

***C. difficile* surveillance**

Quarter Ending September 2009

Surveillance of *C. difficile* associated diarrhoea (CDAD)

Key Points

- ❖ CDAD numbers and rates for hospital in-patients, over 65 years of age, in Northern Ireland have continued to decline during July – September 2009 (Figure 1).
- ❖ CDAD reports from ‘community’ patients, over 65 years of age, for the July – September quarter have increased by 16% (increase of 8 episodes) compared with the previous quarter of 2009 (Figure 1; Appendix A).
- ❖ CDAD reports in hospital in-patients aged 65 years and over fell by 12% between the 2007/08 and 2008/09 financial years (Appendix F)
- ❖ Overall, CDAD reports for hospital inpatients and ‘community’ patients, aged 2 years and over in Northern Ireland have continued to decline during July – September 2009 (Table 2; Appendix A).

C. difficile reporting

- ❖ Reports of *C. difficile* are obtained directly from each diagnostic laboratory through the routine laboratory surveillance programme.
- ❖ Line listings of *C. difficile* cases are returned to the diagnostic laboratories who confirm the totals and the break-down of patients by source (hospital inpatient/community) according to the information provided on laboratory request forms.
- ❖ The data in this report therefore represents CDAD episodes that have been validated by the diagnostic laboratories. It is possible that these numbers may change when cross referenced with the HCAI web-based surveillance system. Any updates will be reflected in the next report.
- ❖ The total number of *C. difficile* episodes in in-patients aged 65 years and over is presented for each Trust, by financial year, in Appendix F.

July – September 2009

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

- ❖ During the quarter, 159 episodes of CDAD were reported in persons aged 65 years and over compared to 196 episodes in the previous quarter of 2009 (19% decrease, 37 reports; Figure 1).
- ❖ This quarter’s CDAD figures are lower than those reported during the same period in previous years, and are the lowest recorded for this quarter since reporting began in 2005 (Figure 1).
- ❖ Of these 159 episodes, 102 were known to have been a hospital in-patient in one of the listed hospitals (Appendix A Table 1) at the time their sample was taken.
- ❖ The remaining 57 isolates reported were from ‘community’ samples which may include: GPs, nursing homes and other non-acute settings. This figure represents an increase in the proportion of CDAD reports from the ‘community’; 25% (49/196 episodes) in the April – June quarter, compared with 36% (57/159) this quarter.

Inpatient episodes for patients aged 65 years and over

- ❖ There has been a decrease of 45 cases (30.6%) in the number of in-patient CDAD cases reported in this quarter (102) compared to the previous quarter (147). This is the seventh consecutive quarter in which there has been a reduction in inpatient CDAD episodes (Figure 2a).
- ❖ Comparing the July – September period in 2009 (102 episodes) to the same quarters in 2008 (238 episodes) and 2007 (215 episodes), there has been a decrease in the number of cases reported (57% and 53% decrease respectively; Figure 2b).
- ❖ For a breakdown of CDAD rates by Trust/hospitals see Figures 4 and 5.

Community episodes for patients aged 65 years and over

- ❖ Community episodes of CDAD have increased by 8 (16%) this quarter when compared to the previous quarter of 2009 (57 reported this quarter compared to 49 reports in April – June, Figure 1 and Appendix A).
- ❖ The number of 'community' isolates in this quarter (57 cases) is lower than the number reported in the same quarter (July – September) 2008 (a reduction of 17 cases; 23% decrease; Figure 1). 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.

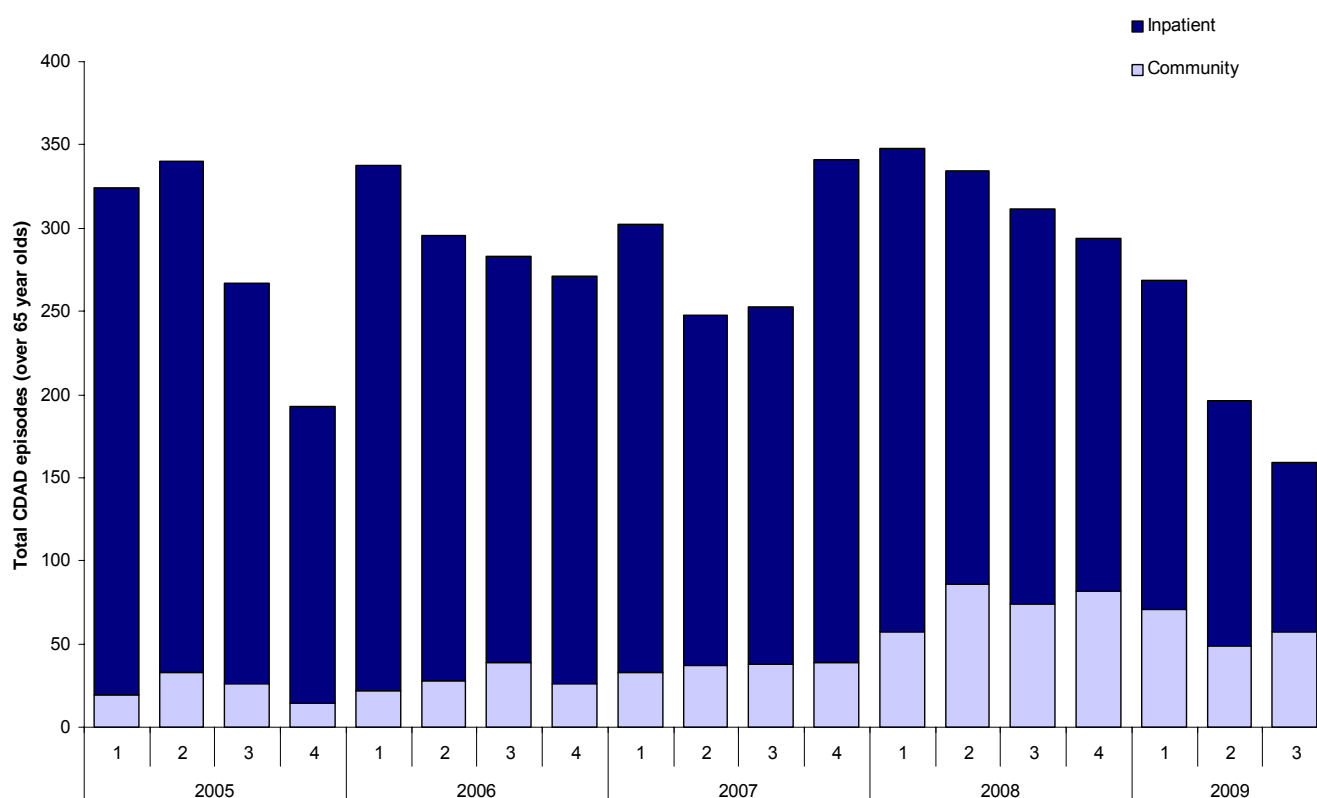


Figure 1: Total CDAD reports, inpatient and community, in Northern Ireland, by quarter (patients ≥ 65 years), between 2005 and 2009.

