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Epidemiology of *Clostridium difficile* infection in Belgium

Report 2014

Hospital surveillance data 2007 - 2013

Hospital stay data 1999 - 2011

Death registrations 1998 - 2010

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Summary

Clostridium difficile infection (CDI) is a major cause of diarrhea and pseudomembranous colitis in acute and chronic care healthcare facilities. During the last decade, an increase in the incidence has been reported worldwide. This had been attributed to multiple factors including a more frail and older patient population, increased use of antibiotics that trigger the infection, and the emergence of virulent strains.

This report summarises the different sources of data available to describe the epidemiology of CDI in Belgium: epidemiological data from the mandatory surveillance scheme in hospitals including reference laboratory data (2007-2013), data on hospital discharges with a diagnostic of CDI (1999 - 2011) and death registration data (1998-2010). The different sources of data confirm an important increase in CDI related incidence and mortality from 2002-2003 onwards. Mortality attained a peak in 2004, (linked particularly to an enormous increase in Brussels) subsequently followed by a decline. In 2010, the crude specific mortality rate for CDI in Belgium was 0.9 /100 000 inhabitants, highest in Brussels and lowest in Wallonia.

The peak in incidence around 2008 has diminished and stabilised in 2010-2011, but at an elevated level. In 2013, the mean CDI incidence for 105 hospitals contributing data the whole year was 1.65 episodes / 1000 admissions, the highest since 2009. The mean incidence of hospital acquired (HA) CDI (onset of symptoms $\geq$ 2 days after admission in the declaring hospital) was 1.0 /1000 admissions (As a comparison, incidence of HA-MRSA, clinical samples, was 1.1/1000 admissions in 2012). The latest hospital surveillance data show a slight increase in the proportion of cases which are community-associated, as described in other countries. Incidence of HA CDI in 2013 was highest in Brussels and lowest in Flanders.

Other characteristics of cases have remained comparable to previous years – age, sex, the proportion of recurrences, the proportion thought to originate in long term care facilities.

The incidence is seasonal with a peak in March-April, and highly variable from one hospital to another, indicating an important potential for prevention.

Ribotyping of 585 CDI strains from 103 different hospitals in 2013 identified 133 different ribotypes, 72 of them isolated only once, 60 never identified before in Belgium. This illustrates the multiplicity of sources of transmission. The ribotypes most frequently isolated were ribotypes O14 (8% of total strains typed) and 020 (7%). The proportion of hospitals with the hypervirulent ribotype 027 decreased from 34% in 2009 to 15% in 2013. A decline in the prevalence of the ribotype 027 has been reported as well in the United Kingdom, and the Netherlands.

International comparisons indicate that Belgium has incidence rates of CDI in the mid-range of other European countries and lower than that in the United States. There are some indications that incidence of CDI is again rising in Europe, as it is in Belgium.

Glossary

CDI	*Clostridium difficile* infection
HA-CDI	Hospital-acquired *Clostridium difficile* infection (onset of diarrhea 2 days or more after admission in declaring hospital)
ICD-10	International Classification of Diseases, 10th Revision
ICD-9-CM	International Classification of Diseases, 9th Revision, Clinical Modification
NRC-CD	National reference centre (laboratory) – *Clostridium difficile*
RHM/MZG	Résumés hospitaliers minima/ Minimale ziekenhuis gegevens (minimum hospital data set)
UE	European Union
UK	United Kindom
US	United States

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1 Introduction

1.1 General background

According to the largest ever prevalence survey across Europe[1] (undertaken in 2013), the prevalence of *Clostridium difficile* infection (CDI), when compared to previous European prevalence surveys, is increasing. The survey shows that gastro-intestinal infection accounted for 7.7% of all healthcare-associated infections, with CDI accounting for 48% of these[2]. Belgium's figures positioned it in the mid-to lower range of included countries in this study. This also compares well to the United States where 17% of all healthcare-associated infections were gastrointestinal in 2011 (ranking third in number after pneumonia and surgical site infection) and of these 71% were due to CDI. *C. difficile* was the number one ranking pathogen for healthcare-associated infections (12% of all infections) in the US[3]. The same study showed that in Belgium, *C. difficile* was the number eight ranking pathogen for healthcare-associated infections (4.2% of all infections).

Historically, there was a global increase in incidence, severity and mortality associated with CDI in the early 2000s.[4-6] In the United States and Canada, this increase was associated with the emergence of an epidemic strain, PCR ribotype 027.[7] This strain quickly spread across Europe[8], and in Belgium the strain was described for the first time in September 2005[9]. This strain has been characterized by increased severity, high recurrence and case-fatality rate.[10,11] It was in this context that the national surveillance programme for CDI in Belgian hospitals was instituted in 2007.

Although throughout Europe as a whole, the prevalence of ribotype 027 apparently continues to increase, previous epidemiological reports on CDI have shown a decreasing prevalence of the ribotype 027 in Belgium[12] and the UK.[13] Ribotype 078 is becoming more prominent, and, at least in the Netherlands and the UK, has been associated with a higher rate of complications compared to other ribotypes.[14,15]

Well recognized risk factors for CDI include prior antibiotic use (particularly cephalosporins, fluoroquinolones [16-18]), hospitalisation,[18,19] advanced age,[10,18] immunosuppression and proton pump inhibitors.[10] Those taking more than one antibiotic are at the greater risk.[20] Antibiotic use not only increases the risk for CDI during therapy but also in the period of 3 months after cessation of antibiotic therapy with the highest risk for CDI during the first month after antibiotic use.[10]

Figures as high as 80%[18] and 94%[19] have been quoted as the proportion of cases of CDI associated with healthcare. However, the incidence and awareness of community-associated CDI has been increasing.[21,22] One UK case-control study in 2008 suggested that community associated CDI accounted for 55% of cases[20] and UK national surveillance data confirm an increasing trend in the proportion of community associated CDI.[23]

Recent advances in typing and enhanced DNA fingerprinting are useful to confirm or refute true CDI clusters and determine transmission dynamics between community, healthcare settings and other sources. A very large variety of genetic strains have been identified and the traditional theory that the majority of new cases are attributable to transmission from symptomatic cases within healthcare settings has been called into question.[24,25] This is supported by two population based studies in Oxfordshire in the UK showing that no more than 25% of cases could be linked to ward based transmission within the hospital[25] and in that period, 45% of *C. difficile* cases in Oxfordshire were

genetically distinct from all previous cases and also a US study showing that incident infections were as frequently linked to asymptomatic carriage as to symptomatic patients.[26]

Other implicated sources include food and animals[24,27] (particularly with the rise of ribotype 078, which is the predominant strain in pigs and veal calves[10]) and also contact with colonised infants.[20,27] Given that community associated cases are less likely to have been exposed to antibiotics[10,20] and the high frequency of asymptomatic carriage of *C. difficile* in infants, this could be a potentially important risk factor.

Technological advances in testing are still awaited, and the latest advances are yet to be implemented in routine practice. Testing regimes vary significantly both between and within countries due to variation in patient selection for testing, low sensitivity of toxin enzyme immunoassays (EIAs), low specificity of nucleic acid amplification tests (NAATs), and prolonged turnaround time for cell cytotoxicity cell assays or stool culture for toxigenic *C.difficile*. The latest European prevalence survey showed that 50% of hospitals were not using the most accurate testing procedures[1]. European guidance[28] based on a large multi-centre trial comparing several diagnostic algorithms[29] recommends a two or three stage testing process but consistency between countries, and within Belgium, may take some time yet.

1.2 Objectives of this report

The objective of this report is to describe the epidemiology of *Clostridium difficile* infection in Belgium. For this 2014 report, we have analysed the latest data available:

- Hospital surveillance data (including reference laboratory data) for the years 2007 – 2013
- Hospital stay data for the years 1999 à 2011
- Death registration data for the years 1998 à 2010

2 Methodology

2.1 Hospital epidemiological surveillance programme co-ordinated by the Scientific Institute of Public Health (WIV-ISP)

Since July 2007, it has been obligatory for all acute hospitals to participate in this surveillance programme for at least one semester (6 months – Jan-June or Jul-Dec) each year. (Arrêté Royal du 26-06-2007). The denominator used to calculate incidences excludes day cases. Specialist psychiatric, geriatric and burns hospitals, are not obliged to participate.

An electronic information portal collects the surveillance data for cases of *C. difficile* (NSIH Web 1).

The methods are described in detail in the protocol, available online in French and Dutch:

https://www.wiv-isp.be/nsih/surv_cdif/download_fr.asp

https://www.wiv-isp.be/nsih/surv_cdif/download_nl.asp

The data analysed for this report are for the period 1st January 2007 - 31 December 2013

An episode of *Clostridium difficile* infection (CDI) is defined as a patient who fulfils one or more of the following criteria:

1. Diarrhoea* or toxic megacolon, and a laboratory confirmed *C. difficile* toxin A and/or B in the stool or a strain producing toxins identified in the stools, by culture or another method
2. Pseudomembranous colitis observed by proctocolonoscopy of the lower gastro-intestinal tract
3. Histopathology characteristic of *C. difficile* in the colon (with or without diarrhoea) obtained by biopsy during endoscopy, colectomy or autopsy

*At least three liquid or non-formed stools (the stools take the form of the container) during 24 hours or less.

