

HEALTHCARE-ASSOCIATED INFECTIONS IN MICHIGAN HOSPITALS

Quarterly Report of Healthcare-Associated Infection Surveillance Activities

July 1, 2011–September 30, 2011

Michigan Department of Community Health

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

Data Accessed: January 4, 2012

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 provide a quarterly 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 were originally methicillin-resistant *Staphylococcus aureus* (MRSA) and *Clostridium difficile* (*C. difficile* or *C. diff*) reports collected through the laboratory-identified (LabID) event option of the multidrug-resistant organism and *C. difficile* infection (MDRO/CDI) module of NHSN.

Additionally, we are actively reviewing device-associated data for CLABSIs, CAUTIs, and SSIs. Aggregated data will be used to show infection rates and trends in the incidence of specific HAIs and MDROs. Previous quarterly reports for 2009, 2010, and the first half of 2011 are posted on the Michigan HAI website at www.michigan.gov/hai. As more 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 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

Surveillance Initiative Statistics

Between July 1 and September 30, 2011, a cumulative total of 53 Michigan hospitals participated in the voluntary SHARP Unit HAI surveillance initiative, as demonstrated by completed data use agreements. Twenty-five of these hospitals used the LabID Event option of the MDRO/CDI module to monitor MRSA in their reporting plan; nineteen of the 25 shared this data with SHARP. Thirty-one monitored and 20 shared *C. difficile* LabID Events. Areas of surveillance within the hospital varied by participating hospital and included the ICU/CCU, SCAs, medical/surgical wards, or other, dependent upon individual hospital choice. Data from this quarter, previous quarters in 2011, and the 2010-2011 Semi-Annual Report were used in this report to establish aggregate infection rates among participating Michigan hospitals and to monitor quarterly trends.

Of the 53 hospitals participating this quarter, most collected additional NHSN module data as indicated in Table 1. For example, 50 of the 53 hospitals utilized the CLABSI module; of these, 45 shared this data with the SHARP Unit. As more 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 Module¹	Number of Facilities Sharing Data²
Central Line-Associated Bloodstream Infection (CLABSI)	50	45
<i>Clostridium difficile</i> Infection (CDI) Laboratory-Identified (LabID) Event	31	20
Ventilator-Associated Pneumonia (VAP)	28	26
Methicillin-Resistant <i>Staphylococcus aureus</i> (MRSA) Laboratory-Identified (LabID) Event	25	19
Catheter-Associated Urinary Tract Infection (CAUTI)	19	21
Surgical Site Infection (SSI)	19	18
Methicillin-Resistant <i>Staphylococcus aureus</i> (MRSA) Infection Surveillance	14	12
<i>Clostridium difficile</i> Infection (CDI) Infection Surveillance	7	8

¹Number of Facilities using each module out of those who have signed a DUA with SHARP as of 12/12/11
²Number of facilities sharing data for each module with SHARP as of 1/4/12. Some numbers in this column may be larger than the number of facilities using each module because this module may have been added to their respective reporting plan between 12/12/11 (the date that the number of modules each facility had in their reporting plan at the time was counted) and 1/4/12 (the date the data were pulled).

Methicillin-Resistant Staphylococcus aureus (MRSA) Data

Table 2 (below) indicates that between July 1 and September 30, 2011, 613 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 MRSA isolate from any specimen per calendar month per patient, or a positive MRSA 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 MRSA exposure burden, and do not distinguish between patient colonization and infection.

