HSC Public Health Agency

C. difficile surveillance

Quarterly report

January-March 2011

Key points

- CDI reports for hospital inpatients aged 65 years and over during quarter one 2011 decreased by 1% (1 episode) compared to quarter four 2010 (Figure 2a). CDI rates decreased by 2% during quarter one.
- CDI reports for community patients aged 65 years and over during quarter one 2011 increased by 15% (eight episodes) compared to quarter four 2010 (Figure 1 and Table 3).
- Total CDI reports, for hospital and community patients aged two years and over, increased by 11% during quarter one 2011 (19 episodes) (Table 4).
- CDI reports for hospital inpatients aged 65 years and over fell by 17% between the 2009/10 and 2010/11 financial years (Table 5).

Surveillance of *C. difficile* infection (CDI)

C. difficile reporting

- Reports of *C. difficile* are obtained directly from each diagnostic laboratory through the routine laboratory surveillance programme and cross-referenced with the Northern Ireland healthcare associated infections (HCAI) web-based surveillance system.
- Line listings of *C. difficile* cases are returned to the diagnostic laboratories, who confirm the totals and the breakdown of patients by source (hospital inpatient/community) according to the information provided on laboratory request forms.
- The data in this report therefore represent CDI episodes that have been validated by the diagnostic laboratories. It is possible that these numbers may change and any updates will be reflected in the next quarterly surveillance report.
- The total number of *C. difficile* episodes for hospital inpatients aged 65 years and over is included for each Health and Social Care Trust (HSCT), by financial year, in Table 5.

All CDI episodes for patients aged 65 years and over (inpatient and community)

- During quarter one 2011, 149 episodes of CDI were reported in persons aged 65 years and over compared to 142 in the previous quarter (5% increase, 7 reports; Figure 1).
- Comparing quarter one 2011 (149 episodes) to the same quarter in 2010 (144 episodes) there has been a slight increase (3%; 5 reports) in the number of CDI inpatient cases, with a larger decrease observed when compared to quarter one 2009 when 269 episodes were reported (45% decrease, 20 reports; Figure 1).
- Of these 149 episodes reported during quarter one 2011, 88 (59%) were known to have been a hospital inpatient in one of the listed hospitals (Table 3) at the time their sample was taken.
- The remaining 61 isolates were from community samples, which may include those from GPs, nursing homes and other non-acute settings. This figure represents an increase in the proportion of CDI reports from the community – 41% (61/149) reported this quarter compared to 37% (53/142 episodes) in quarter four 2010.

Inpatient CDI episodes for patients aged 65 years and over

- This quarter has seen inpatient CDI cases decrease by 1%, from 89 in quarter four to 88 (Figure 2a).
- This quarter's CDI figures for hospital inpatients aged 65 years and over are lower than those reported during the same period in previous years and are the lowest recorded for quarter one since CDI reporting began in 2005 (Figure 2b).
- For a breakdown of CDI rates by HSCT/individual hospital, see Figures 4 and 5.

Community episodes for patients aged 65 years and over

- Community episodes of CDI during quarter one 2011 (61 episodes) have increased by 15% compared to quarter four 2010 (53 episodes) (Figure 1 and Table 3).
- The number of community episodes this quarter (61) is 79% greater than the number reported for the same quarter in 2010 (34; Figure 1). Currently, community episodes are identified by the location of the patient at the time the specimen was taken. Therefore, this number may include patients who have had a recent healthcare interaction.

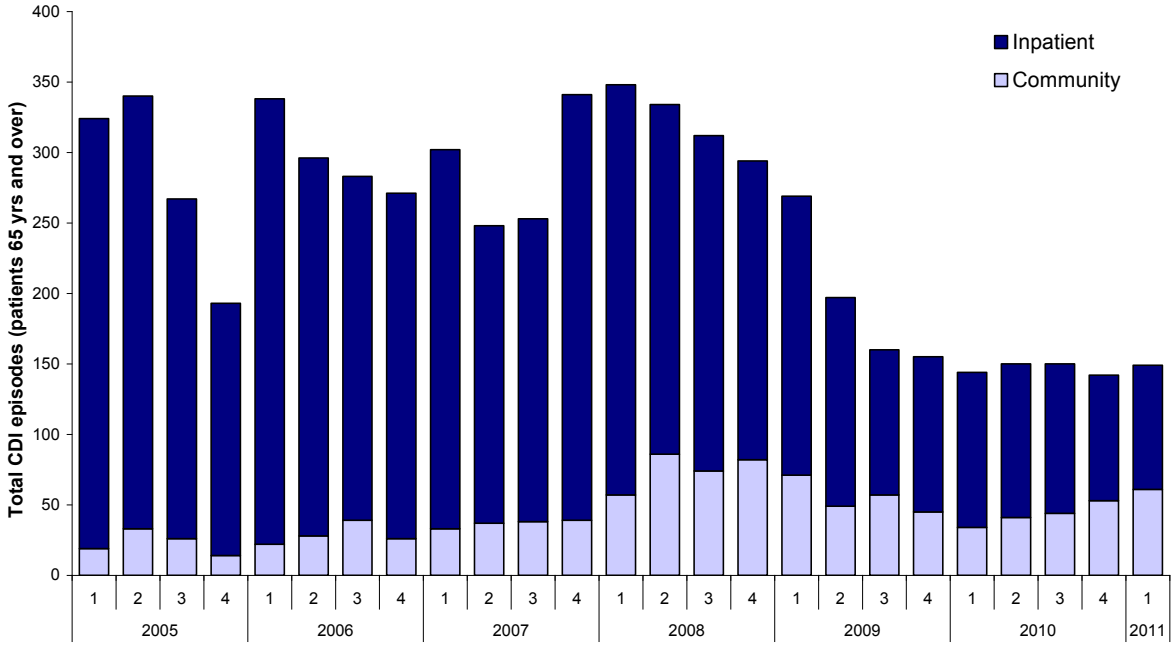


Figure 1: Total CDI reports, inpatient and community, in Northern Ireland, by quarter (patients ≥ 65 years), between 2005 and 2011