Hospital-acquired CDI (HA-CDI) are defined as CDI with an onset of diarrhoea 2 days or more after admission in the declaring hospital (onset date – admission date $\geq$2)

2.2 Hospital stay data

Each hospital stay gives rise to a registration (RHM/MZG – minimum hospital data set). Diagnoses are coded using ICD-9-CM (International Classification of Diseases, 9th Revision, Clinical Modification).[30] We have analysed the hospital stays with a code 008.45 (Intestinal infections due to *C.difficile*) from 1999 to 2011 (latest available year). The diagnoses are classified as "primary diagnosis" – the pathology considered to explain the majority of the hospital stay (most commonly, but not necessarily, the reason for admission), and "secondary diagnosis".

The data provided in this report are provided by the Service Public Fédéral / Federale Overheidsdienst Santé Publique, and cover all hospital stays in Belgium, with the exception of psychiatric stays, and day cases. In previous reports, day cases have been included in the calculations. For this report, the

analyses have been re-run for all years excluding day cases to allow better comparison with the mandatory hospital surveillance data.

2.3 Reference Laboratory data

The *C. difficile* National Reference Centre (laboratory) (NRC-CD) was officially established in 2011 but has been actively involved in the national surveillance since 2006. It is hosted at the Catholic University of Louvain on the site of Woluwe-St-Lambert, Brussels.

Since 2007, the surveillance program includes a mandatory bacteriological component for every Belgian hospital clinical laboratory. It requires each hospital laboratory to send five *C. difficile* strains isolated consecutively during one semester of the year, with additional accompanying information as listed on the website of the WIV-ISP
https://www.wiv-isp.be/nsih/surv_cdif/download_fr.asp

In addition, a hospital may send locally isolated strains to the reference laboratory for typing in order to support the investigation of local increases in the number of cases or suspected outbreaks.

Each received sample is confirmed and typed. The currently applied method of ribotyping is that which is used in the majority of European reference centres. The details of the typing techniques are presented in the Annex.

In recent years, it has been possible to link reference laboratory data with hospital epidemiological surveillance data.

2.4 Death Registration Data

Death certificates in Belgium are coded according to ICD-10[30] system. We counted deaths with code A04.7 as underlying cause of death : “death due to a *Clostridium difficile* related enterocolitis” for the years 1998 – 2010 (latest available). The underlying cause of death is the original disease causing the chain of events immediately leading to death.

Death registrations data were extracted from the database of causes of death in Belgium, provided by DGSIE (“Statistics Belgium”).[31]

The age standardised mortality rate is based on direct standardisation using the mid-year population figures for 2005[32], divided into three age groups: 0-64, 65-79, $\geq$ 80 ans.

Deaths are counted according to region of death, not according to region of residence of the deceased. The denominator for each region remains as the resident population of the region.

3 Results

3.1 Hospital surveillance data

3.1.1 Hospital participation, characteristics of episodes and patients

The data analysed was last updated on 1 April 2014.

Table 1 : Epidemiological surveillance of the mandatory *Clostridium difficile* programme: hospital participation and episodes reported. Belgium 2007-2013.

Year	2007	2008	2009	2010	2011	2012	2013
N hospitals participating at least 1 semester/yr	131	148	149	147	145	144	141
N hospitals participating 2 semesters/yr	91	110	113	117	117	108	112
Total hospital-semesters	222	258	262	264	262	252	253
% hospital-semesters reporting no cases*	32%	13%	10%	8%	7%	10%	10%
Episodes reported by hospital-semester							
P25	0	3	3	3	3	3	3
P50	5	8	8	7	7	7	7
P75	12	15	14	13	12	14	15
max	117	89	113	68	94	96	83

Yr: year

*Before 2008, it was not possible to show the difference between “no cases” and “no reporting”. This very likely explains the high proportion of hospitals reporting no cases in 2007, in comparison to the following years. Thus, for the year 2007, the incidence data are assumed under-estimates (since certain hospitals, having not reported, were considered as having had no cases and included in the denominator).

The participation of hospitals is important and the majority of hospitals participate in the surveillance for the entire year, despite the legal obligation being participation for only one semester.

There is a large variation in the number of episodes reported by hospitals each semester.

Table 2 : Epidemiological surveillance of *Clostridium difficile* infection: characteristics of cases. Belgium 2007-2013.

Year	2007	2008	2009	2010	2011	2012	2013
Episodes							
Total episodes reported	1,886	2,992	2,947	2,461	2,515	2,507	2,658
Hospital-acquired (HA-CDI)* (%)	65%	64%	61%	61%	63%	61%	59%
Recurrent episodes** (%)							
No	75%	71%	72%	74%	76%	74%	73%
Yes	11%	11%	10%	9%	8%	9%	9%
Unknown	14%	17%	18%	17%	16%	17%	17%
Suspected origin of infection (% of episodes other than those acquired in declaring hospital)							
Community	57%	56%	57%	59%	60%	63%	62%
Long term care facilities	12%	16%	14%	12%	10%	10%	11%
Other hospital	22%	19%	16%	17%	18%	15%	15%
Unknown/missing	8%	10%	12%	11%	12%	12%	13%
Patients							
Total patients reported with CDI	1,811	2,831	2,787	2343	2414	2,401	2,528
Sex: female (%)	58%	59%	59%	60%	59%	57%	57%
Median age (years)							
Hospital acquired case	78	80	80	79	80	79	80
Other cases	74	75	74	74	74	74	74
Death within 30 days – CDI indirect or direct cause (%)	11%	10%	5%	4%	3%	3%	4%

**Defined as onset of diarrhoea 2 days or more after admission in the declaring hospital (onset date – admission date ≥2)*

***Defined as the proportion of infections which are recurrent, and not the incidence of recurrences in patients presenting with a new episode of CDI*

The elevated case-fatality seen in 2007-2008 is probably partly an artefact. Before 2008, it was not possible to distinguish a death unrelated to CDI). Hospital surveillance since 2008 assigns a death as linked to CDI by subjective clinical decision.

There has been a very slight increase in the proportion of community associated cases over the years matched by a slightly decreasing proportion of HA-CDIs since 2011, particularly if considered in combination with the more subjective allocation of cases to “other hospital”.

The median age of patients with HA-CDI is higher than that of other CDI patients. The proportion of recurrent cases has remained stable.

3.1.2 Annual incidences

Table 3 : Incidence of infection with *Clostridium difficile*, Belgian hospitals, 2007-2013

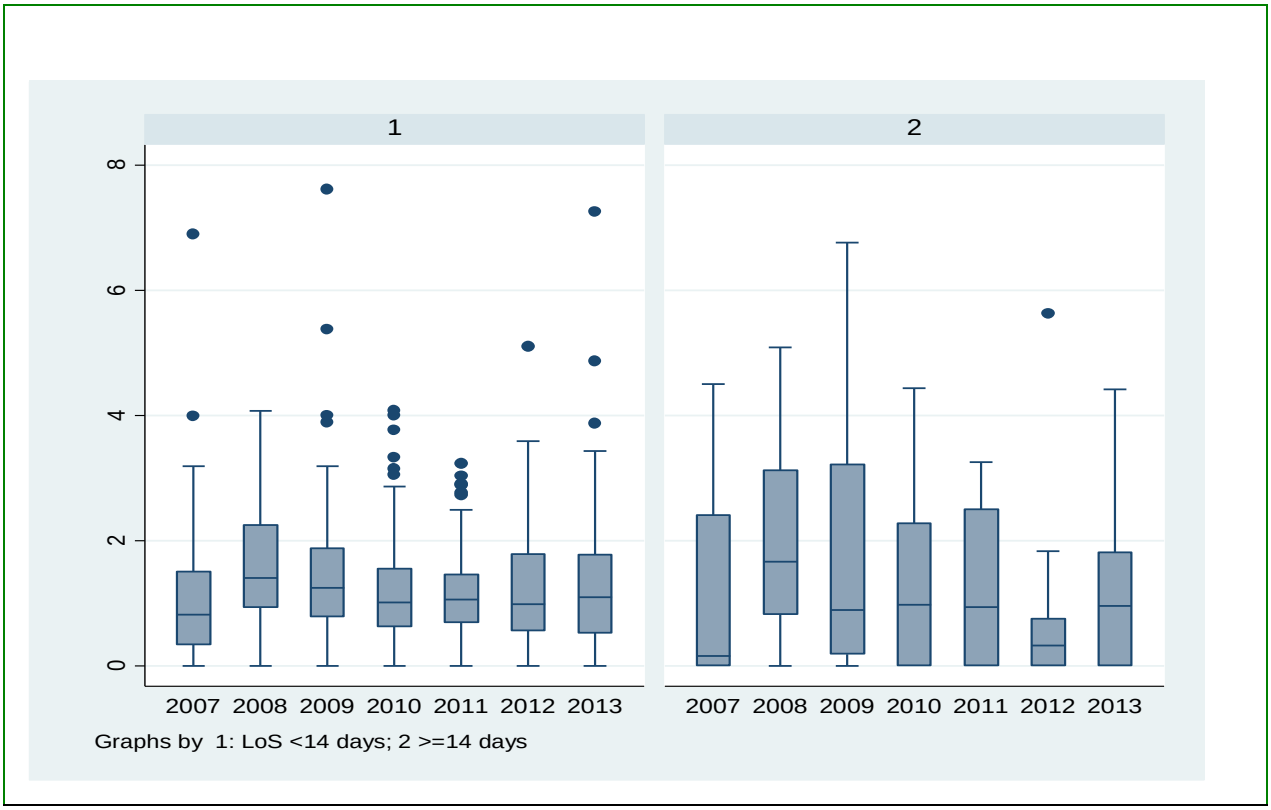
Year	2007	2008	2009	2010	2011	2012	2013
Denominators							
N hospitals included in the calculation of incidence (12 months of available denominator data)	73	103	108	111	113	104	105
N with mean LOS < 14 days	69	94	96	102	102	94	92
N hospitals with LOS > = 14 days	4	9	12	9	11	10	13
Episodes acquired in declaring hospital (HA-CDI)							
/ 10,000 days of hospitalisation :							
Mean Incidence*	1.11	1.57	1.44	1.23	1.20	1.18	1.29
Median	0.75	1.42	1.11	1.00	1.02	0.95	1.08
/ 1000 admissions							
Mean incidence **	0.89	1.24	1.12	0.92	0.90	0.89	0.96
Median	0.60	1.14	1.01	0.80	0.78	0.76	0.87
Other episodes							
/ 1000 admissions							
Mean Incidence **	0.49	0.73	0.71	0.56	0.54	0.61	0.70
Median	0.44	0.69	0.58	0.55	0.51	0.52	0.56
Total episodes							
/1000 admissions							
Mean Incidence**	1.38	1.97	1.83	1.48	1.44	1.50	1.65
Median	1.16	1.94	1.63	1.28	1.41	1.31	1.54

