9.1.0 Healthcare-associated infections (HCAI)

Key Points

- In 2013, 1,835 cases of *Clostridium difficile* infection (CDI) were notified. Of those, 1,668 (91%) were classified as new cases, 146 (8%) as recurrent, with 21 (1%) of unknown case type. This represents a national crude incidence rate of 41.3 cases per 100,000 population, which is similar to the rate reported in 2012 (41.1)
- Of the 1,835 CDI cases, 1,240 (68%) were reported from patients aged 65 years or older
- The voluntary enhanced CDI surveillance scheme received information on 1,801 CDI cases from 50 hospitals, covering 89% of all cases notified to Public Health Departments. Of those, 875 were healthcare-associated, representing a national CDI incidence rate of 2.4 cases per 10,000 bed days used for 2013, a decrease from 2.7 in 2012
- Data collected on patient location at symptom onset highlights that CDI is not confined to acute healthcare facilities. It is commonly encountered in long term care facilities (11% of all CDI) and in the community (29% of all CDI)
- Of 258 *C. difficile* isolates with available ribotyping data (14% of all cases) reported from 19 hospitals, the most frequent ribotypes were: 078 (n=45; 17%), 014 and 001/072 (both n=24; 9%), 005 (n=18; 7%), 015 and 002 (both n=12; 5%)

9.1.1 *Clostridium difficile* Infection

Notifiable *C. difficile* infection

In May 2008, new cases of CDI in persons two years or older became notifiable in Ireland under the disease category "acute infectious gastroenteritis" (AIG). Since January 2012, CDI has become a notifiable infection in its own category, with both new and recurrent CDI cases now notifiable.

In 2013, 1,835 cases of CDI were notified to Public Health Departments via the Computerised Infectious Diseases Reporting (CIDR) system. Of those, 1,668 (91%) were classified as new, 146 (8%) as recurrent, with 21 (1%) of unknown case type (**Table 1**). All cases were laboratory-confirmed.

The national crude incidence rate (CIR) of new CDI cases in 2013 was 37.5 per 100,000 population, an increase of 2.7% from 36.6 per 100,000 population in 2012 (**Table 1**). Taking both new and recurrent cases into account, the overall CIR for 2013 was 41.3 per 100,000 population, which is similar to the reported rate in 2012 (41.1).

Since surveillance began in 2008, there has been a decrease in the incidence of CDI in Ireland (**Table 1, Figure 1**). Since 2012, the CDI incidence rate has remained stable. Fewer recurrent cases were notified in 2013 (n=146) compared to 2012 (n=179). Identification

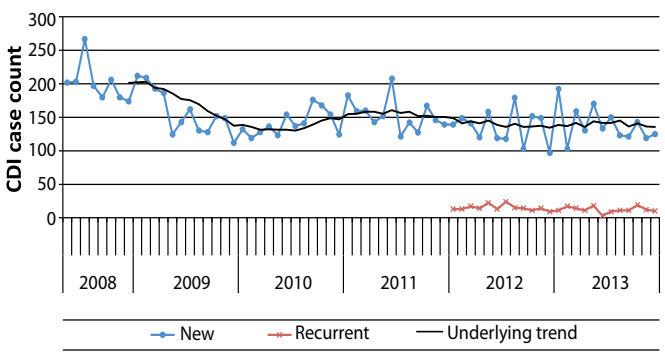

Figure 1. Numbers of CDI notifications by month and case type, 2008 – 2013. (Source: CIDR)

of seasonal patterns from CIDR notification data is hindered by delayed and batched laboratory notifications.

The majority of patients with CDI were female (61%). The mean age was 68 years (range: 2 – 99 years), with 1,240 cases (68%) reported in patients aged 65 years and older.

Regarding patient location at the time of CDI diagnosis, most were classified as 'hospitalised' (73%), with 14% from general practice, 5% from outpatients or day patients, 5% from the emergency department and 4% from either 'other', or 'unknown' patient location. This is similar to that reported in 2012. However, this data does not provide information on the origin or onset of CDI, as that information is collected as part of the enhanced CDI surveillance scheme.

In 2013, 28 deaths were reported in patients with CDI, which is similar to that reported in 2012. Two deaths were attributed to CDI, 16 were not attributed to CDI and for the remaining 10 deaths, the contribution of CDI to death was unknown.

