



**CDSC (NI)**

## ***C. difficile* surveillance**

**Quarter Ending December 2008**

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

## Key Points

- ❖ **CDAD numbers and rates for hospital inpatients, over 65 years of age, in Northern Ireland have continued to decrease during October – December 2008 (Figure 6).**
- ❖ **CDAD reports from ‘community’ patients, over 65 years of age, for the October – December quarter have increased by 5.1% (4 episodes) compared to the previous quarter (Figure 1; Appendix A).**

## *C. difficile* reporting

- ❖ Reports of *C. difficile* are obtained directly from each diagnostic laboratory through the normal laboratory surveillance programme, rather than collecting the data from individual Trusts.
- ❖ Line listings of cases are sent 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.
- ❖ **As of 1<sup>st</sup> April 2008**, mandatory surveillance now covers all individuals over 2 years of age. To reflect this, the quarterly report summarises data for individuals aged 65 years and over, as well as data for CDAD episodes in individuals aged 2 years and over (Figure 6; Appendix A, Table 2), and for CDAD episodes reported in individuals aged 2-64 years (Appendix A, Table 3).
- ❖ This report also contains a summary of Northern Ireland ribotyping results obtained through the mandatory routine ribotyping surveillance scheme (Figure 3; Table 1).

## October – December 2008

### Figures for patients aged 65 years and over

#### All CDAD episodes (inpatient and community)

- ❖ During the quarter, 295 episodes of *C. difficile* associated disease were reported in persons aged 65 years and over compared to 316 episodes the previous quarter (6.6% decrease, 21 reports; Figure 1).
- ❖ The 2008 October - December total CDAD figures are lower than those reported in the same time period in 2007 (13.5%, 46 reports; Figure 1), but higher than those reported in 2006 and 2005 (8.9% and 52.8% higher respectively; Figure 1).
- ❖ Of the 295 episodes, 213 were known to have been a hospital inpatient in one of the listed hospitals in Appendix A Table 1 at the time of the sample being taken.
- ❖ The remaining 82 isolates reported were from ‘community’ samples which may include: GPs, nursing homes and other such non acute settings. This figure represents an increase in the proportion of CDAD reports from the ‘community’; 24.7% (78/316 episodes) in the July – September quarter compared to 27.8% (82/295) this quarter.

#### Inpatient episodes

- ❖ There has been a decrease of 25 cases (10.5%) in the number of inpatient cases reported in this quarter (213) when compared to the previous quarter (238). This is

the fourth consecutive quarter in 2008 where there has been a reduction in inpatient episodes, with a decrease of 78 cases between this quarter and January/March, 2008 (291 cases, 26.8% reduction).

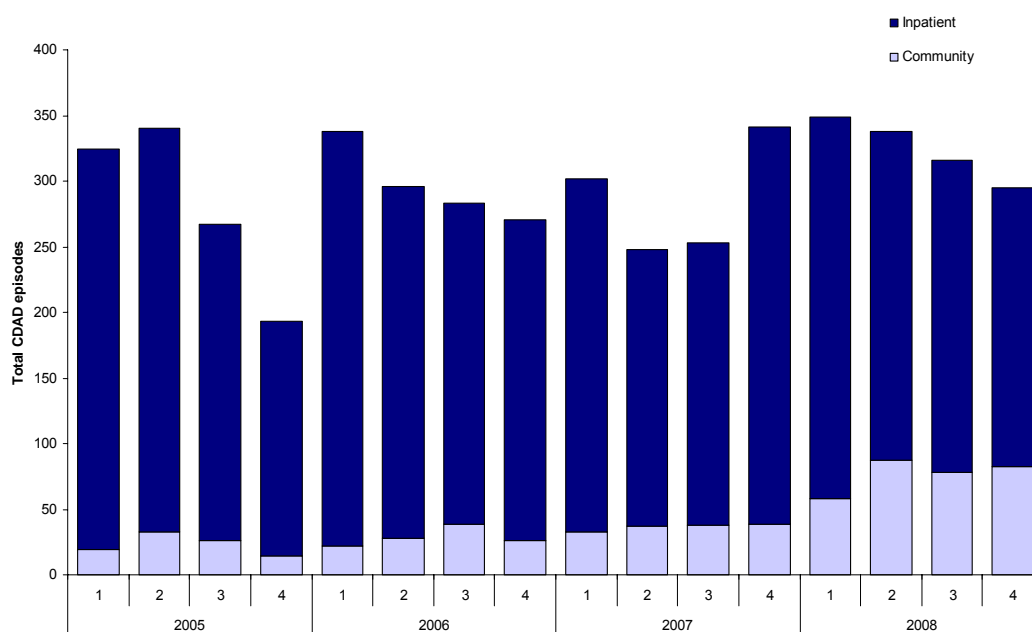
- ❖ Comparing the October – December 2008 period (213 episodes) to the same quarter in 2007 (302 episodes) and 2006 (245 episodes), there has been a decrease in the number of cases reported (29.5% and 13.1% decrease respectively; Figure 2). However, figures for this quarter are higher than those reported for Quarter 4 in 2005 (179 cases, 19% increase; Figure 2). For a breakdown by Trust/hospitals see Figures 4 and 5.