** Mean Incidence : total episodes/total denominator, LOS: length of stay*

For comparison, the mean incidence of hospital acquired methicillin resistant *Staphylococcus aureus* (MRSA) infections (samples from symptomatic patients) was 1.1/1000 admissions and 1.6/10 000 days of hospitalisation in acute hospitals in 2012.[33]

From Table 3 it can be seen that incidence rates decrease from 2008 until 2011/2012. However, there have been three consecutive years of increasing total incidence, with HA-CDI and other CDI episodes at their highest levels since 2009. As explained earlier, incidence rates shown for 2007 may be under-estimates. As demonstrated in Figure 1 there is a large variability between hospitals in the incidence of hospital acquired CDI.

Figure 1 : Distribution of incidence of hospital acquired *Clostridium difficile* infections in Belgium, per 10 000 days of hospitalisation – comparison of acute and chronic hospitals, 2007-2013



Only hospitals providing data for the whole year are included – average no. hospitals participating over seven years: Flanders 49, Wallonia 29, Brussels 15. LOS: length of stay
Acute hospitals defined by mean length of stay <14 days, chronic >= 14 days

Table 4 shows the mean incidence of HA-CDI in acute hospitals, comparing the three regions of Belgium from 2007-2013. These incidences are depicted in Figure 2. Since 2010, mean incidence in Flanders has consistently been lower than in Brussels and Wallonia.

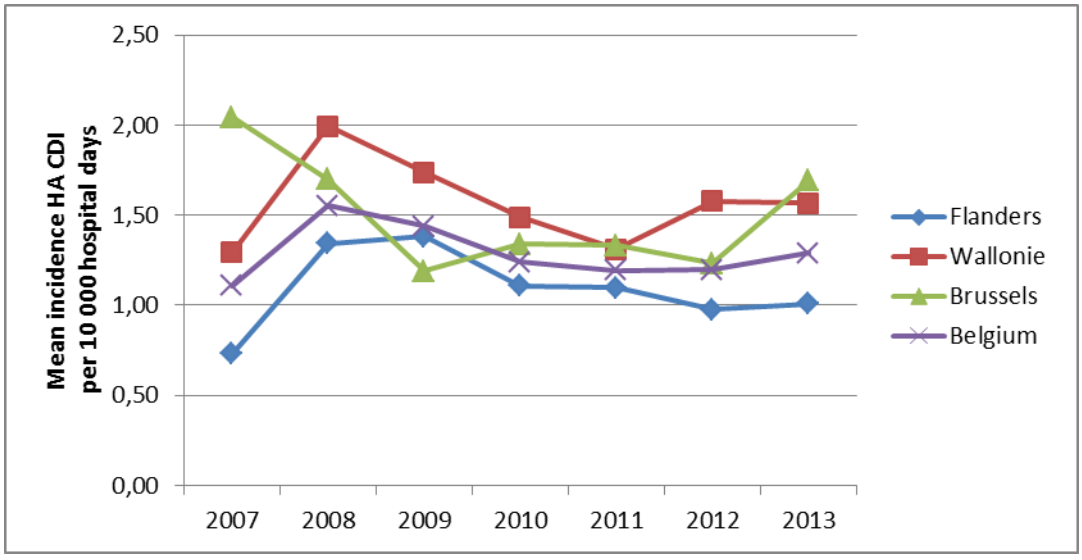
Figure 3 shows the wide variation in incidence between the three regions' hospitals, with the widest variation depicted in Wallonia.

Table 4 : Hospital acquired *Clostridium difficile* infections per 10 000 hospital days in acute hospitals, by region. Belgium, 2007-2013

	Year	2007	2008	2009	2010	2011	2012	2013
Flanders								
	N hospitals	38	52	54	56	54	43	45
	Mean incidence	0.73	1.34	1.38	1.11	1.10	0.98	1.01
Wallonia								
	N hospitals	18	28	28	30	32	34	34
	Mean incidence	1.29	1.99	1.74	1.49	1.31	1.58	1.57
Brussels								
	N hospitals	13	14	14	16	16	17	13
	Mean incidence	2.04	1.70	1.19	1.34	1.33	1.23	1.69

Acute hospitals: defined on the basis that mean length of stay <14 days
Only hospitals providing data for the whole year and with complete denominators are included.
Mean incidence: total episodes/total denominators.

Figure 2 : Hospital acquired *Clostridium difficile* infections per 10 000 hospital days in acute hospitals, by region. Belgium, 2007-2013



Acute hospitals: defined on the basis that mean length of stay <14 days
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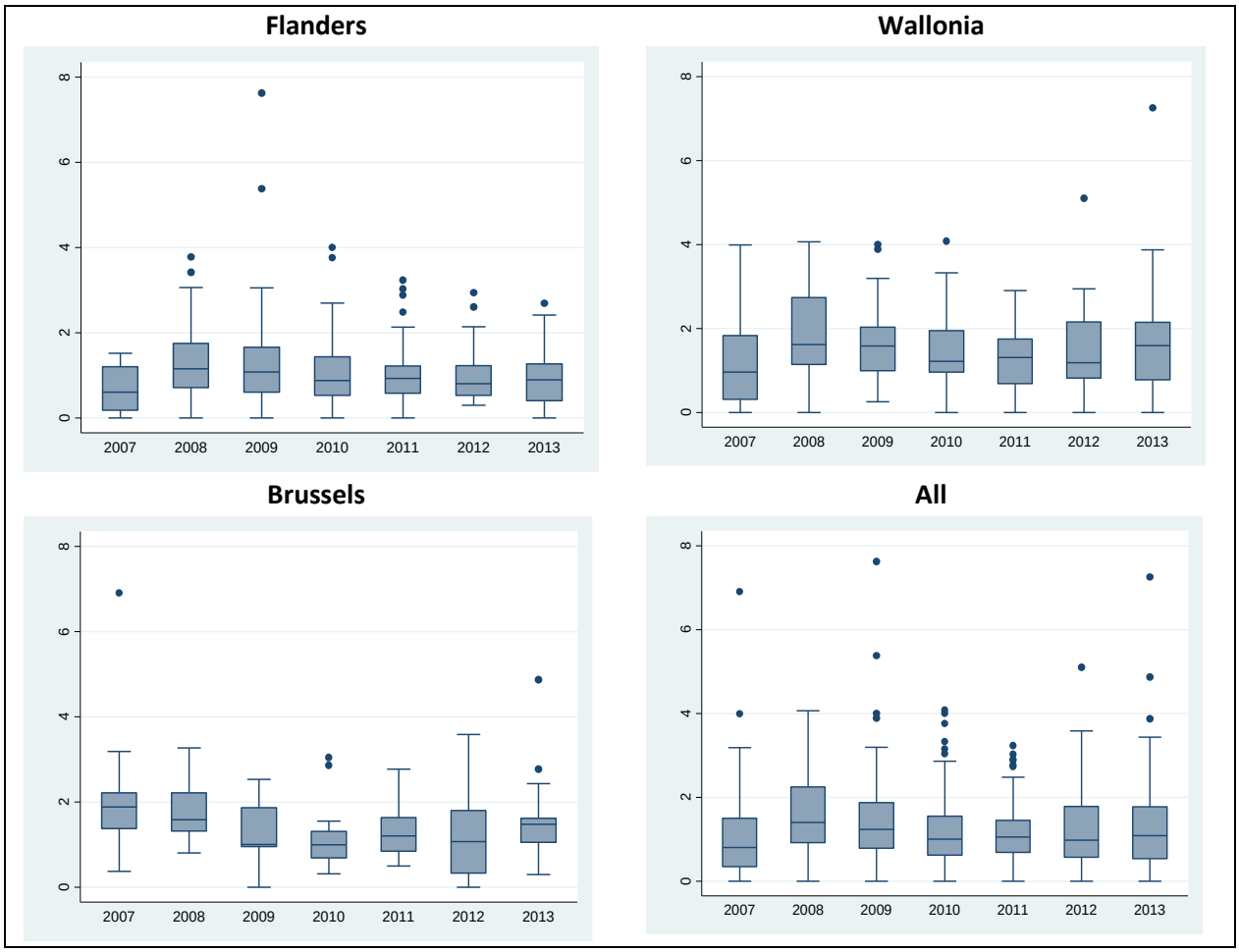
Mean incidence: total episodes/total denominators.

