

C. difficile surveillance

Quarterly report

January - March 2014 (Q1 2014)

Key points

- CDI reports for hospital inpatients aged 65 years and over increased by 18% (from 57 to 67 episodes) during quarter one 2014 compared to quarter four 2013. CDI rates increased by 13% during quarter one 2014 compared to quarter four 2013.
- CDI reports for community patients aged 65 years and over decreased by 19% (from 36 to 29 episodes) during quarter one 2014 compared to quarter four 2013.
- Total CDI reports, for hospital inpatients and community patients combined, aged two years and over, increased by 9% this quarter compared to quarter four 2013 (from 106 to 116 episodes).
- CDI reports for hospital inpatients aged 65 years and over fell by 24% between the 2012/13 and 2013/14 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 one 2014, 96 episodes of CDI were reported in persons aged 65 years and over compared to 93 in the previous quarter (3% increase, 3 reports; Figure 1).
- This quarter's CDI figures are lower than those reported during the same period in previous years from 2005-2014 (Figure 1).
- Of these 96 episodes reported in quarter one 2014, 67 (70%) 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 29 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 – 30% (29/96) reported this quarter compared to 39% (36/93) in quarter four 2013.

Inpatient episodes for patients aged 65 years and over

- This quarter has seen inpatient CDI cases increase by 18%, from 57 in quarter four 2013 to 67 this quarter (Figure 2a).
- This quarter's CDI inpatient figures are lower than those reported during the same period in previous years 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 (29 reports) have decreased by 19% compared to quarter four 2013 (36 reports) (Figure 1 and Table 4).
- The number of community episodes this quarter (29 reports) is lower than the number reported for the same quarter in 2007-2013 but higher than those reported in previous years (2005-2006; Figure 1). This number may include patients who have had a recent healthcare interaction.

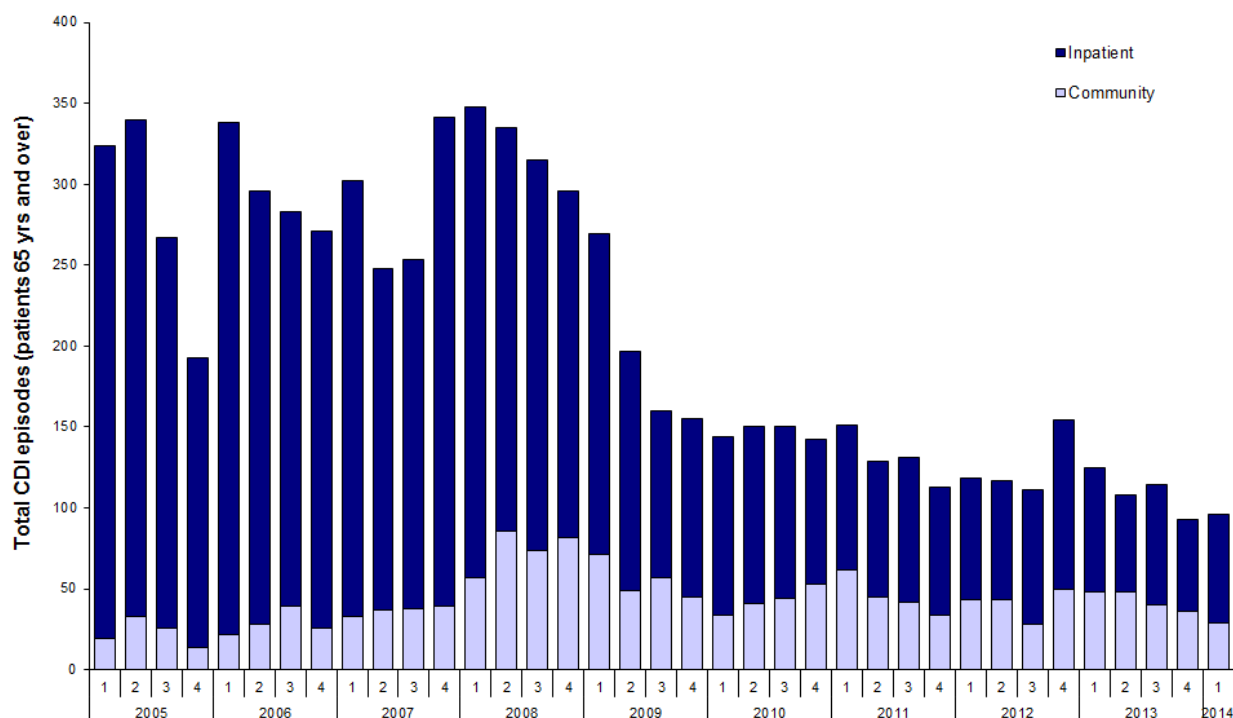


Figure 1: Total CDI reports, inpatient and community, in Northern Ireland, by quarter (patients ≥ 65 years), between 2005 and 2014

