

S. aureus bacteraemia surveillance

Quarterly report

October 2014 - December 2014 (Q4 2014)

Key points

- Overall *S. aureus* (SA) rates for Northern Ireland (MRSA plus MSSA bacteraemias) decreased by approximately 11% during quarter four 2014 compared to quarter three 2014.
- MRSA rates decreased by approximately 32% compared to quarter three 2014.
- MRSA reports during 2013/14 fell 11% compared to 2012/13.
- MSSA rates decreased by approximately 5% compared to quarter three 2014.
- MSSA reports during 2013/14 rose 5% compared to 2012/13.
- 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 0.229/1,000 occupied bed days in quarter three 2014 to 0.204/1,000 occupied bed days this quarter (Figure 1 and Table 3).
- In all, 79 SA reports were notified between October - December 2014, a decrease of 8 (9%) on the previous quarter (87 reports).

MRSA

- The number of MRSA bacteraemias decreased by 30%, from 20 reports in quarter three 2014 to 14 reports this quarter (Table 1).
- The MRSA rate decreased by 32%, from 0.053/1,000 occupied bed days in quarter three 2014 to 0.036/1,000 occupied bed days this quarter (Figure 1 and Table 3).
- The overall percentage of SA patient episodes reported as MRSA decreased by approximately 5.5 percentage points, from 23.1% in quarter two 2014 to 17.6% this quarter (Table 3).
- Four of the five Health and Social Care Trusts (HSCTs) saw a decrease in MRSA rates during this quarter (Figure 3). However, when the MRSA rates for this quarter are compared to quarter four in previous years, using 95% confidence intervals, there is no statistically significant change (Figure 4).

MSSA

- The number of MSSA bacteraemia decreased by 3%, from 67 reports in quarter two 2014 to 65 reports this quarter (Table 2).
- The MSSA rate decreased by 5%, from 0.177/1,000 occupied bed days in quarter three 2014 to 0.168/1,000 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 of the HSCTs reported higher MSSA rates than MRSA (Figure 2).
- MSSA rates decreased in three of the five HSCTs this quarter (Figure 5). When compared to quarter four 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.

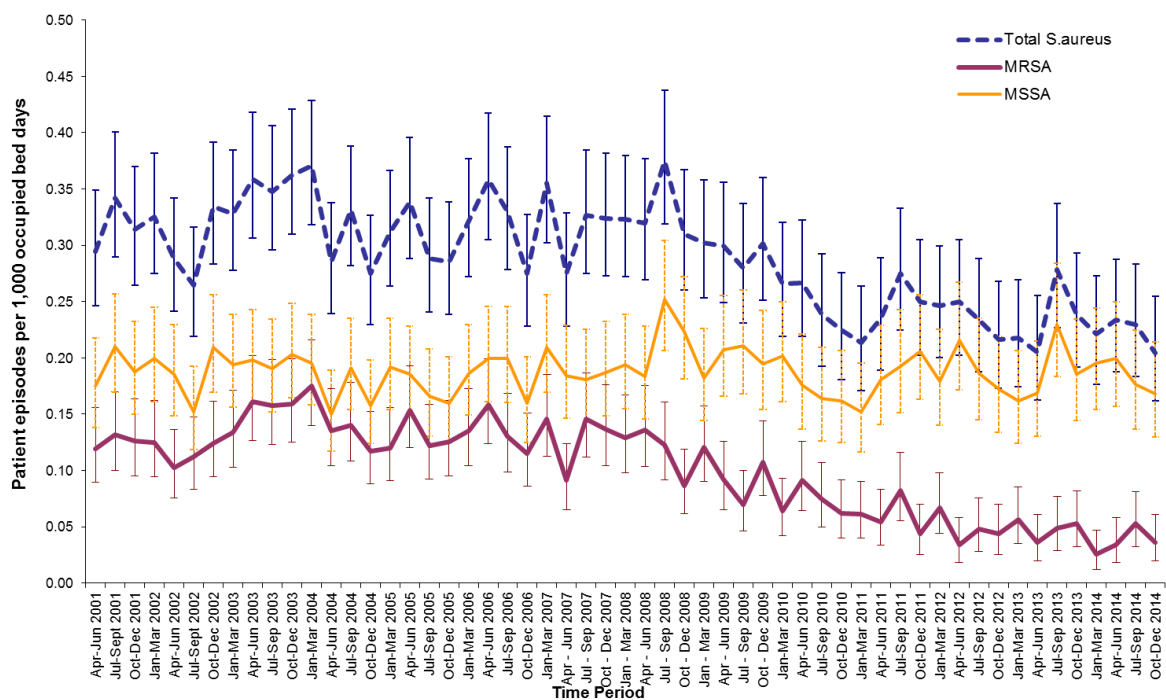


Figure 1: MSSA, MRSA and *S. aureus* patient episode rates in Northern Ireland by quarter, with 95% confidence intervals, April 2001 – December 2014 (see Appendix 3)

