Illinois Department of PUBLIC HEALTH

Pat Quinn, Governor
LaMar Hasbrouck, MD, MPH, Director

122 S. Michigan Ave., Suite 2009 • Chicago, Illinois 60603-6152 • www.idph.state.il.us

Trends in *Clostridium difficile* in Illinois based on Hospital Discharge Data, 1999-2012

Clostridium difficile, also referred to as *C. difficile*, is a common cause of bacterial diarrhea in hospitalized patients. *C. difficile*-associated diarrhea ranges from mild to severe and can sometimes result in severe inflammation of the intestines. The *C. difficile* organism can be found in feces, and is transferred from infected patients or contaminated environmental surfaces to patients via the hands of hospital personnel. Patients also can become infected if they touch objects or surfaces that are contaminated with *C. difficile* and then touch their mouth. Although a person may have the organism in their intestines, it does not usually cause disease until antibiotics alter normal intestinal flora, promoting overgrowth with *C. difficile*.

This report presents information about *C. difficile* from the Illinois Hospital Discharge Dataset for 1999-2012, with emphasis on 2012. The primary utility of the Hospital Discharge Dataset is to follow overall trends in the burden of *C. difficile* in Illinois hospitals. These data are routinely collected and provided to the Illinois Department of Public Health for all acute care hospitals in Illinois. The unit of analysis is the hospital discharge, not the person or patient.

The data presented in this section should be interpreted with caution. Hospital discharge data are collected for billing, rather than disease surveillance. A 2007 study in an Illinois hospital found that only 31 percent of confirmed Methicillin-resistant *Staphylococcus aureus* cases were identified using the first nine diagnosis codes from the Hospital Discharge Dataset (Schaefer, SHEA Annual Scientific Meeting, 2008). However, administrative coding may be more accurate for estimating *C. difficile* rates; one study found the sensitivity to be 78 percent (Dubberke, Emerging Infectious Diseases, 2006). Through 2007, only the first nine diagnosis codes were available to the Illinois Department of Public Health. Beginning in 2008, the Department had access to 25 codes.

The ICD-9 diagnosis code 008.45, appearing anywhere in the list of discharge diagnoses, was used to select cases for this report.

***C. difficile* Trends, 1999-2012**

The data presented in this section include the first nine diagnosis codes listed for each discharge. Rates are calculated by dividing the number of *C. difficile* cases in a given year by the total number of discharges for that year.

Table 1 shows *C. difficile* infections per 1,000 discharges in Illinois for the years 1999-2012. Overall, *C. difficile* rates among patients at Illinois hospitals during this time period increased from 4.5 per 1,000 discharges to 10.5 per 1,000 discharges. During 2012, the last year for which data are available for

Illinois, there were 16,512 *C. difficile* infections among 1,571,693 discharges; approximately 1.1 percent of all hospital discharges had diagnosis codes indicating *C. difficile* infection.

Table 1. Number of *C. difficile* Infections per 1,000 hospital discharges, 1999-2012

Year	Total number of *C. difficile* discharges	Total number of discharges	Number of *C. difficile* discharges per 1,000 discharges
1999	7,082	1,581,086	4.5
2000	7,586	1,636,046	4.6
2001	8,204	1,684,089	4.9
2002	10,309	1,685,051	6.1
2003	11,053	1,677,125	6.6
2004	14,066	1,710,389	8.2
2005	15,570	1,725,033	9.0
2006	15,359	1,724,612	8.9
2007	15,412	1,713,279	9.0
2008	16,260	1,699,853	9.6
2009	15,323	1,668,396	9.2
2010	16,262	1,644,072	9.9
2011	16,994	1,610,588	10.6
2012	16,512	1,571,693	10.5

Figure 1. Number of *C. difficile* Infections per 1,000 hospital discharges in Illinois, 1999-2012