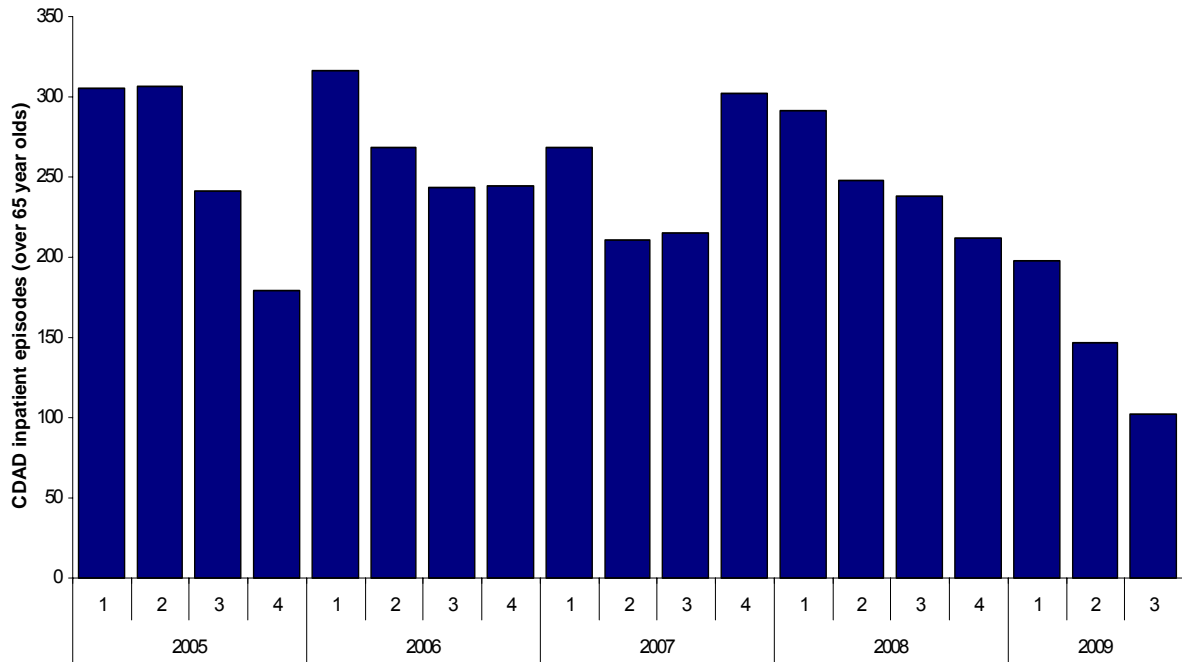


Figure 2a: Total CDAD 'Inpatient' reports, Northern Ireland, by quarter (patients ≥ 65 years), between 2005 and 2009.

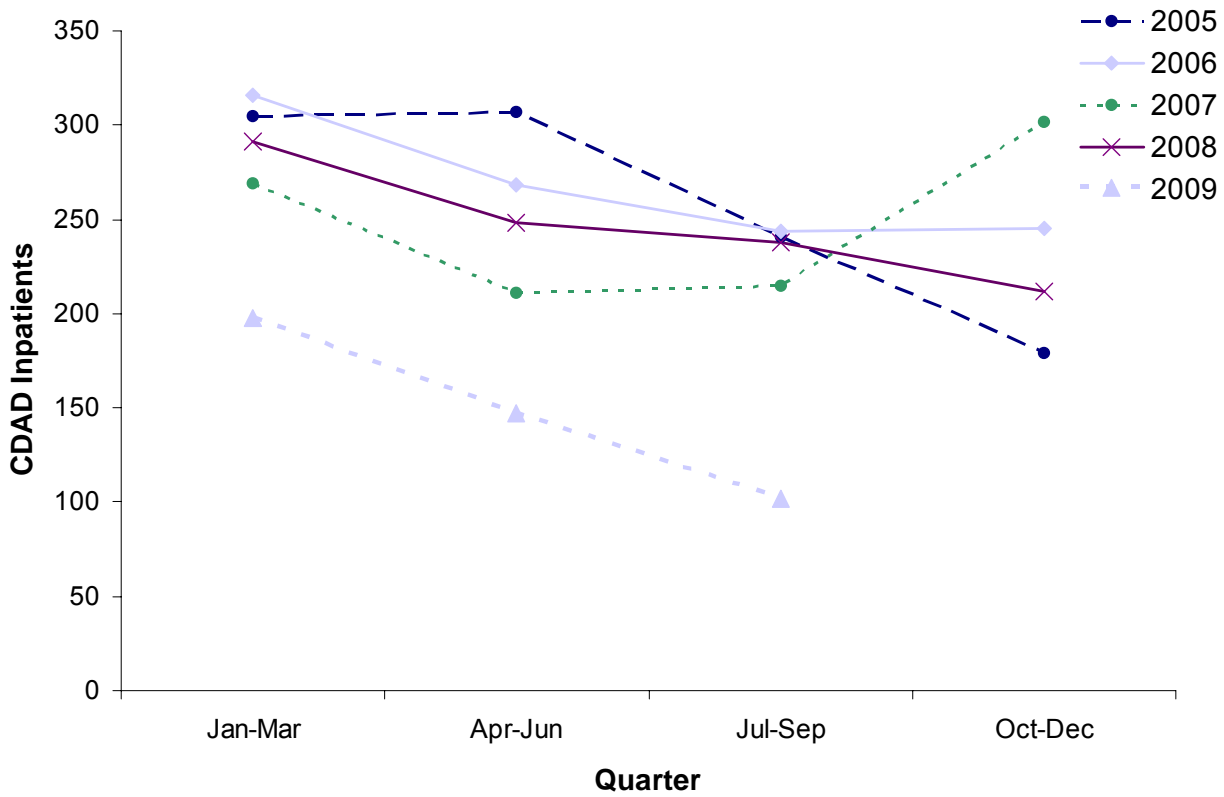


Figure 2b: Total CDAD 'Inpatient' reports, Northern Ireland, by quarter (patients ≥ 65 years), between 2005 and 2009.

