Enhanced Surveillance of *Clostridioides (Clostridium) difficile* Infection in Ireland: Q2 2022 National Report

Executive Summary

- During Q2 2022, a total of 455 cases of CDI were reported to the enhanced surveillance scheme from 60 acute public and private hospitals across Ireland now participating
- The national overall rate of CDI in hospitalised patients was 3.5 cases per 10,000 bed days used (BDU) [360 cases], which is lower than that reported for Q2 2021 [379 cases; rate = 3.9]
- There were 207 cases of CDI deemed to be hospital-acquired (HA-CDI), of which 187 were new, representing a national new HA-CDI rate of 1.8 [median rate = 1.2]
- With regard to acquisition, while *C. difficile* was mostly associated with acute hospitals (207; 45%), there were many cases associated with the community (147; 32%) whereby patients had no overnight stay in a healthcare facility (HCF) in the 12 weeks prior to symptom onset.
- CDI symptom onset occurred in the community for 54% of all cases (246):
    - This emphasises the importance of considering CDI when evaluating any patient with potentially infectious diarrhoea in all healthcare settings, including hospitals, primary care and long-term care facilities (LTCF). Guidance on CDI for primary and long-term care settings is available at the following link:

      http://www.hpsc.ie/a-z/microbiologyantimicrobialresistance/clostridioidesdifficile/guidelines/File,14387,en.pdf
    - It also emphasises the importance for all microbiology laboratories in Ireland to implement the recommendations of the national *C. difficile* clinical guidelines to routinely include *C. difficile* testing for all faeces specimens that take the shape of the container submitted from patients aged ≥2 years, regardless of patient location or clinician request. Guidance on *C. difficile* testing is available in Section 2.5, pages 43 – 54 of the national *C. difficile* clinical guidelines
- Ribotyping data was available for just 9% of cases, with ribotypes 078 (34% of ribotyped cases); 015 and 054 (11% each reported with equal frequency) and 020 (8%) the most frequently reported
- Whole genome sequencing was performed at the Irish *C. difficile* National Reference Laboratory (NRL) on 48 (10.5%) isolates during Q2 with data analysis on 23 isolates with confirmed sample dates within Q2. ST 11 (26%), ST 10 (17%) & ST 8 (13%) were most frequently reported and 6 clusters were notified

Part 1: National CDI Epidemiology Q2 2022

CDI data was reported to the enhanced surveillance programme from 60 acute public and private hospitals across Ireland (***Appendix A***). There were 455 reported CDI cases in patients aged ≥2 years. Of those, 360 were reported in hospitalised patients, giving a national CDI rate in hospitalised patients of 3.5 cases per 10,000 bed days used (BDU), which is lower than that reported for Q2 2021 [379 cases; rate 3.9]. The majority were aged ≥65 years (65%) and were female (58%). ***Table 1*** displays the breakdown of all CDI cases for Q2 2022 compared with Q2 2021 case data, by case type, origin, onset and severity. In Q2 2022, nine cases of severe CDI were reported (2%), defined as requiring critical care admission or colectomy due to complications of CDI in ***Table 2***, with 17 cases (4%) for Q2 2021. Two cases required both colectomy and critical care admission and seven other cases required critical care admission. CDI case definitions are summarised in ***Appendix B***.

CDI Case Type

The majority were categorised as new infections (86%), with 8% recurrent and for 6%, the CDI case type was unknown.

CDI Origin

The majority were categorised as healthcare-associated (HCA) CDI [n=260; 57%], with community-associated (CA) CDI accounting for 32% [n=147]. Of the community-associated cases, 15 cases (10%) were in contact with healthcare facilities for <48 hours, where ambulatory care was received. For the remainder, the origin either could not be determined [n=32; 7%] or was unknown [n=16; 4%]. Of the 260 HCA-CDI cases, the origin was the reporting hospital, termed hospital-acquired (HA) for 207 (80%), a LTCF for 22 (8%) and 'other' or 'unknown healthcare facility' for 31 (12%).

