

C. difficile surveillance

Quarterly report

July - September 2014 (Q3 2014)

Key points

- CDI reports for hospital inpatients aged 65 years and over increased by 37% (from 60 to 82 episodes) during quarter three 2014 compared to quarter two 2014. CDI rates increased by 38% during quarter three 2014 compared to quarter two 2014.
- CDI reports for community patients aged 65 years and over for quarter three 2014 remained the same as quarter two 2014 (48 episodes).
- Total CDI reports, for hospital inpatients and community patients combined, aged two years and over, increased by 26% this quarter compared to quarter two 2014 (from 130 to 164 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 three 2014, 130 episodes of CDI were reported in persons aged 65 years and over compared to 108 in the previous quarter (20% increase, 22 reports; Figure 1).
- This quarter's CDI figures are the higher than those reported in quarter three 2012 & 2013 but are lower than those reported during the same period in previous years from 2005-2011 (Figure 1).
- Of these 130 episodes reported in quarter three 2014, 82 (63%) 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 48 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 – 37% (48/130) reported this quarter compared to 44% (48/108) in quarter two 2014.

Inpatient episodes for patients aged 65 years and over

- This quarter has seen inpatient CDI cases increase by 37%, from 60 in quarter two 2014 to 82 this quarter (Figure 2a).
- This quarter's CDI inpatient figures are higher than those reported in quarter three 2013 but 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 Tables 4 and 5.

Community episodes for patients aged 65 years and over

- Community episodes of CDI this quarter (48 reports) have remained the same as quarter two 2014 (48 reports) (Figure 1 and Table 4).
- Community episodes this quarter are lower than the number reported for the same quarter in 2008 and 2009 but higher than those reported in previous years (2005-2007 & 2010-2013; Figure 1). This number may include patients who have had a recent healthcare interaction.

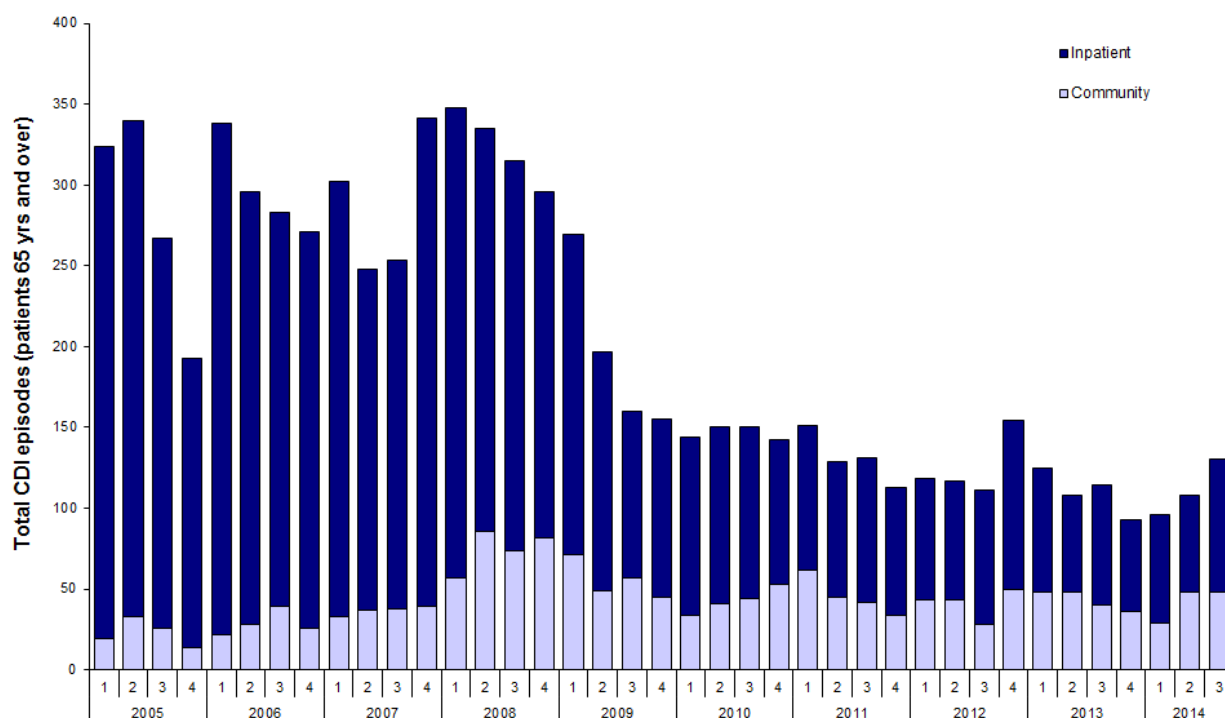


Figure 1: Total CDI reports, inpatient and community, in Northern Ireland, by quarter (patients ≥ 65 years), between 2005 and 2014

