

# Summary of Specific Healthcare-Associated Infections (HAIs)

2011 Results



Kansas Department of Health and Environment  
Division of Public Health  
Bureau of Epidemiology and Public Health Informatics

1000 SW Jackson, Suite 210  
Topeka, Kansas 66612-1290  
Telephone (785) 296-4202  
Fax (785) 291-3775

## **ACRONYMS**

ARRA	American Recovery and Reinvestment Act
CAUTIs	Catheter-associated urinary tract infections
CI	Confidence interval
CDC	Centers for Disease Control and Prevention
CLABSIs	Central line-associated bloodstream infections
CMS	Centers for Medicare and Medicaid Services
HHS	US Department of Health and Human Services
DUR	Device utilization ratio
HAIs	Healthcare-associated infections
ICUs	Intensive care units
IP	Infection Preventionist
IPPS	Inpatient Prospective Payment System
NHSN	National Healthcare Safety Network
KDHE	Kansas Department of Health and Environment
KHAIRG	Kansas Healthcare-Associated Infections Reporting Group
KS	Kansas
SICU	Surgical intensive care unit
SIR	Standardized infection ratio
US	United States

## Executive Summary

### Overview

In 2011, many hospitals in Kansas submitted data about specific healthcare-associated infections (HAIs) to the Centers for Disease Control and Prevention's (CDC) National Healthcare Safety Network (NHSN), a secure, online tracking system used by hospitals and other healthcare facilities. HAIs are infections acquired during the delivery of medical care that were not present or incubating upon exposure to the healthcare setting. HAIs are largely avoidable. Sixty-five hospitals voluntarily shared HAI data with the Kansas Department of Health and Environment (KDHE) through a data sharing group established within NHSN. Monthly data from January 1 to December 31, 2011 were analyzed for acute care hospitals that participated in the Inpatient Prospective Payments System (IPPS) through the Centers for Medicare and Medicaid Services (CMS). In general, these are acute care hospitals that have more than 25 beds. Data were analyzed from intensive care units about patient care volume and two specific HAIs: central line-associated bloodstream infections (CLABSIs) and catheter-associated urinary tract infections (CAUTIs). The information contained within this report establishes the first-ever state-specific baseline estimates of CLABSIs and CAUTIs.

Aggregate data analysis suggests that facilities participating in the Kansas HAI Reporting Group (KHAIRG) in 2011 had significantly fewer infections than expected, based on national baseline data from 2006-2008, and significantly outperformed national results from 2011.

### *Key Findings:*

- Proportionally, Kansas had fewer CLABSIs and CAUTIs in IPPS hospital ICUs than the nation in 2011.
- Proportionally, Kansas used fewer central lines and fewer urinary catheter devices in IPPS hospital ICUs than the nation in 2011.
- Kansas is on track to meet the United States (US) Department of Health and Human Services (HHS) 2013 target goals of a 50% reduction in CLABSIs and 25% reduction in CAUTIs from 2006-2008 levels.
- The Kansas HAI Program has enabled a growing number of healthcare facilities across the continuum of care to collaborate in surveillance and prevention of these infections.

# Summary of Specific Healthcare-Associated Infections (HAIs) in Kansas, 2011

## Introduction

In 2009, the United States Department of Health and Human Services (HHS) released the *Action Plan to Prevent HAIs*, which established national goals and metrics for HAI prevention activities and outlined key actions for achieving reductions in the most common, costly, and deadly HAIs. In the same year, KDHE was awarded funding through the American Recovery and Reinvestment Act (ARRA) to support state-level infrastructure for coordination of HAI surveillance activities. The Kansas HAI Advisory Group (Appendix A) developed a comprehensive HAI state plan and identified HAI surveillance indicators based on the existence of evidence-based practice guidelines, morbidity / mortality associated with each HAI, and the ability to significantly improve patient outcomes. The HAI indicators chosen for surveillance beginning in 2011 were CLABSIs and CAUTIs in adult ICUs.

In 2010, The Kansas HAI Program was created within the Bureau of Epidemiology and Public Health Informatics (formerly Bureau of Surveillance and Epidemiology), Division of Public Health (formerly Division of Health), at KDHE. The program is comprised of a Program Director and a program Epidemiologist, with in-kind program support from the State Epidemiologist & Bureau Director of Epidemiology and Public Health Informatics; the Public Health Informatics Director, Deputy Bureau Director of Epidemiology and Public Health Informatics, and State Registrar; and the Secretary of KDHE & State Health Officer. Guided by the mission set forth by the Kansas HAI Advisory Group, the KDHE HAI Program coordinates statewide HAI prevention and surveillance efforts across the continuum of care. The program has fostered key relationships between the healthcare provider community and state agencies and routinely provides consultative services on issues pertaining to infection prevention and control. One of the key constituents served, are staff in healthcare facilities responsible for infection prevention and control activities, called infection preventionists (IPs).

In 2010, Centers for Medicare and Medicaid Services (CMS) took a major step in recognizing the importance of surveillance and prevention of HAI for reduction of healthcare costs. CMS implemented rules that, beginning in 2011, provided hospitals participating in the Hospital Inpatient Prospective Payment System (IPPS) with financial incentives to report HAI data. These incentives provided strong encouragement for hospitals to take actions toward accomplishing the goals set forth in the HHS *Action Plan to Prevent HAIs*. The HAI indicators chosen by CMS were the same indicators that were predicted by the expert panel members of the Kansas HAI Advisory Group.

## **Objective**

This study was conducted to estimate the burden of illness of two specific HAIs, CLABSIs and CAUTIs, in ICUs of hospitals participating in IPPS, and to provide a meaningful starting point for monitoring the progress made toward meeting national goals of eliminating HAIs.

## **Study Population**

The study population included a representative sample of all patients admitted to ICUs in Kansas at hospitals participating in IPPS.

## Study Design

The results of this study refer to HAI surveillance from January through December 2011 from hospitals that reported data to the CDC by August 1, 2012.

A cross-sectional design was utilized for this study. The representativeness of the available data was assessed by determining the number of hospitals by type, number of hospitals that belonged to the Kansas HAI Reporting Group (KHAIRG), number of hospitals that reported greater than one month of data, the percent of staffed beds KHAIRG member hospitals have out of the total staffed beds in Kansas, and the percent of ICU beds KHAIRG member hospitals have out of the total ICU beds in Kansas.

Completeness and volume of data for each measure were assessed by determining the number of eligible IPPS hospitals reporting data and number of ICUs within those hospitals for which data was reported.

The Device Utilization Ratio (DUR) was aggregated for all ICUs, and stratified by ICU type to estimate potential patient exposure risk for acquiring a CLABSI or CAUTI. The DUR is the ratio of patient-days in which patients had central-line or urinary catheter devices in place divided by the total number of patient-days.

To estimate the burden of illness of CLABSIs and CAUTIs in ICU units of IPPS hospitals within Kansas, the numbers of observed and expected infections in Kansas were used to calculate the Standardized Infection Ratio (SIR). The SIR was aggregated for all ICU types found in Kansas and was stratified by ICU type. The SIR is the ratio of the observed number of infections to the number of expected infections. In this study, the number of expected infections is calculated by applying the US baseline from 2006-2008 to the patient population in Kansas. To provide a more meaningful comparison, the results of the 2011 US SIR were also compared with the 2011 Kansas SIR using a statistical test to determine whether they are statistically different.

Patient- and facility-specific data reported to CDC are kept confidential in accordance with section 304, 306, and 308(d) of the Public Health Service Act (42 USC 242b, 242k, and 242m(d)).

## **Methods**

### **Data Source**

The available data are from 52 of 56 IPPS hospital ICU units in Kansas that voluntarily contribute data to the KHAIRG through NHSN.

### **Data Collection**

De-identified patient information about CLABSIs and CAUTIs are voluntarily submitted monthly by hospitals in Kansas. Data for intensive care units are entered into a secure website interface for the NHSN database. Hospital characteristics were measured from an annual self-reported survey used for accreditation with CMS and from an annual self-reported survey in NHSN.<sup>1</sup> All hospitals not sharing data with KDHE through NHSN provided ICU bed counts through a voluntary ad hoc self-reported survey. Data completeness and volume were measured from NHSN.

The number of patient days, the number of central line days, the number of indwelling urinary catheter days, and the number of CLABSI and CAUTI events that meet NHSN case definitions were entered. Central line days and urinary catheter days were counted at the same time each day. While only one indwelling urinary catheter is typically used on a patient, there could be more than one central line in use for some patients. Each patient with one or more central lines at the time the count was performed was considered one central line day. Each patient with an indwelling urinary catheter in place at the time the count was performed was considered one urinary catheter day. A CLABSI event referred to a bloodstream infection that occurred in a patient with a central line in place and that met a number of additional criteria which assess its relation to other infection sources, per NHSN surveillance definitions.<sup>2</sup> A CAUTI event referred to a urinary tract infection which occurred in a patient with an indwelling urinary catheter in place, and also met a number of additional criteria which assess its relation to other infection sources, per NHSN surveillance definitions.<sup>3</sup> CLABSI and CAUTI events reported in NHSN met specific surveillance definitions which were designed to be applied in a standardized method for all cases.<sup>4</sup> The surveillance definition could be different from the clinical determination used to treat a patient.

KDHE was able to view and analyze data in NHSN only for facilities that actively conferred rights to KHAIRG in NHSN. Facilities that submitted data about CLABSIs and CAUTIs allowed KDHE access to this information for the specific purposes of surveillance and aggregate public reporting of HAI indicators in Kansas.

