HEALTHCARE-ASSOCIATED INFECTIONS IN MICHIGAN HOSPITALS

2013 SEMI-ANNUAL REPORT

Michigan Department of Community Health

Surveillance for Healthcare-Associated & Resistant Pathogens (SHARP) Unit

January 1 – June 30, 2013

Michigan Department of Community Health
MDCH
Rick Snyder, Governor
James K. Haveman, Director

Healthcare-associated Infections
HAI Elimination
www.michigan.gov/hai

Surveillance & Infectious Disease Epidemiology
Michigan Department of Community Health
Bureau of Epidemiology

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Introduction

This report includes statewide healthcare-associated infection (HAI) counts, rates, and ratios in Michigan from January through June, 2013. Surveillance data were collected from Michigan hospitals which voluntarily agreed to share their National Healthcare Safety Network (NHSN) data with the Michigan Department of Community Health (MDCH) Surveillance for Healthcare-Associated and Resistant Pathogens (SHARP) Unit. NHSN is a secure online surveillance system developed by the Centers for Disease Control and Prevention (CDC). Hospitals sign a MDCH SHARP data use and confidentiality agreement (DUA) and confer rights to MDCH SHARP to view their NHSN HAI data. All NHSN data collected from participating hospitals have been aggregated and facility de-identified in this report. Aggregated data have been analyzed for trends and compared with national data where appropriate. Data are displayed only when 5 or more facilities are included in the analyses.

The SHARP Unit collects data from all modules within NHSN. In this semi-annual report, participating hospitals are characterized by hospital affiliation, geographic region, and bed size. This report also describes units under surveillance by participating hospitals and the modules used. This semi-annual report and previous quarterly, semi-annual, and annual reports are published on the MDCH HAI website at www.michigan.gov/hai.

As of the data access date (May 9, 2014) 91 hospitals had signed a data use and confidentiality agreement (DUA) with MDCH SHARP. At that time, all 91 hospitals had conferred rights to SHARP and had a reporting plan in place for at least one month during the inclusive time period. The data from these hospitals were used for development of this report; however, not all participating hospitals provided data for every module. The number of hospitals providing data for analysis is indicated in each table throughout this report and reflects the number of hospitals contributing data to NHSN and sharing that data with MDCH SHARP. For example, although 91 hospitals had conferred rights to their data with at least one monthly reporting plan in place for the time period between January 1 and June 30, 2013, at the data access date (see Table 6 below), only 87 hospitals had the Catheter-Associated Urinary Tract Infection (CAUTI) module in their reporting plan; of these, 86 shared data (Table 6). The text "n=…" is used to indicate the number of hospitals or units being referenced.

Hospital Descriptives and Surveillance

Figure 1 (below) is a graphical representation of the number of facilities who have signed the MDCH SHARP DUA. Hospitals that have agreed to share data with the SHARP Unit are shown by the blue trend line, labeled "Master Agreement." The MDCH SHARP Unit DUA also provides an option to share data with the Michigan Health & Hospital Association (MHA) Keystone Center for Patient Safety & Quality. Hospitals who have agreed to share these data are shown by the red trend line labeled "MHA Data Release". Hospitals can also share Central Line-Associated Bloodstream Infection (CLABSI) data from neonatal intensive care units (NICU) with the Vermont Oxford Network (VON) via the SHARP Unit. These are represented by the green line labeled "VON Data Release."

Figure 1. Number of Michigan Hospitals that have a signed Data Use Agreement (DUA) with SHARP

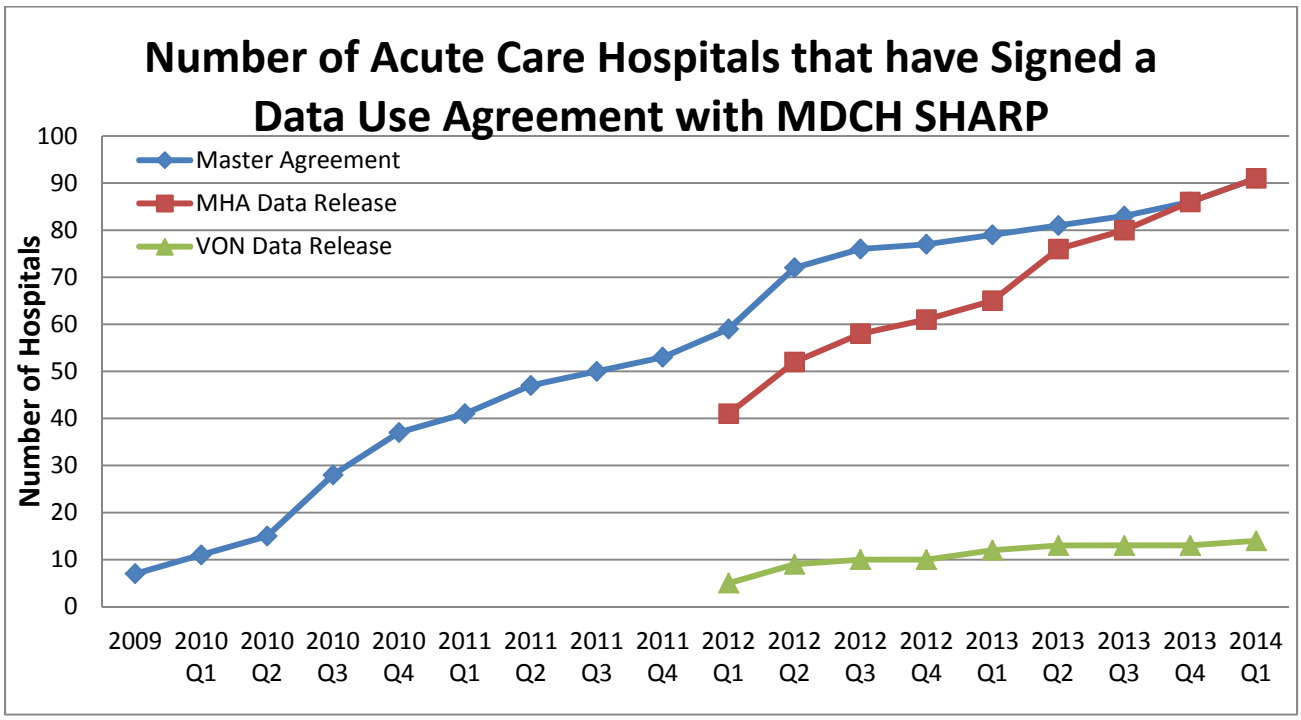
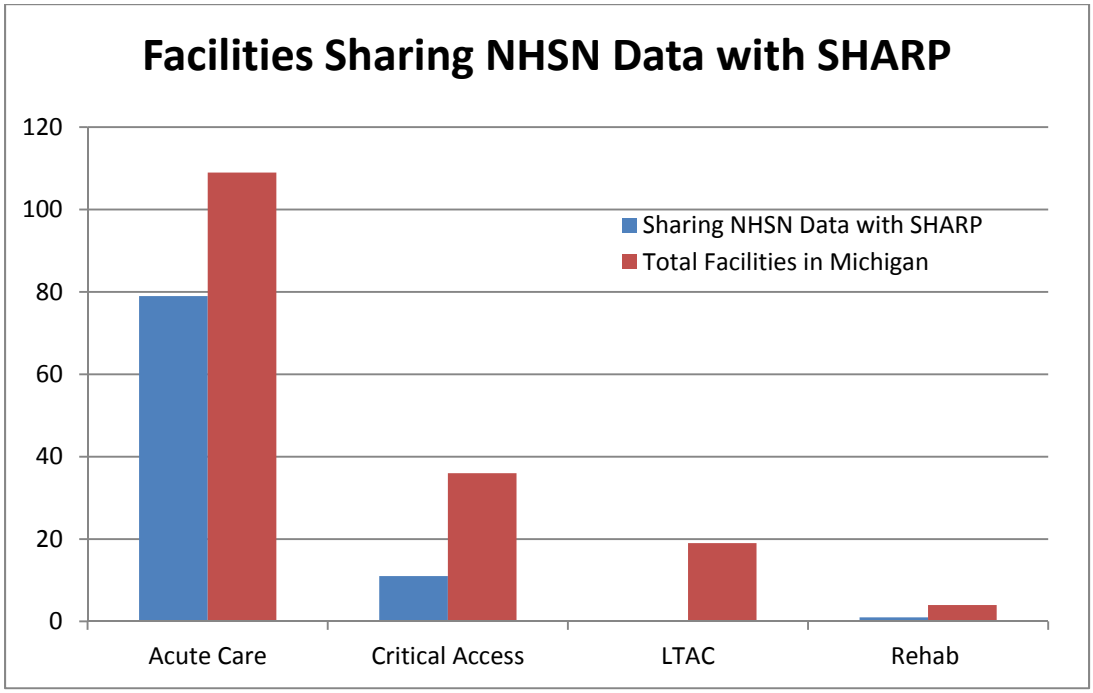


Table 1 and Figure 2 reflect the number of hospitals who have signed a DUA and conferred rights to the SHARP Unit by hospital type compared to the total of each hospital type in Michigan. Fifty-four percent of Michigan hospitals shared data with the SHARP Unit as of the data access date; 87% of participating hospitals were acute care hospitals. Hospital licensure data were obtained from a list generated by the Michigan Department of Licensing and Regulatory Affairs (LARA) on October 13, 2013. There are 19 LTACs in Michigan; however, none of these hospitals are sharing data with the SHARP Unit at this time. Therefore, the number of hospitals enrolled in the SHARP NHSN Group includes acute care hospitals, critical access hospitals, and rehab facilities only. As a requirement of some Centers for Medicare & Medicaid Services (CMS) programs, acute care hospitals and rehab facilities must report certain infections to NHSN; critical access hospitals had no such requirements in 2013.

Table 1. Hospitals Sharing Data with MDCH SHARP Unit					
	Acute Care	Critical Access	Long Term Acute Care	Rehab	**Total**
Number of Participating Facilities (%)	79 (72)	11 (31)	0 (0)	1 (25)	**91 (54)**
Michigan Total	109	36	19	4	**168**

Figure 2. Types of Facilities Sharing NHSN Data with SHARP



The data in Table 2 were obtained from the 2013 NHSN Annual Facility Survey completed by participating hospitals. Among the 88 facilities which completed an annual survey, more teaching hospitals than non-teaching hospitals participated with the SHARP Unit.

Table 2. Hospital Affiliation			
Hospital Type	Teaching[1]	Non-teaching	Total
Number of Facilities (% of Total)	54 (59)	34 (37)	88[2]

[1]Teaching includes major, graduate, and limited affiliation with medical schools as indicated on their facility survey
[2]3 hospitals did not complete a 2013 facility survey

To characterize the geographic distribution of the participating hospitals, hospital locations were categorized according to Public Health Preparedness Regions. The number of participating hospitals by region is indicated in Table 3 (below). The Public Health Preparedness Regions and the counties they include are shown on the map in Figure 3, and a map indicating the number of SHARP-participating facilities by region is shown in Figure 4.

Table 3.

Number of Participating Hospitals by Region

Geographic Region	1	2N	2S	3	5	6	7	8
Number of Facilities (%)	7 (41)	14 (54)	15 (54)	12 (44)	12 (63)	17 (68)	7 (64)	7 (47)
Facilities in Michigan	17	26	28	27	19	25	11	15

Figure 3. Michigan Public Health Preparedness Regions

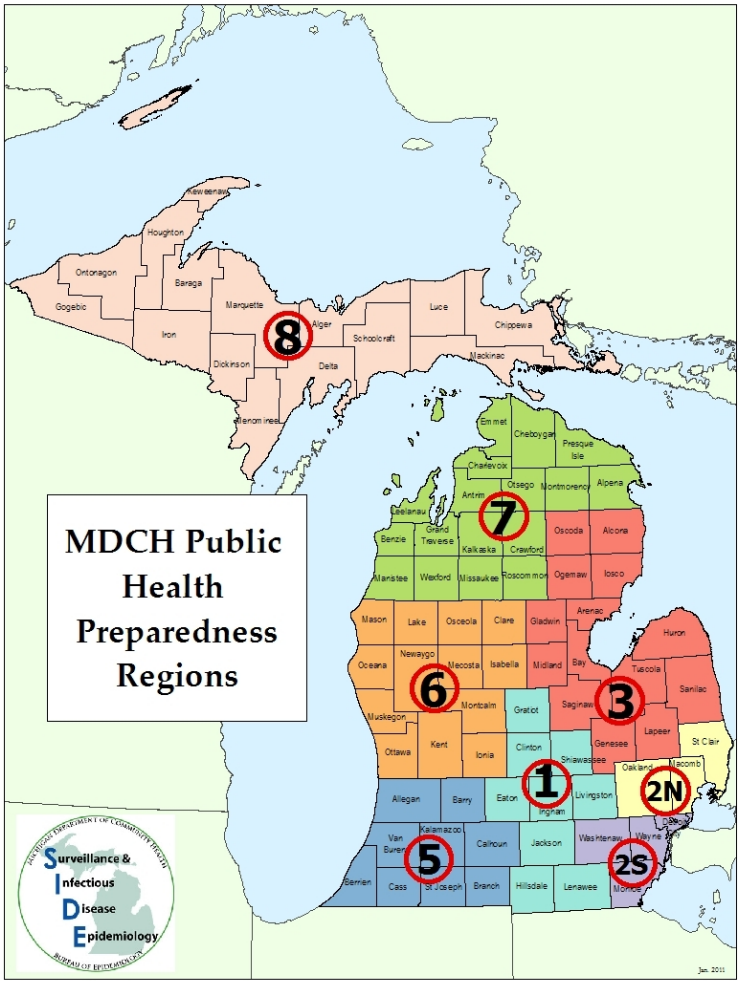


Figure 4. Facilities Participating with MDCH SHARP by Michigan Public Health Preparedness Region

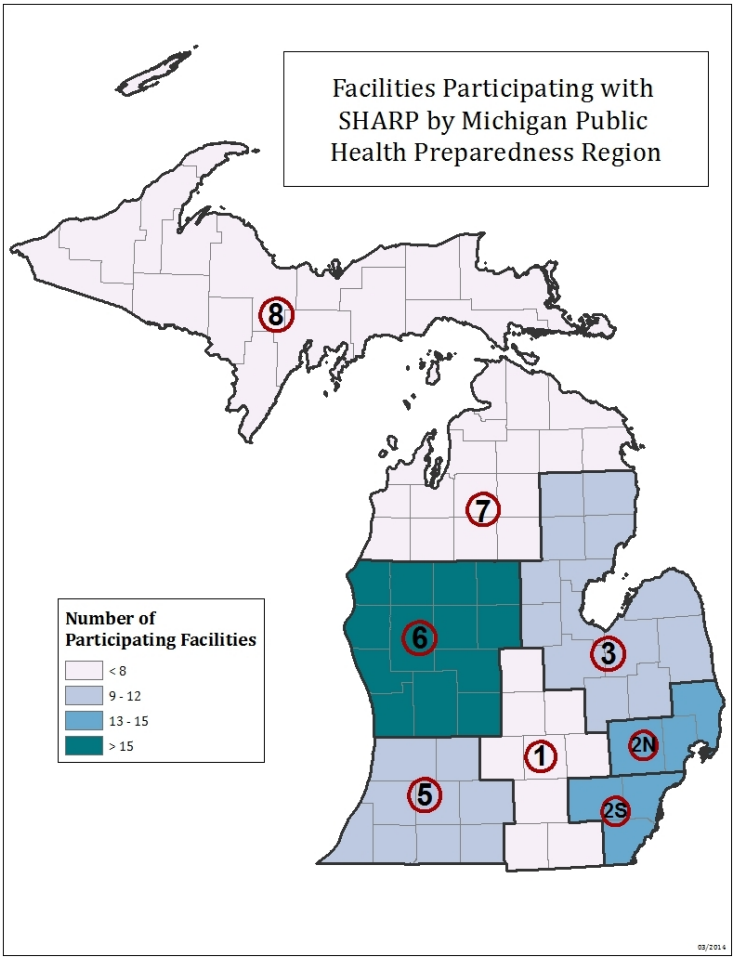


Table 4 shows the number of hospitals of each bed size type participating in SHARP NHSN surveillance. Approximately one-third of participating hospitals had 100 or fewer beds.

Table 4.

Number of Hospitals by Bed Size

Number of Beds in Hospital	**≤100**	**101 – 200**	**201 – 500**	**501 +**	**TOTAL**
Number of Facilities	33	16	28	11	**88**[1]

[1]3 hospitals did not complete a 2013 facility survey

Table 5 indicates that the majority of hospitals participating in SHARP NHSN surveillance are conducting NHSN surveillance facility-wide. Facility-wide inpatient reporting is conducted for LabID reporting. Most hospitals are also reporting individually from an ICU or CCU. The ICU type is not specified in this report.

Eighty-three hospitals are reporting at least one procedure type, contributing to surgical site infection reporting. Many hospitals are also conducting surveillance on one or more patient wards. Ten hospitals are conducting surveillance in a Specialty Care Area (SCA) or a step-down unit (STEP). According to the CDC NHSN Patient Safety Manual, a SCA may be an inpatient long-term acute care unit, a transplant unit, an acute dialysis unit, or a hematology/oncology unit. Hematology/oncology units will no longer be relevant in future reports.

Table 5.

Types of Units in Reporting Plan

Unit Type	FacWideIn[1]	ICU/CCU, NICU[2]	SCA/STEP[3]	Wards[4]	Procedures[5]	Other Inpatient[6]	Outpatient, OP Proc[7]
Number of Facilities [1]	85	82, 17	10	62	83	6	11, 36

[1]FacWideIn: All Facility-Wide Inpatient locations
[2]ICU/CCU: Intensive Care Unit/Critical Care Unit, NICU: Neonatal Intensive Care Unit
[3]SCA/STEP: Specialty Care Area/Step-Down Unit
[4]Wards: Inpatient wards
[5]Procedures: Inpatient Surgical Site Infections
[6]Other: All other inpatient locations, including inpatient rehab facilities, operating rooms, and locations designated as "other"
[7]Outpatient: All outpatient locations, OP Proc: All outpatient procedures (surgical site infection reporting)
[8]These numbers are not mutually exclusive

Table 6 indicates the NHSN module(s) in use, as indicated by monthly reporting plans developed by each participating hospital. From month to month, the type of module(s) being used can change as some modules require varying periods of use. According to data shared with MDCH SHARP, two of the most commonly used modules during this reporting period were the CAUTI and CLABSI modules. This is not surprising because of the previous work done by hospitals in conjunction with the MHA Keystone Center to reduce these types of infections. Use of the CAUTI, CLABSI, and Surgical Site Infection (SSI) modules is also consistent with the CMS Hospital Inpatient Prospective Payment System (IPPS) reporting rules. Beginning January 1, 2011, acute care hospitals were required to use NHSN to report CLABSIs in adult, pediatric, and neonatal ICUs in order to receive full Medicare reimbursements in 2013. They were required to report CAUTIs in adult and pediatric ICUs, and SSI colon surgeries (COLO) and abdominal hysterectomies (HYST) beginning January 1, 2012. Beginning October 2012, LTACs were required to report CLABSIs and CAUTIs in adult and pediatric ICUs and Wards, and rehab facilities were required to report CAUTIs in adult and pediatric wards. Finally, in January 2013, acute care inpatient *C.diff* LabID and MRSA bacteremia LabID event reporting became required by CMS facility-wide.

