Public Health England

Health Protection Report
weekly report

Infection report

Volume 8 Number 19 Published on: 16 May 2014

Bacteraemia

Voluntary surveillance of *Escherichia coli* bacteraemia in England, Wales and Northern Ireland: 2009-2013

This report covers voluntary reports of bacteraemia caused by *Escherichia coli*, made to Public Health England (PHE) between 2009 and 2013 from participating laboratories in England, Wales and Northern Ireland. Only *E. coli* bacteraemia isolates identified by culture were included in the analysis. Data were extracted on 2nd April 2014 and are provisional as the number of reports for 2013 may increase due to late reporting.

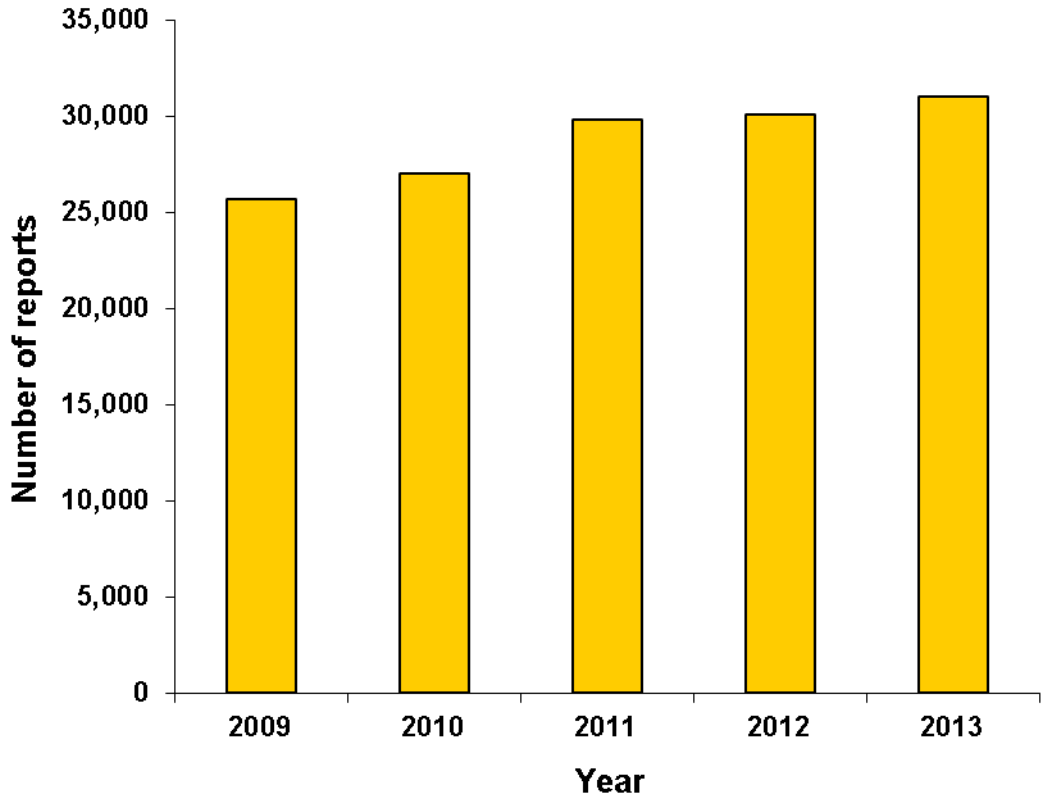
Key Points

- There have been year-on-year increases in the number of *E. coli* bacteraemia reports.
- In 2013 there were 31,023 reports for *E. coli*, which was a slight increase (3.0%), compared to 2012 (30,101) (Figure 1). In the same period, the total number of bacteraemia reports via LabBase2 increased by 2% from 96,469 in 2012 to 98,473 in 2013.
- By 2013 *E. coli* accounted for just under a third (31.5%) of all bacteraemia reports, compared with 27.2% in 2009.
- The rates per 100,000 population of *E. coli* bacteraemia were highest in patients aged 65 years and over and in those under 1 year of age (Figure 2). In both of these groups the rates were generally higher for males. Among those aged 1-14 and 15-44 years, the rates were higher among females.
- The overall incidence rate of infection of *E. coli* bacteraemia in 2013 was 53.1 per 100,000 population (Figure 3).
- There was very little change in the rates of non-susceptibility to 3rd generation cephalosporins and gentamicin from 2009-2013 (Table 2).
- The percentages of isolates non-susceptible to ciprofloxacin and gentamicin in 2013 remain very similar to 2012, at 18% (19% in 2012) and 10% (10% in 2012). Non-susceptibility to ciprofloxacin decreased early in the 2009-13 period, but the decline has since levelled off.