Figure 3 : Distribution of incidence of hospital acquired *Clostridium difficile* infections per 10 000 hospital days in acute hospitals, by region. Belgium, 2007-2013.

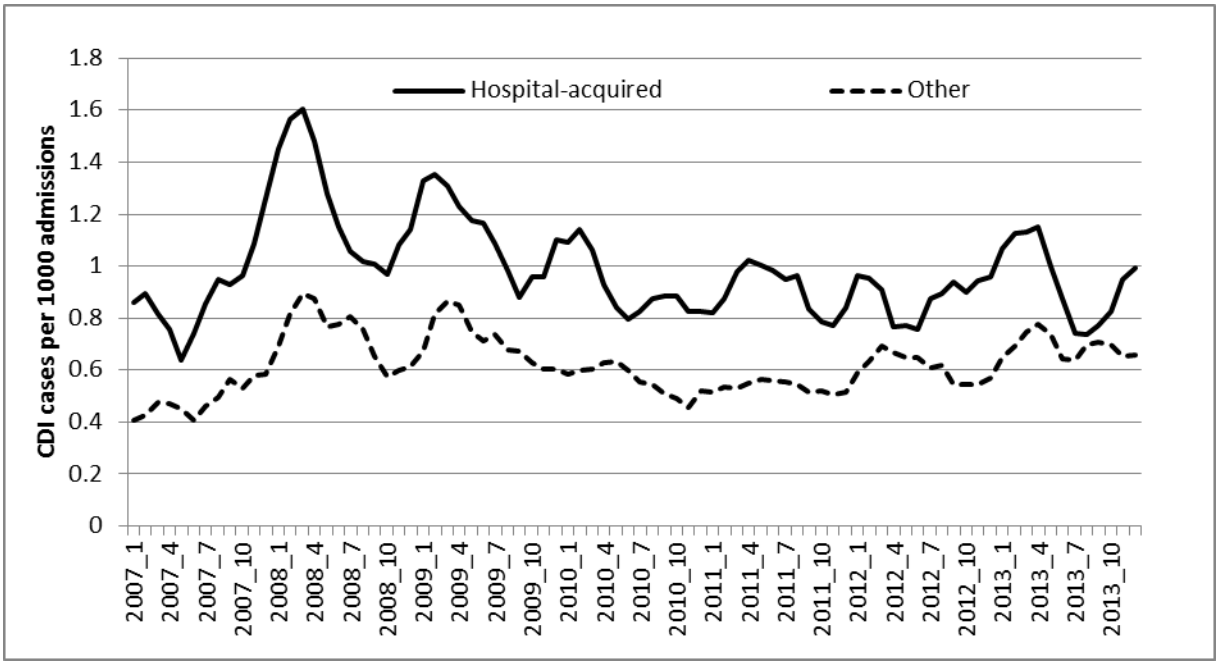


Acute hospitals: defined on the basis that mean length of stay <14 days
Only hospitals providing data for the whole year and with complete denominators are included.

3.1.3 Seasonal variation

Figure 4 shows a seasonal peak of incidence during March-April. HA-CDI follow the same pattern as other cases.

Figure 4 : Monthly incidence of *Clostridium difficile* infections in Belgian hospitals per 1000 admissions 2007-2013



Only hospitals providing data for the whole year are included.
NB : Moving average : each monthly incidence is the mean of the month, the preceding month and the following month.

3.1.4 Further descriptive epidemiology of cases 2013

Table 5 shows that the vast majority of CDI in hospitals are admitted to the geriatrics department and that nearly 70% of cases arise from six out of a total of 29 departments .

Table 5 : Frequency of episodes of *Clostridium difficile* infection by department of diagnosis, 2013

Department	*Frequency*	*%*
Geriatrics	812	31
Gastroenterology	304	11
General Medicine	250	9
Haemato-oncology	199	7
Intensive care	152	6
Respiratory medicine	126	5
Other	815	31
Total	2658	100

The age distribution of cases varied little between 2007 and 2013 and is consistent with that shown in Table 6 for the year 2013 below.

Table 6 : Age distribution of patients, 2013

Age group	*No. of patients*	*%*
0-2	43	1.6%
3-64	638	24.4%
65-79	698	27.6%
80-max	1 149	45.5%
Total	2 528	100%

3.2 Hospital stay data

Hospital stay records mentioning a primary or a secondary diagnostic code of "Intestinal infection due to *Clostridium difficile*" almost trebled from 1999, reaching a peak in 2008, but seem to have subsided again after 2008 (2011 provides the last available data).

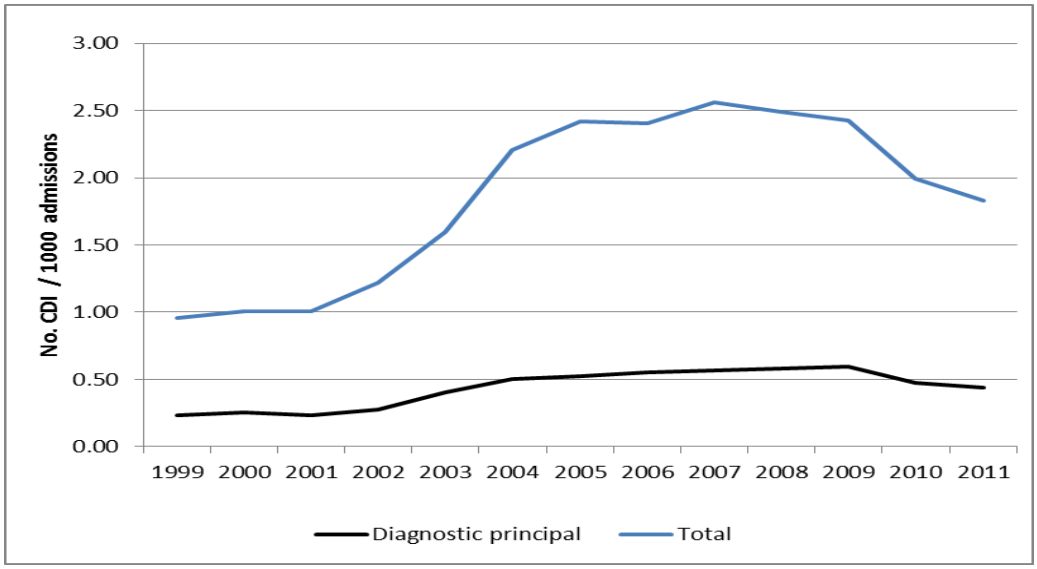
The proportion of stays with a primary diagnostic code of ICD – presumed in this case to be the reason for admission – remains stable. This acts as an approximation of cases acquired in the community (serious enough to justify hospitalization), although for some of these patients, the onset of symptoms may have occurred in a long term care facility or another hospital.

Table 7 : Hospital stays with an intestinal infection due to *Clostridium difficile* , Belgium 1999-2010

	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
CDI as primary diagnostic code* (no.)													
	415	467	423	501	723	907	959	1007	1040	1116	1148	920	866
% of the total													
	25%	26%	23%	23%	25%	23%	22%	23%	22%	23%	25%	24%	24%
CDI as secondary diagnostic code* (no.)													
	1270	1356	1404	1698	2155	3086	3456	3383	3646	3633	3514	2947	2715
Total	1685	1823	1827	2199	2878	3993	4415	4390	4686	4749	4662	3867	3581

code ICD-9_CM 008.45

Figure 5 : Hospital stays with an intestinal infection due to *Clostridium difficile*,* Belgium 1999-2011



** code ICD-9_CM 008.45*

Table 8 shows that the calculated incidence is markedly elevated (25-35%) by measuring incidence using hospital stay data compared to when using the mandatory surveillance data. This could be due partly to different denominators used to calculate the incidence – hospital stay data cover all hospital stays in the country (with exclusions such as psychiatric stays). On the other hand surveillance data include only those hospitals which participate in the system for the whole year, while hospital stay data are exhaustive. The key point is that (excepting the first year of implementation of the hospital surveillance system) the difference between the two measures remains approximately constant, indicating that the surveillance data provide a valid measure of incidence trends for CDI.

