



NINSS
Partnership

Nosocomial Infection National
Surveillance Service



PUBLIC HEALTH LABORATORY SERVICE
PROTECTING THE POPULATION FROM INFECTION

Surveillance of Hospital-Acquired Bacteraemia

in English Hospitals
1997-2002

A national surveillance
and quality improvement
programme

Nosocomial Infection
National Surveillance
Service (NINSS)

Executive Summary

General

- Between 1st May 1997 and 31st March 2002, information was collected on almost three million patients in 102 participating hospitals. The data for the 96 hospitals that could provide complete information showed that there were 10,871 episodes of bacteraemia in 10,300 patients. Overall, 3.5 patients per 1,000 admissions developed bacteraemia, and the mean bacteraemia rate was 0.6 bacteraemias per 1,000 patient-days.
- There was a wide variation in rates of hospital-acquired bacteraemia between specialties. The highest rates occurred in general, paediatric and neonatal intensive care units (ICUs), and haematology.
- Specialty-specific rates varied considerably between hospitals, particularly for general ICU.
- Five of 30 specialties accounted for 71% of all bacteraemias: general medicine, general surgery, general ICU, haematology, and geriatric medicine.

Associated factors

- Overall, almost two-thirds of bacteraemias of known source were associated with an intravascular device or with device-related infections, such as a catheter-associated urinary tract or ventilator-associated respiratory tract infection.
- Central IV catheters were the commonest source of hospital-acquired bacteraemia.
- The sources of bacteraemia varied between specialties. However, in most specialties device-related sources accounted for at least half of the bacteraemias.
- Preventative measures should be focused on specialties with a high rate and a high proportion of bacteraemias from device-related sources, which it may be possible to reduce by appropriate use and care of devices.
- Over 40% of the isolates causing hospital-acquired bacteraemia were staphylococci (26% *Staphylococcus aureus* and 16% coagulase-negative staphylococci).
- Ten per cent of all hospital-acquired bacteraemias were caused by more than one organism.

Antibiotic resistance

- Over half of *Staphylococcus aureus* were resistant to methicillin (i.e. were MRSA). There was no evidence of vancomycin-resistant *S. aureus*.
- Overall, 7% of all enterococci were resistant to vancomycin. However, resistance to vancomycin varied from 3% for *Enterococcus faecalis* to 17% for *Enterococcus faecium*.
- The high ceftazidime resistance rate for some Gram-negative species may reflect its clinical use. Resistance to ciprofloxacin was relatively common in some Gram-negative bacilli, but other antibiotics were still active.
- Antibiotic policies for treatment of bacteraemia must take into account local resistance patterns.

Regional participation

- Participating hospitals were reasonably well distributed geographically throughout England.

Hospital-acquired infection

Infections acquired in hospital are likely to complicate illness, cause anxiety and discomfort, and can lead to death. Previous studies have indicated that one in ten patients will develop an infection related to their hospital stay¹. It has been estimated that the annual cost nationally of these infections is almost £1 billion².

This report is a summary of the data reported by hospitals participating in the hospital-acquired bacteraemia module provided by the Nosocomial Infection National Surveillance Service (NINSS) between 1st May 1997 and 31st March 2002.

NINSS was established in 1996 to provide information that would help the identification of, and reduction in, the extent of avoidable hospital-acquired infection (HAI). The use of standard surveillance methods by hospitals in England to collect information about infections acquired in hospital provides national data that could be used as a benchmark by hospitals to measure their own performance. Participation in NINSS has been both voluntary and confidential.

Hospital-acquired bacteraemia

Although hospital-acquired bacteraemia has been shown to account for a relatively small proportion (6%) of all infections acquired in hospital, they are undoubtedly associated with significant mortality. The economic impact of these infections is also high: a recent study showed that hospital costs increased fourfold².

Hospital-acquired bacteraemia

Hospitals taking part in the NINSS hospital-acquired bacteraemia (HAB) module include all patients admitted to acute in-patient specialties for more than 24 hours. There is a minimum requirement to carry out surveillance for three consecutive months.

Patients with bacteraemia are identified by a daily review of all positive blood cultures, followed by clinical confirmation. Information from patients with bacteraemia is collected by the infection control team, and includes demographic, infection, and risk factor data. Information from all patients at risk of developing bacteraemia is obtained from the hospitals' Information Department.

