

# Pyogenic and non-pyogenic streptococcal bacteraemias, England, Wales, and Northern Ireland: 2004

## Key points:

- This report contains data from 2004, derived from routine laboratory reports of streptococcal bacteraemia\* together with enhanced surveillance of group A streptococci derived from a combination of routine laboratory reporting and isolate referrals to the Health Protection Agency Streptococcus and Diphtheria Reference Unit<sup>†</sup>.
- There were 8029 reports of streptococcal and related genera bloodstream infections in 2004 made by laboratories in England, Wales, and Northern Ireland.
- The number of reports of bacteraemia due to pyogenic species decreased slightly between 2003 and 2004, but is expected to increase due to late submission of reports. The number of non-pyogenic bacteraemia reports increased between 2003 and 2004.
- Rates of both pyogenic and non-pyogenic streptococcal bacteraemia reports in males exceeded those for females in most age groups, and were concentrated in those aged under 1 year and those aged over 65 years.
- A higher proportion of reports were accompanied by antibiotic susceptibility data in 2004 than in the previous two years, but reporting rates were still low for some streptococcal species.
- Reported resistance to all antibiotics remained stable in most streptococcal groups.
- There were no confirmed cases of penicillin resistance in pyogenic streptococcal groups.
- Erythromycin resistance in groups B and C streptococci increased between 2003 and 2004, but the rate remained stable in groups A and G streptococci. Resistance to erythromycin varied considerably among non-pyogenic species.
- Reports of tetracycline resistance in group C streptococci increased in 2004; the rate of resistance remained stable or decreased in other pyogenic and non-pyogenic groups.

\*With the exception of *Streptococcus pneumoniae* which is reported separately. <sup>†</sup>Enhanced surveillance of group A streptococci commenced January 2003.

## Introduction

This report covers laboratory reports of *Streptococcus* species and related genera, excluding *Streptococcus pneumoniae*, isolated from blood specimens in England, Wales, and Northern Ireland in 2004. Reports were made on a voluntary basis to the Health Protection Agency's (HPA) Communicable Disease Surveillance Centre (CDSC). As part of the pan-European EU FP5 funded strep-EURO project, enhanced surveillance of severe invasive group A streptococcal (GAS) infections was carried out between 1 January 2003 and 31 December 2004 (1). A satellite database was developed to pool GAS reports submitted to CDSC through routine laboratory surveillance with reports of isolates referred to the HPA Streptococcus and Diphtheria Reference Unit (SDRU). All data were extracted in April 2005 and late submission of reports from 2004 may occur. As such, the data and conclusions remain provisional.

Rates for 2004 were calculated using 2003 mid-year resident population estimates based on the 2001 census for England, Wales, and Northern Ireland. Regional analyses were made with reference to the Government Office Regions introduced in April 2002.

## Pyogenic streptococci

### Group A streptococci

Improved ascertainment as part of enhanced surveillance led to an increase in reported cases of GAS bacteraemia from 1025 cases in 2002, to 1855 in 2003, and 1604 in 2004 (table 1). This corresponded to an increase of 81% between 2002 and 2003 when enhanced surveillance began. A decrease in the number of GAS bacteraemias of 14% from 2003 to 2004 occurred, although further reports are expected.

The rate of bacteraemia due to GAS in England, Wales, and Northern Ireland in 2004 was 2.9 per 100,000 population (95% CI 2.8-3.1), ranging from 1.9/100,000 (95% CI 1.3-2.7) in Northern Ireland to 4.1/100,000 (95% CI 3.6-4.7) in the Yorkshire and the Humber region (table 2). The highest rates of GAS bacteraemia reports were in those aged under 1 year and in adults aged over 65 years (figure 1).

Fewer GAS bacteraemia reports included antimicrobial resistance data in 2004 than in previous years. Of the antimicrobial susceptibility data available, completeness of susceptibility reporting varied by region (tables 3 and 4).

Table 1 Laboratory reports of streptococcal bacteraemia, England, Wales, and Northern Ireland: 2002-2004				
<i>Streptococcus</i> spp*		2002	2003	2004
Pyogenic streptococci	group A streptococci† group B streptococci group C streptococci group G streptococci <b>Total</b>	1025 1061 218 602 <b>2906</b>	1855 1199 267 720 <b>4041</b>	1604 1125 249 715 <b>3693</b>
Non-pyogenic streptococci	Total	2070	2387	2446
'anginosus group'	<i>Streptococcus anginosus</i> <i>Streptococcus constellatus</i> <i>Streptococcus intermedius</i> 'Streptococcus milleri group' <i>Streptococcus</i> group F <b>Total</b>	148 140 67 153 38 <b>546</b>	146 165 57 200 37 <b>605</b>	191 156 75 175 21 <b>618</b>
'bovis group'	<i>Streptococcus bovis</i> (untyped) <i>Streptococcus bovis</i> biotype I <i>Streptococcus bovis</i> biotype II <i>Streptococcus alactolyticus</i> <i>Streptococcus equinus</i> <i>Streptococcus infantarius</i> sp nov <i>Streptococcus saccharolyticus</i> <b>Total</b>	193 7 14 2 10 – – <b>226</b>	186 19 14 3 12 – – <b>234</b>	180 20 13 1 9 1 – <b>224</b>
'mitis group'	<i>Streptococcus mitis</i> <i>Streptococcus mitior</i> <i>Streptococcus oralis</i> 'Streptococcus mitis group' <b>Total</b>	20 244 500 <b>764</b>	27 307 658 <b>992</b>	49 334 652 <b>1035</b>
'mutans group'	<i>Streptococcus mutans</i> <i>Streptococcus sobrinus</i> <b>Total</b>	44 – <b>44</b>	45 – <b>45</b>	40 1 <b>41</b>
'salivarius group'	<i>Streptococcus salivarius</i> <i>Streptococcus vestibularis</i> <b>Total</b>	178 18 <b>196</b>	159 28 <b>187</b>	192 31 <b>223</b>
'sanguinis group'	<i>Streptococcus gordonii</i> <i>Streptococcus sanguinis</i> <i>Streptococcus parasanguinis</i> 'Streptococcus sanguinis group' <b>Total</b>	21 14 49 210 <b>294</b>	20 4 64 236 <b>324</b>	14 8 57 226 <b>305</b>
Other streptococci	<i>Streptococcus acidominimus</i> <i>Streptococcus suis</i> <i>Streptococcus uberis</i> 'anaerobic streptococcus' <b>Total</b>	37 1 5 47 <b>90</b>	44 2 3 39 <b>88</b>	46 1 4 48 <b>99</b>
Streptococci not fully identified	α-haemolytic streptococci β-haemolytic streptococci non-haemolytic streptococci 'other named streptococci' <i>Streptococcus</i> spp <b>Total</b>	520 155 46 47 287 <b>1055</b>	721 193 85 97 300 <b>1396</b>	720 230 112 189 306 <b>1557</b>
Genera closely related to streptococci	<i>Abiotrophia</i> spp <i>Aerococcus</i> spp <i>Gemella</i> spp <i>Leuconostoc</i> spp <i>Pediococcus</i> spp <b>Total</b>	4 76 50 14 2 <b>146</b>	6 79 79 28 4 <b>196</b>	10 96 90 35 3 <b>234</b>
<b>Grand total</b>		<b>6267</b>	<b>8108</b>	<b>8029</b>

