Infection reports

Pyogenic and non-pyogenic streptococcal bacteraemia, England, Wales and Northern Ireland: 2009

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Introduction

These data are based on records extracted from the voluntary routine surveillance database (LabBase2) on the 14th October 2010 for the period 2005-2009. The exception to this is group A streptococcal (GAS) infection for which data on isolates submitted to the Streptococcus and Diphtheria Reference Unit (SDRU) are merged with routine laboratory reports.

Surveillance of GAS diseases during winter 2008/09 identified levels of activity above that seasonally expected in England for both invasive and non-invasive diseases as well as reports of increased case fatality rates [1]. This triggered a number of public health actions including cascaded alerts to frontline medical staff and initiation of national enhanced surveillance of severe GAS disease from 1st January 2009 to 31st December 2009 [2]. Enhanced surveillance data are not included in this report.

Population rates for 2009 were calculated using 2009 mid year resident population estimates based on the 2001 census for England, Wales and Northern Ireland. Rates of GBS bacteraemia in infants were calculated using 2009 live birth denominators. 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 the database and due to the introduction of a new automated de-duplication process for the merged GAS reports.

Group A streptococci

Data from laboratory reports and isolate referrals showed a 11% increase in the number of reports of GAS bacteraemia in 2009 compared with 2008, from 1301 to 1445 (Table 1).

Table 1 **Number of laboratory reports of streptococcal bacteraemia, England, Wales and Northern Ireland, 2005-2009**

	2005	2006	2007	2008	2009
Pyogenic streptococci	**3543**	**3748**	**3789**	**4107**	**4230**
Group A streptococci	1241	1261	1242	1301	1445
Group B streptococci	1250	1442	1403	1550	1571
Group C streptococci	276	292	320	390	378
Group G Streptococci	776	753	824	866	836
Non-pyogenic streptococci	**2643**	**2838**	**3083**	**3232**	**3182**
Anginosus group	**678**	**728**	**771**	**842**	**842**
Streptococcus anginosus	174	175	222	261	276
Streptococcus constellatus	206	203	201	198	224
Streptococcus intermedius	74	93	93	89	83
"Streptococcus milleri group"	177	214	219	246	197
Streptococcus group F	47	43	36	48	62
Bovis group	**214**	**253**	**264**	**290**	**288**
Streptococcus bovis (untyped)	177	214	217	223	223
Streptococcus bovis biotype I	17	12	20	24	34
Streptococcus bovis biotype II	12	17	14	27	17
Streptococcus equinus	7	7	8	10	9
Streptococcus alactolyticus	1	3	5	6	5
Mitis group	**1052**	**1177**	**1260**	**1196**	**1191**
Streptococcus mitior	6	8	14	13	13
Streptococcus mitis	50	45	111	125	116
Streptococcus oralis	341	366	409	358	353
"*Streptococcus mitis* group"	655	758	726	700	709
Mutans group	**48**	**44**	**53**	**58**	**64**
Streptococcus mutans	47	44	53	56	62
Streptococcus sobrinus	1	0	0	2	2
Salivarius group	**282**	**295**	**334**	**333**	**323**
Streptococcus salivarius	249	263	302	300	294
Streptococcus vestibularis	33	32	32	33	29
Sanguinis group	**369**	**341**	**401**	**513**	**474**
Streptococcus gordonii	26	23	43	53	61
Streptococcus sanguinis	8	16	25	44	31
Streptococcus parasanguinis	73	85	112	146	141
"*Streptococcus sanguinis* group"	262	217	221	270	241
Other streptococci	**1491**	**1724**	**2053**	**2031**	**1875**
Streptococcus acidominimus	52	53	26	20	13

Streptococcus suis	3	3	1	7	1
Streptococcus uberis	6	8	9	5	6
"Anaerobic streptococcus"	31	37	55	47	21
Streptococci not fully identified	1399	1623	1962	1952	1834
Total:	**7677**	**8310**	**8925**	**9370**	**9287**
Genera closely related to streptococci:	**468**	**518**	**555**	**480**	**476**
Abiotropha spp	26	34	28	25	24
Aerococcus spp	106	134	152	123	153
Gemella spp	98	111	139	123	115
Globicatella sanguis	0	2	3	0	2
Leuconostoc spp	31	43	39	38	38
Pediococcus spp	4	3	6	6	1
Peptostreptococcus spp	203	191	188	165	143
** Group D streptococci were excluded from the analysis. Please refer to the entrococcus surveillance reports for further information.*					
Group D streptococci	153	78	118	100	87

The rate of GAS bacteraemia reported in England, Wales and Northern Ireland for 2009 was 2.6 (95% CI 2.4-2.7) per 100,000 population (Table 2). Rates of reported GAS bacteraemia in England were 2.6, an increase from 2008 (2.4), whereas rates in Northern Ireland decreased from 2.4 in 2008 to 1.5 in 2009. The rates in Wales have increased to 2.0 (from 1.5 in 2008). There was a wide variation within England from 2.1 in the East Midlands to 3.2/100,000 in the North West.

Table 2 **Region-specific rates (per 100,000 population) of pyogenic streptococcal bacteraemia: England, Wales and Northern, 2009**

	Rate per 100,000 population			
Region	**Group A**	**Group B**	**Group C**	**Group G**
East Midlands	2.1	3.1	0.7	1.4
East of England	2.3	3.3	0.7	1.9
London	2.2	3.1	0.3	1.0
North East	2.8	2.3	1.1	0.6
North West	3.2	2.3	0.8	1.6
South East	2.8	2.3	0.5	1.4
South West	3.0	2.4	0.6	1.8
West Midlands	2.7	3.2	0.8	2.0
Yorkshire & Humber	2.7	3.1	1.0	1.7
England	**2.6**	**2.8**	**0.7**	**1.5**
Wales	**2.0**	**2.1**	**0.6**	**1.1**
Northern Ireland (N.I.)	**1.5**	**3.9**	**0.5**	**1.0**
England, Wales and N.I.	**2.6**	**2.8**	**0.7**	**1.5**

The highest reported rates of GAS bacteraemia were in adults aged 75 and over (8.8/100,000) and those aged less than 1 year (7.3/100,000) (Figure 1). Rates of GAS bacteraemia reports were higher in males than females across most age groups, the exceptions being in the 5-9 years and 15-44 years age groups.

