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Enhanced surveillance reports on surgical site infection and hospital acquired bacteraemia published



The two reports *Surveillance of surgical site infection in English hospitals* and *Surveillance of hospital acquired bacteraemia in English hospitals* have recently been issued by the Nosocomial Infection National Surveillance Service (NINSS) provided by the PHLS (1,2). The reports summarise the data sent by participating hospitals to the nosocomial infection surveillance unit of the PHLS between 1997 and 2000. NINSS aims to facilitate the collection and use of surveillance data in order to improve patient care, by identifying and reducing avoidable hospital acquired infection. The infection rates derived from this national database provide a benchmark against which participating hospitals can compare their results.

The report on the surveillance of surgical site infection provides information on 2074 infections identified following 48,522 operations in 113 hospitals. Methicillin-resistant *Staphylococcus aureus* (MRSA) was the most common staphylococcus identified in six out of eight of the major categories of surgery investigated. Forty per cent of the total surgical infections identified were caused by *S. aureus*, 59% of which were MRSA.

The report on the surveillance of hospital acquired bacteraemia summarises information on 5,503 hospital acquired bacteraemias collected by 71 participating hospitals. The surveillance coverage totalled more than 1.55 million patients during 9.5 million patients days. MRSA accounted for nearly half the *S. aureus* isolates, that in total comprised 25% of the bacteraemias reported.

As in the two previously published reports (3), there was a wide variation in the rates of both hospital acquired and surgical site infection and of hospital acquired bacteraemia when the outcomes from different hospitals were compared in similar groups of patients. The results from the national surveillance service continue to demonstrate specific areas and patient groups where performance indicates that review of local practice could improve the quality of patient care.

Some hospitals were able to report a subsequent reduction in incidence of infection after instigating changes in clinical practice (for example, adherence to prophylaxis guidelines) following the identification of higher than average rates of infection. In addition to improving the quality of patient care, prevention of hospital acquired infection can effect reductions in both antibiotic resistance and hospital costs.

PDF files of the report are available from <http://www.phls.org.uk/publications/NINSS.htm>

1. Nosocomial Infection National Surveillance Scheme. *Surveillance of surgical site infection in English hospitals 1997-1999*. London: PHLS, 2002.

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Incidence of group B streptococcal disease in infants aged less than 90 days

In order to obtain an estimate on the incidence of group B streptococcal disease (GBS) disease in infants in the United Kingdom (UK) a 13 month study initiated by the PHLS Group B Streptococcus Working Group was undertaken between 1 February 2000 and 28 February 2001 (1,2). Other objectives of the study were to determine the clinical presentation, the mortality, serotype distribution, and antimicrobial susceptibilities of GBS isolates. Paediatricians were asked to report, via the British Paediatric Surveillance Unit (BPSU), all cases of definite GBS invasive disease, *ie* isolation from a normally sterile site, such as blood or cerebrospinal fluid (CSF). Microbiologists were encouraged to report cases to the PHLS Communicable Disease Surveillance Centre and submit all isolates to the PHLS Streptococcus and Diphtheria Reference Unit for typing. Finally, parents of cases were able to notify cases to the study through the GBS Support Charity's website <www.gbss.org.uk>.

A provisional total of 537 cases of invasive disease were confirmed: 67% were aged under 7 days (early onset disease, EOD) and 33% were aged between 7 and 90 days (late onset disease, LOD) with an overall mortality rate of 9.4%. This suggests an estimated overall minimum incidence of 0.7/1000 live births for the UK. For England the overall minimum incidence is 0.8/1000 live births (95% CI 0.7-0.9), EOD 0.5 (0.5-0.6); and for Wales 0.6 / 1000 (0.4-0.9), EOD 0.4 (0.2-0.7). The most common modes of presentation of EOD were sepsis (62%) and pneumonia (26%), and for LOD, meningitis (42%) and sepsis (41%). The predominant serotypes were Ia/c (27%), III (48%), and V (10%) – 3% were serologically non-typable. All GBS isolates were susceptible to penicillin, ampicillin, cefotaxime, glycopeptides, and rifampicin. Fourteen isolates (4.2%) were resistant to erythromycin; of these, 11 had erythromycin MICs of between 1 and 4 mg/L and were susceptible to clindamycin, and three had erythromycin MICs of 16 mg/L and were resistant to clindamycin. Approximately 90% of the isolates were resistant to tetracycline.

This is the first comprehensive national surveillance study of GBS in the UK and it indicates that GBS is the leading cause of serious bacterial infection in young infants. These data will help to formulate guidelines for prevention. The serotype distribution indicates that a limited range of serotypes is responsible for the majority of cases. Ongoing surveillance of type distribution remains essential in informing future development of GBS conjugate vaccines and evaluating their potential impact subsequent to implementation of a vaccination programme. GBS isolates remain fully sensitive to penicillin and ampicillin, which are commonly used in prevention and treatment. Clindamycin remains suitable as prophylaxis for individuals who are allergic to penicillin.

Ongoing GBS studies undertaken by the Working Group include a study of maternal GBS carriage, a case control study addressing the risk factors for disease and the long-term neurodevelopmental outcome of disease and a health economic analysis of GBS disease and of prevention strategies. Financial support for these studies comes from the Meningitis Research Foundation. The Group has also produced interim guidelines for GBS prevention which can be viewed on the PHLS website at <<http://www.phls.org.uk/advice/goodpracticeStrepto.pdf>>.

1. CDSC. Group B Streptococcus Working Group. *Commun Dis Rep CDR Wkly* 1998; **8** (50):439, 442.

2. CDSC. Enhanced surveillance of neonatal group B streptococcal disease. *Commun Dis Rep CDR Wkly* 2000; **10** (3): 21.

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US tourist dies from yellow fever

A 47 year old male from Texas, USA has died from yellow fever following a fishing trip on the Rio

Negro, near Manaus in Brazil. The date of onset of symptoms was 10 March 2002 – the patient was admitted to hospital two days later, but died on 16 March. The traveller was unvaccinated (1). The reason for his non-vaccination is not known. It is likely that, as yellow fever vaccination is not mandatory for entry to Brazil, that he did not seek medical advice. It is, however, possible that a travel clinic advised him that vaccination was not necessary, or that he had a contraindication to the vaccine.

This is the sixth reported death in unvaccinated travellers from yellow fever since 1996, and the third associated with this area of Brazil (2). Manaus is in Amazonas State and it is recommended that travellers to this area be vaccinated, although it is not an entry requirement.

Brazil currently recommends vaccination in travellers to endemic areas including rural areas in Acre, Amapa, Amazonas, Goias, Maranhao, Mato Grossa, Mato Grosso do Sul, Pará; and Rondônia, Roraima, and Tocantins, and certain areas of Minas Gerais, Parana, and Sao Paulo. At present, this does not include the tourist cities of Brazilia, Rio, Sao Paulo and Recife. A yellow fever vaccination certificate is only an entry requirement for travellers to Brazil if they are entering from an infected area, and are over 9 months of age (3).

