

HEALTHCARE-ASSOCIATED INFECTIONS IN MICHIGAN HOSPITALS

Quarterly Report of Healthcare-Associated Infection Surveillance Activities

April 1, 2011–June 30, 2011

Michigan Department of Community Health

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

Data Accessed: August 2, 2011

Introduction

The Surveillance for Healthcare-Associated & Resistant Pathogens (SHARP) Unit within the Bureau of Disease Control, Prevention, and Epidemiology at the Michigan Department of Community Health (MDCH) will quarterly provide an update on healthcare-associated infection (HAI) surveillance activities. This report will include Centers for Disease Control and Prevention (CDC) National Healthcare Safety Network (NHSN) data from Michigan hospitals who have agreed to share their data with MDCH SHARP. The main surveillance foci for the SHARP Unit are methicillin-resistant *Staphylococcus aureus* (MRSA) and *Clostridium difficile* reports collected through the laboratory-identified (LabID) event option of the multidrug-resistant organism and *Clostridium difficile* infection (MDRO/CDI) module of NHSN. However, data from other NHSN modules will also be analyzed as it is made available by participating hospitals. Aggregated data will be used to show infection rates and trends in the incidence of specific healthcare-associated infections (HAIs) and multidrug-resistant organisms (MDROs). Previous quarterly reports for the years of 2009, 2010, and the first quarter of 2011 are posted on the Michigan HAI website at www.michigan.gov/hai. As additional Michigan hospitals agree to participate in this surveillance initiative, the information and data will become more reliable and complete from quarter to quarter.

Additional background information on HAIs, pertinent definitions related to HAIs, Michigan's HAI Surveillance and Prevention Plan, Michigan's HAI Prevention Advisory Group roster, and Michigan's prevention collaboratives, supported under ARRA and other Federal grant programs, can be found at www.michigan.gov/hai.

Acronyms Used in Quarterly Reports

ARRA	American Recovery and Reinvestment Act
CAUTI	Catheter-Associated Urinary Tract Infection
CDC	Centers for Disease Control & Prevention
CDI*	<i>Clostridium difficile</i> Infection
CLABSI	Central Line-Associated Bloodstream Infection
DUA	Data Use Agreement
HAI	Healthcare-Associated Infection
ICU	Intensive Care Unit
LabID	Laboratory-Identified Event
MDCH	Michigan Department of Community Health
MDRO	Multidrug-Resistant Organism
MHA	Michigan Health & Hospital Association
MPRO	Michigan's Quality Improvement Organization
MRSA	Methicillin-Resistant <i>Staphylococcus aureus</i>
NHSN	National Healthcare Safety Network
SCA	Specialty Care Area
SHARP	Surveillance for Healthcare-Associated & Resistant Pathogens Unit
SSI	Surgical Site Infection
VAP	Ventilator-Associated Pneumonia

* The term CDI replaces the term CDAD (*Clostridium difficile*-Associated Disease). According to CDC NHSN, this name change occurred to remain consistent with the subject matter experts and the current terminology. The names are synonymous, and there is no change in *C. difficile* reporting definitions.

Surveillance Initiative Statistics

Between April 1 and June 30, 2011, a cumulative total of 49 Michigan hospitals participated in the SHARP Unit HAI surveillance initiative. Twenty-four of these hospitals used the laboratory-identified (LabID) Event option of the MDRO/CDI module to monitor MRSA; sixteen of the 24 shared this data with SHARP. Thirty monitored and 17 shared *C. difficile* LabID Events. Areas of surveillance within the hospital varied by participating hospital and included the intensive care/critical care unit (ICU/CCU), specialty care areas (SCA), medical/surgical wards, or other, dependent upon individual hospital choice. Data from this quarter, the previous quarter in 2011, and the 2009–2010 annual report were used in this report to establish aggregate infection rates among participating Michigan hospitals and to monitor quarterly trends.

Of the 49 hospitals participating this quarter, most collected additional NHSN module data as indicated in Table 1. For example, 46 of the 49 hospitals participating in the surveillance initiative utilized the CLABSI module; of these, 39 shared this data with the SHARP Unit. As additional hospitals participate with the SHARP Unit and confer rights to these modules, analysis of the data will become more complete and reliable.

