

# Surveillance and outbreak reports

## NATION-WIDE PROSPECTIVE SURVEILLANCE OF CLOSTRIDIUM DIFFICILE INFECTIONS IN HOSPITALS IN BELGIUM, JULY 2007-JUNE 2008

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We report here baseline data from the first year of compulsory surveillance of *Clostridium difficile* infections (CDI) in hospitals in Belgium. Between 1 July 2007 and 30 June 2008, 2,704 CDI were reported: 12% were recurrent and 66% were hospital-associated (half of which occurred 15 days or more after admission). CDI was considered the cause of death (direct or indirect) for 10% of the episodes. The median incidence of CDI was 1.5 per 1,000 admissions and 1.9 per 10,000 hospital-days for all cases, and 0.9 per 1,000 admissions, and 1.1 per 10,000 hospital-days for hospital-associated cases. Further investigation of risk stratification by average length of stay in the reporting hospitals is warranted as a way to improve the comparability of indicators across hospitals and surveillance systems. In spite of methodological issues, the surveillance of CDI in Belgian hospitals has been able to produce robust baseline data that should allow monitoring of trends at hospital and national level, and provide a basis for international comparisons. Remaining challenges are to define and monitor targets for the control of CDI, and to improve the individual feedback of data at hospital level.

### Introduction

*Clostridium difficile* associated infection (CDI) is now recognised as a major cause of morbidity and mortality in hospitals [1]. Robust data are key for setting accurate targets to control the disease and for monitoring how these targets are achieved, but to our knowledge, no incidence data originating from prospective nationwide surveillance systems have yet been published in peer-reviewed journals.

In this article, we report baseline data from the first year of compulsory surveillance of CDI in hospitals in Belgium in the period from July 2007 to June 2008. These data include a basic description of CDI and the distribution of incidence rates across reporting hospitals. The essence of a surveillance system is to provide comparable data, i.e. data that can be compared over time, between hospitals and between surveillance systems. We also discuss methodological issues such as the importance of declaring zero cases and the risk stratification of hospitals per length of stay.

### Materials and methods

Prospective surveillance of CDI in hospitals in Belgium started in July 2006 and has since 1 July 2007 been compulsory by federal law for all hospitals, with the exception of psychiatric hospitals and

hospitals providing chronic care of less than 150 beds (although their voluntary participation is encouraged). Hospitals are requested to report all their CDI over at least one six-month period per year (termed in this article first and/or second “semester”). Therefore the unit of our analyses is a “hospital semester”, although some hospitals contributed data for the entire year. Registration and data entry are web-based and are separate processes. There is no explicit requirement to declare zero cases, making it impossible to differentiate between “no cases” and “no reporting”.

Case-definitions for CDI, hospital-associated (HA) case and recurrent case follow recommendations from the European Working Group on *C. difficile* [2]. Hospital data are limited to denominators from which the average length of stay can be calculated (number of admissions per number of hospital-days). Incidences are computed as number of CDI per 1,000 admissions (or cumulative incidence), and as number of CDI per 10,000 hospital-days (or incidence density).

Stata 10 statistical package was used for data analysis.

### Results

From 1 July 2007 to 30 June 2008, 130 hospitals registered 2,704 CDI over 229 surveillance semesters. We excluded 31 of the 229 (14%) surveillance semesters, for which no denominator data were available. This left 198 surveillance semesters (120 hospitals) for the analysis of incidence rates.

### Description of cases

Of 2,704 CDI 58% occurred in female patients, 12% were recurrent cases and 66% occurred more than two days after admission (hospital-associated CDI). CDI was considered as cause of death (direct or indirect) for 10% of the cases. Median age was 78 years, 75% of cases were in patients 65 years-old or older.

Most CDI occur late in the course of the hospital stay: 75% of HA cases occurred eight days or more after admission (Figure 1).

### Description of hospital-semesters

Table 1 shows the distribution of 198 hospitals semesters in terms of size of the hospitals (number of beds, admissions), length of stay and total hospital-days during the surveillance period. There are clear outliers in the distribution.

For 37 of the 198 hospital-semester (19%), no cases were reported. CDI being a rare event, it is plausible for small hospitals to have zero cases over six months, but less so for larger hospitals. However 20 (54%) of the 37 hospital-semester without cases were in hospitals reporting more than 30,000 hospital-days for the semester.