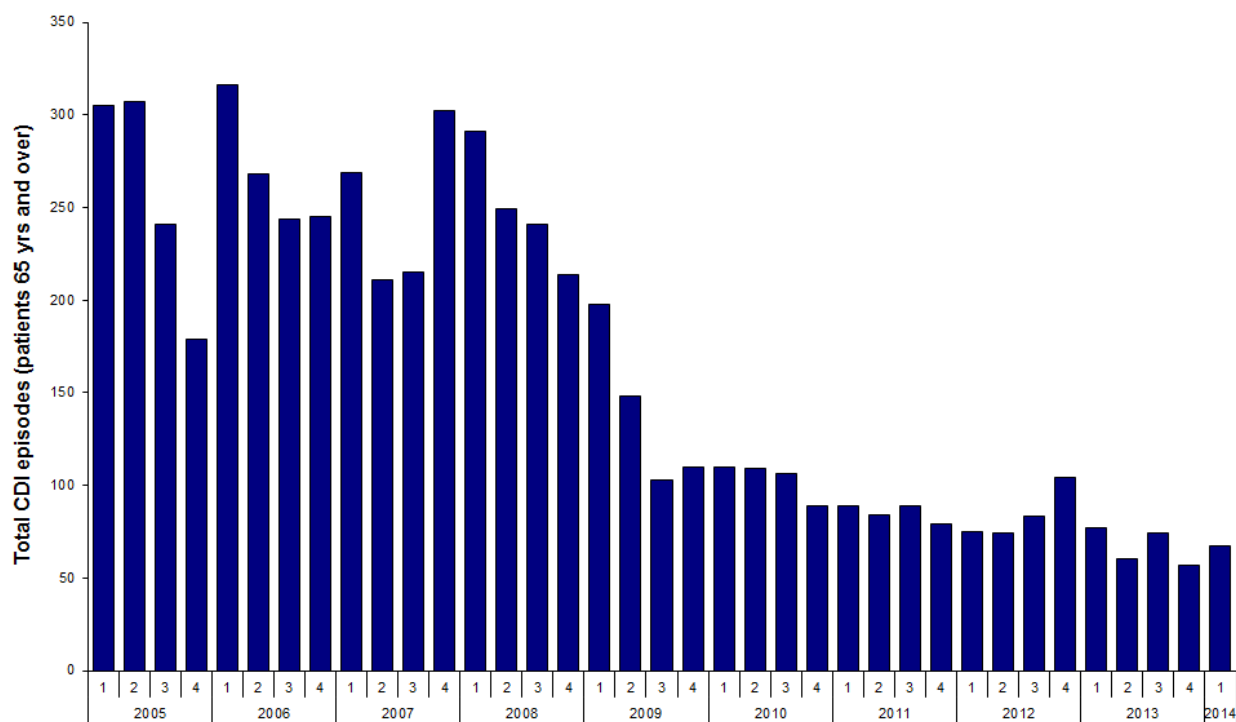


Figure 2a: Total CDI inpatient reports in Northern Ireland, by quarter (patients ≥ 65 years), between 2005 and 2014

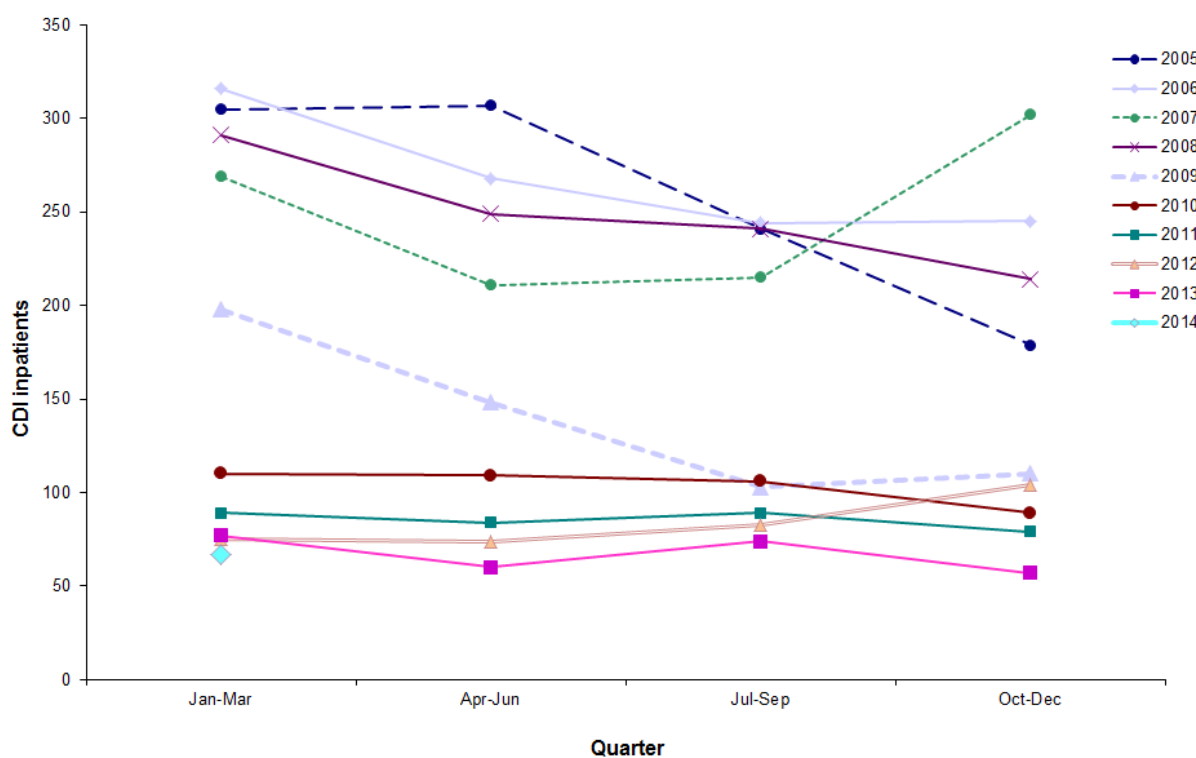


Figure 2b: Total CDI inpatient reports in Northern Ireland, by quarter (patients ≥ 65 years), between 2005 and 2014