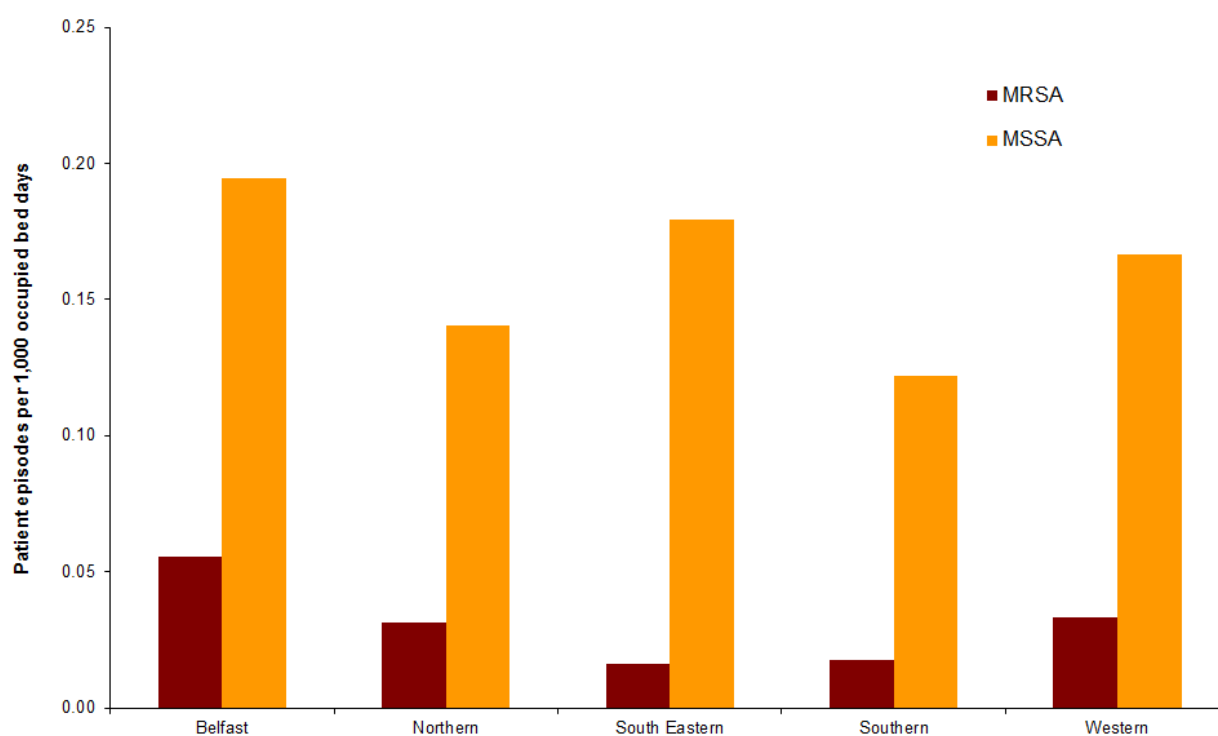


Figure 2: MRSA and MSSA patient episodes per 1,000 occupied bed days, by HSC, October - December 2014

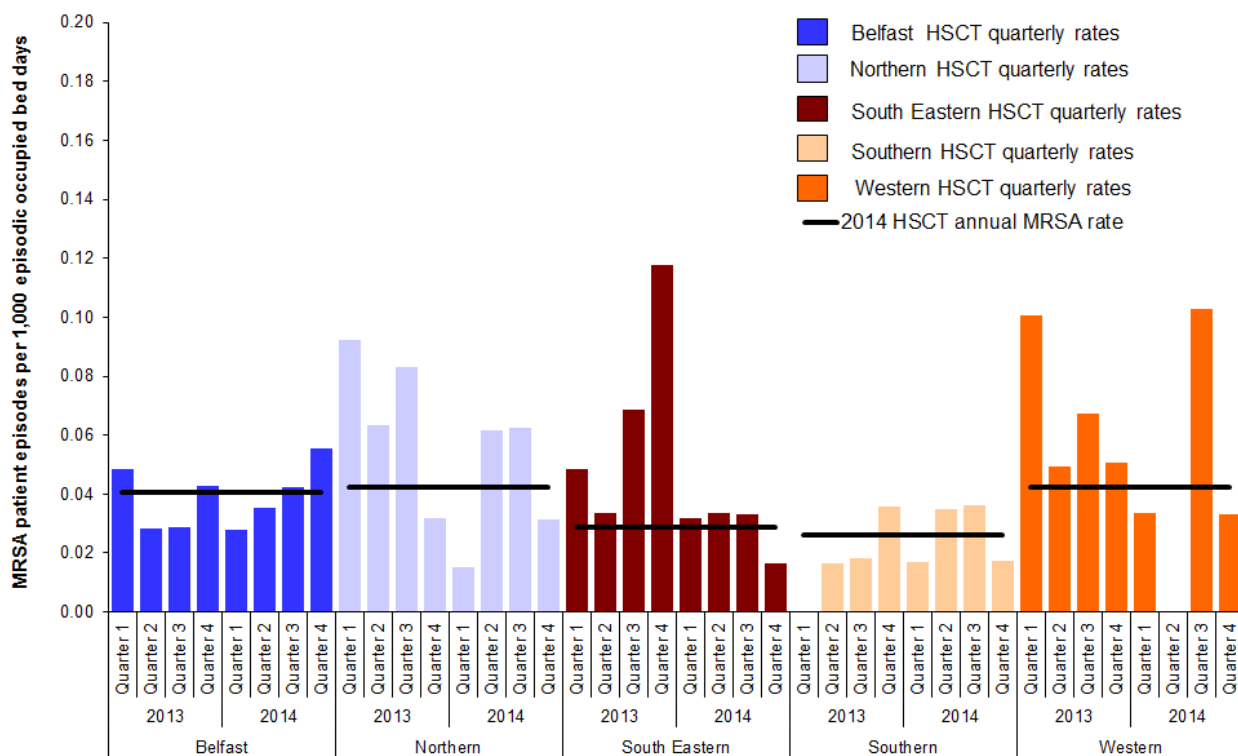


Figure 3: Quarterly rates of MRSA by HSCT, 1 January 2013 – 31 December 2014, with 2014 HSCT annual MRSA rates

