# Clostridium difficile infection: nursing considerations

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## Abstract

*Clostridium difficile* is a bacterium commonly causing diarrhoea in inpatients. *C. difficile* affects hospitalised patients across the world and can pose a significant risk to patients. This article explores the transmission and risk factors for *C. difficile* infection (CDI). There are many aspects to the prevention and control of CDI: appropriate antibiotic use, early instigation and maintenance of prevention and control strategies, and high standards of environmental cleanliness, education, and surveillance. This article discusses the role of the nurse in each of these prevention and control activities.

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*Clostridium difficile*, antibiotic-associated diarrhoea, infection prevention and control, nosocomial infection, surveillance

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*CLOSTRIDIUM DIFFICILE* IS a Gram-positive, anaerobic, spore-forming bacterium commonly causing diarrhoea in hospitalised patients. Well documented epidemics of *C. difficile* infection (CDI) have occurred in North America and Europe, with increases in incidence also reported in other countries (Loo *et al* 2005, Healthcare Commission 2006, Mitchell *et al* 2012). Patients with *C. difficile* may have colonisation with no symptoms or they may have symptoms ranging from mild diarrhoea to pseudomembranous colitis, inflammation of the colon.

*C. difficile* affects hospitalised patients worldwide and can pose a significant risk to patients [Q1 a patient's life?]. Two recent literature reviews indicate that CDI has a significant adverse effect on the mortality of hospitalised patients [Q2 OK as reworded here?] (Karas *et al* 2010, Mitchell and Gardner 2012a). The most recent of these reviews suggests all-cause mortality at 30 days ranges from 9%, in a study from Switzerland, to 38%, in a study undertaken in the UK. Similarly, attributable mortality at 30 days has been shown to be between 5.7% and 6.9% (Mitchell and Gardner 2012a). *C. difficile* infection may also have a significant effect on health services because of prolonged length of stay in hospital (Mitchell and Gardner 2012b).

This article explores the transmission and risk factors for CDI and the important roles nurses play in prevention and control.

## Transmission and risk factors

*C. difficile* can exist in spore or vegetative form. Patients with CDI can contaminate the environment with spores, which increase when patients have diarrhoea. The contaminated environment can subsequently act as a reservoir for transmission, for example via the healthcare worker's hands (Dumford *et al* 2009, Stuart and Marshall 2011). However, the primary mode of transmission of *C. difficile* is person to person via the faecal-oral route.

*C. difficile* spores can survive in the environment for months, posing a continuing

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risk unless adequate environmental cleaning occurs. Environmental cleaning is increasingly being recognised as an important factor in CDI prevention (Rutala and Weber 2013). Studies suggest that CDI 'pressure' – the proportion of patients colonised in an area in a hospital during a specified time period – may be an independent risk factor for infection (Dubberke *et al* 2007a, Ajao *et al* 2011). Similarly, studies have shown that a previous room occupant with CDI is a significant risk factor for CDI acquisition, independent of established CDI risk factors (Shaughnessy *et al* 2011). More recently, the use of whole genome sequencing suggests there may be genetically diverse sources of *C. difficile*, in addition to symptomatic patients, that are involved in *C. difficile* transmission (Eyre *et al* 2013). This particular topic is the source of debate and future research.

Ingestion of the organism does not always result in symptoms or infection, because of the protective effects of the colonic flora (Cartman *et al* 2010). However, disruption of the normal flora can lead to infection. Disruption of the bowel flora can occur following exposure to antibiotics, chemotherapy, antiperistaltic drugs or gastroenterological surgery (Kuijper *et al* 2006, Cartman *et al* 2010). Several studies have supported the association between CDI and antibiotic exposure (Thomas *et al* 2003, Pépin *et al* 2005, Polgreen *et al* 2007).

Generally, risk factors for CDI fall into two categories – host and non-host risk factors. Host factors include advancing age and the presence of comorbidity (DuPont *et al* 2008). Non-host risk factors include exposure to antibiotics, the presence of spores in the environment and associated transmission to other individuals, proton pump inhibitors and H2 receptor [Q3 antagonists?] drugs.

## Diagnosis and treatment

Although the diagnostic and laboratory methods used to diagnose CDI may seem complicated and the detail unnecessary for most nurses, it is important to understand the different methods to ensure appropriate prevention and control strategies are used and healthcare resources best deployed. In patients with CDI, inflammation of the bowel results from the production of two protein toxins: toxin A and toxin B. Isolates of *C. difficile* that do not produce either of these toxins are non-pathogenic.

