HSC Public Health Agency

S. aureus bacteraemia surveillance

Quarterly report

January - March 2014 (Q1 2014)

Key points

- Overall *S. aureus* (SA) rates for Northern Ireland (MRSA plus MSSA bacteraemias) decreased by approximately 8% during quarter one 2014 compared to quarter four 2013.

- MRSA rates decreased by approximately 51% compared to quarter four 2013 (from 20 to 10 reports).
- MRSA reports during 2013/14 fell 11% compared to 2012/13.

- MSSA rates increased by approximately 4% compared to quarter four 2013 (from 71 to 76 reports).
- MSSA reports during 2013/14 rose 5% compared to 2012/13.

- SA rates for quarter one 2014 remain within expected parameters on the SPC chart for Northern Ireland.
- MRSA rates remain within expected parameters on the SPC chart for Northern Ireland.
- MSSA rates remain within expected parameters on the SPC chart for Northern Ireland.

S. aureus bacteraemia surveillance

S. aureus (MRSA plus MSSA)

- The Northern Ireland rate of SA bacteraemia (MRSA plus MSSA) decreased from 0.241/1,000 occupied bed days in quarter four 2013 to 0.221/1,000 occupied bed days this quarter (Figure 1 and Table 3).
- In all, 86 SA reports were notified between January - March 2014, a decrease of 5 (5%) on the previous quarter (91 reports).

MRSA

- The number of MRSA bacteraemias decreased by 50%, from 20 reports in quarter four 2013 to 10 reports this quarter (Table 1).
- The MRSA rate decreased by 51%, from 0.053/1,000 occupied bed days in quarter four 2013 to 0.026/1,000 occupied bed days this quarter (Figure 1 and Table 3).
- The overall percentage of SA patient episodes reported as MRSA decreased by approximately 10.2%, from 22.0% in quarter four 2013 to 11.8% this quarter (Table 3).
- All five Health and Social Care Trusts (HSCTs) saw a decrease in MRSA rates during this quarter (Figure 3). When the MRSA rates for this quarter are compared to quarter one in previous years, using 95% confidence intervals, there is no statistically significant change (Figure 4).

MSSA

- The number of MSSA bacteraemias increased by 7%, from 71 reports in quarter four 2013 to 76 reports this quarter (Table 2).
- The MSSA rate increased by 4%, from 0.188/1,000 occupied bed days in quarter four 2013 to 0.195/1,000 occupied bed days this quarter (Figure 1 and Table 3). There was no statistically significant change in MSSA rates between the two quarters (Figure 1).
- This quarter, all five HSCTs reported higher MSSA rates than MRSA (Figure 2).
- MSSA rates increased in three of the five HSCTs this quarter (Figure 5). However, when compared to quarter one in previous years, there is no statistically significant change in MSSA rates in any of the Trusts (Figure 6).
- Figures 7 and 8 show the rates of MRSA and MSSA patient episodes in each hospital and HSCT during this quarter (see also Tables 1 and 2).

SPC charts

- Trends in overall SA rates, and in MRSA and MSSA rates, since SA reporting commenced in 2001 are presented for each HSCT in the form of Statistical Process Control (SPC) charts in Figure 9 and Appendix 2. 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 4.
- 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.
- For Northern Ireland as a whole, SA, MRSA and MSSA rates remain within expected parameters of the regional SPC charts (Figures 9a, 9b & 9c).

Caveats

- The data in this report reflect SA patient episodes that have been validated by diagnostic laboratories in each HSCT and compared to the Northern Ireland healthcare associated infections (HCAI) web-based surveillance system. The data may be subject to change. Any updates will be reflected in the next quarterly surveillance report.
- A number of recent SA reports (for which patient source was known) have been from patients located in accident and emergency departments at the time of blood sampling. Although the actual source of infection may have been external to the accident and emergency department where the specimens were tested, these patients are included in the relevant HSCT's quarterly SA total. Transferred patients and duplicates between HSCTs (within 14 days) are removed from the dataset, as much as possible, using information from the usual laboratory reporting systems, including CoSurv and EARSS. It should be noted that the potential for including duplicates remains.
- Appendix 5 has been added to this report to assist with clarification of definitions relating to *S. aureus* patient episodes.
- KH03a bed day data was not available for RBHSC; therefore the figure used is based on an estimate generated using quarter one bed day data for this hospital from previous years. This bed day information will be updated when it becomes available.

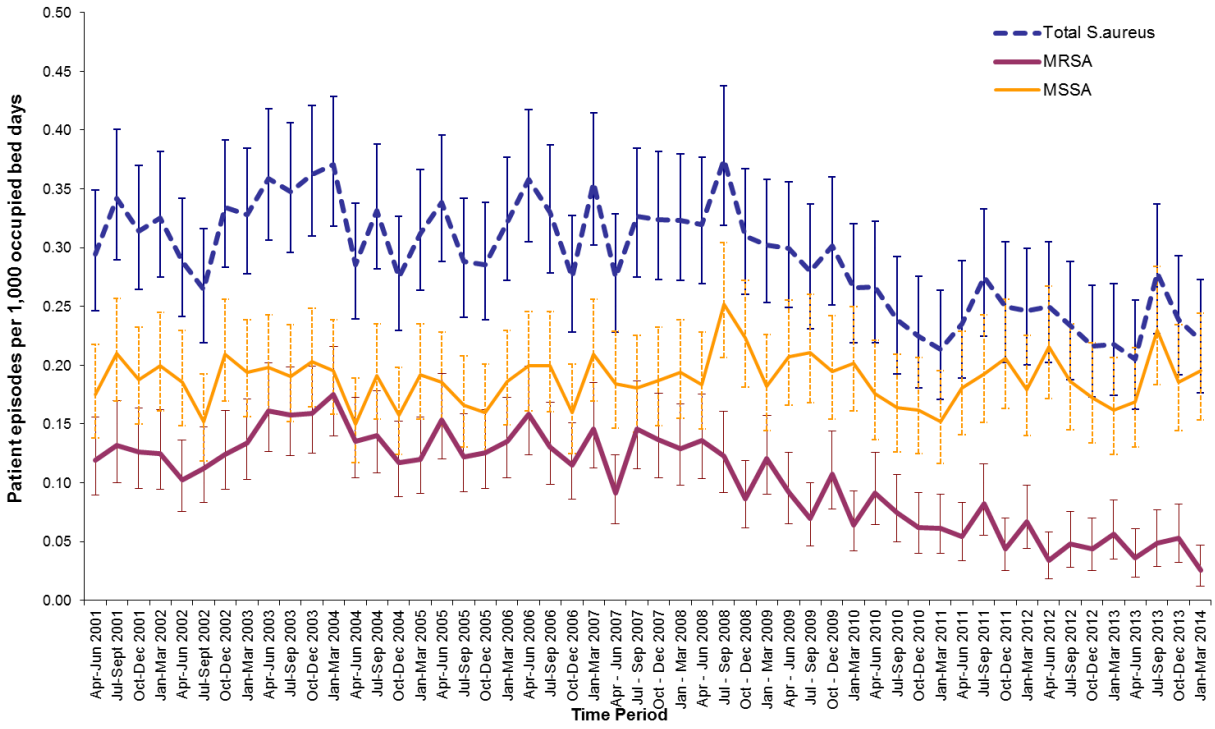


Figure 1: MSSA, MRSA and *S. aureus* patient episode rates in Northern Ireland by quarter, with 95% confidence intervals, April 2001 – March 2014 (see Appendix 3)