Table 1.

National Healthcare Safety Network (NHSN) Modules in Use, as Reported by Facility April 1, 2011 through June 30, 2011

NHSN Module	Number of Facilities Using Module	Number of Facilities Sharing Data
Central Line-Associated Bloodstream Infection (CLABSI)	46	39
<i>Clostridium difficile</i> Infection (CDI) Laboratory-Identified (LabID) Event	30	17
Ventilator-Associated Pneumonia (VAP)	27	24
Methicillin-Resistant <i>Staphylococcus aureus</i> (MRSA) Laboratory-Identified (LabID) Event	24	16
Catheter-Associated Urinary Tract Infection (CAUTI)	20	18
Surgical Site Infection (SSI)	20	8
Methicillin-Resistant <i>Staphylococcus aureus</i> (MRSA) Infection Surveillance	16	12
<i>Clostridium difficile</i> Infection (CDI) Infection Surveillance	10	8

Methicillin-Resistant *Staphylococcus aureus* (MRSA) Data

Table 2 (below) indicates that between April 1, 2011 and June 30, 2011, 415 isolates of MRSA were reported from sixteen participating hospitals using the MDRO/CDI module LabID Event option. The NHSN definition for MRSA LabID Event includes the first positive MDRO isolate from any specimen per calendar month per patient, or a positive MDRO isolate from a blood source when there haven't been any other positive blood specimens in ≤ 2 weeks from that patient. Specimens must be collected for clinical purposes and not for the purpose of active surveillance testing or screening. Additionally, testing protocol and type of test used (i.e. PCR, assay, culture) vary by facility. Note that

data from the LabID Event option of the MDRO/CDI module are considered proxy measures of MDRO exposure burden, and do not distinguish between patient colonization and infection.

Table 2. MRSA Characteristics	Annual Report		
	October 2009– September 2010	January 1– March 31, 2011	April 1– June 30, 2011
Frequency, Number			
<i>Hospitals with DUA¹</i>	26	41	47
<i>Hospitals Reporting MRSA LabID²</i>	10	14	16
<i>Aggregated MRSA LabID Events</i>	706	675	415
Onset, Number (%)			
<i>Healthcare Facility-Onset (HO)</i>	123 (17)	106 (16)	84 (20)
<i>Community-Onset (CO)</i>	583 (83)	569 (84)	331 (80)
Previous MRSA, Number (%)			
<i>Previously positive</i>	Not Available	120 (18)	74 (18)
Specimen Source, Number (%HO)			
<i>Wound</i>	304 (6)	226 (7)	146 (10)
<i>Sputum</i>	187 (41)	112 (38)	102 (38)
<i>Blood</i>	43 (23)	38 (16)	39 (15)
<i>Skin</i>	24 (0)	59 (5)	4 (25)
<i>Abscess</i>	27 (0)	43 (12)	11 (9)
<i>Urine</i>	37 (3)	72 (7)	26 (12)
<i>Other</i>	84 (20)	125 (23)	87 (23)
Surveillance Location, Number (%)			
<i>Intensive/Critical Care Unit</i>	253	117 (17)	123 (30)
<i>Specialty Care Area</i>	-	-	-
<i>Wards</i>	142	217 (32)	228 (55)
<i>Outpatient</i>	311	325 (48)	64 (15)
<i>Other</i>	-	16 (2)	-

¹DUA: Data Use Agreement
²LabID: Laboratory-Identified Event

Eighty-four (20%) of all MRSA LabID Events this quarter were determined to be healthcare facility-onset (HO), and the remainder (331, or 80%) were determined to be community-onset (CO). NHSN defines ‘healthcare facility-onset’ as a ‘LabID Event specimen collected >3 days after admission to the facility (i.e., on or after day 4).’ ‘Community-onset’ 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).’

For this quarter, the percent of events which were healthcare facility-onset varied by specimen source. Sputum specimens had the largest proportion of **healthcare facility-onset** events (38%), followed by skin (25%), other (23%), blood (15%), urine (12%), wound (10%), and abscess (9%). The majority of all MRSA LabID Event specimens were collected from patient wards (55%), followed by intensive/critical care units (30%) and outpatient locations (15%). Eighteen percent of MRSA LabID Events occurred in patients for whom a MRSA LabID Event had been recorded in a prior month.