This, and previous incidents show how important it is that those travelling to endemic zones are vaccinated against yellow fever which, although rare in travellers, is still a potentially fatal disease.

1. WHO. Notifications of diseases received from 5 to 11 April 2002. *Wkly Epidemiol Rec* 2002; **15**: 124. Available at <<http://www.who.int/wer/pdf/2002/wer7715.pdf>>

2. PHLS. Yellow fever and travel. *Commun Dis Rep CDR Wkly* [serial online] 2002 [cited 18 April 2002]; **12** (14): travel health. Available at <www.phls.org.uk/publications/CDR%20Weekly/archive02/travelarchive02.html#yellowf>

3. Lea G and Leese J, editors. *Health information for overseas travel*. 2nd ed. London: The Stationery Office, 2001. ISBN 0-11-322329-3. Available at <<http://www.archive.official-documents.co.uk/document/doh/hinfo/index.htm>>

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Bacteraemia

Last updated: 18 April 2002

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Pyogenic and non-pyogenic streptococcal bacteraemias, England and Wales: 2001

Key points:

- Rates of reports of group A, B, C, and G streptococcal bacteraemia in 2001 were similar to 1999 and 2000.
- Rates of 'Streptococcus mitis group' bacteraemia reported in 2001 have increased from 1.1 per 100,000 in 1999, to 1.3 per 100,000 population.
- Rates of both pyogenic and non-pyogenic bacteraemia were highest in infants and in those aged 65 years and over, with the exception of group B streptococcal bacteraemias that were concentrated in those under 1 year.
- Rates of streptococcal bacteraemia in males generally exceeded those in females across all age groups.
- Pyogenic streptococci remained susceptible to penicillin in 2001.
- Resistance to erythromycin was reported in 4% of group A, 5% of group B, 7% of group C and 14% of group G streptococcal bacteraemias.
- Tetracycline resistance was high in all pyogenic streptococcal groups, from 10% in group A streptococci to 70% of group B, but reporting was not as good as for penicillin or erythromycin susceptibility.
- Two group A streptococcal bacteraemia isolates, 10 group B isolates and 8 group G isolates were reported as resistant to both erythromycin and tetracycline .
- Although reporting of antimicrobial susceptibilities was poor for non-pyogenic streptococci in 2001, improvements were made on 2000.
- Inclusion of clinical information would substantially improve the value of invasive streptococcal reports.

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Pyogenic and non-pyogenic streptococcal bacteraemias, England and Wales: 2001

Key points

- Rates of reports of group A, B, C, and G streptococcal bacteraemia in 2001 were similar to 1999 and 2000.
- Rates of 'Streptococcus mitis group' bacteraemia reported in 2001 have increased from 1.1 per 100 000 in 1999, to 1.3 per 100 000 population.
- Rates of both pyogenic and non-pyogenic bacteraemia were highest in infants and in those aged 65 years and over, with the exception of group B streptococcal bacteraemias that were concentrated in those under 1 year.
- Rates of streptococcal bacteraemia in males generally exceeded those in females across all age groups.
- Pyogenic streptococci remained susceptible to penicillin in 2001.
- Resistance to erythromycin was reported in 4% of group A, 5% of group B, 7% of group C and 14% of group G streptococcal bacteraemias.
- Tetracycline resistance was high in all pyogenic streptococcal groups, from 10% in group A streptococci to 70% of group B, but reporting was not as good as for penicillin or erythromycin susceptibility.
- Two group A streptococcal bacteraemia isolates, 10 group B isolates and 8 group G isolates were reported as resistant to both erythromycin and tetracycline.
- Although reporting of antimicrobial susceptibilities was poor for non-pyogenic streptococci in 2001, improvements were made on 2000.
- Inclusion of clinical information would substantially improve the value of invasive streptococcal reports.

This review brings together data on all routine laboratory reporting of streptococcal bacteraemia, with the exception *Streptococcus pneumoniae*, covered last year in two reports (1,2). Pyogenic streptococci have been grouped according to traditional Lancefield serological groupings (1), and non-pyogenic streptococci according to their biochemical and genetic properties and based on current taxonomy.

All laboratory reports described refer to isolations of streptococci from blood culture, with or without related cerebrospinal fluid (CSF) isolates, from specimens collected in 2001. Rates are calculated using resident population denominators from 2000 for each corresponding age and regional office boundary respectively.

Pyogenic streptococci

Two thousand four hundred and thirty-three bacteraemias caused by pyogenic streptococci were reported in England and Wales in 2001 (table 1). Group B streptococci (*S. agalactiae*) were the most common amongst the pyogenic streptococci (898 reports), closely followed by 839 reports of group A streptococci (*S. pyogenes*). There were 542 reports of group G streptococci, and fewest reports were those received for group C (reported as *S. equi*, *S. dysgalactiae* and *S. equisimilis*), with only 154 reports.

Group A streptococcal bacteraemia

Regional distribution

The largest number of reports of group A streptococcal bacteraemia from any one region in 2001 was 150 from South East region, and the lowest (33) was from Wales (table 2). The overall reporting rate for England and Wales was 1.58 per 100 000 population, with rates varying from 1.12 /100 000 in Wales, to 2.22 /100 000 in the Eastern region (figure 1). This is similar to the overall rate of 1.6/100 000 in 2000, but with a marked reduction in the Welsh rate.

Antimicrobial susceptibility

Of the 839 group A streptococcal bacteraemia reports received for 2001, 584 (70%) were accompanied by susceptibility data. The most commonly reported susceptibility was to penicillin, included in 68% (571) of group A streptococcal bacteraemia reports, followed by erythromycin (64%; 535), ampicillin/amoxycillin (45%; 375), vancomycin (36%; 301), tetracycline (33%; 274).

Most English regions and Wales reported penicillin susceptibility for over 60% of group A streptococcal bacteraemias. Trent (56%) and the West Midlands (54%) were the only regions to fall below that figure. All isolates were reported as being sensitive to penicillin, apart from three reports that have not been validated and are undergoing further investigations.

Reporting of erythromycin susceptibility in group A streptococcal bacteraemia isolates was slightly poorer across all regions than for penicillin, with the most complete reporting coming from the Eastern region (88%). Twenty-four (4%) of 535 group A streptococcal bacteraemias with susceptibility data reported for 2001 were identified as erythromycin-resistant (table 3). Northern and Yorkshire region reported the highest proportion – 9% (4/42) of group A streptococcal bacteraemia isolates as erythromycin-resistant, closely followed by Eastern, with 7% (7/107). Of the 24 erythromycin-resistant reports, two were also reported as tetracycline-resistant (table 4). Twenty-four of the 248 erythromycin-sensitive reports also tested against tetracycline were reported to be tetracycline-resistant.