Figure 1 **Age-specific rates of group A streptococcal bacteraemia reports: England, Wales and Northern Ireland, 2009**

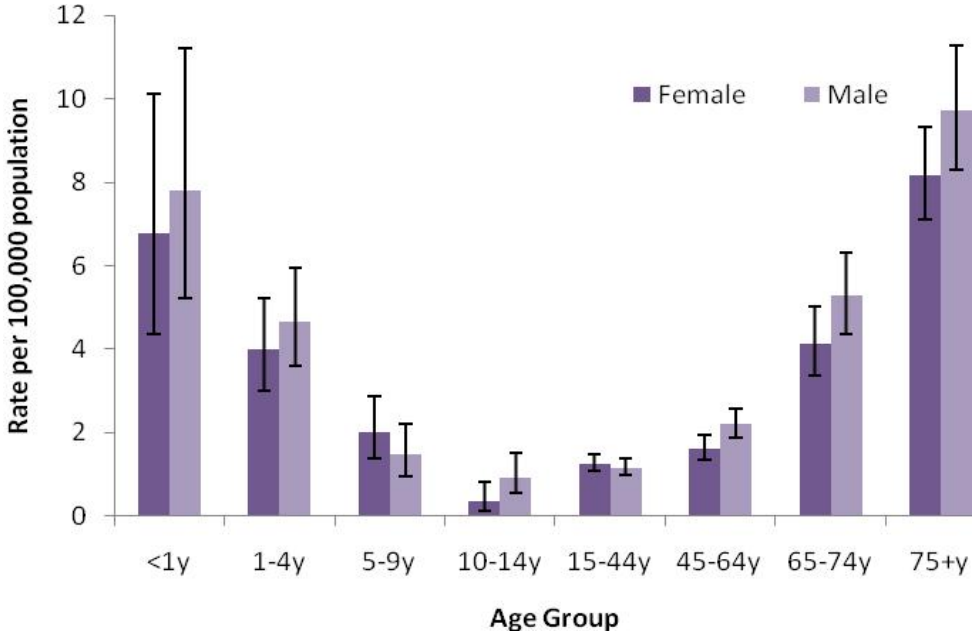


Table 3 **Antibiotic resistance data for streptococcal bacteraemia reports: England, Wales and Northern Ireland, 2005-2009**

		2005		2006		2007		2008		2009	
		No. tested	(% resistant)	No. tested	(% resistant)	No. tested	(% resistant)	No. tested	(% resistant)	No. tested	(% resistant)
Group A	clindamycin	158	(3%)	171	(4%)	216	(4%)	318	(3%)	335	(3%)
	erythromycin	647	(5%)	698	(5%)	787	(6%)	896	(5%)	821	(5%)
	tetracycline	371	(17%)	448	(17%)	569	(15%)	615	(11%)	561	(9%)
Group B	clindamycin	155	(9%)	210	(9%)	257	(7%)	358	(8%)	398	(10%)
	erythromycin	850	(10%)	1016	(11%)	1027	(11%)	1095	(12%)	1058	(14%)
	tetracycline	527	(76%)	695	(80%)	800	(83%)	832	(82%)	814	(79%)
Group C	clindamycin	41	(12%)	38	(8%)	56	(5%)	82	(11%)	83	(4%)
	erythromycin	194	(14%)	195	(8%)	217	(9%)	260	(11%)	247	(13%)
	tetracycline	117	(21%)	127	(24%)	164	(17%)	214	(24%)	187	(24%)
Group G	clindamycin	114	(4%)	115	(6%)	152	(10%)	226	(12%)	192	(8%)
	erythromycin	562	(18%)	540	(19%)	590	(23%)	624	(22%)	547	(24%)
	tetracycline	390	(51%)	381	(47%)	465	(46%)	461	(46%)	421	(49%)
"Anginosus"	erythromycin	427	(10%)	453	(9%)	528	(10%)	579	(8%)	550	(9%)
	penicillin	486	(4%)	556	(4%)	641	(4%)	710	(3%)	713	(3%)
	tetracycline	222	(21%)	311	(15%)	382	(15%)	390	(21%)	390	(19%)
"Bovis"	erythromycin	120	(15%)	148	(21%)	160	(19%)	183	(21%)	169	(23%)
	penicillin	137	(7%)	180	(9%)	197	(5%)	236	(5%)	220	(4%)
	tetracycline	80	(58%)	106	(60%)	122	(66%)	133	(65%)	143	(65%)
"Mitis"	erythromycin	625	(40%)	687	(43%)	814	(41%)	816	(40%)	741	(43%)
	penicillin	728	(22%)	854	(24%)	1009	(23%)	1003	(25%)	961	(23%)
	tetracycline	364	(31%)	459	(32%)	575	(28%)	580	(29%)	554	(28%)
"Salivarius"	erythromycin	159	(31%)	185	(33%)	210	(31%)	229	(37%)	225	(36%)
	penicillin	189	(27%)	216	(27%)	262	(26%)	256	(22%)	254	(22%)
	tetracycline	104	(18%)	125	(17%)	136	(23%)	150	(21%)	156	(21%)
"Sanguinis"	erythromycin	230	(36%)	229	(33%)	272	(35%)	364	(34%)	310	(40%)
	penicillin	266	(22%)	276	(20%)	326	(29%)	412	(27%)	354	(30%)
	tetracycline	140	(34%)	154	(28%)	195	(29%)	237	(30%)	222	(32%)

Antimicrobial resistance

Reported resistance rates to clindamycin, erythromycin and tetracycline were 3%, 5% and 9% respectively in 2009 (Table 3). Resistance to clindamycin and erythromycin has remained stable since 2005, whilst prevalence of tetracycline resistance has declined over recent years. Rates of erythromycin resistance varied geographically within England, ranging between no resistant isolates in the Yorkshire and Humber region to 9% isolates reported as erythromycin resistant from London (Table 4). Within England, substantial variation in tetracycline resistance was evident, from 4% in the South East to 22% in the London region.

