

C. difficile surveillance

Quarterly report

July - September 2011

Key points

- CDI reports for hospital inpatients aged 65 years and over increased by 6% (5 episodes) during quarter three 2011 compared to quarter two. CDI rates increased by 10% during quarter three 2011.
- CDI reports for community patients aged 65 years and over decreased by 7% (3 episodes) compared to quarter two 2011.
- Total CDI reports, for hospital inpatients and community patients combined, aged two years and over, decreased by 7% this quarter (13 episodes).
- CDI reports for hospital inpatients aged 65 years and over fell by 17% between the 2009/10 and 2010/11 financial years.

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 6.

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

- During quarter three 2011, 131 episodes of CDI were reported in persons aged 65 years and over compared to 129 in the previous quarter (2% increase, 2 reports; Figure 1).
- This quarter's CDI figures are lower than those reported during the same period in previous years and are the lowest recorded for quarter three since reporting began in 2005 (Figure 1).
- Of these 131 episodes reported in quarter three 2011, 89 (68%) 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 42 isolates were from community samples, which may include those from GPs, nursing homes and other non-acute settings. 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. This figure represents a decrease in the proportion of CDI reports from the community – 32% (42/131) reported this quarter compared to 35% (45/129 episodes) in quarter two.

Inpatient episodes for patients aged 65 years and over

- This quarter has seen inpatient CDI cases increase by 6%, from 84 in quarter two 2011 to 89 this quarter (Figure 2a).
- This quarter's CDI inpatient figures are lower than those reported during the same period in previous years and are the lowest recorded since 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 this quarter (42 reports) have decreased by 7% compared to quarter two 2011 (45 reports) (Figure 1 and Table 3).
- The number of community episodes this quarter (42 reports) is lower than the number reported for the same quarter in 2010 (44 reports), in 2009 (57 reports) and in 2008 (74 reports; Figure 1). This number may include patients who have had a recent healthcare interaction.

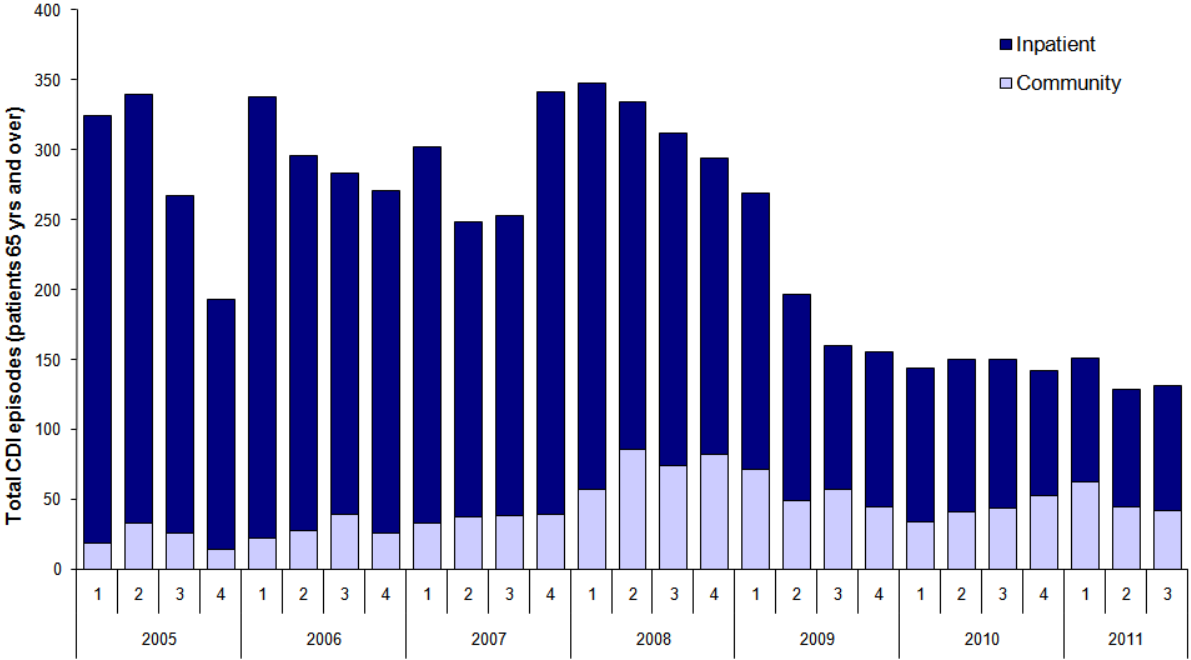


Figure 1: Total CDI reports, inpatient and community, in Northern Ireland, by quarter (patients ≥ 65 years), between 2005 and 2011