<i>Table 2.</i> MRSA Characteristics	January 1– March 31, 2011	Semi-Annual Cummulative Report October 2010- March 2011	April 1– June 30, 2011	July 1 – Sept. 30, 2011*
Frequency, Number				
<i>Hospitals with DUA</i> ¹	41	41	47	53
<i>Hospitals Reporting MRSA LabID</i> ²	14	16	16	25
<i>Aggregated MRSA LabID Events</i>	675	897	415	613
Onset, Number (%)				
<i>Healthcare Facility-Onset (HO)</i>	106 (16)	234 (26)	84 (20)	114 (19)
<i>Community-Onset (CO)</i>	569 (84)	663 (74)	331 (80)	499 (81)
Previous MRSA, Number (%)				
<i>Previously positive</i>	120 (18)	Not Available	74 (18)	126 (21)
Specimen Source, Number (%HO)				
<i>Blood</i>	38 (16)	42 (33)	39 (15)	50 (18)
<i>Sputum</i>	112 (38)	115 (37)	102 (38)	96 (41)
<i>Wound</i>	226 (7)	261 (10)	146 (10)	263 (9)
<i>Abscess</i>	43 (12)	79 (3)	11 (9)	26 (4)
<i>Urine</i>	72 (7)	59 (8)	26 (12)	47 (4)
<i>Skin</i>	59 (5)	76 (1)	4 (25)	9 (0)
<i>Other</i>	125 (23)	98 (29)	87 (23)	122 (32)
Surveillance Location, Number (%)				
<i>Intensive/Critical Care Unit</i>	117 (17)	329 (37)	123 (30)	158 (26)
<i>Specialty Care Area</i>	-	-	-	-
<i>Wards</i>	217 (32)	432 (48)	228 (55)	278 (46)
<i>Outpatient</i>	325 (48)	136 (15)	64 (15)	177 (29)
<i>Other</i>	16 (2)	-	-	-
¹ DUA: Data Use Agreement signed on or before January 4, 2012				
² LabID: Laboratory-Identified Event				
*Note: data for this table was pulled on February 1, 2012				

One-hundred fourteen (19%) of all MRSA LabID Events this quarter were determined to be healthcare facility-onset (HO), and the remainder (449, or 81%) 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 (41%), closely followed by ‘other’ specimen sources (32%). These were followed by blood (18%), wound (9%), abscess and urine (both 4%), and skin (0%). The majority of all MRSA LabID Event specimens were collected from patient wards (46%), followed by outpatient locations (29%) and ICU/CCUs (26%). Twenty-one 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

<i>Table 3.</i> <i>C. difficile</i> Characteristics	January 1– March 31, 2011	Semi-Annual Cummulative Report October 2010– March 2011	April 1– June 30, 2011	July 1 – Sept. 30, 2011*
Frequency, Number				
<i>Hospitals with DUA</i> ¹	41	41	47	53
<i>Hospitals Reporting CDI LabID</i> ²	18	22	22	31
<i>Aggregated CDI LabID Events</i>	344	455	290	358
Onset, Number (%)				
<i>Healthcare Facility-Onset (HO)</i>	95 (28)	184 (40)	119 (41)	125 (35)
<i>Community-Onset Healthcare Facility-Assoc (CO-HA)</i>	77 (22)	92(20)	70 (24)	94 (26)
<i>Community-Onset (CO)</i>	172 (50)	179 (39)	101 (35)	139 (39)
Previous CDI, Number (%)				
<i>Previously positive</i>	52 (15)	Not Available	38 (13)	36 (10)
<i>CDI assay, recurrent</i>	40 (12)	Not Available	24 (8)	25 (7)
Surveillance Location, Number (%)				
<i>Intensive/Critical Care Unit</i>	58 (17)	116 (25)	54 (19)	77 (22)
<i>Specialty Care Area</i>	6 (2)	9 (2)	3 (1)	8 (2)
<i>Wards</i>	165 (48)	309 (68)	208 (72)	205 (57)
<i>Outpatient</i>	108 (31)	21 (5)	25 (9)	67 (19)
<i>Other</i>	7 (2)	-	-	1 (0)
¹ DUA: Data Use Agreement				
² LabID: Laboratory-Identified Event				
*Note: data for this table was pulled on February 1, 2012				

As shown in Table 3 (above), this quarter there were 358 reports of *C. difficile* identified by 31 hospitals which used the MDRO/CDI LabID Event option in their reporting plan. The NHSN definition for CDI LabID Event includes the first positive *C. difficile* test result without a prior positive in ≤ 2 weeks. As with MRSA LabID Events, CDI 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. CDI LabID Event data are considered proxy measures of exposure burden, and do not distinguish between patient colonization and infection.

One-hundred twenty-five, or 35%, of CDI LabID Events were considered healthcare-onset. Ninety-four (26%) were considered community-onset healthcare facility-associated (COHA), and 139 (39%) 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, 205 (57%) were reported from patient wards, 77 (22%) from ICU/CCU, 67 (19%) from outpatient locations, and 8 (2%) from a SCA. Ten percent of CDI LabID Events occurred in patients who had a prior CDI LabID Event entered in a previous month. In addition, 7% of LabID Events were recurrent CDI 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.