Table 4 **Region-specific antibiotic susceptibility data for pyogenic streptococcal bacteraemia reports: England, Wales, and Northern Ireland, 2009**

Group A streptococci

	clindamycin		**erythromycin**		**tetracycline**	
Region	no. tested	(% resistant)	no. tested	(% resistant)	no. tested	(% resistant)
East Midlands	18	(0%)	63	(5%)	28	(11%)
East of England	55	(4%)	92	(3%)	87	(7%)
London	42	(5%)	111	(9%)	45	(22%)
North East	16	(0%)	45	(2%)	27	(11%)
North West	60	(5%)	140	(7%)	85	(12%)
South East	54	(2%)	147	(3%)	70	(4%)
South West	39	(3%)	64	(5%)	73	(7%)
West Midlands	19	(0%)	65	(3%)	62	(5%)
Yorkshire & Humber	15	(0%)	48	(0%)	41	(10%)
England	**318**	**(3%)**	**775**	**(5%)**	**518**	**(9%)**
Wales	**2**	**(0%)**	**24**	**(4%)**	**1**	**(4%)**
Northern Ireland (N.I.)	**15**	**(7%)**	**22**	**(5%)**	**20**	**(0%)**
England, Wales and N.I.	**335**	**(3%)**	**821**	**(5%)**	**48**	**(9%)**

Group B streptococci

	clindamycin		**erythromycin**		**tetracycline**	
Region	no. tested	(% resistant)	no. tested	(% resistant)	no. tested	(% resistant)
East Midlands	18	(6%)	110	(9%)	58	(76%)
East of England	57	(5%)	139	(9%)	118	(79%)
London	61	(8%)	200	(18%)	111	(83%)
North East	32	(3%)	47	(13%)	31	(81%)
North West	57	(18%)	122	(16%)	85	(81%)
South East	57	(21%)	150	(16%)	100	(76%)
South West	28	(14%)	59	(10%)	71	(72%)
West Midlands	36	(6%)	85	(12%)	83	(80%)
Yorkshire & Humber	12	(0%)	55	(15%)	51	(75%)
England	**358**	**(11%)**	**967**	**(13%)**	**708**	**(78%)**
Wales	**0**	**(0%)**	**51**	**(16%)**	**45**	**(82%)**
Northern Ireland (N.I.)	**40**	**(8%)**	**40**	**(13%)**	**61**	**(89%)**
England, Wales and N.I.	**398**	**(10%)**	**1058**	**(14%)**	**814**	**(79%)**

Group C streptococci

	clindamycin		erythromycin		tetracycline	
Region	no. tested	(% resistant)	no. tested	(% resistant)	no. tested	(% resistant)
East Midlands	4	(0%)	21	(14%)	14	(14%)
East of England	14	(14%)	28	(21%)	24	(25%)
London	3	(0%)	19	(16%)	12	(25%)
North East	6	(0%)	15	(13%)	11	(36%)
North West	18	(0%)	47	(13%)	27	(30%)
South East	10	(0%)	30	(10%)	12	(17%)
South West	8	(0%)	16	(25%)	11	(9%)
West Midlands	4	(0%)	23	(4%)	29	(31%)
Yorkshire & Humber	11	(9%)	26	(8%)	27	(19%)
England	**78**	**(4%)**	**225**	**(13%)**	**167**	**(24%)**
Wales	**1**	**(0%)**	**14**	**(7%)**	**12**	**(8%)**
Northern Ireland (N.I.)	**4**	**(0%)**	**8**	**(13%)**	**8**	**(50%)**
England, Wales and N.I.	**83**	**(4%)**	**247**	**(13%)**	**187**	**(24%)**

Group G streptococci

	clindamycin		erythromycin		tetracycline	
Region	no. tested	(% resistant)	no. tested	(% resistant)	no. tested	(% resistant)
East Midlands	6	(0%)	46	(13%)	28	(61%)
East of England	29	(14%)	78	(33%)	64	(39%)
London	23	(13%)	58	(29%)	28	(50%)
North East	1	(0%)	12	(25%)	5	(60%)
North West	26	(12%)	89	(25%)	59	(47%)
South East	52	(10%)	93	(30%)	54	(50%)
South West	25	(0%)	44	(9%)	53	(40%)
West Midlands	14	(0%)	60	(25%)	60	(45%)
Yorkshire & Humber	2	(0%)	30	(10%)	33	(64%)
England	**178**	**(8%)**	**510**	**(24%)**	**384**	**(48%)**
Wales	**2**	**(0%)**	**27**	**(15%)**	**27**	**(67%)**
Northern Ireland (N.I.)	**12**	**(0%)**	**10**	**(20%)**	**10**	**(50%)**
England, Wales and N.I.	**192**	**(8%)**	**547**	**(24%)**	**421**	**(49%)**

Erythromycin resistance was commonly associated with resistance to other antibiotics (Table 7), with 53% and 50% of erythromycin resistant isolates also being resistant to clindamycin or tetracycline respectively. Of the 214 isolates reported as having been tested against all three agents, two (1%) were reported as resistant to all three. This is a slight decrease from that seen in 2008 where 3% showed multiple resistances to the three antibiotics.