- The percentage of isolates testing non-susceptible to the 3rd generation cephalosporins ceftazidime and cefotaxime remains stable at 10-11% in 2012 and 2013.
- Most isolates tested against either imipenem or meropenem were reported susceptible. A small but growing number of *E. coli* resistant to carbapenems are referred to PHE's Antimicrobial Resistance and Healthcare Associated Infections (AMRHAI) Reference Unit, but are largely from samples other than blood.

Trends in reports

E. coli has been the most common cause of bacteraemia in England, Wales and Northern Ireland, for most years since 1990, apart from 2000 and 2003 when reports of MRSA bacteraemia peaked [1]. Since 1990 the number of *E. coli* bacteraemia reports has continued to increase. In 2013 there were 31,023 voluntary reports concerning *E. coli* bacteraemia to PHE (Figure 1). This is a 3% increase compared with 2012 (30,101 reports). In comparison, the total numbers of all bacteraemia reports irrespective of pathogen have also increased slightly by 0.3% over this time period. *E. coli* reports for 2013 are provisional as of 2nd April 2014 and the number of reported cases may increase slightly as late reports are received.

Figure 1. *E. coli* bacteraemia reports, England, Wales and Northern Ireland: 2009 to 2013*



* Data extracted 2nd April 2014

Completeness of laboratory reports

The number of laboratories voluntarily reporting data for *E. coli* bacteraemia has decreased from 184 in 2009 to 163 in 2013 probably due to consolidation into fewer, larger units serving multiple hospitals. The percentage of laboratories reporting drug susceptibility data decreased from 98% in 2009 to 96% in 2013.

Table 1. Laboratories reporting *E. coli* bacteraemia, England, Wales and Northern Ireland: 2009-2013*

	2009	2010	2011	2012	2013
No of *E. coli* bacteraemia reports	**25,662**	**27,045**	**29,851**	**30,101**	**31,023**
Number of reporting laboratories	**184**	**180**	**180**	**172**	**163**
Laboratories reporting susceptibility data	**98%**	**98%**	**98%**	**97%**	**96%**