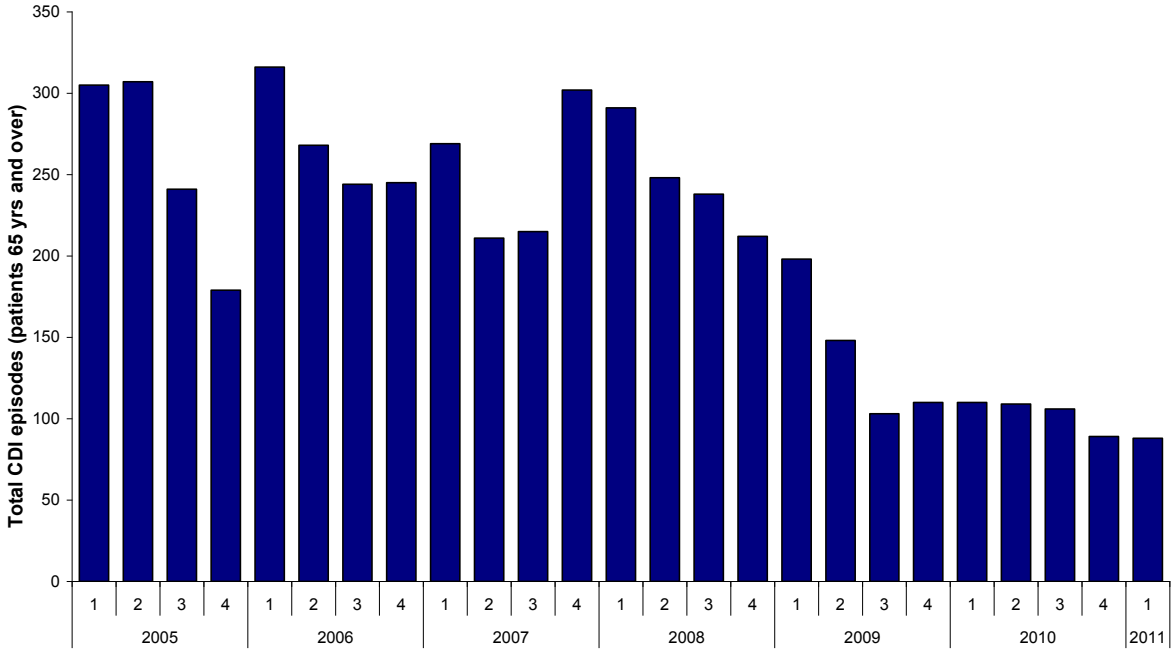


Figure 2a: Total CDI inpatient reports in Northern Ireland, by quarter (patients ≥ 65 years), between 2005 and 2011

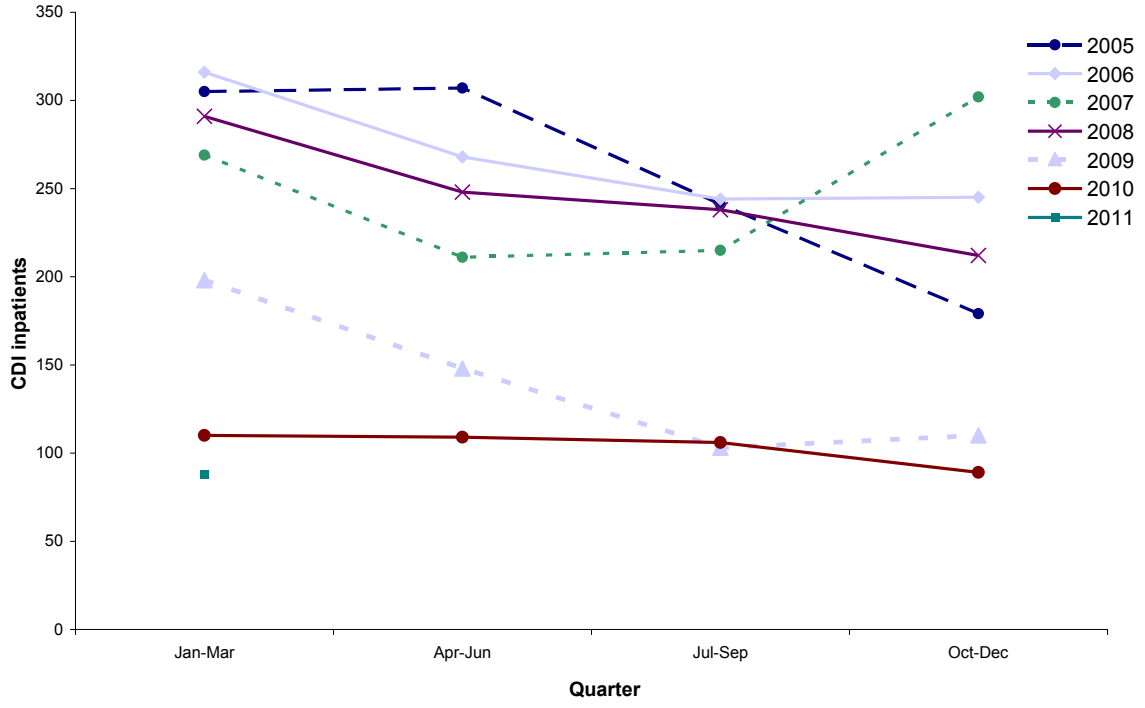


Figure 2b: Total CDI inpatient reports in Northern Ireland, by quarter (patients ≥ 65 years), between 2005 and 2011

All CDI episodes for patients aged two years and over (inpatient and community)

- During this quarter, 192 episodes of *C. difficile* infection were reported in persons aged two years and over (Table 4). This represents a 11% increase on the previous quarter (173 episodes). Of the 192 episodes, 78% were in patients aged 65 years and over (includes inpatient and community).
- In all, 123 patients were known to have been a hospital inpatient in one of the listed hospitals in Table 3 at the time their sample was taken (Figure 6). Of these 123, 72% were patients aged 65 years and over.
- The remaining 69 isolates reported in patients aged two years and over were from community samples, which may include those from GPs, nursing homes and other such non-acute settings. Of these 69, 88% occurred in patients aged 65 years and over. Currently, community isolates are identified by the location of the patient at the time the specimen was taken. Therefore, this number may include patients who have had a recent healthcare interaction.

Rates of *C. difficile* in hospital inpatients

- All HSCTs provide appropriate denominator data (bed occupancy for patients ≥ 65 years) on a regular basis, making the calculation of *C. difficile* rates possible for their constituent hospitals (Figure 5). Notes on this denominator are included in appendix C.
- To determine the rate of *C. difficile* infection in individuals aged two years and over (Figure 6), the most appropriate denominator is all age bed occupancy, determined using the KH03a return (number of occupied beds) obtained from the DHSSPS on a quarterly basis.