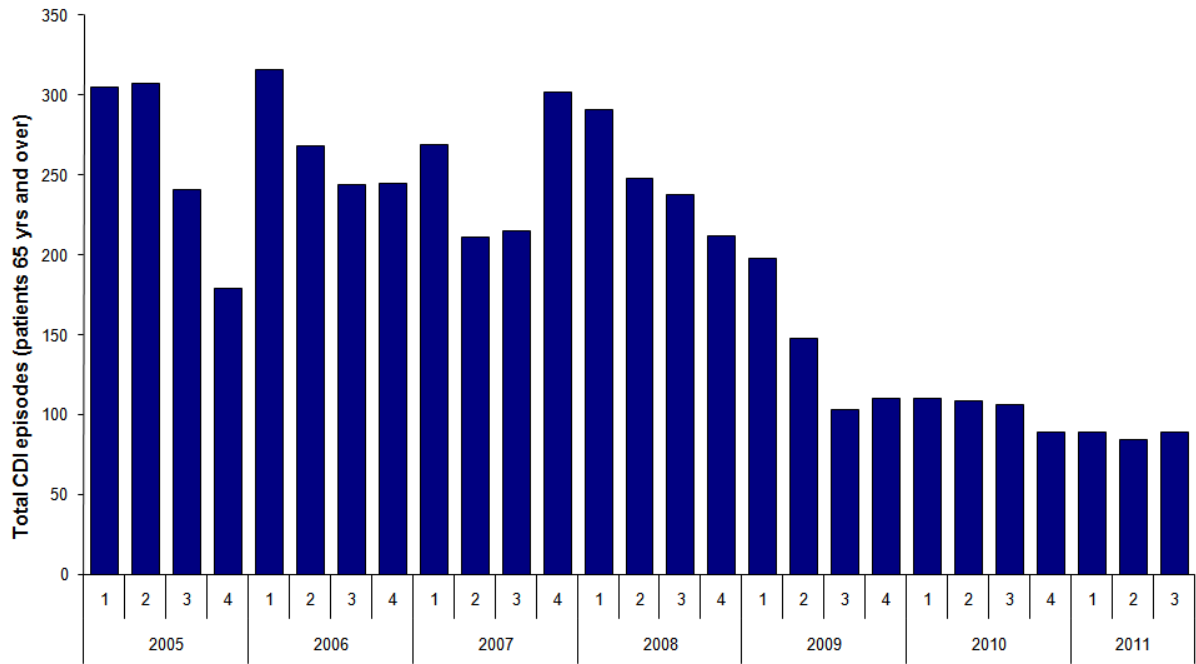


Figure 2a: Total CDI inpatient reports in Northern Ireland, by quarter (patients ≥ 65 years), between 2005 and 2011

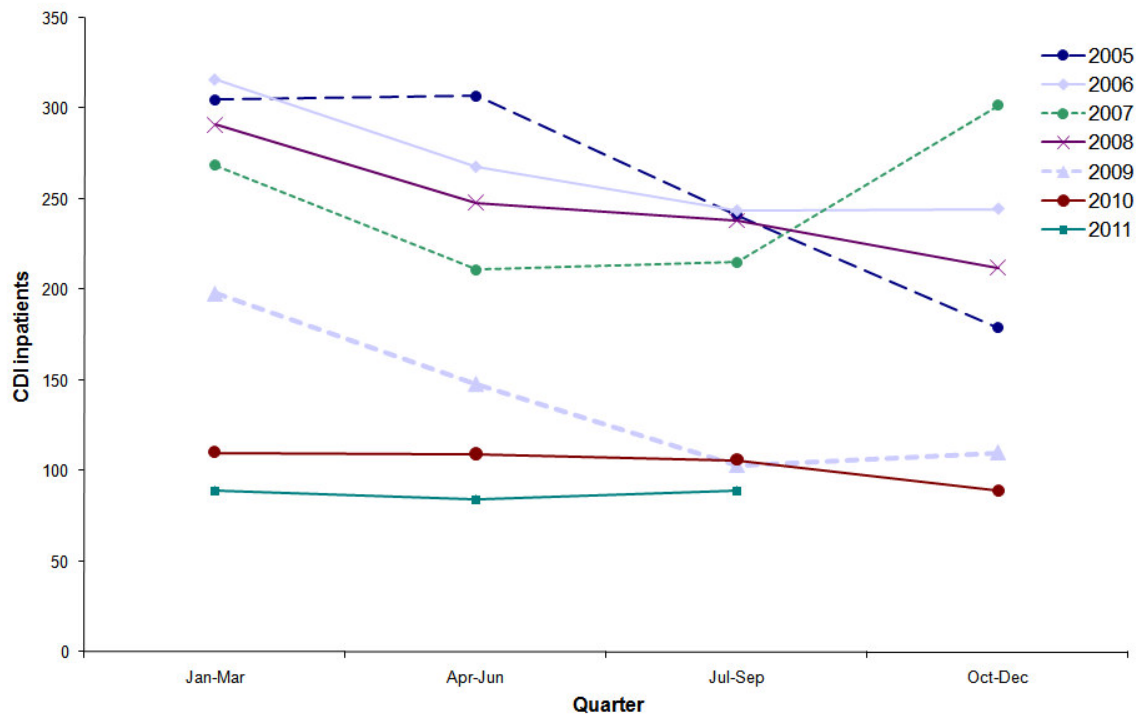


Figure 2b: Total CDI inpatient reports in Northern Ireland, by quarter (patients ≥ 65 years), between 2005 and 2011

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

- During quarter three 2011, 165 episodes of *C. difficile* infection were reported in persons aged two years and over (Table 4). This represents a 7% decrease on the previous quarter (178 episodes). Of the 165 episodes reported, 79% were reported among patients aged 65 years and over (includes inpatient and community).
- In all, 119 patients were known to have been a hospital inpatient in one of the listed hospitals in Table 5 at the time their sample was taken (Figure 6). Of these 119, 75% were patients aged 65 years and over.
- The remaining 46 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 46, 91% 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.
- KH03a bed day data was not available for the Royal Maternity Hospital; therefore, the figures used are based on an estimate generated using quarter three bed day data for this hospital from previous years. This bed day information will be updated when it becomes available.

