SCOTTISH SURVEILLANCE OF HEALTHCARE ASSOCIATED INFECTION PROGRAMME

QUARTERLY REPORT ON METICILLIN RESISTANT *STAPHYLOCOCCUS AUREUS* BACTERAEMIAS IN SCOTLAND. JANUARY 2003 - SEPTEMBER 2006

Section 1: Introduction, Background and Notes on Interpretation

INTRODUCTION

This report provides data from January 2003 to September 2006 on the rates of MRSA bacteraemias (blood infections) for 14 NHS boards:

- 11 mainland NHS boards and 3 Island boards

Previous reports have reported by acute division and for the purposes of continuity and comparability these will be presented in this report in addition to reporting by the newly configured NHS boards.

METHODS

Numbers of identifications of MRSA bacteraemias are obtained from

- the HPS laboratory reporting system and
- referrals of isolates for confirmation and detailed typing to the Scottish MRSA Reference Laboratory, part of HPS's contribution to the European Commission's European Antimicrobial Resistance Surveillance System (EARSS).

The details of these systems are available on the HPS website and the EARSS website respectively (http://www.hps.scot.nhs.uk and http://www.earss.rivm.nl). One episode of MRSA bacteraemia is counted if it appears in either system alone, or in both.

ANALYSIS

Rates are calculated by dividing the number of episodes of MRSA bacteraemia in the period by the number of "acute occupied bed days" (AOBDs) for that period. One patient in one bed for one night is one AOBD. Rates are presented per 1000 AOBDs. This rate gives an indication of the number of episodes relative to the size of the population at risk. The data on AOBDs are obtained from the Information Services Division of the NHS in Scotland. They are based on the daily counts of occupied beds that are undertaken in every hospital at midnight. These counts obviously exclude day patients who, by definition, do not occupy a bed at midnight.

Note that the figures published within this report remain provisional until one quarter after the date of publication.

NOTES ON INTERPRETATION

The quarterly rates are presented in the form of statistical process control charts using each division's average rate over the period of the surveillance (January 2003 to September 2006) as the centre line. This provides a method for monitoring whether a site is performing consistently over time, rather than providing comparison between sites. The control limits are set at three standard deviations from the centre line (mean).

To aid interpretation lines have also been placed on the control charts at one and two standard deviations from the centre line. The lines at two standard deviation from the centre are commonly called the upper and lower warning limits and are labelled uwl and lwl on the charts. The lines at one standard deviation from the centre line are termed the upper and lower highlight limits and are labelled uhl and lhl.

Health Protection Scotland uses the following eight criteria to assess whether a statistically significant change or unnatural variation in the MRSA bacteraemia rate has occurred :

1. One value either above the upper control limit or below the lower control limit.
2. Eight consecutive values on the same side of the central line (or mean).
3. Any 12 of 14 consecutive values on the same side of the central line (or mean).
4. Three consecutive values in either the top third (above uwl) or bottom third (below lwl) of the expected range.
5. Five consecutive values in the top two-thirds (above uhl) or bottom two-thirds (below lhl) of the expected range.
6. Thirteen consecutive values in the middle thirds of the expected range.
7. Eight consecutive values either increasing or decreasing.
8. Cyclic or periodic behaviour.

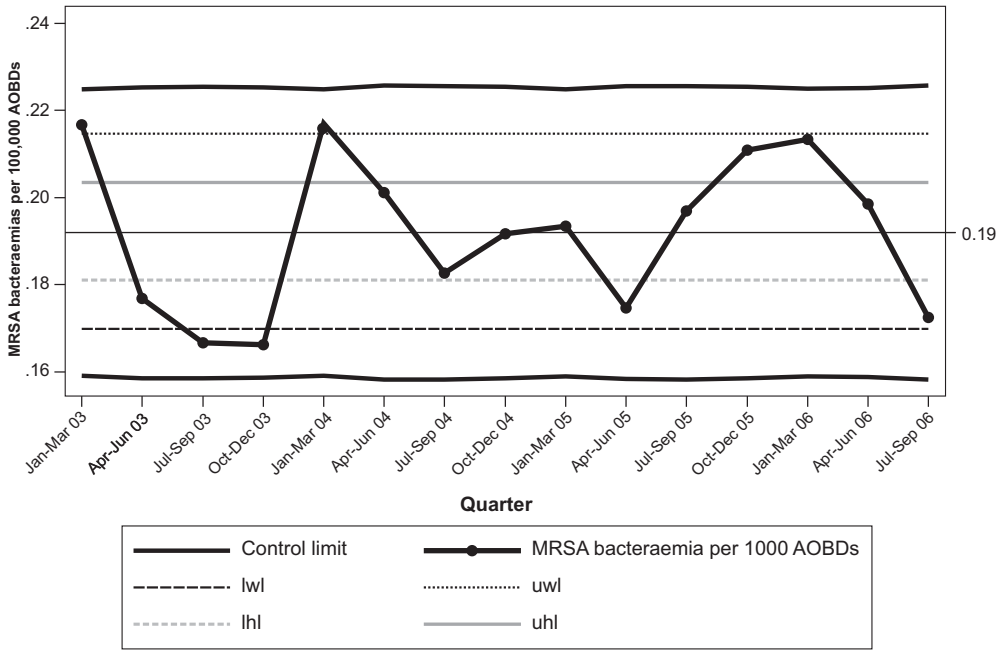
Section 2 : NHS Scotland - Aggregated Data and Trends by Specialty and Hospital Size

RESULTS

Table 1: Quarterly no of MRSA, MSSA and *S. aureus* bacteraemias in Scotland. January 2003 to September 2006

Quarter	No of MRSA bacteraemias	No of MSSA bacteraemias	No of *S. aureus* bacteraemias	Acute Occupied Bed Days (AOBDs)	MRSA bacteraemias per 1000 AOBDs bacteraemias	MSSA bacteraemias per 1000 AOBDs	*S. aureus* bacteraemias per 1000 AOBDs
Jan 03-Mar 03	255	224	479	1337740	0.191	0.167	0.358
Apr 03-Jun 03	227	238	465	1299832	0.175	0.183	0.358
Jul 03-Sep 03	176	239	415	1296013	0.136	0.184	0.320
Oct 03-Dec 03	217	252	469	1301905	0.167	0.194	0.360
Jan 04-Mar 04	267	247	514	1319438	0.202	0.187	0.390
Apr 04-Jun 04	259	259	518	1275344	0.203	0.203	0.406
Jul 04-Sep 04	201	212	413	1221645	0.165	0.174	0.338
Oct 04-Dec 04	247	280	527	1235569	0.200	0.227	0.427
Jan 05-Mar 05	253	247	500	1382016	0.183	0.179	0.362
Apr 05-Jun 05	216	212	428	1236182	0.175	0.171	0.346
Jul 05-Sep 05	243	300	543	1234261	0.197	0.243	0.440
Oct 05-Dec 05	263	260	523	1247260	0.211	0.208	0.419
Jan 06-Mar 06	274	269	543	1283584	0.213	0.210	0.423
Apr 06-Jun 06	252	268	520	1268985	0.199	0.211	0.410
Jul 06-Sep 06	212	377	589	1228899	0.173	0.307	0.479

Figure 1: SPC chart of quarterly MRSA bacteraemias per 1000 AOBDs in Scotland. January 2003 to September 2006



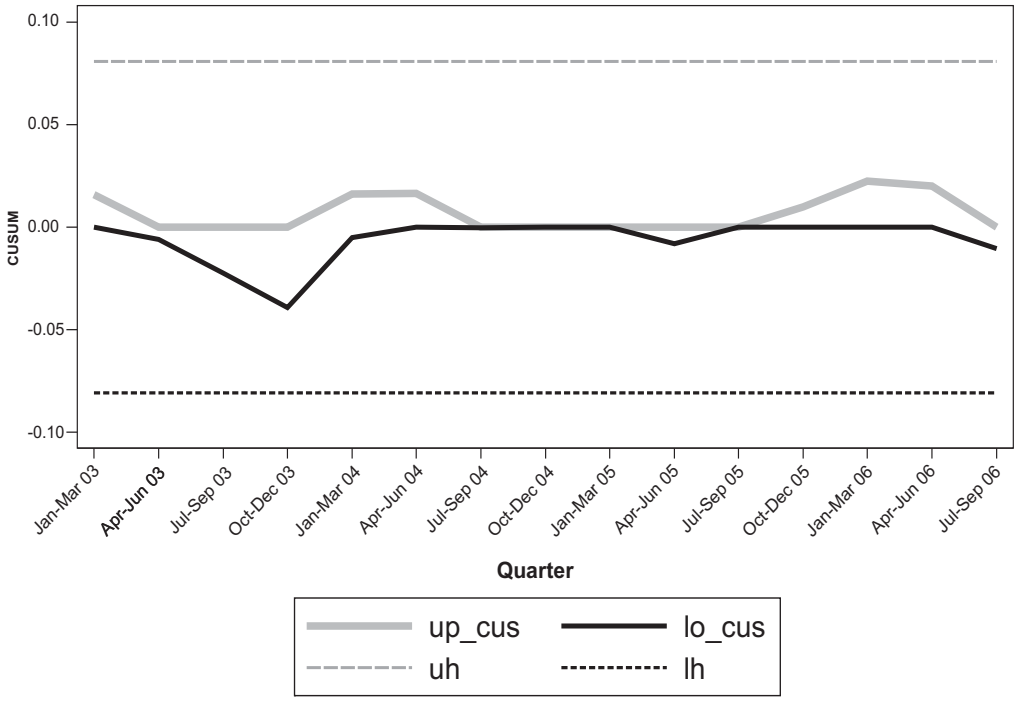
0 quarters are out of control

During the period of surveillance, January 2003 to September 2006, no statistically significant increase or decrease in the rate of MRSA bacteraemia in Scotland was detected.