This fifth annual report for the hospital-acquired bacteraemia module contains the combined data from all hospitals that have participated in the surveillance. Cumulating these data over time enables more precise estimates of the incidence of infection to be calculated.

References

1. Emmerson AM, Enstone JE, Griffin M *et al*. The second national prevalence survey of infection in hospitals - overview of the results. *J Hosp Inf* 1996; **32**: 175-190.
2. Plowman R, Graves N, Griffin M *et al*. *The socio-economic burden of hospital acquired infection*. London: Public Health Laboratory Service, 1999.

Hospital-acquired bacteraemia rates

This report contains information on 96 of 102 hospitals that participated in the surveillance of hospital-acquired bacteraemia (HAB) from 1st May 1997 to 31st March 2002, and were able to provide complete data. These hospitals have contributed data for varying periods of time, ranging from three months (the minimum required) to a maximum of five years.

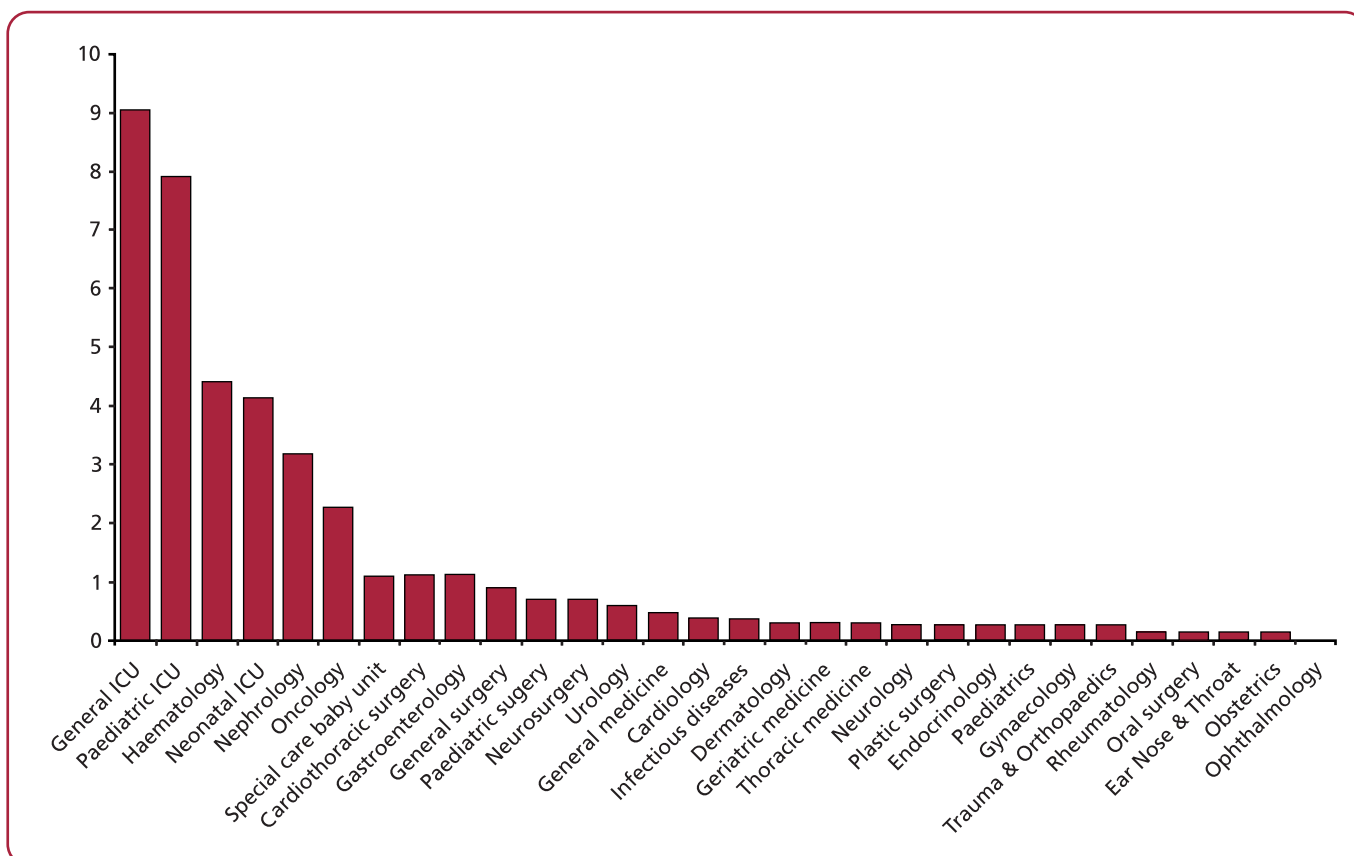
Of 2,905,679 patients included in the surveillance, 10,300 developed one or more episodes of HAB (3.5 patients per 1,000 admissions). Overall, 17,755,465 patient-days and 10,871 episodes of HAB were reported, giving a mean pooled rate of 0.6 bacteraemias per 1,000 patient-days.

