

C. difficile surveillance

Quarterly report

October - December 2012 (Q4 2012)

Key points

- CDI reports for hospital inpatients aged 65 years and over increased by 25% (from 83 to 104 episodes) during quarter four 2012 compared to quarter three 2012. CDI rates increased by 19% during quarter four 2012.
- CDI reports for community patients aged 65 years and over increased by 79% (from 28 to 50 episodes) during quarter four 2012 compared to quarter three 2012.
- Total CDI reports, for hospital inpatients and community patients combined, aged two years and over, increased by 30% this quarter (from 138 to 180 episodes).
- CDI reports for hospital inpatients aged 65 years and over fell by 17% between the 2010/11 and 2011/12 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 four 2012, 154 episodes of CDI were reported in persons aged 65 years and over compared to 111 in the previous quarter (39% increase, 43 reports; Figure 1).
- This quarter's CDI figures are higher than those reported during the same period in 2010 and 2011 but are lower than those reported during the same period in previous years from 2005-2009 (Figure 1).
- Of these 154 episodes reported in quarter four 2012, 104 (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 50 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 an increase in the proportion of CDI reports from the community – 32% (50/154) reported this quarter compared to 25% (28/111) in quarter three 2012.

Inpatient episodes for patients aged 65 years and over

- This quarter has seen inpatient CDI cases increase by 25%, from 83 in quarter three 2012 to 104 this quarter (Figure 2a).
- This quarter's CDI inpatient figures are higher than those reported during the same period in the previous years 2010 and 2011 but lower than those reported in quarter four in 2005 to 2009 (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 (50 reports) have increased by 79% compared to quarter three 2012 (28 reports) (Figure 1 and Table 4).
- The number of community episodes this quarter (50 reports) is lower than the number reported for the same quarter in 2008 and 2010 but higher than those reported in previous years (2005-2007, 2009 & 2011; Figure 1). This number may include patients who have had a recent healthcare interaction.

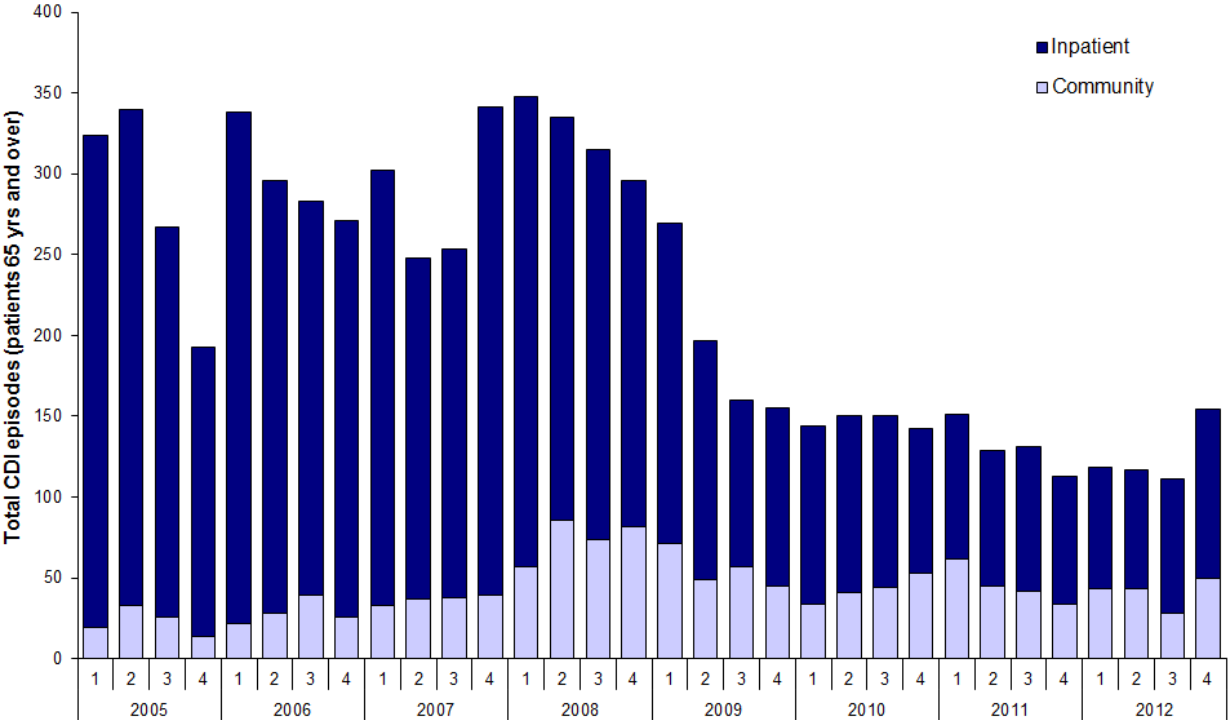


Figure 1: Total CDI reports, inpatient and community, in Northern Ireland, by quarter (patients ≥ 65 years), between 2005 and 2012