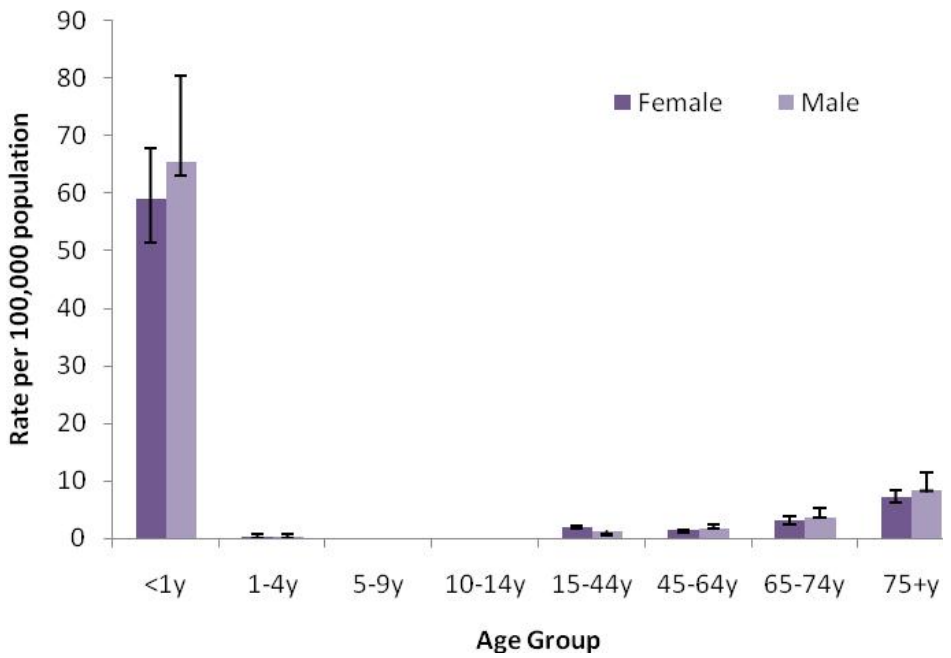
Group B streptococci

Having increased substantially between 2005 and 2008 (Table 1), from 1250 to 1550 (24% increase), reports of bacteraemia due to group B streptococcus (GBS) in England, Wales and Northern Ireland showed a modest increase (1%) in 2009.

The overall rate of GBS bacteraemia in 2009 for England, Wales and Northern Ireland was 2.8 per 100,000 population (Table 2). Rates were lower in Wales (2.1/100,000) than Northern Ireland (3.9/100,000 population) and England (2.8). The rate for Northern Ireland has increased from 2.9 in 2008 to 3.9 per 100,000 population in 2009.

Rates of GBS bacteraemia were highly concentrated in infants, 59 and 65 per 100,000 population in females and males <1y, with rates generally higher in males than females across most age groups, with the notable exception of 15-44 year olds (1.9 and 1.2 in females and males respectively) (Figure 2).

Figure 2 **Age-specific rates of group B streptococcal bacteraemia reports: England, Wales and Northern Ireland, 2009**



Rates of GBS bacteraemia in 0-90 day old infants, 0.64 (0.59-0.71) per 1000 live births, decreased slightly from 2008 (0.66) (Table 5). This decrease is accounted for by reductions in the rate of early (0-6 days) onset disease from 0.39 to 0.37, whilst late (7-90 days) onset disease rate slightly increased for the period (0.27 to 0.28).

Table 5 **Number and rate (per 1000 live births) of group B streptococcal bacteraemia reports in infants 0-90 days old in England, Wales and Northern Ireland, 2009**

Country	All cases (0-90 days old)			Early onset (0-6 days old)			Late onset (7-90 days old)		
	number	rate	(95% CI)	number	rate	(95% CI)	number	rate	(95% CI)
England	428	0.64	(0.58- 0.70)	246	0.37	(0.32- 0.42)	182	0.27	(0.23 - 0.31)
Northern Ireland (N.I.)	24	0.96	(0.62- 1.43)	11	0.44	(0.22- 0.79)	13	0.52	(0.28 - 0.89)
Wales	19	0.54	(0.33- 0.85)	10	0.29	(0.14- 0.53)	9	0.26	(0.12 - 0.49)
England, Wales & N.I.	471	0.64	(0.59- 0.71)	267	0.37	(0.32- 0.41)	204	0.28	(0.24 - 0.32)

Antimicrobial resistance

The proportion of GBS bacteraemia reports accompanied by susceptibility data has increased since 2005 although only 25% reports included results for clindamycin in 2009. Resistance of GBS blood culture isolates to clindamycin, erythromycin and tetracycline was recorded in 10%, 14% and 79% respectively (Table 3). All regions except the East Midlands and East of England reported erythromycin resistance in over 10% of isolates (Table 4). GBS resistance to erythromycin in England, Wales and Northern Ireland has increased from 10% isolate (in 2005) to 14% isolates (in 2009).

Of the erythromycin-resistance GBS isolates tested against clindamyin, 58% were reported to be resistant (Table 8). Of the 276 isolates reported as being tested against all three agents, 23 (8%) were found to be resistant to all three.

Group C & G streptococci

Voluntary reporting has shown a general increase in the numbers of reports of bacteraemia caused by group C streptococci (GCS) from 276 in 2005 to 378 in 2009 (Table 1), however this is a 3% decrease from 2008 where 390 GCS bacteraemia were reported. Reports of bacteraemia in 2009 due to group G streptococci (GGS) decreased 3% from 2008 (Table 1). Population rates of GCS bacteraemia were similar in England (0.7/100,000), Wales (0.6) and Northern Ireland (0.5), and varied from 0.3 (London) to 1.1 (North East) within England (Table 2).

The age distributions of rates of both GCS and GGS bacteraemia reports were concentrated in the elderly, with rates tending to be higher in males than females in all age groups (Figures 3, 4).