This section gives information about the number and rate of HAB for acute specialties and high risk units included in the surveillance.

Figure 1.1 shows the distribution of HAB rates (i.e. the number of HABs per 1,000 patient-days) by specialty.

The specialty designation has been used to classify patients into groups with a similar risk of bacteraemia. However, this does not take into account other factors that also influence the risk of acquiring bacteraemia, such as severity of illness, immunosuppression, or invasive devices.

Figure 1.1 Rates of hospital-acquired bacteraemia by specialty



Key summary point

There was a wide variation in rates of hospital-acquired bacteraemia between specialties. The highest rates occurred in general, paediatric and neonatal intensive care units (ICUs), and haematology.

Table 1.1 gives information about the number and rate of bacteraemia by specialty, together with the range for each rate.

Table 1.1 Hospital-acquired bacteraemia by specialty

Type of specialty	No. Hospitals	No. HABs	HAB Rate *	Range
General ICU	85	1,500	9.1	0 - 112.3
Paediatric ICU	12	77	7.9	0 - 27.5
Haematology	72	899	4.4	0 - 13.9
Neonatal ICU	14	109	4.2	0 - 21.7
Nephrology	26	299	3.2	0 - 15.6
Oncology	33	313	2.3	0 - 12.8
Special care baby unit	72	323	1.1	0 - 34.9
Cardiothoracic surgery	22	159	1.1	0 - 2.6
Gastro-enterology	29	115	1.1	0 - 11.0
General surgery	88	1,938	0.9	0 - 2.4
Paediatric surgery	14	16	0.7	0 - 4.9
Neurosurgery	14	87	0.7	0 - 2.7
Urology	79	354	0.6	0 - 3.6
General medicine	87	2,388	0.5	0 - 3.2
Cardiology	51	109	0.4	0 - 18.5
Infectious diseases	10	24	0.4	0 - 1.1
Dermatology	35	15	0.3	0 - 10.7
Geriatric medicine	74	973	0.3	0 - 2.7
Thoracic medicine	25	33	0.3	0 - 3.5
Neurology	37	44	0.2	0 - 1.8
Plastic surgery	24	20	0.2	0 - 1.2
Endocrinology	7	4	0.2	0 - 9.1
Paediatrics	81	195	0.2	0 - 3.3
Gynaecology	81	94	0.2	0 - 16.7
Trauma & Orthopaedics	86	352	0.2	0 - 2.2
Rheumatology	45	10	0.1	0 - 3.2
Oral surgery	47	5	0.1	0 - 0.8
Ear Nose & Throat	63	16	0.1	0 - 0.8
Obstetrics	78	70	0.1	0 - 0.7
Ophthalmology	45	0	0.0	0 - 0.0

*No. HABs per 1000 patient-days

Key summary points

Specialty-specific rates varied considerably between hospitals, particularly for general ICU.

Five of 30 specialties accounted for 71% of all bacteraemias: general medicine, general surgery, general ICU, haematology, and geriatric medicine.

