REPORT ON METHICILLIN-RESISTANT *STAPHYLOCOCCUS AUREUS* BACTERAEMIA IN SCOTLAND,

JANUARY 2002 TO DECEMBER 2002

Published by Scottish Centre for Infection and Environmental Health 1 April 2003

Key points

- This report of methicillin-resistant *Staphylococcus aureus* (MRSA) in acute trusts in Scotland provides data on the rates of MRSA bacteraemias (blood infections) for 14 acute NHS trusts, one health care trust and three island boards in Scotland in the twelve-month period January 2002 to December 2002.
- Between January and December 2002, recorded MRSA bacteraemia rates ranged from 0.0 per 1000 bed days to 0.37 per 1000 bed days with an average for Scotland of 0.17 /1000 bed days. Statistical analyses of the data suggest that rates of MRSA bacteraemia in Scotland and in individual trusts have remained at approximately the same level (i.e. there has been no statistically significant change in the rates) between January 2001 and December 2002.
- Comparisons between trusts of the bacteraemia rates should be made with great caution for several reasons, including the following:
  - Patients may not have acquired the MRSA in the trust where the MRSA bacteraemia was diagnosed. Laboratory reports of MRSA bacteraemia include reports on patients who became colonized or infected in a different hospital from the one that diagnosed and reported the bacteraemia, as well as reports on patients who became colonized or infected in the community.
  - The data reflect the overall position in trusts that differ in the numbers of patients at high risk of MRSA carriage and infection. Certain groups of patients e.g. the elderly, renal patients, diabetics, some surgical patients and patients with previous hospital admissions are more prone to MRSA carriage and infection.
- These data provide trusts with the opportunity to examine their own performance in the context of the national data. The data provided in the quarterly reports will be used, in the longer term, to monitor trends in MRSA in acute trusts in Scotland and as one of several indicators of the efficacy of infection control processes.

1. Background

1.1 This report of MRSA bacteraemias (blood infections) in acute hospital trusts in Scotland is required by Health Department Letter (2001)57 ‘A Framework for National Surveillance of Hospital Acquired Infection in Scotland’[1].

1.2 Previous reports can be accessed on the web at http://www.show.scot.nhs.uk/scieh/#infectious/hai/MRSA_Scot.htm

1.3 MRSA carriage and infection have been regarded as markers of potential or real hospital acquired infection. However, community acquired carriage is increasingly reported [2,3].

1.4 The rates of MRSA bacteraemia diagnosed in trusts in the period January to December 2002 are reported here. They are based on reports of diagnoses of MRSA bacteraemia to the Scottish Centre for Infection and Environmental Health (SCIEH) by microbiology laboratories in Scotland. Rates of MRSA bacteraemia, a serious infection due to MRSA, are currently the best available indicators of the amount of MRSA in trusts.

1.5 For ease of reference, a description of the methods of data collection, analysis and reporting is provided in Section 2.

1.6 It is important that the results are read in conjunction with the notes on interpreting the data provided in Section 3.

2. Data sources, data analysis and reporting

2.1 The figures and table show the rates of MRSA bacteraemia for 14 acute NHS trusts, one health care trust and three island boards in Scotland (hereafter referred to as 'trusts') reported to SCIEH by microbiology laboratories.

2.2 The rate presented in the graphs and tables is the number of 'episodes' (cases) of MRSA bacteraemia in the trust divided by the total number of occupied acute 'bed days' for the period. (One patient in one bed for one night is one occupied 'bed day'). The rate given is the number of cases of MRSA bacteraemia diagnosed per 1000 bed days. This provides an index of MRSA bacteraemia in the trust that relates the diagnosed cases to the total number of days during which patients have been in hospital in the twelve-month period.

2.3 The data on 'patient bed days' have been obtained from the Information and Statistics Division of the NHS in Scotland. They are based on the 24 hourly midnight counts of occupied beds that are undertaken in every hospital. These counts exclude patients treated as day patients who, by definition, do not occupy a bed at midnight.

2.4 Confidence intervals for the rates (shown in Tables 1 and 2) indicate the range within which one can be 95% confident that the true rate will fall.

