Mortality and risk factors for death in patients with *Clostridium difficile* infection (CDI) in Scotland: a population-based study

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Background

Mandatory surveillance of *Clostridium difficile* Infection (CDI) in Scotland has been carried out since 2007, and incidence rates since then have decreased dramatically. However, national surveillance only enables the monitoring of trends in the incidence rates of CDI; it does not provide any information on the survival of patients. By linking reported CDI case patients from the Scottish national surveillance programme to hospital admission data and mortality records, we can describe the clinical and demographic risk factors of patients with CDI and their survival rates.

Objective

To describe mortality trends of CDI and establish any risk factors associated with death in patients with CDI, using individual-level linked patient records.

Methods

All CDI cases aged ≥15 years reported between 2010 and 2014 were linked with acute and maternity hospital records and death records, as well as *C. difficile* ribotype data previously collected under a representative snapshot programme of ribotypes identified within Scotland. Diagnosis of CDI in Scotland is carried out using a two-step algorithm (GDH/PCR screen followed by toxin A/B EIA or cell culture cytotoxicity test), and all cases are validated by the reporting laboratory as meeting the surveillance case definition. The dataset was linked using probability matching methodology using the Community Health Index (CHI) number (a personal identifier, which is used in Scotland for health care purposes) to link both the laboratory and hospital admission data. 30-day mortality was calculated and an additional range of demographic and clinical risk factors were identified for each case of CDI including age, sex, co-morbidities, Charlson score, number of previous admissions and whether the infection was acquired in hospital (HA-CDI) or community (CA-CDI). Odds ratios were estimated using logistic regression. Univariate and multivariate models were fitted using all risk variables and forward selection methods were used to obtain a parsimonious reduced model. Analysis was carried out in SPSS version 2.1.

Results

Demographics

A total of 9649 episodes of CDI aged ≥15 years were reported to HPS over the study period. After successful linkage, 8323 records were available for statistical analysis. 18% of CDI patients were identified as community acquired (CA-CDI), 73% as hospital acquired (HA-CDI) and 9% as unknown based on standard definitions. CA-CDI patients were significantly younger than HA-CDI patients (median age 75 compared to 79, $p<0.001$) and had significantly less comorbidity ($p<0.001$, using Charlson Comorbidity Index).

All-cause mortality

There was a decrease in the number of patients dying within 30 days of diagnosis of CDI from 20.3% to 14.1% between 2010 and 2014 (Figure 1), with a year on year decrease in case-fatality of 5.6% ($p=0.001$). 30-day survival was higher in CA-CDI patients at 89% compared to 73% in HA-CDI patients. 30-day mortality was highest among RTs 027 (25%), 001 (23%) 106 (20%) and 023 (20%), though no association with mortality for any one ribotype was observed following adjustments for age (Figure 2).

Risk factors for death

Increased age, higher Charlson score, HA-CDI, having had a recent operation, liver comorbidity, lung comorbidity, and malignancy comorbidity were significantly associated with increased mortality. Bowel comorbidity and more than 2 previous CDIs in the last year were found to be significantly associated with increased survival.

Figure 1: 30-day all-cause mortality (%) of CDI cases between 2010 and 2014.

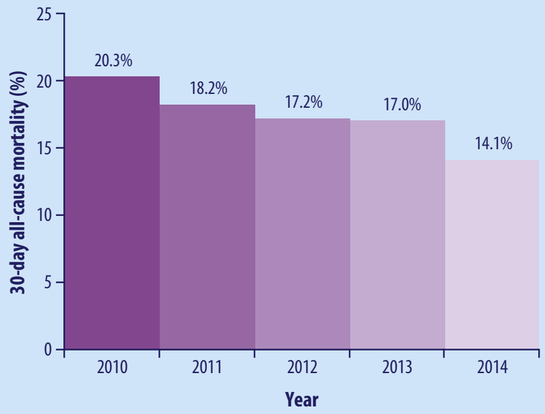
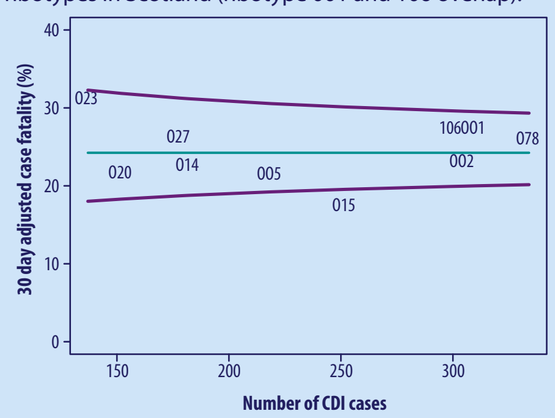


Figure 2: Funnel plot of age-adjusted 30-day all-cause mortality (%) of the ten most common *C. difficile* ribotypes in Scotland (ribotype 001 and 106 overlap).



Discussion

This study has demonstrated that added value can be achieved through the use of linked patient datasets to enhance the information already provided through microbiology based disease surveillance programmes. The use of linked datasets also reduces the burden placed on front-end staff to collect data for epidemiological studies.

The results may suggest improvements in the quality of care received by CDI patients in recent years; however, the observed decline may be indirectly linked to overall improvements in mortality among the general population of Scotland, which needs to be assessed. One of the major limitations in this piece of work was the lack of a control group. Therefore, further work is planned using a control group to facilitate identification of the factors are associated with the increased survival, which will improve CDI patient care and outcomes for the individual patient.

The study also shows that it is important to take into account the distribution of HA-CDI and CA-CDI cases as well as all the more well known risk factors, and underlines that CDI can be fatal as a result of infection by any of the major ribotypes. These findings also support the importance of careful and timely risk assessment of each individual CDI patient to ensure optimal clinical management. Moreover this type of enhanced patient data may provide valuable evidence to develop guidance on management of CDI patient to improve clinical outcome.

Poster produced by the Graphics Section, Health Protection Scotland