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

- During quarter one 2014, 116 episodes of *C. difficile* infection were reported in persons aged two years and over (Table 5). This represents a 9% increase on the previous quarter (106 episodes). Of the 116 episodes reported, 83% (96 episodes) were reported among patients aged 65 years and over (includes inpatient and community).
- In all, 81 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 81, 83% (67 episodes) were patients aged 65 years and over.
- The remaining 35 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 35, 83% (29 episodes) 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 RBHSC; therefore the figure used is based on an estimate generated using quarter one 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.
- For some of the SPC charts the mean rates have been re-set following a run of 8 consecutive points below the mean. The likelihood of this occurring randomly is very low and therefore the occurrence of 8 consecutive points below the mean is treated as special cause variation. As the run occurs below the mean this is evidence of a significant downward shift in the mean rate. New control limits are established using the data from the first point of the downward trend, that is, the first point in the run of 8 that occurs below the mean. This gives a better estimate of the true rate and therefore a better estimate of the variation which is due to common causes only.
- In Northern Ireland this quarter, the rate of *C. difficile* patient episodes are within the expected parameters on the SPC chart (Figure 3).

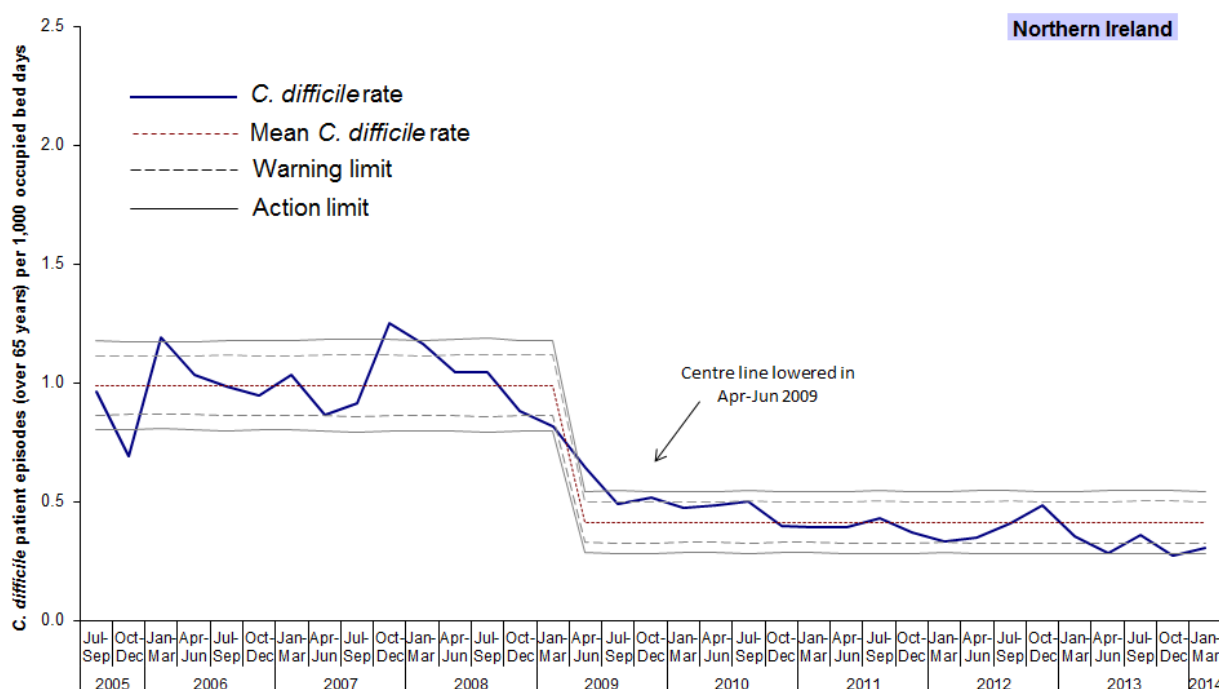


Figure 3: Statistical process control chart for quarterly *C. difficile* rates among inpatients in Northern Ireland aged 65 years and over (for HSCT level, see appendix B)

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 present validated ribotype data for Northern Ireland stratified by patient location at time of sampling for quarters two, three & four 2013. Provisional ribotype data for this quarter (quarter one 2014) are also presented.
- This quarter, the most prevalent ribotypes for CDI inpatients are 078 (12.3%), 002 (7.4%) and 005 (6.2%) (Table 1) and in the community are 078 (14.3%) and 014 (11.4%) (Table 2).
- Descriptive data for January - March 2014, 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, April 2013 - March 2014

