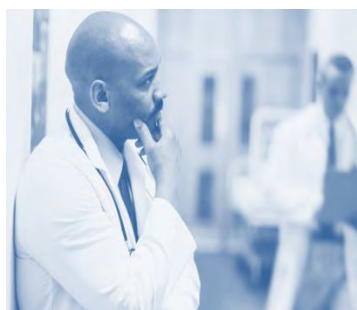


Missouri Nosocomial Infection Reporting Data:

Report to the Governor and General Assembly,
December 2015

Missouri Department of Health and Senior Services
AN EQUAL OPPORTUNITY/AFFIRMATIVE ACTION EMPLOYER
Peter Lyskowski, Acting Director



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2015 Report Overview

Background

In 2004, the Missouri legislature passed Senate Bill 1279, establishing the “Missouri Nosocomial Infection Reporting Act of 2004”. The law requires hospitals and ambulatory surgical centers (ASCs) to report specific categories of healthcare-associated infections (HAIs) to the Department of Health and Senior Services (DHSS). This report summarizes data for the January 1, 2014 - December 31, 2014 time frame for central line-associated bloodstream infections (CLABSIs) and surgical site infections (SSIs). Statewide rates from calendar year 2011 were used throughout the report as a baseline for comparison. All significance tests were run at 95% confidence levels.

Data Collection

CLABSIs are reported by hospitals for the six intensive care unit (ICU) types listed to the right. SSIs are reported by facility, instead of ICU type. Hospitals report SSIs associated with abdominal hysterectomy, hip repair, and coronary artery bypass graft surgery. ASCs report SSIs associated with hernia repair and breast surgery.

Reporting Hospital ICUs

- Coronary
- Surgical
- Medical/Surgical
- Medical
- Pediatric
- Neonatal

Reporting to the Public

The DHSS has developed a public website to report healthcare-associated infection rates to the public. The site provides the most current four quarters of data for viewing. At the time this report was prepared, SSI and CLABSI data for January 1, 2014 - December 31, 2014 were available on that website (http://health.mo.gov/data/hai/drive_noso.php). Historical data is housed at a separate web address (<https://mhirs.dhss.mo.gov/haihistory/default.aspx>) and shows data for calendar years 2006-2012.





Data Summary

Hospitals submit central line data for each ICU that meets DHSS reporting requirements. In all, 96 ICUs from 60 hospitals reported CLABSI data for calendar year 2014. Statewide infection rates for CLABSI were lowest in the surgical ICUs (0.4/1,000 central line-days). Three ICU types (coronary, medical, and pediatric) were tied for the highest statewide CLABSI rate for calendar year 2014, with a value of 0.9/1,000 central line-days.

Fifty-one hospitals and 19 ASCs reported SSI data during the same time period. The lowest SSI rate for hospitals overall was abdominal hysterectomies (1.01/100 surgeries). The highest SSI rate for hospitals was coronary artery bypass graft surgery (1.77/100). Very low SSI rates were reported by ASCs for both hernia repair and breast surgery.

Statewide CLABSI Rates by ICU Type

Coronary	0.9 per 1,000
Surgical	0.4 per 1,000
Med/Surg	0.6 per 1,000
Medical	0.9 per 1,000
Pediatric	0.9 per 1,000
Neonatal	0.7 per 1,000

Statewide SSI Rates for Hospitals

Abdominal Hysterectomy	1.01 per 100
Hip Repair	1.19 per 100
Coronary Artery Bypass Graft Surgery	1.77 per 100

Statewide SSI Rates for ASCs

Hernia Repair	0.13 per 100
Breast Surgery	0.22 per 100

Cautions

Infection rates are affected by a facility's level of resources and commitment to infection control, the severity of the illnesses treated, and the care with which it collects and reports data. A consumer who is choosing a facility for healthcare should consider the advice of their physician, the experience of facility staff, and all the other factors that are unique to his or her situation, in addition to the infection data reported on the DHSS website.

"...patients who were older, had been in the hospital longer at the time of the survey, were in a large hospital, had a central catheter in place, were receiving mechanical ventilator support, or were in a critical care unit had an increased risk of healthcare-associated infection." -Magill, S.S., et al.



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B *Background*

Healthcare-associated infections (HAIs), also known as nosocomial infections, are infections that occur while patients are in a healthcare setting. Because of the seriousness of their conditions, patients treated in intensive care units (ICUs) have an especially high risk of HAIs. HAIs can severely aggravate an illness, lengthen hospital stays, and spread to other individuals. HAIs continue to be a major public health problem in the United States and worldwide. “Guidance on Public Reporting of Healthcare-Associated Infections...” published by the Healthcare Infection Control Practices Advisory Committee (HICPAC) in 2005², reported that in hospitals alone, HAIs accounted for an estimated 2 million infections, 90,000 deaths, and \$4.5 billion in excess healthcare costs annually. A 2010 study reported that adverse events cost Medicare an estimated \$324 million in October 2008.³ Roughly 1 in every 25 U.S. hospital patients will acquire at least one healthcare-associated infection.¹

D *Data Collection*

Procedures and HAIs are reported to the DHSS according to 19 CSR 10-33.050, which became effective July 30, 2005. The reporting rule was promulgated under the authority of the revised statute that mandates data reporting by hospitals and ambulatory surgery centers (ASCs) (Section 192.667, RSMo). The data that are collected follow the recommendations of the infection control advisory panel established by law. The makeup of this panel, also stipulated by law, includes a statistician, a microbiologist, and representatives of consumers, physicians, infection control professionals, and regulators.

Those infections and procedures of a more serious nature and those that occur in a variety of hospitals and ASCs were considered for mandatory reporting. Hospitals and ASCs differ in what they report. Hospitals are required to report central line-associated bloodstream infections (CLABSIs) and surgical site infections (SSIs). The SSIs reported are those associated with procedures for abdominal hysterectomy, hip repair, and coronary artery bypass surgery. ASCs report only SSI data, and are limited to reporting infections associated with procedures for hernia repair and breast surgery. To provide denominators for the infection rates, hospitals and ASCs report every surgery performed in these selected procedure categories, whether or not the surgery resulted in an infection. Because patients in intensive care units are particularly at risk for HAIs, hospital reporting of CLABSIs is done for six specific intensive care units: medical, surgical, medical/surgical, coronary, neonatal, and pediatric. SSIs are reported by facility rather than by ICU type.

To ensure that the data being collected are reliable, the DHSS established reporting requirements for facilities. Following the lead of the Centers for Disease Control and Prevention (CDC), DHSS required that only the hospital ICUs that had at least 50 central line-days in the prior year must report during the current year. Both hospitals and ASCs must report SSIs if they performed at least 20 of the specified surgeries in the prior year. Reporting is done through the Missouri Healthcare-Associated Reporting System (MHIRS), a web-based system developed by DHSS staff and the Information Technology Support Division of the Office of Administration. MHIRS allows facilities to enter HAI data directly into a DHSS database.

Registration for reporting by hospitals and ASCs occurs annually. Facilities report the number of central line-days per ICU, the number of relevant surgeries, and the number of ventilator patients that they had during the previous year. This information determines which facilities will be required to report the selected indicators to the DHSS.