Clarification of episode definitions

- Due to ongoing queries regarding the assignment of CDI episodes to particular HSCTs, supplementary information on situations that may arise, and the resulting actions applied, is provided in appendix E.

Statistical process control (SPC) charts

- SPC charts allow the distinction to be made between natural variation and 'special cause variation', where something unusual may be occurring. Further details on SPC charts can be found in appendix D. Trends in CDI rates since July 2005 are shown for each HSCT in appendix B.
- In Northern Ireland this quarter, the rate of *C. difficile* patient episodes has remained below the lower action limit of the SPC chart. This indicates a significant reduction in the number of *C. difficile* patient episodes not explained by natural variation is noted among hospital inpatients aged 65 years and over (Figure 3).

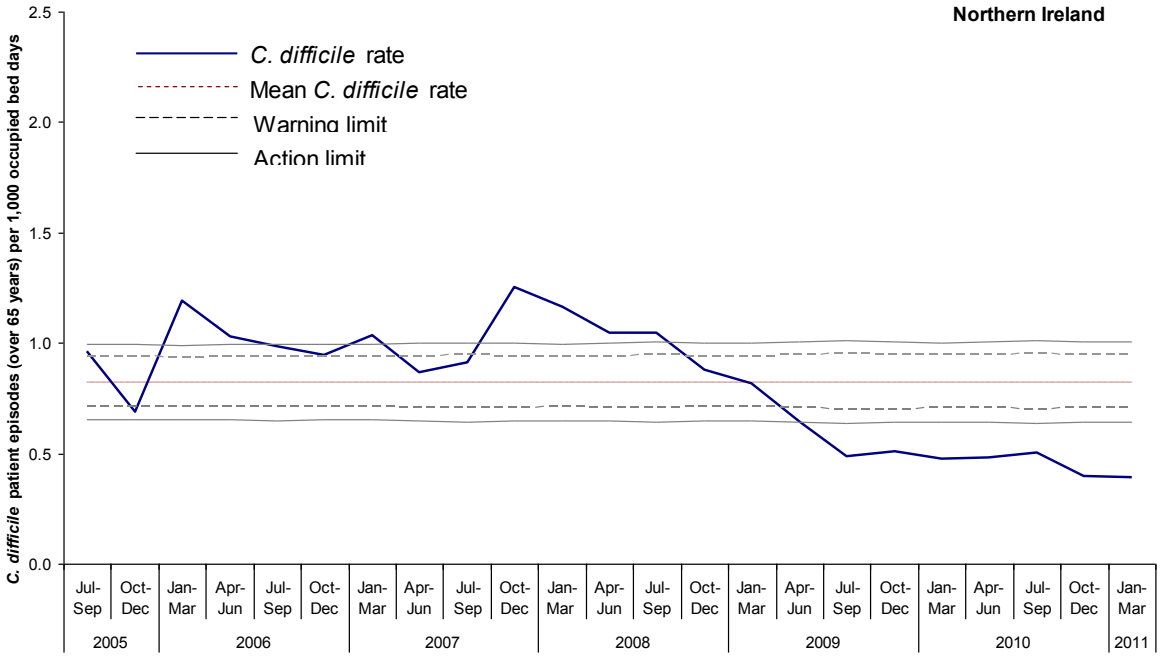


Figure 3: Statistical process control chart for quarterly *C. difficile* rates among inpatients in Northern Ireland aged 65 years and over (for HSCT level, see appendix B)

Ribotype surveillance

- On 1 April 2009, a *C. difficile* ribotyping service was established in Northern Ireland. The NI Ribotyping Service saw the integration of the Belfast HSCT laboratory service into the *Clostridium difficile* Ribotyping Network for England (CDRN).
- HSCTs are now requested to send all CDI positive isolates to the Royal Victoria laboratory, where they are recorded, cultured and ribotyped. The samples sent for ribotyping are matched against validated CDI episodes from CoSurv on a quarterly basis.
- Table 1 and 2 present validated ribotype data for Northern Ireland stratified by inpatient and community CDI episodes for quarters 2, 3, and 4 in 2010. Provisional ribotype data for quarter one 2011 are also presented.
- During quarter one 2011, the most prevalent ribotypes among CDI inpatients are 078 (17.1%), 014 (13.8%) and 002 (8.9%). The most prevalent ribotypes among community CDI cases are 078 (14.8%), 015 (4.1%) and 002 (3.3%). The proportion of ribotype 027 remains low when compared to circulating ribotypes in England, with a slight increase noted from quarter four 2010 (0.9%).
- Descriptive data for January – March 2011, summarising the age, gender, HSCT and source for the three most prevalent ribotypes from all sources, are presented in Table 3.

Table 1: A summary of *C. difficile* ribotypes in Hospital Inpatients aged 2 years and over, and the percentage of each ribotype against the overall total during each quarter, in Northern Ireland, April 2010 – March 2011

	Apr - Jun 2010		Jul - Sep 2010		Oct - Dec 2010		Jan - Mar 2011*	
Ribotype	Number	%	Number	%	Number	%	Number	%
001	12	9.0	5	3.9	7	6.2	6	4.9
002	10	7.5	16	12.4	9	8.0	11	8.9
005	6	4.5	6	4.7	11	9.7	4	3.3
014	10	7.5	12	9.3	4	3.5	17	13.8
015	8	6.0	6	4.7	6	5.3	8	6.5
023	5	3.7	4	3.1	8	7.1	0	0.0
027	3	2.2	3	2.3	2	1.8	3	2.4
078	19	14.2	10	7.8	18	15.9	21	17.1
106	1	0.7	2	1.6	2	1.8	0	0.0
Other	20	14.9	24	18.6	18	15.9	17	13.8
Not groupable**	16	11.9	14	10.9	15	13.3	13	10.6
Not on ribotype list	9	6.7	9	7.0	3	2.7	4	3.3
Not grown***	15	11.2	18	14.0	10	8.8	19	15.4
Total	**134**		**129**		**113**		**123**	

Table 2: A summary of *C. difficile* ribotypes in Community patients aged 2 years and over, and the percentage of each ribotype against the overall total during each quarter, in Northern Ireland, April 2010 – March 2011