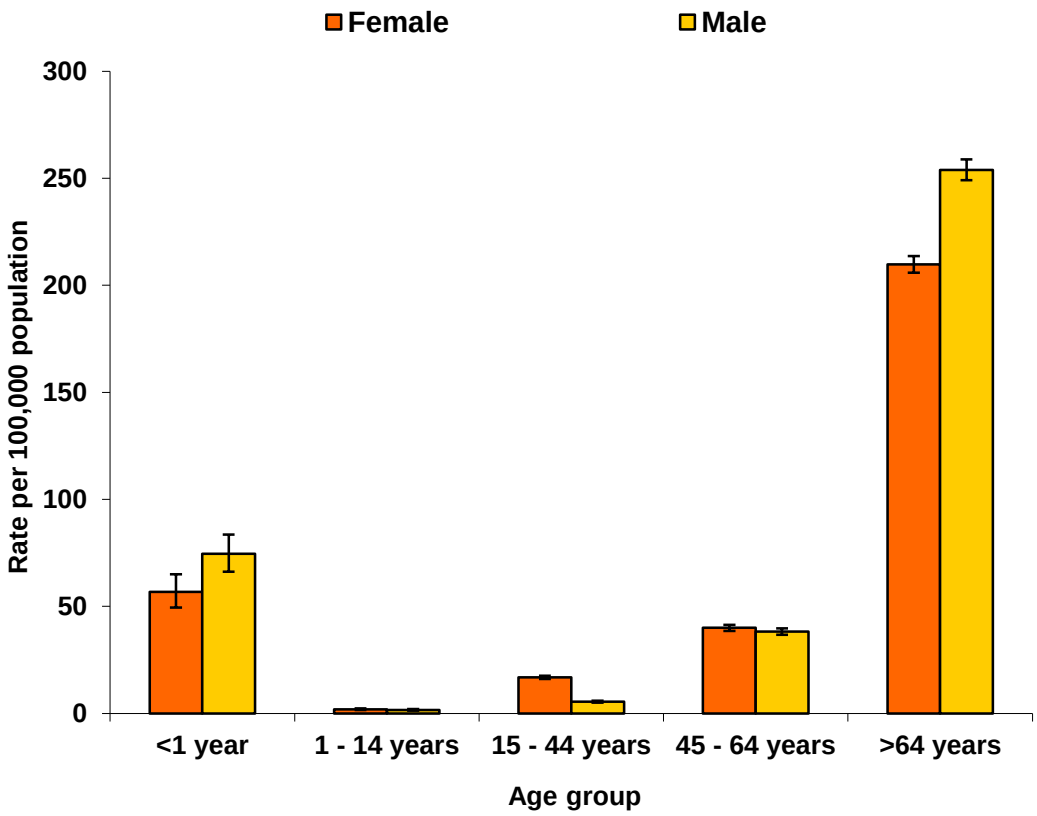
* Data extracted 2nd April 2014

Age and sex distribution

Figure 2 shows the age and sex distribution for patients with *E. coli* bacteraemia reported in 2013 as rates per 100,000 population. The distribution between the sexes differs by age group; reports were more frequent for males than females in those aged under one year or aged 64 years and over; while the infection was more frequent among females in the 1-14 and 15-44 years age groups. The rates of bacteraemia for females and males were similar for those aged 45-64 years.

The rate for males aged less than 1 year has decreased from 79.8/100,000 in 2012 to 74.5/100,000 in 2013, whilst the rate for female infants increased slightly from 51.2/100,000 in 2012 to 56.8/100,000 in 2013. The rate of *E. coli* bacteraemia in females and males aged over 64 remained stable between 2012 and 2013.

Figure 2. *E. coli* bacteraemia reports in 2013, England, Wales and Northern Ireland by age and sex*



Data extracted 2nd April 2014

Distribution by region

Figure 3 shows the reporting rate of bacteraemia based on the total of *E. coli* bacteraemia at country level and at English regional level (Public Health England Centres (PHECs)) in 2013. Geographical analyses were based on the residential location of the patient, derived from their postcode if known (otherwise the GP postcode was used if known, or failing that the postcode of the laboratory was used) with cases in England being assigned to the catchment area of one of the 15 local PHE centres (PHECs) formed from administrative local authority boundaries. Rates for 2013 were calculated using 2012 mid-year population estimates as mid-year population data for 2013 was not available at the time of publication.

Figure 4 is a spatial representation of region-specific bacteraemia rates.