Statistical process control charts are useful tools for identifying large shifts in the rate of MRSA bacteraemias within divisions in any one quarter, however they may be insensitive to smaller changes over longer periods of time and may take a number of quarters to identify this. A more sensitive alternative to the statistical process control chart is the cumulative sum (CUSUM) chart, which is better at detecting small changes over several periods.

Figure 2 shows the upper cusum (monitoring for an increase in the rate and labelled “up_cus”) and lower cusum (monitoring for a decrease in rate and labelled “lo_cus”) statistics plotted against quarter. The horizontal lines are called “decision lines” and indicate when a change has been detected. It can be seen that the lines do not cross the decision lines and vary randomly around the x axis, suggesting that there is no systematic change in the Scottish rate.

Figure 2: CUSUM chart of quarterly MRSA bacteraemias per 1000 AOBDs in Scotland. January 2003 to September 2006



Note for figures 3, 4, 5, and 6:

These data are subject to variation in compliance with reporting in the specialty field in the EARSS dataset, therefore these data should be interpreted with due caution. It is anticipated this reporting will improve as a result of HDL (38)2006, in which reporting to EARSS and reporting all *S. aureus* bacteraemias was made mandatory.

Figure 3 shows the quarterly number of MRSA bacteraemias by specialty identifying the infection over the period January 2003 to September 2006. Of the eight specialties identified the specialties General Medicine, General Surgery, ICU/HDU and Nephrology have the highest numbers of bacteraemias, this result may be due to the higher number of patients admitted to these specialties and the case-mix of the patient population, i.e. more comorbidities therefore increasing the risk of infection.

Figure 3: Chart of quarterly number of MRSA bacteraemias by specialty. January 2003 to September 2006

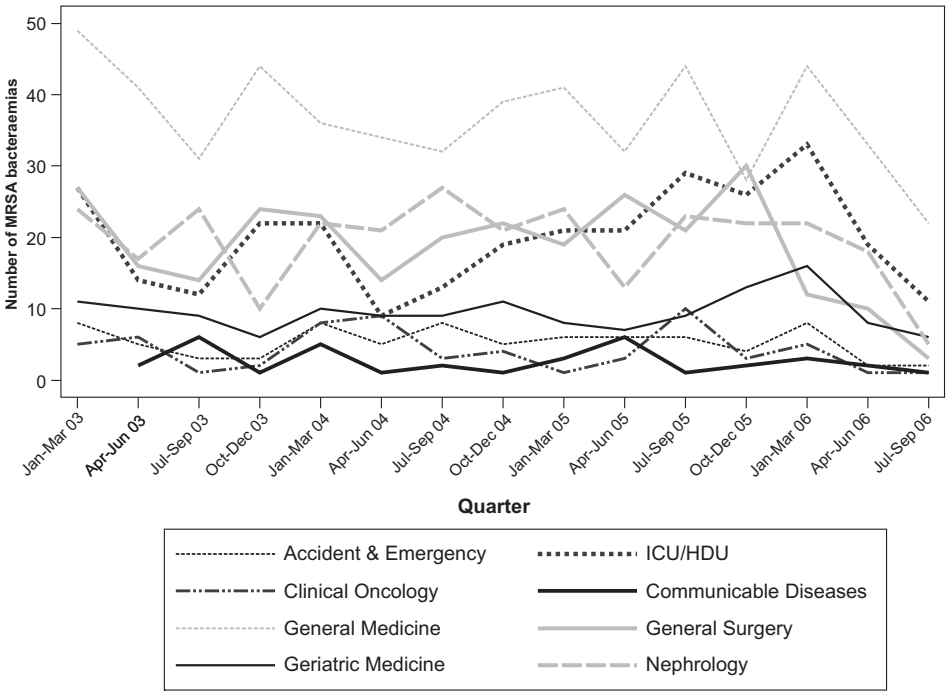
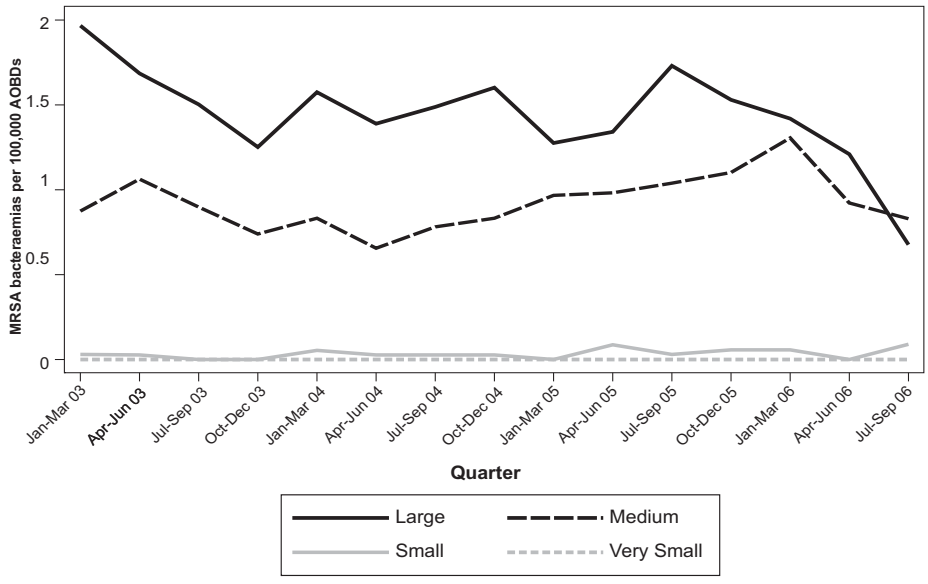


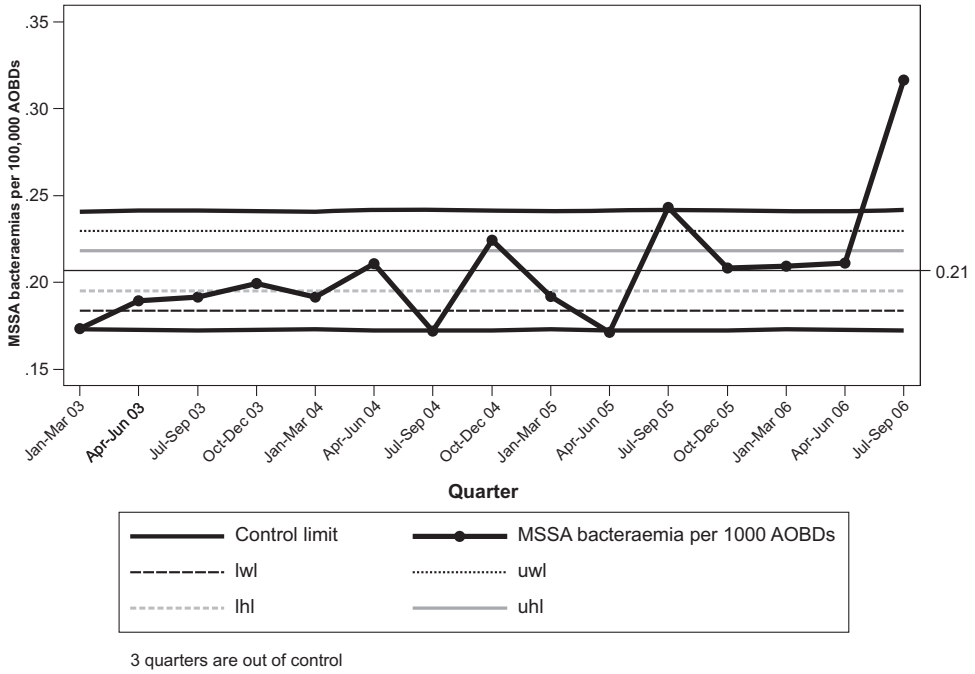
Figure 4 shows the MRSA bacteraemia rate by hospital size for the period January 2003 to September 2006, as would be expected larger institutions have higher rates of MRSA bacteraemia as these tend to have specialist services with more vulnerable patients.

Figure 4: Chart of quarterly MRSA bacteraemias per 1000 AOBDs by hospital size. January 2003 to September 2006



Although previous national reporting in NHS Scotland has focussed on the number of MRSA bacteraemias, those caused by meticillin sensitive *S. aureus* (MSSA) are arguably just as serious to the patient and can cause comparable levels of morbidity and mortality. Figure 5 shows the rate of MSSA bacteraemias per 1000 AOBDs within Scotland as a whole and shows a sharp increase in the most recent quarter. This may be due to the introduction of mandatory reporting of MSSAs to HPS and EARSS introduced by HDL (2006)38 in July 2006. If the MSSA bacteraemia rate remains at this level new control limits will require to be calculated once a sufficient amount of data has accrued.