The diagnosis of CDI is made through the microbiological testing of faecal samples – through the detection of *C. difficile* by culture and/or by detection of its toxins. While the sensitivity of culture is high, it does not produce information about the toxigenicity (toxin A or B) of isolates, and the result can be delayed by the need for a subsequent test to determine the presence of a toxin (Kufelnicka and Kirn 2011).

Alternatively, the detection of *C. difficile* toxin (CDT) A or B in faeces without culture is a method commonly used by laboratories. Compared with culture, the identification of CDT, and hence CDI, is faster because of the availability of commercial CDT assays.

More recently, other detection methods for *C. difficile*, such as polymerase chain reaction (PCR) assay or the detection of glutamate dehydrogenase (GDH), have been used. GDH is a useful test for whether *C. difficile* is present but not for whether it is producing toxins. In other words, the sensitivity of GDH is high – it accurately identifies the presence of *C. difficile* and provides a rapid result – but the specificity is poor (Sharp *et al* 2010). As a result, large numbers of false-positive results may occur, which in turn has implications for bed management and patient placement, including potentially unnecessary isolation.

Repeat testing during the same episode of CDI is of limited value and not encouraged. Recovery from CDI occurs in response to treatment and acquisition of immunity and is not usually associated with clearance of toxigenic *C. difficile* from the stool (Stuart *et al* 2011). *C. difficile* may remain detectable for several weeks (Crobach *et al* 2009, Cohen *et al* 2010). Similarly, *C. difficile* can be cultured from the faeces of 3% of healthy adults, 16-35% of inpatients and up to 80% of healthy newborns and infants – although it is a widely held that *C. difficile* is not pathogenic in neonates (Kuijper *et al* 2006). A person who has recovered from CDI may experience a relapse. Whether the relapse is due to endogenous re-infection from the environment or is host-related remains unclear.

Treatment of symptomatic CDI most commonly involves prescription of either vancomycin or metronidazole, with other agents such as fidaxomicin now also available for use. Similarly, intestinal microbiota transplantation (faecal transplant) is also being used for severe and recurrent cases of CDI (Gough *et al* 2011). It is not within the scope of this article to explore these issues.

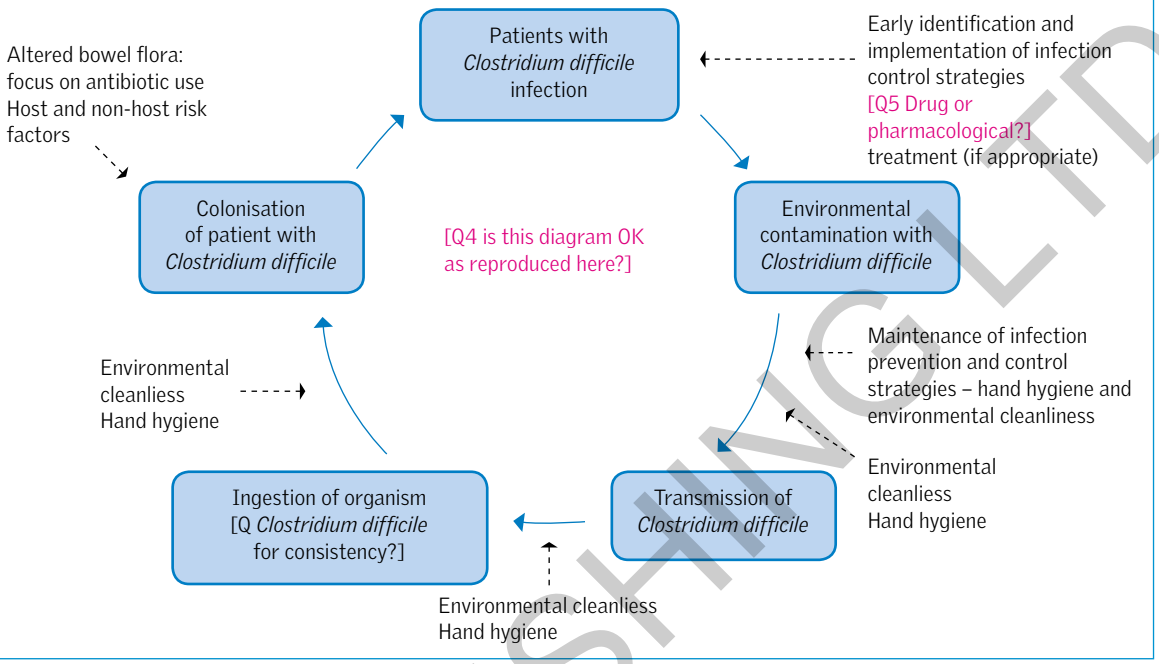
The immune response also has an important role in CDI and in particular its recurrence. As a result, immunotherapy has been used in the treatment of recurrent CDI, although no randomised control trials have been undertaken (Kelly and LaMont 2008).

