# 9.1.0 Healthcare-associated infections (HCAI)

## Key Points

- Prior to 2012, only new cases of *Clostridium difficile* infection (CDI) were notifiable. Effective 1st January 2012, recurrent CDI cases also became notifiable
- In 2012, 1,830 cases of CDI were notified. Of those, 1,624 (89%) were classified as new, 181 (10%) as recurrent and 25 (1%) of unknown case type. This represents a national crude incidence rate of 35.4 new cases per 100,000 population, a decrease of 12% compared with notifications in 2011
- Of the 1,830 CDI cases, 1,174 (64%) were reported from patients aged 65 years or older
- The voluntary enhanced CDI surveillance scheme received information on 1,735 CDI cases [1,499 (86.4%) new, 159 (9.2%) recurrent and 77 (4.4%) of unknown case type] from 46 acute hospitals. This represents a national CDI incidence rate in 2012 of 2.7 cases per 10,000 bed days used, a decrease from 3.1 in 2011. However, caution should be taken when interpreting trends in the national CDI rates due to changes in the numbers of hospitals participating in the enhanced surveillance scheme and also due to changes in laboratory testing protocols
- The majority of CDI cases (68%) originated in a healthcare setting (acute hospital or residential institution), with 17% originating in the community
- Whilst the majority of patients experienced CDI symptom onset in healthcare facilities (64%), 30% had symptom onset in the community
- Of 294 *C. difficile* isolates with available ribotyping data (17% of all cases) that were reported from 14 hospitals, the most frequent ribotypes reported were: 078 (n=26; 13%), 014 (n=23; 11%), 005 (n=21; 10%), 002 and 015 (n=17 each; 8%)

## 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 2012, 1,830 cases of CDI were notified to Public Health Departments via the Computerised Infectious Diseases Reporting (CIDR) system. Of those, 1,624 (89%) were classified as new, 181 (10%) as recurrent and 25 (1%) of unknown case type. All cases were laboratory-confirmed. **Table 1** displays the number and crude incidence rate (CIR) of CDI notifications nationally and by public health region.

The national CIR of new CDI cases in 2012 was 35.4 per 100,000 population. This reflects a decrease of 12% from 40.3 per 100,000 population in 2011. Taking both new and recurrent cases into account, the overall CIR for 2012 was 39.9 per 100,000 population. Variation was observed in the incidence of CDI by public health

*Table 1. Number of CDI cases (both new and recurrent) notified in 2012, CDI CIR, by public health region and overall new CDI notifications with CIR for 2011 and 2012 (Source: CIDR)*

| Public Health Region | No. of cases | *CIR incl. 95% C.I. |
|---|---|---|
| East | 941 | 58.1 (47.9 - 54.9) |
| Midlands | 48 | 17 (10.6 - 19.8) |
| Mid West | 163 | 43 (27.4 - 39) |
| North East | 89 | 20.2 (12.4 - 19.8) |
| North West | 65 | 25.2 (15.3 - 26.5) |
| South East | 188 | 28.3 (22.6 - 30.4) |
| South | 165 | 33.2 (26 - 35.8) |
| West | 171 | 38.4 (30.8 - 42) |
| Total 2012 | 1830 | 39.9 (33.6 - 37) |
| Total 2012 [NEW cases only]** | 1624 | 35.4 (33.6 - 37) |
| Total 2011 [NEW cases only]** | 1848 | 40.3 (38.5 - 42.1) |

** Crude incidence rates (CIR) calculated using 2011 census data*
*** Numbers reflect new CDI cases only. Prior to January 2012, only new cases of CDI were notifiable. As of 1st January 2012, recurrent cases also became notifiable. CIR for new cases only is provided to allow comparison with historical data.*

region. However, this most likely reflects geographical differences in the distribution of acute healthcare facilities and differences in laboratory diagnostic and reporting protocols, rather than true regional variation in CDI incidence. Identification of seasonal patterns from CIDR notification data is hindered by delayed and batched laboratory notifications.

*Figure 1 displays the gender and age breakdown of patients with CDI. The majority of patients were female (61%). The mean patient age was 67 years (range: 2 – 101 years), with 1,174 cases (64%) reported in patients aged 65 years and older.*

Regarding the patient location at the time of CDI diagnosis, the majority were classified as 'hospitalised' (73%), 13% from general practice, 4.4% from outpatients or day patients, 5.5% from the emergency department and 4% from either 'other', or 'unknown' patient location. This is similar to that reported in 2011. 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 2012, 28 deaths were reported in patients with CDI. Two deaths were reported as due to CDI, 14 were reported as not due to CDI and for the remaining 12 deaths, the contribution of CDI to death was unknown.