Notifiable *C. difficile* infection: Outbreaks

In 2013, six CDI outbreaks, all healthcare-associated and involving 30 patients, were notified to Public Health Departments as displayed in **Table 2**. Five were linked to hospitals, and one to a residential institution.

Enhanced surveillance of *C. difficile* infection

Although notifiable CDI data provides important preliminary information on the burden of CDI in Ireland, it represents an underestimate of the true burden of CDI, as it does not capture information on the origin, onset or severity of CDI. National collation of *C. difficile* enhanced surveillance information commenced on a voluntary basis on 1st August 2009. Information on case type, origin, onset and infection severity is collected using the European Society for Clinical Microbiology

Table 1. CDI notifications by year and case type, 2008 – 2013 (Source: CIDR)

	Number of CDI cases notified				CDI rate per 100,000 population	
	New	Recurrent	Unknown	Total	New CDI rate[b]	Total CDI rate[c]
2008 (Wks19-53)[a]	1609	-	-	1609	59.2	-
2009	1900	-	-	1900	42.8	-
2010	1692	-	-	1693	38.1	-
2011	1847	-	-	1848	41.6	-
2012	1624	179	25	1828	36.6	41.1
2013	1668	146	21	1835	37.5	41.3

[a] The CDI rate from 2008 was adjusted for the year; [b] The new CDI rate is based on new cases of CDI only. [c] The total CDI rate is based on both new and recurrent cases of CDI. The CDI rate from 2008 was based on the 2006 census data, the data from 2009 onwards was based on 2011 census data

public hospitals [26 general (100%), nine tertiary (100%) and seven specialist hospitals (58%)] and eight private hospitals (67%).

In 2013, 1,801 CDI cases were reported to the enhanced surveillance scheme (89% of all the CDI cases notified via CIDR). Of those, 1,523 (84.5%) were classified as new, 154 (8.5%) as recurrent and 124 (7%) of unknown CDI case type.

Of the reported cases, 49% (n=875) originated within the reporting healthcare facility. The overall national CDI incidence rate of new and recurrent cases combined, acquired within the reporting healthcare facility was 2.4 cases per 10,000 bed days used (BDU), a decrease from 2.7 in 2012. The incidence rate of new CDI was 2.2 cases per 10,000 BDU, a decrease from 2.4 in 2012. The incidence of recurrent cases remained at 0.2 cases, unchanged from 2012. The CDI rate is based on the number of new and recurrent CDI cases that originated in the participating healthcare facility (both public and private hospitals). The rate is calculated using acute public hospital activity data from the HSE Business Intelligence Unit, Corporate Planning and Corporate Performance (CPCP), with private hospital activity data provided directly by participating hospitals.

Since enhanced surveillance began in 2009, the national CDI rate has declined from 3.1 cases per 10,000 BDU (2009) to 2.8 (2010), with an increase to 3.0 (2011). Since 2011, the rate further decreased from 2.7 (2012) to 2.4 (2013) (**Figure 2**).

Caution should be taken when interpreting national CDI trends, particularly prior to 2012 due to:

(i) Changes in the numbers of participating hospitals, as displayed in **Figure 2.** Throughout 2012, the total number of hospitals participating in enhanced CDI surveillance stabilised. In 2012 and 2013, there was complete participation in CDI enhanced surveillance by all tertiary and general hospitals

Table 2. CDI outbreaks reported in Ireland in 2013 by public health region (Source: CIDR)

Public Health Region	Outbreak location	Total number ill
West	Hospital	7
West	Hospital	7
West	Hospital	6
South	Residential insitution	2
South	Hospital	5
NorthWest	Hospital	3

(ii) Changes in *C. difficile* laboratory testing protocols. Throughout 2012 and 2013, there were fewer changes in laboratory testing protocols. Please also refer to the section on laboratory testing of *C. difficile* in Ireland.

There was a wide range in the incidence of CDI among participating hospitals in 2013 (range, 0 – 6.8 cases per 10,000 BDU; median = 1.8 cases). In 2013, tertiary hospitals (n = 9) had a median CDI rate of 2.6 cases per 10,000 BDUs (range: 2.1 – 3.8), which was higher when compared to that of general hospitals (n = 27), with a median rate of 2.0 (range: 0 – 6.8). Since 2011, the median CDI rate in both tertiary (3.0 to 2.6 cases per 10,000 BDU) and general hospitals (2.4 to 2.0 cases per 10,000 BDU) declined.