National Health Safety Network (NHSN)

In 2012, the Center for Medicare and Medicaid Services (CMS) began requiring that all critical access hospitals submit certain reports to them through NHSN, a national HAI tracking system maintained by the Centers for Disease Control and Prevention. Beginning in September 2012, DHSS developed a way to download infection data for facilities which participate in the CMS program and submit data to NHSN. DHSS developed a method by which department staff could query the NHSN system and download that data for inclusion in the MHIRS data tables for the quarterly public reports. This option allows facilities to only report infection data once instead of reporting separately to both NHSN and DHSS. The NHSN data downloaded into MHIRS include information for both CLABSIs and SSIs.

Reporting to the Public

Figure 1 shows the main page of the public reporting site. This page introduces users to the site with a brief overview of the data collected and links to features useful to those researching HAIs in Missouri. From this main page a user can query infection reporting data by region, look at grouped comparisons of facilities, or view a facility profile. Additional information, such as definitions, frequently asked questions, and links to manuals, laws, and regulations associated with infection reporting in Missouri are also accessible from this main page.

Figure 1. Missouri Healthcare-Associated Infection Reporting

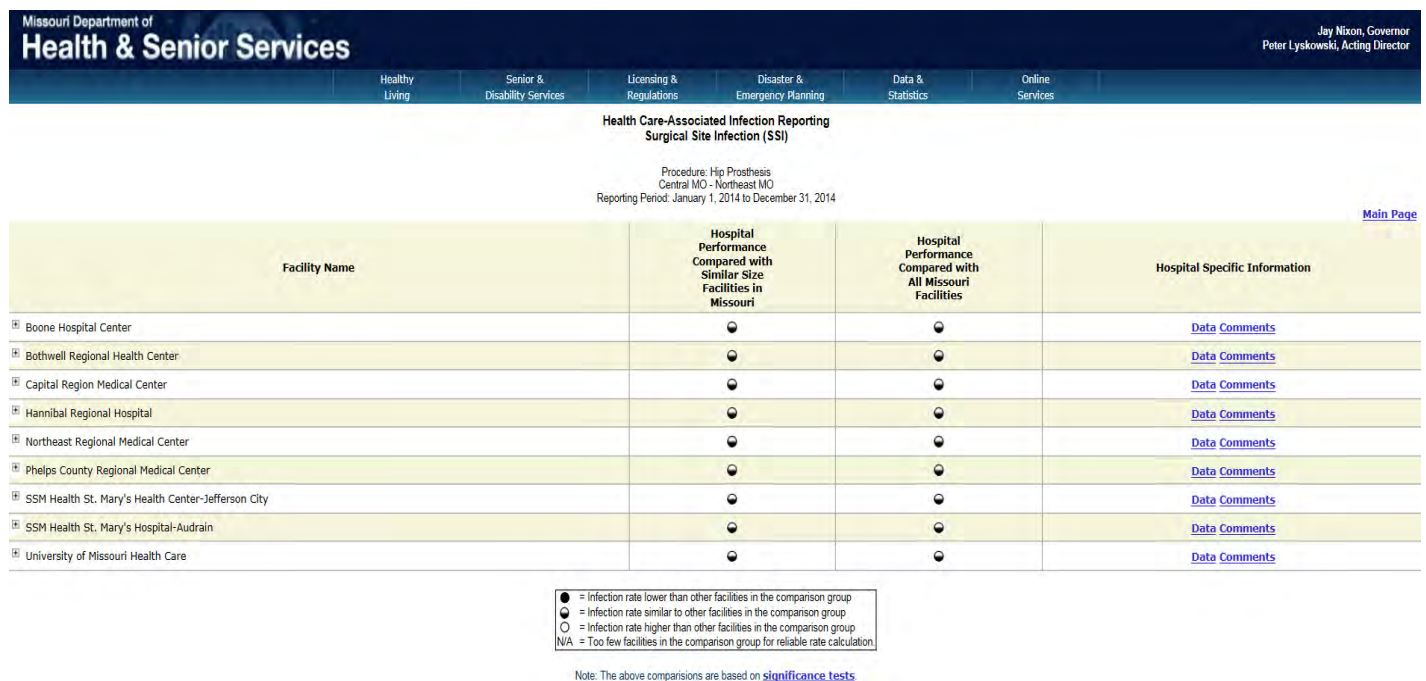
The screenshot shows the homepage of the Missouri Healthcare-Associated Infection Reporting website. At the top, the Missouri Department of Health & Senior Services logo is on the left, and the names of Governor Jay Nixon and Acting Director Peter Lyskowski are on the right. A search bar is located in the top right corner. Below the header is a navigation menu with categories: Healthy Living, Senior & Disability Services, Licensing & Regulations, Disaster & Emergency Planning, Data & Statistics, and Online Services. The main content area is titled "Missouri Health Care-Associated Infection Reporting" and includes a breadcrumb trail: Home » Data, Surveillance Systems & Statistical Reports » Missouri Health Care-Associated Infection Reporting. There are two columns of links: one for "Infection Reporting Data (Search Here)", "Instructions for Using this Site", "About HAI Infections", "Definition of Terms", and "Frequently Asked Questions"; the other for "Laws, Regulations & Manuals", "Reports", "Information for Providers", "MRSA", and "Related Links". A central video player is titled "Stopping Infections Begins with the Hands" and shows a "Wash 'Em - Hand Hygiene Music Video". To the right of the video is a "Data & Statistics" sidebar with links to Profiles, MICA, Priorities MICA, Community Health Improvement Resources (CHIR), Intervention MICA, Births, Deaths, Patient Abstract System (PAS), Behavioral Risk Factor Surveillance System (BRFSS), County-Level Study (CLS), Healthcare-Associated Infection Reporting (HAI), and ESSENCE. Below the sidebar is a "Related Links" section with links to Cancer Registry, Communicable Disease Reporting & Surveillance, and Environmental Public Health Tracking. At the bottom right, the "Bureau of Health Care Analysis & Data Dissemination" is identified as part of the Missouri Department of Health and Senior Services.



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Figure 2 shows the type of data that is available to users wishing to compare infection data of facilities within the same region. Significance tests, based on 95% confidence intervals, determine whether a facility has infection rates that are significantly higher, significantly lower, or not significantly different than other facilities of similar size (categories include under 100 staffed beds, 100-299 staffed beds, and 300+ staffed beds). The same tests are run to compare individual facilities to statewide infection rates. Users can view more specific data, including HAI counts and rates, for each facility and unedited comments submitted by facility administrators by clicking on the hyperlinks included on this page.