All CDAD episodes for patients aged 2 years and over (inpatient and community)

- ❖ During this quarter, 201 episodes of *C. difficile* associated disease were reported in persons aged 2 years and over. This represents a 22% decrease from the previous quarter of 2009 (259 episodes). Of the 201 episodes, 79% were in those aged 65 years and over (includes inpatient and community).
- ❖ 139 patients were known to have been a hospital inpatient in one of the listed hospitals in Appendix A, Table 2 at the time their sample was taken (Figure 6). Of these 139, 73% were patients aged 65 years and over.
- ❖ The remaining 62 isolates reported in patients aged 2 years and over were from 'community' samples which may include: GPs, nursing homes and other such non-acute settings. Of these 62, 92% 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.
- ❖ For further analysis of CDAD episodes in patients aged 2-64 years see Appendix A Table 3.

Rates of *C. difficile* in hospital inpatients

- ❖ All Trusts provide appropriate denominator data (bed occupancy for patients \geq 65 years) on a regular basis, making calculation of *C. difficile* rates possible for their constituent hospitals (Figure 4). Notes on this denominator are included in Appendix C.
- ❖ To determine the rate of *C. difficile* infection in patients aged 2 years and over, the most appropriate denominator data is all age bed occupancy, which is determined using the KH03a return (number of occupied beds) obtained from DHSSPS on a quarterly basis.
- ❖ KH03a bed-day data was not available for the Southern Trust; therefore, the figures used in this report are based on an estimate generated using Quarter 3 bed day data for these hospitals from 2005 – 2008. This bed-day information will be updated when it is made available.

Clarification of episode definitions

- ❖ Due to continuing queries regarding the assignment of CDAD episodes to particular Trusts, supplementary information reflecting situations that may arise and resulting actions applied is outlined in Appendix E.

Statistical Process Control 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.
- ❖ In Northern Ireland, the rate of *C. difficile* patient episodes has remained below the lower action limit of the SPC chart during this quarter. This indicates a significant reduction in the number of *C. difficile* patient episodes not explained by natural variation (Figure 3). This decrease is driven by reductions in CDAD seen across all Trusts, during this quarter of 2009 (Appendix B).
- ❖ SPC charts presenting trends seen in CDAD rates for each Trust in Northern Ireland from July 2005 onwards are shown in Appendix B.

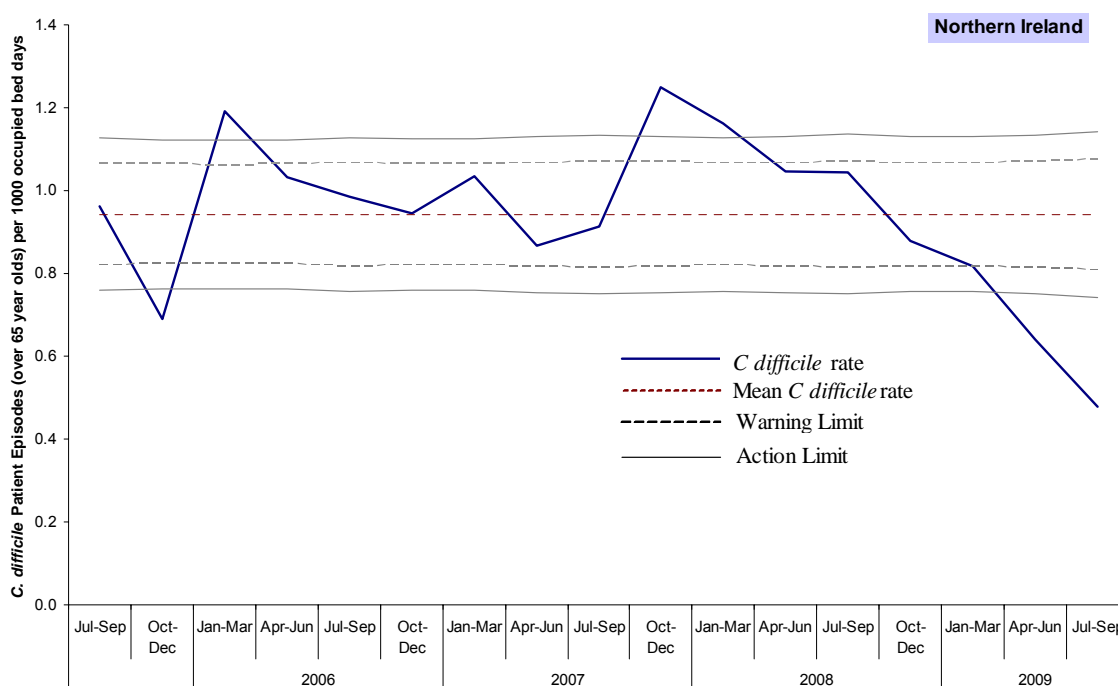


Figure 3: Statistical Process Control chart for quarterly *C. difficile* rates in inpatients aged 65 years and over, in Northern Ireland (For Trust level see Appendix B).

