



**CENTRAL LINE-ASSOCIATED  
BLOODSTREAM INFECTIONS IN  
CALIFORNIA HOSPITALS,  
APRIL 2010 THROUGH MARCH 2011**

HEALTHCARE ASSOCIATED INFECTIONS PROGRAM  
CENTER FOR HEALTH CARE QUALITY  
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# CENTRAL LINE-ASSOCIATED BLOODSTREAM INFECTIONS IN CALIFORNIA HOSPITALS, APRIL 2010 THROUGH MARCH 2011

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## EXECUTIVE SUMMARY

This report is the second by the California Department of Public Health (CDPH) on central line-associated bloodstream infections (CLABSI), and the first using data submitted by California hospitals to the Centers for Disease Control and Prevention (CDC) National Healthcare Safety Network (NHSN). This report, using data reported from April 1, 2010 through March 31, 2011, provides perspective on the prevention and control of CLABSI in California. It is the first CDPH report that provides current, peer-based California standards (average rates) against which hospitals are compared. It is also the first CDPH report to present CLABSI rates by patient care locations where patients with similar medical conditions receive similar levels of care. This provides a straightforward, comprehensive, and accurate means of assessing CLABSI rates within and between hospitals.

Identifying hospitals with CLABSI rates that are statistically lower or higher than the statewide average provides one context for assessing CLABSI prevention and control. Among hospitals, 26 (7.3%) had at least one patient care location CLABSI rate that was statistically lower than the statewide average and 53 (14.8%) hospitals had at least one patient care location with a CLABSI rate that was statistically higher than the statewide average rate. These findings provide information for hospitals to help target prevention efforts to specific patient care locations. The public can also use this information to begin patient safety discussions with their health care providers that focus on those locations most relevant to their healthcare needs.

In general, California average CLABSI rates for 2010 were lower than 2009 U.S. CLABSI rates. In contrast to statewide comparisons, comparing hospitals to currently available U.S. CLABSI rates identifies more hospitals with patient care locations that are statistically lower but fewer hospitals with patient care locations that are statistically higher than the U.S. standard. Specifically, 58 (16.2%) California hospitals had at least one patient care location that was lower than 2009 U.S. rates and 36 (10.1%) had at least one patient care location that was statistically higher than 2009 U.S. rates. This may be partly explained by using CLABSI rates from different time periods (2009 U.S. rates vs. 2010 California rates). However, comparing hospital patient care location CLABSI rates to current California standards ensures hospitals are compared to other peer California hospitals during the same time period.

This report highlights key areas of success in CLABSI prevention and control by identifying patient care locations where a substantial number of hospitals reported no CLABSI during the reporting period. Half of all California hospitals providing neonatal critical care to infants weighing less than or equal to 1500 grams and three-quarters of all hospitals providing neonatal critical care to infants weighing more than 1500 grams reported no CLABSIs in those patient care locations for the reporting period. Additionally, half of all hospitals providing general (non-critical) pediatric care reported no CLABSIs in those locations. Together, neonatal and pediatric patient care locations represent large numbers of high-risk patients and exposures and some of California's most vulnerable patients.

Traditionally, hospital-based CLABSI surveillance and prevention initiatives have focused on critical care areas (e.g., intensive care units). In addition to critical care areas, California statutes require CLABSI reporting from all inpatient locations, including general care and special care. Expanding CLABSI surveillance beyond critical care areas to include special care and general care areas is important as 60.5% of California CLABSI occurred there (41.9% in general care wards and 18.6% special care areas). Evidence-based prevention strategies tailored to the unique challenges in general and special care areas will be an important addition to CLABSI prevention and control efforts in California.

This report reflects steps CDPH took in 2010 to improve data quality. CDPH required hospitals to use standardized surveillance and reporting protocols using a national web-based reporting system, provided timely and targeted quality control reports highlighting specific problem areas to individual hospitals, and provided epidemiology or infection prevention staff consultation to hospitals as needed. These steps significantly improved the utility of data and contributed to increasing hospital participation in CLABSI reporting from 79% (in the previous reporting period) to 97% for this reporting period.

CLABSI rates are affected by numerous factors, including clinical and infection control practices related to central line insertion and maintenance, risk factors related to patient care locations, and surveillance methods. While classifying CLABSI rates by patient care locations makes rates more comparable, it cannot control for all individual patient factors that can affect CLABSI rates.

Distributing information on the health of the community is among the core functions and essential services of public health. CDPH strongly supports the goals of public reporting on healthcare associated infections including the production and distribution of quality data that are valid, fair to hospitals, and useful to the public. To ensure appropriate interpretation of these data, readers should consider the overall context of the rates provided in this report. A low CLABSI rate may reflect greater diligence with infection prevention or may reflect surveillance methods that result in under detection of infections, including failure to apply appropriately standardized surveillance definitions and protocols. Similarly, a high rate may reflect lapses in infection prevention practices or more aggressive surveillance in the detection of infections, including more faithful application of standardized surveillance definitions and protocols.

