

REPORT

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

JULY 2001 TO JUNE 2002

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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 July 2001 to June 2002.
- Between July 2001 and June 2002, recorded MRSA bacteraemia rates ranged from 0.0/1000 bed days to 0.38/1000 bed days with an average for Scotland of 0.16/1000 bed days. Similar rates were reported for January to December, 2001 and April 2001 to March 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 trusts where 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. In this report, data are presented on MRSA bacteraemias in Scottish acute NHS trusts in the twelve-month period July 2001 to June 2002.
- 1.2 The two previous reports can be accessed on the web at http://www.show.scot.nhs.uk/scieih/#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 episodes of MRSA bacteraemia in trusts in the period July 2001 to June 2002 are reported here. They are based on reports of MRSA bacteraemias to the Scottish Centre for Infection and Environmental Health (SCIEH) by microbiology laboratories in Scotland. Rates of MRSA bacteraemia are currently the best available indicators of the amount of MRSA in trusts.
- 1.5 Many trusts and hospitals already monitor and report their own MRSA data locally, using these to audit their performance. The data presented in this report enable all trusts to view their rates within the context of the national rates. The data provide the trusts with an additional perspective on their own performance.
- 1.6 For ease of reference, a description of the methods of data collection, analysis and reporting is provided in section 2.
- 1.7 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 in the twelve-month period, July 2001 to June 2002.
- 2.2 Because of the relatively small numbers of MRSA reported from each trust, twelve-month reporting periods are being used. The twelve month reporting period that is the subject of this report overlaps by nine months with that reported in July 2002.
- 2.3 The rate presented in the figures and table is the number of 'episodes' (cases) of MRSA bacteraemia in the trust for the twelve-month period July 2001 to June 2002, divided by the total number of occupied '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. Patients differ in their vulnerability to MRSA bacteraemia. The measure used does not take account of the actual numbers of patients or the varying types of patients who are treated in the different trusts for different lengths of time. It also takes no account of the different specialties within hospitals in the trusts, some of which treat patients who are more prone to MRSA acquisition.
- 2.4 The numbers on which the rates are based include MRSA bacteraemias caused by MRSA acquired in the community as well as MRSA acquired in hospital.
- 2.5 The data on 'patient bed days' have been obtained from the Information and Statistics Division of NHSScotland. 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.
- 2.6 Confidence intervals (CI) for the rates (shown in Figure 1) indicate the range within which one can be 95% confident that the true rate will fall.
- 2.7 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.

3. Interpreting the data

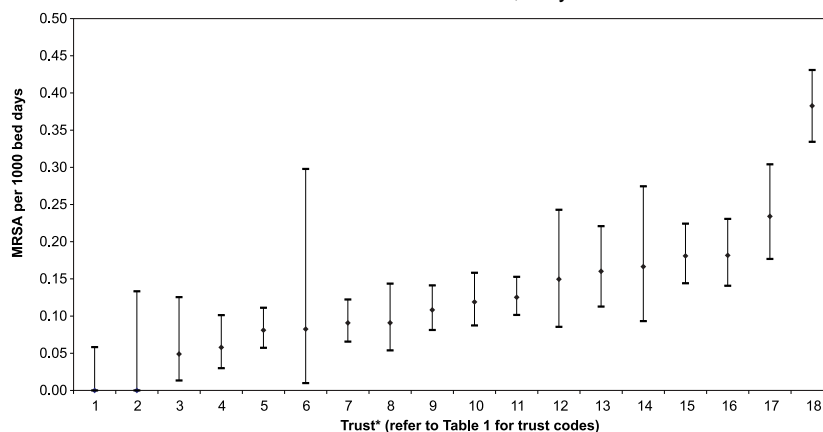
- 3.1 Direct comparisons between trusts of the reported MRSA rates should be made *with great caution* for several reasons: Trusts' patients differ in their vulnerability to MRSA colonization and infection. A single trust may include different kinds of hospitals, e.g. teaching or specialist hospitals and district general hospitals. This differing composition results in each trust having different numbers of patients in a variety of patient groups with differing vulnerability to MRSA bacteraemia. These differences contribute to differences in the MRSA bacteraemia rates. Trusts with more patients in vulnerable categories, e.g. the elderly, renal patients, diabetics, some types of surgical patients and intensive care patients, may have higher rates. Trusts which receive patients transferred from other hospitals e.g. tertiary referral centres, or which admit a large number of patients who have had a recent admission, may also have higher rates of MRSA infection.