Ribotype surveillance

- ❖ Prior to April 2009, all Trusts in Northern Ireland were requested to send 20 CDAD positive isolates per quarter to Leeds (Prof M. Wilcox) for culture and ribotyping. Building on this scheme, all *C. difficile* isolates within Northern Ireland will now be ribotyped.
- ❖ On 1st April 2009, a *C. difficile* ribotyping service was established in Northern Ireland. Establishment of the NI Ribotyping Service has been facilitated by integration of the Belfast Trust laboratory service into the *Clostridium difficile* Ribotyping Network for England (CDRN). This new service will facilitate enhanced surveillance of CDAD ribotypes circulating in NI.
- ❖ Trusts are now requested to send all CDAD positive isolates to the Royal Victoria laboratory, following the move of Belfast City laboratory staff to Royal Victoria labs, where they are recorded, cultured and ribotyped. The samples sent for ribotyping are matched against validated episodes from CoSurv on a quarterly basis with any discrepancies queried and actioned.

- ❖ Table 1 below presents validated ribotype data for Northern Ireland from April – June 2009. Provisional ribotype data for the July – September 2009 quarter is also presented.
- ❖ The data reported in the table is by ribotype and not by patient episode. Please note that one patient may have more than one ribotype.
- ❖ The most prevalent ribotype in Northern Ireland this quarter is ribotype 078 (12.7%), followed by ribotype 014 (10.5%). The proportion of 078 ribotypes has fallen significantly compared to the previous quarter (19.4%). The proportion of 027 ribotypes remains low (2.7%) when compared to circulating ribotypes in England, with little change from the previous quarter (2.6%).
- ❖ Descriptive data summarising the age, gender, Trust and source description of ribotypes 001, 078, 027 is presented in Table 2.

Table 1. A summary of *C. difficile* ribotypes, and the percentage contribution to the overall total, reported in Northern Ireland during routine surveillance, April – September 2009. ***Figures are provisional.**

Ribotype	April - June 2009		July - September 2009*	
	Number	%	Number	%
001	29	12.8	22	10.0
002	10	4.4	14	6.4
014	15	6.6	23	10.5
015	5	2.2	13	5.9
027	6	2.6	6	2.7
078	44	19.4	28	12.7
106	18	7.9	10	4.5
Other	33	14.5	26	11.8
Not groupable***	44	19.4	40	18.2
Not Grown****	23	10.1	38	17.3
Total	227	-	220	-

** 'not groupable' do not match existing profiles

*** 'not grown' represents isolates which have no ribotype information supplied, with at least 6 weeks since the date of the specimen.

Following the validation process for April – June 2009 a total of 34 validated episodes of CDAD were found not to have been sent for ribotyping to the NI Ribotyping Service. Figures for July-September are not yet available.

Table 2 Descriptive data for *C. difficile* ribotypes 001, 078, 027 in Northern Ireland, April - June 2009.

	001		078		027	
Age						
median	80		77		86	
Sex	n	%	n	%	n	%
Female	23	79.3	23	52.3	3	50
Male	6	20.7	21	47.7	3	50

Trust	001		078		027		Total of all 3 ribotypes
	n	%	n	%	n	%	
Belfast	14	51.9	12	44.4	1	3.7	27
Northern	5	19.2	16	61.5	5	19.2	26
Southern	1	25.0	3	75.0	0	0.0	4
South Eastern	3	27.3	8	72.7	0	0.0	11
Western	6	54.5	5	45.5	0	0.0	11
Source	n	%	n	%	n	%	
Inpatient	18	62.1	32	72.7	3	50	
Community*	11	37.9	12	27.3	3	50	

*community specimens include A+E, outpatients, GP and specimens taken in psychiatric facilities.