Data underwent a routine review by the Kansas HAI Program, and facilities that had data missing were informed. All CLABSI and CAUTI events entered into NHSN were reviewed to determine appropriate application of NHSN CLABSI and CAUTI surveillance definitions. Any wide fluctuations in denominator data were discussed with facilities, as they potentially could have been an indication of error (the numbers of patient days and central line days are typically relatively similar from month to month). Patient days, central line days, and urinary catheter days were also reviewed to ensure that the number of these devices' days did not exceed the number of patient days. Facilities were encouraged to consult KDHE and NHSN personnel to review suspect cases that were difficult to classify. Data quality checks were performed against the denominator data submitted. The goal was to ensure that the information reported was timely and accurate.

## Data Analysis

Risk adjustment is used by NHSN to adjust for potential differences in patient populations and their underlying risk.<sup>5</sup> The way in which NHSN allows for individual hospitals to compare their CLABSI and CAUTI data with national outcomes is by establishing definitions for specific unit types. Hospitals use these definitions to classify their units in a standardized fashion, thereby limiting comparison to national patient populations with similar risk factors. For example, adult surgical intensive care unit (SICU) data was compared to data from other adult SICUs.

Because data from all patients for all times at a given healthcare facility cannot be obtained (i.e., a hospital's true population data), it is conventional to use statistical procedures to estimate various measurements. Ninety-five percent confidence intervals (CI) are used to describe the variability around an estimate. The CIs that are used in this report provide the range within which the true value will fall 95% of the time. Confidence intervals are expressed as upper and lower limits, between which likely lies the true value. An additional statistical test reported is that of the p-value, which tells the statistical significance of a result. This report considers a p-value of  $p < 0.05$  as statistically significant.

### *KHAIRG Facilities*

The number of facilities reporting data to KHAIRG in NHSN was obtained from the analysis feature in NHSN. As a group, these hospitals were compared with all hospitals in Kansas for percentage of staffed beds and percentage of ICU beds. The number of staffed beds was obtained from the 2011 Kansas Hospital Survey.<sup>1</sup> The number of ICU beds for KHAIRG members was obtained from NHSN. For hospitals not participating in the KHAIRG, the number of ICU beds was obtained from a voluntary survey. In general, critical access hospitals (CAHs) do not have ICU beds and were therefore not included in the calculation of the percent of ICU beds, nor did they contribute to the total percent of ICU beds (exceptions described in the device utilization methods section). Hospitals that belonged to KHAIRG but that did not report data had no ICU beds did not affect the calculation of percent staffed or ICU beds.

### *Data volume*

Data for the Kansas HAI Reporting Group was obtained from the analysis feature in NHSN.

### *Device utilization*

The use of an invasive device is an extrinsic risk factor for the acquisition of a healthcare-associated infection and is one measure of invasive practice. DUR is measured as a ratio of device days to patient days for each hospital unit type. A high DUR constitutes a greater risk for HAIs. DUR may also serve as a marker for severity of illness of patients, that is, patients' intrinsic susceptibility to infection.

Pooled mean was used to convey the proportion of days a device (a central line or indwelling urinary catheter) was used out of the total patient days. In this report, the term "pooled mean" has the same meaning as "mean" or "average." Multiplying this proportion by 100 would provide an average percentage of patient days that a device was used. The national pooled mean for 2006-2008, 2009, and 2010, was obtained from NHSN reports.<sup>6,7,8,9</sup> The national baseline period for CLABSI was 2006-2008. The national baseline period for CAUTI was 2009. For comparability, national pooled means were limited to adult ICU unit types found in Kansas: burn, medical cardiac, surgical cardiothoracic, medical, medical/surgical, neurosurgical, surgical, and trauma critical care. Excluded were: neurologic, prenatal, and respiratory critical care. Patient days occurred in nearly the same proportion by unit type in the national data as they occurred in Kansas. To prevent facility-specific results identification, reporting by unit type was limited to unit types where five or more facilities reported data to the KHAIRG.

Comparisons of pooled mean rates were performed using a Poisson test. Two CAHs have exceptions that allow for ICU beds. Their data was included in the device utilization calculation but not in measures of the SIR.

#### *Standardized Infection Ratio (SIR)*

SIRs can be calculated at different levels: state, group of facilities, facility, or unit. Most importantly, SIRs can track trends over time in single units or large groups and will reflect changes in risk over time.

The SIR is a ratio that compares the number of observed events to the number expected.

$$\text{SIR} = \frac{\text{observed}}{\text{expected}} = \frac{\text{\# of infections}}{\text{\# of device days} \times \left( \frac{\text{baseline infection rate}}{1000} \right)}$$

A SIR less than 1 indicates that the number of observed HAI events is fewer than the number expected, while a SIR greater than 1 indicates that the number of observed events is greater than expected.

*\*Limitations to the SIR:* The reference population is based on data submitted nationally to NHSN from a time in the past (baseline) for which the risk factors are likely to have changed over time. When comparing SIR calculations across a stratum, they cannot be validly ranked.

#### *Financial*

In order to estimate the burden of costs associated with CLABSIs and CAUTIs in acute care hospitals in Kansas, a metric was developed using estimates from the US Consumer Price Index (CPI) for both urban consumers (which is believed to underestimate cost) and Inpatient Hospital Services (which is believed to overestimate costs), adjusted to 2007 dollars. From the national estimates of the cost per CLABSI and CAUTI, the results were then multiplied by the number of infections reported to the KHAIRG.<sup>9</sup> The results were then extrapolated and indirectly adjusted by the number of ICU beds in all acute care hospitals.

Despite this being the best metric currently available to use, the results should be interpreted carefully as there is significant potential for variability, and the potential for a wide margin of error.

## Results

### **Kansas HAI Reporting Group (KHAIRG) Facilities**

In 2009, the CDC reported that six Kansas hospitals reported data to NHSN.<sup>11,12</sup> In 2010, the Kansas HAI Program began extensive recruiting efforts. Sixty-eight facilities joined NHSN and joined the KHAIRG to voluntarily share HAI data. These included acute care hospitals (ACH), which for the purposes of this report are hospitals with more than 25 beds, and critical access hospitals (CAH), which are hospitals with 25 beds or fewer (designated as such by CMS and the state of Kansas).

Table 1 summarizes the number of hospitals in Kansas in 2011 by type (ACH and CAH), number of hospitals that belonged to the KHAIRG, number of hospitals that reported greater than one month of data, percent of staffed beds KHAIRG member hospitals had out of the total staffed beds in Kansas, and the percent of ICU beds KHAIRG member hospitals had out of the total ICU beds in Kansas.

By the end of data collection for 2011, 68 healthcare facilities, predominately ACHs, belonged to the KHAIRG (Table 3). Of these, 53 shared at least one month of data with KHAIRG. This group of ACH hospitals represented 88% of all staffed beds and 95% of all ICU beds in Kansas.

**Table 1. Number and volume of facilities reporting to the Kansas HAI Reporting Group, 2011.**

	<b>KS Hospitals</b>	<b>KS hospitals belonging to KHAIRG</b>	<b>KS hospitals reporting <math>\geq</math> 1 month of data to KHAIRG</b>	<b>% of staffed beds, KS hospitals reporting <math>\geq</math> 1 month of data to KHAIRG vs. KS</b>	<b>% of ICU beds, KS hospitals reporting <math>\geq</math> 1 month of data to KHAIRG vs. KS</b>
ACHs	55	50	41	88%	95%
CAHs	83	18	12	16%	N/A
<b>All</b>	<b>138</b>	<b>68</b>	<b>53</b>	<b>72%</b>	<b>95%</b>

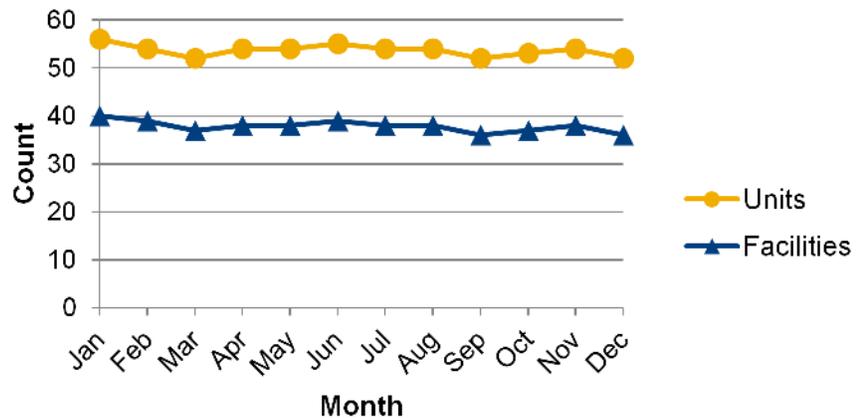
## Central-line Associated Blood Stream Infections

### CLABSI Data

Figure 1 depicts the number of ACHs that reported CLABSI data, by month, during 2011. Because some hospitals have more than one adult ICU, of the same or of varying types, Figure 1 also depicts the number of individual component adult ICU units that reported CLABSI data. A total of 40 facilities submitted CLABSI data

for 56 ICUs between January 1 and December 31, 2011. In total, 644 months of unit-specific data were reported. The number of facilities and units remained relatively stable; however, less variability was expected (a flatter line for units, and especially for facilities). Since CMS requires reporting of all ICUs from ACHs, variability in this measure should only indicate that a facility or unit closed or merged with another, was inactivated for a period of time (e.g. for construction), or failed to report data for the facility or unit.

