2012

Report on Healthcare Associated Infections (HAIs) to the General Assembly

State of Connecticut

Connecticut HAI Program

October 2013

EXECUTIVE SUMMARY

This is the fourth annual report to the Connecticut General Assembly on Healthcare Associated Infections (HAIs), pursuant to C.G.S. 19a-490 o. It is an update on what HAIs are reportable, with data on trends and progress on reducing HAIs in Connecticut healthcare facilities. The DPH HAI website has additional reports, data, and educational materials at http://www.ct.gov/dph/cwp/view.asp?a=3136&q=41731.

From 2008 to 2011, Connecticut acute care hospitals were mandated to report central line associated blood stream infections (CLABSIs) from one adult intensive care unit (ICU) per hospital and all pediatric ICUs , via the Centers for Disease Control and Prevention's (CDC's) secure online data collection system, the National Healthcare Safety Network (NHSN). The Connecticut HAI Advisory Committee then recommended that the state HAI reporting mirror federal Centers for Medicaid and Medicare Services (CMS) health facility quality improvement reporting, which dramatically expanded HAI surveillance to additional ICUs for CLABSI reporting and new types of HAIs: catheter associated urinary tract infections (CAUTIs) in all acute care hospital adult and pediatric ICUs, and surgical site infections after colon surgeries and abdominal hysterectomies. In future years, surveillance will continue to expand to new HAI types, and additional facilities in the healthcare spectrum.

Connecticut, other states, and the CDC use a statistical measure called the Standardized infection Ratio (SIR) to assess the burden of HAIs and to track progress in prevention. For the purposes of this report, the SIR compares the number of HAIs in the state to the number of infections predicted based on the baseline United States experience. An SIR below 1 means the state is doing better than predicted and progress is being made in preventing HAIs. An SIR above 1 means the state is doing worse than predicted. Connecticut is doing well in reducing CLABSIs. From 2009 to 2012, the SIR in adult ICUs decreased from 0.91 to 0.59. Pediatric ICUs made similar gains. We are on track to achieve the federal Department of Health and Human Services' 2013 National Prevention Target: a 50% reduction in CLABSIs (an SIR of 0.50). We have just begun to collect data on CAUTIs and SSIs. The first year of data shows that we need to make progress in the prevention of these types of infection: the CAUTI SIR is 1.84, the colon surgery-associated SIR is 1.2, and the abdominal hysterectomy infection SIR is 1.45.

These data are used by prevention collaboratives in the state (groups of health facilities sharing best practices for prevention) led by the Connecticut Hospital Association and by Qualidigm, working with DPH.

INTRODUCTION

Healthcare associated infections (HAIs) are, as their name implies, infections that persons acquire during or soon after an exposure to health care. Most often patients get HAIs, though sometimes health personnel or visitors develop them. Healthcare associated infections can have a variety of causes, including development of infections from microorganisms patients already have in their bodies (colonization), or transfer of infectious microorganisms from other patients, healthcare workers, visitors, the environment, or contaminated medical products or equipment. There are many types of healthcare associated infections. Their reporting and control needs to be prioritized on those HAIs that cause the most illness and death, and are the most costly.

This fourth annual report is specifically written for the state legislature, pursuant to the Connecticut HAI reporting statute: C.G.S. 19-a 490 o. The primary function of this report is to summarize the HAI data mandatorily reported to the Connecticut DPH pursuant to the law, and to give policymakers in Connecticut useful information on the current trends in HAIs in Connecticut healthcare institutions. Therefore, it focuses on state-wide level data. It is an update on what has been made reportable, on trends and progress on reduction of HAIs in Connecticut, and on comparison of the state to other states and the nation as a whole. It also summarizes anticipated next steps in 2013 and beyond. Different audiences will want information that is specifically targeted to their needs. To that end, the DPH HAI program website includes additional reports, data, and educational materials aimed to meet the needs of health providers, patients, and the public. Data on the website are displayed by healthcare care facility name for HAIs that have been validated by DPH for data quality. The website can be accessed at http://www.ct.gov/dph/cwp/view.asp?a=3136&q=41731_8.

Reportable HAIs are only part of the public health information that Connecticut can use to track and direct the prevention of HAIs (both in targeting resources and in assessing their effectiveness). Other surveillance data used by DPH are data from special epidemiological studies performed by the Emerging Infections Program (EIP), and data on the emergence of antibiotic-resistant bacteria such as Vancomycin-resistant Enterococci (VRE) and Methicillin-resistant *Staphylococcus aureus* (MRSA). These data are not part of this report but are available on the DPH website and are used by the HAI program for situational awareness, planning and evaluation.

HOW AN HAI INFECTION TYPE IS MADE MANDATORILY REPORTABLE

In 2006, the Connecticut Legislature established a state HAI Advisory Committee and directed the Connecticut Department of Public Health to develop a state public health HAI program to raise awareness, promote transparency for healthcare consumers, and promote the collection, analysis, and sharing of data to foster and guide infection prevention action in healthcare settings. Tracking, measuring, and reporting of HAI data are important to understand statewide trends, identify patterns of infection, and ensure readiness for the possible emergence of new or unusual organisms.

The state HAI Advisory Committee meets quarterly to provide recommendations to DPH on HAI public reporting and public awareness. It consists of 11 voting members and approximately 40 regular non-

member participants. Among these committed individuals are hospital epidemiologists, infection preventionists, consumers and advocates, quality improvement professionals, and professional and healthcare associations. Non-voting "participants" attend meetings and participate in discussion, but do not have the authority to vote on formal motions before the Committee. All substantive business, such as recommendations to the DPH on which HAIs should be publicly reported, must be made through formal motion and majority vote of the voting members. These deliberations are informed by the current science of HAI surveillance and prevention in the medical and public health literature, sharing of best practices among states and the CDC, and the practical experience and perspective of the members of the Advisory Committee.

Once the state HAI Advisory Committee makes a recommendation in accordance with Connecticut General Statutes Section 19a-490 o, about which HAIs are to be reported and how, their recommendation is considered by the DPH Reportable Diseases Advisory Committee for inclusion in the annual Connecticut public health reportable conditions list. This list is revised and published each year in compliance with C.G.S. 19a-2a and Section 19a-36-A2 of the Public Health Code. When the recommendation is accepted by the DPH Commissioner (as it has each time a recommendation to include a particular HAI type has been made), it is then placed on the annual reportable conditions list with reporting instructions.

