

# The emergence of community-acquired *Clostridium difficile* in an Australian hospital

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**Abstract.** *Introduction:* The epidemiology of *Clostridium difficile*-related illness is changing. This study aimed to compare risk factors between community- and hospital-acquired *Clostridium difficile* (*C. difficile*) cases.

*Methods:* This study was a case-series analysis in a metropolitan tertiary care hospital. A total of 136 hospitalised patients aged 18 years or older who had laboratory-confirmed *C. difficile*-positive stool samples between 1 September 2011 and 30 September 2012 were analysed. Data were collected electronically from hospital administrative databases. Medical records of patients with toxigenic *C. difficile* were retrospectively reviewed for clinical information. Data matching was used to provide event-based data of the number of cases infected with *C. difficile* and their hospital outcomes.

*Results:* A monthly average of 9% (15 of 168) of diarrhoeal stool samples were toxigenic test-positive. One-third ( $n = 37$ ) of *C. difficile* cases had acquired infection before their hospital admission. These patients were significantly more likely to be diagnosed with enterocolitis due to *C. difficile* compared with patients who were infected in hospital (24% versus 7%,  $P = 0.02$ ). Community-acquired *C. difficile* patients had significantly shorter mean lengths of stay in hospital (14 days versus 48 days for hospital-acquired infection) and were more likely to be discharged before 21 days (81% v. 38%,  $P < 0.001$ ).

*Conclusions:* Patients with community-acquired *C. difficile* infection (CDI) contributed to a third of the burden of this infection in the hospital. A quarter of these patients presented to hospital with potentially life-threatening enterocolitis related to the infection. These data suggest that infection with *C. difficile* demands greater attention, in particular in the community setting.

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## Introduction

*Clostridium difficile* is a spore-forming bacillus that produces toxin-mediated illness in humans. CDI results in a range of symptoms which range from diarrhoea to colitis, sepsis, and death.<sup>1,2</sup> The epidemiology of *C. difficile*-related illness is changing. The global incidence and severity of CDI and the associated disease has increased over the past decade<sup>3</sup> and more recently in Australia.<sup>4</sup> In the US, CDI has replaced methicillin-resistant *Staphylococcus aureus* as the most common cause of healthcare-associated infections.<sup>5</sup>

Studies show that CDI is emerging as an underdiagnosed infection in the general, non-hospitalised community.<sup>4,6–8</sup> Additionally, it is increasingly recognised as a cause of

diarrhoea in the community in people who lack the traditional risk factors.<sup>9–12</sup> Traditional predisposing risk factors include advanced age, antibiotics exposure and admission in a hospital.<sup>13–15</sup> Manifestations of infection can range from asymptomatic colonisation to life-threatening colitis.<sup>16</sup> These outcomes have important consequences for individual patients, the community and health system costs.<sup>6,17,18</sup> Predictors of outcomes such as length of hospitalisation and various risk factors for infection have not been well studied. We aimed to assess *C. difficile* incidence, risk factors, and health outcomes for community- and hospital-acquired infection in an Australian hospital.

### Implications

- CDI is emerging in previously considered low-risk community populations.
- Best strategies in monitoring and understanding community-acquired CDI should be considered.

### Methods

#### Study design

This study was conducted at a large metropolitan teaching hospital in Sydney. The hospital is a tertiary referral and teaching hospital of a major university and has a catchment population of some 313 000 people. A cohort of patients admitted in a defined 1-year time period from September 2011 to September 2012 was studied. For the duration of the study from September 2011 until September 2012, there were a total of 44 783 hospital admissions.

#### *C. difficile* case definition

A case of *C. difficile* was defined as a case of diarrhoea (diarrhoeal stool is a specimen that takes the shape of the specimen container) that meets the following criteria:

- a stool sample with a positive result for *C. difficile* toxin A and/or toxin B, or
- a toxin-producing *C. difficile* organism detected in the stool sample by culture or other means.<sup>19</sup>

Test-positive specimens collected within 2 weeks of an index infection were considered to be a continuation of the same *C. difficile* case. A relapse was defined as a second occurrence of infection within a period of 2 to 8 weeks of the index episode, a second new episode was defined as occurring 8 or more weeks after the index case.<sup>19</sup> Cases were inpatients over the age of 18 years at the hospital during the period of 1 September 2011 until 30 September 2012.

#### Definitions for healthcare- and community-associated *C. difficile* cases

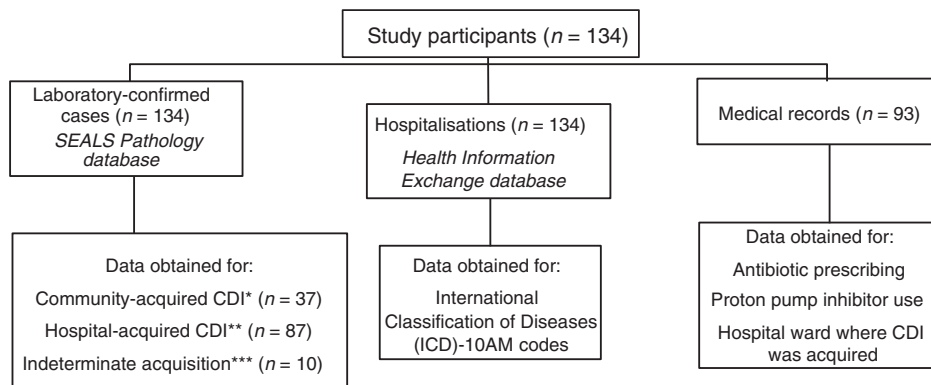
Community-acquired CDI was defined as a case where the patient experienced symptom onset while outside a healthcare facility or within 48 h after admission, and without having occupied a healthcare facility within the previous 12 weeks. A hospital-acquired *C. difficile* case was a patient with symptom onset at least 48 h after admission to a healthcare facility or within 4 weeks of discharge. A case was defined as indeterminate if the patient was discharged from a healthcare facility 4–12 weeks before the onset of symptoms.<sup>19</sup>

#### Data collection and matching

Fig. 1 depicts the data sources used in the study including the number of cases collected. Three data sources were used to gain information about the cases. All 134 cases in this study were laboratory-confirmed *C. difficile* confirmed and identified by South Eastern Area Laboratory Service (SEALS) Pathology Service. Additional data were obtained from hospital discharge records from the Health Information Exchange (HIE) database and from patient medical records. Data matching was used to provide event-based data of the number of cases infected with *C. difficile* and their hospital outcomes. In the first instance, laboratory-confirmed cases were linked by Medical Record Number (MRN), surname and date of birth to hospital outcome data (HIE). Once medical record review was complete, information was entered into the matched database containing cases and hospital outcomes.

#### Statistical analysis

The incidence of toxigenic cases was calculated per 1000 admissions during the same time period. The univariate associations of demographic and clinical characteristics amongst community- and hospital-acquired *C. difficile* cases were assessed via  $2 \times 2$  contingency tables analyses using the Chi-squared ( $\chi^2$ ) statistic and Fisher's exact test. The



**Fig. 1.** Study flow diagram and data sources. \*A community-acquired *Clostridium difficile* infection (CDI) case was defined as a case where the patient experienced symptom-onset while outside a healthcare facility or within 48 h of admission, and without having occupied a healthcare facility within the previous 12 weeks. \*\*Healthcare-associated CDI case was a patient who experienced symptom-onset at least 48 h after admission to a healthcare facility or within 4 weeks of discharge. \*\*\*Indeterminate acquisition of *C. difficile* was defined if the patient was discharged from a healthcare facility 4–12 weeks before the onset of symptoms.

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