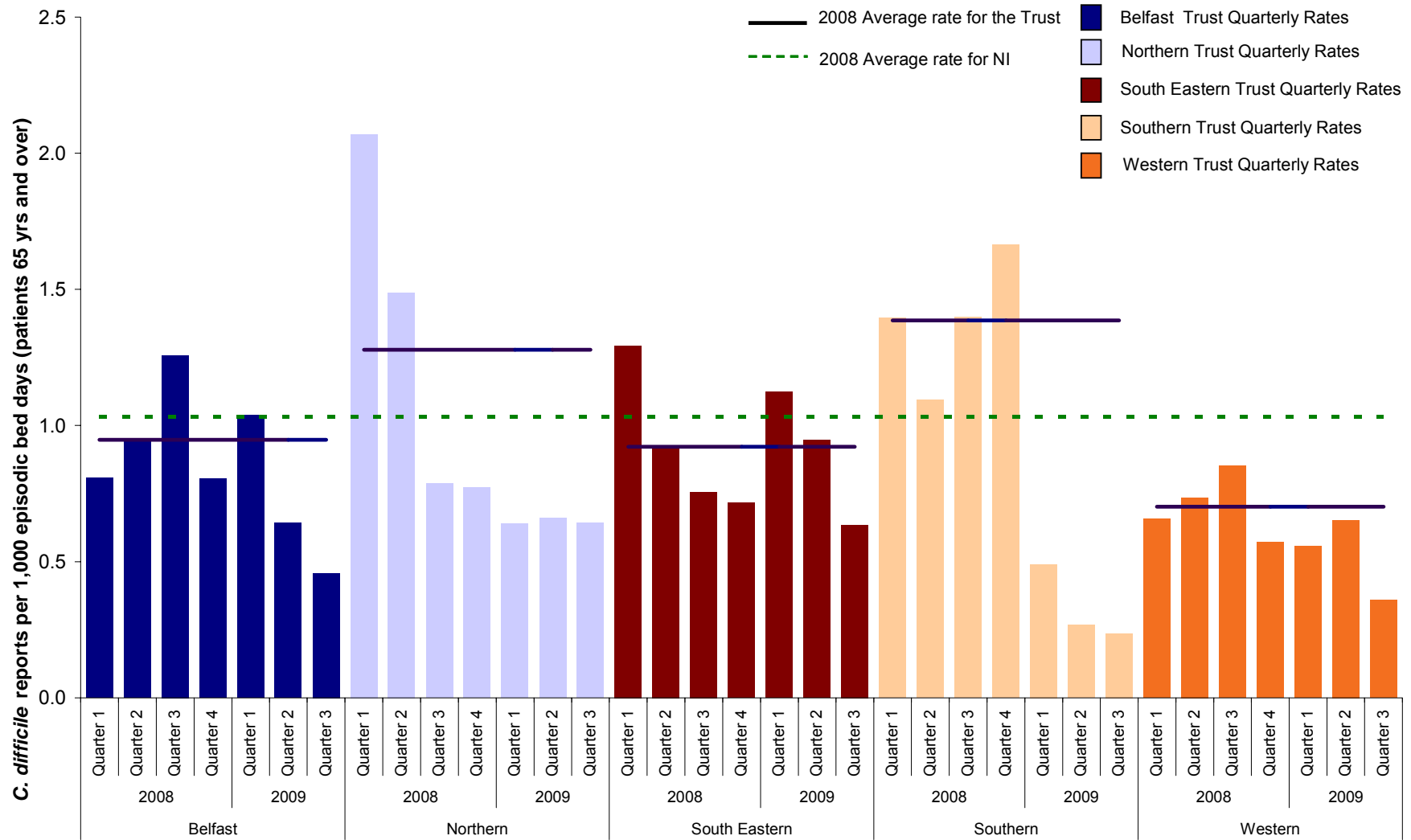


Figure 4: Quarterly rates of *Clostridium difficile* by Trust 1 January 2008 – 30 September 2009, compared with annual NI and Trust rates for 2008; inpatients \geq 65 years.

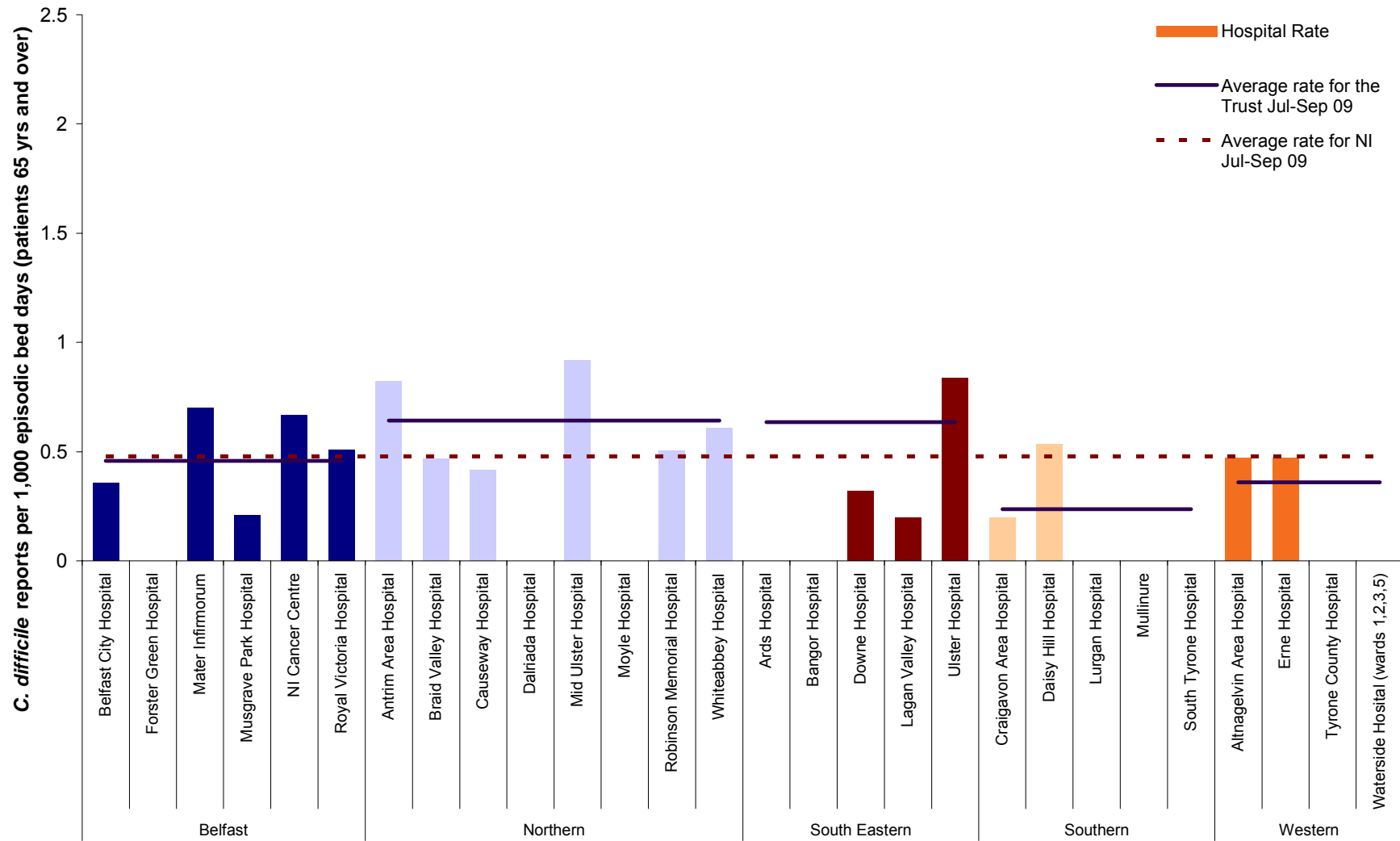


Figure 5: Rates of *Clostridium difficile* by individual Hospitals, 2009 Quarter 3 (inpatients \geq 65 years), including the quarterly Trust rates and an average rate for NI, gaps represent zero episodes (see appendix A Table 1).