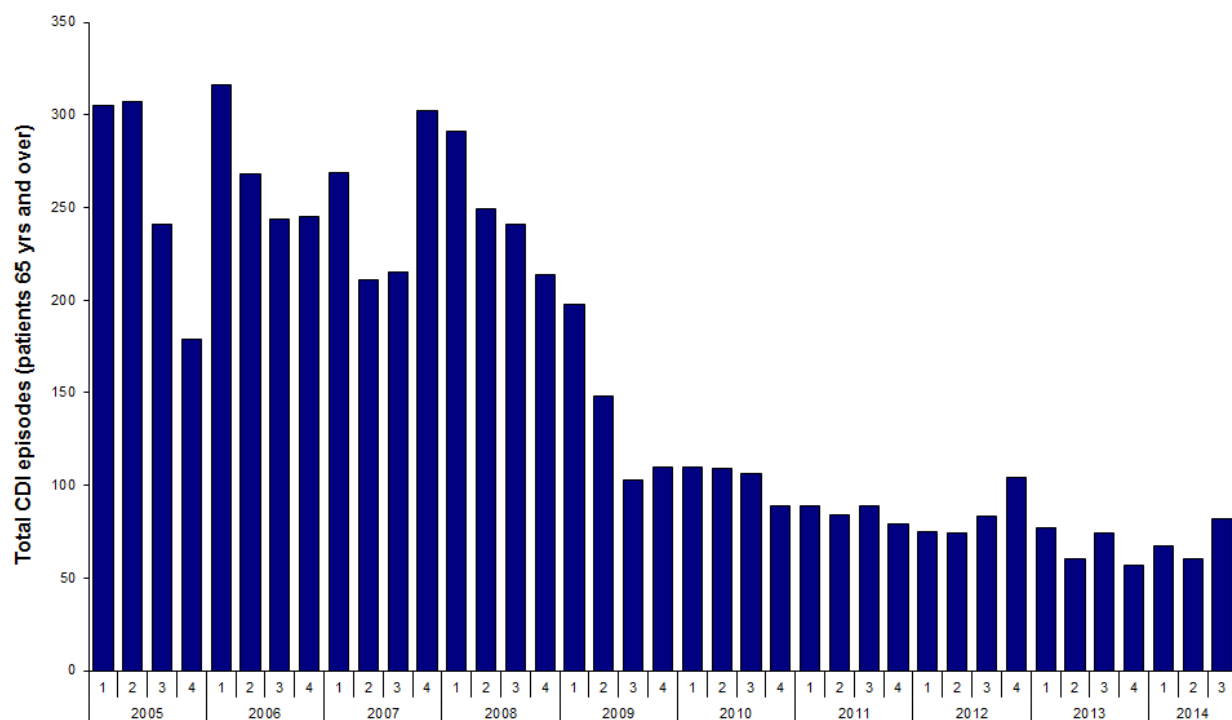


Figure 2a: Total CDI inpatient reports in Northern Ireland, by quarter (patients ≥ 65 years), between 2005 and 2014

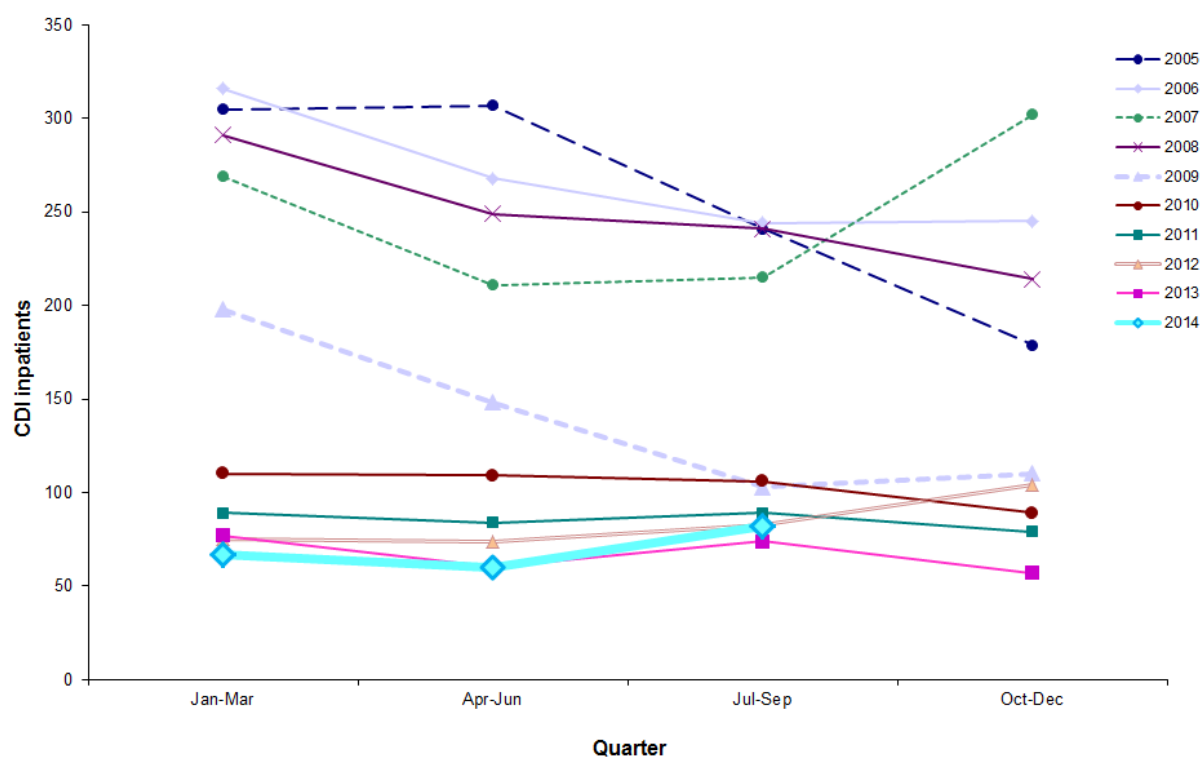


Figure 2b: Total CDI inpatient reports in Northern Ireland, by quarter (patients ≥ 65 years), between 2005 and 2014