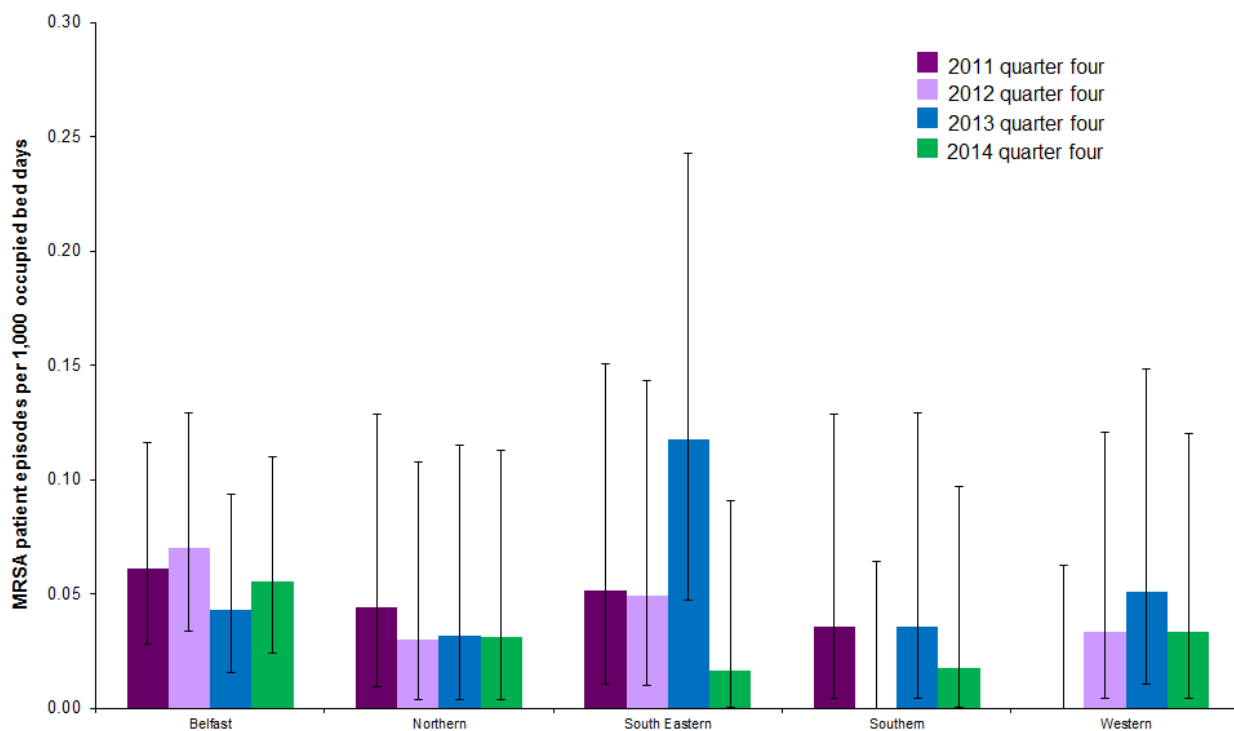


Figure 4: MRSA patient episodes in quarter four, by HSCT, from 2011–2014, with 95% confidence intervals

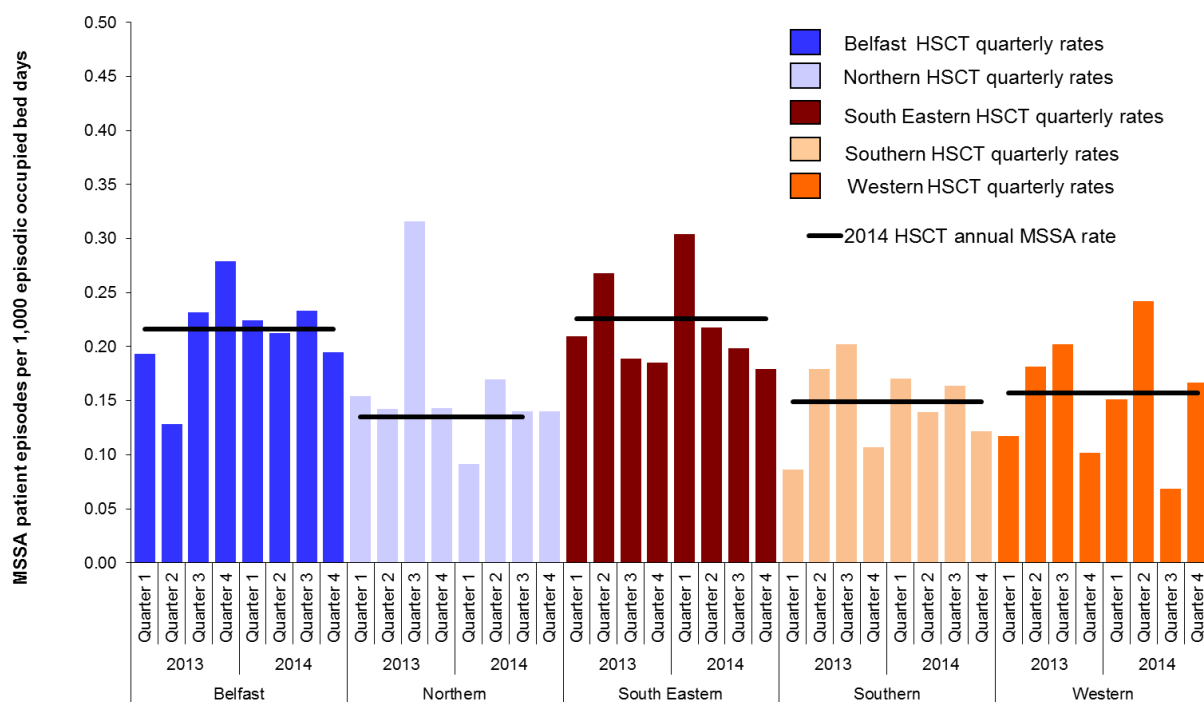


Figure 5: Quarterly rates of MSSA by HSCT, 1 January 2013 – 31 December 2014, with 2014 HSCT annual MSSA rates