Clostridium difficile Infection (CDI) Data

Table 3. <i>C. difficile</i> Characteristics	Annual Report December 2009 – September 2010	January 1– March 31, 2011	April 1– June 30, 2011
Frequency, Number			
<i>Hospitals with DUA</i> ¹	26	41	47
<i>Hospitals Reporting CDI LabID</i> ²	8	18	22
<i>Aggregated CDI LabID Events</i>	184	344	290
Onset, Number (%)			
<i>Healthcare Facility-Onset (HO)</i>	76 (41)	95 (28)	119 (41)
<i>Community-Onset Healthcare Facility-Assoc (CO-HA)</i>	34 (19)	77 (22)	70 (24)
<i>Community-Onset (CO)</i>	74 (40)	172 (50)	101 (35)
Previous CDI, Number (%)			
<i>Previously positive</i>	Not Available	52 (15)	38 (13)
<i>CDI assay, recurrent</i>	Not Available	40 (12)	24 (8)
Surveillance Location, Number (%)			
<i>Intensive/Critical Care Unit</i>	60	58 (17)	54 (19)
<i>Specialty Care Area</i>	8	6 (2)	3 (1)
<i>Wards</i>	78	165 (48)	208 (72)
<i>Outpatient</i>	38	108 (31)	25 (9)
<i>Other</i>	-	7 (2)	-
¹ DUA: Data Use Agreement			
² LabID: Laboratory-Identified Event			

As shown in Table 3 (above), this quarter there were 290 reports of *C. difficile* identified by 22 hospitals which used the MDRO/CDI LabID Event option. The NHSN definition for CDI LabID Event includes the first positive *C. diff* test result without a prior positive in ≤ 2 weeks. As with MRSA LabID Events, *C. difficile* LabID Event specimens must be collected for clinical purposes, not for the purpose of active surveillance testing or screening. Testing protocol and type of test used (i.e. PCR, assay, culture) may vary by facility. *C. difficile* LabID Event data are considered proxy measures of exposure burden, and do not distinguish between patient colonization and infection.

One-hundred nineteen, or 41%, of CDI LabID Events were considered **healthcare-onset**. Seventy (24%) were considered **community-onset healthcare facility-associated (COHA)**, and 101 (35%) were reported as **community-onset**. *Community-onset healthcare facility-associated* is defined as a ‘community-onset LabID Event collected from a patient who was discharged from the facility ≤ 4 weeks prior to the date the stool specimen was collected.’ (Healthcare facility-onset and community-onset are defined under the MRSA LabID Event data heading). Evaluating location of CDI LabID Event specimen collection, 208 (72%) were reported from patient wards, 54 (19%) from intensive/critical care, 25 (9%) from outpatient locations, and 3 (1%) from a specialty care area. Thirteen percent of CDI LabID Events occurred in patients who had a prior CDI LabID Event entered in a previous month. In addition, 8% of LabID Events were

recurrent *Clostridium difficile* infection assays. A recurrent CDI assay is a ‘*C. difficile* LabID Event specimen obtained greater than 2 weeks and less than or equal to 8 weeks after the most recent LabID Event for that patient.’

Multidrug-Resistant Organisms (MDRO) Summary Data

Table 4 (below) provides an overview of the rates of LabID and Infection Surveillance Events for multidrug-resistant organisms (MDROs). Data are shown for organisms where five or more facilities are conducting surveillance for that particular organism. For the first time this quarter, enough facilities shared *C. difficile* infection surveillance data to include that data in the present report.

Table 4.						
Quarterly Multidrug-Resistant Organism (MDRO) Rates						
MDRO Organism	Number of Facilities	Number of Inpatient Events	Number of Patient Days	Number of Patient Admits	MDRO Rate¹	MDRO Admission Prevalence Rate²
MRSA ³	16	203 LabID ⁴	40,625	9,634	5.00	2.11
MRSA	12	3 Infections ⁵	13,504		0.22	
C. diff ⁶	17	133 LabID	76,630	23,390	17.36	0.57
C. diff	8	3 Infections	9,857		3.04	

Michigan Rate among facilities sharing data with SHARP

¹MDRO Rate: The rate of MDRO LabID events or infections per 1,000 patient days (or encounters) for all organisms, except *C. difficile*, which is the number of CDI LabID Events or infections per 10,000 patient days.