The current members of the HAI Advisory Committee are:

Department of Public Health Commissioner or Commissioner's designee

1. Wendy Furniss, Chief, Healthcare Safety & Quality Branch, Connecticut DPH, Hartford, CT

Two representatives from the Connecticut Hospital Association

1. Alison Hong, MD, Director, Quality and Patient Safety, CT Hospital Association, Wallingford, CT
2. James Iacobellis, Connecticut Hospital Association, Wallingford, CT

Two representatives from organizations representing health care consumers

1. Valerie Wyzykowski, Office of Healthcare Advocate, State of CT, Hartford, CT
2. Jean Rexford, Executive Director, Connecticut Center for Patient Safety, Hartford, CT

Two representatives who are hospital-based infectious disease specialists or epidemiologists

1. Louise Dembry, MD, Hospital Epidemiologist, Yale-New Haven Hospital, New Haven, CT
2. Brenda Grant, RN, MPH, CIC, Infection Preventionist, Stamford Hospital, Stamford, CT

One representative from the Connecticut State Medical Society

1. Douglas Waite, MD, VP for Medical Affairs/CMO, Director of ID, Day Kimball Hospital, Putnam, CT

One representative from a labor organization representing hospital-based nurses

1. Dale Cunningham, American Federation of Teachers, Rocky Hill, CT

Two members from the public

1. Raymond Andrews, Trustee, The Donaghue Medical Research Foundation, West Hartford, CT
2. Vacant

HEALTHCARE ASSOCIATED INFECTIONS SUBJECT TO REPORTING IN CONNECTICUT

From 2008 through 2011, the Connecticut HAI reporting requirement mandated acute care hospitals to report the incidence of central line associated blood stream infections (CLABSIs) from one medical or medical/surgical intensive care unit (ICU) and all pediatric ICUs. Central line associated blood stream infections in ICUs were chosen because they relate to procedures that are performed frequently, may result in significant harm to patients, have surveillance definitions that are generally recognized, are relatively easily identified and counted, and have widely accepted prevention methods. Patients in ICUs were chosen because they are a population at high risk for bad outcomes as they are already critically ill and are at a greater risk for CLABSIs. Moreover, surveillance is relatively easy to perform in these locations because these patients are already aggressively monitored.

Beginning in 2011, the federal Centers for Medicaid and Medicare Services (CMS) expanded "pay for reporting" requirements for the Inpatient Prospective Payment System (IPPS) for hospitals and the Quality Improvement Program (QIP) for hemodialysis centers to HAIs as a condition of receiving annual supplemental payments. CMS requires that these data be reported using NHSN. The expansion added new classes of facilities beyond acute care hospitals, new locations within hospitals, and new types of HAIs to the reporting expectations. CMS reporting requirements will continue to expand for the foreseeable future.

The Connecticut HAI Advisory Committee recommended that the Connecticut HAI reporting mandate mirror the CMS reporting mandate. This resulted in an expansion in the HAI surveillance measures that are be reported by acute care facilities to the Connecticut DPH, and subsequently, to the public.

Therefore, as of January 1, 2012, CLABSI reporting was expanded from one to all ICUs (adult and pediatric) and all level III and II/III neonatal units in each acute care hospital. New HAI types were also added: catheter associated urinary tract infections (CAUTIs) in all acute care hospital adult and pediatric ICUs, and surgical site infections related to colon surgeries and abdominal hysterectomies. As a part of their recommendation, the Committee advised DPH to train relevant staff from healthcare facilities on the collecting, recording, and reporting of the new measures; and to validate the accuracy of the data before they are publicly posted.

HOW THE DATA ARE COLLECTED

The HAI reporting mandate requires acute care hospitals to report specific HAI-related data to the CDC National Healthcare Safety Network (NHSN). NHSN is a secure, internet-based surveillance system for healthcare facilities to submit information about HAI. NHSN includes standardized definitions, built-in

analytical tools, user training and support, as well as integrated data quality checks. NHSN has become the standard for HAI monitoring in the United States: twenty-six states, including Connecticut, require its use. Only persons who have completed training on the standard definitions and surveillance methodology may perform NHSN data entry, and all protocols must be followed precisely. These protocols provide a rigorous national and state standard to ensure consistent collection of comparable data. The CDC makes NHSN available to all United States healthcare facilities at no charge, and is currently collecting data from more than 11,000 facilities in all fifty states, the District of Columbia, and the Commonwealth of Puerto Rico.

Participation in NHSN requires a considerable commitment by each participating healthcare facility. Qualified Infection Preventionists (IPs) conduct HAI surveillance. IPs may have been trained in nursing, microbiology, epidemiology, and/or medical technology, and all have obtained additional education in infection prevention and control. These individuals collect the data from a variety of records maintained by the facilities, such as laboratory culture results, medical chart records of the individual patients and flowcharts, such as those maintained on patients in intensive care units. If the hospital infection prevention staffs determine that a patient has a condition that meets the NHSN definition of an HAI, then the infection is reported to the state health department via NHSN. The data are stored on the secure NHSN server which is protected by both software security features and federal law from inappropriate disclosure. Once data are entered, they are immediately available to the facility, to CDC, and to the DPH HAI Program for viewing, analysis, and updating. All patient and facility information is protected by state and federal law and are stored on secure computers.

To help support the facilities in these surveillance efforts, the DPH and NHSN staffs ensure correct use of NHSN and foster data accuracy by training healthcare facility staff on the surveillance definitions that determine what is an NHSN-reportable HAI, as well as how to collect, enter, and analyze the data.

DATA CLEANING AND VALIDATION

Data need to be validated to ensure its timeliness, completeness, accuracy, and compliance with the HAIs reporting protocols. The Connecticut DPH HAI program works to ensure that hospitals are all applying the definitions in the same way by checking the data for inconsistencies. The DPH has developed a data validation process to review the data for completeness and accuracy. There are a number of points at which these data are checked for validity. The NHSN software, where the data are entered and stored, has a series of internal logic checks that prevent users from entering inaccurate data. Further data checks are conducted by the state HAI Program with review for keystroke errors, and missing, incomplete, or duplicate data. Hospital data managers are notified of any flagged data that may be missing or erroneously entered and make corrections. Finally, DPH epidemiologists visit every hospital in the state to validate a sample of patient records. These chart reviews are intended to identify patient outcomes that have been misclassified according to the NHSN definitions. Any inconsistencies are discussed with the hospital IP and changed accordingly to ensure adherence to the reporting guidelines. In total, these tiers of data cleaning and validation act as a broad safety net to ensure publicly reported data is of good and consistent quality among facilities and over time.