Table: MRSA Bacteraemia rates by acute Trust with 95% confidence interval limits: July 2001 to June 2002

	Trust Name	Trust Category	MRSA per 1000 bed days	MRSA per 1000 bed days	
				Lower Limit	Upper Limit
1	Western Isles NHS Board	Island	0.0000	0.0000	0.0583
2	Shetland NHS Board	Island	0.0000	0.0000	0.1333
3	The Yorkhill NHS Trust	Specialist	0.0490	0.0134	0.1255
4	West Lothian Healthcare NHS Trust	General Acute	0.0579	0.0299	0.1012
5	Argyll & Clyde Acute Hospitals NHS Trust	General Acute	0.0810	0.0573	0.1112
6	Orkney NHS Board	Island	0.0825	0.0099	0.2978
7	South Glasgow University Hospitals NHS Trust	Teaching	0.0908	0.0657	0.1223
8	Highland Acute Hospitals NHS Trust	General Acute	0.0909	0.0539	0.1437
9	Grampian University Hospitals NHS Trust	Teaching	0.1082	0.0813	0.1412
10	Ayrshire & Arran Acute Hospitals NHS Trust	General Acute	0.1190	0.0874	0.1583
11	North Glasgow University Hospitals NHS Trust	Teaching	0.1252	0.1016	0.1528
12	Dumfries & Galloway Acute & Maternity Hospitals NHS Trust	General Acute	0.1496	0.0856	0.2429
13	Forth Valley Acute Hospitals NHS Trust	General Acute	0.1602	0.1128	0.2209
14	Borders General Hospital NHS Trust	General Acute	0.1664	0.0932	0.2745
15	Lanarkshire Acute Hospitals NHS Trust	General Acute	0.1809	0.1441	0.2243
16	Tayside University Hospitals NHS Trust	Teaching	0.1817	0.1408	0.2307
17	Fife Acute Hospitals NHS Trust	General Acute	0.2341	0.1769	0.3041
18	Lothian University Hospitals NHS Trust	Teaching	0.3826	0.3343	0.4309

- 3.2 A patient may be admitted already colonized with MRSA and then develop an MRSA bacteraemia in hospital. He/she may have acquired the MRSA in a previous admission to the same or to 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 of patients admitted to different hospitals.
- 3.3 So-called 'acute trusts' also include a varying number of 'non-acute' beds, occupied by patients who are at a lower risk of MRSA infection e.g. psychiatric patients.
- 3.4 Data have been obtained from the laboratories in acute trusts that may also provide services to a primary care trust. It is not possible to exclude these cases (which are likely to be very small in number).

Figure 1: Episodes of MRSA per 1000 total occupied bed days with 95% confidence intervals: Scottish Acute NHS Trusts, July 2001 to June 2002.



*See Table on page 2 for trusts to which numbers refer.

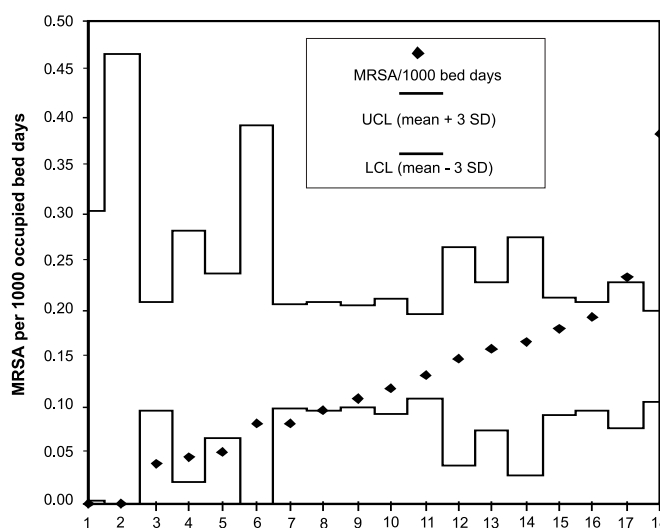
4. Results

- 4.1 Rates of MRSA bacteraemia reported in Scotland in the twelve-month period, July 2001 to June 2002, ranged from 0.0/1000 patient bed days to 0.38 /1000 patient bed days (Figure 1 and Table).
- 4.2 In total, 830 episodes of MRSA bacteraemia were reported in Scotland for the twelve-month period, July 2001 to June 2002, giving an overall rate for Scotland of 0.16/1000 bed days (95% CI 0.14 to 0.17/1000 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 2 shows that the majority of Scottish Trusts report rates within the defined limits. Two trusts have rates that are above the upper limit of three standard deviations based on the all Scotland rate.
- 4.4 Four trusts recorded rates of MRSA that were below the lower limit. Low rates are reported from the island boards but the small numbers of beds in the hospitals in these boards result in a large confidence interval being placed around the rates.
- 4.5 The rates of MRSA bacteraemia in the three six-month periods January to June 2001, July to December 2001 and January to June 2002 were 0.16, 0.15 and 0.17 per 1000 bed days respectively.