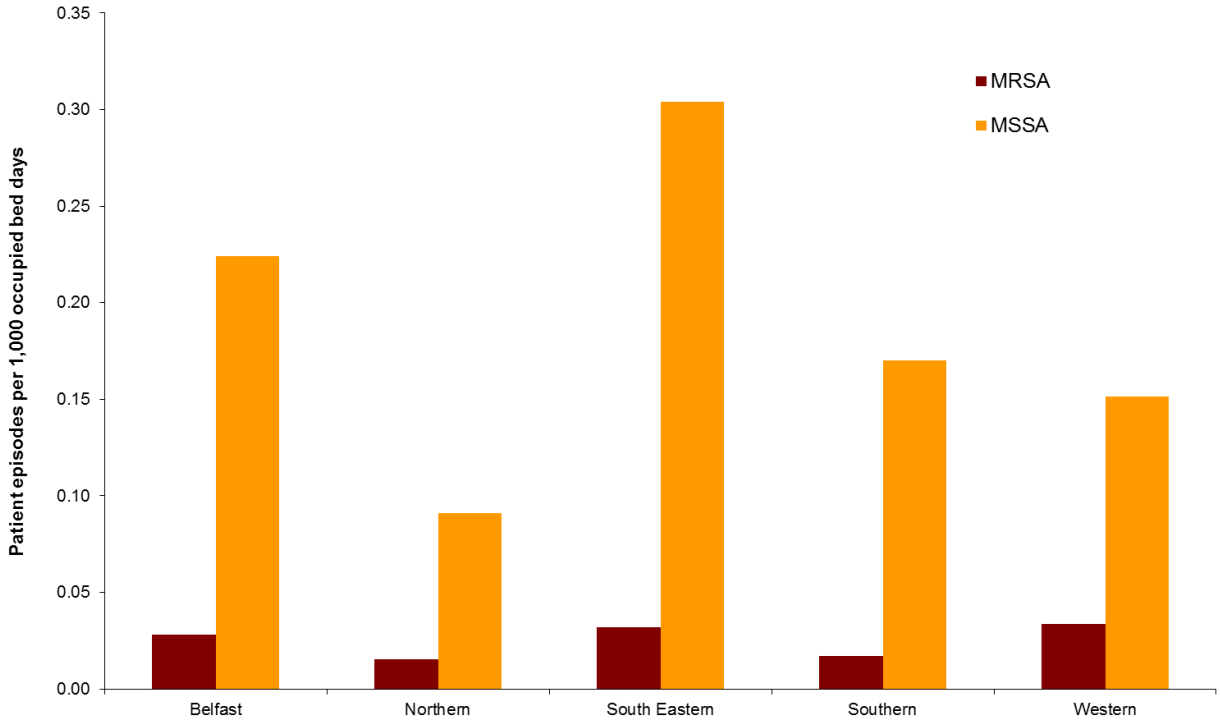


Figure 2: MRSA and MSSA patient episodes per 1,000 occupied bed days, by HSCT, January - March 2014

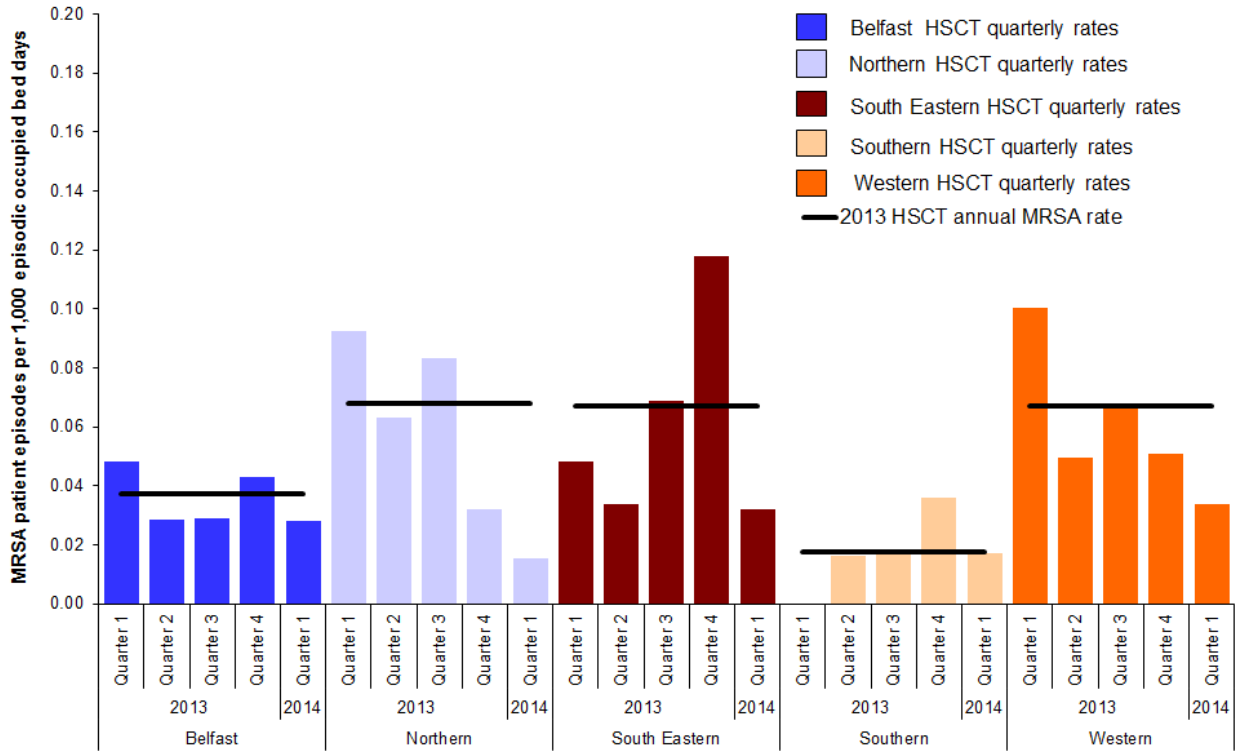


Figure 3: Quarterly rates of MRSA by HSCT, 1 January 2013 - 31 March 2014, with 2013 HSCT annual MRSA rates