The column in Table 6 titled "Number of Hospitals Using Module" displays the number of hospitals that have indicated module use in their reporting plans for at least one month during this report time period. A monthly reporting plan identifies which NHSN modules and surveillance activities a hospital will be participating in during a given month. Because surveillance targets and monthly reporting plans may

vary by hospital and month, hospitals may not report to NHSN each month. The SHARP Unit has requested at least three consecutive months of data for the NHSN surveillance initiative.

The column titled "Number of Hospitals Sharing Data" displays the number of hospitals that have shared data for this report time period as of the data access date. There is a discrepancy between these two columns in some instances because not all hospitals that indicate module use necessarily report data and some hospitals report out-of-plan data which cannot be excluded from certain calculations. The SHARP Unit excludes out-of-plan data when possible because it may not follow NHSN definitions as closely as in-plan data.

Table 6.

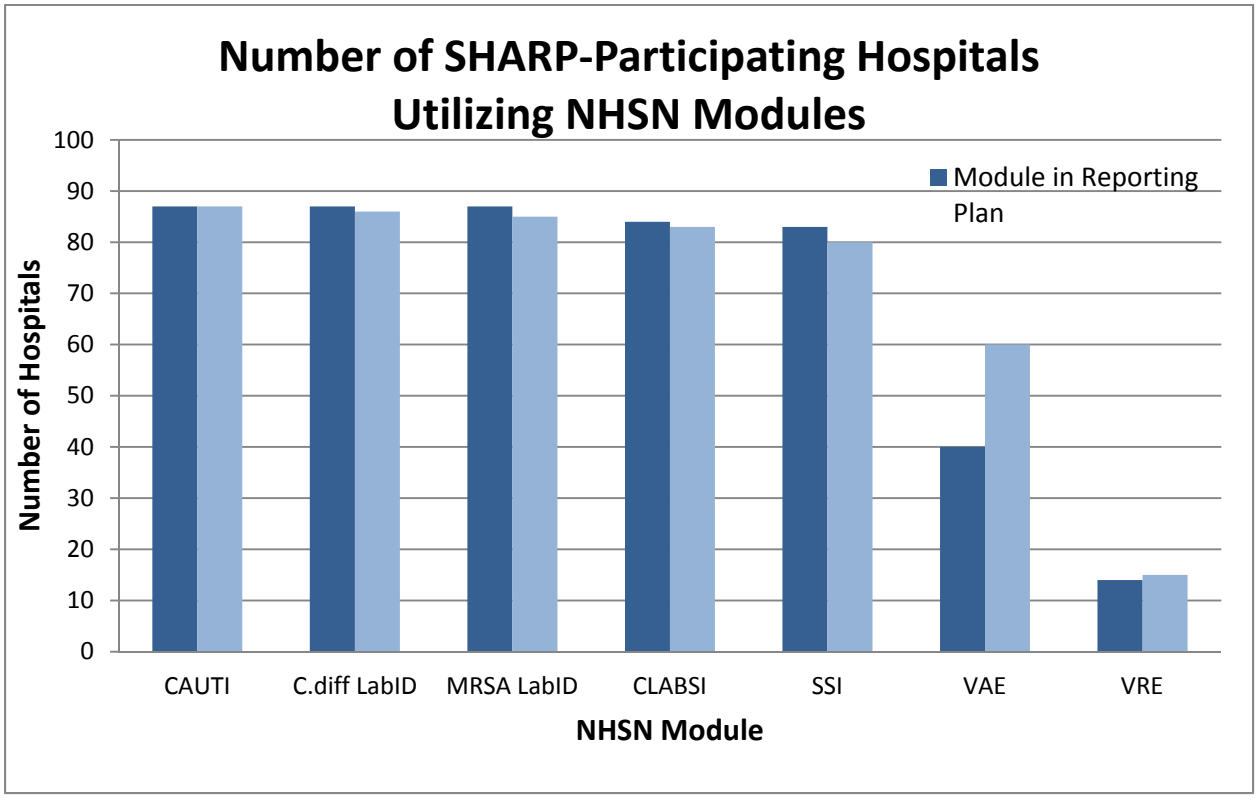
NHSN Modules in use

NHSN Module	Number of Hospitals Using Module[1]	Number of Hospitals Sharing Data[2]
Catheter-Associated Urinary Tract Infection (CAUTI)	87	87
Clostridium difficile Infection (CDI) Laboratory-identified (LabID) Event	87	86
Methicillin-Resistant Staphylococcus aureus (MRSA) Laboratory-identified (LabID)	87	85
Central Line-Associated Bloodstream Infection (CLABSI)	84	83
Surgical Site Infection (SSI)	83	80
Ventilator-Associated Events (VAE)	40	60[3]
Vancomycin-Resistant Enterococci (VRE) LabID	14	15
Acinetobacter LabID	7	N/A[4]
Carbapenem-resistant Enterobacteriaceae LabID	7	N/A
Cephalosporin Resistant Klebsiella LabID	5	N/A

[1]This is the number of hospitals that have indicated module use in their reporting plans for at least one month within the six month time period.
[2]This is the number of hospitals sharing data for the report period, as of the data access date. When contributing to more than one calculation (linelist, rate, SIR, etc…) the highest number of hospitals contributing was used.
[3]In some instances, the number of hospitals sharing data is greater than the number of hospitals using the module. Some hospitals are reporting data out-of-plan; out-of-plan data are included only when impossible to remove.
[4]N/A: data from these modules were not collected for this report.

Figure 5 (below) illustrates the number of SHARP-participating hospitals utilizing each of the NHSN modules. The darker blue bar indicates the number of hospitals indicating module use in the monthly reporting plan for at least one month in the time period from January to June 2013. The lighter blue bar indicates the number of hospitals sharing data for at least one month in the same time period.

Figure 5. SHARP-Participating Hospitals Utilizing NHSN Modules



Cumulative Semi-Annual Aggregate MDRO/CDI Module Reports

Table 7 shows aggregate MRSA LabID Event data by quarter, previously posted in each respective quarterly report, along with cumulative data for the semi-annual time period. Due to different abstraction dates and variable data shared during each respective time period, quarterly report values may not sum to semi-annual report values.

The NHSN definition for MDRO LabID Event is 'all non-duplicate MDRO isolates [in this case MRSA isolates] from any specimen source and unique blood source MDRO [MRSA] isolates, including specimens collected during an Emergency Department or other clinic visit, if collected the same day as patient admission'. A unique blood source is defined as 'a MDRO [MRSA] isolate from blood in a patient with no prior positive blood culture for the same MDRO [MRSA] and location in ≤2 weeks, even across calendar months.' A duplicate MDRO isolate is defined as 'any MDRO [MRSA] isolate from the same patient and location after an initial isolation of the specific MDRO [MRSA] during a calendar month, regardless of specimen source except unique blood source'. The specimens must be obtained for clinical decision-making purposes to be considered a LabID Event; thus, isolates obtained for 'surveillance purposes only' will not be reflected in this data. Additionally, testing protocol and type of test used (i.e. PCR, assay, culture) vary by facility and are not recorded here.

NHSN defines healthcare-onset (HO) as a 'LabID Event specimen collected >3 days after admission to the facility (i.e., on or after day 4).' Community-onset (CO) is defined by NHSN as a 'LabID Event specimen collected as an outpatient or an inpatient ≤3 days after admission to the facility (i.e., days 1, 2, or 3 of admission).' It should also be noted that LabID Event data do not necessarily indicate infection, but denote a positive lab test result from a specimen collected for clinical purposes. MRSA is known to colonize skin and mucosal membranes without causing infections. LabID data provide a proxy measure for MRSA prevalence.

Table 7. **Cumulative Aggregate Methicillin-Resistant Staphylococcus aureus (MRSA) LabID[1] Data**			
	January – March 2013	April – June 2013	**Cumulative Data January – June 2013[2]**
Frequency, Number			
Hospitals with a DUA[3]	83	86	**91**
Hospitals reporting MRSA LabID	81	80	**87**
Hospitals with MRSA LabID Event	69	61	**77**
Aggregated LabID Events	1258	1226	**2598**
Onset, Number (%)			
Healthcare Facility-Onset (HO)	330 (26)	247 (20)	**592 (23)**
Community-Onset (CO)	928 (74)	979 (80)	**2006 (77)**
Specimen Source, Number (%, %HO)[4]			
Blood	483 (38, 26)	419 (34, 22)	**945 (36, 23)**
Sputum	131 (10, 42)	112 (9, 39)	**260 (10, 39)**
Wound	255 (20, 16)	284 (23, 11)	**558 (21, 14)**
Abcess	51 (4, 14)	83 (7, 6)	**139 (5, 9)**
Urine	72 (6, 14)	85 (7, 21)	**167 (6, 17)**
Skin	2 (0, 0)	8 (1, 13)	**14 (1, 14)**
Other	264 (21, 34)	235 (19, 23)	**515 (20, 29)**
Surveillance Location, Number (%, %HO)[5]			
Intensive/Critical Care Unit	436 (35, 42)	362 (30, 38)	**838 (32, 38)**
Specialty Care Area	6 (0, 0)	6 (0, 0)	**12 (0, 0)**
Wards	668 (53, 22)	688 (56, 16)	**1423 (55, 19)**
Outpatient	148 (12, 0)	170 (14, 0)	**325 (13, 0)**

[1]MRSA Lab ID: Methicillin-Resistant *Staphylococcus aureus* (MRSA) Laboratory-Identified (LabID) Event. This is an option within the Multidrug-Resistant Organism / *Clostridium difficile* Infection (MDRO/CDI) Module of NHSN for tracking laboratory results without conducting additional surveillance for infections.
[2]Cumulative Data includes 2013 H1 data pulled on the data access date. Each quarterly column is pulled from the MDCH SHARP Quarterly Reports, found at www.michigan.gov/hai.
[3]DUA: Data Use Agreement. This is a document signed between the hospital and the Michigan Department of Community Health which outlines how the data will be shared and used, and how confidentiality will be protected.
[4]The number in parentheses under "Specimen Source" is the percent of isolates obtained from that source, followed by the percent of isolates obtained from that source which are healthcare-onset.
[5]The numbers in parentheses under "Surveillance Location" are the percent of isolates from each location, followed by the percent of isolates from each location which are healthcare-onset.

MRSA LabID event data remained stable throughout the first half of 2013. Twenty-three percent of the aggregate events were considered HO, which is slightly higher than the 2012 Annual Report. The majority of specimens were from blood specimens (36%), but the greatest percentage of HO specimens were from sputum (39% of sputum specimens were HO). The majority of events came from wards (55%). However, the location with the greatest percentage of HO events was the ICU/CCU (38% of ICU/CCU specimens were HO).

Table 8 shows aggregate CDI LabID data by quarter, previously posted in each respective quarterly report, along with cumulative data for the first half of 2013. Again, due to different abstraction dates and different amounts of data being shared during each respective time period, quarterly report values may not sum to semi-annual report values.

Table 8 displays the number of positive CDI LabID Events entered by facility per quarter following the NHSN definitions. The NHSN definition for a CDI LabID Event is 'all non-duplicate MDRO isolates [in this case, CDI detection via stool culture or a positive CDI assay] from any specimen source, including specimens collected during an Emergency Department or other clinic visit, if collected the same day as patient admission'. For CDI, a duplicate MDRO isolate is defined as 'any MDRO [CDI] isolate [assay] from the same patient and location after an initial isolation [assay] of the specific MDRO [CDI] during a calendar month'. The specimens must be obtained for clinical decision-making purposes to be considered a LabID Event, thus specimens obtained for 'surveillance purposes only' will not be reflected in this data. Additionally, testing protocol and type of test used (i.e. PCR, assay, culture) vary by facility and are not recorded here.

NHSN defines 'healthcare facility-onset' (HO) as a 'LabID Event specimen collected >3 days after admission to the facility (i.e., on or after day 4).' 'Community-onset' (CO) is defined by NHSN as a 'LabID Event specimen collected as an outpatient or an inpatient ≤3 days after admission to the facility (i.e., days 1, 2, or 3 of admission).' Community-onset healthcare facility-associated' (CO-HCFA) is defined as a 'CO LabID Event specimen collected from a patient who was discharged from the facility ≤ 4 weeks prior to specimen collection.' It should also be noted that CDI LabID Event data do not necessarily indicate infection, but denote a positive lab test result from a specimen collected for clinical purposes. LabID data provide a proxy for CDI prevalence.

Table 8.			
Cumulative Aggregate Clostridium difficile Infection (CDI)[1] LabID[2] Data			
	January – March 2013	April – June 2013	**Cumulative Data January – June 2013[3]**
Frequency, Number			
Hospitals with DUA[4]	83	86	**91**
Hospitals Reporting CDI LabID	80	80	**87**
Hospitals with CDI LabID Event	72	78	**82**
Aggregated LabID Events	2555	2398	**5063**
Onset, Number (%)			
Healthcare Facility-Onset (HO)	992 (39)	854 (36)	**1896 (37)**
Community-Onset Healthcare Facility-Associated (CO-HCFA)	451 (18)	480 (20)	**952 (19)**
Community-Onset (CO)	1112 (44)	1064 (44)	**2215 (44)**
Previous CDI, Number (%)			
Previously Positive	196 (8)	259 (11)	**458 (9)**
CDI assay, recurrent	116 (5)	127 (5)	**242 (5)**
Surveillance Location, Number (%, %HO)[5]			
Intensive/Critical Care Unit	568 (22, 47)	576 (24, 44)	**1160 (23, 45)**
Specialty Care Area	----	3 (0, 100)	**3 (0, 100)**
Wards	1856 (73, 39)	1711 (71, 35)	**3667 (72, 37)**
Outpatient	117 (6, 0)	103 (4, 0)	**220 (4, 0)**
Other, LTC, Mixed Adult, etc…	9 (0, 56)	4 (0, 0)	**13 (0, 38)**

[1]The specimen source of all *C.difficile* isolates is stool (100%)
[2]CDI Lab ID: *Clostridium difficile* Infection (CDI) Laboratory-Identified (LabID) Event. This is an option within the Multidrug-Resistant Organism/*Clostridium difficile* Infection (MDRO/CDI) Module of NHSN for tracking laboratory results without conducting additional surveillance for infections.
[3]Cumulative Data includes 2013 H1 data pulled on the data access date. Each quarterly column is pulled from the MDCH SHARP Quarterly Reports, found at www.michigan.gov/hai.
[4]DUA: Data Use Agreement. This is a document signed between the facility and the Michigan Department of Community Health which outlines how the data will be shared and used.
[5]The numbers in parentheses under "Surveillance Location" are the percent of isolates from each location, followed by the percent of isolates from each location which are healthcare-onset.

The number of CDI LabID events was similarly distributed in the first two quarters of 2013. Thirty-seven percent of events were HO, 19% CO-HCFA, and 44% CO. Only nine percent of events were previously positive, and 5% were considered recurrent. The greatest percentage of events came from wards (72%); however, only 37% of these events were HO. As with MRSA LabID events, the surveillance location with the greatest percentage (45%) of HO events was the ICU/CCU.

Cumulative Semi-Annual Aggregate Rates

Table 9 provides the 2013 semi-annual Michigan MRSA inpatient LabID rate, inpatient bacteremia LabID rate, and outpatient LabID rate. There are currently no national rates available for MDRO/CDI data.

Table 9.

Cumulative Michigan MRSA Rate

	Facilities	Number of MRSA Events	Number of Patient Days	Number of Patient Admits/Encounters	MRSA Rate[1]	MRSA Prevalence Rate[2]
MRSA Inpatient LabID[3]	86	2,199 LabID[4]	2,420,141	561,036 Admits	0.9086↓	0.3920↓
MRSA Bacteremia LabID[5]	86	873 LabID	2,420,141	561,036 Admits	0.3607	0.1556
MRSA Outpatient LabID[6]	10	253 LabID	-----	181,265Encounters	0.1396↓	----

Michigan Data

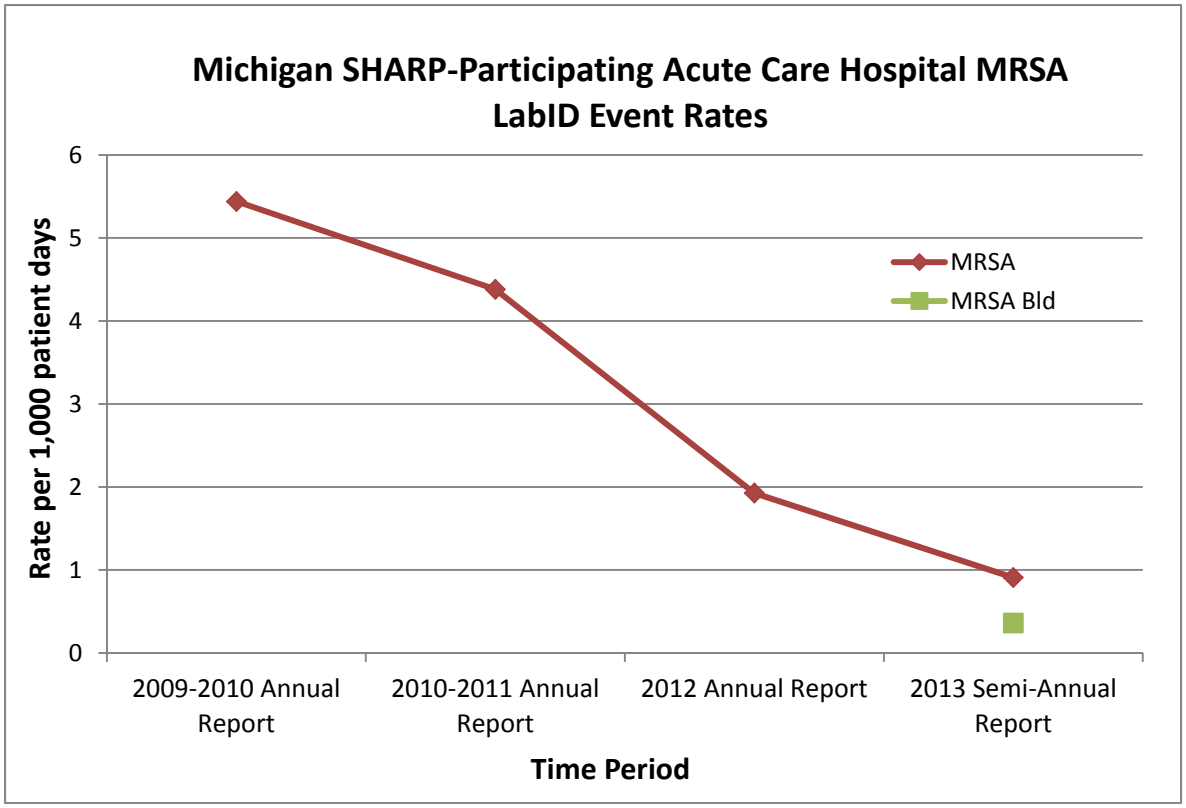
[1]MRSA Rate: Methicillin-Resistant *Staphylococcus aureus* (MRSA) rate. This is the number of MRSA Laboratory-identified (LabID) Events or surveillance infections per 1,000 patient days.
[2]MRSA Prevalence Rate. This is the number of MRSA LabID Events per 100 patients admitted or 100 encounters.
[3]MRSA Lab ID. This is an option within the Multidrug-Resistant Organism / *Clostridium difficile* Infection (MDRO/CDI) Module of NHSN for tracking laboratory results without conducting additional surveillance for infections.
[4]The number of MRSA LabID Events indicated in this table is less than the number of MRSA LabID Events indicated in Table 7. This is because events used to calculate a rate required denominator data (patient days and/or admissions). Those without denominator data were excluded from the calculation.
[5]MRSA bacteremia LabID: MRSA LabID event from a blood specimen
[6]MRSA outpatient LabID: MRSA LabID event taken in an outpatient location, and reported only if the hospital is reporting outpatient events. These events are also reported in inpatient location, and are attributed to the admitting location.
↓ or ↑Indicates statistically significantly lower or higher than previous report (respectively).