INTERPRETING THE DATA

Standardized Infection Ratio

The standardized infection ratio (SIR) is a summary statistical measure used to track HAIs at a national, state, or facility level over time. The SIR adjusts for the fact that each healthcare facility treats different types of patients. For example, the experience with HAIs at a hospital with a large burn unit (a location where patients are increased risk of acquiring infections due to the nature of their illness compared to other patients) cannot be directly compared to a facility without a burn unit. The SIR is calculated by dividing the number of observed infections by the number of predicted infections.

$$\text{Standardized Infection Ratio (SIR)} = \frac{\text{Actual Number of Infections}}{\text{Predicted Number of Infections}}$$

The predicted number of infections is an estimated number of HAIs based on infections reported to NHSN from across the nation during a baseline period. Data from this baseline period are also known as the "standard population." For CLABSIs, the baseline period is 2006-2008. For CAUTIs, the baseline period is 2009. For SSIs, the number of predicted infections for a given operative procedure category is derived from a logistic regression mathematical model using 2006-2008 data as the baseline time period. The predicted number of infections is risk adjusted, adjusting for several risk factors that have been found to be significantly associated with differences in infection rates.

How do I interpret the SIR?

If the **SIR is 1**, then the number of infections reported to NHSN is the same as the number of predicted infections. Another way to think about this is that no progress has been made in reducing infections since the baseline period.

If the **SIR is less than 1**, then there were fewer infections reported than what we would have predicted given the baseline data. In other words, progress has been made since the baseline period.

If the **SIR is greater than 1**, then there were more infections reported than what we would have predicted given the baseline data.

It is important to note that sometimes apparent differences can be due to chance. To help account for this, statistical testing is used to determine if the difference between the observed number of infections and predicted number of infections has meaning or is due to chance. If chance is ruled out, the difference is termed as being "statistically significant." One measure of statistical significance is the 95% confidence interval. An SIR that has a confidence interval (CI) that includes 1.0 should be interpreted as indicating that the number of HAIs that an entity (e.g., healthcare facility, state) observed and reported to NHSN is no different than the standard population from the baseline period. How broad the CI around the SIR will be depends on several factors, including the number of facilities reporting data from

the relevant patient care location type, device type or surgical procedure, the number of patients reported, and the number of device days or surgical procedures reported.

SURVEILLANCE RESULTS

There were 30 acute care hospitals reporting HAI data into NHSN in 2012. Of these 30 hospitals, 16 categorized themselves as major teaching hospitals (Table 1). Major teaching hospitals train medical and nursing students, interns, and residents. There is a total of 58 ICUs among the 30 hospitals, and all reported data.

Table 1: Connecticut hospitals by teaching type

Teaching Type	# (%)
Graduate teaching	2 (6.7)
Major teaching	16 (53.3)
Nonteaching	11 (36.7)
Undergraduate teaching	1 (3.3)

Table 2: Connecticut reporting ICUs by type

Intensive Care Unit Types	# (%)
Burn	1 (1.7)
Medical Cardiac	4 (6.9)
Medical	8 (13.8)
Medical/Surgical	23 (39.7)
Neonatal Level II/III & 3	11 (19.0)
Neurosurgical	2 (3.4)
Pediatric	2 (3.4)
Surgical	3 (5.2)
Surgical Cardiothoracic	4 (6.9)

Central Line Associated Blood Stream Infections (CLABSIs), All ICUs

This type of HAI involves a "central line," a flexible tube that is placed through the skin into a large vein in a patient's chest, arm, neck, or groin and ends in or close to the heart or one of the major blood vessels near the heart. They are used to administer fluids, nutrition, chemotherapy, antibiotics, blood and blood products, to monitor the cardiovascular system, or to draw blood. While they are an essential part of providing medical care for many patients, and are beneficial and often lifesaving, their use also may place patients at risk for infection because the line can serve as a way for bacteria to get across the barrier posed by intact skin and into the blood. These infections are serious, costly, and most can be prevented by following accepted practices for inserting and caring for central lines.

In calendar year 2012, there were 134 CLABSI infections in Connecticut ICUs, which were approximately 40% fewer than what was expected based on 2006-2008 national baseline. This resulted in an SIR of

0.60 which was statistically significantly less than 1 (Table 3). The CLABSI SIR of less than 1 shows that Connecticut did better than predicted, and has shown substantial progress from the national 2006-08 baseline period in reducing CLABSI infections.

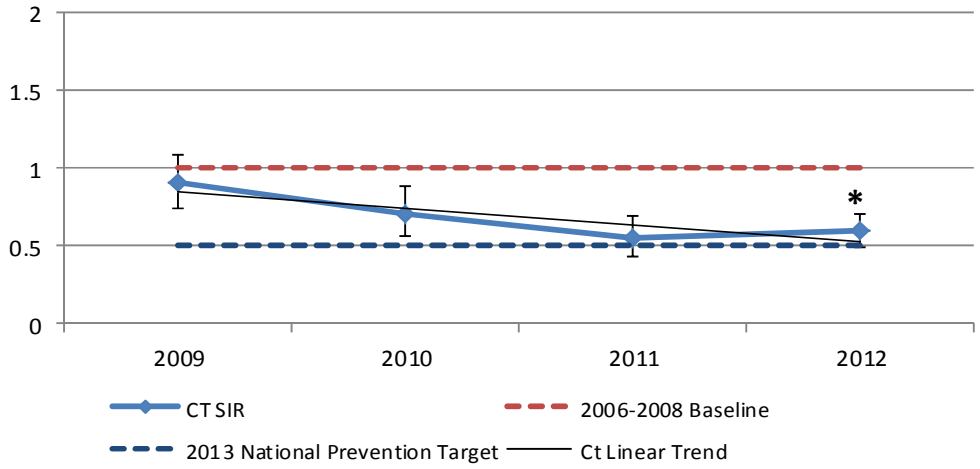
Table 3: CLABSI SIR from all Connecticut acute care hospital ICUs