\*Pyogenic streptococci have been grouped according to traditional Lancefield serological groupings; non-pyogenic streptococci are grouped according to their biochemical and genetic properties and based on their current taxonomy. †Enhanced surveillance commenced in January 2003.

Region	Group A (95% CI)	Group B (95% CI)	Group C (95% CI)	Group G (95% CI)
North East	3.62 (2.92-4.44)	1.73 (1.26-2.33)	0.83 (0.51-1.26)	0.71 (0.42-1.12)
Yorkshire & the Humber	4.09 (3.55-4.69)	2.42 (2.00-2.89)	0.60 (0.40-0.85)	1.40 (1.09-1.77)
East Midlands	2.92 (2.43-3.48)	2.02 (1.62-2.50)	0.49 (0.31-0.75)	1.69 (1.32-2.13)
East of England	3.06 (2.61-3.56)	2.73 (2.31-3.20)	0.46 (0.30-0.68)	1.65 (1.32-2.03)
London	2.13 (1.81-2.48)	1.46 (1.20-1.76)	0.23 (0.13-0.37)	0.72 (0.54-0.94)
South East	2.29 (1.97-2.64)	1.23 (1.00-1.49)	0.20 (0.11-0.32)	0.87 (0.68-1.09)
South West	3.50 (3.00-4.06)	2.82 (2.37-3.33)	0.46 (0.29-0.69)	1.96 (1.59-2.39)
West Midlands	3.48 (2.99-4.02)	3.14 (2.68-3.65)	0.64 (0.44-0.89)	1.94 (1.58-2.35)
North West	2.97 (2.57-3.41)	1.60 (1.32-1.93)	0.48 (0.33-0.68)	1.38 (1.12-1.69)
England	<b>2.99 (2.84-3.15)</b>	<b>2.05 (1.93-2.18)</b>	<b>0.44 (0.38-0.50)</b>	<b>1.34 (1.24-1.45)</b>
Wales	<b>2.69 (2.13-3.35)</b>	<b>1.84 (1.38-2.40)</b>	<b>0.54 (0.31-0.88)</b>	<b>1.23 (0.86-1.70)</b>
Northern Ireland	<b>1.94 (1.33-2.72)</b>	<b>2.76 (2.03-3.67)</b>	<b>0.76 (0.41-1.31)</b>	<b>0.65 (0.32-1.16)</b>
England, Wales & Northern Ireland	<b>2.94 (2.80-3.09)</b>	<b>2.06 (1.95-2.19)</b>	<b>0.46 (0.40-0.52)</b>	<b>1.31 (1.22-1.41)</b>

\*Rates calculated using mid-year 2003 resident population estimates for England, Wales, and Northern Ireland.

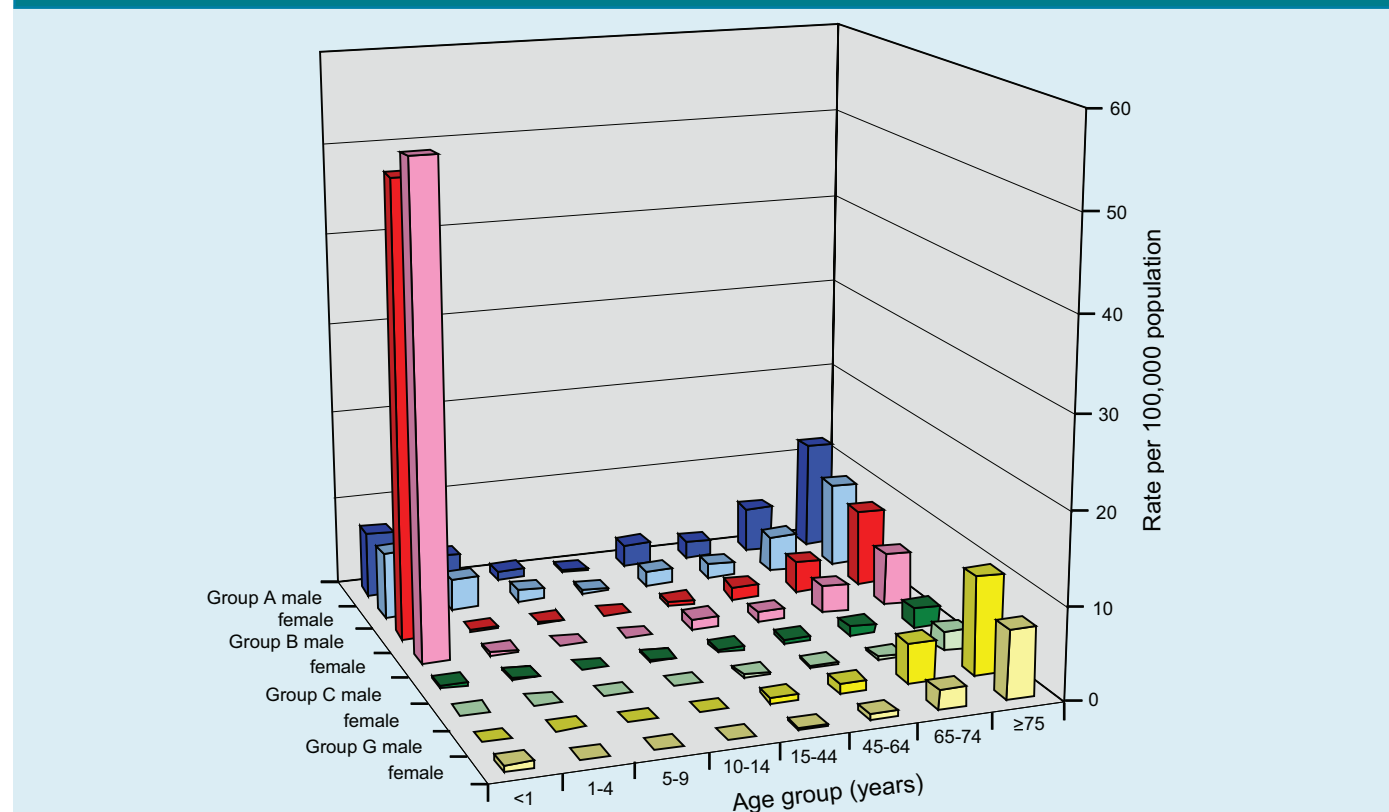
Resistance of GAS blood isolates to penicillin was not observed. Resistance to erythromycin remained relatively stable between 2002 and 2004, within the range 3.3%-3.9%, with 3.8% of GAS bacteraemia reports recording resistance in 2004 (table 3). The 14.5% tetracycline resistance reported in 2004 was higher than in 2002, but similar to that reported in 2003.