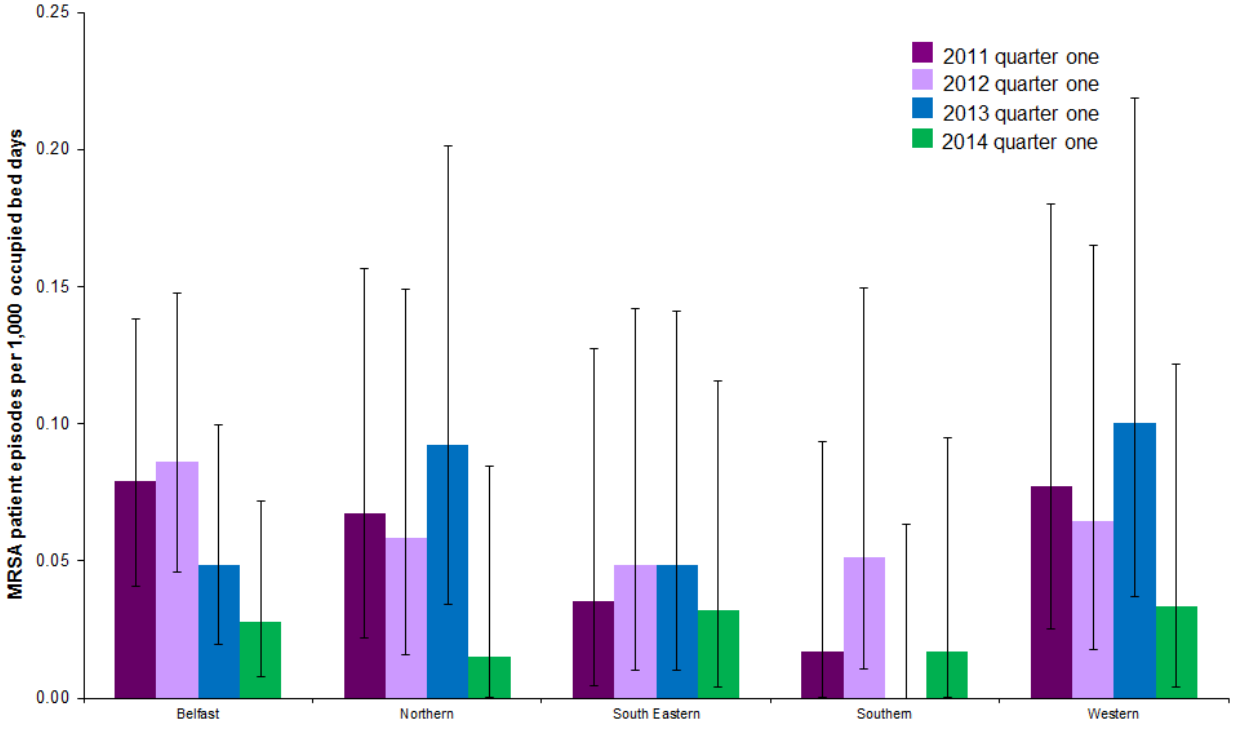


Figure 4: MRSA patient episodes in quarter one, by HSCT, from 2011–2014, with 95% confidence intervals

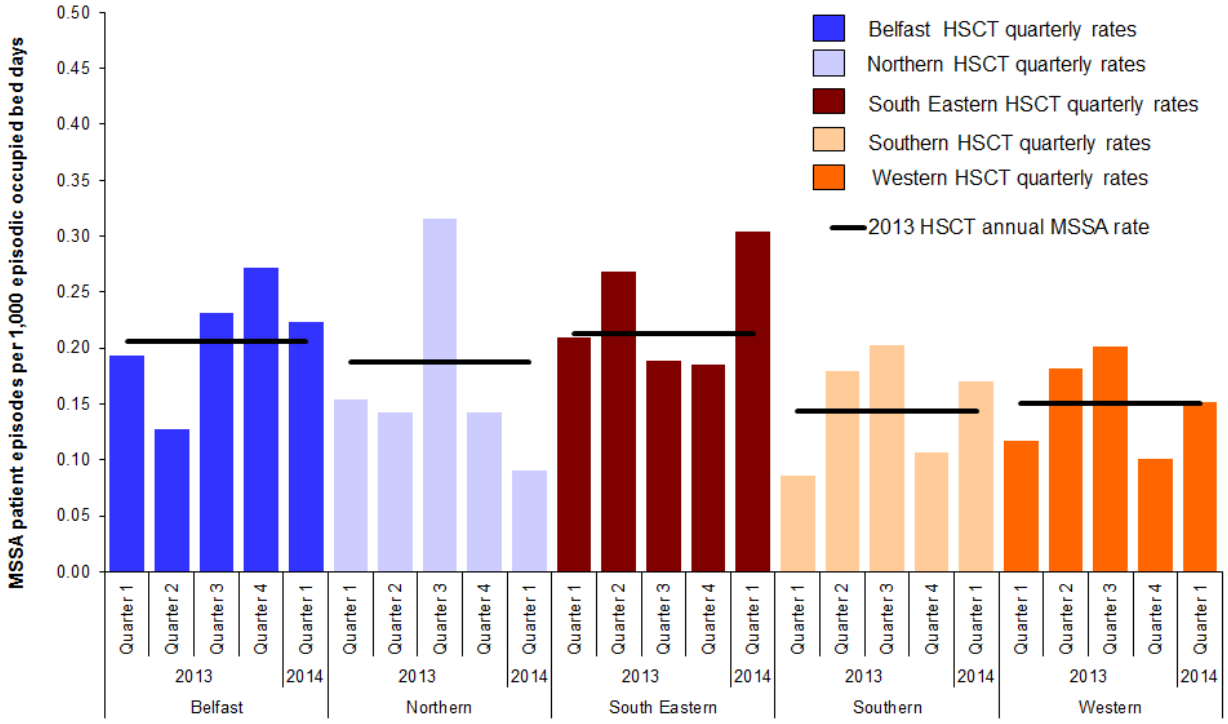


Figure 5: Quarterly rates of MSSA by HSCT, 1 January 2013 – 31 March 2014, with 2013 HSCT annual MSSA rates