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**FIGURE 1**

**Cycle of Clostridium difficile infection and opportunities to prevent and control spread**




Probiotics (organisms thought to improve the balance of organisms that inhabit the gastrointestinal tract) such as *Lactobacillus* species and *Saccharomyces boulardii* have also been used to treat CDI. Probiotics are increasingly available as capsules and in food supplements for purchase in health food stores and supermarkets. A recent Cochrane review evaluated the value of probiotics in the prevention of CDI in adults and children, and concluded that there is moderate quality evidence suggesting probiotics are safe and effective in preventing CDI (Goldenberg *et al* 2013). Probiotics are not effective as a solo treatment option for CDI (Kelly and LaMont 2008).

## Prevention and the nurses' role

There are many aspects to the prevention and control of CDI: appropriate antibiotic use, early instigation and maintenance of prevention and control strategies, and high standards of environmental cleanliness, education and surveillance. Nurses have a vital role in each of these aspects.

### Antibiotics

Antimicrobial stewardship is an important preventive strategy to reduce CDI and antibiotic-resistant organisms more generally. Traditionally, antibiotic stewardship has been seen as the primary responsibility of medical and pharmacy staff. The technical expertise specialist infectious disease physicians, pharmacists and medical microbiologists bring to antimicrobial stewardship is of critical importance, but there is the potential for their roles to be supported by nurses, particularly because nurses are pivotal in administering medication (Charani and Holmes 2013).

The roles of clinical nurses include questioning and highlighting suboptimal drug therapy, ensuring antibiotics are prescribed in line with recommended guidelines, appropriate therapy is initiated promptly, the duration of therapy is suitable and the potential for switching from intravenous to oral therapy is reviewed (Edwards *et al* 2011, Ladenheim *et al* 2013). Senior nurses can ensure that evidence-based local antimicrobial guidelines are in place and reviewed regularly, auditing of antimicrobial guidelines occurs, and reporting and feedback of antibiotic usage data is undertaken both to clinicians and to management (Ladenheim *et al* 2013).

The aim of an antimicrobial stewardship programme as it relates to CDI should be to minimise the frequency and duration of antibiotic use and promote a narrow-spectrum antibiotic policy that particularly restricts use of cephalosporins, lincosamides and quinolones (Price *et al* 2010).

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## Infection prevention and control strategies

The use of contact precautions (aprons or gowns and gloves) for preventing the spread of CDI is an essential infection prevention and control intervention, which can be led by nurses once there is suspicion of CDI. Diarrhoea in hospitalised patients, particularly those with the risk factors describe earlier, should alert nurses. Early instigation of contact precautions and the use of single rooms are likely to reduce environmental contamination and subsequent transmission. Similarly, patients with symptomatic CDI should have their own toilet or commode.

Although there is evidence of contamination of healthcare workers' hands and clothing with *C. difficile*, no data are available to demonstrate clearly that the use of gowns or aprons reduces CDI transmission (Hsu *et al* 2010). Nonetheless, because uniforms and hands are less likely to be contaminated when contact precautions are used, they are recommended. The correct use of personal protection equipment is an important consideration for nurses. Gloves and gowns or aprons must be removed, and hand hygiene performed, on exit from the room of a patient with CDI to avoid further contamination of the environment. As *C. difficile* may still be shed from patients after symptoms subside, contact precautions should continue until at least 48 hours after diarrhoea has ceased. Movement of patients with CDI, for example between wards, should not occur in order to avoid further contamination of the hospital environment.