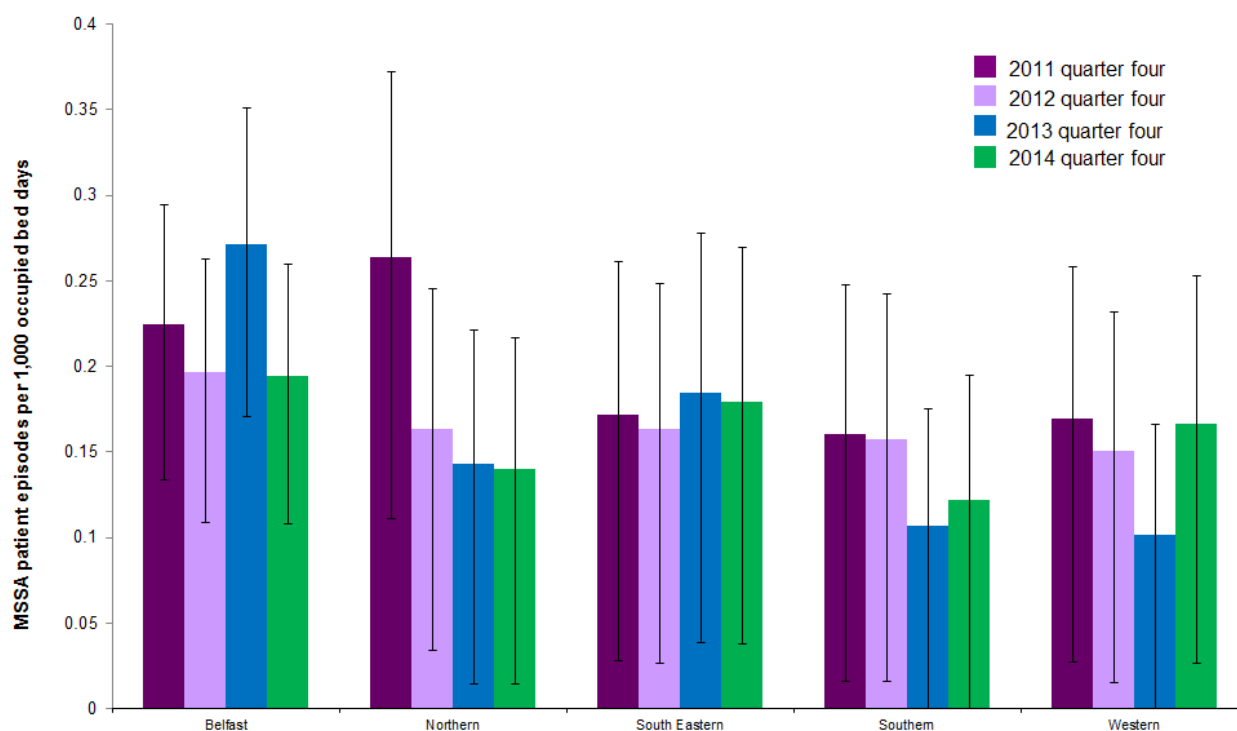


Figure 6: MSSA patient episodes in quarter four, by HSCT, from 2011–2014, with 95% confidence intervals

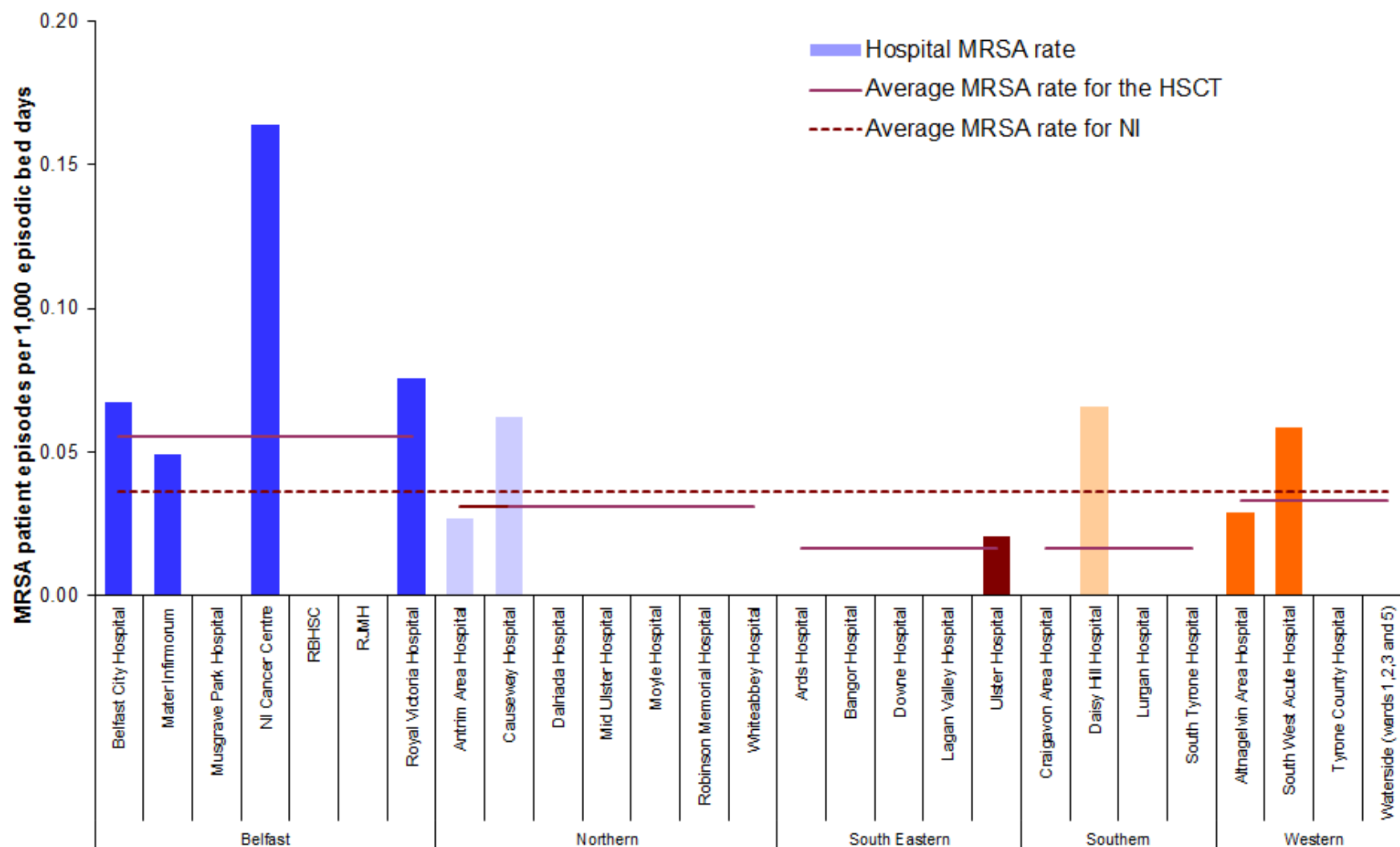


Figure 7: Rates of MRSA, by individual hospitals, for quarter four 2014 (gaps represent zero episodes), compared to quarter four 2014 average rates for Northern Ireland and HSCTs

