

Pyogenic and non-pyogenic streptococcal bacteraemias, England, Wales, and Northern Ireland: 2005

Introduction

These analyses are based on data extracted from our voluntary surveillance database (LabBase2) on the 7th November 2006 for the period 2002-2005. The exception to this is for group A streptococcal (GAS) infections for which an enhanced surveillance system was set up in the UK and many other European countries in 2003 as part of the Strep-EURO programme^{1,2}. Although the project has now been completed, the augmented data collection mechanism established which pools reports from LabBase2 and the Streptococcus and Diphtheria Reference Unit (SDRU) is still in place.

Rates were calculated using 2005 mid-year resident population estimates based on the 2001 census for England, Wales, and Northern Ireland. In infants, rates were calculated using the number of live births in 2005 as the denominator (data from ONS and Northern Ireland Statistics and Research Agency). Regional analyses were made according to the Government Office Regions introduced in April 2002.

The data presented here differ in some instances from data in earlier publications due to the addition of late reports to LabBase2.

Group A streptococci

Data from enhanced surveillance has shown a fall in reports of group A streptococcal bacteraemia from 1688 in 2003 to 1535 in 2004 and 1238 in 2005 (see table 1). The rate of GAS bacteraemias reported in England, Wales and Northern Ireland for 2005 was 2.2 per 100,000 population (95% CI 2.1-2.4). Regional variation in GAS bacteraemia ranged from 1.5/100,000 (95% CI 1.2-1.7) in the South East to 3.3/100,000 (95% CI 2.9-3.8) in Yorkshire and the Humber.

The highest rates of GAS bacteraemia reports were in those aged <1 year (6.8/100000, 95% CI 4.3-10.2) and in adults aged 75 and over (9.2/100000, 95% CI 7.8-10.8). GAS bacteraemia was however more commonly reported in the 15 to 44 years age group than the 45 to 64 years age group. This is likely to be linked to infections in injecting drug users (IDUs), an important risk group in the UK, although the absolute numbers of IDU-associated referrals to the reference laboratory have been falling since 2003³.

Reported resistance rates to clindamycin, erythromycin and tetracycline were 2.5%, 4.6% and 16.8% respectively and have remained relatively stable since 2002 (Table 2). Penicillin resistance has not been seen to date in the UK or elsewhere and remains the therapeutic drug of choice for group A streptococcal infections⁴. Erythromycin resistance was commonly associated with combined resistance for other antibiotics; 33% and 67% of erythromycin isolates being resistant to clindamycin and tetracycline respectively.

Group B streptococci

Reports of bacteraemia due to group B streptococcus (GBS) in England, Wales and Northern Ireland have increased from 1068 in 2002 to 1248 in 2005. From 2004 to 2005 there has been a 6% increase in the number of cases reported. The overall rate

of GBS reports in all age groups was 2.3 per 100,000 (95% CI 2.1-2.4) in 2005 but was considerably higher in infants at 51/100,000 (95% CI 45-56).

Disease in infants is typically classified into an early-onset form (between 0 and 6 days old) and a late-onset form (between 7 and 90 days old). The reporting rate per 1000 live births was 0.31 (95% CI 0.27-0.36) for early-onset disease and 0.20 (95% CI 0.16-0.23) for late-onset disease.

Resistance of GBS blood culture isolates to clindamycin, erythromycin and tetracycline was noted in 9.0%, 9.8% and 76.0% of reports respectively (Table 2). The proportion of GBS bacteraemia reports accompanied by susceptibility data has increased since 2002 although only 12% reports included clindamycin resistance in 2005. Approximately 40% of clindamycin resistant isolates were also reported as resistant to both erythromycin and tetracycline (multi-resistant). Similarly 44% of erythromycin resistant isolates were also reported as multi-resistant; however, only 6% of tetracycline resistant isolates were multi-resistant.

Group C & G streptococci

Voluntary reporting has shown an increase in the numbers of reports of bacteraemia caused by group C streptococcus (GCS) from 220 in 2002 to 275 in 2005. Reports of bacteraemia due to group G streptococcus (GGS) have also increased from 609 in 2002 to 775 in 2005. The reported rate of bacteraemia due to GCS in England, Wales, and Northern Ireland in 2005 was 0.50 per 100,000 (95% CI 0.44-0.56) and the highest regional rate was observed in the West Midlands with 0.88/100,000 (95% CI 0.64-1.2). The rate of GGS bacteraemia reports in England, Wales and Northern Ireland was 1.4/100,000 (95% CI 1.3-1.5) with the highest reported rates being detected in the East of England with 2.2/100,000 (95% CI 1.8-2.7).

Reported resistance to tetracycline in GCS blood culture isolates fell markedly from the 38% peak in 2004 to 23% in 2005, lower than the pre 2004 levels (Table 2). In contrast, tetracycline resistance observed in GGS stayed close to 50% over 2002-2005. Erythromycin resistance has remained close to 15% over the same time period in both GCS and GGS blood culture isolates having been considerably lower for GCS prior to 2004. Approximately half of erythromycin resistant isolates in GCS isolates were also resistant to clindamycin or tetracycline. As for GGS, 14% of erythromycin resistant isolates were resistant to both clindamycin and tetracycline.

Non-pyogenic streptococci

Reports of bacteraemias due to non-pyogenic streptococci increased steadily between 2002 and 2005 from 2099 to 2624 reports for all groups combined. The largest increases were observed in the 'mitis' and 'salivarius' streptococcal groups where reports have increased by 32% and 42% respectively since 2002. In contrast, no increase has been observed in bacteraemia due to the 'bovis group' streptococci.