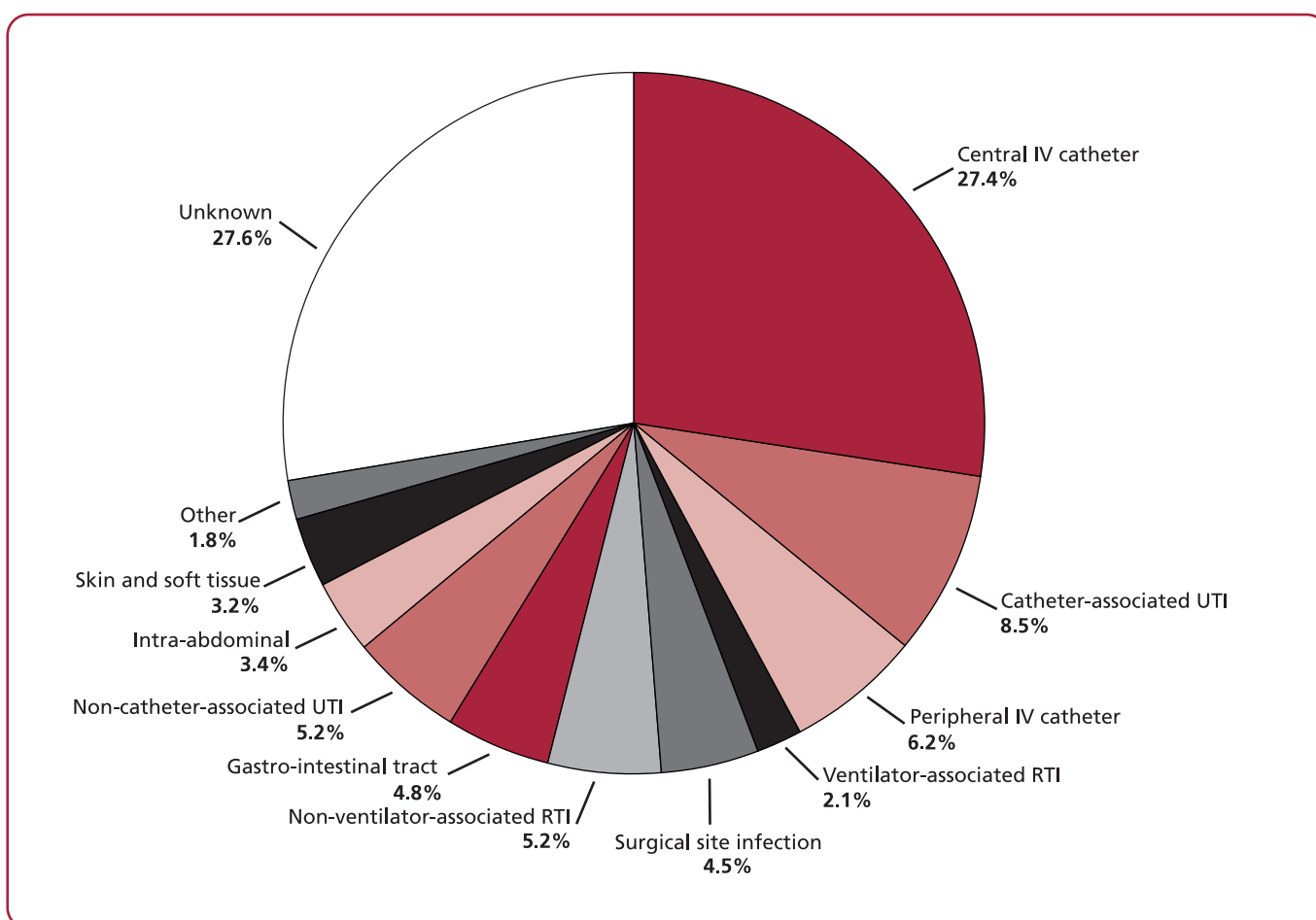
Sources of hospital-acquired bacteraemia

This section gives information about the sources of bacteraemia. Of 10,871 episodes of HAB, the source was identified in 7,867 (72%).

Figure 2.1 shows the overall sources of bacteraemia for all participating hospitals combined. The distribution of known sources for specialties where the total number of bacteraemias was 30 or more is given in Figure 2.2.

This information may indicate where preventative measures should be targeted.