Figure 2. Hip Prosthesis Comparison, Central Region



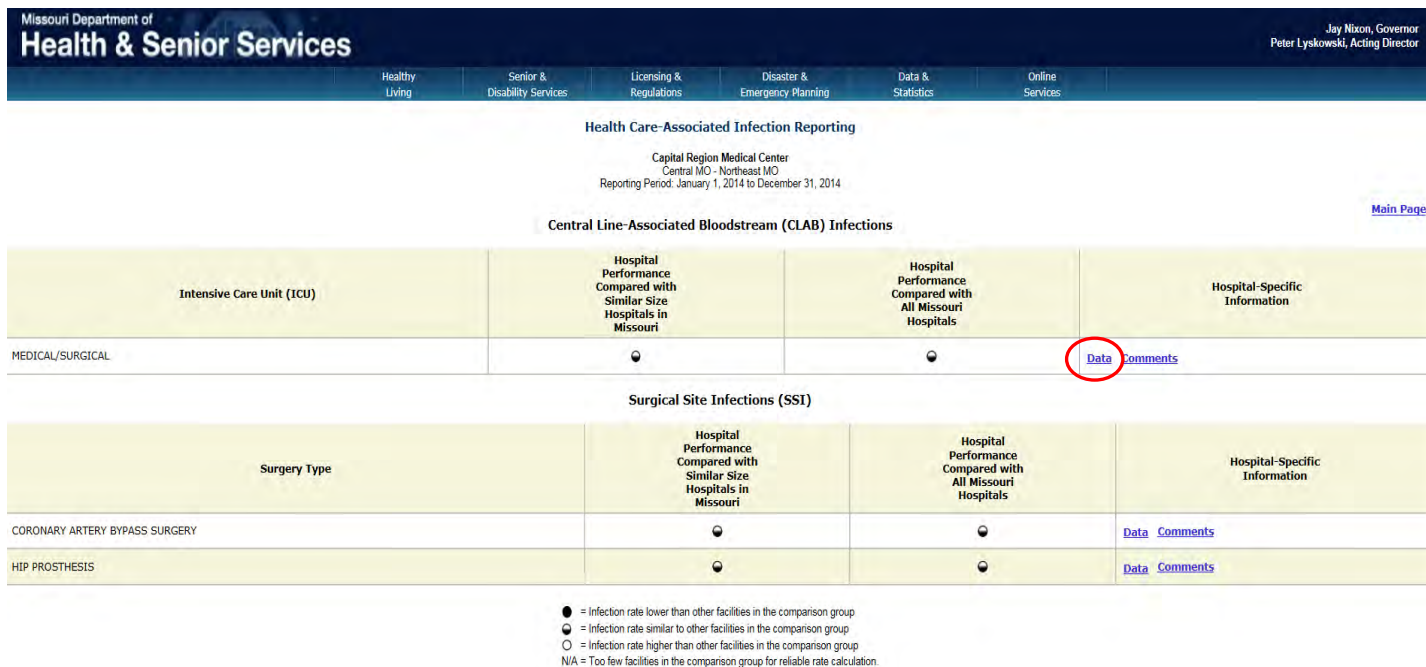
Users also have the option to view a facility profile. As shown in Figure 3, this allows users to view CLABSI and SSI data determined by annual reporting requirements. If users choose an ASC Profile they can view data for each procedure type that the facility is required to report.

“Poor outcomes among patients with nosocomial infections have been linked to higher rates of polymicrobial/multiple sites of infection, higher APACHE II scores, acute respiratory distress syndrome, and co-illnesses.” -Dabar, G., et al.



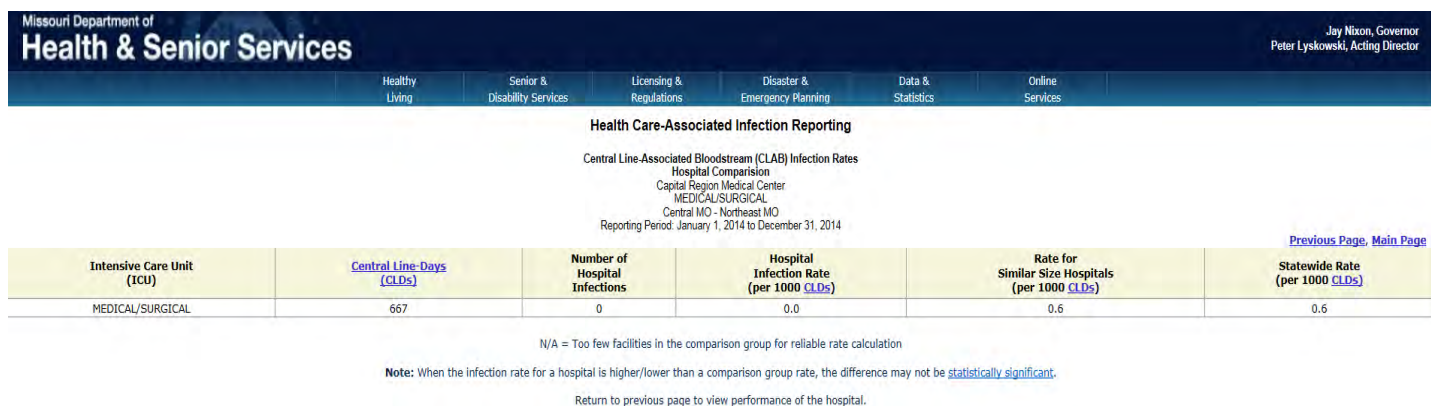
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Figure 3. Capital Region Medical Center Hospital Profile



The Profiles page displays significance columns for two comparison groups. Clicking on the ‘Data’ hyperlink (circled in red above) allows users to view the specific number of infections, denominator data (total central line-days or total procedures), and infection rate for the defined reporting period (as shown in Figure 4).

Figure 4. CLABSI Rates for Medical/Surgical ICU, Capital Region Medical Center



“...trauma patients with sepsis had a 6-fold higher risk of mortality, whereas patients with other HAIs had a nearly 1.5-2-fold higher mortality compared with patients without an HAI. Furthermore, patients with HAIs had...inpatient costs that were approximately 2-fold higher than patients without HAIs.”⁵ -Glance, L. G., et al.



Data Summary

Central Line-Associated Bloodstream Infections (CLABSIs)

Some hospitals have only one or two ICUs required to report to the DHSS, while some may have all six ICU types. As such, the total number of reporting ICUs exceeds the total number of hospitals that report. A total of 96 ICUs from 60 hospitals reported CLABSI data for the January 1, 2014 - December 31, 2014 time period. A total of 132 HAIs were reported from an aggregate 191,816 central line-days (CLDs).

Figure 5 shows the number of ICUs reporting to MHIRS in 2014 by type. The medical/surgical ICU type has three times as many facilities reporting as the next largest ICU type.