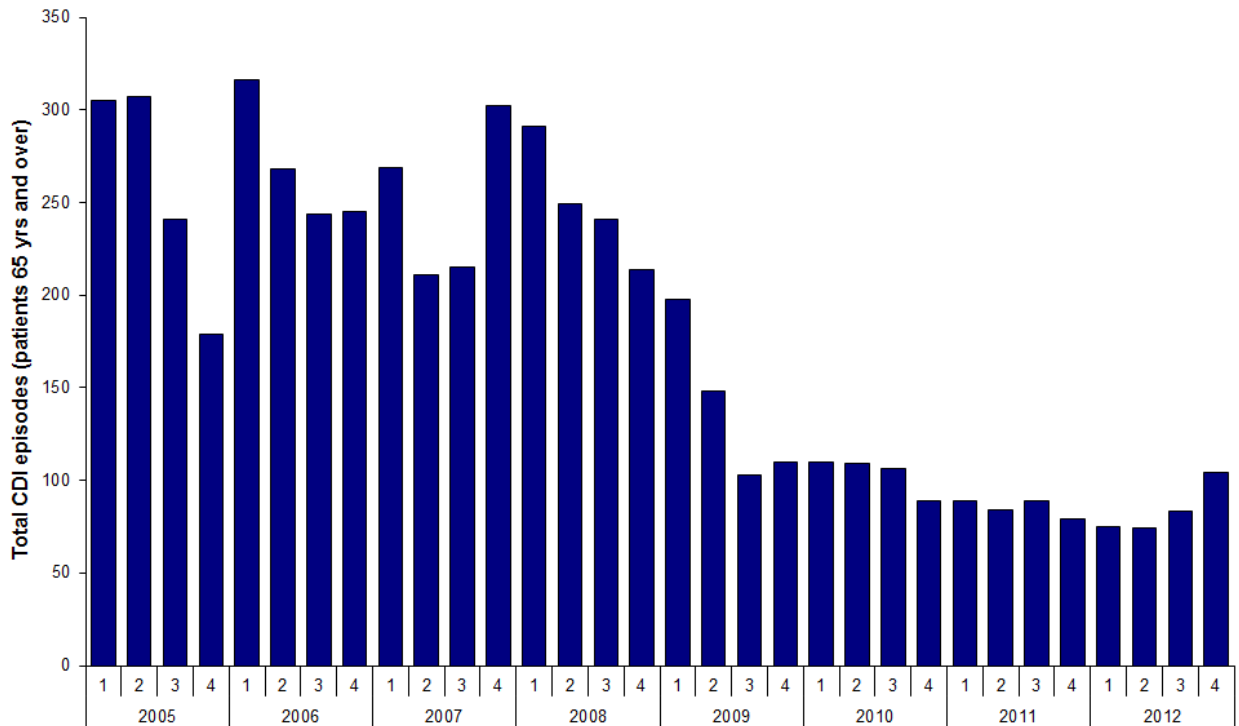


Figure 2a: Total CDI inpatient reports in Northern Ireland, by quarter (patients ≥ 65 years), between 2005 and 2012

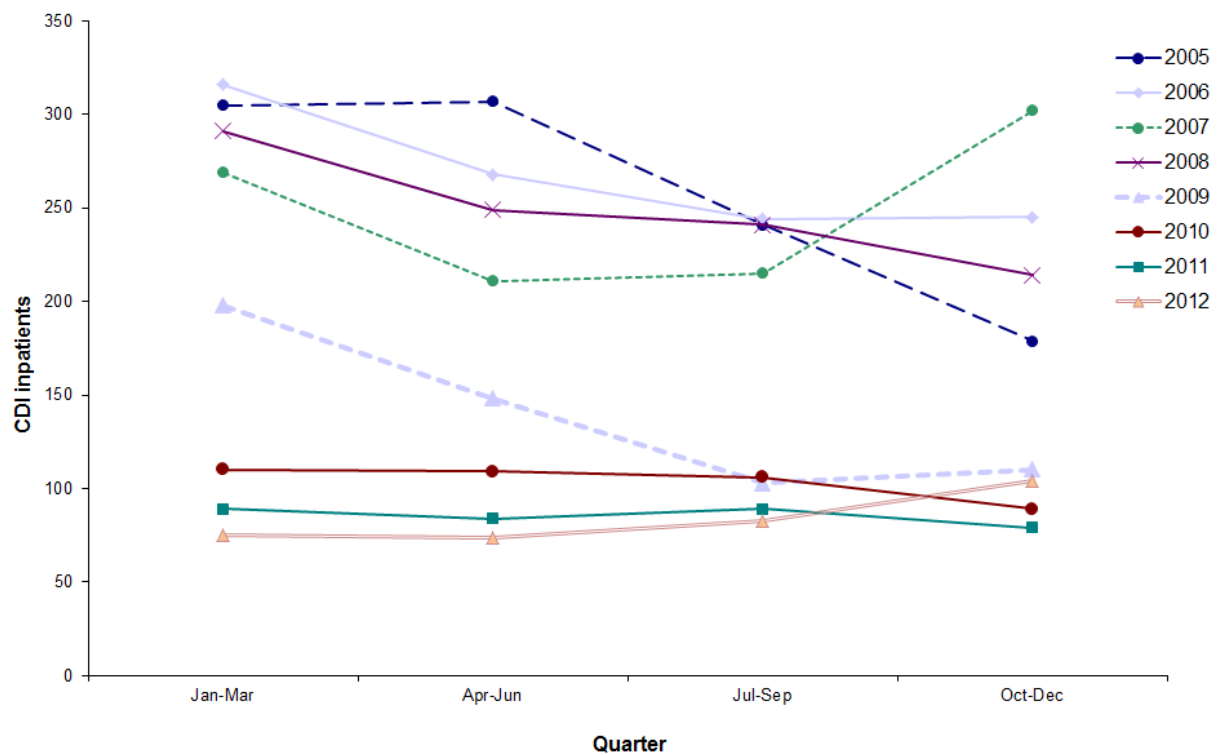


Figure 2b: Total CDI inpatient reports in Northern Ireland, by quarter (patients ≥ 65 years), between 2005 and 2012

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

- During quarter four 2012, 180 episodes of *C. difficile* infection were reported in persons aged two years and over (Table 5). This represents a 30% increase on the previous quarter (138 episodes). Of the 180 episodes reported, 86% were reported among patients aged 65 years and over (includes inpatient and community).
- In all, 126 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 126, 83% were patients aged 65 years and over.
- The remaining 54 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 54, 93% 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 four 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 remains within expected parameters on the SPC chart (Figure 3).