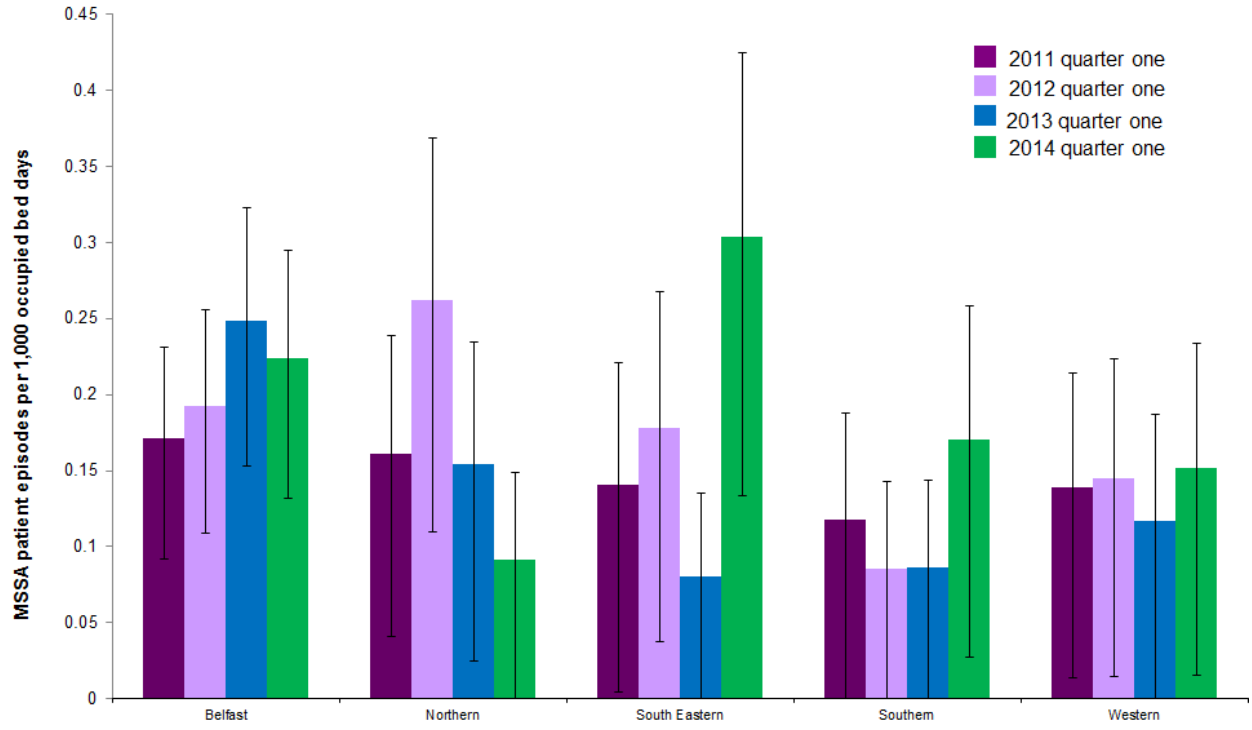


Figure 6: MSSA patient episodes in quarter one, by HSCT, from 2011–2014, with 95% confidence intervals

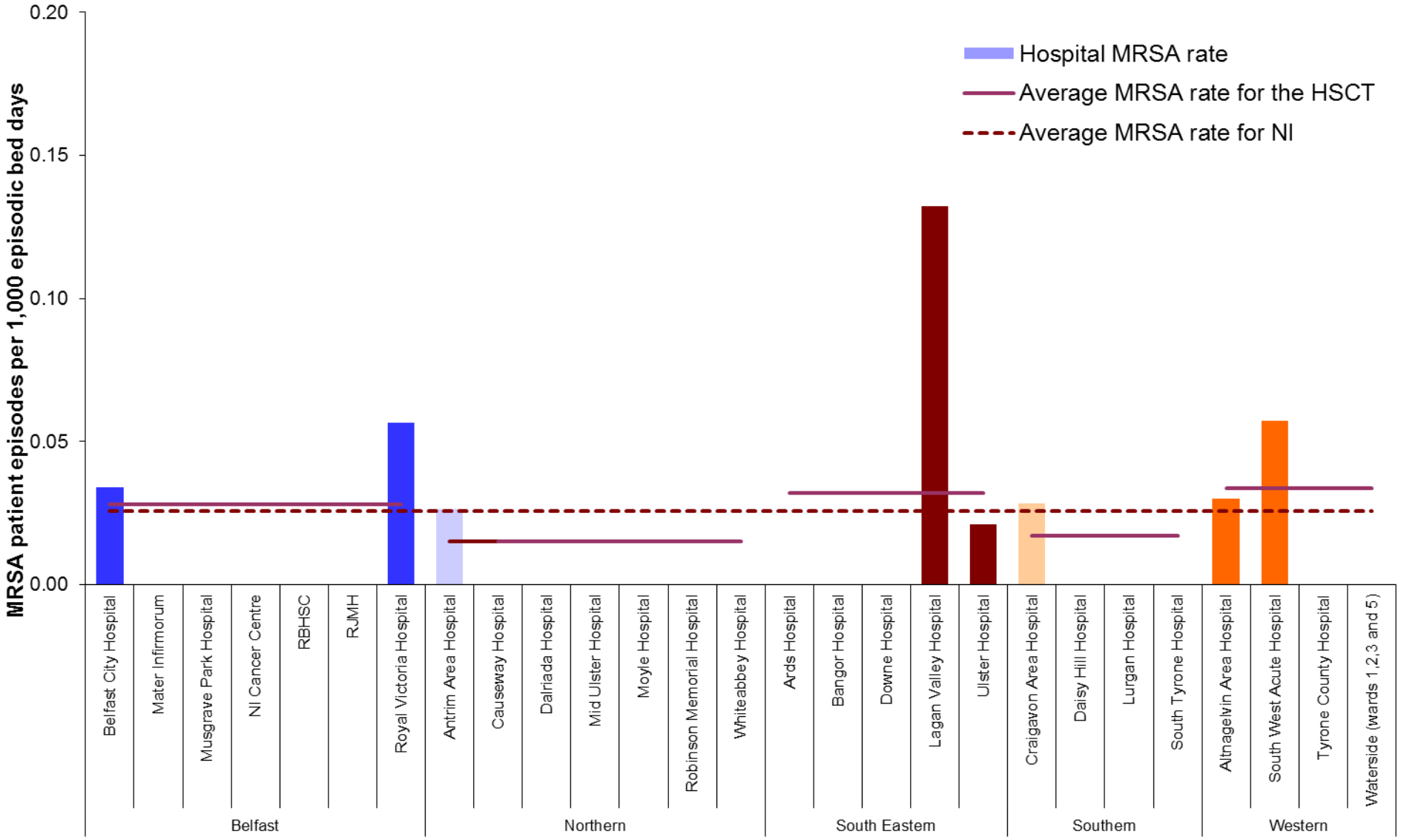


Figure 7: Rates of MRSA, by individual hospitals, for quarter one 2014 (gaps represent zero episodes), compared to quarter one 2014 average rates for Northern Ireland and HSCTs