Figure 5. 2014 CLABSI Reporting

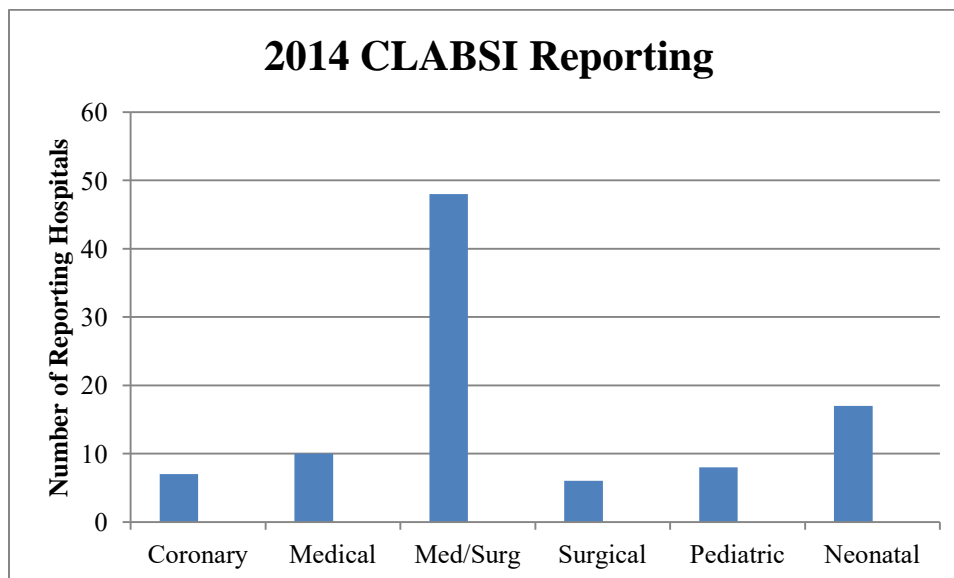


Figure 6 compares CLABSI rates for 2014 and the 2011 baseline year. The percentage differences between the 2014 rate and the baseline ranged from no change (0%) for coronary ICUs to a sharp decline in CLABSI rates for pediatric ICUs (-72%). Overall, the 2014 infection rate for each of the 6 ICU types was either identical or lower than the Missouri baseline rate. The baseline rate was established using values from 2011. The pediatric ICU type was statistically significantly lower than the Missouri baseline and no ICU type was significantly high.



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Figure 6. 2014 CLABSI Comparison to Missouri Baseline

Missouri Central Line-Associated Bloodstream Infections (CLABSIs)			
ICU Type	Missouri Baseline Rate	2014 Infection Rate	Percentage Difference
Coronary	0.9	0.9	↔ 0%
Medical	1.3	0.9	↓ -31%
Medical/Surgical	0.7	0.6	↓ -14%
Surgical	0.6	0.4	↓ -33%
Pediatric	3.2	0.9*	↓ -72%
Neonatal	1.1	0.7	↓ -36%

Rates are reported per 1,000 central line-days.
* indicates a rate statistically significantly different from the baseline

Figures 7 and 8 reflect CLABSI rates for ICUs that primarily serve adults and children, respectively. Figure 7 displays infection rates for the last four years for coronary, medical, medical/surgical and surgical ICUs. The medical/surgical ICU CLABSI rate spiked to a rate of 2.5/1,000 CLDs in 2012 but the rate has since dropped back to levels near the 2011 baseline in years 2013 and 2014. Coronary ICUs had an extremely low rate of 0.3/1,000 CLDs in 2013 but then returned to the 2011 baseline rate of 0.9/1,000 in 2014. Surgical ICUs and medical ICUs both have seen gradual declines from 2011 through 2014. Figure 8 presents CLABSI rates for pediatric and neonatal ICUs. The pediatric ICU rate has declined precipitously from 3.2/1,000 CLDs in 2011 to 0.9/1,000 CLDs in 2014. This rate change was statistically significant. CLABSI rates for neonatal ICUs declined for the second straight year and remain slightly lower than for pediatric ICUs.

Figure 7. Missouri CLABSI Rates, 2011-2014

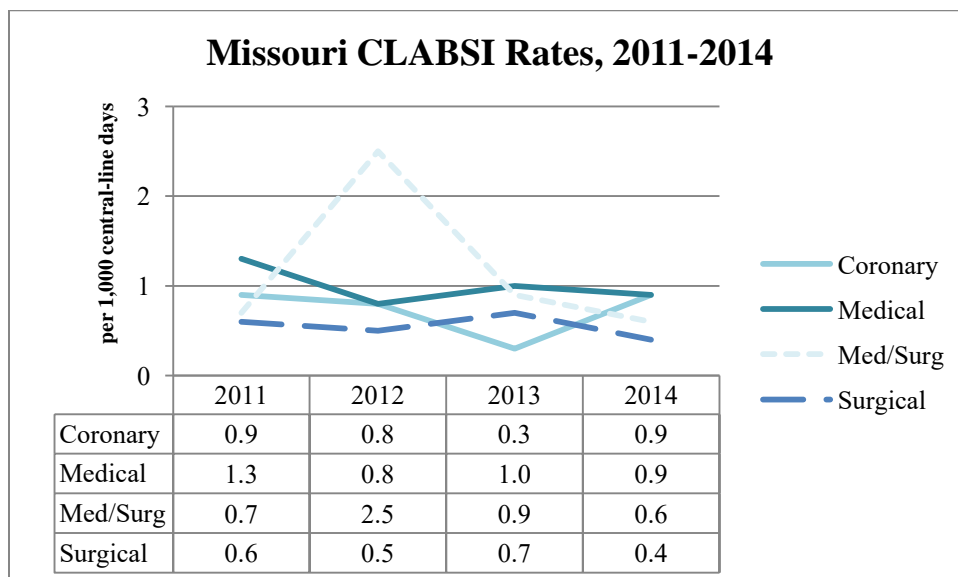




Figure 8. Missouri Child CLABSI Rates, 2011-2014

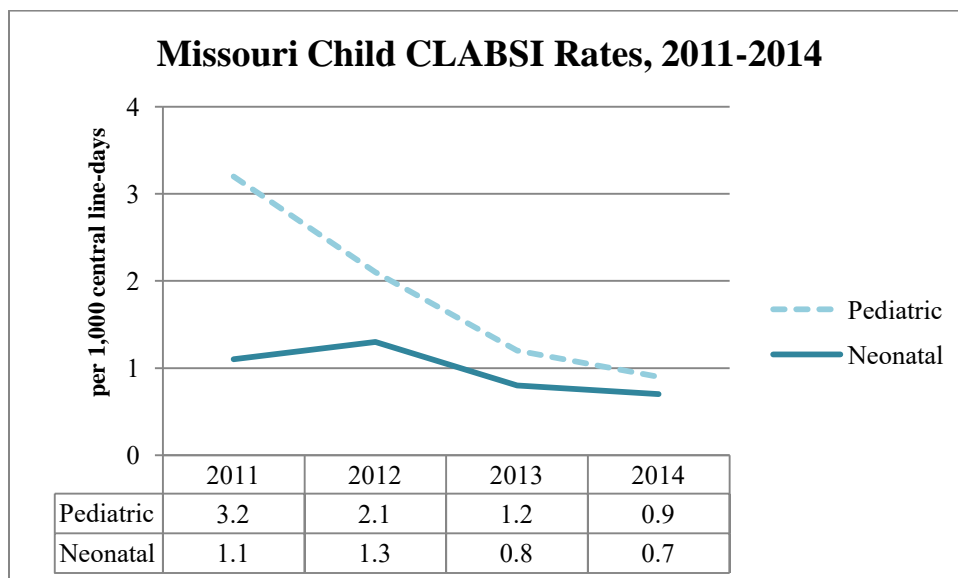


Figure 9 shows the total number of central line-days by ICU type. Medical/surgical ICUs had the highest total frequency (75,289 days), which was nearly double the second highest total, for neonatal ICUs (39,701 days). Coronary ICUs had the lowest total number of days at 11,554. Figure 10 shows the breakdown of the 132 CLABSIs by ICU type. The largest percentage (35%) came from medical/surgical ICUs. This is to be expected due to the fact that this ICU type also reported the largest number of central line-days. Neonatal ICUs had the second highest percentage of infections, at 20%. Surgical ICUs had the lowest total infections. Correspondingly, as Figure 6 displayed, the surgical ICU had the lowest ICU CLABSI rate.