Figure 5: SPC chart of quarterly MSSA bacteraemias per 1000 AOBDs in Scotland. January 2003 to September 2006

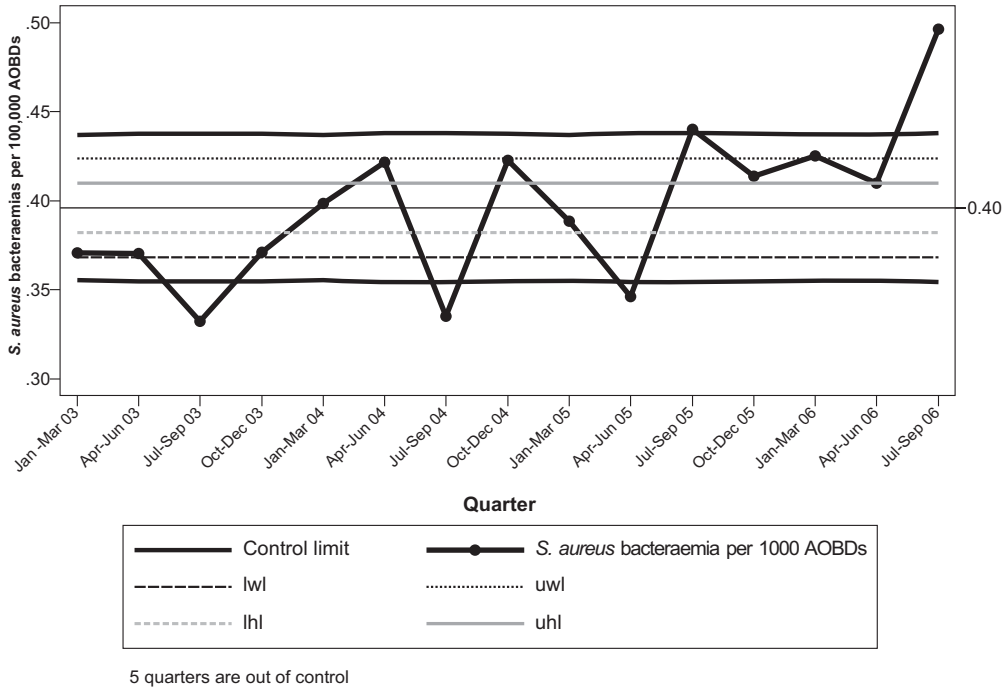


3 quarters are out of control

Figure 6 illustrated the rate of *S. aureus* bacteraemias per 1000 AOBDs in Scotland during the period January 2003 to September 2006 in the form of a control chart. These are the combination of MRSA and MSSA bacteraemias.

There is a large amount of variability within this data with rates below the lower control limit during the quarters July to September 2003, July to September 2004 and April to June 2005 and rates above the upper control limits during July to September 2005 and the most recent quarter, July to September 2006. The high rate in the most recent quarter is due to an increase in the number of MSSA reports to HPS and EARSS after the introduction of mandatory reporting of these organisms.

Figure 6: SPC chart of quarterly *S. aureus* bacteraemias per 1000 AOBDs in Scotland. January 2003 to September 2006



5 quarters are out of control

KEY SUMMARY POINTS - Section 2

The MRSA bacteraemia rate for all of Scotland has remained stable during the period January 2003 to September 2006 (Figure 1), with no values outside the control limits. The national rate shows only natural variation with no indication of special case variation and the process is considered to be in control.

Rates of MRSA bacteraemia vary by hospital size and specialty and this variation may be due to patient population issues relative to these hospitals and specialties.

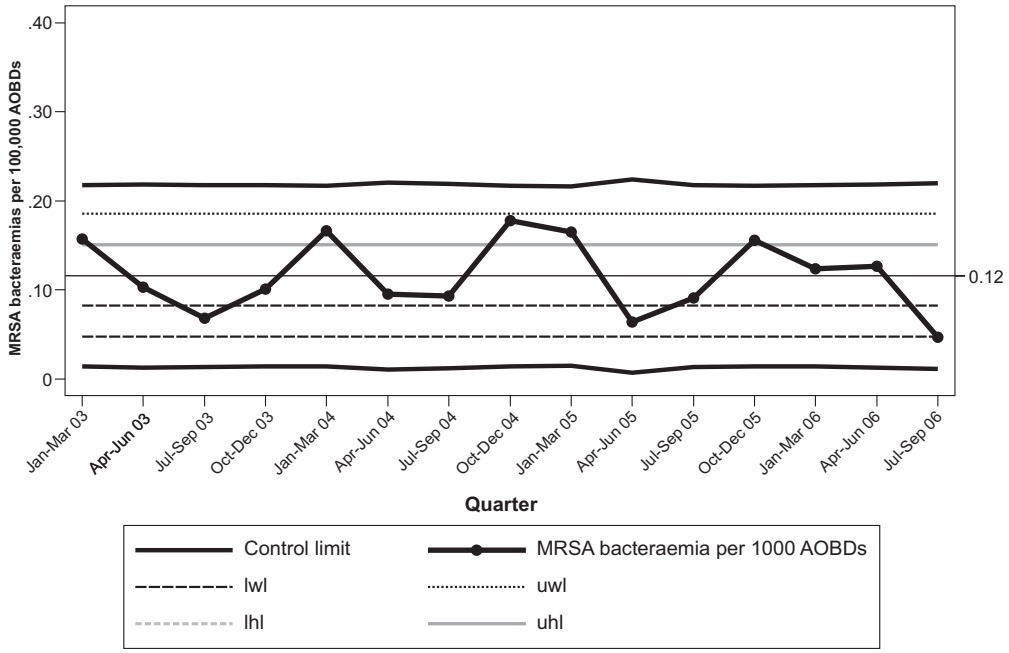
The rate of MSSA bacteraemias rose above the upper control limit in July to September 2005 and subsequently returned to a stable rate until the most recent quarter, July to September 2006. During this quarter the rate of MSSA bacteraemias rose above the upper control limit indicating a significant increase in the number of MSSA bacteraemias reported. This may be due to the introduction of mandatory reporting of these infections to both HPS and the EARSS surveillance project from July 2006.

The rate of total *S. aureus* bacteraemias (MRSA plus MSSA) shows a large amount of variation with the rate below the lower limit in July to September 2003, July to September 2004 and again in April to June 2005 and rising above the upper limit during July to September 2005 (Figure 6). This rate again rose above the upper control limit in the most recent quarter, July to September 2006. The rise is also attributable to increased reporting of MSSA bacteraemias as a result of mandatory surveillance being introduced. HPS are undertaking a validation study of these data to formally examine the reasons for this variation.

Section 3 - SPC Charts by NHS board and acute division for the period January 2003 to September 2006

The MRSA bacteraemia rate for Ayrshire and Arran NHS Board has remained stable throughout the period January 2003 to September 2006 (Figure 7) with no rates outwith the control limits and none of the eight rules being contravened. This NHS board's rate demonstrates only natural variation and the process is considered to be in control.

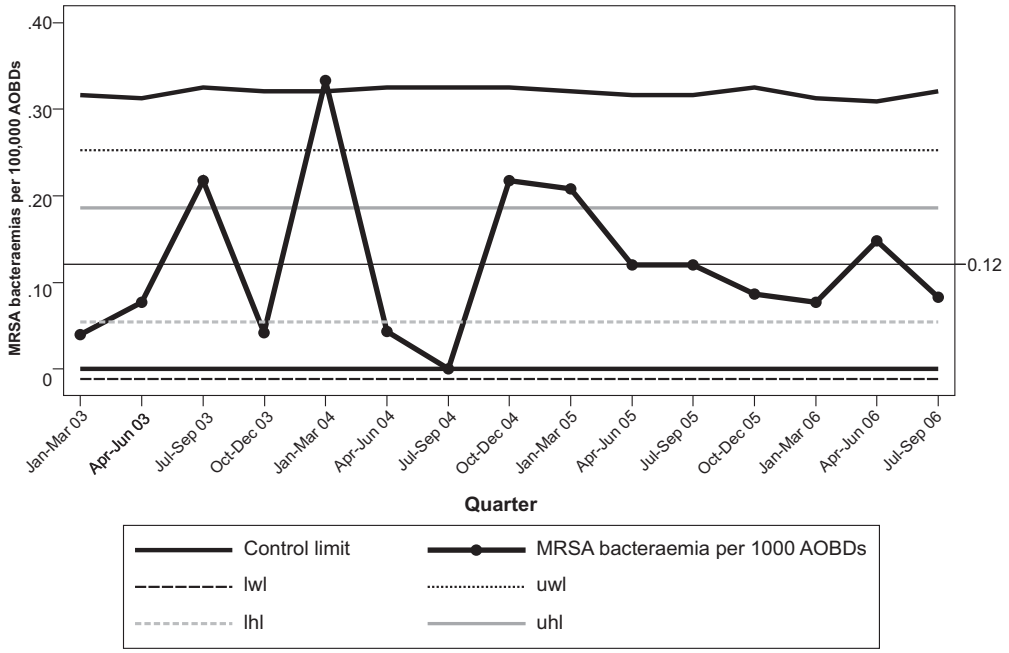
Figure 7: SPC chart of quarterly MRSA bacteraemias per 1000 AOBDs in Ayrshire and Arran NHS Board. January 2003 to September 2006



0 quarters are out of control

The MRSA bacteraemia rate for Borders NHS Board rose above its upper control limit during the quarter January to March 2004 indicating a rise in the number of MRSA bacteraemias during this period (Figure 8). Following this quarter the rate returned to within the control limits and has remained there for the last ten quarters.