### Incidences

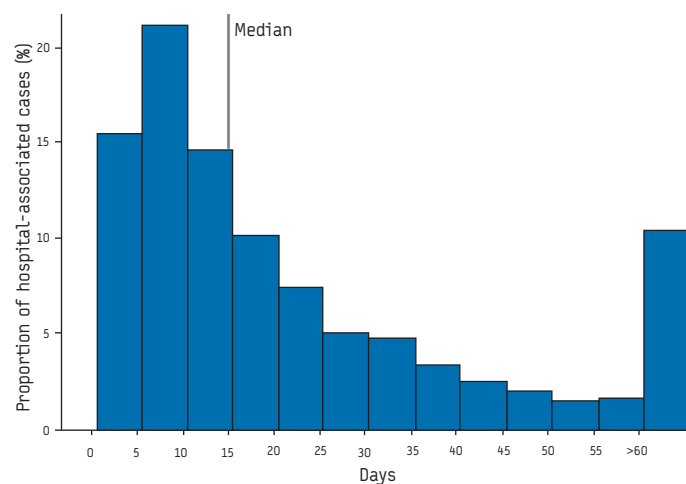
The distributions across hospital-semester are shown in Table 2 and Figure 2 (note that many hospitals contributed data for the full year).

The median incidence of HA-CDI across hospitals in Belgium was 1.1 cases per 10,000 hospital-days, but the figure shows clearly that the mode was below one case per 10,000 hospital days, which is partly due to the large number of hospitals not reporting cases (whether zero case, or not reporting). It further shows *outliers*, which presumably reflect outbreaks, including a very severe one (12 cases per 10,000 hospital-days).

We compared characteristics of hospital-semester and incidences of HA CDI across hospital-semester, categorised according to their average length of stay.

**FIGURE 1**

**Time from hospital admission to beginning of CDI in hospital-associated cases (n=1,794 cases occurring more than two days after admission)**



CDI: *Clostridium difficile* infections

**TABLE 1**

**Characteristics of hospitals contributing data for CDI surveillance in Belgium, July 2007-June 2008 (n=198 hospital-semester)**

Percentiles	P10	P25	P50	P75	P90	Max
Beds	126	197	294	467	822	1,809
Average length of stay [days]	6.2	6.8	7.8	9.6	13.7	127.5
Admissions	1,170	3,168	5,040	7,758	13,871	32,145
Hospital-days	17,488	27,389	37,706	59,962	106,774	248,112

CDI: *Clostridium difficile* infections

This table shows that hospitals with patients staying for an average period of 14 days or more tend to be smaller than those with a length of stay shorter than 14 days. They more often do not report CDI cases, but when they do, report higher rates.

### Discussion

The median incidence of all CDI across Belgian hospitals in the period from July 2007 to June 2008 was 1.5 per 1,000 admissions, an incidence higher than the median of 1.1 per 1,000 admissions reported in the first European survey (212 laboratories in eight countries surveyed in the year 2000) [3]. By contrast, the median incidence of all CDI in 35 hospitals in Germany in 2007 was 5.6 per 10,000 hospital-days [4], compared to 1.9 in Belgium (July 2007-June 2008). In Germany, the proportion of hospital-associated cases was 73%, compared to 66% in Belgium. In England, the mean incidence of all CDI in patients 65 years-old or older ranged from 17.5 to 27.4 per 10,000 hospital-days in 2007, depending on the region [5]. In a representative sample of community hospitals in the United States, the mean CDI incidence was 1.3 CDI per 1,000 discharges in 2005 (ICD\_9 code O845) [6]. Overall, the data available for comparisons (i.e. data from a representative sample of hospitals) are rather scarce.

It is noteworthy that 50% of HA cases occurred more than 15 days after admission, reflecting not only the risk associated with a longer exposure [7], but also presumably the fact that a longer period of stay is a proxy for the severity of the condition of the hospitalised patients, in itself a risk factor for CDI.

