2018

Data Element Name	Data Description
Facility ID	New York State (NYS) Facility Identification Number. Facility ID '0000' represents the sum (or average) of all the reported data in NYS. Note: Prior to 2016, five hospitals reported combined data from two campuses. During this time period, all data was assigned to one campus (1737->1740, 0698->0694, 0686->0699, 0042->0058, 3376->1630).
Hospital name	Hospital Name
Indicator name	<u>Central line-associated blood stream infection (CLABSI) indicators:</u> CLABSI Cardiothoracic Intensive Care Unit (ICU) CLABSI Coronary ICU CLABSI Medical ICU CLABSI Medical Surgical ICU CLABSI Neonatal ICU Level 2/3 CLABSI Neonatal ICU Level 3 CLABSI Neonatal ICU Regional Perinatal Center CLABSI Neurosurgical ICU CLABSI Pediatric ICU CLABSI Surgical ICU CLABSI Medical Ward CLABSI Surgical Ward CLABSI Medical Surgical Ward CLABSI Step-down Unit CLABSI Pediatric Medical/Surgical Ward CLABSI Overall Standardized Infection Ratio (SIR) – summarizes the average performance across all types of ICUs and wards listed above. The SIR compares the infection rates in a small population (a hospital) to infection rates in a standard population (NYS in

	the same year), after adjusting for risk factors that might affect the chance of developing an infection. The SIR is the actual number of infections in the hospital, divided by the number of infections that would be statistically predicted if the standard population (NYS) had the same risk distribution as the observed population. • A SIR of 1.0 means the observed number of infections is equal to the number of predicted infections. • A SIR above 1.0 means that the infection rate is higher than that found in the standard population. The difference above 1.0 is the percentage by which the infection rate exceeds that of the standard population. • A SIR below 1.0 means that the infection rate is lower than that of the standard population. The difference below 1.0 is the percentage by which the infection rate is lower than that experienced by the standard population. See 'Infections predicted' below for additional information. <u>Surgical Site Infection (SSI) Indicators</u> SSI Coronary artery bypass graft (CABG) chest site SSI CABG donor site SSI Colon SSI Hip SSI Abdominal hysterectomy SSI Overall Standardized Infection Ratio (SIR) – summarizes the average performance across all types of SSIs listed above. The SIR is the ratio of the total observed number of SSIs in a given year to the total predicted number of SSIs in that year. See 'Infections predicted' below for additional information. <u>*Clostridium difficile* infection (CDI) indicators:</u> CDI Community Onset Not-My-Hospital - cases in which the positive stool sample was obtained during the first three days of the patient's hospital admission and more than 4 weeks after any previous discharge from that same hospital. These cases are presumed unrelated to the patient's stay in that hospital. CDI Possibly-My-Hospital-Associated – incident cases in which a patient who was discharged from the same hospital within the previous 4 weeks is readmitted to that hospital with a new positive *C. difficile* test during the first three days of admission (these are sometimes called 'community onset healthcare facility associated' cases).

	CDI Hospital Onset – incident cases in which the positive stool sample was obtained on day four or later during the hospital stay. <u>Carbapenem-resistant Enterobacteriaceae (CRE) Indicators</u> CRE hospital onset infection rate for bloodstream infections CRE hospital onset infection rate for all body sites (e.g. bloodstream, urinary tract, respiratory system, skin/soft tissue) CRE admission prevalence rate for bloodstream infections CRE admission prevalence rate for all body sites
Year	Year of data. Hospital-specific pilot year data are not included. Thus, start dates are 2008 for CLABSIs in ICUs, colon SSIs, CABG SSIs, and hip SSIs; 2010 for *C. difficile*; 2013 for hysterectomy SSIs, 2014 for CRE, and 2015 for CLABSIs in wards. All hospitals with complete data for a given year are included. In the case of hospital closures, data are provided up to the last complete year prior to closure.
Infections observed	Number of infections reported by hospital in the given year. Result is shown as long as at least 20 procedures were performed (for SSI data), at least 50 central line days were reported (for CLABSI data), or least 50 patient days were reported (for hospital onset CDI and CRE data).
Infections predicted	The number of infections predicted to occur in the hospital based on average infection rates in NYS among similar patients in the same year. For CLABSIs, the number of predicted infections is calculated using CLABSI rates within each location (and NICU birth weight category) in NYS in a given year. Result is shown if at least 50 central line days were reported. For SSIs, the number of predicted infections is calculated from procedure-specific logistic regression models (see annual NYS reports for risk factors included in the models). Result is shown as long as at least 20 procedures were performed. For CDI, the number of predicted infections is calculated from regression models (see annual NYS reports for risk factors included in the models). Result is shown if at least 50 patient days were reported and not a specialty hospital. CRE data were not risk adjusted so the number of predicted infections is not shown.