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

- During quarter three 2014, 164 episodes of *C. difficile* infection were reported in persons aged two years and over (Table 5). This represents a 26% increase on the previous quarter (130 episodes). Of the 164 episodes reported, 79% (130 episodes) were reported among patients aged 65 years and over (includes inpatient and community).
- In all, 105 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 105, 78% (82 episodes) were patients aged 65 years and over.
- The remaining 59 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 59, 81% (48 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.

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).

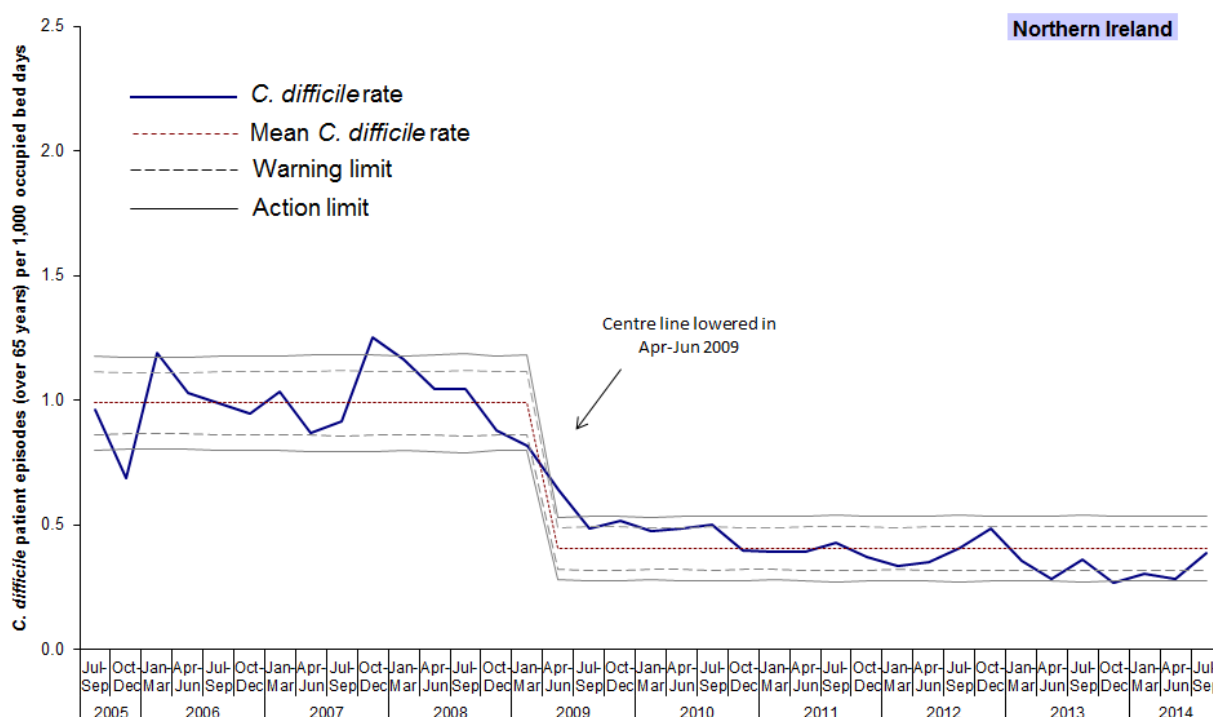


Figure 3: Statistical process control chart for quarterly *C. difficile* rates among inpatients in Northern Ireland aged 65 years and over (for HSCT level, see appendix B)

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 quarter four 2013 and quarters one and two 2014. Provisional ribotype data for this quarter (quarter three 2014) are also presented.
- This quarter, the most prevalent ribotypes for CDI inpatients are 078 (25.7%), 005 (13.5%), 002 (12.2%) and 015 (12.2%) (Table 1) and in the community are 078 (26.8%), 014 (19.6%) and 015 (12.5%) (Table 2).
- Descriptive data for July – September 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, October 2013 - September 2014