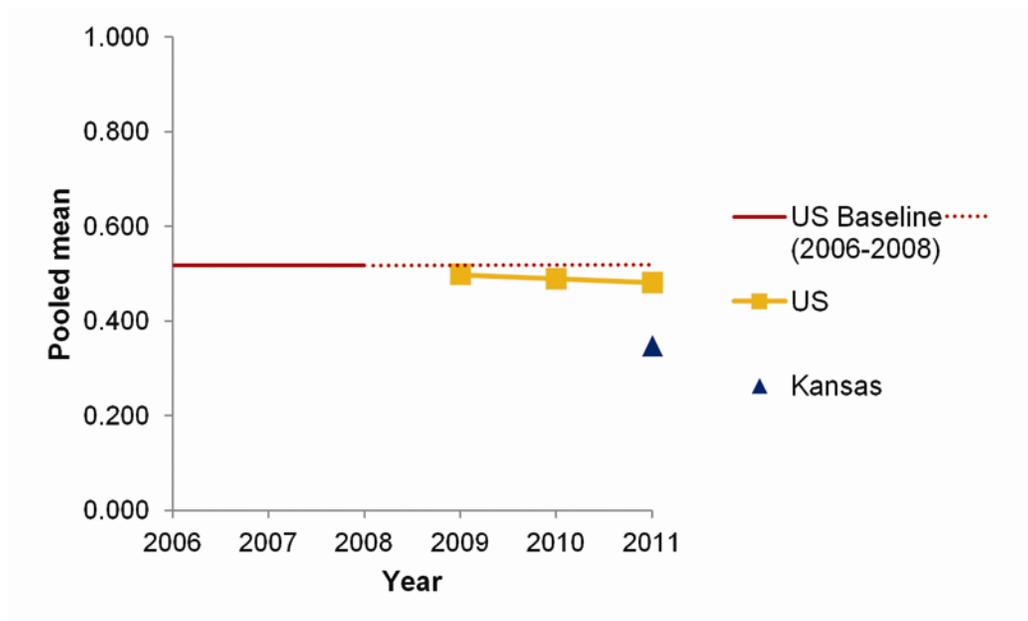
**Figure 1: Count of Kansas hospitals and adult ICU units that reported CLABSI data, 2011.**



### Device Utilization Ratio

The device utilization ratio (DUR) constitutes an extrinsic risk factor for HAI. When fewer devices are used the risks of HAIs are lower. In 2011, a central line device was used during 35% of ICU patient days in Kansas, compared to 48% of ICU patient days in the US (Figure 2 and Appendix B, Table 7). The difference between Kansas and the US in 2011 was statistically significant ( $p < 0.0001$ ).

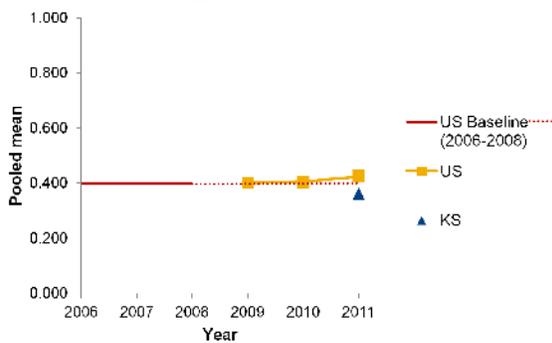
**Figure 2. Pooled mean of patient days in adult ICUs with a central line device in use, US trend and Kansas, 2011.**



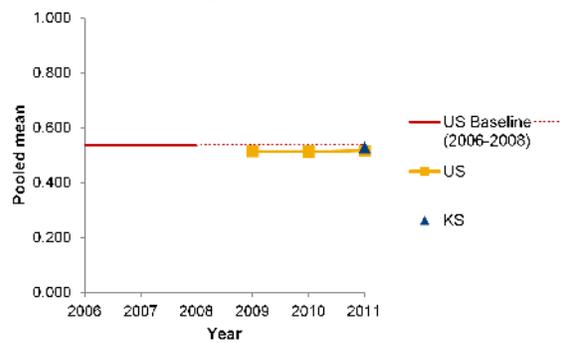
Figures 3-6 show the pooled mean device utilization ratios for four of the most common types of adult ICUs found in Kansas. In 2011, a central line device was used during 36% of cardiac ICU patient days in Kansas, compared to 42% of cardiac ICU patient days in the US (Figure 3 and Appendix B, Table 8). A central line device was used during 53% of medical ICU patient days in Kansas, compared to 52% of medical ICU patient days in the US (Figure 4). Medical/surgical ICUs with 15 or fewer beds provided the most influence on the lower overall device utilization ratio in Kansas. A central line device was used during 17% of medical/surgical ICU patient days, in units with 15 or fewer beds, in Kansas, compared to 35% of medical/surgical ICU patient days, in units with 15 or fewer beds, in the US (Figure 4). A central line device was used during 51% of medical/surgical ICU patient days, in units more than 15 beds, in Kansas, compared to 49% of medical/surgical ICU patient days, in units with more than 15 beds, in the US (Figure 6). The difference between Kansas and the US for each unit type, in 2011 was statistically significant ( $p < 0.0001$ ,  $p = 0.0003$ ,  $p < 0.0001$ , and  $p < 0.0001$  respectively).

**Figures 3-6. Pooled mean of patient days in adult ICUs, by type, with central line device(s) in use, US trend and Kansas, 2011.**

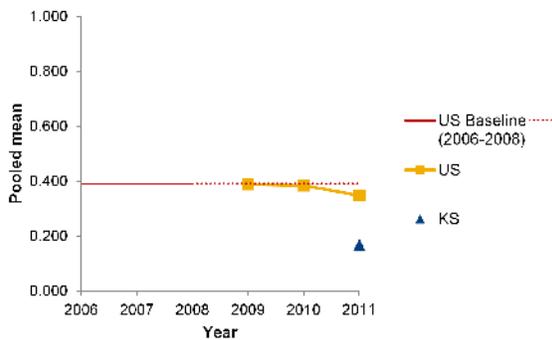
**Figures 3. Cardiac**



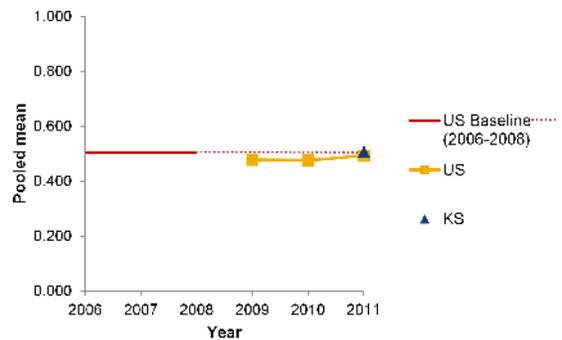
**Figure 4. Medical**



**Figure 5. Medical/surgical ≤ 15 beds**



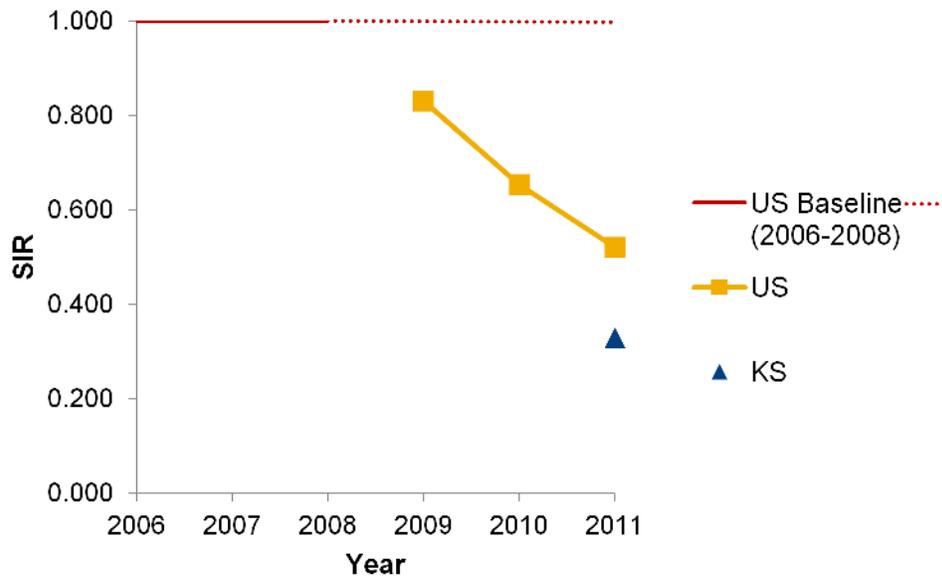
**Figure 6. Medical/surgical > 15 beds**



