Public Health England

Health Protection Report
weekly report

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Laboratory confirmed pertussis in England: July-September 2015 (in summary)

In England there were 1322 laboratory confirmed cases of pertussis (culture, PCR, serology or oral fluid) reported to the Public Health England pertussis enhanced surveillance programme in the third quarter of 2015, from July to September 2015. Total cases were 21% higher than those reported in the same quarter of 2014 (1093 cases between July and September 2014). See full report in the Infection Reports section of this issue.

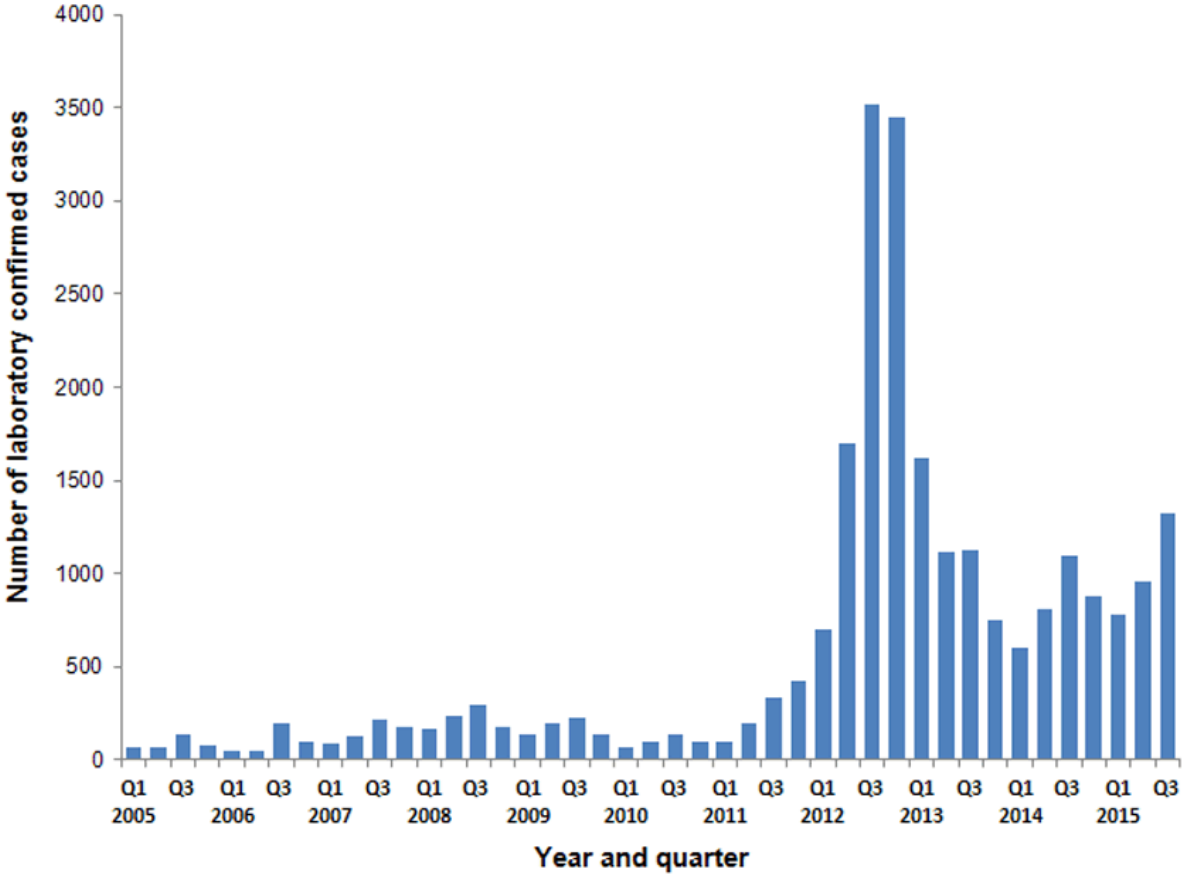
The number of confirmed cases in infants under three months in the third quarter of 2015 (46 cases) was similar to the same quarter in 2014 (47 cases) and remains low. One infant with pertussis confirmed between July and September 2015 died. Of the 13 infants who have died following confirmed pertussis disease and who were born after the introduction of the maternal programme on 1 October 2012, 11 have been born to mothers who had not been immunised against pertussis during pregnancy.

Coverage of the whooping cough vaccine programme for pregnant women has increased in the third quarter of 2015 from 55.6% in June to 57.7% in September 2015 [1].

Total case numbers of pertussis in all age groups greater than three months were higher in Q1-3 2015 (see figure) than the same quarters in 2014 with the greatest proportionate increase observed in infants aged 3-5 months and children aged 1-9 years. Overall activity remained higher in all age groups from one year and older relative to the pre-2012 peak and exceeded 2012 Q1-3 cases in the 5-9 year age group.

These raised levels of pertussis persisting in all age groups other than infants <3 months make it important that women continue to be encouraged to be immunised against pertussis during pregnancy (ideally between 28-32 weeks) in order to protect their babies from birth. The pertussis immunisation in pregnancy programme in England has shown high levels of protection against pertussis in babies born to vaccinated mothers [2,3].

Total number of laboratory-confirmed pertussis cases per quarter (England) 2005-15 (Q3)



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1. Pertussis Vaccination Programme for Pregnant Women: vaccine coverage estimates in England, June to September 2015. *HPR* **9**(42): infection report.
2. Amirthalingam G, Andrews N, Campbell H et al (2014). Effectiveness of maternal pertussis vaccination in England: an observational study, *Lancet*.
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Group A streptococcal infections: first report on seasonal activity 2015/16 (in summary)

Public Health England is continuing to monitor notifications of scarlet fever cases in England in the early phase of the 2015/16 season, following the high levels recorded last spring. According to the first report on Group A Streptococcus activity for the 2015/16 season [1], as of mid-December 2015, national scarlet fever activity is showing a typical seasonal pattern, gradually increasing from a low level of notifications each week, nevertheless elevated compared with previous years. Invasive disease reports are elevated for this point in the season although this might just reflect an earlier peak in seasonal activity than in recent years.

Reference

1. “Group A streptococcal infections: first report on activity during the 2015/16 season” (see Infection Reports section of this issue).

Trends in mandatory MRSA, MSSA and *E. coli* bacteraemia, and CDI reports (England): data to end-September 2015

PHE’s latest quarterly epidemiological commentary on trends in reports of *Staphylococcus aureus* (MRSA and MSSA) and *Escherichia coli* bacteraemia, and of *Clostridium difficile* infections, mandatorily reported by NHS acute Trusts in England up to July-September 2015, has been published on the GOV.UK website [1].

MRSA bacteraemia

There has been a 13.3% decrease (1.7 to 1.5 reports per 100,000 population) in the rate of all reported MRSA bacteraemia between April-June 2012 and the current quarter (July-September 2015). This is part of an overall decreasing trend beginning from April 2007. However, more recently (July-September 2014 and July-September 2015) increases in both the counts and rates of total MRSA bacteraemia have been reported (from 182 to 200 and from 1.3 to 1.5 per 100,000 population, respectively). This has been observed in both Trust assigned counts and rates (from 69 to 78 reports and from 0.8 to 0.9 per 100,000 bed-days, respectively) and CCG assigned counts and rates (from 86 to 94 reports and from 0.6 to 0.7 per 100,000 population, respectively).

MSSA bacteraemia

The current quarter (July-September 2015) saw the highest rate of total MSSA bacteremia (19.2 reports per 100,000 population) since the mandatory reporting of MSSA bacteraemia cases was initiated in January 2011. The count of total MSSA bacteraemia has increased by 8.5% in the current quarter (July-September 2015, n=2,622) when compared to the same quarter in the previous year (July-September 2014, n=2,417). Similarly, in both the counts and rates of Trust apportioned MSSA bacteraemia reports, there has been a 4.2% increase from 674 to 702 reports and 7.9 to 8.2 per 100,000 bed-days, respectively, over the same time period.

E coli bacteraemia

A 6.2% increase (from 69.2 to 73.5 reports per 100,000 population) has been observed in the rate of *E. coli* bacteraemia when comparing the current quarter (July-September 2015) with the same quarter of the previous year (July-September 2014), with an overall increase of 21.1% in the rate of bacteraemia from 60.7 to 73.5 reports per 100,000 population since April-June 2012.

C. difficile infection (CDI)

From July-September 2014 to July-September 2015 there was a slight increase (1%) in the counts and rates of total CDI reported from 3,971 to 4,009 reports and from 29.0 to 29.3 reports per 100,000 population, respectively. However within the same period, counts and rates of the Trust apportioned CDI reported have remained steady (from 1,353 to 1,355 reports, respectively, and 15.8 reports per 100,000 bed-days for both quarters).

Reference

1. PHE (10 December 2015). Quarterly Epidemiological Commentary: Mandatory MRSA, MSSA and *E. coli* bacteraemia, and *C. difficile* infection data (up to July-September 2015).

Increase in *Salmonella* Paratyphi B in England associated with travel to the Middle East

The PHE Salmonella Reference Service has identified a whole genome sequencing cluster of 10 cases of travel-associated enteric fever caused by infection with Salmonella Paratyphi B. Cases are geographically spread within England. Seven of the cases in this cluster are in UK residents who have returned from travelling to visit family in Kurdistan, northern Iraq; an additional two cases travelled to Turkey and one did not travel abroad. Within this cluster, two more closely related clusters containing three and five cases each have also been identified suggesting a common source. Between 2006 and 2014, only one case of Salmonella Paratyphi B associated with travel to Iraq has been reported so this cluster is unusual.

Seven cases travelled to Northern Iraq (n=5) and Turkey (n=2) during the English school holidays and symptom onset dates range from 5 to 29 August 2015 with travel occurring during July and August. A later family cluster of three cases had onset of symptoms in October and November after travelling to Northern Iraq in September and October.

On average, 1-3 cases of enteric fever associated with travel to Iraq or Turkey are reported in travellers from England, Wales and Northern Ireland each year and most of these have been caused by *Salmonella* Typhi, although in 2009, 15 cases were associated with travel to Turkey [1].

The Travel and Migrant Health Section (TMHS) within the National Infections Service are monitoring this situation and the health authorities in Iraq have been informed. Typhoid and paratyphoid (enteric fever) are subject to enhanced surveillance and all suspected cases of typhoid and paratyphoid should be investigated as per the Typhoid and paratyphoid: public health operational guidelines and reported to TMHS as soon as investigations are complete. Provisional data for enteric fever are published in the Health Protection Report on a quarterly basis.

Health advice for travellers to Iraq and other countries where typhoid or paratyphoid is a risk is available from the National Travel Health Network and Centre website.

Advice leaflets about typhoid and paratyphoid is available on the PHE webpages at: https://www.gov.uk/government/publications/typhoid-health-advice-for-travellers

Specific advice for those visiting friends and family abroad is also available from the PHE webpages: https://www.gov.uk/government/publications/travelling-overseas-to-visit-friends-and-relatives-health-advice.

Reference

1. HPA (2009). Enteric fever (*Salmonella* Typhi and Paratyphi) – 2009 update.

Avian influenza in France, November-December 2015

French authorities have reported 30 separate outbreaks of highly pathogenic avian influenza in France since 24 November 2015. The term “highly pathogenic” specifically refers to the illness the virus causes in birds rather than in humans. These outbreaks include:

- in Dordogne, 11 outbreaks were reported between 24 November and 15 December due to H5N1, H5N9 and H5N2
- in Landes, 13 outbreaks were reported between the 6 December, the 15 December, due to H5N9 and H5N2
- in Haute-Vienne, an outbreak of H5N1 was reported on 3 December
- in Gers, three outbreaks of HPAI H5 have been reported between 10 and 15 December, one due to H5N2, and two others awaiting full subtyping
- in the Pyrenees-Atlantiques two outbreaks were reported between 11 and 15 December, one due to H5N9 and one other awaiting full subtyping.

ANSES (the French Agency for Food, Environmental and Occupational Health and Safety) has confirmed that in the outbreaks, the identified strains are considered to be of European, rather than Asian lineage. It should also be noted that human infections have not been previously reported for H5N9 or H5N2 or for European origin H5N1.

The response to outbreaks of HPAI in Europe is governed by European legislation, and culling, cleaning and disinfection measures will be implemented. The risk of human infections would be limited to those directly involved in the culling and clean-up operations, however providing adequate PPE is worn then the risk is considered to be very low. The French authorities are actively following up the event. People exposed to infected birds are being monitored to immediately identify persons who develop influenza-like illness (ILI) or conjunctivitis, so that they can undergo further tests.

Defra is monitoring the situation closely in the UK and has published a risk assessment for the impact on the UK bird population. PHE is also closely following the situation in relation to public health, although to date there have been no human cases of avian influenza reported by the French authorities. Well established national guidance for managing the public health response to avian influenza incidents is available [1].

Reference

1. PHE health protection collection: Avian influenza: guidance, data and analysis.

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Infection Reports

Immunisation

- **Laboratory confirmed cases of pertussis reported to the enhanced pertussis surveillance programme in England during July to September 2015**
- **Laboratory confirmed invasive meningococcal infections (England): July to September 2015**

HCAI-bacteraemia

- **Group A streptococcal infections: first report on activity during the 2015/16 season**
- **Uncommon pathogens involved in bacteraemia: England, Wales and Northern Ireland, 2010-2014**
- **Surveillance of *Proteus*, *Morganella* and *Providencia* species causing bacteraemia in England, Wales and Northern Ireland: 2014**

Vaccine coverage

- **Quarterly vaccination coverage statistics for children aged up to five years in the UK (COVER programme): Q3/2015**

Immunisation

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Laboratory confirmed cases of pertussis reported to the enhanced pertussis surveillance programme in England during July to September 2015 (Q3)

In England there were 1322 laboratory confirmed cases of pertussis (culture, PCR, serology or oral fluid) reported to the Public Health England (PHE) pertussis enhanced surveillance programme in the third quarter of 2015, from July to September 2015 (table 1). Total cases were 21% higher than those reported in the same quarter of 2014 (1093 cases between July and September 2014).

The HPA declared a national outbreak of pertussis (level 3 incident [1]) in April 2012 and, as a response to the ongoing outbreak and a high number of infant deaths, the Department of Health announced the introduction of a temporary immunisation programme for pregnant women on 28 September 2012 [2]. Pertussis vaccine coverage in pregnant women increased over the third quarter of 2015 from 55.1% in June to 55.6% in July, 56.6% in August and 57.7% in September 2015. As observed in 2013 and 2014, coverage declined in late winter and early spring but was maintained at higher levels through the summer months than in the previous two years [3].

Following the high levels of activity in 2012 (see figure), an overall decrease has been observed with slight increases in the third quarters of 2013, 2014 and 2015, in line with the usual seasonal pattern. The highest number of laboratory confirmed cases in England has persisted in individuals aged 15 years and over whilst disease incidence continues to be highest in infants <3 months. The number of confirmed cases in infants under three months in the third quarter of 2015 (46 cases) was similar to the same quarter in 2014 (47 cases) and remains low (table 2). One infant with pertussis confirmed between July and September 2015 died. Of the thirteen infants who have died following confirmed pertussis disease and who were born after the introduction of the maternal programme on 1 October 2012, 11 have been born to mothers who had not been immunised against pertussis during pregnancy.

Total case numbers of pertussis in all age groups greater than three months are higher in Q1-3 2015 than the same quarters in 2014 (table 2) with the greatest proportionate increase observed in infants aged 3-5 months and children aged 1-9 years. Overall activity remained higher in all age groups from 1 year and older relative to the pre-2012 peak and exceeded 2012 Q1-3 cases in the 5-9 year age group.

Surveillance data in young infants following the introduction of the pertussis immunisation in pregnancy programme are encouraging as a relatively low incidence has been maintained, with expected seasonal increases. It is important to be aware, however, that raised levels of pertussis persist in older age groups and women should therefore continue to be encouraged to be immunised against pertussis during pregnancy (ideally between 28-32 weeks) in order to protect their babies from birth. The pertussis immunisation in pregnancy programme in England has shown high levels of protection against pertussis in babies born to vaccinated mothers [4,5]. The Medicines and Healthcare Products Regulatory Agency also found no safety concerns relating to pertussis vaccination in pregnancy based on a large study of nearly 18,000 vaccinated women with similar rates of normal, healthy births in vaccinated and in unvaccinated women [6].

Please see previous reports for details of appropriate laboratory investigation of suspected cases of pertussis which may be affected by the age of the suspect case and time since onset of their symptoms.

