Using the Waterlow tool to predict Clostridium difficile infection risk in hospital settings

Tackling the spread of C difficile is a priority for the NHS. A team explain how they adapted and tested the Waterlow tool to assess patients at risk of infection

WHAT IS CLOSTRIDIUM DIFFICILE?
Around 2% of healthy adults are colonised with C difficile, although rates are higher among nursing home residents and patients who are hospitalised (Simor et al, 2002).

C difficile is a bacterium found in soil and the human gastrointestinal tract. In the latter, it mainly causes asymptomatic colonisation as the bacteria are kept under control by normal healthy intestinal flora. When these flora are altered, the C difficile bacteria flourish and produce two types of toxins, called A and B. Toxin A causes mucosal damage and intestinal inflammation. Toxin B is 1,000 times more potent than toxin A and causes significant diarrhoea by stimulating gastrointestinal contractions.

Ultimately, toxins A and B can cause major tissue damage with colon ulceration leading to colitis. Additional symptoms include dehydration, hypotension and bacteraemia (Kuijper et al, 2006).

C difficile associated disease (CDAD) refers to the spectrum of diseases caused by a C difficile infection, which range from mild diarrhoea to a severe life threatening condition. In 2008, C difficile was mentioned on nearly 6,000 death certificates, and was directly responsible for 49% of these deaths (Office for National Statistics, 2008).

Risk factors for developing C difficile infection include clinical interventions that alter normal gastrointestinal flora, exposure to toxigenic strains of C difficile and other factors such as increasing age, reduced immunity and comorbidities that predispose patients to infection. Clinical interventions that alter normal intestinal flora include repeated enemas, prolonged nasogastric feeding, gastrointestinal tract surgery and overuse of antibiotics, especially amoxicillin, clindamycin and cephalosporins.

C difficile bacteria are spread easily as diarrhoea from an infected patient can release spores into the environment, which can survive for 70 days (O’Neill et al, 1993). The spores can be transported through contact with contaminated surfaces such as floors, bedpans and toilets, as well as the hands of healthcare staff and patients.

C DIFFICILE INFECTIONS IN THE UK
The C difficile organism was identified in the 1930s and, by the 1980s, was a widely recognised cause of diarrhoea in hospitals. Infection rates increased in the early 1990s and outbreaks became more common. An outbreak in Manchester in 1991 affected 175 patients and was directly responsible for 17 deaths (Cartmill et al, 1994). Increased incidence occurred again in 1996 and rose steadily from 2001, peaking in 2006 with 35,635 cases (Health Protection Agency, 2008).

In the UK in the early 2000s, a new strain of C difficile, which had been associated with outbreaks in Canada, North America and Europe, began to emerge (Healthcare Commission, 2006). This new 027 strain produces toxins at a faster rate, which results in a more severe disease with increasing numbers of complications and deaths. The 027 strain is resistant to fluoroquinolone antibiotics (Drudy et al, 2007).

In 2004, surveillance of C difficile in England became mandatory for all patients over the age of 65, with hospitals having to report cases to the HPA (2008). Surveillance was extended in 2007 to include all cases of C difficile in patients aged over two years (HPA, 2008).

Tackling the spread of C difficile infections became a priority for the NHS, as set out in The NHS in England: The Operating Framework for 2008/9 (Department of
Health, 2007a) and the public service agreement Ensure Better Care for All (Cabinet Office, 2007). A national target was set to reduce cases by 30% in the financial year beginning 2010 (DH, 2007a) and, from 2007, primary care trusts were required to agree local targets with NHS hospital trusts (DH, 2007b).

**INTERVENTIONS TO PREVENT C. DIFFICILE INFECTION**

Five main interventions have been identified to reduce or prevent the spread of *C. difficile* infection (Healthcare Commission, 2005). These have been included in HPA (2009a) guidance and are listed in Box 1.

![Box 1. Interventions to Prevent *C. difficile* Infections](image1)

These interventions are implemented either: across an entire trust for all patients (intensive cleaning programmes, prudent antibiotic prescribing and increased hand hygiene); or for specific patients who already show symptoms of *C. difficile* infection (patient isolation/barrier nursing and personal protective equipment). A combination of these interventions appears to have been successful in reducing *C. difficile* as rates have dropped. The latest report from 2008-09 shows a 35% reduction in cases compared with the previous year (HPA, 2009b).

While recommended interventions have achieved some success, they are not ideal. For example, trust wide interventions require significant resources to implement and identifying at risk patients would be more cost effective. Similarly, actions aimed at preventing the spread from infected patients are crucial but the emphasis should be on preventing the infection at the outset.

The most effective strategy is to prevent new cases by targeting patients at risk. This approach of identifying those at risk and intervening has been used successfully in healthcare, for example, using assessment tools to identify those at risk of falling (Oliver et al, 2004).

The DH (2008) published an assessment tool that aims to identify patients at risk of acquiring *C. difficile*, as part of the Clean, Safe Care campaign (www.clean-safe-care.nhs.uk). Patients are assessed using two scoring systems. The first score is based on three critical risk factors:

- Is the patient over 65?
- Do they have a severe underlying disease?
- Are they taking antibiotics or have they taken antibiotics in the last eight weeks?

