

Clostridium difficile – an Important Opportunistic Pathogen in Healthcare-Associated Infections¹

Soohyoun Ahn and Amarat H. Simonne²

Opportunistic pathogens are significant health threats to vulnerable people with weakened immune systems, such as people with HIV/AIDS or those on immune-suppressing therapies. One opportunistic pathogen, *Clostridium difficile*, has been getting more attention in recent years because of its association with antibiotic use and high death rate in the elderly. This factsheet will provide an overview of *Clostridium difficile* infection (CDI) with a focus on healthcare-associated infections.

What are opportunistic pathogens?

Opportunistic pathogens are microorganisms that are normally associated with different parts of the human body. They usually do not cause disease in healthy individuals but have the ability to cause disease under certain conditions such as weakened immunity. Opportunistic pathogens are different from other pathogens that commonly cause disease; these microorganisms are usually benign and frequently associated with normal human body functions. Usually the human body gets along well with these opportunistic pathogens and in some cases even depends on them. However, sometimes things can go wrong, and a good relationship can turn bad. For example, generic *E. coli* plays an important role in degrading organic matter in the intestine and providing key nutrients to the body, but under certain circumstances, *E. coli* can migrate into the urinary

tract or bladder and cause infection. When opportunistic pathogens cause infections, they are called opportunistic infections.

Different kinds of opportunistic pathogens have been known to humans for many years. *Candida albicans*, a normal inhabitant of the mucous membranes of the oral cavity and genitourinary tract, can cause an oral disease called oral thrush in people who have a compromised immune system or who are taking antibiotics. *E. coli* normally inhabits the intestine, but it may cause infection when transferred to other body regions. Oral *Streptococcus* species that enter the bloodstream during oral surgery have been linked to heart disease (Banas 2004). *Pseudomonas aeruginosa*, found on vegetables and in soil, is one of the most prevalent causes of infections on burned skin and a significant cause of pneumonia in long-term hospital patients (Pruitt et al. 1998; Tredget et al. 2004; Chroneou et al. 2007). Additionally, some bacteria are known to cause serious infections in people who have received services in healthcare facilities. These include *Clostridium difficile*, *Staphylococcus aureus*, *Acinetobacter* and *Klebsiella* spp (CDC, 2014).

When do opportunistic pathogens cause infection?

Opportunistic infections usually occur when there are changes in the overall status of the body. We become

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2. Soohyoun Ahn, assistant professor, Food Science and Human Nutrition Department; and Amarat H. Simonne, professor, Family, Youth, and Community Sciences Department; UF/IFAS Extension, Gainesville, FL 32611

susceptible to opportunistic infections when we develop another disease or injury, when we undergo antibiotic treatment, when our immune systems become compromised, or after artificial manipulations such as use of catheter (Pagano and Caira 2012; Dabziger-Isakov 2014; Kyi et al. 2014).

What is *Clostridium difficile*?

Clostridium difficile (pronounced as klos-TRID-e-um dif-uh-SEEL) is an anaerobic, gram-positive bacterium that is best known for causing antibiotic-associated diarrhea (Knoop et al. 1993). *C. difficile* can form spores when environmental conditions cannot support its continued growth, and the spore-forming ability allows this organism to persist in the environment. It can live in soil or even on dry surfaces for extended periods of time. Usually, *C. difficile* is a part of normal colonic microflora, but when competing bacteria in the gut are wiped out by antibiotic treatment, *C. difficile* can cause diarrheal disease and, in severe cases, a life-threatening inflammation of the colon called toxic megacolon (Hookmand Barkin 2009).

Why is *Clostridium difficile* important?

As explained above, antibiotic use may increase the risk of *C. difficile* infection (CDI) and lead to antibiotic-associated diarrhea. Additionally, *C. difficile* is the most frequent agent for “healthcare-associated infection (HAI),” infection that is acquired from healthcare facilities. It is one of the few anaerobic organisms that can be originated from hospital settings. Additionally, *C. difficile* is the only hospital-originating pathogen that can form spores that are nearly impossible to eliminate. While most types of HAIs are declining, infection caused by *C. difficile* remains at historically high levels. According to CDC reports, the number of deaths due to *C. difficile* infection substantially increased from 793 deaths in 1999 to 6,226 deaths in 2006, and the disease is estimated to cause 14,000 deaths in the United States every year (Heron et al. 2009; CDC 2013). In the National Vital Statistics Reports published in 2009 listing causes of death and death rates in 2006, CDI ranked among the top 20 causes of death for the population aged 65 years and older (Heron et al. 2009). Figure 1 shows the age-adjusted death rate in the United States due to CDI from 1999 through 2006, by sex and race. During this period, the rate for this disease increased an average of approximately 30% per year for both men and women and for both the white and black populations. In addition, a report from US Department of Health and Human Services shows that the national rate of CDI-related hospitalizations have continually increased for

the past decade, from 5.6 per 1000 adult discharges in 2001 to 11.5 in 2010, with a projection of continuous increase for coming years (Steiner et al. 2012). In Florida, deaths related to CDI increased steadily during the five-year period from 2000 to 2005 (Figure 2).

