

# THE INCIDENCE OF *S. AUREUS* BACTERAEMIA IN ACUTE HOSPITALS OF THE MID-WESTERN AREA, IRELAND, 2002-2004

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Concerns about healthcare-associated infections and the global crisis in antimicrobial resistance has combined to accentuate the fears around so-called 'superbugs'. In Ireland there is no single agreed indicator regarded as a true measure of the level of methicillin resistant *Staphylococcus aureus* (MRSA) in hospitals. The objective of this study was to compare two crude measures of MRSA – the percentage of bacteraemia caused by MRSA and the incidence rate (per 1000 bed days used) of MRSA bacteraemia in six acute hospitals. We examined all blood cultures positive for *S. aureus* (methicillin sensitive and resistant) from 2002 to 2004 in the Health Service Executive (HSE) Mid-Western Area of Ireland. Hospital In-Patient Enquiry (HIPE) data was used to determine monthly in-patient bed days used. Of 245 patient episodes of bacteraemia, 119 were MRSA. The trends in the percentage of isolates that were MRSA and the incidence rate calculated were compared. The incidence rate appears to be a more reliable and robust indicator of MRSA in hospitals than the percentage. Despite many difficulties in interpreting indicators of MRSA they should not preclude the regular publication of data at least at regional level in Ireland.

Euro Surveill 2005; 10(5): 75-7

Published online May 2005

**Key words:** Bacteraemia, hospital, incidence, MRSA, *S. aureus*

## Introduction

Healthcare associated infections represent an enormous challenge to patient care in the Irish hospital and healthcare system. This issue is further compounded by the increase in antimicrobial resistance in Ireland and around the world. There is rising concern in Ireland about what are commonly perceived as 'superbugs'. Methicillin resistant *Staphylococcus aureus* (MRSA) is a topic that has dominated headlines in medical journals for three decades. The public have genuine concerns about the 'level' of MRSA in the institutions that deliver healthcare and the consequences of the organism for patients. Infections with MRSA may require treatment with parenteral second-line antimicrobials, possibly more expensive and toxic, necessitating prolonged hospital stay [1]. Bacteraemia is an important indicator of bloodstream infection. In many cases these infections are healthcare-associated or hospital-acquired infections [2]. There is a lack of consensus as to how to define hospital-acquired infections and how to measure MRSA in Irish hospitals. Two measures often quoted include the percentage of *S. aureus* isolates that are MRSA and the incidence rate of *S. aureus* (and MRSA) expressed per 1000 bed days used. In contrast to the United Kingdom, in Ireland there is little data published and readily available on *S. aureus* bacteraemia and specifically MRSA bacteraemia. The results of surveillance of bacteraemia due to *S. aureus* are seen as indicators of the extent of MRSA in hospitals [3]. This study examines how representative two measures for MRSA bacteraemia are in the Mid-Western Area – the percentage of isolates MRSA and the incidence rate of MRSA bacteraemia expressed per 1000 hospital bed days.

## Methods and Materials

Cases of *S. aureus* bacteraemia were identified from blood cultures investigated at the Microbiology Laboratory at the Mid-Western Regional Hospital, Limerick. This laboratory provided the blood culture service for all acute hospitals in the region in 2002-2004 (St. John's Hospital, since July 2002). Cases were exclusively blood cultures (including those taken through intravascular devices) and did not include any fluids (e.g., knee aspirates) that may have been cultured in the same manner. No duplicates were included, first isolates were taken but this did not exclude cases where MRSA bacteraemia followed an MSSA bacteraemia. Non-residents of the HSE Mid-Western Area were not excluded from analyses. All patient episodes were assigned to the hospital referring the sample to the laboratory. The incidence rate of bacteraemia is the number of new bacteraemia episodes expressed per in-patient bed days used over a period. These data were extracted from the Laboratory Information System at the Mid-Western Regional Hospital.

Data on inpatient bed days used were kindly provided by the HIPE Department of the Mid-Western Regional Hospital and St. John's Hospital, Limerick, Ireland.

## Abbreviations:

Hospital 1	Mid-Western Regional Hospital Ennis, Co. Clare
Hospital 2	Mid-Western Regional Hospital, Limerick City
Hospital 3	Mid-Western Regional Hospital Nenagh, Co. Tipperary
Hospital 4	Mid-Western Regional Maternity Hospital, Limerick City
Hospital 5	Mid-Western Regional Orthopaedic Hospital, Co. Limerick
Hospital 6	St John's Hospital, Limerick City
MSSA	Methicillin sensitive <i>S. aureus</i>
MRSA	Methicillin resistant <i>S. aureus</i>

## Results

Data on 245 episodes of *S. aureus* bacteraemia were collected for the three years January 2002 to December 2004. Table 1 shows the number of MSSA and MRSA bacteraemia in each year by hospital and the average percentage of MRSA in each centre over the three years. Overall in the region, the percentage of bacteraemia caused by MRSA was 44% in 2002, 56% in 2003 and 48% in 2004. Table 2 shows the relative size and activity in each of the hospitals in the area. Hospital 2, the largest hospital, recorded the highest number of patients with *S. aureus* bacteraemia in the area and the incidence rate has fallen each year unlike the percentage which rose from 42% in 2002 to 54% in 2003. In isolation, the percentage MRSA in Hospital 3 and Hospital 5 appear similar but the incidence rate for both hospitals [TABLE 2] shows the level of MRSA to be very different. The annual incidence rate in Hospital 3 is rising from 2002 to 2004.