Reporting rates for England Wales, and Northern Ireland in 2005 ranged from 0.39 per 100,000 population (95% CI 0.34-0.44) for bacteraemia due to 'bovis group' streptococci to 1.9/100,000 (95% CI 1.8-2.0) for the 'mitis group'. 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.

Since 2002, the proportion of bacteraemia reports accompanied by susceptibility data has increased markedly for all non-pyogenic groups. However, almost half of all

reports are still lacking information on key susceptibilities to ampicillin, erythromycin, penicillin and tetracycline. In contrast to the pyogenic streptococci, where penicillin resistance has not been observed, 16% of non-pyogenic isolates with antimicrobial susceptibility data were reported as penicillin resistant (compared to 14% in 2002). The highest frequency of reported penicillin resistance was observed in the 'salivarius group' with 27% of isolates reported as resistant.

Erythromycin resistance was also high in the non-pyogenic groups compared to the 'pyogenic groups', with 26% of all non-pyogenic isolates reported as erythromycin resistant. Levels of tetracycline resistance increased across all groups except in the 'mitis group' and the 'salivarius group' where levels stayed at approximately 30% and 20% respectively. The highest levels of tetracycline resistance were observed in the 'bovis group' where almost 60% of isolates were reported as resistant.

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.

The Streptococcus and Diphtheria Reference Unit offers a referred (charged for) taxonomic identification service for streptococci and other related gram positive, catalase negative genera from systemic and other significant infections. However, a free-of-charge reference service will continue to be available for urgent public health investigations, outbreaks and incident management, either nosocomial or community based.

Laboratories are requested to send any pyogenic streptococcal isolates exhibiting a decreased sensitivity to penicillin to the Antibiotic Resistance Monitoring and Reference Laboratory (ARMRL) for confirmation. Both laboratories are based at the Health Protection Agency, Centre for Infections in Colindale. In addition, any streptococci (pyogenic or non-pyogenic) with suspected glycopeptide or linezolid resistance should be referred for further investigation.

References

1. PHLS. Enhanced surveillance of invasive group A streptococcal infections. *Commun Dis Rep CDR Wkly* [serial online] 2002;12.
2. Lamagni TL, Efstratiou A, Vuopio-Varkila J, Jasir A, Schalén C, Strep-EURO. The epidemiology of severe *Streptococcus pyogenes* associated disease in Europe. *Euro Surveill* 2005;10:179-84.
3. Health Protection Agency, Health Protection Scotland, National Public Health Service for Wales, CDSC Northern Ireland, CRDHB, and UASSG. Shooting Up; Infections among injecting drug users in the United Kingdom 2005. 13-10-2006. London, Health Protection Agency.
4. HPA. Pyogenic and non-pyogenic streptococcal bacteraemias, England, Wales and Northern Ireland: 2004. *Commun Dis Rep CDR Wkly* [serial online] 2005;15:bacteraemia.

Footnote

*LabBase2 is the database that collects laboratory reports of all microorganisms isolated at nearly 400 NHS and other laboratories throughout England and Wales. The database is managed and accessed at the Centre for Infections.

Table 1 Laboratory reports of streptococcal bacteraemia, England, Wales, and Northern Ireland: 2002-2005

Pyogenic streptococci	2002	2003	2004	2005
group A streptococci	1038	1688	1535	1238
group B streptococci	1068	1226	1176	1248
group C streptococci	220	275	255	275
group G streptococci	609	727	744	775
Total	2935	3916	3710	3536
Non-pyogenic streptococci				
"anginosus group"	553	612	631	676
"bovis group"	227	235	231	214
"mitis group"	783	1005	1074	1039
"mutans group"	44	45	41	48
"salivarius group"	197	189	226	280
"sanguinis group"	295	327	317	367
Total	2099	2413	2520	2624
Total identified streptococci	5034	6329	6230	6160
Other streptococci	90	90	99	91
Streptococci not fully identified	1111	1518	1645	1622
Genera closely related to streptococci	148	196	242	252

Table 2 Trends in antibiotic resistance (2002-2005) for streptococcal bacteraemias in England, Wales and Northern Ireland