Year	# CLABSI Infections	Predicted # CLABSI infections	Central Line Days	SIR	SIR 95% Confidence Interval
2012	134	225.28	105,191	0.60	0.50, 0.70

Data reported as of 9/30/2013

As noted earlier, Connecticut's CLABSI reporting mandate broadened to include all of Connecticut's ICUs in acute care hospitals in 2012. The previous mandate, in place from 2008-2011, only required hospitals to report from one adult ICU and all pediatric ICUs. The change increased the number of reporting ICUs from 29 to 58. This widening of the reporting mandate may have contributed to a slight rise in the CLABSI SIR between 2011 and 2012. Nevertheless, Connecticut has shown a general decrease in its SIR since 2009, from 0.91 in 2009, to 0.60 in 2012. This shows progress towards the 2013 National Prevention Target set forth by the US Department of Health and Human Services, which is a CLABSI SIR of 0.50 (Figure 1). If this progress continues, as indicated by the "Ct Linear Trend" line in the figure, Connecticut will achieve the target on time.

Figure 1: CLABSI SIRs, Connecticut acute care hospital ICUs from 2009-2012



**Mandate changed to reflect CMS reporting (from one to all ICUs in each acute care hospital)*
The vertical bars accompanying each data point represent the 95% confidence interval

CLABSIs in Pediatric and Neonatal ICUs

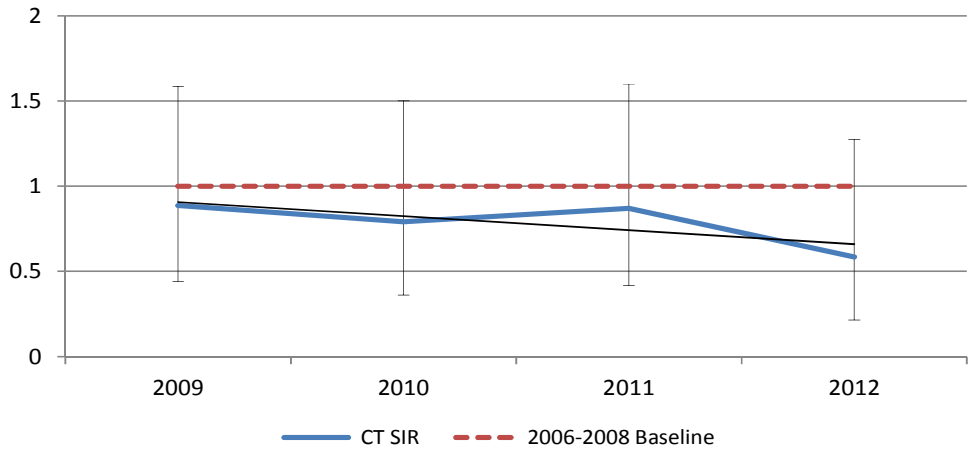
There are currently two pediatric ICUs (PICUs) in Connecticut. These PICU locations experienced six infections during 2012, which were approximately four fewer than predicted based on 2006-2008 baseline. This resulted in an SIR of 0.59 (Table 4). While this SIR is encouraging, the confidence interval (0.22 thorugh 1.27) crosses 1.0, which indicates that the SIR is not statistically different than 1. Between 2009 and 2012, the CLABSI SIR in PICUs decreased overall, from 0.89 to 0.59 (Figure 2), which is encouraging.

Table 4: CLABSI SIR, pediatric ICUs

Year	# CLABSI Infections	Predicted # CLABSI Infections	Central Line Days	SIR	SIR 95% Confidence Interval
2012	6	10.25	3,416	0.59	0.22, 1.27

Data reported as of 9/30/2013

Figure 2: CLABSI SIR in pediatric ICUs from January 1, 2009 through December 31, 2012, compared to the 2006-2008 national reference group



The vertical bars accompanying each data point represent the 95% confidence interval

Connecticut began collecting CLABSI data from its 11 neonatal intensive care units (NICUs) in 2012. During 2012, there were 12 infections in Connecticut's NICUs, approximately 60% less than predicted based on 2006-2008 national rates. This resulted in a statistically significant SIR of 0.4, indicating that Connecticut NICUs did better than expected in 2012 in the number of CLABSIs.

Table 5: CLABSI SIR, neonatal ICUs

Year	# CLABSI Infections	Predicted # CLABSI Infections	Central Line Days	SIR	SIR 95% Confidence Interval
2012	12	29.98	12,816	0.40	0.21, 0.70

Data reported as of 9/30/2013

Central Line Device Utilization

The central line device utilization (DU) ratio measures the proportion of total patient days in which central lines are used. It is calculated by dividing the number of patients with at least one central line, by all patients in a patient care location (usually an ICU) during the specified reporting period. DU is a measure of the degree of invasive care interventions in a patient location and can serve as a marker for severity of illness. Because central line use is a necessary condition for the development of a CLABSI, reducing central line use and the duration of use when the patient's condition permits it may lead to lower rates of CLABSIs. CLABSI prevention guidelines include recommendations to remove central lines as soon as the patient no longer needs it. Of the locations analyzed in table 6, Connecticut experienced lower DU ratios in 6 of the 11 ICU types in 2012 than the nation as a whole. In the NICU locations, Connecticut's 2012 DU ratio is lower than the national DU ratio for every baby birth-weight category (Table 7). This is encouraging data, and suggests that Connecticut ICUs are making progress in following national recommendations on CLABSI prevention. Such success in implementing practice recommendations is consistent with the excellent progress Connecticut hospitals are making in preventing central line infections.