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 LabID ⁴	19	237	53,223	12,833	4.45	1.85
MRSA Infection ⁵	12	4	21,039		0.19	
C. diff ⁶ LabID	20	138	86,495	26,415	15.95	0.52
C. diff Infection	8	3	11,028		2.72	

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 decreased this quarter from in the second quarter of 2011, from 5.00 to 4.45 per 1,000 patient days. The *C. difficile* LabID Event rate decreased from 17.36 to 15.95 per 10,000 patient days. The MRSA infection surveillance rate decreased from 0.22 to 0.19 per 1,000 and the *C. difficile* infection surveillance rate decreased from 3.04 to 2.72 per 10,000 patient days. The Admission Prevalence Rates for MRSA and *C. difficile* LabID Events decreased from 2.11 to 1.85 per 100 patients admitted and from 0.57 to 0.52 per 100 patients admitted, respectively. However, none of these decreases were statistically significantly lower than the previous quarter rates.

Figures 1, 2, and 3 (below) detail the trends of the different MDRO module rates for the first three quarters of 2011.

Figure 1.

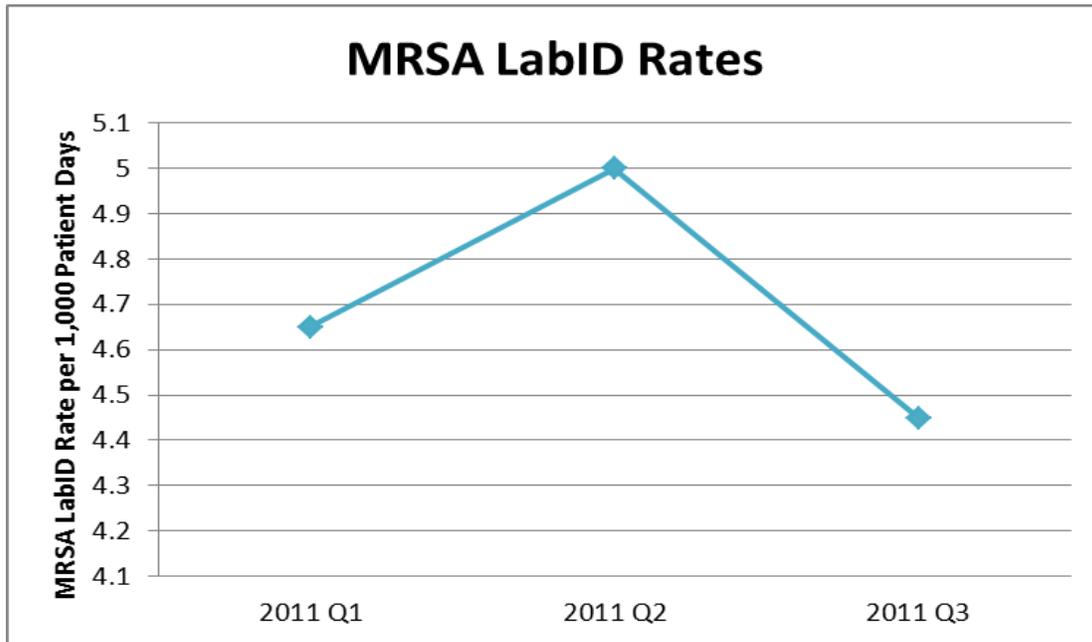


Figure 2.