**Notifiable *C. difficile* infection: Outbreaks**
In 2012, seven CDI outbreaks, all healthcare-associated and involving 40 patients, were notified to Public Health Departments as displayed in **Table 2**. Five were linked to hospitals, and two to residential institutions.

*Table 2. CDI outbreaks reported in Ireland in 2012 by public health region (Source, CIDR)*

| Public Health Region | Outbreak location | Total number ill |
|---|---|---|
| East | Hospital | 6 |
| East | Hospital | 9 |
| East | Residential insitution | 4 |
| Mid West | Hospital | 6 |
| North East | Residential insitution | 2 |
| West | Hospital | 5 |
| West | Hospital | 8 |

**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 and Infectious Diseases Study Group on *C. difficile* (ESCMID-ESGCD) interim case definitions. To the end of 2012, 46 acute hospitals participated in the voluntary enhanced surveillance CDI scheme, comprising 40 public hospitals (26 general (100%), nine tertiary (100%) and five specialist hospitals (42%)) and six private hospitals (50%).

In 2012, 1,735 CDI cases were reported to the enhanced surveillance scheme (representing 83% of all the CDI cases notified to Public Health Departments via CIDR). Of these, 1,499 (86%) were classified as new, 159 (7.1%) as recurrent and 77 (4.4%) of unknown CDI case type.

Of the reported cases, 52% (n=894) originated within the reporting healthcare facility. The overall national CDI incidence rate of new and recurrent cases combined, which were acquired within the reporting healthcare facility was 2.7 cases per 10,000 bed days used (BDU), a decrease from 3.1 in 2011. The incidence rate of new CDI cases was 2.4 cases per 10,000 BDUs representing a decrease from 2.8 in 2011 while the incidence of recurrent cases remained at 0.2 cases, unchanged from 2011.

Caution should be taken when interpreting national CDI trends, particularly prior to 2012 because of:
(i) Changes in the numbers of participating hospitals as displayed in **Figure 2.** Throughout 2012, the overall number of hospitals participating in enhanced CDI surveillance stabilised. In 2012, there was complete participation in CDI enhanced surveillance by all tertiary and general hospitals

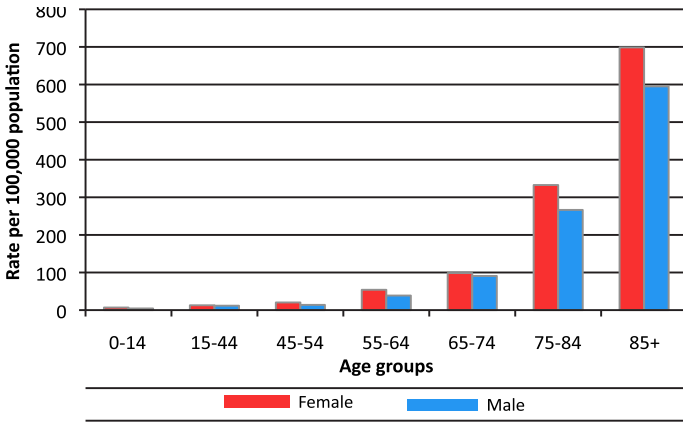


*Figure 1: Age and gender distribution of CDI in Ireland, 2012 (Source, CIDR)*

** Rates calculated using 2011 census data*

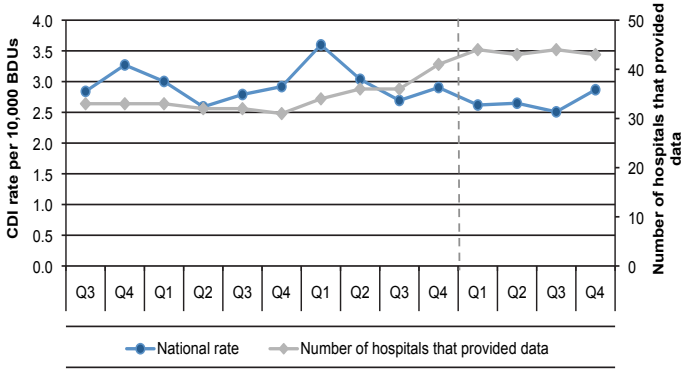


*Figure 2. Quarterly national rate of healthcare-associated CDI (new and recurrent): 2009 – 2012.*

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

During 2012, the national CDI rate remained relatively stable as displayed in **Figure 2**. The CDI rate is based on the number of new and recurrent CDI cases that originated in the participating healthcare facility. The rate is calculated using acute public hospital activity data from the HSE Business Intelligence Unit, Corporate Planning and Corporate Performance (CPCP).
There was a wide range in the incidence of CDI among participating hospitals in 2012 (range, 0 – 6.6 cases per 10,000 BDU; median, 1.7 cases). The median incidence rate for the nine participating tertiary hospitals was higher compared to the 26 general hospitals (2.7 versus 1.9 CDI cases per 10,000 BDU). The differences in CDI median incidence rates may reflect variation between hospitals 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 2012.