Table 8 : Mean incidence of *Clostridium difficile* infections per 1000 hospital stays, Belgium, 2008-2010, according to data source

	2007	2008	2009	2010	2011
Hospital stay data (RHM/MZG)(a)	2.56	2.49	2.43	1.99	1.83
Mandatory hospital surveillance data (b)	1.38	1.97	1.83	1.48	1.44
a/b	186%	126%	132%	135%	127%

3.3 Microbiological surveillance – Reference Laboratory data

3.3.1 Evolution of ribotypes

(full reference lab report, annex). A wide variety of types has been identified.

Annual trends show a constant diminution of ribotype 027.

Table 9 : Frequency of specific *Clostridium difficile* ribotypes in Belgian hospitals, 2009-2013

Year of surveillance	2009	2010	2011	2012	2013
N hospitals (different sites) sending samples for typing	104	103	84	111	103
N hospitals with ribo27	35	34	17	19	15
% hospitals with ribo 27	**34%**	**33%**	**20%**	**17%**	**15%**
N hospitals with 014 (type UCL 16)	35	34	32	45	38
% hospitals with ribo 014	**34%**	**33%**	**38%**	**41%**	**37%**
N hospitals with 078 (type UCL 03)	11	26	20	35	37%
% hospitals with ribo 078	**11%**	**26%**	**24%**	**32%**	**24%**

Source: National reference laboratory for Clostridium difficile – (NRC-CD)

Table 10 : Percentage of samples testing positive with specific *Clostridium difficile* ribotypes

	2009	2010	2011	2012	2013
N type-able samples received by ref lab for surveillance	389	505	462	648	585
N ribo 027	72	62	36	32	22
% samples ribo 027	**19%**	**12%**	**8%**	**5%**	**4%**
N ribo 014 (UCL 16)	44	51	56	67	50
% ribo 014 (UCL 16)	**11%**	**10%**	**12%**	**10%**	**9%**
N 078 (UCL 3)	13	33	35	48	30
% ribo 078 (UCL 3)	**3%**	**7%**	**8%**	**7%**	**5%**

Source: National reference laboratory for Clostridium difficile – (NRC-CD)

3.3.2 Epidemiological linkage

We were able to match 621 (82%) of the reference laboratory specimens with hospital epidemiological surveillance data for the year 2013.

There was very little difference in distribution of ribotypes according to age group (shown in Table 11) or sex (not shown).

There was a slight preponderance of ribotype 014/020 in hospital acquired cases compared to other cases (27% versus 22%). There was no apparent difference in occurrence of any other ribotype between community and hospital acquired cases.

Of those 512 cases for whom infection was reported as recurrent or not, there were 36 recurrent infections. Among these, there were 18 different ribotypes and no one ribotype predominated.

Table 11 : Distribution of *Clostridium difficile* ribotypes according to age group, 2013

Age group	*Number of cases*	*Riboytpe (% of total)*
0-64	137	014/020 (28%), 015/001 (12%), 078 (7%) 027 (1%)
65-79	171	014/020 (16%), 015/001 (11%), 002 (6%), 078 (6%), 027 (2%)
80+	312	014/020 (22%), 002 (9%), 015/001 (8%), 027 (5%), 078 (3%)

(Figures only shown for ribotypes with prevalence greater than 5% and for ribotypes 027 and 078)

3.4 Death registration data

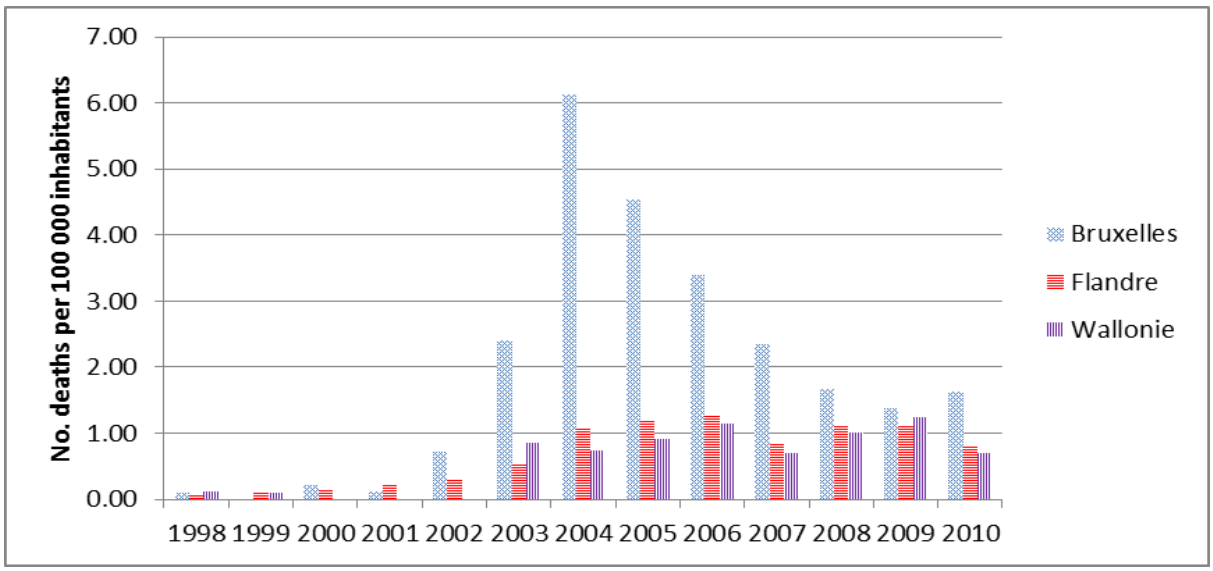
The following data are taken from death certificates recording underlying cause of death as enterocolitis due to *Clostridium difficile* (Code ICD-10 A04.7)

Table 12 : Deaths attributed to enterocolitis due to *Clostridium difficile by region, Belgium 1998-2010**

	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Number of death certificates with ICD-10 code A04.7 as underlying cause of death													
Brussels	1	0	2	1	7	24	61	47	36	24	16	14	17
Flanders	4	6	7	11	17	30	63	72	80	54	75	76	55
Wallonia	3	3	NA	NA	NA	17	24	31	40	25	36	45	26
Belgium	8	9	NA	NA	NA	71	148	150	156	103	127	135	98
Crude specific mortality rate per 100 000 inhabitants													
Brussels	0.10	0.00	0.21	0.10	0.71	2.41	6.08	4.64	3.51	2.31	1.51	1.30	1.54
Flanders	0.07	0.10	0.12	0.18	0.28	0.50	1.04	1.19	1.31	0.88	1.21	1.22	0.88
Wallonia	0.09	0.09	NA	NA	NA	NA	0.71	0.91	1.17	0.73	1.04	1.29	0.74
Belgium	0.08	0.09	NA	NA	NA	0.68	1.42	1.43	1.48	0.97	1.19	1.25	0.90

The mortality associated with enterocolitis due to *Clostridium difficile* increased rapidly from 1998 until 2004. Since 2006, one can see an important decline in deaths attributable to *Clostridium difficile*. The years 2008 - 2010 seem more stable for the three regions. Brussels has the highest standardised mortality rate, followed by Flanders and Wallonia, respectively.

Figure 6 : *Clostridium difficile* infections: age-standardised mortality rate, by region, Belgium 1998-2010



Enterocolitis due to Clostridium difficile as *underlying cause of death* (Code ICD-10 A04.7). *Direct standardisation using Belgian mid-year 2005 population as reference population, according to 3 age groups (0-64, 65-79, 80+).*

3.5 International comparisons

Table 13: International comparison of incidence of *Clostridium difficile* infection

	France[34,35]	US[36]	Australia[37]	England[13,38]	Scotland[39,40]	Germany[41]	Netherlands[14]	Belgium*
	2009 **6 mnths** Voluntary survey	**2010** **1 yr** Hosp discharge	**2011-2012** **1 yr** Voluntary surveillance	**2012/13** **1 yr** Mandatory surveillance	**2012** **1 yr** Mandatory surveillance	**2012** **1 yr** Voluntary surveillance	**2012-13** **1 yr** Voluntary surveillance	**1 yr** Mand surv 2013 Hosp disch 2011
N hospitals	105	92% of all	450	161	all – age 15+	163	19	105 or all
Trend of incidence		↑ 2001-2010	↑ 2011-2012	↓ 2007 - 2013	↓ 2007-2012	Stable 2007-2012	Stable 2010-2013	Stable or ↑
total cases /								
10 000 hospital days	2.3		3.7		3.8	7.2	2.9	
1 000 admissions	11.5				2.1	1.5	1.7	
100 000 popn				27.7				34.2
Hospital associated cases /								
10 000 hospital days	1.3		3.0	1.73		4.2		1.3
1 000 admissions	0.6							1.0
100 000 popn		26.0						
% Hospital associated				41		59		59

Definitions of numerators vary between studies
Denominators vary between studies, some include only those >2 years, others all ages, some include in-patients only, others in-and out-patients, UK includes non-hospitalised patients, others only hospitalised cases
**Figures taken from mandatory surveillance data 2013 (105 hospitals) and hospital minimum data set 2011 (all Belgian hospitals) used to compile this report*
[β] *Figures taken from 5 month US survey (voluntary participation) of 183 hospitals in-patients in 2011*[3,42]
Hosp: hospital, Mand: mandatory; popn: population (inhabitants)

Table 13 shows that the reported national average incidence in Belgium in 2013 falls between that of Germany (greater) and the Netherlands (less), higher than that in France (in 2009) and lower than that in England. The rate of hospital acquired cases in Belgium in 2013 was the same as that reported in France in 2009 and less than those rates reported in Germany, Australia and England in years between 2011-2013.