Table 6: 2012 CLABSI DU ratios, adult and pediatric ICUs

ICU Type	# Patient Days	# CL Days	CT DU Ratio*	National DU Ratio 2011***
Burn ICU	1255	710	0.57**	0.46
Medical Cardiac ICU	12736	7098	0.56**	0.42
Medical ICU, all others	6097	2298	0.38**	0.45
Medical ICU, Major Teaching	27000	15716	0.58**	0.62
Medical/Surgical ICU, all others, <=15 beds	26720	7960	0.30**	0.35
Medical/Surgical ICU, all others, > 15 beds	3493	1730	0.50**	0.49
Medical/Surgical ICU,Major Teaching	53964	26895	0.50**	0.54
Neurosurgical ICU	10443	6006	0.58**	0.44
Pediatric medical/surgical ICU	8768	3416	0.39**	0.47
Surgical Cardiothoracic ICU	16595	12849	0.77**	0.66
Surgical ICU, Major Teaching	12723	7697	0.60**	0.62

Data reported as of 9/30/2013

***** # Central line days /# Patient days***

****** Difference between Ct DU ratio and national DU ratio is statistically significant***

*****Taken from the National Healthcare Safety Network (NHSN)***

Table 7: 2012 DU ratios, NICUs

Birth-weight category	# Patient Days	# CL Days	CT DU Ratio*	National DU Ratio 2011***
≤750 g	8027	3052	0.38**	0.43
751-1,000 g	6969	1887	0.27**	0.37
1,001-1,500 g	11616	2996	0.26**	0.28
1,501-2,500 g	19641	2514	0.13**	0.18
> 2,500 g	15388	2367	0.15**	0.25

Data reported as of 9/30/2013
**** # Central line days /# Patient days***
***** Difference between Ct DU ratio and national DU ratio is statistically significant***
******Taken from the National Healthcare Safety Network (NHSN)***

CLABSI SIRs in Connecticut compared to the nation

Each year CDC publishes a national report on the HAI data submitted from healthcare facilities across the nation. The report uses the SIR statistic on data reported from NHSN. In the most recent report, on calendar year 2011, state level data (i.e., data broken out and listed by name of state) was reported on CLABSIs only. The data included in the report are not limited to what is mandated by the states, and includes data that facilities are voluntarily submitting to NHSN, data to which the states do not have access. Therefore, the Connecticut numbers provided in these annual CDC reports may differ slightly from the results of our state surveillance. However, the CDC reports still allows us to gage how we compare with the other states in the nation.

Table 8 is an excerpt from the latest CDC report, "2011 National and State Healthcare-Associated Infections Standardized Infection Ratio Report." Connecticut compares favorably in CLABSI SIRs to the nation. We are slightly higher (worse) when all healthcare facility locations (wards and ICUs) are lumped together, but lower (better) when focusing only on ICUs. These differences are not statistically significant. In any case, these data from Connecticut are encouraging, and all our Connecticut state CLABSI SIRs are significantly below 1.

Table 8: Central Line-associated Bloodstream Infections (CLABSI), by location, 2011

	All locations		ICU		Ward (non-critical care)		NICU	
	SIR	95% CI	SIR	95% CI	SIR	95% CI	SIR	95% CI
Connecticut	0.627	0.534-0.733	0.543	0.448-0.653	.	. .	0.548	0.300-0.920
All US	0.592	0.583-0.600	0.557	0.546-0.567	0.642	0.626-0.659	0.645	0.618-0.672

CLABSI Pathogens

A total of 142 pathogens were isolated from 134 CLABSIs (one CLABSI infection can have one or more than one pathogen isolated from the blood). Enterococcus bacteria, followed by *Staphylococcus aureus*, were the pathogens most often associated with CLABSIs. Enterococcus bacteria and *Staphylococcus aureus* can sometimes become resistant to antibiotics used to treat infections caused by these organisms, giving rise to Vancomycin-resistant enterococcus (VRE) and Methicillin-resistant *Staphylococcus aureus* (MRSA). These drug resistant organisms were associated with 2.8% and 4.9% of CLABSIs respectively.

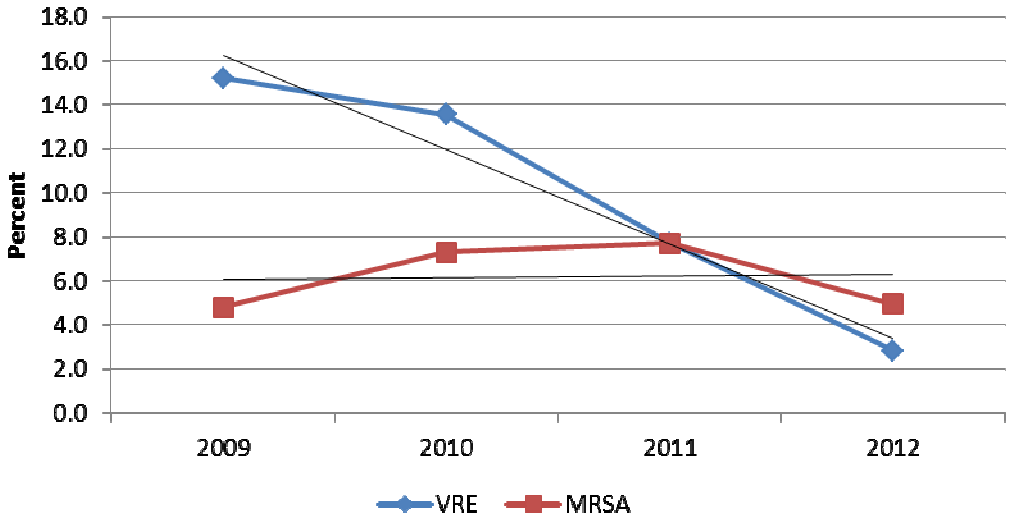
Table 9: Pathogens associated with CLABSIs, 2012

Pathogen	#	%
Enterococcus	27	19.0
VRE*	4	2.8
Staphylococcus aureus	21	14.8
MRSA*	7	4.9
Candida	22	15.5
Coagulase negative staphylococcus	15	10.6
Escherichia	9	6.3
Serratia	7	4.9
Enterobacter	4	2.8
Klebsiella	5	3.5
Pseudomonas	4	2.8
Acinetobacter	2	1.4
Clostridium	2	1.4
Proteus	2	1.4
Staphylococcus unspecified	2	1.4
Streptococcus	2	1.4
Other	7	4.9

Data reported as of 9/30/2013
**antibiotic resistant*

The spread of multi-drug resistant organisms (MDROs) is of great public health concern due to the limited treatment options available for infections caused by these organisms. During the period 2009 through 2012, the numbers of CLABSI infections associated with VRE and MRSA were not high in Connecticut, totaling 42 for VRE and 26 for MRSA. The percentage of CLABSI infections associated with VRE steadily declined during this period, from 15.2 in 2009 to 2.8 in 2012. The percentage of CLABSIs associated with MRSA stayed relatively low, but steady.