	2002		2003		2004		2005	
	no. tested	no. resistant	no. tested	no. resistant	no. tested	no. resistant	no. tested	no. resistant
group A								
clindamycin	114	3 (2.6%)	828	7 (0.8%)	213	13 (6.1%)	160	4 (2.5%)
erythromycin	681	22 (3.2%)	1408	59 (4.2%)	903	34 (3.8%)	649	30 (4.6%)
tetracycline	414	48 (11.6%)	1110	180 (16.2%)	571	82 (14.4%)	387	65 (16.8%)
group B								
clindamycin	108	4 (3.7%)	165	13 (7.9%)	162	9 (5.6%)	155	14 (9.0%)
erythromycin	708	45 (6.4%)	824	55 (6.7%)	856	70 (8.2%)	861	84 (9.8%)
tetracycline	423	295 (69.7%)	537	405 (75.4%)	566	438 (77.4%)	567	431 (76.0%)
group C								
clindamycin	18	0 (0.0%)	31	2 (6.5%)	50	8 (16.0%)	40	5 (12.5%)
erythromycin	135	10 (7.4%)	174	21 (12.1%)	173	27 (15.6%)	194	27 (13.9%)
tetracycline	81	25 (30.9%)	110	32 (29.1%)	97	37 (38.1%)	122	28 (23.0%)
group G								
clindamycin	59	2 (3.4%)	91	8 (8.8%)	123	7 (5.7%)	114	4 (3.5%)
erythromycin	442	69 (15.6%)	534	81 (15.2%)	575	79 (13.7%)	568	100 (17.6%)
tetracycline	262	126 (48.1%)	338	164 (48.5%)	382	192 (50.3%)	409	204 (49.9%)
"anginosus"								
ampicillin/amoxycillin	182	3 (1.6%)	247	0 (0.0%)	270	2 (0.7%)	282	0 (0.0%)
erythromycin	276	21 (7.6%)	365	26 (7.1%)	399	31 (7.8%)	430	42 (9.8%)
penicillin	311	4 (1.3%)	413	13 (3.1%)	461	14 (3.0%)	491	21 (4.3%)
tetracycline	148	24 (16.2%)	211	34 (16.1%)	218	27 (12.4%)	233	50 (21.5%)
"bovis"								
ampicillin/amoxycillin	108	2 (1.9%)	109	0 (0.0%)	129	0 (0.0%)	99	1 (1.0%)
erythromycin	108	20 (18.5%)	122	16 (13.1%)	145	23 (15.9%)	120	18 (15.0%)
penicillin	126	7 (5.6%)	139	6 (4.3%)	167	3 (1.8%)	138	10 (7.2%)
tetracycline	59	36 (61.0%)	72	40 (55.6%)	88	41 (46.6%)	84	49 (58.3%)
"mitis"								
ampicillin/amoxycillin	289	12 (4.5%)	422	28 (6.6%)	473	23 (4.9%)	495	25 (5.1%)
erythromycin	355	127 (35.8%)	584	209 (35.8%)	631	225 (35.7%)	633	253 (40.0%)
penicillin	384	78 (20.3%)	627	125 (19.9%)	721	148 (20.5%)	753	161 (21.4%)
tetracycline	188	39 (23.2%)	328	94 (28.7%)	305	94 (30.8%)	378	117 (31.0%)
"salivarius"								
ampicillin/amoxycillin	52	2 (3.8%)	89	0 (0.0%)	111	4 (3.6%)	138	3 (2.2%)
erythromycin	71	18 (25.4%)	111	21 (18.9%)	124	44 (35.5%)	161	50 (31.1%)
penicillin	81	16 (19.8%)	122	27 (22.1%)	160	32 (20.0%)	192	52 (27.1%)
tetracycline	37	2 (5.4%)	73	16 (21.9%)	78	16 (20.5%)	109	20 (18.3%)
"sanguinis"								
ampicillin/amoxycillin	104	7 (6.7%)	141	8 (5.7%)	142	8 (5.6%)	189	16 (9.5%)
erythromycin	135	42 (31.1%)	189	52 (27.5%)	193	54 (28.0%)	230	82 (35.7%)
penicillin	157	37 (23.6%)	219	38 (17.4%)	225	41 (18.2%)	270	59 (21.9%)
tetracycline	71	18 (25.4%)	132	33 (25.0%)	111	25 (22.5%)	146	51 (34.9%)

E-Table 1 Laboratory reports of streptococcal bacteraemia, England, Wales, and Northern Ireland: 2002-2005

Streptococcus spp	2002	2003	2004	2005
Pyogenic streptococci:	2935	3916	3710	3536
group A streptococci	1038	1688	1535	1238
group B streptococci	1068	1226	1176	1248
group C streptococci	220	275	255	275
group G streptococci	609	727	744	775
Non-pyogenic streptococci:	2094	2408	2516	2618
anginosus group	553	612	631	676
<i>Streptococcus anginosus</i>	148	146	193	174
<i>Streptococcus constellatus</i>	143	169	160	206
<i>Streptococcus intermedius</i>	69	57	77	72
<i>Streptococcus milleri</i> group	154	203	179	177
<i>Streptococcus</i> group F	39	37	22	47
bovis group	227	235	231	214
<i>Streptococcus bovis</i> (untyped)	194	186	187	177
<i>Streptococcus bovis</i> biotype I	7	20	20	17
<i>Streptococcus bovis</i> biotype II	14	14	13	12
<i>Streptococcus equinus</i>	10	12	9	7
<i>Streptococcus alactolyticus</i>	2	3	1	1
<i>Streptococcus infantarius</i> sp nov	0	0	1	0
<i>Streptococcus saccharolyticus</i>	0	0	0	0
mitis group	778	1000	1070	1033
<i>Streptococcus mitis</i>	20	27	50	50
<i>Streptococcus oralis</i>	246	310	340	334
<i>Streptococcus mitis</i> group	512	663	680	649
mutans group	44	45	41	48
<i>Streptococcus mutans</i>	44	45	40	47
<i>Streptococcus sobrinus</i>	0	0	1	1
salivarius group	197	189	226	280
<i>Streptococcus salivarius</i>	178	161	195	247
<i>Streptococcus vestibularis</i>	19	28	31	33
sanguinis group	295	327	317	367
<i>Streptococcus gordonii</i>	21	21	14	26
<i>Streptococcus sanguinis</i>	14	4	10	8
<i>Streptococcus parasanguinis</i>	50	64	58	73
<i>Streptococcus sanguinis</i> group	210	238	235	260
Other streptococci:	1200	1608	1744	1713
<i>Streptococcus acidominimus</i>	37	45	47	51
<i>Streptococcus suis</i>	0	2	0	3
<i>Streptococcus uberis</i>	5	3	4	6
Anaerobic streptococcus	47	40	48	31
Streptococci not fully identified	1111	1518	1645	1622
TOTAL:	6229	7932	7970	7867
Genera closely related to streptococci:	148	196	242	252
<i>Abiotrophia</i> spp	8	8	16	20
<i>Aerococcus</i> spp	73	75	96	100
<i>Gemella</i> spp	50	80	92	98
<i>Leuconostoc</i> spp	15	29	35	30
<i>Pediococcus</i> spp	2	4	3	4