All of these inter-country comparisons must be taken with a very large caveat. Completeness of surveillance varies widely – with only Belgium and England using mandatory surveillance, others continuous voluntary surveillance and others using surveys to quantify infection in a subset of hospitals over a short period; the frequency of testing varies between countries (a variation of up to 47 times as measured by the European survey of 1998); testing algorithms vary, with a variety of different sensitivity tests used; definitions of infection, hospital-associated or -acquired cases and denominators vary between countries; post-discharge events which can be attributed to hospital care may be more completely included in some countries.

Despite these caveats we believe it can be said that Belgium has an incidence of CDI in the mid-range of European rates, and somewhat lower than the United States.

Some data from Europe indicate that the rapid rise of CDI in the early 2000s started to level off around 2007-2009[43,44]. However, although incidence in some countries has dramatically declined e.g. in England and Scotland and seems to be continuing in this direction[13,38-40], incidence rates in US and Australia continue to increase[36,37], and repeated European prevalence studies indicate a continuing increasing trend in Europe as a whole. The European surveys calculated an average of 2.5, 4.1[1] and 7.9 episodes per 10 000 hospital days respectively in 2005[11], 2008-9[18] and 2012-13[1]. It remains to be seen whether the very recent trend in increase in Belgium continues. The European prevalence studies also noted an increase in the prevalence of ribotype 027 across Europe as a whole[1], in marked contrast to the declining trend in UK[13] and Belgium (see Table 10). Mortality (table 14), on the other hand appears to have been decreasing throughout Europe and US since around 2007 or 2008.[41,45-47] Direct comparisons in figures again have to be caveated. Belgium counts deaths certificates coded as ICD-10 A04.7. The UK definition of CDI attributable death is more inclusive.

[1] *Calculated using only figures for countries that tested >=150 patients*

Table 14 : International comparison of *Clostridium difficile* infection mortality and severity

	Northern Ireland[46]	England & Wales[47]	Germany[41]	Europe[11]	Belgium*
	2012	2012	2012	2005	2010
Deaths /1m popn*	26.5	15.3			9.4
Trend	↓ Since peak 2008	↓ Since peak 2007			↓ Since peak 2006
% of all hospital deaths	0.7	0.8			
Severe CDI			↓ Since 2007		

*Standardised specific mortality rates using European standard population. m: million; popn: population

4 Discussion and conclusions

4.1 Discussion

This report summarises the different sources of available data on the epidemiology of *Clostridium difficile* infection (CDI) in Belgium. A large number of hospitals participate in the mandatory surveillance programme and the majority of them provide data for the whole year, despite the legal obligation being to provide data for only six months. All different sources confirm an important increase in incidence in CDI and mortality, reaching a peak between 2007-2008. Incidence subsequently declined until 2011 but the latest data suggest an increasing trend in incidence once again, with 2013 demonstrating the highest incidence since 2009. The latest hospital surveillance data show a slight increase in the proportion of cases which are community-associated, as described in other countries, but the increase is not substantial. More data from forthcoming years of hospital surveillance will be needed, as well as hospital discharge data for years 2011 onwards, to confirm this trend.

In 2013, the total incidence of CDI was 1.65 per 1000 admissions. The mean incidence of hospital acquired CDI was 1.29 episodes per 10 000 hospital days, slightly more than the preceding year. Incidence has consistently been lowest in Flanders.

Mortality rates for CDI decreased markedly after the peak in 2005-2006 and now are either stable or decreasing in all regions. The CDI mortality rate for Belgium was 0.90 deaths per 100 000 inhabitants in 2010 (the latest year with available data). Mortality rates (crude or age standardized) are highest in Brussels and for most years since the peak, have been lowest in Wallonia.

There is a consistent seasonal variation in incidence of CDI with a peak during March-April months each year. Hospital acquired cases follow the same seasonal pattern as other cases. Research could examine a possible association with antibiotic therapy for seasonal respiratory tract.

There exists a large variability in the incidence of hospital acquired CDI between hospitals and between regions. Even with the usual precautions of interpretation applied (different populations of patients, different diagnostic tests with different sensitivity), there may, nevertheless, remain an important potential for prevention of CDI.

No marked differences were observed in 2013 in comparison to previous years, for the characteristics of patients – age, sex, proportion of patients who died of CDI related causes within 30 days following diagnosis of CDI, the proportion of recurrent cases or the proportion of cases coming from care homes.

The incidence of CDI calculated when using hospital stay data was greater than that calculated when using hospital surveillance data (mandatory hospital programme), but the difference between the two measures remains constant (2008-2011), indicating the validity of the surveillance data.

Other countries use slightly different definitions and include slightly different cases within their surveillance. As far as possible we have tried to be consistent with common practice and guidelines throughout the EU and the world. Examples of differences are the inclusion of 0-2 year olds in the Belgian surveillance system and a difference in the definition of healthcare-associated cases. We have shown that only 43 (1.6%) of all cases in 2013 were 0-2 years old, and the exclusion of them made

little difference to the results of our analyses. There was also very little difference in the results when we re-defined hospital-acquired cases as those with onset >3 days after admission.

We have shown that there is a great variety of ribotypes circulating in Belgium, which indicates that transmission is not caused by one particular strain and that there are multiple pathways of transmission. The prevalence of ribotype 027 continues to diminish. The was an initial rise in the prevalence of ribotype 078 but this levelled off quickly at around 7%. The predominant strain is now 014 (26% of samples). We are now able to link reference laboratory data with hospital epidemiological surveillance data. Linkage is improving year on year.

International comparisons indicate that Belgium has incidence rates of CDI in the mid-range of other European countries and lower than that in the United States.

In conclusion, the incidence of CDI has been stable over recent years, but may be starting to increase again in Belgium and in Europe. Mortality in Belgium remains stable but varies between regions.. aucune There is a large variety of circulating ribotypes. The strain responsible for the epidemic of 2003-4 is in decline in Belgium..

4.2 Conclusions and key points

- There was a peak in incidence in 2008. However, incidence in 2013 is the highest since 2009.
- Mortality rates decreased after their peak in 2004-2005, and there is no further sign of increasing severity or mortality of cases in recent years
- The incidence of hospital acquired infection is very variable between hospitals and regions and indicates a potentially important area for prevention
- The incidence of infection is seasonal
- Although too early to confirm trends, the data suggest an increase in the proportion of community cases since 2011
- Reference laboratory data provide evidence of a large variety of strains. The most notable trend is the decline since 2009, of the hypervirulent strain responsible for outbreaks in 2003-2004 (ribotype 027). The predominant strain in Belgium is now 014/020.

5 Annex: Full report – national reference laboratory (French)

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Depuis 2007, le programme de surveillance comprend obligatoirement pour chaque laboratoire médical hospitalier belge agréé un volet bactériologique. Il est demandé à chaque entité d'envoyer cinq souches de *C. difficile* isolées consécutivement durant un semestre de l'année en y adjoignant les renseignements tels que repris sur le site de l'ISP (https://www.wiv-isp.be/Nsihweb/App_GUI/COMMON/Login.aspx). De façon facultative chaque laboratoire peut adresser une seconde série de cinq souches durant le second semestre de l'année.

En cas de problème épidémique dans une unité d'hospitalisation ou un hôpital, les souches isolées peuvent également être adressées au centre de référence aux fins de typage.

Chaque souche reçue dans ce cadre est préalablement confirmée quant à son identification et typée. La méthode de typage utilisée est le ribotypage qui est actuellement la méthode utilisée dans la majorité des centres de références européens

5.1 Ribotypage

La technique de ribotypage est basée sur l'existence chez les bactéries de plusieurs opérons de l'ARN ribosomial. Ceux-ci codent les gènes 16S-23S-5S. Les gènes 16S et 23S sont séparés par une région intergénique (non-codante) de taille variable. La technique du ribotypage consiste à amplifier par PCR ces régions intergéniques qui varient donc en nombre et en longueur. Les amorces choisies permettent une amplification depuis un segment du gène du 16S jusqu'à un autre du 23S. Les amplicons obtenus sont analysés par électrophorèse capillaire sur un séquençeur. La figure 1 montre un exemple de profil ainsi obtenu. Un logiciel d'analyse des tracés et d'interprétation est utilisé pour classifier les souches (GeneMapper).