### Standardized Infection Ratio (SIR)

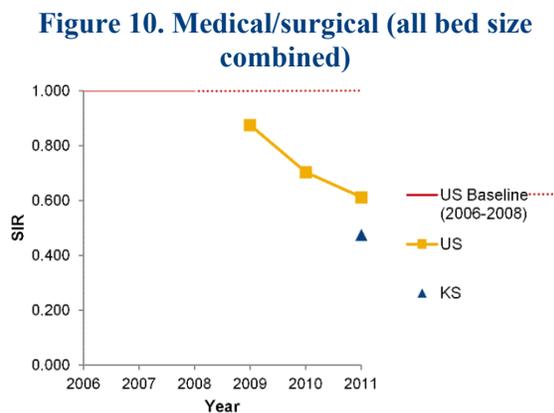
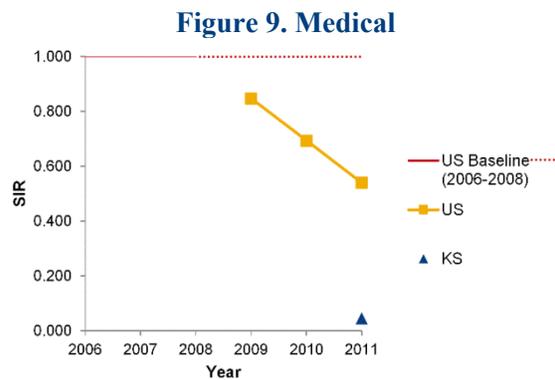
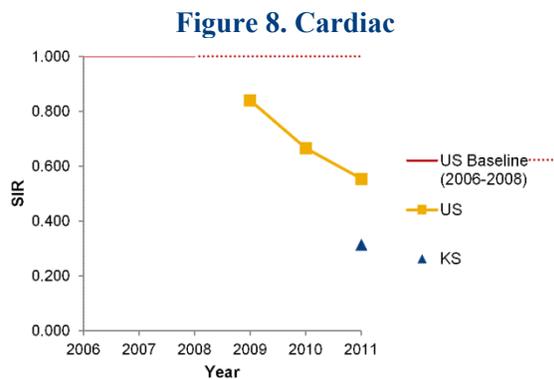
The standardized infection ratio (SIR) is a ratio that compares the number of observed events to the number expected. In 2011, the CLABSI SIR in adult ICUs was 0.329 in Kansas, compared to 0.521 in the US (Figure 7 and Appendix B, Table 9). This result represents an estimated 67% fewer CLABSIs than expected in Kansas, based on the US baseline from 2006-2008, compared to 48% fewer CLABSIs in the US in 2011. The difference between Kansas and the US in 2011 was statistically significant ( $p = 0.0027$ ).

**Figure 7. CLABSI SIR in adult ICUs, US trend and Kansas, 2011.**



Figures 8-10 show the SIR for four of the most common types of adult ICUs found in Kansas. In 2011, the CLABSI SIR in cardiac ICUs was 0.314 in Kansas, compared to 0.554 in the US (Figure 8 and Appendix B, Table 10). This result represents an estimated 69% fewer CLABSIs than expected in Kansas, based on the US baseline for cardiac ICUs from 2006-2008, compared to 45% fewer CLABSIs in the US in 2011. Medical ICUs provided the most influence on the overall SIR in Kansas. The CLABSI SIR in medical ICUs was 0.046 in Kansas, compared to 0.540 in the US (Figure 9). This result represents an estimated 95% fewer CLABSIs than expected in Kansas, based on the US baseline for cardiac ICUs from 2006-2008, compared to 46% fewer CLABSIs in the US in 2011. The CLABSI SIR in medical/surgical ICUs was 0.475 in Kansas, compared to 0.612 in the US (Figure 9). This result represents an estimated 53% fewer CLABSIs than expected in Kansas, based on the US baseline for cardiac ICUs from 2006-2008, compared to 39% fewer CLABSIs in the US in 2011. The differences for cardiac ICU and medical/surgical ICU unit types between Kansas and the US in 2011 were not statistically significant ( $p = 0.3902$  and  $p = 0.0847$ ). The difference for medical ICU unit type, between Kansas and the US in 2011, was statistically significant ( $p = 0.0019$ ).

**Figures 8-10. CLABSI SIR in adult ICUs, by type, US trend and Kansas, 2011.**



All CLABSIs reported to NHSN must be confirmed and identified by a laboratory test. Table 2 describes the number of laboratory confirmed bloodstream infections (LCBIs), based on two different criteria, as they occurred in critical care (ICU) areas in Kansas hospitals. Eighty-four percent of LCBIs in 2011 matched Criterion 1, which identifies infections caused by a recognized pathogen. The remaining 16% of LCBIs matched Criterion 2, which identifies infections caused by common commensal organisms. These are organisms that are commonly found on the human body, but do not cause infections where they normally reside. These organisms can, however, cause infections when introduced into an area of the body that is normally sterile, like the bloodstream. Understanding which infections are caused by organisms known to be normally found on the human body is important because it can be used to potentially indicate an infection caused by either improper skin disinfection before placement of the central line, or improper line care allowing for the migration of common commensal organisms into the blood.

**Table 2. Distribution of criteria for central line-associated laboratory-confirmed BSI by location, 2011.**

Type of location	LCBI				Total
	Criterion 1		Criterion 2		
	Count	n (%)	Count	n (%)	
Medical Cardiac Critical Care	3	100%	0	0%	<b>3</b>
Medical Critical Care	1	100%	0	0%	<b>1</b>
Medical Surgical Critical Care	15	71%	6	29%	<b>21</b>
Other Critical Care	18	95%	1	5%	<b>19</b>
<b>Total</b>	<b>37</b>	<b>84%</b>	<b>7</b>	<b>16%</b>	<b>44</b>

## Organisms

As shown in Table 3, the most common organism identified through laboratory analysis was *Enterococcus faecalis*, accounting for 15% of CLABSIs, followed by *Candida glabrata* (11%), and *Staphylococcus epidermidis* (9%). A patient can be co-infected with more than one bacterial organism. Although there were 44 CLABSIs in 2011, there were 46 pathogens. In the table below, “pan susceptible” means that when the organism was tested to see if it was susceptible to antibiotics of interest in determining possible treatment, the organism was susceptible to all of the antibiotics it was tested against. Multi-drug resistance (MDR) means that the organism was non-susceptible to more than one antibiotic which it was tested against.

**Table 3. Laboratory identified organisms from CLABSIs, 2011.**

CLABSI	Pan susceptible	MDR	Count
<i>Enterococcus faecalis</i> - ENTFS	0	0	7
<i>Candida glabrata</i> - CG	---	---	5
<i>Staphylococcus epidermidis</i> - SE	0	1	4
<i>Candida albicans</i> - CA	---	---	3
<i>Enterobacter cloacae</i> - ENC	1	0	3
<i>Staphylococcus aureus</i> - SA	0	1	3
Coagulase-negative <i>Staphylococcus</i> - CNS	0	0	3
<i>Enterobacter aerogenes</i> - EA	0	0	2
<i>Klebsiella pneumoniae</i> - KP	0	0	2
<i>Prevotella melaninogenica</i> - PREM	0	0	2
<i>Acinetobacter baumannii</i> - ACBA	0	0	1
<i>Acinetobacter lwoffii</i> - ACLW	0	0	1
<i>Anaerococcus prevotii</i> - ANAPRE	---	---	1
<i>Candida dubliniensis</i> - CANDUB	---	---	1
<i>Candida parapsilosis</i> - CP	---	---	1
<i>Candida tropicalis</i> - CT	---	---	1
<i>Enterococcus casseliflavus</i> - ENTCA	0	0	1
<i>Enterococcus faecium</i> - ENTFM	1	0	1
<i>Klebsiella rhinoscleromatis</i> - KLERH	0	0	1
<i>Pseudomonas aeruginosa</i> - PA	0	0	1
<i>Stenotrophomonas maltophilia</i> - STEMA	0	0	1
<i>Streptococcus anginosus</i> group - STRANG	0	0	1
<b>Total</b>	<b>2 (4.3%)</b>	<b>2 (4.3%)</b>	<b>46</b>

**Financial:**

As shown in Table 4, if Kansas had the same national average CLABSI rate as the nation in 2006-2008, 104 CLABSI events in Kansas would have been expected. (Again, CLABSIs were not measured during this time period in Kansas, so the true CLABSI rate during that time is not known.) Based on the 2007 CPI for all urban consumers, the expected cost per CLABSI would range from \$6,461 to \$25,156. Using this CPI for 104 CLABSIs, the estimated total cost for medical care would be between \$878,696 and \$3,513,464.

Based on the 2007 CPI for all inpatient hospital services, the expected cost per CLABSI would range from \$7,288 to \$29,156. Using this CPI for 104 CLABSIs, the estimated total cost for medical care would be between \$991,168 and \$3,965,216.

Based on the 2007 CPI for all urban consumers, with 44 estimated CLABSIs in 2011, the estimated total cost for medical care would be between \$284,284 and \$1,137,356.

Based on the 2011 CPI for all inpatient hospital services, with 44 estimated CLABSIs in 2011, the estimated total cost for medical care would be between \$320,672 and \$1,282,864.

Using the 2007 CPI for all urban consumers, the cost savings projected when only 44 infections occurred rather than the projected 104, would represent a potential savings of \$594,412 to \$2,378,108. Using the 2007 CPI for all inpatient hospital services, the cost savings projected when only 44 infections occurred rather than the projected 104, would represent a potential savings of \$670,496 to \$2,682,352.