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 a 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 that a significant reduction in the number of *C. difficile* patient episodes has occurred which may not be explained by natural variation (Figure 3).

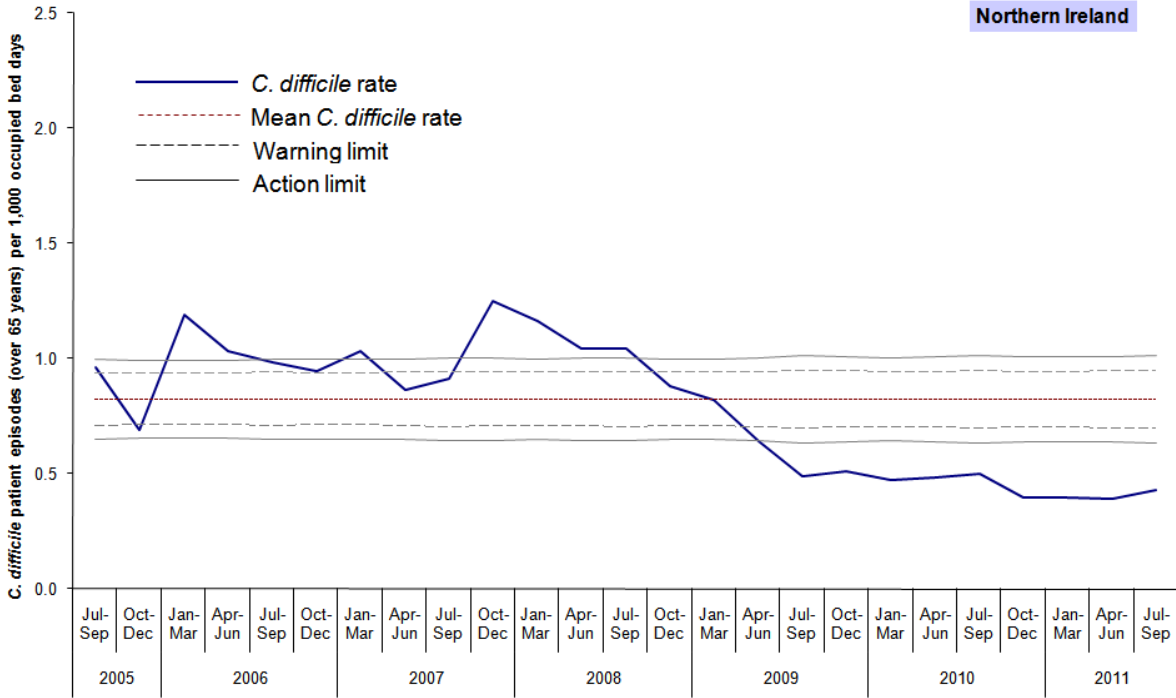


Figure 3: Statistical process control chart for quarterly *C. difficile* rates among inpatients in Northern Ireland aged 65 years and over (for HSCT level, see appendix B)

NI Ribotype Surveillance Programme

- 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.
- Tables 1 and 2 presents validated ribotype data for Northern Ireland stratified by inpatient and community CDI episodes for quarter four 2010, quarter one 2011 and quarter two 2011. Provisional ribotype data for this quarter (quarter three 2011) are also presented.
- This quarter, the most prevalent ribotypes for CDI inpatients are 078 (12.6%), 023 (8.4%) and 002 (7.6%) (Table 1) and in the community are 078 (26.1%), 020 (10.9%), 005 (8.7%) and 015 (8.7%) (Table 2). The overall proportion of ribotype 027 remains low when compared to circulating ribotypes in England, with a slight decrease noted from quarter two 2011 (0.4%) (total inpatient and community 027 cases).
- Descriptive data for July – September 2011, summarising the age, gender, HSCT and source description of 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 against the overall total, in Northern Ireland during routine surveillance, October 2010 – September 2011

Ribotype	Oct - Dec 2010		Jan - Mar 2011		Apr - Jun 2011		Jul - Sep 2011*	
	Number	%	Number	%	Number	%	Number	%
001	7	6.2	7	5.6	2	1.7	6	5.0
002	9	8.0	11	8.8	10	8.3	9	7.6
005	11	9.7	4	3.2	4	3.3	8	6.7
014	4	3.5	17	13.6	7	5.8	7	5.9
015	6	5.3	9	7.2	8	6.6	6	5.0
020	4	3.5	1	0.8	7	5.8	7	5.9
023	8	7.1	0	0.0	2	1.7	10	8.4
027	2	1.8	3	2.4	1	0.8	4	3.4
078	18	15.9	22	17.6	27	22.3	15	12.6
106	2	1.8	0	0.0	1	0.8	2	1.7
193	4	3.5	6	4.8	7	5.8	1	0.8
Other	10	8.8	10	8.0	13	10.7	14	11.8
Not groupable**	15	13.3	13	10.4	12	9.9	16	13.4
Not on ribotype list	3	2.7	3	2.4	4	3.3	6	5.0
Not grown***	10	8.8	19	15.2	16	13.2	8	6.7
Total	113		125		121		119	