	Apr - Jun 2010		Jul - Sep 2010		Oct - Dec 2010		Jan - Mar 2011*	
Ribotype	Number	%	Number	%	Number	%	Number	%
001	6	4.5	2	1.6	7	6.2	1	0.8
002	0	0.0	4	3.1	3	2.7	4	3.3
005	1	0.7	1	0.8	5	4.4	3	2.5
014	1	0.7	6	4.7	3	2.7	3	2.5
015	2	1.5	2	1.6	4	3.5	5	4.1
023	3	2.2	3	2.3	2	1.8	1	0.8
027	0	0.0	0	0.0	0	0.0	1	0.8
078	14	10.4	8	6.2	10	8.8	18	14.8
106	1	0.7	1	0.8	0	0.0	2	1.6
Other	7	5.2	4	3.1	10	8.8	16	13.1
Not groupable**	6	4.5	11	8.5	11	9.7	9	7.4
Not on ribotype list	3	2.2	2	1.6	0	0.0	1	0.8
Not grown***	5	3.7	8	6.2	5	4.4	5	4.1
Total	**49**		**52**		**60**		**69**	

* Figures are provisional

** 'Not groupable' ribotypes do not match existing profiles

*** 'Not grown' indicates isolates that have no ribotype information supplied, with at least six weeks since the date of the specimen

Table 3: Descriptive data for *C. difficile* ribotypes 002, 014 and 078 in Northern Ireland, January-March 2011

	002 (n=15)		014 (n=20)		078 (n=39)	
Age						
min, max	61, 94		36, 96		45, 96	
median	79		77		83	
Sex	n	%	n	%	n	%
Female	13	86.7	9	45.0	25	64.1
Male	2	13.3	11	55.0	14	35.9
Trust						
Belfast	7	46.7	9	45.0	12	30.8
Northern	5	33.3	5	25.0	14	35.9
Southern	0	0.0	2	10.0	1	2.6
South Eastern	1	6.7	3	15.0	5	12.8
Western	2	13.3	1	5.0	7	17.9
Source						
Inpatient	11	73.3	17	85.0	21	53.8
Community*	4	26.7	3	15.0	18	46.2

* Community specimens include those taken from accident and emergency, outpatients, GPs and psychiatric facilities

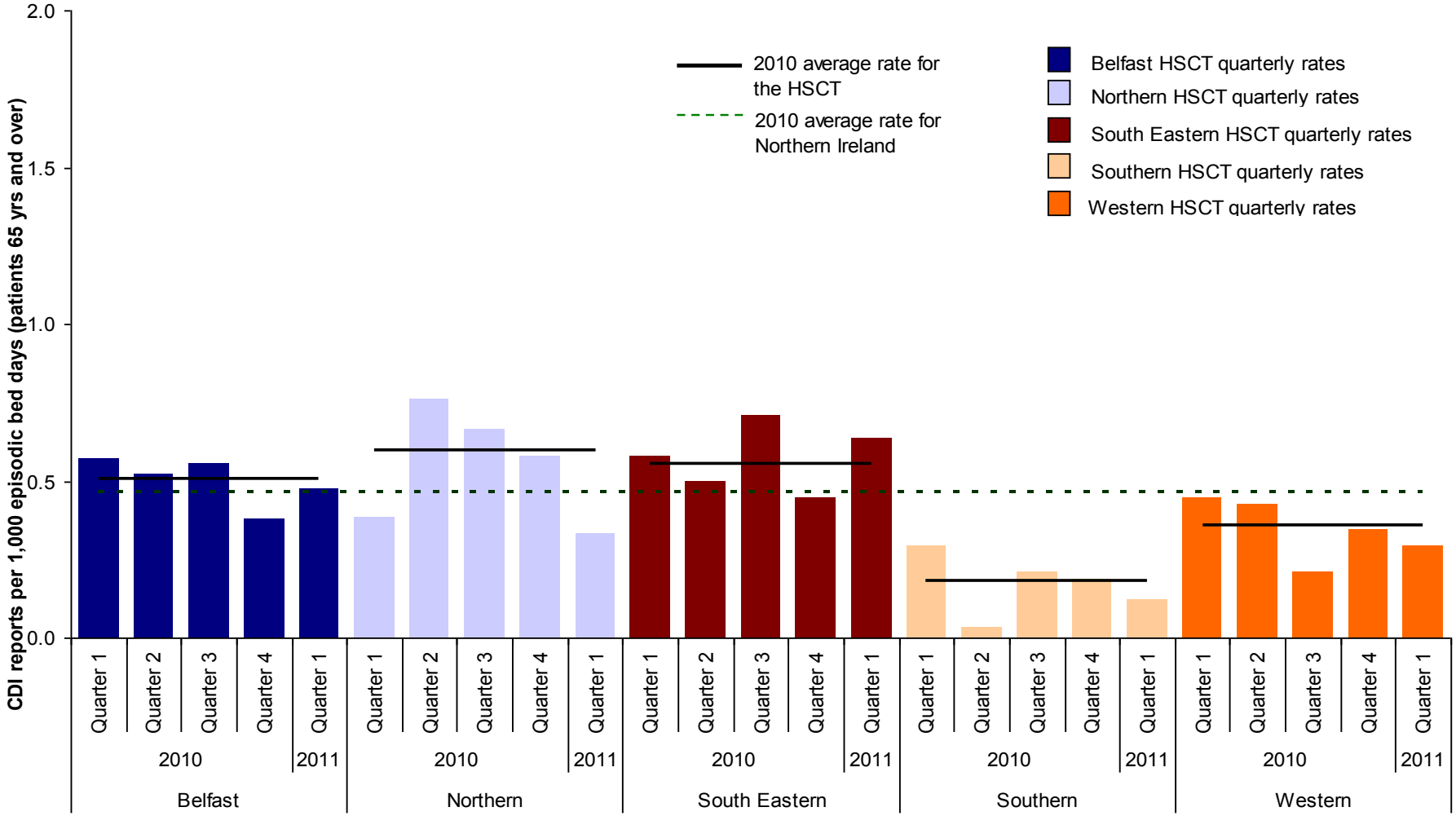


Figure 4: Quarterly rates of *C. difficile* among inpatients aged 65 years and over, by HSCT, 1 January 2010–31 March 2011, compared with annual Northern Ireland and HSCT rates for 2010