E-Table 2a Region-specific rates (per 100,000 population) of pyogenic streptococcal bacteraemia: England, Wales and Northern Ireland, 2005

Region	rate per 100,000 population (95% CI)			
	Group A	Group B	Group C	Group G
North West	2.7 (2.3-3.1)	2.5 (2.1-2.9)	0.6 (0.5-0.9)	1.3 (1.1-1.6)
North East	2.0 (1.5-2.6)	2.1 (1.6-2.7)	0.7 (0.4-1.1)	0.6 (0.3-1.0)
Yorkshire & Humber	3.3 (2.9-3.9)	3.7 (3.2-4.2)	0.7 (0.5-1.0)	2.0 (1.6-2.5)
West Midlands	2.7 (2.2-3.1)	2.8 (2.4-3.3)	0.9 (0.6-1.2)	2.1 (1.8-2.6)
East Midlands	2.3 (1.9-2.8)	2.4 (1.9-2.9)	0.6 (0.4-0.9)	1.3 (1.0-1.7)
East of England	2.0 (1.6-2.4)	2.3 (1.9-2.8)	0.4 (0.2-0.6)	2.2 (1.8-2.7)
South West	2.3 (1.9-2.7)	2.4 (2.0-2.8)	0.5 (0.3-0.7)	2.0 (1.6-2.4)
South East	1.5 (1.2-1.7)	1.3 (1.0-1.5)	0.2 (0.1-0.3)	0.7 (0.5-0.9)
London	2.1 (1.8-2.5)	1.8 (1.5-2.1)	0.2 (0.1-0.3)	0.7 (0.5-0.9)
England	2.3 (2.1-2.4)	2.3 (2.1-2.4)	0.5 (0.4-0.5)	1.4 (1.3-1.5)
Wales	1.9 (1.4-2.5)	2.0 (1.5-2.6)	0.7 (0.4-1.0)	1.8 (1.3-2.3)
Northern Ireland	1.9 (1.3-2.7)	2.7 (2.0-3.6)	0.9 (0.5-1.4)	0.8 (0.4-1.4)
England, Wales and N.I.	2.3 (2.1-2.4)	2.3 (2.1-2.4)	0.5 (0.4-0.6)	1.4 (1.3-1.5)

E-Table 2b Region-specific rates (per 100,000 population) of non-pyogenic streptococcal bacteraemia: England, Wales and Northern Ireland, 2005

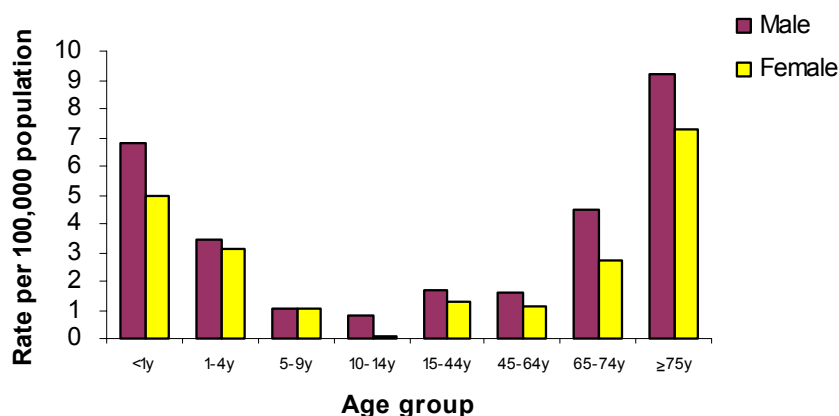
Region	rate per 100,000 population (95% CI)				
	"Anginosus Group"	"Bovis Group"	"Mitis Group"	"Salivarius Group"	"Sanguinis Group"
North West	1.5 (1.2-1.8)	0.3 (0.2-0.4)	3.0 (2.6-3.5)	0.6 (0.5-0.9)	0.8 (0.6-1.0)
North East	1.6 (1.2-2.2)	0.6 (0.4-1.0)	3.1 (2.4-3.9)	0.7 (0.5-1.2)	0.8 (0.5-1.3)
Yorkshire & Humber	1.7 (1.4-2.1)	0.6 (0.4-0.9)	2.2 (1.8-2.6)	0.4 (0.2-0.6)	0.6 (0.4-0.9)
West Midlands	1.5 (1.2-1.8)	0.5 (0.3-0.7)	2.3 (1.9-2.7)	0.4 (0.2-0.6)	0.8 (0.6-1.1)
East Midlands	1.0 (0.7-1.4)	0.3 (0.2-0.5)	1.4 (1.1-1.8)	0.5 (0.3-0.7)	0.6 (0.4-0.9)
East of England	1.1 (0.9-1.4)	0.5 (0.3-0.7)	1.4 (1.1-1.8)	0.7 (0.5-0.9)	0.9 (0.6-1.1)
South West	1.6 (1.3-2.0)	0.6 (0.4-0.9)	2.2 (1.8-2.6)	0.7 (0.5-1.0)	0.8 (0.6-1.1)
South East	0.8 (0.6-1.0)	0.2 (0.2-0.4)	1.2 (1.0-1.5)	0.4 (0.2-0.5)	0.6 (0.4-0.8)
London	0.9 (0.7-1.1)	0.2 (0.1-0.4)	1.8 (1.5-2.1)	0.5 (0.4-0.7)	0.6 (0.4-0.7)
England	1.2 (1.1-1.3)	0.4 (0.3-0.4)	2.0 (1.9-2.1)	0.5 (0.5-0.6)	0.7 (0.6-0.8)
Wales	0.9 (0.6-1.3)	0.2 (0.1-0.5)	0.5 (0.3-0.8)	0.3 (0.2-0.6)	0.4 (0.2-0.7)
Northern Ireland	1.5 (0.9-2.1)	0.7 (0.4-1.2)	1.2 (0.8-1.9)	0.4 (0.1-0.8)	0.5 (0.2-0.9)
England, Wales and N.I.	1.2 (1.1-1.3)	0.4 (0.3-0.4)	1.9 (1.8-2.0)	0.5 (0.5-0.6)	0.7 (0.6-0.7)