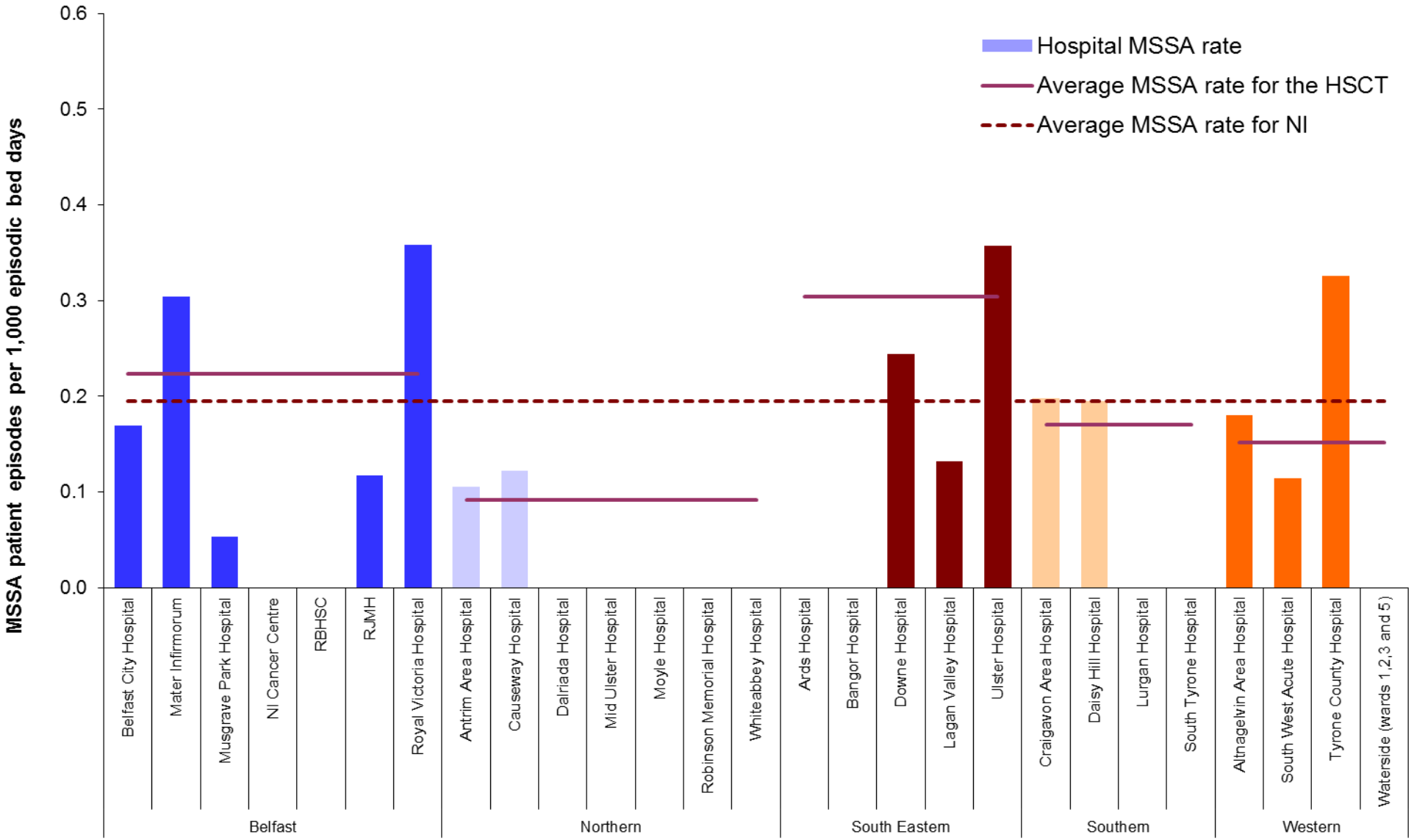


Figure 8: Rates of MSSA, by individual hospitals, for quarter one 2014 (gaps represent zero episodes), compared to quarter one 2014 average rates for Northern Ireland and HSCTs

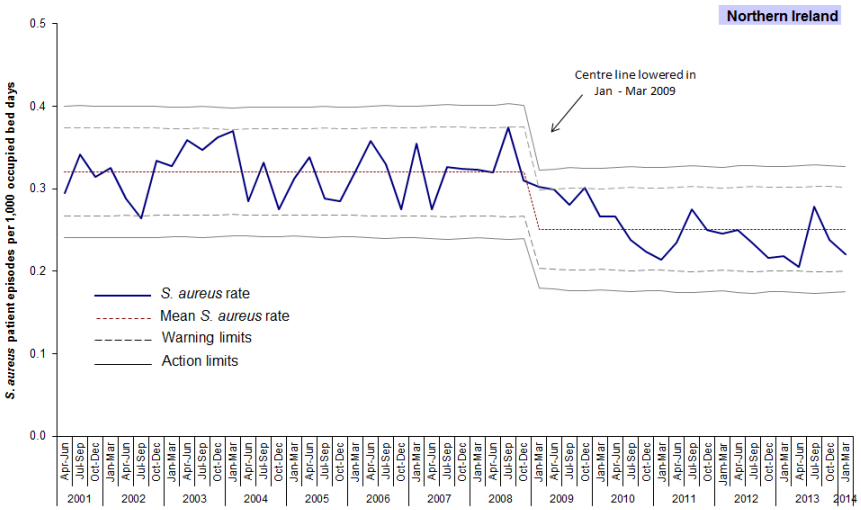


Figure 9a: Statistical process control chart for quarterly *S. aureus* rates in Northern Ireland

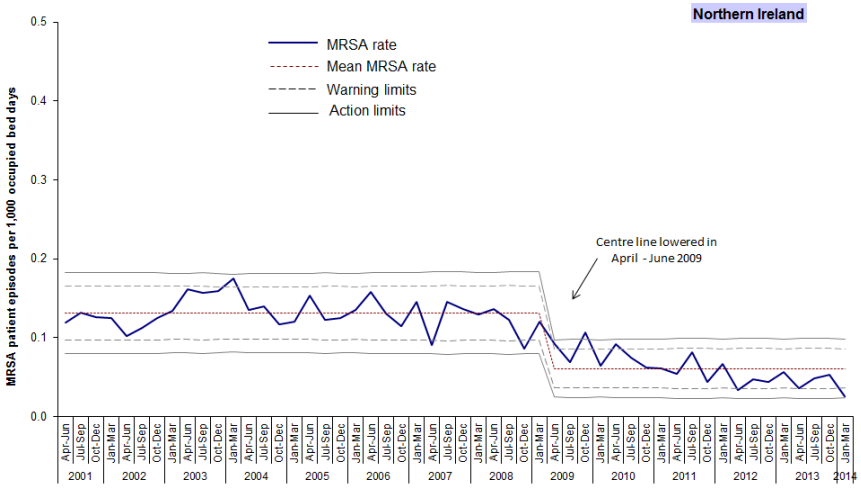


Figure 9b: Statistical process control chart for quarterly MRSA rates in Northern Ireland

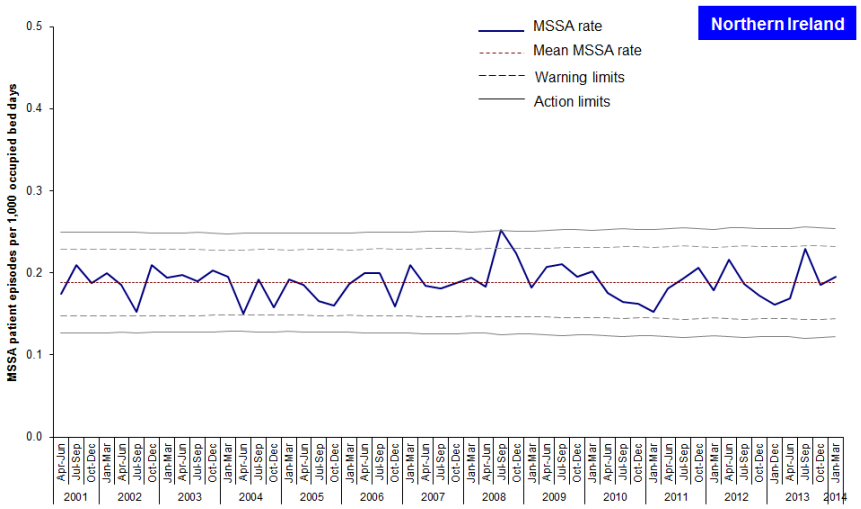


Figure 9c: Statistical process control chart for quarterly MSSA rates in Northern Ireland

Appendix 1

Table 1: Quarterly number and rate of MRSA patient episodes, by hospital, Apr 2013 - Mar 2014