²MDRO Admission Prevalence Rate. The number of MDRO LabID Events per 100 inpatients admitted.

³Methicillin-Resistant *Staphylococcus aureus* (MRSA)

⁴Lab ID: 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.

⁵Infection: MDRO event under infection surveillance. This is an option in the MDRO/CDI module for conducting infection surveillance.

⁶C. diff: *Clostridium difficile*

The MRSA LabID Event rate increased slightly this quarter, from 4.65 in the first quarter of 2011 to 5.00 per 1,000 patient days. The *C. diff* LabID Event rate increased slightly from 14.53 to 17.36 per 10,000 patient days. The MRSA infection surveillance rate decreased from 0.53 to 0.22 per 1,000. The Admission Prevalence Rates for MRSA and *C. diff* LabID Events increased from 1.78 to 2.11 per 100 patients admitted and from 0.45 to 0.57 per 100 patients admitted, respectively, from the first quarter of 2011 to the second. No rates were statistically significant compared to each respective 2011 Quarter 1 Report value.

Device-Associated Summary Data

Table 5 (below) provides a summary of the Device-Associated Infection Rates as well as the Device Utilization (DU) Ratios for each device: urinary catheters, central lines, and ventilators. Data are shown for infections where five or more facilities collected and shared data for that particular infection. Of twenty facilities participating in the Catheter-Associated Urinary Tract Infection (CAUTI) module, 18 shared data with MDCH SHARP. Thirty-nine of the 46 facilities utilizing the Central Line-Associated Blood Stream Infection (CLABSI) module provided data to the SHARP Unit, and 24 of 27 facilities participating in the Ventilator-Associated Pneumonia (VAP) module also provided data.

Table 5.**Device-Associated Rates**

Device-Associated Infection	Number of Facilities	Number of Infections	Number of Patient Days	Number of Device Days	MI Device-Associated Infection Rate ¹	US Device-Associated Infection Rate ²	MI DU ³	US DU
CAUTI ⁴	18	28	76,162	22,792	1.23	1.67	0.30	0.26
CLABSI ⁵	39	23	143,266	43,325	0.53	1.43	0.30	0.28
VAP ⁶	24	20	46,565	14,060	1.42	1.88	0.30	0.33

Michigan Rate among facilities sharing data with SHARP Comparative National Rate

¹MI Device-Associated Infection Rate: The number of infections per 1,000 device days among participating MI facilities.

²US comparative rates were calculated using a pooled mean from the national estimate on the National Healthcare Safety Network (NHSN). This estimate varies by unit type and with the proportion of device days reported in the unit.

³DU: Device Utilization Ratio. The proportion of patient days spent 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.