CDI Onset

Patient locations at onset of CDI symptoms included; while admitted to a healthcare facility, termed healthcare-onset (HO) for 246 cases (54%), while residing in the community, termed community-onset (CO) for 205 cases (45%), and unknown patient location for four cases (1%). Of 246 HO CDI cases, the reporting hospital was the onset location for 188 (76%), a LTCF for 18 (7%), other healthcare facilities for 14 (6%) and unknown healthcare location for 26 cases (11%).

Table 1. National CDI epidemiology: Q2 2022 versus 2021

	2022 Q2		2021 Q2	
	n	%	n	%
Total reported cases	**455**	-	**456**	-
CDI Case Type				
– New	391	*86%*	405	*89%*
– Recurrent	36	*8%*	34	*7%*
– Unknown	28	*6%*	17	*4%*
CDI Origin				
– Healthcare-associated (HCA)	**260**	***57%***	**251**	***55%***
Reporting hospital	207	*80%*	199	*79%*
Long term care facility	22	*8%*	26	*10%*
Other healthcare facility	15	*6%*	23	*9%*
Unknown healthcare facility	16	*6%*	3	*1%*
– Community associated (CA)	**147**	***32%***	**165**	***36%***
Ambulatory care*	15	*3%*	-	-
– Discharged 4 – 12 weeks from HCF	**32**	***7%***	**21**	***5%***
– Unknown origin	**16**	***4%***	**19**	***4%***
CDI Onset				
– Healthcare onset (HO)	**246**	***54%***	**234**	***51%***
Reporting hospital	188	*76%*	192	*82%*
Long term care facility	18	*7%*	24	*10%*
Other healthcare facility	14	*6%*	13	*6%*
Unknown location	26	*11%*	5	*2%*
– Community onset (CO)	**205**	***45%***	**214**	***47%***
– Unknown onset location	**4**	***1%***	**8**	***2%***
CDI Severity				
Critical care admission or colectomy	9	*2%*	17	*4%*

*Fifteen community-acquired cases received ambulatory care in Q2 2022 which was described as: Oncology (n=1); Nephrology (n=1); and an Outpatient department patient (n=13; of which one site was described as a GP clinic)