Ribotype	Oct - Dec 2013		Jan - Mar 2014		Apr - Jun 2014		Jul - Sep 2014	
	Number	%	Number	%	Number	%	Number	%
001	2	3.0	3	3.7	2	2.7	4	5.4
002	8	12.1	6	7.4	4	5.4	9	12.2
005	3	4.5	5	6.2	3	4.1	10	13.5
014	2	3.0	2	2.5	3	4.1	8	10.8
014/020	5	7.6	3	3.7	0	0.0	1	1.4
015	1	1.5	2	2.5	2	2.7	9	12.2
020	1	1.5	1	1.2	2	2.7	5	6.8
023	1	1.5	4	4.9	6	8.1	3	4.1
027	0	0.0	0	0.0	0	0.0	0	0.0
078	8	12.1	10	12.3	20	27.0	19	25.7
106	0	0.0	0	0.0	1	1.4	1	1.4
193	2	3.0	2	2.5	3	4.1	1	1.4
Other	13	19.7	11	13.6	13	17.6	19	25.7
Not groupable**	9	13.6	12	14.8	5	6.8	6	8.1
Not on ribotype list	8	12.1	7	8.6	5	6.8	1	1.4
Not isolated***	3	4.5	13	16.0	5	6.8	9	12.2
Total	66		81		74		105	

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 2013 - September 2014

Ribotype	Oct - Dec 2013		Jan - Mar 2014		Apr - Jun 2014		Jul - Sep 2014	
	Number	%	Number	%	Number	%	Number	%
001	1	2.5	1	2.9	0	0.0	0	0.0
002	3	7.5	2	5.7	5	8.9	4	7.1
005	1	2.5	3	8.6	5	8.9	3	5.4
014	2	5.0	4	11.4	4	7.1	11	19.6
014/020	1	2.5	3	8.6	0	0.0	0	0.0
015	3	7.5	1	2.9	4	7.1	7	12.5
020	2	5.0	3	8.6	0	0.0	2	3.6
023	1	2.5	0	0.0	1	1.8	2	3.6
027	0	0.0	0	0.0	1	1.8	0	0.0
078	7	17.5	5	14.3	17	30.4	15	26.8
106	0	0.0	0	0.0	0	0.0	1	1.8
193	1	2.5	0	0.0	1	1.8	3	5.4
Other	5	12.5	7	20.0	9	16.1	4	7.1
Not groupable**	3	7.5	4	11.4	3	5.4	2	3.6
Not on ribotype list	9	22.5	2	5.7	6	10.7	1	1.8
Not isolated***	1	2.5	0	0.0	0	0.0	4	7.1
Total	40		35		56		59	

* 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, 014 and 015 in Northern Ireland, July – September 2014

		078 (n=34)		014 (n=19)		015 (n=16)	
Age		5-91		39-97		16-94	
	range	76		84		76	
	median						
Sex		n	%	n	%	n	%
Female		16	47.1	11	57.9	11	68.8
Male		18	52.9	8	42.1	5	31.3
Trust							
Belfast		14	41.2	6	31.6	5	31.3
Northern		13	38.2	8	42.1	6	37.5
South Eastern		1	2.9	2	10.5	1	6.3
Southern		4	11.8	0	0.0	2	12.5
Western		2	5.9	3	15.8	2	12.5
Source							
Inpatient		19	55.9	8	42.1	9	56.3
Community*		15	44.1	11	57.9	7	43.8

