

## **TECHNICAL NOTES**

### ***Clostridium difficile* Infections in California Hospitals, 2011**

#### **Introduction**

*Clostridium difficile* (*C. difficile*) is a common cause of diarrhea in health care settings, resulting in longer hospital stays and higher hospital costs [1]. Morbidity and mortality rates due to *Clostridium difficile* infection (CDI) have increased over the past several years as a result of the emergence of *C. difficile* strains that are more infectious and more virulent [2]. Infection control precautions including hand hygiene and environmental cleaning are essential in prevention transmission. Virtually all patients with CDI received antibiotics between two weeks and three months prior to the infection; therefore, judicious use of antibiotics is also important in decreasing and preventing CDI [2, 3].

Health and Safety Code section 1288.55(a)(1) requires general acute care hospitals to report to the California Department of Public Health (CDPH) all cases of CDI identified in their facilities. These *Technical Notes* describe the definitions, methods, and limitations associated with the CDPH data release on CDI. The reporting period for this release (January through December 2011) overlaps by 1 quarter the reporting period for the previous CDPH release (April 2010 through March 2011). Data for both releases were submitted by California hospitals to the Centers for Disease Control and Prevention (CDC) National Healthcare Safety Network (NHSN).

The distribution of information on the health of the community is a core function and essential service of public health. CDPH strongly supports the goals of public reporting on HAIs including the production and distribution of quality data that are valid, fair to hospitals, and useful to the public. Bearing in mind important limitations, the public can use these data as a starting point to discuss patient safety and quality of care with their healthcare providers and to make more informed healthcare decisions. Hospitals and health care providers can also use these data to examine their patient safety practices and improve quality of care, as appropriate.

#### **Materials and Methods**

##### ***Reporting hospitals***

As indicated in the table below, we identified 378 licensed general acute care hospitals representing 424 physical campuses with active acute care beds that operated continuously (for the full 12 months) during the reporting period. Of these, 42 licensed hospitals had more than one campus associated with its license. We defined a multi-campus reporting facility as a licensee that reported HAI data combined for two or more jointly operated general acute care campuses (35 licenses comprising 73 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 (336 licenses comprising 336 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, there were 386 reporting entities, hereafter referred to as hospitals. 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.

<b>General Acute Care Hospitals (GACHs)</b>	<b>Number of Licenses</b>	<b>Number of Campuses</b>
With active beds (total)	378	424
Consolidated license, <b>reported together</b>	<b>35</b>	73
Consolidated license, <b>reported separately</b>	7	<b>15</b>
Single license, reporting separately	336	<b>336</b>
<b>Reporting entities</b>	<b>35 + 15 + 336 = 386</b>	

### **Data sources**

California hospitals submitted CDI data into NHSN using the surveillance and reporting protocols described in the Multidrug Resistant Organism (MDRO) Laboratory-Identified (LabID) Event Module [4]. Hospitals provided CDPH with electronic permission to access these data. On July 23, 2012, we accessed the NHSN CDI data for the reporting period January 1, 2011 through December 31, 2011. The data included NHSN-produced files listing all CDI LabID events (event file) and number of inpatient days and CDI rates (rate file).

### **Missing data**

In some cases, hospitals reported CDI LabID events but did not report corresponding monthly counts for inpatient days. We excluded from this analysis hospitals that reported CDI LabID events but did not report monthly numbers of inpatient days or did not report any data at all.

### **Definitions**

CDPH required hospitals to comply with NHSN surveillance and reporting protocols, including NHSN standardized definitions. Key definitions are defined here.

- A **C. difficile LabID Event** is a positive result for a laboratory assay for *C. difficile* toxin A and/or B or a toxin-producing *C. difficile* organism detected in stool sample. This included laboratory tests positive for *C. difficile* from all available inpatient locations, excluding neonatal intensive care units (NICUs) and well-baby nurseries.
- **Hospital Onset (HO)** is a LabID Event that occurs more than three days after admission to the facility (i.e., on or after day four), excluding NICUs and well-baby nurseries.

- **Community Onset Hospital Associated (CO-HA)** is a LabID Event from a patient within the first three days of admission who was discharged from the same facility within four weeks prior to the current date of stool specimen collection, excluding NICUs and well-baby nurseries.
- **Hospital Associated (HA)** is the sum of HO LabID Events and CO-HA LabID Events, excluding NICUs and well-baby nurseries.
- **Inpatient Days** are the cumulative numbers of patients hospitalized each day during the reporting period, excluding NICUs and well-baby nurseries.
- **Polymerase Chain Reaction (PCR)** is a type of nucleic acid amplification test that detects *C. difficile* toxin gene(s); it is commonly referred to as a molecular test method. Advantages for this laboratory test method are the high sensitivity (the ability of the test to detect *C. difficile* when present) and short turn-around time compared to other methods.
- **Long-Term Acute Care** is a hospital defined by the Centers for Medicare & Medicaid Services (CMS) as a licensed general acute care hospital providing care for patients with medically complex conditions requiring an average length of stay for all patients of greater than 25 days [5].
- **Reporting Period** was January 1, 2011 through December 31, 2011.