The differences in CDI median incidence rates may reflect inter-hospital variation with regard to patient case mix, *C. difficile* ribotypes, laboratory testing protocols, antimicrobial prescribing policies, antimicrobial stewardship interventions and surveillance resources. No obvious seasonal trend for CDI is distinguishable from enhanced surveillance data in 2013.

The percentage coverage of acute hospital activity was calculated using bed days used data from participating hospitals as a percentage of total acute hospital bed days used activity in Ireland

Severe CDI

A severe case of CDI is defined as (i) a patient requiring admission to an intensive care unit (ICU) for treatment of CDI or its complications, (ii) a patient requiring colectomy or (iii) death within 30 days after diagnosis, if CDI is either the primary or contributory cause of death. The enhanced CDI surveillance scheme does not collect information on patient outcome. Therefore, surgery and ICU admission for CDI are the two markers of severity captured via enhanced surveillance. In 2013, 31 (1.7%) severe CDI cases were reported, similar to 2012 (1.5%). Six patients required both surgery and ICU admission, six required surgery only and 19 required ICU admission without surgery.

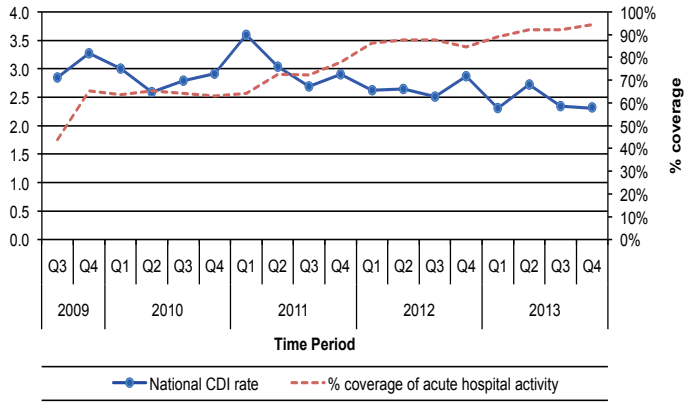

Figure 2. Quarterly national rate of healthcare-associated CDI (new and recurrent): 2009 – 2013
The percentage coverage of acute hospital activity was calculated using bed days used data from participating hospitals as a percentage of total acute hospital bed days used activity in Ireland

Onset & Origin of CDI

Onset: Patient location when symptoms of CDI commenced

Sixty percent (n=1,088) of patients had CDI symptom onset in a healthcare facility (healthcare-onset), 29% (n=520) had symptom onset in the community and for 11% (n=193), location at CDI onset was unknown (**Table 3**).

Of the 1,088 patients with healthcare onset CDI, 75.3% (n=819) had onset in the reporting hospital, 2.4% (n=26) in another hospital, 18% (n=196) in a long term care facility (LTCF) and for the remaining 4% (n=47) onset location was unknown.

Between 2011 and 2013, there was a decrease in the proportion of patients with CDI symptom onset in a healthcare facility (71 to 60%), with the exception of LTCFs, where an increase was noted (14 to 18%). While community onset remained unchanged over this period, an increase in the proportion with unknown location of symptom onset was observed (2 to 11%) (**Table 3**).

Origin: Location where the patient acquired the CDI

For the majority of CDI cases, the infection was acquired in a healthcare setting (healthcare-associated) (n=1,145; 64%). Community-associated cases accounted for 18% (n = 324) and in 5% (n = 87) the origin could not be assigned as either healthcare or community-associated, as the patient had been discharged from a healthcare facility between four and 12 weeks prior to the CDI

Table 3. Origin and onset of CDI, 2011 – 2013

	Year		
	2011 %	2012 %	2013 %
ONSET: Location of where patient symptoms occurred			
Healthcare-onset	71	64	60
Breakdown of healthcare-onset cases:			
Within reporting hospital	78	77	76
Other hospital	6	4	2
Nursing home/LTCF	14	16	18
Unknown	1	3	4
Community-onset	27	30	29
Unknown	2	6	11
ORIGIN: Location of where infection was acquired			
Healthcare-associated	74	68	64
Breakdown of healthcare-associated cases:			
Within reporting hospital	78	76	76
Other hospital	8	6	5
Nursing home/LTCF	13	15	17
Unknown	1	3	2
Community-associated	20	17	18
Indeterminate	3	5	5
Unknown	4	10	14

onset date. For the remaining 14% (n = 245) of cases, the origin was unknown (**Table 3**).