Total number of laboratory-confirmed pertussis cases per quarter in England, 2005 to 2015(Q3)

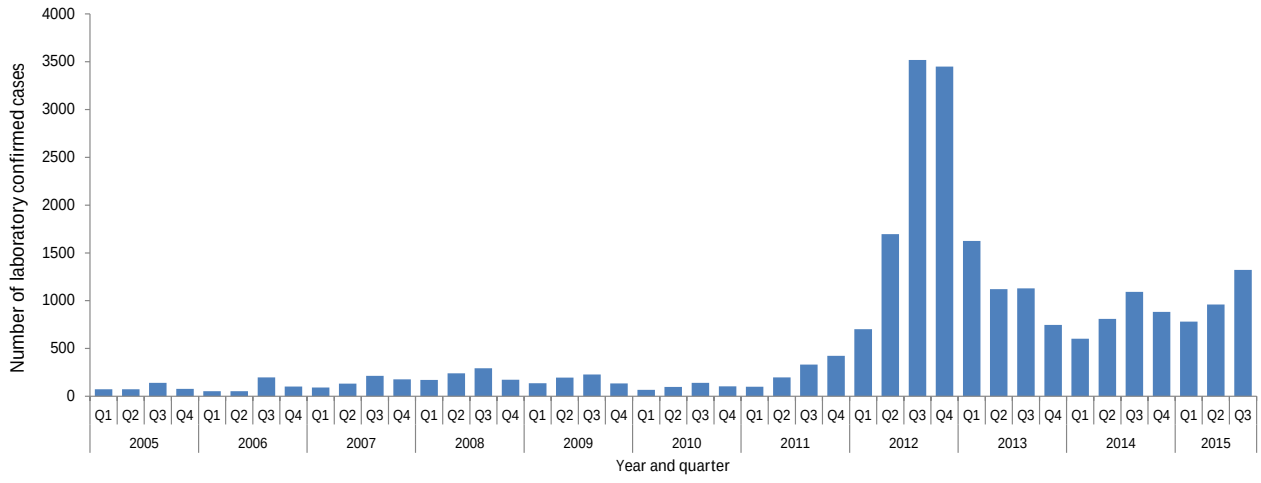

Table 1. Laboratory-confirmed cases of pertussis by age and testing method in England, July-September 2015

Age group	Culture	PCR	Serology	Oral fluid only	Total
<3 months	21	24	1	0	46
3-5 months	10	6	1	0	17
6-11 months	2	3	1	0	6
1-4 years	7	2	13	0	22
5-9 years	3	1	48	22	74
10-14 years	2	1	95	31	129
15+ years	3	5	1018	2	1028
Total	48	42	1177	55	1322

Table 2. Laboratory-confirmed cases of pertussis by age and year England, 2012-2015 (Q1-Q3)

Age group	2012	2013	2014	2015
<3 months	335	72	85	93
3-5 months	64	23	10	28
6-11 months	22	7	10	12
1-4 years	58	41	27	51
5-9 years	116	75	94	161
10-14 years	566	382	267	349
15+ years	4757	3274	2012	2369
Grand Total	5918	3874	2505	3063

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1. *HPR* 6(15), 13 April 2012, http://webarchive.nationalarchives.gov.uk/20140714084352/http://www.hpa.org.uk/hpr/archives/2012/news1512.htm
2. Department of Health: https://www.gov.uk/government/news/pregnant-women-to-be-offered-whooping-cough-vaccination
3. *HPR* 9(42), 27 November 2015, https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/480405/hpr4215_prtss-vu.pdf
4. G Amirthalingam, N Andrews, H Campbell, S Ribeiro, E Kara, K Donegan, N K Fry, *et al* (2014). Effectiveness of maternal pertussis vaccination in England: an observational study. *Lancet*.
5. Dabrera G, Amirthalingam G, Andrews N, *et al* (2014). A case-control study to estimate the effectiveness of maternal pertussis vaccination in protecting newborn infants in England and Wales, 2012–2013. *Clin Infect Dis*.
6. Donegan K, King B, Bryan P, *et al* (2014). Safety of pertussis vaccination in pregnant women in UK: observational study. *BMJ*.

Immunisation

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Laboratory confirmed reports of invasive meningococcal disease in England: July to September 2015

In England, the national Public Health England (PHE) Meningococcal Reference Unit (MRU) confirmed 114 cases of invasive meningococcal disease (IMD) between July and September 2015 [1]. IMD cases were 20% higher this quarter than the 95 cases confirmed in the equivalent quarter in 2014 (table 1). There were 173 cases confirmed in April to June 2015 [2].

The distribution of meningococcal capsular groups causing IMD by age is summarised in table 2, with capsular group B (MenB) accounting for 57% (65/114) of all cases, followed by MenW (n=26, 23%), MenY (n=13, 11%) and MenC (n=6, 5%). The 26 cases of MenW IMD confirmed in the first quarter of the 2015/16 epidemiological year (running 1 July one year to 30 June the following year) was similar to the 24 cases confirmed during the same period in 2014/15, whilst MenY increased by 62.5% from 8 to 13 cases. MenB cases increased from 59 in the first quarter of 2014/15 to 65 cases (10% increase) in the same period of 2015/16 and the number of MenC cases increased from 4-6 cases (50% decrease). During the first quarter of 2015/16, there were no reported cases for capsular groups A, X and Z/E (table 1) in England.

In quarter 3 of 2015 MenB was responsible for the majority of IMD cases in infants (16/25, 64%) and toddlers (23/31, 74%) but, as expected, contributed to a lower proportion of cases in older age groups (table 2). The introduction of a routine national MenB immunisation programme for infants was announced in June 2015 [3] with immunisation of infants starting from 1 September 2015.

Capsular groups other than MenB were more prevalent in older age groups (table 2). However, 42% of the 26 MenW cases were in children under five years with 35% in adults aged 65+ years, and 23% in 15-24 year-olds. The increase in MenW cases, which has been previously reported, [4,5] led to the introduction of MenACWY conjugate vaccine to the national immunisation programme in England [6,7] and accounted for 23% (n=26) of all cases in 2015 Q3 compared to 25% (n=24) in 2014 Q3. MenACWY vaccine replaced the existing time-limited ‘freshers’ programme from August 2015 and was directly substituted for MenC vaccine in the routine adolescent schools programme (school year 9 or 10) from Autumn 2015. In addition a catch-up campaign is being implemented offering MenACWY vaccine to all adolescents aged 14 to 18 years (to school year 13); 2015 school leavers (aged 17/18) have been prioritised for the first phase of the catch-up. It is too early following the introduction of these new vaccination programmes to assess their impact on IMD.

Table 1: Invasive meningococcal disease in England by capsular group and laboratory testing method: July - September (Q3), 2015

Capsular groups~	CULTURE AND PCR		CULTURE ONLY		PCR ONLY		Total		Cumulative Total#	
	2014	2015	2014	2015	2014	2015	2014	2015	2014/15	2015/16
	Q3	Q3	Q3	Q3	Q3	Q3	Q3	Q3	Q1	Q1
A	0	0	0	0	0	0	0	0	0	0
B	18	19	20	13	21	33	59	65	59	65
C	1	2	1	2	2	2	4	6	4	6
W	1	5	21	20	2	1	24	26	24	26
Y	1	2	7	10	0	1	8	13	8	13
Ungrouped*	0	0	0	0	0	3	0	3	0	3
Ungroupable*	0	0	0	1	0	0	0	1	0	1
Total	21	28	49	46	25	40	95	114	95	114

2015/16 epidemiological year (running from 01/07/2015 to 30/06/2016).
~ No cases of groups X or Z/E were confirmed during the periods summarised in the table.
* Ungroupable refers to invasive clinical meningococcal isolates that were non-groupable, while ungrouped cases refers to culture-negative but PCR screen (ctrA) positive and negative for the four genogroups [B, C, W and Y] routinely tested for.

Table 2: Invasive meningococcal disease in England by capsular group and age group at diagnosis: July - September (Q3), 2015

Age groups	Capsular Group~										Total		2015/16# Total to date	
	B		C		W		Y		Other*		Q3		Q3	
	Total	%	Total	%	Total	%	Total	%	Total	%	Total	%	Total	%
<1 year	16	(25)	0	-	6	(6)	1	(8)	2	(50)	25	(22)	25	(22)
1-4 years	23	(35)	0	-	5	(5)	1	(8)	2	(50)	31	(27)	31	(27)
5-9 years	5	(8)	0	-	0	-	0	-	0	-	5	(4)	5	(4)
10-14 years	1	(2)	0	-	0	-	0	-	0	-	1	(1)	1	(1)
15-19 years	4	(6)	0	-	5	(5)	5	(38)	0	-	14	(12)	14	(12)
20-24 years	3	(5)	0	-	1	(1)	0	-	0	-	4	(4)	4	(4)
25-44 years	5	(8)	4	(67)	0	-	0	-	0	-	9	(8)	9	(8)
45-64 years	3	(5)	1	(17)	0	-	2	(15)	0	-	6	(5)	6	(5)
>=65 years	5	(8)	1	(17)	9	(9)	4	(31)	0	-	19	(17)	19	(17)
Total	65		6		26		13		4		114		114	

2015/16 epidemiological year (running from 01/07/2015 to 30/06/2016).
~ No cases of groups A, X or Z/E were confirmed during the periods summarised in the table.
* Other includes Ungroupable and Ungrouped.

References

1. Data source: Public Heath England Meningococcal Reference Unit, Manchester.
2. Public Health England. Health Protection Report 2015 Volume 9 Number 34 (25 September 2015) https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/463955/hpr3415_IMD.pdf
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7. https://www.gov.uk/government/collections/meningococcal-acwy-menacwy-vaccination-programme

Bacteraemia and HCAI

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Group A streptococcal infections: first report on activity during the 2015/16 season

Following the substantial elevation in scarlet fever notifications last two seasons, indications from the early part of this 2015/16 season continue to show elevated levels of activity, similar to the same period last year [1].

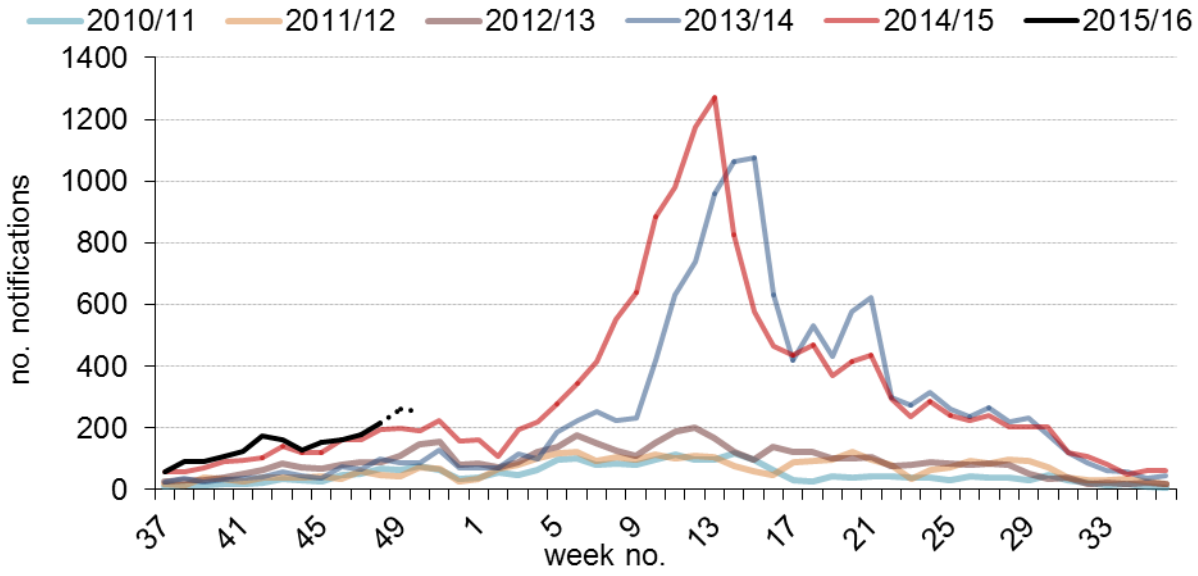
The seasonal levels of invasive group A streptococcal (iGAS) disease appear elevated compared with what would normally be expected at this low point within the season, which may be suggestive of the seasonal peak occurring earlier than in previous seasons. Close monitoring is recommended due to the potentially severe outcomes of iGAS disease.

Scarlet fever

So far this season, scarlet fever activity is showing a similar pattern to previous years, with gradually increasing numbers of notifications each week. A total of 2155 scarlet fever notifications have been made so far this season (figure 1; weeks 37 to 50 2015). This pattern varies geographically; most areas are reporting the same levels as this time last year, however a few areas are showing elevated levels of notifications compared to the same period last year.

The age distribution of scarlet fever cases reported to date remains similar to previous years, with 89% of cases reported in children under 10 years of age (median 4y; range <1y to 93y).

Figure 1. Weekly scarlet fever notifications in England, 2010/11 onwards*



* Dashed line indicates that numbers may increase as further notifications expected.

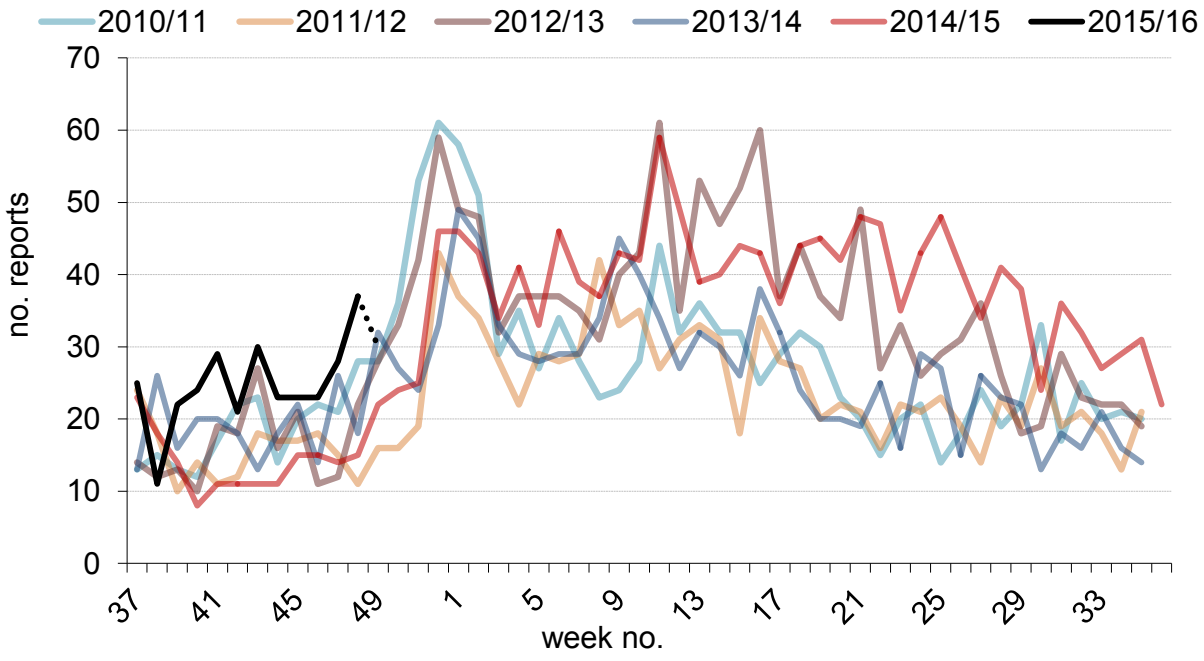
Invasive Group A Streptococcus

Laboratory reports of iGAS disease notified through routine laboratory surveillance in England so far this season total 326 cases (week 37 to 49 2015), higher than the average for the previous five years (223 reports) or the range seen during these years (188 to 256; figure 2).

The median age of patients with iGAS infection so far this season is 49 years (range <1y to 99y), which is lower than was reported at the same point last season (61y) as well as the preceding five seasons (56.5y to 63y last five seasons). Twenty per cent of infections reported so far this season are in children (<15y), within the range of what has been reported at the same point in the previous 5 seasons (average 14%; range 12% to 20%).

Analysis of iGAS *emm* strain diversity remains similar to what is normally seen with *emm* st1 and *emm* st12 and *emm* st89 the most common types identified so far this season.

Figure 2. Weekly laboratory reports of invasive GAS infection, England, 2010/11 onwards*



* Dashed line indicates that numbers may increase as further isolates expected

The number of cases of iGAS disease notified through routine laboratory surveillance in England was slightly elevated last season compared with levels normally seen, and the slight elevation so far this season is a concern. Clinicians, microbiologists and Health Protection Teams should continue to be mindful of potential increases in invasive disease and maintain a high index of suspicion in relevant patients as early recognition and prompt initiation of specific and supportive therapy for patients with iGAS infection can be life-saving.

Since the peak in scarlet fever notifications reported in the 2013/14 season, levels of scarlet fever have remained elevated. Whilst this might reflect heightened awareness and improved diagnosis and/or notification practices, the reasons behind this increase are unclear but may be

attributable to long-term natural cycles in disease incidence. Close monitoring, rapid and decisive response to potential outbreaks remains essential given the potential complications associated with GAS infections.

