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***Clostridium difficile* in Illinois Hospitals, 2009**

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 1999-2009, with emphasis on 2009. 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 nine diagnosis codes, out of up to 25 collected codes, were available to the Illinois Department of Public Health.

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, 1999-2009**

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 1999-2009. Overall, *C. difficile* rates among patients at Illinois hospitals during this time period increased from 4.5 per 1,000 discharges to 9.2 per 1,000 discharges. During 2009, the last year for which data are available for Illinois, there were 15,323 *C. difficile* infections among 1,668,396 discharges; approximately 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, 1999-2009

Year	Total number of <i>C. difficile</i> discharges	Total number of discharges	Number of <i>C. difficile</i> 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

Figure 1. Number of *C. difficile* Infections per 1,000 hospital discharges in Illinois, 1999-2009

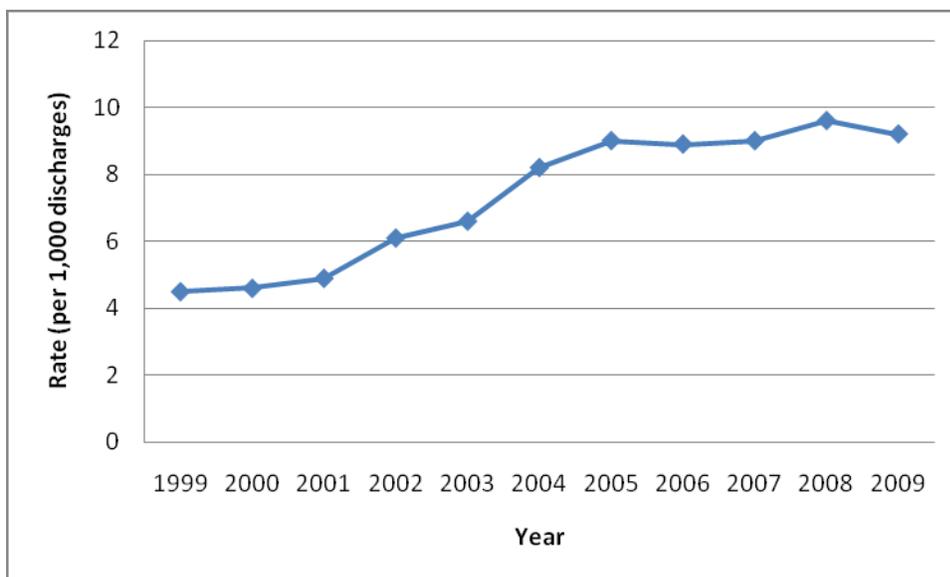


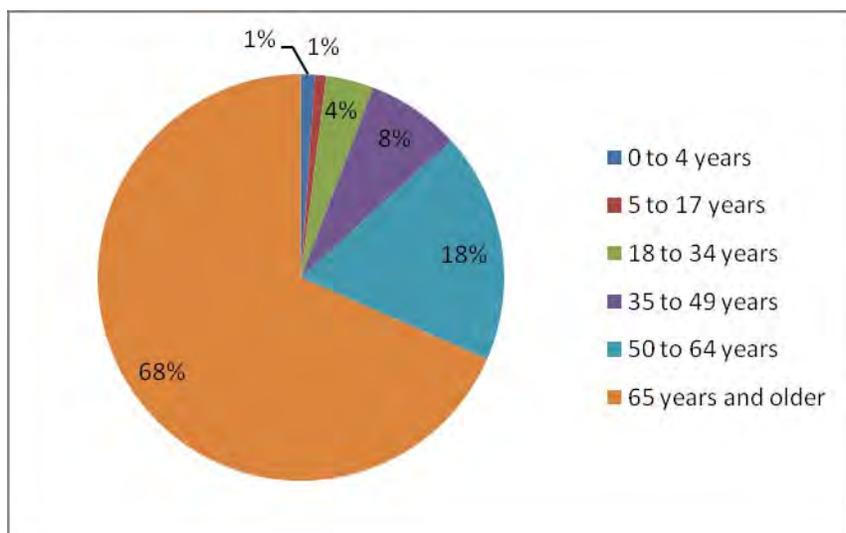
Figure 1 shows the annual *C. difficile* rates (per 1,000 hospital discharges) between 1999 and 2009, and illustrates the steady increase in *C. difficile* rates between 1999 and 2005, after which time the rate remained at this elevated level through 2009.