## INTRODUCTION

The California Department of Public Health (CDPH) maintains a mandatory, passive reporting system for healthcare associated infections (HAIs), including primary bloodstream infections arising from a central line (a medical device) used during inpatient treatment in acute care hospitals. This report provides numbers and rates of central line-associated bloodstream infections (CLABSI) reported by hospitals from April 1, 2010 through March 31, 2011. This is the second report on CLABSIs developed by CDPH [1], and the first report using data submitted by hospitals using the National Healthcare Safety Network (NHSN), a web-based surveillance and reporting system for HAIs developed and maintained by the Centers for Disease Control and Prevention (CDC).

Bearing in mind important limitations, hospitals and health care providers can use these data to examine their patient safety practices and improve quality of care, as appropriate. The public can use these data as a starting point to discuss patient safety and quality of care with their healthcare providers.

### *Central line-associated bloodstream infections*

A central line is an intravenous catheter that terminates at or close to the heart or in one of the great vessels and is used for infusion, withdrawal of blood, or hemodynamic monitoring. These vascular access devices are potentially lifesaving but are also associated with adverse events that are both hazardous to patients and expensive to treat [2]. These complications include infections in the blood originating from the device.

Healthcare associated bloodstream infections, including CLABSIs, are among the most severe of all HAIs [3]. CLABSI rates in U.S. hospital critical care areas have declined significantly in the last decade [3]. These reductions are in part the result of evidence-based best practices aimed at choosing the best type of catheter, insertion and maintenance practices, and prompt removal [3, 4]. Such reductions suggest that CLABSI are largely preventable. The first CDPH report on central line insertion practices in California hospitals is also available [5]. CLABSI rates are important markers for overall health care and patient safety, as central lines are used throughout the hospital setting, CLABSIs are quickly recognizable and can largely be prevented using established and clearly defined strategies.

### *CDPH method for risk adjustment*

California Health and Safety Code section 1288.55 (c) (1) requires CDPH to publicly disclose information on hospital-specific CLABSI rates following a risk adjustment process consistent with NHSN methodology. To make fair comparisons across hospitals, it is necessary to adjust for differences in the severity of illness of patients across hospitals, as sicker patients are more likely to have a central line and be at increased risk for CLABSI. Patient care settings within hospitals are organized into units that generally reflect the severity of illness and type of care and are a proxy (substitute)

measure for severity of illness among patients. As expected, CLABSI rates vary by hospital unit type [6]. Therefore, CDPH presents rates in a way that accounts for differences in the underlying distribution of unit types across hospitals. This accounting does not control for all potential confounding variables, but provides an appropriate level of risk adjustment given the information that is available [7].

CDPH sought a risk adjustment strategy that was consistent with NHSN methodology and provided the most straightforward, comprehensive, and accurate means of comparing CLABSI rates within and between hospitals using the timeliest data available. To help consider options, CDPH convened the CDPH Metrics Work Group which provided specific recommendations on appropriate measures for CLABSI public reporting [8]. The CDPH Metrics Work Group and HAI Advisory Committee recommended using hospital-specific CLABSI rates stratified (classified) by patient care locations and, for this reporting period, recommended against publishing other supplemental measures, such as the standardized infection ratio [8, 9]. This report provides a 95% confidence interval (see confidence intervals below) to measure the precision of each stratified rate [10]. We also provide a summary table that displays results of statistical comparisons of each hospital-specific patient care location CLABSI rate with the California average rate. Similar to consumer product evaluations, this table provides a visual summary of all hospitals listed in one 'snapshot' table.

## **METHODS**

### *California acute care hospitals*

We identified 375 licensed general acute care hospitals representing 427 physical campuses with active acute care beds that operated for the full 12 months during the reporting period. Of these, 44 licensed hospitals had more than one campus associated with their license. We defined a multi-campus reporting facility as a licensee that reported CLABSI data combined for two or more jointly operated general acute care campuses (37 licenses comprising 81 campuses). We defined a single-campus reporting facility as an individual general acute care campus whose license included: (a) only one general acute care campus (331 licenses representing 331 acute care campuses) or (b) more than one jointly operated general acute care campus each of which reported infection information separately (7 licenses representing 15 campuses). In total, 383 entities hereafter referred to as hospitals, reported CLABSI data. We referred to multi-campus hospitals by the business name of the licensee in CDPH Licensing and Certification (L&C) records except for the licenses involving University of California hospitals, which are described as such.

### *Data sources*

The primary source of data for this report is NHSN. Hospital personnel reported data into NHSN. For each NHSN-defined unit type, the hospitals reported CLABSIs, central line days, and patient days following NHSN surveillance and reporting protocols [11]. CLABSI data included information on each CLABSI and aggregate numbers of central

line days and patient days by NHSN-defined unit and month. Hospitals provided CDPH electronic permission to access their NHSN data. On August 9, 2011, CDPH accessed NHSN CLABSI data reported from all inpatient acute care patient locations from April 1, 2010 through March 31, 2011.