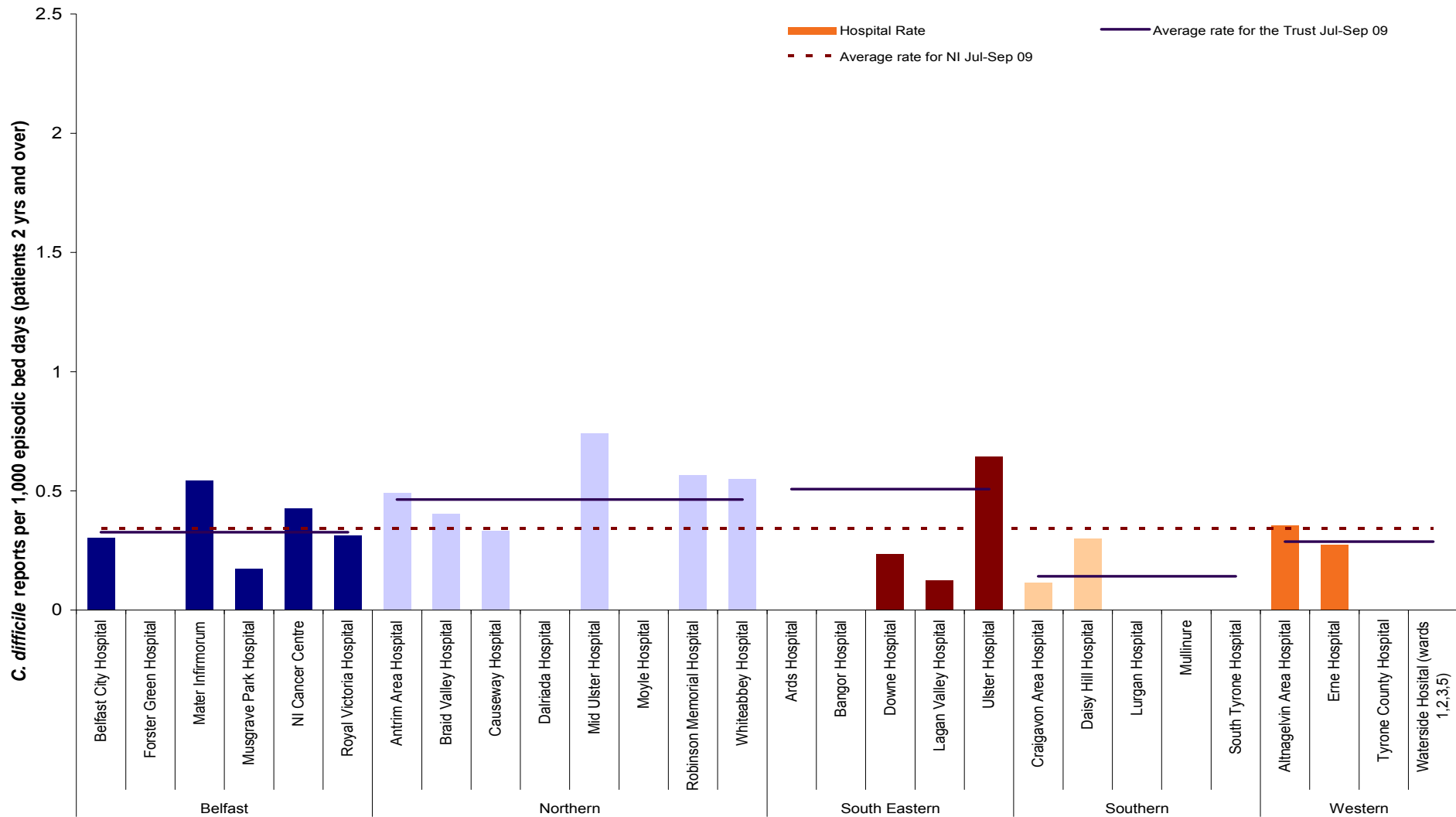


Figure 6: Rates of *Clostridium difficile* by individual Hospitals, 2009 Quarter 3 (inpatients 2 years and over), including the quarterly Trust rates and an average rate for NI, gaps represent zero episodes (see appendix A Table 2).

Appendix A

Table 1: Quarterly number of *Clostridium difficile* patient episodes, patients 65 years and over, and rates by Hospital, January – September 2009. Figures in parentheses represent data for October – December 2008.

Hospital	Jan-Mar 2009		Apr-Jun 2009		Jul-Sep 2009	
	Episodes	Rate	Episodes	Rate	Episodes	Rate
Belfast City Hospital	30	1.17	17	0.741	8	0.359
Forster Green Hospital	0	0.000	0	0.000	0	0.000
Mater Infirmorum	17	1.261	8	0.648	8	0.700
Musgrave Park Hospital	7	0.626	1	0.090	2	0.210
NICCO (formerly at Belvoir Park)	2	0.638	1	0.329	2	0.667
Royal Victoria Hospital	29	1.030	22	0.829	13	0.509
Belfast Health & Social Care Trust	85 (66)	1.038	49	0.643	33	0.458
Antrim Area Hospital	12	0.710	13	0.824	12	0.822
Braid Valley Hospital	2	0.714	2	0.827	1	0.466
Causeway Hospital	11	1.028	6	0.647	4	0.416
Dalriada Hospital	0	0.000	0	0.000	0	0.000
Mid Ulster Hospital	2	0.296	2	0.321	6	0.919
Moyle Hospital	0	0.000	0	0.000	0	0.000
Robinson Memorial Hospital	0	0.000	0	0.000	1	0.505
Whiteabbey Hospital	4	0.536	6	0.912	4	0.609
Northern Health & Social Care Trust	31 (38)	0.640	29	0.660	28	0.642
Ards Hospital	0	0.000	1	0.719	0	0.000
Bangor Hospital	0	0.000	0	0.000	0	0.000
Downe Hospital	1	0.260	1	0.375	1	0.318
Lagan Valley Hospital	4	0.608	4	0.657	1	0.199
Ulster Hospital	39	1.504	29	1.136	20	0.838
South Eastern Health & Social Care Trust	44 (29)	1.123	35	0.946	22	0.635
Craigavon Area Hospital	13	0.811	6	0.389	3	0.199
Daisy Hill Hospital	1	0.106	2	0.239	4	0.533
Lurgan Hospital	3	0.483	0	0.000	0	0.000
Mullinure	1	0.540	1	0.582	0	0.000
South Tyrone Hospital	0	0.000	0	0.000	0	0.000
Southern Health & Social Care Trust*	18 (59)	0.490	9	0.268	7	0.236
Altnagelvin Area Hospital	13	0.752	19	1.062	8	0.471
Erne Hospital	5	0.659	6	0.638	4	0.471
Tyrone County Hospital	2	0.456	0	0.000	0	0.000
Waterside Hospital (Wards 1, 2, 3, 5)	0	0.000	0	0.000	0	0.000
Western Health & Social Care Trust	20 (21)	0.557	25	0.653	12	0.359
NI TOTAL	198 (213)	0.818	147	0.642	102	0.478
NI Community TOTAL	71 (82)	-	49	-	57	

Appendix A

Table 2: Quarterly number of *Clostridium difficile* patient episodes, patients 2 years and over, and rates by Hospital, January – September 2009. Figures in parentheses represent data for October – December 2008.