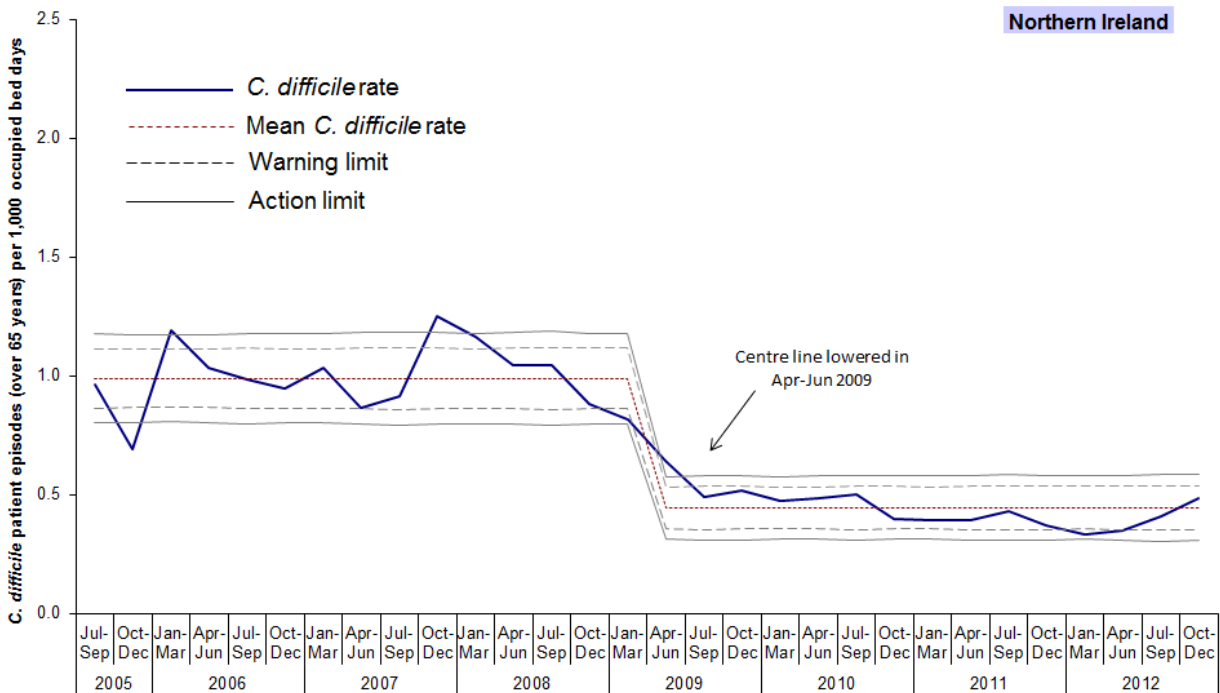


Figure 3: Statistical process control chart for quarterly *C. difficile* rates among inpatients in Northern Ireland aged 65 years and over (for HSCT level, see appendix B)

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 one, quarter two and quarter three 2012. Provisional ribotype data for this quarter (quarter four 2012) are also presented.
- This quarter, the most prevalent ribotypes for CDI inpatients are 078 (27.8%), 002 (7.9%) and 005 (6.3%) (Table 1) and in the community are 078 (25.9%), 002 (9.3%) and 193 (7.4%) (Table 2).
- Descriptive data for October – December 2012, summarising the age, gender, HSCT and source description of the four 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, January – December 2012

Ribotype	Jan - Mar 2012		Apr - Jun 2012		Jul - Sep 2012		Oct - Dec 2012*	
	Number	%	Number	%	Number	%	Number	%
001	0	0.0	4	4.4	1	1.0	2	1.6
002	12	13.2	7	7.7	9	8.7	10	7.9
005	3	3.3	3	3.3	3	2.9	8	6.3
014	4	4.4	7	7.7	9	8.7	6	4.8
015	3	3.3	3	3.3	6	5.8	5	4.0
020	6	6.6	4	4.4	3	2.9	6	4.8
023	4	4.4	0	0.0	4	3.9	4	3.2
027	0	0.0	0	0.0	0	0.0	1	0.8
078	20	22.0	29	31.9	25	24.3	35	27.8
106	1	1.1	0	0.0	4	3.9	0	0.0
193	1	1.1	3	3.3	4	3.9	5	4.0
Other	16	17.6	12	13.2	12	11.7	19	15.1
Not groupable**	10	11.0	7	7.7	7	6.8	11	8.7
Not on ribotype list	3	3.3	5	5.5	9	8.7	8	6.3
Not isolated***	8	8.8	7	7.7	7	6.8	6	4.8
Total	91		91		103		126	