What are healthcare-associated infections?

Healthcare-associated infections (HAIs) are infections that patients acquire during the course of receiving healthcare treatment for other conditions. These infections related to medical care can be devastating to human health and are sometimes deadly. In 2002, the estimated number of HAIs in US hospitals, adjusted to include federal facilities, was approximately 1.7 million (Klevens et al. 2007). The overall annual direct medical costs of HAI to US hospitals ranges from \$28.4 to \$33.8 billion (Scott 2009).

It is notable that HAIs commonly occur not only in hospital settings but also in outpatient and long-term care settings such as nursing homes. Many vulnerable patients frequently use outpatient care to maintain their health. For example, each year more than one million cancer patients receive outpatient chemotherapy or radiation therapy. Moreover, as life expectancy increases, so do nursing home and skilled nursing facility populations. Compared to inpatient acute care settings (hospitals), outpatient care and long-term care settings lack resources to support infection prevention. To reduce patients’ suffering and bring down death rates from dangerous opportunistic infections like *C. difficile*, nursing homes, skilled nursing facilities, and outpatient care operations must devise and implement special care protocols like those hospitals use to minimize or prevent risks of HAIs.

Because HAIs are commonly associated with the insertion of medical devices like catheters and ventilators, limiting the spread of HAIs means training practitioners and direct care workers to use these devices as safely as possible. Some HAIs associated with invasive medical devices and procedures include central-line-associated bloodstream infections from tubes placed into patients’ veins to draw blood or give medications, catheter-associated urinary tract infections, and ventilator-associated pneumonia. Additionally, *C. difficile* can cause gastrointestinal infection.

What are the symptoms of *Clostridium difficile* infection (CDI)?

Symptoms of CDI include watery diarrhea, at least three bowel movements per day that last for two or more days, fever, loss of appetite, nausea, and abdominal pain and/or tenderness. Many patients with CDI remain asymptomatic after infection, but can shed *C. difficile* in the stool.

How is CDI transmitted to humans?

Clostridium difficile is shed in feces. Therefore, any surface, device, or material (e.g., toilets, bathing tubs, and electronic rectal thermometers) that become contaminated with feces may serve as a reservoir for the *C. difficile* or its spores. *C. difficile* and/or its spores are transferred to patients mainly via the hands of healthcare personnel who have come in contact with a contaminated surface or item. Spores produced by *C. difficile* can live for long periods on surfaces and may be found on bed linens, bed rails, bathroom fixtures, and medical equipment. Spores on these surfaces easily spread to patients, either directly or through the hands of doctors, nurses, and other healthcare providers, as well as visitors.

Who is at risk of CDI?

Illness from CDI mostly affects the elderly in hospitals or in long-term care facilities. *C. difficile* infection also typically occurs after use of antibiotic treatment. Immunosuppression, gastrointestinal procedures and surgery, and use of feeding tube are considered as other risk factors for CDI. However, studies show increasing rates of CDI among people traditionally not considered high risk, such as younger and healthy individuals without a history of antibiotic use or exposure to health care facilities.

How can CDI be treated?

C. difficile infection is generally treated for 10 days with antibiotics prescribed by a doctor, most commonly oral metronidazole or oral vancomycin (Kelly and Lamont 2014). This treatment is effective and has few side effects. In about 25% of patients, CDI can be resolved without any treatment simply by discontinuing the antibiotic the patient was taking within 2–3 days (JCR 2012). In severe cases, however, a patient might need surgery to remove the infected part of the intestines. This type of surgery is needed in only 1–2% of patients with CDI (Arizona Department of Health Services 2012).

How can CDI be prevented?

Preventing CDI in Individuals

Do not take antibiotics unless they have been prescribed by your healthcare provider. If you begin taking antibiotics, continue taking them as directed until you have finished all the pills, even if you feel better after just one or two. If you don't finish your antibiotics, you risk growing antibiotic-resistant bacteria in your own gut. If you have trouble tolerating your antibiotics, call your healthcare provider. Practice good basic personal hygiene and wash your hands thoroughly and frequently (Dubberke and Gerding 2011). You should wash hands carefully with soap and warm water, especially after using the bathroom and before eating. Since *C. difficile* is commonly associated with healthcare-originated infection, your healthcare providers should clean their hands properly and frequently, and use gloves appropriately.