Ten per cent (28/274) of group A streptococcal bacteraemia isolates tested against tetracycline were reported as resistant (table 3). Two of 26 tetracycline-resistant isolates tested for erythromycin susceptibility were found to be resistant to both antibiotics (table 4). A

Table 1 Laboratory reports of streptococcal bacteraemia: England and Wales, 2001

Pyogenic streptococci	2433	'mutans group'	30
group A streptococci	839	<i>Streptococcus mutans</i>	30
group B streptococci	898		
group C streptococci	154	'salivarius group'	138
group G streptococci	542	<i>Streptococcus salivarius</i>	121
		<i>Streptococcus vestibularis</i>	17
'anginosus group'	429	'sanguinis group'	223
<i>Streptococcus anginosus</i>	140	<i>Streptococcus gordonii</i>	14
<i>Streptococcus constellatus</i>	96	<i>Streptococcus sanguinis</i>	7
<i>Streptococcus intermedius</i>	68	<i>Streptococcus parasanguinis</i>	23
'Streptococcus milleri group'	101	'Streptococcus sanguinis group'	179
Streptococcus group F	24		
'bovis group'	184	Other streptococci	935
<i>Streptococcus bovis</i>	138	<i>Streptococcus acidominimus</i>	33
<i>Streptococcus bovis</i> biotype I	20	<i>Streptococcus suis</i>	1
<i>Streptococcus bovis</i> biotype II	12	<i>Streptococcus uberis</i>	5
<i>Streptococcus equinus</i>	13	'anaerobic streptococcus'	40
<i>Streptococcus saccharolyticus</i>	1	<i>Streptococcus</i> sp	856
'mitis group'	698	Genera closely related to streptococci	24
<i>Streptococcus mitis</i>	10	<i>Abiotrophia defectiva</i>	4
<i>Streptococcus oralis</i>	227	<i>Leuconostoc</i> sp	19
'Streptococcus mitis group'	461	<i>Pediococcus</i> sp	1

Table 2 Pyogenic streptococcal bacteraemia laboratory reports by region, England and Wales: 2001

Region	group A streptococci	group B streptococci	group C streptococci	group G streptococci
Northern and Yorkshire	85	97	20	49
Trent	78	86	14	58
Eastern	121	130	16	71
London	100	79	18	36
South East	150	161	23	94
South West	92	109	17	70
West Midlands	104	107	20	94
North West	76	78	14	40
Wales	33	51	12	30
England and Wales	839	898	154	542

Table 3 Antibiotic susceptibility data for pyogenic streptococcal bacteraemia reports: England and Wales, 2001

	Resistant (%)	Sensitive(%)	(R as % S + R of S + R)	No Information (%)
group A streptococci (n=839)				
penicillin	–	571 (68%)	571 (0%)	268 (32%)
erythromycin	24 (2.9%)	511 (61%)	535 (4%)	304 (36%)
tetracycline	28 (3.3%)	246 (29%)	274 (10%)	565 (67%)
group B streptococci (n=898)				
penicillin	0 (0%)	584 (65%)	584 (0%)	314 (35%)
erythromycin	29 (3%)	530 (59%)	559 (5%)	339 (38%)
tetracycline	195 (22%)	84 (9%)	279 (70%)	619 (69%)
group C streptococci (n=154)				
penicillin	–	103 (67%)	103 (0%)	51 (33%)
erythromycin	6 (4%)	84 (55%)	90 (7%)	64 (42%)
tetracycline	16 (10%)	36 (23%)	52 (31%)	102 (66%)
group G streptococci (n=542)				
penicillin	–	357 (66%)	357 (0%)	185 (34%)
erythromycin	47 (9%)	291 (54%)	338 (14%)	204 (38%)
tetracycline	84 (16%)	111 (20%)	195 (43%)	347 (64%)

* three reports of penicillin resistance in group A streptococcal, three in group B, and five in group G were received, but as yet unconfirmed

Figure 1 Region-specific rates of group A streptococcal bacteraemia, England and Wales: 2001

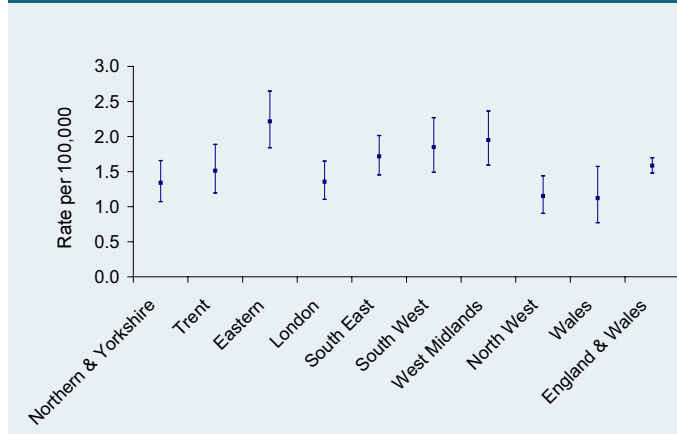
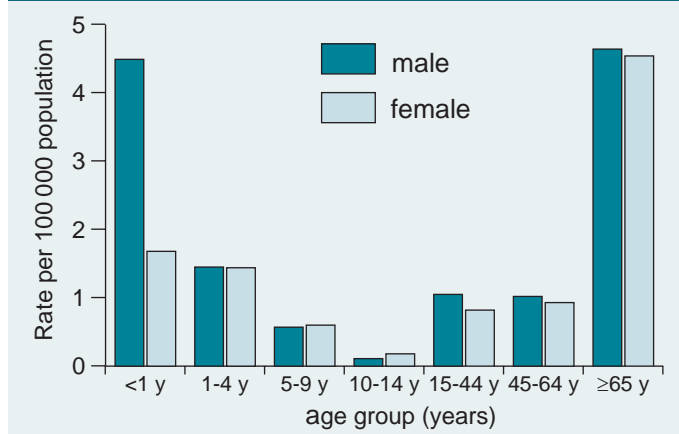


Figure 2 Age-specific rates of group A streptococcal bacteraemia reports, England and Wales: 2001



lower proportion of tetracycline-sensitive than tetracycline-resistant isolates were resistant to erythromycin.

All group A streptococcal isolates were reported as vancomycin-sensitive.

Age distribution

Rates of group A streptococcal bacteraemias in males were highest in the young and elderly age groups: 4.49 per 100 000 population for those aged under 1 year, and 4.64/100 000 in those aged 65 and over (figure 2). Females aged 65 and over had a similar high rate (4.54/100 000) to males, but the rate in females aged under 1 year (although higher than in any female age group other than those aged 65 and over) was considerably lower than for males in the same age group, at only 1.68 /100 000.

Group B streptococcal bacteraemia

Regional distribution

The South East region reported 161 group B streptococcal bacteraemias in 2001, the greatest number reported by a single region (table 2). Wales had the least, with only 51 reports. Region-specific rates ranged from 2.38 per 100 000 population for the Eastern region to 1.07/100 000 in London (figure 3). The overall rate for England and Wales was 1.70/100 000.

Antimicrobial susceptibility

Two-thirds (603/898) of group B streptococcal bacteraemia reports were accompanied by antibiotic susceptibility

information in 2001. Penicillin and erythromycin were most commonly reported, with data for 65% (584) and 62% (559) of isolates reported respectively (table 3). Just under half (47%; 423) of group B streptococcal bacteraemia reports were accompanied by ampicillin/amoxycillin susceptibility results, and approximately a third contained vancomycin (34%; 308) or tetracycline results (31%; 279).