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, January – December 2012

Ribotype	Jan - Mar 2012		Apr - Jun 2012		Jul - Sep 2012		Oct - Dec 2012*	
	Number	%	Number	%	Number	%	Number	%
001	4	8.2	4	8.7	3	8.6	1	1.9
002	5	10.2	0	0.0	3	8.6	5	9.3
005	2	4.1	3	6.5	5	14.3	3	5.6
014	4	8.2	2	4.3	1	2.9	0	0.0
015	2	4.1	3	6.5	1	2.9	3	5.6
020	1	2.0	1	2.2	0	0.0	3	5.6
023	1	2.0	2	4.3	1	2.9	3	5.6
027	0	0.0	0	0.0	0	0.0	1	1.9
078	14	28.6	16	34.8	9	25.7	14	25.9
106	0	0.0	0	0.0	1	2.9	1	1.9
193	2	4.1	1	2.2	1	2.9	4	7.4
Other	6	12.2	7	15.2	5	14.3	6	11.1
Not groupable**	3	6.1	1	2.2	3	8.6	5	9.3
Not on ribotype list	0	0.0	4	8.7	0	0.0	2	3.7
Not isolated***	5	10.2	2	4.3	2	5.7	3	5.6
Total	49		46		35		54	

* 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, October – December 2012

	078 (n=49)		002 (n=15)		005 (n=11)	
Age	range		range		range	
	15-95		55-91		43-86	
	median		median		median	
	77		79		81	
Sex	n	%	n	%	n	%
Female	29	59.2	8	53.3	7	63.6
Male	20	40.8	7	46.7	4	36.4
Trust						
Belfast	15	30.6	5	33.3	4	36.4
Northern	15	30.6	5	33.3	3	27.3
South Eastern	1	2.0	2	13.3	1	9.1
Southern	8	16.3	1	6.7	0	0.0
Western	10	20.4	2	13.3	3	27.3
Source						
Inpatient	35	71.4	10	66.7	8	72.7
Community*	14	28.6	5	33.3	3	27.3

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

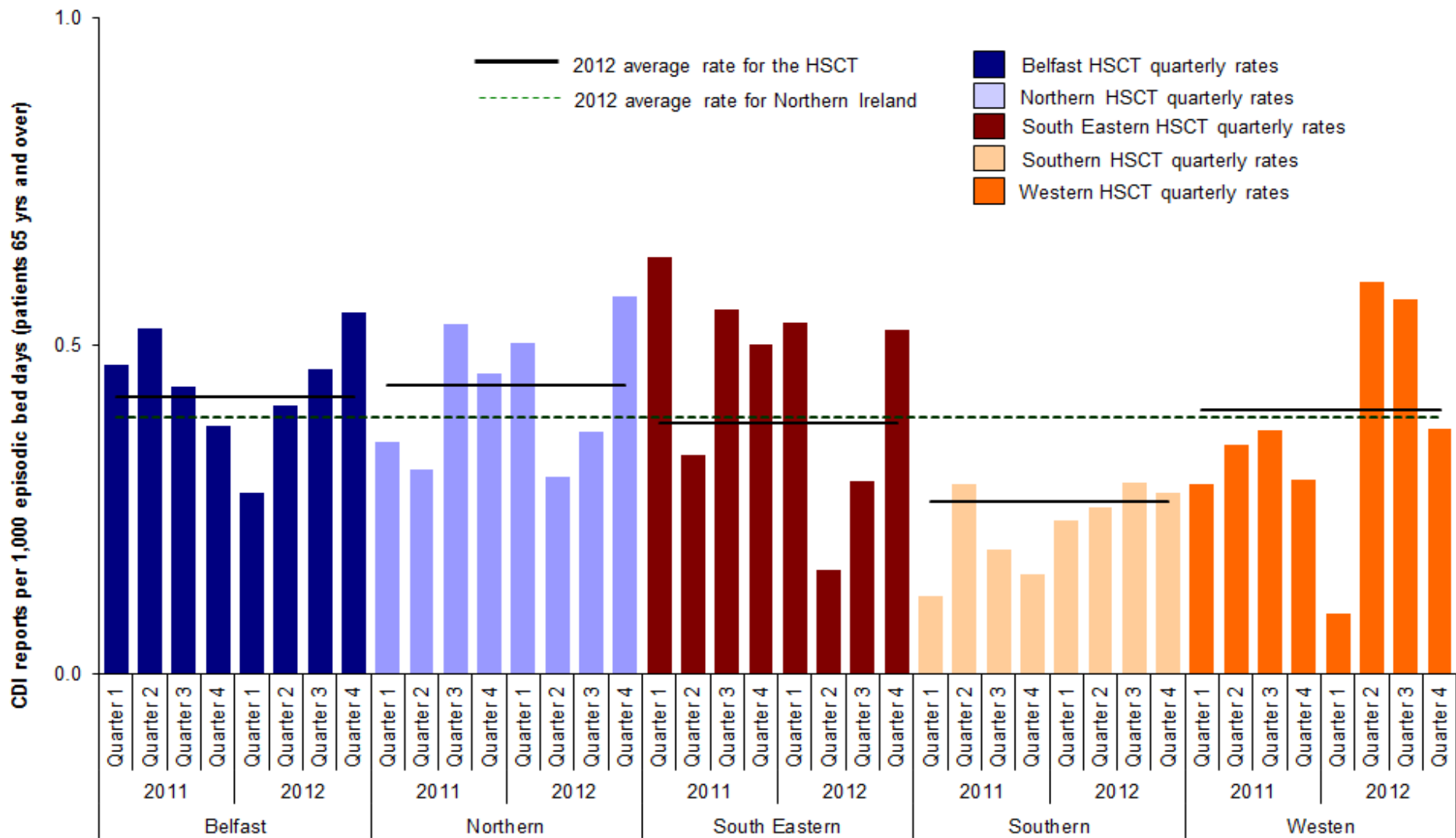


Figure 4: Quarterly rates of *C. difficile* among inpatients aged 65 years and over, by HSCT, 1 January 2011 – 31 December 2012, compared with annual Northern Ireland and HSCT rates for 2012

