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# **The Association for Professionals in Infection Control and Epidemiology, Inc. (APIC) National Prevalence Study of *Clostridium difficile* in U.S. Healthcare Facilities**

## **OVERVIEW AND KEY FINDINGS**

### **A BRIEF HISTORY OF *CLOSTRIDIUM DIFFICILE***

*Clostridium difficile* (CD) is a spore-forming, gram-positive bacillus that produces exotoxins that are pathogenic to humans. CD is associated with a spectrum of diseases ranging from asymptomatic colonization to severe diarrhea, colitis, toxic megacolon, sepsis and death. Over the past 30 years, CD initially slowly and more recently rapidly emerged as an important healthcare-associated infection (HAI) pathogen. Currently, CD is the most common cause of infectious healthcare-associated diarrhea, occurring in about 20% of hospitalized patients with antibiotic-associated diarrhea. A variety of studies have attempted to determine the “true” incidence/prevalence of CD. Archibald et al showed in 2001 that 12.2 CD infections [CDI] per 10,000 patient-days (incidence study) occurred in the Centers for Disease Control and Prevention (CDC) National Nosocomial Infections Surveillance (NNIS) system’s hospital ICU patients. McDonald et al analyzed National Hospital Discharge Survey (NHDS) data and found that CDI incidence rates increased from 31 per 100,000 hospital population in 1996 to 61 per 100,000 hospital population in 2003.

A variety of factors are coalescing to potentially cause an increase in CDI. This includes the aging of the U.S. population, the widespread use of broad-spectrum antimicrobials, inadequate healthcare environmental cleaning, and inadequate CDI infection control measures (e.g., delayed diagnosis, delayed isolation precautions, poor hand hygiene or environmental cleaning). These factors, together with the recent emergence of a more virulent strain of *C. difficile*, the North American Pulse-field type 1 (NAP1) strain, makes it even more urgent that we have a better estimate of the magnitude of CDI in U.S. healthcare facilities.

Thus, in May 2008, we initiated the Association for Professionals in Infection Control and Epidemiology, Inc. (APIC) National *Clostridium difficile* Prevalence Survey. In this survey, we asked infection preventionists at APIC member healthcare facilities to

determine on one day during the period of May - August, 2008, all CDI patients who were inpatients in their facilities. From this, we could calculate the true prevalence of CDI at these facilities and make estimates of the magnitude of CDI at U.S healthcare facilities

## THE SURVEY

APIC's National *C. difficile* Prevalence Study is the largest, most comprehensive of its kind and provides valuable new information about *C. difficile* infections/colonization in U.S. healthcare facilities. The survey asked infection preventionists (primarily APIC's 12,000+ members in the U.S.) to collect data about all patients in their facilities who were identified with *C. difficile* infection or colonization on one day during May-August, 2008. So in a sense, this survey is a "snapshot" of *C. difficile* prevalence in the U.S. *C. difficile* infected/colonized patients were identified using microbiologic, medical, infection control, and/or other types of healthcare facility records.

## Scope

- ❖ Survey results include responses from 12.5 percent of all acute care hospitals in the United States (648 facilities – mostly acute care)
- ❖ Responses were received from facilities in 47 states
- ❖ Responses were received from facilities caring for virtually every type of patient: acute care, cancer, cardiac, children's, long-term care, rehabilitation facilities. In addition, they included county, private, and public facilities.
- ❖ Responses were received from all sizes of facilities/hospitals: <100, 100-300, and >300-bed facilities
- ❖ Survey includes data on both *C. difficile* infection and colonization.

## TOP SURVEY RESULTS

1. Data shows that 13 out of every 1,000 inpatients in the survey were either infected or colonized with *C. difficile* (94.4% infected). This rate is 6.5-20 times higher than previous incidence estimates that were more limited in scope (one hospital or hospitals in one state and used different methodologies).