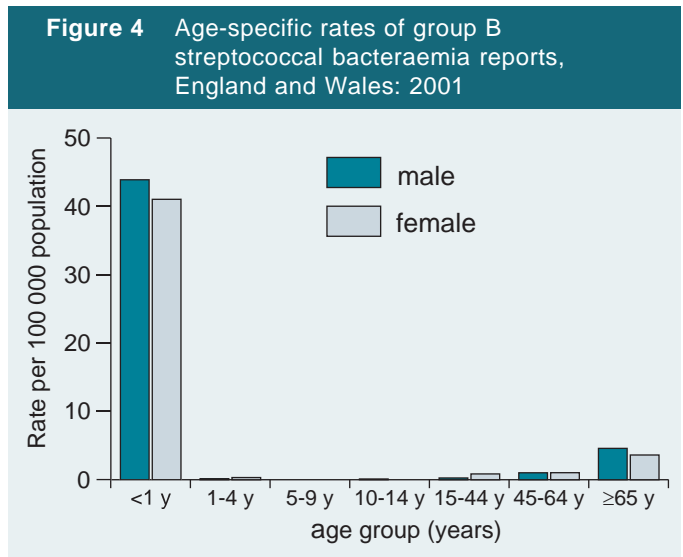
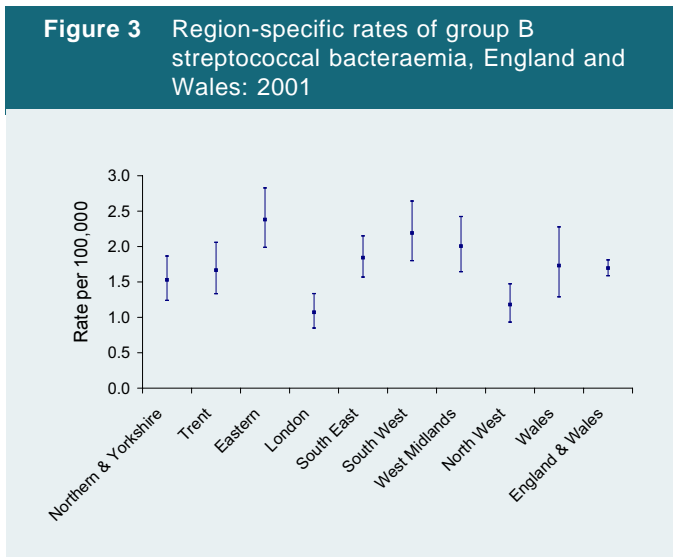
There was even more marked regional variation in the reporting of penicillin resistance in group B streptococci than group A, with Trent (44%) and the West Midlands (45%) again having the lowest completion rates for these data. Although three reports of penicillin-resistant group B streptococcal bacteraemia were received in 2001, as for the group A reports, these remain unconfirmed.

As with group A streptococcal bacteraemia reports, information on erythromycin susceptibility was generally less commonly reported than for penicillin. Eastern region had the highest level of completeness (90%), all other regions and Wales giving information in between 38% and 82% of reports.

Five per cent (29/559) of group B streptococcal bacteraemia isolates in 2001 were reported as erythromycin-resistant, a similar proportion to group A streptococcal bacteraemia (table 3). There were quite marked regional variations in resistance, from 2% (1/49) in the North West to 10% in Wales (4/42). Twelve of the 29 erythromycin-resistant isolates were also tested for tetracycline susceptibility (table 5); all but two (83%) were resistant. A slightly lower proportion of erythromycin-

Table 4 Multiple antibiotic resistance patterns for group A streptococcal bacteraemia laboratory reports, England and Wales: 2001

		Erythromycin			Tetracycline		
		resistant (%)	sensitive	no info	resistant (%)	sensitive	no info
Erythromycin	resistant (n=24)	2 (8%)	24	2	2 (17%)	10	12
	sensitive (n=511)	10 (4%)	224	12	24 (10%)	224	263
Tetracycline	resistant (n=28)	2 (8%)	24	2			
	sensitive (n=246)	10 (4%)	224	12			



sensitive isolates were tetracycline-resistant (180/262). Seventy per cent (195/279) of group B streptococcal bacteraemia isolates were reported as tetracycline-resistant, a much higher proportion than for any other pyogenic streptococcal group. Ten of 190 (5%) tetracycline-resistant reports were reported as erythromycin-resistant, compared to 2 of 84 (2%) tetracycline-sensitive reports (table 5). No reports of vancomycin-resistant group B streptococcal bacteraemia were received in 2001.

Age distribution

Reports of group B streptococci were concentrated in those under 1 year of age, with the rate for males being 43.90 per 100 000 population, and 41.04/100 000 in females (figure 4). Reports were lower in subsequent age groups, rising to 4.59 in males and 3.62/100 000 in females aged 65 and over.

Group C streptococcal bacteraemia

Regional distribution

The number of reports of group C streptococci ranged from 23 in the South East to 12 in Wales. The rate of group C bacteraemia in England and Wales was 0.29 per 100 000 population, with similar rates among the regions (figure 5).

Antimicrobial susceptibility

Ninety-eight of the 154 group C streptococcal bacteraemia reports in 2001 were accompanied by antimicrobial susceptibility information. Completeness of antimicrobial

susceptibility was similar to the other pyogenic groups (table 3), aside from erythromycin results that were received in 58% (90) of reports. Penicillin susceptibility was given in 67% (103) of group C streptococcal reports, with 34% (52) including tetracycline susceptibility.

Seven per cent (6/90) of group C streptococcal reports with information on erythromycin susceptibility indicated erythromycin-resistance, and 31% (16/52) indicated tetracycline resistance (table 3). No penicillin or vancomycin-resistant reports for group C streptococcal bacteraemia were received.

Age distribution

There were very few reports of group C streptococci in those under 15 (figure 6). After this age, rates increased to a peak of 1.07 per 100 000 population in males and 0.89 per 100 000 population in females aged 65 plus. In all age groups, rates of group C streptococcal bacteraemia were higher in males than females.

Group G streptococcal bacteraemia

Regional distribution

The South East and West Midlands reported the greatest number of group G bacteraemias in 2001 (94), and Wales the least (30) (table 2). The lowest rate was in London, and the highest in the West Midlands (0.49 and 1.76 per 100 000 population respectively). The overall rate of group G streptococcal bacteraemias was 1.02/100 000 in England and Wales (figure 7).