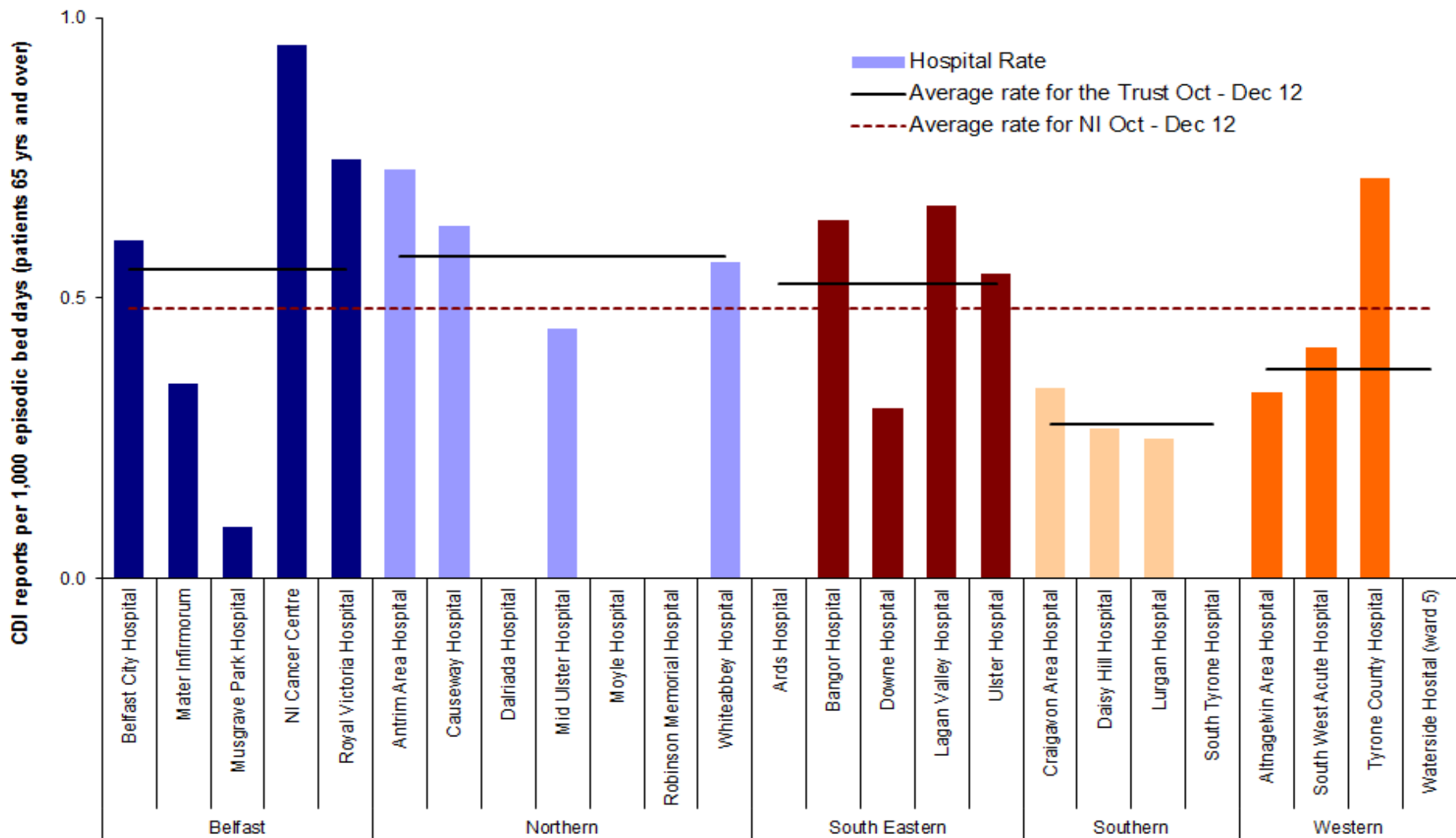


Figure 5: Rates of *C. difficile* in quarter four 2012 among inpatients aged 65 years and over, by hospital, including the quarterly HSCT rates and an average rate for Northern Ireland (see appendix A, Table 3)