### Community episodes

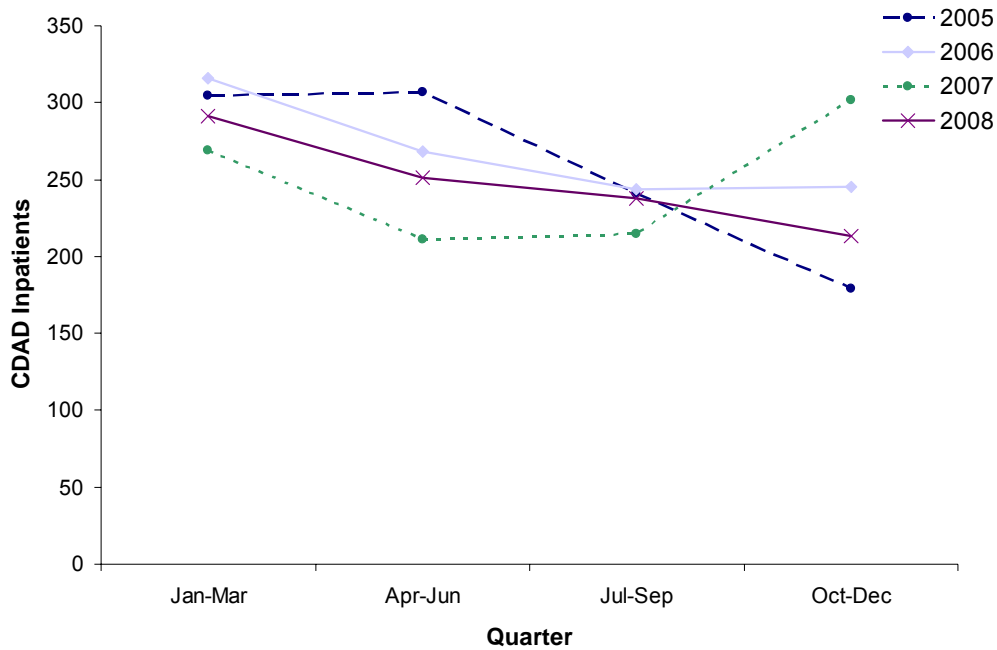
- ❖ Community figures have increased by 4 episodes (5.1%) this quarter (78 reports in July-September to 82 reports this quarter; Figure 1 and Appendix A).
- ❖ When October – December 2008 (82 cases) is compared to the same quarter in 2007 (39 cases) it is clear that there is a significant rise in the number of episodes (43 cases; 110.3% increase; Figure 1). It should be noted that it is not possible to distinguish true ‘community’ episodes from those patients who may have recently been discharged from hospital.

### Statistical Process Control charts

- ❖ Trends in rates since July 2005 are shown for each Trust configuration in appendix B. SPC charts allow the 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, this quarter, the rate of *C. difficile* patient episodes remains within the control limits of the chart (Figure 6).
- ❖ This quarter, the rate of *C. difficile* patient episodes in the Southern Trust breached the action limit of the chart (Appendix B).



**Figure 1:** Total CDAD reports, inpatient and community, in Northern Ireland, by quarter (patients ≥ 65 years), between 2005 and 2008.



**Figure 2:** Total CDAD ‘Inpatient’ reports, Northern Ireland, by quarter (patients  $\geq 65$  years), between 2005 and 2008.

### Figures for patients aged 2 years and over

#### All CDAD episodes (inpatient and community)

- ❖ During the quarter, 368 episodes of *C. difficile* associated disease were reported in persons aged 2 years and over. This represents an 12.6% decrease from the previous quarter (421 episodes). Of the 368 episodes, 80% were in those (inpatient and community) aged 65 years and over.
- ❖ 271 patients were known to have been a hospital inpatient in one of the listed hospitals in Appendix A, Table 2 at the time of the sample being taken (Figure 5). Of the 271, 79% occurred in patients aged 65 years and over.
- ❖ The remaining 97 isolates reported were from ‘community’ samples which may include: GPs, nursing homes and other such non acute settings. Of the 97, 84.5% occurred in patients aged 65 years and over. It should be noted that it is not possible to distinguish true ‘community’ episodes from those patients who may have recently been discharged from hospital.
- ❖ For a breakdown of episodes in individuals aged 2-64 years see Appendix A Table 3.

#### Rates of hospital inpatient *C. difficile* episodes

- ❖ All Trusts provide appropriate denominator data (bed occupancy for patients  $\geq 65$  years) on a regular basis, making the 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 individuals aged 2 years and over the most appropriate denominator data is all age bed occupancy determined using the KH03A return (number of occupied beds) which is obtained from DHSSPS on a quarterly basis.
- ❖ Bed day data was not available for the Belfast City Hospital; therefore, the figures used are based on an estimate generated using Quarter 4 bed day data for the Belfast City Hospital from 2004 – 2007. The bed day information will be updated when it becomes available.
- ❖ Maintenance work has continued in the Robinson Memorial Hospital which has significantly reduced their number of bed days. This may have slight implications for the overall Northern Trust figure.

### **Ribotype surveillance**

- ❖ The latest data received from the routine surveillance scheme is presented in Table 1. This data excludes the Northern Trust for the April – September 2008 period as during this time they were sending their samples for ribotyping independently.
- ❖ The proportion of isolates represented by ribotype 078 has declined since the initial report in April – June (Table 1).
- ❖ The Northern Trust data for January – September 2008 is presented in Table 2. This information has been extracted from lab reports to CoSurv.
- ❖ The data presented in Tables 1 and 2 represents *C. difficile* ribotypes and not patient episodes. That is, one patient may have two different ribotypes reported for the same specimen.

### **Clarification of episode definitions**

- ❖ Due to a number of queries about the assignment of episodes to Trusts, new information to reflect situations that may arise and the action to be taken has been applied in Appendix E.

**Table 1:** Total number of individual ribotypes, and percentage contribution to the total, reported in Northern Ireland\*\* during routine surveillance, April – December 2008. **Figures are provisional.** Data courtesy of Professor M Wilcox, Leeds.