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

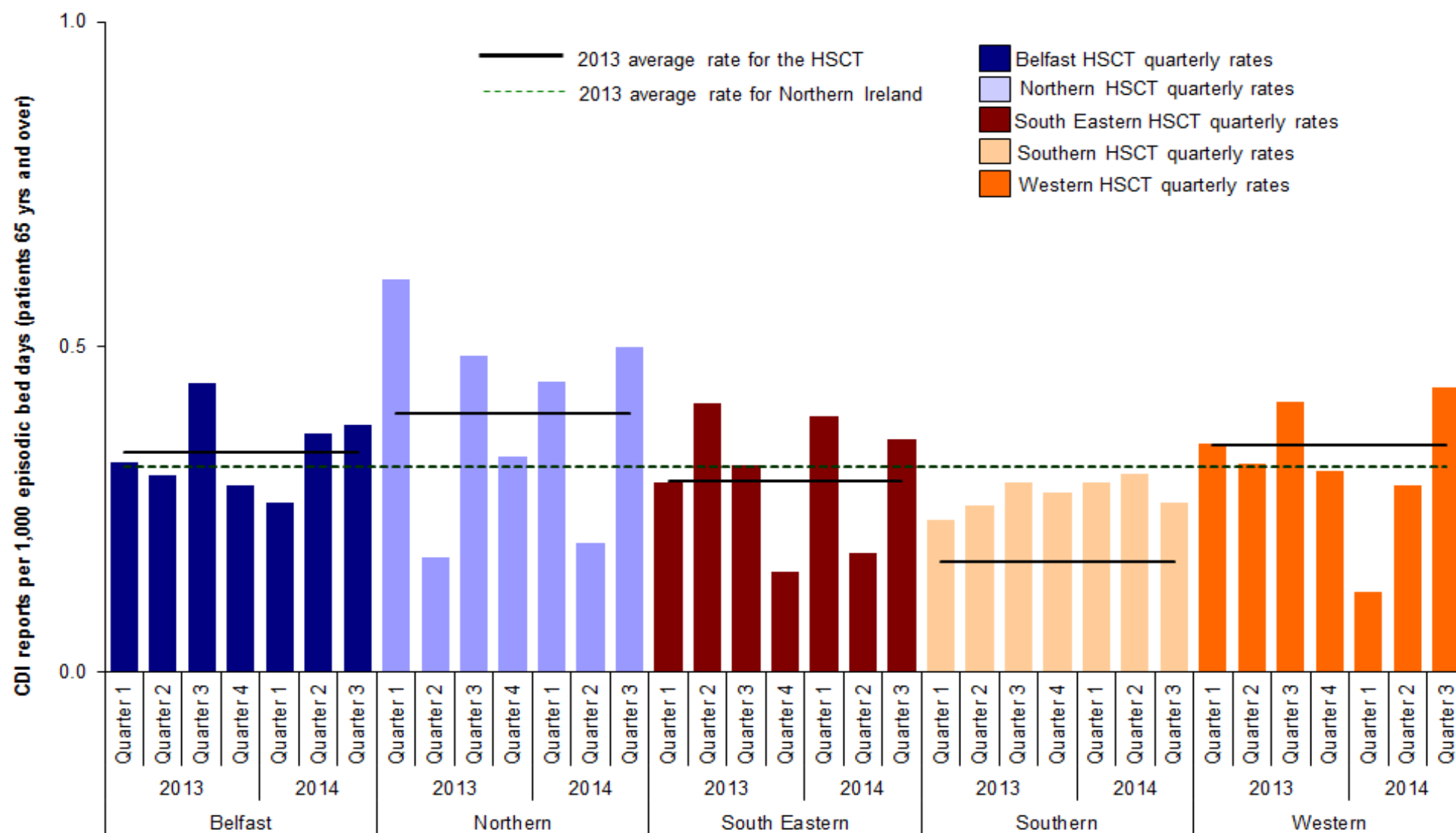


Figure 4: Quarterly rates of *C. difficile* among inpatients aged 65 years and over, by HSCT, 1 January 2013 - 30 September 2014, compared with annual Northern Ireland and HSCT rates for 2013

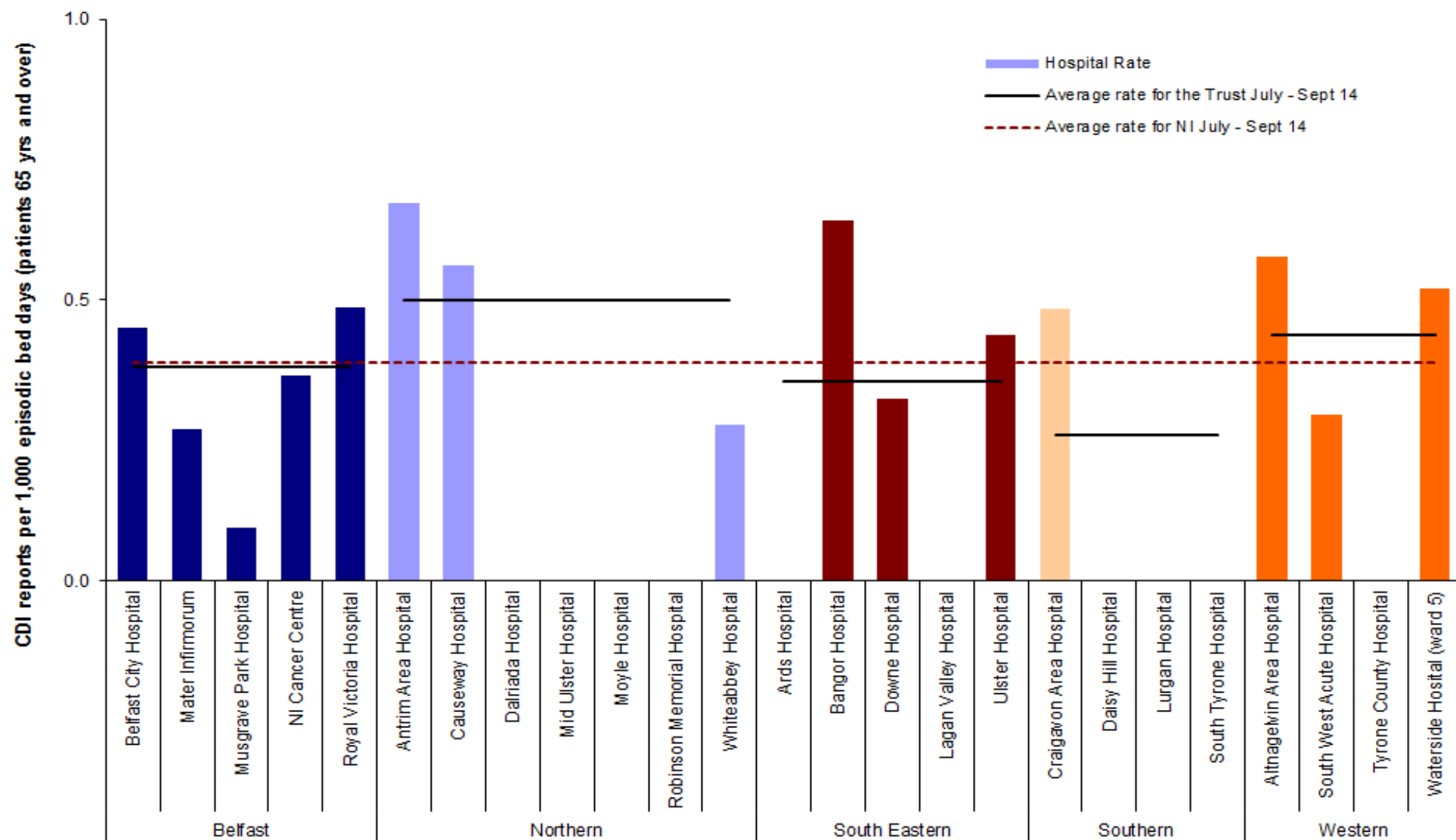


Figure 5: Rates of *C. difficile* in quarter three 2014 among inpatients aged 65 years and over, by hospital, including the quarterly HSCT rates and an average rate for Northern Ireland (see appendix A, Table 3)