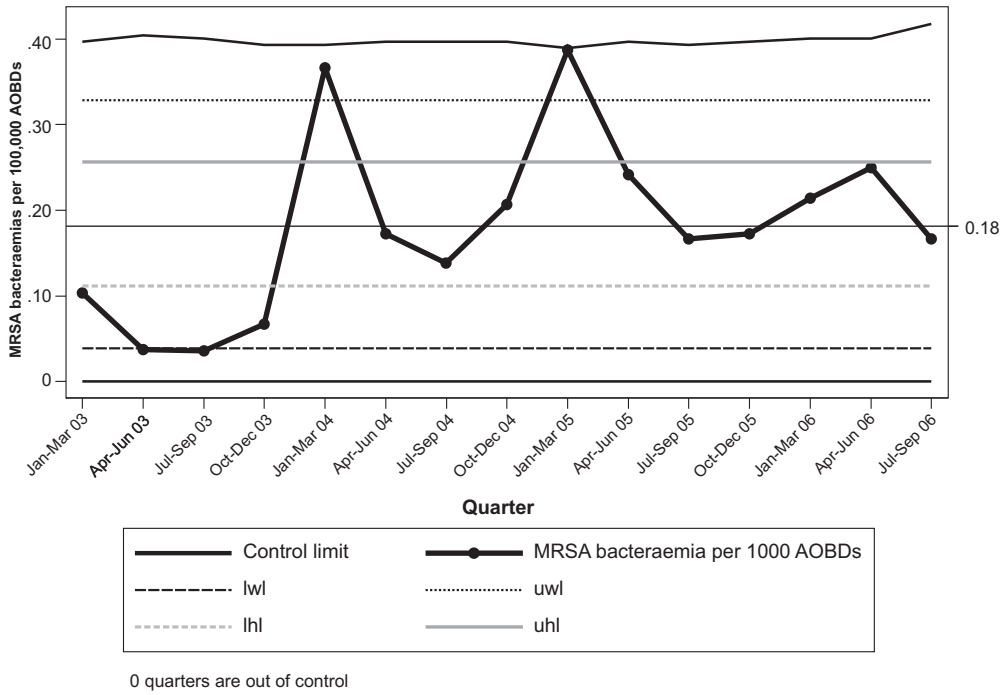
Figure 8: SPC chart of quarterly MRSA bacteraemias per 1000 AOBDs in Borders NHS Board. January 2003 to September 2006



1 quarter is out of control

The MRSA bacteraemia rate for Dumfries & Galloway NHS Board has remained stable throughout the period January 2003 to September 2006 (Figure 9) with no rates outwith the control limits and none of the eight rules being contravened. This NHS board's rate demonstrates only natural variation and the process is considered to be in control.

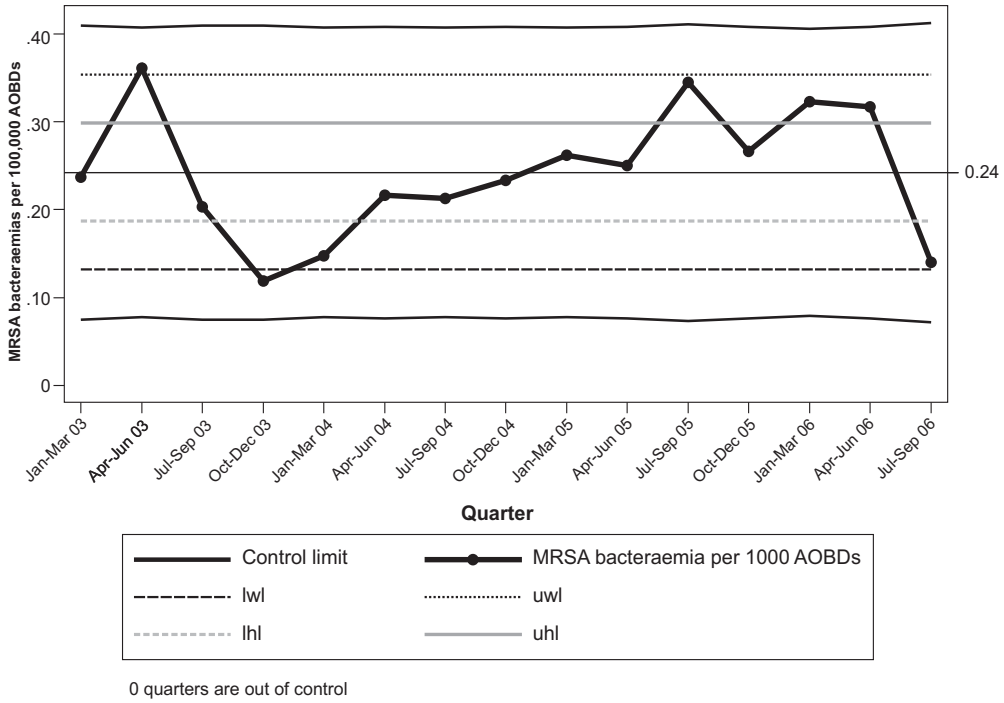
Figure 9: SPC chart of quarterly MRSA bacteraemias per 1000 AOBDs in Dumfries and Galloway NHS Board. January 2003 to September 2006



0 quarters are out of control

The MRSA bacteraemia rate for Fife NHS Board has remained stable throughout the period January 2003 to September 2006 (Figure 10) with no rates outwith the control limits and none of the eight rules being contravened. This board's rate demonstrates only natural variation and the process is considered to be in control.

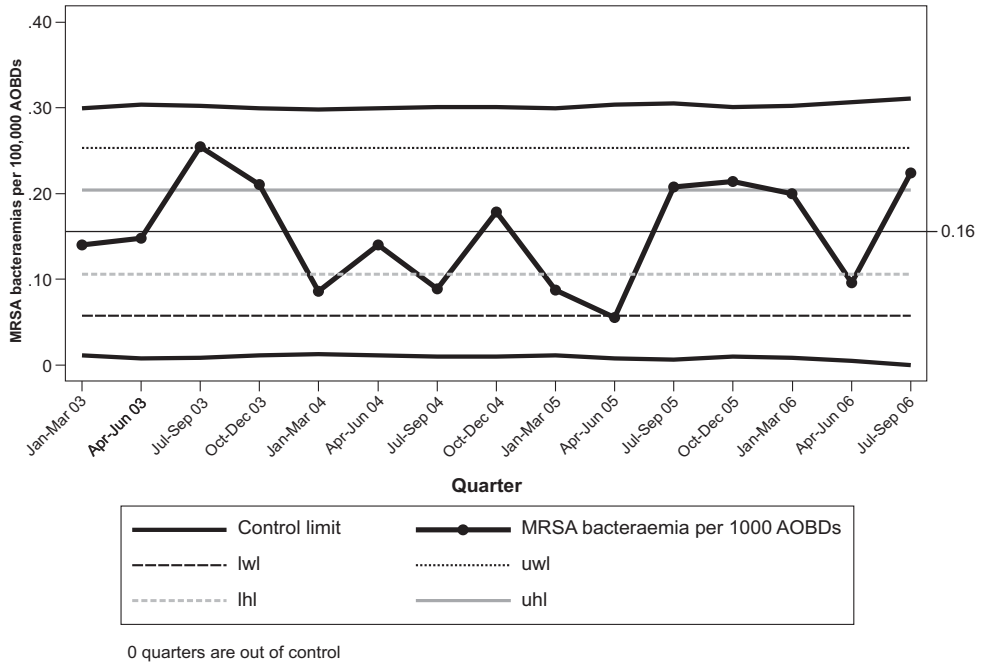
Figure 10: SPC chart of quarterly MRSA bacteraemias per 1000 AOBDs in Fife NHS Board. January 2003 to September 2006



0 quarters are out of control

The MRSA bacteraemia rate for Forth Valley NHS Board has remained stable throughout the period January 2003 to September 2006 (Figure 11) with no rates outwith the control limits and none of the eight rules being contravened. This board's rate demonstrates only natural variation and the process is considered to be in control.

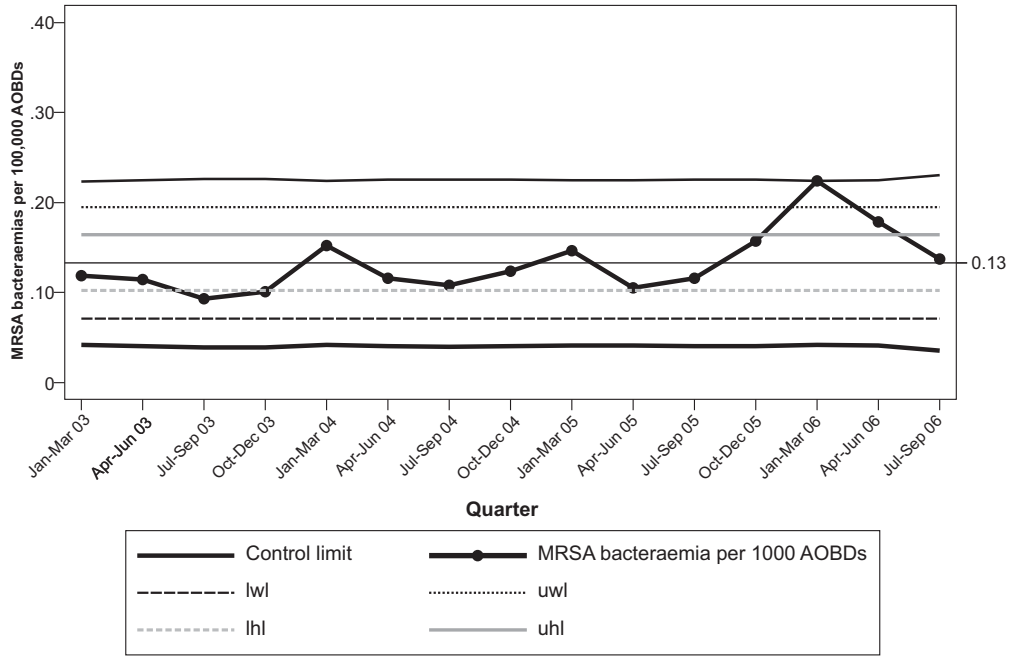
Figure 11: SPC chart of quarterly MRSA bacteraemias per 1000 AOBDs in Forth Valley NHS Board. January 2003 to September 2006



0 quarters are out of control

The MRSA bacteraemia rate for Grampian NHS Board rose above its upper control limit during the quarter January to March 2006 indicating a rise in the number of MRSA bacteraemias during this period (figure 12). Following this quarter the rate returned to within the control limits and has remained there for the last two quarters.