There were significant changes in laboratory testing protocols for *C. difficile* between 2009 and 2011. The vertical grey dotted line (Q1 2012) reflects a time beyond which there have been fewer changes in laboratory testing.

***Severe CDI***

A severe case of CDI is defined as a patient requiring admission to an intensive care unit (ICU) for treatment of CDI or its complications, a patient requiring colectomy or 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 2012, 26 (1.5%) severe CDI cases were reported, which was similar to 2011 (1.4%). Three patients required both surgery and ICU admission, five required surgery only and 18 required ICU admission without surgery.

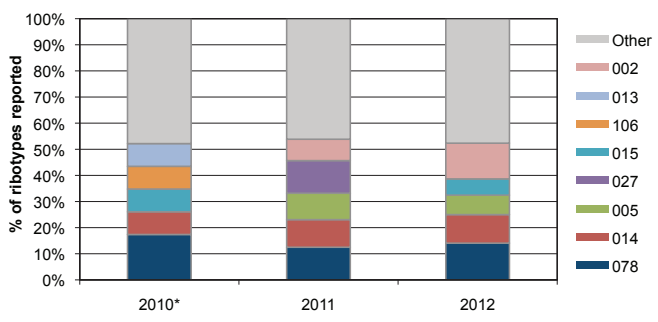


*Figure 3. Most frequently reported C. difficile ribotypes in Ireland: 2010 – 2012*

***Onset & Origin of CDI***

**Onset: Patient location when symptoms of CDI commenced**

Sixty-four percent (n=1,118) of patients had CDI symptom onset in a healthcare facility (healthcare onset), 30% (n=515) had symptom onset in the community and for 6%, location at CDI onset was unknown.

Of the 1,118 patients with healthcare onset CDI, 77% (n=859) had onset in the reporting hospital, 3% (n=39) in another hospital, 17% (n=177) in a nursing home and for the remaining 3% (n=39) onset was in another unspecified healthcare facility or of unknown location. Over the period 2010 to 2012, there was a decrease in the proportion of patients with CDI symptom onset in a healthcare facility (73% to 64%). Conversely, there was an increase in the proportion of patients with symptom onset in the community (27% to 30%) and those with unknown location of symptom onset (0 – 6%) (**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=1,174; 68%). Community-associated cases accounted for 17% (n = 303) and for 5% (n = 90) of CDI cases the origin could not be assigned as either healthcare or community-associated, as the patient had been discharged from a healthcare facility between 4 and 12 weeks prior to the CDI onset date. For the remaining 10% (n = 168) of cases the origin was unknown, an increase from 2010 (3%) and 2011 (4%).

Of the 1,174 healthcare-associated CDI cases, 76% (n=894) originated in the reporting hospital, 6% (n=71) originated in a hospital other than the reporting hospital, 15% (n=174) originated in nursing homes and 3% (n=30) originated in another unspecified healthcare facility or were of unknown origin (**Table 3**).

Of the 1,174 cases of healthcare-associated CDI:
- 90.4% (n=1,061) experienced onset of CDI symptoms at least 48 hours following admission to a healthcare facility (healthcare-onset, healthcare-associated)
- 8.8% (n=104) experienced symptom onset in the community within four weeks of discharge from a healthcare facility (community-onset, healthcare-associated)
- 0.8% (n = 9) had no information recorded on symptom onset

Of the 303 cases of community-associated CDI:
- 91% (n=275) experienced CDI symptom onset while outside a healthcare facility and without a history of discharge from a healthcare facility within the previous 12 weeks
- 8.2% (n=25) 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
- 0.8% (n = 3) had no information recorded on symptom onset

Information was captured on the location where the patient's faecal specimen was taken. The reporting hospital accounted for the majority (75%) of patient specimens (n=1,306), with 9% (n=151) taken in the GP surgery, 9% (n=156) in nursing homes and 3% (n=50) in a hospital other than the reporting hospital. For the remaining 4% (n=72) of specimens, no information was provided.