Figure 2.1 Sources of hospital-acquired bacteraemia



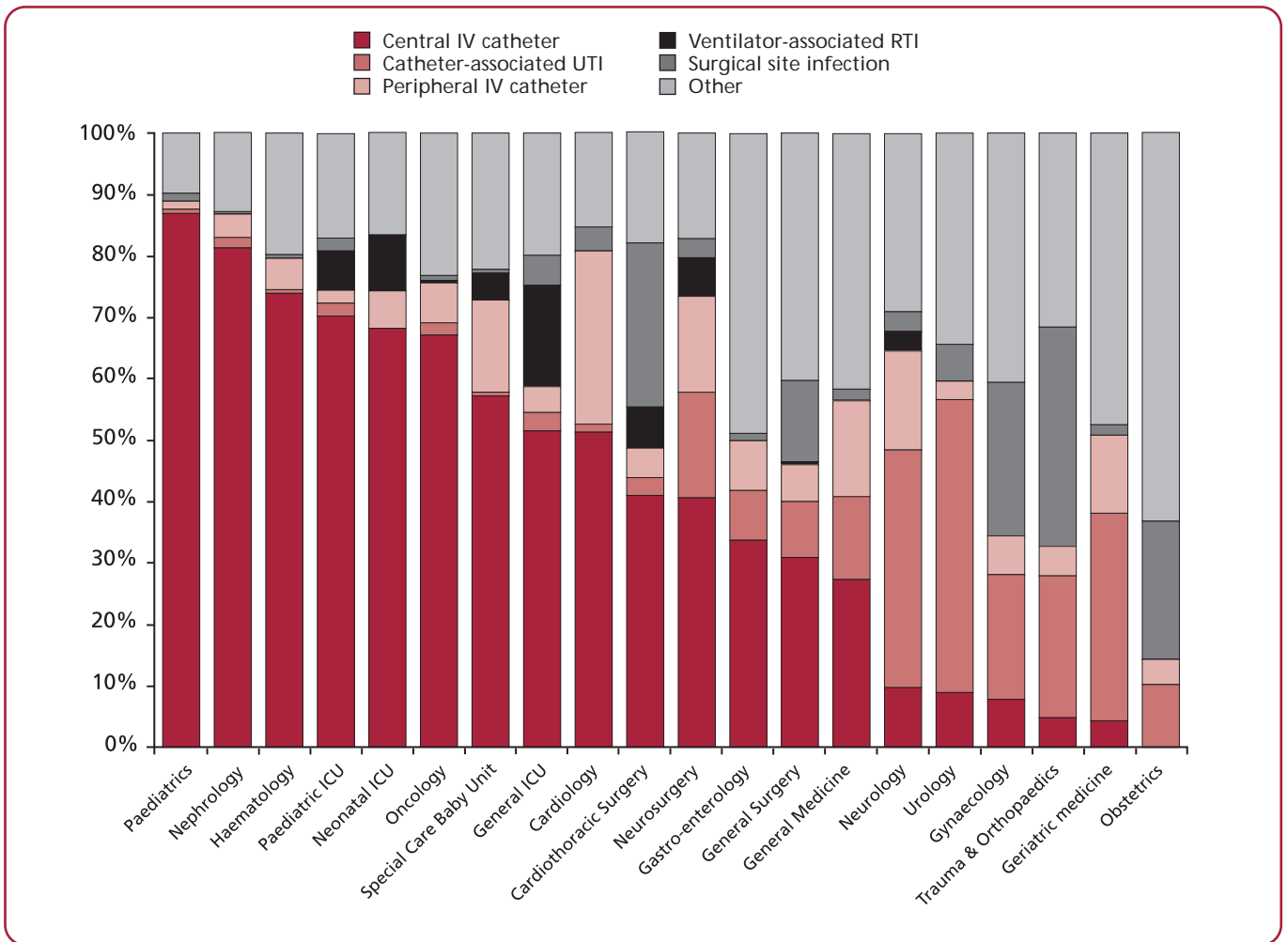
Abbreviations: IV, intravascular; UTI, urinary tract infection; RTI, respiratory tract infection

Key summary points

Overall, almost two-thirds of bacteraemias of known source were associated with an intravascular device or with device-related infections, such as a catheter-associated urinary tract or ventilator-associated respiratory tract infection.

Central IV catheters were the commonest source of hospital-acquired bacteraemia.