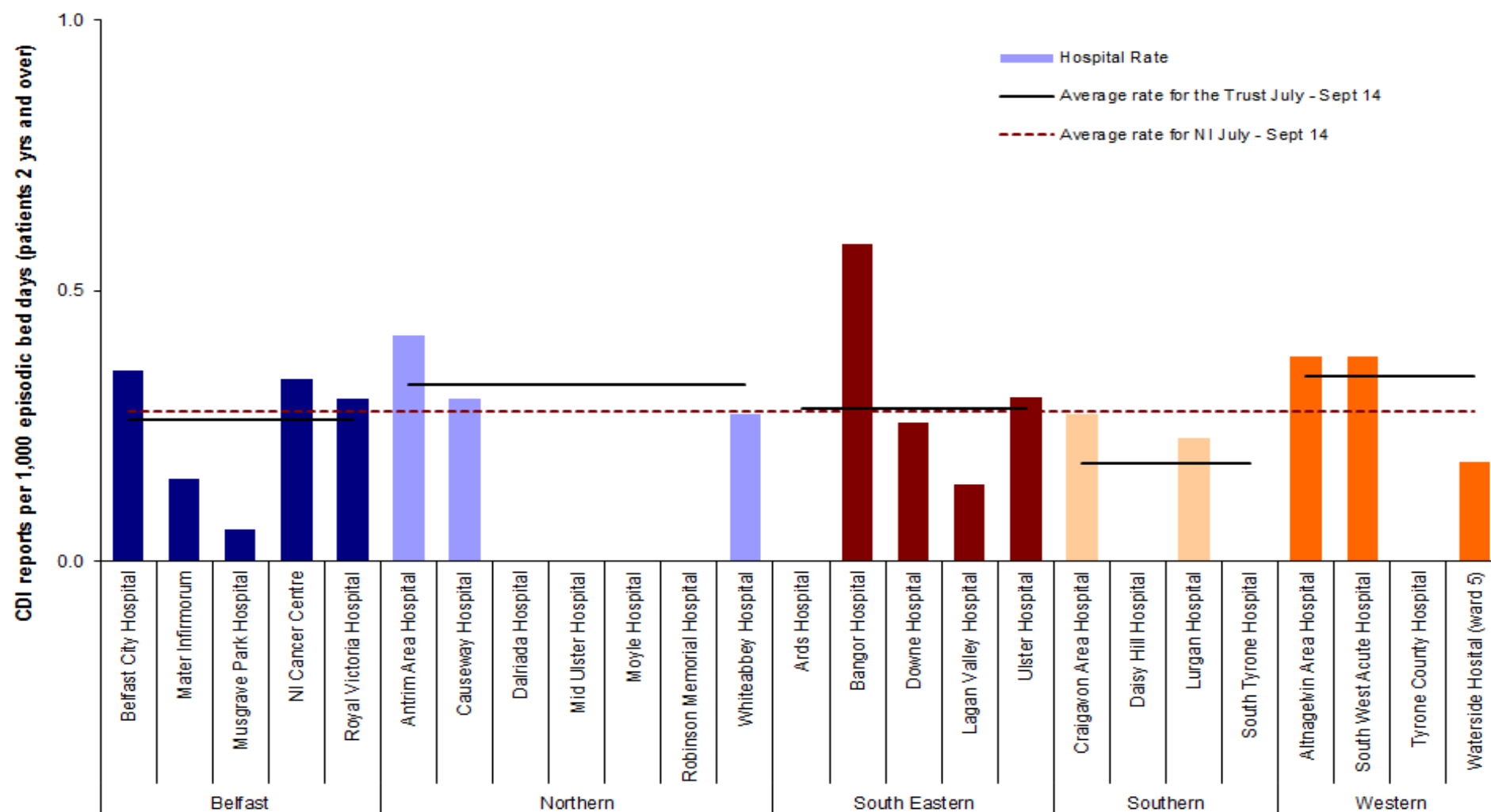


Figure 6: Rates of *C. difficile* in quarter three 2014 among inpatients aged two years and over, by hospital, including the quarterly HSCT rates and an average rate for Northern Ireland (see appendix A, Table 4)