The 2013 semi-annual Michigan MRSA inpatient LabID rate was 0.9086 events per 1,000 patient days, which showed a significant decrease from the last annual report LabID rate of 1.9258 ($p<0.0001$). This number is calculated by dividing the number of total inpatient MRSA LabID Events by the number of patient days. The MRSA prevalence rate is calculated by dividing the number of inpatient MRSA LabID Events by the number of patient admissions. The semi-annual Michigan MRSA prevalence rate was 0.3920 per 100 patient admissions, significantly less than the previous annual MRSA prevalence rate of 0.8305 per 100 patient days ($p<0.0001$). This semi-annual report is the first time the MRSA bacteremia LabID rate was calculated: 0.3607 per 1,000 patient days. Finally, the MRSA outpatient LabID rate of

0.1396 was significantly less than the previous annual MRSA outpatient LabID rate of 0.2375 ($p<0.0001$). Note that LabID event data do not necessarily indicate infection, but denote a positive lab test result from a specimen collected for clinical purposes. LabID data provide a proxy measure for MRSA prevalence.

Figure 6 is a graphical demonstration of the Michigan MRSA LabID event rates from the 2009-2010 annual report through the 2013 semi-annual report. The 2010-2011 MRSA LabID rate was statistically significantly lower than the 2009-2010 LabID event rate, the 2012 LabID rate was statistically significantly lower than the 2010-2011 MRSA LabID rate, and the 2013 semi-annual LabID rate was statistically significantly lower than the 2012 LabID rate..

Figure 6. Michigan MRSA LabID Event Rate Trend



In table 10 (below), Michigan inpatient MRSA LabID rates are stratified by onset. HO events occur when the LabID specimen was collected on or after day 4 of admission to the facility. Because they are incident events, only a MRSA incidence rate can be calculated. CO events occur when the LabID specimen was collected ≤3 days after admission to the facility. These are prevalent events, so a MRSA prevalence rate is calculated.

Table 10.

Michigan Inpatient MRSA LabID[1] Rate by Onset

Number of Facilities	Onset	Number (%)[2] of Inpatient MRSA LabID[2] Events	Number of Patient Days	Number of Patient Admits	HO Incidence Rate[3]	CO Prevalence Rate[4]
86	**HO[5]**	**450 (21) LabID**	**2,420,141**	**----**	**0.1859↓**	**----**
		181 (21) Bld LabID[6]	2,420,141	----	0.0748	----
86	**CO[7]**	**1654(79) LabID**	**----**	**561,036**	**----**	**0.2948↓**
		683(79) Bld LabID	----	561,036	----	0.1217

Michigan Rate

[1] MRSA Lab ID: MRSA Laboratory-Identified (LabID) Event. This is an option within the Multidrug-Resistant Organism / *Clostridium difficile* Infection (MDRO/CDI) Module of NHSN for tracking laboratory results without conducting additional surveillance for infections.

[2] Percentage of LabID events, or bacteremia LabID events, which are either HO or CO

[3]MRSA HO Incidence Rate: Methicillin-Resistant *Staphylococcus aureus* (MRSA) rate. This is the number of incident HO MRSA LabID Events per 1,000 patient days. Prior to Quarter 3, 2012, this rate included both prevalent and incident HO MRSA LabID events; currently, prevalent HO MRSA LabID events are not included. Prevalent infections are those already in existence; all CO infections are prevalent because the patient entered the hospital with the infection. Prevalent HO infections are those that are HO but have already been counted in another location, so they are prevalent upon entering the new location. Previous positive MRSA events are not included.

[4]MRSA CO Prevalence Rate. This is the number of MRSA LabID Events per 100 patients admitted.

[5]HO: Healthcare facility-onset

[6]Bld LabID: MRSA bacteremia LabID events (LabID events from a blood specimen)

[7]CO: Community-onset

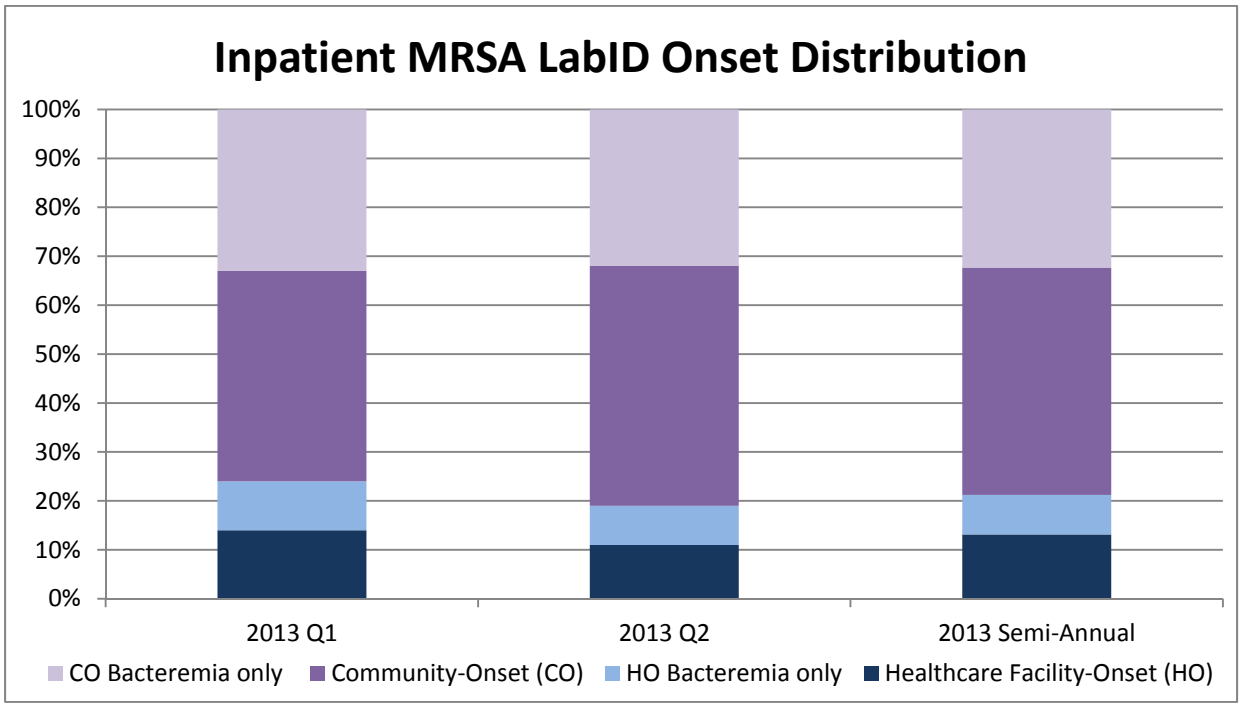
↓ or ↑Indicates statistically significantly lower or higher than previous report (respectively).

The HO semi-annual incidence rate was 0.1859 per 1,000 patient days, which is significantly less than the previous annual rate of 0.4088 ($p<0.0001$). Forty percent of HO LabID events were from blood specimens, but the same percentage of blood specimens were HO as all specimens (21%). This report only included incident HO LabID events, and excluded prevalent HO LabID events (LabID events that, although they are considered HO based on the date admitted to the facility, are considered prevalent because of the date admitted to a new location within the facility). Previous positive MRSA events are also excluded.

The CO prevalence rate was 0.2948 per 100 admissions, which is significantly less than the 2012 annual CO LabID prevalence rate of 0.6036 ($p<0.0001$). Forty-one percent of CO events were from blood specimens, but the same percentage of blood specimens were CO as all specimens (79%). The percentage distributions of CO and HO LabID Events in Table 10 are slightly different from the percentage distributions in Table 7; there are fewer LabID events in Tables 9 and 10 than in Table 7 because only LabID events which had corresponding denominators (i.e. patient days) were included in the rate tables. The percentages of CO and HO should be very similar, but may not be identical. The

graphical display of the overall and quarterly distributions from rate tables can be seen in Figure 7 (below).

Figure 7. Quarterly and Semi-Annual (Overall) MRSA LabID Rate by Onset



In Table 11 (below), the semi-annual Michigan inpatient CDI rate and CDI prevalence rate are provided along with the CDI outpatient LabID rate. Note that CDI LabID event data do not necessarily indicate infection but denote a positive lab test result from a specimen collected for clinical purposes. LabID Event data provide a proxy measure for *C. difficile* prevalence.

Table 11.

Cumulative Michigan CDI Rate

	Facilities	Number of CDI Events	Number of Patient Days	Number of Patient Admits/Encounters	CDI Rate[1]	CDI Prevalence Rate[2]
CDI Inpatient LabID[3]	85	4,740 LabID[4]	2,244,610	519,090 Admits	21.1173↑	0.9131↑
CDI Outpatient LabID	10	152 LabID	----	179,696 Encounters	0.0846↑	----

Michigan Data

[1]CDI Rate: *Clostridium difficile* Infection (CDI) rate. This is the number of CDI laboratory-identified (LabID) or surveillance events per 10,000 patient days.
[2]CDI Prevalence Rate. This is the number of *C. diff* LabID events per 100 patients admitted or per 100 encounters.
[3]CDI Lab ID. This is an option within the Multidrug-Resistant Organism / *Clostridium difficile* Infection (MDRO/CDI) Module of NHSN for tracking laboratory results without conducting additional surveillance for infections.
[4]The number of CDI LabID Events indicated in this table is less than the number of CDI LabID Events indicated in Table 8. This is because events used to calculate a rate required denominator data (patient days and/or admissions). Those without denominator data were excluded from the calculation.
↓ or ↑Indicates statistically significantly lower or higher than previous report (respectively).

The 2013 semi-annual CDI rate increased significantly from 18.3922 to 21.1173 per 10,000 patient days ($p<0.0001$), and the prevalence rate also increased significantly from 0.7738 to 0.9131 per 100 admissions ($p<0.0001$) from the previous annual report. The CDI outpatient prevalence rate was 0.0846 per 100 admissions, which was significantly higher than the 2012 annual outpatient rate of 0.0568 ($p<0.0001$).

Figure 8 (below) shows the overall CDI LabID event rate trends from the last three annual reports and the current semi-annual report. From the 2009-2010 to the 2010-2011 annual report, there were no significant changes. However, from the 2010-2011 to the 2012 annual report, the CDI LabID rate increased significantly, and again from the 2012 annual report to the 2013 semi-annual report.

Figure 8. Michigan CDI LabID Rate Trends

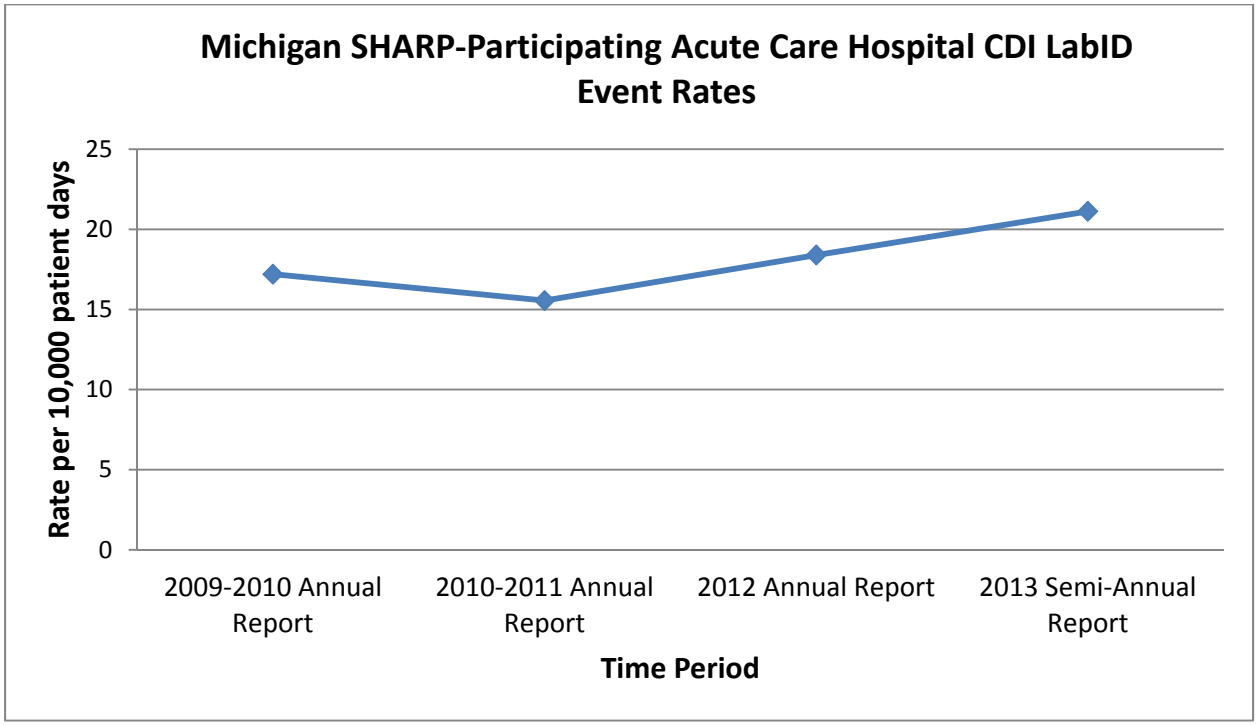


Table 12 (below) provides inpatient CDI LabID rates stratified by onset. HO events occur when the LabID specimen was collected on or after day 4 of admission to the facility. Because they are incident events, only a CDI incidence rate can be calculated. CO events occur when the LabID specimen was collected ≤3 days after admission to the facility. These are prevalent events, so a CDI prevalence rate is calculated. Community-onset, healthcare facility-associated (CO-HCFA) is defined as a CO LabID Event collected from a patient who was discharged from the facility ≤4 weeks prior to current date of stool specimen collection.

Table 12.

Michigan CDI LabID[1] Rate by Onset

Number of Reporting Facilities	Onset	Number of Inpatient CDI LabID Events	Number of Patient Days	Number of Patient Admits	HO Incidence Rate[2]	CO/CO-HCFA Prevalence Rate[3]	Percentage of Total
85	HO	1,806 LabID	2,244,610	----	8.0459↑	----	38
85	CO-HCFA	884 LabID	----	519,090	----	0.1703↑	19
85	CO	2,022 LabID	----	519,090	----	0.3895↑	43

Michigan Rate

[1] CDI Lab ID: *Clostridium difficile* Infection (CDI) Laboratory-Identified (LabID) Event. This is an option within the Multidrug-Resistant Organism / *Clostridium difficile* Infection (MDRO/CDI) Module of NHSN for tracking laboratory results without conducting additional surveillance for infections.

[2]HO Incidence Rate: This is the number of CDI LabID events or surveillance infections per 10,000 patient days. This is the number of incident healthcare facility-onset (HO) CDI LabID Events per 10,000 patient days. Prior to Quarter 3, 2012, this rate included both prevalent and incident HO CDI LabID events; currently, prevalent HO CDI LabID events are not included. Incident infections are new infections that occur at the hospital; therefore, HO infections are incident infections. Prevalent infections are those already in existence; therefore, CO infections are prevalent because the patient entered the hospital with the infection. Prevalent HO infections are those that are HO but have already been counted in another location, so they are prevalent upon entering the new location.

[3]CO or CO-HCFA Prevalence Rate. This is the number of community-onset or community-onset, healthcare facility-associated CDI LabID events per 100 patients admitted.

↓ or ↑Indicates statistically significantly lower or higher than previous report (respectively).

The CDI HO incidence rate was 8.0459 per 10,000 patient days, which is significantly higher than the previous annual rate of 7.3682 ($p<0.0001$). The present report only included incident HO LabID events, and excluded prevalent HO LabID events (LabID events that, although they are considered HO based on the date admitted to the facility, are considered prevalent because of the date admitted to a new location within the facility). The CDI CO prevalence rate increased significantly from 0.3155 to 0.3895 per 100 admissions ($p<0.0001$), and the CDI CO-HCFA prevalence rate also increased significantly from 0.1369 to 0.1703 per 100 admissions ($p<0.0001$).

The majority (43%) of inpatient CDI LabID events were CO, followed by HO (38%). The remaining 19% were CO-HCFA. This is reverse of the 2012 annual report, which reported 44% HO and 38% CO. The graphical display of this can be seen below in Figure 9 (below).

The percentage distributions of CO, CO-HCFA, and HO LabID Events in Table 12 are slightly different from the distributions in Table 8. This can be explained by the greater number of overall LabID events in Table 8. There are fewer LabID events in Tables 11 and 12 than in Table 8 because only LabID events which had corresponding denominators (i.e. patient days) were included in the rate table. Therefore, the percentages of CO, CO-HCFA, and HO should be very similar, but may not be identical.