Since there is no requirement to explicitly report zero cases, hospitals that do not report at all are included in the evaluation as reporting zero cases. CDI being a rare event (in the absence of outbreaks), having zero cases over a period of six months is plausible in small hospitals but less likely in larger hospitals, and our data are therefore an underestimation of the real rates, because for these hospitals reporting no case more likely indicates no reporting. This shows the importance of explicit reporting of zero cases, which we are now implementing in Belgium (hospitals registering online for a new surveillance period, will be requested to actively declare closure of the previous reporting period, with or

**TABLE 2**

**Incidences of CDI in hospitals in Belgium, July 2007-June 2008 (for 198 hospital-semester)**

	All cases		Hospital-associated cases	
	per 1,000 admissions	per 10,000 hospital-days	per 1,000 admissions	per 10,000 hospital-days
Mean of means	2.5	2.3	1.9	1.5
95% CI	1.8-3.3	2.0-2.5	1.2-2.5	1.3-1.7
Percentiles				
P10	0.0	0.0	0.0	0.0
P25	0.6	0.7	0.3	0.4
P50	1.5	1.9	0.9	1.1
P75	2.8	3.4	1.9	2.3
P90	4.8	4.5	3.1	3.3
Maximum				
	56.4	13.9	46.7	12.0

CDI: *Clostridium difficile* infections; CI: confidence interval.

without cases). On the other hand, given that surveillance of CDI in Belgium is compulsory for only one half of a year, we cannot exclude that hospitals would prefer to report on semesters with higher CDI incidence, or outbreak. This would lead to an overestimation of the real rates at national level. In Belgium, hospitals with a longer average period of stay tend to be smaller than those with a shorter stay: our data show that they are more likely not to report cases, but they are also more likely to report high rates when reporting cases, supporting the hypothesis of a bias towards reporting in case of outbreaks. Finally, 13% of surveillance semesters were excluded from the calculation of rates because of missing denominator data, but we do not know if this created a bias, or not.

An issue particularly important for international comparisons is the different mix of hospitals contributing to the computation of national CDI incidence estimates. In Belgium, "acute" hospitals accommodate a varying number of beds for chronic patients. In that respect, stratifying hospitals based on patients' average length of stay might be more appropriate than a stratification of acute versus

chronic hospitals based on administrative definitions at national level. We intend to investigate further whether risk stratification by average length of stay of the reporting hospital is a way to improve the comparability of indicators across hospitals, and across surveillance systems.

### Conclusions

Although it raises methodological issues, such as the need for an explicit reporting of zero cases, the surveillance of CDI in hospitals in Belgium has been able to produce robust baseline data that can improve our understanding of the epidemiology of the disease. It should also allow for a monitoring of trends at hospital and national level and provide a basis for international comparisons. Remaining challenges are to define and monitor targets for the control of CDI, and to improve the usefulness of data at hospital level through result-oriented individual feed-back.

### References

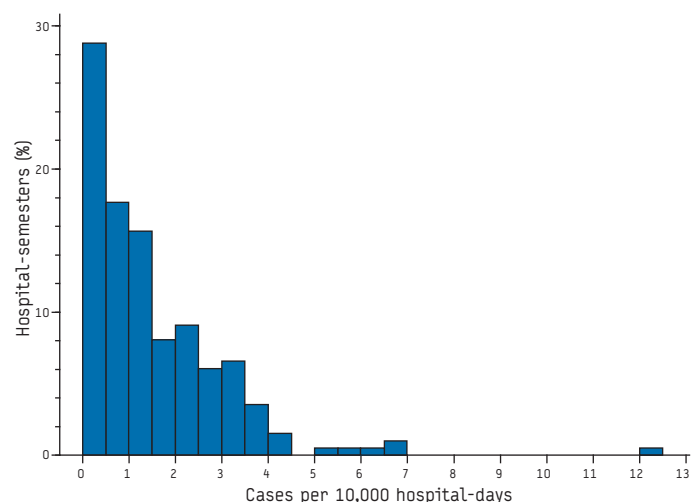
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FIGURE 2

### Incidences of hospital-associated CDI in hospitals in Belgium, July 2007-June 2008 (n=198 hospital-semester)



CDI: Clostridium difficile infections

TABLE 3

### Hospital characteristics and incidence of CDI, by average length of stay of reporting hospitals. Belgium, July 2007-June 2008

Average length of stay	< 14 days	≥14 days	
Hospital-semester (n)	181	17	
Hospital-semester not reporting cases (n)	31 (17%)	6 (35%)	Chi <sup>2</sup> =3.4, p=0.07
Number of beds, median	319	166	
Number of admissions, median	5,239	503	
Number of hospital-days per semester, median	39,357	20,350	
HA CDI per 10,000 hospital-days			
P25	0.4	0.0	
P50	1.1	1.1	
P75	2.2	3.5	
Hospital-semester with more than three HA cases per 10,000 hospital-days	23 (13%)	6 (35%)	Chi <sup>2</sup> =6.3, p=0.01

CDI: Clostridium difficile infections; HA: hospital-associated.