### Group B streptococci

Reports of bacteraemia due to group B streptococci (GBS) increased between 2002 and 2003, but decreased slightly from

1199 in 2003 to 1125 in 2004 (table 1). The rate of GBS reports in all age groups was 2.1 per 100,000 population (95% CI 2.0-2.2) in 2004. There was considerable regional variation in reported rate of GBS infection, from 1.2/100,000 (95% CI 1.0-1.5) in the South East to 3.1/100,000 (95% CI 2.7-3.7) in the West Midlands (table 2). The vast majority of GBS blood infections were concentrated in the under 1 year age group, with rates of 49.9 and 53.4/100,000 population for males and females respectively (figure 1). Disease in infants less than 90 days old can be categorised into one of two syndromes: early-onset, occurring between 0 and 6 days old, and late-onset, occurring

**Figure 1 Age-specific rates\* of pyogenic streptococcal bacteraemia reports: England, Wales, and Northern Ireland: 2004**



\*Rates calculated using mid-year 2003 resident population estimates for England, Wales, and Northern Ireland.

<b>Table 3</b>		<b>Antibiotic susceptibility data for pyogenic streptococcal bacteraemia reports: England, Wales, and Northern Ireland: 2002-2004</b>								
		2002			2003			2004		
		No. with susceptibility data	No. resistant (%*)	No. with no information (%†)	No. with susceptibility data	No. resistant (%*)	No. with no information (%†)	No. with susceptibility data	No. resistant (%*)	No. with no information (%†)
<b>Group A</b>	penicillin	774	- (-)	251 (24.5)	1390	- (-)	465 (25.1)	1004	- (-)	600 (37.4)
	erythromycin	673	22 (3.3)	352 (34.3)	1308	51 (3.9)	547 (29.5)	905	34 (3.8)	699 (43.6)
	tetracycline	409	48 (11.7)	616 (60.1)	1035	155 (15.0)	820 (44.2)	572	83 (14.5)	1032 (64.3)
<b>Group B</b>	penicillin	771	- (-)	290 (27.3)	876	- (-)	323 (26.9)	912	- (-)	213 (18.9)
	erythromycin	702	45 (6.4)	359 (33.8)	810	57 (7.0)	389 (32.4)	831	67 (8.1)	294 (26.1)
	tetracycline	419	295 (70.4)	642 (60.5)	524	398 (76.0)	675 (56.3)	555	429 (77.3)	570 (50.7)
<b>Group C</b>	penicillin	147	- (-)	71 (32.6)	194	- (-)	73 (27.3)	188	- (-)	61 (24.5)
	erythromycin	135	10 (7.4)	83 (38.1)	168	21 (12.5)	99 (37.1)	168	29 (17.3)	81 (32.5)
	tetracycline	81	25 (30.9)	137 (62.8)	106	31 (29.2)	161 (60.3)	95	37 (39.0)	154 (61.8)
<b>Group G</b>	penicillin	474	- (-)	128 (21.3)	576	- (-)	144 (20.0)	617	- (-)	98 (13.7)
	erythromycin	439	68 (15.5)	163 (27.1)	531	81 (15.3)	189 (26.3)	556	80 (14.4)	159 (22.2)
	tetracycline	261	126 (48.3)	341 (56.6)	336	166 (49.4)	384 (53.3)	367	186 (50.7)	348 (48.7)

\*Calculated as a proportion of isolates with susceptibility data provided.

†Calculated as a percentage of total reports.