Invasive disease isolates and those from suspected clusters/outbreaks should be submitted to the Respiratory and Vaccine Preventable Bacteria Reference Unit at Public Health England, 61 Colindale Avenue, London NW9 5HT. Relevant guidelines/FAQs are available on the PHE website, as follows:

- Guidelines on infection control in schools and other childcare settings, including recommended exclusion periods for scarlet fever and guidelines on management of scarlet fever outbreaks, can be found at:
  https://www.gov.uk/government/publications/scarlet-fever-managing-outbreaks-in-schools-and-nurseries
  https://www.gov.uk/government/publications/infection-control-in-schools-poster
- FAQs on scarlet fever can be found at: https://www.gov.uk/government/collections/scarlet-fever-guidance-and-data
- Guidelines for the management of close community contacts of invasive GAS cases and the prevention and control of GAS transmission in acute healthcare and maternity settings are also available here: https://www.gov.uk/government/collections/group-a-streptococcal-infections-guidance-and-data

Reference

1. PHE (2015). Group A streptococcal infections: sixth update on seasonal activity, 2014/145. *HPR* **9**(23): infection (news) report.

Bacteraemia and HCAI

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Uncommon pathogens involved in bacteraemia: England, Wales and Northern Ireland, 2010-2014

The analysis presented in this report is based on data extracted from the Public Heath England (PHE) voluntary surveillance database, Second Generation Surveillance System, on 19 November 2015 for the period between 1 January 2010 to 31 December 2014 in England, Wales, and Northern Ireland. The reports made to PHE provide data on both community and hospital-acquired bacteraemia. This report describes uncommon pathogens (genera with fewer than 50 reports in 2014) identified from blood cultures or blood specimens where the diagnostic method was not stated. Data in this report may differ slightly from data in earlier publications due to inclusion of late reports.

A total of 114,276 bacterial isolates from blood samples were reported by laboratories in England, Wales, and Northern Ireland in 2014. Eighty eight uncommon genera causing bacteraemia were reported in 2014, comprising a total of 986 bacteraemic episodes (table 1). Gram-negative organisms accounted for 57.5% of these episodes. By definition of inclusion in this analysis, small numbers of reports preclude robust or meaningful analysis of trends, but of note are the general decreases in *Leuconostoc, Burkholderia* and *Elizabethkingia*, and increases in *Arcanobacterium*, *Bifidobacterium, Dermabacter, Eggerthella, Granulicatella, Kocuria, Rhodococcus, Brevundimonas, Capnocytophaga, Chryseobacterium, Eikenella, Gardnerella,* and *Roseomonas*.

Discussion

The purpose of this review is to describe unusual bacterial genera not included in the monthly bacteraemia reports published in the *Health Protection Report*. Examining trends in these unusual pathogens can provide a means of identifying emerging or re-emerging infections [1], providing opportunities for preventative measures or education of frontline clinical staff.

There has been a general improvement in the identification of cultured organisms to the species level by increased use of automated biochemical identification systems, molecular techniques such as 16S ribosomal RNA, and the introduction of MALDI-TOF mass spectrometry in some laboratories. This has increased the accuracy of species identified, and permits robust trend analysis of hitherto difficult to identify species causing significant disease, such as identification of *Kocuria* spp that were previously identified as coagulase-negative staphylococci or micrococci. It should be borne in mind that findings by MALDI-TOF reflect organisms that are present in the database; therefore non-identification or identification at the genus level is expected to be improved with expansion of the database.

Although these bacteria only account for a very low proportion of total bacteraemia reports, they can be associated with important clinical consequences, such as endocarditis [2]. Infections imported from endemic regions, such as *Brucella* species [3] although rarely diagnosed in this country can cause severe illness in those affected. Others represent opportunistic pathogens causing infection in specific subpopulations, such as *Granulicatella* [4] in immunocompromised patients or are associated with specific exposures such as catheter-related bacteraemia due to *Brevibacterium* [5], non-cholera *Vibrio* due to exposure to contaminated salt water or infections due to *Erysipelothrix rhusiopathiae* in workers in contact with animals or handling animal products [6] Certain pathogens which primarily cause self-limiting gastrointestinal infections like *Shigella* spp, *Yersinia enterocolitica*, *Yersinia pseudotuberculosis* can rarely cause bacteraemias in specific hosts [7,8].

This year has seen a continuing increase in reports of bacteraemia caused by *Bifidobacterium* genus in the 5 year period (table 1). Reports of bacteraemia caused by species of the *Dermabacter* genus increased sharply in 2013 compared to previous years and rose further in 2014 (table 1). While *Dermabacter hominis* is commonly found on human skin, it has been isolated from a range of clinical specimens, such as blood cultures, abscesses, as well as wound and eye infections [9]. There has been a resurgence of reports of *Granulicatella* this year, largely due to increases in *Granulicatella adiacens*. Reports of *Kocuria* have doubled during the last year (possibly due to the increased accuracy of species identification) and similar trends have been observed in other countries [10].

Although reports of *Burkholderia* were sufficiently common in 2013 to warrant removal from the report, numbers have declined this year, principally due to decreases in *Burkholderia cepacia* (although the relatively high incidence of this species may reflect lack of speciation within the *Burkholderia cepacia* complex by some laboratories). Species belonging to the *B. cepacia* complex are relatively commonly found from the sputum of patients with cystic fibrosis, in whom

they (particularly *B. cenocepacia* genomovar IIIA) can be associated with 'cepacia syndrome' leading to a rapid decline and death [11]; the decline in numbers of these organisms causing bacteraemia suggests the incidence of this syndrome has decreased. *Ochrobactrum* were also reintroduced in 2014 due to a decrease in these organisms.

Reports of bacteraemia due to *Peptoniphilus* and *Psychrobacter* were noted for the first time in 2012 during the five year period [12]. The number of reports of *Peptoniphilus* has increased since then. Both of these have been reported to cause blood stream infections in patients with underlying morbidities [13, 14].

A number of new genera featured in this report, namely *Alloiococcus*, *Brevibacillus*, *Collinsella, Dermacoccus*, *Finegoldia*, *Calymmatobacterium, Herbasprillum*, *Leminorella*, *Massilia*, *Methylobacterium*, *Pandoraea*, *Parabacteroides*, *Sneathia*. Some of these genera have previously been associated with bacteraemia [15-21].

Whilst the bacteraemia reported to this voluntary surveillance system should, according to national reporting guidelines, reflect clinically significant disease, it should be borne in mind that some of these reports may reflect skin colonisers or contaminants due to difficulties in blood culture sampling or contamination in laboratory processing [22, 23]. Inclusion of reports with diagnostic method recorded in the database as unknown should be taken into account in interpreting these data as some of these reports may not represent bloodstream infections. Improvements in laboratory reporting of diagnostic methods would allow the exclusion of these reports without artificially decreasing the number of genuine bacteraemia infections.

If confirmation of unusual bacterial pathogens is required, isolates can be sent to the relevant laboratory within the Bacteriology Reference Department, Reference Microbiology Services, PHE Colindale.

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Appendix/Table 1: Uncommon pathogens associated with bacteraemia in England, Wales and N. Ireland: 2010-14*

Genus	Species	Number of bacteraemia reports				
		2010	2011	2012	2013	2014
Gram positive bacteria						
***Abiotrophia* spp**		**9**	**17**	**23**	**17**	**24**
	Abiotrophia defectiva	5	8	17	12	21
	Abiotrophia other named	0	2	2	1	1
	Abiotrophia sp	4	7	4	4	2
***Actinobaculum* spp**		**0**	**1**	**1**	**1**	**2**
	Actinobaculum schaalii	0	1	1	1	2
***Alloiococcus* spp**		**0**	**0**	**1**	**0**	**2**
	Alloiococcus otitis	0	0	1	0	2
***Anaerococcus* spp**		**7**	**11**	**7**	**4**	**11**
	Anaerococcus (peptostreptococcus) prevotti	7	11	7	3	6
	Anaerococcus sp	0	0	0	0	5
	Anaerococcus tetradius	0	0	0	1	0
***Arcanobacterium* spp**		**18**	**11**	**10**	**14**	**25**
	Arcanobacterium haemolyticum	18	11	10	14	25
***Arthrobacter* spp**		**4**	**4**	**9**	**5**	**12**
	Arthrobacter sp	4	4	9	5	12
***Atopobium* spp**		**0**	**0**	**0**	**1**	**2**
	Atopobium rimae	0	0	0	1	1
	Atopobium vaginae	0	0	0	0	1
***Bifidobacterium* spp**		**4**	**7**	**11**	**20**	**31**
	Bifidobacterium named	0	0	3	3	16
	Bifidobacterium sp	4	7	8	17	15
***Brevibacillus* spp**		**0**	**0**	**0**	**0**	**4**
	Brevibacillus borstelensis	0	0	0	0	4
***Brevibacterium* spp**		**21**	**19**	**36**	**41**	**40**
	Brevibacterium casei	0	0	0	0	2
	Brevibacterium other named	6	1	5	19	19
	Brevibacterium sp	15	18	31	22	19
***Cellulomonas* spp**		**1**	**0**	**0**	**0**	**0**
	Cellulomonas sp	1	0	0	0	0
***Collinsella* spp**		**0**	**0**	**0**	**1**	**8**
	Collinsella aerofaciens	0	0	0	1	8
***Dermabacter* spp**		**2**	**1**	**4**	**16**	**21**
	Dermabacter hominis	2	1	4	16	21
***Dermacoccus* spp**		**0**	**0**	**0**	**0**	**1**
	Dermacoccus sp	0	0	0	0	1
***Eggerthella* spp**		**7**	**12**	**30**	**32**	**36**
	Eggerthella lenta (eubacterium lentum)	7	12	30	32	35
	Eggerthella sp	0	0	0	0	1

***Erysipelothrix* spp**		**7**	**4**	**11**	**3**	**3**
	Erysipelothrix other named	0	0	0	1	0
	Erysipelothrix rhusiopathiae (insidiosa)	7	3	10	2	2
	Erysipelothrix sp	0	1	1	0	1
***Eubacterium* spp**		**5**	**9**	**13**	**8**	**6**
	Eubacterium other named	2	5	9	4	4
	Eubacterium sp	3	4	4	4	2
***Facklamia* spp**		**0**	**1**	**0**	**1**	**1**
	Facklamia hominis	0	0	0	0	1
	Facklamia ignava	0	1	0	0	0
	Facklamia languida	0	0	0	1	0
***Finegoldia* spp**		**0**	**0**	**0**	**0**	**5**
	Finegoldia sp	0	0	0	0	5
***Flavonifractor* spp**		**0**	**1**	**0**	**0**	**0**
	Flavonifractor plautii	0	1	0	0	0
***Globicatella* spp**		**4**	**3**	**0**	**4**	**5**
	Globicatella sanguinis	4	3	0	3	4
	Globicatella sulfidifaciens	0	0	0	1	1
***Gordonia* spp**		**0**	**0**	**1**	**2**	**5**
	Gordonia bronchialis (rhodococcus bronchialis)	0	0	1	1	1
	Gordonia polyisoprenivorans	0	0	0	0	1
	Gordonia sp	0	0	0	1	3
***Granulicatella* spp**		**7**	**13**	**24**	**20**	**42**
	Granulicatella adiacens (abiotrophia adjacens)(strep adjacens)	7	13	23	19	38
	Granulicatella elegans	0	0	1	1	1
	Granulicatella sp	0	0	0	0	3
***Helcococcus* spp**		**0**	**0**	**0**	**2**	**0**
	Helcococcus kunzii	0	0	0	2	0
***Janibacter* spp**		**0**	**0**	**1**	**0**	**0**
	Janibacter anophelis	0	0	1	0	0
***Kocuria* spp**		**1**	**0**	**8**	**13**	**27**
	Kocuria kristinae	0	0	1	4	6
	Kocuria rhizophila	0	0	0	1	4
	Kocuria rosea	0	0	3	2	9
	Kocuria sp	1	0	4	6	8
***Kurthia* spp**		**1**	**0**	**0**	**0**	**0**
	Kurthia other named	1	0	0	0	0
***Leuconostoc* spp**		**34**	**34**	**42**	**41**	**23**
	Leuconostoc sp	34	34	42	41	23
***Microbacterium* spp**		**0**	**1**	**0**	**4**	**5**
	Microbacterium imperiale	0	0	0	1	0
	Microbacterium luteolum	0	0	0	1	1
	Microbacterium sp	0	1	0	2	4

***Mobiluncus* spp**		**2**	**1**	**0**	**1**	**0**
	Mobiluncus curtisii	1	0	0	0	0
	Mobiluncus sp	1	1	0	1	0
***Nocardia* spp**		**5**	**4**	**1**	**3**	**5**
	Nocardia asteroides	1	0	0	0	0
	Nocardia farcinica	0	0	0	0	1
	Nocardia other named	2	2	0	1	1
	Nocardia sp	2	2	1	2	3
***Oerskovia* spp**		**0**	**0**	**1**	**0**	**0**
	Oerskovia sp	0	0	1	0	0
***Paenibacillus* spp**		**0**	**0**	**1**	**1**	**4**
	Paenibacillus sp	0	0	1	1	4
***Parvimonas* spp**		**1**	**1**	**3**	**3**	**8**
	Parvimonas micra	1	1	3	3	8
***Pediococcus* spp**		**6**	**2**	**3**	**3**	**11**
	Pediococcus other named	2	2	2	1	4
	Pediococcus sp	4	0	1	2	7
***Peptococcus* spp**		**14**	**13**	**16**	**6**	**17**
	Peptococcus named	5	3	2	1	6
	Peptococcus sp	9	10	14	5	11
***Peptoniphilus* spp**		**0**	**0**	**3**	**5**	**10**
	Peptoniphilus harei (peptostreptococcus harei)	0	0	1	3	5
	Peptoniphilus sp	0	0	2	2	5
***Rhodococcus* spp**		**10**	**11**	**12**	**10**	**18**
	Rhodococcus equi (corynebacterium equi)	0	0	2	0	1
	Rhodococcus other named	0	1	0	1	1
	Rhodococcus sp	10	10	10	9	16
***Robinsoniella* spp**		**1**	**0**	**0**	**0**	**0**
	Robinsoniella peoriensis	1	0	0	0	0
***Ruminococcus* spp**		**0**	**1**	**0**	**2**	**1**
	Ruminococcus gnavus	0	1	0	2	1
***Slackia* spp**		**0**	**0**	**0**	**1**	**0**
	Slackia exigua	0	0	0	1	0
***Stomatococcus* spp**		**6**	**1**	**5**	**4**	**4**
	Stomatococcus mucilaginosus	4	0	4	0	4
	Stomatococcus sp	2	1	1	4	0
***Streptomyces* spp**		**0**	**0**	**0**	**1**	**0**
	Streptomyces other	0	0	0	1	0
***Trueperella* spp**		**0**	**0**	**1**	**0**	**0**
	Trueperella bernardiae	0	0	1	0	0
***Vagococcus* spp**		**0**	**0**	**1**	**0**	**0**
	Vagococcus fluvialis	0	0	1	0	0
Total Gram positive bacteria		**177**	**183**	**279**	**290**	**419**

Gram negative bacteria						
***Actinobacillus* spp**		**3**	**6**	**9**	**3**	**2**
	Actinobacillus other named	3	2	6	1	2
	Actinobacillus sp	0	3	2	2	0
	Actinobacillus ureae	0	1	1	0	0
***Aggregatibacter* spp**		**1**	**2**	**5**	**7**	**9**
	Aggregatibacter (haemophilus) segnis	0	1	0	3	1
	Aggregatibacter actinomycetemcomitans	1	1	3	1	6
	Aggregatibacter sp	0	0	2	3	2
***Agrobacterium* spp**		**4**	**2**	**3**	**1**	**4**
	Agrobacterium other named	2	0	1	1	4
	Agrobacterium sp	2	2	2	0	0
***Alcaligenes* spp**		**25**	**23**	**21**	**17**	**19**
	Alcaligenes denitrificans	0	0	1	0	0
	Alcaligenes faecalis	13	12	12	13	13
	Alcaligenes other named	1	0	0	0	1
	Alcaligenes sp	6	8	4	2	0
	Alcaligenes xylosoxidans xylosoxidans	5	3	4	2	5
***Alistipes* spp**		**0**	**0**	**0**	**1**	**0**
	Alistipes finegoldii	0	0	0	1	0
***Anaerobiospirillum* spp**		**4**	**2**	**2**	**9**	**15**
	Anaerobiospirillum other named	3	2	2	6	7
	Anaerobiospirillum sp	1	0	0	2	8
	Anaerobiospirillum succiniciproducens	0	0	0	1	0
***Arcobacter* spp**		**0**	**1**	**1**	**0**	**0**
	Arcobacter butzleri	0	1	0	0	0
	Arcobacter sp	0	0	1	0	0
***Aurantimonas* spp**		**1**	**0**	**0**	**0**	**2**
	Aurantimonas altamirensis	1	0	0	0	2
***Azospirillum* spp**		**0**	**1**	**0**	**0**	**0**
	Azospirillum brasilense	0	1	0	0	0
***Bilophila* spp**		**0**	**1**	**0**	**1**	**1**
	Bilophila sp	0	0	0	0	1
	Bilophila wadsworthia	0	1	0	1	0
***Bordetella* spp**		**6**	**4**	**4**	**2**	**7**
	Bordetella bronchiseptica	1	2	0	1	1
	Bordetella other named	1	0	3	0	2
	Bordetella parapertussis	0	0	1	1	1
	Bordetella sp	4	2	0	0	3
***Borrelia* spp**		**2**	**5**	**5**	**7**	**3**
	Borrelia other named	0	1	1	1	1
	Borrelia sp	2	4	4	6	2