Figure 3: Percent of CLABSI pathogens isolated from Connecticut acute care hospitals that are VRE or MRSA



CAUTIs, All ICUs

Urinary tract infections (UTIs) are the 4th most common type of healthcare-associated infection in acute care hospitals, according to a recent study by the CDC with collaborating states in the Emerging Infection Program.[1] Most UTIs are related to the patient having an indwelling urinary catheter (generally called a "Foley" catheter). In various studies CAUTIs have been associated with increased illness, death, cost, and longer stays in the hospital. Sometimes catheters are not necessary, and removal of those catheters can prevent this HAI.

Beginning in 2012, all of Connecticuts adult and pediatric ICUs were required to report their incidence of catheter associated urinary tract infections (CAUTI) to the state health department. During 2012, Connecticut experienced 501 CAUTIs, approximately 84% more than expected based on 2009 CAUTI rates. This resulted in a statistically significant SIR of 1.84, indicating that Connecticut did worse than expected in 2012 in the number of CAUTIs (Table 10).

The National Prevention Target for CAUTIs set forth by the US Department of Health and Human Services is to achieve an SIR of 0.75 by then end of 2014. This would represent a 25% reduction (from the baseline period of 2009) in CAUTIs for patients in ICUs and wards. Connecticut's 2012 SIR of 1.84 is much higher than the national prevention target, and strenuous efforts by facilties will be necessary to meet this goal.

[1] Magill S et al., Multi-State Point Prevalence Survey and National Burden of Healthcare-Associated Infections (In press)

Table 10: CAUTI SIR from all Connecticut acute care hospital ICUs

Year	# CAUTI Infections	Predicted # CAUTI infections	Urinary Catheter Days	SIR	SIR 95% Confidence Interval
2012	501	272.43	120,232	1.84	1.68, 2.01

Data reported as of 9/30/2013

Catheter Associated Urinary Tract Infections, Pediatric ICUs

A very small percentage (1%) of Connecticut's ICU CAUTI infections in 2012 was in children. There were five infections in pediatric ICUs (PICU), which is approximately equal to what was expected (4.72). This resulted in an SIR of 1.06 which was not statistically significant, indicating that Connecticut is performing as predicted in PICUs in the number of CAUTIs (Table 11).

Table 11: CAUTI SIR, Pediatric ICUs

Year	# CAUTI Infections	Predicted # CAUTI infections	Urinary Catheter Days	SIR	SIR 95% Confidence Interval
2012	5	4.72	1,687	1.06	0.34, 2.47

Data reported as of 9/30/2013

Urinary Catheter Device Utilization

The device utilization (DU) ratio is the proportion of patient days (defined the same way as patient days for CLABSI calculations) in a particular patient location in which a urinary catheter is used. Eight of the 11 ICU types analyzed in Table 12 have DU ratios that are higher than the national ratio. All of these differences are statistically significant. This is a possible factor in the state's high SIR. We do not know why this is the case, but there are some possible explanations for this. One is that Connecticut patients are more ill than their counterparts elsewhere in the nation, thus a higher proportion of them need urinary catheters. Another possible explanation is that a portion of these catheters are left in patients for too long, which increases the possibility of bacteria entering the bladder via the catheter. Connecticut hospital infection prevention staffs are making a concerted effort to address the second possibility, and are working to ensure that catheters are promptly removed when they are no longer needed.

Table 12: 2012 CAUTI DU ratios, adult and pediatric ICUs

ICU Type	# Patient Days	# Cath Days	CT DU Ratio*	National DU Ratio 2011***
Burn	1255	706	0.56**	0.50
Medical , All Others	6097	4300	0.71**	0.61
Medical , Major Teaching	27000	20226	0.75**	0.70
Medical Cardiac	12736	6127	0.48**	0.51
Medical/Surgical, All Others, <=15 beds	29242	14053	0.48**	0.54
Medical/Surgical, All Others, >15 beds	3493	2733	0.78**	0.66
Medical/Surgical, Major Teaching	53964	38971	0.72**	0.69
Neurosurgical	10443	8509	0.81**	0.70
Pediatric medical/surgical ICU	8768	1687	0.19**	0.23
Surgical Cardiothoracic	16595	12213	0.74**	0.67
Surgical, Major Teaching	12723	10707	0.84**	0.76

Data reported as of 9/30/2013
***** # Central line days /# Patient days***
****** Difference between Ct DU ratio and national DU ratio is statistically significant***
*****Taken from the National Healthcare Safety Network (NHSN)***

CAUTI Pathogens

A total of 548 pathogens were isolated from 501 CAUTIs. Escherichia, gram negative bacteria that normally inhabit the gastrointestinal tract, was the pathogen most commonly associated with this type of infection, followed by Candida and other yeasts. Like Escherichia, many of the other CAUTI pathogens are GI tract gram negative bacteria. Antibiotic resistant bacteria were found among CAUTI pathogens: Vancomycin-resistant Enterococci (VRE) and MRSA were associated with 4.4% and 0.2% of CAUTIs respectively (Table 13).

Table 13: Pathogens associated with CAUTIs, 2012

Pathogen	#	Percent
Escherichia	130	23.7
Candida	103	18.8
Yeast not specified	61	11.1
Enterococcus	54	9.9
VRE*	24	4.4
Klebsiella	47	8.6
Pseudomonas	41	7.5
Enterobacter	20	3.6
Citrobacter	15	2.7
Proteus	14	2.6
Coagulase negative staphylococci	11	2.0
Other	8	1.5
Staphylococcus aureus	5	0.9
MRSA*	1	0.2
Streptococcus	5	0.9
Serratia	5	0.9
Staphylococcus	5	0.7

Data reported as of 9/30/2013
**antibiotic resistant*

Surgical site infections

SSIs are the most common type of healthcare-associated infection in acute care hospitals, according to the study referred to earlier. They are also a significant cause of post- surgical morbidity and possible mortality, but also can result in the need for hospital readmissions or extended courses of antibiotics. Beginning in 2012, all of Connecticut's acute care hospitals were required to report the incidence of SSIs related to all colon (COLO) and abdominal hysterectomy (HYST) surgeries. The most serious types of SSIs are deep incisional and organ space. In 2012, there were a total of 191 of these types of infections reported, 65.4% of which were organ space (Table 14).