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. There was a decrease in the number of new CDI cases reported in 2012 compared to 2011. However, this may be partly due to changes in laboratory testing protocols for *C. difficile*. Please refer to section on laboratory testing of *C. difficile* in Ireland. In 2012, recurrent CDI accounted for 9% of notifications through the enhanced surveillance scheme. This reflects a small increase in recurrent CDI from 7% in 2011. Recurrent CDI may result in severe infection, places a further burden on limited hospital isolation resources and results in significant patient morbidity.

*Table 3 National CDI rates and breakdown by enhanced data types, 2010 – 2012*

| | 2010 | 2011 | 2012 |
|---|---|---|---|
| **Total CDI cases reported nationally** | **1187** | **1511** | **1735** |
| Cases known to have originated in a hospital | 726 | 862 | 894 |
| National CDI rate | 2.8 | 3.0 | 2.7 |
| National median rate | 2.3 | 2.2 | 1.7 |
| | | | |
| **Case Type** | | | |
| % New cases | 92% | 92% | 86% |
| % Recurrent cases | 8% | 7% | 9% |
| % Unknown cases | 0% | 1% | 4% |
| | | | |
| **Age/Sex** | | | |
| % >65 | 71% | 69% | 66% |
| % M | 44% | 39% | 41% |
| %F | 56% | 61% | 59% |
| | | | |
| **Origin** | | | |
| Healthcare-associated | 77% | 74% | 68% |
| Breakdown of those that were healthcare associated: | | | |
| Within reporting hospital | 80% | 78% | 76% |
| Other Hospital | 7% | 8% | 6% |
| Nursing Home/LTCF | 10% | 13% | 15% |
| Unknown | 2% | 1% | 3% |
| Community-associated | 20% | 20% | 17% |
| Discharged 4-12 wks from healthcare facility | 0% | 3% | 5% |
| Unknown | 3% | 4% | 10% |
| | | | |
| **Onset** | | | |
| Healthcare-onset | 73% | 71% | 64% |
| Breakdown of those that were healthcare-onset | | | |
| Within reporting hospital | 82% | 78% | 77% |
| Other Hospital | 5% | 6% | 3% |
| Nursing Home/LTCF | 10% | 14% | 16% |
| Unknown | 2% | 1% | 3% |
| Community-onset | 27% | 27% | 30% |
| Unknown | 0% | 2% | 6% |
| | | | |
| **Severity** | | | |
| % Severe cases | 1.4% | 1.4% | 1.5% |

Enhanced surveillance data collected since Q3 2009 indicates that CDI is not confined to healthcare settings and is increasingly common in community and nursing home settings. In 2012, 30% of all CDI cases had symptom onset in the community an increase from 27% in 2011 and 2010. In 2012, 17% of CDI cases were community-associated and 10% were associated with nursing homes, a figure which is similar to data from 2011 and 2010.

Of the 303 community-associated cases reported in 2012, 91% of those patients experienced CDI symptom onset in the community, without a history of discharge from a healthcare facility within the previous 12 weeks. It is essential that CDI is considered in the differential diagnosis of all patients presenting with diarrhoea and that specimens are sent in a timely fashion for laboratory diagnosis.

Patients with CDI in healthcare facilities must be isolated with contact precautions as outlined in national guidelines. All healthcare professionals must promote practices known to reduce the incidence of CDI including; compliance with infection prevention and control measures, awareness of local CDI surveillance data and prudent use of antimicrobials. The national guidelines for antimicrobial stewardship in hospitals in Ireland are available at: http://www.hpsc.ie/hpsc/A-Z/MicrobiologyAntimicrobialResistance/

### *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 have a national *C. difficile* reference laboratory or ribotyping service. Therefore, laboratories submit specimens abroad for ribotyping. In 2012, ribotyping data was provided for 294 *C. difficile* isolates (17% of all samples) submitted from 14 hospitals. This represents an increase from data reported in 2010 and 2011 as displayed in **Table 4**.

The most common ribotypes reported in 2012 were: 078 (n=26, 13%), 014 (n=23, 11%), 005 (n=21, 10%), 015 and 002 (both n=17, 8%). Many of these ribotypes were also reported as the five most common ribotypes in 2010 and 2011 (**Figure 3**). In 2012, one hospital reported that 75% of all *C. difficile* isolates were ribotyped. The most common ribotypes reported from that hospital correlate with the most common ribotypes reported nationally in 2012 and include: 002 (n=23, 14%), 078 and 014 (n = 16 each, 10%), 005 and 015 (n=13 each, 8%), 023 (n=5, 3%) and 027 (n=1, 1%).