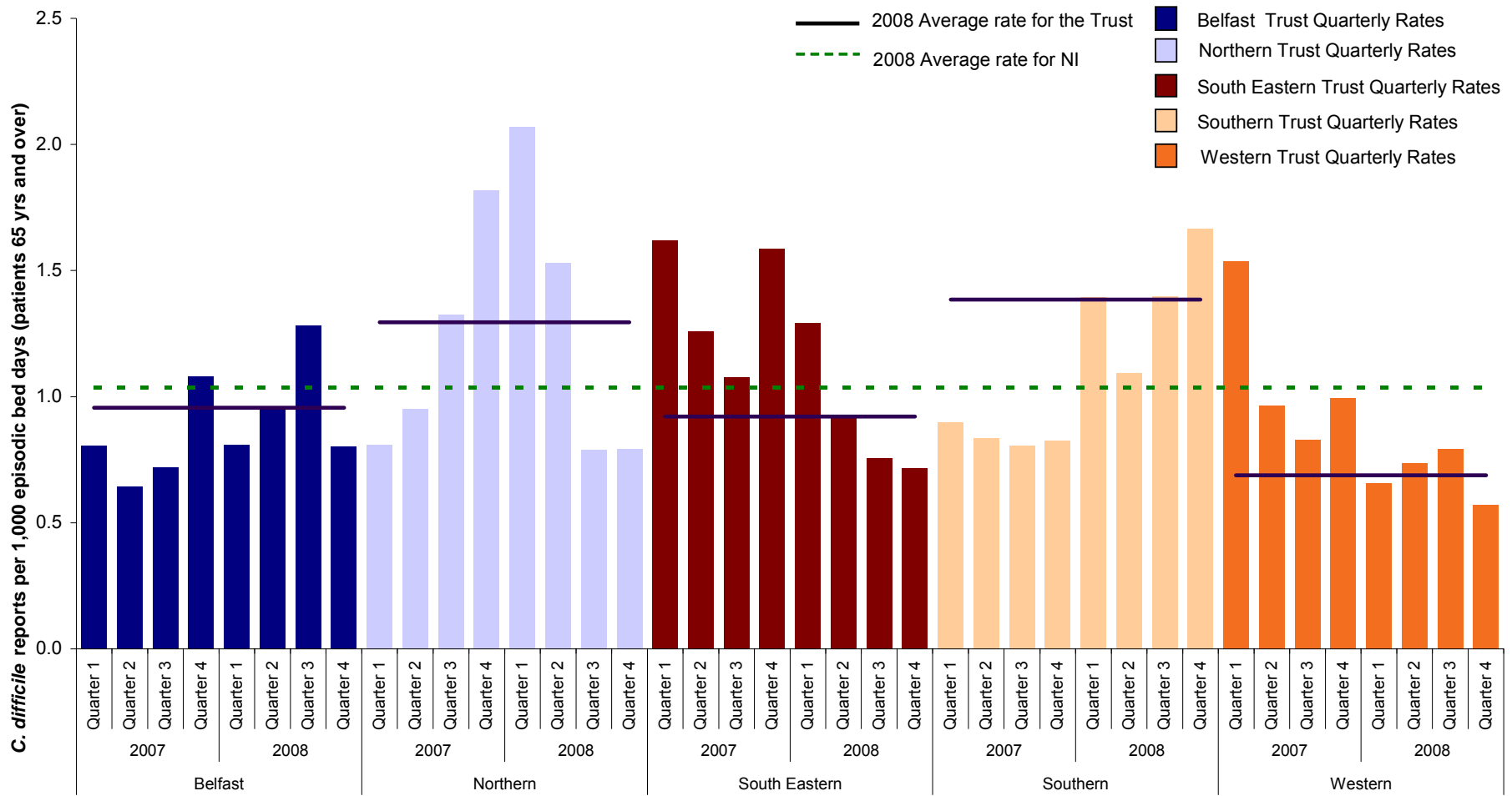
Ribotype	Apr – Jun 08		Jul – Sep 08		Oct-Dec 08	
	Number	% total	Number	% total	Number	% total
<b>001</b>	25	<b>19.5</b>	29	<b>20.7</b>	18	<b>17.6</b>
<b>002</b>	5	<b>3.9</b>	6	<b>4.3</b>	6	<b>5.9</b>
<b>015</b>	3	<b>2.3</b>	5	<b>3.6</b>	6	<b>5.9</b>
<b>027</b>	5	<b>3.9</b>	2	<b>1.4</b>	3	<b>2.9</b>
<b>078</b>	26	<b>20.3</b>	5	<b>3.6</b>	4	<b>3.9</b>
<b>106</b>	10	<b>7.8</b>	13	<b>9.3</b>	9	<b>8.8</b>
<b>Other</b>	22	<b>17.2</b>	25	<b>17.9</b>	20	<b>19.6</b>
<b>Not cultured</b>	19	<b>14.8</b>	41	<b>29.3</b>	32	<b>31.4</b>
<b>Sporadic</b>	0	<b>0.0</b>	4	<b>2.9</b>	4	<b>3.9</b>
<b>Unrecognised Profiles</b>	11	<b>8.6</b>	0	<b>0.0</b>	0	<b>0.0</b>
<b>Unique Ribotypes</b>	2	<b>1.6</b>	7	<b>5.0</b>	0	<b>0.0</b>
<b>Unknown</b>	0	<b>0.0</b>	3	<b>2.1</b>	0	<b>0.0</b>
<b>Grand total</b>	<b>128</b>	<b>-</b>	<b>140</b>	<b>-</b>	<b>102</b>	<b>-</b>