Figure 9. 2014 CLDs by ICU Type

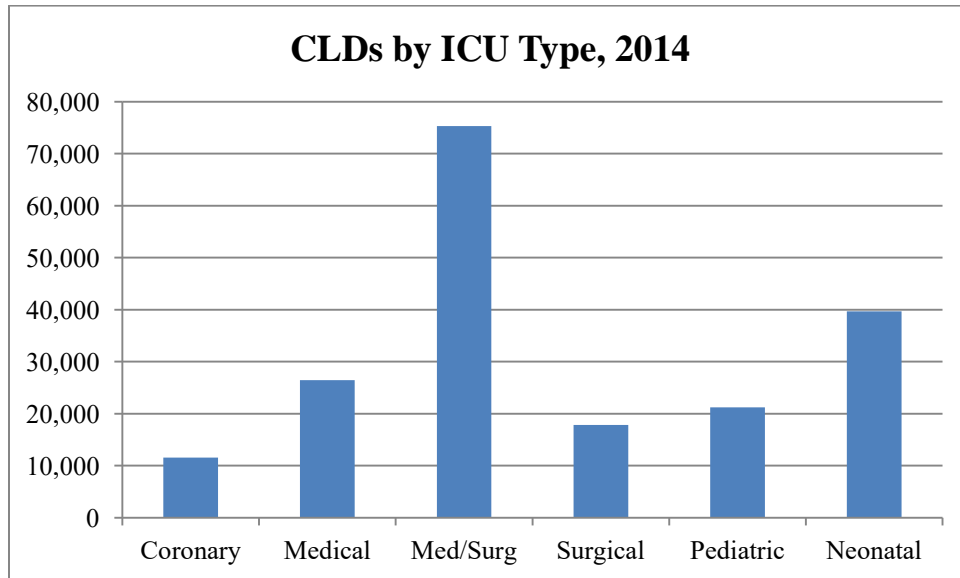
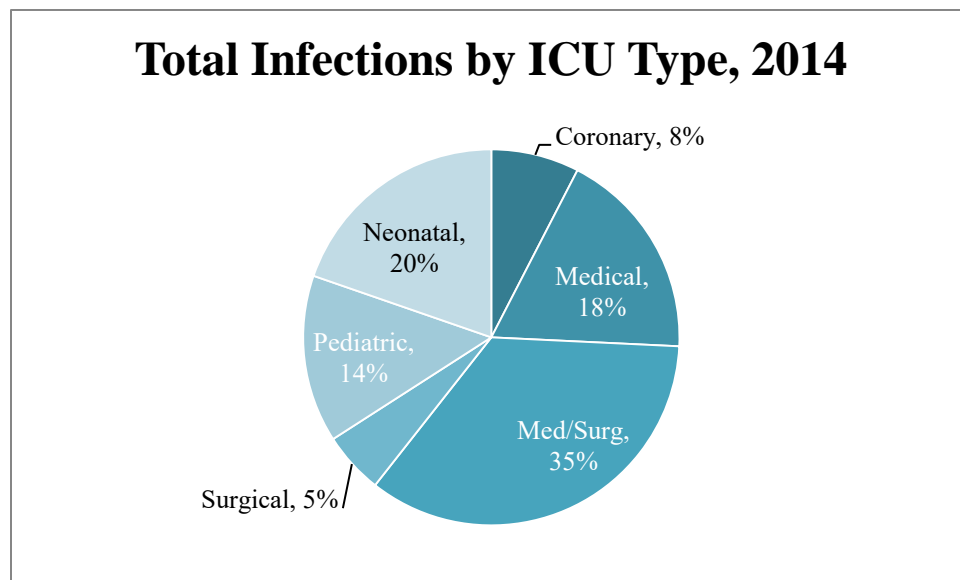


Figure 10. 2014 Total Infections by ICU Type, 2014



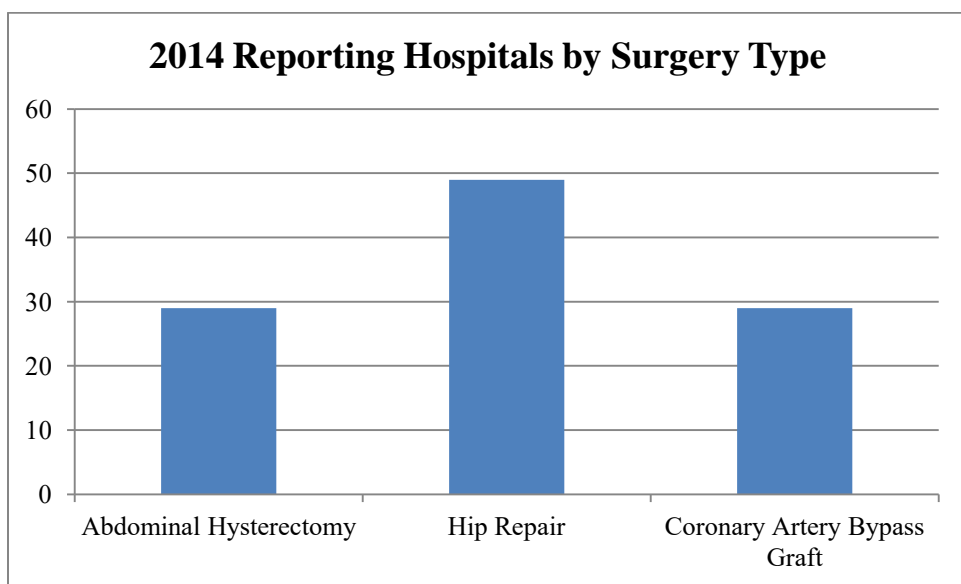
“The risk of CLABSI in ICU patients is high. Reasons for this include the frequent insertion of multiple catheters, the use of specific types of catheters that are almost exclusively inserted in ICU patients and associated with substantial risk (eg, arterial catheters), and the fact that catheters are frequently placed in emergency circumstances, repeatedly accessed each day, and often needed for extended periods.”⁶ –Marshall, J., et al.



Surgical Site Infections (SSIs)

The SSIs reported by hospitals are those associated with procedures for abdominal hysterectomy, hip repair and coronary artery bypass surgery (with both chest and donor site incisions). Ambulatory surgery centers (ASCs) report only SSI data, and are limited to reporting infections associated with procedures for hernia repair and breast surgery. To provide denominators for the infection rates, hospitals and ASCs report every one of the selected procedures regardless of whether the procedure results in an infection. Both hospitals and ASCs must report SSIs if they performed at least 20 of the specified surgeries in the prior year. All data reported in this section comes from records submitted for the 2014 calendar year.

Figure 11. 2014 Reporting Hospitals by Surgery Type



Hospital SSI reporting by the numbers:

- 51/130 Missouri acute care hospitals met SSI reporting requirements.
- 29 report on abdominal hysterectomies.
- 49 report hip repair procedures.
- 29 report coronary artery bypass surgeries.

Figure 12. 2014 SSI Comparison to Missouri Baseline (Hospitals)

2014 SSI Comparison to Missouri Baseline (Hospitals)				
Surgery Type	Missouri Baseline Rate	2014 Infection Rate		
Abdominal Hysterectomy	1.21	1.01		-17%
Hip Repair	1.49	1.19		-20%
Coronary Artery Bypass Graft	1.83	1.77		-3%

Rates are reported per 100 procedures and are adjusted based on risk group.