Figure 2.2 Known sources of hospital-acquired bacteraemia by specialty



Key summary points

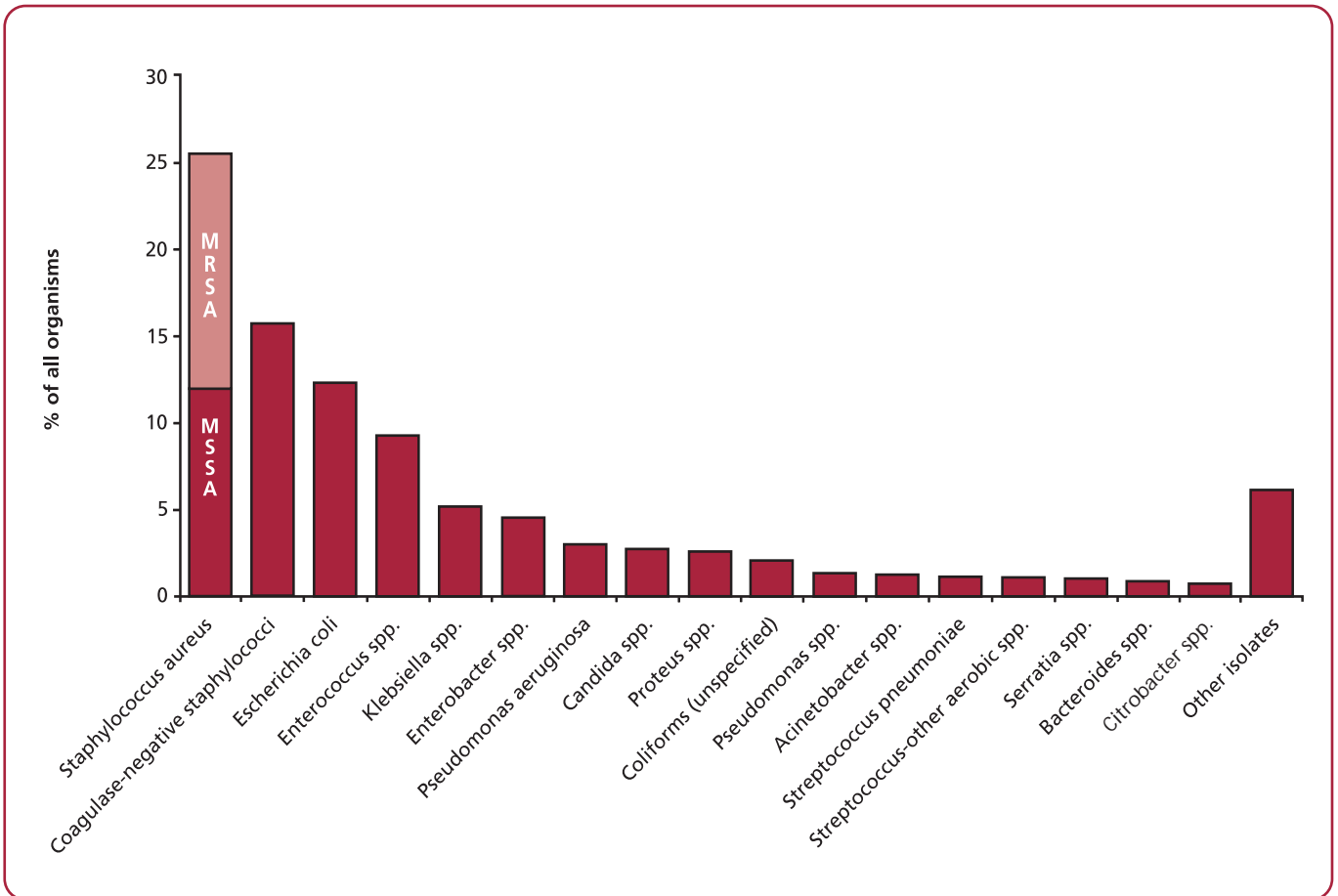
The sources of bacteraemia varied between specialties. However, in most specialties device-related sources accounted for at least half of the bacteraemias.

Preventative measures should be focused on specialties with a high rate and a high proportion of bacteraemias from device-related sources, which it may be possible to reduce by appropriate use and care of devices.

Micro-organisms causing hospital-acquired bacteraemia

This section gives information about the micro-organisms causing hospital-acquired bacteraemia.

Figure 3.1 Micro-organisms causing hospital-acquired bacteraemia



Key summary points

Over 40% of the isolates causing hospital-acquired bacteraemia were staphylococci (26% *Staphylococcus aureus* and 16% coagulase-negative staphylococci).

Ten per cent of all hospital-acquired bacteraemias were caused by more than one organism.

Antibiotic resistance of micro-organisms causing hospital-acquired bacteraemia

This section gives information about the resistance of organisms that most commonly cause bacteraemia to antibiotics of current interest. Micro-organisms were not always tested against all the antibiotics.