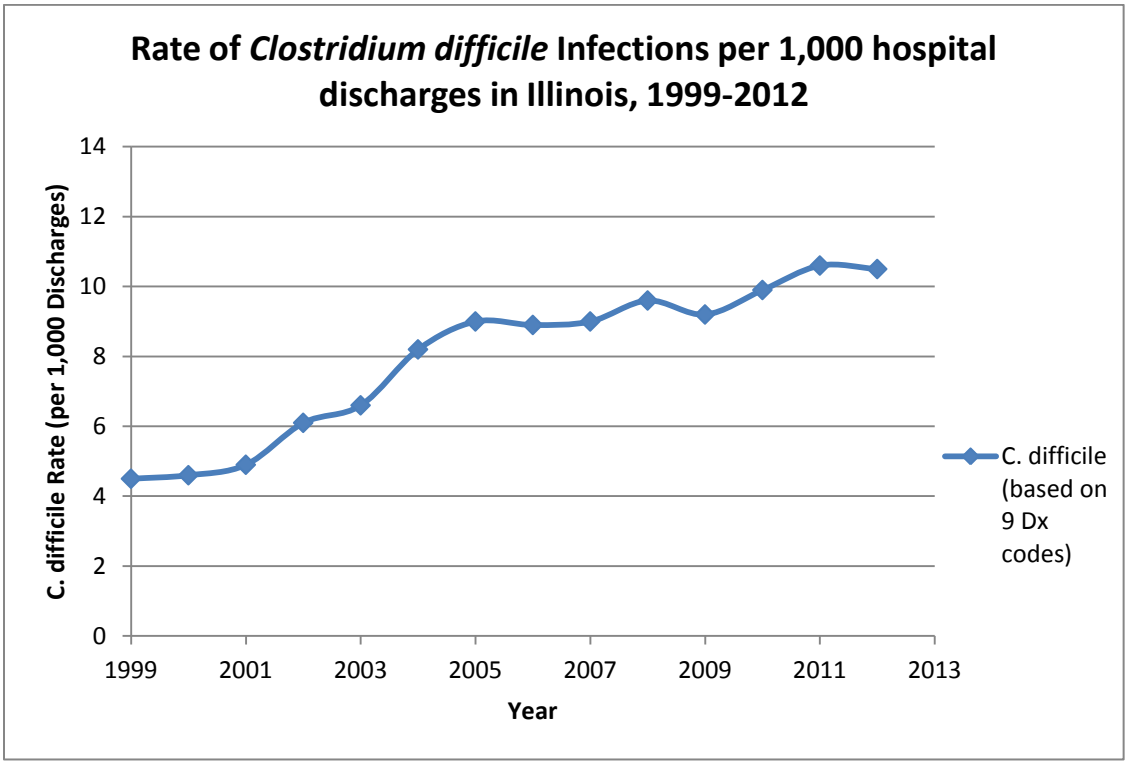


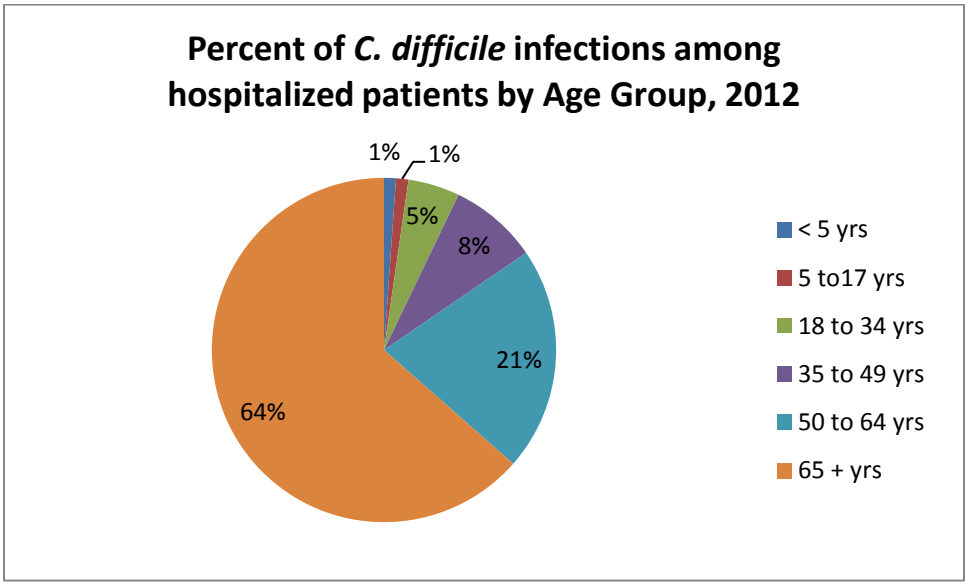
Figure 1 shows the annual *C. difficile* rates (per 1,000 hospital discharges) between 1999 and 2012, and illustrates the steady increase in *C. difficile* rates between 1999 and 2005, after which time the rate remained at this elevated level through 2009, with rates continuing to increase through 2012.