***Branhamella* spp**		**2**	**1**	**3**	**0**	**0**
	Branhamella sp	2	1	3	0	0
***Brevundimonas* spp**		**28**	**26**	**27**	**30**	**42**
	Brevundimonas diminuta	8	9	7	11	13
	Brevundimonas sp	3	9	7	9	12
	Brevundimonas vesicularis	17	8	13	10	17
***Brucella* spp**		**4**	**8**	**8**	**4**	**10**
	Brucella melitensis	3	7	6	4	9
	Brucella sp	1	1	2	0	1
***Burkholderia* spp**		**45**	**45**	**46**	**50**	**27**
	Burkholderia cenocepacia	4	2	2	2	1
	Burkholderia cepacia	37	37	36	33	20
	Burkholderia gladioli	0	2	1	0	0
	Burkholderia multivorans	1	1	2	6	1
	Burkholderia other named	0	1	2	3	0
	Burkholderia pseudomallei	2	1	0	2	3
	Burkholderia sp	1	1	3	4	2
***Buttiauxella* spp**		**0**	**0**	**0**	**1**	**0**
	Buttiauxella agrestis	0	0	0	1	0
***Calymmatobacterium* spp**		**0**	**0**	**0**	**0**	**1**
	Calymmatobacterium sp	0	0	0	0	1
***Capnocytophaga* spp**		**12**	**7**	**13**	**20**	**34**
	Capnocytophaga ochracea	1	0	0	1	0
	Capnocytophaga other named	7	2	3	11	18
	Capnocytophaga sp	4	5	10	8	16
***Cardiobacterium* spp**		**4**	**6**	**3**	**11**	**5**
	Cardiobacterium hominis	2	4	2	11	4
	Cardiobacterium other named	1	1	1	0	1
	Cardiobacterium sp	1	1	0	0	0
***Cedecea* spp**		**2**	**3**	**1**	**0**	**0**
	Cedecea neteri	0	1	0	0	0
	Cedecea sp	2	2	1	0	0
***Chromobacterium* spp**		**1**	**0**	**2**	**2**	**0**
	Chromobacterium other named	0	0	1	0	0
	Chromobacterium sp	0	0	1	0	0
	Chromobacterium violaceum	1	0	0	2	0
***Chryseobacterium* spp**		**16**	**20**	**31**	**28**	**35**
	Chryseobacterium gleum	0	0	1	1	1
	Chryseobacterium indologenes	14	17	22	19	28
	Chryseobacterium sp	2	3	8	8	6
***Chryseomonas* spp**		**1**	**6**	**2**	**1**	**0**
	Chryseomonas sp	1	6	2	1	0

***Comamonas* spp**		**10**	**15**	**7**	**6**	**12**
	Comamonas other named	1	1	3	1	2
	Comamonas sp	2	4	1	0	3
	Comamonas testosteroni	7	10	3	5	7
***Delftia* spp**		**9**	**7**	**4**	**3**	**10**
	Delftia acidovorans (comamonas acidovorans)	9	7	4	3	10
***Desulfovibrio* spp**		**0**	**0**	**1**	**1**	**1**
	Desulfovibrio desulfuricans	0	0	0	1	0
	Desulfovibrio fairfieldensis	0	0	1	0	0
	Desulfovibrio sp	0	0	0	0	1
***Dialister* spp**		**1**	**3**	**3**	**3**	**2**
	Dialister microaerophilus	0	1	1	0	0
	Dialister pneumosintes	1	2	2	3	2
***Edwardsiella* spp**		**2**	**3**	**2**	**1**	**0**
	Edwardsiella other named	2	0	1	1	0
	Edwardsiella sp	0	0	1	0	0
	Edwardsiella tarda	0	3	0	0	0
***Eikenella* spp**		**8**	**8**	**8**	**7**	**18**
	Eikenella corrodens	8	7	8	7	18
	Eikenella sp	0	1	0	0	0
***Elizabethkingia* spp**		**5**	**11**	**4**	**5**	**3**
	Elizabethkingia meningoseptica	5	11	4	4	2
	Elizabethkingia sp	0	0	0	1	1
***Empedobacter* spp**		**2**	**0**	**0**	**0**	**1**
	Empedobacter brevis	2	0	0	0	1
***Erwinia* spp**		**2**	**0**	**0**	**0**	**0**
	Erwinia other named	1	0	0	0	0
	Erwinia sp	1	0	0	0	0
***Ewingella* spp**		**1**	**1**	**0**	**1**	**0**
	Ewingella americana	1	1	0	1	0
***Flavobacterium* spp**		**4**	**3**	**8**	**8**	**4**
	Flavobacterium other named	2	0	0	3	2
	Flavobacterium sp	2	3	8	5	2
***Gardnerella* spp**		**10**	**6**	**6**	**15**	**20**
	Gardnerella other named	1	0	0	3	1
	Gardnerella sp	0	1	0	0	2
	Gardnerella vaginalis	9	5	6	12	17
***Hafnia* spp**		**38**	**27**	**37**	**35**	**39**
	Hafnia alvei	38	26	37	35	39
	Hafnia sp	0	1	0	0	0
***Herbasprillum* spp**		**0**	**0**	**0**	**0**	**1**
	Herbasprillum huttiense	0	0	0	0	1
***Janthinobacterium* spp**		**0**	**0**	**0**	**1**	**0**
	Janthinobacterium lividum	0	0	0	1	0

***Kingella* spp**		**6**	**9**	**12**	**16**	**14**
	Kingella denitrificans	0	1	1	0	0
	Kingella kingae	5	6	10	15	12
	Kingella sp	1	2	1	1	2
***Kluyvera* spp**		**21**	**12**	**26**	**30**	**26**
	Kluyvera ascorbata	1	1	2	2	0
	Kluyvera sp	20	11	24	28	26
***Koserella* spp**		**1**	**0**	**0**	**0**	**0**
	Koserella trabulsii	1	0	0	0	0
***Leclercia* spp**		**12**	**5**	**4**	**4**	**8**
	Leclercia adecarboxylata	12	5	4	4	8
***Legionella* spp**		**1**	**1**	**0**	**0**	**0**
	Legionella pneumophila	1	1	0	0	0
***Leminorella* spp**		**0**	**0**	**0**	**0**	**1**
	Leminorella sp	0	0	0	0	1
***Leptospira* spp**		**3**	**8**	**6**	**4**	**7**
	Leptospira autumnalis	0	0	1	0	0
	Leptospira interrogans	0	0	0	0	1
	Leptospira other named	1	0	0	0	0
	Leptospira sp	2	8	5	4	6
***Leptotrichia* spp**		**3**	**3**	**3**	**5**	**8**
	Leptotrichia buccalis	1	1	1	3	1
	Leptotrichia sp	2	2	2	2	7
***Luteimonas* spp**		**0**	**0**	**1**	**0**	**0**
	Luteimonas sp	0	0	1	0	0
***Massilia* spp**		**0**	**0**	**0**	**0**	**1**
	Massilia timonae	0	0	0	0	1
***Methylobacterium* spp**		**0**	**0**	**0**	**0**	**1**
	Methylobacterium sp	0	0	0	0	1
***Myroides* spp**		**2**	**1**	**3**	**3**	**2**
	Myroides odoratus	0	0	2	0	0
	Myroides sp	2	1	1	3	2
***Ochrobactrum* spp**		**26**	**38**	**53**	**49**	**43**
	Ochrobactrum anthropi	26	35	51	43	40
	Ochrobactrum sp	0	3	2	6	3
***Oligella* spp**		**2**	**1**	**1**	**0**	**2**
	Oligella ureolytica	2	1	0	0	0
	Oligella urethralis	0	0	1	0	2
***Pandoraea* spp**		**0**	**0**	**2**	**0**	**1**
	Pandoraea apista	0	0	1	0	0
	Pandoraea sp	0	0	1	0	0
	Pandoraea sputorum	0	0	0	0	1
***Parabacteroides* spp**		**0**	**0**	**0**	**0**	**6**
	Parabacteroides distasonis	0	0	0	0	6
***Paracoccus* spp**		**0**	**0**	**0**	**1**	**1**
	Paracoccus yeei	0	0	0	1	1

***Plesiomonas* spp**		**0**	**2**	**0**	**0**	**0**
	Plesiomonas shigelloides	0	2	0	0	0
***Porphyromonas* spp**		**4**	**5**	**3**	**0**	**1**
	Porphyromonas asaccharolytica	0	3	1	0	1
	Porphyromonas sp	4	2	2	0	0
***Psychrobacter* spp**		**0**	**0**	**1**	**6**	**3**
	Psychrobacter phenylpyruvicus (moraxella phenylpyruvica)	0	0	1	5	0
	Psychrobacter sanguinis	0	0	0	1	3
***Rahnella* spp**		**4**	**5**	**1**	**2**	**3**
	Rahnella named	3	4	1	2	3
	Rahnella sp	1	1	0	0	0
***Ralstonia* spp**		**17**	**2**	**6**	**8**	**10**
	Ralstonia insidiosa	0	0	0	1	0
	Ralstonia pickettii	17	2	6	7	10
***Rhizobium* spp**		**32**	**18**	**33**	**32**	**30**
	Rhizobium radiobacter (agrobacterium tumefaciens)	32	18	33	31	30
	Rhizobium sp	0	0	0	1	0
***Roseomonas* spp**		**3**	**9**	**23**	**21**	**33**
	Roseomonas gilardii	2	4	12	8	16
	Roseomonas sp	1	5	11	13	17
***Shewanella* spp**		**2**	**3**	**2**	**4**	**2**
	Shewanella putrefaciens (pseudomonas putrefaciens)	2	2	1	3	2
	Shewanella sp	0	1	1	1	0
***Shigella* spp**		**5**	**5**	**7**	**8**	**7**
	Shigella boydii	0	0	0	1	2
	Shigella flexneri	2	1	1	3	2
	Shigella sonnei	1	2	2	1	3
	Shigella sp	2	2	4	3	0
***Sneathia* spp**		**0**	**0**	**0**	**0**	**1**
	Sneathia sanguinegens	0	0	0	0	1
***Sphingobacterium* spp**		**4**	**10**	**7**	**5**	**9**
	Sphingobacterium multivorum	2	3	1	4	1
	Sphingobacterium sp	1	3	3	1	2
	Sphingobacterium spiritivorum	0	3	1	0	5
	Sphingobacterium thalpophilum	1	1	2	0	1
***Sphingomonas* spp**		**2**	**1**	**4**	**3**	**8**
	Sphingomonas sp	2	1	4	3	8
***Streptobacillus* spp**		**0**	**1**	**0**	**1**	**1**
	Streptobacillus moniliformis	0	0	0	1	0
	Streptobacillus sp	0	1	0	0	1

Bacteraemia and HCAI

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Surveillance of *Proteus, Morganella* and *Providencia* species causing bacteraemia in England, Wales and Northern Ireland: 2014

These analyses are based on data relating to diagnoses of *Proteus* spp., *Morganella* spp. *and Providencia* spp. bloodstream infections during 2007 – 2014 in England, Wales and Northern Ireland (E, W & NI) extracted from Public Health England's (PHE) voluntary surveillance database Second Generation Surveillance System (SGSS).

SGSS comprises a communicable disease module (CDR; formerly CoSurv/LabBase2) and an antimicrobial resistance module (AMR; formerly AmSurv). Most analyses presented here are based on data extracted from the CDR module of SGSS data on 3rd December 2015, except for the evaluation of multi-drug resistance data from the AMR module of SGSS. This module captures more comprehensive antibiogram data allowing more robust evaluation of multi-resistance rates. However these data cannot be used for the trend analysis due to the addition of this data collection being relatively recent and therefore a lower laboratory coverage in previous years.

The data presented here will differ in some instances from those in earlier publications partly due to the inclusion of late reports.

Rates of bacteraemia laboratory reports were calculated using mid-year resident population estimates for the respective year and geography [1]. Geographical analyses were based on the residential postcode of the patient if known (otherwise the GP postcode if known or failing that the postcode of the laboratory) with cases in England being assigned to the catchment area of one of 15 local PHE centres (PHECs) formed from administrative local authority boundaries, which were correct at the time the data were reported.

This report includes analyses of the trends, patient demographic and geographical distribution as well as antimicrobial susceptibility among these bacteraemia episodes.

Key points

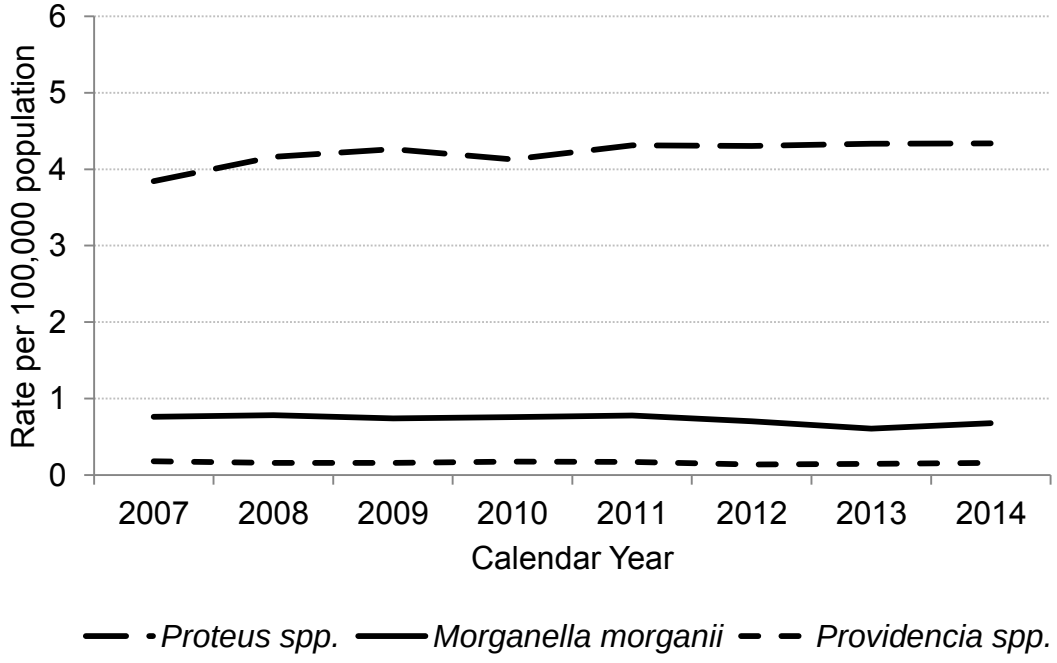
- the overall rate of *Proteus* spp. bacteraemia in England, Wales and Northern Ireland was 4.3 per 100,000 population in 2014, which has steadily increased from 3.8/100,000 population observed in 2007
- the rate of *Morganella morganii* bacteraemia was 0.7/100,000 population in 2014 and has remained consistent since 2007. No other *Morganella* spp. were isolated
- the rate of *Providencia* spp. bacteraemia remained consistent at 0.2/100,000 population between 2007 and 2014
- England had the highest reported incidence rate of *Proteus* spp. in 2014 with 4.4/100,000 population followed by Northern Ireland (4.1) and Wales (3.3)
- England had the highest reported incidence rate of *Morganella morganii* in 2014 with 0.7/100,000 population, where Northern Ireland and Wales both had a rate of 0.4/100,000 population
- the most frequently identified *Proteus* species in blood isolates in 2014 (as in previous years) was *P. mirabilis* (90%)
- the most frequently identified *Providencia* species in blood isolates in 2014 were *P. stuartii* (44%) and *P. rettgeri* (45%)
- the highest rates of *Proteus* spp., *M. morganii* and *Providencia* spp. bacteraemia were observed in those aged 75 years or older and those that were male
- overall the proportion of *P. mirabilis* and *P. vulgaris* bacteraemia reports reported as resistant (defined as reduced- or non-susceptible) to an antimicrobial in 2014 remained steady compared to the previous four years, except for emerging resistance to ertapenem
- a decrease of *M. morganii* resistance to cephalosporins was observed
- all the pathogens in this report were universally susceptible to meropenem in 2014.

Trends

The overall rate of *Proteus* spp. bacteraemia for England, Wales and Northern Ireland was 4.3 per 100,000 population in 2014, which is marginally higher than the 3.8/100,000 population observed in 2007 (13% increase; figure 1). The rate of *Morganella morganii* bacteraemia was 0.7/100,000 population in 2014, representing a decline of 11% since 2007 (0.8/100,000 population; figure 1). No other *Morganella* species were isolated. The rate of *Providencia* spp. bacteraemia remained consistent at 0.2/100,000 between 2007 and 2014 (figure 1).