⁴CAUTI: Catheter-Associated Urinary Tract Infection

⁵CLABSI: Central Line-Associated Blood Stream Infection

⁶VAP: Ventilator-Associated Pneumonia

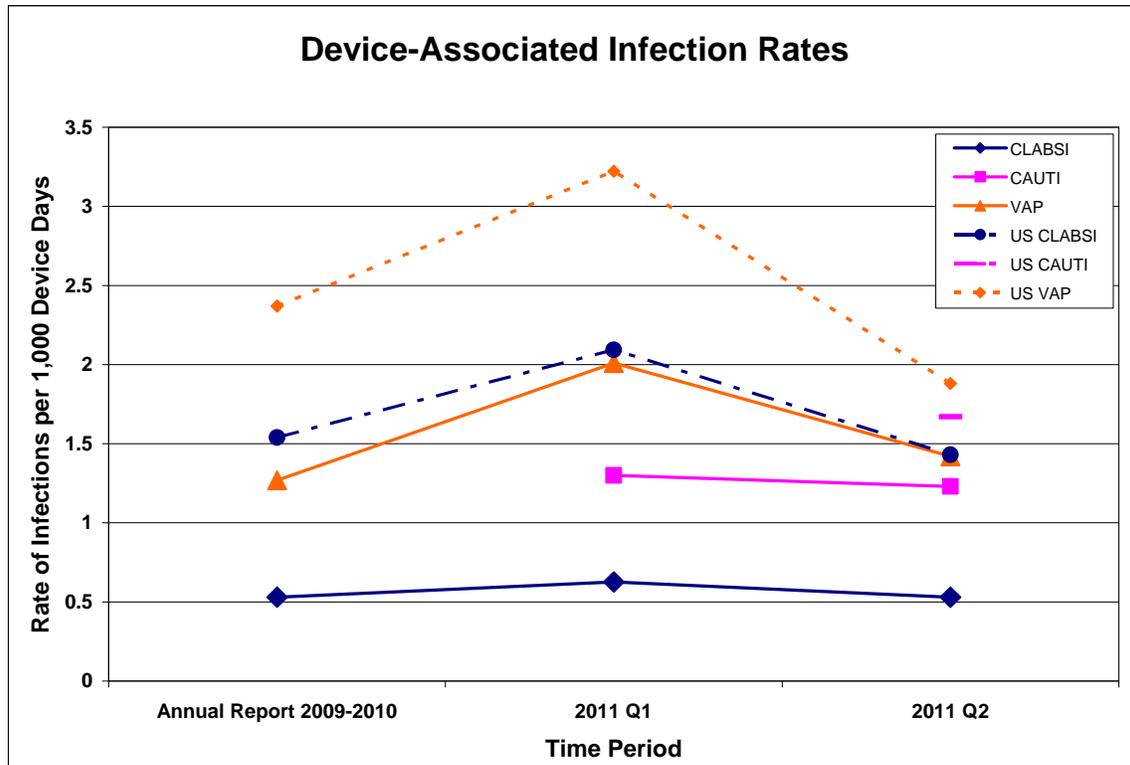
Compared to the first quarter of 2011, there were substantially more facilities participating in all three of the Device-Associated Infection modules. This allowed for more precise and accurate data to be collected. Also, there were enough data available within NHSN to provide a U.S. Device-Associated Infection Rate for CAUTIs, which had been unavailable for the previous quarterly report and can now be used to compare the U.S. rate to the Michigan rate.

The MI Device-Associated Infection rate decreased from the previous quarter to the present quarter for all three modules. However, none of these decreases were statistically significant. CAUTI rates decreased from 1.30 to 1.23 per 1,000 device days. CLABSI

rates decreased from 0.63 to 0.53 per 1,000 device days. VAP rates decreased the greatest amount between quarters, from 2.01 to 1.42 per 1,000 device days. The Michigan DU ratio remained fairly stable from the previous quarter to the present for all three devices.

Figure 1 (below) displays the Michigan and U.S. Device-Associated Infection Rates for the prior 2009–2010 Annual Report, the 2011 Quarter 1 Report, and the 2011 Quarter 2 Report for all three NHSN modules.