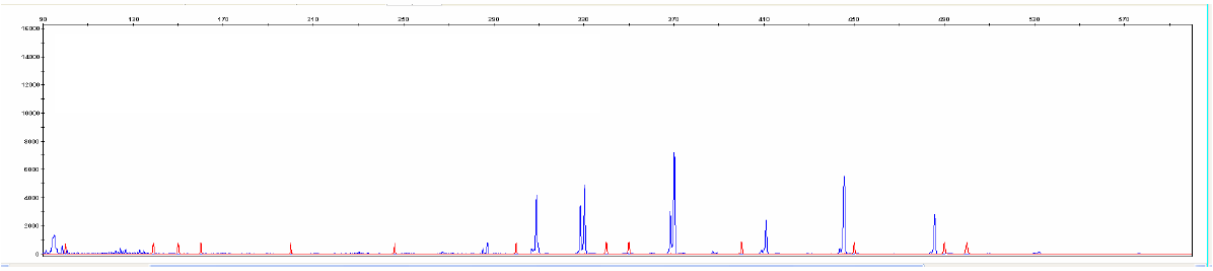

Figure 1. Exemple de tracé obtenu en électrophorèse capillaire pour le ribotypage.

Il existe une collection de souches de référence européennes qui permet de classifier 21 ribotypes. Ceux-ci sont spécifiquement mentionnés dans les rapports. Le tableau 1 reprend la correspondance entre les 21 ribotypes de référence et la nomenclature interne que nous utilisons à l'échelle belge. Dans notre centre de référence, près de cinq cents profils différents (n=485) ont déjà été identifiés.

Lorsque la nomenclature européenne est utilisée le ribotype est indiqué avec le préfixe « BR » tandis que les autres ribotypes ont le préfixe « UCL ».

Ribotype Nomenclature Européenne (Brazier)	Ribotype Nomenclature UCL
001	23e
002	32*
003	49
012	44
014	16
015	23
017	14
020	16a*
023	4
027	027
029	28
053	395
056	55a
070	47
075	141
078	3
081	33
087	24
095	21d
106	48d
131	48c

Tableau 1 Correspondances entre la nomenclature européenne des ribotypes et celle du NRC-CD belge.

5.2 Technique MLVA

La technique de typage appelée MLVA (MultiLocus Variable number tandem repeat Analysis) permet une caractérisation différente des souches ce qui permet de distinguer des clones au sein d'un même ribotype. Elle est basée sur l'existence sur le chromosome de *C. difficile* d'une série de séquences d'ADN répétées en tandem situées à de nombreux endroits différents dans le génome bactérien. Ces régions sont appelées loci. Plusieurs de ces loci, choisis pour leur pouvoir discriminant, sont amplifiés et les tailles des amplicons sont mesurées par électrophorèse capillaire.

Lorsque la longueur d'un élément répétitif est connue, on peut calculer le nombre de répétitions. Ceci peut se faire via un logiciel (BioNumerics) qui permet également d'analyser et de visualiser les données sous forme d'un dendrogramme ou sous forme de « Minimum Spanning Tree » (MST).

Cette technique est appliquée en cas d'épidémie hospitalière ou pour suivre les ribotypes les plus répandus en Belgique.

5.3 Résultats

En 2013, 103 sites hospitaliers ont participé au programme de surveillance annuel ce qui est comparable aux taux de participation observés en 2009 et 2010 mais en retrait par rapport à celui de 2012 (111). Nonante-deux laboratoires ont envoyé des souches au premier semestre, 57 au second semestre et 46 laboratoires ont participé aux deux semestres. Depuis 2011, les souches sont classées dans un millésime suivant leur date d'isolement et non plus suivant leur date de réception au laboratoire de référence.

Le Tableau 2 détaille la répartition des laboratoires en fonction du nombre de souches (1 à 10) envoyées dans le cadre de la surveillance annuelle. Un quart des laboratoires a envoyé les cinq souches d'un semestre et un autre quart a envoyé les dix souches de deux semestres.

nbr de souches envoyées en 2013	nbr de laboratoires
1	8
2	8
3	9
4	14
5	23
6	4
7	5
8	7
9	2
10	23
Total	103

Tableau 2. Nombres de souches incluses en 2013 par laboratoire

Au total, 846 souches isolées en 2013 ont été réceptionnées au NRC-CD. Parmi celles-ci, 33 souches n'ont pas été confirmées (autre espèce ou culture impossible). Certains laboratoires ayant dépassé le quota de cinq souches par semestre, seules les cinq premières sont entrées dans les calculs, ce qui a concerné au total 585 souches. Ce nombre reste comparable à celui de l'année précédente, quoi que légèrement en retrait (Tableau 3).

ECHANTILLONS	2009	2010	2011	2012	2013
N souches reçues et typables dans le cadre de la surveillance	389	505	462	648	585
N souches BR027 (UCL027)	72	62	36	32	22
%	18,5	12,3	7,8	4,9	3,76
N souches BR014 (UCL 16)	44	51	56	67	50
%	11,3	10,1	12,1	10,3	8,55
N Souches BR078 (UCL 3)	13	33	35	48	30
%	3,3	6,5	7,6	7,4	5,13
N Souches BR020 (UCL16a)	20	31	31	56	42
%	5,14	6,14	6,71	8,64	7,18
N Souches BR002(UCL32)	15	21	37	52	36
%	3,86	4,16	8,01	8,02	6,15
N SouchesBR070 (UCL 47)				10	29
%				1,54	4,96
N Souches BR106 (UCL 48d)				7	18
%				1,08	3,08

Tableau 3. Nombres de souches incluses dans le programme de surveillance et statistiques des principaux ribotypes.

Le ribotypage de ces 585 souches a permis d'identifier 133 ribotypes différents et 72 d'entre eux n'ont été rencontrés qu'une seule fois, 19 deux fois et 10 trois fois. Parmi eux, 60 étaient des ribotypes nouveaux jamais rencontrés auparavant.

Comme indiqué au Tableau 2 et au Tableau 4, le ribotype BR027 poursuit en 2013 une diminution de sa fréquence aussi bien en nombre de souches (22 versus 32 en 2012) qu'en nombre d'hôpitaux touchés (15 versus 19).

Le ribotype BR014 (UCL16) reste, comme en 2011 et 2012, le ribotype le plus fréquemment isolé mais sa fréquence marque une légère diminution par rapport à 2012 (8.8% versus 10.3%) et le nombre de sites touchés est lui aussi en diminution (52 versus 67).

Les ribotypes BR020 (UCL16a), BR002 (UCL32) et BR078 (UCL3) occupent les positions 2 à 4 mais marquent tous une régression par rapport à l'année précédente.

Par contre, plusieurs ribotypes émergent de façon remarquable. Le ribotype BR070 a été isolé 29 fois en 2013 (4.96%) pour 10 fois en 2012 (1.54%) et il a été retrouvé dans 24 hôpitaux différents (versus

10 en 2012). Le ribotype BR106 est lui aussi en augmentation significative avec 18 souches isolées dans 13 hôpitaux différents.

PARTICIPATIONS A LA SURVEILLANCE	2009	2010	2011	2012	2013
N hôpitaux (sites différents) ayant envoyé des échantillons pour typage	104	103	84	111	103
N hôpitaux avec BR027 (UCL027)	35	34	17	19	15
%	33,6	33	20,2	17,12	14,56%
N hôpitaux avec BR014 (UCL16)	35	34	32	45	38
%	33,6	33	38	40,54	36,89%
N hôpitaux avec BR078 (UCL 3)	11	26	20	35	25
%	10,6	25,3	23,8	31,53	24,27%
N hôpitaux avec Souches BR020 (UCL16a)				42	29
%				37,84	28,16%
N hôpitaux avec Souches BR002 (UCL32)				39	28
%				35,14	27,18%
N hôpitaux avec Souches BR070 (UCL47)				10	24
%				9,01	23,30%
N hôpitaux avec Souches BR106 (UCL48d)				6	13
%				5,41	12,62%

Tableau 4. Participation à la surveillance (par site) et évolution des ribotypes principaux.

Les Figures 2 et 3 présentent en graphiques les évolutions des principaux ribotypes en nombre et en pourcentage.