Table 2: A summary of *C. difficile* ribotypes in Community Patients aged 2 years and over, and the percentage of each against the overall total, in Northern Ireland during routine surveillance, October 2010 – September 2011

Ribotype	Oct - Dec 2010		Jan - Mar 2011		Apr - Jun 2011		Jul - Sep 2011*	
	Number	%	Number	%	Number	%	Number	%
001	7	11.7	1	1.4	3	5.3	2	4.3
002	3	5.0	4	5.7	3	5.3	3	6.5
005	5	8.3	3	4.3	2	3.5	4	8.7
014	3	5.0	3	4.3	1	1.8	1	2.2
015	4	6.7	5	7.1	6	10.5	4	8.7
020	3	5.0	4	5.7	3	5.3	5	10.9
023	2	3.3	1	1.4	4	7.0	1	2.2
027	0	0.0	1	1.4	4	7.0	0	0.0
078	10	16.7	18	25.7	8	14.0	12	26.1
106	0	0.0	2	2.9	2	3.5	0	0.0
193	1	1.7	2	2.9	4	7.0	1	2.2
Other	6	10.0	10	14.3	6	10.5	6	13.0
Not groupable**	11	18.3	9	12.9	6	10.5	4	8.7
Not on ribotype list	0	0.0	2	2.9	2	3.5	1	2.2
Not grown***	5	8.3	5	7.1	3	5.3	2	4.3
Total	60		70		57		46	

* 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, 005, 020 and 078 in Northern Ireland, July - September 2011

	002 (n=12)		005 (n=12)		020 (n=12)		078 (n=27)	
Age								
min_max	45, 86		47, 93		54, 91		49, 92	
median	68		74		75		79	
Sex	n	%	n	%	n	%	n	%
Female	8	66.7	9	75.0	7	58.3	15	55.6
Male	4	33.3	3	25.0	5	41.7	12	44.4
Trust								
Belfast	4	33.3	5	41.7	5	41.7	8	29.6
Northern	3	25.0	3	25.0	2	16.7	14	51.9
Southern	1	8.3	2	16.7	0	0.0	2	7.4
South Eastern	3	25.0	1	8.3	3	25.0	2	7.4
Western	1	8.3	1	8.3	2	16.7	1	3.7
Source								
Inpatient	9	75.0	8	66.7	7	58.3	15	55.6
Community*	3	25.0	4	33.3	5	41.7	12	44.4