Table 2 shows the number (N) and proportion (%) of *C. difficile* infections stratified by age group for the years 2004-2009. 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 18.3% in 2009. School-aged children (5-17 years) 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 2004-2009, approximately 70 percent 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, 2004-2009

Age range (years)	2004 N (%)	2005 N (%)	2006 N (%)	2007 N (%)	2008 N (%)	2009 N (%)
0-4	174 (1.2)	143 (0.9)	176 (1.1)	188 (1.2)	180 (1.1)	162 (1.1)
5-17	105 (0.7)	107 (0.7)	109 (0.7)	126 (0.8)	168 (1.0)	137 (0.9)
18-34	592 (4.2)	627 (4.0)	596 (3.9)	564 (3.7)	657 (4.0)	580 (3.8)
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)
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)
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)

Figure 2. Age distribution of *C. difficile* infections among hospitalized patients, 2009



The sex distribution of *C. difficile* cases remained relatively stable during this period (2004-2009), 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, 2004-2009

Sex	2004	2005	2006	2007	2008	2009
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)
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)

***C. difficile* in Illinois Hospitals, 2009**

Beginning in 2008, 25 diagnosis codes were available to the Illinois Department of Public Health for each discharge. Using all 25 codes, 16,504 discharges with a *C. difficile* diagnosis code occurred in 2009, or 9.9 *C. difficile* cases per 1,000 discharges. In 2008, when all 25 codes were included, there were 17,369 discharges coded for *C. difficile* out of a total of 1,699,853 discharges, or 10.2 *C. difficile* cases per 1,000 discharges.

Also beginning in 2008, a code was included with each diagnosis to indicate whether the condition was present on admission to the hospital. This code, along with the source of the admission (i.e. emergency department, non-health care facility, skilled nursing facility) and the dates of previous hospital admissions, can inform estimates of the proportions of *C. difficile* infections in hospitalized patients that are acquired in healthcare settings.

Table 4 uses the information described above to estimate the proportions of *C. difficile* infections acquired in different settings.

Table 4. Present on admission status and recent healthcare exposures for *C. difficile* cases, 2009

Present on admission and healthcare exposures	Frequency	Percent
Infection not present on admission	3,796	23.0
Infection present on admission, with recent health care exposure documented in discharge data*	4,166	25.2
Infection present on admission, with no recent health care exposure documented in discharge data	8,475	51.4
Unavailable	67	0.4
Total	16,504	100.0

* A patient is considered to have had recent health care exposure if a previous admission is documented in the four weeks before the current admission or if the patient was admitted from a different hospital, a skilled nursing or intermediate care facility, a health care facility, an ambulatory surgery center, or hospice, or if the source of admission is same facility, separate claim.

Conclusions

This report summarizes trends in *C. difficile* in Illinois hospitals during 1999-2009. 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 2009 *C. difficile* discharge data were analyzed using two approaches. In order to compare 2008 and 2009 *C. difficile* discharge rates with those from 1999-2007, the rates were calculated based on the first nine discharge diagnosis codes. However, when the *C. difficile* rate for 2009 was calculated using 25 discharge diagnoses codes, the rate was, as might be expected, greater 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.

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 diagnostic 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 extra when patients developed specified complications 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.

Analysis of *C. difficile* infection data for 2008 and 2009 using the Illinois Hospital Discharge Dataset revealed trends in POA coding that bring into question the accuracy and usefulness of this variable in differentiating between community-acquired infections and hospital-acquired infections. Attempts were made to refine the POA status using a coding algorithm that incorporated elements from the discharge dataset that identified the source of admission (i.e. emergency department, non-health care facility, skilled nursing facility) and the dates of previous hospital admissions, which can serve as a proxy for recent health care exposure. This index is not without its limitations. Possible sources of error could be the inaccurate coding of the POA variable and/or the inaccurate or incomplete coding of the date of previous admission, which would underestimate the percentage of discharges having had an admission within the past 28 days. Also, the source of the majority of admissions was the emergency department; it is not known whether these patients were residents of long-term care facilities prior to their emergency room visits.

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 – both acute and long-term care. This would help identify previous healthcare exposures and track infections.

A hospital-based infection surveillance program, such as the U.S. Centers for Disease Control and Prevention's National Healthcare Safety Network (NHSN), which is currently being used to track central line-associated bloodstream infections and surgical site infections in Illinois hospitals, would provide more useful data on health care-associated infections. NHSN has the capacity to monitor *C. difficile* rates using laboratory data.