Table 4.1 Antibiotic-resistant staphylococci

Antibiotic	Species	No. tested	Resistant	
			No.	%
Methicillin	<i>Staphylococcus aureus</i>	3,044	1,634	54
	Coagulase-negative staphylococci	1,635	1,089	67
Vancomycin	<i>Staphylococcus aureus</i>	2,501	0	0
	Coagulase-negative staphylococci	1,658	8	<1
Gentamicin	Methicillin-sensitive <i>Staphylococcus aureus</i>	1,252	12	1
	Methicillin-resistant <i>Staphylococcus aureus</i>	1,383	177	13
Ciprofloxacin	Methicillin-sensitive <i>Staphylococcus aureus</i>	574	48	8
	Methicillin-resistant <i>Staphylococcus aureus</i>	1,086	1,038	96

Table 4.2 Antibiotic-resistant enterococci

Antibiotic	Species	No. tested	Resistant	
			No.	%
Ampicillin	<i>Enterococcus faecalis</i> *	441	50	11
	<i>Enterococcus faecium</i>	174	149	86
	Other enterococci	306	115	38
Gentamicin	<i>Enterococcus faecalis</i>	216	115	53
	<i>Enterococcus faecium</i>	89	62	70
	Other enterococci	201	125	62
Vancomycin	<i>Enterococcus faecalis</i>	425	12	3
	<i>Enterococcus faecium</i>	184	31	17
	Other enterococci	329	19	6
Vancomycin & Gentamicin	<i>Enterococcus faecalis</i>	195	3	2
	<i>Enterococcus faecium</i>	88	16	18
	Other enterococci	186	2	1

* Some of these organisms, reported as *Enterococcus faecalis*, may not be because this species is rarely ampicillin resistant.

Key summary points

Over half of *Staphylococcus aureus* were resistant to methicillin (i.e. were MRSA). There was no evidence of vancomycin-resistant *S. aureus*.

Overall, 7% of all enterococci were resistant to vancomycin. However, resistance to vancomycin varied from 3% for *Enterococcus faecalis* to 17% for *Enterococcus faecium*.

Section 4

Table 4.3 Gram-negative bacilli resistant to gentamicin and ceftazidime

Species	Gentamicin			Ceftazidime			Gentamicin & Ceftazidime		
	No. tested	Resistant		No. tested	Resistant		No. tested	Resistant	
		No.	%		No.	%		No.	%
<i>Escherichia coli</i>	1,486	61	4	910	25	3	880	10	1
<i>Klebsiella</i> spp.	623	36	6	420	41	10	412	24	6
<i>Enterobacter</i> spp.	551	45	8	382	129	34	372	25	7
<i>Pseudomonas aeruginosa</i>	403	21	5	323	15	5	317	3	1
<i>Proteus</i> spp.	289	7	2	167	2	1	158	1	1
<i>Acinetobacter</i> spp.	176	33	19	128	61	48	118	14	12
<i>Serratia</i> spp.	151	1	1	115	9	8	113	0	0

Table 4.4 Gram-negative bacilli resistant to amikacin, imipenem/meropenem, and ciprofloxacin

Species	Amikacin			Imipenem/ Meropenem			Ciprofloxacin		
	No. tested	Resistant		No. tested	Resistant		No. tested	Resistant	
		No.	%		No.	%		No.	%
<i>Escherichia coli</i>	366	10	3	834	4	<1	1,401	120	9
<i>Klebsiella</i> spp.	196	5	3	387	0	0	600	57	10
<i>Enterobacter</i> spp.	165	3	2	342	4	1	531	65	12
<i>Pseudomonas aeruginosa</i>	106	3	3	271	24	9	393	49	12
<i>Proteus</i> spp.	68	1	1	135	1	1	276	7	3
<i>Acinetobacter</i> spp.	70	14	20	132	9	7	179	64	36
<i>Serratia</i> spp.	42	1	2	93	1	1	143	31	22