2.5 The data are also presented in the form of a 'control chart'[4]. On the chart the rates for individual trusts are plotted. The chart also includes upper and lower limits (in this case defined by +/- three standard deviations of the Scottish rate). This approach is based on an assumption that rates in trusts will be largely similar, and allows the distinction between 'common cause' or natural variation, when a trust's rate falls within the limits, and 'special cause' variation, where something unusual is occurring in a trust which results in a rate which falls outside these limits. The latter result should lead to a search for the explanation for the unusual situation, unique to that trust, which results in a rate that lies outside the limits. This could be the result of either a true high or low rate of MRSA bacteraemia or due to reporting biases, e.g. incomplete reporting or over-reporting.

Table 1: MRSA bacteraemia rates by acute Trust with 95% confidence interval limits: January to December 2002

Trust Name	Trust Category	MRSA per 1000 bed days	MRSA per 1000 bed days	
			Lower Limit	Upper Limit
Shetland	Island	0.0000	0.0000	0.1371
Western Isles	Island	0.0159	0.0005	0.0884
Orkney	Island	0.0405	0.0012	0.2257
West Lothian	General Acute	0.0537	0.0268	0.0960
Yorkhill	Specialist	0.0613	0.0199	0.1432
Argyll & Clyde	General Acute	0.0888	0.0634	0.1209
South Glasgow	Teaching	0.0961	0.0706	0.1279
Grampian	Teaching	0.1114	0.0842	0.1447
Ayrshire & Arran	General Acute	0.1143	0.0833	0.1529
Highland	General Acute	0.1219	0.0781	0.1814
Forth Valley	General Acute	0.1504	0.1048	0.2092
Dumfries & Galloway	General Acute	0.1551	0.0903	0.2484
Lanarkshire	General Acute	0.1730	0.1372	0.2153
North Glasgow	Teaching	0.1816	0.1518	0.2113
Borders	General Acute	0.1999	0.1185	0.3159
Tayside	Teaching	0.2191	0.1737	0.2727
Fife	General Acute	0.2592	0.1987	0.3322
Lothian	Teaching	0.3712	0.3232	0.4191

Table 2: MRSA bacteraemia rates by acute Trust with 95% confidence interval limits: January to December 2001

Trust Name	Trust Category	MRSA per 1000 bed days	MRSA per 1000 bed days	
			Lower Limit	Upper Limit
Shetland	Island	0.0000	0.0000	0.1298
Western Isles	Island	0.0309	0.0037	0.1115
Orkney	Island	0.0426	0.0013	0.2374
West Lothian	General Acute	0.0703	0.0393	0.1159
Yorkhill	Specialist	0.0000	0.0000	0.0439
Argyll & Clyde	General Acute	0.0566	0.0373	0.0823
South Glasgow	Teaching	0.0902	0.0655	0.1211
Grampian	Teaching	0.1060	0.0794	0.1387
Ayrshire & Arran	General Acute	0.1147	0.0840	0.1530
Highland	General Acute	0.0750	0.0420	0.1237
Forth Valley	General Acute	0.1267	0.0848	0.1819
Dumfries & Galloway	General Acute	0.1127	0.0582	0.1968
Lanarkshire	General Acute	0.1880	0.1500	0.2328
North Glasgow	Teaching	0.1321	0.1065	0.1578
Borders	General Acute	0.1765	0.1010	0.2867
Tayside	Teaching	0.2217	0.1766	0.2748
Fife	General Acute	0.2503	0.1910	0.3221
Lothian	Teaching	0.3358	0.2907	0.3809

3 Interpreting the data

Direct comparisons between trusts of the reported MRSA rates should be made with great caution for several reasons:

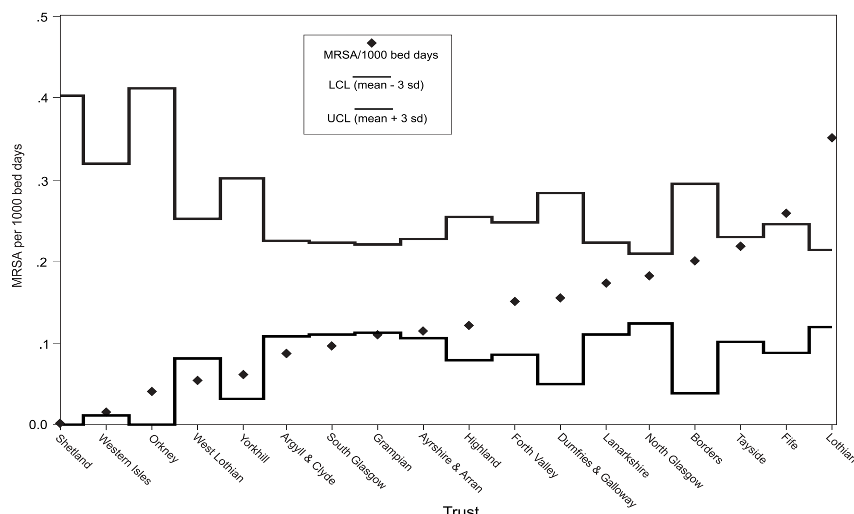

Figure 1: Episodes of MRSA bacteraemia per 1000 total occupied bed days. January to December 2002. In Scottish Acute NHS Trusts.