Figure 3 **Age-specific rates of group C streptococcal bacteraemia reports: England, Wales and Northern Ireland, 2009**

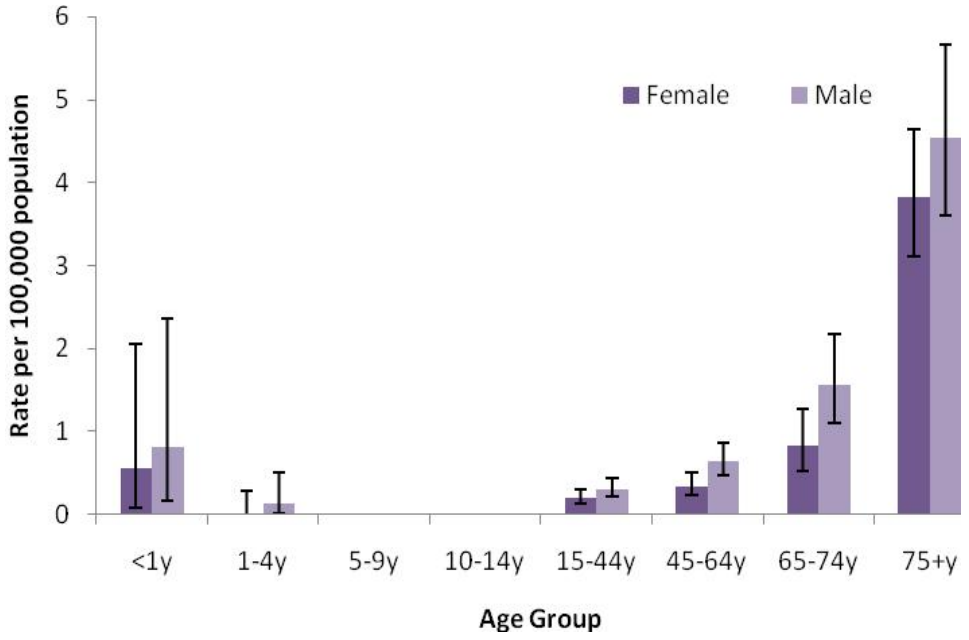
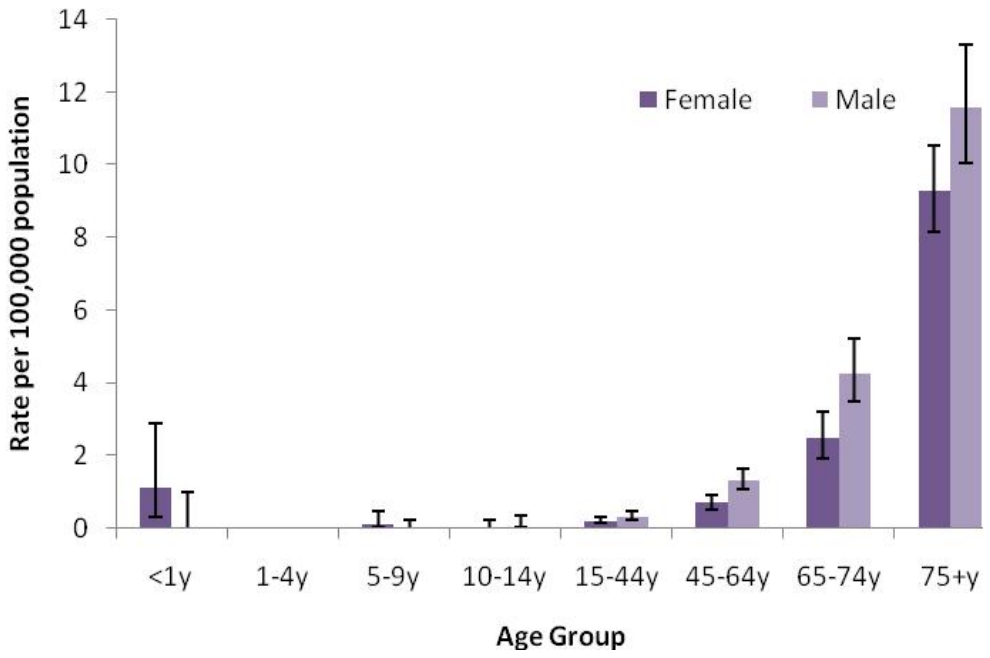


Figure 4 **Age-specific rates of group G streptococcal bacteraemia reports: England, Wales and Northern Ireland, 2009**



Antimicrobial resistance

For both GGS and GCS bacteraemia, resistance to clindamycin, erythromycin and tetracycline showed some changes between 2005 and 2009. After an increase in clindamycin resistance in 2008 (5% to 11%), resistance to clindamycin for GCS has decreased to 4% in 2009 (Table 3). Similarly, prevalence of clindamycin resistance showed a general increase between 2005 and 2008 for GGS, 4% to 12%, decreasing to 8% in 2009. Resistance to erythromycin continued to increase in 2009 for GCS (13%) and GGS (24%).

Small numbers of reports preclude analysis of antibiotic resistance by region for GCS bacteraemia. For GGS bacteraemic isolates, erythromycin resistance was lower in Wales (15%) than for England (24%) or Northern Ireland (20%) (Table 4). Within England substantial variation in erythromycin resistance was evident, from 9% in the South West to 33% in the East of England.

Multidrug resistance patterns for GCS and GGS are given in Tables 9-10. Three per cent of GCS bacteraemia reports indicated multiple resistance to clindamycin, erythromycin and tetracycline and 5% of GGS bacteraemia reports.

Non-pyogenic streptococci

Reports of bacteraemia due to non-pyogenic streptococci increased steadily between 2005 and 2009 from 2643 to 3182 reports for all groups combined (Table 1), although 2009 shows a 2% decrease from 2008. 'Anginosus' group streptococci reports have remained steady between 2008 and 2009, with 842 reports, compared with the steady increase seen in earlier years. Bacteraemia reports for both the 'Bovis' group and 'Mitis' group streptococci have similarly remained steady.

