HOW TO CUT CLOSTRIDIUM DIFFICILE INFECTION

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This article provides an update on Clostridium difficile and highlights the appropriate infection-control measures that need to be in place to reduce the infection.

Clostridium difficile, so called because when it was first discovered it was difficult to grow in the laboratory, is a bacterium of the Clostridium family (Department of Health, 2007a). Although C. difficile was first described in the 1930s, it was not identified as the cause of diarrhoea and colitis following antibiotic therapy until the late 1970s (DH, 2007a). The family includes the bacteria that cause tetanus, botulism and gas gangrene. It is an anaerobic bacterium (it does not grow in the presence of oxygen) and produces spores that can survive for a long time in the environment. The spores protect the organism against heat and chemical disinfection. The spore-forming bacterium forms part of the normal flora in the large intestine and is found in up to 3% of healthy adults (Health Protection Agency, 2007a).

The effects of C. difficile can range from a relatively mild illness to diarrhoea of varying severity, and occasionally to severe inflammation of the bowel that may result in serious illness and even death. Other symptoms can include fever, loss of appetite, nausea and abdominal pain or tenderness. As it is difficult to diagnose C. difficile infection on the basis of its symptoms alone, the infection is normally diagnosed by laboratory testing, which shows the presence of the C. difficile toxins in faecal samples (HPA, 2007a).

The bacterium produces two toxins, A and B, that are responsible for the diarrhoea and damage the cells lining the bowel (Borriello, 1998). The main diagnostic test is by a cytotoxin test or enzyme-linked immunosorbent assay (ELISA) test to determine the presence of toxins A and B. If a hospital has clinical and/or epidemiological evidence to suggest an outbreak problem due to increased cases or deaths associated with C. difficile, further laboratory testing may be required to enable the identification of the strain type.

In order to identify which particular strain of C. difficile is causing the infection, ribotyping of the stool sample is conducted. Ribotyping can help determine if cases are linked, and due to, cross infection.

C. difficile infection may result in death, particularly in patients who are older or immunocompromised. It is common in the intestines of babies and infants, although it does not cause infection. The toxins do not damage immature intestinal cells of babies as it is thought they do not have the receptors to enable C. difficile to attach to the lining of the bowel and, hence, cause infection (Eglow et al, 1992).

Mode of transmission

Although some people can be healthy carriers of C. difficile, in most cases the disease develops after cross infection from another patient, usually through direct patient-to-patient contact in the healthcare environment or via a contaminated environment. Quite often, a patient with C. difficile diarrhoea is taking, or has recently been given, antibiotic therapy (Association of Medical Microbiologists, 1998).

A patient with C. difficile diarrhoea excretes large numbers of the spores in their liquid faeces. These can contaminate and survive in the environment for long periods, on floors and around the patient’s bed (including surfaces, keypads, equipment), in toilet areas, sluices, commodes and in bed-pan washers. Fawley and Wilcox (2001) demonstrated that if C. difficile spores are not present in the environment, infection is likely by patient-to-patient and/or staff-to-patient spread. As the spores are able to survive for a long time, they can be a source of hand-to-mouth infection.

Surveillance

Surveillance data is essential if trends in infection are to be monitored. They can also indicate that infection control practices need to be
modified if ‘abnormal’ patterns are observed. The DH Mandatory C. difficile Surveillance Scheme began in 2004 and made it mandatory for all acute NHS trusts to report C. difficile cases for patients aged 65 years and over. The scheme was extended in April 2007 to include C. difficile cases for patients aged two years and over (DH, 2007b). It is mandatory for all acute NHS trusts to enter the records into the healthcare-associated infections (HCAI) web-based Data Capture System (DH, 2008a). PCTs have also agreed local targets with their local providers to reduce C. difficile infections. In addition, trusts in England will have to reduce their C. difficile infections by 30% by 2011 from the 2007–2008 numbers (DH, 2007c).

The introduction of the HPA’s sampling scheme in 2005, led to the identification of a strain known as C. difficile 027. This strain was the cause of an epidemic of C. difficile infection in 2002 with increased morbidity and mortality in Quebec province, Canada (Warny et al, 2005). C. difficile 027 was also identified as the cause of the outbreaks at Maidstone and Tunbridge Wells NHS Trust in 2006 (Healthcare Commission, 2007). The investigation recommended that trusts have policies in place to respond to outbreaks. Also, all acute trusts should have guidelines for the management of patients infected with C. difficile, in particular there needs to be sufficient guidance on the importance of their being isolated from other patients (HCC, 2007).

The annual rate of C. difficile has continued to increase since mandatory surveillance began in 2004, where a rate of 1.92 per 1,000 bed days was reported by acute NHS trusts in England. A 7.3% increase in cases has been reported since 2005, when 51,829 cases were reported with a rate of 2.23 cases per 1,000 bed days, and a rate of 2.39 per 1,000 bed days was reported in 2006 (HPA, 2007c). It is important to note that rates are affected by factors such as trust size, services offered, population served and the use of antibiotics, as well as the strain of C. difficile.

The number of death certificates in England and Wales that mentioned C. difficile increased from 1,214 in 2001 to 3,807 in 2005, and between 2004 and 2005 the number of deaths involving C. difficile increased by 69% (Office of National Statistics, 2007). The increase in death certificates mentioning C. difficile as an underlying cause of death may be due to advances in laboratory diagnosis of C. difficile toxins or improvements in the accuracy of completing death certificates. In October 2007 the chief medical officer for England provided further guidance on completing death certificates (DH, 2007d).