\*2 records omitted – no match found with laboratory reports (Ribotype 014/20 & 078)

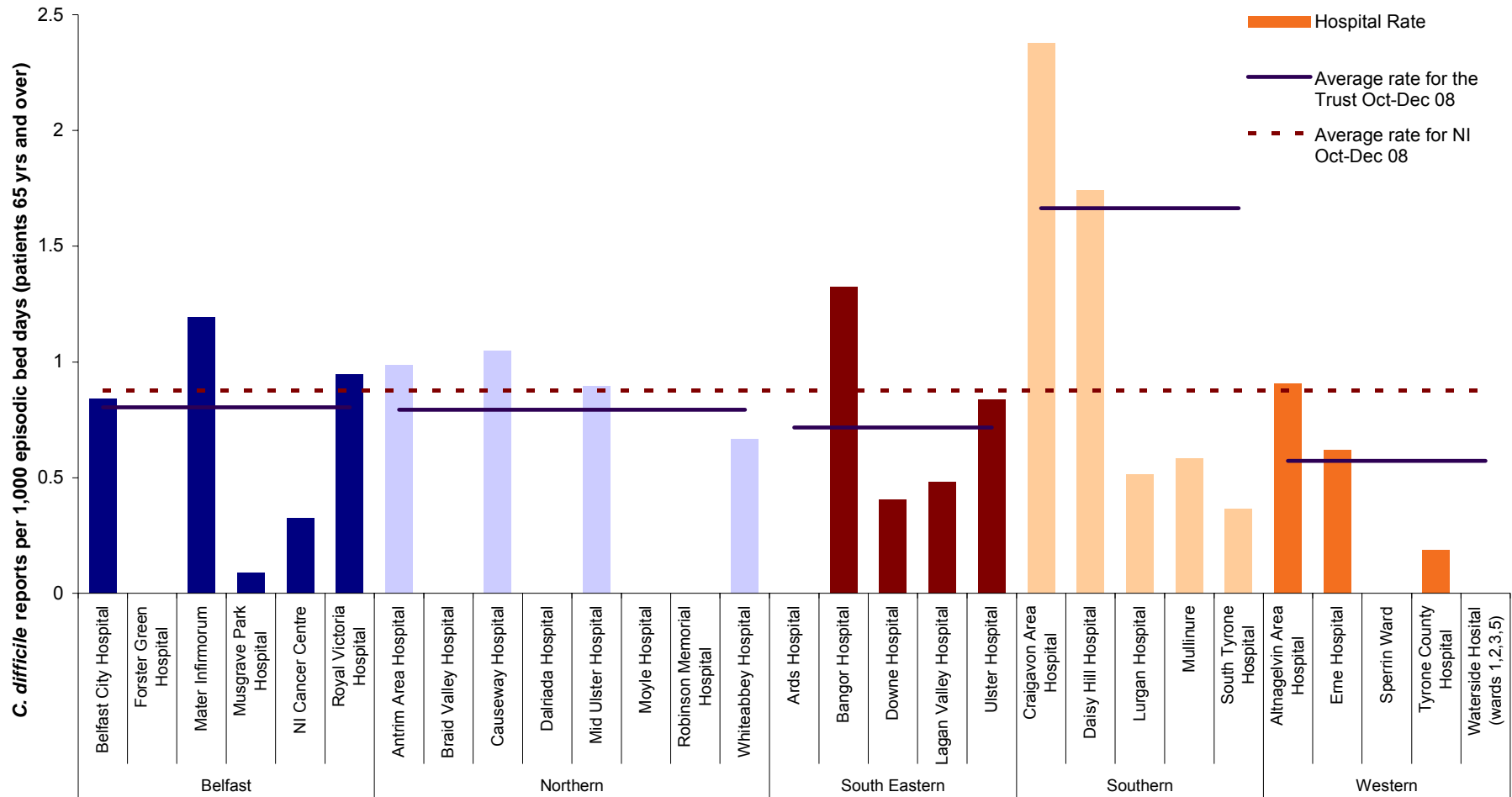
\*\* Northern Trust data excluded

**Table 2:** Total number of individual ribotypes within the Northern Trust, and percentage contribution to the total, reported by the Trust to CoSurv, January – September 2008. **Figures are provisional.** Data courtesy of Dr J Brazier, Cardiff.