Proteus spp. accounted for 2.1% of mono-microbial bloodstream infections (BSI; all reported bacteraemia and/or fungaemia) in 2014; making them the ninth most commonly reported cause of mono-microbial BSI. In contrast, *M. morganii* and *Providencia* spp. accounted for 0.3% (ranked 24th) and 0.06% (ranked 41st) of mono-microbial BSI respectively in 2014 [2]. *Proteus* spp,, *M. morganii* and *Providencia* spp. were identified in 7.2%, 1.5% and 0.4% of poly-microbial BSI respectively in 2014.

Figure 1. Eight year trend in *Proteus* spp., *Morganella morganii* and *Providencia* spp. bacteraemia reports per 100,000 population (England Wales and Northern Ireland); 2007 to 2014



Geographic distribution

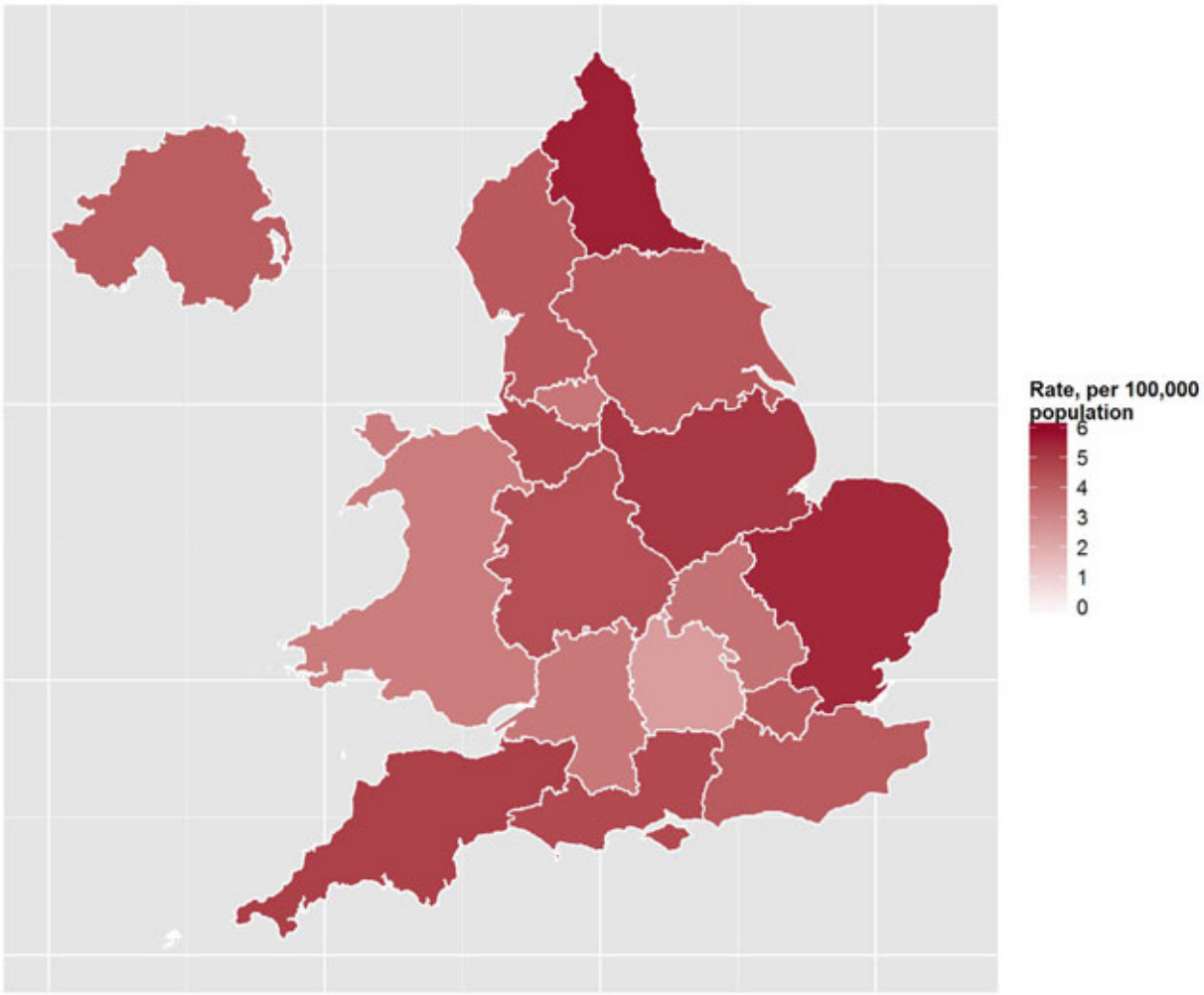
England had the highest reported incidence rate of *Proteus* spp. in 2014 with 4.4/100,000 population followed by Northern Ireland (4.1/100,000) and Wales (3.3/100,000) (table 1a). However, Northern Ireland observed a steep 34% decline of the *Proteus* spp. bacteraemia incidence rate between 2013 and 2014 (6.2 vs. 4.1/100,000 population, respectively; table 1a).

Within the English PHECs, the rate of *Proteus* spp. bacteraemia has varied between 2010 and 2014 (table 1a). In 2014, the Thames Valley had the lowest rate of *Proteus* spp. bacteraemia (2.4/100,000 population) compared to the highest rates in Anglia and Essex (5.5/100,000 population) and the North East (5.7/100,000 population; table 1a, figure 2a).

Table 1a. Five year PHE Centre *Proteus* spp. bacteraemia per 100,000 population (England, Wales and Northern Ireland); 2010 to 2014

Region		Rate per 100,000 population				
		2010	2011	2012	2013	2014
London	London	3.7	4.5	4.2	4.2	4.3
Midlands	South Midlands and Hertfordshire	2.5	2.3	3.3	3.2	3.6
	East Midlands	5.6	5.4	5.6	5.8	5.2
	Anglia and Essex	4.6	4.8	5.1	5.1	5.5
	West Midlands	4.5	4.7	4.9	4.7	4.5
Northern	Cheshire and Merseyside	3.7	4.9	4.1	5.0	4.7
	Cumbria and Lancashire	2.7	4.0	3.7	4.4	4.3
	Greater Manchester	5.2	3.4	4.6	3.0	3.5
	North East	3.6	4.4	4.3	4.8	5.7
	Yorkshire and Humber	4.6	4.2	4.2	3.7	4.3
Southern	Avon, Gloucestershire and Wiltshire	3.2	4.3	4.1	3.9	3.4
	Devon, Cornwall and Somerset	5.0	4.8	4.4	4.2	4.9
	Wessex	4.0	4.3	4.6	4.4	4.7
	Kent, Surrey and Sussex	4.5	4.1	3.7	4.9	4.2
	Thames Valley	2.9	2.5	2.1	2.0	2.4
England		**4.1**	**4.3**	**4.3**	**4.3**	**4.4**
Northern Ireland		**5.1**	**5.1**	**6.1**	**6.2**	**4.1**
Wales		**3.2**	**4.0**	**3.4**	**3.3**	**3.3**
England, Wales and Northern Ireland		**4.1**	**4.3**	**4.3**	**4.3**	**4.3**

Figure 2a. Geographical distribution of *Proteus* spp. bacteraemia per 100,000 population in England, Wales and Northern Ireland; 2014



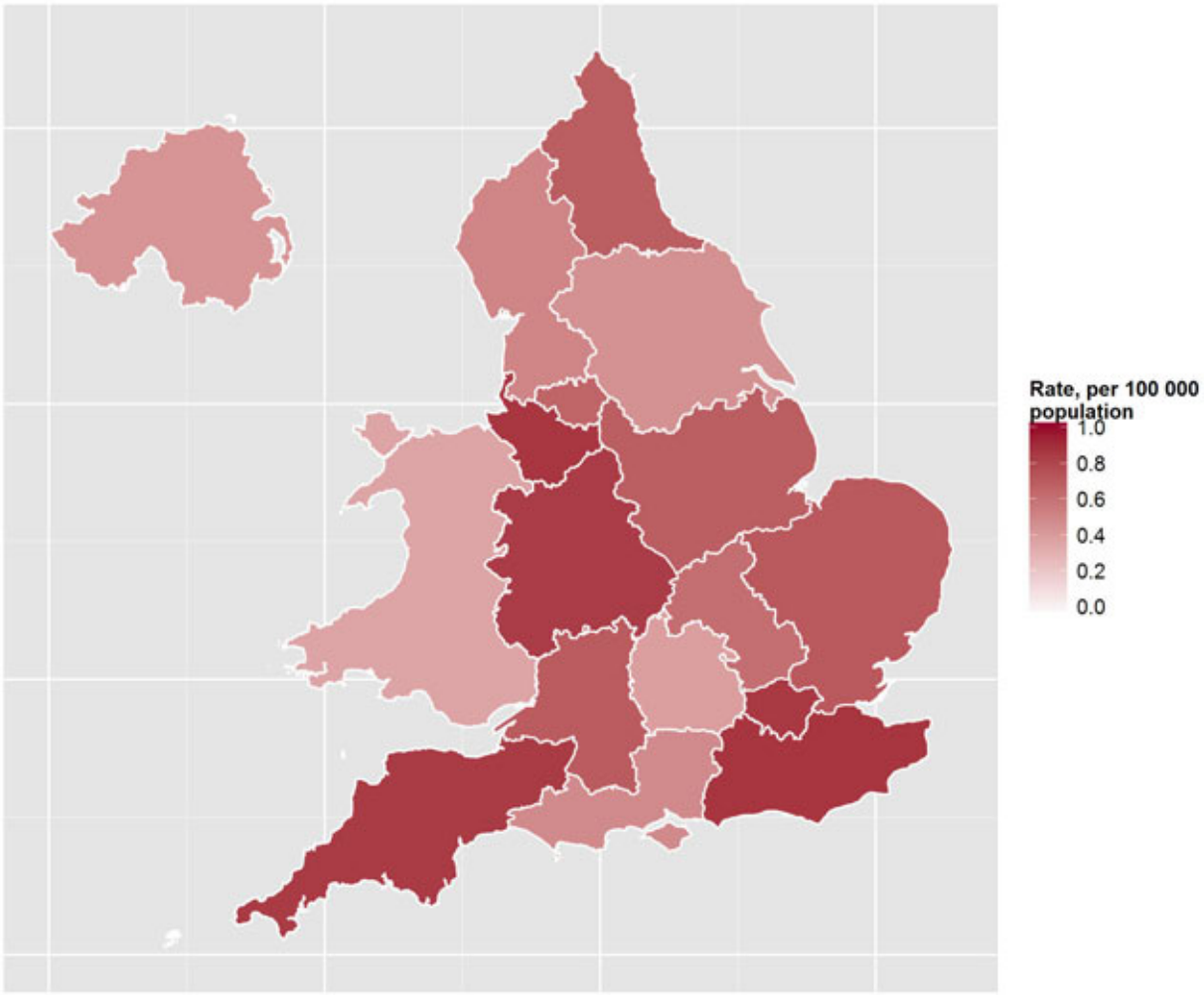
England had the highest reported incidence rate of bacteraemia due to *M. morganii* in 2014 with 0.7/100,000 population, whereas Northern Ireland and Wales both had a rate of 0.4/100,000 population, which was their lowest rate in the five-year period (table 1b).

There was marginal variation in the rate of *M. morganii* bacteraemia within the English PHECs between 2010 and 2014 (table 1b), although the majority of rates remained <1/100,000 population. In 2014, Yorkshire and the Humber and Thames Valley had the lowest rate of *M. morganii* bacteraemia (0.4/100,000 population) compared to the highest rate of 0.9/100,000 population in London, Cheshire and Merseyside, and Kent, Surrey and Sussex (table 1b, figure 2b).

Table 1b. Five year PHE Centre *Morganella morganii* bacteraemia per 100,000 population (England, Wales and Northern Ireland); 2010 to 2014

Region		Rate per 100,000 population				
		2010	2011	2012	2013	2014
London	London	0.8	0.8	0.9	0.7	0.9
Midlands	South Midlands and Hertfordshire	0.3	0.5	0.6	0.5	0.6
	East Midlands	1.1	1.1	0.7	0.7	0.7
	Anglia and Essex	0.7	0.8	0.6	0.8	0.7
	West Midlands	0.7	0.8	0.7	0.7	0.8
Northern	Cheshire and Merseyside	0.8	0.5	0.7	0.5	0.9
	Cumbria and Lancashire	0.7	0.7	1.2	0.7	0.5
	Greater Manchester	0.8	0.9	0.7	0.4	0.7
	North East	0.6	0.5	0.6	0.4	0.7
	Yorkshire and Humber	0.9	0.9	0.7	0.4	0.4
Southern	Avon, Gloucestershire and Wiltshire	0.7	0.7	0.4	0.5	0.7
	Devon, Cornwall and Somerset	1.0	0.6	0.5	0.9	0.8
	Wessex	0.5	0.5	0.5	0.5	0.5
	Kent, Surrey and Sussex	0.6	0.9	0.8	0.8	0.9
	Thames Valley	0.6	0.5	0.3	0.3	0.4
England		**0.7**	**0.8**	**0.7**	**0.6**	**0.7**
Northern Ireland		**0.8**	**0.7**	**0.8**	**0.7**	**0.4**
Wales		**1.0**	**1.1**	**0.7**	**0.6**	**0.4**
England, Wales and Northern Ireland		**0.8**	**0.8**	**0.7**	**0.6**	**0.7**

Figure 2b. Geographical distribution of *Morganella morganii* bacteraemia per 100,000 population in England, Wales and Northern Ireland; 2014



Species distribution

Ninety-three per cent of *Proteus* bacteraemia cases were identified to species level in 2014, demonstrating an improving trend from the 90% reported to species level in 2010. The most frequently identified *Proteus* species in blood isolates in 2014 (as in previous years) was *P. mirabilis* (90%; table 2).

The most frequently identified *Providencia* species in blood isolates in 2014 were *P. stuartii* (44%) and *P. rettgeri* (45%; table 2). This is the first year that *P. rettgeri* has been more frequently isolated than *P. stuartii,* for which a 34% decrease in the numbers since 2010 was observed (from 62 isolates in 2010 to 41 isolates in 2014).

Table 2. Distribution of *Proteus* spp., *Morganella morganii*, and *Providencia* spp. species identified in blood specimens (England, Wales and Northern Ireland); 2010 to 2014

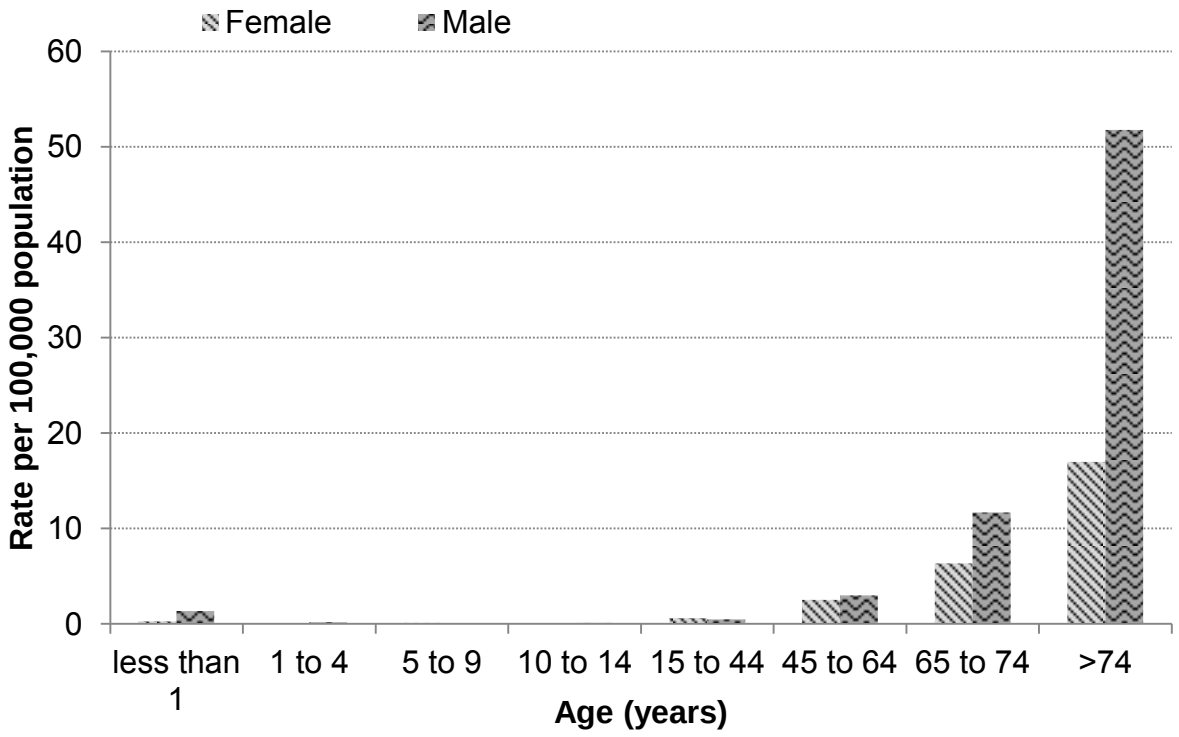
	2010		2011		2012		2013		2014	
Species	**Count**	**%**	**Count**	**%**	**Count**	**%**	**Count**	**%**	**Count**	**%**
***Proteus* spp.**	2374	100%	2500	100%	2512	100%	2546	100%	2570	100%
P. mirabilis	2048	86%	2176	87%	2192	87%	2260	89%	2303	90%
P. vulgaris	91	4%	87	3%	88	4%	66	3%	80	3%
Proteus spp., other named	10	0%	4	0%	2	0%	4	0%	7	0%
Proteus spp., sp. not recorded	225	9%	233	9%	230	9%	216	8%	180	7%
Morganella morganii	435	100%	452	100%	412	100%	356	100%	402	100%
***Providencia* spp.**	102	100%	100	100%	80	100%	86	100%	94	100%
P. stuartii	62	61%	56	56%	37	46%	49	57%	41	44%
P. rettgeri	32	31%	27	27%	32	40%	30	35%	42	45%
Providencia spp., other named	3	3%	10	10%	10	13%	7	8%	6	6%
Providencia spp., sp. not recorded	5	5%	7	7%	1	1%	0	0%	5	5%

Age and sex distribution

The age distribution of *Proteus* spp. bacteraemia for 2014 is presented in figure 3a. The highest rates of *Proteus* spp. bacteraemia were observed in those aged 75 years or older (31.5/100,000 population), followed by those aged between 65 and 74 years (8.9/100,000 population; figure 3a). Very few cases were reported in children aged between 0-14 years.