Appendix A

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

Hospital	Oct - Dec 2013		Jan - March 2014		Apr - Jun 2014		Jul - Sept 2014	
	Episodes	Rate	Episodes	Rate	Episodes	Rate	Episodes	Rate
Belfast City Hospital	5	0.278	5	0.284	7	0.403	8	0.451
Mater Infirmorum	*	0.352	*	0.172	*	0.277	*	0.270
Musgrave Park Hospital	*	0.194	*	0.089	*	0.097	*	0.094
NICCO (formerly at Belvoir Park)	0	0.000	*	0.339	*	0.310	*	0.365
Royal Group of Hospitals	9	0.332	10	0.335	14	0.483	14	0.487
Belfast Health & Social Care Trust	20	0.287	19	0.260	26	0.367	27	0.380
Antrim Area Hospital	6	0.303	10	0.454	*	0.181	13	0.671
Causeway Hospital	5	0.553	6	0.687	*	0.117	*	0.562
Dalriada Hospital	*	0.540	0	0.000	0	0.000	0	0.000
Mid Ulster Hospital	*	0.499	0	0.000	0	0.000	0	0.000
Moyle Hospital	0	0.000	0	0.000	0	0.000	0	0.000
Robinson Memorial Hospital	0	0.000	*	0.712	0	0.000	0	0.000
Whiteabbey Hospital	0	0.000	*	0.297	*	0.878	*	0.278
Northern Health & Social Care Trust	13	0.331	18	0.446	8	0.198	19	0.500
Ards Hospital	0	0.000	0	0.000	0	0.000	0	0.000
Bangor Hospital	0	0.000	*	1.236	*	0.661	*	0.643
Downe Hospital	0	0.000	*	0.321	0	0.000	*	0.325
Lagan Valley Hospital	*	0.175	*	0.482	0	0.000	0	0.000
Ulster Hospital	*	0.185	10	0.353	*	0.228	12	0.439
South Eastern Health & Social Care Trust	6	0.154	16	0.392	7	0.183	14	0.356
Craigavon Area Hospital	*	0.408	*	0.381	5	0.286	8	0.484
Daisy Hill Hospital	0	0.000	0	0.000	*	0.245	0	0.000
Lurgan Hospital	*	0.262	0	0.000	*	0.239	0	0.000
South Tyrone Hospital	0	0.000	*	0.838	*	0.643	0	0.000
Southern Health & Social Care Trust	8	0.254	*	0.292	10	0.304	8	0.259
Altnagelvin Area Hospital	*	0.454	*	0.183	*	0.246	10	0.577
South West Acute Hospital	*	0.201	*	0.088	*	0.282	*	0.295
Tyrone County Hospital	0	0.000	0	0.000	*	0.751	0	0.000
Waterside Hospital (Wards 1, 2, 3, 5)	0	0.000	0	0.000	0	0.000	*	0.521
Western Health & Social Care Trust	10	0.309	*	0.124	9	0.287	14	0.436
NI TOTAL	57	0.269	67	0.303	60	0.281	82	0.388
NI community TOTAL	36		29		48		48	

*Cells with a value between 1 and 4 will now be anonymised with an astrix. In addition, where the anonymised cell can be deduced from the totals, the next smallest cells will also be anonymised.

Appendix A

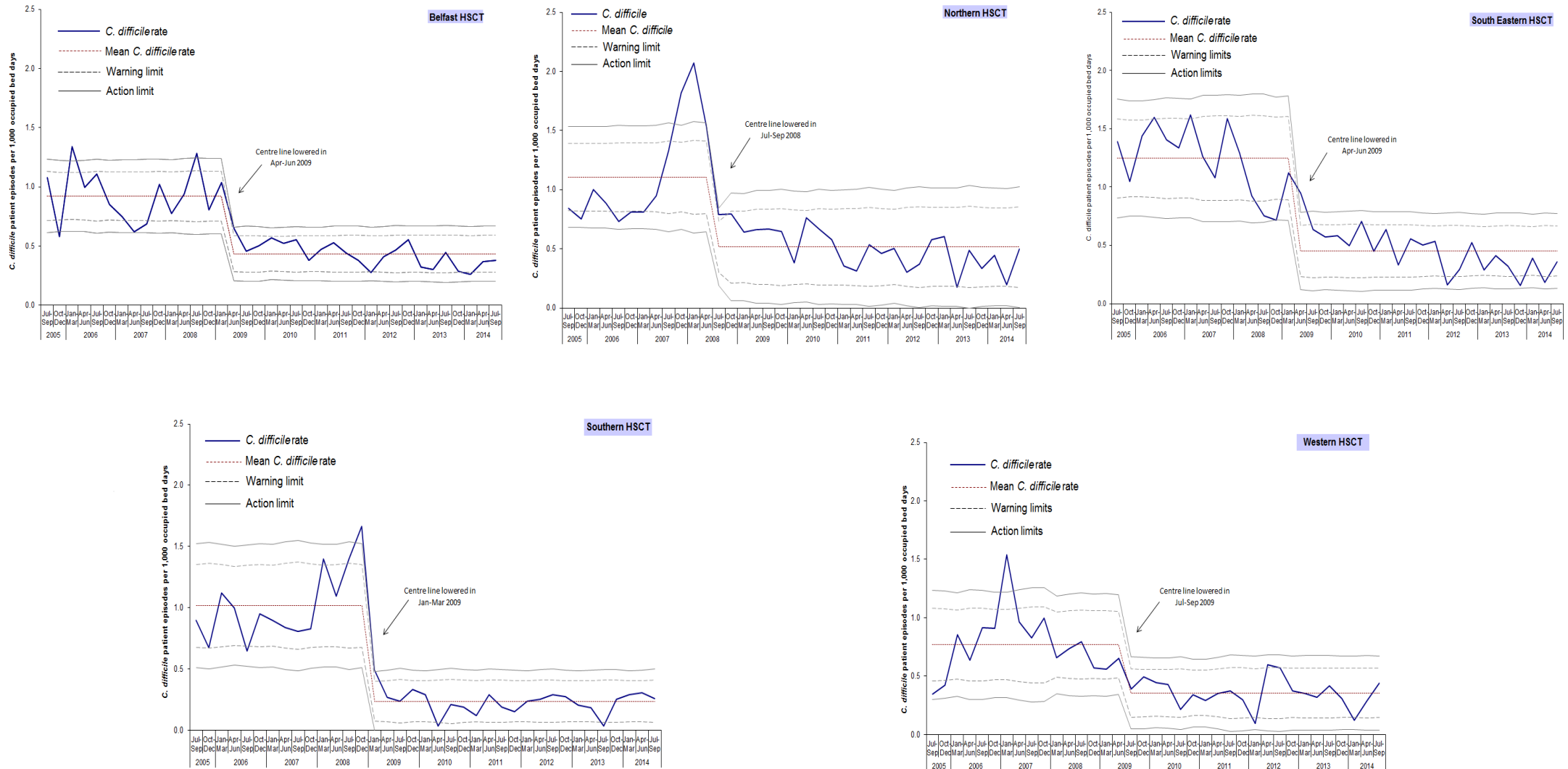
Table 5: Quarterly number and rate of *C. difficile* episodes in patients aged two years and over, by hospital, October 2013 - September 2014