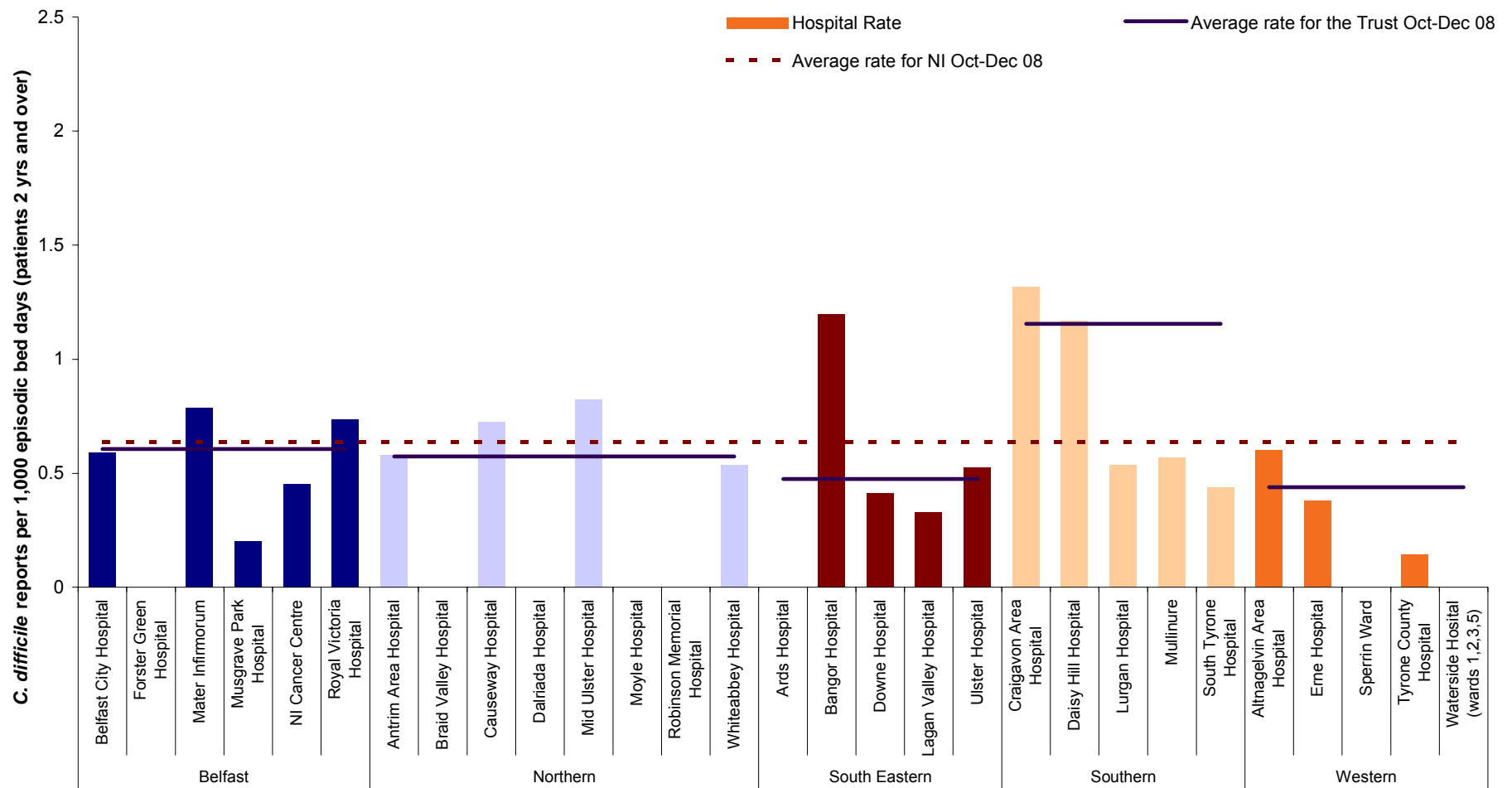
Ribotype	Jan – Mar 08		Apr – Jun 08		Jul – Sep 08	
	Number	% total	Number	% total	Number	% total
<b>001</b>	15	<b>16.1</b>	9	<b>11.0</b>	4	<b>9.1</b>
<b>002</b>	3	<b>3.2</b>	4	<b>4.9</b>	2	<b>4.5</b>
<b>015</b>	2	<b>2.2</b>	3	<b>3.7</b>	2	<b>4.5</b>
<b>027</b>	41	<b>44.1</b>	23	<b>28.0</b>	10	<b>22.7</b>
<b>078</b>	6	<b>6.5</b>	15	<b>18.3</b>	9	<b>20.5</b>
<b>106</b>	4	<b>4.3</b>	4	<b>4.9</b>	0	<b>0.0</b>
<b>Other</b>	22	<b>23.7</b>	24	<b>29.3</b>	17	<b>38.6</b>
<b>Grand Total</b>	<b>93</b>	<b>-</b>	<b>82</b>	<b>-</b>	<b>44</b>	<b>-</b>



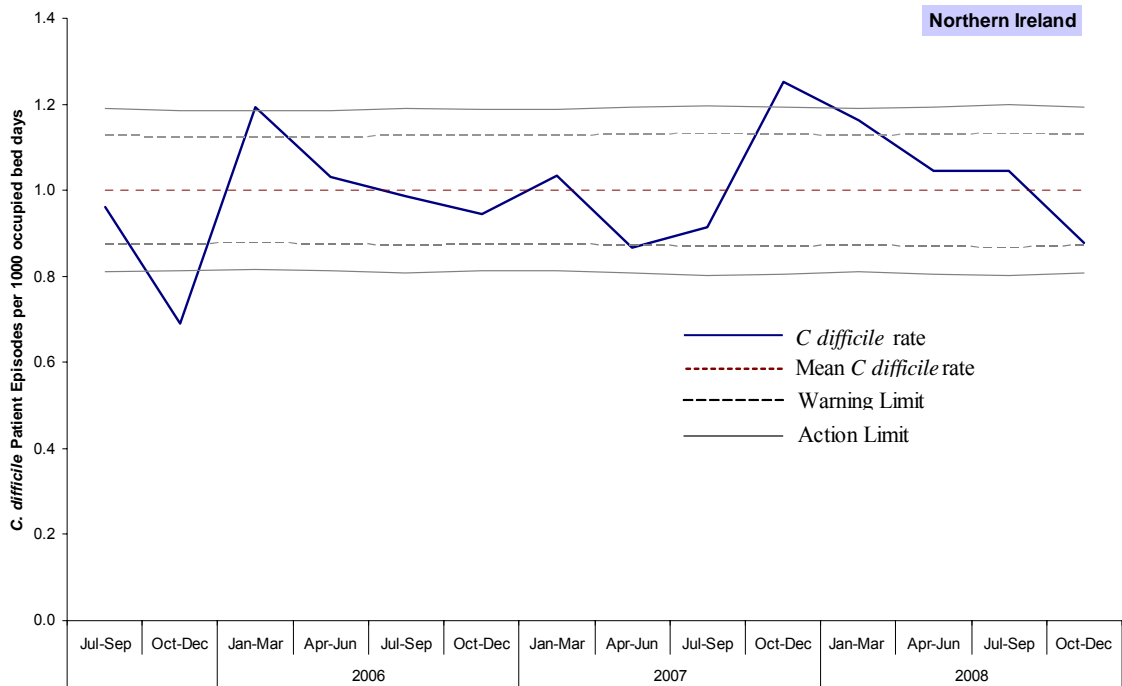
**Figure 3:** Quarterly rates of *Clostridium difficile* by Trust 1 January 2007 – 31 December 2008, compared with annual NI and Trust rates for 2008; inpatients  $\geq$  65 years.