<b>Table 4</b>		<b>Antibiotic susceptibility data for group A streptococcal bacteraemia reports: England, Wales, and Northern Ireland: 2004</b>								
		Penicillin			Erythromycin			Tetracycline		
<b>Region/Country</b>		No. with susceptibility data	No. resistant (%*)	No. with no information (%†)	No. with susceptibility data	No. resistant (%*)	No. with no information (%†)	No. with susceptibility data	No. resistant (%*)	No. with no information (%†)
<b>North East</b>		54	- (-)	38 (41.3)	65	3 (4.6)	27 (29.3)	28	5 (17.9)	64 (69.6)
	<b>Yorkshire &amp; the Humber</b>	135	- (-)	70 (34.1)	97	6 (6.2)	108 (52.7)	80	13 (16.3)	125 (61.0)
<b>East Midlands</b>		96	- (-)	28 (22.6)	85	1 (1.2)	39 (31.5)	71	10 (14.1)	53 (42.7)
<b>East of England</b>		145	- (-)	22 (13.2)	135	5 (3.7)	32 (19.2)	107	12 (11.2)	60 (35.9)
<b>London</b>		62	- (-)	95 (60.5)	61	3 (4.9)	96 (61.1)	31	5 (16.1)	126 (80.3)
<b>South East</b>		75	- (-)	110 (59.5)	62	1 (1.6)	123 (66.5)	35	5 (14.3)	150 (81.1)
<b>South West</b>		103	- (-)	72 (41.1)	98	4 (4.1)	77 (44.0)	70	6 (8.6)	105 (60.0)
<b>West Midlands</b>		137	- (-)	48 (25.9)	131	4 (3.1)	54 (29.2)	62	12 (19.4)	123 (66.5)
<b>North West</b>		140	- (-)	62 (30.7)	118	6 (5.1)	84 (41.6)	48	10 (20.8)	154 (76.2)
<b>England</b>		947	- (-)	545 (36.5)	852	33 (3.9)	640 (42.9)	532	78 (14.7)	960 (64.3)
<b>Wales</b>		47	- (-)	32 (40.5)	43	1 (2.3)	36 (45.6)	30	5 (16.7)	49 (62.0)
<b>Northern Ireland</b>		10	- (-)	23 (69.7)	10	- (-)	23 (69.7)	10	- (-)	23 (69.7)
<b>England, Wales, and Northern Ireland</b>		<b>1004</b>	<b>- (-)</b>	<b>600 (37.4)</b>	<b>905</b>	<b>34 (3.8)</b>	<b>699 (43.6)</b>	<b>572</b>	<b>83 (14.5)</b>	<b>1032 (64.3)</b>

\*Calculated as a proportion of isolates with susceptibility data provided.

†Calculated as a percentage of total reports.

**Table 5** Rate (per 1000 live births) of group B streptococcal bacteraemia in infants in England, Wales and Northern Ireland: 2004

Country	Live births 2003*	Total cases	Early-onset cases (0-6 days)	Late-onset cases (7-90 days)	Rate per 1000 live births (95% CI)		
					Total	Early-onset	Late-onset
England	589851	282	189	93	0.48 (0.42-0.54)	0.32 (0.28-0.37)	0.16 (0.13-0.19)
Wales	31400	15	7	8	0.48 (0.27-0.79)	0.22 (0.09-0.46)	0.25 (0.11-0.50)
Northern Ireland	21648	14	11	3	0.65 (0.35-1.09)	0.51 (0.25-0.91)	0.14 (0.03-0.40)
<b>Total</b>	<b>642899</b>	<b>311</b>	<b>207</b>	<b>104</b>	<b>0.48 (0.43-0.54)</b>	<b>0.32 (0.28-0.37)</b>	<b>0.16 (0.13-0.20)</b>

\*Data from the Office for National Statistics (ONS) and Northern Ireland Statistics and Research Agency.

between 7 and 90 days old. A total of 207 cases of early-onset bacteraemia and 104 cases of late-onset bacteraemia were reported in 2004 (table 5). The reporting rate per 1000 live births was 0.48 (95% CI 0.43-0.54) (0 to 90 days), with a rate of 0.32/1000 (95% CI 0.28-0.37) for early-onset and a rate of 0.16/1000 (95% CI 0.13-0.20) for late-onset disease.

The proportion of GBS bacteraemia reports accompanied by susceptibility data increased in 2004, but there were large regional differences (tables 3 and 6). To date, there have been no confirmed cases of penicillin resistant GBS in the United Kingdom (UK). The proportion of isolates reported as resistant to erythromycin showed a steady upward trend from 6.4% in 2002 to 8.1% in 2004. There was substantial resistance to tetracycline in 2004 ranging from 68.6% to 85.7% by region, similar to previous years

### Group C streptococci

Reports of bacteraemia due to group C streptococci (GCS) increased between 2002 and 2003, with a slight decrease from 267 in 2003 to 249 in 2004 (table 1). The rate of bacteraemia due to GCS reported in England, Wales, and Northern Ireland in 2004 was 0.5 per 100,000 population (95%CI 0.4-0.5), ranging from 0.2/100,000 in the South East (95%CI 0.1-0.3) to 0.8/100,000 in the North East (95%CI 0.5-1.3) (table 2). The reported rate of disease of GCS increased with age (figure 1).

The number of reports of GCS bacteraemia submitted with antibiotic resistance data increased steadily from 2002 to 2004, varying by region (tables 3 and 7). Resistance to penicillin was not observed, while resistance to erythromycin increased nationally from 7.4% in 2002 to 17.3% in 2004. In the same

**Table 6** Antibiotic susceptibility data for group B streptococcal bacteraemia reports: England, Wales, and Northern Ireland: 2004

