Enhanced Surveillance of *Clostridioides (Clostridium) difficile* Infection in Ireland: Q4 2023 National Report

Executive Summary

- This report includes enhanced surveillance of *C. difficile* infection (CDI) in Ireland for Q3 and Q4 2022 with a focus on Q4 2023, compared with Q4 2022, in the executive summary. This report compares these quarters in Table 1 and Figure 1
- During Q4 2023, a total of 582 cases of CDI were reported to the enhanced surveillance scheme, with 59 of the 61[1] acute Irish public and private hospitals now participating.
- The national overall rate of CDI in hospitalised patients in Q4 2023 was 4.1 cases per 10,000 bed days used (BDU) [444 cases], which is higher to that reported for Q4 2022 [315 cases; rate = 3.4]
- There were 272 cases of CDI deemed to be hospital-acquired (HA-CDI), of which 246 were new, representing a national HA-CDI rate of 2.2 [median rate = 1.2]
- With regard to acquisition, while *C. difficile* was mostly associated with acute hospitals (272; 47%), there were many cases associated with the community (191; 33%) and long-term care facilities (15; 5%)
- CDI symptom onset occurred in the community for 45% of all cases (n=259):
    - 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.
- Whole genome sequencing was performed at the Irish *C. difficile* National Reference Laboratory (NRL) on isolates during Q3 and Q4 2023. ST8 (12%) ST11 (10%) and ST2 (10%) were most frequently reported with 110 clusters notified.
- Ribotyping data was available for 8% (n=40) of cases in Q4, with ribotypes 002 and 078 cases (each 10%) the most frequently reported.

[1] Data for Q3 and Q4 2023 was not returned by one general hospital from HSE regional area F due to resource constraints

Part 1: National CDI Epidemiology Q4 2023

CDI data was reported to the enhanced surveillance programme from 59[2] of the 61 participating acute public and private hospitals across Ireland (***Appendix A***). There were 582 reported CDI cases in patients aged ≥2 years. Of those, 444 were reported in hospitalised patients, giving a national CDI rate in hospitalised patients of 4.1 cases per 10,000 bed days used (BDU), which is higher to that reported for Q4 2022 [315 cases; rate 3.4]. The majority were aged ≥65 years (66%) and were female (58%). ***Table 1*** displays the breakdown of all CDI cases for Q4 2023 compared with Q4 2022 case data, by case type, origin, onset and severity. In Q4 2023, 17 cases (3%) of severe CDI were reported, defined as requiring critical care admission or colectomy due to complications of CDI in ***Table 2***, with 10 cases (2%) for Q4 2022. Two cases required both colectomy and critical care admission; two cases required colectomy and 13 other cases required critical care admission. CDI case definitions are summarised in ***Appendix B***

CDI Case Type

The majority were categorised as new infections (85%), with 8% recurrent and for 7%, the CDI case type was unknown.

CDI Origin

The majority were categorised as healthcare-associated (HCA) CDI [n=317; 54%], with community-associated (CA) CDI accounting for 33% [n=191]. Of the community-associated cases, eight cases (4%) 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; 5%] or was unknown [n=42; 7%]. Of the 317 HCA-CDI cases, the origin was the reporting hospital, termed hospital-acquired (HA) for 272 (86%), a LTCF for 15 (5%) and 'other' or 'unknown healthcare facility' for 29 (9%) cases.

CDI Onset

Patient locations at onset of CDI symptoms included; while admitted to a healthcare facility, termed healthcare-onset (HO) for 290 cases (50%), while residing in the community, termed community-onset (CO) for 259 cases (45%), and unknown patient location for 33 cases (6%). Of 290 HO CDI cases, the reporting hospital was the onset location for 252 (87%), a LTCF for 19 (7%), other healthcare facilities for 10 (3%) and unknown healthcare location for six cases (2%).

[2] Data for Q3&Q4 2023 was not returned by one general hospital from HSE regional area F due to resource constraints