E-Table 3 Incidence of group B streptococcal bacteraemia in infants in England, Wales, and Northern Ireland: 2005

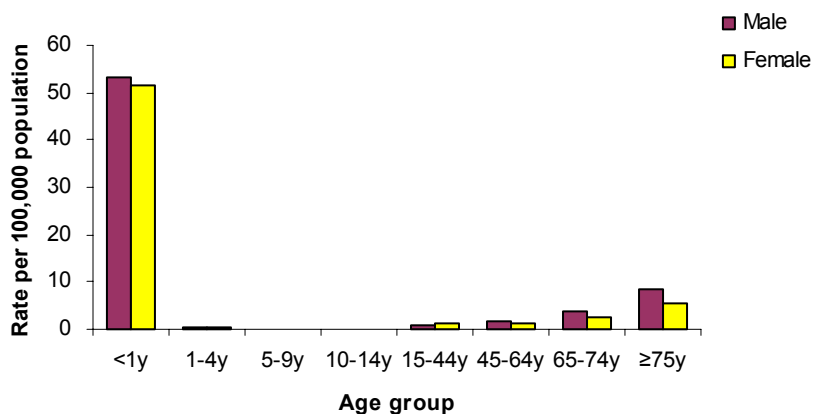
Country	Live Births 2005	Total		Early onset [†]		Late onset [†]	
		Cases	Rate* (95% CI)	Cases	Rate* (95% CI)	Cases	Rate* (95% CI)
England	613,028	308	0.50 (0.45-0.56)	187	0.31(0.26-0.35)	121	0.20 (0.16-0.24)
Wales	32,593	16	0.49 (0.28-0.80)	11	0.34 (0.17-0.60)	7	0.21 (0.09-0.44)
Northern Ireland	22,328	14	0.63 (0.34-1.05)	9	0.40 (0.18-0.77)	3	0.13 (0.03-0.39)
Total	667,949	338	0.51 (0.45-0.56)	207	0.31 (0.27-0.36)	131	0.20 (0.16-0.23)

* Rate per 1000 live births [†]Early onset (0-6 days); Late onset (7-90 days)

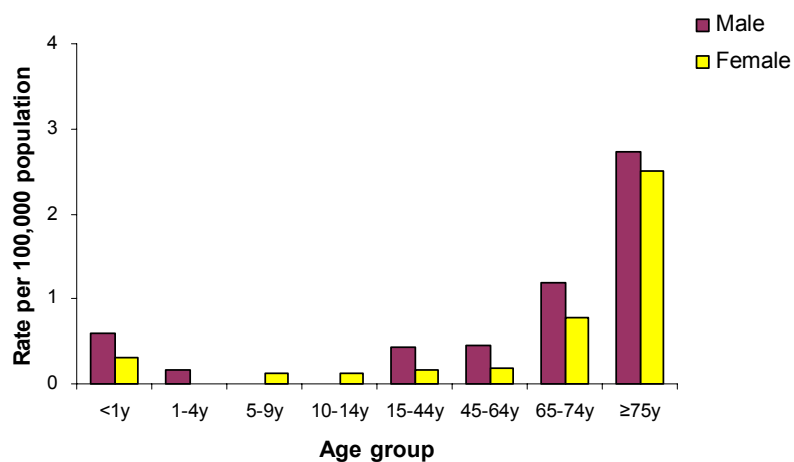
E-Figure 1 Age-specific rates of group A streptococcal bacteraemia reports: England, Wales and Northern Ireland, 2005



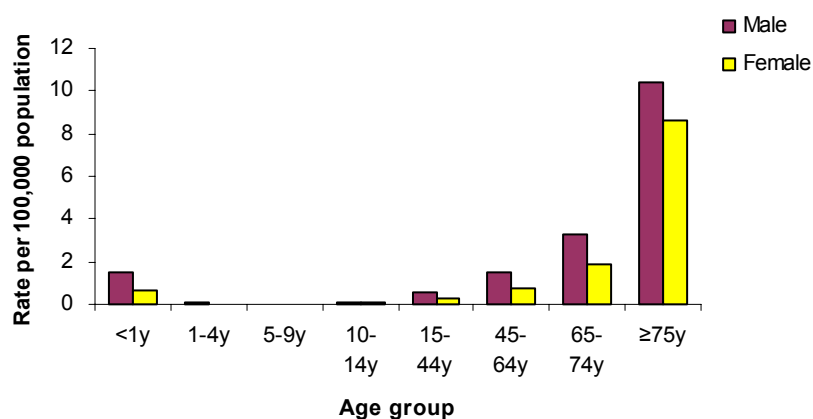
E-Figure 2 Age-specific rates of group B streptococcal bacteraemia reports: England, Wales and Northern Ireland, 2005