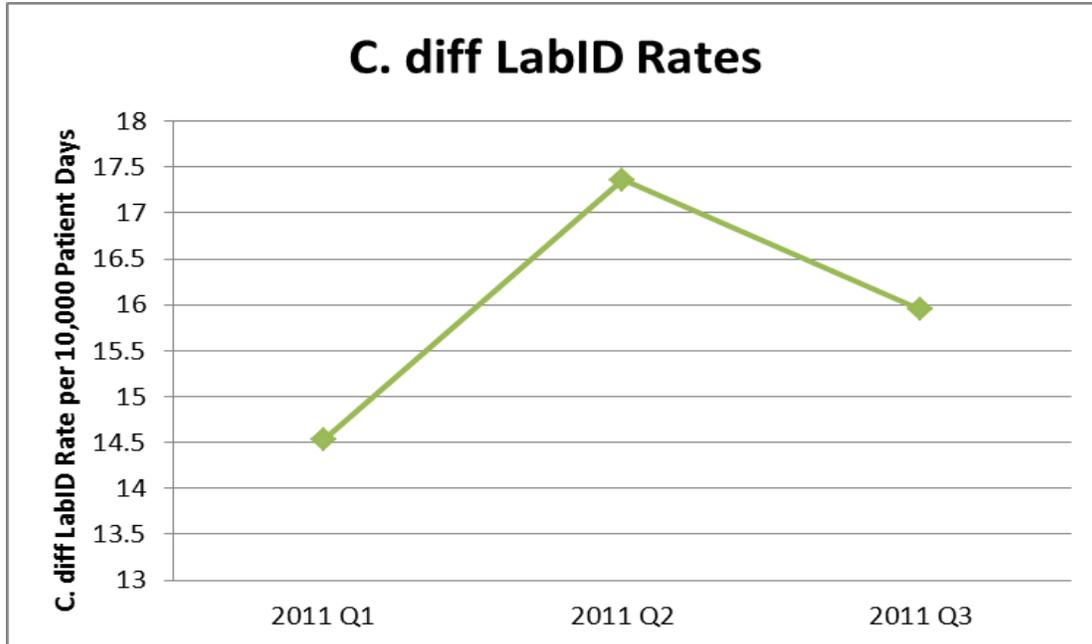


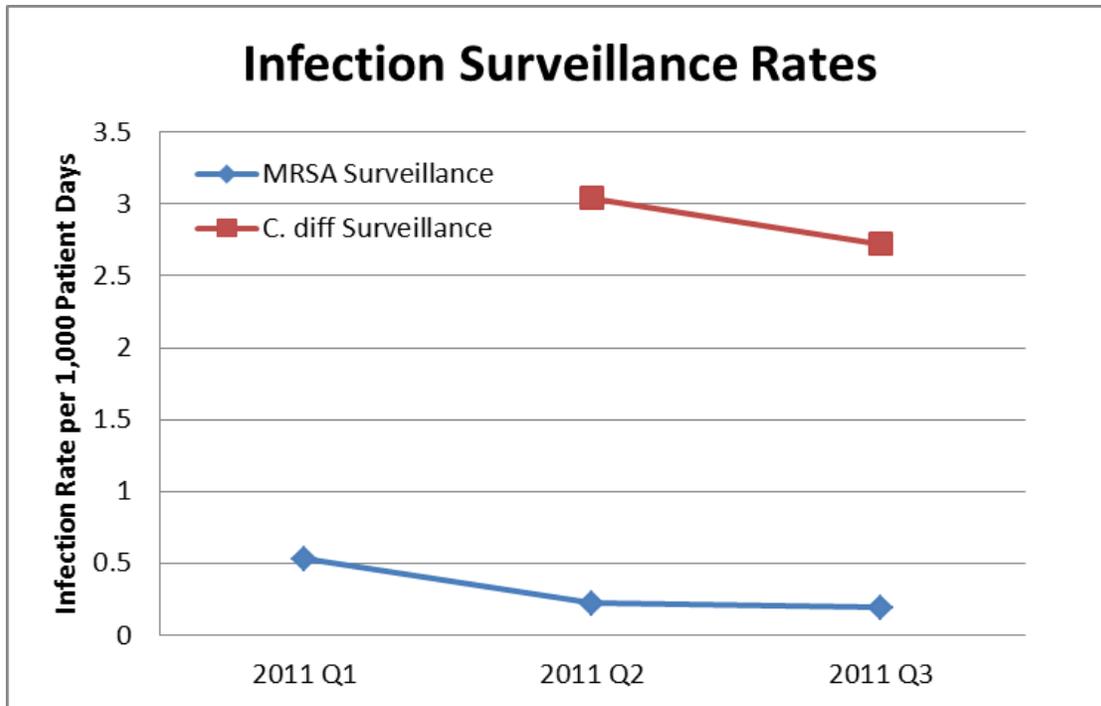
Figure 3**Device-Associated Summary Data**