Healthcare Providers and Patient Visitors

If you are a healthcare provider or if you take care of or visit CDI patients, you should wear gloves and a gown whenever you visit, especially during the duration of the patient's diarrhea to prevent transmission of *C. difficile* to other people (Sehulster and Chinn 2003; Siegel et al. 2007). Remove gloves and gown immediately on leaving the patient's room and dispose of them appropriately (or follow established protocols for re-usable gowns). All healthcare providers, as well as patients' family and visitors, should comply with hand hygiene recommendations. Room and items used by CDI patients must be adequately cleaned and disinfected with a fresh 10% bleach solution. CDI patients should use a single room or share a room only with other CDI patients, and they should remain confined to their rooms; they should not go to common areas except for treatments or tests. Because it is very difficult to completely eliminate all *C. difficile* spores, it should be assumed that *C. difficile* is present in healthcare settings, and every person who enters the treatment area, including healthcare providers, housekeeping and administration staff, patients and their families, visitors, and volunteers must be educated about CDI and how to prevent the spread of the infection.

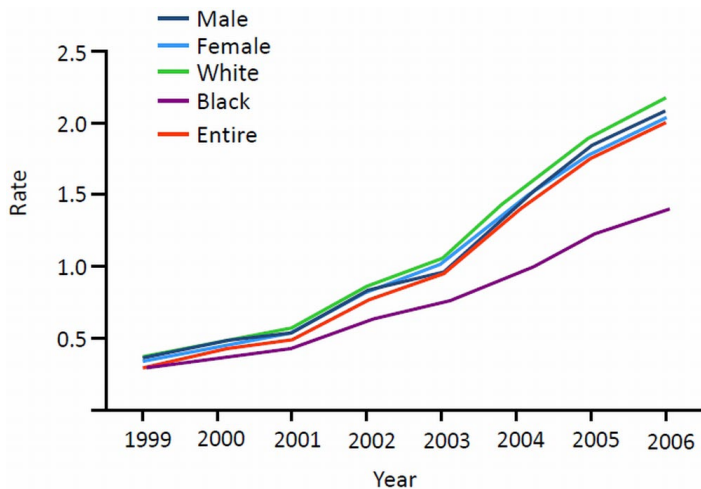


Figure 1. Death rate for *C. difficile* infection from 1999 to 2006 shown as rate per 100,000 US standard population (modified from National Vital Statistics Reports, http://www.cdc.gov/nchs/data/nvsr/nvsr57/nvsr57_14.pdf)

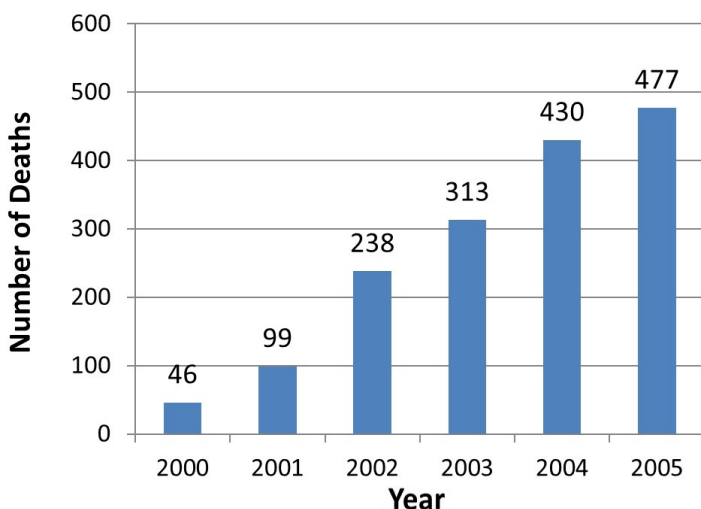


Figure 2. Number of deaths from *C. difficile* infection in Florida, 2000 to 2005.

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Resources:

Healthcare-associated infections (HAIs) – *Clostridium difficile* infection (<http://www.cdc.gov/hai/organisms/cdiff/Cdiff-patient.html>)

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Investigating *Clostridium difficile* infections across the US. (<http://www.cdc.gov/hai/eip/pdf/Cdiff-factsheet.pdf>)

Frequently asked questions about *Clostridium difficile* for healthcare providers (http://www.cdc.gov/HAI/organisms/cdiff/Cdiff_faqs_HCP.html)

National Vital Statistics Reports – Deaths: Final Data for 2006. Vol. 57, No. 14 (http://www.cdc.gov/nchs/data/nvsr/nvsr57/nvsr57_14.pdf)

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