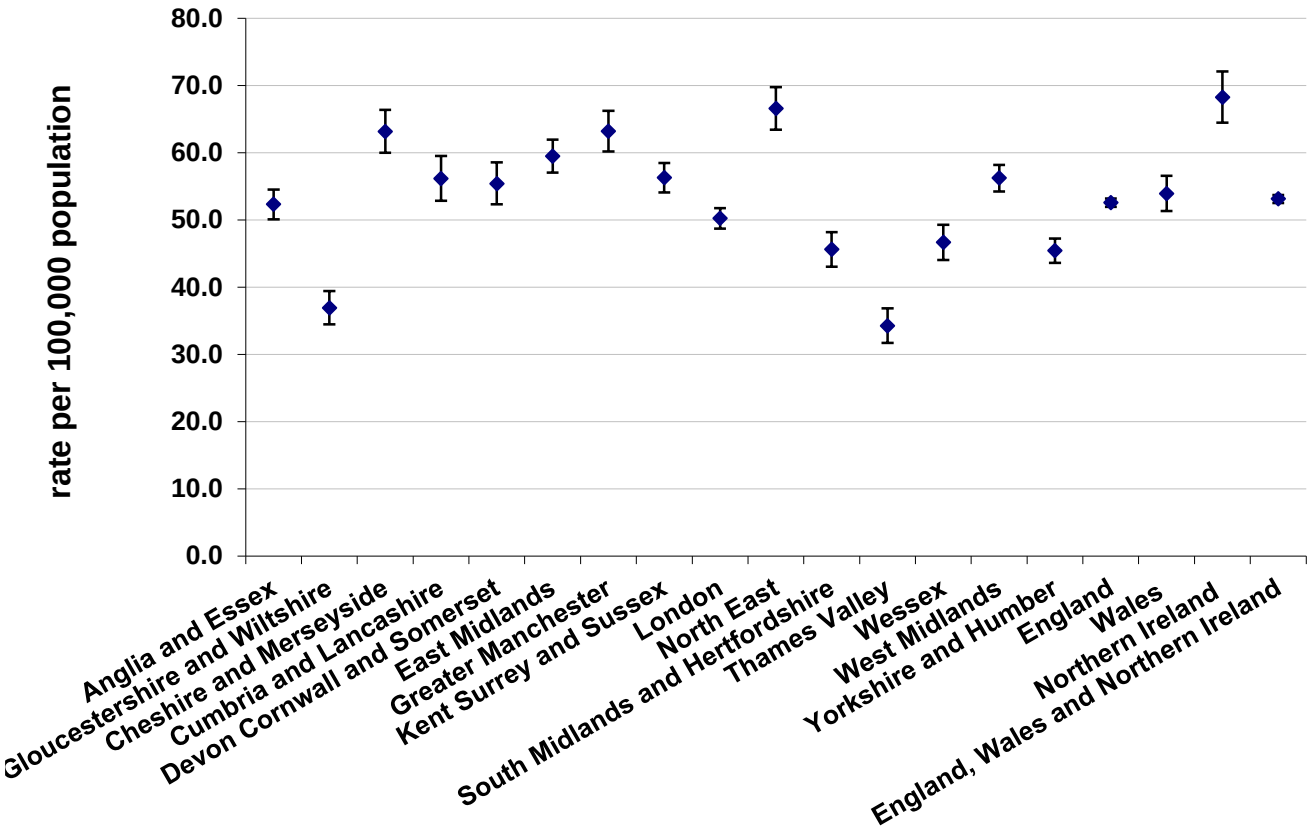
Based on voluntary reporting, the overall rate of *E. coli* bacteraemia in England, Wales and Northern Ireland was 53.1 per 100,000 population. Regions with high rates of infection include the North East (66.6/100,000), Greater Manchester and Cheshire and Merseyside (63.1/100,000). The country with the highest rate of infection was Northern Ireland (68.2 per 100,000). The region with the lowest incidence was Thames Valley (34.2/100,000).

England's rate increased from 45.2/100,000 in 2009 to 52.6/100,000 in 2013. For England as a whole, comparison of voluntary and mandatory surveillance showed that the voluntary system had 84% case ascertainment. The rates of infection for Wales and Northern Ireland increased from 44.0/100,000 and 55.6/100,000 in 2009 to 53.9/100,000 and 68.2/100,000 in 2013, respectively. The overall rate of *E. coli*

bacteraemia for England, Wales and Northern Ireland has increased from 41.6/100,000 in 2009 to 53.1/100,000 in 2013.