Ribotype	Apr - June 2013		Jul - Sept 2013		Oct - Dec 2013		Jan - March 2014	
	Number	%	Number	%	Number	%	Number	%
001	2	2.7	1	1.1	2	3.0	3	3.7
002	9	12.3	6	6.7	8	12.1	6	7.4
005	4	5.5	6	6.7	3	4.5	5	6.2
014	3	4.1	6	6.7	2	3.0	2	2.5
014/020	4	5.5	0	0.0	5	7.6	3	3.7
015	4	5.5	5	5.6	1	1.5	2	2.5
020	3	4.1	6	6.7	1	1.5	1	1.2
023	3	4.1	2	2.2	1	1.5	4	4.9
027	0	0.0	1	1.1	0	0.0	0	0.0
078	19	26.0	20	22.2	8	12.1	10	12.3
106	1	1.4	0	0.0	0	0.0	0	0.0
193	2	2.7	1	1.1	2	3.0	2	2.5
Other	13	17.8	20	22.2	13	19.7	11	13.6
Not groupable**	1	1.4	6	6.7	9	13.6	12	14.8
Not on ribotype list	4	5.5	7	7.8	8	12.1	7	8.6
Not isolated***	1	1.4	3	3.3	3	4.5	13	16.0
Total	73		90		66		81	

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, April 2013 - March 2014

Ribotype	Apr - June 2013		Jul - Sept 2013		Oct - Dec 2013		Jan - March 2014	
	Number	%	Number	%	Number	%	Number	%
001	1	1.8	1	2.2	1	2.5	1	2.9
002	6	10.9	6	13.3	3	7.5	2	5.7
005	7	12.7	2	4.4	1	2.5	3	8.6
014	2	3.6	1	2.2	2	5.0	4	11.4
014/020	3	5.5	0	0.0	1	2.5	3	8.6
015	5	9.1	6	13.3	3	7.5	1	2.9
020	0	0.0	1	2.2	2	5.0	3	8.6
023	1	1.8	0	0.0	1	2.5	0	0.0
027	0	0.0	0	0.0	0	0.0	0	0.0
078	17	30.9	7	15.6	7	17.5	5	14.3
106	0	0.0	1	2.2	0	0.0	0	0.0
193	2	3.6	2	4.4	1	2.5	0	0.0
Other	4	7.3	7	15.6	5	12.5	7	20.0
Not groupable**	2	3.6	5	11.1	3	7.5	4	11.4
Not on ribotype list	2	3.6	4	8.9	9	22.5	2	5.7
Not isolated***	3	5.5	2	4.4	1	2.5	0	0.0
Total	55		45		40		35	

* Figures are provisional

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

*** 'Not isolated' 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 078, 002 and 005 in Northern Ireland, January - March 2014

		078 (n=15)		002 (n=8)		005 (n=8)	
Age		48-93		59-93		36-89	
	range	84		77		70	
	median						
Sex		n	%	n	%	n	%
	Female	8	53.3	4	50.0	6	75.0
	Male	7	46.7	4	50.0	2	25.0
Trust							
	Belfast	5	33.3	2	25.0	3	37.5
	Northern	6	40.0	0	0.0	4	50.0
	South Eastern	3	20.0	4	50.0	0	0.0
	Southern	1	6.7	2	25.0	0	0.0
	Western	0	0.0	0	0.0	1	12.5
Source							
	Inpatient	10	66.7	6	75.0	5	62.5
	Community*	5	33.3	2	25.0	3	37.5