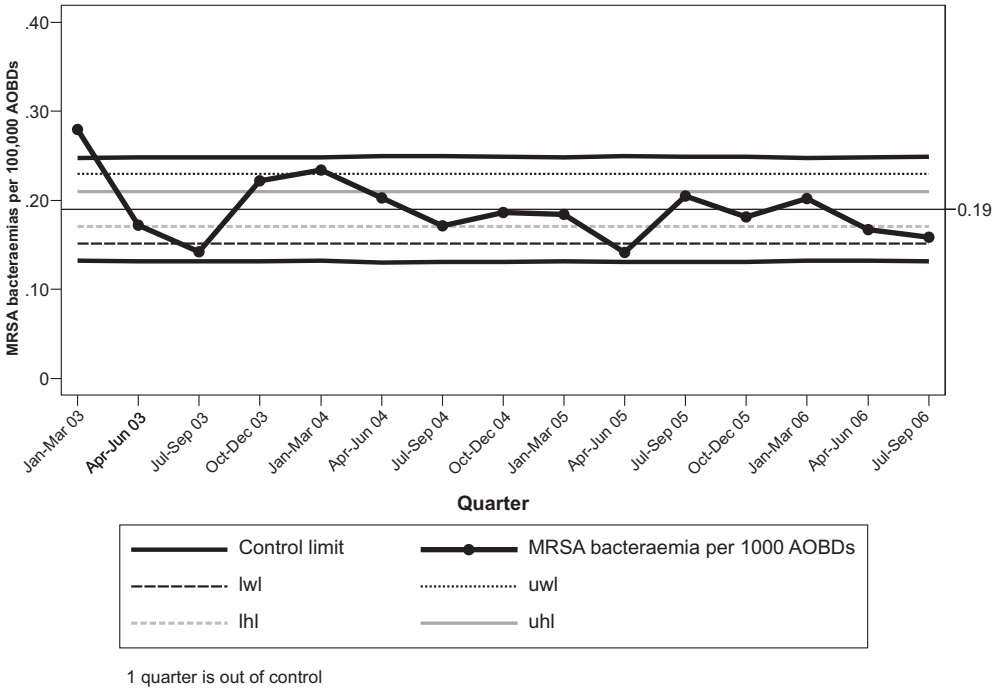
Figure 12: SPC chart of quarterly MRSA bacteraemias per 1000 AOBDs in Grampian NHS Board. January 2003 to September 2006



1 quarter is out of control

The MRSA bacteraemia rate for Greater Glasgow and Clyde NHS Board was above the upper control limit during the quarter January to March 2003, after this the rate returned to within the control limit and has remained there for the last fourteen quarters (Figure 13).

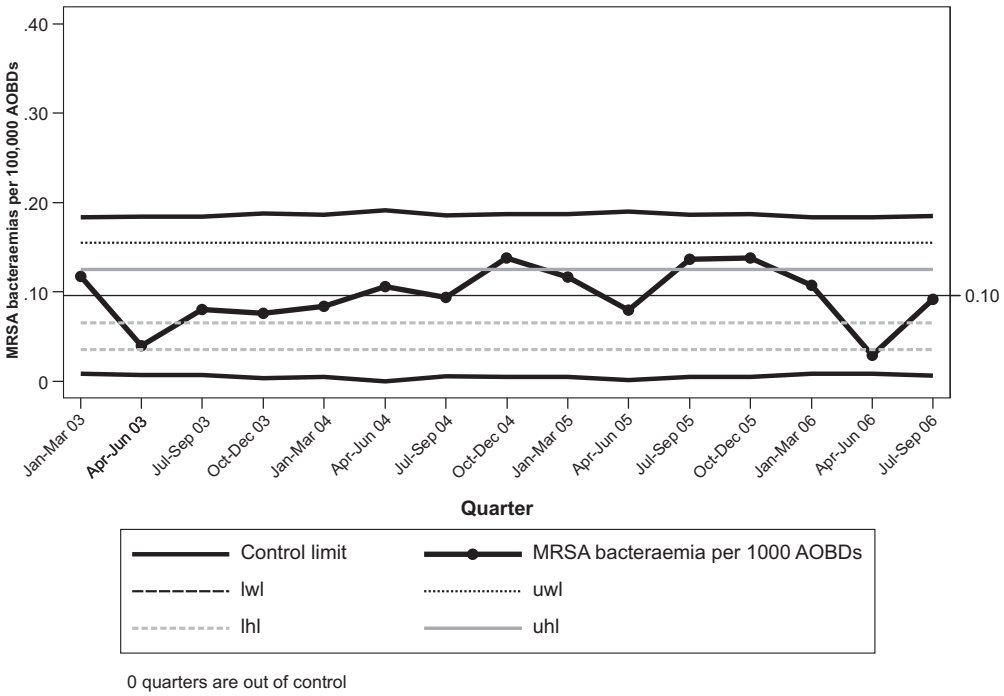
Figure 13: SPC chart of quarterly MRSA bacteraemias per 1000 AOBDs in Greater Glasgow and Clyde NHS Board. January 2003 to September 2006



1 quarter is out of control

The MRSA bacteraemia rate for Argyll and Clyde acute division has remained stable throughout the period January 2003 to September 2006 (Figure 13a) with no rates outwith the control limits and none of the eight rules being contravened. This division's rate shows only natural variation with no unnatural variation being identified and is considered to be in control.

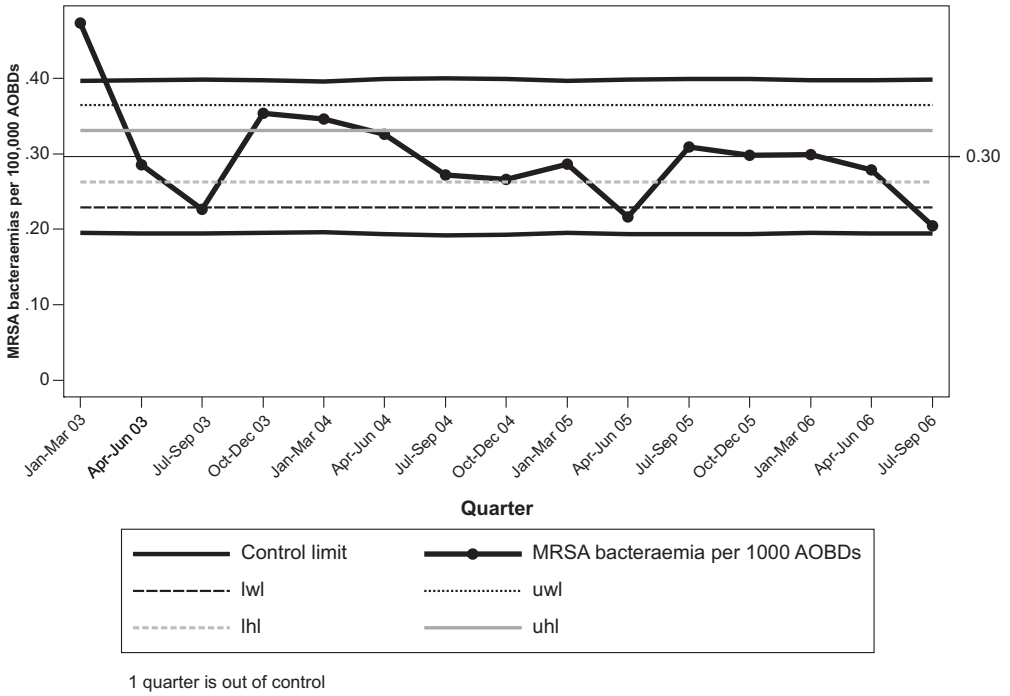
Figure 13a: SPC chart of quarterly MRSA bacteraemias per 1000 AOBDs in Argyll and Clyde. January 2003 to September 2006



0 quarters are out of control

The MRSA bacteraemia rate for North Glasgow acute division was above the upper control limit during the quarter January to March 2003, after this period the rate returned to within the control limits and has remained there for the last fourteen quarters (Figure 13b).

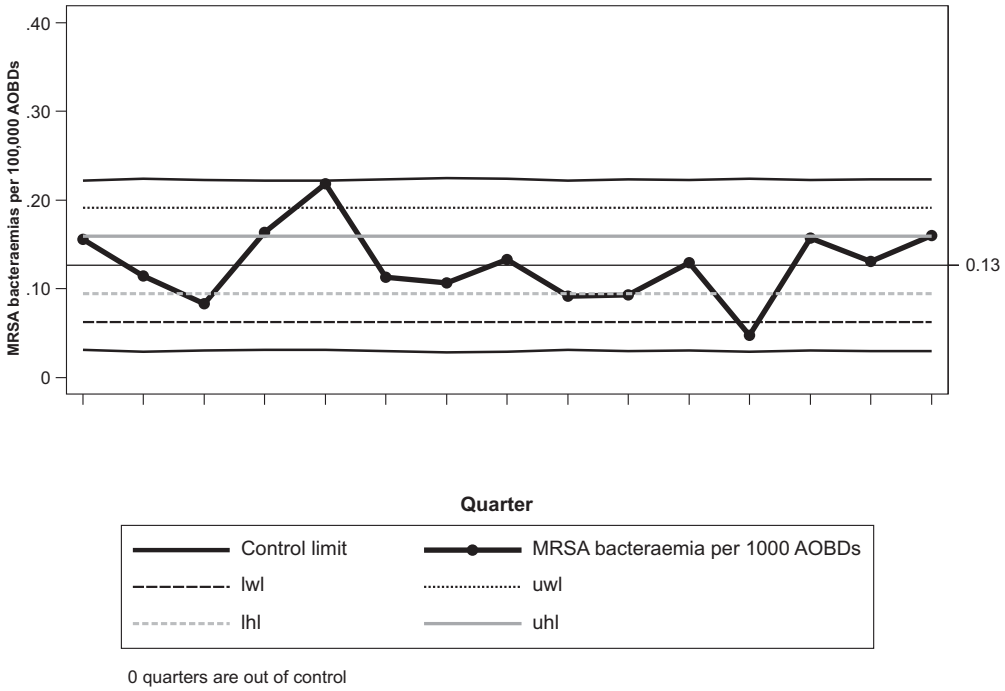
Figure 13b: SPC chart of quarterly MRSA bacteraemias per 1000 AOBDs in North Glasgow. January 2003 to September 2006



1 quarter is out of control

The MRSA bacteraemia rate for South Glasgow acute division has remained stable throughout the period January 2003 to September 2006 (Figure 13c) with no rates outwith the control limits and none of the eight rules being contravened. This division's rate demonstrates only natural variation and the process is considered to be in control.