**Figure 4:** Rates of *Clostridium difficile* by individual Hospitals, 2008 Quarter 4 (inpatients ≥ 65 years), including the quarterly Trust rates and an average rate for NI, gaps represent zero episodes (see appendix A Table 1).



**Figure 5:** Rates of *Clostridium difficile* by individual Hospitals, 2008 Quarter 4 (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).



**Figure 6:** Statistical Process Control chart for quarterly *C difficile* rates in inpatients, in Northern Ireland (For Trust level see Appendix B).

## Appendix A

**Table 1:** Quarterly number of *Clostridium difficile* patient episodes, patients 65 years and over, and rates by Hospital, January – December 2008

Hospital	Jan - Mar 2008		Apr - Jun 2008		Jul - Sep 2008		Oct - Dec 2008	
	Episodes	Rate	Episodes	Rate	Episodes	Rate	Episodes	Rate
Belfast City Hospital	21	0.674	25	0.846	35	1.338	22	0.840
Forster Green Hospital	0	0.000	0	0.000	0	0.000	0	0.000
Mater Infirmorum	17	1.339	21	1.695	20	1.641	15	1.192
Musgrave Park Hospital	2	0.184	6	0.588	3	0.276	1	0.088
NICCO (formerly at Belvoir Park)	5	1.656	2	0.573	7	2.113	1	0.326
Royal Victoria Hospital	26	0.879	24	0.923	36	1.388	27	0.946
<b>Belfast Health &amp; Social Care Trust</b>	<b>71</b>	<b>0.808</b>	<b>78</b>	<b>0.953</b>	<b>101</b>	<b>1.283</b>	<b>66</b>	<b>0.804</b>
Antrim Area Hospital	49	3.097	36	2.240	23	1.511	16	0.987
Braid Valley Hospital	0	0.000	0	0.000	0	0.000	0	0.000
Causeway Hospital	11	1.164	13	1.292	5	0.556	11	1.046
Dalriada Hospital	0	0.000	0	0.000	0	0.000	0	0.000
Mid Ulster Hospital	16	2.578	9	1.335	3	0.492	6	0.895
Moyle Hospital	0	0.000	0	0.000	0	0.000	0	0.000
Robinson Memorial Hospital	1	0.566	1	0.531	0	0.000	0	0.000
Whiteabbey Hospital	16	2.426	13	2.050	3	0.473	5	0.668
<b>Northern Health &amp; Social Care Trust</b>	<b>93</b>	<b>2.070</b>	<b>72</b>	<b>1.530</b>	<b>34</b>	<b>0.788</b>	<b>38</b>	<b>0.793</b>
Ards Hospital	1	0.677	1	0.760	0	0.000	0	0.000
Bangor Hospital	0	0.000	0	0.000	0	0.000	2	1.324
Downe Hospital	5	1.377	4	1.222	1	0.274	2	0.406
Lagan Valley Hospital	5	0.690	4	0.650	3	0.549	3	0.482
Ulster Hospital	39	1.568	25	1.012	24	0.947	22	0.838
<b>South Eastern Health &amp; Social Care Trust</b>	<b>50</b>	<b>1.293</b>	<b>34</b>	<b>0.923</b>	<b>28</b>	<b>0.756</b>	<b>29</b>	<b>0.717</b>
Craigavon Area Hospital	31	1.951	28	1.706	28	1.904	38	2.378
Daisy Hill Hospital	7	0.752	7	0.799	7	0.846	16	1.743
Lurgan Hospital	9	1.332	2	0.309	5	0.812	3	0.513
Mullinure	2	1.122	1	0.551	2	1.245	1	0.585
South Tyrone Hospital	2	0.708	2	0.644	5	1.719	1	0.366
<b>Southern Health &amp; Social Care Trust*</b>	<b>51</b>	<b>1.395</b>	<b>40</b>	<b>1.094</b>	<b>47</b>	<b>1.397</b>	<b>59</b>	<b>1.664</b>
Altnagelvin Area Hospital	14	0.745	20	1.140	17	1.051	15	0.905
Erne Hospital	3	0.449	0	0.000	7	1.178	5	0.621
Sperrin Ward (T&F)	0	0.000	0	0.000	0	0.000	0	0.000
Tyrone County Hospital	7	1.025	7	1.360	4	0.741	1	0.186
Waterside Hospital (Wards 1, 2, 3, 5)	2	0.322	0	0.000	0	0.000	0	0.000
<b>Western Health &amp; Social Care Trust</b>	<b>26</b>	<b>0.656</b>	<b>27</b>	<b>0.736</b>	<b>28</b>	<b>0.794</b>	<b>21</b>	<b>0.572</b>
<b>NI TOTAL</b>	<b>291</b>	<b>1.175</b>	<b>251</b>	<b>1.050</b>	<b>238</b>	<b>1.044</b>	<b>213</b>	<b>0.878</b>
<b>NI Community TOTAL</b>	<b>58</b>	<b>-</b>	<b>87</b>	<b>-</b>	<b>78</b>	<b>-</b>	<b>82</b>	