	No results are shown for "New York State – All Hospitals" since the predicted number is the same as the observed number.
Denominator	For CLABSI indicators, this is the number of central line days. For SSI indicators, this is the number of procedures. For CDI hospital onset prior to 2015, this is the number of patient days at risk (i.e. excluding first three days of admission) excluding newborns and NICU. For CDI hospital onset in 2015, this is the number of patient days excluding newborns and NICU. For CDI possibly-my-hospital-associated, this is the number of patient days excluding newborns and NICU. For CDI community onset not-my-hospital, this is the number of admissions excluding newborns and NICU. For CRE hospital onset, this is the number of patient days. For CRE admission prevalence, this is the number of admissions. For all CDI and CRE indicators, beginning in 2015 all denominators exclude inpatient rehabilitation units and inpatient psychiatric units with different Centers for Medicaid and Medicare Services Certification Numbers CCNs.
Indicator value	For CLABSI indicators within ICUs, this is the unadjusted CLABSI rate. For SSI procedure-specific indicators, this is the risk adjusted SSI rate. For CLABSI and SSI SIRs, this is the SIR. For CDI hospital onset, this is the adjusted CDI rate. For CDI community onset not-my-hospital and possibly-my-hospital associated, these are the unadjusted CDI rates. For CRE, these are unadjusted CRE rates.
Indicator lower confidence limit	Lower 95% confidence limit for indicator.
Indicator upper confidence limit	Upper 95% confidence limit for indicator.
Indicator units	Describes numerator and denominator used to calculate indicator. The SIR does not have units because it is the number of observed infections divided by the number of predicted infections.
Comparison results	For CLABSI, SSI, and hospital onset CDI a statistical test was performed to determine if each hospital performed significantly better or worse than average for the given year. Result may be: Significantly higher than NYS average,

	Significantly lower than NYS average, Not significantly different than NYS average, Not compared - if fewer than 20 procedures (SSI) or 50 central line days (CLABSI), or specialty hospital (CDI).
Address, city, state, ZIP, county, latitude, longitude	Address information obtained from the NYS Hospital Facility Information System.

Additional notes and caveats:

HAI data were reported as of 6/25/18 for SSI, CLABSI, and CRE, and as of 7/31/18 for CDI.

Use caution when interpreting trends over time. See 2015 report for additional information on changes in HAI surveillance definitions over time.

Hospital performance statistics published by the NYS HAI Reporting Program and CMS Hospital Compare are different.

The first important difference is the peer group to which each hospital is compared.

- In the NYS 2017 report, each hospital's 2017 data are compared to 2017 data reported by other hospitals in NYS.
- In CMS Hospital Compare, each hospital's 2017 data are compared to 2015 data reported by other hospitals in the United States.

In general, NYS hospital Standardized Infection Ratios (SIRs) tend to be higher than CMS SIRs for two reasons.

- HAI rates decrease over time as infection prevention practices improve; the NYS benchmark is expected to decrease over time (but the average SIR is always 1.0 because comparison is in the same year), while the CMS benchmark remains the same (SIRs decrease over time).

- NYS HAI data are audited more than data from other states. Auditing is likely to increase HAI rates because missed infections are identified and entered into the National Healthcare Surveillance Network (NHSN), and training efforts lead to better identification of HAIs.

We also note that by comparing data within the same year, NYS ensures that the same protocol is followed by the hospital and comparison data. There were minimal changes in surveillance definitions and guidance between 2015 and 2017.

Finally, the statistical models used to predict HAI rates in NYS and CMS models are slightly different. These differences are described in the following table.