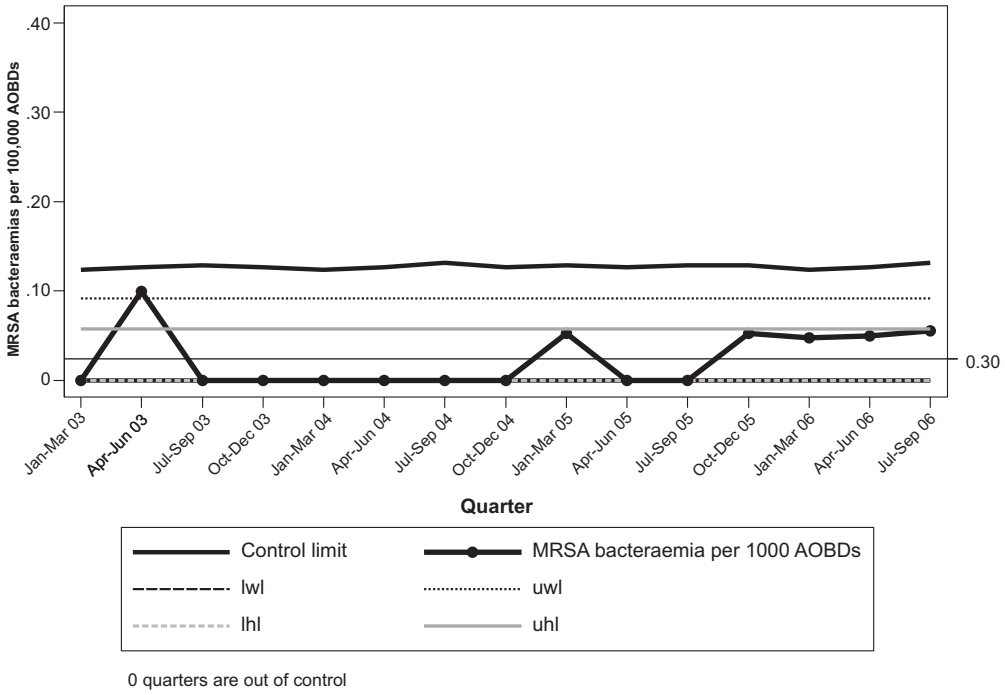
Figure 13c: SPC chart of quarterly MRSA bacteraemias per 1000 AOBDs in South Glasgow. January 2003 to September 2006



0 quarters are out of control

The MRSA bacteraemia rate for Yorkhill acute division has remained stable throughout the period January 2003 to September 2006 (Figure 13d) with no rates outwith the control limits and none of the eight rules being contravened. This division's rate demonstrates only natural variation and the process is considered to be in control.

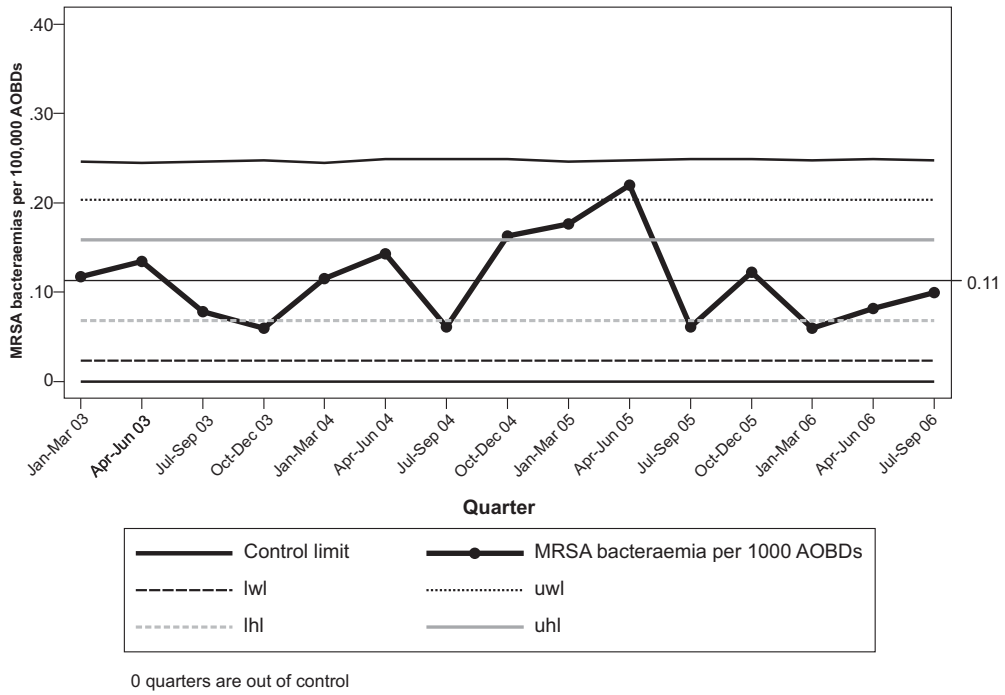
Figure 13d: SPC chart of quarterly MRSA bacteraemias per 1000 AOBDs in Yorkhill. January 2003 to September 2006



0 quarters are out of control

The MRSA bacteraemia rate for Highland NHS Board has remained stable throughout the period January 2003 to September 2006 (Figure 14) with no rates outwith the control limits and none of the eight rules being contravened. This board's rate demonstrates only natural variation and the process is considered to be in control.

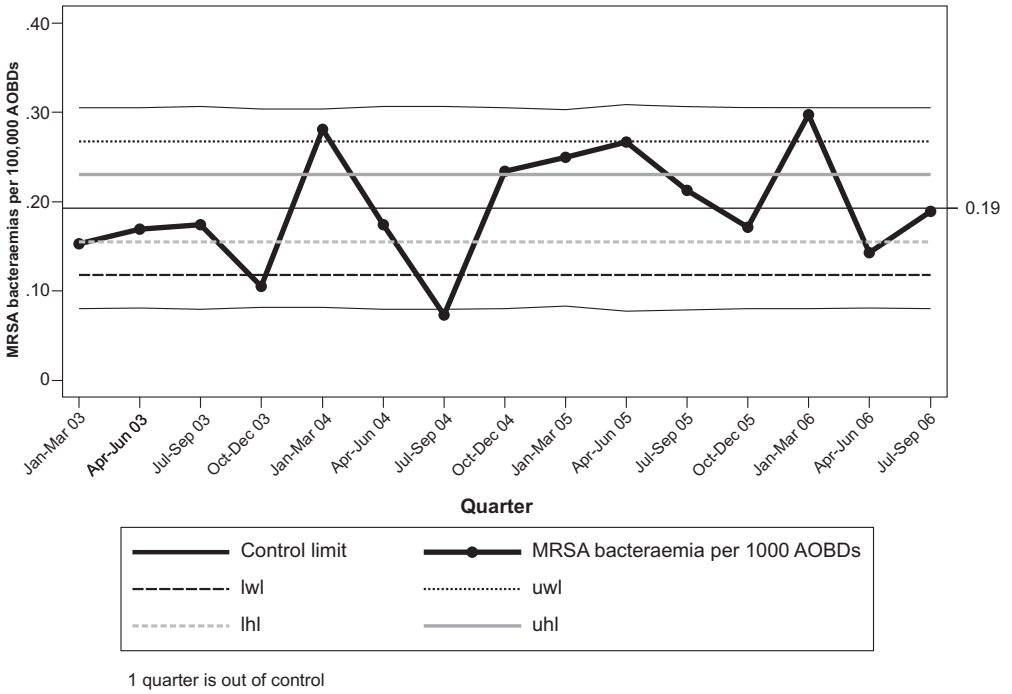
Figure 14: SPC chart of quarterly MRSA bacteraemias per 1000 AOBDs in Highland NHS Board. January 2003 to September 2006



0 quarters are out of control

The MRSA bacteraemia rate for Lanarkshire NHS Board fell below the lower control limit in the quarter July to September 2004 (Figure 15), suggesting a reduction in the rate during this period. The rate then returned to within the control limits and remained there for the last eight quarters.