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

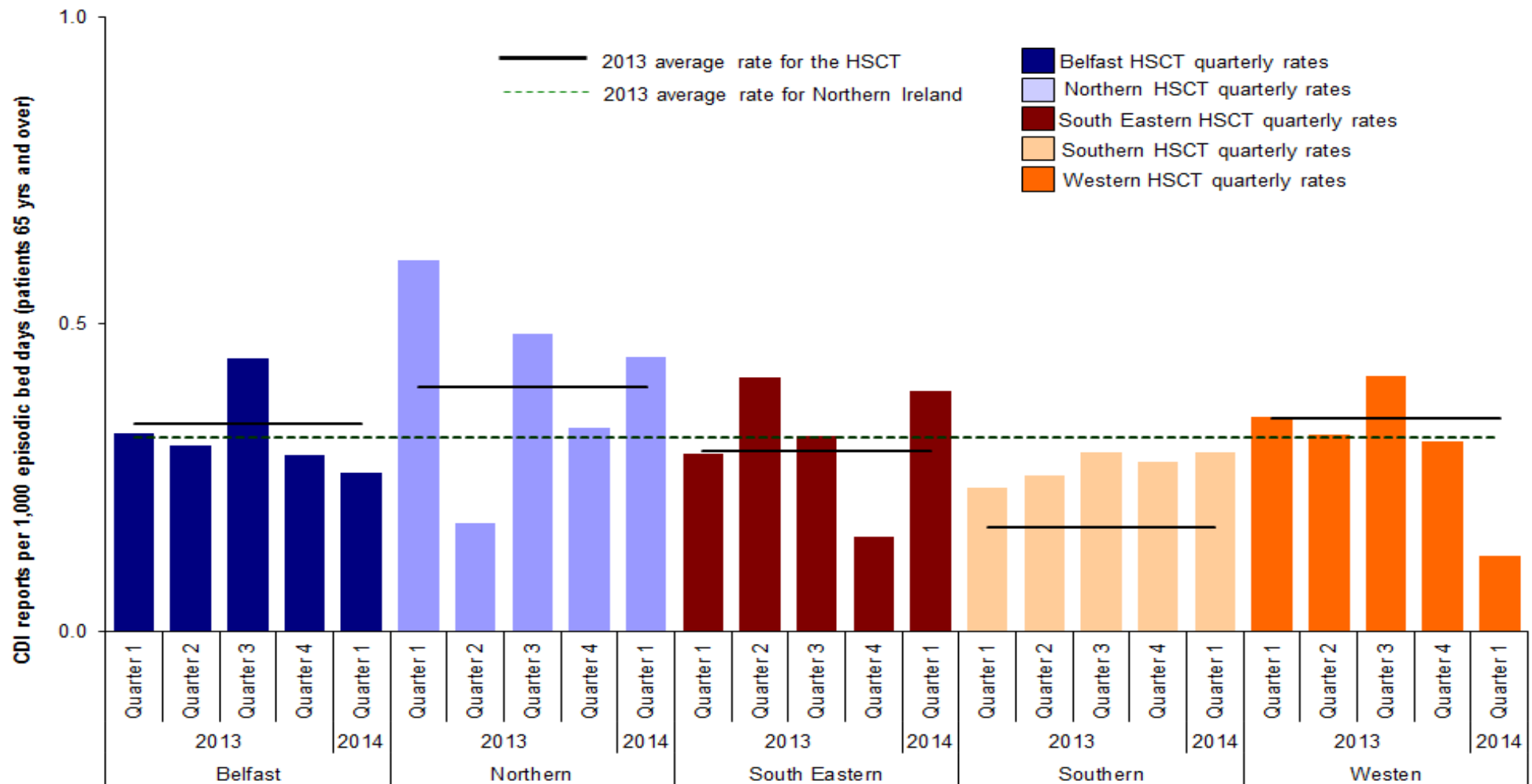


Figure 4: Quarterly rates of *C. difficile* among inpatients aged 65 years and over, by HSCT, 1 January 2013 - 31 March 2014, compared with annual Northern Ireland and HSCT rates for 2013