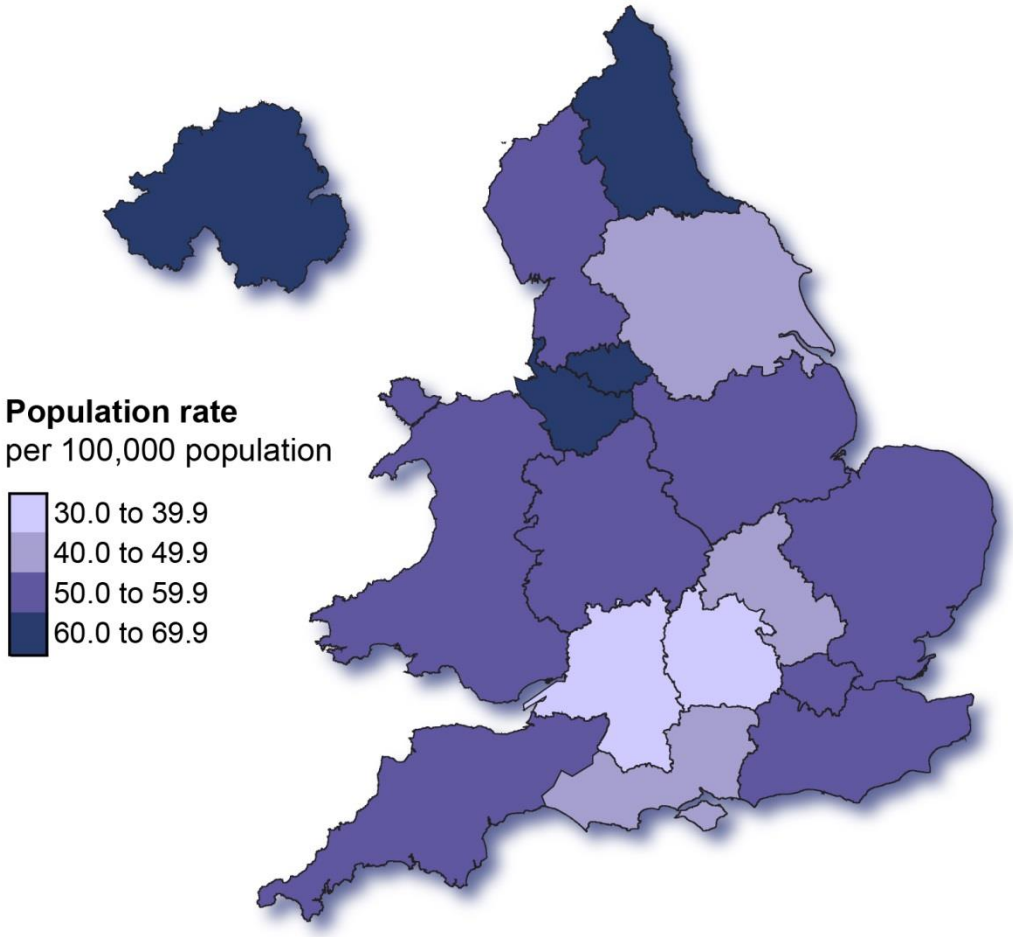
As data-collection is based on a voluntary reporting system, it is important to note that variation in regional rates of infection may reflect regional differences in reporting rather than genuine differences.

Figure 3: Region-specific rates of *E. coli* bacteraemia: England, Wales and Northern Ireland, 2013*



* Data extracted 2nd April 2014

Figure 4: Region-specific rates of *E. coli* bacteraemia: England, Wales and Northern Ireland, 2013*



* Data extracted 2nd April 2014

Antimicrobial susceptibility

Trends in non-susceptibility to key antimicrobials are presented in Table 2. The percentages of *E. coli* isolates showing non-susceptibility to 3rd generation cephalosporins and gentamicin were stable between 2009 and 2013; changes were within 2%. Specifically, non-susceptibility rates for cefotaxime and ceftazidime were 10-11% in both 2012 and 2013 whereas, rates for ciprofloxacin and gentamicin also remained similar at 18-19% and 9-10%, respectively.