### *Missing data*

On rare occasions, hospital personnel reported CLABSI case(s) for a particular unit and month but did not report a corresponding monthly count of central line days. Additionally, CDPH identified records in NHSN that contained counts of CLABSI greater than or equal to one but zero central line days. Because all central line days are needed to report accurate annual rates, CDPH excluded from analyses all data from hospital-specific patient care locations with apparently missing central line days. Additionally, we excluded NHSN-defined units that were identified only as mixed acuity units because these units cannot be categorized by the type of care provided.

### *Definitions*

CDPH required hospitals to comply with NHSN surveillance and reporting protocols including NHSN standardized definitions [11-13]. Key definitions are briefly restated here.

- **CLABSI** is a primary laboratory-confirmed bloodstream infection in a patient with a central line at the time of (or within the 48-hours prior to) the onset of symptoms and the infection was not related to an infection from another site.
- **Patient days** are the cumulative numbers of patients hospitalized each day over the reporting period.
- **Central line days** are the cumulative numbers of hospitalized patients with a central line in place each day over the reporting period.
- A **permanent central line** is a central line placed into an incision and threaded through a tunnel of tissue until it enters the appropriate vein or artery.
- A **temporary central line** is one that is not tunneled.
- The **device (central line) utilization ratio** is the ratio of central line days to patient days and is, for each location, one measure of invasive practices and may serve as a marker for severity of illness of patients. For this reporting period, device utilization ratios included only those months when central lines were used. This may overestimate the ratio for some patient care locations for some hospitals.
- A **major teaching hospital** is a facility that is an important part of the teaching program of a medical school and where the majority of medical students rotate through multiple clinical services. We implemented a process to ensure that California hospitals were correctly identified according to major teaching status for this report.
- **Patient care areas** are three broad categories of care provided in inpatient general acute care hospital settings. They include critical care areas (further subdivided as adult-pediatric and neonatal), general care areas (i.e., 'wards'), and special care areas (inpatient bone marrow transplant, oncology, solid organ

transplant, or long-term acute care). In this report, references to ‘oncology’ include hematology services.

NHSN defines more than 60 unit types for inpatient acute care hospital settings [14]. California hospitals self-identified 50 NHSN-defined unit types. Following the recommendations of the CDPH Metrics Work Group [8], CDPH consolidated NHSN-defined unit types into 20 patient care locations [Appendix A]. The CDPH Metrics Work Group judged these patient care locations as providing similar types of care and having similar risks of CLABSI based on published 2009 U.S. CLABSI rates [6].

The 20 CDPH-defined patient care locations relate to three broad categories of patient care areas as follows:

Critical care areas include these seven patient care locations:

- medical critical care (further subdivided into major teaching and all others), medical/surgical (further subdivided into major teaching and all others), surgical, burn, trauma, pediatric, and neonatal (further subdivided into five birth weight categories).

General care areas (‘wards’) include these nine patient care locations:

- step down (further subdivided into adult, pediatric, and neonatal), medical, medical/surgical, surgical, rehabilitation (further subdivided into adult and pediatric), labor/delivery/recovery/postpartum, behavioral/psychiatric, jail, and general pediatric.

Special care areas include these four patient care locations:

- bone marrow transplant (further subdivided into adult and pediatric and by temporary and permanent central lines), oncology (further subdivided into adult and pediatric and by temporary and permanent central lines), solid organ transplant (further subdivided by temporary and permanent central lines), and long-term acute care (further subdivided by temporary and permanent central lines).

### *Quality assurance and control*

Hospital personnel were solely responsible for the quality and completeness of their CLABSI data. CDPH helped hospitals identify potential systematic data errors by reviewing hospital-specific NHSN data and identifying and reporting to hospitals potential discrepancies. In March and April 2011, we distributed to hospitals quality assurance and control reports that identified missing, incomplete, or potentially aberrant data for the reporting period. We strongly encouraged hospitals to investigate and resolve these data issues. Additionally, in July 2011, we sent to hospitals a detailed report highlighting potential data quality issues. We encouraged hospitals to conduct a final review and complete all changes by August 5, 2011. CDPH made available to hospitals the assistance of epidemiologists or regional infection prevention staff, as needed, to help resolve NHSN enrollment or reporting issues.

When publicly reporting HAIs, the CDC Healthcare Infection Control Practices Advisory Committee (HICAP) recommended states use established public health surveillance methods including many of the methods introduced by CDPH in 2011 [7]. In an ongoing effort to improve data quality, CDPH is evaluating strategies to begin independent data validation.

### *Data presentation, organization, and statistical analyses*

We report as primary measures the number of CLABSIs, central line days, patient days, unadjusted CLABSI rates per 1000 central line days, 95% confidence intervals assuming an exact Poisson distribution, and device (central line) utilization ratios, classified by patient care locations. Because of instability of rates with small sample sizes, we did not present rates with fewer than 50 central line days. Because they are inherently not informative, we did not compare hospital CLABSI rates with state average rates for patient care locations with fewer than 10 reporting hospitals.