Of the 1,145 healthcare-associated CDI cases, 76% (n=875) originated in the reporting hospital, 5% (n=53) originated in a hospital other than the reporting hospital, 17% (n=189) originated in a LTCF and 2% (n=28) originated in another unspecified healthcare facility or were of unknown origin.

Between 2011 and 2013, there was a decrease in the proportion of cases associated with a healthcare facility (74 to 64%), in particular for the reporting hospital and other hospital categories. However an increase in cases associated with LTCFs was reported (13 to 17%). There was little change in cases classified as community-associated or indeterminate, while cases classified as 'unknown' increased (4 to 14%) (**Table 3**).

Of the 1,145 cases of healthcare-associated CDI:

- 88.5% (n=1,013) experienced onset of CDI symptoms at least 48 hours following admission to a healthcare facility (healthcare-onset, healthcare-associated)
- 11.2% (n=128) experienced symptom onset in the community, within four weeks of discharge from a healthcare facility (community-onset, healthcare-associated)
- 0.3% (n = 4) had no information recorded on symptom onset

Of the 324 cases of community-associated CDI:

- 89% (n=289) experienced CDI symptom onset while outside a healthcare facility and without a history of discharge from a healthcare facility within the previous 12 weeks
- 10% (n=33) experienced symptom onset within the first 48 hours of admission to a healthcare facility, without a history of admission to or residence in a healthcare facility within the previous 12 weeks
- 1% (n = 2) had no information recorded on symptom onset

Information was also captured on the location where the patient's faeces specimen was taken. The reporting hospital accounted for the majority (76%) of specimens (n=1,379), with 10% (n=179) taken in the GP surgery, 11% (n=203) in LTCF and 2% (n=28) in a hospital other than the reporting hospital. For the remaining 1% (n=12), no information was provided.

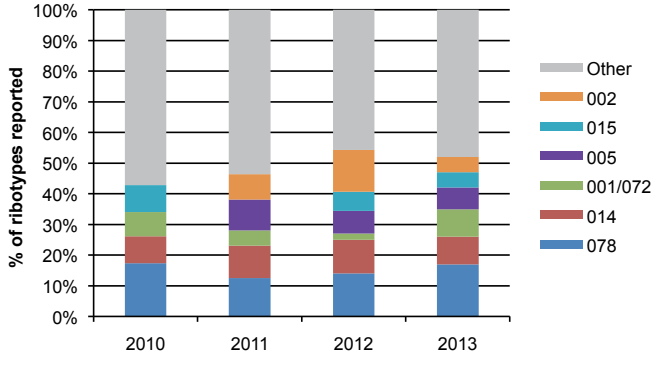

Figure 3. Most frequently reported C. difficile ribotypes in Ireland: 2010 – 2013

Discussion

The collation of national data on *C. difficile* through CIDR notifications and the enhanced CDI surveillance system has provided a valuable insight into the burden of CDI in Ireland. Both surveillance systems present a similar decreasing trend since 2009. The notifiable surveillance system, which reflects total burden of disease, shows that the CDI rate stabilised in 2012 and 2013, while the enhanced surveillance system shows a decrease in the CDI rate during this time period, including a decrease in the number of new CDI cases acquired in an acute hospital. The reasons for this decrease are unknown, but may be attributed to improved hand hygiene compliance and other infection control practices, changes in antimicrobial prescribing or changes in laboratory testing practices.

In 2013, recurrent CDI accounted for 8.5% of notifications through the enhanced surveillance scheme, a slight decrease from 9.2% in 2012. Recurrent CDI may result in severe infection, places a further burden on limited hospital isolation resources and results in significant patient morbidity.