Region/ Country	Penicillin			Erythromycin			Tetracycline		
	No. with susceptibility data	No. resistant (%*)	No. with no information (%†)	No. with susceptibility data	No. resistant (%*)	No. with no information (%†)	No. with susceptibility data	No. resistant (%*)	No. with no information (%†)
North East	33	- (-)	11 (25.0)	40	5 (12.5)	4 (9.1)	17	13 (76.5)	27 (61.4)
Yorkshire & the Humber	87	- (-)	34 (28.1)	67	7 (10.4)	54 (44.6)	49	40 (81.6)	72 (59.5)
East Midlands	81	- (-)	5 (5.8)	69	6 (8.7)	17 (19.8)	55	39 (70.9)	31 (36.0)
East of England	140	- (-)	9 (6.0)	130	9 (6.9)	19 (12.8)	114	86 (75.4)	35 (23.5)
London	84	- (-)	24 (22.2)	75	4 (5.3)	33 (30.6)	49	37 (75.5)	59 (54.6)
South East	61	- (-)	38 (38.4)	55	2 (3.6)	44 (44.4)	28	22 (78.6)	71 (71.7)
South West	124	- (-)	17 (12.1)	117	9 (7.7)	24 (17.0)	86	69 (80.2)	55 (39.0)
West Midlands	152	- (-)	15 (9.0)	148	17 (11.5)	19 (11.4)	85	69 (81.2)	82 (49.1)
North West	97	- (-)	11 (10.2)	88	6 (6.8)	21 (19.3)	35	24 (68.6)	74 (67.9)
England	<b>859</b>	<b>- (-)</b>	<b>164 (16.0)</b>	<b>789</b>	<b>65 (8.2)</b>	<b>235 (22.9)</b>	<b>518</b>	<b>399 (77.0)</b>	<b>506 (49.4)</b>
Wales	38	- (-)	16 (29.6)	28	1 (3.6)	26 (48.1)	23	18 (78.3)	31 (57.4)
Northern Ireland	14	- (-)	33 (70.2)	14	1 (7.1)	33 (70.2)	14	12 (85.7)	33 (70.2)
<b>England, Wales, and Northern Ireland</b>	<b>911</b>	<b>- (-)</b>	<b>213 (19.0)</b>	<b>831</b>	<b>67 (8.1)</b>	<b>294 (26.1)</b>	<b>555</b>	<b>429 (77.3)</b>	<b>570 (50.7)</b>

\*Calculated as a proportion of isolates with susceptibility data provided.

†Calculated as a percentage of total reports.

**Table 7 Antibiotic susceptibility data for group C streptococcal bacteraemia reports: England, Wales, and Northern Ireland: 2004**

Region/ Country	Penicillin			Erythromycin			Tetracycline		
	No. with susceptibility data	No. resistant (%*)	No. with no information (%†)	No. with susceptibility data	No. resistant (%*)	No. with no information (%†)	No. with susceptibility data	No. resistant (%*)	No. with no information (%†)
North East	15	- (-)	6 (28.6)	19	2 (10.5)	2 (9.5)	1	- (-)	20 (95.2)
Yorkshire and the Humber	23	- (-)	7 (23.3)	19	2 (10.5)	11 (36.7)	13	7 (53.8)	17 (56.7)
East Midlands	17	- (-)	4 (19.0)	12	- (-)	9 (42.9)	11	4 (36.4)	10 (47.6)
East of England	25	- (-)	- (-)	24	10 (41.7)	1 (4.0)	22	5 (22.7)	3 (12.0)
London	11	- (-)	6 (35.3)	11	1 (9.1)	6 (35.3)	4	3 (75.0)	13 (76.5)
South East	11	- (-)	5 (31.3)	10	1 (10.0)	6 (37.5)	6	2 (33.3)	10 (62.5)
South West	19	- (-)	4 (17.4)	18	6 (33.3)	5 (21.7)	12	7 (58.3)	11 (47.8)
West Midlands	30	- (-)	4 (11.8)	27	5 (18.5)	7 (20.6)	9	4 (44.4)	25 (73.5)
North West	24	- (-)	9 (27.3)	17	1 (5.9)	16 (48.5)	8	4 (50.0)	25 (75.8)
England	175	- (-)	45 (20.5)	157	28 (17.8)	63 (28.6)	86	36 (41.9)	134 (60.9)
Wales	10	- (-)	6 (37.5)	8	1 (12.5)	8 (50.0)	6	1 (16.7)	10 (62.5)
Northern Ireland	3	- (-)	10 (76.9)	3	- (-)	10 (76.9)	3	- (-)	10 (76.9)
England, Wales, and Northern Ireland	188	- (-)	61 (24.5)	168	29 (17.3)	81 (32.5)	95	37 (38.9)	154 (61.8)

\*Calculated as a proportion of isolates with susceptibility data provided. †Calculated as a percentage of total reports.

time period, tetracycline resistance increased from around 30% in 2002 to 39.0% in 2004.

### Group G streptococci

Reports of bacteraemia due to group G streptococci (GGS) increased between 2002 and 2003, but as for groups A, B, and C, decreased slightly to 715 in 2004 from 720 in 2003 (table

1). The reported rate of GGS bacteraemia in England, Wales, and Northern Ireland in 2004 was 1.3 per 100,000 population (95% CI 1.2-1.4), ranging from 0.7/100,000 (95% CI 0.3-1.2) in Northern Ireland to 2.0/100,000 (95% CI 1.6-2.4) in the South West (table 2). Bacteraemia reports for GGS were concentrated in adults aged 65 years and over (figure 1).

Antibiotic susceptibility reporting greatly improved

**Table 8 Antibiotic susceptibility data for group G streptococcal bacteraemia reports: England, Wales and Northern Ireland, 2004**

Region/ Country	Penicillin			Erythromycin			Tetracycline		
	No. with susceptibility data	No. resistant (%*)	No. with no information (%†)	No. with susceptibility data	No. resistant (%*)	No. with no information (%†)	No. with susceptibility data	No. resistant (%*)	No. with no information (%†)
North East	6	- (-)	6 (33.3)	17	2 (11.8)	1 (5.6)	7	2 (28.6)	11 (61.1)
Yorkshire & the Humber	21	- (-)	21 (30.0)	33	3 (9.1)	37 (52.9)	31	22 (71.0)	39 (55.7)
East Midlands	2	- (-)	2 (2.8)	62	3 (4.8)	10 (13.9)	47	23 (48.9)	25 (34.7)
East of England	3	- (-)	3 (3.3)	81	13 (16.0)	9 (10.0)	68	33 (48.5)	22 (24.4)
London	14	- (-)	14 (26.4)	36	3 (8.3)	17 (32.1)	18	7 (38.9)	35 (66.0)
South East	19	- (-)	19 (27.1)	35	6 (17.1)	35 (50.0)	28	11 (39.3)	42 (60.0)
South West	10	- (-)	10 (10.2)	81	19 (23.5)	17 (17.3)	56	26 (46.4)	42 (42.9)
West Midlands	5	- (-)	5 (4.9)	95	15 (15.8)	8 (7.8)	53	30 (56.6)	50 (48.5)
North West	8	- (-)	8 (8.5)	78	14 (17.9)	16 (17.0)	28	17 (60.7)	66 (70.2)
England	580	- (-)	88 (13.2)	518	78 (15.1)	150 (22.5)	336	171 (50.9)	332 (49.7)
Wales	6	- (-)	6 (16.7)	31	2 (6.5)	5 (13.9)	24	12 (50.0)	12 (33.3)
Northern Ireland	4	- (-)	4 (36.4)	7	- (-)	4 (36.4)	7	3 (42.9)	4 (36.4)
England, Wales, and Northern Ireland	98	- (-)	98 (13.7)	556	80 (14.4)	159 (22.2)	367	186 (50.7)	348 (48.7)

\*Calculated as a proportion of isolates with susceptibility data provided.