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

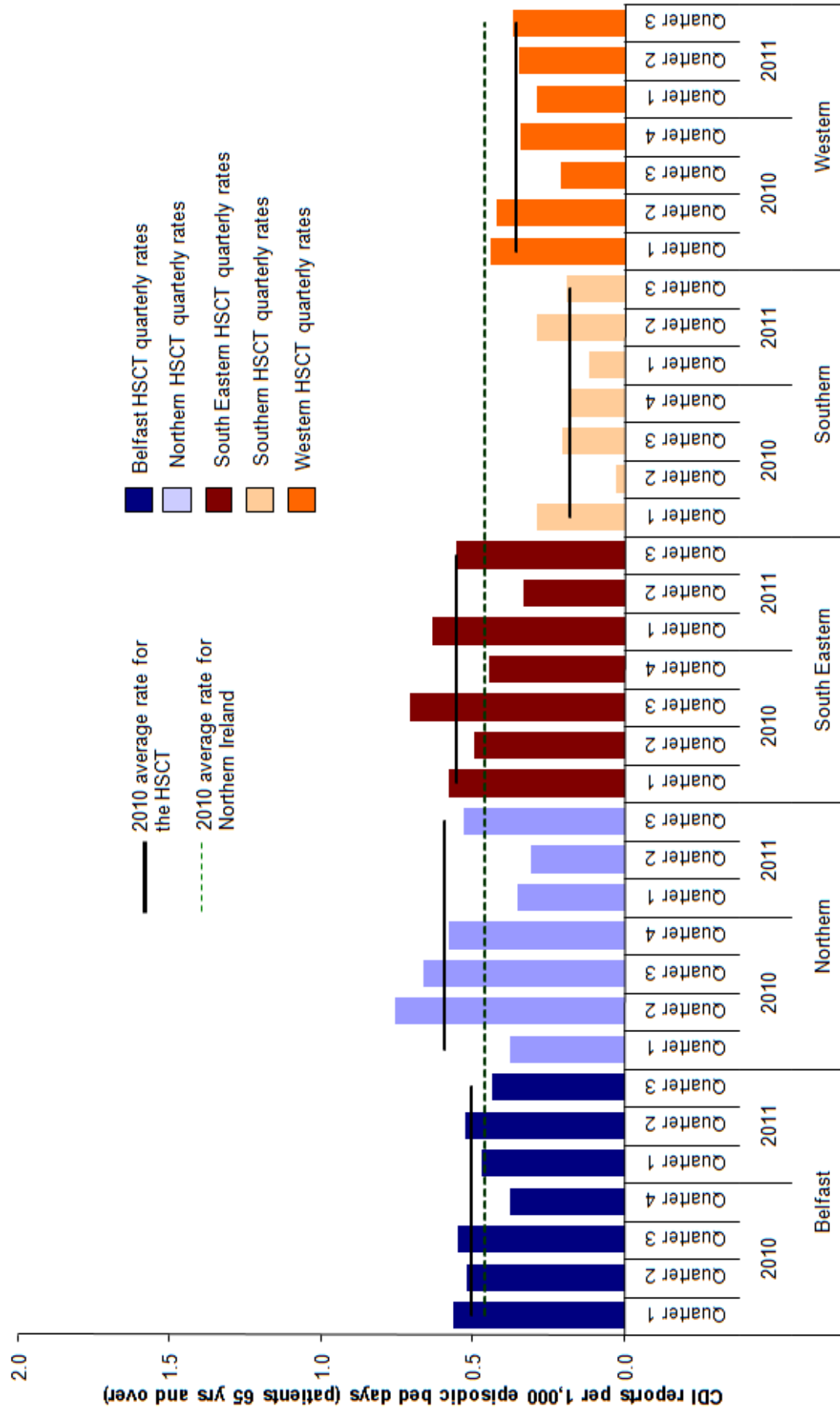


Figure 4: Quarterly rates of *C. difficile* among inpatients aged 65 years and over, by HSCCT, 1 January 2010 – 30 September 2011, compared with annual Northern Ireland and HSCCT rates for 2010

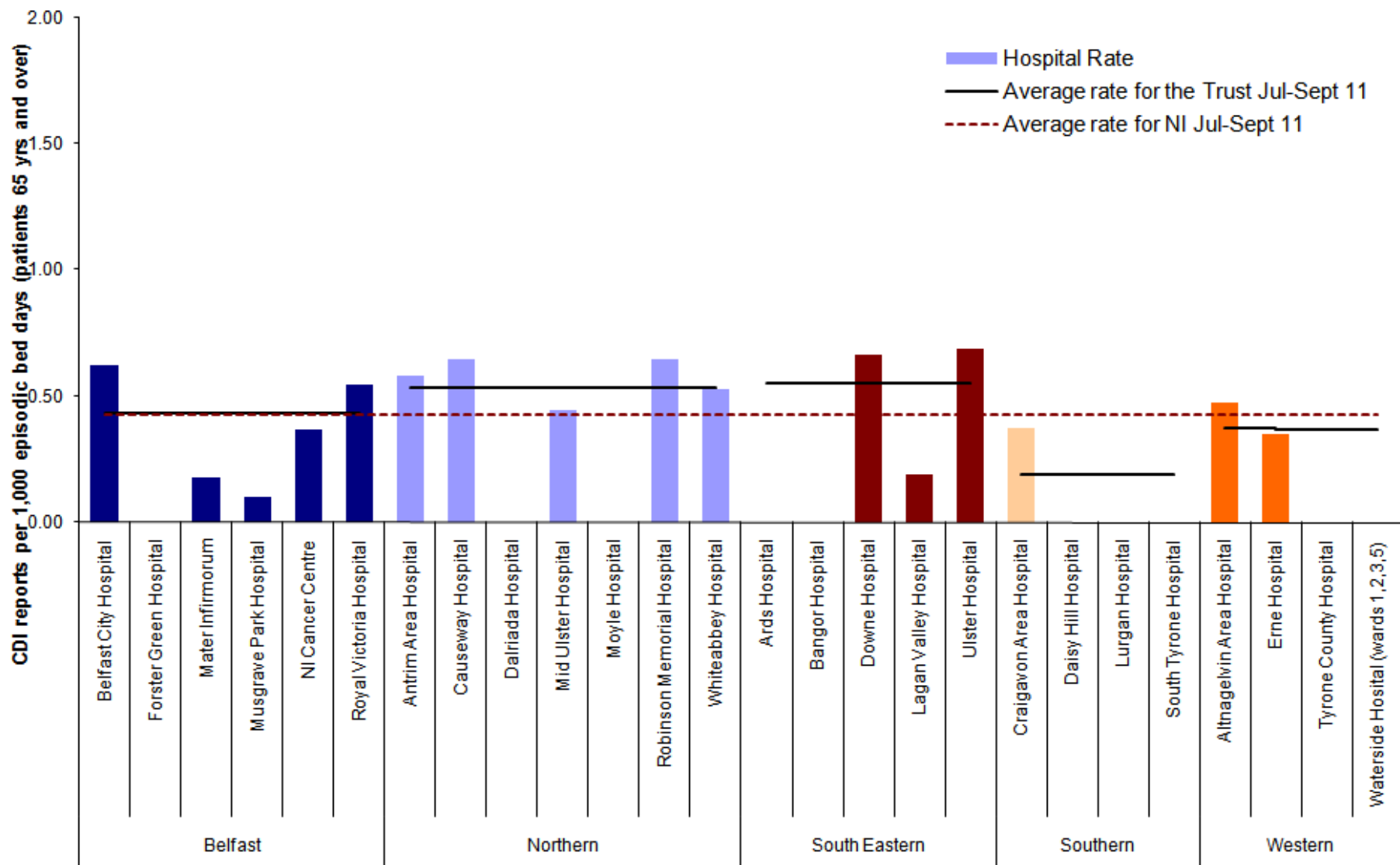


Figure 5: Rates of *C. difficile* in quarter three 2011 among inpatients aged 65 years and over, by hospital, including the quarterly HSCT rates and an average rate for Northern Ireland (see appendix A, Table 3)