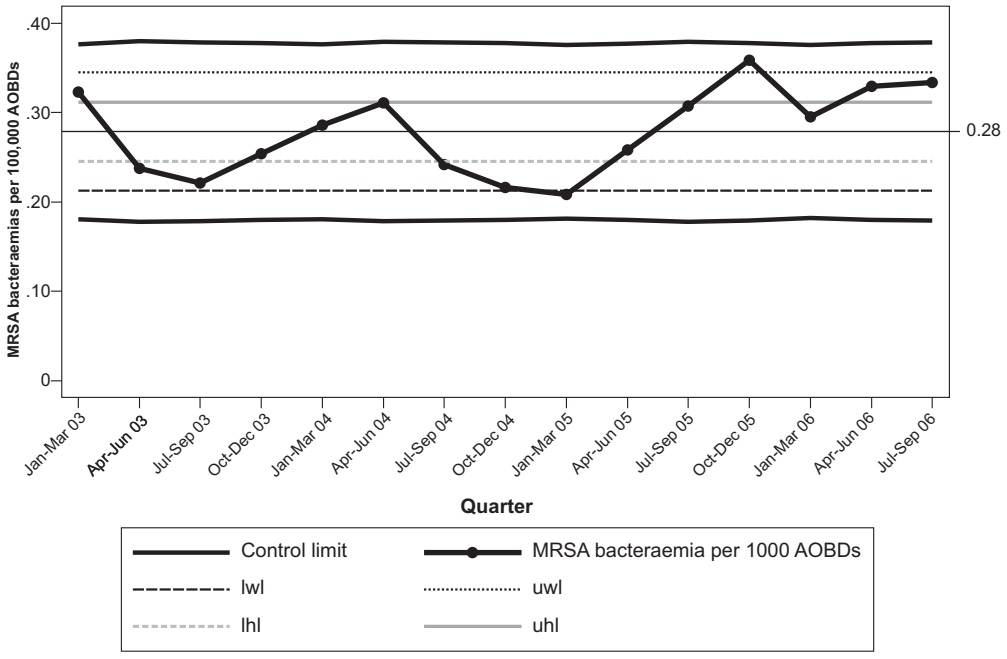
Figure 15: SPC chart of quarterly MRSA bacteraemias per 1000 AOBDs in Lanarkshire NHS Board. January 2003 to September 2006



1 quarter is out of control

The MRSA bacteraemia rate for Lothian NHS Board has remained stable throughout the period January 2003 to September 2006 (figure 16) with no rates outwith the control limits and none of the eight rules being contravened. This board's rate demonstrates only natural variation and the process is considered to be in control.

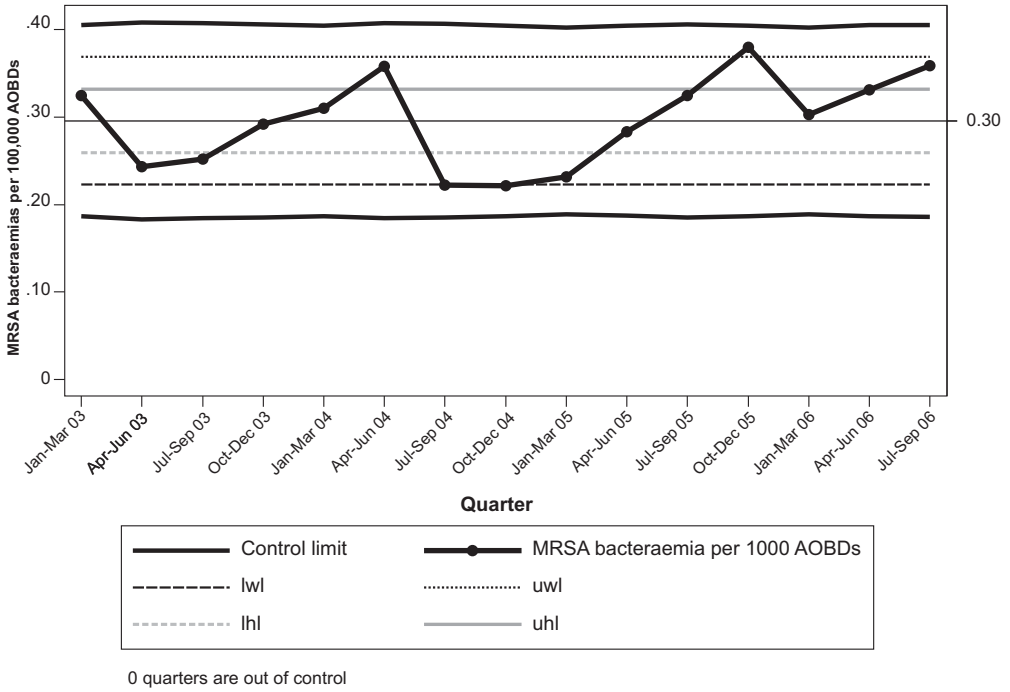
Figure 16: SPC chart of quarterly MRSA bacteraemias per 1000 AOBDs in Lothian NHS Board. January 2003 to September 2006



0 quarters are out of control

The MRSA bacteraemia rate for Lothian acute division has remained stable throughout the period January 2003 to September 2006 (Figure 16a) with no rates outwith the control limits and none of the eight rules being contravened. This division's rate demonstrates only natural variation and the process is considered to be in control.

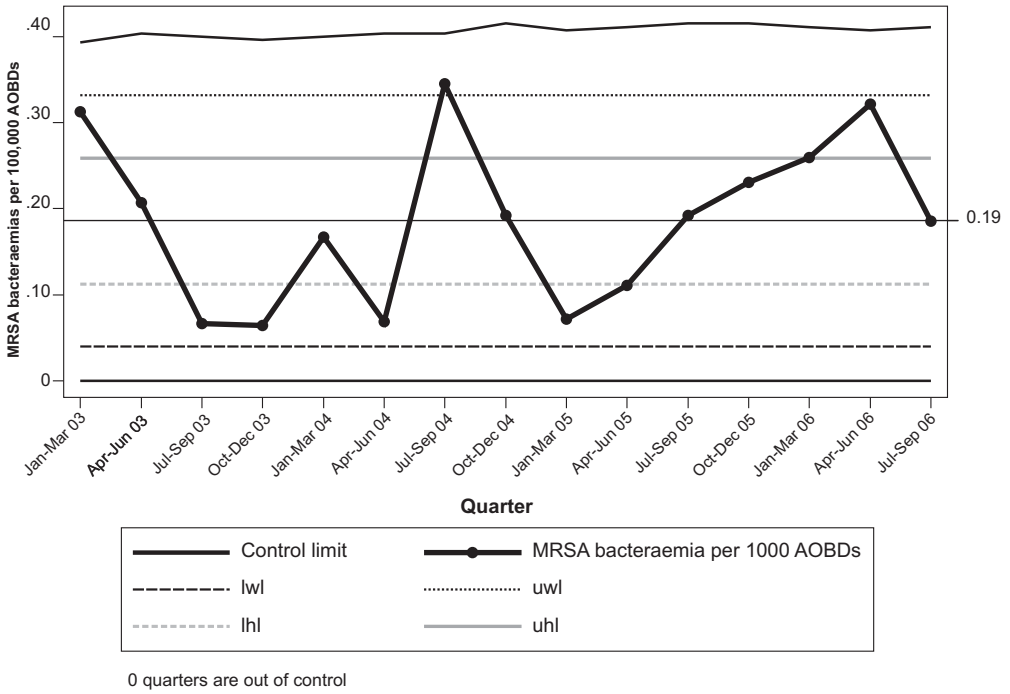
Figure 16a: SPC chart of quarterly MRSA bacteraemias per 1000 AOBDs in Lothian. January 2003 to September 2006



0 quarters are out of control

The MRSA bacteraemia rate for West Lothian acute division has remained stable throughout the period January 2003 to September 2006 (Figure 16b) with no rates outwith the control limits and none of the eight rules being contravened. This division's rate demonstrates only natural variation and the process is considered to be in control.

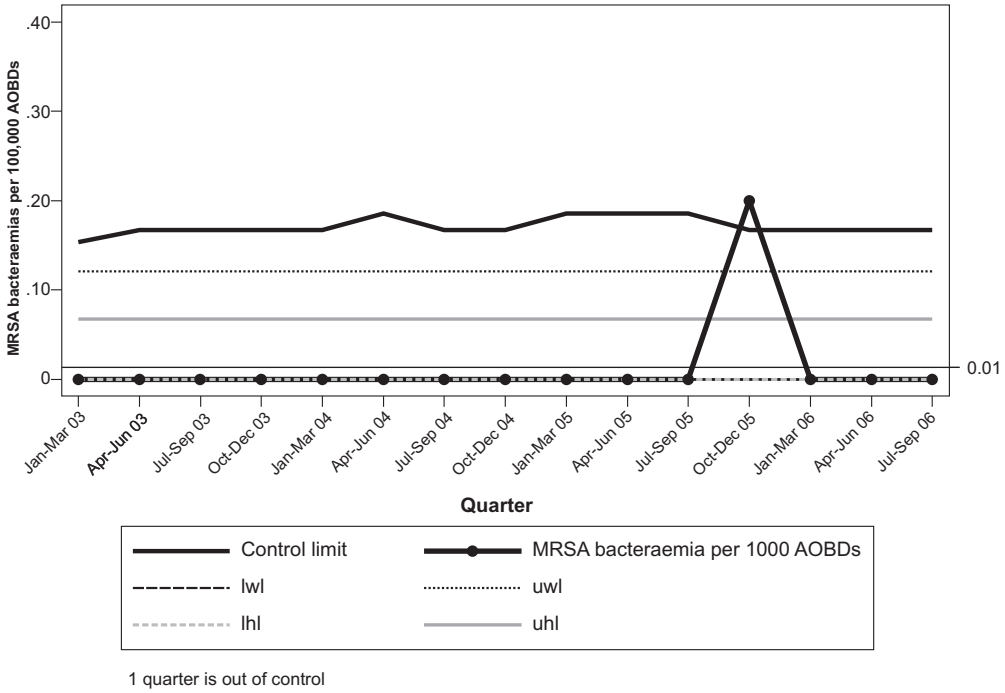
Figure 16b: SPC chart of quarterly MRSA bacteraemias per 1000 AOBDs in West Lothian. January 2003 to September 2006



0 quarters are out of control

Orkney NHS Board has reported only one MRSA bacteraemia during the period January 2003 to September 2006, due to the rarity of these reports this one case caused the rate to rise above the upper control limit (Figure 17). Since this quarter the rate has returned to zero.