Figure 9. Quarterly and Semi-Annual (Overall) CDI LabID Rate by Onset

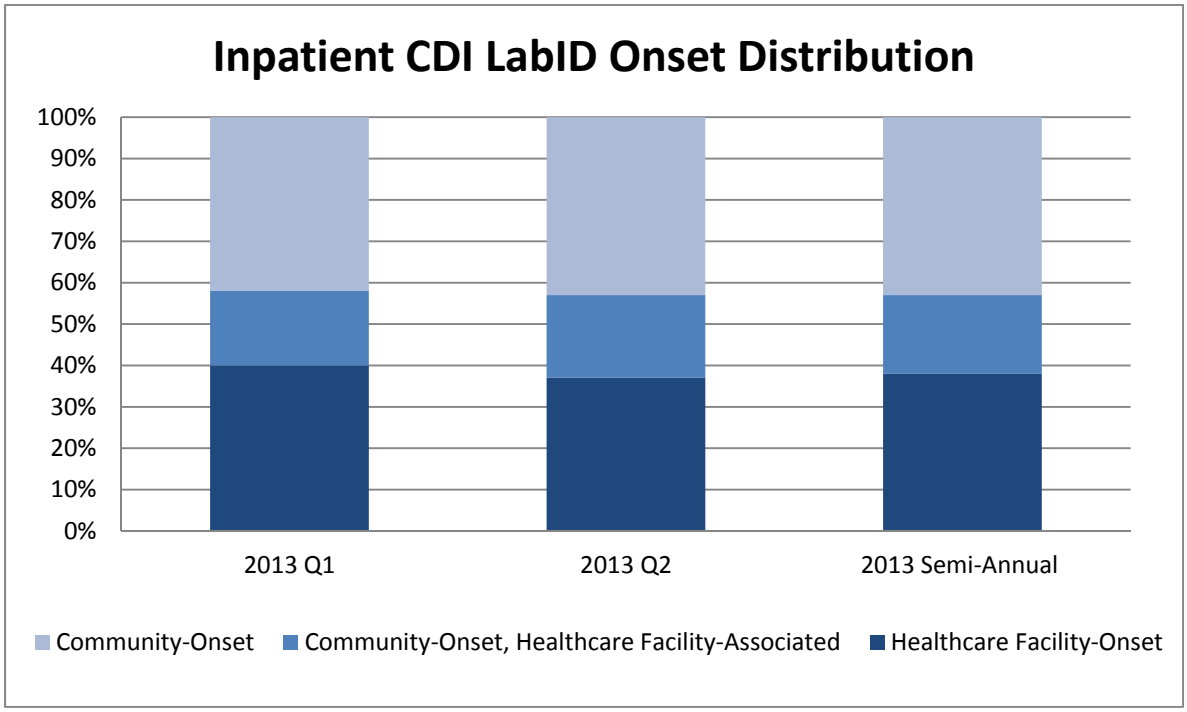


Table 13 shows the inpatient Vancomycin-Resistant Enterobacteriaceae (VRE) LabID rates and the outpatient VRE LabID rate. As with MRSA and CDI, there is no comparative national rate for VRE.

Table 13.

Cumulative Michigan Vancomycin-Resistant Enterobacteriaceae (VRE) Rate

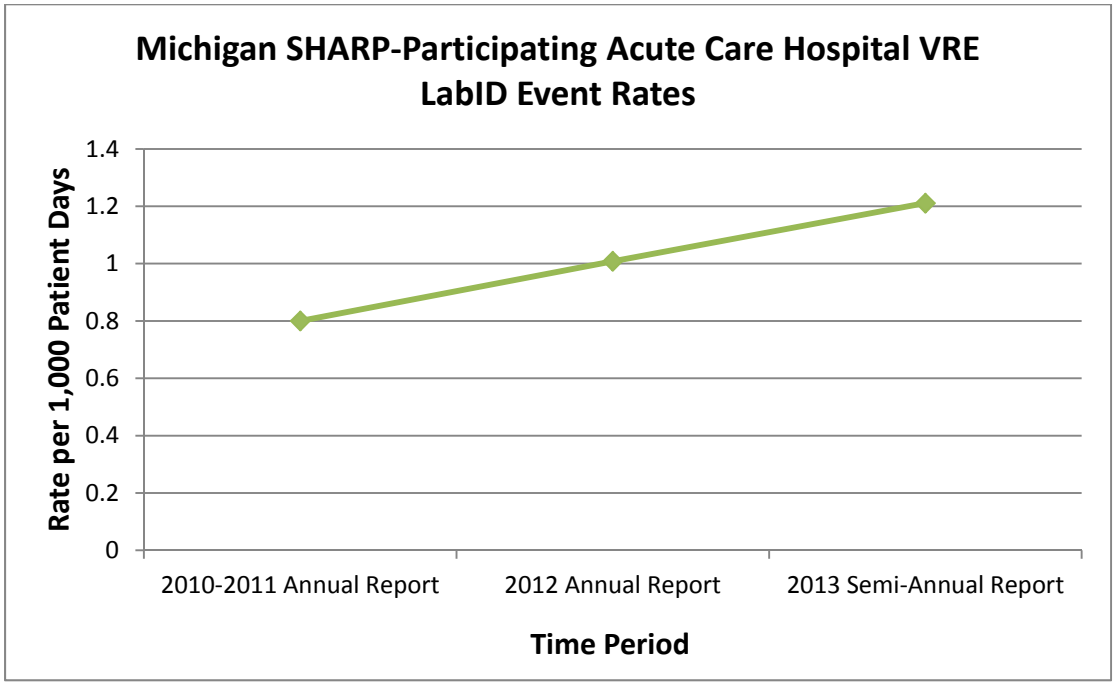
	Number of Facilities	Number of Inpatient VRE Events	Number of Patient Days	Number of Patient Admits/Encounters	VRE Rate[1]	VRE Prevalence Rate[2]
VRE Inpatient LabID[3]	15	426 LabID[4]	351,749	85,703	1.2111↑	0.4971
VRE Outpatient LabID	5	19 LabID	-----	114,046	----	0.0167↑

Michigan Rate

[1]VRE Rate: Vancomycin-Resistant Enterococci (VRE) rate. This is the number of inpatient VRE laboratory-identified (LabID) Events or surveillance infections per 1,000 patient days or encounters.
[2]VRE Prevalence Rate. This is the number of VRE LabID Events per 100 patients admitted.
[3]VRE Lab ID. This is an option within the Multidrug-Resistant Organism / *Clostridium difficile* Infection (MDRO/CDI) Module of NHSN for tracking laboratory results without conducting additional surveillance for infections.
[4]The number of inpatient VRE LabID Events indicated here may be less than the total number of VRE LabID Events. This is because events used to calculate a rate required denominator data (patient days and/or admissions). Those without denominator data were excluded from the calculation.
↓ or ↑Indicates statistically significantly lower or higher than previous report (respectively).

The VRE inpatient LabID rate increased significantly from 1.0083 to 1.2111 per 1,000 patient days (p=0.0078). The VRE prevalence rate did not change significantly. The VRE outpatient LabID rate increased significantly from 0.0079 to 0.0176 (p=0.0442).

Figure 10. Michigan Vancomycin-Resistant Enterobacteriaceae (VRE) Laboratory-Identified (LabID) Event Rate Trends



LabID Standardized Infection Ratios (SIRs)

Table 14 (below) shows the 2013 semi-annual standardized infection ratios (SIRs) for facilities sharing data with the SHARP Unit. The table displays the number of observed and predicted infections for both MRSA bacteremia LabID and CDI LabID. **Note: these SIRs included all data viewable by MDCH, and are not limited to the facilities included in CMS reporting.**

Table 14.

MDRO/CDI Standardized Infection Ratios (SIR)

Type of Infection	Hospitals	Patient Days	Observed[1]	Predicted[2]	MI SIR[3]	MI p-value	MI 95% CI[4]
MRSA Bac LabID[5]	82	2,389,221	180	173.397	1.038	0.6359	0.895, 1.198
***C.diff* LabID[6]**	82	2,222,334	1,790	1,854.136	0.965	0.1382	0.921, 1.010

Michigan Data **US Data**

Highlight: Indicates significantly fewer infections than expected

Highlight: Indicates significantly more infections than expected

[1]Observed: Number of infections reported during the time frame.

[2]Predicted: The number of infections predicted based on the type of hospital unit(s) under surveillance compared to the 2011 national baseline.

[3]SIR: Standardized Infection Ratio: Ratio of observed events compared to the number of predicted events, accounting for unit type or procedure. An SIR of 1 can be interpreted as having the same number of events that were predicted. An SIR that is between 0 and 1 represents **fewer** events than predicted, while an SIR of greater than 1 represents **more** events than expected.

[4]95% CI: 95% confidence interval around the SIR estimate. A 95% CI indicates that 95% of the time, the actual SIR will fall within this interval.

[5]MRSA Bacteremia LabID: Inpatient facility-wide MRSA bacteremia Laboratory-identified Event

[6]Clostridium difficile LabID: Inpatient facility-wide Clostridium difficile Laboratory-identified Event

↓ or ↑Indicates statistically significantly lower or higher than previous report (respectively).

The MRSA bacteremia LabID SIR was 1.038, which means that there were approximately the same amount of MRSA LabID events from blood specimens as expected, based on the national baseline. The CDI LabID SIR was 0.965, which also indicates that there were approximately the same amount of CDI LabID events as expected, based on the national baseline. Although it was not statistically significantly different than the baseline, an SIR of 0.965 can be interpreted as 3.5% fewer CDI LabID events than predicted.

Device-Associated Module Annual Aggregated Rates

Table 15 shows both the Michigan rate and device-utilization (DU) ratio for all in-plan CAUTI, CLABSI, and ventilator-associated event (VAE) modules. It also provides a US comparative rate and DU ratio for each module (if available). As noted in the table, the US comparative rates and ratios were calculated using data from the national estimate from 2012 NHSN data. These national rates should be used as a descriptive, comparative reference only, and do not necessarily represent the true national rates or ratios.

Table 15.

Michigan Device-Associated Rates

Type of Infection	Number of Hospitals	Number of Infections	Number of Patient Days	Number of Device Days	MI Rate[1]	US Rate[2]	MI DU[3]	US DU[4]
CAUTI[5]	87	596	640,476	224,083	2.6597↑	1.6723	0.3499↓	0.3118
CLABSI[6]	81	148	535,748	179,734	0.8234	0.9351	0.3355↑	0.2485
VAC[7]	60	190	146,158	52,222	3.6383	N/A	0.3573	N/A
IVAC[8]	60	70	146,158	52,222	1.3404	N/A	0.3573	N/A
Possible VAP[9]	60	40	146,158	52,222	0.7660	N/A	0.3573	N/A
Probable VAP[10]	60	10	146,158	52,222	0.1915	N/A	0.3573	N/A
Total VAE[11]	**60**	**310**	**146,158**	**52,222**	**5.9362**	N/A	**0.3573**	N/A

Michigan Rate **US Comparative Rate**

[1]MI Rates are the number of device-associated infections per 1,000 device days among participating hospitals.
[2]The US comparative rates were calculated using data from the national estimate on the National Healthcare Safety Network (NHSN). This is according to 2012 NHSN data (Am J Infect Control 2013;41:1148-66). These data are for a descriptive reference only, and do not necessarily represent the true national rate. US data were not available this report for the VAE module.
[3]DU: Device Utilization. The proportion of days on a device divided by the total number of patient days reported for the unit. The device could be a catheter, central line, or ventilator. The MI DU is the proportion of patient days that are spent using a device.
[4]The US comparative DU was calculated using data from the national estimate on the National Healthcare Safety Network (NHSN). This is according to 2012 NHSN data (Am J Infect Control 2013;41:1148-66). These data are for a descriptive reference only, and do not necessarily represent the true national DU ratio.
[5] CAUTIs are defined using symptomatic urinary tract infection (SUTI) criteria or Asymptomatic Bacteremic UTI (ABUTI) criteria. UTIs must be catheter-associated (i.e. patient had an indwelling urinary catheter at the time of or within 48 hours before onset of the event).
[6]CLABSIs are laboratory-confirmed bloodstream infections (LCBI) that are not secondary to a community-acquired infection, or an HAI meeting CDC/NHSN criteria at another body site. BSIs must be central line associated (i.e., a central line or umbilical catheter was in place at the time of, or within 48 hours before, onset of the event).
[7]VAC: Ventilator-Associated Condition
[8]IVAC: Infection-related Ventilator-Associated Condition
[9]Possible VAP: Possible Ventilator-Associated Pneumonia
[10]Probable VAP: Probable Ventilator-Associated Pneumonia
[11]Total VAE: Total Ventilator-Associated Events: Cumulative VAEs including VAC, IVAC, Probable/Possible VAPs. For VAE definitions, see http://www.cdc.gov/nhsn/PDFs/pscManual/10-VAE_FINAL.pdf.
↓ or ↑Indicates statistically significantly lower or higher than previous report (respectively).

The Michigan CAUTI rate increased significantly from 2.2744 in the 2012 annual report to 2.6597 per 1,000 catheter days (p=0.0028) in the 2013 semi-annual report. A CAUTI rate increase may be caused by the reduction of catheter usage. The Michigan catheter DU ratio decreased significantly from 0.3720 to 0.3499 (p<0.0001).

Hospitals in Michigan have been working diligently with MHA Keystone to reduce CLABSI rates; this is reflected in the data in Table 15 (above). With data collected from 81 hospitals, Michigan's central line device utilization ratio increased significantly from the 2012 annual report (0.3287 to 0.3355 (p<0.0001)). The Michigan CLABSI rate of 0.8234 is not significantly different from the previous annual report.

The data below indicate that the Michigan total VAE rate was 5.9362 per 1,000 ventilator days within the hospitals participating in this module and sharing data with the MDCH SHARP Unit. The majority of ventilator-associated events were ventilator-associated conditions.

Figures 11 and 12 (below) show device-associated infection rates and DU ratios from 2009-2013.

Figure 11. Device-Associated Infection Rates over time

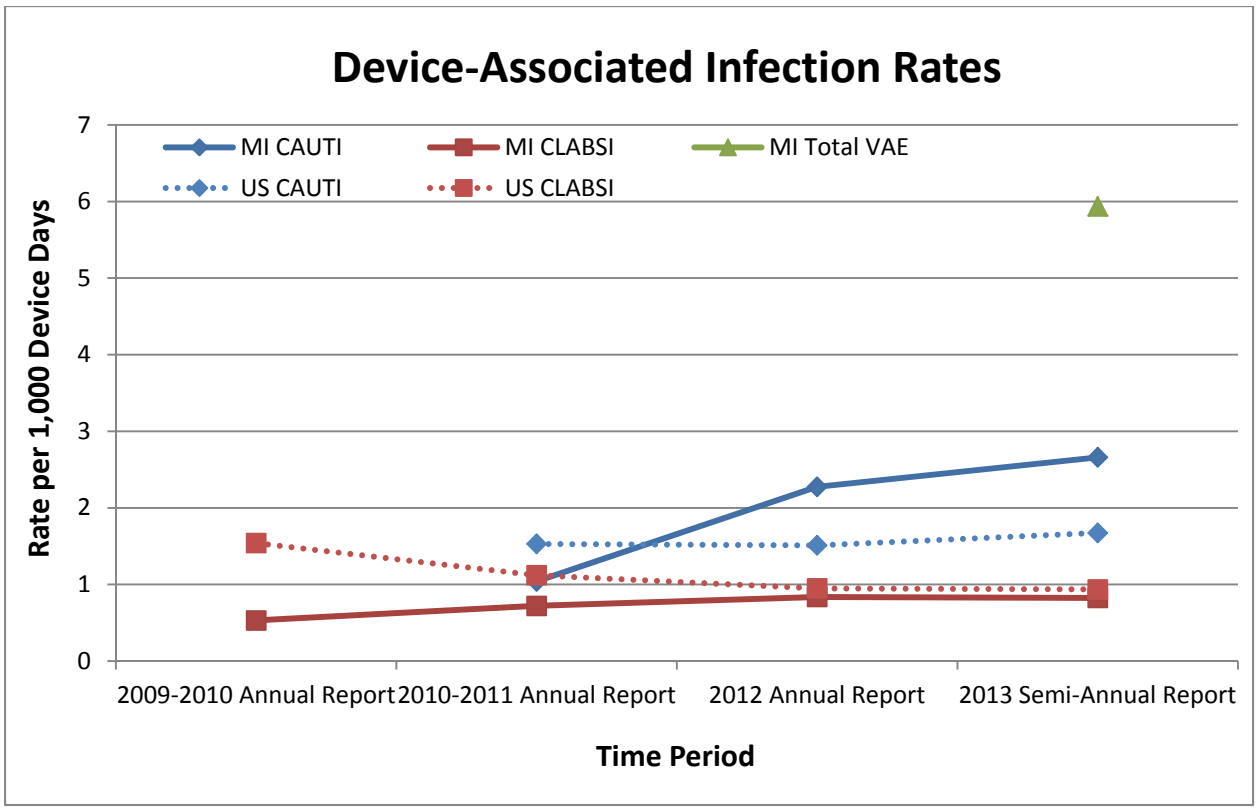


Figure 12. Device Utilization Ratios over time

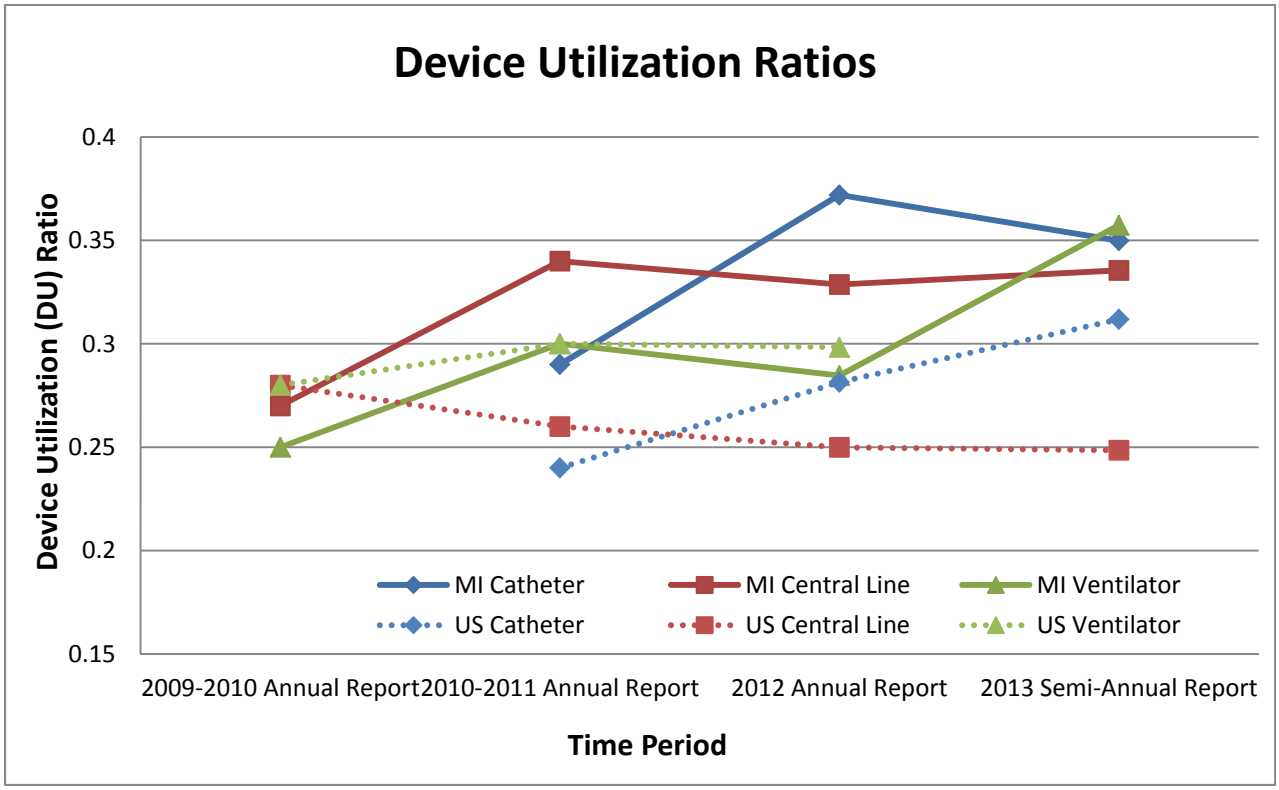


Table 16 provides NICU-specific CLABSI and VAP rates by birth weight. There are up to 17 hospitals sharing CLABSI NICU data, and up to 8 hospitals sharing VAP NICU data (depending on birthweight code). Only hospitals with >0 device days were included in the table for each birthweight code.