Table 2 shows the number (N) and proportion (%) of *C. difficile* infections stratified by age group for the years 2004-2012. The distribution of *C. difficile* discharges across the age categories remained stable over time, with the exception of the 50-64 year old age category which experienced an increase from 15.3% in 2004 to 20.4% in 2012. Children and teens under 18 years of age had the lowest burden of *C. difficile* infections among hospitalized patients, and the greatest burden of *C. difficile* infections occurred among older individuals, especially those older than 65. Throughout 2004-2012, approximately two thirds of all *C. difficile* infections occurred among individuals aged 65 and older. This information is highlighted in figure 2.

Table 2. Age distribution of *C. difficile* infections among hospitalized patients, 2004-2012

Age range (years)	2004 N(%)	2005 N (%)	2006 N (%)	2007 N (%)	2008 N (%)	2009 N (%)	2010 N (%)	2011 N (%)	2012 N (%)
0-4	174 (1.2)	143 (0.9)	176 (1.1)	188 (1.2)	180 (1.1)	162 (1.1)	146 (0.9)	155 (1.0)	185 (1.1)
5-17	105 (0.7)	107 (0.7)	109 (0.7)	126 (0.8)	168 (1.0)	137 (0.9)	159 (1.0)	204 (1.2)	197 (1.2)
18-34	592 (4.2)	627 (4.0)	596 (3.9)	564 (3.7)	657 (4.0)	580 (3.8)	652 (4.0)	718 (4.2)	801 (4.9)
35-49	1,123 (8.0)	1,211 (7.8)	1,202 (7.8)	1,198 (7.8)	1,178 (7.2)	1,145 (7.5)	1,329 (8.2)	1,281 (7.5)	1,370 (8.3)
50-64	2,147 (15.3)	2,521 (16.2)	2,490 (16.2)	2,723 (17.7)	2,862 (17.6)	2,805 (18.3)	3,168 (19.5)	3,291 (19.4)	3,372 (20.4)
65 and older	9,925 (70.6)	10,961 (70.4)	10,786 (70.2)	10,613 (68.9)	11,215 (69.0)	10,494 (68.5)	10,808 (66.5)	11,335 (66.7)	10,587 (64.1)

Figure 2. Age distribution of *C. difficile* infections among hospitalized patients, 2012



The sex distribution of *C. difficile* cases remained relatively stable during this period (2004-2012), with females accounting for 57 percent to 60 percent of *C. difficile* discharges (Table 3).