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. Although nineteen facilities are participating in the Catheter-Associated Urinary Tract Infection (CAUTI) module, 21 shared data with MDCH SHARP. This is most likely a result of differing data pull dates. Forty-five of the 50 facilities utilizing the Central Line-Associated Blood Stream Infection (CLABSI) module provided data to the SHARP Unit, and 26 of 28 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	21	34	92,948	24,315	1.40	1.66	0.26	0.25
CLABSI ⁵	45	49	196,874	61,922	0.79	1.45	0.31	0.29
VAP ⁶	26	4	56,054	17,378	0.23	1.82	0.31	0.32

■ 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.

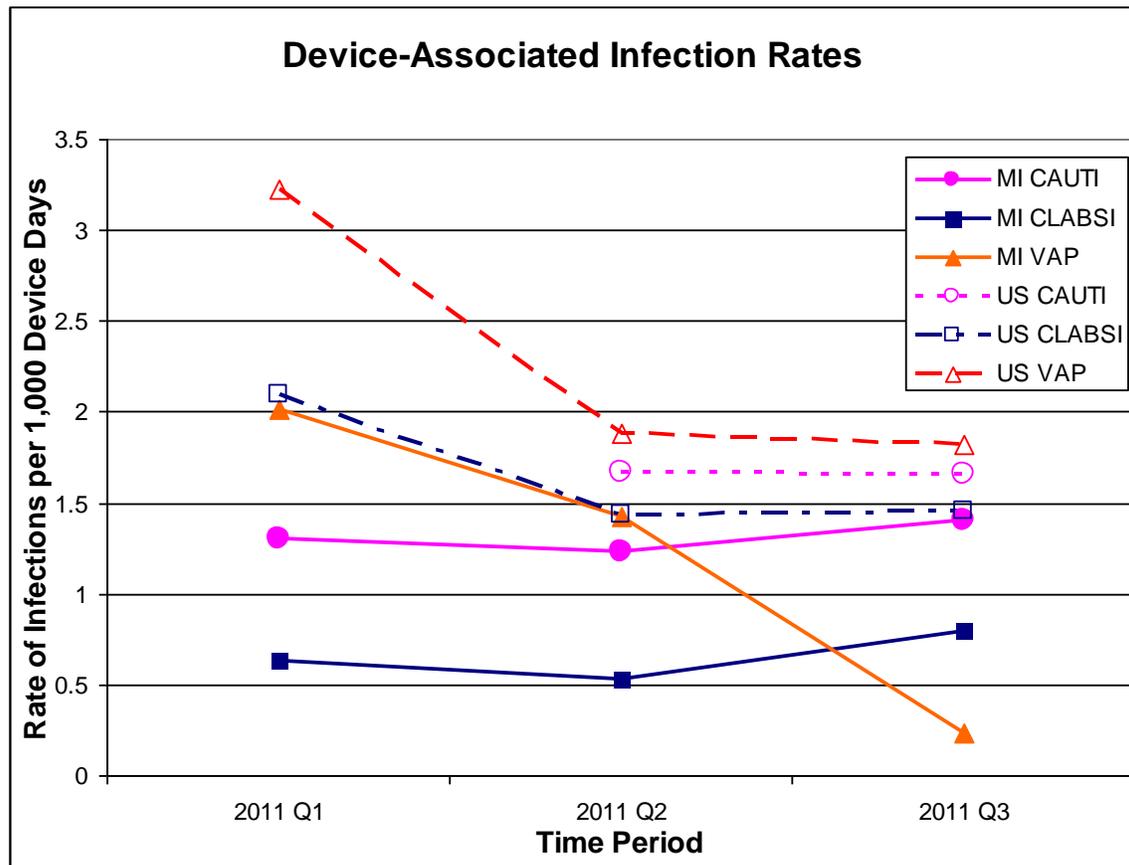
⁴CAUTI: Catheter-Associated Urinary Tract Infection

⁵CLABSI: Central Line-Associated Blood Stream Infection

⁶VAP: Ventilator-Associated Pneumonia

From the previous quarter to the present, CAUTI rates increased from 1.23 to 1.40 per 1,000 device days. CLABSI rates increased from 0.53 to 0.79 per 1,000 device days. However, neither of these increases was statistically significant. VAP rates had a statistically significant decrease from 1.42 to 0.23 per 1,000 device days. The Michigan DU ratio remained quite stable from the previous quarter to the present for the CLABSI and VAP modules, and decreased slightly for the CAUTI module.