**Table 4. Estimated cost of CLABSIs in Kansas, based on Consumer Price Index (2007).**

	Consumer Price Index (2007)			
	2006-2008 baseline		2011	
	All urban consumers	Inpatient hospital services	All urban consumers	Inpatient hospital services
# of CLABSIs	104		44	
Cost per infection	\$6,461 - \$25,849	\$7,288 - \$29,156	\$6,461 - \$25,849	\$7,288 - \$29,156
<b>Total cost</b>	<b>\$878,696 - \$3,515,464</b>	<b>\$991,168 - \$3,965,216</b>	<b>\$284,284 - \$1,137,356</b>	<b>\$320,672 - \$1,282,864</b>

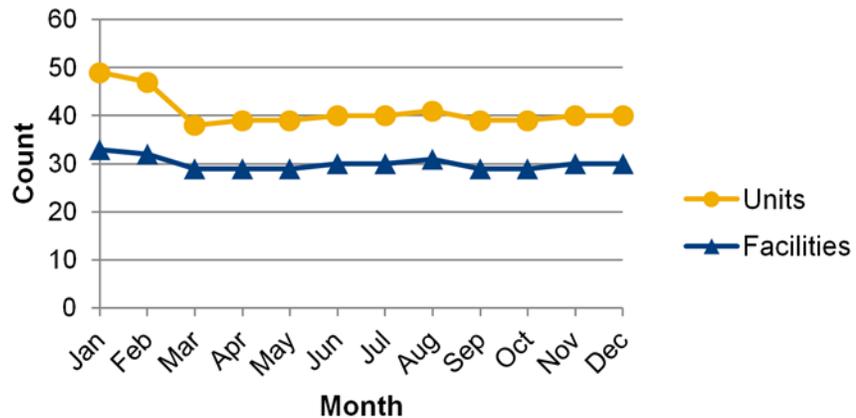
## Catheter-Associated Urinary Tract Infection

### CAUTI Data

Figure 11 depicts the number of ACHs that reported CAUTI data, by month, during 2011. Because some hospitals have more than one adult ICU, of the same or of varying types, figure 11 also depicts the number of individual component adult ICU units that reported CAUTI data. A total of 35 facilities submitted CAUTI data

for 50 ICUs between January 1, 2011 and December 31, 2011. In total, 491 months worth of unit-specific data were reported. The number of facilities and units remained relatively stable; however, less variability was expected (a flatter line for units, and especially for facilities). Possible reasons for variability in this measure include a facility or unit closed or merged with another, was inactivated for a period of time (e.g. for construction), or failed to report data for the facility or unit. CMS did not require reporting of CAUTIs during 2011, (reporting of this measure was voluntary), which could account for the variability in the number of units and facilities reporting.

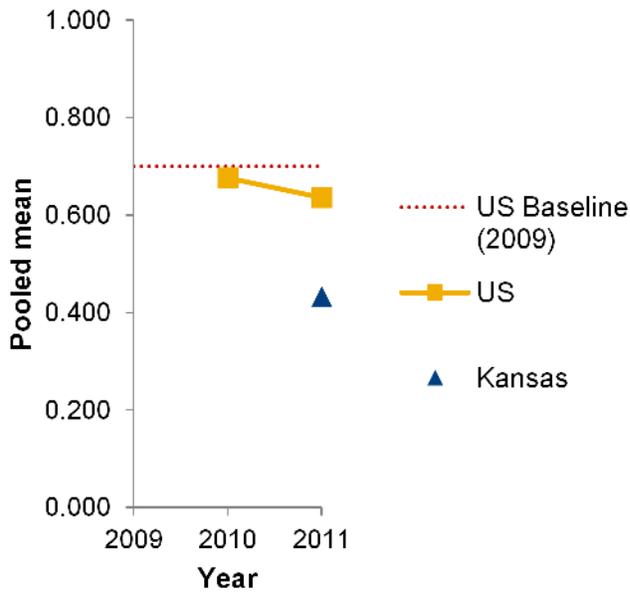
**Figure 11. Count of Kansas hospitals and adult ICU units that reported CAUTI data, 2011.**



Device Utilization Ratio

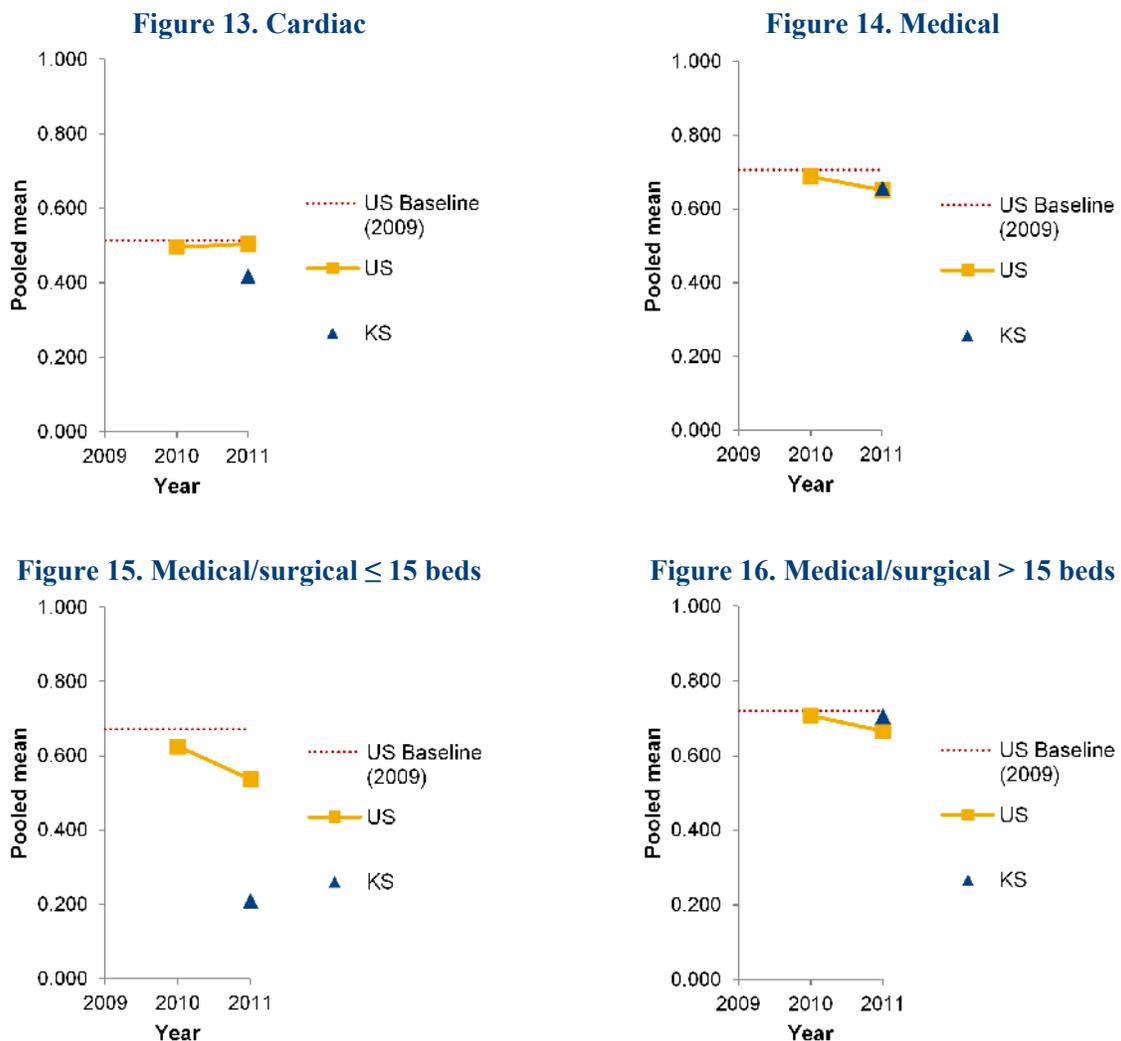
The device utilization ratio (DUR) constitutes an extrinsic risk factor for HAI. When fewer devices are used the risk of HAIs are lower. In 2011, an indwelling urinary catheter device was used during 43% of ICU patient days in Kansas, compared to 64% of ICU patient days in the US (Figure 12 and Appendix B, Table 11). The difference between Kansas and the US in 2011 was statistically significant ( $p < 0.0001$ ).

**Figure 12. Pooled mean of patient days in adult ICUs with an indwelling urinary catheter device in use, US trend and Kansas, 2011.**



Figures 3-6 show the pooled mean device utilization ratios for four of the most common types of adult ICUs found in Kansas. In 2011, an indwelling urinary catheter device was used during 42% of cardiac ICU patient days in Kansas, compared to 51% of cardiac ICU patient days in the US (Figure 13 and Appendix B, Table 12). An indwelling urinary catheter device was used during 66% of medical ICU patient days in Kansas, compared to 65% of medical ICU patient days in the US (Figure 14). Medical/surgical ICUs with 15 or fewer beds provided the most influence on the lower overall device utilization ratio in Kansas. An indwelling urinary catheter device was used during 21% of medical/surgical ICU patient days, in units with 15 or fewer beds, in Kansas, compared to 54% of medical/surgical ICU patient days, in units with 15 or fewer beds, in the US (Figure 15). An indwelling urinary catheter device was used during 71% of medical/surgical ICU patient days, in units more than 15 beds, in Kansas, compared to 67% of medical/surgical ICU patient days, in units with more than 15 beds, in the US (Figure 16). The difference in the results for the medical ICU unit type, between Kansas and the US in 2011, was not statistically significant ( $p = 0.1479$ ). The differences in the results for cardiac ICU and medical/surgical ICUs with 15 or fewer beds and medical/surgical ICUs with more than 15 beds, between Kansas and the US in 2011, were statistically significant ( $p < 0.0001$ ).