Hospital	Jan - Mar 2009		Apr - Jun 2009		Jul - Sep 2009	
	Episodes	Rate	Episodes	Rate	Episodes	Rate
Belfast City Hospital	41	0.940	30	0.719	12	0.304
Forster Green Hospital	0	0.000	0	0.000	0	0.000
Mater Infirmorum	19	0.783	11	0.483	12	0.542
Musgrave Park Hospital	8	0.407	1	0.052	3	0.172
NICCO (formerly at Belvoir Park)	5	0.755	2	0.292	3	0.425
Royal Victoria Hospital	42	0.785	34	0.649	21	0.313
Belfast Health & Social Care Trust	115 (94)	0.765	78	0.534	51	0.327
Antrim Area Hospital	18	0.604	17	0.548	15	0.492
Braid Valley Hospital	2	0.000	2	0.715	1	0.405
Causeway Hospital	16	0.818	7	0.369	6	0.334
Dalriada Hospital	0	0.000	0	0.000	0	0.000
Mid Ulster Hospital	2	0.232	3	0.369	6	0.740
Moyle Hospital	0	0.000	0	0.000	0	0.000
Robinson Memorial Hospital	0	0.000	0	0.000	1	0.566
Whiteabbey Hospital	5	0.526	6	0.735	4	0.551
Northern Health & Social Care Trust	43 (45)	0.544	35	0.471	33	0.463
Ards Hospital	0	0.000	1	0.328	0	0.000
Bangor Hospital	0	0.000	0	0.000	0	0.000
Downe Hospital	1	0.209	1	0.267	1	0.235
Lagan Valley Hospital	7	0.768	5	0.545	1	0.125
Ulster Hospital	47	1.040	33	0.743	27	0.644
South Eastern Health & Social Care Trust	55 (31)	0.853	40	0.645	29	0.507
Craigavon Area Hospital	21	0.577	10	0.286	4	0.114
Daisy Hill Hospital	2	0.113	2	0.125	5	0.302
Lurgan Hospital	3	0.412	0	0.000	0	0.000
Mullinure	1	0.394	1	0.407	0	0.000
South Tyrone Hospital	0	0.000	0	0.000	0	0.000
Southern Health & Social Care Trust	27 (73)	0.404	13	0.207	9	0.141
Altnagelvin Area Hospital	16	0.425	28	0.739	13	0.357
Erne Hospital	5	0.359	7	0.504	4	0.275
Tyrone County Hospital	2	0.350	0	0.000	0	0.000
Waterside Hospital (Wards 1, 2, 3, 5)	0	0.000	0	0.000	0	0.000
Western Health & Social Care Trust	23 (28)	0.359	35	0.560	17	0.288
NI TOTAL	263 (271)	0.619	201	0.493	139	0.341
NI community TOTAL	88 (96)	-	58	-	62	-

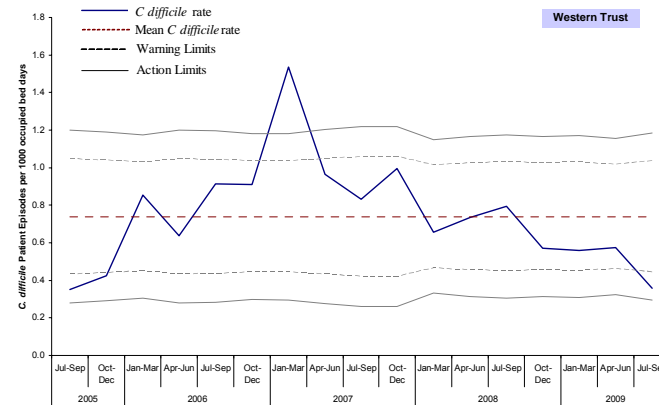
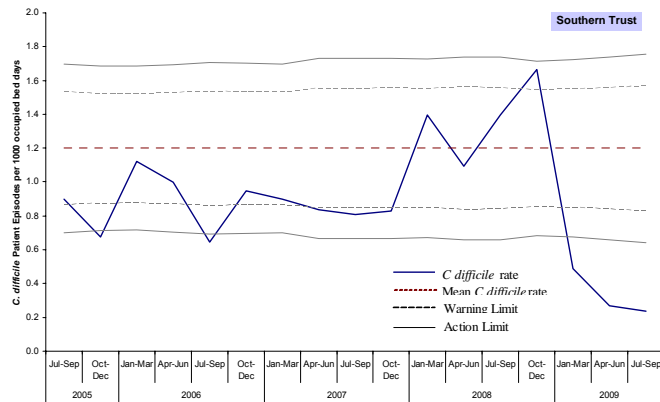
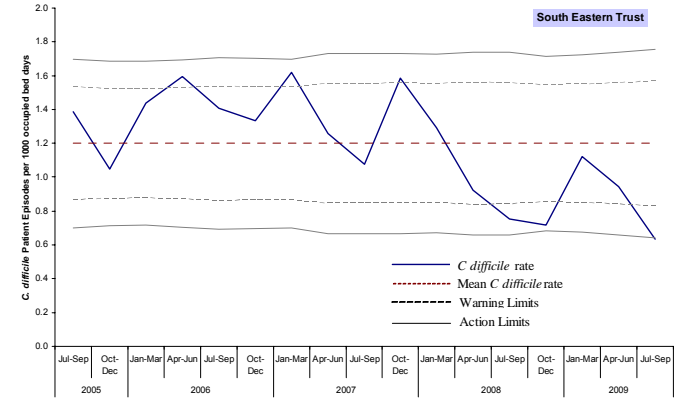
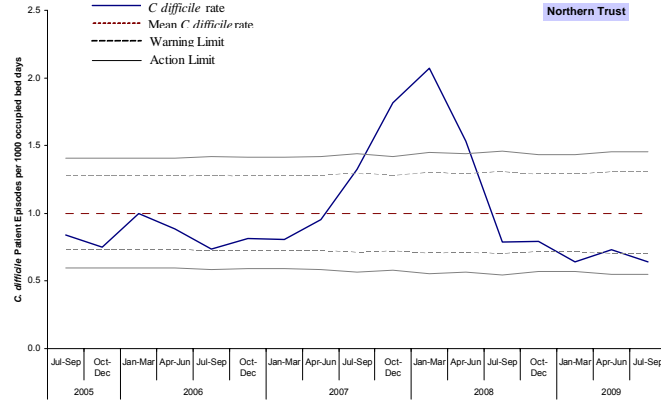
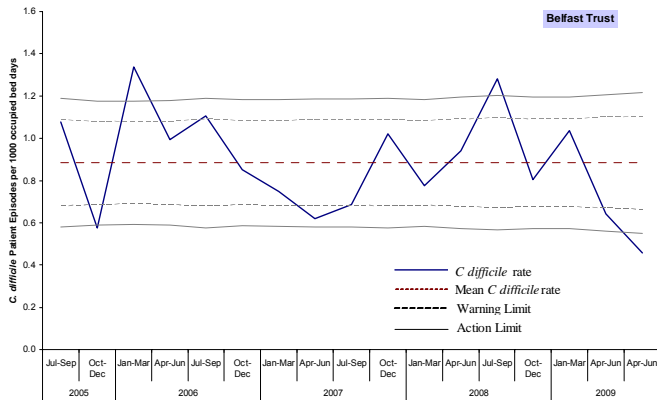
Appendix A