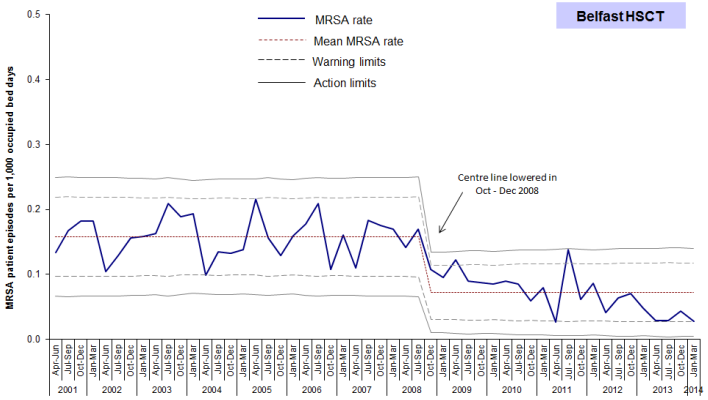
Hospital	Apr - Jun 2013		July - Sept 2013		Oct - Dec 2013		Jan-Mar 2014	
	Episodes	Rate	Episodes	Rate	Episodes	Rate	Episodes	Rate
Belfast City Hospital	0	0.000	1	0.035	0	0.000	1	0.034
Mater Infirmorum	3	0.148	0	0.000	3	0.152	0	0.000
Musgrave Park Hospital	0	0.000	0	0.000	1	0.057	0	0.000
NICCO (formerly at Belvoir Park)	0	0.000	1	0.161	0	0.000	0	0.000
RBHSC	0	0.000	0	0.000	0	0.000	0	0.000
RJMH	0	0.000	0	0.000	0	0.000	0	0.000
Royal Victoria Hospital	1	0.020	2	0.039	2	0.039	3	0.057
Belfast HSCT	**4**	**0.028**	**4**	**0.029**	**6**	**0.043**	**4**	**0.028**
Antrim Area Hospital	4	0.116	3	0.091	2	0.056	1	0.026
Causeway Hospital	0	0.000	2	0.122	0	0.000	0	0.000
Dalriada Hospital	0	0.000	0	0.000	0	0.000	0	0.000
Mid Ulster Hospital	0	0.000	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	0.000	0	0.000	0	0.000
Whiteabbey Hospital	0	0.000	0	0.000	0	0.000	0	0.000
Northern HSCT	**4**	**0.063**	**5**	**0.083**	**2**	**0.032**	**1**	**0.015**
Ards Hospital	0	0.000	0	0.000	0	0.000	0	0.000
Bangor Hospital	0	0.000	0	0.000	0	0.000	0	0.000
Downe Hospital	0	0.000	0	0.000	0	0.000	0	0.000
Lagan Valley Hospital	0	0.000	1	0.151	3	0.423	1	0.132
Ulster Hospital	2	0.044	3	0.067	4	0.089	1	0.021
South Eastern HSCT	**2**	**0.034**	**4**	**0.069**	**7**	**0.118**	**2**	**0.032**
Craigavon Area Hospital	1	0.029	1	0.030	1	0.029	1	0.028
Daisy Hill Hospital	0	0.000	0	0.000	0	0.000	0	0.000
Lurgan Hospital	0	0.000	0	0.000	1	0.232	0	0.000
South Tyrone Hospital	0	0.000	0	0.000	0	0.000	0	0.000
Southern HSCT	**1**	**0.016**	**1**	**0.018**	**2**	**0.036**	**1**	**0.017**
Altnagelvin Area Hospital	3	0.087	0	0.000	2	0.059	1	0.030
South West Acute Hospital	0	0.000	4	0.250	1	0.062	1	0.057
Tyrone County Hospital	0	0.000	0	0.000	0	0.000	0	0.000
Waterside Hospital (Wards 1-3, 5)	0	0.000	0	0.000	0	0.000	0	0.000
Western HSCT	**3**	**0.050**	**4**	**0.067**	**3**	**0.051**	**2**	**0.034**
Northern Ireland total	**14**	**0.036**	**18**	**0.049**	**20**	**0.053**	**10**	**0.026**

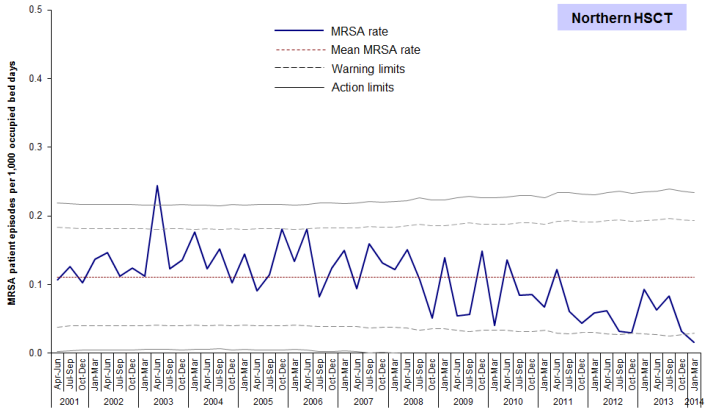
Appendix 1

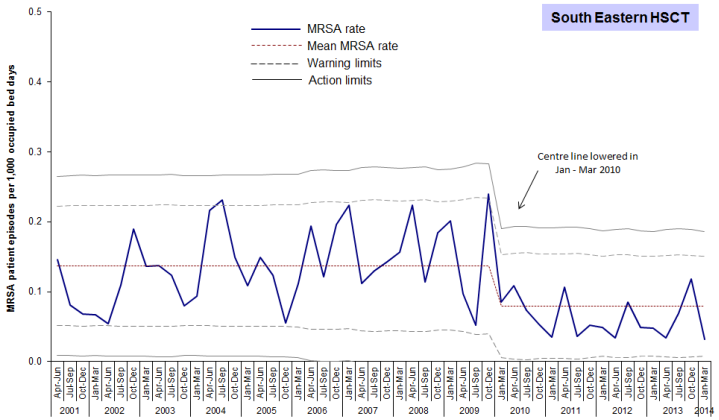
Table 2: Quarterly number and rate of MSSA patient episodes, by hospital, Apr 2013 - Mar 2014