†Calculated as a percentage of total reports.

**Table 9** Region-specific rates\* (per 100,000 population) of non-pyogenic streptococcal bacteraemia: England, Wales, and Northern Ireland: 2004

Region/ Country	'Anginosus Group' (95% CI)	'Bovis Group' (95% CI)	'Mitis Group' (95% CI)	'Salivarius Group' (95% CI)	'Sanguinis Group' (95% CI)
North East	1.7 (1.3-2.3)	0.8 (0.5-1.3)	2.7 (2.1-3.4)	0.4 (0.2-0.8)	0.8 (0.5-1.2)
Yorkshire & the Humber	1.6 (1.3-2.0)	0.7 (0.5-0.95)	1.6 (1.3-2.0)	0.5 (0.3-0.7)	0.4 (0.2-0.6)
East Midlands	0.7 (0.5-1.0)	0.2 (0.1-0.34)	1.2 (0.9-1.6)	0.4 (0.2-0.6)	0.4 (0.2-0.6)
East of England	1.5 (1.2-1.9)	0.4 (0.2-0.59)	1.7 (1.4-2.1)	0.4 (0.3-0.6)	0.7 (0.5-1.0)
London	0.7 (0.5-0.9)	0.2 (0.1-0.35)	1.4 (1.2-1.7)	0.2 (0.1-0.4)	0.3 (0.2-0.5)
South East	0.5 (0.4-0.7)	0.2 (0.1-0.37)	1.4 (1.1-1.6)	0.4 (0.2-0.5)	0.5 (0.4-0.7)
South West	2.0 (1.7-2.5)	0.6 (0.4-0.81)	2.7 (2.2-3.2)	0.5 (0.3-0.7)	0.8 (0.6-1.1)
West Midlands	1.2 (0.0-1.5)	0.6 (0.4-0.85)	2.8 (2.4-3.3)	0.4 (0.3-0.7)	0.6 (0.4-1.0)
North West	1.3 (1.0-1.6)	0.5 (0.3-0.66)	2.9 (2.5-3.3)	0.5 (0.3-0.7)	0.7 (0.5-1.0)
<b>England</b>	<b>1.2 (1.0-1.3)</b>	<b>0.4 (0.4-0.48)</b>	<b>2.0 (1.9-2.1)</b>	<b>0.4 (0.4-0.5)</b>	<b>0.6 (0.5-0.6)</b>
Wales	0.7 (0.4-1.0)	0.2 (0.1-0.40)	1.1 (0.7-1.5)	0.4 (0.24-0.8)	0.4 (0.2-0.8)
Northern Ireland	1.4 (0.9-2.1)	0.5 (0.2-1.00)	1.1 (0.6-1.7)	0.4 (0.2-0.9)	0.5 (0.2-1.0)
<b>England, Wales, and Northern Ireland</b>	<b>1.1 (1.1-1.3)</b>	<b>0.4 (0.4-0.47)</b>	<b>1.9 (1.8-2.0)</b>	<b>0.4 (0.4-0.5)</b>	<b>0.6 (0.5-0.6)</b>

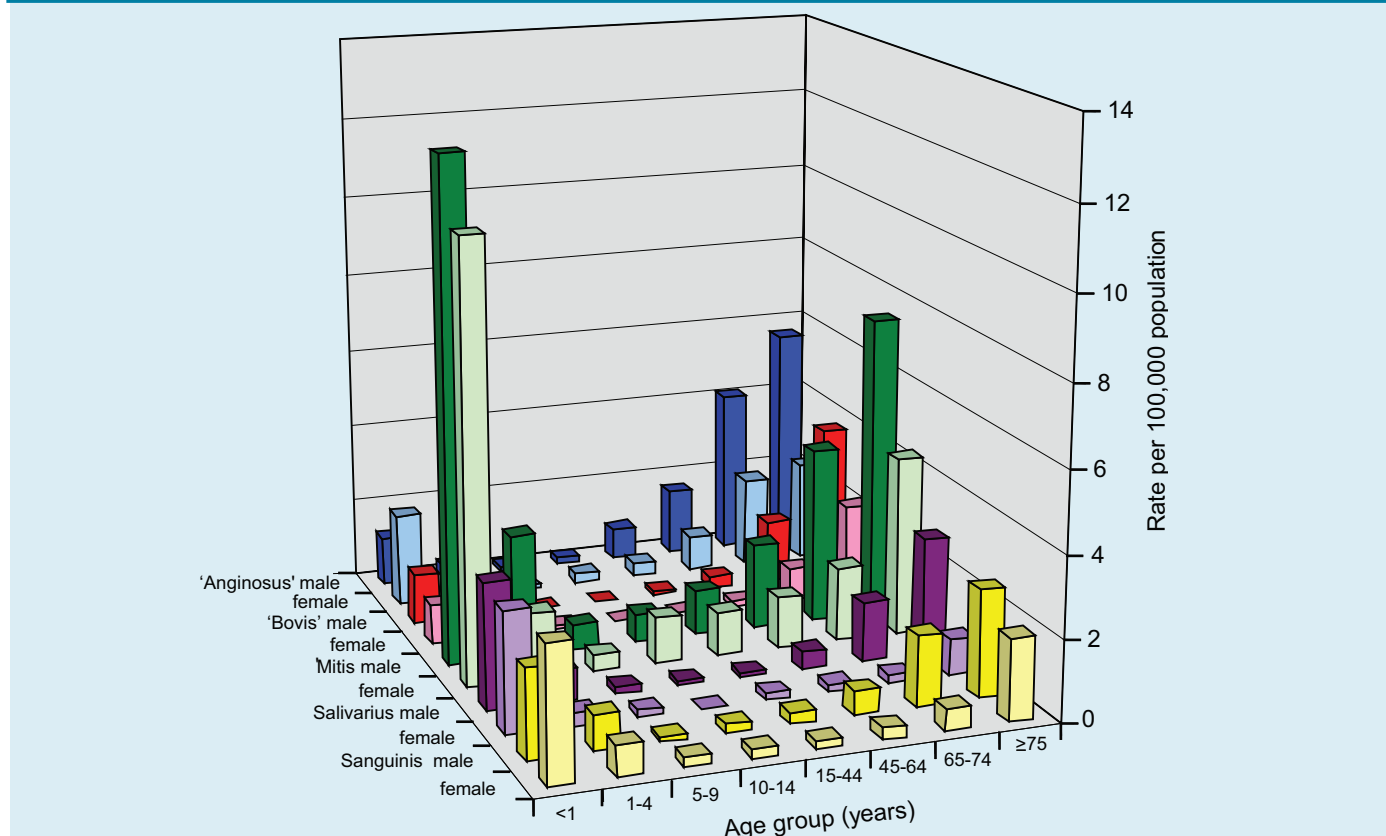
\*Rates were calculated using mid-year 2003 resident population estimates for England, Wales, and Northern Ireland.