## Appendix A

**Table 2:** Quarterly number of *Clostridium difficile* patient episodes, patients 2 years and over, and rates by Hospital, April – December 2008

Hospital	Apr - June 2008		Jul - Sep 2008		Oct - Dec 2008	
	Episodes	Rate	Episodes	Rate	Episodes	Rate
Belfast City Hospital	38	0.841	46	1.072	29	0.592
Forster Green Hospital	0	0.000	0	0.000	0	0.000
Mater Infirmorum	23	0.959	23	0.990	19	0.787
Musgrave Park Hospital	7	0.350	4	0.235	4	0.201
NICCO (formerly at Belvoir Park)	4	0.599	13	1.869	3	0.454
Royal Victoria Hospital	37	0.677	46	0.895	39	0.737
<b>Belfast Health &amp; Social Care Trust</b>	<b>109</b>	<b>0.711</b>	<b>132</b>	<b>0.907</b>	<b>94</b>	<b>0.606</b>
Antrim Area Hospital	47	1.420	29	0.930	19	0.581
Braid Valley Hospital	0	0.000	0	0.000	0	0.000
Causeway Hospital	14	0.700	8	0.410	14	0.727
Dalriada Hospital	0	0.000	0	0.000	0	0.000
Mid Ulster Hospital	12	1.358	3	0.384	7	0.823
Moyle Hospital	0	0.000	0	0.000	0	0.000
Robinson Memorial Hospital	1	0.540	0	0.000	0	0.000
Whiteabbey Hospital	14	1.729	5	0.634	5	0.537
<b>Northern Health &amp; Social Care Trust</b>	<b>88</b>	<b>1.104</b>	<b>45</b>	<b>0.600</b>	<b>45</b>	<b>0.574</b>
Ards Hospital	1	0.264	0	0.000	0	0.000
Bangor Hospital	0	0.000	0	0.000	2	1.199
Downe Hospital	4	0.909	2	0.507	2	0.415
Lagan Valley Hospital	4	0.426	3	0.341	3	0.329
Ulster Hospital	34	0.784	33	0.761	24	0.526
<b>South Eastern Health &amp; Social Care Trust</b>	<b>43</b>	<b>0.688</b>	<b>38</b>	<b>0.618</b>	<b>31</b>	<b>0.475</b>
Craigavon Area Hospital	31	0.829	37	1.045	48	1.316
Daisy Hill Hospital	10	0.615	9	0.573	20	1.169
Lurgan Hospital	2	0.338	5	0.851	3	0.538
Mullinure	1	0.529	2	1.184	1	0.570
South Tyrone Hospital	3	1.086	5	1.980	1	0.440
<b>Southern Health &amp; Social Care Trust*</b>	<b>47</b>	<b>0.732</b>	<b>58</b>	<b>0.947</b>	<b>73</b>	<b>1.155</b>
Altnagelvin Area Hospital	37	0.992	26	0.739	22	0.603
Erne Hospital	0	0.000	9	0.748	5	0.382
Sperrin Ward (T&F)	0	0.000	0	0.000	0	0.000
Tyrone County Hospital	7	0.984	4	0.587	1	0.143
Waterside Hospital (Wards 1, 2, 3, 5)	0	0.000	0	0.000	0	0.000
<b>Western Health &amp; Social Care Trust</b>	<b>44</b>	<b>0.683</b>	<b>39</b>	<b>0.630</b>	<b>28</b>	<b>0.439</b>
<b>NI TOTAL</b>	<b>331</b>	<b>0.781</b>	<b>312</b>	<b>0.770</b>	<b>271</b>	<b>0.637</b>
<b>NI community TOTAL</b>	<b>108</b>	<b>-</b>	<b>109</b>	<b>-</b>	<b>97</b>	<b>-</b>