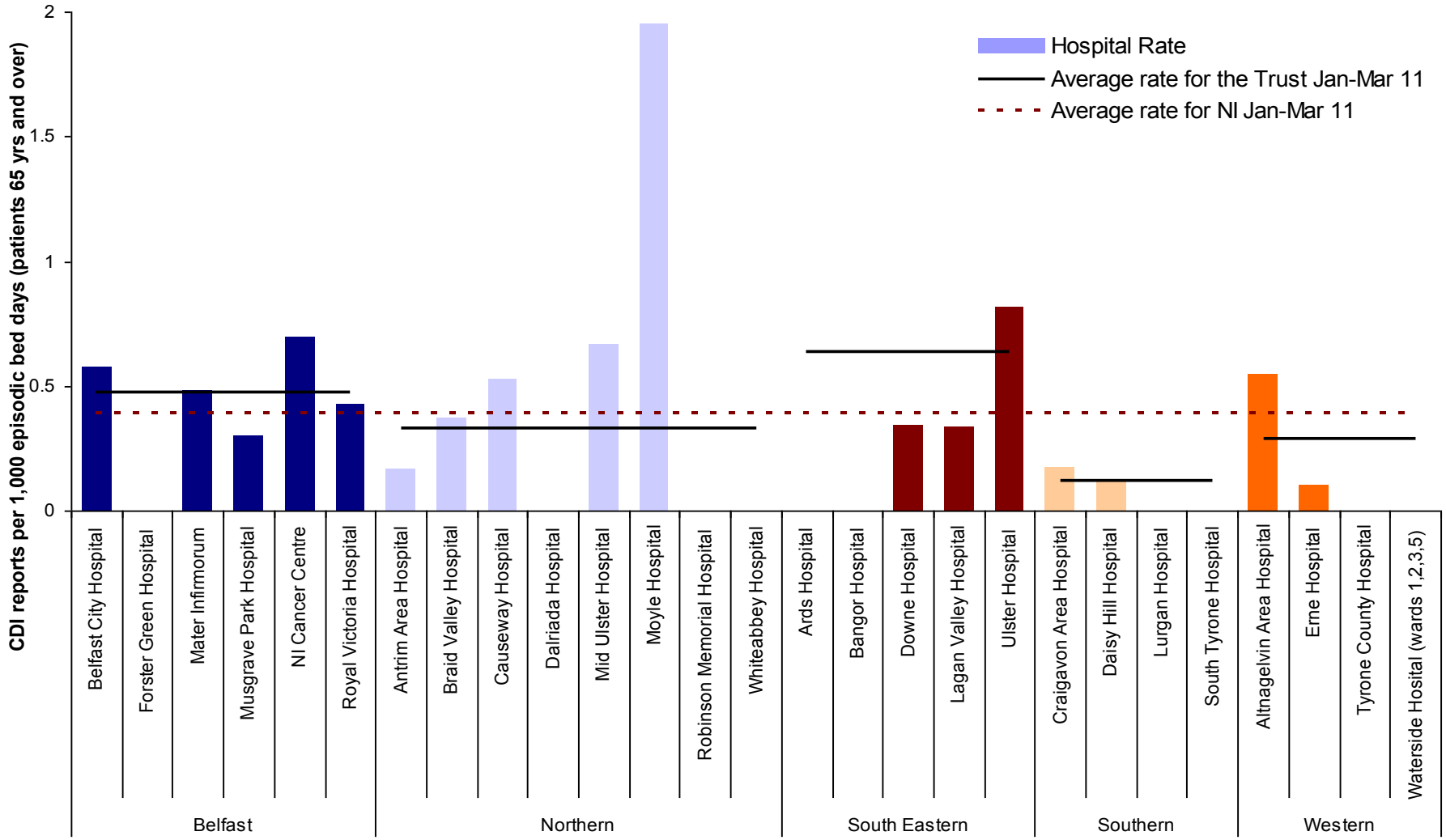


Figure 5: Rates of *C. difficile* in quarter one 2011 among inpatients aged 65 years and over, by hospital, including the quarterly HSCT rates and an average rate for Northern Ireland (see appendix A, Table 3)