We report CLABSI rates separately for permanent central lines and temporary central lines in special care locations because the risk of CLABSI differs by central line type and both types are frequently used in special care locations. In this report, we considered central line and umbilical catheters to be synonymous for neonatal critical care locations and reported them together as CLABSI and central line days. Beginning in 2012, NHSN will also combine neonatal umbilical and central lines. CLABSI rates in neonatal critical patient care locations are presented for each of five infant birth weight categories (less than or equal to 750 grams, 751-1000 grams, 1001-1500 grams, 1501-2500 grams and more than 2500 grams).

This report presents primary CLABSI measures in three ways:

1. We present statewide average CLABSI rates and average device (central line) utilization ratios for each patient care location. Additionally, for patient care locations with at least 10 reporting hospitals, we present the distributions of hospital-specific CLABSI rates (as key percentiles). California average CLABSI rates are the peer-based standards against which individual hospital CLABSI rates are compared. Device (central line) utilization ratios, by patient care location, are a measure of how often, on average, central lines are used in each location. A high device utilization ratio compared with other hospitals might indicate greater severity of illness. On the other hand, device utilization ratios may be lower in some hospitals due to reductions in unnecessary line use, one of the means for preventing CLABSIs. Key percentiles provide a measure of the inter-hospital variability in CLABSI rates for each patient care location (*Table 1*).
2. We present an alphabetical list of California hospitals, patient care locations, and symbols identifying those hospital-specific locations where CLABSI rates were significantly higher, lower, or no different than state average rates (*Table 2*).
3. We present detailed, hospital-specific CLABSI information for each of the 20 patient care locations and their subdivisions. Information includes an alphabetical list of California hospitals, numbers of CLABSI, central line days and patient days,

CLABSI rates and their 95% confidence intervals, device (central line) utilization ratios, and symbols indicating patient care locations that were significantly higher, lower, or no different from statewide average rates (*Tables 3 - 39*).

In Tables 3-39, CDPH also compares hospital CLABSI rates with 2009 U.S. rates published by CDC [6]. CDC only publishes CLABSI rates for a subset of NHSN-defined units; therefore, we conducted comparisons between hospitals and U.S. data using only these published units. On occasion, hospital-specific patient care locations may have no comparable NHSN-defined unit with a published rate. In these situations, we made no comparisons and the table cell for U.S. to hospital comparisons is blank.

In Table 40, we present those hospitals that were not included in analyses (Tables 1-39) because they did not report CLABSI data, reported no central line days (i.e., did not use central lines during the reporting period), had missing central line days that prevented calculation of any CLABSI rate for the reporting period, or reported only mixed acuity patient care locations that could not be risk adjusted.

#### *Statistical analyses: Comparisons using patient care location-specific confidence intervals*

A confidence interval is a range of values that is used to quantify the precision of a rate that is associated with random variation. The wider the interval, the greater the uncertainty associated with the rate. The width of the confidence interval is in part related to the reported numbers of central line days. Smaller facilities with fewer central line days have the least precision associated with their rates and the widest confidence intervals. Confidence intervals provide no information about systematic errors or bias.

We used confidence intervals to compare hospital-specific rates with the state average rate for each patient care location. This approach assumes that the statewide average is the 'true value' for the rate and the comparison is equivalent to performing an exact single-sample test. A hospital-specific CLABSI rate was significantly (statistically) higher than the California average rate if the hospital's entire 95% confidence interval was higher than the average, significantly (statistically) lower than the California average rate if the hospital's entire confidence interval was lower than the average rate and statistically no different from the California average rate if the hospital's confidence interval contained the average rate.

Symbols used to convey the results of rate comparisons are as follows:

- statistically higher than the average rate;
- statistically lower than the average rate;
- ⊙ statistically no different from the average rate;
- comparisons are not made because of rate instability (i.e., a hospital rate with fewer than 50 central line days); and
- \* comparisons are not made for patient care locations with fewer than 10 hospitals as these comparisons are uninformative.

A hospital is more likely to have significantly higher or lower CLABSI rates if the hospital-specific rates are very extreme (much higher or much lower than the California average CLABSI rate). A hospital is also more likely to be significantly higher or lower than the average rate if the hospital has a large number of central line days because the rate is more stable and the confidence interval is narrower. Two hospitals with the exact same rate can have different statistical testing conclusions solely as a result of the numbers of central line days reported. Any assessment of rates must take into account the degree of precision in the rate as reflected by the confidence interval. Additionally, a report of no CLABSIs may not be significantly different from the statewide average if the rate is based on few central line days; this is especially true as the statewide average itself becomes lower (as detecting the difference between a low average CLABSI rate and zero becomes very difficult).

Confidence intervals for hospital-specific rates in this report may be used, with caution, to compare rates between hospitals [10, 15]. This method is useful as a quick but potentially inconclusive guide [10, 15] and its interpretation differs from those made when comparing a hospital rate with the statewide average. Generally, if two hospital location-specific confidence intervals do not overlap, the rates are significantly different from one another. However, if the confidence intervals do overlap, one may not conclude that the rates are not significantly different. In other words, when the confidence intervals overlap, it does not mean that the rates are statistically the same. In this case, other statistical testing strategies (such as calculating the ratio of the two rates) are required to determine if two hospital-specific rates differ.