Comparison of New York State and Centers for Medicare and Medicaid Services (CMS) Methods for 2017 Hospital-Acquired Infection Reports

Indicator	Report	Exclusions	Risk Adjustment
CLABSI	NYS	Mucosal barrier injury CLABSIs; oncology, neurologic, burn, trauma, prenatal, and respiratory ICUs	In adult/pediatric units, CLABSI rates are compared within each CDC location independently. In NICUs, CLABSI rates are compared by level (RPC, Level 3, Level 2/3) and birthweight group. Hospital compared to NYS 2017 average.
	CMS	Mucosal barrier injury CLABSIs; step down units	In adult/pediatric units, negative binomial regression model with location type, facility bed size, medical school affiliation, and facility type. In NICUs, only birthweight group. Hospital compared to National 2015 average.
Colon SSI	NYS	SSIs detected by post discharge surveillance (PDS) or present at time of surgery (PATOS)	ASA, duration, BMI, laparoscope, trauma. Hospital compared to NYS 2017 average.
	CMS	Complex 30-day SSI model: age<18, superficial SSIs, PATOS, outliers	Diabetes, ASA, gender, age, BMI, closure technique, oncology hospital. Hospital compared to National 2015 average.

Hysterectomy SSI	NYS	PDS, PATOS	Diabetes, ASA, BMI, duration, laparoscope. Hospital compared to NYS 2017 average.
	CMS	Complex 30-day SSI model: age<18, superficial SSIs, PATOS, outliers	Diabetes, ASA, BMI, age, cancer hospital. Hospital compared to National 2015 average.
Hip SSI	NYS	PDS, PATOS	ASA, BMI, procedure type. Hospital compared to NYS 2017 average.
	NHSN	Complex admission/readmission model: superficial SSIs, PDS, PATOS, outliers	Adults: Diabetes, trauma, anesthesia, ASA, wound class, medical school affiliation, hospital bed size, age, duration, BMI, procedure type. Children: intercept only. Hospital compared to National 2015 average.
CABG chest SSI	NYS	PDS, PATOS	Diabetes, BMI, gender, trauma. Hospital compared to NYS 2017 average.
	NHSN	Complex admission/readmission model: superficial SSIs, PDS, PATOS, outliers, children.	Diabetes, gender, ASA, trauma, wound class, medical school affiliation, hospital bed size, age duration, BMI, age-gender interaction. Hospital compared to National 2015 average.
CABG donor SSI	NYS	PDS, PATOS	BMI, diabetes. Hospital compared to NYS 2017 average.
	NHSN	Not applicable	No model
Clostridium difficile	NYS	Outlier community onset (CO) prevalence rate	CDI test type, CO admission prevalence rate, % patient days in adult ICUs, facility bed size. Hospital compared to NYS 2017 average.
	CMS	Outlier CO prevalence rate	Hospitals: CDI test type, CO admission prevalence rate, medical school affiliation, number of ICU beds, facility type, facility bed size, reporting from ED. LTACHs: CDI test type, CO rate, % ventilator, % single occupancy. Hospital compared to National 2015 average.

Additional Technical Information on Risk Adjustment and the Standardized Infection Ratio (SIR)

This section describes the risk adjustment method in more detail. The method is called "Indirect Risk Adjustment". We have contrived an example where we want to calculate SIRs and risk adjusted rates for two hospitals compared to the state average. In this simple example, patients can be divided into three risk groups: low, medium, and high, based on their risk for developing an infection after surgery.

The first three columns in the table below summarize the HAI data for the state. Fifteen-thousand procedures were performed, equally divided among the three risk groups. In the low risk group 2% of the patients developed an HAI; in the medium risk group 5% of the patients developed an HAI; and in the high risk group 8% of the patients developed an HAI.

Column 4 states that both hospitals had a 4% HAI rate in the low risk group (higher than the state average), a 5% HAI rate in the medium risk group (the same as the state average), and a 6% HAI rate in the high risk group (lower than the state average). Each hospital performed the same number of procedures, and had the same HAI rate within each risk group, but hospital 1 had a lot more low risk patients, and hospital 2 had a lot more high risk patients.