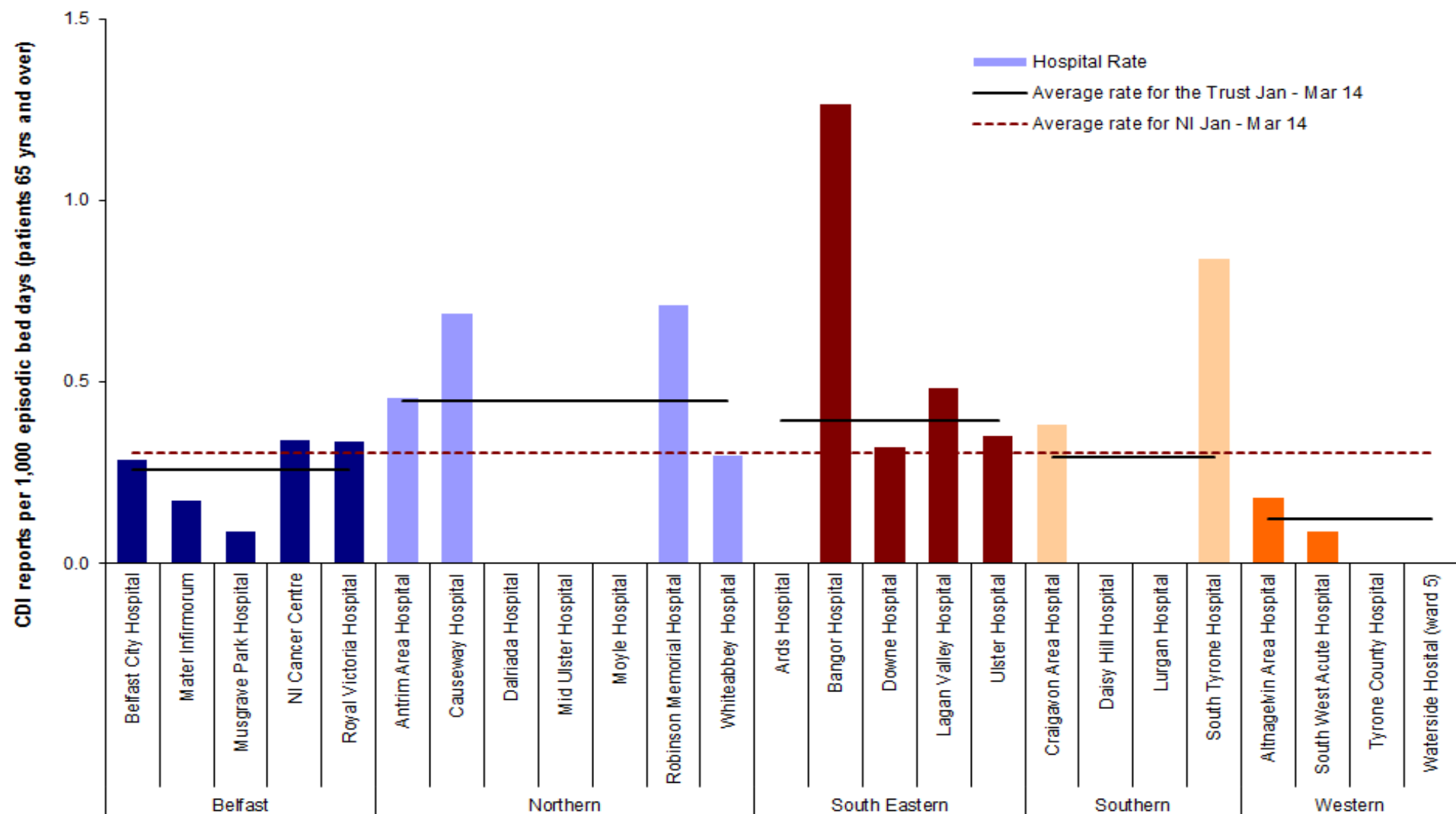


Figure 5: Rates of *C. difficile* in quarter one 2014 among inpatients aged 65 years and over, by hospital, including the quarterly HSCT rates and an average rate for Northern Ireland (see appendix A, Table 3)

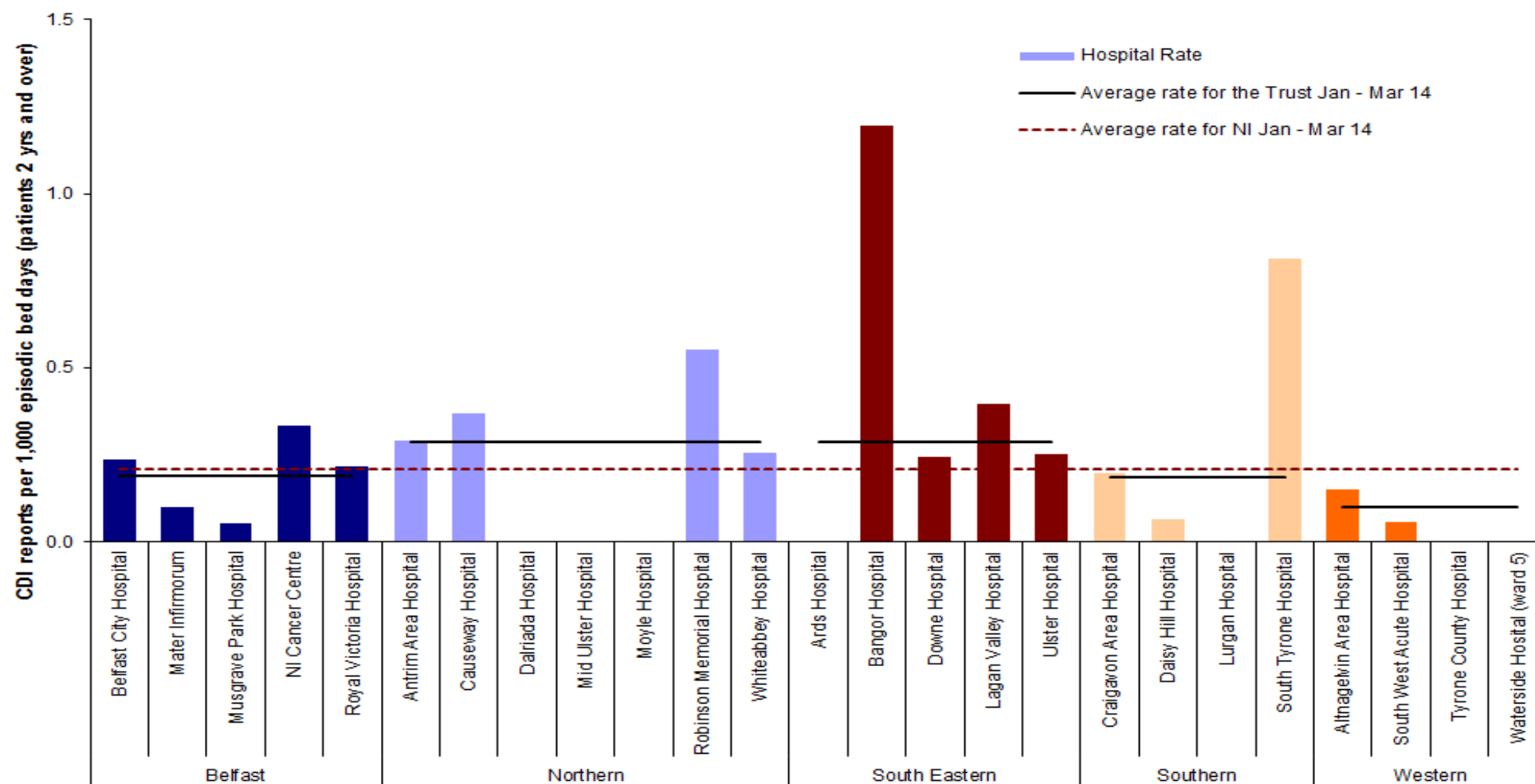


Figure 6: Rates of *C. difficile* in quarter one 2014 among inpatients aged two years and over, by hospital, including the quarterly HSCT rates and an average rate for Northern Ireland (see appendix A, Table 4)

Appendix A

Table 4: Quarterly number and rate of *C. difficile* episodes in patients aged 65 years and over, by hospital, April 2013 - March 2014