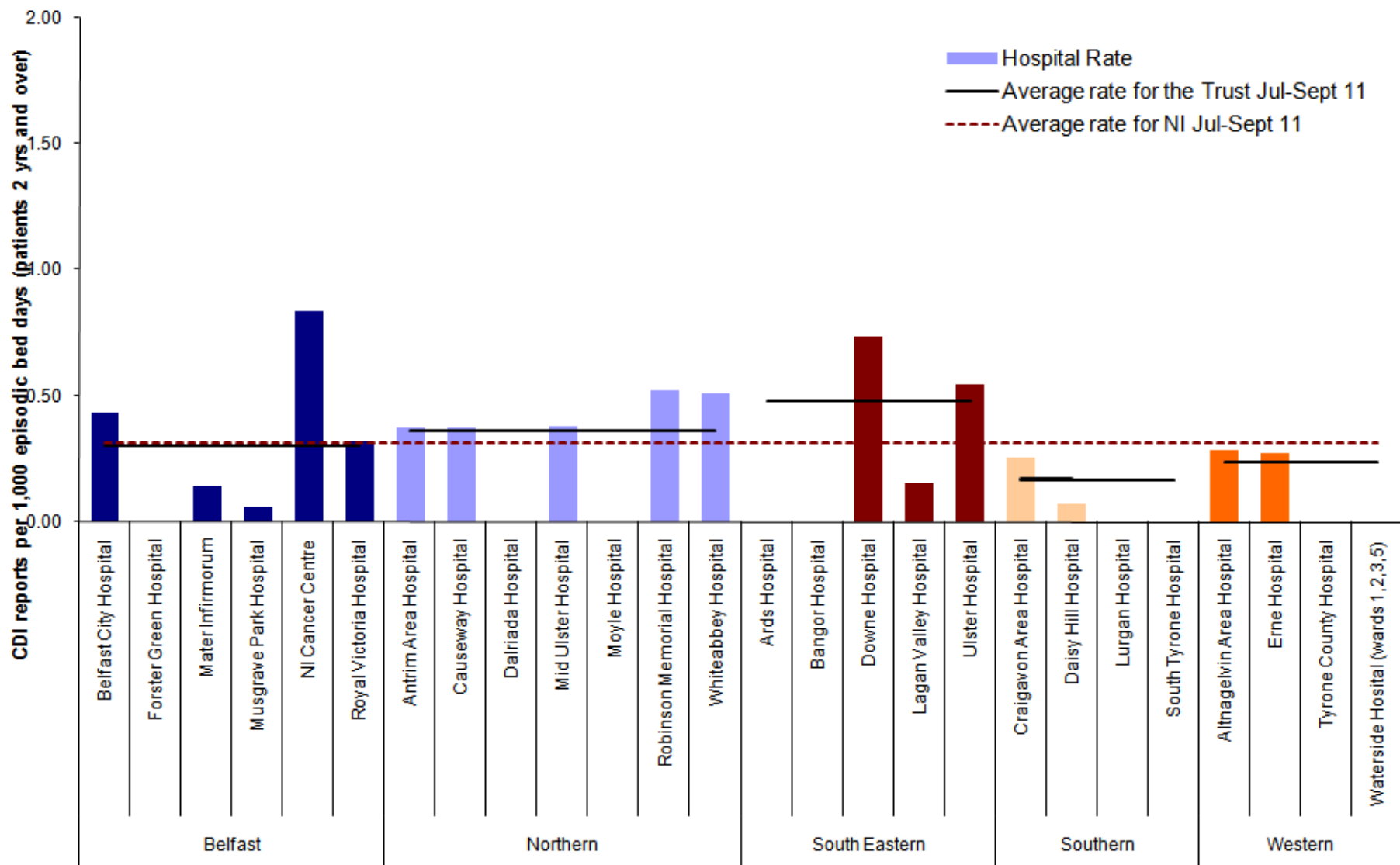


Figure 6: Rates of *C. difficile* in quarter three 2011 among inpatients aged two years and over, by hospital, including the quarterly HSCT rates and an average rate for Northern Ireland (see appendix A, Table 4)

Appendix A

Table 4: Quarterly number and rate of *C. difficile* episodes in patients aged 65 years and over, by hospital, Oct 2010–Sept 2011