5. Comments

- 5.1 The range of MRSA bacteraemia rates for the period July 2001 to June 2002 was 0.0 to 0.38 per 1000 bed days. This compares with 0.0 to 0.36 per 1000 bed days for the twelve months between April 2001 and March 2002. The report from England for the period April 2001 to March 2002 gives a range for specialist trusts (including teaching hospitals) of 0.08 to 0.66 per 1000 bed days and, for general acute trusts, of 0.02 to 0.39 per 1000 bed days⁵. The overall rate for trusts in Scotland was 0.16 per 1000 bed days. The overall rate for England for the period April 2001 to March 2002 was 0.17 per 1000 bed days.
- 5.2 The overall rate recorded for July 2001 to July 2002 is similar to that reported for April 2001 to March 2002. However nine months are common to the two reporting periods.
- 5.3 Figure 2 shows that most trusts recorded rates within the limits of +/- three standard deviations of the Scottish rate. It is particularly important that trusts whose rates fall at the upper end of the range examine critically the measures they are taking to control MRSA. However no trust should be complacent about their rates and all trusts should continue to monitor closely the trends in MRSA in their hospitals in order to target interventions to contain and control the spread of the infection.

Figure 2: Episodes of MRSA bacteraemia per 1000 total occupied bed days: Scottish Acute NHS Trusts, July 2001 to June 2002



*See Table on page 2 for trusts to which numbers refer.

- 5.4 MRSA bacteraemia may be diagnosed following colonisation and progression to bacteraemia during the same admission or following the development of bacteraemia in a patient colonised prior to the admission in which the bacteraemia was diagnosed. Colonisation may have occurred, during a previous admission to the same or to a different hospital or in the community. The bacteraemia rates reported here represent the sum of these possibilities, and the proportion of all MRSA bacteraemias diagnosed that are due to colonization and the development of bacteraemia within the hospital during the same admission is unknown. In a recent study nasal carriage was reported to account for 82% of *Staphylococcus aureus* bacteraemia in patients in an intensive care unit⁶. However the study did not record how many of the patients who went on to develop bacteraemias were colonized during the current admission.
- 5.5 A recent study has looked specifically for evidence of clusters of MRSA among new cases of both colonization and infection after admission. Grundmann and colleagues undertook a cohort study of risk factors for transmission of MRSA in an adult intensive care unit⁷. This was combined with modelling to ascertain the potential impact of preventive measures. In this study patients were screened for MRSA on admission and twice weekly thereafter, and typing of isolates by pulsed field gel electrophoresis was performed. They report specifically on clustered and sporadic cases of MRSA finding that 23/45 new isolates occurred within three clusters. On multivariate analysis only 'relative staff deficit' was significantly associated with clustered cases, while sporadic cases had different risk profiles relating to events that preceded admission to the ITU e.g. 'admitted urgently', surgery prior to ITU admission, airway management prior to ITU admission, 'underwent bronchoscopy'. The authors estimate mathematically that a 12% increase in adherence to hand hygiene policies might have compensated for staff shortages but comment that 'this would be hard to achieve'.
- 5.6 Recent papers^{8,9} have drawn attention to the ability of *Staphylococcus aureus* to evolve continuously, developing resistance in response to the use of new antibiotics. The first case of vancomycin-resistant *Staphylococcus aureus* was reported in July 2002¹⁰. In the USA some community strains of MRSA have distinct PFGE patterns and lack resistance to multiple drugs⁹. Hiramatsu et al¹¹ comment: '*S.aureus* could be one of the most dexterous microorganisms in exchanging useful genetic information with other bacterial species, and although it presents us with ever-challenging infections, we should never stop appreciating the *S aureus* evolutionary 'plot' that is unfolding before us.' A major, urgent and continuing challenge is to develop and implement effective antibiotic control policies, and to monitor adherence to these. The publication of the 'Antimicrobial Resistance Strategy and Scottish Action Plan'¹² is an initial step towards this achieving these goals.

Acknowledgements

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