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TABLE 1

Number of patients with *S. aureus* bacteraemia (MRSA and MSSA) by year and hospital and % MRSA in HSE Mid-Western Area, Ireland, 2002-2004

Patient episodes of bacteraemia (MRSA/MSSA)													
Hospital	2002		Total	2003		Total	2004		Total	2002-4		Total	% MRSA
	MRSA	MSSA		MRSA	MSSA		MRSA	MSSA		MRSA	MSSA		
1	4	5	9	4	3	7	4	2	6	12	10	22	54.5
2	31	43	74	25	21	46	20	30	50	76	94	170	44.7
3	5	3	8	6	0	6	9	4	13	20	7	27	74.1
4	0	0	0	0	4	4	1	0	1	1	4	5	20
5	2	1	3	0	0	0	1	0	1	3	1	4	75
6	0	2	2*	4	3	7	3	5	8	7	10	17	41.2
ALL	42	54	96	39	31	70	38	41	79	119	126	245	48.6

\* Data for 2002 incomplete.

TABLE 2

Incidence rate (per 1000 bed days used - BDU) and percentage bacteraemia due to MRSA by hospital, Ireland, 2002-2004

Hospital	Beds	2002			2003			2004		
		BDU	Incidence	%MRSA	BDU	Incidence	%MRSA	BDU	Incidence	%MRSA
1	88	28 661	0.140	44	29 888	0.134	57	32 422	0.123	67
2	426	113 134	0.274	42	121 629	0.206	54	125 074	0.160	40
3	75	25 117	0.199	62	25 468	0.236	100	26 653	0.338	69
4	80	29 919	0.000	0	28653	0.000	0	26 201	0.038	100
5	68	12 886	0.155	67	12 348	0.000	0	12 510	0.080	100
6	95	28 710	0.000*	0*	26 852	0.149	57	26 784	0.112	38
ALL (95% CI)**	882	23 8427	0.176 (0.12-0.23)	44 (33-55)	24 4838	0.159 (0.11-0.21)	56 (43-68)	249 644	0.152 (0.10-0.20)	48 (37-60)

\* Data for 2002 incomplete.

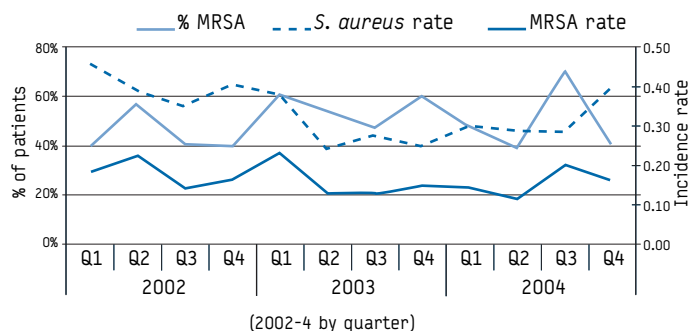
\*\* 95% confidence intervals (95% CI) for aggregate data.

The annual trend in % MRSA in hospitals from 2002 to 2004 are opposite to the trend shown by the incidence rate. In the largest hospital in the area the crude annual incidence rate of MRSA bacteraemia has fallen 40% over the three years. Year on year for the region there is no significant difference between annual incidence rates or percentage MRSA at the 5% level.

Figure 1 compares the percentage of patients with *S. aureus* bacteraemia that were MRSA and the incidence rate (per 1000 bed days used) of patients with bacteraemia due to MRSA and all *S. aureus* in the Mid-Western Area from 2002 to 2004 by quarter. Aggregate data merges opposite trends in MRSA from hospitals. While there is little change in the incidence rate of MRSA bacteraemia in the area, the rate of all *S. aureus* bacteraemia (including MSSA) fell slightly in 2003 before rising again in late 2004. Up to early 2003 the two measures appear very similar but then the percentage of patients that yield MRSA isolates from bacteraemia fluctuates in the area from quarter to quarter. In one nine-month period the percentage of bacteraemia caused by MRSA rose from 39% to 71% and fell again to 40%. The difference between the two measures is not as obvious at regional level and is probably not statistically significant.