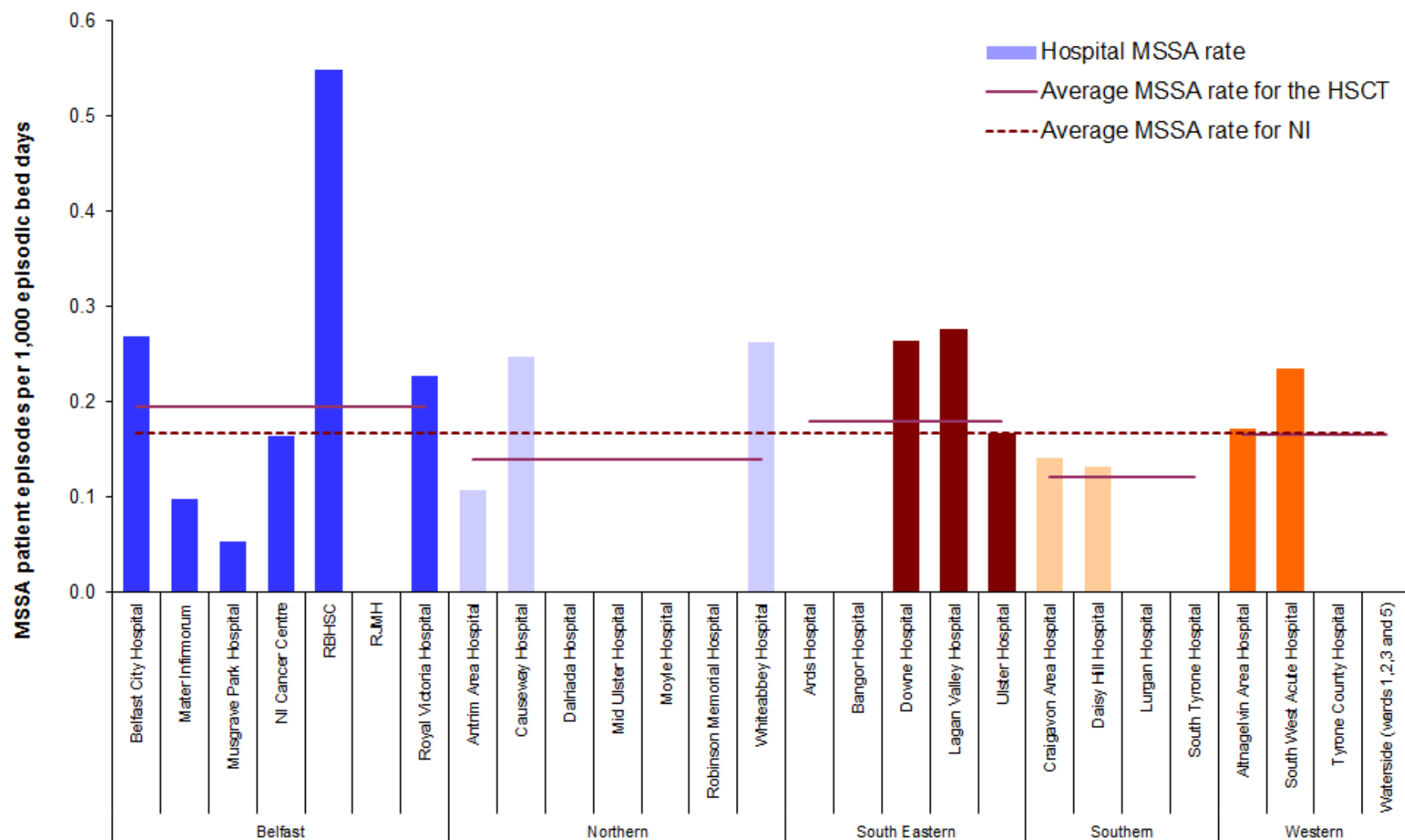


Figure 8: Rates of MSSA, by individual hospitals, for quarter four 2014 (gaps represent zero episodes), compared to quarter four 2014 average rates for Northern Ireland and HSCTs

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

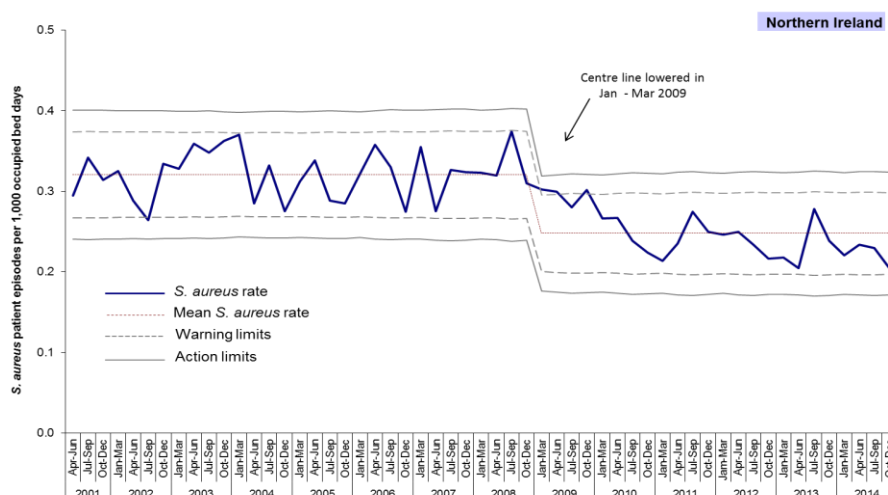


Figure 9b: Statistical process control chart for quarterly MRSA rates in Northern Ireland

