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***Clostridium difficile* Infection (CDI) Backgrounder**

What is *C. difficile*?

Clostridium difficile or *C. difficile* is a bacterium found in the intestines that can cause severe diarrhea and life-threatening intestinal conditions such as pseudomembranous colitis (inflammation of the large intestine), toxic megacolon (extreme inflammation and distention of the colon) and sepsis (a condition where the body is fighting a severe infection that has spread via the bloodstream). It is frequently associated with previous antibiotic use and is most commonly contracted by the elderly and those with recent exposure to hospitals, nursing homes and other healthcare institutions.

C. difficile infection (CDI) appears to be increasing rapidly in the United States. It is the most common cause of infectious healthcare-associated or antibiotic-associated diarrhea, accounting for 15 percent to 25 percent of hospitalized patients with antibiotic-associated diarrhea.¹

The U.S. Agency for Healthcare Research and Quality (AHRQ) estimates that the number of hospital discharges with CDI more than doubled from 2001 to 2005.² CDI patients had lengths of stay that were nearly three times higher than average.² In the United States, more than 28,000 people die from CDI² and there are approximately 500,000 CDI infections annually.³

In November 2008, the Association for Professionals in Infection Control and Epidemiology (APIC) released results of the first national *C. difficile* prevalence study which showed the prevalence rate for CDI to be at least 13 cases per 1,000 inpatients, which is at least 6.5 to 20 times higher than previous estimates.⁴

How is CDI spread?

The *C. difficile* bacteria are found in the feces and can contaminate areas, materials or surfaces that may come into contact with feces. The bacteria produce toxins that can result in disease. The bacteria have two forms – a vegetative and a spore form. The *C. difficile* spores can survive outside the body on inanimate surfaces for months and thus can be transmitted on frequently touched surfaces like bed rails, IV poles, toilets, grab bars, light switches and faucets. People can become infected if they touch items or surfaces that are contaminated with feces or the spores and then touch their mouth or mucous membranes. Healthcare workers can spread the bacteria to other patients or contaminate surfaces through hand contact and touching contaminated surfaces.

Acquisition of *C. difficile* occurs by oral ingestion of spores that resist the acidity of the stomach. These spores germinate into vegetative bacteria in the small intestine. Alteration of the normal colonic flora by exposure to antimicrobials provides an environment in which *C. difficile* is able to establish itself, multiply, and produce toxins that cause inflammation and gastrointestinal mucosal damage.

The major risk factors for CDI are exposure to antimicrobials, hospitalization and advanced age. Nearly all antimicrobials have been implicated as risk factors for CDI, but certain antimicrobial classes, such as cephalosporins, clindamycin or fluoroquinolones, seem to cause higher risk for disease.

C. difficile spores are highly resistant to cleaning and disinfection measures. Alcohol is not effective in killing *C. difficile* spores. Healthcare workers should wash their hands with soap and water exclusively (rather than the usually recommended alcohol-based hand rubs or gels) when caring for patients with known CDI. The benefit of hand washing with soap and water is the physical removal and dilution of spores from the hands, rather than the killing of spores.

How serious is CDI?

The severity of the disease is increasing and has affected children, adults and the elderly. CDI is associated with an increased length of stay in healthcare facilities by 3.6⁵ to 7 days,⁶ and attributable costs for inpatient care have been estimated to be \$2,500 to more than \$7,000 per episode.⁷ In the United States, CDI is estimated to lead to \$1 billion in excess healthcare costs annually.⁸

A more virulent and antibiotic resistant strain of *C. difficile* was found to be associated with outbreaks in Quebec and has appeared in at least 38 U.S. states and the U.K. since 2004. This more severe strain, the North American Pulse-field type 1 (NAP1) strain, has a genetic alteration which enables the strain to produce larger amounts of toxins, has afflicted otherwise healthy individuals not thought to be at risk for CDI, and has been associated with higher numbers of colectomies, treatment failures and deaths.

What are the symptoms of CDI?

The symptoms of *C. difficile* infection include watery diarrhea (at least three bowel movements per day for two or more days), fever, loss of appetite, nausea, abdominal pain/tenderness and abdominal cramping. Treatment may include discontinuing the antibiotic that caused the infection and prescribing a different antibiotic – usually oral metronidazole or vancomycin. Both drugs kill only the active form of *C. difficile*, not the spores. The *C. difficile* bacteria can survive in the intestines after treatment. Relapse occurs in 15 percent to 20 percent of cases of CDI after treatment and requires further treatment.⁹

Who is at risk for CDI?

C. difficile infection rarely occurs in healthy people or those without antimicrobial exposure. Individuals who have other illnesses or conditions requiring prolonged use of antibiotics, compromised immune systems and the elderly are at greater risk of acquiring this disease. Antibiotics can kill good bacteria as well as bad, often upsetting the natural balance in the body. *C. difficile* may flourish after antibiotic use because that balance is upset.

The risk for disease increases in patients with:

- antibiotic exposure
- gastrointestinal surgery/manipulation
- long length of stay in healthcare settings
- a serious underlying illness
- conditions that weaken the immune system
- advanced age

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- ¹ Centers for Disease Control and Prevention. (2005, July 22). Information for healthcare providers. Retrieved June 27, 2008 from http://www.cdc.gov/ncidod/dhqp/id_CdiffFAQ_HCP.html
- ² McDonald, L.C. (2008, June). The changing epidemiology of *Clostridium difficile*. Poster session presented at the annual meeting of the Association for Professionals in Infection Control and Epidemiology, Denver, CO.
- ³ Agency for Healthcare Research and Quality. (2008, April). Clostridium difficile-associated disease in U.S. hospitals, 1993-2005 (Statistical Brief #50). Rockville, MD: Elixhauser, A., & Jhung, M.
- ⁴ Association for Professionals in Infection Control and Epidemiology. (2008). National U.S. inpatient healthcare facility *Clostridium difficile* survey. Retrieved December 23, 2008 from <http://www.apic.org/AM/CM/ContentDisplay.cfm?ContentFileID=11410>
- ⁵ Kyne, L., Hamel, M.B., Polavaram, R., & Kelly, C.P. (2002). Health care costs and mortality associated with nosocomial diarrhea due to *Clostridium difficile*. *Clinical Infectious Diseases*, 34, 346-353.
- ⁶ Vonberg, R.P., Reichardt, C., Behnke, M., Schwab, F., Zindler, S., & Gastmeier, P. (2008). Costs of nosocomial *Clostridium difficile*-associated diarrhoea. *Journal of Hospital Infection*, 70, 15-20.
- ⁷ Dubberke, E.R., Reske, K.A., Olsen, M.A., McDonald, L.C., & Fraser, V.J. (2008). Short- and long-term attributable costs of *Clostridium difficile*-associated disease in nonsurgical inpatients. *Clinical Infectious Diseases*, 46, 497-504.
- ⁸ McDonald, L.C., Owings, M., & Jernigan, D.B. (2006). *Clostridium difficile* infection in patients discharged from US short-stay hospitals, 1996-2003. *Emerging Infectious Diseases*, 12(3), 409-415.
- ⁹ Kelly, C.P., & LaMont, J.T. (2008). *Clostridium difficile* – More difficult than ever. *New England Journal of Medicine*, 359(18), 1932-1940.

This backgrounder is adapted, in part, from materials and sources provided by APIC (Association for Professionals in Infection Control and Epidemiology, Inc., Washington, DC); see www.apic.org