## RESULTS

Among 383 California hospitals in continuous operation during the reporting period, 13 reported no central line days (i.e., had no patients at risk of developing CLABSIs). Of the remaining 370 hospitals covered by the state's CLABSI reporting statutes, 366 reported at least one central line day, three submitted to NHSN their intention to report but provided no data on central line days, and one submitted no data to NHSN. The 366 hospitals reported 3519 CLABSIs from all inpatient, acute-care settings. We excluded 172 cases (4.9% of CLABSIs) from further analyses because 14 had insufficient information on the location of patient care and 158 cases occurred in locations with missing central line days. Excluding these 172 cases removed eight hospitals (3.2%) from the analyses. In total, we excluded 25 hospitals from Tables 1-39; we describe the reasons for their exclusion in Table 40.

The remaining 358 hospitals reported 3347 CLABSI. Among hospitals, 306 (85.2%) reported data for critical care areas excluding neonatal, 123 (34.4%) reported data for neonatal critical care areas, 334 (93.3%) reported data for general care areas, and 60 (16.7%) reported data for special care areas. CLABSI rates varied across areas as follows:

- critical care excluding neonatal (1.1 per 1,000 central line days),
- neonatal critical care (1.0 per 1,000 central line days),

- general care (0.9 per 1,000 central line days), and
- special care (1.5 per 1,000 central line days).

Hospitals reported central line days most frequently from:

- general care areas (48.5%, 1512873 central line days),
- critical care areas excluding neonatal (32.7%, 1020818 central line days),
- special care areas (13.2%, 410322 central line days), and
- neonatal critical care areas (5.6%, 174380 central line days).

Device (central line) utilization (frequency of central line use among patients) was most common in:

- critical care areas excluding neonatal (52.6%),
- special care areas utilizing
  - temporary central lines (42.9%) or
  - permanent central lines (30.7%),
- neonatal critical care areas (26.3%), and
- general care areas (16.2%).

Hospitals reported 1986 patient care locations; the median number of patient care locations per hospital was 4 (range: 1 to 22 patient care locations).

#### *California average CLABSI rates (Table 1)*

California average CLABSI rates varied widely by patient care location but were generally lower than equivalent U.S. CLABSI rates (data not shown). The relative differences between California patient care location-specific CLABSI rates were generally as expected. However, in contrast to U.S. rates, California permanent CLABSI rates in special care patient care locations were generally higher than temporary CLABSI rates. The ratios of permanent to temporary central line days were generally lower in California compared with U.S. data [6]. In oncology patient care locations, U.S. data demonstrate 1.9 permanent central line days for every temporary central line day, whereas California data demonstrate 0.5 permanent central line days for every temporary central line day. In pediatric oncology patient care locations, national data indicate 5.0 permanent central line days for every temporary central line day whereas California data indicate 1.9 permanent central line days for every temporary central line day. In long-term acute care locations, national data indicate 0.14 permanent central line days for every temporary central line day whereas California data indicate 0.05 permanent central line days for every temporary central line day. It is unclear whether these findings indicate a systematic error in central line day reporting (perhaps misclassifying permanent line days as temporary line days) or a genuine difference in the use of permanent and temporary central lines in California hospitals. However, because California CLABSI rates in special care settings appear to be different than expected for the type of central lines used, they should be viewed and interpreted with caution.

The distributions of hospital-specific CLABSI rates by key percentiles illustrate several key findings. First, the median CLABSI rate was zero for hospitals reporting these patient care locations: neonatal critical care (regardless of birth weight category), neonatal step down, general adult rehabilitation, labor/delivery/recovery, behavioral/psychiatric, general pediatric care, and long term acute care locations using permanent central lines. This translates to at least half of all hospitals reporting no CLABSIs in these locations and is most notable in patient care locations with large numbers of reporting hospitals and central line days (i.e., neonatal critical care, general pediatric care, and general adult rehabilitation). Second, the interquartile range (from the 25<sup>th</sup> to the 75<sup>th</sup> percentile) communicates information about inter-hospital variation in rates. Two patient care locations had interquartile ranges with four- to five- fold differences (burn critical care and neonatal step down). This suggests that hospitals with these locations had unusually large variations in patient-centered factors (e.g., severity of illness), infection control practices, or surveillance methodologies.

*California hospitals compared with average California and U.S. CLABSI rates (Tables 2-39)*

Of 358 hospitals, 102 (28.4%) reported no CLABSIs (no cases in any patient care location) for the reporting period but accounted for only 4.8% of all central line days. Of these 102, only 3 (2.9%) had at least one patient location CLABSI rate that was significantly lower than either the state average or U.S. CLABSI rates.

Of 358 hospitals, 26 (7.3%) had at least one patient care location CLABSI rate that was statistically lower than the statewide average and 53 (14.8%) hospitals had at least one patient care location with a CLABSI rate that was statistically higher than the statewide average.