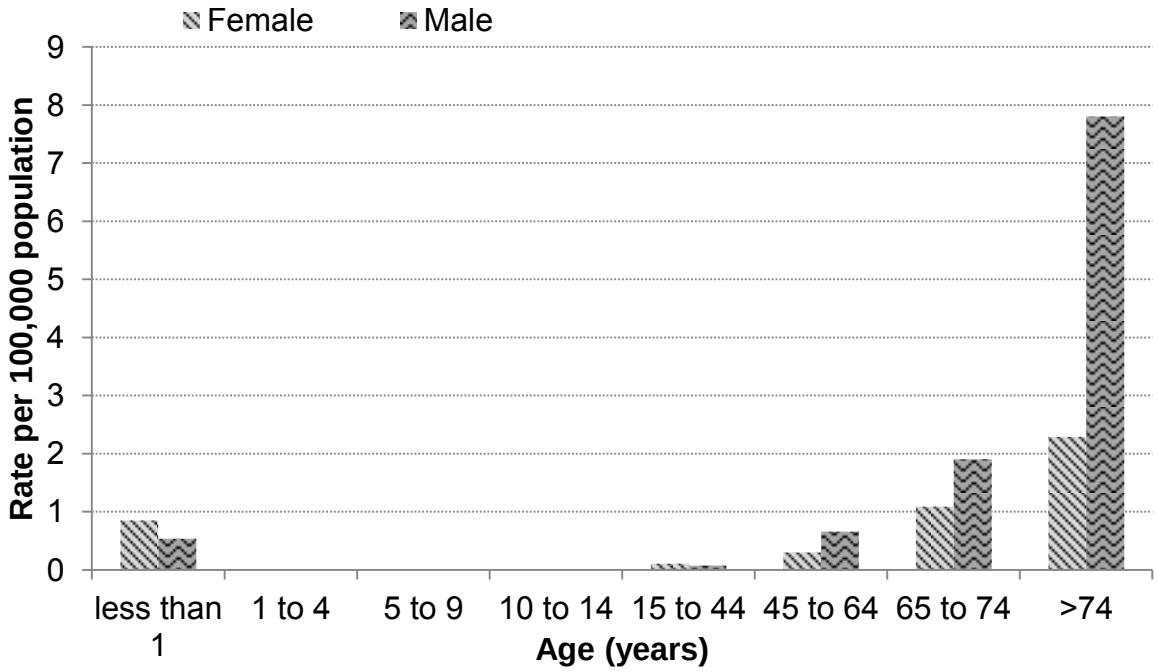
Males had higher rates of *Proteus* bacteraemia than females in all those aged 45 years or more, particularly those aged 75 years or older (51.7 vs. 17.0/100,000 population, respectively).

Figure 3a. Rate per 100,000 population *Proteus* spp. by age and sex (England, Wales and Northern Ireland); 2014



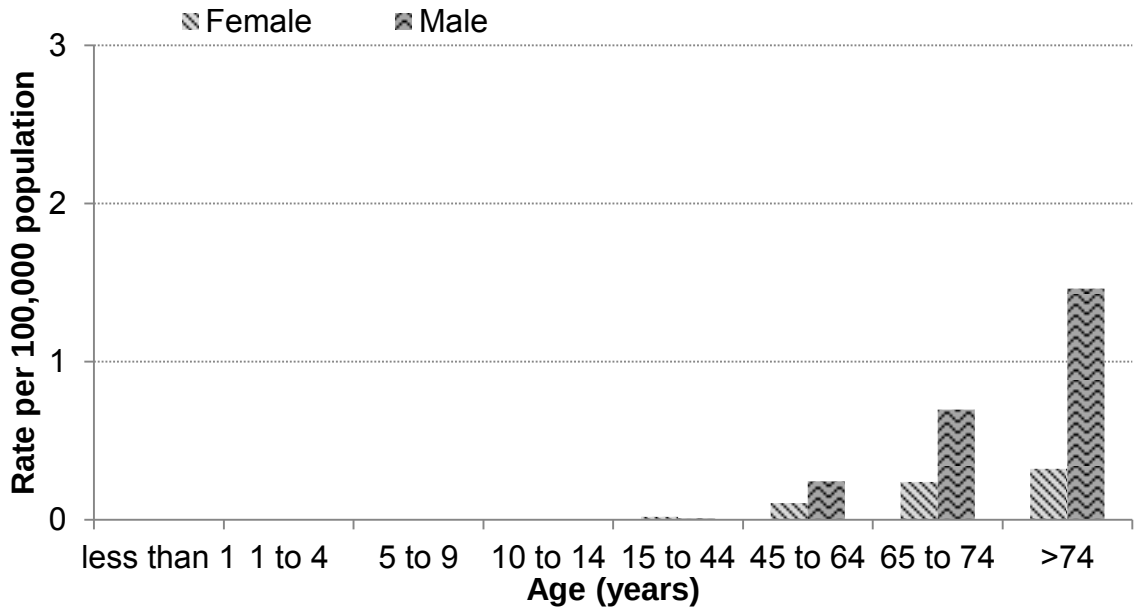
The age distribution of *M. morganii* bacteraemia for 2014 is presented in figure 3b. Those aged 75 years or older had the highest rates of *M. morganii* bacteraemia (4.6/100,000 population; figure 3b); the rate was much higher for males than females in this age-group (7.8 vs.2.3/100,000 population, respectively). Conversely, in children aged <1 year, there was a higher rate in females than males (0.9 vs. 0.5/100,000, respectively). All other age-groups had a rate of <2.0/100,000 population and there were no reported bacteraemias in children aged between 1 and 14 years.

Figure 3b. Population rate by age group for bacteraemia caused by *Morganella morganii* (England, Wales and Northern Ireland); 2014



The age distribution of *Providencia* spp. bacteraemia for 2014 is presented in figure 3c. Those aged 75 years or older had the highest rates of *Providencia* bacteraemia (0.8/100,000 population; figure 3b); the rate was higher for males than females (1.5 vs. 0.3/100,000 population, respectively) in this age-group, as well as the other age-groups. Very few *Providencia* bacteraemia were reported in children aged 14 years or less (<1/100,000 population).

Figure 3c. Population rate by age group for bacteraemia caused by *Providencia* spp. (England, Wales and Northern Ireland); 2014



Antimicrobial resistance

The proportion of *Proteus mirabilis and Proteus vulgaris* isolates with susceptibility test results reported ranged between 44-85% and 40-86% respectively for the key antimicrobials in 2014 (table 3a and 3b).

The percentage of resistant *P. mirabilis* bacteraemia isolates reported was ampicillin/amoxicillin (35%), cefotaxime (2%), ceftazidime (2%), ciprofloxacin (8%), ertapenem (1%), gentamicin (8%) and meropenem (0%). Unlike among *E. coli* and *Klebsiella* spp., cephalosporin resistance remains very unusual in *P. mirabilis* in the UK, although ESBLs or plasmid AmpC have disseminated in the species e.g. in Italy[3]. The percentage of resistant *P. vulgaris* bacteraemia isolates reported was ampicillin/amoxicillin (92%), cefotaxime (8%), ceftazidime (5%), ciprofloxacin (2%), ertapenem (3%), gentamicin (1%) and meropenem (0%).

Overall the proportion of *P. mirabilis* and *P. vulgaris* bacteraemia isolates reported as resistant (defined as reduced- or non-susceptible) to an antimicrobial in 2014 remained steady compared to the previous four years (table 3a). The exception to this was a reported 1% resistance (*P. mirabilis*) and 3% resistance (*P. vulgaris*) to ertapenem that was not seen in previous years; both *Proteus* species remained fully susceptible to meropenem.

For *M. morganii*, the proportion of bacteraemia isolates reported as resistant to an antimicrobial in 2014 also remained steady compared to the previous four years, with a slight decrease observed for the cephalosporins (table 3c). This decrease is consistent with the decrease in resistance reported in *Enterobacter* spp. between 2010-2014 (from 33% to 26% for cefotaxime and 32% to 28% for ceftazidime)[4]. This is notable because the principal mechanism of resistance (derepression of AmpC) is the same in both organisms. Isolates continue to be fully susceptible to meropenem, and in 2014 this was also the case for ertapenem.

Providencia stuartii remained fully susceptible to ertapenem and meropenem, and the other reported rates of resistance remained steady across the five year period (table 3d). EUCAST advises that all isolates should be reported as resistant to aminoglycosides except for amikacin and streptomycin owing to the production of a chromosomally mediated acetyltransferase [5].

Table 3a. Antimicrobial susceptibility for *Proteus mirabilis* bacteraemia (England, Wales and Northern Ireland); 2010 to 2014

Antimicrobial	2010		2011		2012		2013		2014	
	No. tested	% resistant (%R)*	No. tested	%R*	No. tested	%R*	No. tested	%R*	No. tested	%R*
Ampicillin/Amoxicillin	1651	33%	1761	34%	1875	34%	1867	34%	1795	35%
Cefotaxime	981	1%	1052	2%	1146	2%	1186	3%	1105	2%
Ceftazidime	1354	1%	1482	2%	1486	2%	1476	3%	1441	2%
Ciprofloxacin	1642	6%	1740	8%	1826	9%	1868	8%	1778	8%
Ertapenem	222	0%	469	0%	659	0%	848	0%	1032	1%
Gentamicin	1756	7%	1861	7%	1968	10%	2011	9%	1965	8%
Meropenem	1165	0%	1339	0%	1477	0%	1609	0%	1577	0%
Total reports	**2048**		**2176**		**2192**		**2260**		**2303**	

Table 3b. Antimicrobial susceptibility for *Proteus vulgaris* bacteraemia (England, Wales and Northern Ireland); 2010 to 2014

Antimicrobial	2010		2011		2012		2013		2014	
	No. tested	% resistant (%R)*	No. tested	%R*	No. tested	%R*	No. tested	%R*	No. tested	%R*
Ampicillin/Amoxicillin	70	90%	73	88%	70	94%	57	95%	61	92%
Cefotaxime	47	4%	38	3%	46	9%	32	6%	36	8%
Ceftazidime	58	3%	66	5%	58	7%	40	8%	55	5%
Ciprofloxacin	70	0%	73	3%	65	0%	57	0%	61	2%
Ertapenem	7	0%	16	0%	24	0%	24	0%	32	3%
Gentamicin	72	1%	75	4%	75	7%	59	5%	69	1%
Meropenem	50	0%	56	2%	60	0%	48	0%	61	0%
Total reports	**91**		**87**		**88**		**66**		**80**	

Table 3c. Antimicrobial susceptibility for *Morganella morganii* bacteraemia (England, Wales and Northern Ireland); 2010 to 2014

Antimicrobial	2010		2011		2012		2013		2014	
	No. tested	% resistant (%R)*	No. tested	%R*	No. tested	%R*	No. tested	%R*	No. tested	%R*
Ampicillin/Amoxicillin	343	97%	351	97%	339	98%	279	96%	303	98%
Cefotaxime	215	20%	234	24%	225	20%	176	20%	181	16%
Ceftazidime	290	22%	293	24%	275	21%	241	19%	243	19%
Ciprofloxacin	355	12%	371	11%	339	12%	293	9%	317	12%
Ertapenem	53	2%	97	0%	120	0%	135	1%	177	0%
Gentamicin	379	8%	394	10%	365	9%	315	10%	343	8%
Meropenem	252	0%	295	0%	271	0%	250	0%	286	0%
Total reports	**435**		**452**		**412**		**356**		**402**	

Table 3d. Antimicrobial susceptibility for *Providencia stuartii* bacteraemia (England, Wales and Northern Ireland); 2010 to 2014

Antimicrobial	2010		2011		2012		2013		2014	
	No. tested	% resistant (%R)*	No. tested	%R*	No. tested	%R*	No. tested	%R*	No. tested	%R*
Ampicillin/Amoxicillin	48	85%	43	98%	28	93%	39	87%	28	100%
Cefotaxime	28	4%	25	8%	18	6%	31	6%	23	9%
Ceftazidime	41	5%	36	6%	28	7%	35	6%	26	12%
Ciprofloxacin	45	13%	48	8%	31	3%	42	12%	31	13%
Ertapenem	4	0%	14	0%	12	0%	18	0%	18	0%
Gentamicin	50	50%	45	51%	29	62%	45	56%	33	64%
Meropenem	35	0%	34	0%	24	0%	38	0%	25	0%
Total reports	**62**		**56**		**37**		**49**		**41**	

Tables 4a-d show the dual resistance of *P. mirabilis, P. vulgaris, M. morganii* and *P. stuartii* respectively to third-generation cephalosporin, gentamicin or ciprofloxacin. Dual resistance in these pathogens is rare, and was seen for only 0-3% of all bacteraemias due to *Proteus* spp., 3-7% due to *M. morganii* and 3-6% of *Providencia* spp. In other European countries, individual resistance of *M. morganii* to ciprofloxacin (9-20%), gentamicin (6-16%) and 3rd generation cephalosporins (3-30% depending on the individual antimicrobial) have been reported.[6] Isolates of *Providencia* spp. are inherently resistant to gentamicin, which is why there is a dual resistance of 3-6%.

No dual resistance, when including meropenem, was detected (results not shown).

Table 4a. Pair-Wise antimicrobial testing and resistance summary for *Proteus mirabilis* (England); 2014

Antimicrobial	3rd generation cephalosporin*		Ciprofloxacin		Gentamicin	
	No. tested	% Resistant (R)	No. tested	% R	No. tested	% R
3rd generation cephalosporin*						
Ciprofloxacin	1541	<1%				
Gentamicin	1562	<1%	1608	3%		

***Cefotaxime or Ceftriaxone or Ceftazidime or Cefpodoxime**

Table 4b. Pair-Wise antimicrobial testing and resistance summary for *Proteus vulgaris* (England); 2014

Antimicrobial	3rd generation cephalosporin*		Ciprofloxacin		Gentamicin	
	No. tested	% Resistant (R)	No. tested	% R	No. tested	% R
3rd generation cephalosporin*						
Ciprofloxacin	52	0%				
Gentamicin	53	0%	54	0%		

***Cefotaxime or Ceftriaxone or Ceftazidime or Cefpodoxime**

Table 4c. Pair-Wise antimicrobial testing and resistance summary for *Morganella morganii* (England); 2014

Antimicrobial	3rd generation cephalosporin*		Ciprofloxacin		Gentamicin	
	No. tested	% Resistant (R)	No. tested	% R	No. tested	% R
3rd generation cephalosporin*						
Ciprofloxacin	256	4%				
Gentamicin	260	3%	276	7%		

*Cefotaxime or Ceftriaxone or Ceftazidime or Cefpodoxime

Table 4d. Pair-Wise antimicrobial testing and resistance summary for *Providencia stuartii* (England); 2014

Antimicrobial	3rd generation cephalosporin*		Ciprofloxacin		Gentamicin	
	No. tested	% Resistant (R)	No. tested	% R	No. tested	% R
3rd generation cephalosporin*						
Ciprofloxacin	34	3%				
Gentamicin	33	3%	34	6%		

*Cefotaxime or Ceftriaxone or Ceftazidime or Cefpodoxime

For advice on treatment of antibiotic-resistant infections due to these opportunistic pathogens or for reference services including species identification and confirmation of susceptibility testing results, laboratories should contact the Medical Microbiologists at PHE's Bacteriology Reference Department at Colindale on colindalemedmicro@phe.gov.uk and PHE's Antimicrobial Resistance and Healthcare Associated Infections (AMRHAI) Reference Unit in London [7].

