

Prevention Strategies for Community-Acquired *Clostridium difficile* Infections

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ABSTRACT: Researchers and public health specialists now recognize infection with *Clostridium difficile* as an emerging infectious disease, particularly as more cases occur within the community, and given the emergence of a more virulent strain. Patients with community-acquired *C difficile* infection (CA-CDI) present with symptoms similar to those with hospital-acquired *C difficile* infection (HA-CDI) but have different risk factors. Abundant information in the literature pertains to HA-CDI and prevention strategies for them, but a dearth of information exists on prevention strategies for CA-CDI. This article discusses the pathogenesis of, risk factors for, symptoms of, and prevention strategies for CA-CDI.

KEYWORDS: Community-acquired *Clostridium difficile* infection, hospital-acquired *C difficile* infection, prevention

Clostridium *difficile*, a gram-positive, anaerobic, spore-forming bacillus, was first identified in 1935 as a part of the normal newborn fecal flora.¹ Although *C difficile* is thought to be nonpathogenic in newborns, it can result in the acute inflammatory bowel syndrome pseudomembranous colitis in older children and adults.¹

C difficile infection (CDI) is now recognized by researchers and public health specialists as an emerging infectious disease due to its increasing incidence, severity, and mortality,^{2,3} particularly among cases occurring within the community.³ The change in epidemiology is concerning, given that patients who are discharged from a hospital with CDI might transmit the bacteria to household members if they are not educated about prevention strategies. Adequate inpatient information is currently available about prevention of hospital-acquired CDI (HA-CDI). Significantly, however, little information about prevention is available for these patients upon discharge home or to other community sites, which might be a contributing factor to the increased rate of community-acquired CDI (CA-CDI) occurring among close contacts of these discharged patients.⁴

To address this gap, this article discusses the pathogenesis, risk factors, and symptoms, and prevention strategies of CA-CDI.

PUBLIC HEALTH IMPACT

The reported occurrence rate of CA-CDI has increased over the past 3 decades.^{5,6} The change in epidemiology and increased incidence of CDI is thought to be associated with the emergence of a more virulent strain of *C difficile* identified as North American pulsed-field gel electrophoresis type 1, restriction enzyme analysis group BI, polymerase chain reaction ribotype 027 (NAP1/BI/027). This strain was responsible for outbreaks in Pittsburgh in 2000, Atlanta in 2001-2002, and Montreal in 2003,² and it is associated with greater than expected rates of mortality and morbidity compared with other *C difficile* strains such as ribotype 078.⁷

CA-CDI has been defined as cases in which symptoms occur within 48 hours after admission to a health care facility or greater than 12 weeks after discharge from a health care facility.⁸ Symptoms of CA-CDI may present atypically; in some cases, patients have become acutely ill. In a case review of 5 university-affiliated

acute-care hospitals in the United States, 8569 cases of CDI were identified, and 75 patients had CDI-related colectomy, representing an overall colectomy rate of 8.7 per 1000 CDI cases.⁹ Moreover, the colectomy rate was approximately 4 times higher among patients with CA-CDI (16.5/1000) compared with patients with HA-CDI (4.3/1000).⁹

The economic burden of CDI continues to be significant. While studies of CDI in the community or in long-term care facilities are limited, the authors of one analysis of 2008 data estimated a total annual US excess cost of \$4.8 billion for CDI-hospitalized patients in acute-care facilities alone.¹⁰ In another study, 10,857 patients with HA-CDI discharged between April 1, 2002, and March 31, 2007, had a mean cost of \$55,769 per case compared with a mean cost of \$28,609 per case in 19,214 matched control patients.¹¹ In addition, the mean length of stay for HA-CDI patients was 21.1 days, which was twice as long as that of controls (10.0 days).¹¹

PATHOGENESIS

C difficile bacteria exist in 2 forms, active and nonactive. The active form is the infectious form, while the nonactive

form exists as spores within the environment.¹² Contamination occurs via the fecal-oral route when an individual is exposed to the spores. Once ingested, these spores germinate, causing disease if the normal flora of the colon is disrupted, such as when a person takes an antibiotic.¹² Two toxins produced by *C difficile*—toxin A, an enterotoxin, and toxin B, a cytotoxin¹—can cause inflammation of the lining of the colon, typically manifested as pseudomembranous colitis.¹² The virulent form of *C difficile* is associated with an increased production of these 2 toxins, as well as the production of an additional binary toxin.²

The outer layer of the *C difficile* spore is very strong and is resistant to disinfectant techniques, making the pathogen difficult to eradicate.¹³ *C difficile* can therefore survive on bedpans, furniture, toilet seats, linens, stethoscopes, and other environmental surfaces for prolonged periods.^{12,14} Furthermore, studies have indicated that *C difficile* can be carried in the air.^{13,14} Fawley and colleagues¹⁴ found *C difficile* in elevated areas of hospitals such as windows, smoke detectors, and curtain rods.