Table 16.

Michigan NICU Device-Associated Rates by Birth Weight

Type of Infection	Birth weight Code	Number of Hospitals	Number of Infections	Number of Patient Days	Number of Device Days	MI Rate[1]	US Rate[2]	MI DU[3]	US DU[4]
CLABSI[5]	**Overall**	**17**	**23**	**82,632**	**17,470**	**1.3165**	**1.2921**	**0.2114↑**	**0.2537**
	A[6]	16	7	11,414	3,936	1.7785	2.3277	0.3448↑	0.4014
	B[7]	16	8	10,718	2,877	2.7807	1.6945	0.2684↓	0.3451
	C[8]	16	6	18,673	4,343	1.3815	1.0692	0.2326↑	0.2614
	D[9]	16	1	24,098	3,113	0.3212	0.6359	0.1292↑	0.1664
	E[10]	16	1	17,729	3,201	0.3124	0.7242	0.1806	0.2205
VAP[11]	**Overall**	**8**	**5**	**43,766**	**4,523**	**1.1055**	**0.9199**	**0.1033↓**	**0.1524**
	A	7	2	5,133	1,806	1.1074	1.3475	0.3518	0.3788
	B	7	1	5,913	1,004	0.9960	1.2041	0.1698↓	0.2298
	C	8	1	10,748	876	1.1416	0.6128	0.0815↑	0.0999
	D	8	1	13,431	495	2.0202	0.2080	0.0369↑	0.0659
	E	7	0	8,541	342	0.0000	0.3283	0.0400↓	0.1081

Michigan Data **US Comparative Data**

[1]MI Rates are the number of device-associated infections per 1,000 device days among participating hospitals.

[2]The US comparative rates were calculated using data from the national estimate on the National Healthcare Safety Network (NHSN). This is according to 2012 NHSN data (Am J Infect Control 2013;41:1148-66). These data are for a descriptive reference only, and do not necessarily represent the true national rate.

[3]DU: Device Utilization. The proportion of days on a device divided by the total number of patient days reported for the unit. The device could be a catheter, central line, or ventilator. The MI DU is the proportion of patient days that are spent using a device.

[4]The US comparative DU was calculated using data from the national estimate on the National Healthcare Safety Network (NHSN). This is according to 2012 NHSN data (Am J Infect Control 2013;41:1148-66). These data are for a descriptive reference only, and do not necessarily represent the true national DU ratio.

[5]Central Line-Associated Bloodstream Infections (CLABSIs) are laboratory-confirmed bloodstream infections (LCBI) that are not secondary to a community-acquired infection, or an HAI meeting CDC/NHSN criteria at another body site. BSIs must be central line associated (i.e., a central line or umbilical catheter was in place at the time of, or within 48 hours before, onset of the event).

[6]A: Birthweight ≤750g

[7]B: Birthweight 751 – 1000g

[8]C: Birthweight 1001 – 1500g

[9]D: Birthweight 1501 – 2500g

[10]E: Birthweight >2500g

[11]Ventilator-Associated Pneumonias (VAPs) can be identified by using a combination of radiologic, clinical and laboratory criteria. PNEUs must be ventilator-associated (i.e., patient was intubated and ventilated at the time of, or within 48 hours before, the onset of the event).

↓ or ↑Indicates statistically significantly lower or higher than previous report (respectively).

Device-Associated Standardized Infection Ratios (SIRs)

The 2013 semi-annual device-associated standardized infection ratios (SIRs) are shown in Table 17 (below). The table shows the number of observed and predicted infections for both CAUTI and CLABSIs. **Note: these SIRs included all data viewable by MDCH SHARP, and are not limited to the hospitals and locations included in CMS reporting.**

Table 17.

Device Standardized Infection Ratios (SIR)

Type of Infection	Number Hospitals	Device Days	Observed[1]	Predicted[2]	MI SIR[3]	MI SIR p-value[4]	MI 95% CI[5]
CAUTI[6]	86	206,309	569	447.9000	1.270↑	<0.0001	1.169, 1.378
CLABSI[7]	83	193,585	167	403.8108	0.414	<0.0001	0.354, 0.480
CLABSI ICU	83	176,115	144	362.1758	0.398	<0.0001	0.337, 0.467
CLABSI NICU	16	17,470	23	41.6350	0.552	0.0018	0.359, 0.816

Michigan Data **US Data**

Highlight: Indicates significantly fewer infections than expected
Highlight: Indicates significantly more infections than expected
[1]Observed: Number of infections (CAUTI or CLABSIs) reported during the time frame.
[2]Predicted: The number of CAUTIs or CLABSIs predicted based on the type of hospital unit(s) under surveillance.
[3]SIR: Standardized Infection Ratio: Ratio of observed events compared to the number of predicted events, accounting for unit type or procedure. An SIR of 1 can be interpreted as having the same number of events that were predicted. An SIR that is between 0 and 1 represents **fewer** events than predicted, while an SIR of greater than 1 represents **more** events than expected.
[4]P-value: An SIR p-value of <0.05 is considered significantly different than expected. It can show either significantly more infections (if the SIR is greater than 1 and the p-value is <0.05) or significantly fewer infections (if the SIR is less than 1 and the p-value is <0.05).
[5]95% CI: 95% confidence interval around the SIR estimate. A 95% CI indicates that 95% of the time, the actual SIR will fall within this interval.
[5]CAUTI: Catheter-Associated Urinary Tract Infection
[7]CLABSI: Central Line-Associated Blood Stream Infection
↓ or ↑Indicates statistically significantly lower or higher than previous report (respectively).

Michigan's CAUTI SIR was 1.270 for 86 participating hospitals. This SIR can be interpreted as Michigan having twenty-seven percent more of CAUTIs than expected, as determined by national NHSN baseline data. This SIR also indicated significantly more infections than the 2012 Annual Report CAUTI SIR of 1.130 (p=0.0286).

Michigan's overall CLABSI SIR, using data from 83 participating hospitals, was 0.414. This SIR can be interpreted as Michigan having 58.6% fewer CLABSIs than expected, as determined by national NHSN data. This is statistically significantly lower than the expected value. It is not statistically

significantly different than the previous annual report's SIR of 0.455. Michigan's ICU-only CLABSI SIR is even lower at 0.398. Figures 13 and 14 (below) show the CLABSI and CAUTI SIR trends from 2009 through 2013.

Figure 13. Michigan CLABSI SIR Trends

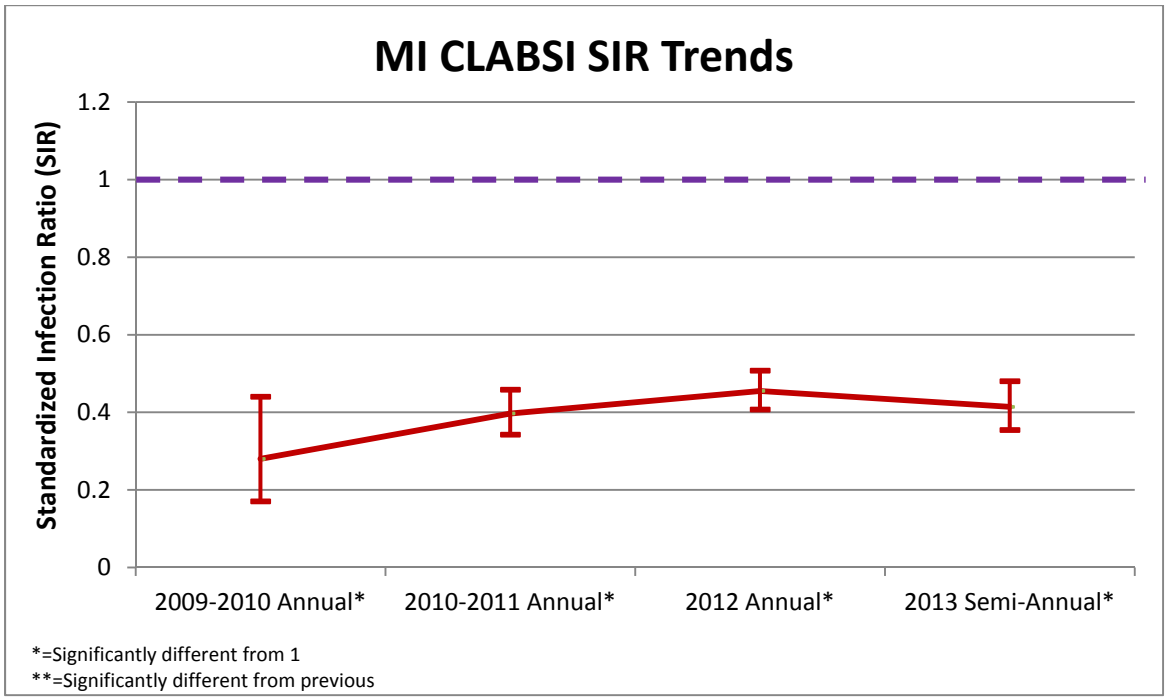
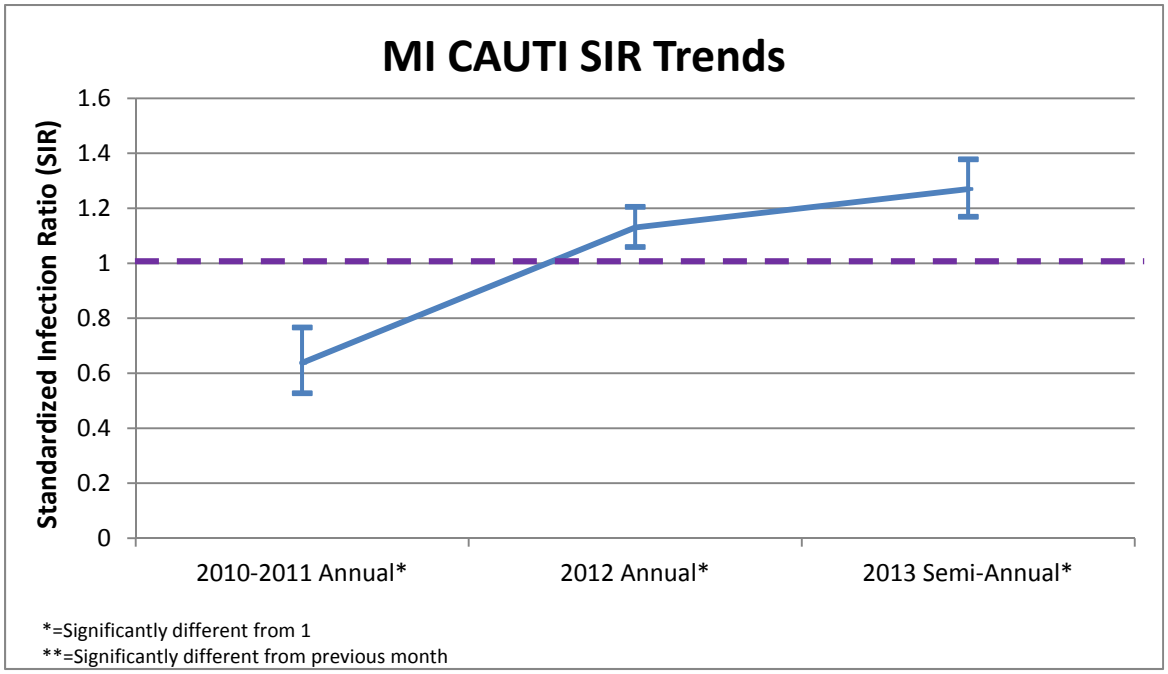


Figure 14. Michigan CAUTI SIR Trends



Procedure-Associated Module Aggregated Data

Table 18 shows the SSI infection rates and SIRs by procedure type for the time period included. Only procedure types for which five or more hospitals provided data were included in the present report. Beginning January 1, 2012, hospitals were required by CMS to reports all colon surgery (COLO) and abdominal hysterectomy (HYST) procedures through NHSN. SSI rates and SIRs shown in italics were not evaluated for statistically significant difference from the 2012 annual report as those procedures were not available in that report. It should also be noted that rates are taken from the rate table calculation within NHSN and may not match the numbers in the SIR exactly.

Table 18.

SSI Rates and SIR by Procedure Type

Procedure Type	Number of Hospitals	Number of Procedures	Number of Observed[1] SSIs	Number of Expected[2] SSIs	MI SSI Rate[3]	MI SSI SIR[4]	MI SIR p-value[5]	MI SIR 95% Confidence Interval[6]
Overall	**80**	**25,110**	**513**	**577.191**	**1.9275**	**0.889**	**<0.0001**	**0.814, 0.968**
AMP[7]	8	136	2	3.656	*1.0638*	*0.547*	0.6153	0.027, 2.698
APPY[8]	6	504	4	12.496	0.8772	0.32	0.0658	0.054, 1.058
BRST[9]	6	834	10	6.712	1.0067↓	1.49	0.3716	0.546, 3.302
CARD[10]	5	626	6	6.736	0.9554	0.891	0.9113	0.227, 2.424
CBGB[11]	10	1,460	22	33.61	1.766	0.655	0.1456	0.344, 1.138
CBGC[12]	9	142	2	2.77	1.2821	0.722	0.8473	0.036, 3.561
CHOL[13]	7	1,456	6	10.532	0.3876	0.57	0.3336	0.145, 1.550
COLO[14]	79	9,114	468	537.074	5.1232	0.871	0.0346	0.765, 0.989
FUSN[15]	8	2,872	46	43.088	1.5928	1.068	0.7311	0.693, 1.577
FX[16]	7	1,040	12	15.892	0.9554	0.755	0.5162	0.306, 1.571
GAST[17]	6	854	12	14.926	0.9375	0.804	0.6287	0.326, 1.672
HER[18]	7	1,342	28	19.666	1.5195	1.424	0.1987	0.810, 2.332
HPRO[19]	28	5,992	64	82.498	1.053↓	0.776↓	0.1422	0.540, 1.082
HYST[20]	74	8,042	172	152.452	1.9754	1.128	0.2654	0.908, 1.386
KPRO[21]	29	8,754	64	83.884	0.8063	0.763	0.1163	0.531, 1.064
LAM[22]	6	2,084	22	19.468	0.9726↓	1.13↓	0.6571	0.594, 1.964
OVRY[23]	6	396	2	1.716	0.554	----	----	----
PVBY[24]	5	344	18	23.922	5.814	0.752	0.4034	0.367, 1.381
SB[25]	6	388	16	20.858	4.1026	0.767↓	0.4705	0.356, 1.457

VHYS[26]	8	306	2	3.011	1.3889	0.664	0.7782	0.033, 3.277

US Data **Michigan Data**

Highlight: Indicates significantly fewer infections than expected

Highlight: Indicates significantly more infections than expected

[1]Observed: Number of SSIs reported during the time frame.

[2]Predicted: The number of SSIs predicted for the same number and type of procedures performed based upon 2009 national SSI rates by procedure type.

[3]MI SSI Rate is the number of SSIs per 100 procedures among participating hospitals. This number is taken from the rate table calculation within NHSN and may not match the numbers in the SIR exactly. ↑: significant rate increase from previous annual report, ↓: significant rate decrease from previous annual report. Rates shown in italics were not evaluated for statistically significant difference from the 2010-2011 Annual Report. Rates were not available for all procedures in the 2010-2011 Annual Report.

[4]SIR: Standardized Infection Ratio: Ratio of observed events compared to the number of predicted events, accounting for unit type or procedure. An SIR of 1 can be interpreted as having the same number of events that were predicted. An SIR that is between 0 and 1 represents **fewer** events than predicted, while an SIR of greater than 1 represents **more** events than expected. SIRs with significant p-values are highlighted in either green (significantly lower than expected) or red (significantly higher). SIRs shown in italics were not. evaluated for statistically significant difference from the 2010-2011 Annual Report. SIRs were not available for all procedures in the 2010-2011 Annual Report.

[5]P-value: An SIR p-value of <0.05 is considered significantly different than expected. It can show either significantly more infections (if the SIR is greater than 1 and the p-value is <0.05) or significantly fewer (if the SIR is less than 1 and the p-value is <0.05).

[6]95% CI: 95% confidence interval around the SIR estimate. A 95% CI indicates that 95% of the time, the actual SIR will fall within this interval.

[7]AMP: Limb Amputation

[8]APPY: Appendix surgery

[9]BRST: Breast surgery

[10]CARD: Cardiac surgery

[11] CBGB: Coronary artery bypass graft with both chest and donor site incisions

[12]CBGC: Coronary artery bypass graft with chest incision only

[13]CHOL: Gallbladder surgery

[14]COLO: Colon surgery

[15]FUSN: Spinal fusion

[16]FX: Open reduction of fracture

[17]GAST: Gastric surgery

[18]HER: Herniorrhaphy

[19]HPRO: Hip prosthesis

[20]HYST: Abdominal hysterectomy

[21]KPRO: Knee prosthesis

[22]LAM: Laminectomy

[23]OVRY: Ovarian Surgery

[24]PVBY: Peripheral vascular bypass surgery

[25]SB: Small Bowel Surgery

[26]VHYS: Vaginal hysterectomy

↓ or ↑Indicates statistically significantly lower or higher than previous report (respectively).