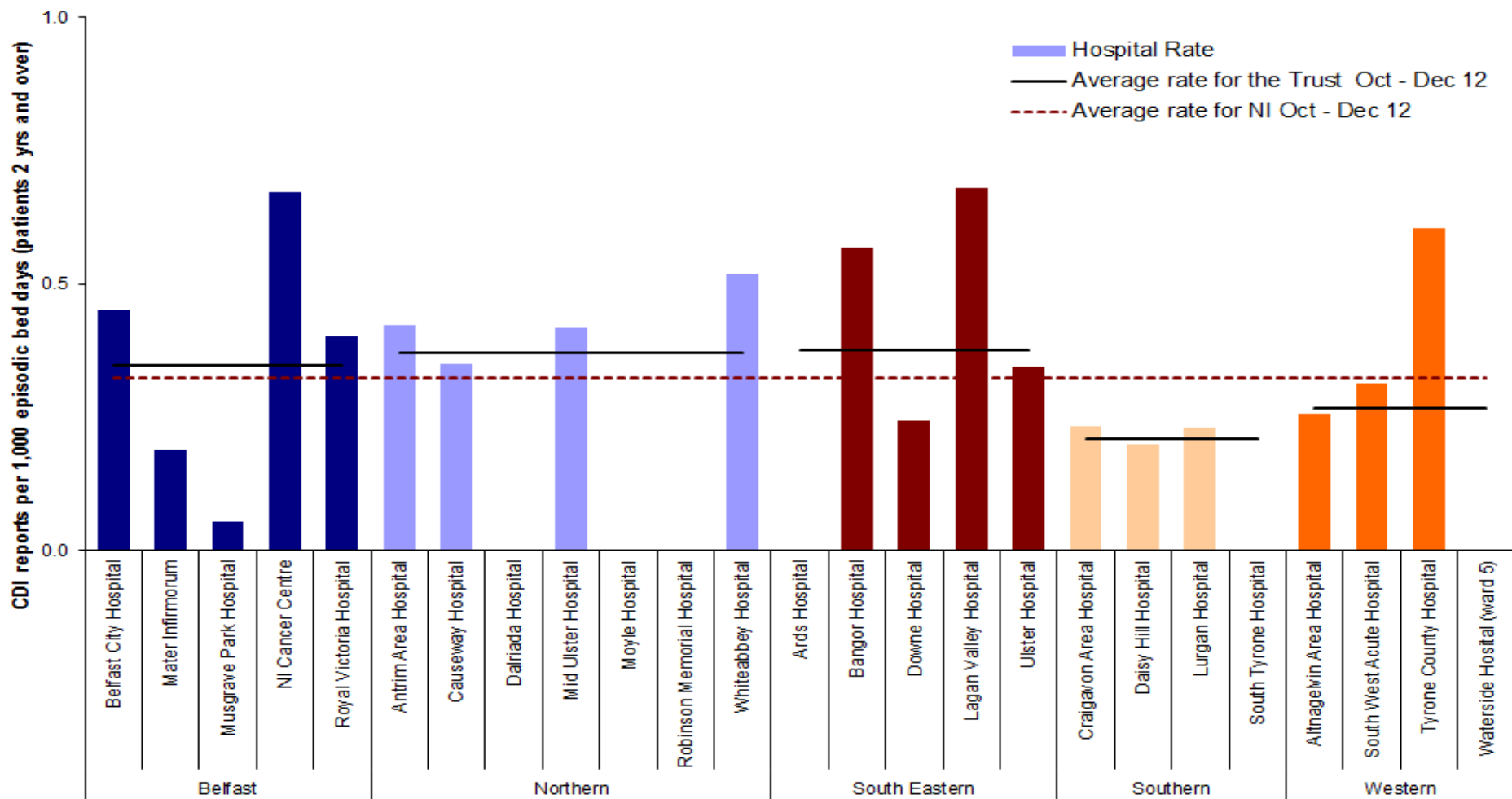


Figure 6: Rates of *C. difficile* in quarter four 2012 among inpatients aged two years and over, by hospital, including the quarterly HSCT rates and an average rate for Northern Ireland (see appendix A, Table 4)

Appendix A

Table 4: Quarterly number and rate of *C. difficile* episodes in patients aged 65 years and over, by hospital, January - December 2012

Hospital	Jan-Mar 2012		Apr-Jun 2012		Jul-Sept 2012		Oct - Dec 2012	
	Episodes	Rate	Episodes	Rate	Episodes	Rate	Episodes	Rate
Belfast City Hospital	8	0.390	11	0.549	8	0.399	12	0.602
Forster Green Hospital*	0	0.000	-	-	-	-	-	-
Mater Infirmorum	2	0.158	4	0.333	8	0.732	4	0.348
Musgrave Park Hospital	4	0.368	1	0.093	3	0.301	1	0.093
NICCO (formerly at Belvoir Park)	0	0.000	2	0.715	4	1.371	3	0.951
Royal Victoria Hospital	7	0.243	12	0.434	9	0.359	19	0.748
Belfast Health & Social Care Trust	21	0.277	30	0.410	32	0.464	39	0.552
Antrim Area Hospital	9	0.427	6	0.306	8	0.445	14	0.730
Causeway Hospital	8	0.760	4	0.424	4	0.410	6	0.628
Dalriada Hospital	0	0.000	0	0.000	0	0.000	0	0.000
Mid Ulster Hospital	1	0.412	0	0.000	0	0.000	1	0.446
Moyle Hospital	0	0.000	0	0.000	0	0.000	0	0.000
Robinson Memorial Hospital	0	0.000	0	0.000	0	0.000	0	0.000
Whiteabbey Hospital	4	0.901	2	0.530	2	0.624	2	0.564
Northern Health & Social Care Trust	22	0.504	12	0.300	14	0.369	23	0.567
Ards Hospital	0	0.000	0	0.000	0	0.000	0	0.000
Bangor Hospital	0	0.000	1	0.660	1	0.675	1	0.639
Downe Hospital	4	1.275	0	0.000	1	0.335	1	0.303
Lagan Valley Hospital	5	0.835	0	0.000	2	0.378	4	0.664
Ulster Hospital	12	0.446	5	0.195	7	0.268	15	0.544
South Eastern Health & Social Care Trust	21	0.535	6	0.159	11	0.294	21	0.524
Craigavon Area Hospital	6	0.330	6	0.370	5	0.314	6	0.340
Daisy Hill Hospital	1	0.121	0	0.000	4	0.530	2	0.267
Lurgan Hospital	0	0.000	1	0.242	0	0.000	1	0.250
South Tyrone Hospital	1	0.290	1	0.298	0	0.000	0	0.000
Southern Health & Social Care Trust	8	0.234	8	0.255	9	0.292	9	0.275
Altnagelvin Area Hospital	2	0.108	13	0.739	12	0.704	6	0.332
Erne / South West Acute Hospital**	1	0.103	4	0.471	2	0.221	4	0.411
Tyrone County Hospital	0	0.000	1	0.385	3	1.223	2	0.741
Waterside Hospital (Wards 1, 2, 3, 5)	0	0.000	0	0.000	0	0.000	0	0.000
Western Health & Social Care Trust	3	0.092	18	0.597	17	0.570	12	0.374
NI TOTAL	75	0.333	74	0.348	83	0.405	104	0.483
NI community TOTAL	43	-	43	-	28	-	50	-