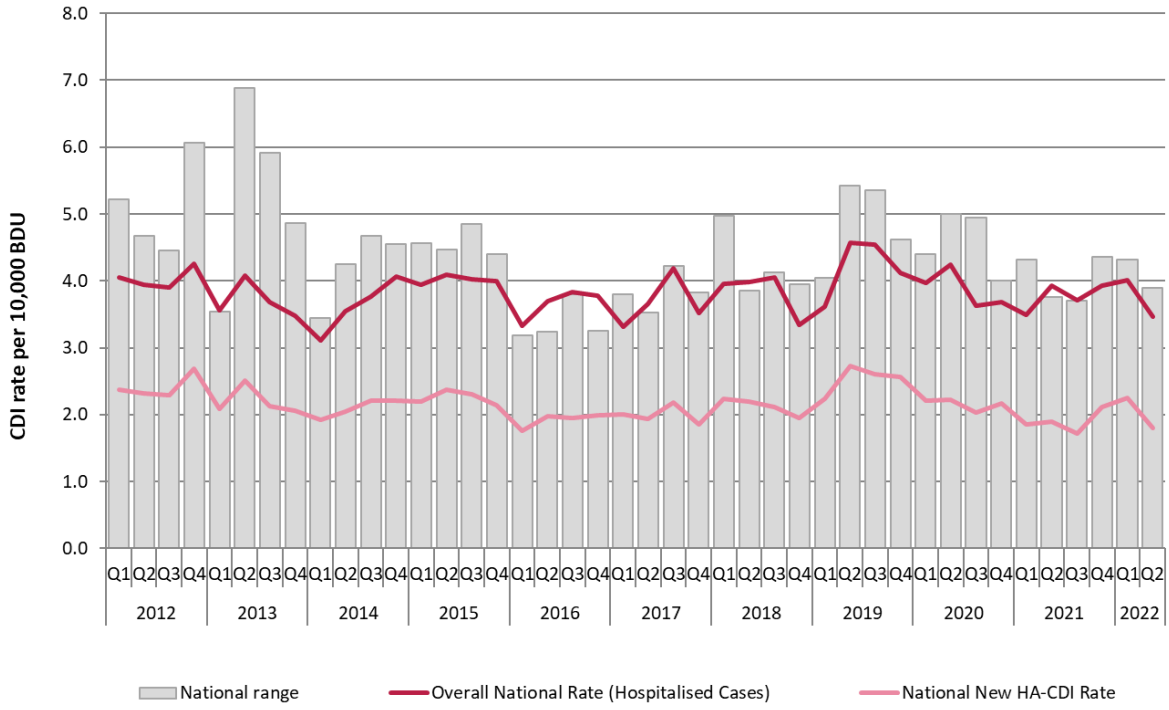
Table 2. Severity of illness: Q2 2022

		ICU Admission			Total
		Yes	No	Unknown	
Surgery (Colectomy)	Yes	2	-	-	**2**
	No	6	355	1	**362**
	Unknown	1	18	72	**91**
	Total	**9**	**373**	**73**	**455**

Part 2: Hospital-acquired CDI (HA-CDI) Epidemiology – Q2 2022

Data on HA-CDI was reported from 60 acute public and private hospitals across Ireland. There were 207 HA-CDI cases in patients aged ≥2 years during Q2 2022. Of those, 187 were new HA-CDI cases, representing a national new HA-CDI rate of 1.8 [median rate = 1.2], similar to that reported for Q2 2021 [183 cases; rate = 1.9; median rate = 1.3]. ***Figure 1*** displays quarterly HA-CDI rates since 2012 and ***Table 3*** displays quarterly HA-CDI data from 2020 to 2022.

Figure 1. Quarterly national HA-CDI rates: 2012 – 2022



The overall national CDI rate represents all CDI diagnosed in hospitalised patients per 10,000 BDU, while the HA-CDI rate represents **new** cases of hospital-acquired CDI per 10,000 BDUs. Raw data for this graph is provided in Table 3. The national range is represented by the 5th to 95th percentile of the CDI rate.

CDI Case Type

The majority of 207 HA-CDI cases were categorised as new infections (187; 90%), with 17 (8%) recurrent cases. For three cases (1%), the case type was unknown.

CDI Onset

Patient locations at onset of HA-CDI symptoms included; while admitted to a healthcare facility, termed healthcare-onset (HO) for 181 cases (87.5%) and while residing in the community, termed community-onset (CO) for 25 cases (12%) and was unknown for one case (0.5%).

Of 181 HO-CDI cases, the reporting hospital was the onset location for 156 (86%); a LTCF for one case (0.5%); an 'other' hospital for one case (0.5%) and unknown for 23 cases (13%).

Table 3. Quarterly HA-CDI data: 2020 – 2022

YearQ	Number of participating hospitals[a]	Number of cases reported				CDI rate per 10,000 BDUs[b]		
		New	Recurrent	Unknown	Total	Rate	Range[c]	Median
2020Q3	57	185	8	2	**195**	2.0	0 - 4.9	1.5
2020Q4	57	195	15	0	**210**	2.2	0 - 4	1.2
2021Q1	58[d]	167	20	1	**188**	1.9	0 - 4.3	1.0
2021Q2	58[d]	183	12	1	**196**	1.9	0 - 3.8	1.3
2021Q3	57[e]	164	17	1	**182**	1.7	0 - 3.7	0.8
2021Q4	57[e]	203	18	1	**222**	2.1	0 - 4.4	1.0
2022Q1	57[f]	191	22	2	**215**	2.2	0 - 4.3	1.3
2022Q2	60	187	17	3	**207**	1.8	0 - 3.9	1.2

a Since Q1 2012, 97% of all tertiary and general hospitals participated in the enhanced surveillance system.
b The CDI rate is the number of **new** cases of CDI that were acquired in the reporting hospital - per 10,000 bed days used (BDUs).
c The national range corresponds to the 5th to 95th percentile of the data.
d Data was retrospectively submitted by the Hermitage Medical Clinic for Q1 & 2 2021.
e Since Q3 2021, the National Rehabilitation Hospital and Hermitage Medical Clinic have joined, bringing the total number of participating hospitals to 59. Data was not available from one tertiary and one specialist hospital for Q3 or Q4 2021.
f Since Q1 2022, Children's Health Ireland at Tallaght is reporting separately to Tallaght University Hospital bringing the total number of participating hospitals to 60. Data was not available from one tertiary, one general and one specialist hospital in Q1 2022
Data for Q2 2022 are provisional