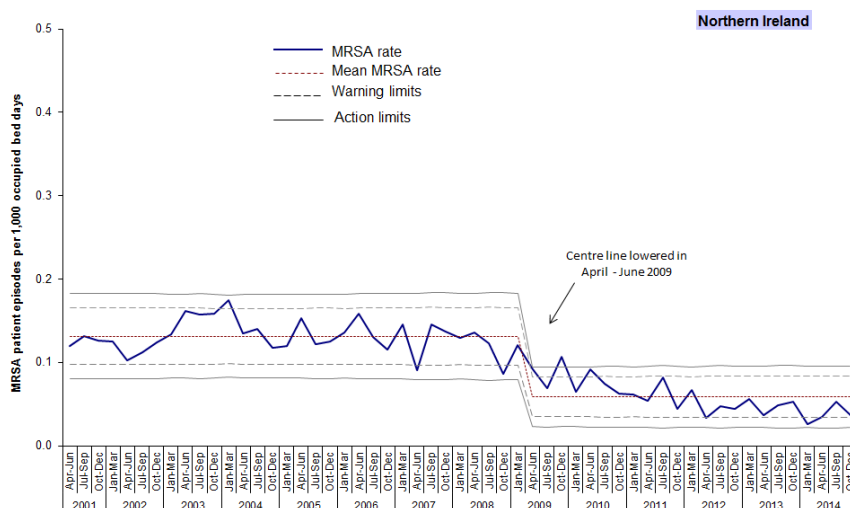
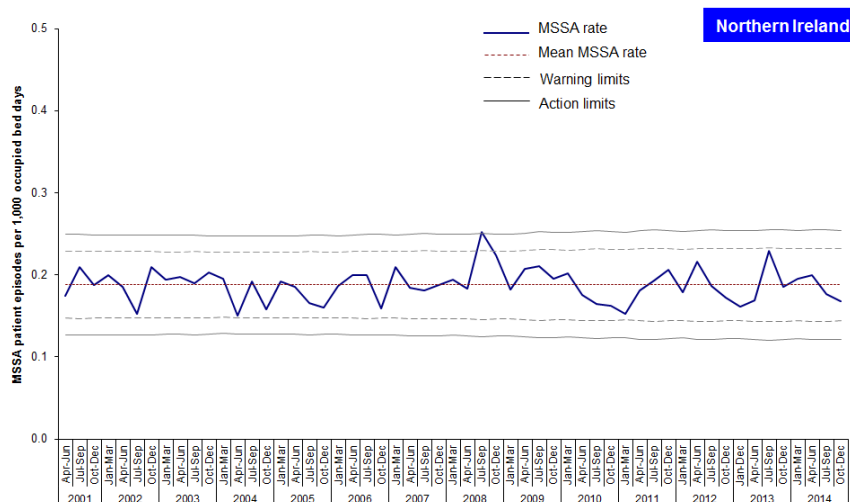


Figure 9c: Statistical process control chart for quarterly MSSA rates in Northern Ireland



Appendix 1

Table 1: Quarterly number and rate of MRSA patient episodes, by hospital, Jan 2014 - Dec 2014