*Neurology Unit in Forster Green relocated to Musgrave Park.

**South West Acute Hospital opened 21st June 2012.

Appendix A

Table 5: Quarterly number and rate of *C. difficile* episodes in patients aged two years and over, by hospital, January - December 2012

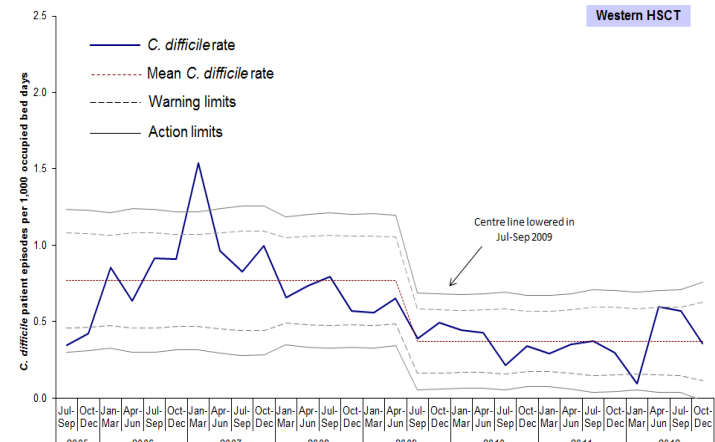
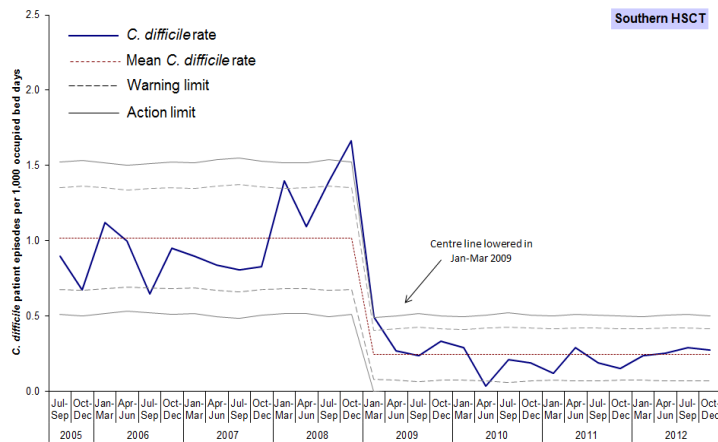
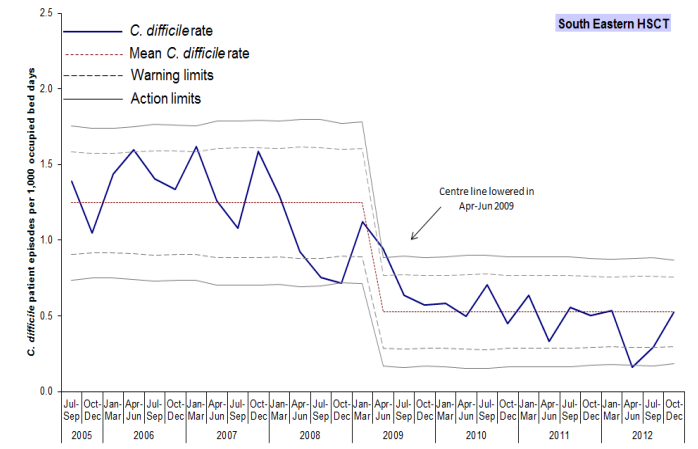
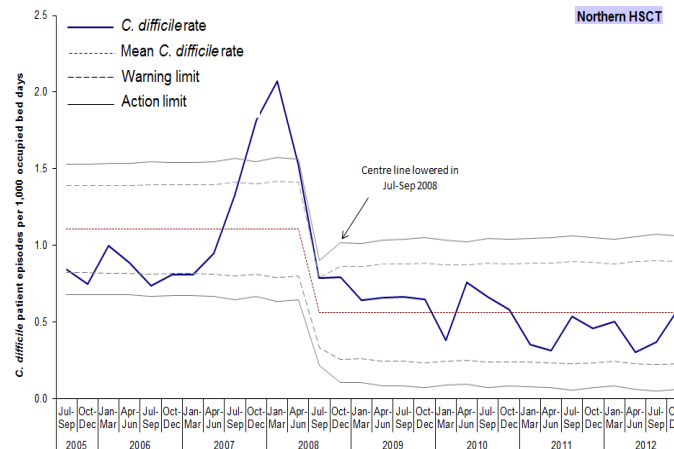
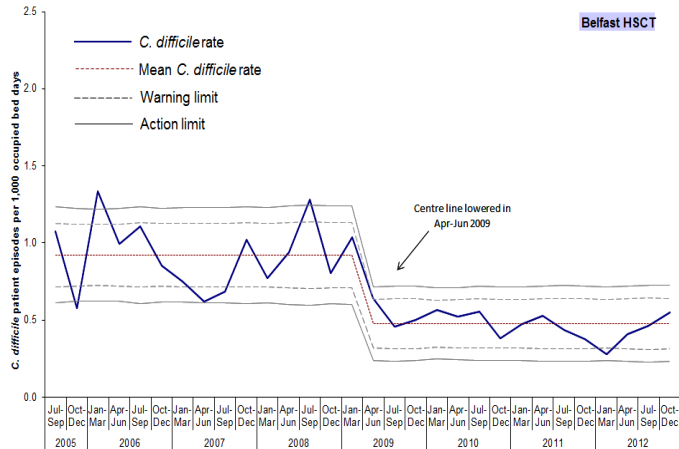
Hospital	Jan-Mar 2012		Apr-Jun 2012		Jul-Sept 2012		Oct - Dec 2012	
	Episodes	Rate	Episodes	Rate	Episodes	Rate	Episodes	Rate
Belfast City Hospital	10	0.294	15	0.444	11	0.334	15	0.450
Forster Green Hospital*	0	0.000	-	-	-	-	-	-
Mater Infirmorum	3	0.135	4	0.183	8	0.384	4	0.189
Musgrave Park Hospital	5	0.287	1	0.053	3	0.165	1	0.053
NICCO (formerly at Belvoir Park)	1	0.161	2	0.327	6	0.987	4	0.671
Royal Victoria Hospital	10	0.145	20	0.303	14	0.219	26	0.403
Belfast Health & Social Care Trust	29	0.192	42	0.287	42	0.296	50	0.348
Antrim Area Hospital	12	0.325	7	0.203	12	0.362	15	0.424
Causeway Hospital	11	0.582	4	0.214	4	0.216	7	0.349
Dalriada Hospital	0	0.000	0	0.000	0	0.000	0	0.000
Mid Ulster Hospital	1	0.371	0	0.000	0	0.000	1	0.416
Moyle Hospital	0	0.000	0	0.000	0	0.000	0	0.000
Robinson Memorial Hospital	0	0.000	0	0.000	0	0.000	0	0.000
Whiteabbey Hospital	4	0.941	2	0.509	2	0.537	2	0.518
Northern Health & Social Care Trust	28	0.407	13	0.200	18	0.284	25	0.372
Ards Hospital	0	0.000	0	0.000	0	0.000	0	0.000