Table 3. Sex distribution of *C. difficile* infections among hospitalized patients, 2004-2012

Sex	2004	2005	2006	2007	2008	2009	2010	2011	2012
Male	5,705 (40.6)	6,419 (41.2)	6,513 (42.4)	6,377 (41.4)	6,853 (42.1)	6,440 (42.0)	6,779 (41.7)	7,114 (41.9)	6,973 (42.2)
Female	8,361 (59.4)	9,151 (58.8)	8,846 (57.6)	9,035 (58.6)	9,407 (57.9)	8,883 (58.0)	9,483 (58.3)	9,880 (58.1)	9,538 (57.8)

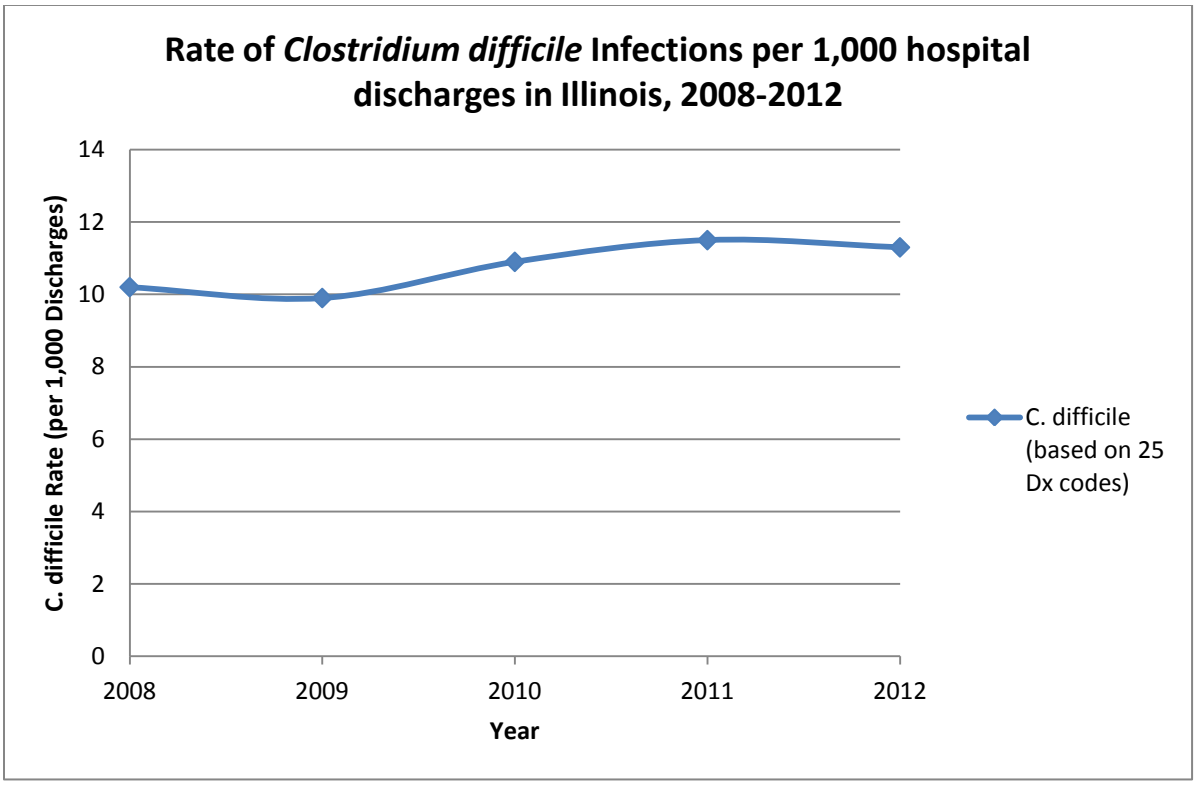
***C. difficile* in Illinois Hospitals, 2012**

Beginning in 2008, 25 diagnosis codes were available to the Illinois Department of Public Health for each discharge. Using all 25 codes, *C. difficile* rates among patients at Illinois hospitals during this time period had a slight increase from 10.2 per 1,000 discharges in 2008 to 11.3 per 1,000 discharges in 2012. During 2012, there were 17,793 *C. difficile* infections among 1,571,693 discharges; approximately 1.1 percent of all hospital discharges had diagnosis codes indicating *C. difficile* infection.