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Vaccine coverage

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Quarterly vaccination coverage statistics for children aged up to five years in the UK (COVER programme): July to September 2015

This report summarises UK quarterly vaccine coverage data for each routine childhood vaccination for children who reached their first, second, or fifth birthday during the evaluation quarter (July to September 2015). Analyses are presented at NHS England local and area team, country and UK levels.

Key points for the second quarterly report for 2015/16

- England and UK level data for completed two-dose rotavirus vaccine courses and one dose of MenC vaccine, evaluated at one year, are available for the first time. UK coverage is 89.3% for rotavirus and 95.4% for MenC and in England coverage is 88.4% and 94.9% respectively.

- At one year, Scotland and Northern Ireland achieved at least 97% coverage, Wales at least 96%, and England at least 93% for DTaP/IPV/Hib3, PCV2 and MenC. Within England 13 out of 25 ATs achieved at least 95% coverage for these vaccines, and 23 out of 25 achieved at least 90%.

- UK MMR coverage for two year olds decreased by 0.5% to 92.1%, reversing the increase reported in the last two quarters (92.5% and 92.6% respectively). Coverage is now around 1% lower than in the July to September 2013 quarter. In England, MMR coverage was down 0.6% to 91.5%. In Wales and Northern Ireland coverage decreased by 0.4% and 0.3% respectively although both still achieved coverage above 95%. Scotland reported an increase in MMR coverage this quarter, up 0.4% to 95.7%.

- A decrease of 0.2% to 94.9% in UK MMR1 coverage at five years means the WHO target of 95% was narrowly missed this quarter.

- Following a drop of 0.7% in UK pre-school booster coverage (DTaP/IPV) last quarter, coverage increased by 0.2% this quarter to 88.7%. Increases were seen in all countries except Scotland.

Results for July to September 2015

Children who reached their first birthday in the quarter (born July to September 2014) were scheduled for three doses of the combined diphtheria, tetanus, acellular pertussis, polio, and *Haemophilus influenzae* type b vaccine (DTaP/IPV/Hib vaccine), two doses of pneumococcal conjugate vaccine (PCV), one dose of meningococcal serogroup C conjugate vaccine (MenC vaccine) at three months of age and two doses of rotavirus vaccine at two and three months of age [1].

Children who reached their second birthday in the quarter (born July to September 2013) were scheduled to receive their third DTaP/IPV/Hib, second MenC and PCV vaccinations between November 2013 to January 2014, and their first measles, mumps, and rubella (MMR) vaccination, a booster dose of Hib and MenC (given as a combined Hib/MenC vaccine) and PCV vaccines at the same visit at 12 months of age, between August and October 2014 [11].

Children who reached their fifth birthday in the quarter (born July to September 2010) were scheduled to receive their third dose DTaP/IPV/Hib and second MenC and PCV vaccinations between November 2010 and January 2011. They were also scheduled to receive their first MMR, Hib/MenC booster and PCV booster after their first birthday (July to September 2011) between August and October 2011 and their pre-school diphtheria, tetanus, acellular pertussis, inactivated polio booster and second dose MMR from October 2013.

Appendix A describes coverage evaluated at the first, second and fifth birthdays by country and NHS England local and area teams.

Participation and data quality

Data were received from all Health Boards (HBs) in Scotland, Northern Ireland and Wales. In England, ATs and Child Health Record Departments (CHRDs) submitted data for all former PCTs.

In England, implementation of the new COVER Information Standard Notice (ISN) by the majority of CHIS suppliers has allowed estimates of national 12 month rotavirus and MenC coverage in England and the UK to be included in this report for the first time. The coverage estimates are based on CHIS data provided by 112/151 and 131/151 former PCTs respectively (table 1a). In Scotland, Wales and Northern Ireland the programmes extracting COVER data from CHISs have been modified to reflect these changes for some time and rotavirus and MenC coverage have been reported in the last three quarterly reports. Additionally, data representing ten former PCTs in England had data quality issues reported this quarter related to changes in information flows resulting in incomplete data returns. Individual former PCT and local authority data (available for 125/152), with any relevant caveats for missing data values, are available here.

Coverage at 12 months

One year old children evaluated in the current quarter (born July to September 2014), are the fourth quarterly cohort to have been routinely offered rotavirus vaccine at two and three months, and the sixth quarterly cohort offered only one primary MenC dose at three months of age [1]. UK coverage is 89.3% for rotavirus and 95.4% for MenC. In England coverage is 88.4% and 94.9% respectively (table 1a).

Compared with previously published estimates from the PHE temporary sentinel rotavirus coverage collection using information from over 95% of GPs in England via the ImmForm web platform [2], the CHIS-derived rotavirus coverage estimates are the same. Two-dose rotavirus coverage in ImmForm for the children born between July and September 2014 (i.e. the current 12 month quarterly COVER cohort), assessed at aged 25 weeks in January to March 2015, was estimated at 88.4% nationally during these months [3].

Compared with the previous quarter, UK coverage for DTaP/IPV/Hib3 and PCV2 evaluated at 12 months decreased by 0.2% and 0.1% respectively to 94.0%, 0.8% lower than the same quarter two years ago [4, 5] (table 1a). Scotland and Northern Ireland achieved at least 97% coverage, Wales at least 96%, and England at least 93% for DTaP/IPV/Hib3, PCV2 and MenC. Within England 13 out of 25 ATs achieved at least 95% coverage at 12 months for these vaccines (table 1a), and all ATs except for Surrey and Sussex, and Kent and Medway, achieved at least 90% for all three vaccines.

Coverage at 24 months

Coverage achieved the 95% target for the primary course of DTaP/IPV/Hib in all four UK countries at two years of age. Lancashire (Q47), Kent and Medway (Q67), Surrey and Sussex (Q68) and London (Q71) are the only ATs with DTaP/IPV/Hib3 coverage below the 95% target (table 2b).

Compared with the previous quarter, UK coverage for Hib/MenC booster decreased by 0.3% to 92.4% and PCV booster remained at 92.6% (table 2a).

UK MMR coverage for two year olds decreased by 0.5% to 92.1%, reversing the increase reported in the last two quarters (92.5% and 92.6% respectively). Coverage is now around 1% lower than in the July to September 2013 quarter. In England, MMR coverage was down 0.6% to 91.5%. In Wales and Northern Ireland coverage decreased by 0.4% and 0.3% respectively although both still achieved coverage above 95%. Scotland reported an increase in MMR coverage this quarter, up 0.4% to 95.7% (table 2a).

Coverage at five years

A decrease of 0.2% to 94.9% in UK MMR1 coverage at five years means the WHO target of 95% was narrowly missed this quarter. All countries achieved the WHO target except England where coverage was 94.5%, although 19/25 Area Teams achieving at least 95% (table 3b). UK MMR2 coverage decreased by 0.5% to 88.7%; all countries had lower coverage than in the previous quarter (table 3a).

UK coverage evaluated at five years for DTaP/IPV/Hib3 and Hib/MenC booster increased by 0.1% compared to the previous quarter, to 96.2% and 93.7% respectively. Following a drop of 0.7% in UK pre-school booster coverage (DTaP/IPV) last quarter, the current evaluation showed an increase of 0.2% to 88.7%; increases were seen in all countries except Scotland (table 3a). All devolved administrations and 14 English ATs achieved at least 90% coverage for the DTaP/IPV booster.

Neonatal hepatitis B vaccine coverage in England: July to September 2015

Vaccine coverage data in England for three doses of hepatitis B vaccine, in infants born to hepatitis B surface antigen (HBsAg) positive mothers, who reached the age of one year in this quarter (i.e. those born between July and September 2014), and coverage of four doses of vaccine in infants who reached two years of age (i.e. those born between July and September 2013) are presented by Area Team in table 4.

PHE received 12 and 24 month coverage returns for 125/151 (83%) former PCTs. The quality of these data is variable and coverage by area team relies on small numbers and as such should be interpreted with additional caution. Compared to the previous quarter, coverage for three doses by 12 months of age increased by 2% to 87%, and decreased by 3% to 72% for those receiving four doses by 24 months [4] (table 4).

Relevant links for country-specific coverage data

England
http://www.ic.nhs.uk/statistics-and-data-collections/health-and-lifestyles/immunisation

Northern Ireland
http://www.publichealthagency.org/directorate-public-health/health-protection/vaccination-coverage

Scotland
http://www.isdscotland.org/Health-Topics/Child-Health/Immunisation/

Wales: http://www.wales.nhs.uk/sites3/page.cfm?orgid=457&pid=54144/

Other relevant links: https://www.gov.uk/government/collections/immunisation.

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Appendix: Tables

Table 1a. Completed UK primary immunisations at 12 months by country and English Local Teams: July to September 2015 (*April to June 2015*)

	Country	No. of PCTs/ HBs†	DTaP/IPV/Hib3 %	MenC%	PCV2%	Rota2%
	United Kingdom	**176**	**94.0** *(94.2)*	**95.4** *(n/a)*	**94.0** (*94.1*)	**89.3** *(n/a)*
	Wales	**7**	**96.6** (*96.9*)	**97.8** (*98.1*)	**96.6** (*96.8*)	**93.2** *(94.4)*
	Northern Ireland	**4**	**97.2** (*97.4*)	**98.2** (*98.4*)	**97.1** (*97.3*)	**94.1** *(94.9)*
	Scotland	**14**	**97.2** (*97.3*)	**97.9** (*98.1*)	**97.2** (*97.3*)	**93.0** *(93.2)*
	England (Total)	**151**	**93.5** (*93.6*)	**94.9** (*n/a*)	**93.5** (*93.5*)	**88.4** *(n/a)*
LT code	***NHS England Local Teams***					
Q70	Wessex	6	94.9 (95.5)	96.1 *(n/a)*	95.0 (95.3)	93.0 *(n/a)*
Q71	London	31	90.2 (90.0)	92.2 *(n/a)*	90.0 (90.1)	85.4 *(n/a)*
Q72	North (Yorkshire & Humber)	15	95.1 (95.7)	96.3 *(n/a)*	95.1 (95.6)	91.0 *(n/a)*
Q73	North (Lancashire & Grt Manchester)	15	94.3 (92.9)	94.8 *(n/a)*	94.3 (91.9)	80.3 *(n/a)*
Q74	North (Cumbria & North East)	13	96.4 (96.6)	97.4 *(n/a)*	96.3 (96.4)	87.2 *(n/a)*
Q75	North (Cheshire & Merseyside)	8	95.2 (95.9)	97.0 *(n/a)*	95.3 (95.7)	91.0 *(n/a)*
Q76	Midlands & East (North Midlands)	9	95.6 (96.2)	97.3 *(n/a)*	95.3 (95.8)	91.1 *(n/a)*
Q77	Midlands & East (West Midlands)	12	93.5 (93.7)	96.1 *(n/a)*	93.1 (93.8)	87.8 *(n/a)*
Q78	Midlands & East (Central Midlands)	8	95.9 (96.1)	97.1 *(n/a)*	95.9 (95.9)	92.0 *(n/a)*
Q79	Midlands & East (East)	10	95.6 (95.8)	96.6 *(n/a)*	95.4 (95.6)	87.1 *(n/a)*
Q80	South (South West)	8	94.0 (94.6)	96.3 *(n/a)*	94.3 (95.0)	88.0 *(n/a)*
Q81	South (South East)	8	88.0 (88.5)	87.9 *(n/a)*	88.6 (89.1)	85.0 *(n/a)*
Q82	South (South Central)	8	94.1 (94.4)	95.6 *(n/a)*	94.0 (94.0)	91.3 *(n/a)*

† Primary Care Trusts/health boards.

Table 1b. Completed UK primary immunisations at 12 months NHS England Area Teams : July to September 2015 (*April to June 2015*)

*NHS England Local team code**	English Area Team (AT code)	No. of former PCT's	DTaP/IPV/Hib3%	MenC%[1]	PCV2%	Rota2%[2]
Q70	Wessex (Q70)	6	95.3 (*95.5*)	96.5 (*n/a*)	95.4 (*95.3*)	93.5 *(n/a)*
Q71	London (Q71)	31	90.2 (*90.0*)	92.2 (*n/a*)	90.0 (*90.1*)	85.4 *(n/a)*
Q72	N Yorkshire and Humber (Q50)	5	95.3 (*96.2*)	96.8 (*n/a*)	95.7 (*96.1*)	93.3 *(n/a)*
	S Yorkshire and Bassetlaw (Q51)	5	94.8 (*95.1*)	96.6 (*n/a*)	94.5 (*94.8*)	88.6 *(n/a)*
	W Yorkshire (Q52)	5	95.1 (*95.8*)	95.6 (*n/a*)	95.1 (*95.8*)	91.3 *(n/a)*
Q73	Greater Manchester (Q46)	10	94.6 (*94.5*)	96.8 (*96.5*)	94.6 (*94.3*)	80.3 *(n/a)*
	Lancashire (Q47)	5	93.4 (*89.6*)	90.8 (*94.2*)	93.5 (*87.0*)	n/a[3] *(n/a)*
Q74	Durham, Darlington and Tees (Q45)	6	96.4 (*96.4*)	97.1 (*n/a*)	96.7 (*96.1*)	95.3 *(n/a)*
	Cumbria, Northumberland, Tyne and Wear (Q49)	7	96.4 (*96.7*)	97.6 (*n/a*)	96.1 (*96.5*)	84.1 *(n/a)*
Q75	Cheshire, Warrington and Wirral (Q44)	4	95.6 (*96.6*)	97.0 (*97.9*)	95.9 *(96.4)*	92.4 *(n/a)*
	Merseyside (Q48)	4	94.7 (*95.1*)	97.0 (*n/a*)	94.7 (*94.9*)	89.5 *(n/a)*
Q76	Derbyshire and Nottinghamshire (Q55)	4	94.9 (*95.4*)	96.4 (*n/a*)	94.5 (*94.8*)	88.5 *(n/a)*
	Shropshire and Staffordshire (Q60)	5	96.5 (*97.3*)	98.1 (*98.2*)	96.5 (*97.1*)	93.4 *(93.6)*
Q77	Arden, Herefordshire and Worcestershire (Q53)	4	96.4 (*97.0*)	97.8 (*98.0*)	94.9 (*96.9*)	91.9 *(94.0)*
	Birmingham and the Black Country (Q54)	8	92.0 (*92.1*)	95.1 (*n/a*)	92.1 (*92.2*)	86.2 *(n/a)*
Q78	Hertfordshire and the S Midlands (Q58)	5	96.1 (*96.3*)	97.2 (*n/a*)	96.1 (*95.9*)	92.6 *(n/a)*
	Leicestershire and Lincolnshire (Q59)	3	95.6 (*95.9*)	97.1 (*96.7*)	95.6 (*96.0*)	90.9 *(92.6)*
Q79	East Anglia (Q56)	5	95.6 (*95.6*)	96.6 (*n/a*)	95.4 (*95.4*)	81.5 *(n/a)*
	Essex (Q57)	5	95.5 (*96.1*)	96.6 (*96.9*)	95.4 (*96.0*)	91.4 *(n/a)*
Q80	Bristol, N Somerset, Somerset and S Gloucestershire (Q65)	4	95.3 (*95.7*)	97.0 (*97.6*)	95.4 (*96.0*)	89.8 *(90.6)*
	Devon, Cornwall, Isles of Scilly (Q66)	4	92.8 (*93.4*)	95.6 (*96.4*)	93.2 (*93.8*)	86.3 *(85.2)*
Q81	Kent and Medway (Q67)	3	89.4 (*89.1*)	92.4 (*n/a*)	89.1 (*89.4*)	84.2 *(n/a)*
	Surrey and Sussex (Q68)	5	87.0 (*88.0*)	84.3 (*n/a*)	88.3 (*88.8*)	86.3 *(n/a)*
Q82	Bath, Gloucestershire, Swindon and Wiltshire (Q64)	4	94.1 (*95.0*)	96.0 (*97.5*)	94.1 (*94.8*)	*92.4 (n/a)*
	Thames Valley (Q69)	4	94.1 (*94.0*)	95.3 (*95.3*)	94.0 (*93.5*)	*93.0 (90.7[2])*

n/a accurate estimate not available (see commentary above)

[1]based on coverage data from 131/151 former PCTs, see full tables here

[2]based on coverage data from 112/151 former PCTs, see full tables here

[3]data quality issues reported

* See table 1a for key to local team organisational code

Table 2a. Completed UK primary immunisations at 24 months by country and NHS England local team: July to September 2015 (*April to June 2015*)

Country	No. of former PCTs/ HBs†	DTaP/IPV/Hib3 %	PCV booster %	Hib/MenC %	MMR1 %
United Kingdom	**176**	**95.8** (*95.9*)	**92.6** (*92.6*)	**92.4** (*92.7*)	**92.1** (*92.6*)
Wales	**7**	**97.7** (*97.6*)	**95.7** (*96.1*)	**94.9** (*95.0*)	**95.4** (*95.8*)
Northern Ireland	**4**	**98.3** (*98.2*)	**95.8** (*95.9*)	**95.8** (*95.8*)	**95.8** (*96.1*)
Scotland	**14**	**97.9** (*97.9*)	**95.7** (*95.4*)	**95.9** (*95.6*)	**95.7** (*95.3*)
England (Total)	**151**	**95.4** (*95.5*)	**92.1** (*92.1*)	**91.8** (*92.2*)	**91.5** (*92.1*)
NHS England local teams*					
Q70	6	95.9 *(96.8)*	93.5 *(93.9)*	94.3 *(94.0)*	93.2 *(94.1)*
Q71	13	93.0 *(92.8)*	86.5 *(86.3)*	86.4 *(86.4)*	86.0 *(86.7)*
Q72	15	97.1 *(97.1)*	94.7 *(94.8)*	94.3 (*94.8*)	94.0 (*94.3*)
Q73	15	94.3 *(94.9)*	91.9 *(92.0)*	91.8 *(91.9)*	92.0 *(92.4)*
Q74	13	98.2 *(97.7)*	95 5 *(95.5)*	95.7 *(95.7)*	95.0 *(95.3)*
Q75	8	96.5 *(97.0)*	93.5 *(93.8)*	94.3 *(94.8)*	93.3 *(94.3)*
Q76	9	97.3 *(97.6)*	94.0 *(94.9)*	94.2 *(94.7)*	93.6 *(94.4)*
Q77	12	96.3 *(95.8)*	92.9 *(92.6)*	92.7 *(92.8)*	92.6 (*92.6*)
Q78	8	97.2 *(97.4)*	95.1 *(95.0)*	95.1 *(95.2)*	94.6 *(94.6)*
Q79	10	96.2 *(96.7)*	93.6 *(94.6)*	93.3 *(94.6)*	92.6 *(94.0)*
Q80	8	96.9 (*96.8*)	96.8 *(93.8)*	93.2 *(93.8)*	93.4 *(93.6)*
Q81	8	90.7 *(91.6)*	87.2 *(88.8)*	87.1 *(89.0)*	87.0 (*88.7*)
Q82	8	96.3 *(96.0)*	92.7 *(93.1)*	92.8 *(92.9)*	92.8 *(93.0)*

* See table 1a for key to local team organisational code.