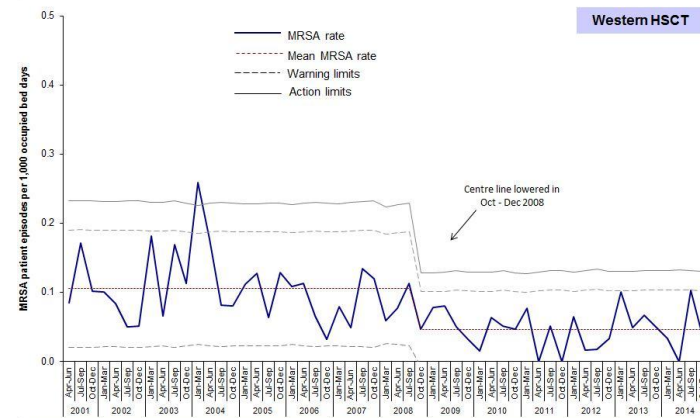
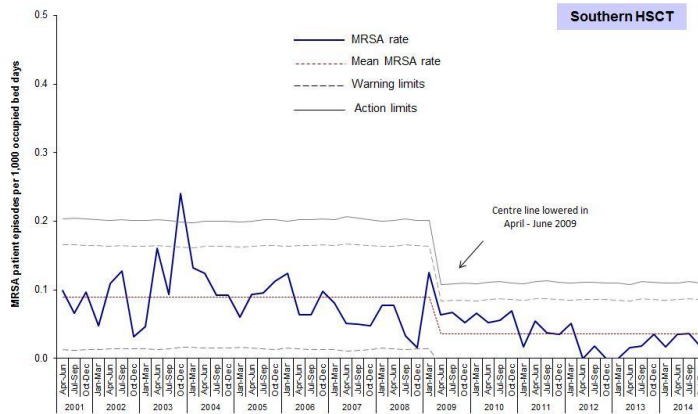
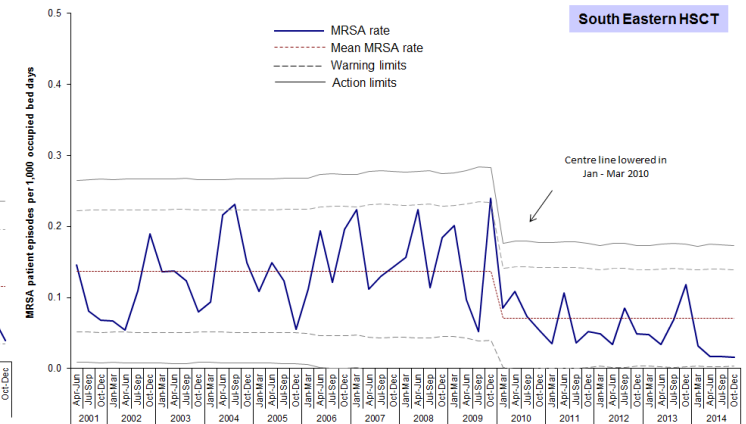
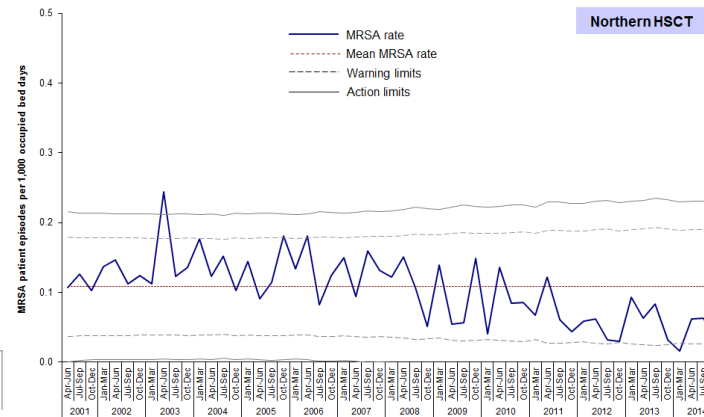
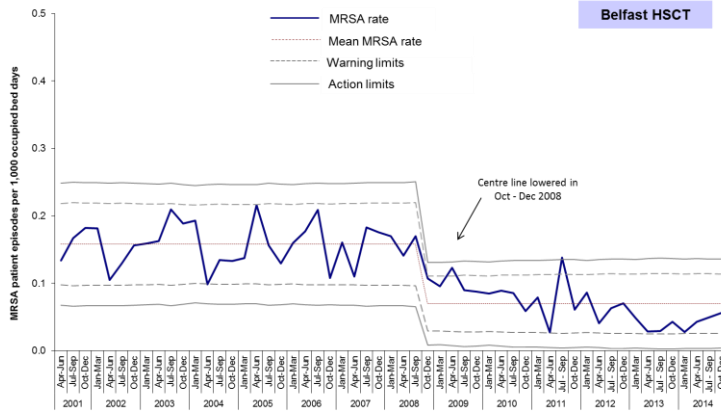
Hospital	Jan-Mar 2014		Apr - Jun 2014		July - Sept 2014		Oct - Dec 2014	
	Episodes	Rate	Episodes	Rate	Episodes	Rate	Episodes	Rate
Belfast City Hospital	*	0.034	0	0.000	*	0.035	*	0.067
Mater Infirmorum	0	0.000	*	0.052	*	0.050	*	0.049
Musgrave Park Hospital	0	0.000	0	0.000	0	0.000	0	0.000
NICCO (formerly at Belvoir Park)	0	0.000	0	0.000	0	0.000	*	0.164
RBHSC	0	0.000	*	0.140	0	0.000	0	0.000
RJMH	0	0.000	0	0.000	0	0.000	0	0.000
Royal Victoria Hospital	*	0.057	*	0.057	*	0.075	*	0.076
Belfast HSCT	*	0.028	5	0.035	6	0.042	8	0.056
Antrim Area Hospital	*	0.026	*	0.053	*	0.028	*	0.027
Causeway Hospital	0	0.000	*	0.123	*	0.180	*	0.062
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	*	0.015	*	0.062	*	0.062	*	0.031
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	*	0.132	*	0.139	*	0.142	0	0.000
Ulster Hospital	*	0.021	*	0.022	*	0.022	*	0.021
South Eastern HSCT	*	0.032	*	0.034	*	0.033	*	0.016
Craigavon Area Hospital	*	0.028	*	0.058	*	0.030	0	0.000
Daisy Hill Hospital	0	0.000	0	0.000	*	0.068	*	0.066
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	*	0.017	*	0.035	*	0.036	*	0.017
Altnagelvin Area Hospital	*	0.030	0	0.000	0	0.000	*	0.029
South West Acute Hospital	*	0.057	0	0.000	*	0.316	*	0.059
Tyrone County Hospital	0	0.000	0	0.000	*	0.353	0	0.000
Waterside Hospital (Wards 1-3, 5)	0	0.000	0	0.000	0	0.000	0	0.000
Western HSCT	*	0.034	0	0.000	*	0.103	*	0.033
Northern Ireland total	10	0.026	13	0.030	20	0.053	14	0.036