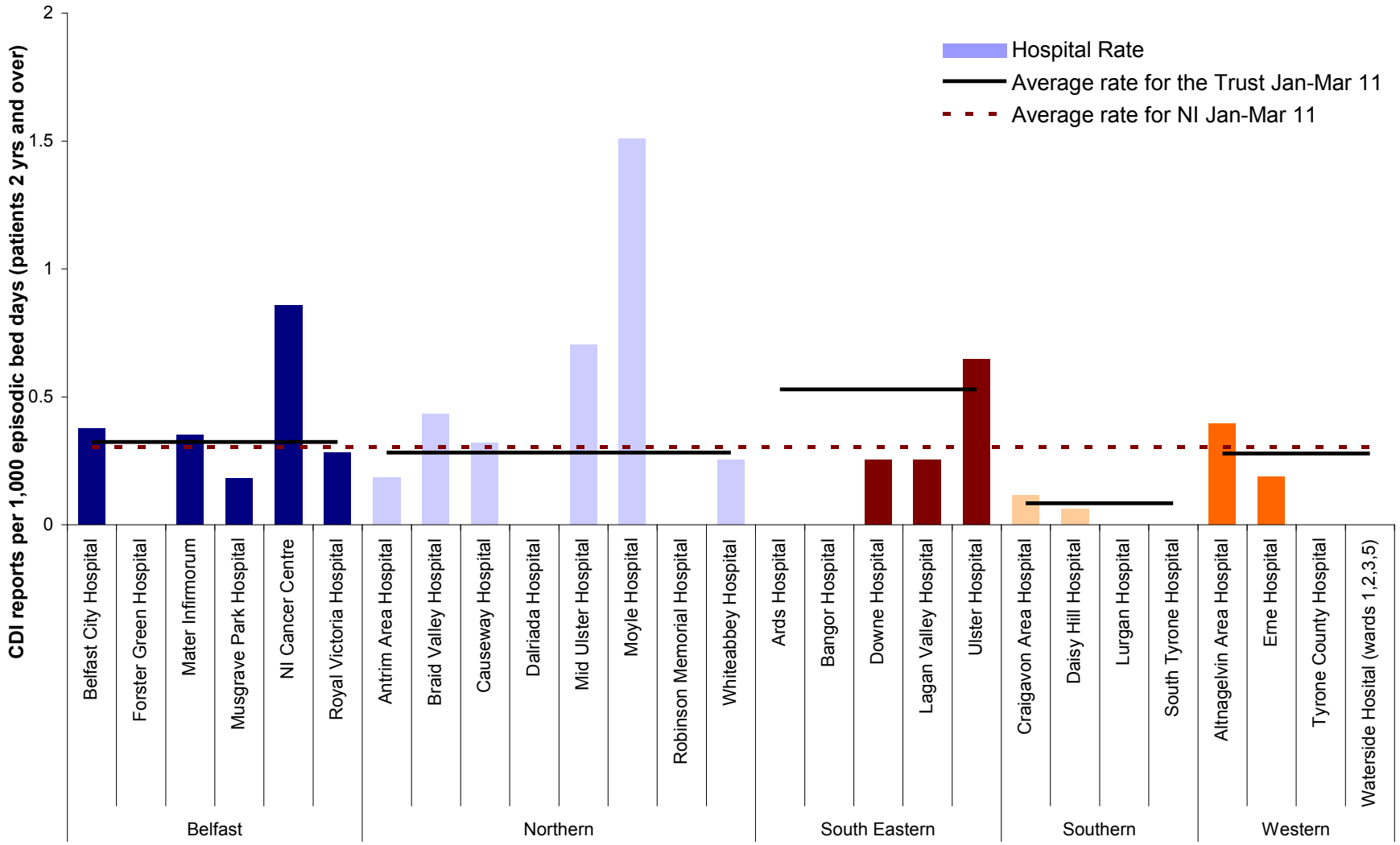


Figure 6: Rates of *C. difficile* in quarter one 2011 among inpatients aged two years and over, by hospital, including the quarterly HSCT rates and an average rate for Northern Ireland (see appendix A, Table 4)

Appendix A

Table 3: Quarterly number and rate of *C. difficile* episodes in patients aged 65 years and over, by hospital, April 2010–March 2011

Hospital	Apr-Jun 2010		Jul-Sep 2010		Oct-Dec 2010		Jan-Mar 2011	
	Episodes	Rate	Episodes	Rate	Episodes	Rate	Episodes	Rate
Belfast City Hospital	17	0.682	15	0.627	8	0.336	13	0.574
Forster Green Hospital	0	0.000	0	0.000	0	0.000	0	0.000
Mater Infirmorum	7	0.577	11	0.913	7	0.563	6	0.479
Musgrave Park Hospital	2	0.203	0	0.000	2	0.203	3	0.302
NICCO (formerly at Belvoir Park)	2	0.579	4	1.259	1	0.287	2	0.700
Royal Victoria Hospital	13	0.466	11	0.440	11	0.411	12	0.427
Belfast Health & Social Care Trust	**41**	**0.522**	**41**	**0.554**	**29**	**0.379**	**36**	**0.472**
Antrim Area Hospital	22	1.271	14	0.794	10	0.545	3	0.167
Braid Valley Hospital	0	0.000	1	0.408	1	0.408	1	0.373
Causeway Hospital	4	0.404	5	0.578	10	1.047	5	0.526
Dalriada Hospital	0	0.000	0	0.000	0	0.000	0	0.000
Mid Ulster Hospital	6	1.128	1	0.209	2	0.392	3	0.666
Moyle Hospital	0	0.000	1	0.950	0	0.000	2	1.949
Robinson Memorial Hospital	1	0.525	0	0.000	0	0.000	0	0.000
Whiteabbey Hospital	2	0.349	6	1.487	2	0.590	0	0.000
Northern Health & Social Care Trust	**35**	**0.761**	**28**	**0.666**	**25**	**0.579**	**14**	**0.329**
Ards Hospital	1	0.796	0	0.000	0	0.000	0	0.000
Bangor Hospital	0	0.000	0	0.000	0	0.000	0	0.000
Downe Hospital	1	0.314	3	0.941	2	0.690	1	0.344
Lagan Valley Hospital	2	0.363	1	0.182	1	0.172	2	0.335
Ulster Hospital	13	0.565	20	0.882	13	0.533	20	0.814
South Eastern Health & Social Care Trust	**17**	**0.495**	**24**	**0.707**	**16**	**0.447**	**23**	**0.635**
Craigavon Area Hospital	1	0.060	4	0.267	2	0.124	3	0.174
Daisy Hill Hospital	0	0.000	1	0.134	1	0.118	1	0.118
Lurgan Hospital	0	0.000	0	0.000	3	0.767	0	0.000
South Tyrone Hospital	0	0.000	1	0.363	0	0.000	0	0.000
Southern Health & Social Care Trust	**1**	**0.032**	**6**	**0.208**	**6**	**0.189**	**4**	**0.120**
Altnagelvin Area Hospital	12	0.654	4	0.236	9	0.485	10	0.544
Erne Hospital	2	0.221	3	0.352	4	0.409	1	0.101
Tyrone County Hospital	0	0.000	0	0.000	0	0.000	0	0.000
Waterside Hospital (Wards 1, 2, 3, 5)	1	0.204	0	0.000	0	0.000	0	0.000
Western Health & Social Care Trust	**15**	**0.426**	**7**	**0.213**	**13**	**0.343**	**11**	**0.290**
NI TOTAL	**109**	**0.483**	**106**	**0.501**	**89**	**0.395**	**88**	**0.389**
NI Community TOTAL	**41**	**-**	**44**	**-**	**53**	**-**	**61**	**-**