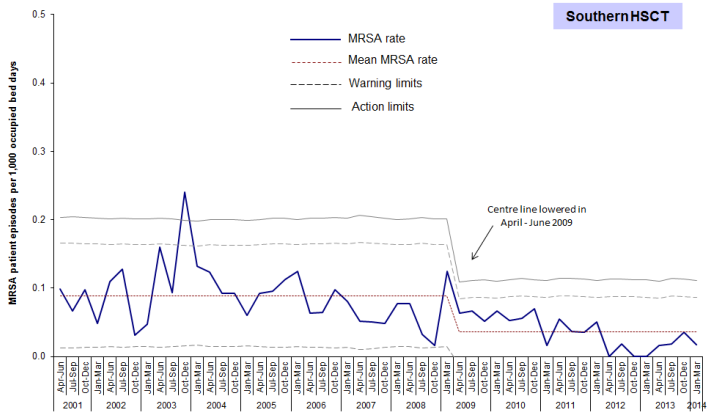
Hospital	Apr - Jun 2013		July - Sept 2013		Oct - Dec 2013		Jan - Mar 2014	
	Episodes	Rate	Episodes	Rate	Episodes	Rate	Episodes	Rate
Belfast City Hospital	2	0.065	7	0.247	10	0.336	5	0.170
Mater Infirmorum	4	0.197	3	0.154	6	0.304	6	0.304
Musgrave Park Hospital	1	0.053	0	0.000	2	0.115	1	0.053
NICCO (formerly at Belvoir Park)	2	0.339	1	0.161	1	0.163	0	0.000
RBHSC	1	0.148	4	0.640	7	1.058	0	0.000
RJMH	1	0.121	0	0.000	0	0.000	1	0.118
Royal Victoria Hospital	7	0.140	17	0.333	13	0.252	19	0.358
Belfast HSCT	**18**	**0.128**	**32**	**0.232**	**39**	**0.279**	**32**	**0.224**
Antrim Area Hospital	8	0.233	12	0.364	8	0.226	4	0.105
Causeway Hospital	1	0.057	6	0.367	1	0.061	2	0.122
Dalriada Hospital	0	0.000	0	0.000	0	0.000	0	0.000
Mid Ulster Hospital	0	0.000	1	0.470	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	0.000	0	0.000	0	0.000
Whiteabbey Hospital	0	0.000	0	0.000	0	0.000	0	0.000
Northern HSCT	**9**	**0.142**	**19**	**0.316**	**9**	**0.143**	**6**	**0.091**
Ards Hospital	0	0.000	0	0.000	0	0.000	0	0.000
Bangor Hospital	0	0.000	0	0.000	0	0.000	0	0.000
Downe Hospital	2	0.505	2	0.509	1	0.246	1	0.244
Lagan Valley Hospital	2	0.280	3	0.454	1	0.141	1	0.132
Ulster Hospital	12	0.264	6	0.135	9	0.200	17	0.358
South Eastern HSCT	**16**	**0.268**	**11**	**0.189**	**11**	**0.185**	**19**	**0.304**
Craigavon Area Hospital	7	0.201	5	0.151	5	0.147	7	0.198
Daisy Hill Hospital	4	0.259	6	0.428	1	0.072	3	0.195
Lurgan Hospital	0	0.000	0	0.000	0	0.000	0	0.000
South Tyrone Hospital	0	0.000	0	0.000	0	0.000	0	0.000
Southern HSCT	**11**	**0.179**	**11**	**0.202**	**6**	**0.107**	**10**	**0.170**
Altnagelvin Area Hospital	9	0.260	12	0.354	5	0.146	6	0.180
South West Acute Hospital	2	0.122	0	0.000	1	0.062	2	0.114
Tyrone County Hospital	0	0.000	0	0.000	0	0.000	1	0.326
Waterside Hospital (Wards 1-3, 5)	0	0.000	0	0.000	0	0.000	0	0.000
Western HSCT	**11**	**0.182**	**12**	**0.202**	**6**	**0.102**	**9**	**0.151**
Northern Ireland total	**65**	**0.169**	**85**	**0.230**	**71**	**0.188**	**76**	**0.195**

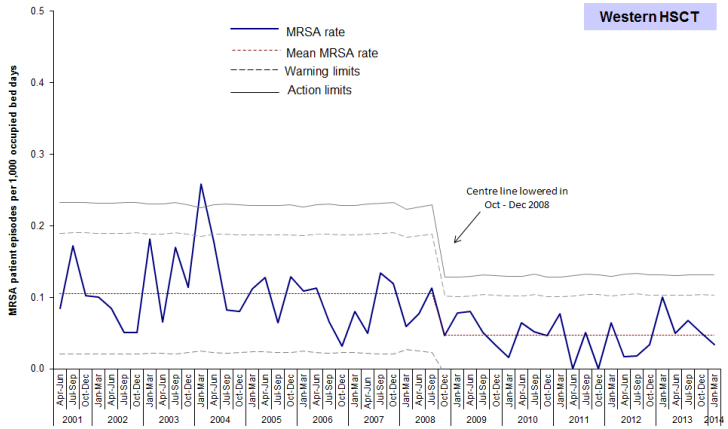
Appendix 2: Trends in MRSA rates, by HSCT and quarter, 2001–2014



