

Epidemiology and Transmission of *Clostridium difficile* Infection

C. difficile is an important cause of morbidity in hospital and nursing home patients since they are more likely to take antibiotics in an environment that is highly contaminated with *C. difficile* spores (Fig. 1). An estimated three to four million new cases of *C. difficile* diarrhea and colitis occur in United States hospitals each year, affecting as many as 10% of patients hospitalized for more than two days.¹ *C. difficile* typically infects elderly, debilitated inpatients.²¹ In contrast, the infection is quite rare in the outpatients setting with only 20,000 estimated cases of infection yearly.²² Risk factors for infection include exposure to multiple antibiotics, gastrointestinal tract surgery, enteral tube feeding and exposure to an infected roommate.^{23,24} The presence or absence of serum antibodies to *C. difficile* toxins may also play an important role in determining the susceptibility to and severity of colitis.²⁵

Once antibiotic therapy has rendered the bowel susceptible to infection, fecal-oral colonization by *C. difficile* occurs by ingestion of *C. difficile* heat-resistant spores that persist in the environment for months. Contamination in the environment is especially common in hospitals and facilities providing long term care.^{21,26,27} *C. difficile* can be cultured from swabs taken from toilets, bedpans, floors, mops, scales and furniture in hospitals and nursing homes. Fecal carriage of the organism by health care workers is unusual, but carriage of *C. difficile* on the hands, clothing and stethoscopes of hospital staff probably allows passive spread of the infection. The use of vinyl examining gloves and careful hand washing after examining patients can drastically reduce the spread of infection.²⁸

Newborns also acquire *C. difficile* from the hospital environment where the organism is commonly cultured from environmental surfaces in newborn nurseries and neonatal intensive care units.²⁹ The asymptomatic carriage rate of *C. difficile* is as high as 60% or 70% in

several longitudinal studies of healthy infants less than one year of age. Many infants carry toxigenic strains with high titers of toxin in the stools, but they are completely asymptomatic.²⁹ This suggests that one or more host factors required for pathogenesis are lacking in the first year of life. One possibility is that infant intestine lacks specific receptors for the toxins, which then develop later in life. Indeed, specific toxin A binding sites are absent in newborn rabbit intestine and are then expressed after weaning, gradually reaching adult levels.³⁰

Clinical Presentation

The clinical presentation of *C. difficile* infection is quite variable and includes asymptomatic carriage, antibiotic-associated colitis without pseudomembrane formation, pseudomembranous colitis, and fulminant colitis.

The carrier state

Whereas over 50% of healthy neonates are asymptomatic carriers, less than 1% of adults carry *C. difficile* spores in their intestine. The number of adult carriers increases in hospitalized patients recently treated with antibiotics. The host and bacterial factors that determine asymptomatic carriage are not clear. Asymptomatic carriers are an important reservoir of *C. difficile*, since they can contaminate the environment and perpetuate the chain of infection.³¹ However, treatment of asymptomatic carriers with antibiotics is not recommended, since it does not permanently reduce the rate of carriage.³²

Diarrhea without colitis

The most common clinical presentation of *C. difficile* infection is mild to moderate diarrhea sometimes accompanied with lower abdominal cramping whereas systemic symptoms are generally absent. Typically symptoms begin either during or shortly after antibiotic therapy, but can be delayed for several weeks. In these patients with mild disease physical examination and sigmoidoscopy are frequently normal whereas *C. difficile* toxins are present in the stools. The diarrhea often subsides when the initiative antibiotic is stopped, thus making specific treatment unnecessary.

Colitis

C. difficile infection can cause severe colitis without formation of pseudomembranes and is generally associated with profuse diarrhea, abdominal distension and pain. Systemic manifestations include fever, anorexia,

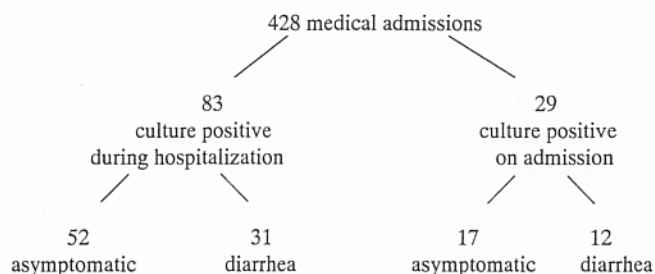


Fig. 1 Hospital-acquired *Clostridium difficile* infection. In this study¹ the overall rate of infection was 26% in patients hospitalized for more than 2 days. Note that most of the infected patients were asymptomatic carriers who did not have diarrhea.