Table 14: # SSIs by procedure and infection type

		Deep Incisional Primary	Organ Space	Total
COLO	#	52	91	144
	%	36.4	63.6	100.0
HYST	#	13	34	47
	%	27.7	72.3	100.0
Total	#	65	125	191
	%	34.0	65.4	100.0

Data reported as of 9/30/2013

When performing SIR analysis for SSIs, some procedures, and any infections related to them, are excluded because they are "outliers." Procedures are considered outliers if they are missing data, or if their duration is unusually long or short for that procedure type. After eliminating the outliers, there were 132 COLO and 47 HYST infectious included in the SIR. Based on 2006-08 SSI infection baseline data, this is approximately 22% more than expected for COLO procedures, and 44% more than expected for HYST procedures. This resulted in SIRs of 1.22 and 1.44 for COLOs and HYSTs respectively, and both SIRs are statistically significantly higher than 1. This means that Connecticut did worse than expected for both procedure types in 2012.

Table 15: SSI SIRs, by procedure type

Procedure Code	Year	Procedure Count	# of infections	Predicted # SSI infections	Ct SIR	SIR 95% Confidence Interval
COLO	2012	3568	132	108.15	1.22	1.02, 1.45
HYST	2012	3901	47	32.73	1.44	1.05, 1.91

Data reported as of 9/30/2013

A total of 194 pathogens were isolated from 130 SSIs related to colon surgeries. Enterococcus bacteria were the type of pathogen most commonly associated with these types of SSIs, followed by Escherichia and Bacteroides. All of these are gram negative bacteria that normally inhabit the GI tract, not surprising considering the anatomic location of these surgeries. Drug-resistant bacteria are also a concern among SSI: of the 42 Enterococcus isolates identified, seven were resistant to the antibiotic Vancomycin. Of the 18 *Staphylococcus aureus* isolates identified, 13 were Methicillin-resistant (MRSA).

Table 16: Pathogens associated with SSIs related to colon surgeries, 2012

Pathogen	#	Percent
Enterococcus	37	19.1
VRE*	7	3.6
Escherichia	37	19.1
Bacteroides	23	11.9
Staphylococcus aureus	6	3.1
MRSA*	13	6.7
Streptococcus	12	6.2
Candida	8	4.1
Coagulase negative staphylococci	8	4.1
Pseudomonas	8	4.1
Clostridium	6	3.1
Proteus	6	3.1
Klebsiella	5	2.6
Prevotella	3	1.5
Corynebacterium	2	1.0
Enterobacter	2	1.0
Yeast	2	1.0
Other	9	4.6

Data reported as of 9/30/2013

A total of 38 pathogens were isolated from 47 SSIs related to abdominal hysterectomy surgeries. Enterococcus bacteria were the type of pathogen most commonly associated with these types of SSIs, followed by Bacteroides and Streptococcus.

Table 17: Pathogens associated with SSIs related to abdominal hysterectomy surgeries, 2012

Pathogen	#	Percent
Enterococcus	7	18.4
Bacteroides	5	13.2
Streptococcus	3	7.9
Klebsiella	3	7.9
Proteus	3	7.9
Escherichia	2	5.3
Gram-negative rod unspecified	2	5.3
Other	13	34.2

Data reported as of 9/30/2013

PARTNERSHIPS AND HAI PREVENTION

HAI surveillance to gather actionable data is a first step that healthcare facilities and DPH are taking to improve patient safety. The data are used to inform and direct prevention activities that include participating in collaboratives with other facilities to share and follow best practices, and implementing facility-based initiatives to improve hand hygiene, disinfection procedures for medical equipment, and other preventive measures.

Working in partnership with the Connecticut Hospital Association (CHA) and Qualidigm, the DPH collaborates with hospitals to facilitate sharing local and national best practices, tools and resources, and strategies for implementing prevention initiatives and garnering leadership support. The DPH has either hosted or participated in a number of seminars on infection prevention and approaches for promoting quality improvement. DPH Commissioner Mullen has been regularly communicating with hospital Chief Executive Officers through circular letters and memos about HAI reporting initiatives.

All hospitals licensed by the DPH have a hospital-wide program for the prevention, control, and investigation of infectious diseases. Nurses, physicians, medical technologists, and other professionals who have acquired special training in infection control or epidemiology manage these programs. Through their infection prevention and control programs, hospitals strive to improve the care and safety of patients by following the recommendations and standards of agencies such as the DPH and the CDC.

The efforts of these infection prevention and control programs have resulted in the development of several national HAI prevention programs that offer participants opportunities for shared learning, support, and tools to help eliminate HAIs. The best known of these is the Comprehensive Unit-based Safety Program (CUSP) developed by staff of the Johns Hopkins Center for Patient Safety under the leadership of Dr. Peter Pronovost (a native of Connecticut). This uses carefully crafted quality improvement and workplace culture change methods to achieve the goal of consistently and sustainably incorporating proven best practices to prevent CLABSIs (including the famous “checklist”). CUSP has been used to reduce CLABSIs at Hopkins and in a consortium of most of the hospitals in the state of Michigan. The Michigan “Keystone Center” project has sustained a 70 percent reduction in CLABSI over several years in a wide variety of hospitals, and has been successfully used in Connecticut.

The Connecticut Hospital Association has lead several prevention collaboratives based on CUSP over the past three years. CHA has led both CLABSI and CAUTI prevention collaboratives, and has recently embarked on SSI prevention collaborative. This year, they are working with hospitals on an ambitious statewide initiative to eliminate all-cause preventable harm using high reliability science to create a culture of safety. To date, nearly 3,000 hospital staff, leaders, and physicians have been trained in high reliability science and behaviors. All acute care hospitals are also participating in Partnership for Patients, a national initiative to eliminate preventable patient harm by 20% and avoidable readmissions by 40%. Engagement in these collaboratives builds upon hospitals’ prior work. Working collaboratively, hospitals committed to eliminating central line-associated bloodstream infections, catheter-associated urinary tract infections, and surgical-site infections.

This past year, two other important prevention collaboratives were launched in Connecticut. The first, which has enrolled 25 long term care facilities, was developed in partnership with the Public health Foundation and uses quality improvement methodology to improve infection control processes in the

long-term care setting, with a specific focus on reducing *Clostridium difficile* infections. The use of Quality Improvement (QI) methods in healthcare is a cutting-edge activity that DPH is promoting throughout DPH and the public health system in Connecticut as a whole. The second collaborative is made up of communities of healthcare providers across the healthcare continuum (acute care hospitals, long-term care, home health agencies, clinicians, and other providers of care) that care for the same patients. This project, facilitated by Qualidigm, a Connecticut-based national consulting and research company and the Centers for Medicare & Medicaid Services designated Quality Improvement Organization (QIO) for Connecticut, is developing innovative methods of reducing antibiotic resistance through stewardship programs.