† Primary Care Trusts/health boards

Table 2b. Completed primary immunisations at 24 months by NHS England Area Teams : July to September 2015 (*April to June 2015*)

NHS England Local Team Code*	Area Team code*	No. of former PCTs†	DTaP/IPV/Hib3 %	PCV booster %	Hib/MenC %	MMR1 %
Q70	Q70	6	95.9 *(96.8)*	93.5 *(93.9)*	94.3 *(94.0)*	93.2 *(94.1)*
Q71	Q71	31	93.0 (*92.8*)	86.5 (*86.3*)	86.4 (*86.4*)	86.0 (*86.7*)
Q72	Q50	5	96.8 (*97.3*)	94.5 (*95.6*)	93.5 (*94.9*)	93.9 (*95.1*)
	Q51	5	96.7 (*96.7*)	93.9 (*93.3*)	93.7 (*94.0*)	92.6 (*92.9*)
	Q52	5	97.5 (*97.3*)	95.3 (*95.1*)	95.2 (*95.2*)	94.8 (*94.7*)
Q73	Q46	10	97.0 (*96.9*)	93.5 (*93.5*)	93.2 (*93.2*)	93.6 (*93.9*)
	Q47	5	88.6 (*90.5*)	88.5 (*89.0*)	88.9 (89.0)	88.7 (*89.3*)
Q74	Q45	6	98.3 (*97.7*)	96.0 (*95.4*)	96.8 (*95.8*)	95.5 (*95.1*)
	Q49	7	98.1 (*97.7*)	95.1 (*95.6*)	94.9 (*95.7*)	94.6 (*95.5*)
Q75	Q44	4	96.6 (*97.1*)	93.1 (*93.4*)	94.8 (*95.8*)	94.0 (*94.7*)
	Q48	4	96.4 (*97.0*)	93.9 (*94.3*)	93.8 (*93.7*)	92.5 (*92.8*)
Q76	Q55	4	97.2 (*97.2*)	93.2 (*93.8*)	93.4 (*93.7*)	92.8 (*93.4*)
	Q60	5	97.6 (*98.2*)	95.0 (*96.2*)	95.1 (*96.0*)	94.7 (*95.7*)
Q77	Q53	4	98.3 (*98.4*)	96.3 (*96.0*)	96.3 (*96.5*)	96.2 (*96.8*)
	Q54	8	95.3 (*94.5*)	91.3 (*90.9*)	90.9 (*91.0*)	90.8 (*90.6*)
Q78	Q58	5	97.2 (*97.3*)	95.4 (*95.2*)	95.3 (*95.3*)	94.7 (*94.6*)
	Q59	3	97.3 (*97.6*)	94.6 (*94.7*)	94.5 (*95.0*)	94.5 (*94.8*)
Q79	Q56	5	95.7 (*96.5*)	93.0 (*93.6*)	92.5 (*93.8*)	92.3 (*93.4*)
	Q57	5	96.7 (*97.1*)	94.4 (*95.7*)	94.3 (*95.7*)	93.1 (*94.8*)
Q80	Q65	4	97.0 (*97.4*)	97.2 (*94.4*)	93.8 (*94.4*)	93.7 (*93.6*)
	Q66	4	96.8 (*96.1*)	96.4 (*93.2*)	92.6 (*93.2*)	93.1 (*93.5*)
Q81	Q67	3	92.6 (*92.6*)	89.0 (*89.7*)	89.5 (*90.2*)	88.9 (89.7)
	Q68	5	89.5 (*91.0*)	86.0 (*88.1*)	85.5 (*88.3*)	85.8 (*88.0*)
Q82	Q64	4	96.6 (*96.8*)	92.9 (*94.0*)	93.0 (*93.5*)	92.5 (*93.3*)
	Q69	4	96.1 (*95.4*)	92.7 (*92.4*)	92.7 (*92.5*)	93.0 (*92.8*)

* See table 1a and 1b for keys to NHS England local team/Area Team organisational code.

† former Primary Care Trusts

Table 3a. Completed UK primary immunisations and boosters at five years by country and NHS England local team: July to September 2015 (*April to June 2015*)

Country	Number of PCTs/HBs†	Primary		Booster		
		DTaP/IPV Hib3%	MMR1%	MMR2%	DTaP/IPV%	Hib/ MenC%
United Kingdom	**176**	**96.2** *(96.1)*	**94.9** *(95.1)*	**88.7** *(89.2)*	**88.7** *(88.5)*	**93.7** *(93.6)*
Wales	**7**	**97.1** *(97.1)*	**97.2** *(97.2)*	**92.3** *(92.6)*	**92.5** *(92.3)*	**94.5** *(94.5)*
N. Ireland	**4**	**98.2** *(98.0)*	**97.6** *(97.6)*	**93.0** *(93.2)*	**92.2** *(93.6)*	**96.6** *(96.7)*
Scotland	**14**	**98.2** *(98.5)*	**97.0** *(97.5)*	**93.2** *(93.5)*	**94.0** *(94.2)*	**96.1** *(96.5.)*
England (Total)	**151**	**95.9** *(95.8)*	**94.5** *(94.7)*	**87.9** *(88.5)*	**87.9** *(87.7)*	**93.3** *(93.2)*
English Local Teams						
Q70	6	95.7 *(95.5)*	94.7 *(94.4)*	89.5 *(90.0)*	89.6 *(90.5)*	93.4 *(93.0)*
Q71	31	93.2 *(93.0)*	91.2 *(91.5)*	80.5 *(80.4)*	79.8 *(78.4)*	89.3 *(88.8)*
Q72	15	97.2 *(97.1)*	96.1 *(96.2)*	90.8 *(91.7)*	91.5 *(92.1)*	95.5 *(95.6)*
Q73	15	96.5 *(96.5)*	96.0 *(96.3)*	88.2 *(89.8)*	85.5 *(89.1)*	93.5 *(93.7)*
Q74	13	97.6 *(97.9)*	96.4 *(97.0)*	92.8 *(93.3)*	93.2 *(94.0)*	96.3 *(96.8)*
Q75	8	96.8 *(96.6)*	97.0 *(96.9)*	90.6 *(90.9)*	91.2 *(91.6)*	95.0 *(95.0)*
Q76	9	97.7 *(97.8)*	96.5 *(96.6)*	91.1 *(91.8)*	92.5 *(92.2)*	96.2 *(96.1)*
Q77	12	96.6 *(96.5)*	96.2 *(96.3)*	88.9 *(88.8)*	88.0 *(87.7)*	93.1 *(93.2)*
Q78	8	97.3 *(97.1)*	96.0 *(96.0)*	91.9 *(91.8)*	92.6 *(92.4)*	95.0 *(94.4)*
Q79	10	96.1 *(96.7)*	93.9 *(94.9)*	90.3 *(92.0)*	91.0 *(92.0)*	94.2 *(94.4)*
Q80	8	97.6 *(96.9)*	95.5 *(96.2)*	91.1 *(90.8)*	88.2 *(87.0)*	95.8 *(95.0)*
Q81	8	92.7 *(92.5)*	90.1 *(90.5)*	82.0 *(83.7)*	83.2 *(82.9)*	90.5 *(89.8)*
Q82	8	96.7 *(96.7)*	95.5 *(95.6)*	90.1 *(91.3)*	89.5 *(90.1)*	94.2 *(94.5)*

* See table 1a for key to NHS England local team organisational code.

3b. Completed primary immunisations and boosters at five years by NHS England Area Team, July to September 2015 (*April to June 2015*)

NHS England local team Code*	Area Team (AT) code*	No. of former PCTs† in AT	Primary		Booster		
			DTaP/IPV Hib3 %	MMR1 %	MMR2 %	DTaP/ IPV %	Hib/ MenC
Q70	Q70	6	95.7 *(95.5)*	94.7 *(94.4)*	89.5 *(90.0)*	89.6 *(90.5)*	93.4 *(93.0)*
Q71	Q71	31	93.0 (*93.0*)	91.5 (*91.5*)	80.4 (*80.4*)	78.5 (*78.5*)	88.8 (*88.8*)
Q72	Q50	5	96.8 (*97.4*)	96.0 (*96.5*)	90.8 (*92.4*)	90.9 (*92.4*)	94.3 (*94.7*)
	Q51	5	97.1 (*96.4*)	95.4 (*95.4*)	89.9 (*90.3*)	91.1 (*90.7*)	95.2 (*95.6*)
	Q52	5	97.5 (*97.2*)	96.6 (*96.5*)	91.4 (*92.1*)	92.1 (*92.6*)	96.3 (*96.4*)
Q73	Q46	10	96.9 (*96.7*)	96.2 (*96.6*)	90.7 (*91.6*)	88.7 (*89.7*)	93.6 *(94.1)*
	Q47	5	95.6 (*96.1*)	95.6 (*95.7*)	83.0 (*86.2*)	78.9 (*79.2*)	93.1 (*93.1*)
Q74	Q45	6	97.6 (*97.9*)	96.6 *(96.7)*	92.8 (*93.2*)	93.4 (*94.0*)	96.5 (*96.7*)
	Q49	7	97.7 *(97.8)*	96.2 (*97.1*)	92.8 (*93.4*)	93.0 (*93.9*)	96.2 (*96.9*)
Q75	Q44	4	96.8 (*96.2*)	96.7 (*96.4*)	91.6 (91.2)	92.2 (*92.2*)	95.1.2 (*94.2*)
	Q48	4	96.8 (*97.0*)	97.3 (*97.4*)	89.6 (*90.6*)	90.2 (*90.9*)	94.9 (*95.9*)
Q76	Q55	4	97.7 (*97.8*)	96.3 (*96.0*)	90.5 (*91.3*)	92.4 (*91.8*)	96.0 (*95.6*)
	Q60	5	97.7 (*97.8*)	96.7 *(97.3)*	92.0 (*92.4*)	92.6 (*92.7*)	96.4 (*96.7*)
Q77	Q53	4	97.5 (*97.5*)	97.7 (*97.5*)	92.6 (*92.8*)	92.2 (*92.1*)	94.2 (*93.9*)
	Q54	8	96.0 (*96.0*)	95.4 *(95.6)*	86.8 *(86.5)*	85.7 *(85.2)*	92.5 (*92.7*)
Q78	Q58	5	97.2 (*96.9*)	95.7 (*95.7*)	91.8 (*92.1*)	92.6 (*92.8*)	95.7 (*95.0*)
	Q59	3	97.4 *(97.4)*	96.5 (*96.5*)	92.0 (*91.2*)	92.7 (*91.6*)	93.8 (*93.3*)
Q79	Q56	5	95.3 (*96.2*)	93.1 (*94.2*)	88.8 (*91.4*)	89.5 *(90.7)*	93.0 *(93.1)*
	Q57	5	97.1 (*97.4*)	94.9 (*95.8*)	92.2 (*92.7*)	93.0 (*93.7*)	95.8 (*96.2*)
Q80	Q65	4	98.0 (*97.9*)	96.6 (*97.1*)	90.7 (*91.5*)	88.8 (*88.8*)	96.3 (*96.1*)
	Q66	4	97.2 (*96.0*)	94.5 (*95.3*)	91.4 (*90.2*)	87.6 (*85.2*)	95.4 (*94.0*)
Q81	Q67	3	95.2 *(95.4)*	93.4 *(94.5)*	81.3 (*87.4*)	85.5 (*87.2*)	93.6 (*93.3*)
	Q68	5	91.1 (90.7)	87.9 (*88.0*)	82.5 (*81.3*)	81.6 (*80.2*)	88.4 (*87.5*)
Q82	Q64	4	97.2 (*96.9*)	95.5 (*95.9*)	90.8 (*91.9*)	90.8 (*91.7*)	95.1 (*95.3*)
	Q69	4	96.4 (*96.5*)	95.4 (*95.3*)	89.6 (*90.9*)	88.8 (*89.2*)	93.7 (*94.1*)

* See table 1a and 1b for keys to NHS England local team/Area Team organisational code .

† former Primary Care Trusts

Table 4. Neonatal hepatitis B coverage in England by NHS England Area Team July to September 2015 (*April to June 2015*)

Area Team (AT code)*	Former PCT returns with 12 month data	12 month deno-minator	% Coverage at 12 months	Former PCT returns with 24 month data	24 month deno-minator	% Coverage at 24 months
Q44	2 of 4	2	100 (*100*)	2 of 4	1	100 (*100*)
Q45	6 of 6	4	100 (*100*)	6 of 6	5	80 (*100*)
Q46	9 of 10	55	73 (*55*)	9 of 10	94	37 (*31*)
Q47	0 of 5	–	– (–)	0 of 5	–	– (–)
Q48	2 of 4	8	75 (*71*)	2 of 4	7	86 (*80*)
Q49	7 of 7	1	0 (*83*)	7 of 7	6	100 (*100*)
Q50	5 of 5	3	67 (*100*)	5 of 5	12	42 (*100*)
Q51	5 of 5	14	100 (*92*)	5 of 5	8	100 (*100*)
Q52	5 of 5	30	83 (100)	5 of 5	18	94 (*94*)
Q53	4 of 4	15	100 (*83*)	4 of 4	9	89 (*100*)
Q54	6 of 8	30	100 (*83*)	6 of 8	25	64 (*67*)
Q55	4 of 4	8	100 (*100*)	4 of 4	14	79 (*88*)
Q56	5 of 5	8	100 (*100*)	5 of 5	15	100 (*80*)
Q57	5 of 5	11	91 (*89*)	5 of 5	7	100 (*100*)
Q58	5 of 5	38	97 (*100*)	5 of 5	23	100 (*94*)
Q59	3 of 3	11	36 (*17*)	3 of 3	8	88 (29)
Q60	5 of 5	6	100 (*83*)	5 of 5	10	100 (*100*)
Q64	4 of 4	4	100 (*100*)	4 of 4	5	80 (*80*)
Q65	4 of 4	6	50 (*100*)	4 of 4	8	75 (*100*)
Q66	4 of 4	3	100 (*100*)	4 of 4	2	100 (*-*)
Q67	3 of 3	15	100 (*100*)	3 of 3	12	100 (*100*)
Q68	1 of 5	10	10 (*100*)	1 of 5	26	19 (*100*)
Q69	4 of 4	32	78 (*90*)	4 of 4	24	83 (*94*)
Q70	5 of 6	25	100 (*100*)	5 of 6	3	100 (*89*)
Q71	22 of 31	174	91 (*88*)	22 of 31	197	80 (*81*)
England	**125 of 151**	**513**	**87 (*85*)**	**125 of 151**	**539**	**72 *(75)***

* See table 1b for key to NHS England Area Team organisational code

Notes: " – " indicates "no data available" for the denominator but "not applicable" for coverage; see table 1a for key to Area Team organisational codes.