Of 358 hospitals, 58 (16.2%) California hospitals had at least one patient care location that was lower than 2009 U.S. average CLABSI rates and 36 (10.1%) had at least one patient care location that was statistically higher than 2009 U.S. CLABSI rates.

Box 1 indicates numbers of hospitals with CLABSI rates that were lower, no different than, or higher than the California average rate for each patient care location. Also provided are the numbers of hospitals for which we could not perform a comparison either because the hospital rate was based on fewer than 50 central line days or there were fewer than 10 reporting hospitals for that patient care location. The numbers of hospitals with at least one patient care location with CLABSI rates higher or lower than the comparable statewide average rates were somewhat similar across patient care locations. Within each patient care location, the numbers of hospitals with at least one patient care location CLABSI rate that was higher than the average rate tended to be modestly higher than the numbers of hospitals with significantly lower CLABSI rates. This may arise in part from the difficulty in detecting significantly lower CLABSI rates (even if the hospital has had no CLABSIs) as average rates become lower.

Box 1. Summary of comparisons between hospital-specific CLABSI rates and California average CLABSI rates by patient care locations

Patient care locations	Numbers of hospitals				
	Total	Lower than the state average	No different than the state average	Higher than the state average	Not tested
<b>Critical care areas</b>					
Medical Critical Care - Major Teaching	16	1	12	3	0
Medical/Surgical Critical Care - Major Teaching	11	1	9	1	0
Medical Critical Care - All Others	57	2	53	2	0
Medical/Surgical Critical Care - All Others	240	5	216	14	5
Surgical Critical Care	53	1	50	2	0
Burn Critical Care	12	2	9	1	0
Trauma Critical Care	12	0	11	1	0
Pediatric Critical Care	35	1	30	4	0
Neonatal critical care					
Birth weight ≤= 750 Grams	98	0	70	2	26
Birth weight: 751-1000 Grams	110	0	79	2	29
Birth weight : 1001-1500 Grams	116	0	92	4	20
Birth weight : 1501-2500 Grams	119	0	92	1	26
Birth weight: >2500 Grams	118	0	75	2	41
<b>General care areas (wards)</b>					
Step Down - Adult	105	2	96	5	2
Step Down - Neonatal	18	0	9	0	9
Step Down - Pediatric	4	*	*	*	4
Medical	153	4	136	10	3
Medical/Surgical	267	2	238	9	18
Surgical	107	1	96	5	5
Adult: Rehabilitation	53	0	50	3	0
Labor, Deliver, Recovery, Postpartum	72	0	16	0	56
Behavioral Health/Psych	12	0	5	0	7
Jail	10	0	8	0	2
Pediatric - All General	69	0	43	4	22
Pediatric: Rehabilitation	2	*	*	*	2
<b>Special care areas</b>					
<i>Permanent central lines</i>					
Bone Marrow Transplant	7	*	*	*	7
Bone Marrow Transplant - Pediatric	3	*	*	*	3
Oncology	19	1	15	3	0
Oncology - Pediatric	8	*	*	*	8
Solid Organ Transplant	3	*	*	*	3
Long Term Acute Care	11	1	8	1	1
<i>Temporary central lines</i>					
Bone Marrow Transplant	5	*	*	*	5
Bone Marrow Transplant - Pediatric	3	*	*	*	3
Oncology	24	4	15	4	1
Oncology - Pediatric	8	*	*	*	8
Solid Organ Transplant	6	*	*	*	6
Long Term Acute Care	19	4	11	3	1

\* indicates no statistical testing conducted

## DISCUSSION

This report is the first public disclosure of the numbers and rates of CLABSIs in California hospitals using data submitted to CDPH by California hospitals using NHSN. The report provides perspective on CLABSI prevention and control in California and is the first CDPH report to provide peer-based standards (average CLABSI rates) against which hospitals are compared. It is also the first CDPH report to present rates stratified (classified) by patient care locations. These stratified rates provide a straightforward, comprehensive, and accurate means of assessing CLABSI rates within and between hospitals.

Identifying hospitals with CLABSI rates that are statistically lower or higher than the statewide average provides one context for assessing CLABSI prevention and control. Among hospitals, 26 (7.3%) had at least one patient care location CLABSI rate that was statistically lower than the statewide average and 53 (14.8%) hospitals had at least one patient care location with a CLABSI rate that was statistically higher than the statewide average rate. These findings provide information for hospitals to help target prevention efforts to specific patient care locations. The public can also use this information to begin patient safety discussions with their health care providers that focus on those locations most relevant to their healthcare needs.

In general, California average CLABSI rates for 2010 were lower than 2009 U.S. CLABSI rates. As a result, comparing hospitals to currently available U.S. CLABSI rates identifies more hospitals with patient care locations that are statistically lower but fewer hospitals with patient care locations that are statistically higher than the U.S. average rates. Specifically, 58 (16.2%) California hospitals had at least one patient care location that was lower than 2009 U.S. rates and only 36 (10.1%) had at least one patient care location that was statistically higher than 2009 U.S. rates. This may be partly explained by using CLABSI rates from different time periods (2009 U.S. rates vs. 2010 California rates). However, comparing hospital patient care location CLABSI rates to current California standards ensures hospitals are compared to other peer California hospitals during the same time period.