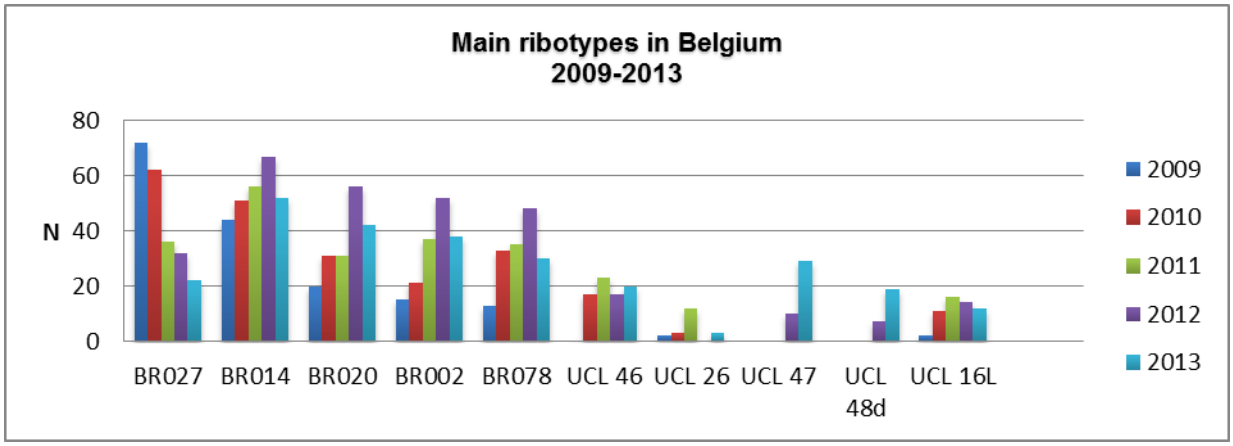

Figure 2. Evolution du nombre de souches appartenant aux principaux ribotypes entre 2009 et 2013.

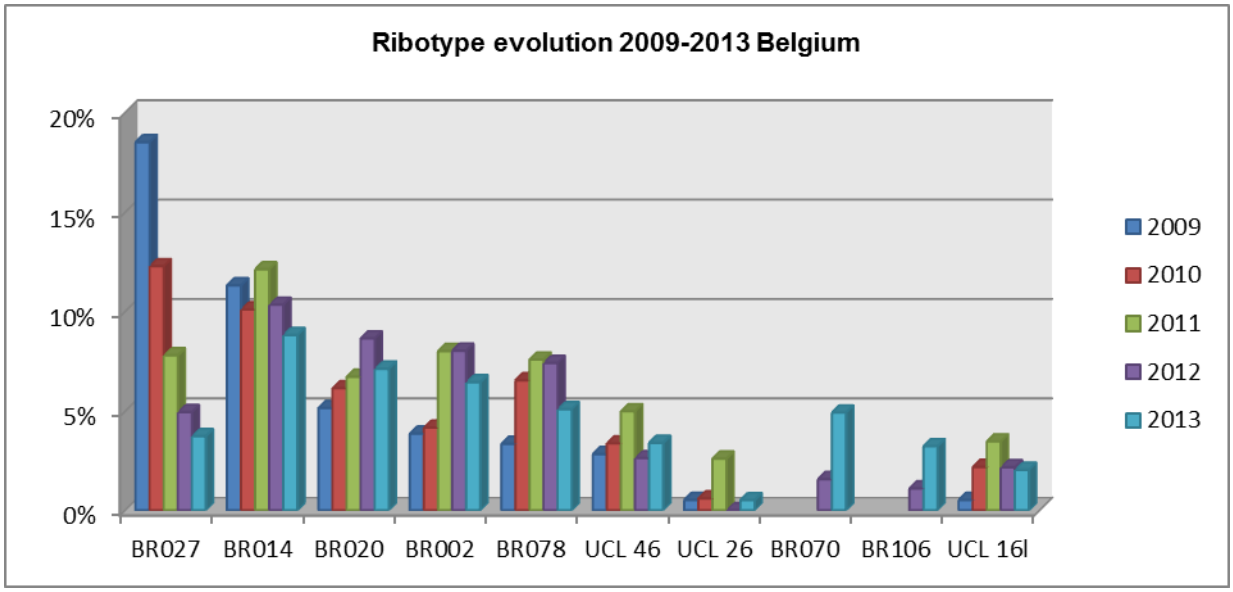

Figure 3. Evolution du pourcentage de souches appartenant aux principaux ribotypes entre 2009 et 2013.

	2010 N=505				2011 N=462				2012 N=648				2013 N=590		
	Ribotype	Nbr strains	% strains		Ribotype	Nbr strains	% strains		Ribotype	Nbr strains	% strains		Ribotype	Nbr strains	% strains
0	BR027	62	12,2	1	BR014	56	12,1	0	BR014	67	10,5%	0	BR014	50	8,47%
0	BR014	51	10,1	4	BR002	37	8	3	BR020	56	8,8%	0	BR020	42	7,12%
4	BR078	33	6,5	-2	BR027	36	7,8	-1	BR002	52	8,2%	0	BR002	36	6,10%
-1	BR020	31	6,1	-1	BR078	35	7,6	0	BR078	48	7,5%	0	BR078	30	5,08%
-1	BR001	24	4,7	-1	BR020	31	6,7	-2	BR027	32	5,0%	10	BR070	29	4,92%
-2	BR002	21	4,1	1	UCL 46	23	4,7	0	UCL 46	17	2,7%	-1	BR027	22	3,73%
1	UCL 46	17	3,36	4	UCL 16L	16	3,3	6	UCL 16b	15	2,4%	2	BR001	20	3,39%
6	BR023	16	3,10	8	UCL 26	12	2,6	2	BR023	15	2,4%	-1	UCL 46	20	3,39%
0	UCL 16b	12	2,40	-4	BR001	10	2,1	-2	UCL 16L	14	2,2%	8	BR106	18	3,05%
3	BR012	12	2,40	-1	BR023	10	2,1	0	BR001	14	2,2%	2	UCL 23f	15	2,54%
4	UCL 16L	11	2,10	6	UCL 23f	9	2		UCL 33	13	2,0%	-3	BR023	15	2,54%
0	UCL 5a	10	2,00	-2	BR012	9	2	-1	UCL 23f	12	1,9%	0	UCL 5a	15	2,54%
-7	BR015	9	1,80	-4	UCL 16b	8	1,7		UCL 44	11	1,7%	4	UCL 49	13	2,20%
-3	UCL 20a	6	1,10	-1	BR015	4	0,87	1	UCL 5a	11	1,7%	-5	UCL 16L	12	2,03%
-6	UCL 49	5	0,90	-2	UCL 5a	4	0,87		UCL 47	10	1,6%		UCL 36a	12	2,03%
-1	UCL 26	3	0,60	0	UCL 20a	4	0,87		UCL 32*	8	1,3%	-1	UCL 44	10	1,69%
0	UCL 23f	0	0,00	-2	UCL 49	2	0,43		UCL 16r	7	1,1%	-10	UCL 16b	8	1,36%
								-3	UCL 20a	7	1,1%	0	BR015	8	1,36%
								-3	BR015	7	1,10%		UCL 24	7	1,19%
									UCL 48d	7	1,1%	-3	UCL 36	7	1,19%
								0	UCL 49	7	1,1%	1	UCL 22	6	1,02%
									UCL 118	6	0,9%		UCL 237	6	1,02%
									UCL 22	6	0,9%	-10	UCL 33	6	1,02%
									UCL 36	6	0,9%				

Tableau 5. Evolution de 2010 à 2013 de la fréquence des principaux ribotypes identifiés.

Dans le Tableau 5, les flèches accompagnées d'un nombre indiquent le gain ou la perte de place des différents sérogroupes dans le classement en fréquence.

De façon remarquable également, les ribotypes les plus fréquents sont retrouvés dans la plupart des régions du pays (Tableau 6)

Rybotypes				
	BR027	BR014	BR070	BR106
Anvers	4	9	1	1
Brabant Flamand		2	2	1
Brabant Wallon		2	1	
Bruxelles	1	14	8	8
Flandre Occidentale	5	4	3	2
Flandre orientale	3	4	5	
Hainaut	2	3		
Liège	7	5	7	9
Limbourg		4		
Luxembourg		0		
Namur		2	2	

Tableau 6. Répartition par provinces des principaux ribotypes.

5.4 Conclusions

L'année 2013 a confirmé une stabilisation dans le processus d'envoi des souches par les différents laboratoires. Cela doit être souligné et tous les laboratoires participants sont félicités.

La tendance au déclin du ribotype 027 se confirme et c'est une observation qui est faite dans d'autres pays comme la Hollande et la Grande-Bretagne. D'après une étude européenne récemment présentée à l'ECCMID 2014 par K. Davies et al., le ribotype BR027 reste cependant le plus fréquent en Europe où il totalisait 18.4% d'une série de 1211 souches collectées un même jour dans 20 pays européens. Mais alors qu'il était dominant en Belgique et dans les pays limitrophes, il est maintenant devenu prépondérant en Allemagne, en Hongrie, en Pologne et en Roumanie.

Le ribotype BR106 dont la fréquence augmente chez nous cette année est un ribotype qui était le deuxième en fréquence en Grande-Bretagne en 2007 et 2008 mais qui a décliné depuis lors (http://www.hpa.org.uk/webc/HPAwebFile/HPAweb_C/1317140658750). La toxine binaire n'est pas présente chez ces souches.

La surveillance nationale montre enfin que les différents ribotypes sont généralement répartis sur l'ensemble du territoire sans focalisation particulière de certains d'entre eux à une ville ou une région.

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