Hospital	Oct-Dec 2010		Jan-Mar 2011		Apr-Jun 2011		Jul-Sep 2011	
	Episodes	Rate	Episodes	Rate	Episodes	Rate	Episodes	Rate
Belfast City Hospital	8	0.336	13	0.574	15	0.708	13	0.621
Forster Green Hospital	0	0.000	0	0.000	0	0.000	0	0.000
Mater Infirmorum	7	0.563	6	0.479	5	0.409	2	0.176
Musgrave Park Hospital	2	0.203	3	0.302	5	0.504	1	0.102
NICCO (formerly at Belvoir Park)	1	0.287	2	0.700	3	1.053	1	0.367
Royal Victoria Hospital	11	0.411	12	0.427	10	0.387	14	0.546
Belfast Health & Social Care Trust	29	0.379	36	0.472	38	0.526	31	0.438
Antrim Area Hospital	10	0.545	4	0.223	7	0.387	11	0.579
Braid Valley Hospital*	1	0.408	1	0.373	-	-	-	-
Causeway Hospital	10	1.047	5	0.526	1	0.110	6	0.646
Dalriada Hospital	0	0.000	0	0.000	1	0.540	0	0.000
Mid Ulster Hospital	2	0.392	3	0.666	2	0.391	1	0.446
Moyle Hospital	0	0.000	2	1.949	0	0.000	0	0.000
Robinson Memorial Hospital	0	0.000	0	0.000	0	0.000	1	0.650
Whiteabbey Hospital	2	0.590	0	0.000	2	0.485	2	0.529
Northern Health & Social Care Trust	25	0.579	15	0.353	13	0.311	21	0.534
Ards Hospital	0	0.000	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	2	0.690	1	0.344	0	0.000	2	0.662
Lagan Valley Hospital	1	0.172	2	0.335	2	0.338	1	0.191
Ulster Hospital	13	0.533	20	0.814	10	0.417	17	0.686
South Eastern Health & Social Care	16	0.447	23	0.635	12	0.333	20	0.555
Craigavon Area Hospital	2	0.124	3	0.174	6	0.383	6	0.375
Daisy Hill Hospital	1	0.118	1	0.118	1	0.129	0	0.000
Lurgan Hospital	3	0.767	0	0.000	1	0.239	0	0.000
South Tyrone Hospital	0	0.000	0	0.000	1	0.290	0	0.000
Southern Health & Social Care Trust	6	0.189	4	0.120	9	0.290	6	0.190
Altnagelvin Area Hospital	9	0.485	10	0.544	9	0.499	8	0.472
Erne Hospital	4	0.409	1	0.101	3	0.338	3	0.349
Tyrone County Hospital	0	0.000	0	0.000	0	0.000	0	0.000
Waterside Hospital (Wards 1, 2, 3, 5)	0	0.000	0	0.000	0	0.000	0	0.000
Western Health & Social Care Trust	13	0.343	11	0.290	12	0.350	11	0.372
NI TOTAL	89	0.395	89	0.393	84	0.390	89	0.429
NI Community TOTAL	53	-	62	-	45	-	42	-

*Braid Valley Hospital closed 31/03/2011

Appendix A

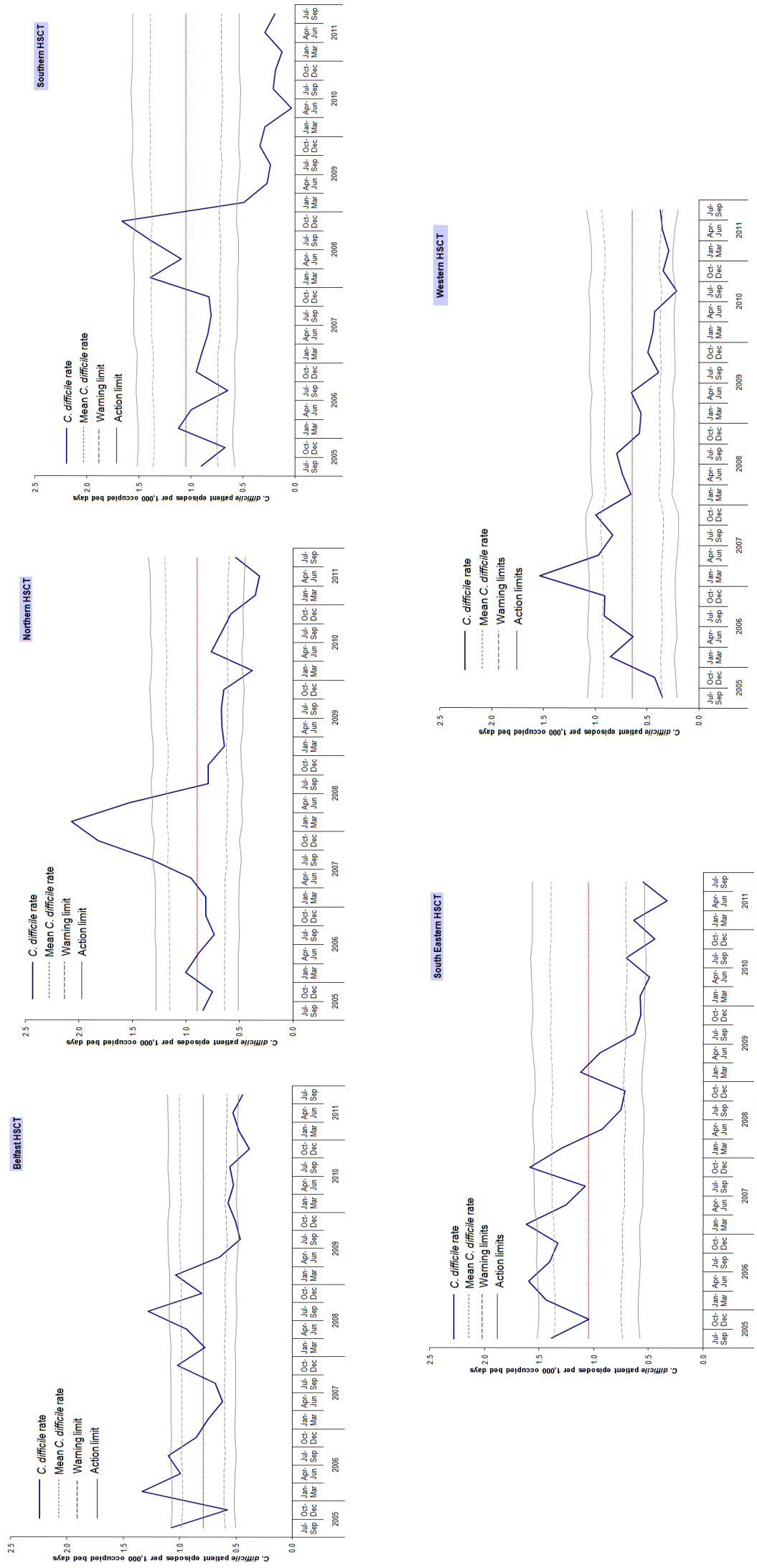
Table 5: Quarterly number and rate of *C. difficile* episodes in patients aged two years and over, by hospital, Oct 2010–Sept 2011