3.1 Trusts' patients differ in their vulnerability to MRSA colonization and infection. A single trust may include different kinds of hospitals, e.g. teaching or general hospitals, different specialties with varying numbers of patients, and therefore differing numbers of vulnerable patients. These differences contribute to differences in the MRSA bacteraemia rates. Trusts with more patients in vulnerable categories, e.g. the elderly, renal patients, some types of surgical patients, may have higher rates. Trusts that receive patients transferred from other hospitals or large numbers of patients with recent hospital admissions, may also have higher rates of MRSA infection.

3.2 MRSA bacteraemias in renal dialysis patients are included in the number of cases diagnosed in trusts where such patients are treated. The bed days occupied by them are not included in the 'total occupied bed days' as these patients are treated as day patients. As a result, calculated rates may be artificially high.

3.3 A patient may be admitted already colonized with MRSA and then develop an MRSA bacteraemia in hospital. He/she may have become colonized in another hospital or in the community. The numbers of bacteraemias diagnosed therefore may include MRSA acquired elsewhere. For this reason it is not correct to use the numerical data provided to quantitatively estimate differences in the risk of MRSA acquisition in different hospitals.

3.4 MRSA bacteraemia data have been obtained from laboratories in acute trusts that may also provide services to a primary care trust. It is not possible to exclude MRSA bacteraemias from these trusts (which are likely to be very small in number).

4. Results

4.1 Rates of MRSA bacteraemia reported in Scotland in the twelve-month period, January to December 2002, ranged from 0.0 /1000 patient bed days to 0.37 /1000 patient bed days (Table 1).

4.2 In total, 895 episodes of MRSA bacteraemia were reported in Scotland for the twelve- month period, January to December 2002, giving an overall rate for Scotland of 0.17/1000 bed days (95% CI 0.16/1000 bed days to 0.18/1000 bed days). This suggests that, on average, a patient who stays in hospital for 10 days has approximately a one in 600 chance of getting an MRSA bacteraemia. However, it is important to note that the risk to an individual may be higher or lower, as patients differ in their vulnerability to MRSA infection.

4.3 Figure 1 shows that the majority of Scottish Trusts reported MRSA bacteraemia rates in 2002 that fall within the defined limits. Two trusts have rates that are above the upper limit of three standard deviations based on the all-Scotland rate. Four trusts recorded rates of MRSA bacteraemia that are below the lower limit.

4.4 Table 2 presents the MRSA bacteraemia rates reported by trusts in 2001, for comparison with the data presented in Table 1.

4.5 Figure 2, which shows the trends in MRSA bacteraemia rates in Scotland for the eight three-month periods between January 2001 and December 2002, indicates that the rates have not increased or decreased consistently over the period. Graphical representation of the trends in MRSA bacteraemia in individual trusts also did not show any consistent trend. These observations are supported by statistical analyses of the data.

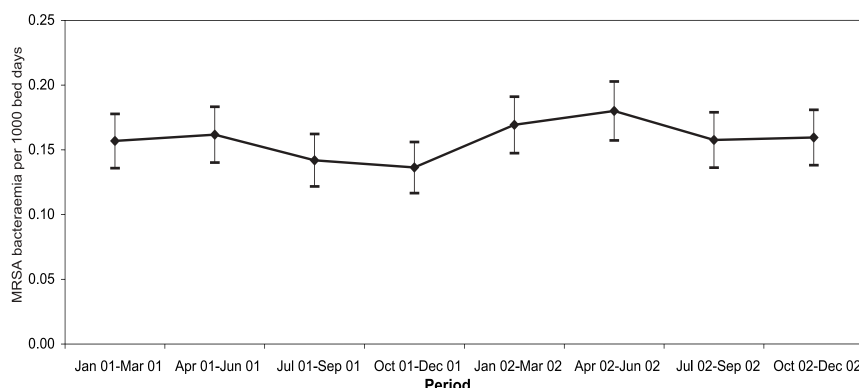

Figure 2: Quarterly MRSA bacteraemia rates per 1000 occupied bed days for Scotland. January 2001 to December 2002.