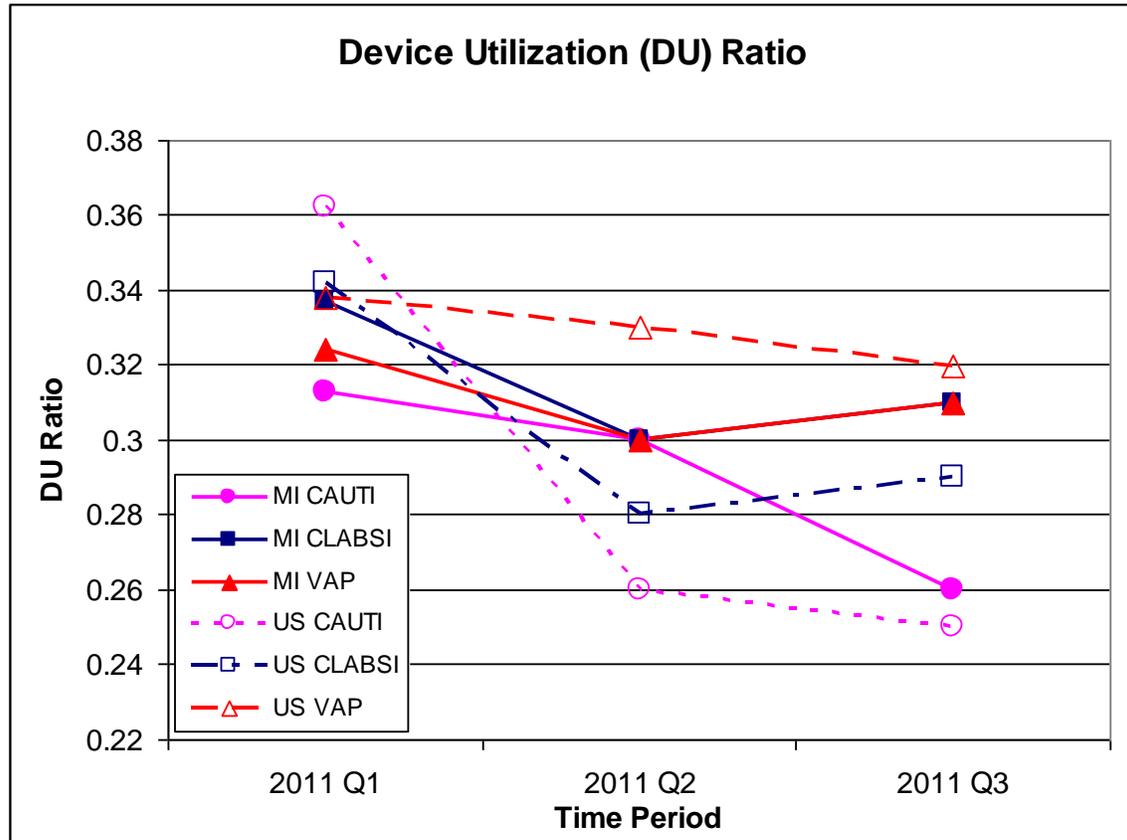
Figure 4 (below) displays the Michigan and U.S. Device-Associated Infection Rates for the three most recent quarters.

Figure 4.

As displayed in Figure 4, the Michigan infection rates tend to follow the same distribution as the National NHSN infection rates, except for VAPs, which decreased significantly in Michigan from the second to the third quarter of 2011. Michigan rates are all substantially lower than each of their US counterparts.

Figure 5 (below) displays the DU ratio for Michigan and the US for the three most recent quarters. The DU ratios for Michigan and the US have been comparable, particularly in the most recent quarter.

Figure 5.