The Overall SSI SIR was 0.889 (95% CI: 0.814, 0.968), which demonstrated significantly fewer infections than expected. This was not significantly different from the 2012 SSI SIR. The colon surgery (COLO) SSI SIR was the only other SIR significantly different than expected at 0.871 (95% CI: 0.765, 0.989).

Cumulative Rates and SIRs Aggregated by Specifiers

MRSA and CDI LabID rates were calculated on an aggregate level by hospital type (teaching or non-teaching), region group (based on Michigan emergency preparedness region), and bed size (≤200 beds or >200 beds). Device rates and CAUTI and CLABSI SIRs were also calculated. Rates and SIRs were provided when 5 or more hospitals shared data for that particular module and significance testing was performed comparing rates and SIRs to 2012 annual data.

Table 19.

MDRO Rates[1] by Hospital Type

Hospital Type	MDRO Infection Type (number of hospitals)	Rate	CO Rate (%CO) [2]
Teaching	**MRSA LabID[3] (46)**	0.8231↓	0.2643 (73)
	CDI LabID[4] (46)	21.1449↑	0.3757 (41)
Non-Teaching	**MRSA LabID (39)**	1.3208↓	0.4322 (80)
	CDI LabID (39)	20.9834	0.4527 (52)

Michigan Data

[1]Rates were calculated using the number of infections/events per 1,000 (or per 10,000 for CDI) patient days or device days according to the same MI rate shown in Tables 9–14 among hospitals that shared data with MDCH SHARP through the NHSN.
[2]CO Rate(%CO): Community Onset Rate (Percent community-onset): Number of community-onset LabID events per patient days (percent LabID events that were community onset)
[3]MRSA LabID: Methicillin-Resistant *Staphylococcus aureus* (MRSA) Laboratory-identified (LabID) Event option within the Multidrug-Resistant Organism / *Clostridium difficile* Infection (MDRO/CDI) Module of NHSN for tracking MRSA laboratory results without conducting additional surveillance for infections.
[4] CDI LabID: *Clostridium difficile (C. diff)* Infection (CDI) LabID Event option within the MDRO/CDI Module of NHSN for tracking CDI laboratory results without conducting additional surveillance for infections.
↓ or ↑Indicates statistically significantly lower or higher than previous report (respectively).

Non-teaching hospitals had higher MRSA rates than teaching hospitals; they also had a higher percentage of community-onset MRSA LabID events. MRSA LabID rates decreased significantly in both teaching and non-teaching hospitals, from 1.8491 to 0.8231 ($p<0.0001$) and from 2.3528 to 1.3208 ($p<0.0001$), respectively (see Figures 14 and 15).

Non-teaching hospitals had a lower rate of CDI LabID events than teaching hospitals, but a higher community-onset rate. From the 2012 annual report to the present report, CDI LabID Event rates increased significantly in teaching hospitals (from 18.4168 to 21.1449 ($p<0.0001$)).

Figure 15. MDRO/CDI Rate Trends for Teaching Hospitals

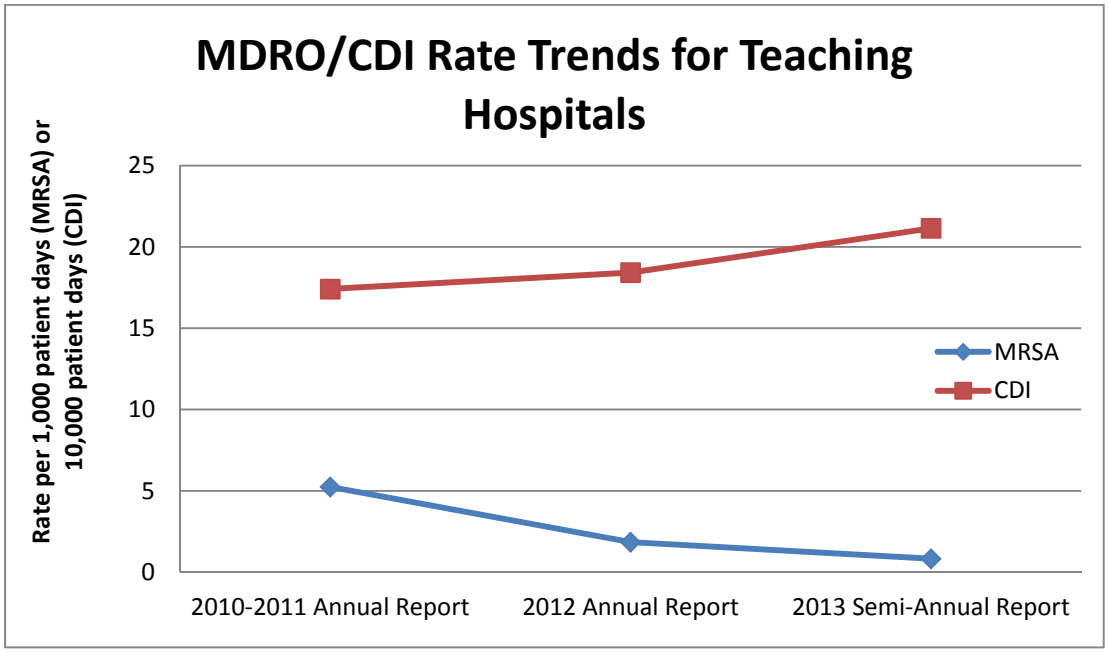


Figure 16. MDRO/CDI Rate Trends for Non-Teaching Hospitals

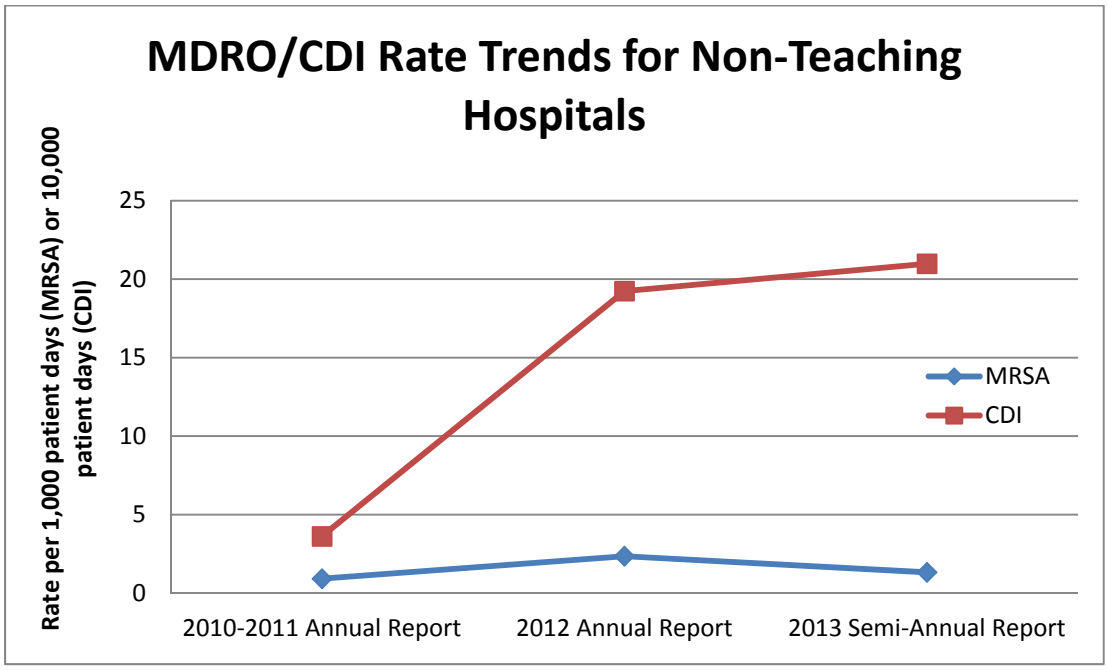


Table 20.

Device Rates[1] and SIR by Hospital Type

Hospital Type	Device-Associated Infection	Rate (Number of Hospitals)	US Rate[2]	SIR[3]	SIR p-value[4]	SIR 95% Confidence Interval[5]
Teaching	CAUTI[6]	2.9309(47) ↑	1.8303	1.350	<0.0001	1.239, 1.469
	CLABSI[7]	0.8002(46)	0.9617	0.406	<0.0001	0.345, 0.474
	Total VAE[8]	8.3156(23)	-----	-----	-----	-----
Non-Teaching	CAUTI	1.3114(40) ↓	1.4278	0.696	0.0188	0.499, 0.945
	CLABSI	0.9984(35)	0.8934	0.509	0.0028	0.301, 0.809
	Total VAE	5.6281(4)	-----	-----	-----	-----

US Data **Michigan Data**

Highlight: Indicates significantly fewer infections than expected

Highlight: Indicates significantly more infections than expected

[1]Rates were calculated using the number of infections/events per 1,000 device days according to the same MI rate shown in Tables 9-14 among hospitals that shared data with MDCH SHARP through the NHSN.

[2]The US comparative rates were calculated using data from the national estimate on the National Healthcare Safety Network (NHSN). This is according to 2012 NHSN data (Am J Infect Control 2013;41:1148-66). These data are for a descriptive reference only, and do not necessarily represent the true national rate. US data were not available this report for the VAE module. Each rate is individually matched to the Michigan data by facility type and unit type, then aggregated into an overall rate.

[3]SIR: Standardized Infection Ratio: Ratio of observed events compared to the number of predicted events, accounting for unit type or procedure. An SIR of 1 can be interpreted as having the same number of events that were predicted. An SIR that is between 0 and 1 represents **fewer** events than predicted, while an SIR of greater than 1 represents **more** events than expected.

[4]P-value: An SIR p-value of <0.05 is considered significantly different than expected. It can show either significantly more infections (if the SIR is greater than 1 and the p-value is <0.05) or significantly fewer (if the SIR is less than 1 and the p-value is <0.05).

[5]95% CI: 95% confidence interval around the SIR estimate. A 95% CI indicates that 95% of the time, the actual SIR will fall within this interval.

[6]CAUTI: Catheter-Associated Urinary Tract Infection

[7]CLABSI: Central Line-Associated Blood Stream Infection

[8]VAP: Ventilator-Associated Pneumonia

↓ or ↑Indicates statistically significantly lower or higher than previous report (respectively).

Michigan teaching hospitals observed a significantly higher number of CAUTIs than expected with an SIR of 1.350 (95% CI: 1.239, 1.469), while non-teaching hospitals observed significantly fewer CAUTIs than expected with an SIR of 0.696 (0.499, 0.945) (see Figures 17 and 18). Both teaching and non-teaching hospitals observed significantly fewer CLABSIs than expected with SIRs of 0.406 (0.345, 0.474) and 0.509 (0.301, 0.809), respectively.

The Michigan teaching CAUTI rate increased significantly to 2.9309 ($p<0.0001$), while the Michigan non-teaching CAUTI rate decreased significantly to 1.3114 ($p<0.0001$). No CLABSI rate changes were significant.

Figure 17. Device Rate Trends for Teaching Hospitals

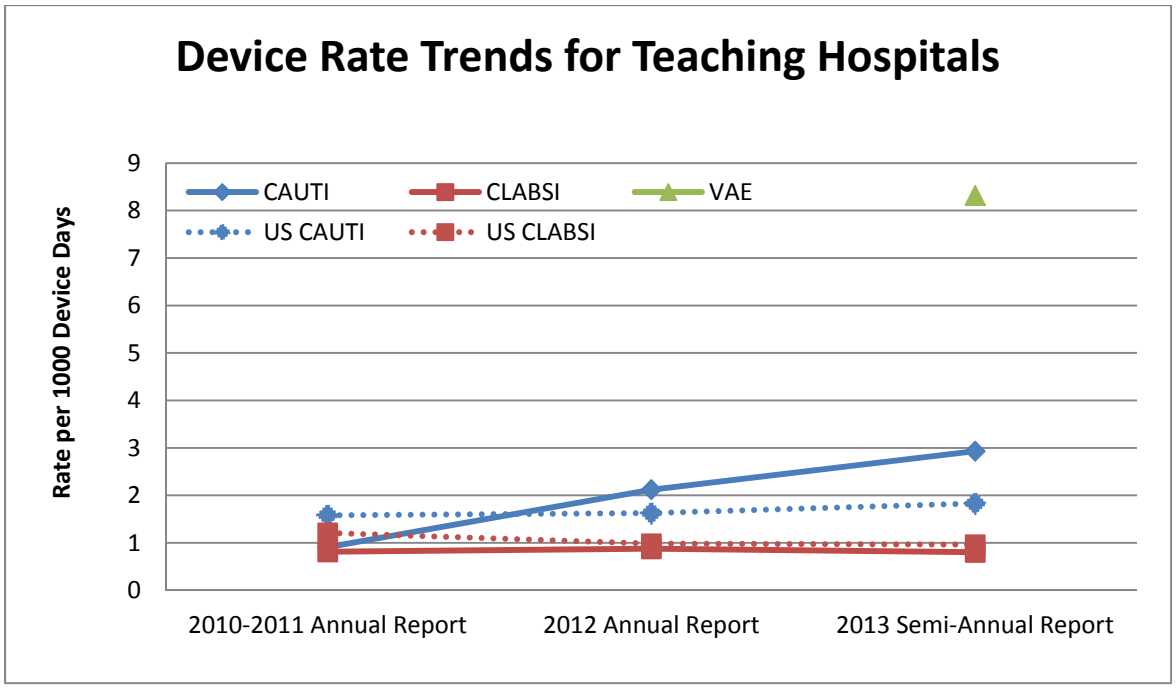


Figure 18. Device Rate Trends for Non-Teaching Hospitals

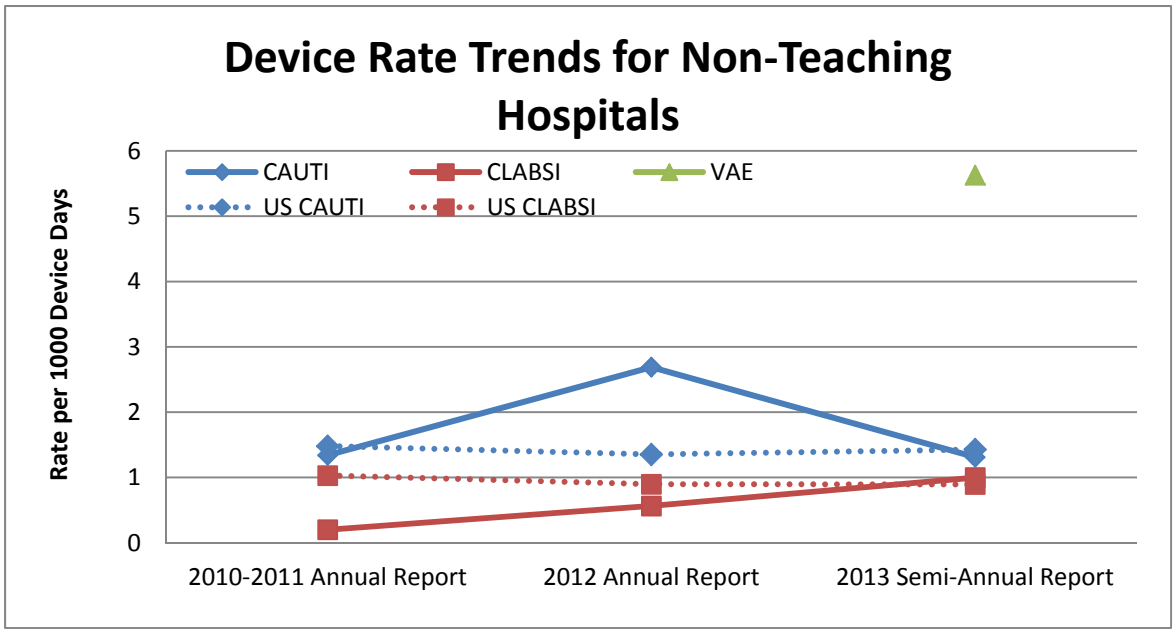


Table 21.

MDRO Rates[1] by Michigan Region

Michigan Region	MDRO Infection Type (Number of Hospitals)	Rate	CO Rate[2] (%CO)
Group 1 (Regions 1, 2N, 2S)	**MRSA LabID[3] (34)**	0.8658↓	0.2779(73)
	CDI LabID[4] (34)	23.1967↑	0.4135(40)
Group 2 (Regions 3, 5, 6)	**MRSA LabID (40)**	0.9663↓	0.3098(78)
	CDI LabID (40)	16.7630↑	0.3210(47)
Group 3 (Regions 7, 8)	**MRSA LabID (11)**	1.0088	0.3740(84)
	CDI LabID (11)	23.0204↑	0.5413(52)

Michigan Data

[1]Rates were calculated using the number of infections/events per 1,000 (or per 10,000 for CDI) patient days or device days according to the same MI rate shown in Tables 9–14 among hospitals that shared data with MDCH SHARP through the NHSN.
[2]CO Rate(%CO): Community Onset Rate (Percent community-onset): Number of community-onset LabID events per patient days (percent LabID events that were community onset)
[3]MRSA LabID: Methicillin-Resistant *Staphylococcus aureus* (MRSA) Laboratory-identified (LabID) Event option within the Multidrug-Resistant Organism / *Clostridium difficile* Infection (MDRO/CDI) Module of NHSN for tracking MRSA laboratory results without conducting additional surveillance for infections.
[4] CDI LabID: *Clostridium difficile (C. diff)* Infection (CDI) LabID Event option within the MDRO/CDI Module of NHSN for tracking CDI laboratory results without conducting additional surveillance for infections.
↓ or ↑Indicates statistically significantly lower or higher than previous report (respectively).

MRSA LabID rates decreased significantly in Groups 1 and 2, and did not significantly change in Group 3. Group 3 had the highest MRSA LabID rate of 1.0088, along with the highest percentage of CO events (84%).

The CDI LabID rate increased significantly in all three Groups. Group 2 had the lowest CDI LabID rate of 16.7630, but Group 1 had the lowest percentage of CO events (40%).