The second asks more specific questions, concerning matters such as recent contact with healthcare settings and use of proton pump inhibitors.

There are two main problems with this tool. The first is the sensitivity of this assessment. Patients who answer yes to each of the three questions in the first assessment will be labelled as at high risk of developing a *C. difficile* infection. However, the proportion of hospital patients who are over 65, have an underlying disease and have taken antibiotics recently is considerable. This means that large numbers will be identified as at risk and it is not possible to implement resource intensive interventions for large numbers.

The second concern is specific to not only this assessment tool but also new assessment tools in general. Numerous studies have shown that nursing staff are poor at assessing and documenting risk assessment scores (O’Conner, 2007). Implementing another new risk assessment tool will merely add to the burden of paperwork on admission, resulting in inaccurate or incomplete assessments, rendering the tool worthless.

**AN ALTERNATIVE RISK ASSESSMENT**

Recent HPA guidance on *C. difficile* calls for “prognostic risk scores [which] will require development and validation” (HPA, 2009a).

The Waterlow risk assessment tool has been found to be easy to use, inexpensive and imposes no extra burdens on nurses. It appears to be the only tool that can be used specifically for identifying patients at risk of *C. difficile* on admission (Tanner et al, 2009).

The Waterlow is an assessment tool used to identify patients at risk of developing pressure ulcers. It was designed in 1984 by Judy Waterlow for use by student nurses (Waterlow, 1985) and a revised version, available on www.judy-waterlow.co.uk, includes new categories for nutrition, organ failure and time spent in surgery. The Waterlow tool is widely used by nurses in many countries around the world and risk factors for a high score are shown in Box 2.

A team at De Montfort University, Leicester successfully adapted the Waterlow tool to assess risks for *C. difficile* infection. To show that the Waterlow is a valid and reliable tool for assessing *C. difficile* infection, as well as pressure ulcers, the team carried out a study (reported in more detail in Tanner et al, 2009). To be truly rigorous, this study tested the Waterlow tool using a three stage process. The first stage identified risk factors, the second tested the tool’s validity in one hospital and the third assessed its validity in a different hospital.

For the first stage, 25 patients with *C. difficile* infection were matched (in pairs) with another 25 who had not developed the infection. They were matched by age, gender, admission date, presenting diagnosis and specialty. The notes from the 25 matched pairs of patients were examined for known risk factors for *C. difficile* as well as the Waterlow score and a frailty score (Woods et al, 2005). Statistical analysis of this data showed that a high Waterlow score (20 or above) was significantly associated with patients having a *C. difficile* infection.

The second stage tested the validity of the Waterlow score in predicting which patients would be likely to develop *C. difficile* infection. All those admitted to an adult medical assessment unit over three months were followed up to determine which ones went on to develop *C. difficile* infection. Waterlow scores for all patients were documented on admission. Some 1,468 patients were included in this stage of the study and 83 had a high score (20 or above). Twenty patients of the overall total developed *C. difficile* infection, and 14 of these patients were in the small group of 83 patients with the high Waterlow scores. By identifying 70% of the *C. difficile* cases, this shows that the Waterlow score is effective in predicting patients at risk of developing *C. difficile* infection.

To further validate the reliability of the Waterlow score as a risk assessment tool for *C. difficile* infection, the tool was tested in a second hospital using a larger sample.

The electronic records of 29,211 patients were analysed to identify Waterlow scores on admission and *C. difficile* status. Some 1,347 patients had a high score of 20 or
above and 98 (of the overall total) developed *C. difficile* infection. Thirty-two infected patients were in the small group with high Waterlow scores of 20 or above. The Waterlow tool identified 33% of those who went on to develop *C. difficile* infections. While not appearing to be as supportive of this use of the Waterlow tool, this study still confirms that it is effective in predicting patients at risk of developing *C. difficile* infection.

### Advantages of using Waterlow

The major benefits of using the Waterlow score to predict those at risk of developing *C. difficile* infection include:

- It is already widely used;
- Nurses are familiar with it;
- They do not have to carry out extra assessments.

It is therefore inexpensive and easy to implement, although it still needs to be used accurately.

Another advantage of this tool is that it identifies a small group of at risk patients, allowing resource intensive interventions to be targeted. These are outlined in Box 3.

### CONCLUSION

This article has proposed an inexpensive and effective assessment tool for identifying hospital inpatients who are at risk of developing *C. difficile* infection. A rigorous study has shown the Waterlow tool is appropriate for identifying those most at risk of developing *C. difficile* infection and, as an existing assessment, it is easy to use and implement, thus keeping costs down.

This tool will enable nurses to target resource intensive interventions at those patients who are most at risk, thus preventing a number of these potentially life threatening infections.

### REFERENCES


Health Protection Agency (2009a) Clostridium Difficile Infection: How to Deal with the Problem. London: HPA. tinyurl.com/c-diff-problem


Healthcare Commission (2006) Investigation into Outbreaks of *Clostridium difficile* at Stoke Mandeville Hospital, Buckinghamshire Hospitals NHS Trust. London: HC.