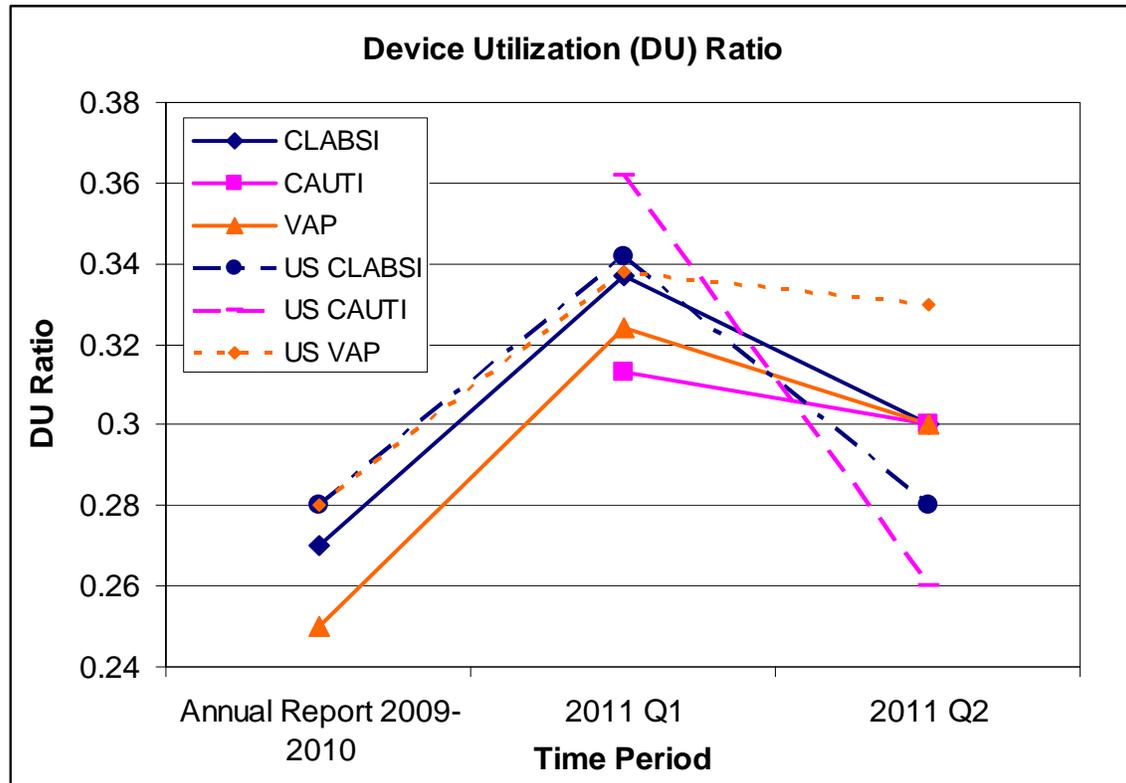
Figure 1.



As displayed in Figure 1, the Michigan infection rates follow the same distribution as the National NHSN infection rates. However, while the Michigan rates follow the general distribution as the US infection rates, they are all substantially lower than each of their US counterparts.

Figure 2 (below) displays the DU ratio for Michigan and the US for the 2009-2010 Annual Report, the 2011 Quarter 1 Report, and the 2011 Quarter 2 Report for all three NHSN modules.

Figure 2.



Standardized Infection Ratios

Table 6 (below) provides information on the Standardized Infection Ratio (SIR) for CLABSIs and SSIs in the second quarter of 2011. An SIR is defined as the ratio of observed events compared to the number of predicted events, while accounting for unit type or procedure. Of the 46 facilities participating in the CLABSI reporting module, 39 provided data to the SHARP Unit. Of the 20 facilities participating in the SSI reporting module, 15 shared data.

The SIR for CLABSIs this quarter demonstrates that Michigan facilities had significantly fewer CLABSIs than what was predicted based on national averages. An SIR of 0.33 indicates that Michigan had 67% fewer CLABSIs than expected. The SIR for SSIs demonstrates that, while Michigan had 5% fewer SSIs than expected, this number was not statistically significantly different from the expected value.

Table 6

Standardized Infection Ratio (SIR)

Type of Infection	Number of Facilities	Procedures Done	Observed ¹	Predicted ²	SIR ³	95% CI ⁴
CLABSI ⁵	39	NA	31	94.92	0.33	(0.22, 0.46)
SSI ^{6,7}	15	2741	41	42.99	0.95	(0.68, 1.30)

Michigan Rate among facilities sharing data with SHARP Comparative National Rate

¹Observed: Number of infections (CLABSIs or SSIs) reported during the time frame.

²Predicted: The number of CLABSIs predicted based on the type of hospital unit(s) under surveillance, or the number of SSIs predicted for the same number and type of procedures performed based upon national SSI rates by procedure type.

³SIR: 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.

⁴95% CI: 95% confidence interval around the SIR estimate.