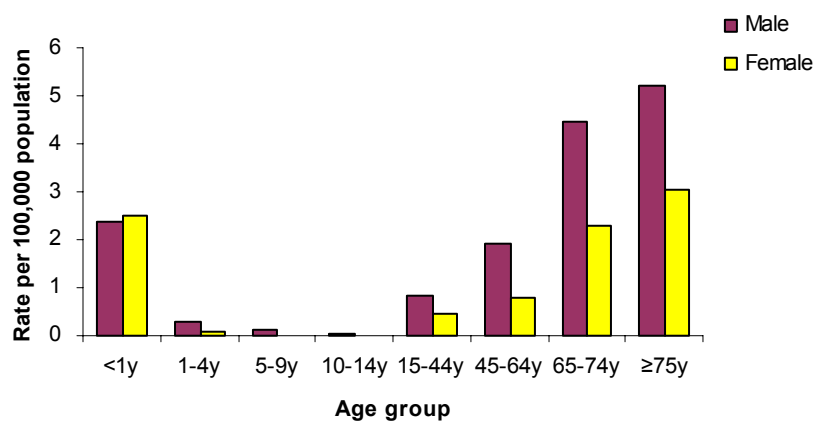
E-Figure 3 **Age-specific rates of group C streptococcal bacteraemia reports: England, Wales and Northern Ireland, 2005**



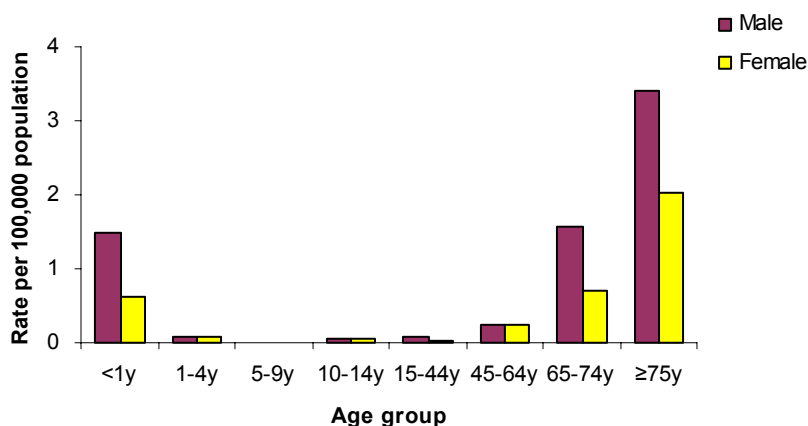
E-Figure 4 **Age-specific rates of group G streptococcal bacteraemia reports: England, Wales and Northern Ireland, 2005**



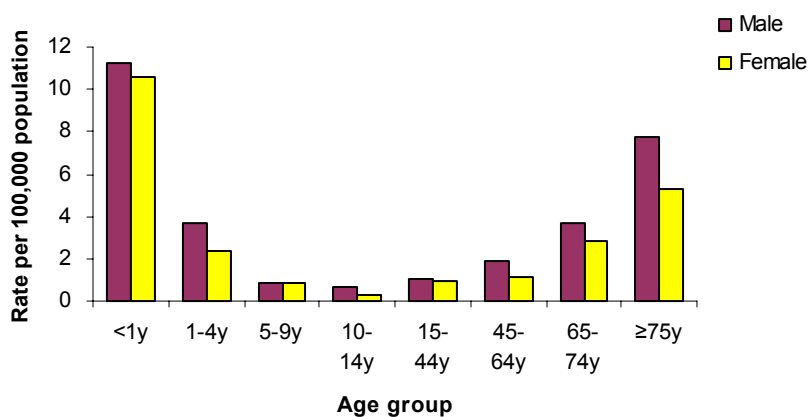
E-Figure 5 **Age-specific rates of "Anginosus" group streptococcal bacteraemia reports: England, Wales and Northern Ireland, 2005**



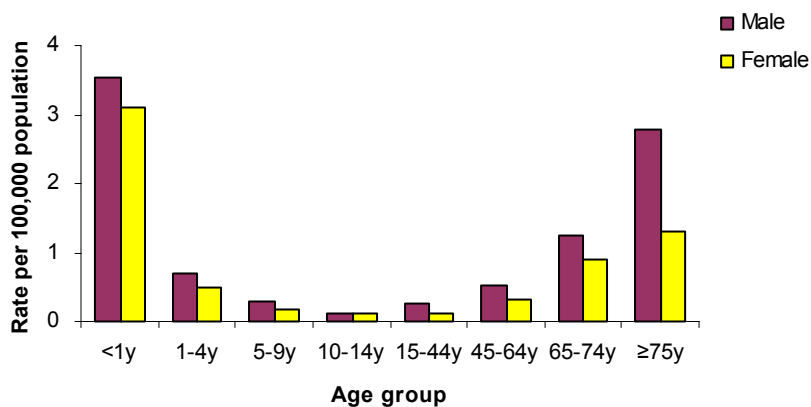
E-Figure 6 **Age-specific rates of "Bovis" group streptococcal bacteraemia reports: England, Wales and Northern Ireland, 2005**



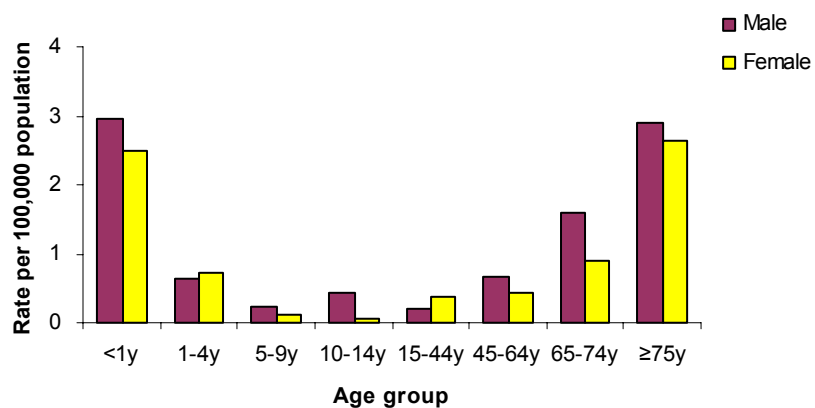
E-Figure 7 **Age-specific rates of "Mitis" group streptococcal bacteraemia reports: England, Wales and Northern Ireland, 2005**