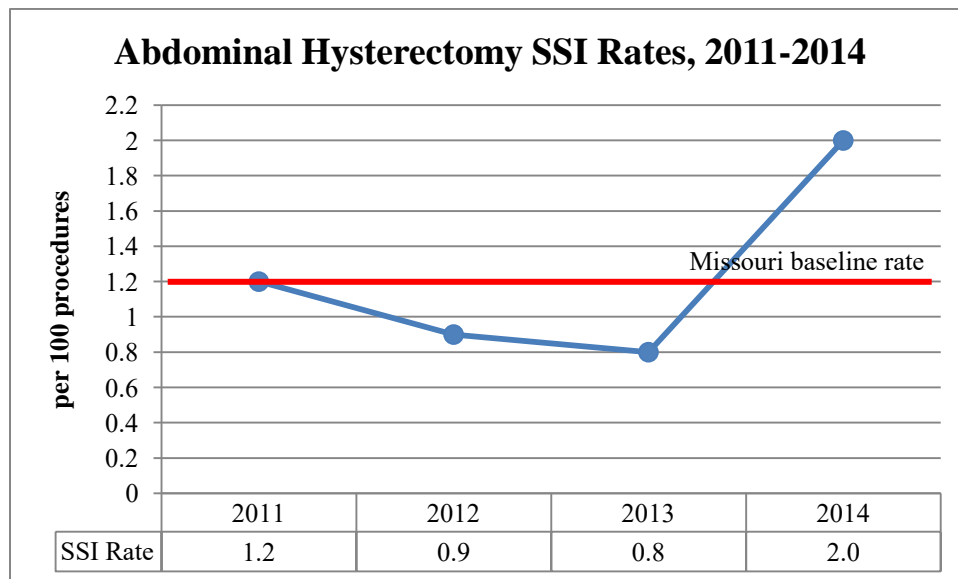
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Each procedure type featured infection rate decreases compared to the Missouri baseline, ranging from -3% difference (coronary artery bypass graft surgeries) to a 20% infection rate decrease for hip repairs. However, none of the three procedures had rates that were statistically significantly different from the Missouri baseline (Figure 12).

When comparing individual hospital infection rates to overall state HAI rates for abdominal hysterectomies, two hospitals had an infection rate that was significantly lower than the 2014 overall state rate (1.01/100 surgeries). In contrast, only one hospital had a statistically significantly high infection rate for this surgery type.

The Missouri baseline infection rate for abdominal hysterectomy procedures was 1.21 (per 100 procedures). Statewide rates for 2014 were 17% lower than this baseline figure. However, the infection rate did increase from calendar year 2013 (Figure 13).

Figure 13. Abdominal Hysterectomy SSI Rates, 2011-2014

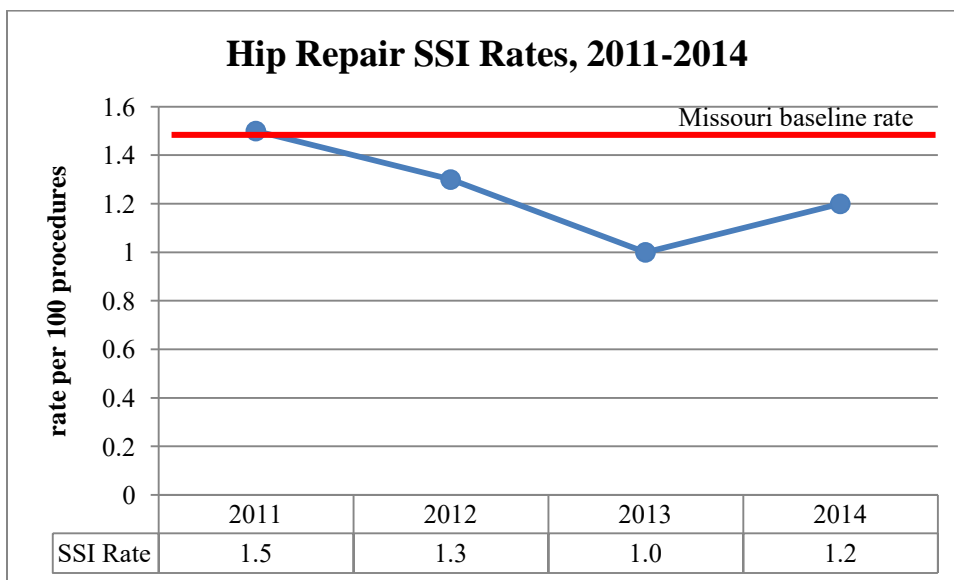


Four hospitals had an infection rate that was significantly higher than the 2014 overall state rate (1.19/100 surgeries) for hip repair, or hip prosthesis, surgeries. One hospital had a statistically significantly low infection rate for hip repair.

Hip repair procedures generated a Missouri baseline infection rate of 1.49 (per 100 procedures). Statewide rates, for calendar year 2014, were 20% lower than this baseline figure, though the difference was not significant. Like abdominal hysterectomies, rates increased slightly in 2014 after declining steadily over 2011-2013 (Figure 14).



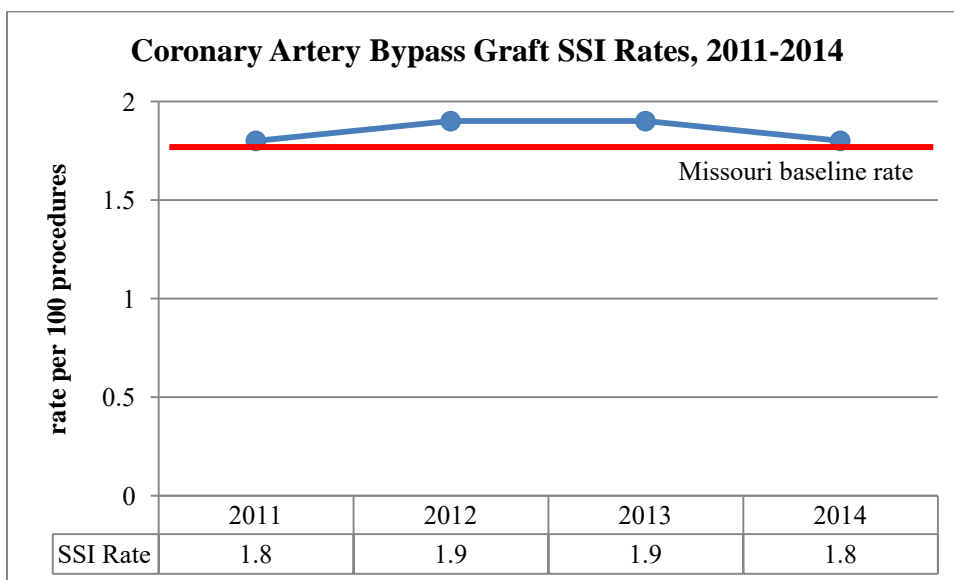
Figure 14. Hip Repair SSI Rates, 2011-2014



When comparing CBGB hospital rates to overall CBGB state rates, one hospital had an infection rate that was significantly lower than the 2014 overall state rate (1.77/100 surgeries) for CBGB and one hospital had a statistically significantly high infection rate.