*Table 4.0 Increases in the National Reporting of C. difficile ribotyping data in Ireland, 2010 - 2012*

| | 2010 | 2011 | 2012 |
|---|---|---|---|
| Total number of CDI cases reported | 1187 | 1511 | 1735 |
| Number (%) of cases with ribo-type data | 48 (4%) | 204 (14%) | 294 (17%) |
| Number of hospitals providing ribotype data | 5 | 10 | 14 |

**Laboratory Testing of *C. difficile* in Ireland**
There have been significant changes in *C. difficile* diagnostic methods in Ireland in recent years. In 2006, a laboratory survey on *C. difficile* diagnostic practices in 25 Irish microbiology laboratories reported that all 25 used an enzyme immunoassay (EIA) for toxin detection. Changes in the recommended *C. difficile* laboratory testing practice were proposed in 2009 and 2010 by the European Society for Clinical Microbiology and Infectious Diseases (ESCMID) and the United Kingdom (UK) National Health Service (NHS).

The Irish laboratory survey was repeated in 2011, with information received from 33 laboratories performing on-site testing for *C. difficile*. Over half (58%) reported having changed the *C. difficile* testing algorithm in the past two years. The majority (74%) reported that the change in testing had involved a move from a one-step to a two-step testing algorithm.

In 2012, a further survey was conducted to update information on current laboratory diagnostic methods used. Combined information from repeated surveys on laboratory testing methodologies has provided a quarterly summary of testing methods between Q1 2010 and Q4 2012 as displayed in **Figure 4.**

Over that time period, there was a large decrease in the numbers using the one step testing method (17 to 7) and contemporaneously, there was an increase in two-step testing methods, of which there are a variety in use (**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.

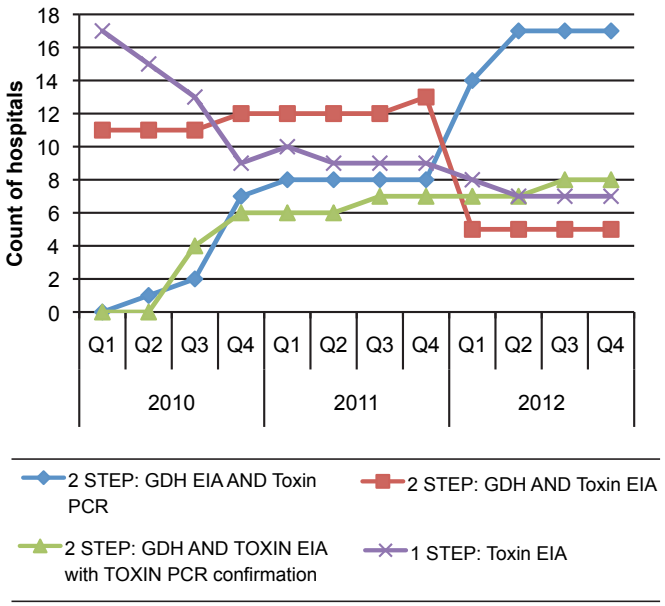


*Figure 4. Changes in C. difficile laboratory testing protocols: 2010 - 2012*

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

- **2 STEP: GDH AND TOXIN EIA** - EIA for the detection of 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 AND TOXIN EIA with TOXIN PCR confirmation** - Same as for 2 STEP: GDH AND TOXIN EIA but with the addition of a confirmatory TOXIN PCR if the first Toxin EIA is negative.

**Conclusion**
As a result of changes to the Infectious Diseases Regulations, effective January 2012, CIDR notification now includes both new and recurrent cases of CDI in their own category. 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. To maintain the quality of this information, it is important that all positive *C. difficile* laboratory results are discussed with the clinician responsible for the patient to ascertain the following information:

1. That the patient with the positive laboratory test result for *C. difficile* meets the CDI case definition – if the case definition is not met, the laboratory result is not notifiable

2. Whether the patient has previously had a positive *C. difficile* test result within the past eight weeks:
   a. If yes, and the patient's diarrhoea had resolved but has subsequently returned, this represents recurrent CDI
   b. If yes, and the patient's diarrhoea has not yet resolved, this is a repeat positive specimen from the same CDI episode

The original 2008 *C. difficile* national guideline was updated in 2012 by the Sub-Committee of the Health Protection Surveillance Centre (HPSC) and has been approved by the Scientific Advisory Committee of the HPSC in February 2013. The updated *C. difficile* guidelines may be accessed on the HPSC website at: http://www.hpsc.ie/hpsc/A-Z/Gastroenteric/Clostridiumdifficile/Publications/