### ***Quality assurance and control***

Hospital personnel were solely responsible for the quality and completeness of their CDI data. In May 2011 and November 2011, CDPH distributed quality assurance and control reports that identified missing, incomplete, or potentially aberrant data for the reporting period. CDPH made available to hospitals the assistance of data managers, epidemiologists, and regional infection prevention staff to help resolve NHSN enrollment or reporting issues. Additionally, in July 2012 we emailed hospitals with fewer than 12 months of data to notify them of missing data in NHSN. We encouraged hospitals to conduct a final review of their data and complete all corrections and changes before the final data download on July 23, 2012.

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

We report the following primary CDI measures: number of HO CDI LabID events, number of HA CDI LabID events, inpatient days, unadjusted HO and HA CDI rates per 10,000 inpatient days, and 95% confidence intervals assuming an exact Poisson distribution [6]. Confidence intervals provide a measure of the precision of each CDI rate. We also report whether a hospital uses PCR to detect CDI, as these hospitals may have higher rates resulting from use of a more sensitive laboratory test. In this report, we do not group or stratify hospitals by PCR use. Some hospitals use different testing algorithms in addition to PCR; it would be difficult to calculate rates by testing

methodology. Additionally, grouping hospitals by PCR use does not indicate that rates from those hospitals would be comparable, as the rates are unadjusted for other risk factors associated with CDI (e.g., hospital type, characteristics of patient population, and community onset rates).

We present CDI rates and PCR testing data for LTAC hospitals separately from other hospitals based on the likelihood that their CDI rates will be higher as a result of longer patient lengths of stay. Length of stay is an established risk factor for CDI [1]. We do not present CDI rates for hospitals by peer group or type of hospital (i.e., major teaching, pediatric, trauma) as there is no evidence that risk for acquiring CDI in these types of hospitals is higher or lower than in hospitals outside of these peer groups. Additionally, comparisons within hospital peer groups might be misleading due to differences in laboratory testing methodology between individual hospitals.

We performed the following calculations on data submitted to NHSN during the reporting period. The numerators for the rates were all LabID Events categorized as HO or HA. The denominators for the rates were total inpatient days for all available inpatient locations, excluding NICUs and well-baby nurseries. For each hospital we calculated the HO Incidence Rate and HA Incidence Rate. The equations for the rate calculations are:

$$HO \text{ Rate per } 10,000 \text{ inpatient days} = \frac{\text{Number of HO Cases}}{\text{Total Inpatient Days}} \times 10,000$$

$$HA \text{ Rate per } 10,000 \text{ inpatient days} = \frac{\text{Number of HA Cases}}{\text{Total Inpatient Days}} \times 10,000$$

We used 10,000 as the multiplier to yield whole numbers or large fractions because CDI rates generally are low. Also, total inpatient days are most commonly in the tens of thousands. Hospitals summed and entered into NHSN all denominator data (inpatient days). We calculated HO and HA incidence rates for each hospital that reported data into NHSN for 12 months of the reporting period.

For each incidence rate, we calculated exact 95 percent confidence intervals using the Poisson distribution [6]. We calculated the statewide pooled mean (average) rate for general acute care and LTAC hospitals by dividing the sum of all CDI LabID Events by the sum of all inpatient days and multiplying 10,000.

A confidence interval is a range of values that quantifies the random variation of a rate; it does not provide information about systematic errors or bias. 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 number of inpatient days. Smaller facilities with fewer inpatient days have the least precision associated with their rates and the widest confidence intervals.

## **Limitations and context**

Differences in rates can result from differences in laboratory testing methodology, patient populations, infection and transmission prevention practices, antibiotic utilization, and/or community onset rates of CDI. Rates from facilities using different types of laboratory tests are not comparable, as there can be as much as a two-fold difference in test sensitivity. Additionally, some facilities may have changed laboratory testing methodology during the reporting period. Laboratory-based reporting depends on appropriate clinician test ordering and laboratory processing. Hospital CDI rates also may differ due to patient populations with different risks for infection such as age. The rate of community onset cases has also been shown to affect the rate of HO infections, perhaps reflecting higher admission rates of patients already at increased risk for CDI, such as patients from skilled nursing facilities. Facilities may have falsely lower rates if patient days from NICUs and well-baby nurseries were not excluded from denominator data. Currently, there are no accepted methods for adjusting CDI rate data to account for these differences in laboratory method and patient population. Therefore, the hospital-specific rates presented here have not been risk adjusted and are not comparable. With the implementation of CMS reporting requirements for CDI beginning January 2013, an NHSN risk-adjustment method should be available in late 2012.

There are no national reports of CDI incidence rates from NHSN data for comparison with this release except for the CDPH report from the previous release; therefore, it is not possible to compare these rates from California hospitals with national data. However, New York state reported a pooled mean rate of 8.2 per 10,000 patient days for 2010 [7], which is comparable to the California pooled mean rate of 7.7 per 10,000 patient days in 2011. Additionally, these data could be used to evaluate rates in California hospitals over time.

## References

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