Hospital	Apr - Jun 2013		Jul - Sept 2013		Oct - Dec 2013		Jan - March 2014	
	Episodes	Rate	Episodes	Rate	Episodes	Rate	Episodes	Rate
Belfast City Hospital	4	0.215	8	0.468	5	0.278	5	0.284
Mater Infirmorum	4	0.343	7	0.648	4	0.352	2	0.172
Musgrave Park Hospital	3	0.280	0	0.000	2	0.194	1	0.089
NICCO (formerly at Belvoir Park)	0	0.000	0	0.000	0	0.000	1	0.339
Royal Victoria Hospital	10	0.389	15	0.573	9	0.332	10	0.335
Belfast Health & Social Care Trust	21	0.303	30	0.444	20	0.287	19	0.260
Antrim Area Hospital	4	0.207	12	0.652	6	0.303	10	0.454
Causeway Hospital	1	0.100	5	0.554	5	0.553	6	0.687
Dalriada Hospital	0	0.000	1	0.676	1	0.540	0	0.000
Mid Ulster Hospital	0	0.000	0	0.000	1	0.499	0	0.000
Moyle Hospital	0	0.000	0	0.000	0	0.000	0	0.000
Robinson Memorial Hospital	2	1.206	0	0.000	0	0.000	1	0.712
Whiteabbey Hospital	0	0.000	0	0.000	0	0.000	1	0.297
Northern Health & Social Care Trust	7	0.176	18	0.485	13	0.331	18	0.446
Ards Hospital	0	0.000	0	0.000	0	0.000	0	0.000
Bangor Hospital	1	0.683	0	0.000	0	0.000	2	1.236
Downe Hospital	0	0.000	1	0.357	0	0.000	1	0.321
Lagan Valley Hospital	3	0.519	2	0.377	1	0.175	3	0.482
Ulster Hospital	12	0.442	9	0.338	5	0.185	10	0.353
South Eastern Health & Social Care Trust	16	0.413	12	0.318	6	0.154	16	0.392
Craigavon Area Hospital	6	0.336	1	0.059	7	0.408	7	0.381
Daisy Hill Hospital	0	0.000	0	0.000	0	0.000	0	0.000
Lurgan Hospital	0	0.000	0	0.000	1	0.262	0	0.000
South Tyrone Hospital	0	0.000	0	0.000	0	0.000	3	0.838
Southern Health & Social Care Trust	6	0.180	1	0.032	8	0.254	10	0.292
Altnagelvin Area Hospital	7	0.420	7	0.417	8	0.454	3	0.183
South West Acute Hospital	2	0.192	5	0.494	2	0.201	1	0.088
Tyrone County Hospital	1	0.361	0	0.000	0	0.000	0	0.000
Waterside Hospital (Wards 1, 2, 3, 5)	0	0.000	1	0.571	0	0.000	0	0.000
Western Health & Social Care Trust	10	0.319	13	0.415	10	0.309	4	0.124
NI TOTAL	60	0.283	74	0.361	57	0.269	67	0.303
NI community TOTAL	48		40		36		29	