The total number of patients identified with *C. difficile* colonization/infection was 1,443. Of those 1,443, the following detailed data was provided for 1062 (73.5%) of the patients:

- 55.9% were female, 44.1 % were male
- 84.7% were on the medical service
- 69.2% were >60 years of age
- 67.6% had co-morbid conditions (renal failure, diabetes, or heart failure)

- 57.9% had an initial episode of mild or moderate disease
- 10.94% had severe to complicated disease
- 89.8% of patients were detected by enzyme-linked immunoassay for A and B toxins (rather than culture)
- 1.98% were detected by culture
- 54.4% were detected <48 hours of admission
- 45.5% were detected >48 hours of admission\*
- 72.5% were considered healthcare-associated infection
- 26.6% required ICU admission, 18.2% had shock, and 16.5% required vasopressors.
- 35.1% had long-term facility residence within 30 days of onset
- 79.4% had antimicrobial exposures before onset. (17.14% as surgical prophylaxis)
- 47.4% had hospitalization within 90 days of onset
- 46.5% had resolution of diarrhea within 6 days (CDC definition of cure)

(\*many papers in the literature divide HA-*C. difficile* infection (CDI) from CA-CDI using this artificial cut-off of hours after admission, ignoring the fact that many patients are repeatedly admitted and thus become colonized with *C. difficile* at one admission and then are detected with infection at a subsequent admission.)

## 2. National estimates\*\*:

- **If the only U.S. hospital CDI patients were those reported in the survey (1,443 patients):**
  - Cost: \$3.5 million - \$10.4 million, average: \$6.5 million (based on published rates ranging from \$2,454-\$7,179 cost per patient)
  - Extra hospital days: 5,195 days - 10,101 days, average: 8,081 days (based on published rates ranging from 3.6 to 7 extra days per patient)
  - Mortality: 33-88 patients, average: 61 patients (based on published rates ranging from 2.3-6.1 percent).

Extrapolating the impact to all inpatients on any one day:

- **Based on the average number of U.S. hospital inpatients (using 2006 AHA data of approximately 547,945 inpatients on any day) and our CDI rate (13/1,000 inpatients), we estimate:**
  - 7,178 CDI patients as inpatients in U.S. hospitals on any one day
  - Cost: \$17.6 million-\$51.5 million, average: \$32.1 million
  - Extra hospital days: 25,841 - 50,246, average: 40,197 days
  - Mortality: On any one day, the number of patients that would die from CDI would range from 165 to 438 with an average of 301.

3. 54.4% of those with *C. difficile* in the survey were identified within 48 hours of hospital admission, which means that over half of the *C. difficile* infected patients are being admitted to the hospital/healthcare facility already infected or colonized with the bug, having acquired it either in a previous healthcare facility stay or in the community at large.

4. Only 1.98% of *C. difficile* infected patients were identified by culture and only 4.2% of healthcare facilities routinely perform cultures for *C. difficile*. This means that most of the patients with *C. difficile* infection are detected by immunologic means and that their isolates are not available for further testing, e.g., antimicrobial susceptibility or genotyping to detect the NAP1 strain.

5. 84.7% of all *C. difficile* infected patients were on the medical services, meaning they were being treated for general medical conditions like diabetes and pulmonary and cardiac problems.

6. 79.4% of *C. difficile* infected patients received antimicrobials before their CDI onset. A wide variety of antimicrobials were associated with CDI. Furthermore, a wide variety of treatment regimens were used to treat the CDI.

7. Detailed data on the facilities that participated in the survey include:

- There was an average 1.5 infection preventionists at participating facilities
- Of participating healthcare facilities, 65.3% were urban and 34.7% rural
- Facilities had a median of 224 licensed beds and ranged in size from 6-1097 licensed beds
- Facilities had a total of 110,550 inpatients during survey period, averaging 171 patients per facility
- 26.5% of facilities were medical school affiliated and 24.4% were tertiary care facilities
- Most used a hypochlorite solution for environmental disinfection
- 46.7% reported having an antimicrobial stewardship program (62% of medical school affiliated and 41% of non-medical school affiliated facilities.).

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**\*\*Costs based on published rates ranging from:**

Cost (per patient):

\$3,669 (Kyne CID 2002;34:346-53)  
\$2454-\$3240 (hospital only) (Dubberke CID 2008;46:505-506)  
\$5142-\$7119 (180 days) (Dubberke CID 2008;46:505-506)  
\$5325 (excess) (Lawrence ICHE 2007;28:123-30)  
Minimum-maximum (Average): \$2454-\$7179 (\$4475)

**\*\*Extra days based upon published rates:**

Extra hospital length of stay:

3.6 days (Kyne CID 2002;34:346-53)  
7 days (Vonberg JHI 2008;70:15-20)  
6.1 days (Lawrence ICHE 2007;28:123-30)  
Minimum-maximum (Average): 3.6-7 (5.6) days

**\*\*Mortality based on published rates:**

Mortality:

2.3% (overall unadjusted) (Zilberberg EID 2008;14:929-931)  
6.1% (ICU CDAD) (Kenneally Chest 2007;132:418-24)  
Average: 4.2%