Table 1. National CDI epidemiology: Q3&Q4 2022 versus Q3&Q4 2023

	2022 Q3		2022 Q4		2023 Q3		2023 Q4	
	n	%	n	%	n	%	n	%
Total reported cases	**450**	-	**406**	-	**533**	-	**582**	-
CDI Case Type								
– New	395	*88%*	347	*85%*	444	*83%*	496	*85%*
– Recurrent	40	*9%*	41	*10%*	51	*10%*	45	*8%*
– Unknown	15	*3%*	18	*4%*	38	*7%*	41	*7%*
CDI Origin								
– Healthcare-associated (HCA)	**254**	***56%***	**229**	***56%***	**304**	***57%***	**317**	***54%***
Reporting hospital	209	*82%*	194	*85%*	241	*79%*	272	*86%*
Long term care facility	22	*9%*	12	*5%*	25	*8%*	15	*5%*
Other healthcare facility	21	*8%*	16	*7%*	34	*11%*	20	*6%*
Unknown healthcare facility	2	*1%*	7	*3%*	4	*1%*	9	*3%*
– Community associated (CA)	**147**	***33%***	**141**	***35%***	**150**	***28%***	**191**	***33%***
Ambulatory care*	7	*5%*	7	*5%*	8	*5%*	8	*4%*
– Discharged 4 – 12 weeks from HCF	**37**	***8%***	**24**	***6%***	**52**	***10%***	**32**	***5%***
– Unknown origin	**12**	***3%***	**12**	***3%***	**27**	***5%***	**42**	***7%***
CDI Onset								
– Healthcare onset (HO)	**227**	***50%***	**225**	***55%***	**280**	***53%***	**290**	***50%***
Reporting hospital	186	*82%*	189	*84%*	224	*80%*	252	*87%*
Long term care facility	26	*11%*	14	*6%*	23	*8%*	19	*7%*
Other healthcare facility	11	*5%*	18	*8%*	25	*9%*	10	*3%*
Unknown location	4	*2%*	4	*2%*	8	*3%*	6	*2%*
– Community onset (CO)	**216**	***48%***	**177**	***44%***	**237**	***44%***	**259**	***45%***
– Unknown onset location	**7**	***2%***	**4**	***1%***	**16**	***3%***	**33**	***6%***
CDI Severity								
Critical care admission or colectomy	10	*2%*	10	*2%*	17	*3%*	17	*3%*

*8 community-acquired cases received ambulatory care in Q3 2023 which was described as: Nephrology/Dialysis (n=1); Oncology (n=3) Haematology/Oncology (n=1); Cardiology (n=1) , Medical OPD (n=2). 8 community-acquired cases received ambulatory care in Q4 2023 which included Oncology (n=4); Haematology/Oncology (n=3);Haematology (n=1).

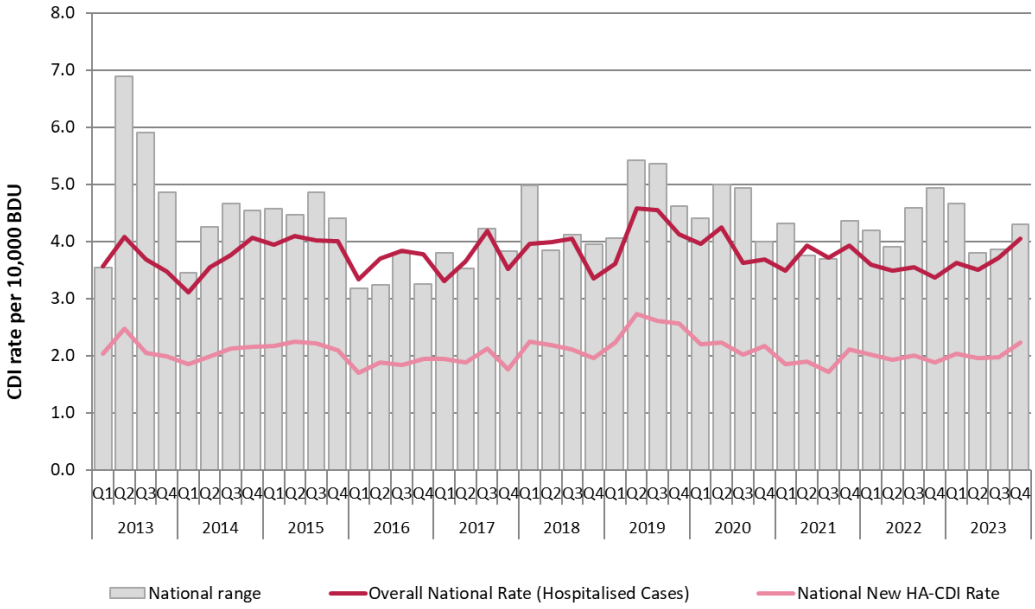
Table 2. Severity of illness: Q4 2023

		ICU Admission			Total
		Yes	No	Unknown	
Surgery (Colectomy)	Yes	2	2	-	**4**
	No	10	484	1	**495**
	Unknown	3	30	50	**83**
	Total	**15**	**516**	**51**	**582**

Part 2: Hospital-acquired CDI (HA-CDI) Epidemiology – Q4 2023

Data on HA-CDI was reported from 59[3] of the 61 acute public and private hospitals across Ireland. There were 272 HA-CDI cases in patients aged ≥2 years during Q4 2023. Of those, 246 were new HA-CDI cases, representing a national new HA-CDI rate of 2.2 [median rate = 1.2], similar than that reported for Q4 2022 [176 cases; rate = 1.9; median rate = 1.0]. ***Figure 1*** displays quarterly HA-CDI rates since 2013 and ***Table 3*** displays quarterly HA-CDI data from 2021 to 2023.