FIGURE

Percentage of patients with *S. aureus* bacteraemia that were methicillin resistant and incidence rate (per 1000 bed days used) of patients with *S. aureus* bacteraemia (MRSA and all *S. aureus*), in HSE Mid-Western Area, Ireland, 2002-2004



## Discussion

In Ireland, bacteraemia caused by *S. aureus* became a statutorily notifiable disease from January 2004. In the United Kingdom, the publication of the incidence of *S. aureus* bacteraemia (including MRSA) has been mandatory since April 2001. The publication of incidence rates for Trusts and hospitals in England, Wales, Scotland and Northern Ireland has proved informative.

Interventions designed to reduce antibiotic resistance and control MRSA in hospitals are vital to minimise morbidity and mortality due to infections caused by resistant organisms. Prudent antibiotic usage, handwashing/hand disinfection, active screening, contact precautions and environmental hygiene are key aspects to minimising MRSA in hospitals. Consistent and comparative measures will be required to evaluate such interventions. The strategy for control of antimicrobial resistance in Ireland (SARI) outlines considerable data on the surveillance, infrastructure and burden of disease in Ireland as well as proposals for the implementation of future strategies to control antimicrobial resistance [1]. It is suggested that studies that link information on interventions to control and prevent MRSA with resistance rates at the level of the hospital, region or both, may increase our understanding of the nature of the MRSA epidemic [4].

Data on *S. aureus* and MRSA bacteraemia are important indicators of healthcare associated infections because they estimate true infections (in the majority of cases) rather than colonisation. The number of cases of MRSA bacteraemia is a small proportion of all MRSA infections but this indicator is less likely to be influenced by bias due to sampling variations between centres (e.g. differential screening policies or sites tested) [5]. Regional variations can occur if there are outbreaks of MRSA. Different types of MRSA may be present in the regions but in Ireland there are no regional data on *S. aureus* bacteraemia published regularly.

An appropriate and consistent measure of the 'level' of MRSA in a hospital is difficult to establish. Measures vary considerably by time and place. It is claimed that MRSA has been endemic in a number of large hospitals in Dublin since the 1980s [1]. Large tertiary healthcare facilities may have higher rates of MRSA given that they provide more specialist services (e.g., dialysis, oncology and intensive care) for patients with complex medical needs. Laboratory methods of antimicrobial susceptibility testing can vary between regions in Ireland and standardisation may minimise this as a cause of variability. Admission and discharge data are often not readily available through laboratory information and communication technology, placing the burden of surveillance on infection control staff. Complete case ascertainment is a crucial aspect of surveillance and electronic data extraction of all cases highlighted issues for surveillance in one hospital.

The percentage of isolates that are MRSA varies widely between different time periods and depends on the type of hospital. The percentage alone does not indicate the number of MRSA bacteraemias.

The incidence rate of MRSA does not show as much variability in time and is better as a measure between hospitals of different size and casemix compared to the percentage of bacteraemia that are MRSA. Peaks in the incidence rate reflect increases in MRSA and not MSSA changes.

The situation is always more complex when percentages and rates are applied to small numbers, such data must not be over-interpreted. Confidence intervals are wide in such circumstances.

Percentage MRSA bacteraemia may be useful at a national 'ecological' level. Data on 477 cases from over 20 Irish hospitals participating in European Antimicrobial Resistance Surveillance System (EARSS) showed the percentage of bacteraemia that are MRSA in Ireland was 42% in 2003. This was much lower than the percentage in the Mid-Western Area (56%). However, the incidence rate of MRSA bacteraemia in the Mid-Western Area in 2003 is the same as the rate nationally (0.16). Objectively, we cannot say that one measure is superior to the other and we may be biased to a measure that shows a less negative aspect. This incidence rate appears reliable and useful for comparative purposes because it takes into account the difference in the relative size of hospitals. However, services and casemix are not equivalent, so unqualified comparisons between hospitals are not as helpful. Indeed the attribution of a case of MRSA bacteraemia to a particular healthcare facility is fraught with problems – carriage of MRSA may have preceded admission or infection may already be advanced on admission to one hospital from another facility. Certain agreed time limits, consistently applied, may make surveillance data more useful and some risk adjustment of crude rates may facilitate comparisons in future. At the very least high quality data on *S. aureus* bacteraemia (including MRSA) should be published regularly by region if not by hospital. It would be useful to determine the trends in the percentage of *S. aureus* bacteraemia due to MRSA compared to trends in the incidence rate per 1000 bed days used in other European countries at national and hospital level as well.

## Acknowledgements

The authors acknowledge the assistance of Trina Dooley and Anne Fitzgerald, HIPE Departments, Limerick and Breda Tuohy, Surveillance Assistant, Department of Public Health. The commitment and dedication of all involved in the multi-disciplinary Infection Control Teams in the Mid-Western Area is acknowledged. The co-operation and work of the staff of the Microbiology Department of the Mid-Western Regional Hospital is greatly appreciated.

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