Table 5 Multiple antibiotic resistance patterns for group B streptococcal bacteraemia laboratory reports, England and Wales: 2001

		Erythromycin			Tetracycline		
		resistant (%)	sensitive	no info	resistant (%)	sensitive	no info
Erythromycin	resistant (n=29)				10 (83%)	2	17
	sensitive (n=530)				180 (69%)	82	268
Tetracycline	resistant (n=195)	10 (5%)	180	5			
	sensitive (n=84)	2 (2%)	82	-			

Figure 5 Region-specific rates of group C streptococcal bacteraemia, England and Wales: 2001

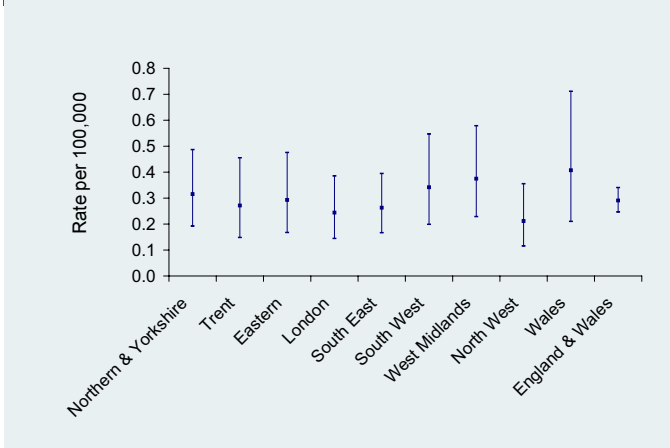


Figure 6 Age-specific rates of group C streptococcal bacteraemia reports, England and Wales: 2001



Antimicrobial susceptibility

Of the 542 reports of group G streptococcal bacteraemia received for 2001, 368 (68%) were accompanied by results of susceptibility to any antimicrobial. Levels of susceptibility reporting for each key antibiotic were very similar to those for group A and group B streptococci (table 3), with 66% (357) and 62% (338) of reports being accompanied by information on penicillin and erythromycin susceptibility results respectively, just under a half (247) for ampicillin/amoxycillin and just over a third for vancomycin (192) and tetracycline (195).

Most English regions and Wales reported penicillin susceptibility for over half of group G streptococcal bacteraemia reports, with Eastern region nearing completion at 97%. Reporting from Trent was again poor (28%). Five unconfirmed reports of penicillin-resistant group G streptococcal bacteraemia were received for 2001. One of these was also reported as resistant to other agents tested (erythromycin, tetracycline, penicillin and vancomycin).

Erythromycin resistance was reported in 47 (14%) of group G streptococcal bacteraemia reports tested against this antibiotic (table 3). Reporting of erythromycin susceptibility was more complete in all regions than

amoxycillin/ampicillin, with Eastern region nearing completeness (93%). Reports from Trent were low at 24%. All regions reported erythromycin-resistance in group G streptococcal isolates, generally at around 1 in 10. Eastern, and Northern and Yorkshire regions reported considerably higher erythromycin-resistance, in a fifth and a quarter of isolates respectively. Eight of 19 of the erythromycin-resistant isolates were reported as tetracycline-resistant (table 6). A similar proportion of erythromycin-sensitive isolates were found to be tetracycline-resistant (44%; 74/168).

Tetracycline-resistance was reported in 43% (84/195) of all group G streptococcal bacteraemia isolates in England and Wales in 2001 (table 3). Ten per cent of both tetracycline resistant and sensitive isolates were also reported as erythromycin-resistant (table 6).

Age distribution

In contrast to the other pyogenic streptococci, reports of group G bacteraemia in younger age groups were higher in females than males (figure 8), but this was reversed in the higher age groups. The highest rate in both males and females was in those aged 65 years and over, and the second highest rates in those aged under one year.

Figure 7 Region-specific rates of group G streptococcal bacteraemia, England and Wales: 2001

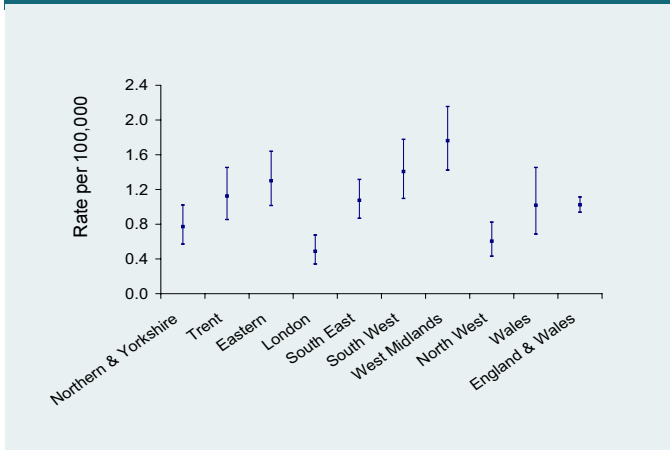


Figure 8 Age-specific rates of group G streptococcal bacteraemia reports, England and Wales: 2001

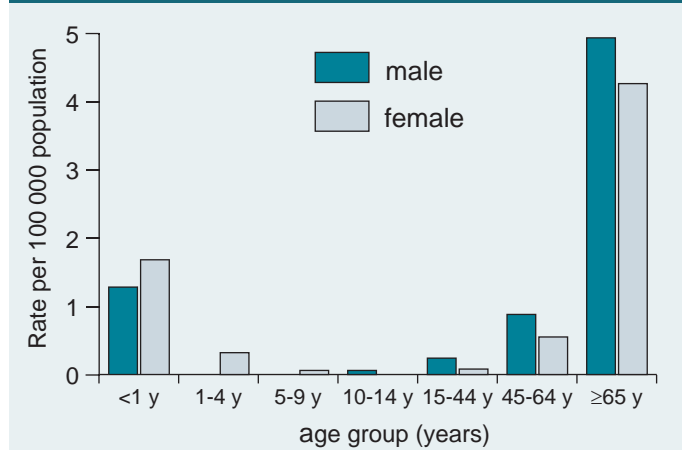


Table 6 Multiple antibiotic resistance patterns for group G streptococcal bacteraemia laboratory reports, England and Wales: 2001

		Erythromycin			Tetracycline		
		resistant (%)	sensitive	no info	resistant (%)	sensitive	no info
Erythromycin	resistant (n=47)				8 (42%)	11	28
	sensitive (n=291)				74 (44%)	94	123
Tetracycline	resistant (n=84)	8 (10%)	74	2			
	sensitive (n=111)	11 (10%)	94	6			

Non-pyogenic streptococci

The 'Streptococcus mitis group' were most common among non-pyogenic bacteraemias, with 698 reports (table 7). The next most common was the 'anginosus group', with 429 reports. The other 'groups' all had under 250 reports for 2001: 'sanguinis group' 223, 'bovis group' 184, 'salivarius group' 138, and the 'mutans group' 30. Among the other streptococci, there were 33 reports of *S. acidominimus*, five reports of *S. uberis*, and one of *S. suis*.

There were 896 reports of streptococci that were not fully identified. There were also reports of genera related to streptococci: four reports of *Abiotrophia defectiva*, 19 of *Leuconostoc* sp, and one of *Pediococcus* sp.

Regional distribution

The highest overall rate in England and Wales for any of the non-pyogenic streptococci was 1.32 per 100 000 population for the 'mitis group'. The next was 0.81/100 000 for the 'anginosus group', followed by 0.42/100 000 in the 'sanguinis group'. The lowest rates were in the 'bovis group' (0.35/100 000) and 'salivarius group' (0.26/100 000) (figures 9 to 13).