E-Figure 8 **Age-specific rates of "Salivarius" group streptococcal bacteraemia reports: England, Wales and Northern Ireland, 2005**



E-Figure 9 **Age-specific rates of "Sanguinis" group streptococcal bacteraemia reports: England, Wales and Northern Ireland, 2005**



E-Table 4 Antibiotic resistance data for streptococcal bacteraemia reports: England, Wales, and Northern Ireland: 2002-2005

		2002		2003		2004		2005	
		no. tested	percentage resistant	no. tested	percentage resistant	no. tested	percentage resistant	no. tested	percentage resistant
group A	clindamycin	114	2.6%	828	0.8%	213	6.1%	160	2.5%
	erythromycin	681	3.2%	1408	4.2%	903	3.8%	649	4.6%
	tetracycline	414	11.6%	1110	16.2%	571	14.4%	387	16.8%
group B	clindamycin	108	3.7%	165	7.9%	162	5.6%	155	9.0%
	erythromycin	708	6.4%	824	6.7%	856	8.2%	861	9.8%
	tetracycline	423	69.7%	537	75.4%	566	77.4%	567	76.0%
group C	clindamycin	18	0.0%	31	6.5%	50	16.0%	40	12.5%
	erythromycin	135	7.4%	174	12.1%	173	15.6%	194	13.9%
	tetracycline	81	30.9%	110	29.1%	97	38.1%	122	23.0%
group G	clindamycin	59	3.4%	91	8.8%	123	5.7%	114	3.5%
	erythromycin	442	15.6%	534	15.2%	575	13.7%	568	17.6%
	tetracycline	262	48.1%	338	48.5%	382	50.3%	409	49.9%
"anginosus"	ampicillin/amoxycillin	182	1.6%	247	0.0%	270	0.7%	282	0.0%
	erythromycin	276	7.6%	365	7.1%	399	7.8%	430	9.8%
	penicillin	311	1.3%	413	3.1%	461	3.0%	491	4.3%
	tetracycline	148	16.2%	211	16.1%	218	12.4%	233	21.5%
"bovis"	ampicillin/amoxycillin	108	1.9%	109	0.0%	129	0.0%	99	1.0%
	erythromycin	108	18.5%	122	13.1%	145	15.9%	120	15.0%
	penicillin	126	5.6%	139	4.3%	167	1.8%	138	7.2%
	tetracycline	59	61.0%	72	55.6%	88	46.6%	84	58.3%
"mitis"	ampicillin/amoxycillin	269	4.5%	422	6.6%	473	4.9%	495	5.1%
	erythromycin	355	35.8%	584	35.8%	631	35.7%	633	40.0%
	penicillin	384	20.3%	627	19.9%	721	20.5%	753	21.4%
	tetracycline	168	23.2%	328	28.7%	305	30.8%	378	31.0%
"salivarius"	ampicillin/amoxycillin	52	3.8%	89	0.0%	111	3.6%	138	2.2%
	erythromycin	71	25.4%	111	18.9%	124	35.5%	161	31.1%
	penicillin	81	19.8%	122	22.1%	160	20.0%	192	27.1%
	tetracycline	37	5.4%	73	21.9%	78	20.5%	109	18.3%
"sanguinis"	ampicillin/amoxycillin	104	6.7%	141	5.7%	142	5.6%	169	9.5%
	erythromycin	135	31.1%	189	27.5%	193	28.0%	230	35.7%
	penicillin	157	23.6%	219	17.4%	225	18.2%	270	21.9%
	tetracycline	71	25.4%	132	25.0%	111	22.5%	146	34.9%

E-Table 5a Region-specific antibiotic susceptibility data for group A streptococcal bacteraemia reports: England, Wales, and Northern Ireland: 2005

Region	Clindamycin		Erythromycin		Tetracycline	
	no. tested	percentage resistant	no. tested	percentage resistant	no. tested	percentage resistant
North West	27	0.0%	98	2.0%	36	27.8%
North East	12	0.0%	26	0.0%	6	16.7%
Yorkshire & the Humber	26	11.5%	77	10.4%	66	13.6%
West Midlands	17	0.0%	110	3.6%	55	16.4%
East Midlands	8	0.0%	55	5.5%	45	13.3%
East of England	28	0.0%	82	4.9%	70	14.3%
South West	18	5.6%	78	3.8%	54	14.8%
South East	6	0.0%	30	0.0%	7	28.6%
London	12	0.0%	54	9.3%	18	33.3%
England	154	2.6%	610	4.8%	357	17.1%
Wales	3	0.0%	24	4.2%	15	26.7%
Northern Ireland (N.I.)	3	0.0%	15	0.0%	15	0.0%
England, Wales, and N.I.	160	2.5%	649	4.6%	387	16.8%

E-Table 5b Region-specific antibiotic susceptibility data for group B streptococcal bacteraemia reports: England, Wales, and Northern Ireland: 2005