Part 3: *C. difficile* Testing Methods – Q2 2022

All 60 hospitals participating in the enhanced CDI surveillance system during Q2 2022 reported use of a *C. difficile* testing method recommended by the updated National Clinical Guidelines for Surveillance, Diagnosis & Management of *C. difficile* Infection in Ireland (2014). This includes either one of a variety of two-step testing methods (n=48; 80%) or a single-step method using molecular polymerase chain reaction (PCR) test for *C. difficile* toxin gene (n = 12; 20%), as displayed in ***Table 4***, along with stratification by hospital type.

Table 4. *C. difficile* testing methods utilised in Q2 2022, by hospital type

Test Category	Hospital Type				Total
	General	Private	Specialist	Tertiary	
1 STEP: PCR for toxin gene	4	-	6	2	**12**
2 STEP: GDH EIA, followed by confirmatory *C. difficile* toxin EIA	3	3	-	-	**6**
2 STEP: Combined GDH with toxin EIA, followed by PCR*	4	6	1	-	**11**
2 STEP: GDH EIA, followed by confirmatory toxin PCR	3	-	-	-	**3**
2 STEP: PCR, followed by confirmatory toxin EIA	13	3	5	7	**28**
Total	**27**	**12**	**12**	**9**	**60**

PCR for *C. difficile* toxin gene: Polymerase chain reaction (PCR) for the detection of TcdA and/or TcdB genes
GDH EIA: Enzyme immunoassay (EIA) for the detection of glutamate dehydrogenase (GDH) of *C. difficile*
GDH AND TOXIN EIA: Enzyme immunoassay (EIA) for the detection of both *C. difficile* GDH and *C. difficile* toxin TcdA and/or TcdB
***2 STEP: Combined GDH with toxin EIA, followed by confirmatory PCR:** Addition of confirmatory PCR if the initial toxin EIA is negative

Part 4: *C. difficile* Ribotyping & Sequence Typing – Q2 2022

Ribotyping

Ribotyping data was available for just 9% (n=38) of CDI cases reported to the CDI enhanced surveillance scheme. Ribotypes 078 (34% of ribotyped cases), 015 and 054 (11% each reported with equal frequency) and 020 (8%) were the most frequently reported.

Sequence typing

The new National Reference Laboratory (NRL) service for *C. difficile* commenced in 2022 at the Public Health Laboratory, HSE, Dublin. The NRL cultured 48 (10.5%) isolates from CDI samples (1 per case) submitted to the NRL in Q2 from 11 diagnostic laboratories nationally. These were all whole genome sequenced and analysed using cgMLST (Jolley et al 2018). Ribotyping is not part of the Irish NRL *C. difficile* service. Unfortunately, due to gaps in the request data submitted, only 23 of the 48 isolates were confirmed with sample dates within Q2. Furthermore only 8 could be linked to the national enhanced surveillance scheme. This data deficit emphasizes the necessity for the comprehensive completion of the NRL *C. difficile* request forms when submitting samples.