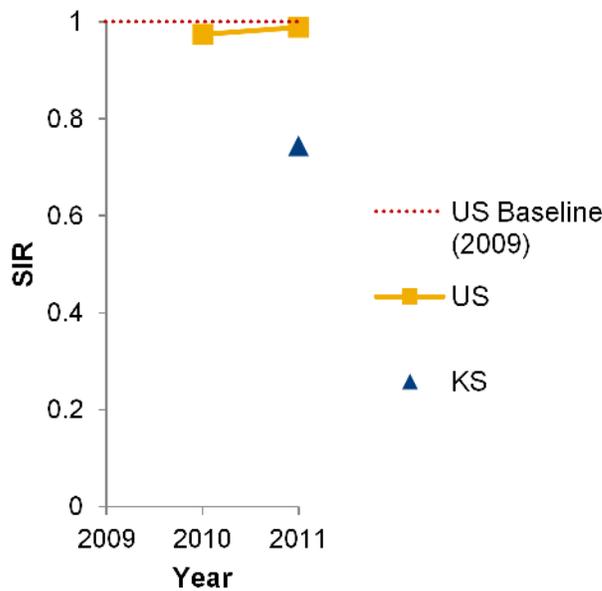
**Figures 13-16. Pooled mean of patient days in adult ICUs, by type, with indwelling urinary catheter device in use, US trend and Kansas, 2011.**



**Standardized Infection Ratio (SIR)**

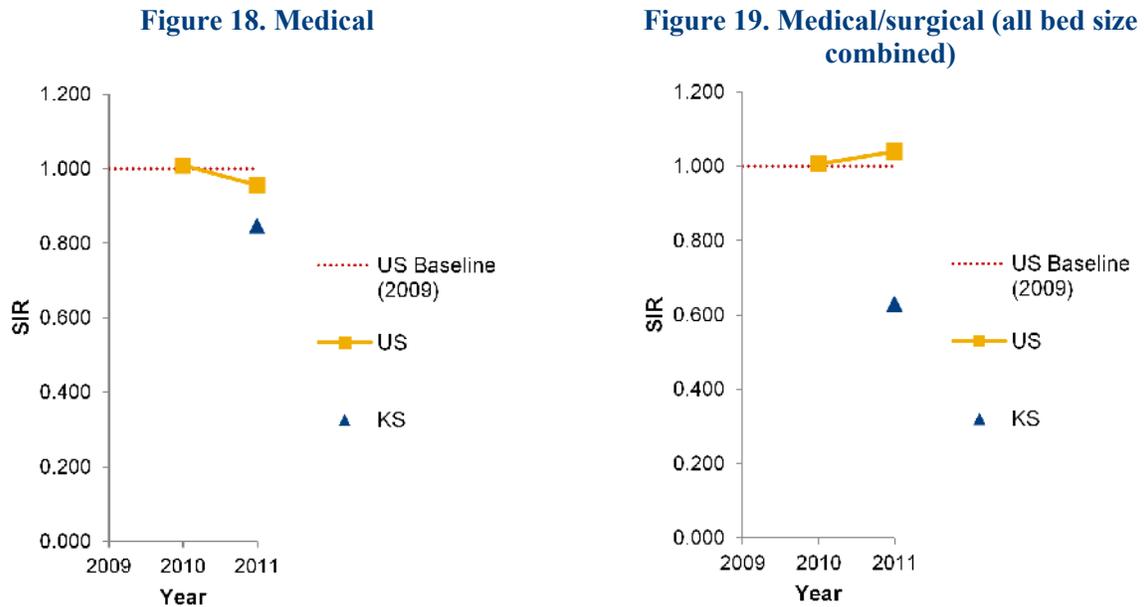
The standardized infection ratio (SIR) is a ratio that compares the number of observed events to the number expected. In 2011, the CAUTI SIR in adult ICUs was 0.744 in Kansas, compared to 0.989 in the US (Figure 17 and Appendix B, Table 13). This result represents an estimated 26% fewer CAUTIs than expected in Kansas, based on the US baseline from 2006-2008, compared to 1% fewer CAUTIs in the US in 2011. The difference between Kansas and the US in 2011 was statistically significant ( $p = 0.0042$ ).

**Figure 17. CAUTI SIR in adult ICUs, US trend and Kansas, 2011.**



Figures 18-19 show the SIR for two of the most common types of adult ICUs found in Kansas. In 2011, the CAUTI SIR in medical ICUs was 0.848 in Kansas, compared to 0.956 in the US (Figure 18 and Appendix B, Table 14). This result represents an estimated 15% fewer CAUTIs than expected in Kansas, based on the US baseline for cardiac ICUs from 2006-2008, compared to 4% fewer CAUTIs in the US in 2011. Medical/surgical ICUs provided the most influence on overall SIR in Kansas. The CAUTI SIR in medical/surgical ICUs was 0.631 in Kansas, compared to 1.039 in the US (Figure 19). This result represents an estimated 37% fewer CAUTIs than expected in Kansas, based on the US baseline for cardiac ICUs from 2006-2008, compared to a zero net change in the US in 2011. The difference in the results for the medical ICU unit type between Kansas and the US in 2011 was not statistically significant ( $p = 0.6641$ ). The difference in the results for medical/surgical ICU unit type between Kansas and the US in 2011 was statistically significant ( $p = 0.0092$ ).

**Figures 18-19. CAUTI SIR in adult ICUs, by type, US trend and Kansas, 2011.**



## Organisms

As shown in Table 5, the most common organism identified through laboratory analysis was *Escherichia coli*, accounting for 30% of CAUTIs, followed by *Pseudomonas aeruginosa* (12%), *Candida albicans* (12%), and *Klebsiella pneumoniae* (10%). A patient can be co-infected with more than one bacterial organism. Although there were 102 CAUTIs in 2011, there were 103 pathogens. In the table below, “pan susceptible” means that when the organism was tested to see if it was susceptible to antibiotics of interest in determining possible treatment, the organism was susceptible to all of the antibiotics it was tested against. Multi-drug resistance (MDR), means that the organism was non-susceptible to more than one antibiotic which it was tested against.

**Table 5. Laboratory identified organisms from CAUTIs, 2011.**

CAUTI	Pan susceptible	MDR	Count
<i>Escherichia coli</i> - EC	5	4	31
<i>Pseudomonas aeruginosa</i> - PA	0	5	13
<i>Candida albicans</i> - CA	---	---	12
<i>Klebsiella pneumoniae</i> - KP	0	0	10
<i>Enterococcus faecalis</i> - ENTFS	1	0	6
<i>Enterococcus</i> spp. - ENTSP	1	0	5
Yeast NOS - YEAST	---	---	4
<i>Proteus mirabilis</i> - PM	0	0	3
<i>Candida krusei</i> - CK	---	---	2
<i>Enterobacter cloacae</i> - ENC	0	1	2
<i>Enterococcus faecium</i> - ENTFM	2	0	2
<i>Staphylococcus aureus</i> - SA	0	1	2
Coagulase-negative <i>Staphylococcus</i> - CNS	0	0	2
<i>Candida glabrata</i> - CG	---	---	1
<i>Candida parapsilosis</i> - CP	---	---	1
<i>Citrobacter freundii</i> - CF	0	0	1
<i>Citrobacter koseri</i> - CITKO	0	0	1
<i>Enterobacter aerogenes</i> - EA	0	0	1
<i>Enterobacter cloacae</i> complex - ENCCX	0	0	1
<i>Klebsiella oxytoca</i> - KO	0	1	1
<i>Kluyveromyces marxianus</i> - KLUYMAR	---	---	1
<i>Providencia stuartii</i> - PRS	0	0	1
<i>Staphylococcus epidermidis</i> - SE	0	0	1
<b>Total</b>	<b>9 (8.7%)</b>	<b>12 (11.7%)</b>	<b>103</b>

**Financial**

Shown in Table 6, if Kansas had the same average CAUTI rate as the nation in 2006-2008, 143 CAUTI events in Kansas would have been expected. (Again, CAUTIs were not measured during this time period in Kansas, so the true CAUTI rate during that time is not known.) Based on the 2007 CPI for all urban consumers, the expected cost per CAUTI would range from \$749 to \$832. Using this CPI for 143 CAUTIs, the estimated total cost for medical care would be between \$107,107 and \$118,976.

Based on the 2007 CPI for all inpatient hospital services, the expected cost per CAUTI would range from \$862 to \$1,007. Using this CPI for 143 CAUTIs, the estimated total cost for medical care would be between \$123,266 and \$144,011.

Based on the 2007 CPI for all urban consumers, with 102 estimated CAUTIs in 2011, the estimated total cost for medical care would be between \$76,398 and \$84,864.

Based on the 2011 CPI for all inpatient hospital services, with 102 estimated CAUTIs in 2011, the estimated total cost for medical care would be between \$87,924 and \$102,714.

Using the 2007 CPI for all urban consumers, the cost savings projected when only 102 infections occurred rather than the projected 143, would represent a potential savings of \$28,465 to \$31,616. Using the 2007 CPI for all inpatient hospital services, the cost savings projected when only 102 infections occurred rather than the projected 143, would represent a potential savings of \$32,756 to \$38,266.