The Missouri baseline infection rate for CBGB was 1.83 (per 100 procedures). Statewide rates for 2014 were slightly lower than the baseline figure (-3%). Rates for this surgery type have remained steady in Missouri over the past four years, with a slight decrease from 2013 to 2014 (Figure 15).

Figure 15. Coronary Artery Bypass Graft SSI Rates, 2011-2014





Infection rates for ASCs are usually lower than hospitals. ASCs tend to perform less serious surgeries and have generally healthier patient populations than inpatient facilities.⁷ The relatively brief stays in the ambulatory setting reduces a patient’s risk for infection; it also lessens the possibility of detecting post-surgical infections. A typical patient does not stay very long in an ASC (less than 24 hours) so an infection may not be discovered until days after the surgery. In this situation, the patient is more likely to seek care in an emergency room or a physician’s office, and the ASC may never become aware of the infection.

Ambulatory Surgical Center SSI reporting by the numbers:

- 18/108 operating Missouri ASCs met SSI reporting requirements.
- 12 report hernia repair procedures.
- 9 report on breast surgeries.

Figure 16. 2014 Reporting ASCs by Surgery Type

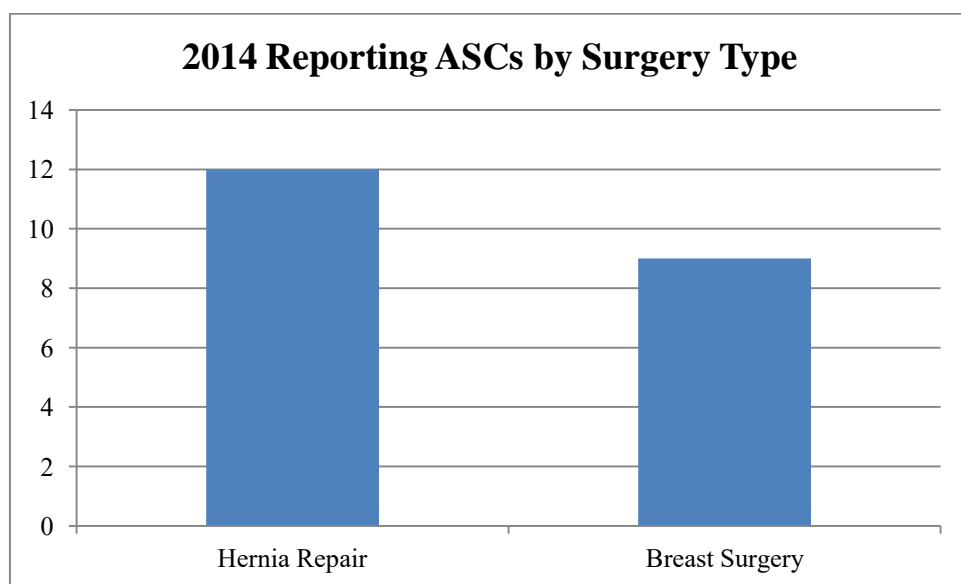


Figure 17. 2014 SSI Comparison to Missouri Baseline (ASCs)

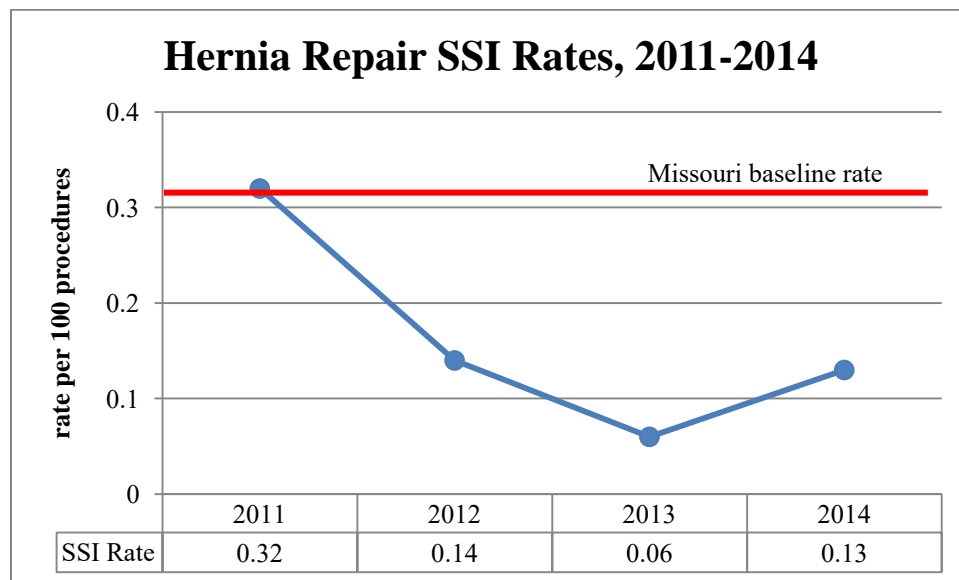
2014 SSI Comparison to Missouri Baseline (ASCs)				
Surgery	Missouri Baseline Rate	2014 Infection Rate		
Hernia Repair	0.32	0.13		-59%
Breast Surgery	0.18	0.22		+22%

Rates are reported per 100 procedures and are adjusted based on risk group.



The hernia repair infection rate was 0.13 (per 100 procedures) in 2014. This represented a 59% decrease compared to the baseline rate of 0.32. However, the 2014 rate did increase from the record low in 2013. The infection rate for calendar year 2014 corresponds closely to the rate of 0.14 from 2012 (Figure 18).

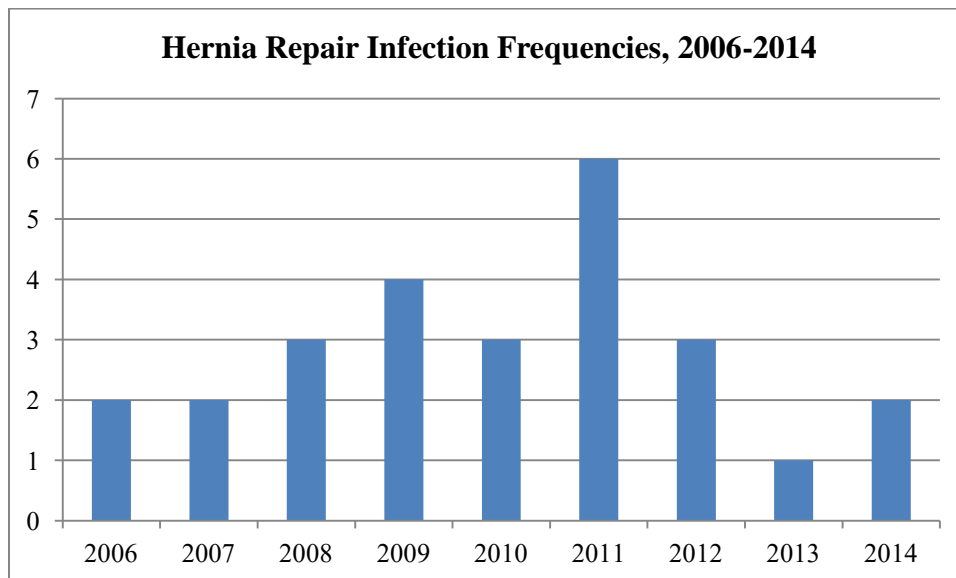
Figure 18. Hernia Repair SSI Rates, 2011-2014



The low frequency of infections associated with this type of surgery could partially explain the extreme rate changes from year-to-year. Since Missouri began collecting data on hernia repair surgeries in 2006, there have been only 26 healthcare-associated infections related to this procedure that met public reporting requirements (through 2014). To put these frequencies into perspective, in 2011 (the year with the most reported infections), fifteen facilities reported 1,883 hernia repair surgeries (which resulted in 6 HAIs). A comparable number of procedures, 1,757 (from 16 facilities) were reported in 2013, during which only 1 HAI associated with hernia repair procedures was reported. Note that frequencies will also fluctuate based on how many facilities meet MHIRS reporting requirements each calendar year.