Successful implementation of these models is dependent upon executive leadership guiding overall institutional commitment to foster, promote, and support collaborative goals of improvement. Hospitals have also implemented prevention activities specific to their facility to eliminate HAI based on needs identified within their facilities, frequently focusing in hand hygiene.

FUTURE STEPS: EXPANSION OF HAI REPORTING IN CONNECTICUT

The federal government and the states are engaged in a coordinated effort to implement the Department of Health and Human Services *National Action Plan to Prevent Healthcare-Associated Infections.* This plan has specific and very ambitious goals for HAI reduction by the end of 2013 and is being updated to continue after that time. It will also expand beyond the acute care setting to the full range of healthcare settings. The current metrics that are being tracked by the federal government are for hospitals and are summarized in this table derived from the *Action Plan*:

Table 18: HAI Metrics from the HHS Action Plan

Metric	Data	Target
Central line bloodstream infections	NHSN	↓ 50%
Adherence to central line insertion practices	NHSN	100%
Hospitalizations with *Clostridium difficile*	Admin	≥ ↓ 30%
Clostridium difficile infections	NHSN	≥ ↓ 30%
Catheter-associated urinary tract infections	NHSN	≥ ↓ 25%
MRSA incidence rate (healthcare-associated)	EIP	≥ ↓ 50%
MRSA bacteremia (healthcare facility-wide)	NHSN	≥ ↓ 25%
Surgical site infections	NHSN	≥ ↓ 25%
Surgical Care Improvement Program adherence	SCIP	≥ 95%

The CMS is aligning their payment incentive programs (e.g., Inpatient Prospective Payment System, Quality Improvement Program) with the overall federal metrics above. CMS's plans are outlined in the following table prepared by the CDC Division of Healthcare Quality Promotion. The four Long Term Acute Care Hospitals (LTACs) in the state are reporting CLABSIs and CAUTIs from all locations within each facility; the four Inpatient Rehabilitation Facilities - IRFs (the latter all associated with acute care hospitals) are reporting CAUTI only. Each of the 40 outpatient hemodialysis centers in the state are to report data elements required by the NHSN Dialysis Event (DE) module (i.e., blood stream infections, antibiotic starts, and vascular access site infections). This reporting to DPH will begin in the autumn of 2013 for data entered into NHSN starting in January 2013. Acute care hospitals continue to report SSI

and CAUTI and CLABSIs from ICUs and NICUs, but as of January 1st 2013, have expanded reporting to include MRSA "LabID event" and *Clostridium difficile* "LabID event" NHSN modules. The "LabID events" report patient -specific data on these two infections generated from hospital microbiology laboratory results and are facility-wide (with the exception of the NICU) for *C. difficile*.

Additional measures and facility types will be added in future years, following the plan summarized in the table below, to ensure that Connecticut mirrors the future expansion in CMS reporting (NB: there are no PPS-exempt cancer hospitals in Connecticut). Each fall, the measures that CMS will require will be presented to the DPH Reportable Diseases Advisory Committee for review, and inclusion in the list promulgated each January. CMS metrics with October start dates will generally be deferred three months to start state reporting in January, to align with the publication of the annual list of reportable public health conditions.

Table 19: Healthcare Facility HAI Reporting Requirements to CMS via NHSN – Current and Proposed Requirements; (9/6/2012 version)

CMS Reporting Program	HAI Event	Reporting Specifications	Reporting Start Date
Hospital Inpatient Quality Reporting (IQR) Program	CLABSI	Acute Care Hospitals: Adult, Pediatric, and Neonatal ICUs	January 2011
Hospital Inpatient Quality Reporting (IQR) Program	CAUTI	Acute Care Hospitals: Adult and Pediatric ICUs	January 2012
Hospital Inpatient Quality Reporting (IQR) Program	SSI	Acute Care Hospitals: Inpatient COLO and HYST Procedures	January 2012
ESRD Quality Incentive Program (QIP)	I.V. antimicrobial start	Outpatient Dialysis	January 2012
ESRD Quality Incentive Program (QIP)	Positive blood culture	Outpatient Dialysis	January 2012
ESRD Quality Incentive Program (QIP)	Signs of vascular access infection	Outpatient Dialysis	January 2012
Long Term Care Hospital Quality Reporting (LTCHQR) Program	CLABSI	Long Term Care Hospitals *: Adult and Pediatric LTAC ICUs and Wards	October 2012
Long Term Care Hospital Quality Reporting (LTCHQR) Program	CAUTI	Long Term Care Hospitals *: Adult and Pediatric LTAC ICUs and Wards	October 2012
Inpatient Rehabilitation Facility Quality Reporting Program	CAUTI	Inpatient Rehabilitation Facilities: Adult and Pediatric IRF Wards	October 2012
Hospital Inpatient Quality Reporting (IQR) Program	MRSA Bacteremia LabID Event	Acute Care Hospitals: all inpatients	January 2013
Hospital Inpatient Quality Reporting (IQR) Program	*C. difficile* LabID Event	Acute Care Hospitals: all inpatients	January 2013
Hospital Inpatient Quality Reporting (IQR) Program	Healthcare Personnel Influenza Vaccination	Acute Care Hospitals	January 2013
PPS-Exempt Cancer Hospital Quality Reporting (PCHQR) Program	CLABSI	PPS-Exempt Cancer Hospitals: all locations	January 2013
PPS-Exempt Cancer Hospital Quality Reporting (PCHQR) Program	CAUTI	PPS-Exempt Cancer Hospitals: all locations	January 2013
Long Term Care Hospital Quality Reporting (LTCHQR) Program	Healthcare Personnel Influenza Vaccination	Long Term Care Hospitals*	October 2013
Ambulatory Surgery Centers Quality Reporting Program	Healthcare Personnel Influenza Vaccination	Ambulatory Surgery Centers	October 2014
Ambulatory Surgery Centers Quality Reporting Program	TBD *(future proposal)*	Hospital Outpatient Departments and Ambulatory Surgery Centers	TBD

* Long Term Care Hospitals are called Long Term Acute Care Hospitals in NHSN