The position of each region relative to the other regions varied according to the 'group' involved. Some trends are, however, discernible. For example, London and Wales both have one of the lowest three rates in all of the non-pyogenic 'groups'. Trends are less clear among the high rates, although the North West has the highest rate for both the 'mitis' and 'salivarius groups', and the South West and West Midlands each appear above the average for the whole of England and Wales for four out of the five 'groups'.

Antimicrobial susceptibility

Of all non-pyogenic streptococcal groups, antimicrobial reporting was poorest in 'anginosus group' streptococci, with only 21% of reports (91/429) including any susceptibility results. Of these, one was reported as penicillin resistant (1/86) and none as amoxycillin/ampicillin resistant (table 8). Two (2/80) erythromycin and six (6/48) tetracycline-resistant isolates were reported.

'Bovis group' streptococcal bacteraemia reports had the highest antimicrobial susceptibility completion of any non-pyogenic streptococci, 37% (68/184) of reports including any such information. Tetracycline-resistance was reported in over three-quarters (20/26) of 'bovis group' streptococci (table 8). Resistance to amoxycillin/ampicillin and penicillin was reported in 1/54 reports, and to erythromycin in 13/52 reports (table 8).

Just over a quarter (180/698) of 'mitis group' streptococcal bacteraemia reports included information on susceptibility to any antimicrobial. Twenty per cent (33/164) of reports were reported as penicillin-resistant and 6% (7/125) as amoxycillin/ampicillin resistant (table 8). Although only 66 (9%) of reports were accompanied by tetracycline susceptibility, a third were reported as resistant (22). Twenty-eight per cent of 'mitis group' streptococcal reports indicated (43/152) erythromycin resistance.

Thirty-five per cent of the 138 'salivarius group' streptococcal bacteraemias reported in 2001 included antimicrobial susceptibility information. This non-pyogenic group had the highest reported resistance to penicillin, 27% (11/41) of reports indicating this (table 8). Resistance was noted in 1 of 29 isolates to amoxycillin/

Table 7 Non-pyogenic streptococcal bacteraemia laboratory reports by region, England and Wales: 2001

Region	'anginosus group'	'bovis group'	'mitis group'	'salivarius group'	'sanguinis group'
Northern and Yorkshire	45	39	102	17	26
Trent	57	15	33	15	23
Eastern	50	15	56	16	43
London	37	13	68	6	13
South East	66	31	148	22	29
South West	58	21	83	16	15
West Midlands	60	20	76	10	35
North West	38	22	115	30	34
Wales	18	8	17	6	5
England and Wales	429	184	698	138	223

Figure 9 Region-specific rates of 'S. anginosus group' bacteraemia, England and Wales: 2001

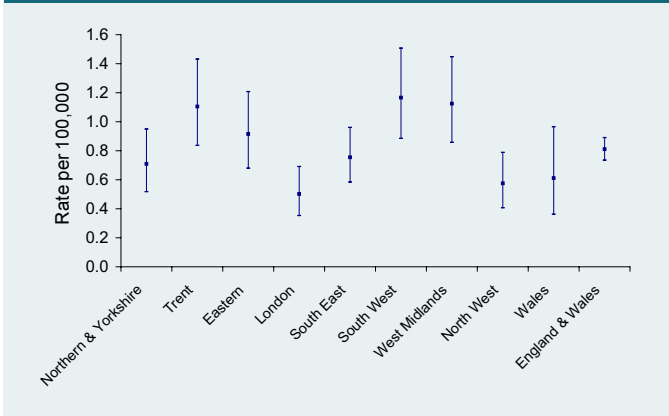


Figure 10 Region-specific rates of 'S. bovis group' bacteraemia, England and Wales: 2001

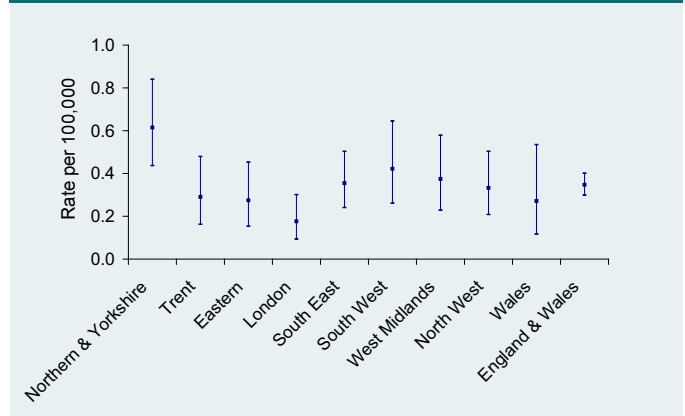


Figure 11 Region-specific rates of 'S. mitis group' bacteraemia, England and Wales: 2001

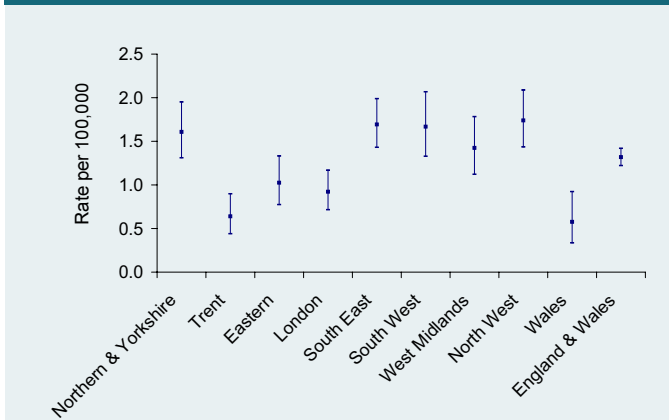
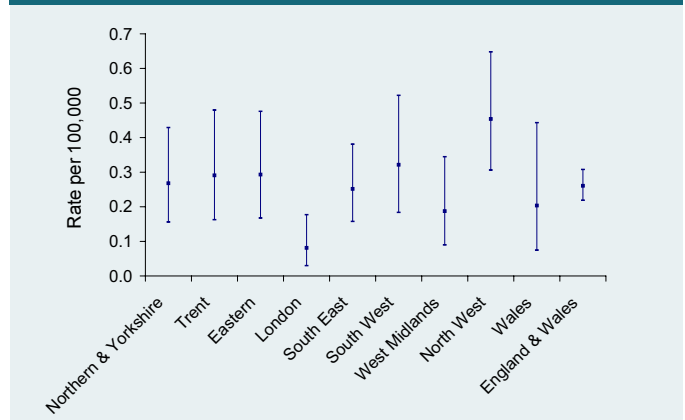


Figure 12 Region-specific rates of 'S. salivarius group' bacteraemia, England and Wales: 2001



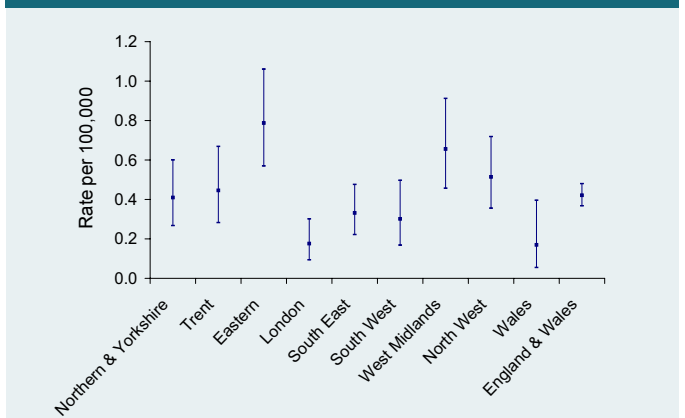
ampicillin, in 2 of 20 isolates to tetracycline, 12 of 39 erythromycin isolates.