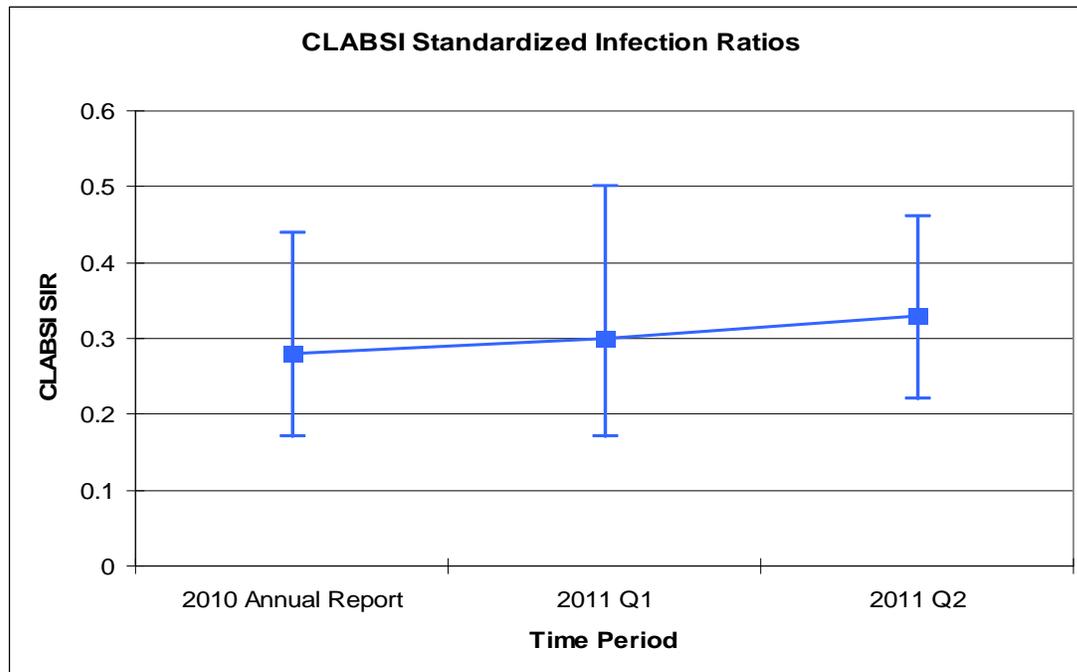
⁵CLABSI: Central Line-Associated Blood Stream Infection

⁶SSI: Surgical Site Infection

⁷SIR data for SSIs was accessed August 16, 2011.

In the report for the first quarter of 2011, there were enough data to publish a Michigan SSI SIR for the first time. As the present report is only the second report in which an SIR has been published, there is not yet enough data to display this information in graphical form. A graph representing the trend data for SSI SIRs should be available in the third quarter 2011 report.

Figure 3 (below) displays a CLABSI SIR for each of the following reports: the 2009–2010 Annual Report, the 2011 Quarter 1 Report, and the 2011 Quarter 2 Report. The center dot on each point represents the calculated SIR for the respective time period. The upper and lower marks represent the upper and lower ends of the 95% Confidence Interval (CI) surrounding the SIR. A 95% CI means that 95% of the time, the true SIR will be located within this interval. If the interval does not surround 1, then the calculated SIR is statistically significantly different from the predicted value.

Figure 3.**Conclusions**

Aggregated data from this quarter for both MRSA and *C. difficile* appear to be fairly stable and consistent from the previous year. The overall percentages of healthcare facility-onset, community-onset and (*C.diff*) community-onset healthcare facility-associated LabID Events, as determined by NHSN, are comparable to those reported in the 2009–2010 Annual Report. The percentage of LabID Events by surveillance location is also similarly distributed to the annual report.

For the first time, there were enough facilities sharing CDI infection surveillance information this quarter to allow for calculation of rates. This will continue to be monitored over time. There are still fewer facilities sharing infection surveillance data than LabID Event data. The small infection surveillance sample size might have negatively influenced the accuracy and precision of reported data in the current report. Infection surveillance module information will continue to become more accurate as more facilities participate with the SHARP Unit and add infection surveillance reporting.

The device-associated infection rates (CAUTI, CLABSI and VAP) have decreased from the rates reported in 2011 first quarter report. In the first quarter report, VAP rates were quite high; however, this was attributed to the small number of facilities reporting data. In the present report, 11 additional facilities reported data on VAP infections.

Overall, this quarter saw a considerable increase in participating hospitals. Not only did new hospitals join the MDCH SHARP HAI Surveillance Initiative, but previously participating hospitals also began sharing data from additional modules within NHSN. As this trend continues, the data for these reports will continue to become more accurate and analyses on additional modules will become possible in future reports.