Figure 1. Quarterly national HA-CDI rates: 2013 – 2023



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 272 HA-CDI cases were categorised as new infections (246; 90%), with 22 (8%) recurrent cases and for four cases (2%) 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 290 cases (50%) and while residing in the community, termed community-onset (CO) for 259 cases (45%).

Of 290 HO-CDI cases, the reporting hospital was the onset location for 252 cases (87%), a LTCF for nineteen cases (7%), other healthcare facility for ten cases (3%) and location was unknown for six cases (2%).

[3] Data for Q3& Q4 2023 was not returned by one general hospital from HSE regional area F due to resource constraints

Table 3. Quarterly HA-CDI data: 2021 – 2023

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
2022Q1	57[f]	191	22	2	**215**	2.0	0 - 4.2	1.3
2022Q2	60	200	18	3	**221**	1.9	0 - 3.9	1.2
2022Q3	55[g]	192	17	0	**209**	2.0	0 - 4.6	1.1
2022Q4	53[h]	176	18	0	**194**	1.9	0 - 4.9	1.0
2023Q1	59[i]	212	14	2	**228**	2	0 - 4.7	1.4
2023Q2	60	213	14	4	**231**	2	0 - 3.8	1.3
2023Q3	59	214	24	3	**241**	2.0	0 - 3.9	0.9
2023Q4	59	246	22	4	**272**	2.2	0 - 4.3	1.2

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
g Data for Q3 2022 was not available from one tertiary hospital on behalf of five participating hospitals (one tertiary, three general and one specialist hospital) from HSE regional health Area C
h In Q4 2022, the Rotunda Hospital has joined, bringing the total number of participating hospitals to 61. Data for Q4 2022 was not returned by eight hospitals: two tertiary, four general and one specialist hospital in HSE regional Area C and one private hospital in Area F
i Data for Q1 2023 was not returned by one tertiary hospital from HSE regional Area D and one general hospital from HSE regional Area F
Data for Q3& Q4 2023 are provisional.

Part 3: *C. difficile* Testing Methods – Q4 2023

All 59 hospitals participating in the enhanced CDI surveillance system during Q4 2023 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=52;88%) or a single-step method using molecular polymerase chain reaction (PCR) test for *C. difficile* toxin gene (n=7;12%), as displayed in ***Table 4***, along with stratification by hospital type.

Table 4. *C. difficile* testing methods utilised in Q4 2023, by hospital type.

Test Category	Hospital Type				Total
	General	Private	Specialist	Tertiary	
1 STEP: PCR for *C difficile* toxin gene	2	–	4	1	**7**
2 STEP: GDH AND Toxin EIA	–	2	–	–	**2**
2 STEP: GDH AND TOXIN EIA with TOXIN PCR confirmation	5	7	1	–	**13**
2 STEP: GDH EIA AND Toxin PCR	3	–	–	–	**3**
2 STEP: PCR followed by confirmatory EIA toxn	15	3	8	8	**34**
Total	**25**	**12**	**13**	**9**	**59**

Part 4: *C. difficile* Irish National Reference Laboratory (NRL) Genomic Sequence results – Q3 & Q4 2023

1. Whole-genome sequencing profile of *C. difficile* isolates matched with HPSC enhanced surveillance data.

The NRL received 236 *C. difficile* isolates in Q3 2023 and 236 *C. difficile* isolates in Q4 2023 (total n=472) spanning 22 hospitals nationally out of which 343 (73%) matched with the enhanced surveillance programme at the HPSC as displayed in ***Table 5***. (Please note not all isolates sent to NRL are notifiable CDI cases, isolates can be sent for epidemiological studies, further investigation and so forth. Reason for typing is not currently recorded).