Thirty per cent (68/223) of 'sanguinis group' streptococci reports gave information on antimicrobial susceptibility. Sixteen per cent (9/58) of isolates were reported as penicillin-resistant, 15% (8/53) of isolates were reported as erythromycin-resistant, 18% (5/28) as tetracycline-resistant. Six per cent (3/47) of isolates tested against amoxicillin/ampicillin were found to be resistant, higher than for any other non-pyogenic group (table 8).

Age distribution

Across all of the non-pyogenic streptococcal groups, bacteraemia rates were highest in the youngest and oldest age groups, with low rates in the intervening age groups (figures 14 to 18). Which of these age groups had the higher rates depended on both sex and 'group'. For example, in the 'anginosus group' the rate for males was highest in those over 65 years, but in females higher rates were observed in those under 1 year of age (figure 14). This was reversed in the 'salivarius group' (figure 17), where for males a higher rate was observed in the youngest group compared with the oldest (65 years and above), and the opposite was seen for females. For both 'mitis' and 'sanguinis groups', rates were highest in those aged under 1 year, for both males and females. The 'bovis group' had

Figure 13 Region-specific rates of 'S. sanguinis group' bacteraemia, England and Wales: 2001



very few reports in children (only two reports in those aged under 14 years) and consequently had the highest rates in those aged 65 years and above.

In general there were more reports of non-pyogenic streptococci in males than females. There were some exceptions, mostly in the 10 to 14 year age group where the total number of reports tended to be low for both sexes.

Table 8 Antibiotic susceptibility data for non-pyogenic streptococcal bacteraemia reports: England and Wales, 2001

	Resistant (%)	Sensitive(%)	(R as % S + R of S + R)	No Information (%)
'anginosus group' (n=429)				
penicillin	1 (0.2%)	85 (20%)	86 (1%)	343 (80%)
amoxycillin/ampicillin	0 (0.0%)	58 (14%)	58 (0%)	371 (86%)
erythromycin	2 (0.5%)	78 (18%)	80 (3%)	349 (81%)
tetracycline	6 (1.4%)	42 (10%)	48 (13%)	381 (89%)
'bovis group' (n=184)				
penicillin	1 (0.2%)	58 (14%)	59 (2%)	370 (86%)
amoxycillin/ampicillin	1 (0.5%)	53 (29%)	54 (2%)	130 (71%)
erythromycin	13 (7.1%)	39 (21%)	52 (25%)	132 (72%)
tetracycline	20(10.9%)	6 (3%)	26 (77%)	158 (86%)
'mitis group' (n=698)				
penicillin	33 (7.7%)	131 (31%)	164 (20%)	265 (62%)
amoxycillin/ampicillin	7 (1.0%)	118 (17%)	125 (6%)	573 (82%)
erythromycin	43 (6.2%)	109 (16%)	152 (28%)	546 (78%)
tetracycline	22 (3.2%)	44 (6%)	66 (33%)	632 (91%)
'salivarius group' (n=138)				
penicillin	11 (2.6%)	30 (7%)	41 (27%)	388 (90%)
amoxycillin/ampicillin	1 (0.7%)	28 (20%)	29 (3%)	109 (79%)
erythromycin	12 (8.7%)	27 (20%)	39 (31%)	99 (72%)
tetracycline	2 (1.4%)	18 (13%)	20 (10%)	118 (86%)
'sanguinis group' (n=223)				
penicillin	9 (4.0%)	49 (11%)	58 (16%)	371 (86%)
amoxycillin/ampicillin	3 (1.3%)	44 (20%)	47 (6%)	176 (79%)
erythromycin	8 (3.6%)	45 (20%)	53 (15%)	170 (76%)
tetracycline	5 (2.2%)	23 (10%)	28 (18%)	195 (87%)

Otherwise, rates for females were only higher than for males in females aged less than 1 year, and only in the 'anginosus' and 'mitis groups'.

Discussion

The numbers of reports of pyogenic streptococci (groups A, B, C and G) in 2001 were similar to 2000 (2,3), although delayed reporting by laboratories may see some of these numbers increase for 2001. Marked increases in invasive group A streptococcal reports over the 1990s were observed in England and Wales (4), and Scotland (5). The non-pyogenic groups were also generally similar to 2000 in terms of the number of reports received and the reporting rates. An increase was, however, observed in the number of 'streptococcus mitis group' bacteraemias (from 553 in 1999, to 610 in 2000, and 698 in 2001).

For the pyogenic streptococci, antibiotic resistance data were received for between 64% and 70% of reports depending on the pyogenic group, with completeness of reporting worst for group C and best for group A. In general penicillin susceptibility was more often reported than erythromycin, followed by vancomycin and tetracycline. Erythromycin resistance was more commonly reported in group G streptococci than in any other pyogenic group, 14% across England and Wales. Higher rates of tetracycline resistance were noted for all pyogenic streptococci, although susceptibility was given less frequently for this antimicrobial.

Completeness of antibiotic susceptibility reporting for all antibiotics improved in non-pyogenic groups from 2000 (3),

but was still less complete than the pyogenic groups. The non-pyogenic group with the most complete reporting was the 'bovis group', with 37% of reports including susceptibility data. The lowest level of reporting was the 'anginosus group', with only 21% of reports containing this information. Although resistance to penicillin was noted in a high proportion of 'salivarius' (27%), 'mitis' (20%), and 'sanguinis' (16%) group streptococcal bacteraemias, the low overall level of susceptibility information makes this difficult to interpret as there may be a bias towards reporting antimicrobial susceptibilities where resistance is found. A review of streptococcal isolates causing endocarditis referred to CPHL between January 1996 and March 2000 did indicate reduced susceptibility to penicillin in 13% of *Streptococcus oralis*, which largely comprises the 'mitis group', and in 15% and 6% of *S. sanguinis* and *S. gordonii* respectively, key constituents of the 'sanguinis group' (6).

For both pyogenic and non-pyogenic streptococci, age-specific rates of all streptococcal bacteraemias were highest in the youngest and oldest age groups. Rates in males in the 65 and over age group were higher than their female peers in every group. Males also had the higher rates in the under ones age group, except for the 'anginosus' and 'mitis' non-pyogenic groups, and Group G of the pyogenic groups.