Key summary points

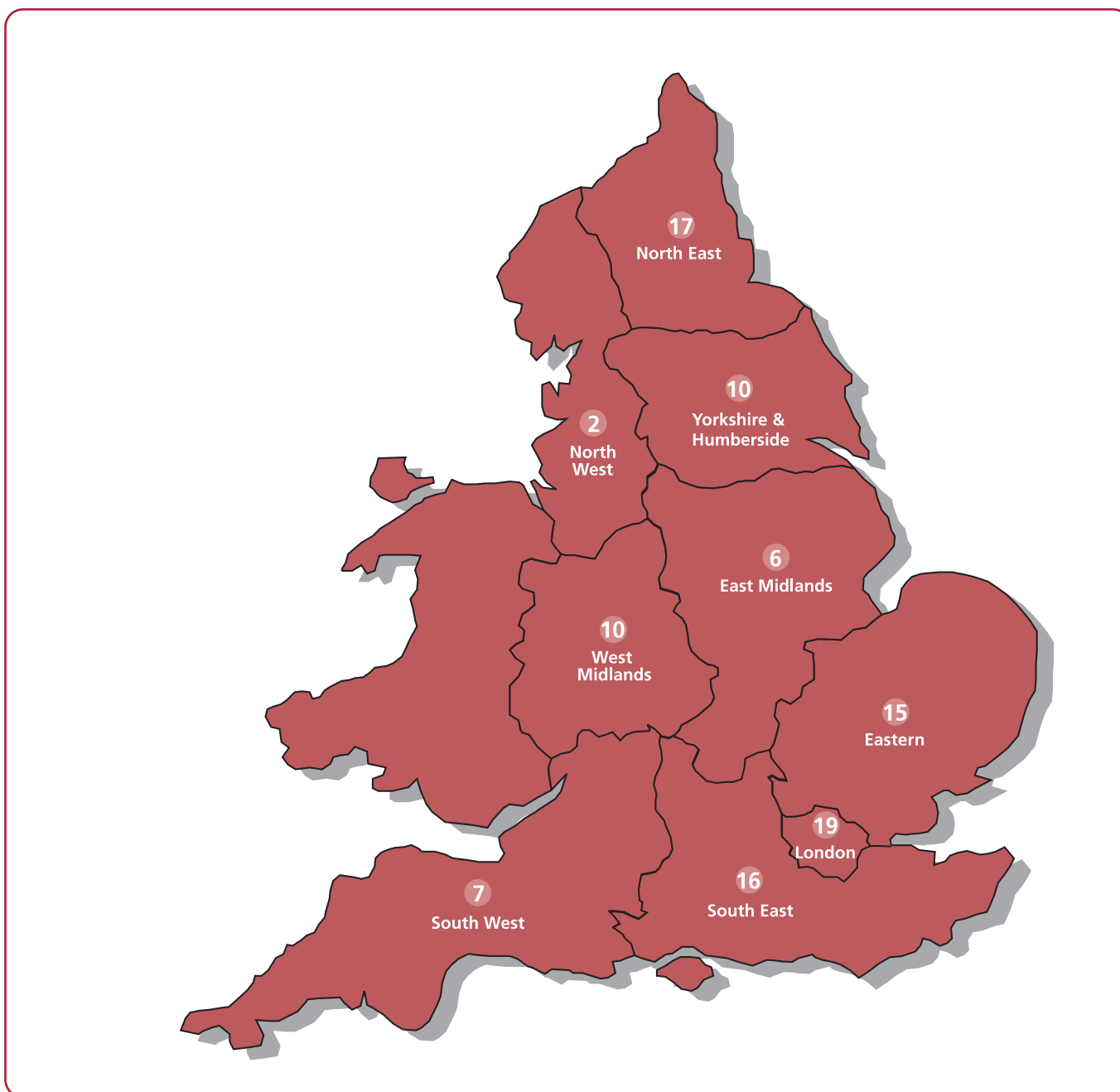
The high ceftazidime resistance rate for some Gram-negative species may reflect its clinical use. Resistance to ciprofloxacin was relatively common in some Gram-negative bacilli, but other antibiotics were still active.

Antibiotic policies for treatment of bacteraemia must take into account local resistance patterns.

Hospitals participating in the surveillance of hospital-acquired bacteraemia

This section gives information about the distribution by Region of the 102 NHS hospitals that participated in the surveillance of hospital-acquired bacteraemia in the period under review. These figures cannot be directly compared with previous HAB Annual Reports due to regional boundary changes in 2002.

Figure 5.1 Number of hospitals participating in the surveillance by Region



Key summary point

Participating hospitals were reasonably well distributed geographically throughout England.

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