**Table 6. Estimated cost CAUTIs in Kansas, based on Consumer Price Index (2007).**

	Consumer Price Index (2007)			
	2006-2008 baseline		2011	
	All urban consumers	Inpatient hospital services	All urban consumers	Inpatient hospital services
# of CAUTIs	143		102	
Cost per infection	\$749 - \$832	\$862-\$1,007	\$749 - \$832	\$862-\$1,007
<b>Total cost</b>	<b>\$107,107 – \$118,976</b>	<b>\$123,266 - \$144,001</b>	<b>\$76,398 - \$84,864</b>	<b>\$87,924 – \$102,714</b>

## Discussion

The findings of this report reflect the first year of surveillance, 2011, in Kansas. In the development of this study, attention was given to present methods used consistently by NHSN, and by states, for the public reporting of HAI data. While this report is not inclusive of all hospitals in Kansas that were eligible to contribute data to the Kansas HAI Reporting Group, it represented 95% of all ICU beds. It is reasonable to assume that the data are adequately representative of the population of interest.

Maintaining strong relationships with participating facilities and continuing to recruit Kansas hospitals will allow for more accurate observations of the burden of HAIs in Kansas. Data reporting each month by participating hospitals has been sufficiently consistent for the purposes of this study. There is a continued need for facilities to report data in an accurate and timely manner to qualify for reimbursement payments through the CMS IPPS program. It has been suggested that increased reporting can have an impact on reducing HAIs.<sup>12, 14</sup>

The use of central lines and urinary catheter devices in Kansas appears to be lower than overall use across the nation. The reason for this is not entirely clear, yet additional analysis of central line use from hospital discharge billing data supports the conclusion that use is lower in Kansas. Use of these devices greatly contributes to the risk of acquiring a bloodstream infection or urinary tract infection, so using these devices only when medically necessary is an important factor in reducing the risk of infections. Why the use is lower in Kansas, while challenging to answer, could be a valuable question to attempt to answer in the future.

Kansas is on track to meet the US HHS 2013 target goals of a 50% reduction in CLABSIs and 25% reduction in CAUTIs. In 2011, an initiative was already in place in Kansas to reduce CLABSIs from a valued partner in HAI prevention. The Kansas Healthcare Collaborative (KHC), a member of the Kansas HAI Advisory Group, led the Comprehensive Unit-based Safety Program (CUSP) Stop Blood Stream Infections (On the CUSP: Stop BSI) initiative. This multi-year effort, in which many Kansas HAI Reporting Group hospitals participated, was completed in 2012. Maintaining lessons learned and potential gains made from this initiative could be very important in keeping CLABSI reductions on track with the HHS 2013 target goal, but may be challenging. Beginning in 2012, KHC began the On the CUSP: Stop CAUTI initiative, building on the successes of their previous initiative. In 2011 in Kansas, the estimated reduction of CAUTIs from the 2009 baseline only slightly exceeded the HHS 2013 target goal. Nationally, the results from 2010 and 2011 showed little, if any, change in CAUTI rates. In order for Kansas to remain on target to meet the HHS 2013 target goal, participation in initiatives like On the CUSP: Stop CAUTI, as well as facility led efforts, are extremely important.

For the locations observed in this report, Medical/Surgical ICUs, particularly those having 15 or fewer beds, provided the most influence across all metrics. This type of unit is one of the most common types of units in Kansas. Prevention efforts focused in these ICUs, particularly for CLABSI, can provide a strong impact on the overall reduction of HAIs.

Public health is well equipped to work with healthcare facilities from across the continuum of care to address HAI reduction efforts. Public health surveillance involves ongoing, systematic collection, analysis and interpretation of health data for planning, implementation and evaluation of public health practice, and is closely integrated with the timely dissemination of these data to those responsible for prevention and control. In essence, HAI surveillance aims to accurately quantify the burden of the infection, establish a baseline, and develop tools and methods to decrease the burden of the disease.

Surveillance data is most effective when it is used to drive prevention efforts and focus application of best practice measures. A number of national efforts, some governmental and some private, are creating structures for implementing broad-based and infection-specific HAI prevention initiatives. As national focus on HAIs increases, surveillance becomes key to further define the magnitude of the problem, understand trends, and monitor progress in reducing and eliminating these infections. Significant progress is being made in the US toward nationwide HAI surveillance through the cooperation of federal regulatory agencies, state health departments, healthcare stakeholders, and an informed and active public.

Healthcare facilities that provided CLABSI data to CMS as part of Inpatient Quality Reporting (IQR) for hospitals participating in the IPPS incentive program have their data publicly reported through the Hospital Compare website. Beginning in January 2012, CLABSI data in the form of a SIR for each facility has been reported on Hospital Compare, beginning with data from the first quarter of 2011. These data are not expected to be consistent with the SIR values represented in this report because the website uses a facility-specific SIR, not a unit-specific SIR. As more data is submitted to NHSN through time and as it is analyzed by CMS, the SIR results will be perpetually displayed on the Hospital Compare website. Continuing growth in the collaboration and coordination between CMS and stakeholders in HAI surveillance and prevention will be important in order to promote the most efficient surveillance methods and meaningful reporting efforts.

Recent successes in HAI elimination have been encouraging. The CDC recently published an estimate that in 2009, U.S. ICUs had reduced CLABSIs by 58% (from 43,000 to 18,000 per year) since 2001. This reduction could represent up to 6,000 lives saved and \$414 million in potential excess health-care costs saved in 2009. Cumulatively, an approximate savings of \$1.8 billion in excess health-care costs occurred since 2001.<sup>15</sup> While reductions have been demonstrated for some HAIs and in some healthcare settings, much more remains to be done. Ongoing vigilance and adherence to infection prevention guidelines is needed to ensure that all care is safe care. This includes traditional hospital settings as well as outpatient surgery centers, long-term care facilities, rehabilitation centers, and community clinics.

Data from NHSN, the same data used for these reports, can also help identify institutional problems and are used to monitor infection rates over time to help evaluate the implementation of new and innovative infection prevention practices.

## **Limitations**

Data submitted to NHSN during 2011 have not been validated. Therefore, there is limited assurance of consistent case finding and accurate application of surveillance definitions. Additionally, four IPPS hospitals did not participate in sharing data with KHAIRG, two of which had one or more ICU. Misapplication of the case definitions could have contributed to misclassification of cases, resulting in either over- or under-representation of the numerator. Incorrect patient-day counts could have contributed

to misclassification of the population under surveillance, resulting in either over- or under-representation of the denominator.

## **Strengths**

The strong support and high voluntary participation rate of IPPS hospitals in Kansas provides good estimation of the burden of CLABSIs and CAUTIs. The hospitals submitting data for this report, representing 88% of staffed beds and 95% of ICU beds, are deemed to be highly representative of the population of ACHs in Kansas. Particularly, these provide a good estimation of the burden of CLABSIs in Kansas, and more specific to location, CAUTIs in ICU settings. A large number of central lines are placed and managed in ICU settings in Kansas, and ICU settings are almost exclusively limited to IPPS hospitals. Urinary catheters are utilized across the continuum of care, so understanding the burden of CAUTIs in additional settings in the future will be important.

The Kansas HAI Program includes numerous individuals and organizations that are committed to the reduction and, wherever possible, the elimination of HAIs. While these early findings are encouraging, the Kansas HAI Advisory Committee and partner healthcare facilities will continue to follow progress in the state as they implement best practices for monitoring and preventing HAI in order to improve the health status for the population of Kansas. Collaboration among healthcare facilities and with partner entities, such as the Kansas HAI Advisory Committee and its component organizations, is exceptionally strong. This has served the Kansas HAI Program well, as evidenced by early outcomes. Research to understand the broad issues at the state and national levels will evolve, and stakeholders will continue to provide input that will influence state and national goals and objectives related to HAI prevention. The Kansas HAI Advisory Committee plans to continue to provide a report such as this one to the public on an annual basis.

## **Appendix A: Kansas Healthcare-associated Infections Advisory Committee**

### **APIC Heart of America**

Vivien Nutsch, RN  
*Mercy Regional Medical Center, Manhattan, KS*

### **APIC Kansas City Chapter**

Katherine Kilmartin, MT, ASCP, CIC  
*Stormont-Vail Health Care, Topeka, KS*

Jill Greig, RN, BSN, CIC  
*Shawnee Mission Medical Center, Shawnee Mission, KS*

Kathleen Hall-Mayer, RN, MBA, CIC  
*Saint Lukes South, Overland Park, KS*

Lori Swope, RN, BSN, MHA, CIC  
*Shawnee Mission Medical Center, Shawnee Mission, KS*

### **APIC Wichita Chapter**

Kim Byers, RN, CIC  
*Kansas Infection Control Consultants, Arkansas City, KS*

Brenda Davis, RN, BSN, CIC  
*Via Christi Clinic, Wichita, KS*

Cheryl Donelan  
*Wesley Medical Center, Wichita, KS*

Theresa Gasset-Haynes, RN, BSN, CIC  
*Kansas Spine Hospital, Wichita, KS*

### **Kansas Association of Ambulatory Surgery Centers**

Joan M. Shearer, CASC  
*Lawrence Surgery Center, Lawrence, KS*

### **Kansas Department of Health and Environment**

*Topeka, KS*

D. Charles Hunt, MPH

Lou Saadi, PhD

Joyce Smith

Joseph Scaletta, MPH, RN, CIC

Robert Geist, MPH, CIC

### **Kansas Foundation for Medical Care**

*Topeka, KS*

Nadyne Hagmeier, RN

### **Kansas Healthcare Collaborative**

*Topeka, KS*

Kendra Tinsley, MS

Michele Clark, MBA, ABC

Eric Wiens, MPH

### **Kansas Hospital Association**

*Topeka, KS*

Deborah Stern, RN, Esq.