The number of referrals of group A streptococcal isolates from invasive disease to the PHLS Streptococcus and Diphtheria Reference Unit (SDRU) at the Respiratory and Systemic Infection Laboratory (RSIL) has increased since 1999. The number of referred isolates remained

Figure 14 Age-specific rates of 'S. anginosus group' bacteraemia reports, England and Wales: 2001

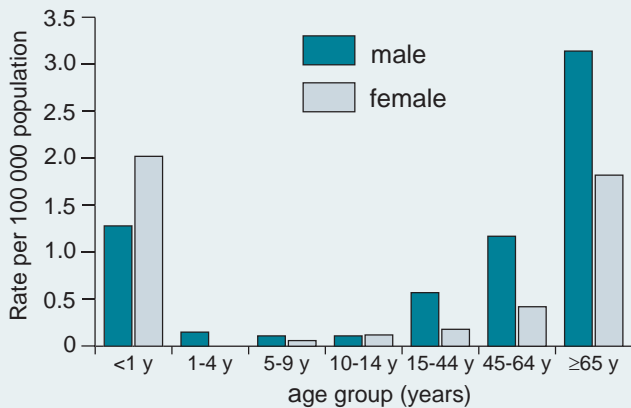


Figure 15 Age-specific rates of 'S. bovis group' bacteraemia reports, England and Wales: 2001

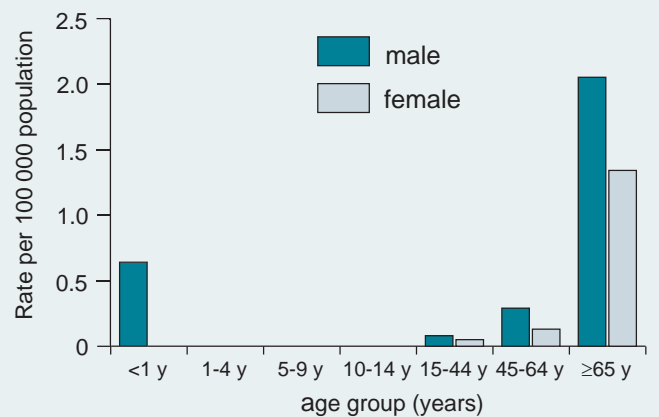


Figure 16 Age-specific rates of 'S. mitis group' bacteraemia reports, England and Wales: 2001

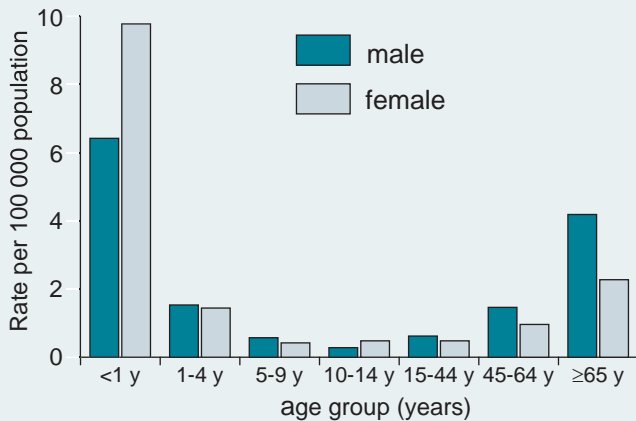


Figure 17 Age-specific rates of 'S. salivarius group' bacteraemia reports, England and Wales: 2001

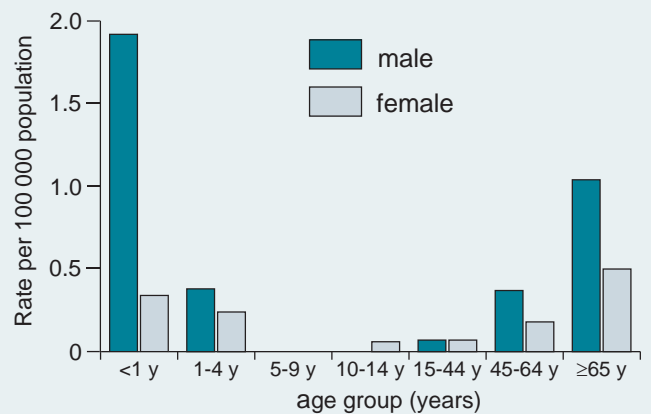
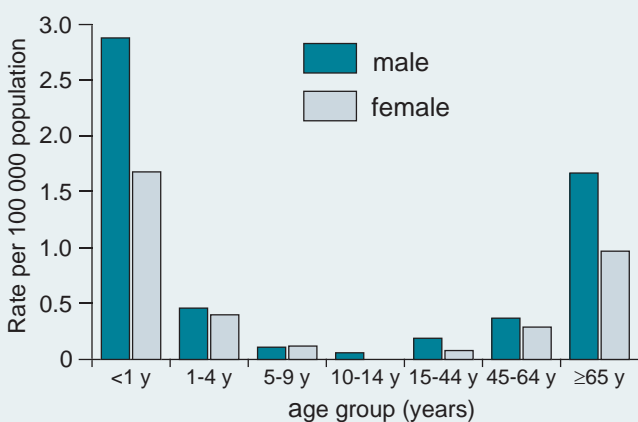


Figure 18 Age-specific rates of 'S. sanguinis group' bacteraemia reports, England and Wales: 2001



stable during 2000 and 2001 (from 515 in 1999 to 781 in 2000, and 719 in 2001). The predominant M types during 2001 were similar to those seen in 2000: M1, M89, R28, M3, and M12. Most notable was the emergence of M89 between 1999 and 2001. Type M1 has predominated during

the last three years, with a peak incidence observed in 2000. It comprised 41% of all referred invasive isolates in 2000, compared to 23% in 2001. As in previous years, it has been noted that, as the numbers of M1 isolates increased so did reports of invasive disease. Epidemiological and microbiological surveillance activities at both a national and global level are essential to determine trends in disease manifestations, type distributions and any changes in antimicrobial susceptibilities.

The lack of clinical information accompanying invasive streptococcal reports made to CDSC severely limited the ability to draw conclusions on the changing incidence of clinical syndromes, such as necrotising fasciitis. Of all 5094 pyogenic and non-pyogenic streptococcal bacteraemia reports described in this review, only 179 contained clinical features. Although results from an enhanced surveillance programme examining invasive group A streptococci laboratory reports suggested that 7% are associated with necrotising fasciitis (7), this should not be extrapolated to current laboratory reports, especially given the changing incidence in serotypes described above.

Laboratories are reminded that all streptococcal isolates from sterile sites should be sent to RSIL for typing, and all isolates with apparently unusual resistance (such as to

penicillin, vancomycin, teicoplanin, quinupristin/dalfopristin, or linezolid) should be sent to ARMRL for confirmation. ARMRL also offers minimum inhibitory concentration (MIC) testing of endocarditis isolates, irrespective of susceptibility.

Acknowledgement

These reports would not be possible without the enduring weekly contributions from microbiology colleagues in laboratories across England and Wales, without which there would be no surveillance data. Laboratory reporting is the bedrock of national surveillance. In addition, the support from colleagues within the PHLS, CPHL in particular, is valued in the preparation of the reports.

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