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State HAI rate summary			Hospitals 1 and 2	Hospital 1: More low risk patients			Hospital 2: More high risk patients		
Risk Group	# procedures	HAI rate	HAI rate	# procedures	# observed infections	# predicted infections	# procedures	# observed infections	# predicted infections
low	5,000	2.0%	4.0%	200	8	4.0	50	2	1.0
medium	5,000	5.0%	5.0%	100	5	5.0	100	5	5.0
high	5,000	8.0%	6.0%	50	3	4.0	200	12	16.0
All	15,000	5.0%		350	16	13.0	350	19	22.0
Standardized Infection Ratio (SIR)				1.23			0.86		
Risk adjusted HAI rate				6.2%			4.3%		

The first step in the risk adjustment procedure is to calculate the predicted number of infections in each risk group in each hospital. The logic behind this step is that if you had to guess how many infections you would expect to see in Hospital 1 in each risk group, a good guess would be the state average. For example, across the state we know that 2%, or 2 out of every 100 low-risk patients, develop an infection. Therefore we would predict that 2% of the 200 procedures performed at Hospital 1 would become infected: 200 multiplied by 2 and divided by 100 is 4 predicted infections.

The next step in the risk adjustment procedure is to calculate the SIR for each hospital. The SIR is equal to the total observed number of infections divided by the total predicted number of infections. At Hospital 1, 16 divided by 13 is 1.23. The HAI rate at Hospital 1 is 23% higher than the average state HAI rate, after making the distribution of patient risk in the state the same as in

Hospital 1. At Hospital 2, 19 divided by 22 is 0.86. The HAI rate at Hospital 2 is 14% lower than the average state HAI rate, after making the distribution of patient risk in the state the same as in Hospital 2.

The last step in the risk adjustment procedure is to convert the SIRs to risk adjusted rates. Because the SIR at Hospital 1 is 1.23 times higher than the state average, the risk adjusted rate for Hospital 1 is 1.23 multiplied by the state average of 5%, which is equal to 6.2%.

The interesting anomaly to notice about this example is that the SIR and risk adjusted rate for Hospital 1 are higher than the SIR and risk adjusted rate for Hospital 2, despite the fact that each hospital had the same infection rate within each risk group (see Column 4). This shows that it is not statistically valid to compare SIRs and risk adjusted rates between hospitals; it is only valid to compare each SIR and risk adjusted rate to the state average. Both hospitals performed poorly in the low risk group, but because hospital 1 had so many more patients in this group, this had a strong negative impact on the overall hospital rate. Both hospitals performed well in the high risk group, but because hospital 2 had so many more patients in this group, this had a strong positive impact on the over hospital rate. We cannot compare the rates between hospitals because during the risk adjustment procedure, we forced the state to have the same level of patient risk as the hospital rather than forcing the hospital to have the same level of patient risk as the state, in which case the hospital rates would have comparable. (The latter method is called direct risk adjustment. In direct risk adjustment the predicted number of infections in the state would be the HAI rate in the hospital multiplied by the number of procedures in state. This calculation requires stable HAI rates in each hospital in each risk group. We do not use direct risk adjustment because rates can be very unstable in small hospitals that have only a small number of patients in each risk).

This example explained how to calculate an SIR for one type of procedure. The method can be extended to calculate an SIR across all surgical procedures. The overall SSI SIR is calculated as the sum of the observed number of colon, CABG chest, CABG donor, and hip infections divided by the sum of the predicted number of colon, CABG chest, CABG donor, and hip infections. We do not convert the overall SSI SIR to an overall adjusted rate because the HAI rates for colon, CABG, and hip surgeries are different; there is no meaningful overall procedure SSI rate to use in such a calculation.

Additionally, there are several reasons why the SSI SIR and CLABSI SIR should not be combined into one overall HAI SIR. First, they are different types of infections with different prevention methods. One of the most important reasons for reporting infection data is to help hospitals determine which prevention measures need to be strengthened, which means that they need SIRs for each type of infection individually rather than a combined SIR. Second, there are many more SSIs than there are CLABSIs. If the numbers were combined, the resulting SIR would mostly reflect the SSI data. Third, SSIs and CLABSIs may each vary in severity and may have different implications for patients. It is inaccurate to say that an SSI equals a CLABSI, which is what combining the numbers would do. In other words, combining the numbers would be like adding apples and oranges.