Table 4. Number of *C. difficile* Infections per 1,000 hospital discharges, 2008-2012

	2008	2009	2010	2011	2012
Number of *C. difficile* Discharges	17,367	16,504	17,857	18,523	17,793
Rate per 1,000 Dischrges	10.2	9.9	10.9	11.5	11.3

Figure 3. Number of *C. difficile* Infections per 1,000 hospital discharges in Illinois, 2008-2012



Conclusions

This report summarizes trends in *C. difficile* in Illinois hospitals from 1999 to 2012. The burden of *C. difficile* in Illinois hospitals is significant, and the number of cases has more than doubled since 1999.

These data are not without limitations and caution is advised in their interpretation. Due to hospital discharge dataset coding modifications implemented in 2008, the 2012 *C. difficile* discharge data were analyzed using two approaches. In order to compare 2008-2012 *C. difficile* discharge rates with those from 1999-2007, where the rates were calculated based on the first nine discharge diagnosis codes. However, when the *C. difficile* rate for 2012 was calculated using 25 discharge diagnoses codes, the rate was, as might be expected, higher, in large part due to the increased pool of discharge diagnosis codes. Future trend analyses will have to account for this shift in coding practices to make valid temporal comparisons.

One possible explanation for the increasing trend that has been observed in *C. difficile* rates in the last decade is adoption of a more sensitive test for the bacteria in hospitals. Hospitals using the polymerase chain reaction (PCR) test are likely to identify more patients infected with *C. difficile* than hospitals using what was previously the most common test, enzyme immunoassay (EIA) (Morelli, Clinical Gastroenterology and Hepatology, 2004). Another possible contributing factor to the increasing rate is the presence of a strain of *C. difficile* that has been associated with outbreaks and severe disease. A recent study in the Chicago area found that over 60% of cases were infected with this strain (Black, Infection Control and Hospital Epidemiology, 2011).

To have a better understanding of the burden of *C. difficile* in Illinois hospitals, it is necessary to distinguish between health care-facility onset and community-onset cases. Historically, discharge data have not been able to discern whether a disease or condition was acquired during hospitalization. Beginning in 2008, hospitals were required to include a present on admission (POA) code with each diagnosis code. The mandated use of this code, which indicates whether each diagnosis occurred before or after hospital admission, was part of the Centers for Medicare and Medicaid Services' (CMS) Hospital-Acquired Conditions Initiative, in which CMS would no longer pay hospitals for treatment of specific complications patients developed after admission.

Because the implementation of the POA code was part of a quality improvement strategy explicitly linking payment with health care outcomes, its use in epidemiological studies has not been explored. No published studies have evaluated the validity of the POA variable in hospital discharge data with respect to health care-associated infections such as C. *difficile* and MRSA.

Reliance on administrative databases, such as the Illinois Hospital Discharge Dataset, to assess trends in health care-associated infections, detect outbreaks, and provide inter-facility comparisons is not ideal. Further study will be required to validate POA coding. A personal health care identification number would facilitate linkage of medical records over time and across facilities – in both acute and long-term care. This would help identify previous healthcare exposures and track infections.

As of January 2012, Illinois hospitals began to monitor *C. difficile* and Methicillin-resistant *Staphylococcus aureus* (MRSA) using the Centers for Disease Control and Prevention National Healthcare Safety Network surveillance system. This surveillance system gathers data that is based on laboratory data rather than diagnosis code. It distinguishes between health care-facility onset, health care facility-associated and community onset *C. difficile* cases, based on when a positive laboratory result occurs in relation to when a patient receives care in a given reporting facility. This more specific information can be used to help prioritize targeted infection prevention and hospital quality improvement programs. More information on the MRSA NHSN Surveillance Report for 2012 may be found at Illinois of Public Health Hospital Report Card website, State Reports of Current Interest: http://www.healthcarereportcard.illinois.gov/contents/view/State_Reports_of_Current_Interest