RISK FACTORS

The emergence of CA-CDI has also led to a change in associated risk factors. Typically, the risk factors for CDI include antibiotic exposure, advanced age, the use of proton-pump inhibitors, certain chronic conditions, gastrointestinal tract surgery or disease, and immunocompromisation.² However, with the emergence of the NAP1 strain, the risk factors associated with CA-CDI appear to be different than the risk factors associated with HA-CDI. Khanna and colleagues¹⁵ noted that patients with CA-CDI were younger, were female, and had less comorbidity than patients with HA-CDI. Additionally, they reported that 40% of the 157 patients in their study with CA-CDI required hospitalization, 20% had treatment failure, and 28% had recurrent infection.¹⁵

Kuntz and colleagues⁶ examined the

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epidemiology of CA-CDI and HA-CDI in a population-based, retrospective, nested, case-control study. Analysis of data on 684 cases of CDI (304 CA-CDI, 338 HA-CDI, and 42 indeterminate CDI) from the University of Iowa Wellmark Data Repository from January 2004 to December 2007 revealed that the incidence rate of CA-CDI was 11.16 cases per 100,000 person-years, while the incidence rate of HA-CDI was 12.41 cases per 100,000 person-years. The CA-CDI cases were more likely than controls to receive antibiotics and gastric acid suppressants in the 180 days prior to diagnosis. However, 27% of patients with CA-CDI did not receive antibiotics in the 180 days prior to diagnosis, and 17% did not exhibit the traditional risk factors associated with CDI.

Although these studies emphasize the need for health care providers to be informed about the changing epidemiology of *C difficile* and the atypical presentation of symptoms in patients with CA-CDI, further research is needed to assess the risk factors associated with CA-CDI.

SIGNS AND SYMPTOMS

CA-CDI presents no differently from HA-CDI.⁸ Once infected with *C difficile*, the patient may present with the following symptoms: watery diarrhea (at least 3 daily bowel movements for 2 or more days); decreased appetite; fever; nausea; and abdominal tenderness or pain.¹⁶ On rare occasions, patients may present with occult blood in the stool.⁸ Some patients may have positive test results for *C difficile* but be asymptomatic;

these patients are identified as having *C difficile* colonization but not infection.²

PREVENTION STRATEGIES

Discharge teaching must impart innovative education about the prevention of CDI and introduce a team approach to infection control. Families, household members, coworkers, visitors, and those with CDI should partner in the prevention of the infection. Furthermore, discharge instructions should safeguard that visitors and family members are aware of who may be at high risk for acquiring CDI.^{4,17} Prevention strategies include proper hand washing, environmental cleaning, and judicious use of certain medications.

Strict adherence to hand hygiene is critical in minimizing the spread of infection; therefore, family and household members should be instructed on the importance of proper hand hygiene. *C difficile* in the spore form is known to be highly resistant to alcohol,¹⁸ and so alcohol-based products likely are not as effective in removing *C difficile* spores as are soap and water. Mechanical scrubbing with soap and water should be further emphasized among family and household members.⁸

Household members of a person with CDI also should receive education on appropriate contact precautions. A 1:10 chlorine bleach and water solution should be used to clean the bathroom and kitchen of the infected household member.^{4,19} Family or household members should be advised of the importance of not sharing the bathroom, towels, or

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hygiene products of the infected person, especially if diarrhea is present. Gloves should be used to handle soiled linens and clothing. In addition, soiled linens and clothing should be kept separate from the laundry of other household members and should be washed in hot water, with laundry detergent and a 1:10 dilution of chlorine bleach.^{4,19}

Children with diarrhea should be excluded from attending daycare facilities. Daycare workers should be educated on the importance of good hand washing after diaper changes, as well wearing gloves when caring for children with sudden-onset diarrhea episodes. In-services should be held regularly to educate the daycare staff about the proper cleaning of changing areas and the proper disinfection of child care areas.^{20,21}

It is important that health care providers educate their patients on the appropriate use of antibiotics. Frequent and improper use of antibiotics is associated with increased microbial resistance. The Centers for Disease Control and Prevention has developed the Get Smart program,²² which offers resources for patients and health care providers on the appropriate and inappropriate uses of antibiotics, including charts that can be easily displayed in a primary care office for patients to read while waiting.²³ Additionally, patients should be informed that certain classes of antibiotics (fluoroquinolones, cephalosporins, penicillins, and clindamycin) have been associated with an increased risk of CDI.^{24,25} Furthermore, limited use of gastric acid suppressants, whenever possible, should be emphasized.⁴

SUMMARY

Associated with a more virulent strain (NAP1), *C. difficile* is now presenting with increased incidence in the community. Patients present with symptoms similar to those of HA-CDI, but with different risk factors. The changing epidemiology of CDI makes it important for health care professionals to provide accurate and timely education about the

transmission and prevention of *C. difficile* within the community. Patient education on proper hand washing and environmental cleaning when a patient returns home to the community, as well as a dialogue about the inappropriate use of antibiotics and other medications, may positively impact the incidence of this emerging infectious disease. ■

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