Standardized Infection Ratios

Table 6 (below) provides information on the Standardized Infection Ratio (SIR) for CLABSIs and SSIs in the third 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 50 facilities participating in the CLABSI reporting module, 45 provided data to the SHARP Unit. Of the 19 facilities participating in the SSI reporting module, 18 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 0.42 indicates that Michigan had 58% fewer CLABSIs than expected. The SIR for SSIs demonstrates that Michigan had slightly more SSIs than expected (1%). However, this value was not significantly different than expected.

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	45	NA	48	115.24	0.42	(0.31, 0.55)
SSI ⁶	18	3,948	66	65.09	1.01	(0.78, 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

Figure 6 (below) displays a CLABSI SIR for each of the first three quarterly reports for 2011. 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. The number 1, or the null value, is indicated by the dashed line.

Figure 6.

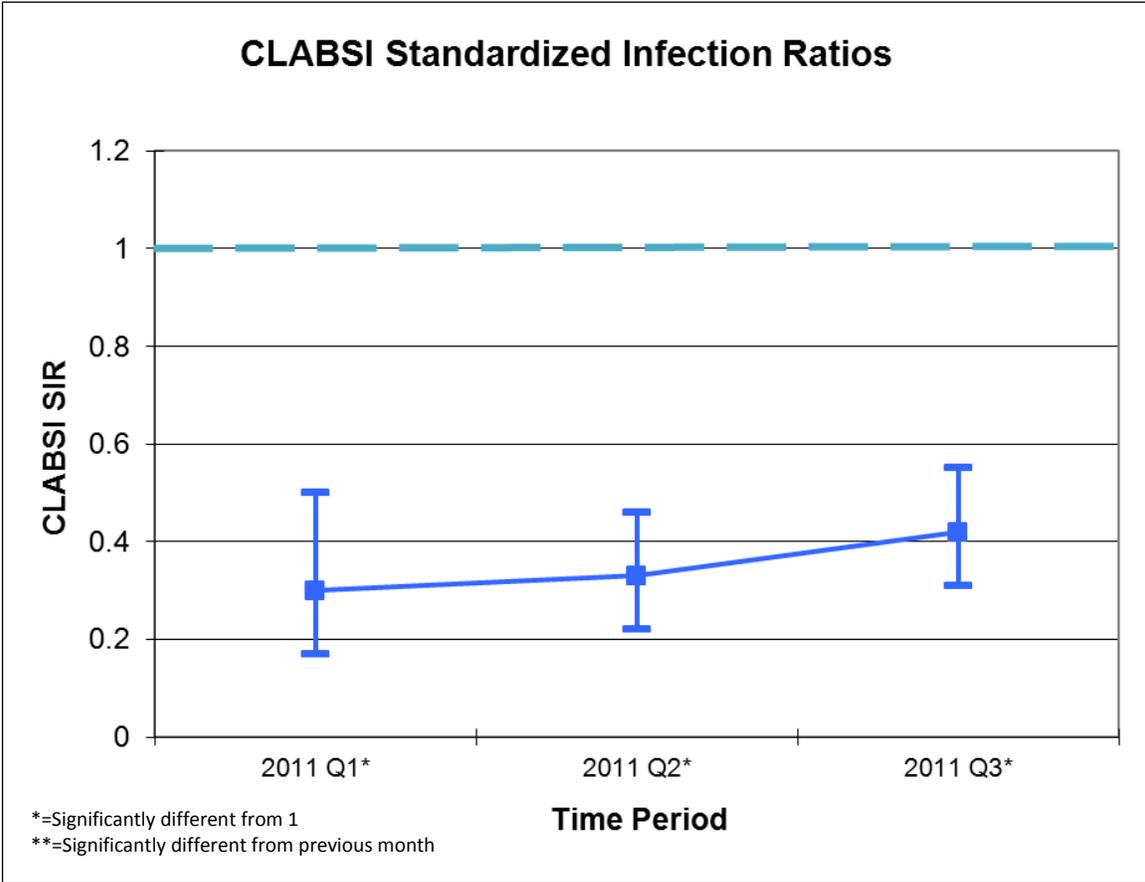
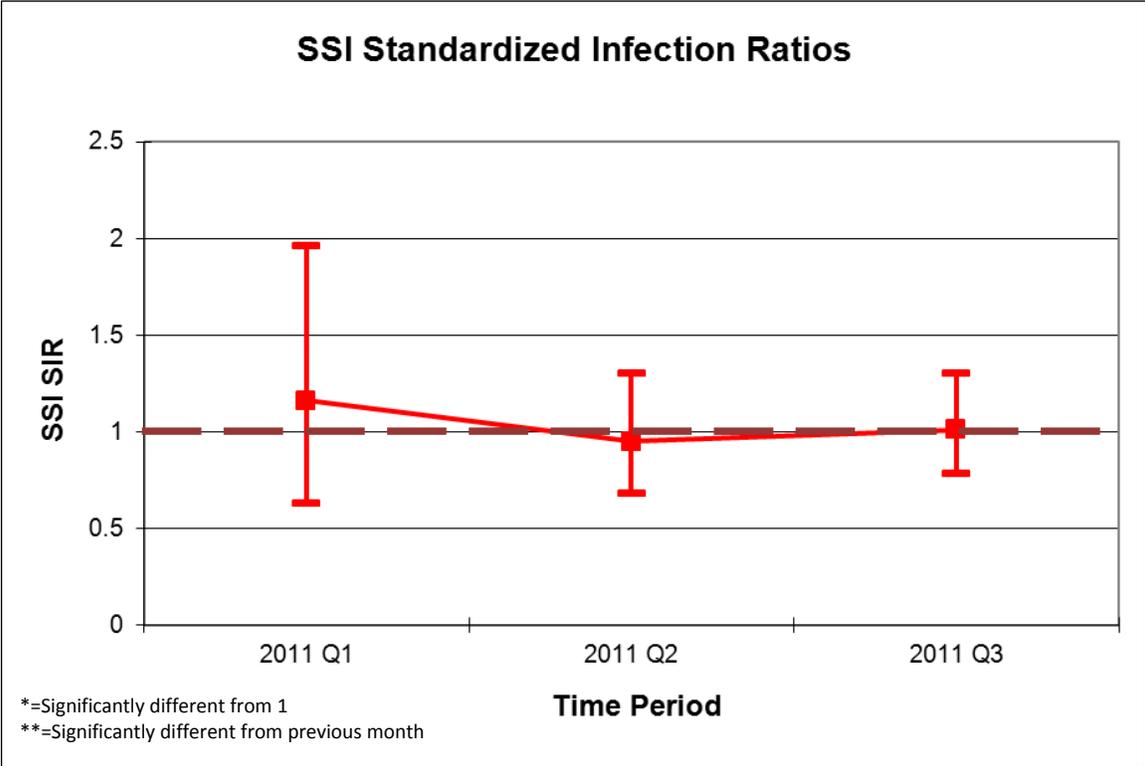