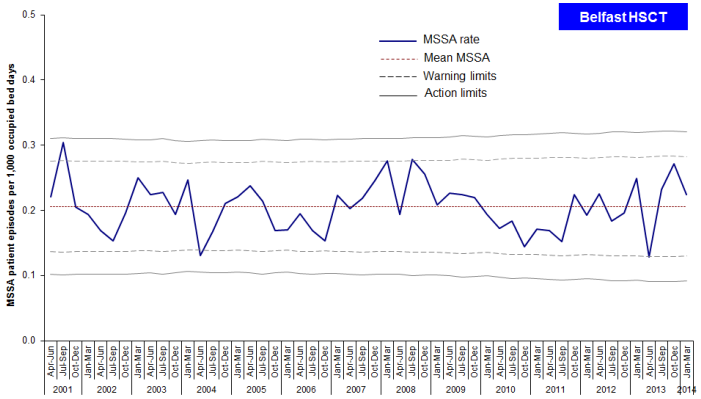


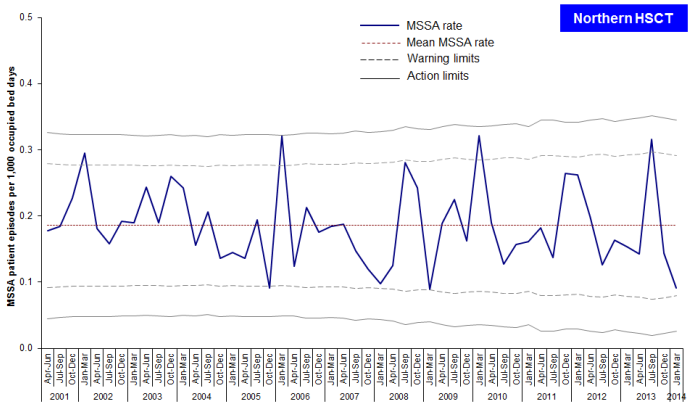


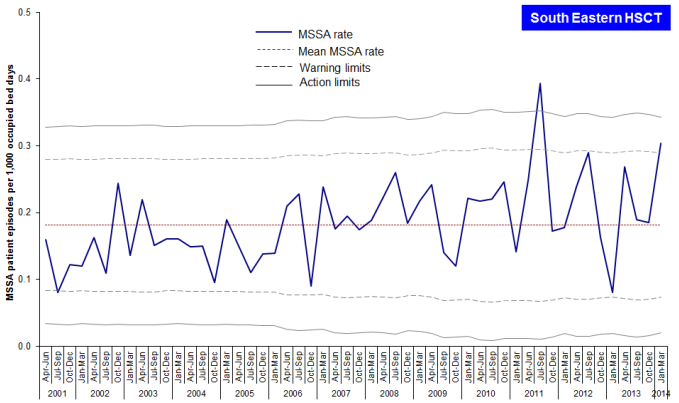


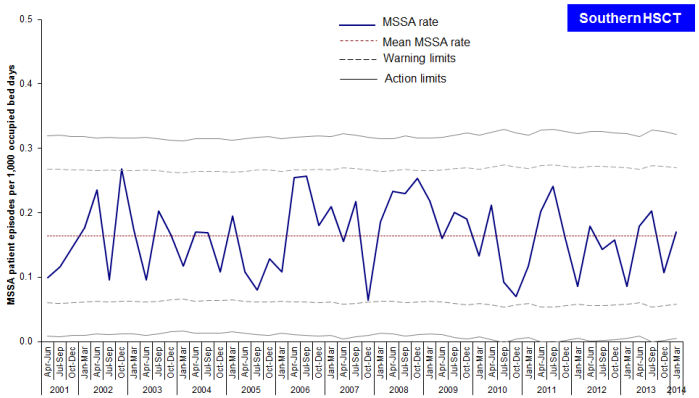


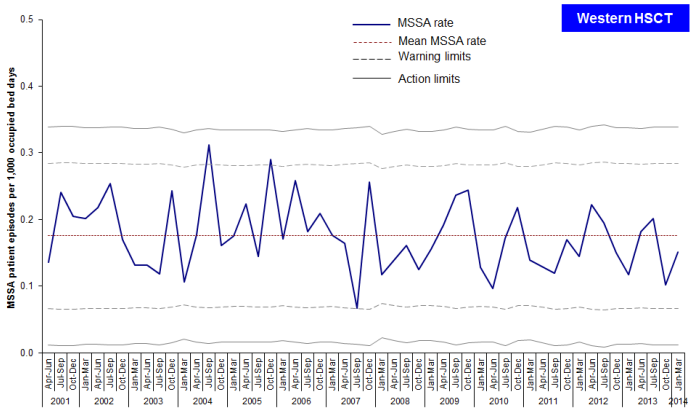
Appendix 2: Trends in MSSA rates, by HSCT and quarter, 2001–2014











Appendix 3

Table 3: MSSA, MRSA and total *S. aureus* patient episode rates, and the percentage of *S. aureus* reported as MRSA, in Northern Ireland, Jul 2005 – Mar 2014

Quarter	MSSA rate	MRSA rate	All *S. aureus* rate	% MRSA
Jul-Sep 2005	0.166	0.122	0.29	42.1
Oct-Dec 2005	0.16	0.125	0.285	43.9
Jan-Mar 2006	0.186	0.135	0.321	42.1
Apr-Jun 2006	0.199	0.157	0.356	44.1
Jul-Sep 2006	0.201	0.129	0.33	39.1
Oct-Dec 2006	0.159	0.115	0.273	42.1
Jan-Mar 2007	0.208	0.145	0.353	41.1
Apr-Jun 2007	0.183	0.091	0.274	33.2
Jul-Sep 2007	0.181	0.146	0.326	44.8
Oct-Dec 2007	0.187	0.137	0.324	42.3
Jan-Mar 2008	0.194	0.129	0.323	39.9
Apr-Jun 2008	0.184	0.136	0.32	42.5
Jul-Sep 2008	0.252	0.122	0.375	32.5
Oct-Dec 2008	0.223	0.087	0.31	28.1
Jan-Mar 2009	0.182	0.120	0.302	39.7
Apr-Jun 2009	0.207	0.092	0.299	30.8
Jul-Sep 2009	0.206	0.069	0.275	25.1
Oct-Dec 2009	0.195	0.107	0.302	35.4
Jan-Mar 2010	0.202	0.064	0.266	24.1
Apr-Jun 2010	0.175	0.091	0.267	34.1
Jul-Sep 2010	0.164	0.074	0.239	31.0
Oct-Dec 2010	0.162	0.062	0.224	27.7
Jan-Mar 2011	0.152	0.061	0.214	28.5
Apr-Jun 2011	0.181	0.054	0.235	23.0
Jul-Sep 2011	0.193	0.082	0.275	29.8
Oct-Dec 2011	0.206	0.044	0.250	17.6
Jan-Mar 2012	0.179	0.067	0.246	27.2
Apr-Jun 2012	0.216	0.034	0.250	13.6
Jul-Sep 2012	0.186	0.048	0.234	20.5
Oct-Dec 2012	0.173	0.044	0.216	20.4
Jan-Mar 2013	0.162	0.056	0.218	25.7
Apr-Jun 2013	0.169	0.036	0.205	17.6
Jul-Sep 2013	0.230	0.049	0.278	17.6
Oct-Dec 2013	0.188	0.053	0.241	22.0
Jan-Mar 2014	0.195	0.026	0.221	11.8

Appendix 4

Statistical process control charts

The statistical process control (SPC) chart is now commonly used for the reporting of MRSA rates throughout the UK. SPC charts assume that rates within a HSCT will be largely similar over time. They present the occurrence of *S. aureus* bacteraemias 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 April 2001. 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:

$$Warning\ Limit = M \pm 2\sqrt{\frac{\mathrm{Ei}}{(\mathrm{Ni})^2}} \qquad Action\ Limit = M \pm 3\sqrt{\frac{\mathrm{Ei}}{(\mathrm{Ni})^2}}$$

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 $Ei = M \times Ni$

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.

Trust activity is defined as the number of occupied beds (from KH03A return) and is used to calculate a rate per 1,000 occupied bed days. KH03A data are obtained from the Department of Health, Social Services and Public Safety (DHSSPS) on a quarterly basis.

The number of patient episodes is defined as the total number of patients from whom blood culture set(s) collected during the quarter grew *S. aureus*. If repeat specimens were collected from a single patient, and the patient was considered to have had two episodes of bacteraemia, they should be counted as two patients. As an arbitrary measure, if positive blood culture sets are collected more than 14 days apart, they should be considered as reflecting different episodes.

Appendix 5

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 *S. aureus*. If the new admission is within 14 days of the original positive specimen date, the duplicate rule applies regardless of the change of hospital and the isolate should not be reported.

Specimens taken in hospices

A patient may have a specimen taken whilst resident/attending a hospice. In this instance, the record should be entered onto the HCAI web based surveillance system with a comment indicating that it was taken in a hospice. The record will not be counted towards MRSA reduction targets and will not be included in reports.

Appendix 6

Table 4: MRSA patient episodes for each financial year, by HSCT

	Financial Year								
HSCT	2005/06	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14
Belfast	118	115	109	86	62	48	46	32	18
Northern	46	47	42	35	22	27	19	14	12
South Eastern	32	49	34	46	28	15	14	13	15
Southern	27	19	14	16	15	11	10	1	5
Western	27	18	22	20	11	15	7	10	12
Northern Ireland	250	248	221	203	138	116	96	70	62

Table 5: MSSA patient episodes for each financial year, by HSCT

	Financial Year								
HSCT	2005/06	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14
Belfast	141	130	161	157	138	103	109	115	121
Northern	66	60	46	57	66	46	57	42	43
South Eastern	39	51	46	56	43	46	57	54	57
Southern	27	56	38	59	40	28	38	32	38
Western	52	51	37	37	49	39	34	40	38
Northern Ireland	325	348	328	366	336	262	295	283	297