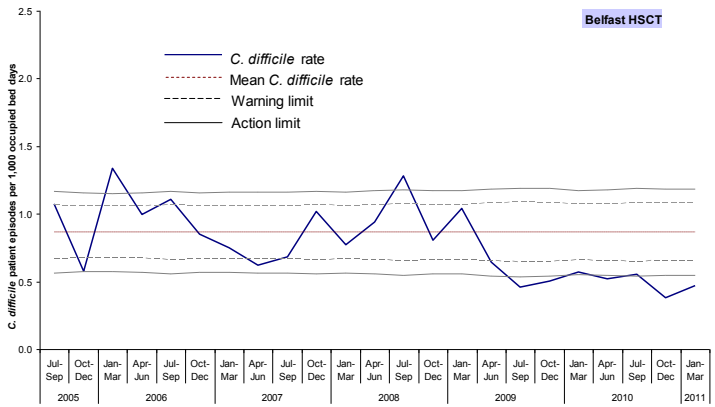
Appendix A

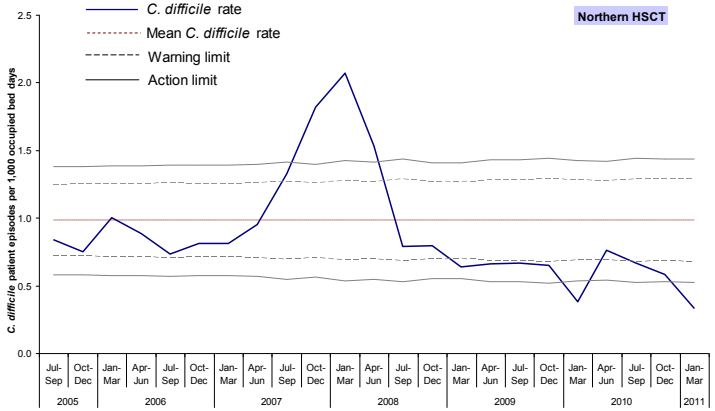
Table 4: Quarterly number and rate of *C. difficile* episodes in patients aged two years and over, by hospital, April 2010–March 2011

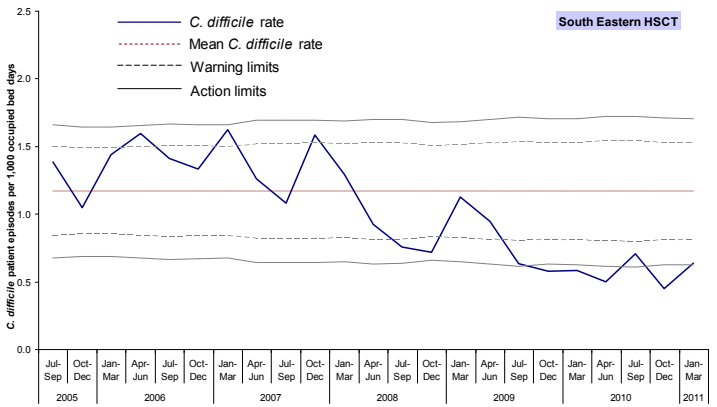
Hospital	Apr-Jun 2010		Jul-Sep 2010		Oct-Dec 2010		Jan-Mar 2011	
	Episodes	Rate	Episodes	Rate	Episodes	Rate	Episodes	Rate
Belfast City Hospital	20	0.505	20	0.522	10	0.263	14	0.375
Forster Green Hospital	0	0.000	0	0.000	0	0.000	0	0.000
Mater Infirmorum	9	0.395	11	0.478	8	0.353	8	0.351
Musgrave Park Hospital	2	0.118	1	0.062	3	0.180	3	0.180
NICCO (formerly at Belvoir Park)	2	0.304	5	0.712	3	0.500	5	0.856
Royal Victoria Hospital	18	0.266	16	0.243	20	0.296	19	0.282
Belfast Health & Social Care Trust	**51**	**0.325**	**53**	**0.348**	**44**	**0.288**	**49**	**0.323**
Antrim Area Hospital	23	0.695	17	0.513	13	0.386	7	0.183
Braid Valley Hospital	0	0.000	1	0.334	1	0.366	1	0.434
Causeway Hospital	7	0.367	5	0.259	10	0.535	6	0.320
Dalriada Hospital	0	0.000	0	0.000	0	0.000	0	0.000
Mid Ulster Hospital	6	0.928	1	0.166	2	0.333	4	0.704
Moyle Hospital	0	0.000	1	0.795	0	0.000	2	1.508
Robinson Memorial Hospital	1	0.544	0	0.000	0	0.000	0	0.000
Whiteabbey Hospital	2	0.311	6	1.416	2	0.575	1	0.253
Northern Health & Social Care Trust	**39**	**0.530**	**31**	**0.436**	**28**	**0.399**	**21**	**0.282**
Ards Hospital	1	0.686	0	0.000	0	0.000	0	0.000
Bangor Hospital	0	0.000	0	0.000	0	0.000	0	0.000
Downe Hospital	1	0.228	3	0.762	3	0.755	1	0.252
Lagan Valley Hospital	3	0.362	1	0.127	1	0.120	2	0.252
Ulster Hospital	19	0.481	22	0.554	14	0.336	27	0.646
South Eastern Health & Social Care Trust	**24**	**0.435**	**26**	**0.478**	**18**	**0.316**	**30**	**0.528**
Craigavon Area Hospital	2	0.061	4	0.127	5	0.151	4	0.115
Daisy Hill Hospital	0	0.000	1	0.069	1	0.063	1	0.061
Lurgan Hospital	0	0.000	0	0.000	3	0.625	0	0.000
South Tyrone Hospital	0	0.000	1	0.318	0	0.000	0	0.000
Southern Health & Social Care Trust	**2**	**0.035**	**6**	**0.111**	**9**	**0.157**	**5**	**0.084**
Altnagelvin Area Hospital	14	0.381	10	0.281	10	0.267	15	0.396
Erne Hospital	3	0.191	3	0.205	4	0.257	3	0.186
Tyrone County Hospital	0	0.000	0	0.000	0	0.000	0	0.000
Waterside Hospital (Wards 1, 2, 3, 5)	1	0.152	0	0.000	0	0.000	0	0.000
Western Health & Social Care Trust	**18**	**0.289**	**13**	**0.223**	**14**	**0.218**	**18**	**0.278**
NI TOTAL	**134**	**0.331**	**129**	**0.331**	**113**	**0.282**	**123**	**0.302**
NI community TOTAL	**49**	**-**	**52**	**-**	**60**	**-**	**69**	**-**