Table 3: Quarterly number of *Clostridium difficile* patient episodes, patients 2 to 64 years, by Hospital, January – September 2009. Figures in parentheses represent data for October – December 2008.

Hospital	Jan - Mar 09	Apr - Jun 09	Jul-Sep 09
	Episodes	Episodes	Episodes
Belfast City Hospital	11	13	4
Forster Green Hospital	0	0	0
Mater Infirmorum	2	3	4
Musgrave Park Hospital	1	0	1
NICCO (formerly at Belvoir Park)	3	1	1
Royal Victoria Hospital	13	12	8
Belfast Health & Social Care Trust	30	29	18
Antrim Area Hospital	6	4	3
Braid Valley Hospital	0	0	0
Causeway Hospital	5	1	2
Dalriada Hospital	0	0	0
Mid Ulster Hospital	0	1	0
Moyle Hospital	0	0	0
Robinson Memorial Hospital	0	0	0
Whiteabbey Hospital	1	0	0
Northern Health & Social Care Trust	12	6	5
Ards Hospital	0	0	0
Bangor Hospital	0	0	0
Downe Hospital	0	0	0
Lagan Valley Hospital	3	1	0
Ulster Hospital	8	4	7
South Eastern Health & Social Care Trust	11	5	7
Craigavon Area Hospital	8	4	1
Daisy Hill Hospital	1	0	1
Lurgan Hospital	0	0	0
Mullinure	0	0	0
South Tyrone Hospital	0	0	0
Southern Health & Social Care Trust	9	4	2
Altnagelvin Area Hospital	3	9	5
Erne Hospital	0	1	0
Tyrone County Hospital	0	0	0
Waterside Hospital (Wards 1, 2, 3, 5)	0	0	0
Western Health & Social Care Trust	3	10	5
NI TOTAL	65	54	37
NI community TOTAL	17	9	5

Appendix B

Trends in inpatients, aged 65 years and over, *C difficile* rates by trust and quarter (2005-2009)



Appendix C

Notes:

As of the 1st April 2008 the **number of CDAD patient episodes** is defined as the total number of patients aged 2 years and over from whom a diarrhoeal specimen tested positive for *C. difficile* toxins A and toxin 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 CDAD; 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 CDAD in patients aged 2 years and over Kh03a data is 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 Trust individually on a quarterly basis, to obtain occupied bed data on those patients aged 65 years and over. All rates have been calculated for both individual Trusts and Northern Ireland as a whole.

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

- The denominator supplied by each Trust is that of the number of 'episodic bed days' for patients aged 65 years and over. Patient age is according to the age of each patient at the end of 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 Trust level, that is, on a hospital basis, is less accurate than for an entire Trust. 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 Trusts 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 a patient 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 with all laboratories using identical testing methods and interpretation of 2005 data should be undertaken with caution. Surveillance originally focussed on individuals aged 65 years and over, but this has been reviewed as of the 1st April 2008 to include all patients aged 2 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 Trust will be largely similar over time. They present the occurrence of *C difficile* in a Trust in relation to what would be expected, based upon the mean rate for the Trust and calculated statistical process control limits.

The mean for each Trust has been calculated using the data from all quarters since July 2005. Control limits, derived from plus or minus 2 or 3 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, whilst 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 trust.

Control limits were set up by 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 Trust. If any of the following criteria are met then there is said to be “special cause variation” which should be investigated, as this could not statistically have occurred by chance alone:

- 1 value above the upper action limit, or below the lower action limit
- 3 consecutive values between the upper warning limit and upper action limit (or between lower limits)
- 8 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)
- 8 consecutive values either increasing or decreasing

Appendix E

Patient Transfers

A patient may be an inpatient in a healthcare facility and at some point may be transferred to another hospital/Trust, symptom free. Upon admission to the second facility, if the patient develops the symptoms of *C. diff* or *S. aureus* within 2 days and a specimen is taken and tested at this point, the episode is attributed to the current stay i.e. the receiving hospital. Whilst the infection may likely have been acquired during their first hospital admission, it is the hospital where the patient is **at the time the specimen is taken** that must report the episode. For this reason, CDSC ensures that there are caveats to state that this does not infer the patient acquired their infection in that hospital. Trusts should be aware of such circumstances so that they are in a position to clarify any episodes that developed within 2 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 are 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 then the duplicate rule applies regardless of the change in hospital and the isolate should not be reported.

Appendix F

Table 1 *C. difficile* patient episodes in inpatients aged 65 years and over by financial year and Trust, in Northern Ireland.

Trust	Financial Year			
	2005/06	2006/07	2007/08	2008/09
Belfast	352	336	280	327
Northern	184	172	297	172
South Eastern	243	256	199	135
Southern	168	130	134	164
Western	96	132	109	98
Northern Ireland	1043	1026	1019	896