4.6 Statistical analyses have also been undertaken to examine the contribution to the variation in rate between trusts, of the type of trust (teaching, general, island or

specialist paediatric), the three-month period and the geographic location of the trust. These support the observation that rates in teaching and general trusts are similar and are different from those in the island boards and the single specialist paediatric hospital where MRSA bacteraemia rates are lower.

5. Comments

5.1 Rates of MRSA bacteraemia in Scotland and in individual trusts have not changed over the two years under surveillance. The overall MRSA bacteraemia rate in 2002 of 0.17 per 1000 patient bed days was not significantly different from the overall rate of 0.15 per 1000 recorded in 2001. The total numbers of bacteraemias recorded were 895 in 2002 and 802 in 2001.

5.2 MRSA is now endemic in many Scottish hospitals, and at this particular point in time it is encouraging to note that there have not been statistically significant increases in incidence. It is probably unrealistic to expect decreases in rates over such a short period. The MRSA Bacteramia Report published in July 2002 drew attention to the multiplicity of factors - numbers of colonized patients admitted, prevalence of MRSA carriage, MRSA screening policies, vulnerability profile of patients, infection control measures including the availability and use of handwashing facilities, availability and use of isolation wards, hospital hygiene, patient movements between wards, patient throughput in relation to staffing levels – that contribute to MRSA bacteraemia rates. Control must be multifaceted. High priority is now being given to infection control at senior management levels in the NHS, and concerted action is being taken by the Scottish Executive Health Department to address some of these factors, especially hand hygiene[5]. The impact on local MRSA bacteraemia rates over the longer term remains to be seen. In the endemic situation it could prove extremely difficult and costly to decrease infection rates[6].

5.3 Over recent years statistical models have been developed to predict the impact on MRSA incidence of the many factors that have an effect on the rates within hospital units[7]. These have illustrated the complexity and interrelationships of the impact of these many factors on MRSA rates. Two important points have been made with respect to these models. First, because of the small populations involved, fluctuations in incidence will happen just by chance. Secondly, the impact on incidence of specific infection control measures is not linear. Further development of stochastic models to quantify the impact on MRSA rates of various interventions and of the contributory factors listed above, along with intervention studies to examine the validity of the models, may enable the prioritization of initiatives which could realistically and cost-effectively be expected to lead to a reduction in bacteraemia rates.

5.4 Bacteraemia rates in individual trusts will also be better understood and better monitored when specialty-specific incidence can be reported and it is hoped that this will be possible in the near future. Meanwhile the regular reporting of MRSA bacteraemia rates provides an opportunity for the trusts to monitor their own performance in the light of national rates and to take any additional measure they feel are necessary to control the transmission of MRSA in their hospitals.

Acknowledgements

The Scottish Centre for Infection and Environmental Health 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 to Colin Houston of the Information and Statistics Division of the NHS in Scotland who provided the hospital activity data.

References

1. NHS HDL (2001) 57: A framework for national surveillance of hospital acquired infection in Scotland.
2. Fraise AP, Mitchell K, O'Brien SJ, Oldfield K et al. Methicillin-resistant *Staphylococcus aureus* (MRSA) in nursing homes in a major UK city: an anonymised point prevalence study. *Epidemiol Infect* 1997;**118**:1-5.
3. SCIEH. Community MRSA and Panton-Valentine leukocidin. *SCIEH Weekly Report* 2002;**36(46)**:298.
4. Mohammed MA, Cheng KK, Rouse A, Marshall T. Bristol, Shipman and clinical governance. Shewhart's forgotten lessons. *Lancet* 2001;**357**: 463-467.
5. NHS HDL (2002) 82: Ministerial Action Plan on Healthcare associated infection, Watt Group Report on the outbreak of Salmonella infection at the Victoria Infirmary and HAI & Patient Care Environment Questionnaire.
6. Farrington M, Redpath C, Trundle C et al. Winning the battle but losing the war: methicillin-resistant *Staphylococcus aureus* (MRSA) infection at a teaching hospital. *Q J Med* 1998; **91**:539-548.
7. Bonten MJM, Austin DJ, Lipsitch M. Understanding the spread of antibiotic resistant pathogens in hospitals: mathematical models as tools for control. *Clin Infect Dis* 2001;**33**:1739-1746.