This report highlights several key areas of success in CLABSI prevention and control by identifying patient care locations where a substantial number of hospitals report no CLABSI during the reporting period. Half of all California hospitals providing neonatal critical care to infants weighing less than or equal to 1500 grams and three-quarters of all hospitals providing neonatal critical care to infants weighing more than 1500 grams reported no CLABSIs in those patient care locations for the reporting period. Additionally, half of all hospitals providing general (non-critical) pediatric care also reported no CLABSIs in these locations. Together, neonatal and pediatric patient care locations represent large numbers of high-risk patients and exposures and represent some of California's most vulnerable patients.

Traditionally, hospital-based CLABSI surveillance and prevention initiatives have focused on critical care areas [3, 4]. Few states report CLABSI rates outside of these

areas. California statutes require CLABSI reporting from all inpatient locations, which include critical care areas, general care areas, and special care areas. Report findings underscore the importance of expanding CLABSI surveillance beyond critical care areas into general and special care areas as 60.5% of California CLABSIs occurred there (41.9% in general care areas and 18.6% in special care areas). Evidence-based prevention strategies tailored to the unique challenges in general and special care areas will be an important addition to CLABSI prevention and control efforts in the future.

This report reflects data quality improvement steps CDPH took in 2010. CDPH required hospitals to use standardized surveillance and reporting protocols using a national web-based reporting system, provided timely and targeted quality control reports highlighting specific problem areas to individual hospitals, and provided epidemiology or regional infection prevention staff consultation to hospitals, as needed. These steps improved the utility of data and helped to increase CLABSI reporting from hospitals from 79% (in the previous CDPH CLABSI report) to 97% for this reporting period.

The findings of this report highlight opportunities for future improvements in CLABSI surveillance, reporting, prevention, and control in California. This reporting period reflects the first period during which CDPH required California hospitals to report CLABSI data using NHSN and hospitals were still adjusting to NHSN standardized definitions and protocols. Anomalies detected in the reporting of permanent and temporary central line days in special care settings may be the result of an unclear understanding of NHSN definitions or may reflect unique usages of these line types in California. Independent validation of data submitted to NHSN by hospitals would further improve data accuracy and completeness [7-8, 16-17].

CLABSI rates are affected by numerous factors, including clinical and infection control practices related to central line insertion and maintenance practices, risk factors related to a patient care locations, and surveillance methods [7]. While stratifying CLABSI rates by patient care location makes rates more comparable, it cannot control for all individual patient factors that can affect CLABSI rates [7]. Therefore, readers should consider the overall context of these rates. A low CLABSI rate may reflect greater diligence with infection prevention or may reflect less effective surveillance methods that detect fewer infections, including failure to appropriately apply standardized surveillance definitions and protocols. Similarly, a high rate may reflect lapses in infection prevention practices or more aggressive infection surveillance including more consistent application of standardized surveillance definitions and protocols. CLABSI rates in this report provide a starting point for discussions about patient safety between the public and their health care providers.

## **CONCLUSIONS**

The distribution of information on the health of the community is among the core functions and essential services of public health [18]. CDPH strongly supports the goals of public reporting on healthcare associated infections including the production and distribution of quality data that are valid, fair to hospitals, and useful to the public. Bearing in mind the limitations noted above, hospitals and health care providers can use

the information in this report to examine their patient safety practices and improve quality of care. Hospitals not participating in CLABSI prevention collaborative partnerships should explore available opportunities for participation. The public can use information in this report to discuss patient safety with their health care providers and hospital staff.

In follow-up to this report, CDPH will take the following steps:

- Evaluate capacity to help hospitals with statistically high and low CLABSI rates to identify barriers and opportunities to CLABSI prevention and control;
- Evaluate capacity to begin validating CLABSI data reported by hospitals while continuing to monitor data completeness and accuracy;
- Use these data as an evidence base for evaluating the effectiveness of infection prevention strategies; and

Hospitals should review these data and consider the following:

- Review processes for identifying and classifying bloodstream infections as CLABSIs and modify them as indicated;
- Review processes for collecting central line days and modify them as indicated; and
- Investigate patient care locations with the highest and lowest rates of CLABSI to ensure complete and accurate reporting and identify opportunities to improve CLABSI prevention and control

The public should consider the following:

- Review the information presented for your hospital, including the context for interpreting CLABSI rates;
- Ask your health care provider about the actions your provider and your hospital are taking to ensure patient safety, including steps to protect patients against CLABSIs; and
- Ask your health care provider about the actions you can take to ensure your safety in the hospital, including protecting against CLABSIs.

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**APPENDIX A**  
**CDPH-DEFINED PATIENT CARE LOCATIONS**

## CDPH-DEFINED PATIENT CARE LOCATIONS

NHSN defines more than 60 unit types for inpatient acute care hospital settings. California hospitals self-identified 50 different NHSN-defined unit types. As recommended by the CDPH Metrics Work Group and HAI Advisory Committee, CDPH rolled NHSN-defined unit types into **20 patient care locations**. The CDPH Metrics Work Group judged these 20 patient care locations to provide similar types of care, have similar risks of CLABSI based on published 2009 U.S. CLABSI rates, and to be appropriate for consolidation. This Appendix identifies the CDPH-defined patient care locations and their subdivisions and lists NHSN-defined units included within each location.