CDI is not confined to acute healthcare settings and is increasingly common in LTCF and the community. In 2013, 11% of cases had onset in LTCF, with 29% having onset in the community. Of the 324 community-associated cases reported in 2013, 89% experienced CDI symptom onset in the community, without a history of discharge from a healthcare facility within the previous 12 weeks. It is important to consider CDI in the differential diagnosis of all patients presenting with diarrhoea of potentially infectious origin and to send specimens in a timely fashion for laboratory diagnosis.

***C. difficile* PCR ribotyping**

As part of the voluntary *C. difficile* enhanced surveillance scheme, participating hospitals are requested to provide *C. difficile* PCR ribotyping information, where available. Ireland does not yet have a national *C. difficile* reference laboratory or ribotyping service. Therefore, laboratories submit specimens abroad for ribotyping. In 2013, ribotyping data was provided for 258 *C. difficile* isolates (14% of all samples) from 19 hospitals.

The most common ribotypes reported in 2013 were: 078 (n=45; 17%), 014 and 001/072 (both n=24; 9%), 005 (n=18; 7%), 015 and 002 (both n=12; 5%) (**Figure 3**). In 2013, one tertiary hospital reported that 60% of all *C. difficile* isolates were ribotyped, with a similar pattern of ribotypes to the national picture.

Laboratory Testing of *C. difficile* in Ireland
Since 2010, information on *C. difficile* testing has been collected quarterly as part of the enhanced surveillance system. In the first quarter of 2010, the majority of hospitals participating in the enhanced surveillance project were using a one step Toxin EIA (60%). In the last quarter of 2013, this had reduced to 18%. A gradual increase in the use of more sensitive testing approaches, such as PCR has been observed: 0% (Q1 2010) versus 61% (Q4 2013) (**Figure 4**).

Owing to considerable variations in current Irish laboratory *C. difficile* testing methodologies, inter-hospital comparison of CDI rates is not recommended where testing methods differ, as the data in the national quarterly enhanced surveillance reports are not adjusted for differences in the sensitivities of the different diagnostic methodologies.

Conclusion
The continued excellent participation in the voluntary CDI enhanced surveillance scheme ensures that a significant amount of information is collected regarding the burden of CDI in Ireland.

The updated National Clinical Guidelines on the Surveillance, Diagnosis and Management of CDI in Ireland were updated in 2013 and endorsed by the National Clinical Effectiveness Committee in 2014. The updated guidelines may be accessed on the HPSC website at:
www.hpsc.ie/A-Z/Gastroenteric/Clostridiumdifficile/Guidelines/.

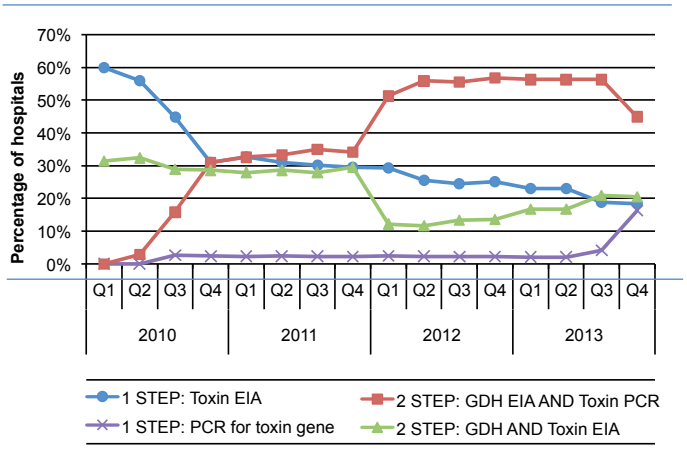

Figure 4. Changes in C. difficile laboratory testing protocols: 2010 - 2013

1 STEP: Toxin EIA: EIA for the detection of *C. difficile* TcdA and/or TcdB. **1 STEP: PCR for toxin gene:** Polymerase chain reaction (PCR) for the detection of TcdA and/or TcdB genes; **2 STEP: GDH AND TOXIN EIA:** Enzyme immunoassay (EIA) for the detection of glutamate dehydrogenase (GDH) of *C. difficile* as well as or followed by an EIA for the detection of *C. difficile* TcdA and/or TcdB.; **2 STEP: GDH EIA AND Toxin PCR:** EIA for the detection of GDH of *C. difficile* as a first screening test followed by a PCR for the detection of TcdA and/or TcdB genes.