Table 6 **Region-specific rates (per 100,000 population) of non-pyogenic streptococcal bacteraemia: England, Wales and Northern Ireland, 2009**

	Rate per 100,000 population				
Region	**"Anginosus Group"**	**"Bovis Group"**	**"Mitis Group"**	**"Salivarius Group"**	**"Sanguinis Group"**
East Midlands	1.4	0.4	1.8	0.7	0.8
East of England	1.5	0.4	1.8	0.5	0.9
London	1.1	0.5	2.1	0.5	0.7
North East	1.6	0.7	1.7	0.8	1.2
North West	1.7	0.5	2.4	0.8	0.9
South East	2.0	0.5	2.2	0.4	0.8
South West	1.5	0.7	2.2	0.7	1.1
West Midlands	1.5	0.7	2.9	0.8	1.3
Yorkshire & Humber	1.6	0.4	2.3	0.4	0.5
England	**1.6**	**0.6**	**2.3**	**0.6**	**0.9**
Wales	**0.6**	**0.4**	**0.5**	**0.1**	**0.2**
Northern Ireland (N.I.)	**1.2**	**0.3**	**1.2**	**0.7**	**0.8**
England, Wales and N.I.	**1.5**	**0.5**	**2.1**	**0.6**	**0.8**

Reporting rates for England, Wales and Northern Ireland in 2008 ranged from 0.5 per 100,000 population (95% CI 0.45-0.57) for bacteraemia due to 'bovis group' streptococci to 2.1/100,000 (95% CI 1.96-2.20) for the 'mitis group' (Table 6).

Distribution of non-pyogenic streptococcal bacteraemia reports by age group and sex showed a concentration in the youngest and oldest age groups, and in most cases among males compared to females (Figures 5-9). For the 'mitis', 'salivarius' and 'sanguinis' streptococcal groups, the rates were highest in infants.

Figure 5 **Age specific rates of 'anginosus group' streptococcal bacteraemia reports: England, Wales and Northern Ireland, 2009**

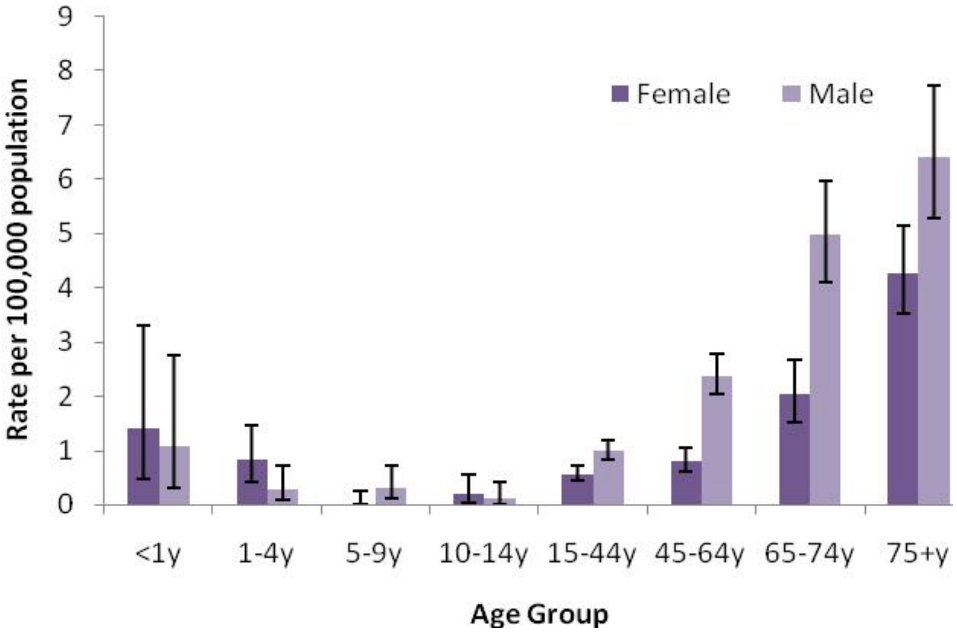


Figure 6 **Age-specific rates of 'bovis group' streptococcal bacteraemia reports: England, Wales and Northern Ireland, 2009**

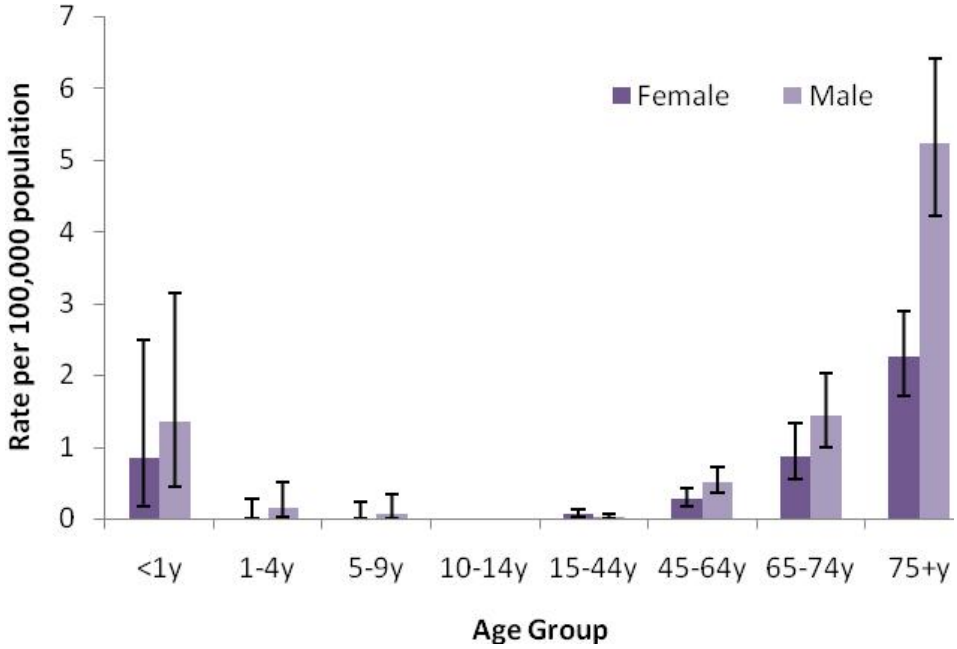


Figure 7 **Age-specific rates of 'mitis group' streptococcal bacteraemia reports: England, Wales and Northern Ireland, 2009**