Hospital	Oct - Dec 2013		Jan - March 2014		Apr - Jun 2014		Jul - Sept 2014	
	Episodes	Rate	Episodes	Rate	Episodes	Rate	Episodes	Rate
Belfast City Hospital	5	0.168	7	0.238	9	0.306	10	0.354
Mater Infirmorum	*	0.203	*	0.101	*	0.209	*	0.151
Musgrave Park Hospital	*	0.115	*	0.053	*	0.055	*	0.058
NICCO (formerly at Belvoir Park)	*	0.163	*	0.332	*	0.170	*	0.337
Royal Group of Hospitals	9	0.135	15	0.218	16	0.233	21	0.300
Belfast Health & Social Care Trust	21	0.150	27	0.189	31	0.220	37	0.262
Antrim Area Hospital	7	0.197	11	0.290	6	0.159	15	0.416
Causeway Hospital	5	0.304	6	0.367	*	0.062	*	0.300
Dalriada Hospital	*	0.491	0	0.000	0	0.000	0	0.000
Mid Ulster Hospital	*	0.442	0	0.000	0	0.000	0	0.000
Moyle Hospital	0	0.000	0	0.000	0	0.000	0	0.000
Robinson Memorial Hospital	0	0.000	*	0.553	0	0.000	0	0.000
Whiteabbey Hospital	0	0.000	*	0.255	*	0.869	*	0.272
Northern Health & Social Care Trust	14	0.223	19	0.289	10	0.154	21	0.328
Ards Hospital	0	0.000	0	0.000	0	0.000	0	0.000
Bangor Hospital	0	0.000	*	1.195	*	0.618	*	0.585
Downe Hospital	*	0.246	*	0.244	0	0.000	*	0.257
Lagan Valley Hospital	*	0.282	*	0.397	0	0.000	*	0.142
Ulster Hospital	6	0.133	12	0.252	*	0.199	14	0.304
South Eastern Health & Social Care Trust	9	0.151	18	0.288	10	0.168	17	0.281
Craigavon Area Hospital	*	0.293	7	0.198	5	0.145	*	0.272
Daisy Hill Hospital	0	0.000	*	0.065	*	0.198	0	0.000
Lurgan Hospital	*	0.232	0	0.000	*	0.229	*	0.229
South Tyrone Hospital	0	0.000	*	0.814	*	0.595	0	0.000
Southern Health & Social Care Trust	11	0.197	11	0.187	11	0.192	10	0.182
Altnagelvin Area Hospital	*	0.264	*	0.150	6	0.181	13	0.380
South West Acute Hospital	*	0.124	*	0.057	*	0.237	*	0.379
Tyrone County Hospital	0	0.000	0	0.000	*	0.716	0	0.000
Waterside Hospital (Wards 1, 2, 3, 5)	0	0.000	0	0.000	0	0.000	*	0.182
Western Health & Social Care Trust	11	0.186	6	0.101	12	0.207	20	0.343
NI TOTAL	66	0.175	81	0.208	74	0.194	105	0.277
NI community TOTAL	40		35		56		59	

***Cells with a value between 1 and 4 will now be anonymised with an astrix. In addition, where the anonymised cell can be deduced from the totals, the next smallest cells will also be anonymised.**

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, N_i is the number of occupied bed days per quarter and E_i 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