Healthcare workers must remain vigilant and work with infection control teams to monitor cases and rates of HCAIs in their hospitals. All staff should be aware of the latest developments in policies and guidance for surveillance and infection control precautions.

**Nursing practice**

**Antibiotic prescribing**

A major contributory factor for C. difficile infection is antibiotic therapy (DH, 2007a). Narrow-spectrum antibiotics such as penicillin, which only destroy a small range of bacteria, are preferred to broad-spectrum agents, which can have an effect on a wide range of bacteria.

Oral administration of metronidazole or vancomycin for 10–14 days is considered appropriate treatment of C. difficile infection. Further information on antimicrobial prescribing for healthcare workers is available on the DH’s Clean, Safe, Care website (www.clean-safe-care.nhs.uk). Under the Health Act 2006 all acute NHS trusts must ensure that appropriate measures are in place to ensure prudent prescribing (DH, 2008b).

**Management of infection**

C. difficile spores can easily spread in the environment, from patient to patient by direct contact, on the hands of healthcare workers and via equipment such as bed pans, commode chairs and bed rails. In order to prevent or reduce the risk of C. difficile infection in patients, healthcare workers should wear disposable gloves and aprons when caring for patients who are infected (DH, 2007a). Patients infected with C. difficile should be isolated or cohorted and staff caring for them should follow infection control procedures and always observe good handwashing practice (HPA, 2007c). There is no evidence that alcohol-based hand rubs are effective in destroying spores on hands or in the environment, but handwashing with soap and water is effective in removing spores of C. difficile (HPA, 2007b).

The DH and Public Health Laboratory Working Group for C. difficile recommend that, wherever possible, patients who are affected – including those with diarrhoea who have not yet been confirmed as having a C. difficile infection – are transferred to an isolation ward (DH and Public Health Laboratory Service, 1994). A public consultation of the document, Clostridium difficile Infection: How to Deal with the Problem – A Board to Ward Approach, is under way, and the revised guidelines are expected later this year (HPA, 2008).

**REFERENCES**


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Care bundles
A multifactorial approach is required in order to reduce *C. difficile* infection in a healthcare setting. Care bundles aim to ensure that all patients consistently receive the best care or treatment, all of the time (Cooke and Holmes, 2007). Care bundles consist of simple evidence-based clinical tools designed to improve the reliability and safety of clinical procedures. They are specifically targeted at areas where the risk of infection is highest and enable individuals, wards, units and departments to develop action plans for improvement and ensure practices and procedures conform to relevant guidance.

The DH recommends the use of care bundles and has compiled a package of resources, self-assessment tools and high-impact interventions/care bundles in the *Saving Lives* programme to assist trusts in reducing *C. difficile* infection (DH 2006). High-impact intervention number 7, *Reducing the Risk of C. difficile* (DH, 2007e), demonstrates the combination of measures that need to be implemented in order to lower the risks of infection to patients (Box 1).

Future developments
It is important that we continue to conduct research on ways to reduce cases of *C. difficile* infection, such as developing potential vaccines. Péchiné et al (2007) used the flagellar cap protein FliD of *C. difficile* to test several immunisation routes: intranasal, rectal and intragastric. The rectal route, which is the most efficient, was used to vaccinate groups of mice with different antigen combinations. After immunisations, the mice were challenged with toxigenic *C. difficile* and a significant statistical difference between the control group and the immunised groups was observed in the colonisation levels of *C. difficile*. Although probiotics have been used to treat patients with *C. difficile* infection, there is insufficient evidence to demonstrate that they can be used routinely to reduce the risk of, or alleviate the symptoms of, the infection (Isakow et al, 2007). Clinical trials and further research are required to establish whether or not probiotics can successfully be used as a substitute for antibiotic treatment.

## Conclusion
Understanding the epidemiology and virulence of prevalent strains is important if *C. difficile* infection is to be controlled successfully. All healthcare workers, from those on the wards to senior management, have a role to play in creating a safer environment for staff and patients alike. We must remember that infection control is paramount and it is everyone’s responsibility.

## BOX 1. HIGH-IMPACT INTERVENTION TO REDUCE C. DIFFICILE

- Prudent antibiotic prescribing to reduce the use of broad spectrum antibiotics.
- Isolation/cohort nursing of patients with *C. difficile* infection and compliance with infection control precautions.
- Handwashing with soap and water (alcohol is not effective).
- Personal protective equipment to be worn including gloves and aprons, especially when dealing with bed pans, commode chairs and toilet seats. The possibility of transmitting infections via uniforms is an important issue for employers, staff and patients. The Department of Health recently issued an evidence base for developing local uniform policy (DH, 2007f). The document outlines the existing legal requirements and current findings, to support and advise employers when reviewing local policies in this area.
- Enhanced environmental cleaning using chlorine-containing disinfectants or other sporicidal products.
- Healthcare workers should be trained in learning to spot the early signs of a potential case, cluster and outbreak. Managers should incorporate infection control in the job descriptions for all clinical and medical staff.

## BOX 2. KEY POINTS

- **Trusts should ensure all healthcare workers:**
  - Are routinely and actively involved in the surveillance and monitoring of all healthcare-associated infections.
  - Are familiar and comply with infection control guidance and policies regarding *C. difficile* infections.
  - Are adequately trained in hand hygiene, in particular using soap and water to remove spores of *C. difficile*.