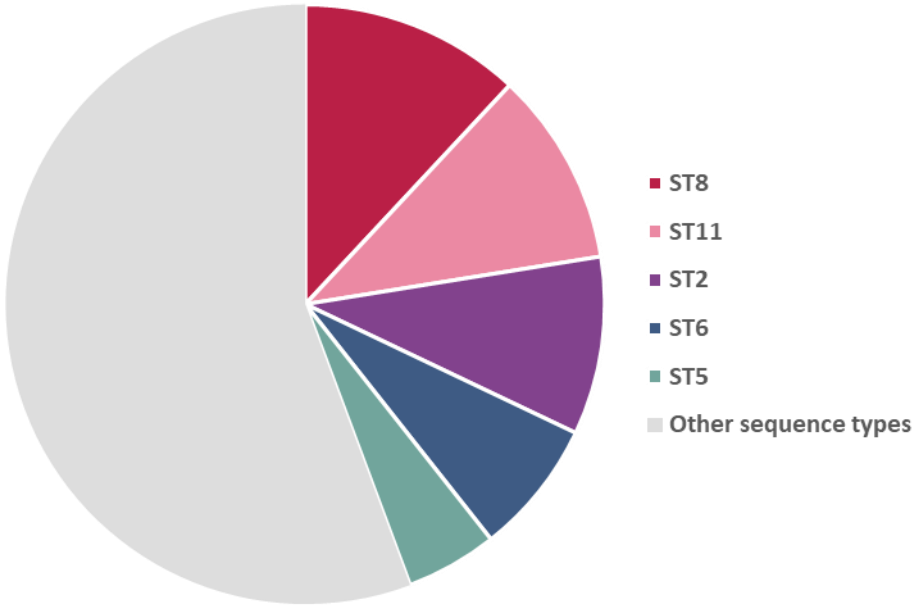
Of these 343 cases, the majority (94%; n=324) were new infections. A high proportion (69%; n=238) had an origin associated with a healthcare facility and 21% (n=73) were associated with infection in the community.

Table 5. *C. difficile* genotypic profile of most frequent whole-genome sequence types by epidemiological variables for matched CDI cases (Source: HPSC enhanced surveillance & NRL whole genome sequencing results; n=343), Q3 & Q4 2023

	Total cases		ST8		ST11		ST2	
	n	%	n	%	n	%	n	%
Total reported cases with sequence typing	**343**	-	41	*12%*	36	*10%*	33	*10%*
CDI toxin genotype								
***tcdA* positive**	283	*83%*	34	*83%*	36	*100%*	21	*64%*
***tcdB* positive**	340	*99%*	41	*100%*	36	*100%*	33	*100%*
***tcdC* positive**	285	*83%*	41	*100%*	0	*0%*	32	*97%*
***cdtA/cdtB* positive**	61	*18%*	0	*0%*	36	*100%*	0	*0%*
CDI cases identified as part of clusters	188	*55%*	29	*71%*	29	*81%*	18	*55%*
CDI Case Type								
– New	324	*94%*	38	*93%*	33	*92%*	31	*94%*
– Recurrent	16	*5%*	2	*5%*	3	*8%*	2	*6%*
– Unknown	3	*1%*	1	*2%*	0	*0%*	-	-
CDI Origin								
– Healthcare-associated (HCA)	238	*69%*	34	*83%*	25	*69%*	20	*61%*
– Community associated (CA)	73	*21%*	4	*10%*	3	*8%*	9	*27%*
– Discharged 4-12 weeks from HCF	28	*8%*	1	*2%*	8	*22%*	3	*9%*
– Unknown	4	*1%*	2	*5%*	-	-	1	*3%*
CDI Severity								
Critical care admission or colectomy	9	*3%*	1	*2%*	1	*3%*	1	*3%*

A total of 52 different sequence types (Jolley *et. al.,* 2018) were detected for the matched isolates – see ***Figure 2***. ST8 (12% of matched isolates), ST11 (10%) and ST2 (10%) were the most frequently detected sequence types.

Figure 2. Most frequently detected *C. difficile* sequence types of matched cases, Q3& Q4 2023 (Source: NRL)



For genomic data, please refer to the Public Health Laboratory website, for the C. difficile 2023 NRL annual report.

Ribotyping of *C. difficile* infection cases, Q2 2023 (accessed in the UK)

Ribotyping data was available for 8% (n=40) cases in Q3 2023 and 5% (n=30) cases reported to the CDI enhanced surveillance scheme. Ribotypes 002 (10%) and 078 (10% of ribotyped cases reported) were the most frequently reported. This decrease in ribotyping data reported corresponded to an increase in whole genome sequence typing reported directly to the enhanced surveillance scheme, 73% (n=171) in Q3 2023, 73% (n=172) in Q4 2023, corresponding to 73% (n=343) for both quarters when combined

In total, 353 (32%) specimens from reported CDI cases in Q3 2023 and Q4 2023 combined have undergone at least one genomic typing method (n=70 cases with ribotyping; 343 with sequence typing; 60 with both methods). As WGS & ribotyping are not directly comparable and cgMLST WGS is a more discriminatory molecular typing tool, it is now preferable that all Irish *C.difficile* isolates are characterised using the WGS platform at the NRL for improved integration with the national enhanced surveillance data.

The continued development of this Irish national reference laboratory service will add significantly to the understanding of the epidemiology of this significant infection and ultimately influence its control and preventative actions, 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 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
	Rotunda Hospital Dublin	Specialist	-	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