Of the 23 *C. difficile* isolates confirmed with sample dates within Q2 2022, all (100%) were phenotypically susceptible to both metronidazole & vancomycin (EUCAST 2022 criteria). A total of 13 different sequenced types (STs) were detected submitted from 11 hospital diagnostic laboratories. ST11 (6 isolates, 26%), ST10 (4 isolates, 17%) & ST8 (3 isolates, 13%) were the commonest sequence types followed by single isolates of 10 other sequence types (ST12, ST18, ST13, ST28, ST21, ST2, ST7, ST14, ST49, ST6). Cluster identification was performed weekly using cgMLST. 6 clusters were notified to clients & relevant Regional Public Health Depts. with Q2 data, which also included genetic related clustered isolates from Q1 2022 & Q4 2021. The largest cluster was of 7 ST11 isolates submitted from 7 different hospital laboratories, followed by a ST18 cluster of 3 samples from 1 hospital laboratory & 2 ST12 isolates from 2 hospital laboratories. Interestingly there were 3 distinct ST10 clusters, all of 2 isolates each, 2 of which were each from a single hospital laboratory, while 1 cluster involved 2 hospital laboratories. Unfortunately, it was not possible to associate any sequence type with origin, onset or severity of infection due to gaps in the metadata provided and consequent inability to link to the national enhanced surveillance scheme. We hope this will improve as clients become more familiar with the *C. difficile* NRL request forms.

In total, isolates from 19% (n= 86) of cases processed in Q2 have undergone at least one genomic typing method as reported.

The further development of this national reference laboratory service will add significantly to the understanding of the epidemiology of this important healthcare–associated infection and ultimately to its control and prevention, both here in Ireland and internationally.

Acknowledgments

The HPSC & National Reference Laboratory Service for *C. difficile* would like to sincerely thank all who have contributed to this report, especially due to the additional demands placed on those involved in HCAI surveillance in Ireland, caused by the impact of COVID-19: Microbiology Surveillance Scientists, Infection Prevention and Control Nurses, Microbiology Laboratory Scientists, Clinical Microbiologists, along with all the staff of the Departments of Public Health across Ireland.

Appendix A: National CDI Enhanced Surveillance Participating Hospitals

Hospital Group	Hospital Name	Category	Type of Hospital	Area
Dublin Midlands	Coombe Women and Infant's University Hospital	Specialist	-	B
	Midland Regional Hospital Portlaoise	General	Model 3	B
	Midland Regional Hospital Tullamore	General	Model 3	B
	Naas General Hospital	General	Model 3	B
	St James's Hospital	Tertiary	Model 4	B
	St Luke's Hospital, Dublin	Specialist	-	B
	Tallaght University Hospital	Tertiary	Model 4	B
Ireland East Hospital Group	Cappagh National Orthopaedic Hospital, Dublin	Specialist	-	A
	Mater Misericordiae University Hospital	Tertiary	Model 4	A
	Midland Regional Hospital Mullingar	General	Model 3	B
	National Maternity Hospital, Holles Street	Specialist	-	C
	National Rehabilitation Hospital, Dun Laoghaire	Specialist	-	C
	Our Lady's Hospital, Navan	General	Model 3	A
	Royal Victoria Eye & Ear Hospital, Dublin	Specialist	-	C
	St Columcille's Hospital, Loughlinstown	General	Model 2	C
	St Luke's General Hospital, Kilkenny	General	Model 3	C
	St Michael's Hospital, Dun Laoghaire	General	Model 2	C
	St Vincent's University Hospital	Tertiary	Model 4	C
	Wexford General Hospital	General	Model 3	C
RCSI Hospital Group	Beaumont Hospital	Tertiary	Model 4	A
	Cavan General Hospital	General	Model 3	A
	Connolly Hospital, Blanchardstown	General	Model 3	A
	Louth County Hospital, Dundalk	General	Model 2	A
	Our Lady of Lourdes Hospital, Drogheda	General	Model 3	A
Saolta Hospital Group	Letterkenny University Hospital	General	Model 3	F
	Mayo University Hospital	General	Model 3	F
	Portiuncula University Hospital	General	Model 3	F
	Roscommon University Hospital	General	Model 2	F
	Sligo University Hospital	General	Model 3	F
	University Hospital Galway	Tertiary	Model 4	F
South/South West Hospital Group	Bantry General Hospital	General	Model 2	D
	Cork University Hospital	Tertiary	Model 4	D
	Cork University Maternity Hospital	Specialist	-	D
	University Hospital Kerry	General	Model 3	D
	Lourdes Orthopaedic Hospital, Kilcreene, Kilkenny	Specialist	-	C
	Mallow General Hospital	General	Model 2	D
	Mercy University Hospital, Cork	General	Model 3	D
	South Infirmary - Victoria University Hospital, Cork	General	Model 2	D
	South Tipperary General Hospital, Clonmel	General	Model 3	C
	University Hospital Waterford	Tertiary	Model 4	C
UL Hospital Group	Croom Hospital	Specialist	-	E
	Ennis Hospital	General	Model 2	E
	Nenagh Hospital	General	Model 2	E
	St John's Hospital	General	Model 2	E
	University Hospital Limerick	Tertiary	Model 4	E
	University Maternity Hospital Limerick	Specialist	-	E
Private Hospitals	Aut Even, Kilkenny	Private	-	
	Beacon Hospital, Dublin	Private	-	
	Blackrock Clinic	Private	-	
	Bon Secours, Cork	Private	-	
	Bon Secours, Galway	Private	-	
	Bon Secours, Glasnevin	Private	-	
	Bon Secours, Tralee	Private	-	
	Galway Clinic	Private	-	
	Hermitage Medical Clinic, Dublin	Private	-	
	Mater Private, Dublin	Private	-	
	Mater Private, Cork	Private	-	
	St Vincents Private Hospital	Private	-	
Children's Health Ireland	Children's Health Ireland at Tallaght	Specialist	-	
	Children's Health Ireland at Temple St	Specialist	-	