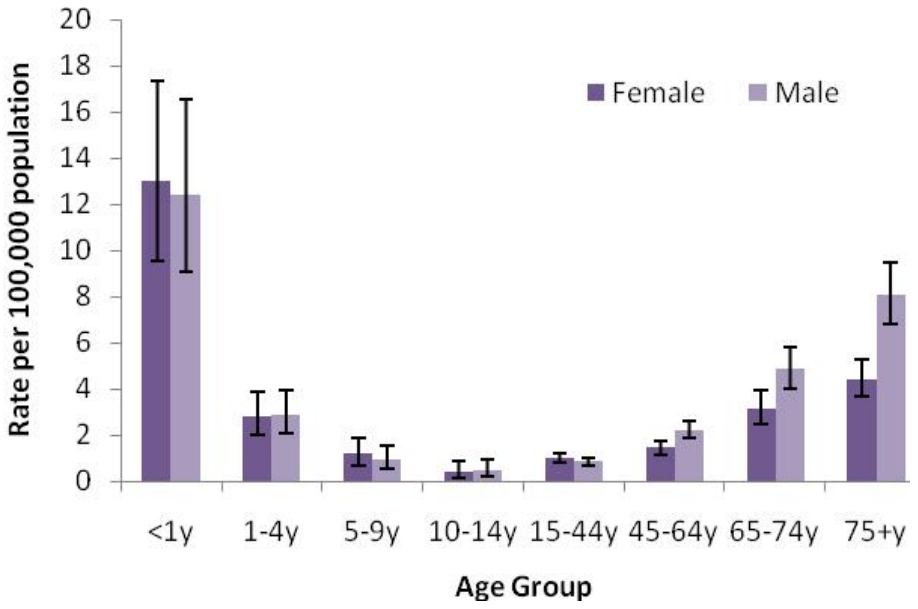


Figure 8 **Age-specific rates of 'salivarius group' streptococcal bacteraemia reports: England, Wales and Northern Ireland, 2009**

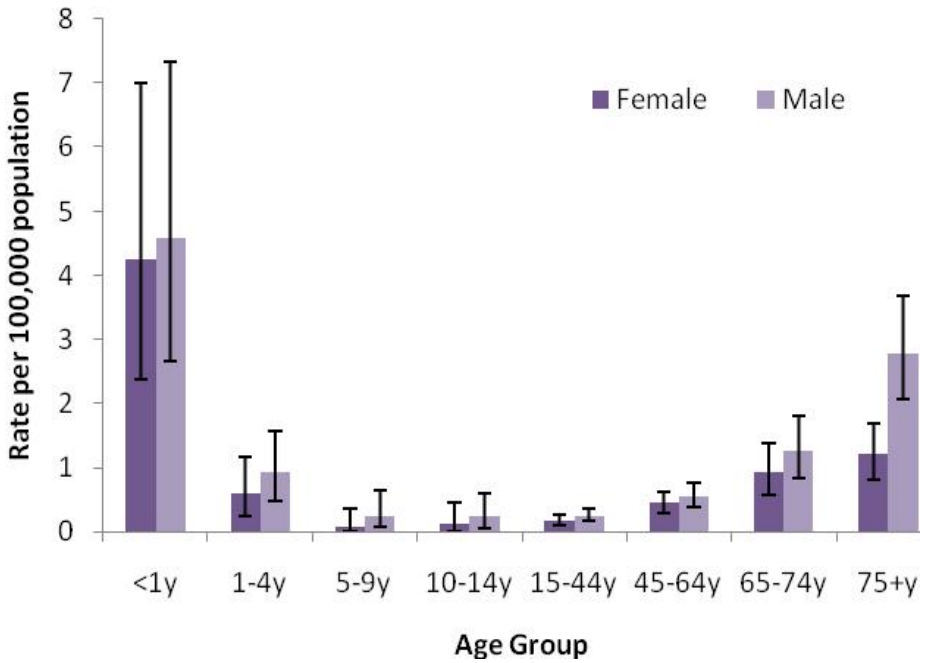
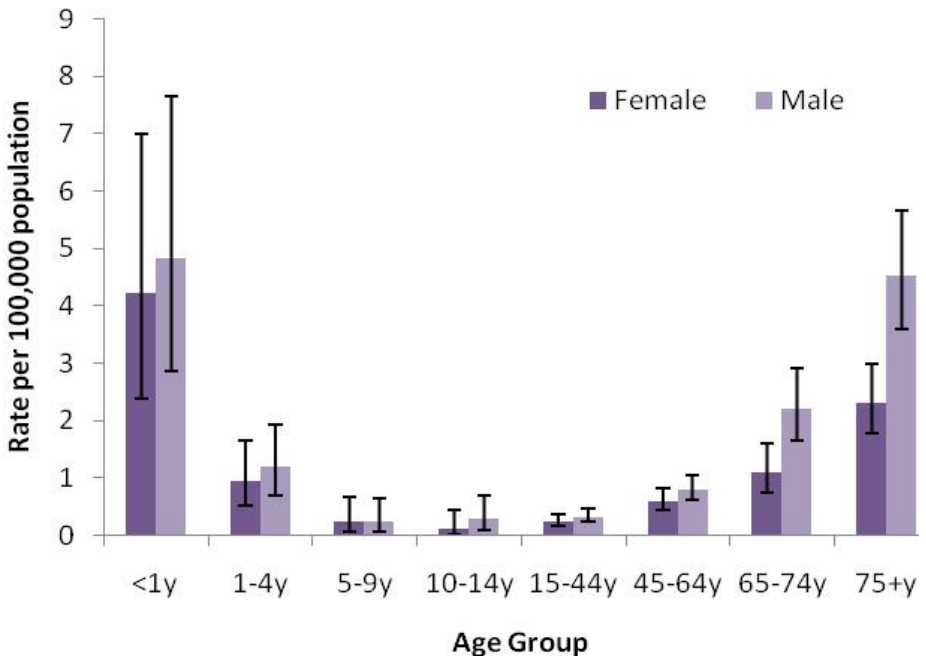