Bangor Hospital	0	0.000	1	0.583	1	0.607	1	0.567
Downe Hospital	4	0.977	0	0.000	2	0.511	1	0.243
Lagan Valley Hospital	5	0.681	0	0.000	2	0.300	5	0.681
Ulster Hospital	13	0.278	7	0.158	10	0.224	16	0.345
South Eastern Health & Social Care Trust	22	0.356	8	0.136	15	0.256	23	0.376
Craigavon Area Hospital	6	0.172	7	0.212	6	0.180	8	0.233
Daisy Hill Hospital	1	0.064	0	0.000	4	0.273	3	0.200
Lurgan Hospital	0	0.000	1	0.232	0	0.000	1	0.230
South Tyrone Hospital	1	0.276	1	0.287	0	0.000	0	0.000
Southern Health & Social Care Trust	8	0.136	9	0.162	10	0.179	12	0.209
Altnagelvin Area Hospital	3	0.081	14	0.394	13	0.388	9	0.257
Erne / South West Acute Hospital**	1	0.064	4	0.281	2	0.133	5	0.313
Tyrone County Hospital	0	0.000	1	0.324	3	1.014	2	0.603
Waterside Hospital (Wards 1, 2, 3, 5)	0	0.000	0	0.000	0	0.000	0	0.000
Western Health & Social Care Trust	4	0.064	19	0.325	18	0.318	16	0.268
NI TOTAL	91	0.226	91	0.237	103	0.274	126	0.324
NI community TOTAL	49	-	46	-	35	-	54	-

*Neurology Unit in Forster Green relocated to Musgrave Park.

**South West Acute Hospital opened 21st June 2012.

Appendix B

Trends in *C. difficile* rates in inpatients aged 65 years and over, by HSCT and quarter, 2005–2012



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
Belfast	352	336	280	327	163	147	117
Northern	184	172	297	172	102	103	75
South Eastern	243	256	199	135	98	80	72
Southern	168	130	134	164	37	17	28
Western	96	132	109	104	71	46	35
Northern Ireland	1043	1026	1019	902	471	393	327