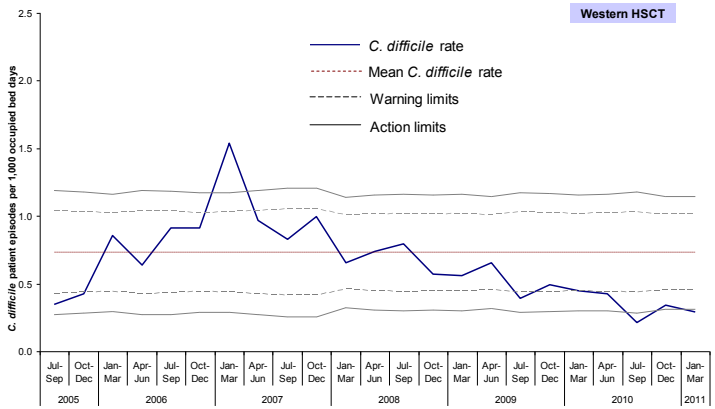
Appendix B

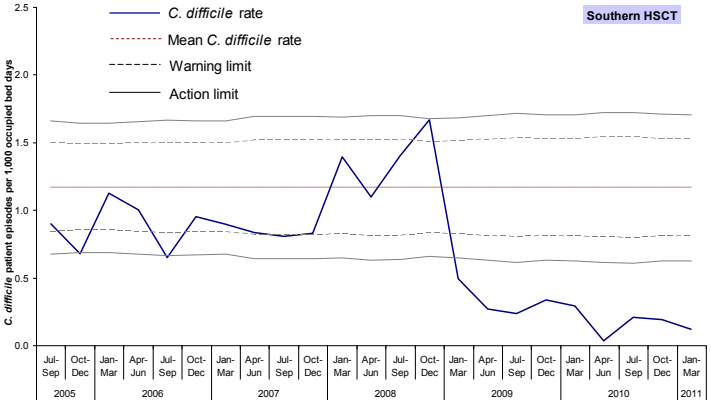
Trends in *C. difficile* rates in inpatients aged 65 years and over, by HSCT and quarter, 2005–2011











Appendix C

Notes and definitions

As of 1 April 2008, **the number of CDI patient episodes** is defined as the total number of patients aged two years and over from whom a diarrhoeal specimen tested positive for *C. difficile* toxins A and B during the relevant time period. If repeat specimens were collected from a single patient at least 28 days apart, the patient is considered to have had two episodes of CDI, counted as two patient episodes.

The **rates** described in this report are patient episodes per 1,000 occupied bed days. The denominator used for this calculation varies slightly with the different age groups. For rates of CDI in patients aged two years and over, KH03a data are used, similar to the method for *S. aureus* bacteraemia surveillance. For patients aged 65 years and over, the denominator is derived from patient episode statistics obtained from each HSCT individually on a quarterly basis. All rates have been calculated for both individual HSCTs and Northern Ireland as a whole.

The more refined the criteria for selecting patients for inclusion into the denominator, the more limitations there are on the accuracy of the data.

- The denominator supplied by each HSCT is the number of 'episodic bed days' for patients aged 65 years and over. Patient age is the age of the patient at the end of the episode and so is potentially an overestimate as patients who entered this age group during their stay would be included.

- The estimation of numbers below HSCT level, that is, on a hospital basis, is less accurate than for an entire HSCT. As with the use of age as an identifier, a patient's status and location can change during the course of an episode. In some HSCTs, there is the potential for patients to begin an episode in one hospital and be transferred to a different hospital, yet remain under the care of the same consultant. Therefore, the use of patient location at the start or end of an episode has limitations and, as such, is subject to error.

This surveillance programme started on 1 January 2005 and during that year, laboratories changed their testing methodology to conform to new national guidelines. Therefore, 2006 was the first year that all laboratories used identical testing methods and interpretation of 2005 data should be undertaken with caution. Surveillance originally focused on individuals aged 65 years and over, but this has been reviewed as of 1 April 2008 to include all patients aged two years and over.

Appendix D

Statistical process control charts

The statistical process control (SPC) chart is now commonly used for the reporting of MRSA rates throughout the UK and can be applied to *C. difficile* surveillance. SPC charts assume that rates within a HSCT will be largely similar over time. They present the occurrence of *C. difficile* in a HSCT in relation to what would be expected, based upon the mean rate for the HSCT and calculated statistical process control limits.

The mean for each HSCT has been calculated using data from all quarters since July 2005. Control limits, derived from plus or minus two or three standard deviations from the mean, represent the range of variation in rates that might be expected to occur due to chance alone.

The warning limit is set at two standard deviations from the mean, while the action limit is set at three standard deviations from the mean. The limits vary slightly every quarter because of the varying occupancy in the hospitals within each HSCT. Control limits were set up using the following formulae:

$$Warning\ Limit = M \pm 2\sqrt{\frac{Ei}{Ni^2}} \qquad Action\ Limit = M \pm 3\sqrt{\frac{Ei}{Ni^2}}$$

Where M is the mean, Ni is the number of occupied bed days per quarter and Ei is the expected number of reports calculated as $Ei = M \times Ni$

SPC charts allow the distinction to be made between natural variation and 'special cause variation', where something unusual is occurring in a HSCT. If any of the following criteria are met, there is said to be 'special cause variation', which should be investigated, as this could not statistically have occurred by chance alone:

- One value above the upper action limit, or below the lower action limit.
- Three consecutive values between the upper warning limit and upper action limit (or between lower limits).
- Eight consecutive values on the same side of the mean (either above or below).
- Any 12 of 14 consecutive values on the same side of the mean (either above or below).
- Eight consecutive values either increasing or decreasing.

Appendix E

Clarification of existing HCAI definitions

Patient transfers

A patient may be an inpatient in a healthcare facility and, at some point, may be transferred to another hospital/HSCT, symptom free. Upon admission to the second facility, if the patient develops the symptoms of *C. diff* or *S. aureus* within two days and a specimen is taken and tested at this point, the episode is attributed to the current stay, ie the receiving hospital. While the infection may have been acquired during their first hospital admission, it is the hospital where the patient is situated **at the time the specimen is taken** that must report the episode. For this reason, CDSC ensures there are caveats to state that this does not infer the patient acquired their infection in that hospital. HSCTs should be aware of such circumstances, so they are in a position to clarify any episodes that developed within two days of transfer/admission, and are therefore likely to have been acquired prior to admission to that hospital.

Patient in one hospital and, after discharge, is later admitted to another

A patient may be an inpatient in a healthcare facility and test positive for a healthcare associated infection. Once discharged, the patient may develop new symptoms and be readmitted to the same hospital or to a different hospital and be retested for *C. difficile*. If the new admission is within 28 days of the original positive specimen date, the duplicate rule applies regardless of the change of hospital and the isolate should not be reported.

Appendix F

Table 5: *C. difficile* episodes among inpatients in Northern Ireland aged 65 years and over, by financial year and HSCT

	Financial year					
HSCT	2005/06	2006/07	2007/08	2008/09	2009/10	2010/11
Belfast	352	336	280	327	163	147
Northern	184	172	297	172	102	102
South Eastern	243	256	199	135	98	80
Southern	168	130	134	164	37	17
Western	96	132	109	98	71	46
Northern Ireland	1043	1026	1019	896	471	392