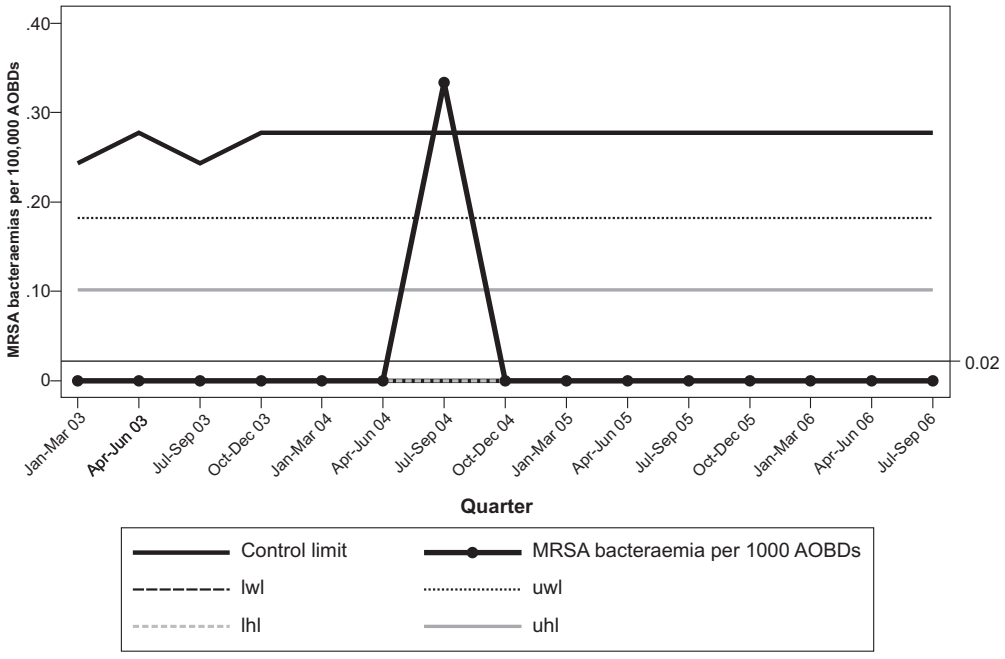
Figure 17: SPC chart of quarterly MRSA bacteraemias per 1000 AOBDs in Orkney NHS Board. January 2003 to September 2006



1 quarter is out of control

Shetland NHS Board has reported only one MRSA bacteraemia during the period January 2003 to September 2006, due to the rarity of these reports this one case caused the rate to rise above the upper control limit (Figure 18). Since this quarter the rate has returned to zero for the last eight quarters.

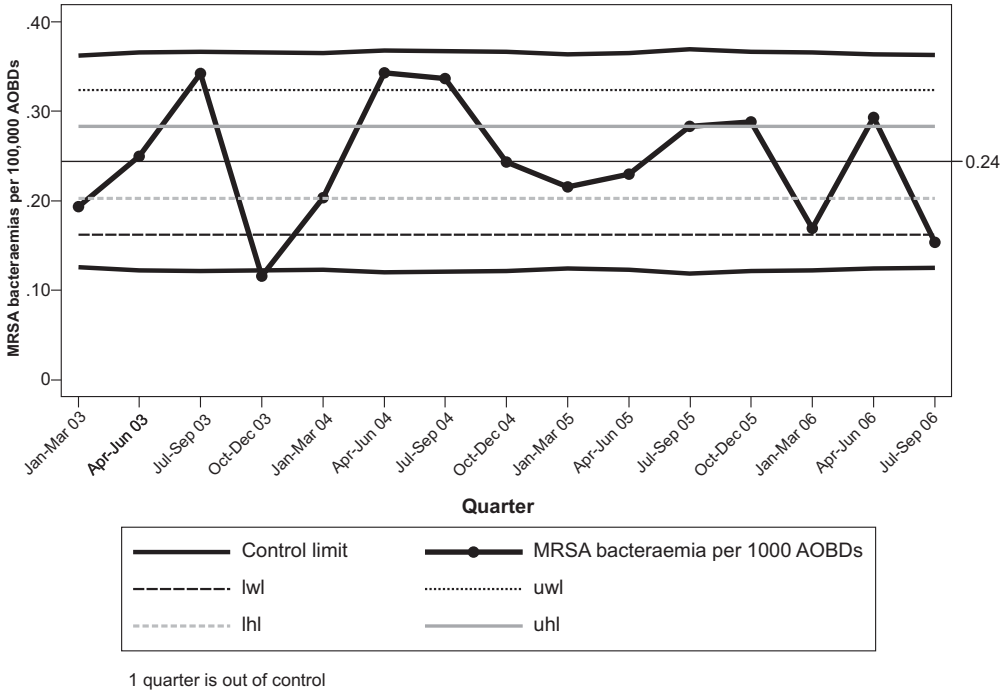
Figure 18: SPC chart of quarterly MRSA bacteraemias per 1000 AOBDs in Shetland NHS Board. January 2003 to September 2006



1 quarter is out of control

The MRSA bacteraemia rate for Tayside NHS Board fell below the lower control limit in the quarter October to December 2003, suggesting a decrease in the number of MRSA bacteraemia in this period (Figure 19). Since this quarter the rate has remained within its control limits for eleven quarters.

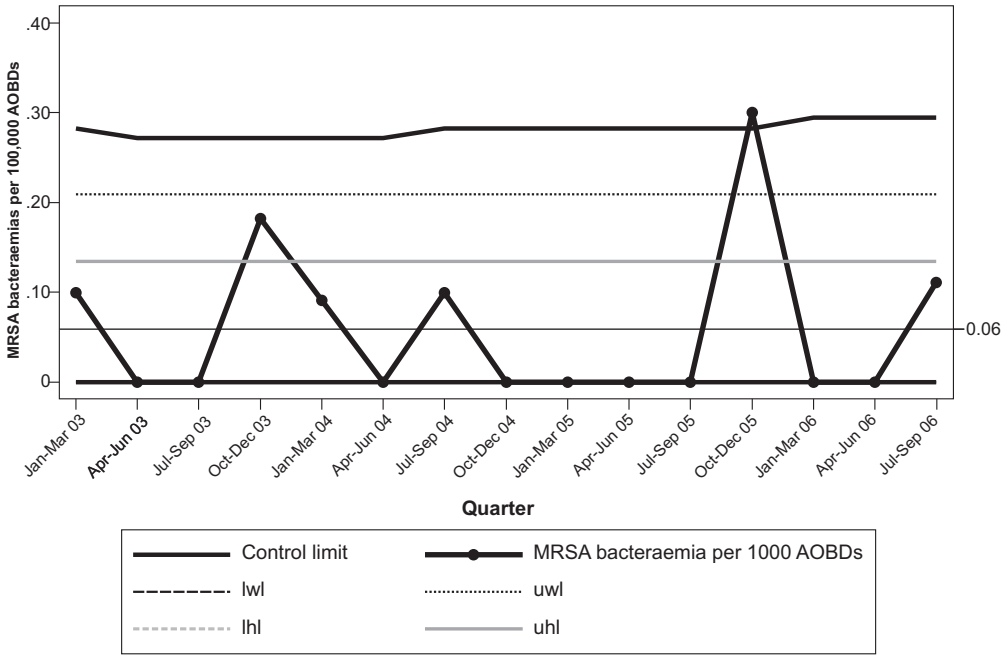
Figure 19: SPC chart of quarterly MRSA bacteraemias per 1000 AOBDs in Tayside NHS Board. January 2003 to September 2006



1 quarter is out of control

The MRSA bacteraemia rate for Western Isles NHS Board rose above the control limit during the quarter October to December 2005, indicating a rise in the number of episodes of MRSA bacteraemia during this period (Figure 20). The rate returned to a low level in the most recent quarters.

Figure 20: SPC chart of quarterly MRSA bacteraemias per 1000 AOBDs in Western Isles NHS Board. January 2003 to September 2006



1 quarter is out of control

KEY SUMMARY POINTS - Section 3

During the period January 2003 to September 2006 six NHS boards have remained consistently within their control limits, eight NHS boards have reported a rate above the upper control limit or below the lower control limit during one quarter.

In the most recent quarter reported, July to September 2006, no NHS boards reported a rate above the upper control limit.

SUMMARY

The MRSA bacteraemia rate for all of Scotland has remained stable during the period January 2003 to September 2006, with no values outside the control limits. The national rate shows only natural variation with no indication of special case variation and the process is considered to be in control.

No NHS boards reported a rate above their control limit during the most recent quarter, July to September 2006.

MSSA and *S. aureus* rates were seen to vary substantially during the period covered by this report. HDL (2006) 38 has made reporting of all *S. aureus* bacteraemias mandatory from July 2006. This may be responsible for this rise in MSSA bacteraemia reports. Future reports will examine *S. aureus* rates by NHS Board.

Acknowledgements

Health Protection Scotland is grateful to all the microbiologists in the Scottish laboratories who provided the MRSA bacteraemia data for this report and helped in its preparation, and the Information and Statistics Division of the NHS in Scotland who provided the hospital activity data.

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