**Critical care areas** Nursing care areas that provide intensive observation, diagnosis, and therapeutic procedures for patients who are critically ill. These areas exclude step-down, intermediate, or telemetry care areas. The following are the CDPH-defined patient care locations associated with critical care areas:

- **Medical critical care** locations specialize in care of critically ill patients with nonsurgical conditions including cardiac, neurological, prenatal, or respiratory conditions.
  - These CDPH-defined patient care locations are further subdivided by
    - Major teaching institutions
    - All other (non-major teaching) institutions
- **Medical/surgical critical care** locations specialize in care of critically ill patients with medical and/or surgical conditions.
  - These CDPH-defined patient care locations are further subdivided by
    - Major teaching institutions
    - All other (non-major teaching) institutions
- **Surgical critical care** patient locations specialize in critical care for pre- or post-surgical conditions, including cardiac and thoracic surgery and neurosurgery.
- **Burn critical care** locations specialize in care of critically ill patients with significant/major burns.
- **Trauma critical care** patient locations specialize in care of critically ill patients who require a high level of monitoring and/or intervention following trauma or during critical illness related to trauma.
- **Pediatric critical care** locations specialize in critical care to patients less than or equal to 18 years of age including surgical and/or medical care.
- **Neonatal critical care** locations specialize in Level II/III and/or Level III critical care provided to newborns and infants; in these locations umbilical catheter and central line bloodstream infections and device line days are combined
  - These CDPH-defined patient care locations are further subdivided by birth weight categories of
    - *less than or equal to 750 grams*
    - *751 grams - 1000 grams*
    - *1001 grams - 1500 grams*
    - *1501 grams - 2500 grams*

- *more than 2500 grams*

### **General care areas**

- ***Step down general care*** locations specialize in patients that are hemodynamically stable who can benefit from close supervision and monitoring. These CDPH-defined patient care locations are further subdivided by age groups as
  - *Adult*
  - *Neonatal* (infants of weight  $\geq 1500$  grams requiring resuscitation and stabilization before transfer to a facility at which newborn intensive care is provided)
  - *Pediatric step down general care* locations specialize in patients less than or equal to 18 years of age
- ***Medical general care*** locations provide evaluation and treatment of nonsurgical conditions including acute stroke, burn, gerontology, medical, neurology, pulmonary, or telemetry services.
- ***Medical/surgical general care*** locations provide evaluation and treatment of medical and/or surgical conditions including gynecological.
- ***Surgical general care*** locations provide evaluation and treatment for pre- or post-surgical conditions including neurosurgery, orthopedic, orthopedic trauma, or vascular surgery.
- ***Rehabilitation general care*** locations provide care to patients who have lost function due to acute or chronic pain, musculoskeletal problems, stroke, or catastrophic events resulting in complete or partial paralysis. These CDPH-defined locations are further subdivided by age of patient
  - *Adult*
  - *Pediatric patients* (patients' less than or equal to 18 years of age)
- ***Labor, delivery, postpartum general care*** locations provide evaluation and treatment of normal and high risk pregnancy patients.
- ***Behavioral general care*** locations provide evaluation and treatment of patients with acute psychiatric or behavioral disorders.
- ***Jail general care*** locations provide evaluation and treatment of patients who are in custody of law enforcement during their treatment.
- ***Pediatric general care*** locations provide evaluation or treatment to any patient less than or equal to 18 years of age for any medical or surgical condition.

### **Special care areas**

- ***Bone marrow transplant special care*** locations specialize in patients who undergo bone marrow (stem cell) transplant for the treatment of various disorders. These CDPH-defined locations are further subdivided by age of patients
  - Adult patients further subdivided by the type of central line
    - Permanent central lines
    - Temporary central lines
  - Pediatric patients (patients less than or equal to 18 years of age) further subdivided by the type of central line
    - Permanent central lines

- Temporary central lines
- **Oncology special care** locations specialize in patients who require management and treatment for cancer and/or blood disorders. These CDPH-defined locations are further subdivided by age of patients
  - Adult further subdivided by the type of central line
    - Permanent central lines
    - Temporary central lines
  - Pediatric patients (patients less than or equal to 18 years of age) further subdivided by the type of central line
    - Permanent central lines
    - Temporary central lines
- **Solid organ transplant special care** locations specialize in patients requiring postoperative care after solid organ transplant. These CDPH-defined locations are further subdivided by the type of central line
  - Permanent central lines
  - Temporary central lines
- **Long-term acute care special care** locations specialize in patients suffering from medically complex conditions, or patients who have suffered recent catastrophic illness or injury and require an extended stay in an acute care environment. These CDPH-defined locations are further subdivided by the type of central line
  - Permanent central lines
  - Temporary central lines

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