Figure 19. MDRO/CDI Rate Trends for Group 1 (Regions 1, 2N, 2S) Hospitals

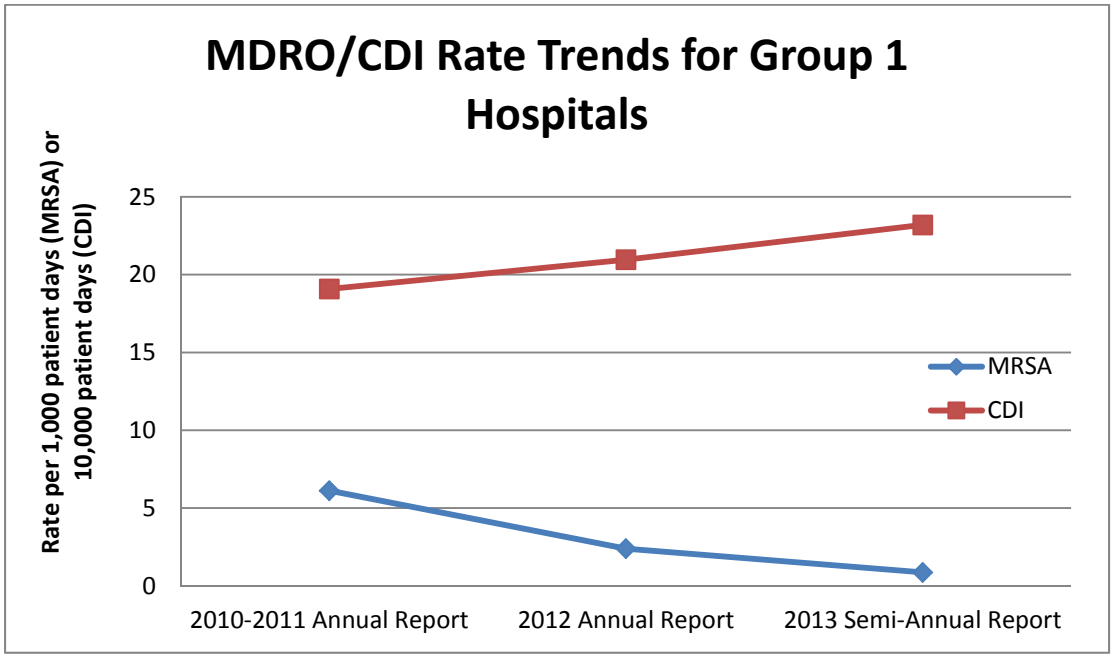


Figure 20. MDRO/CDI Rate Trends for Group 2 (Regions 3, 5, 6) Hospitals

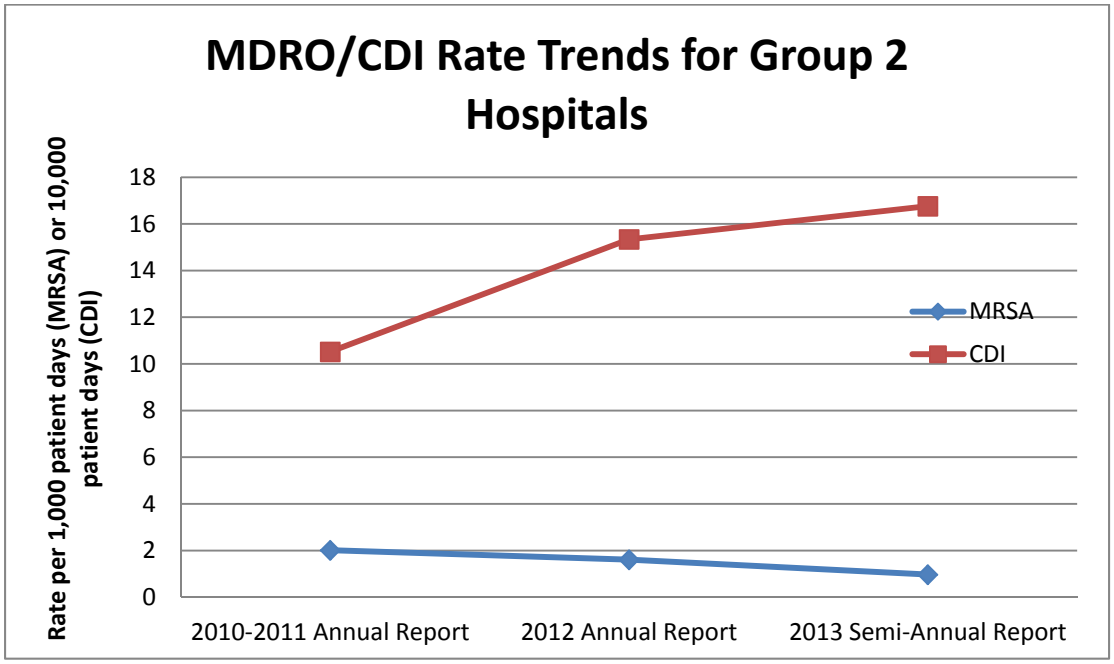


Figure 21. MDRO/CDI Rate Trends for Group 3 (Regions 7, 8) Hospitals

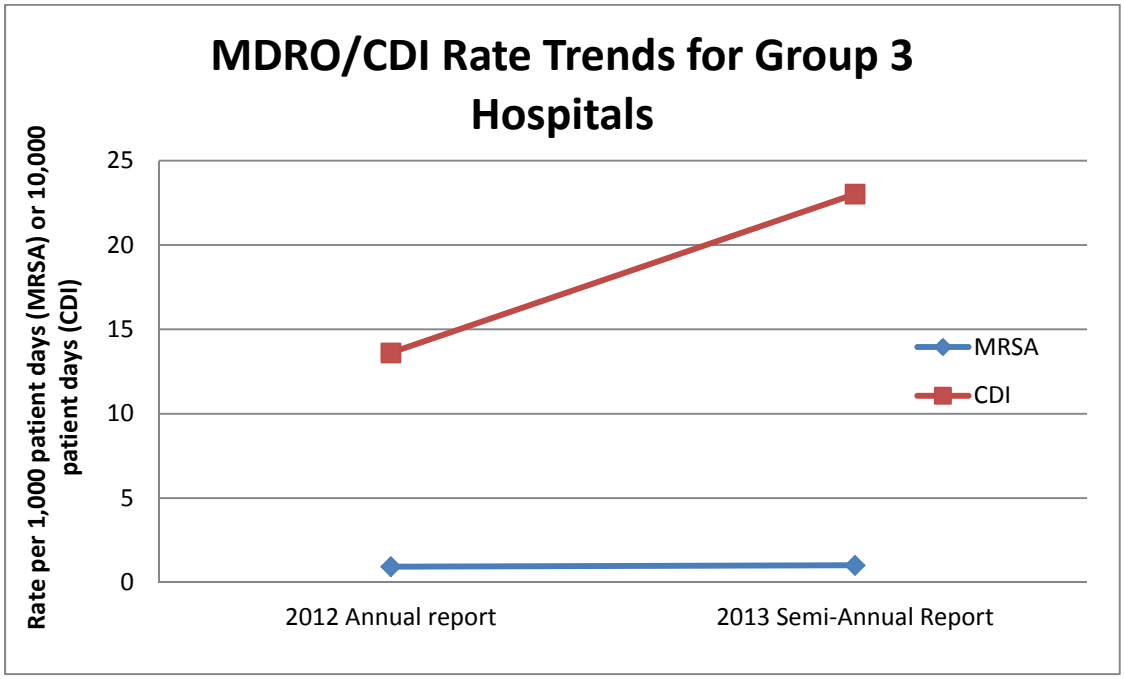


Table 22.

Device Rates[1] and SIR by Michigan Region

Region	Device-Associated Infection	Rate (Number of hospitals)	US Rate[2]	SIR[3]	SIR p-value[4]	SIR 95% Confidence Interval[5]
Group 1 (Regions 1, 2N, 2S)	**CAUTI[6]**	2.9796(35) ↑	1.8599	1.328	<0.0001	1.200, 1.465
	CLABSI[7]	0.7898(34)	0.9609	0.350	<0.0001	0.282, 0.429
	Total VAE[8]	6.9758(16)	-----	-----	-----	-----
Group 2 (Regions 3, 5, 6)	**CAUTI**	2.2796(40)	1.5952	1.214	0.0168	1.039, 1.411
	CLABSI	0.8636(36)	0.9283	0.523	<0.0001	0.412, 0.654
	Total VAE	9.3752(10)	-----	-----	-----	-----
Group 3 (Regions 7, 8)	**CAUTI**	1.5214(12)	1.3892	0.878	0.5783	0.551, 1.332
	CLABSI	0.8967(11)	0.8825	0.479	0.0323	0.210, 0.948
	Total VAE	16.6297(1)	-----	-----	-----	-----

US Data **Michigan Data**

Highlight: Indicates significantly fewer infections than expected

Highlight: Indicates significantly more infections than expected

[1]Rates were calculated using the number of infections/events per 1,000 device days according to the same MI rate shown in Tables 9-14 among hospitals that shared data with MDCH SHARP through the NHSN.

[2]The US comparative rates were calculated using data from the national estimate on the National Healthcare Safety Network (NHSN). This is according to 2012 NHSN data (Am J Infect Control 2013;41:1148-66). These data are for a descriptive reference only, and do not necessarily represent the true national rate. US data were not available this report for the VAE module. Each rate is individually matched to the Michigan data by facility type and unit type, then aggregated into an overall rate.

[3]SIR: Standardized Infection Ratio: Ratio of observed events compared to the number of predicted events, accounting for unit type or procedure. An SIR of 1 can be interpreted as having the same number of events that were predicted. An SIR that is between 0 and 1 represents **fewer** events than predicted, while an SIR of greater than 1 represents **more** events than expected.

[4]P-value: An SIR p-value of <0.05 is considered significantly different than expected. It can show either significantly more infections (if the SIR is greater than 1 and the p-value is <0.05) or significantly fewer (if the SIR is less than 1 and the p-value is <0.05).

[5]95% CI: 95% confidence interval around the SIR estimate. A 95% CI indicates that 95% of the time, the actual SIR will fall within this interval.

[6]CAUTI: Catheter-Associated Urinary Tract Infection

[7]CLABSI: Central Line-Associated Blood Stream Infection

[8]VAP: Ventilator-Associated Pneumonia

↓ or ↑Indicates statistically significantly lower or higher than previous report (respectively).

The CAUTI rate for Group 1 increased significantly from 2.4718 in the 2012 annual report to 2.9796 per 1,000 device days (p=0.0085). No other rate changes were significantly different from the previous report. Group 3 had the highest VAE and CLABSI rates, but the lowest CAUTI rates.

Both Groups 1 and 2 had CAUTI SIRs significantly greater than 1, at 1.328 and 1.214, respectively. However, Group 3's SIR of 0.878 indicated 12.2% fewer infections than predicted, although this was not

significantly different than expected. All three groups had a CLABSI SIR significantly lower than 1; Group 1 had the lowest CLABSI SIR of 0.350 (0.282, 0.429).

Figure 22. Device Rate Trends for Group 1 (Regions 1, 2N, 2S) Hospitals

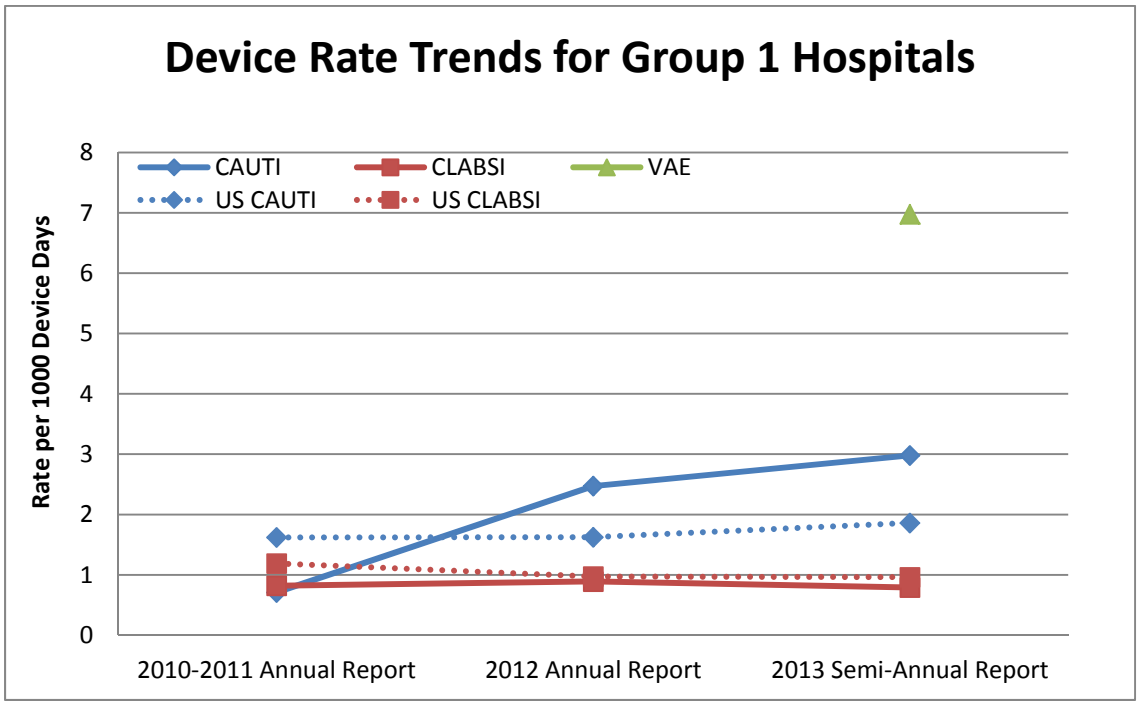


Figure 23. Device Rate Trends for Group 2 (Regions 3, 5, 6) Hospitals

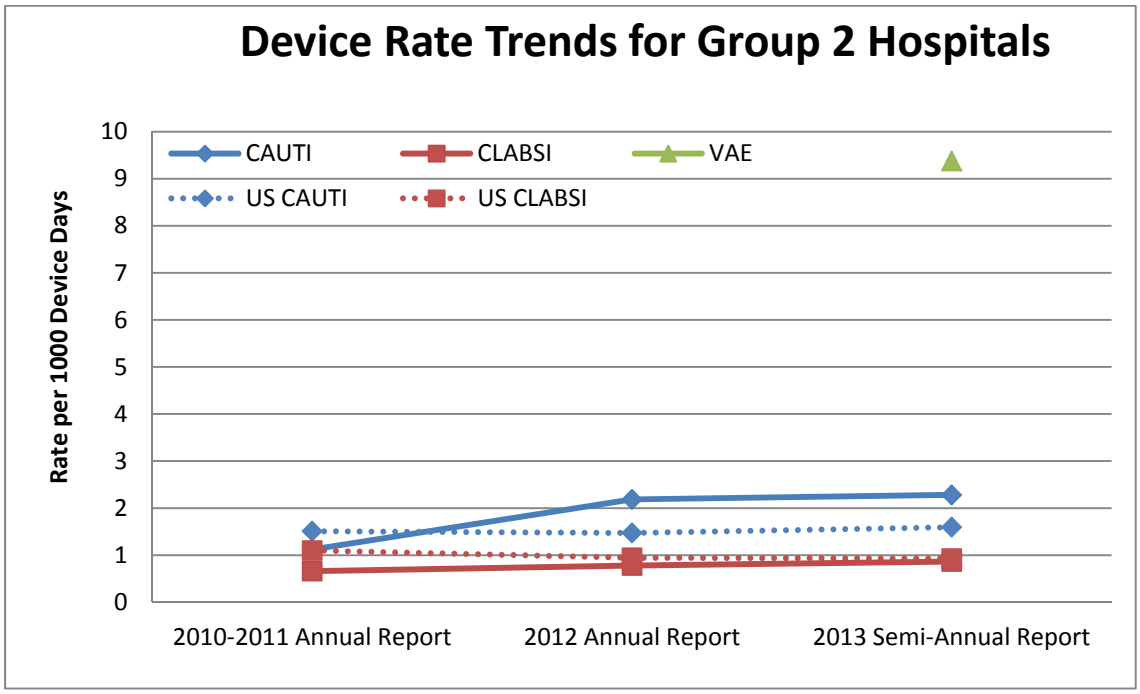


Figure 24. Device Rate Trends for Group 3 (Regions 7, 8)

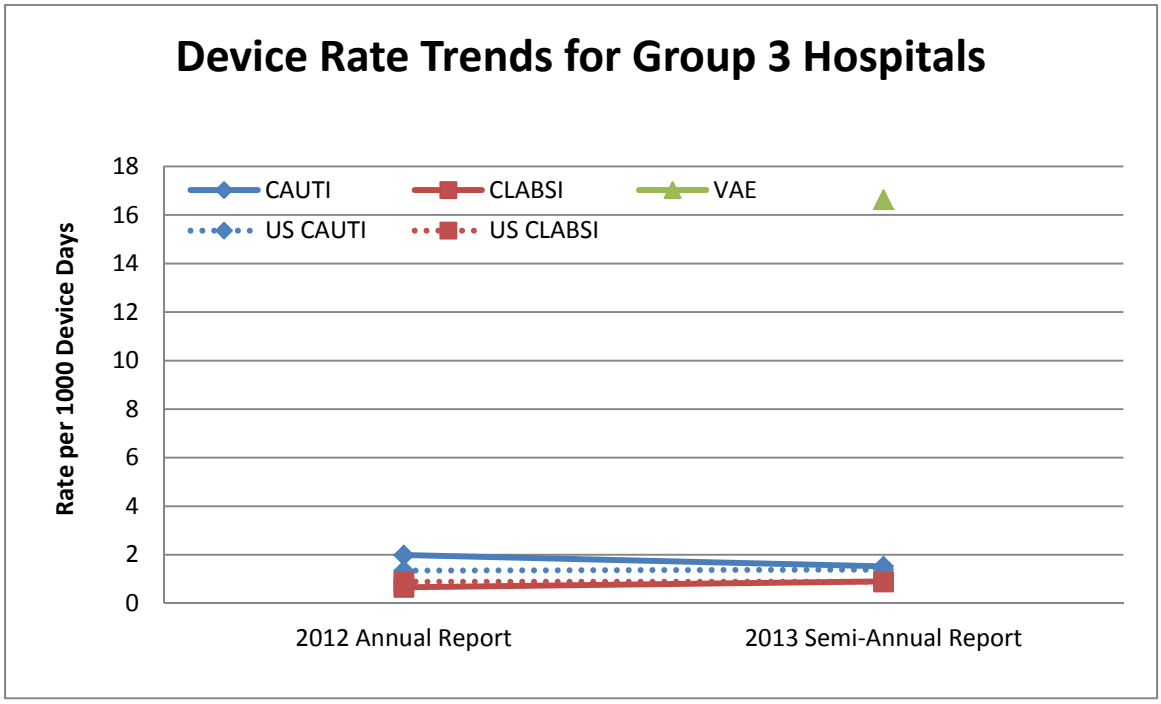


Table 23.