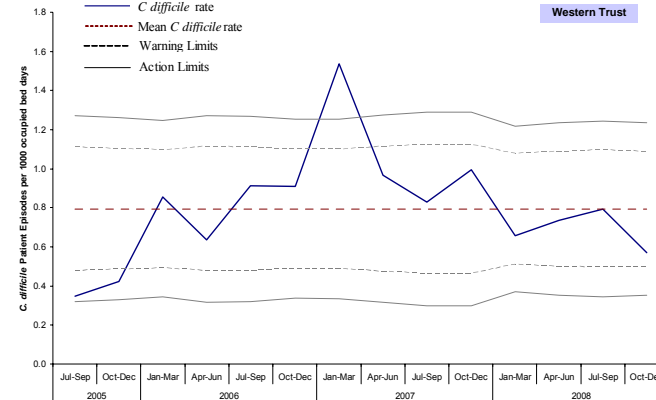
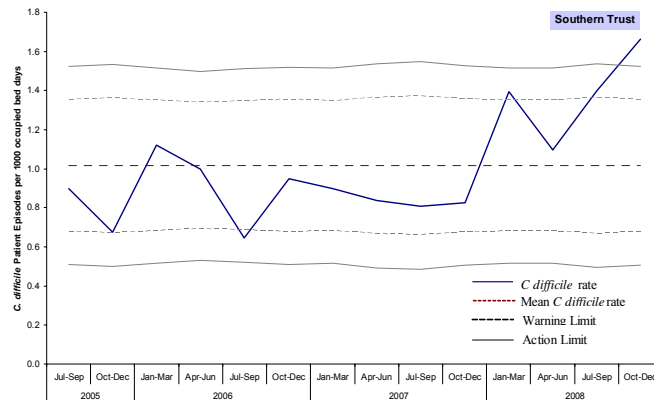
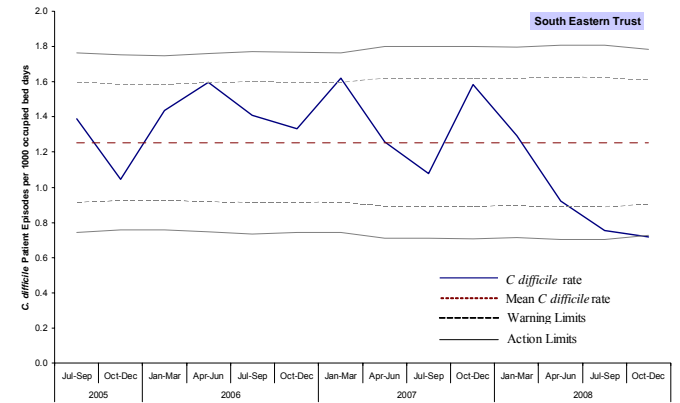
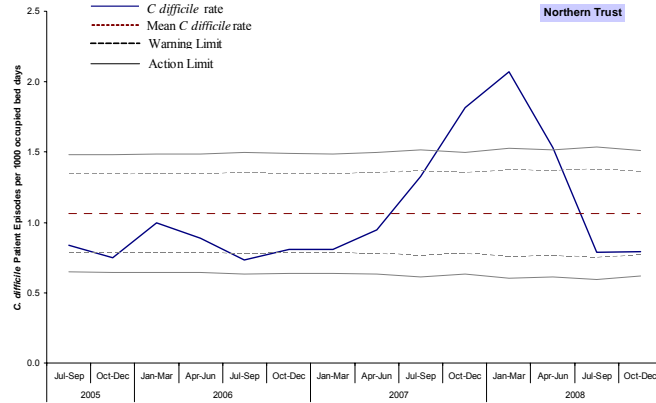
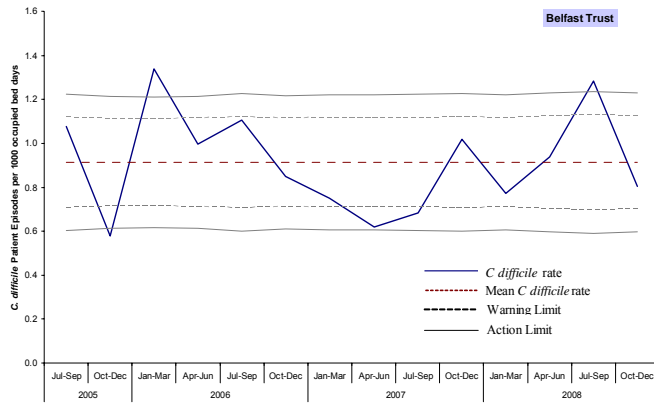
## Appendix A

**Table 3:** Quarterly number of *Clostridium difficile* patient episodes, patients 2 to 64 years, by Hospital, April – December 2008

Hospital	Apr - Jun 2008	Jul - Sep 2008	Oct - Dec 2008
	Episodes	Episodes	Episodes
Belfast City Hospital	13	11	7
Forster Green Hospital	0	0	0
Mater Infirmorum	2	3	4
Musgrave Park Hospital	1	1	3
NICCO (formerly at Belvoir Park)	2	6	2
Royal Victoria Hospital	13	10	12
<b>Belfast Health &amp; Social Care Trust</b>	<b>31</b>	<b>31</b>	<b>28</b>
Antrim Area Hospital	11	6	3
Braid Valley Hospital	0	0	0
Causeway Hospital	1	3	3
Dalriada Hospital	0	0	0
Mid Ulster Hospital	3	0	1
Moyle Hospital	0	0	0
Robinson Memorial Hospital	0	0	0
Whiteabbey Hospital	1	2	0
<b>Northern Health &amp; Social Care Trust</b>	<b>16</b>	<b>11</b>	<b>7</b>
Ards Hospital	0	0	0
Bangor Hospital	0	0	0
Downe Hospital	0	1	0
Lagan Valley Hospital	0	0	0
Ulster Hospital	9	9	2
<b>South Eastern Health &amp; Social Care Trust</b>	<b>9</b>	<b>10</b>	<b>2</b>
Craigavon Area Hospital	3	9	10
Daisy Hill Hospital	3	2	4
Lurgan Hospital	0	0	0
Mullinure	0	0	0
South Tyrone Hospital	1	0	0
<b>Southern Health &amp; Social Care Trust</b>	<b>7</b>	<b>11</b>	<b>14</b>
Altnagelvin Area Hospital	17	9	7
Erne Hospital	0	2	0
Sperrin Ward (T&F)	0	0	0
Tyrone County Hospital	0	0	0
Waterside Hospital (Wards 1, 2, 3, 5)	0	0	0
<b>Western Health &amp; Social Care Trust</b>	<b>17</b>	<b>11</b>	<b>7</b>
<b>NI TOTAL</b>	<b>80</b>	<b>74</b>	<b>58</b>
<b>NI community TOTAL</b>	<b>21</b>	<b>31</b>	<b>15</b>

## Appendix B

**Trends in inpatients, aged 65 years and over, *C difficile* rates by trust and quarter (2005-2008)**



### Notes:

As of the 1<sup>st</sup> 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 1<sup>st</sup> 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

### 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. If the new admission is within 28 days of the original positive specimen date, for *C. difficile*, then the duplicate rule applies regardless of the change in hospital and the isolate should not be reported.