Hand hygiene is a critical element of preventing healthcare-associated infections, including CDI. In the UK, there is a clear recommendation that hand washing, as opposed to the use of an alcohol-based hand rub (ABHR), is recommended when caring for patients with CDI (Health Protection Network 2009, Public Health England 2013). This view is not shared universally (Gordin *et al* 2005, Boyce *et al* 2006, Vernaz *et al* 2008). Australian national guidelines, contrary to guidelines in the UK, promote the use of ABHR (Stuart *et al* 2011). Rationale to support this stance includes the suggestions that inappropriate glove use may lead to potential spread of the organism and that confusing healthcare workers with mixed messages about the use of ABHR may be detrimental to hand hygiene compliance (Stuart *et al* 2011).

## Environmental cleanliness

As described earlier, the environment is an important source of transmission for CDI. Several studies have demonstrated widespread and frequent contamination of patients' equipment and rooms (McCoubrey *et al* 2003, Martirosian *et al* 2005, Dubberke *et al* 2007b). The frequency of environmental contamination has been associated with the time-course and treatment status of patients with CDI, with a study demonstrating the frequency of environmental contamination was highest before treatment and remained high at the time of resolution of diarrhoea (Sethi *et al* 2010). This has clear implications for nurses, who can assist in breaking the cycle of transmission by early identification and isolation of patients who have CDI.

Multiple studies have demonstrated that surfaces in hospital rooms are poorly cleaned during terminal cleaning (Rutala and Weber 2013), using a variety of methods to assess the standards of cleanliness (Mitchell *et al* 2013, Smith *et al* 2013). Surfaces can remain contaminated even after a terminal clean, potentially because the rooms are inadequately cleaned and/or the fact that *C. difficile* is not susceptible to most commonly used surface disinfectants, such as phenolics and quaternary ammonium compound, because these agents are not sporicidal (Russell 1990, Vohra and Poxton 2011). Sodium hypochlorite and hydrogen peroxide have been demonstrated to be effective in killing *C. difficile* spores; however, contact time and disinfectant concentration are important considerations (Perez *et al* 2005, Barbut *et al* 2009).

Several guidelines recommend the use of disinfectant in the environmental cleaning element of *C. difficile* prevention. In most instances, these recommendations refer to the use of sodium hypochlorite (Siegel 2007, Dubberke *et al* 2014). In areas that house patients with CDI, all surfaces (particularly horizontal, frequently touched items) within patient reach and the patient's toilet/commode should be cleaned at least daily with neutral detergent followed by disinfectant active against *C. difficile*. It is important for nurses to understand their role in cleaning a patient environment; this role is often determined locally.

## Education

Nurses play a role in educating patients and their visitors about CDI, including how to use personal protection equipment correctly and where to perform hand hygiene. If the visitor is providing care for the patient, gowns or aprons and gloves should be worn and hands cleaned. As *C. difficile* is likely to heavily contaminate the bathroom when patients use the toilet, visitors should be advised not to use the patient's bathroom. Information should also be provided to the patient by the nurse not only during the course of the infection but also following the infection. Relapse of CDI is a

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common occurrence (Kelly and LaMont 2008), and nurses can educate patients about the potential risk of relapse, particularly if patients are being exposed to antibiotics again in the near future. This is a potentially important message on discharge.

### Surveillance

Surveillance is the cornerstone of infection prevention and control activities (Mitchell and Gardner 2013). While surveillance is generally undertaken by infection prevention and control staff, nurses working in clinical areas should be alert to the incidence of CDI in their organisation and ward, to better understand and manage the risk to patients. In addition, nurses caring for patients with CDI have an important role in monitoring the frequency and consistency of stools. This can be achieved by using a tool such as the Bristol Stool Chart (Pai *et al* 2012). The use of such a tool can assist in providing high standards of nursing documentation, in an objective manner, and provide valuable information for infection prevention and control staff in determining isolation requirements. Surveillance of process measures should also be undertaken. Audits of compliance with contact precautions and environmental cleaning can provide ward staff with vital information on their own performance when managing patients with CDI, and these data can be used to identify and target educational needs.

## Conclusion

*C. difficile* infection is a common cause of diarrhoea in hospitalised patients and can have a significant effect on patient outcomes and health service resources. Our understanding of the aetiology of CDI continues to improve. With refined diagnostic testing and clear evidence of the role of antimicrobial prescribing practices, healthcare worker hand hygiene and the importance of the healthcare environment, it is clear that multiple preventive strategies should be employed. Nurses have a vital role in the prevention of CDI, including assisting appropriate antibiotic use, patient education, early instigation and maintenance of prevention and control strategies, and assisting with high standards of environmental cleanliness and surveillance **NS**

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