MDRO Rates[1] by Hospital Bed Size

Bed Size	MDRO Infection Type (Number of Hospitals)	Rate	CO Rate[2] (%CO)
≤200 Beds	**MRSA LabID[3] (47)**	1.1223↓	0.3954(83)
	CDI LabID[4] (47)	20.3516	0.4562(51)
>200 Beds	**MRSA LabID[3] (38)**	0.8662↓	0.2746(73)
	CDI LabID[4] (38)	21.2667↑	0.3768(41)

Michigan Data

[1]Rates were calculated using the number of infections/events per 1,000 (or per 10,000 for CDI) patient days or device days according to the same MI rate shown in Tables 9–14 among hospitals that shared data with MDCH SHARP through the NHSN.
[2]CO Rate(%CO): Community Onset Rate (Percent community-onset): Number of community-onset LabID events per patient days (percent LabID events that were community onset)
[3]MRSA LabID: Methicillin-Resistant *Staphylococcus aureus* (MRSA) Laboratory-identified (LabID) Event option within the Multidrug-Resistant Organism / *Clostridium difficile* Infection (MDRO/CDI) Module of NHSN for tracking MRSA laboratory results without conducting additional surveillance for infections.
[4]CDI LabID: *Clostridium difficile (C. diff)* Infection (CDI) LabID Event option within the MDRO/CDI Module of NHSN for tracking CDI laboratory results without conducting additional surveillance for infections.
↓ or ↑Indicates statistically significantly lower or higher than previous report (respectively).

The MRSA LabID rate for small and large hospitals decreased significantly from the 2012 annual report. However, the MRSA LabID rate for hospitals ≤200 beds is slightly higher than in larger hospitals.

The CDI LabID rate increased significantly in hospitals >200 beds, from 18.4023 to 21.2667 per 10,000 patient days ($p<0.0001$).

Figure 25. MDRO/CDI Rate Trends for ≤200 Beds

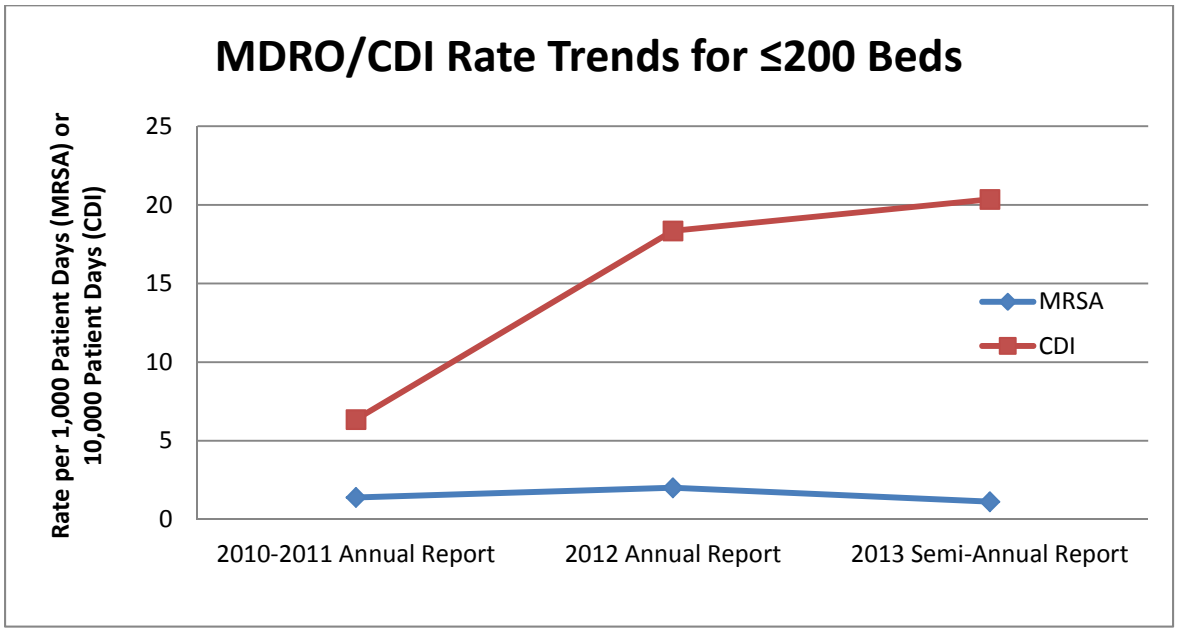


Figure 26. MDRO/CDI Rate Trends for >200 Beds

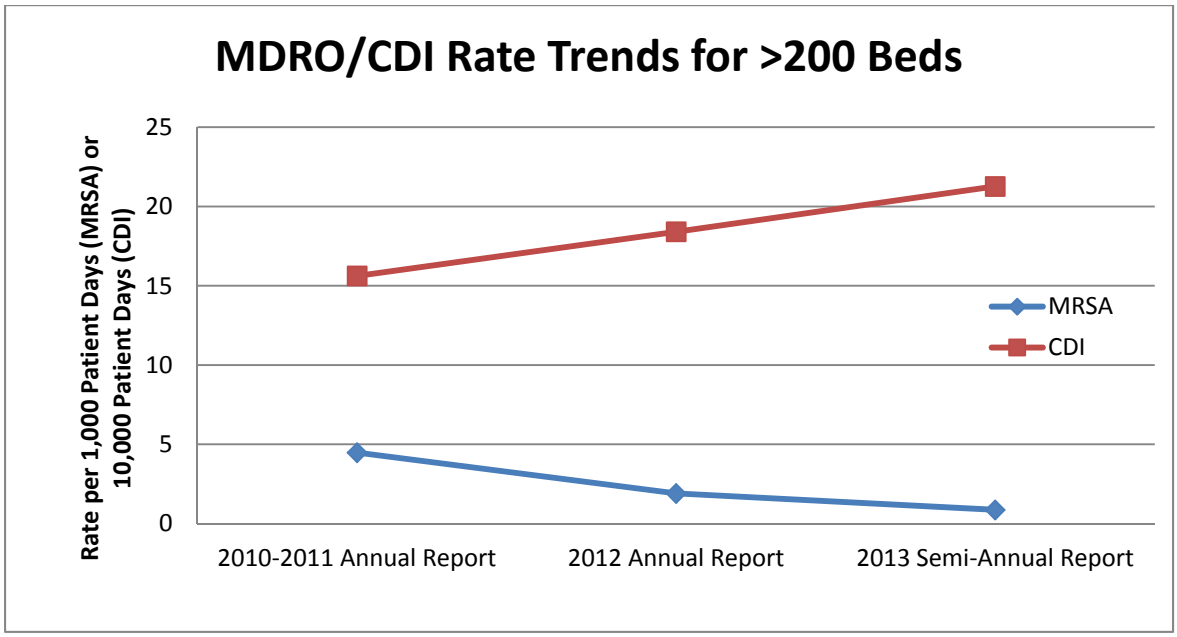


Table 24.

Device Rates[1] and SIR by Hospital Bed Size

Bed Size	Device-Associated Infection	Rate (Number of Hospitals)	US Rate[2]	SIR[3]	SIR p-value[4]	SIR 95% Confidence Interval[5]
≤200 Beds	CAUTI[6]	1.1342(48) ↓	1.3955	0.653	0.0064	0.464, 0.894
	CLABSI[7]	0.6868(42)	0.8896	0.303	<0.0001	0.176, 0.488
	Total VAE[8]	2.9459(31)	-----	-----	-----	-----
>200 Beds	CAUTI	2.9704(39) ↑	1.9262	1.357	<0.0001	1.246, 1.476
	CLABSI	0.8395(39)	0.9746	0.429	<0.0001	0.365, 0.502
	Total VAE	6.3830 (29)	-----	-----	-----	-----

US Data **Michigan Data**

Highlight: Indicates significantly fewer infections than expected

Highlight: Indicates significantly more infections than expected

[1]Rates were calculated using the number of infections/events per 1,000 patient days or device days according to the same MI rate shown in Tables 9–14 among hospitals that shared data with MDCH SHARP through the NHSN.

[2]The US comparative rates were calculated using data from the national estimate on the National Healthcare Safety Network (NHSN). This is according to 2012 NHSN data (Am J Infect Control 2013;41:1148-66). These data are for a descriptive reference only, and do not necessarily represent the true national rate. US data were not available this report for the VAE module. Each rate is individually matched to the Michigan data by facility type and unit type, then aggregated into an overall rate.

[3]SIR: Standardized Infection Ratio: Ratio of observed events compared to the number of predicted events, accounting for unit type or procedure. An SIR of 1 can be interpreted as having the same number of events that were predicted. An SIR that is between 0 and 1 represents **fewer** events than predicted, while an SIR of greater than 1 represents **more** events than expected.

[4]P-value: An SIR p-value of <0.05 is considered significantly different than expected. It can show either significantly more infections (if the SIR is greater than 1 and the p-value is <0.05) or significantly fewer (if the SIR is less than 1 and the p-value is <0.05).

[5]95% CI: 95% confidence interval around the SIR estimate. A 95% CI indicates that 95% of the time, the actual SIR will fall within this interval.

[6]CAUTI: Catheter-Associated Urinary Tract Infection

[7]CLABSI: Central Line-Associated Blood Stream Infection

[8]VAP: Ventilator-Associated Pneumonia

↓ or ↑Indicates statistically significantly lower or higher than previous report (respectively).

Hospitals with 200 beds or less had a CAUTI SIR of 0.653 (95% CI: 0.464, 0.894), which indicates that they had significantly fewer infections than expected. The ≤200 bed CAUTI rate decreased significantly from the 2012 annual report to the present report. Hospitals with greater than 200 beds had significantly more observed infections than expected (SIR=1.357, 95% CI: 1.246, 1.476). The >200 bed CAUTI rate increased significantly from the 2012 annual report.

Both smaller and larger hospitals had statistically significantly fewer CLABSI infections than expected, with SIRs of 0.303 (0.176, 0.488) and 0.429 (0.365, 0.502), respectively.

Figure 27. Device Rate Trends ≤200 Beds

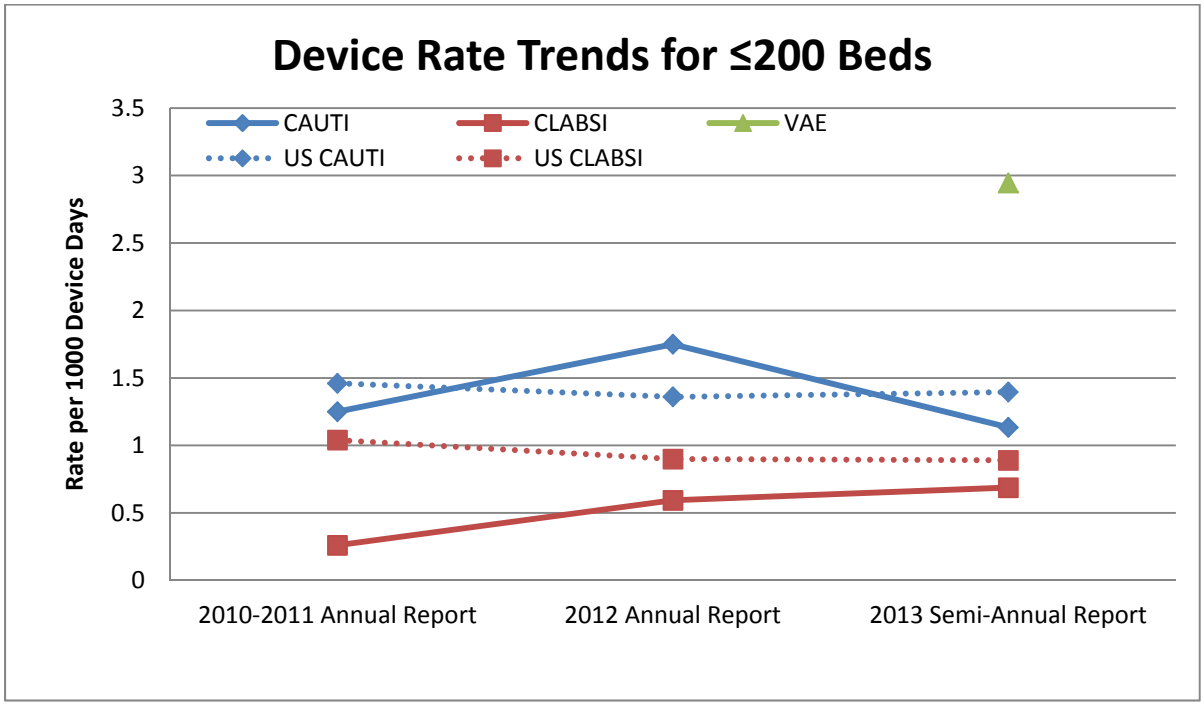
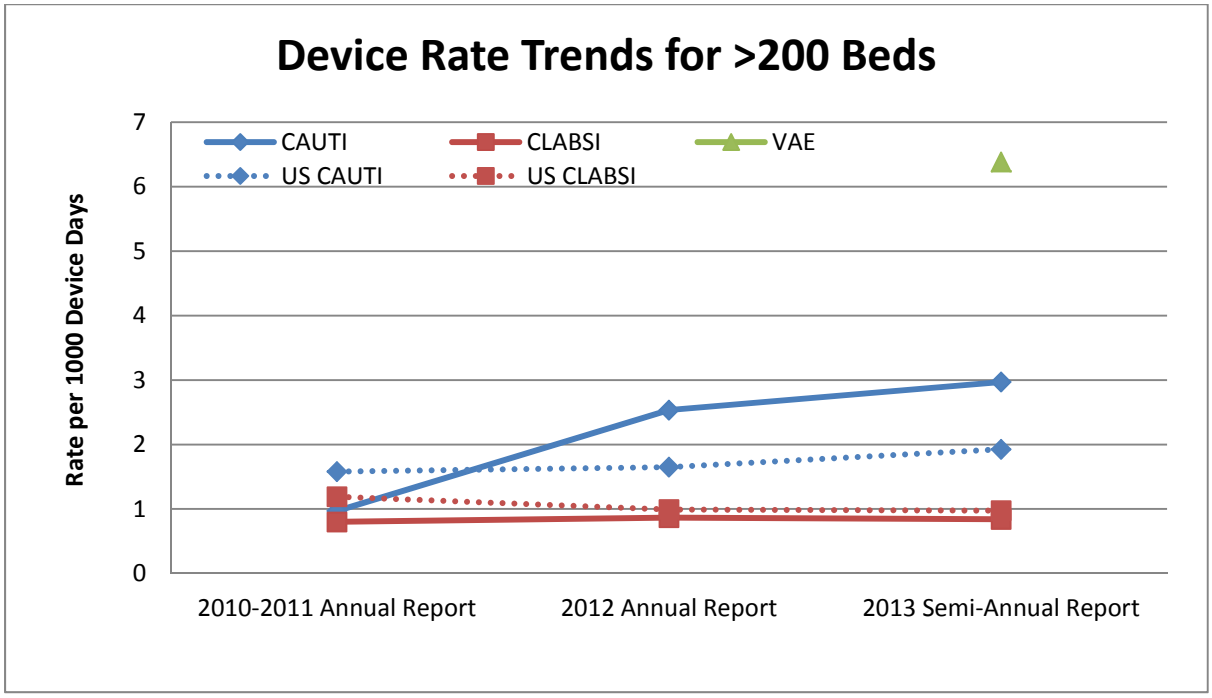


Figure 28. Device Rate Trends >200 Beds



Conclusions

HAIs continue to occur in Michigan healthcare facilities and throughout the U.S. Although the numbers and rates of CLABSIs have dropped significantly in Michigan since the introduction of the CLABSI checklist by the MHA Keystone Center for Patient Safety & Quality, all HAIs remain a concern. The future holds many challenges related to infection prevention and control – challenges that will continue to affect patient safety and healthcare quality, as well as patient morbidity and mortality.

It is important to note that the rates provided in this report are unadjusted rates from all participating hospitals. Therefore, comparison of rates throughout time may not be completely accurate, as the demographics of the participating hospitals have been shifting. The present hospital population may not be the same as the hospital population analyzed in previous reports. That is why, wherever possible, an SIR was calculated. An SIR risk-adjusts for the differences between hospitals to provide a fair overall view into the HAIs in Michigan hospitals. SIRs will be made available for MRSA bacteremia LabID events and CDI LabID events on the next report, along with graphical representation of SIR trends in place of rate trends.

This report compiled Michigan HAI data voluntarily shared via NHSN with the MDCH SHARP Unit for the first half of the calendar year 2013 reporting period. This report followed the same structure as the previous 2012 Annual Report with a few additional tables and graphs. Note that these data from participating hospitals have not been validated. Validation studies will be conducted as additional funding becomes available. This report contains data from many more facilities than in previous reports. Data will continue to become more reliable as additional Michigan hospitals participate in this surveillance initiative.

Acronyms

Below is a list of commonly used acronyms throughout this report to facilitate ease in reading.

CAUTI	Catheter-Associated Urinary Tract Infection
CCU	Critical Care Unit
CDC	Centers for Disease Control & Prevention
CDI	*Clostridium difficile* Infection
CI	Confidence Interval
CLABSI	Central Line-Associated Bloodstream Infection
CMS	Centers for Medicare and Medicaid Services
CO	Community-Onset
CO-HCFA	Community-Onset Healthcare Facility-Associated
DU	Device Utilization
DUA	Data Use Agreement
HAI	Healthcare-Associated Infection
HHS	U.S. Department of Health & Human Services
HO	Healthcare Facility-Onset
ICU	Intensive Care Unit
LabID	Laboratory-Identified Event
MDCH	Michigan Department of Community Health
MDRO	Multidrug-Resistant Organism
MHA	Michigan Health & Hospital Association
MRSA	Methicillin-Resistant *Staphylococcus aureus*
NHSN	National Healthcare Safety Network
SCA	Specialty Care Area
SHARP	Surveillance for Healthcare-Associated & Resistant Pathogens
SIR	Standardized Infection Ratio
SSI	Surgical Site Infection
VAE	Ventilator-Associated Event
VAP	Ventilator-Associated Pneumonia

Surveillance for Healthcare-Associated & Resistant Pathogens (SHARP) Unit

Contact us at 517-335-8165 or MDCH-SHARP@michigan.gov

Allison Murad, MPH, National Healthcare Safety Network (NHSN) Epidemiologist
MuradA@michigan.gov
Xiaotong Liu, BS, SHARP Unit Intern
LiuX@michigan.gov
Jennie Finks, DVM, MVPH, SHARP Unit Manager
FinksJ@michigan.gov
Jennifer Beggs, MPH, Infectious Disease & Preparedness Epidemiologist
BeggsJ@michigan.gov
Brenda Brennan, MSPH, CRE Prevention Initiative Coordinator
BrennanB@michigan.gov
Gail Denkins, RN, MRSA/CDI Prevention Initiative Coordinator
DenkinsG@michigan.gov
Noreen Mollon, MS, Infection Control Consultant
MollonN@michigan.gov
Judy Weber, MPH, Healthcare Facility Liaison
WeberJ4@michigan.gov