A National Surveillance Programme for *Clostridium difficile* Infection (CDI) in Scotland

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Introduction

Clostridium difficile infection (CDI) is a major cause of morbidity and mortality, especially in the healthcare setting, and is often associated with the use of antibiotics (Kuijper et al, 2006). Disease ranges from mild self-limiting diarrhoea to severe diarrhoea, pseudomembranous colitis, toxic megacolon and death (Bartlett and Gerding, 2008).

In Scotland, a significant increase in the number of reported cases of CDI was observed in the period 1995-2005. As a result, a national mandatory surveillance programme for Scotland was introduced in all healthcare settings (including acute and non-acute hospitals and primary care) to monitor CDI in patients aged 65 and over. Surveillance activities have been coordinated with the provision of infection prevention tools, including antimicrobial prescribing policies and guidance on infection prevention and control to facilitate the reduction of CDI in healthcare settings. A reference service was also implemented to aid understanding of the epidemiology of *C. difficile*.

Methods

A surveillance protocol was developed which included a case definition for CDI (see Box 1), and guidance on specimen sampling and toxin testing. Diagnostic laboratories in each of the 14 NHS boards in Scotland submit results of all *C. difficile* toxin positives from all acute and non-acute hospitals, as well as general practices. Samples from severe cases and outbreaks are also submitted to the reference service for PCR ribotyping and measurement of antibiotic sensitivities. After deduplication of CDI data, each laboratory has an opportunity to review cases assigned to them. Rates are calculated by health board area using hospital bed days (occupied bed days (OCBDs)) as denominator data. Case-review studies to validate the surveillance data have been carried out on a subset of the data.

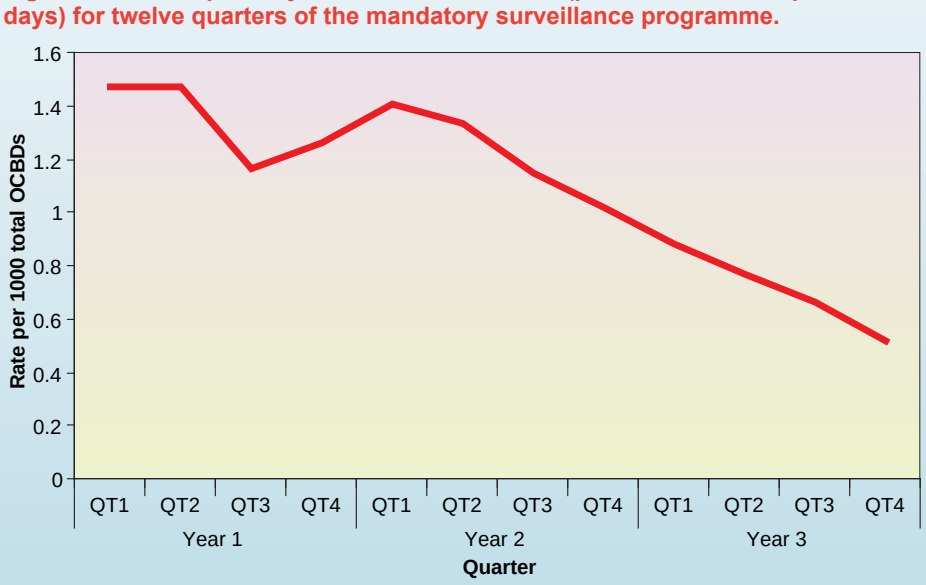
Box 1. Case definition of CDI used in the Scottish CDI surveillance protocol.

Case definition of CDI:
Someone in whose stool *C. difficile* toxin has been identified at the same time as they have experienced diarrhoea not attributable to any other cause, or someone from whose stool *C. difficile* has been cultured at the same time as they have been diagnosed with PMC (pseudomembranous colitis).

Results

All NHS boards and hospitals have complied with the surveillance protocol. In Year 1, 6430 cases were reported (for an annual rate of 1.34 per 1000 total OCBDs); in Year 2, 6322 cases were reported (annual rate of 1.23); and in Year 3, 3625 cases were reported (annual rate of 0.71). Rates have decreased for seven consecutive quarters since the beginning of Year 2. The most recent rate for the fourth quarter of Year 3 was 0.52 per 1000 total OCBDs, which is the lowest reported rate since the beginning of the surveillance programme and is a decrease of 63% from the peak rate in the first two quarters of Year 1, and a 49% decrease compared to the rate in the same period of Year 2 (see Figure 1). Compared to Year 2, the number of cases in Year 3 has dropped 43% and the annual rate for Scotland has decreased 42%.

Figure 1. Overall quarterly CDI rates for Scotland (per 1000 total occupied bed days) for twelve quarters of the mandatory surveillance programme.



Case-review studies have shown that between 9-35% (n = 4; median = 14%) of reported cases have no documented symptoms, and that community-associated CDI varies among the NHS boards with one board reporting no community cases and two further boards reporting 26% of their cases as community-associated.