between 2002 and 2004, with completeness of reporting varying by region (tables 3 and 8). There were no confirmed cases of penicillin resistance in GGS isolates. Resistance to erythromycin remained fairly constant at 14% to 15% over the three year period, but there was an annual increase in tetracycline resistance from 44.5% in 2001 to 50.7% in 2004.

### Non-pyogenic streptococci (excluding *Streptococcus pneumoniae*)

Reports of bacteraemias due to non-pyogenic streptococci increased steadily between 2002 and 2004 from 1826 to 2446 for

**Figure 2** Age-specific rates\* of non-pyogenic streptococcal bacteraemia reports: England, Wales, and Northern Ireland: 2004



\*Rates were calculated using mid-year 2003 resident population estimates for England, Wales, and Northern Ireland.

**Table 10 Antibiotic susceptibility data for non-pyogenic streptococcal bacteraemia reports, England, Wales, and Northern Ireland: 2001-2003**

	2002			2003			2004		
	No. with susceptibility data	No. resistant (%*)	No. with no information (%†)	No. with susceptibility data	No. resistant (%*)	No. with no information (%†)	No. with susceptibility data	No. resistant (%*)	No. with no information (%†)
<b>'Anginosus' group</b>									
penicillin	308	4 (1.3)	238 (43.6)	411	13 (3.2)	194 (32.1)	455	13 (2.9)	163 (26.4)
amoxycillin/ampicillin	181	3 (1.7)	365 (66.8)	245	1 (0.4)	360 (59.5)	266	2 (0.8)	352 (57.0)
erythromycin	275	21 (7.6)	271 (49.6)	363	27 (7.4)	242 (40.0)	393	31 (7.9)	225 (36.4)
tetracycline	144	23 (16.0)	402 (73.6)	211	34 (16.1)	394 (65.1)	215	26 (12.1)	403 (65.2)
<b>Bovis' group</b>									
penicillin	126	7 (5.6)	100 (44.2)	139	8 (5.8)	95 (40.6)	163	6 (3.7)	61 (27.2)
amoxycillin/ampicillin	108	2 (1.9)	118 (52.2)	109	– (–)	125 (53.4)	126	– (–)	98 (43.8)
erythromycin	108	20 (18.5)	118 (52.2)	121	16 (13.2)	113 (48.3)	142	23 (16.2)	82 (36.6)
tetracycline	59	36 (61.0)	167 (73.9)	72	40 (55.6)	162 (69.2)	85	41 (48.2)	139 (62.1)
<b>Mitis' group</b>									
penicillin	374	75 (20.1)	390 (51.0)	623	129 (20.7)	369 (37.2)	696	155 (22.3)	339 (32.8)
amoxycillin/ampicillin	263	13 (4.9)	501 (65.6)	420	33 (7.9)	572 (57.7)	456	27 (5.9)	579 (55.9)
erythromycin	347	126 (36.3)	417 (54.6)	583	213 (36.5)	409 (41.2)	613	222 (36.2)	422 (40.8)
tetracycline	163	38 (23.3)	601 (78.7)	329	95 (28.9)	663 (66.8)	292	88 (30.1)	743 (71.8)
<b>Salivarius' group</b>									
penicillin	81	16 (19.8)	115 (58.7)	123	28 (22.8)	64 (34.2)	156	35 (22.4)	67 (30.0)
amoxycillin/ampicillin	52	2 (3.8)	144 (73.5)	89	– (–)	98 (52.4)	111	5 (4.5)	112 (50.2)
erythromycin	71	18 (25.4)	125 (63.8)	111	22 (19.8)	76 (40.6)	119	41 (34.5)	104 (46.6)
tetracycline	37	2 (5.4)	159 (81.1)	72	15 (20.8)	115 (61.5)	75	16 (21.3)	148 (66.4)
<b>Sanguinis' group</b>									
penicillin	156	38 (24.4)	138 (46.9)	217	40 (18.4)	107 (33.0)	219	40 (18.3)	86 (28.2)
amoxycillin/ampicillin	105	7 (6.7)	189 (64.3)	140	8 (5.7)	184 (56.8)	139	8 (5.8)	166 (54.4)
erythromycin	136	42 (30.9)	158 (53.7)	187	52 (27.8)	137 (42.3)	186	51 (27.4)	119 (39.0)
tetracycline	71	18 (25.4)	223 (75.9)	131	33 (25.2)	193 (59.6)	106	24 (22.6)	199 (65.2)

\*Calculated as a proportion of isolates with susceptibility data provided

†Calculated as a percentage of total reports

all groups, with the biggest increases seen in the 'streptococcus mitis' and 'streptococcus salivarius' groups (table 1). Reporting rates in England, Wales, and Northern Ireland in 2004 ranged from 0.4 per 100,000 population (95% CI 0.4-0.5) in both the 'bovis' and 'salivarius' groups, to 1.9/100,000 (95% CI 1.8-2.0) in the 'mitis group' (table 9). Distribution of non-pyogenic streptococcal bacteraemia reports by age-group and gender showed a concentration in the youngest and oldest age groups, and in most cases among males compared to females (figure 2). Although the proportion of reports accompanied by susceptibility data increased, there were nonetheless a large number of reports for which key susceptibilities were not reported (table 10).