Figure 9 **Age-specific rates of 'sanguinis group' streptococcal bacteraemia reports: England, Wales and Northern Ireland, 2009**



Antimicrobial resistance

Since 2005, the proportion of non-pyogenic streptococcal bacteraemia reports accompanied by susceptibility data has increased markedly for all non-pyogenic groups, with over 75% including information on susceptibility to penicillin.

In contrast to the pyogenic streptococci, where penicillin resistance is undocumented in the UK, between 3% and 30% of isolates from non-pyogenic groups were reported as penicillin resistant, the highest frequency being observed in the 'sanguinis group'. Erythromycin resistance was also high in the non-pyogenic groups compared to the pyogenic groups, with between 23% and 40% of isolates reported as resistant, with the exception of the 'anginosus group' (9%; Table 3). The highest levels of tetracycline resistance were observed in the 'bovis group' where 65% isolates were reported as resistant.

Reference microbiology service

In 2009 the numbers of reports of streptococcal bacteraemia in which the organism is not fully identified has begun to decline, with the proportion of such reports reducing from 21% in 2008 to 18% in 2009. Precise species identification of isolates would improve the monitoring of trends in 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 hospital 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.

E-Table 7 **Multiple antibiotic resistance patterns for group A streptococcal bacteraemia reports: England, Wales, and Northern Ireland, 2009**

				erythromycin				clindamycin				tetracycline			
				resistant	(%)	sensitive	no info	resistant	(%)	sensitive	no info	resistant	(%)	sensitive	no info
erythromycin															
	resistant	(n=	39)					8	(53%)	7	24	12	(50%)	12	15
	sensitive	(n=	782)					1	(0%)	276	505	31	(7%)	419	332
clindamycin															
	resistant	(n=	10)	8	(89%)	1	1					3	(33%)	6	1
	sensitive	(n=	325)	7	(2%)	276	42					18	(8%)	207	100
tetracycline															
	resistant	(n=	48)	12	(28%)	31	5	3	(14%)	18	27				
	sensitive	(n=	513)	12	(3%)	419	82	6	(3%)	207	300				

E-Table 8 **Multiple antibiotic resistance patterns for group B streptococcal bacteraemia reports: England, Wales, and Northern Ireland, 2009**

				erythromycin				clindamycin				tetracycline			
				resistant	(%)	sensitive	no info	resistant	(%)	sensitive	no info	resistant	(%)	sensitive	no info
erythromycin															
	resistant	(n=	143)					31	(58%)	22	90	88	(86%)	14	41
	sensitive	(n=	915)					2	(1%)	285	628	444	(79%)	118	353
clindamycin															
	resistant	(n=	41)	31	(94%)	2	8					30	(94%)	2	9
	sensitive	(n=	357)	22	(7%)	285	50					225	(79%)	60	72
tetracycline															
	resistant	(n=	645)	88	(17%)	444	113	30	(12%)	225	390				
	sensitive	(n=	169)	14	(11%)	118	37	2	(3%)	60	107				

E-Table 9 **Multiple antibiotic resistance patterns for group C streptococcal bacteraemia reports: England, Wales, and Northern Ireland, 2009**

			erythromycin				clindamycin				tetracycline			
			resistant	(%)	sensitive	no info	resistant	(%)	sensitive	no info	resistant	(%)	sensitive	no info
erythromycin														
	resistant	(n= 32)					3	(33%)	6	23	6	(40%)	9	17
	sensitive	(n= 215)					0	(0%)	66	149	30	(22%)	109	76
clindamycin														
	resistant	(n= 3)	3	(100%)	0	0					1	(100%)	0	2
	sensitive	(n= 80)	6	(8%)	66	8					11	(18%)	50	19
tetracycline														
	resistant	(n= 45)	6	(17%)	30	9	1	(8%)	11	33				
	sensitive	(n= 142)	9	(8%)	109	24	0	(0%)	50	92				

E-Table 10 **Multiple antibiotic resistance patterns for group G streptococcal bacteraemia reports: England, Wales, and Northern Ireland, 2009**

			erythromycin				clindamycin				tetracycline			
			resistant	(%)	sensitive	no info	resistant	(%)	sensitive	no info	resistant	(%)	sensitive	no info
erythromycin														
	resistant	(n= 130)					12	(29%)	30	88	45	(56%)	36	49
	sensitive	(n= 417)					1	(1%)	116	300	128	(49%)	133	156
clindamycin														
	resistant	(n= 15)	12	(92%)	1	2					7	(64%)	4	4
	sensitive	(n= 177)	30	(21%)	116	31					58	(47%)	65	54
tetracycline														
	resistant	(n= 206)	45	(26%)	128	33	7	(11%)	58	141				
	sensitive	(n= 215)	36	(21%)	133	46	4	(6%)	65	146				

References

[1] Lamagni TL, Efstratiou A, Dennis J, Nair P, Kearney J, George R, on behalf of the national incident management team. Increase in invasive group A streptococcal infections in England, Wales and Northern Ireland, 2008-9. *Euro Surveill.* 2009;14(5):pii=19110.

[2] HPA. Cessation of enhanced data collection for invasive group A streptococcal disease. Health Protection Report [serial online] 2010; 4(3):news