64% of the ribotypes reported by the reference service were of three main types: 106, 001 and 027, with 106 predominating (see Figure 2). 48 different ribotypes were reported in total. The majority of the isolates of types 106, 001 and 027 were multiply resistant to a range of antibiotics (see Table 1). 95% of all ribotypes isolated by the reference service were resistant to clindamycin. Although most cases of clindamycin resistance were low-level, a small number of isolates showing high-level resistance have been observed (data not shown). All of the isolates typed were sensitive to metronidazole and vancomycin.

Figure 2. C. difficile PCR ribotypes in Scotland. Specimens were submitted in the period November 2007-December 2009.

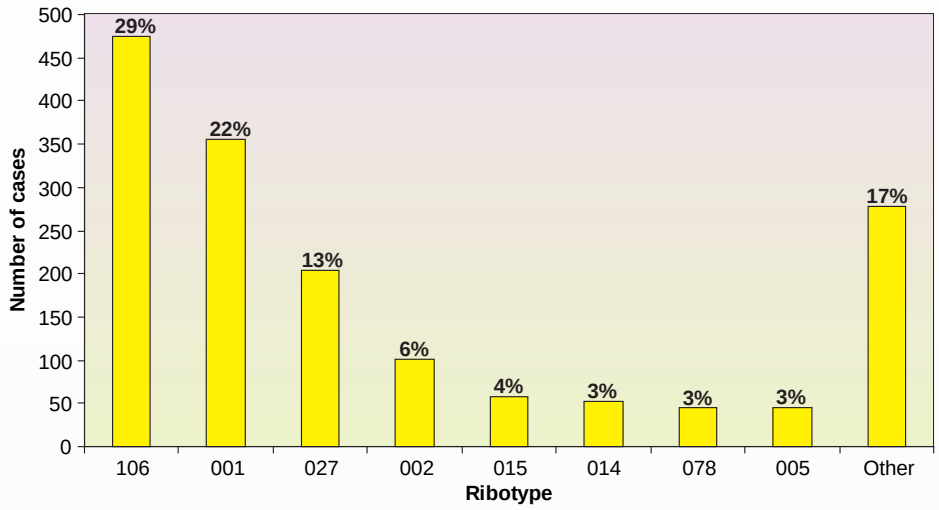


Table 1. Resistance profiles in ribotypes 106, 001 and 027 (November 2007-December 2009).

Antibiotic	Ribotypes		
	001 (n=355)	027 (n=204)	106 (n=475)
	No. resistant isolates (%)	No. resistant isolates (%)	No. resistant isolates (%)
Cefotaxime	93.8	85.3	96.4
Moxifloxacin	96.3	100	98.9
Levofloxacin	96.3	100	99.4
Erythromycin	96.9	100	99.6
Clindamycin	96.6	97.5	97.3

Conclusions

The national mandatory surveillance programme has led to improvements in the standardisation of testing, diagnosis and reporting of CDI, with the same case definition used by all clinicians in all hospitals across Scotland since the beginning of the surveillance programme. Surveillance, along with the implementation of guidance, has raised awareness of CDI and supported the reduction in reported rates, with recent rates decreasing continuously over a 2-year period to a low of 0.52 per 1000 total OCBDs compared to a peak of 1.41 per 1000 total OCBDs at the start of Year 1.

Typing results suggest that ribotypes 106, 001 and 027 have become predominant in Scotland. Type 106 is thought to be unique in the UK compared to the wider distribution of 027 and 001, although it has recently been detected in one other country, Brazil (Balassiano et al, 2009). Multiple resistance to the antibiotics cefotaxime, moxifloxacin, levofloxacin, erythromycin and clindamycin is a feature of ribotypes 106, 001 and 027 in Scotland, and the small number of high-level clindamycin resistant isolates is of interest. These resistance profiles could reflect the importance that the use of these classes of antibiotics may play in the spread and persistence of these types. Antimicrobial stewardship is therefore essential to obtaining further reductions in the rates of CDI.

Case-review studies have shown that a significant proportion of CDI cases (up to 26%) may be community-associated, which warrants further investigation. In addition, the studies have shown that up to 35% of reported cases have no documented symptoms; therefore, some of these cases may have been reported as false-positives. Further case-review studies will improve the understanding and accuracy of the incidence estimates of CDI in Scotland.

The national surveillance programme for CDI in Scotland is now in its fourth year, and results have shown that great progress had been made in reducing the rate of CDI in persons aged 65 years or older. This has been achieved through a coordinated effort among the health service and reference service, and the implementation of supporting documents including guidance and infection prevention tools. Continued surveillance that maintains this coordinated and cooperative approach will help to further reduce the burden of CDI in Scotland.

References

Balassiano, I. T. et al. Characterization of *Clostridium difficile* strains isolated from immunosuppressed inpatients in a hospital in Rio de Janerio, Brazil. Anaerobe, 2009. 15: 61-64.

Bartlett, J. G. and D. N. Gerding. Clinical recognition and diagnosis of *Clostridium difficile* infection. Clin Infect Dis 46 Suppl 1 (2008): 12-8.

Kuijper, E.J., B. Coignard and P. Tull, Emergence of *Clostridium difficile*-associated disease in North America and Europe. Clin Microbiol Infect, 2006. 12 Suppl 6: p. 2-18.

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