Appendix 1

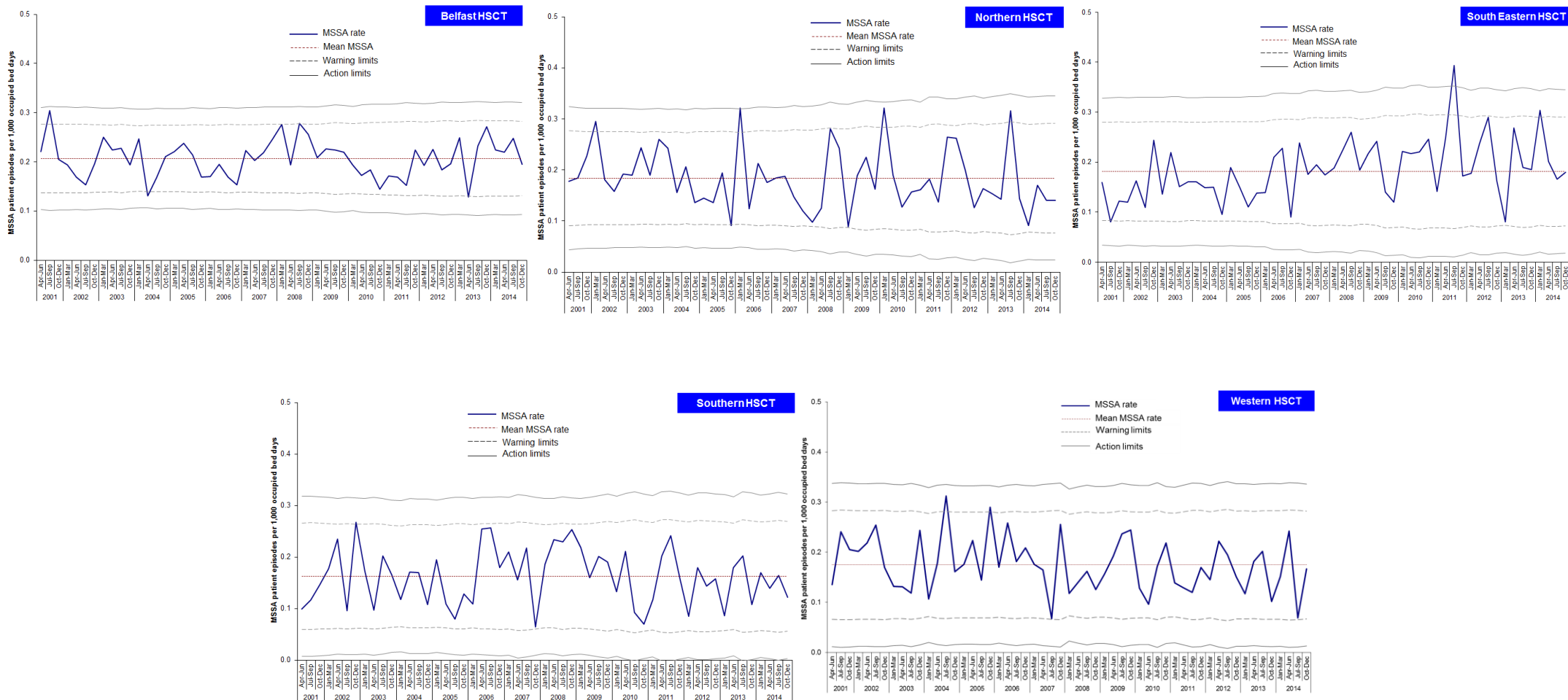
Table 2: Quarterly number and rate of MSSA patient episodes, by hospital, Jan 2014 – Dec 2014

Hospital	Jan - Mar 2014		Apr - Jun 2014		July - Sept 2014		Oct - Dec 2014	
	Episodes	Rate	Episodes	Rate	Episodes	Rate	Episodes	Rate
Belfast City Hospital	5	0.170	*	0.034	6	0.212	8	0.270
Mater Infirmorum	6	0.304	8	0.418	*	0.151	*	0.100
Musgrave Park Hospital	*	0.053	*	0.055	*	0.058	*	0.050
NICCO (formerly at Belvoir Park)	0	0.000	*	0.170	*	0.169	*	0.160
RBHSC	0	0.000	*	0.559	*	0.126	*	0.550
RJMH	*	0.118	0	0.000	0	0.000	0	0.000
Royal Victoria Hospital	19	0.358	15	0.283	21	0.395	12	0.230
Belfast HSCT	32	0.224	30	0.213	33	0.234	28	0.195
Antrim Area Hospital	*	0.105	*	0.238	*	0.111	*	0.110
Causeway Hospital	*	0.122	*	0.123	*	0.240	*	0.250
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	*	0.272	*	0.260
Northern HSCT	6	0.091	11	0.170	9	0.140	9	0.140
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	*	0.244	0	0.000	*	0.257	*	0.260
Lagan Valley Hospital	*	0.132	*	0.139	*	0.142	*	0.280
Ulster Hospital	17	0.358	*	0.265	10	0.217	8	0.170
South Eastern HSCT	19	0.304	13	0.218	12	0.199	11	0.180
Craigavon Area Hospital	*	0.198	*	0.116	5	0.151	*	0.140
Daisy Hill Hospital	*	0.195	*	0.264	*	0.204	*	0.130
Lurgan Hospital	0	0.000	0	0.000	0	0.000	0	0.000
South Tyrone Hospital	0	0.000	0	0.000	*	0.367	0	0.000
Southern HSCT	10	0.170	8	0.140	9	0.164	7	0.122
Altnagelvin Area Hospital	6	0.180	9	0.272	*	0.117	*	0.170
South West Acute Hospital	*	0.114	*	0.237	0	0.000	*	0.230
Tyrone County Hospital	*	0.326	*	0.358	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	9	0.151	14	0.242	4	0.069	10	0.167
Northern Ireland total	76	0.195	76	0.200	67	0.177	65	0.168

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, Jan 2006 – Dec 2014

Quarter	MSSA rate	MRSA rate	All <i>S. aureus</i> rate	% MRSA
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
Apr-Jun 2014	0.200	0.034	0.234	14.5
Jul-Sep 2014	0.177	0.053	0.229	23.1
Oct-Dec 2014	0.168	0.036	0.204	17.6

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:

$$\text{Warning Limit} = M \pm 2 \sqrt{\frac{E_i}{(N_i)^2}} \quad \text{Action Limit} = M \pm 3 \sqrt{\frac{E_i}{(N_i)^2}}$$

Where M is the mean, N_i is the number of occupied bed days per quarter and E_i is the expected number of reports calculated as $E_i = M \times N_i$

SPC charts allow the distinction to be made between natural variation and 'special cause variation', where something unusual is occurring in a HSCT. If any of the following criteria are met, there is said to be 'special cause variation', which should be investigated, as this could not statistically have occurred by chance alone:

- One value above the upper action limit, or below the lower action limit.
- Three consecutive values between the upper warning limit and upper action limit (or between lower limits).
- Eight consecutive values on the same side of the mean (either above or below).
- Any 12 of 14 consecutive values on the same side of the mean (either above or below).
- Eight consecutive values either increasing or decreasing.

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, and are unvalidated at the time of reporting.

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

HSCT	Financial Year								
	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

HSCT	Financial Year								
	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