### **Kansas Medical Society**

*Topeka, KS*

Jerry Slaughter

### **Heartland Kidney Network**

*Kansas City, Mo*

Katherine Brown, CSSBB

### **University of Kansas Medical Center**

*Kansas City, KS*

Carole Dale Grube, MA

Elizabeth Wenske-Mullinax, PhD

## Appendix B: Additional tables

### CLABSI

**Table 7. Central-line device utilization ratio in Kansas adult ICUs versus US, 2011.**

Location	No. of units	Central-line days	Patient days	2011 KS Pooled mean	2006-2008 US Pooled mean	2009 US Pooled mean	2010 US Pooled mean	2011 US Pooled mean
KS ICUs	56	67705	194830	<b>0.348</b>	0.517	0.498	0.490	<b>0.481</b>

**Table 8. Unit-specific (adult) central-line device utilization ratio in Kansas versus US, 2011.**

Type of location	No. of units	Central-line days	Patient days	2011 KS Pooled mean	2006-2008 US Pooled mean	2009 US Pooled mean	2010 US Pooled mean	2011 US Pooled mean
Medical Cardiac Critical Care	5	4778	13208	<b>0.362</b>	0.397	0.401	0.405	<b>0.424</b>
Medical Critical Care	7	9470	17900	<b>0.529</b>	0.536	0.514	0.513	<b>0.516</b>
Medical/Surgical Critical Care <=15 beds	27	15616	92852	<b>0.168</b>	0.389	0.388	0.384	<b>0.348</b>
Medical/Surgical Critical Care >15 beds	7	14521	28539	<b>0.509</b>	0.505	0.478	0.476	<b>0.492</b>

**Table 9. CLABSI SIRs in Kansas adult ICUs versus US, 2011.**

No. of units	Observed CLABSIs	Expected CLABSIs	2011 aggregate KS SIR	p-value	95% Confidence interval	2006-2008 US SIR	2009 US SIR	2010 US SIR	2011 US SIR
57	44	133.657	<b>0.329</b>	< 0.0001	0.239, 0.442	1.000	0.834	0.653	<b>0.521</b>

**Table 10. Unit-specific (adult) CLABSI SIRs in Kansas versus US, 2011.**

Type of location	No. of units	Observed CLABSIs	Expected CLABSIs	2011 KS aggregate unit SIR	p-value	95% Confidence interval	2006-2008 US SIR	2009 US SIR	2010 US SIR	2011 US SIR
Medical Cardiac Critical Care	5	3	9.556	<b>0.314</b>	0.0143	0.065, 0.917	1.000	0.839	0.665	<b>0.554</b>
Medical Critical Care	7	1	21.532	<b>0.046</b>	<0.0001	0.001, 0.259	1.000	0.847	0.693	<b>0.540</b>
Medical/Surgical Critical Care (combined)	33	21	50.471	<b>0.475</b>	<0.0001	0.294, 0.726	1.000	0.875	0.703	<b>0.612</b>

## CAUTI

**Table 11. Urinary catheter device utilization ratio in Kansas adult ICUs versus US, 2011.**

Location	No. of units	Catheter days	Patient days	2011 KS Pooled mean	2009 US Pooled mean	2010 US Pooled mean	2011 US Pooled mean
KS ICUs	49	69683	160835	<b>0.433</b>	0.700	0.677	<b>0.636</b>

**Table 12. Unit-specific (adult) catheter device utilization ratio in Kansas versus US, 2011.**

Type of location	No. of units	Catheter days	Patient days	2011 KS Pooled mean	2009 US Pooled mean	2010 US Pooled mean	2011 US Pooled mean
Medical Cardiac Critical Care	5	3487	8361	<b>0.417</b>	0.514	0.495	<b>0.505</b>
Medical Critical Care	5	10582	16159	<b>0.655</b>	0.706	0.687	<b>0.651</b>
Medical/Surgical Critical Care <=15 beds	25	17087	81633	<b>0.209</b>	0.672	0.625	<b>0.537</b>
Medical/Surgical Critical Care >15 beds	7	16548	23446	<b>0.706</b>	0.720	0.707	<b>0.665</b>

**Table 13. CAUTI SIRs in Kansas adult ICUs versus US, 2011.**

No. of units	Observed CAUTIs	Expected CAUTIs	2011 aggregate KS SIR	p-value	95% Confidence interval	2009 US SIR	2010 US SIR <sup>1</sup>	2011 US SIR
54	102	137.020	<b>0.744</b>	0.0011	0.607, 0.904	1.000	0.974	<b>0.989</b>

**Table 14. Unit-specific (adult) CAUTI SIRs in Kansas versus US, 2011.**

Type of location	No. of units	Observed CAUTIs	Expected CAUTIs	2011 KS aggregate unit SIR	p-value	95% Confidence interval	2009 US SIR	2010 US SIR <sup>1</sup>	2011 US SIR
Medical Critical Care	6	19	22.401	<b>0.848</b>	0.2772	0.510, 1.325	1.000	1.009	<b>0.956</b>
Medical/Surgical Critical Care (combined)	27	28	44.370	<b>0.631</b>	0.0058	0.419, 0.912	1.000	1.006	<b>1.039</b>

## References

1. Kansas Hospital Association. 2011 Kansas Hospital Survey.
2. Centers for Disease Control and Prevention. NHSN manual: patient safety component protocols: central line-associated bloodstream infection (CLABSI) events. Available from: [http://www.cdc.gov/nhsn/PDFs/pscManual/4PSC\\_CLABScurrent.pdf](http://www.cdc.gov/nhsn/PDFs/pscManual/4PSC_CLABScurrent.pdf). Accessed September 14, 2011.
3. Centers for Disease Control and Prevention. NHSN manual: patient safety component protocols: catheter-associated urinary tract infection (CAUTI) events. Available from: <http://www.cdc.gov/nhsn/acute-care-hospital/CAUTI/index.html>. Accessed September 14, 2011.
4. Centers for Disease Control and Prevention. Surveillance definition of healthcare-associated infection and criteria for specific types of infections in the acute care setting. Available from: [http://www.cdc.gov/nhsn/PDFs/pscManual/17pscNosInfDef\\_current.pdf](http://www.cdc.gov/nhsn/PDFs/pscManual/17pscNosInfDef_current.pdf). Accessed September 14, 2011.
5. Tokars JI, Klevens M, Edwards JR, Horan T. Measurement of the Impact of Risk Adjustment for Central Line-Days on Interpretation of Central Line-Associated Bloodstream Infection Rates. *Infect Control Hosp Epidemiol*. 2007 Sept; 28(9):1025-1029
6. Centers for Disease Control and Prevention. Edwards J, Peterson K, Yi M, Banerjee S, Allen-Bridson K, Morrell G, Dudeck M, Pollock D, Horan T. National Healthcare Safety Network (NHSN) report: Data summary for 2006 through 2008. *Am J Infect Control* 2009;37:783-805
7. Centers for Disease Control and Prevention. Dudeck M, Horan T, Peterson K, Allen-Bridson K, Morrell G, Pollock D, Edwards J. National Healthcare Safety Network (NHSN) report: Data summary for 2009. *Am J Infect Control* 2011;39:349-67.
8. Centers for Disease Control and Prevention. Dudeck M, Horan T, Peterson K, Allen-Bridson K, Morrell G, Pollock D, Edwards J. National Healthcare Safety Network (NHSN) report: Data summary for 2010. *Am J Infect Control* 2011;39:798-816.
9. Centers for Disease Control and Prevention. Dudeck M, Horan T, Peterson K, Allen-Bridson K, Morrell G, Antila A, Pollock D, Edwards J. National Healthcare Safety Network (NHSN) report: Data summary for 2011. *Am J Infect Control* 2013;39:286-300.
10. Centers for Disease Control and Prevention. Scott R. The Direct Medical Costs of Healthcare-Associated Infections in U.S. Hospitals and the Benefits of Prevention. March 2009
11. Centers for Disease Control and Prevention. First State-Specific Healthcare-Associated Infections Summary Data Report. Using Data Reported to the National Healthcare Safety Network, January 2009 through June 2009. Accessed on March 21, 2012 at [http://www.cdc.gov/hai/pdfs/stateplans/SIR\\_05\\_25\\_2010.pdf](http://www.cdc.gov/hai/pdfs/stateplans/SIR_05_25_2010.pdf)
12. Centers for Disease Control and Prevention. National Healthcare-associated Infections Standardized Infection Ratio Report, Using Data Reported to the National Healthcare Safety Network, July 2009 through December 2009. Accessed on March 21, 2012 at [http://www.cdc.gov/HAI/pdfs/stateplans/SIR-2010\\_JunDec2009.pdf](http://www.cdc.gov/HAI/pdfs/stateplans/SIR-2010_JunDec2009.pdf)
13. McKibbens L, Horan T, Tokars J, Fowler G, Cardo D, Pearson M, Brennan P, et. al. Guidance on Public Reporting of Healthcare-Associated Infections: Recommendations of the Healthcare Infection Control Practices Advisory Committee. *Am J Infect Control* 2005;33:217-26
14. Centers for Disease Control and Prevention. Monitoring hospital-acquired infections to promote patient safety-United States, 1990-1999 [Erratum appears in MMWR 49(09);189]. *MMWR* 2000;49:149-53
15. CDC. Vital Signs: Central Line-Associated Blood Stream Infections —United States, 2001, 2008, and 2009. *Morbidity and Mortality Weekly Report (MMWR)*. 2011; 60(08):243-248. Accessed on March 21, 2012 at <http://www.cdc.gov/mmwr/preview/mmwrhtml/mm6008a4.htm>