Appendix B
Case Definitions for Surveillance of *Clostridioides difficile* Infection

***For surveillance purposes, a confirmed Clostridioides difficile* infection (CDI) case is a patient two years or older, to whom one or more of the following criteria applies:**

- Diarrhoeal* stools or toxic megacolon, with either a positive laboratory assay for *C. difficile* toxin A (TcdA) and/or toxin B (TcdB) in stools or a toxin-producing *C. difficile* organism detected in stool via culture or other means.
- Pseudomembranous colitis (PMC) revealed by lower gastrointestinal endoscopy.
- Colonic histopathology characteristic of *C. difficile* infection (with or without diarrhoea) on a specimen obtained during endoscopy, colectomy or autopsy.

*** Diarrhoea is defined as three or more loose/watery bowel movements (which are unusual or different for the patient) in a 24 hour period**

CASE TYPE

- **New Case of CDI:**
  - The first episode of CDI, **OR**
  - A subsequent episode of CDI with onset of symptoms **more than eight weeks** after the onset of a previous episode.

- **Recurrent Case of CDI:**
  - A patient with an episode of CDI that occurs **within eight weeks** following the onset of a previous episode **provided that CDI symptoms from the earlier episode resolved with or without therapy.**

ONSET

- **Healthcare onset** » Symptoms start during a stay in a healthcare facility.
- **Community onset** » Symptoms start in a community setting, outside healthcare facilities.
- **No information available** » If no information was available on onset of symptoms

ORIGIN

- **Healthcare-associated case.** This is a CDI patient with either:
  - Onset of symptoms at least 48 hours following admission to a healthcare facility (healthcare-onset, healthcare-associated), OR
  - With onset of symptoms in the community within four weeks following discharge from a healthcare facility (community-onset, healthcare-associated).
- **Community-associated case.** This is a CDI patient with either:
  - Onset of symptoms while outside a healthcare facility, and without discharge from a healthcare facility within the previous 12 weeks (community-onset, community-associated), OR
  - With onset of symptoms within 48 hours following admission to a healthcare facility without residence in a healthcare facility within the previous 12 weeks (healthcare-onset, community-associated).
- **Discharged 4 – 12 weeks from a healthcare facility**

»This is a CDI patient who was discharged from a healthcare facility between four and 12 weeks before the onset of symptoms.

- **No information available**

SEVERE CDI Case

This is a CDI patient to whom any of the following criteria apply:

- Admission to an intensive care unit for treatment of CDI or its complications (e.g., for shock requiring vasopressor therapy)
- Surgery (colectomy) for toxic megacolon, perforation or refractory colitis
- Death within 30 days after diagnosis if CDI is either the primary or a contributive cause