Hospital	Oct-Dec 2010		Jan-Mar 2011		Apr-Jun 2011		Jul-Sep 2011	
	Episodes	Rate	Episodes	Rate	Episodes	Rate	Episodes	Rate
Belfast City Hospital	10	0.263	14	0.375	18	0.497	15	0.433
Forster Green Hospital	0	0.000	0	0.000	0	0.000	0	0.000
Mater Infirmorum	8	0.353	8	0.351	8	0.358	3	0.141
Musgrave Park Hospital	3	0.180	3	0.180	6	0.350	1	0.060
NICCO (formerly at Belvoir Park)	3	0.500	5	0.856	4	0.670	5	0.839
Royal Victoria Hospital	20	0.296	19	0.282	18	0.277	21	0.318
Belfast Health & Social Care Trust	44	0.288	49	0.323	54	0.364	45	0.307
Antrim Area Hospital	13	0.386	8	0.210	9	0.267	13	0.375
Braid Valley Hospital*	1	0.366	1	0.434	-	-	-	-
Causeway Hospital	10	0.535	6	0.320	6	0.325	7	0.373
Dalriada Hospital	0	0.000	0	0.000	1	0.488	0	0.000
Mid Ulster Hospital	2	0.333	4	0.704	2	0.457	1	0.377
Moyle Hospital	0	0.000	2	1.508	0	0.000	0	0.000
Robinson Memorial Hospital	0	0.000	0	0.000	0	0.000	1	0.523
Whiteabbey Hospital	2	0.575	1	0.253	2	0.496	2	0.512
Northern Health & Social Care Trust	28	0.399	22	0.295	20	0.303	24	0.366
Ards Hospital	0	0.000	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	3	0.755	1	0.252	1	0.253	3	0.736
Lagan Valley Hospital	1	0.120	2	0.252	2	0.274	1	0.153
Ulster Hospital	14	0.336	27	0.646	14	0.335	23	0.548
South Eastern Health & Social Care	18	0.316	30	0.528	17	0.302	27	0.483
Craigavon Area Hospital	5	0.151	4	0.115	7	0.220	8	0.255
Daisy Hill Hospital	1	0.063	1	0.061	1	0.069	1	0.070
Lurgan Hospital	3	0.625	0	0.000	1	0.230	0	0.000
South Tyrone Hospital	0	0.000	0	0.000	1	0.275	0	0.000
Southern Health & Social Care Trust	9	0.157	5	0.084	10	0.184	9	0.167
Altnagelvin Area Hospital	10	0.267	15	0.396	15	0.402	10	0.286
Erne Hospital	4	0.257	4	0.248	5	0.334	4	0.276
Tyrone County Hospital	0	0.000	0	0.000	0	0.000	0	0.000
Waterside Hospital (Wards 1, 2, 3, 5)	0	0.000	0	0.000	0	0.000	0	0.000
Western Health & Social Care Trust	14	0.218	19	0.293	20	0.323	14	0.239
NI TOTAL	113	0.282	125	0.307	121	0.311	119	0.313
NI community TOTAL	60	-	70	-	57	-	46	-

*Braid Valley Hospital closed 31/03/2011

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:

$$\text{Warning Limit} = M \pm 2\sqrt{\frac{E_i}{(N_i)^2}} \quad \text{Action Limit} = M \pm 3\sqrt{\frac{E_i}{(N_i)^2}}$$

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 $E_i = M \times N_i$

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 6: *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	103
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	393