Region	Clindamycin		Erythromycin		Tetracycline	
	no. tested	percentage resistant	no. tested	percentage resistant	no. tested	percentage resistant
North West	15	6.7%	117	12.0%	44	72.7%
North East	24	12.5%	50	14.0%	16	62.5%
Yorkshire & the Humber	14	21.4%	77	3.9%	80	78.8%
West Midlands	14	7.1%	123	6.5%	68	73.5%
East Midlands	22	4.5%	71	11.3%	55	78.2%
East of England	33	12.1%	112	11.6%	91	74.7%
South West	11	9.1%	105	7.6%	77	80.5%
South East	10	0.0%	62	9.7%	50	70.0%
London	9	0.0%	92	14.1%	41	87.8%
England	152	9.2%	809	9.9%	522	76.4%
Wales	1	0.0%	36	8.3%	31	80.6%
Northern Ireland (N.I.)	2	0.0%	16	6.3%	14	50.0%
England, Wales, and N.I.	155	9.0%	861	9.8%	567	76.0%

E-Table 5c Region-specific antibiotic susceptibility data for group C streptococcal bacteraemia reports: England, Wales, and Northern Ireland: 2005

Region	Clindamycin		Erythromycin		Tetracycline	
	no. tested	percentage resistant	no. tested	percentage resistant	no. tested	percentage resistant
North West	18	11.1%	68	16.2%	12	16.7%
North East	8	37.5%	12	25.0%	5	0.0%
Yorkshire & the Humber	2	0.0%	53	20.8%	19	21.1%
West Midlands	3	0.0%	96	18.8%	20	25.0%
East Midlands	1	0.0%	37	10.8%	13	38.5%
East of England	2	0.0%	113	16.8%	16	31.3%
South West	4	0.0%	84	11.9%	13	23.1%
South East	1	0.0%	25	16.0%	3	0.0%
London	1	0.0%	38	23.7%	2	0.0%
England	40	12.5%	526	16.9%	103	23.3%
Wales	0	0.0%	40	27.5%	12	8.3%
Northern Ireland (N.I.)	0	0.0%	2	0.0%	7	42.9%
England, Wales, and N.I.	40	12.5%	568	17.6%	122	23.0%

E-Table 5d Region-specific antibiotic susceptibility data for group G streptococcal bacteraemia reports: England, Wales, and Northern Ireland: 2005

Region	Clindamycin		Erythromycin		Tetracycline	
	no. tested	percentage resistant	no. tested	percentage resistant	no. tested	percentage resistant
North West	20	0.0%	68	16.2%	26	50.0%
North East	1	0.0%	12	25.0%	7	71.4%
Yorkshire & the Humber	15	20.0%	53	20.8%	51	51.0%
West Midlands	14	0.0%	96	18.8%	66	57.6%
East Midlands	7	0.0%	37	10.8%	32	59.4%
East of England	29	3.4%	113	16.8%	90	46.7%
South West	15	0.0%	84	11.9%	64	50.0%
South East	6	0.0%	25	16.0%	21	28.6%
London	6	0.0%	38	23.7%	20	40.0%
England	113	3.5%	526	16.9%	377	50.1%
Wales	1	0.0%	40	27.5%	29	48.3%
Northern Ireland (N.I.)	0	0.0%	2	0.0%	3	33.3%
England, Wales, and N.I.	114	3.5%	568	17.6%	409	49.9%

Table 7 Multiple antibiotic resistance patterns for group A streptococcal bacteraemia reports: England, Wales, and Northern Ireland: 2005

		Erythromycin		Clindamycin		Tetracycline		no. multiresistant
Erythromycin		no. tested	% resistant	no. tested	% resistant	no. tested	% resistant	(total tested)
Resistant	30			3	33%	15	67%	0 (1)
Sensitive	619			129	2%	344	13%	
Clindamycin								
Resistant	4	4	57%			3	0%	0 (3)
Sensitive	156	128	50%			78	14%	
Tetracycline								
Resistant	65	56	55%	11	0%			0 (10)
Sensitive	322	303	50%	69	4%			

Table 8 Multiple antibiotic resistance patterns for group B streptococcal bacteraemia reports: England, Wales, and Northern Ireland: 2005

		Erythromycin		Clindamycin		Tetracycline		no. multiresistant
Erythromycin		no. tested	% resistant	no. tested	% resistant	no. tested	% resistant	(total tested)
R	84			14	57%	45	87%	4 (9)
S	777			117	5%	459	75%	
Clindamycin								
R	14	14	57%			10	80%	4 (10)
S	141	117	5%			76	74%	
Tetracycline								
R	431	385	10%	64	13%			4 (64)
S	136	119	5%	22	9%			

Table 9 Multiple antibiotic resistance patterns for group C streptococcal bacteraemia reports: England, Wales, and Northern Ireland: 2005

		Erythromycin		Clindamycin		Tetracycline		no. multiresistant
Erythromycin		no. tested	% resistant	no. tested	% resistant	no. tested	% resistant	(total tested)
R	27			8	50%	15	53%	0 (4)
S	166			28	0%	97	20%	
Clindamycin								
R	5	4	100%			1	0%	0 (1)
S	35	32	13%			21	19%	
Tetracycline								
R	28	27	30%	4	0%			0 (4)
S	94	85	8%	18	6%			

Table 10 Multiple antibiotic resistance patterns for group A streptococcal bacteraemia reports: England, Wales, and Northern Ireland: 2005

		Erythromycin		Clindamycin		Tetracycline		no. multiresistant
Erythromycin		no. tested	% resistant	no. tested	% resistant	no. tested	% resistant	(total tested)
R	100			15	13%	66	48%	2 (14)
S	468			79	3%	301	51%	
Clindamycin								
R	4	2	50%			4	100%	2 (4)
S	108	13	14%			69	45%	
Tetracycline								
R	204	32	17%	35	11%			2 (35)
S	204	34	19%	38	0%			