## Related genera

The number of reports of genera related to streptococci causing bacteraemia increased from 146 in 2002 to 234 in 2004 (table 1). The largest increase in reports was in *Gemella* species from 50 reports in 2002 to 90 in 2004.

## Discussion

The increasing trend in the number of streptococcal bacteraemia reports documented between 2001 and 2003

(2) appeared to stabilise in 2004. Reports of bloodstream infections due to pyogenic streptococcal groups B, C, and G decreased only slightly, whereas more substantial decreases were seen for GAS bacteraemia in 2004. The small decreases in the number of reports in 2004 compared with 2003 may be due in part to incomplete reporting at the time of data extraction, although much of the decrease observed in GAS bacteraemia reports was accounted for by a fall in numbers of reports from the Yorkshire and the Humber region in 2004. Given the previously reported increases in invasive GAS infections in injecting drug users (IDUs) in this region (3), this fall may relate to a drop in IDU-associated infections. The link to IDUs may also explain the high rate of GAS bacteraemia reported in the Yorkshire and the Humber region when compared to other regions.

In comparison to the pyogenic species, reports of bacteraemia due to non-pyogenic streptococcal species continued to increase overall, though their relative importance as a proportion of all reported streptococcal bacteraemias did not change. 'Mitis' was the largest of the non-pyogenic streptococcal groups implicated in bacteraemia in England, Wales, and Northern Ireland between 2002 and 2004 based on routine laboratory surveillance, consistent with studies from

elsewhere in Europe (4).

Reports of streptococcal bacteraemias demonstrated typical age distributions for bloodstream infections, with cases concentrated in those aged under 1 year and those aged over 65 years. GAS bacteraemia, however, was more commonly reported in the 15 to 44 years age group than the 45 to 64 years age group, and was more common in males than females, which is likely to be linked to infections in IDUs, in whom severe GAS infections are increasing (5).

The large increase in GAS bacteraemia reports from 2002 to 2003 when enhanced surveillance began suggests that a substantial proportion of cases are not identified through the voluntary reporting system. For this reason, the true rates of diagnosed bacteraemias in other streptococcal species are likely to be higher than those reported here. Databases that pool routine reports with reference laboratory data, similar to the one used in enhanced GAS surveillance, are being planned for other streptococci to improve ascertainment.

The proportion of both pyogenic and non-pyogenic *Streptococcus* isolates containing antibiotic resistance data for one or more of penicillin, tetracycline, or erythromycin improved slightly from 72% in 2003 to 73% in 2004, varying by group. Antibiotic susceptibility data should be reported for all streptococcal isolates so that trends in single and multiple-drug resistances can be observed and appropriate recommendations developed.

There were no confirmed cases of penicillin resistance among pyogenic isolates in 2004, consistent with data from across the world (6,7). The rates of resistance to erythromycin of groups A and B streptococci were similar to those found in the British Society for Antimicrobial Chemotherapy (BSAC) Bacteraemia Resistance Surveillance Programme in 2003 (8)\*, whereas BSAC found a lower rate of resistance in GGS to that calculated from routine voluntary reporting, at 11.4% compared to 14.4%. The increase in GBS erythromycin resistance reported here has been described worldwide (9,10). Of particular note, however, is the rise in reports of erythromycin resistance in GCS bacteraemia isolates from 7% in 2002 to 17% in 2004. Rates of tetracycline resistance reported by BSAC in groups A, B, and G in 2003 were consistently higher by about 2% to 5% than those reported to CDSC by routine reporting in 2004. The high rates of tetracycline resistance, especially in the group B streptococci, have been noted in other studies (7), but remain as yet unexplained as tetracycline is not used in neonates or expectant mothers who largely get these infections.

Resistance among non-pyogenic streptococcal species varied greatly according to group. Reports showed the 'mitis' group to be most commonly resistant to all agents in 2004, as found in a United States (US) study of viridans streptococci isolated from blood cultures (11). Penicillin resistance was common in the 'mitis', 'salivarius' and 'sanguinis' streptococcal groups, where around 20% of isolates demonstrated resistance. Altogether, 14.9% of non-pyogenic isolates with antimicrobial susceptibility data were penicillin resistant, similar to the 13.4% reported in the US in 1996 (11). Erythromycin resistance was also high in the non-pyogenic groups when compared to the pyogenic groups, with 25% of all non-pyogenic isolates reported as erythromycin resistant. High levels of resistance

to erythromycin and tetracycline comparable to those reported in the UK non-pyogenic bloodstream isolates were described in the US (11).

Substantial numbers of reports continue to be made of streptococcal bacteraemia in which the organism is not fully identified. Precise species identification of isolates would improve the monitoring of disease trends of non-pyogenic streptococci and related genera in particular, as these species can be difficult to identify. Laboratories are reminded that all streptococci isolated from sterile sites should be submitted to SDRU for characterisation. Laboratories are also requested to send any pyogenic streptococcal isolates exhibiting a decreased sensitivity to penicillin or suspected resistance to the Antibiotic Resistance Monitoring and Reference Laboratory (ARMRL) for confirmation. Both laboratories are based at the Health Protection Agency, Centre for Infections, 61 Colindale Avenue, London NW9 5HT. In addition, any streptococci (pyogenic or non-pyogenic) with suspected glycopeptide or linezolid resistance should be referred for further investigation.

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