Figure 7 (below) displays the first SSI SIR graph that we have been able to produce. It includes data from each of the first three quarterly reports for 2011. This graph can be interpreted in the same fashion as figure 6. The null value of 1 is indicated by the dashed line.

Figure 7.



Conclusions

Aggregate MRSA and *C.difficile* LabID Events are much higher this quarter compared to the previous quarter. Due to the changed Conferred Rights Templates in the second quarter of 2011, it is likely that fewer LabID Events reports were shared than actually occurred. This was noted in previous reports, and has been corrected for the present report. The numbers presented in this report are more accurate because of the updated Conferred Rights Template, and because more facilities are providing data. It should be noted though that the percentages of most variables within these modules (such as community-onset (CO), and healthcare facility-onset (HO)) remained stable throughout the previous quarterly reports as well as the Semi-Annual Report.

All MDRO module rates decreased this quarter from the previous. This is a good sign that infection rates are going down. Although none of these decreased rates were statistically significant, any decrease in rates is noteworthy.

In the Device-Associated Module, both CAUTI and CLABSI rates increased slightly. However, these increases were not statistically significant. VAP rates have been steadily declining in each quarter of 2011. This quarter, the VAP rate was statistically significantly lower than in the second quarter of 2011.

Overall, this quarter saw a more moderate increase in participating hospitals than in the previous quarter. Even though fewer hospitals joined the MDCH SHARP Unit group to share data, the facilities that are participating have been participating in more modules and sharing more data than previously. As the trend of more facilities joining and current facilities sharing more data continues, the data will continue to become more representative and more analysis options will be able to be conducted.