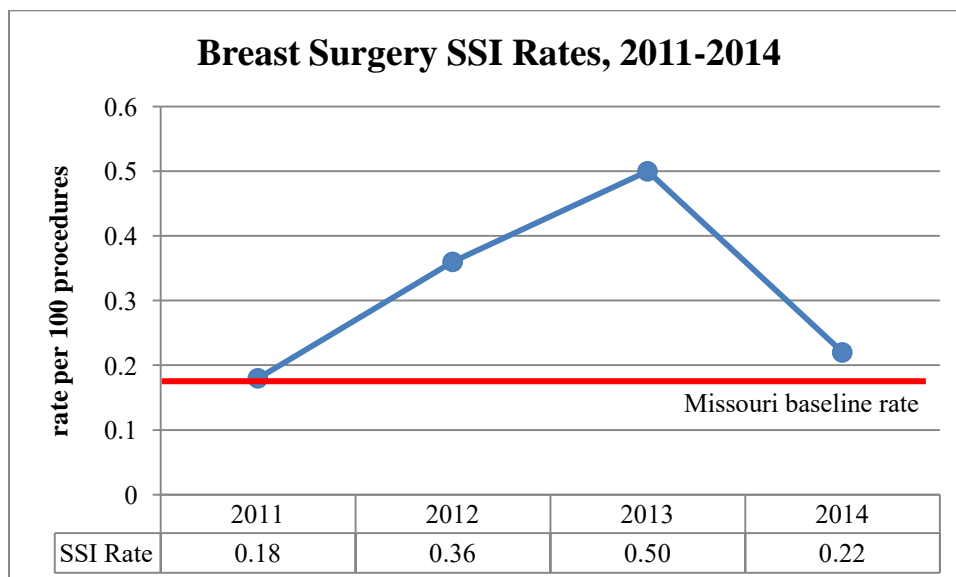


Figure 19. Hernia Repair Infection Frequencies, 2006-2014



The 2014 breast surgery infection rate was 0.22 (per 100 procedures). This represents a small increase from the baseline of 0.18. However, the 2014 rate was less than half the 2013 rate of 0.50 (Figure 20).

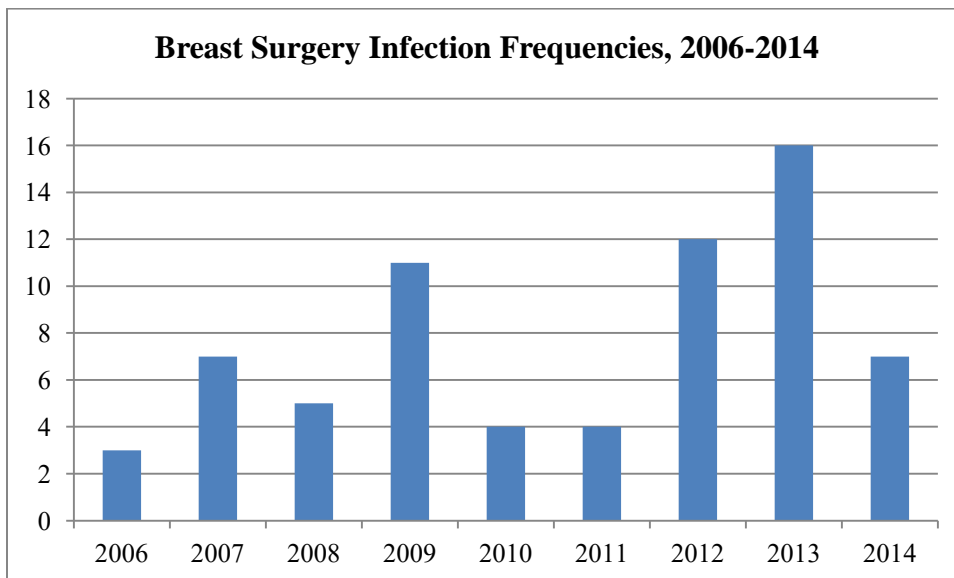
Figure 20. Breast Surgery SSI Rates, 2011-2014



Similar to hernia repair surgeries, the relative rareness of HAIs in conjunction with breast surgeries can cause SSI rates to fluctuate wildly from year-to-year. For the past nine calendar years, Missouri reporting hospitals have averaged only 7.7 SSIs a year for this procedure (again, this represents only the infections from facilities meeting public reporting requirements). In 2006 seven facilities reported 986 breast surgeries, a low number compared to the 3,230 reported by 12 facilities in 2013.



Figure 21. Breast Surgery Infection Frequencies, 2006-2014



“In 2010 an estimated 16 million operative procedures were performed in acute care hospitals in the United States and an American prevalence study found that SSIs were the most common healthcare-associated infection, accounting for 31% of all HAIs among hospitalized patients.”⁸ - Werra, C. et al.



Cautions

The infection rates reported by the DHSS are affected by a facility's level of resources and commitment to infection control, the severity of illnesses treated, and the care with which it collects and reports data. Beyond checking for obvious errors, the DHSS is not able to verify the data that the facilities submit each month, and it is likely that some facilities do a more accurate job of reporting than others. On the other hand, it is to each facility's advantage to accurately diagnose and monitor all infections. We believe most, if not all, facilities are guided by this philosophy.

A further consideration is that hospitals and ASCs vary in the types of patients they treat. A facility that treats severely ill patients will be at a higher risk for HAIs. In order to mitigate this effect, CLABSIs are reported separately for each type of ICU and as a rate per 1,000 central-line days. On the public website, SSI comparisons are adjusted for the severity level of the surgery and the condition of the patient and reported as a rate per 100 surgeries. While those adjustments help make the data between facilities more comparable, users of the data should understand that these adjustments are imperfect, and the rates on Missouri's website (and in this report) should not be the sole basis for choosing a healthcare facility. A consumer who is trying to select a facility for healthcare should also consider the experience of the staff, the advice of their physician, and all other factors that are unique to his or her situation.

Due to complications related to the implementation of a new registration system for facilities, head-of-bed data (a proxy measure for ventilator-associated pneumonia) is not available for 2014.



Endnotes

1. Multistate point- prevalence survey of health care-associated infections. Magill, S.S., Edwards, J.R., Bamberg, W., et al. *New England Journal of Medicine* 2014; 370: 1198-1208.
2. Guidance on public reporting of healthcare-associated infections: recommendations of the Healthcare Infection Control Practices Advisory Committee. McKibben. L., Horan, T., Tokars, J.I., et al. and the Healthcare Infection Control Practices Advisory Committee. *American Journal of Infection Control* 2005; 3(4):217-226.
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