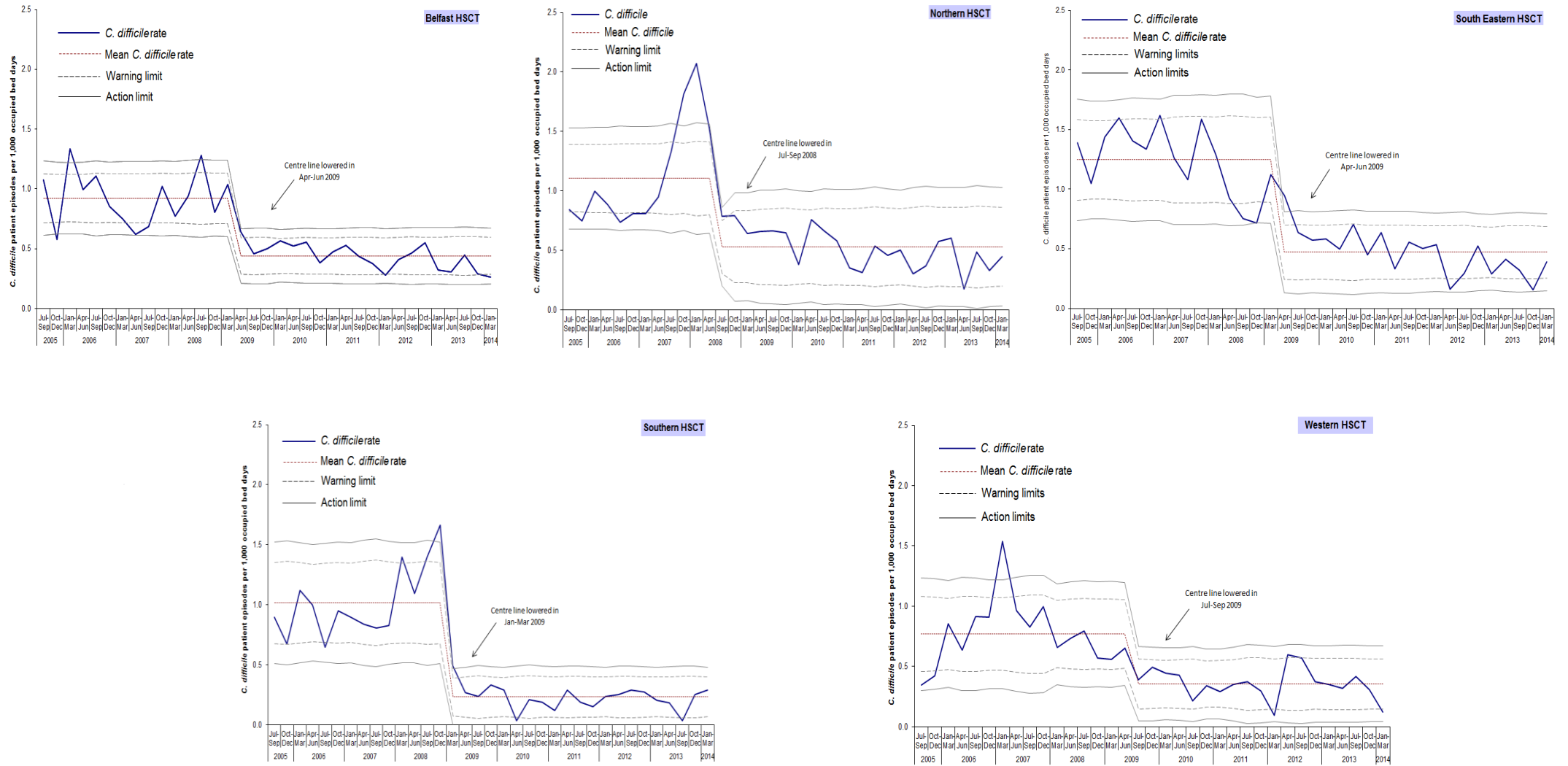
Appendix A

Table 5: Quarterly number and rate of *C. difficile* episodes in patients aged two years and over, by hospital, April 2013 - March 2014

Hospital	Apr - Jun 2013		Jul - Sept 2013		Oct - Dec 2013		Jan - March 2014	
	Episodes	Rate	Episodes	Rate	Episodes	Rate	Episodes	Rate
Belfast City Hospital	6	0.196	9	0.317	5	0.168	7	0.238
Mater Infirmorum	4	0.197	8	0.410	4	0.203	2	0.101
Musgrave Park Hospital	3	0.160	0	0.000	2	0.115	1	0.053
NICCO (formerly at Belvoir Park)	1	0.170	1	0.161	1	0.163	2	0.332
Royal Victoria Hospital	12	0.185	18	0.272	9	0.135	15	0.218
Belfast Health & Social Care Trust	26	0.185	36	0.261	21	0.150	27	0.189
Antrim Area Hospital	5	0.146	15	0.455	7	0.197	11	0.290
Causeway Hospital	2	0.114	6	0.367	5	0.304	6	0.367
Dalriada Hospital	0	0.000	1	0.487	1	0.491	0	0.000
Mid Ulster Hospital	0	0.000	0	0.000	1	0.442	0	0.000
Moyle Hospital	0	0.000	0	0.000	0	0.000	0	0.000
Robinson Memorial Hospital	2	1.047	0	0.000	0	0.000	1	0.553
Whiteabbey Hospital	0	0.000	0	0.000	0	0.000	1	0.255
Northern Health & Social Care Trust	9	0.142	22	0.366	14	0.223	19	0.289
Ards Hospital	0	0.000	0	0.000	0	0.000	0	0.000
Bangor Hospital	1	0.637	0	0.000	0	0.000	2	1.195
Downe Hospital	0	0.000	1	0.255	1	0.246	1	0.244
Lagan Valley Hospital	3	0.420	2	0.303	2	0.282	3	0.397
Ulster Hospital	13	0.286	9	0.202	6	0.133	12	0.252
South Eastern Health & Social Care Trust	17	0.285	12	0.206	9	0.151	18	0.288
Craigavon Area Hospital	7	0.201	2	0.060	10	0.293	7	0.198
Daisy Hill Hospital	0	0.000	1	0.071	0	0.000	1	0.065
Lurgan Hospital	0	0.000	0	0.000	1	0.232	0	0.000
South Tyrone Hospital	0	0.000	0	0.000	0	0.000	3	0.814
Southern Health & Social Care Trust	7	0.114	3	0.055	11	0.197	11	0.187
Altnagelvin Area Hospital	10	0.289	10	0.295	9	0.264	5	0.150
South West Acute Hospital	2	0.122	6	0.375	2	0.124	1	0.057
Tyrone County Hospital	2	0.628	0	0.000	0	0.000	0	0.000
Waterside Hospital (Wards 1, 2, 3, 5)	0	0.000	1	0.150	0	0.000	0	0.000
Western Health & Social Care Trust	14	0.231	17	0.286	11	0.186	6	0.101
NI TOTAL	73	0.189	90	0.243	66	0.175	81	0.208
NI community TOTAL	55		45		40		35	

Appendix B

Trends in *C. difficile* rates in inpatients aged 65 years and over, by HSCT and quarter, 2005–2014



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, PHA 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

HSCT	Financial Year								
	2005/06	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14
Belfast	352	336	280	327	163	147	117	124	90
Northern	184	172	297	172	102	103	75	73	56
South Eastern	243	256	199	135	98	80	72	50	50
Southern	168	130	134	164	37	17	28	33	25
Western	96	132	109	104	71	46	35	58	37
Northern Ireland	1043	1026	1019	902	471	393	327	338	258