These stable rates contrasted with the significant increases in the number of *E. coli* non-susceptible to cephalosporins from 2001 to 2006 [2], which largely reflected the emergence and spread of strains producing extended-spectrum β-lactamases (ESBLs), particularly **c**efo**t**a**x**ime-**M**unich-β-lactamase enzyme type 15 (CTX-M-15), which has become the dominant ESBL in the species [3, 4]. Ciprofloxacin resistance decreased from 20% in 2009 to 19% resistance in 2012 (p<0.0001). This trend is not in agreement with that of the Bacteraemia Surveillance Programme of the British Society for Antimicrobial Chemotherapy (BSAC) data, which has a different sampling scheme to LabBase2 and includes data from Scotland and the Irish Republic (http://www.bsacsurv.org), which showed a decrease in resistance from 26% in 2006 to 18% in 2008, but increased from 14% in 2009 to 22% in 2012. Susceptibility of isolates tested against 3rd generation cephalosporins (cefotaxime & ceftazidime) showed that rates of resistance remained largely stable between 2009 and 2012 (10-11% of isolates were resistant). BSAC also showed that the resistance to cephalosporins between 2009 and 2012 remained broadly stable, ranging from 7% to 11% for cefotaxime and from 6% to 8% for ceftazidime respectively.
The BSAC data for 2013 have not been released at the time of publication. Nevertheless the pictures from the two surveillance schemes are broadly consistent.

Most isolates tested against either imipenem or meropenem remained fully susceptible. The numbers of isolates reported resistant to imipenem were 7 out of 4,938 in 2012 and 5 out of 4,378 in 2013. The numbers resistant to meropenem were 26 out of 20,826 in 2012 and 12 out of 21,742 in 2013. There was a significant increase in meropenem resistant isolates between 2009 and 2013 (p < 0.025). A growing number of *E.coli* isolates (and substantially more *Klebsiella pneumonia*) with acquired carbapenemases are confirmed by PHE's AMRHAI Reference Unit and variously produce New Delhi Metallo β-lactamase-1 (NDM-1), which is epidemiologically often linked to India and Pakistan [6].

Table 2. Antibiotic susceptibility data for reports of *E. coli* bacteraemia, England, Wales and Northern Ireland: 2009-2013*

E. coli		**2009**	**2010**	**2011**	**2012**	**2013**
Total reports:		**25,662**	**27,045**	**29,851**	**30,101**	**31,023**
Cefotaxime	**% Non-susceptible**	**10%**	**10%**	**11%**	**11%**	**11%**
	Reports with susceptibility data	12,850	13,487	15,393	16,323	16,165
Ceftazidime	**% Non-susceptible**	**10%**	**10%**	**11%**	**10%**	**10%**
	Reports with susceptibility data	16,507	18,437	20,798	21,201	20,608
Ciprofloxacin	**% Non-susceptible**	**20%**	**19%**	**19%**	**19%**	**18%**
	Reports with susceptibility data	20,063	21,817	24,796	25,505	26,029
Gentamicin	**% Non-susceptible**	**8%**	**9%**	**9%**	**10%**	**10%**
	Reports with susceptibility data	22,106	23,632	26,711	27,402	27,619
Imipenem	**% Non-susceptible**	**0.1%**	**0.0%**	**0.1%**	**0.1%**	**0.1%**
	Reports with susceptibility data	7,220	6,456	5,755	4,938	4,378
Meropenem	**% Non-susceptible**	**0.1%**	**0.1%**	**0.1%**	**0.1%**	**0.1%**
	Reports with susceptibility data	13,524	15,434	19,296	20,826	21,742

* Data extracted 2nd April 2014

Concluding remarks

The data presented in this report show that the number of laboratory reports of *E. coli* bacteraemia continues to rise year-on-year [7], with a 27% increase in bacteraemia reports since 2009 and a 3.0% increase from 2012 to 2013. In addition, there are continuing concerns about antimicrobial resistance in this species [2,3,4].

Compared to 2012, the rate of *E. coli* bacteraemia laboratory reports per 100,000 population in 2013 have remained stable in England, Wales and Northern Ireland (51.9/100,000 in 2012 to 53.1/100,00 in 2013).

Trends in non-susceptibility to key antimicrobials (3rd generation cephalosporins, quinolones and gentamicin) showed that there was a decrease in *E. coli* resistance to ciprofloxacin (from 20% in 2009 to 18% in 2013) while resistance to 3rd generation cephalosporins and gentamicin remained stable. The percentages of *E. coli* resistant to ciprofloxacin, 3rd generation cephalosporins and gentamicin in 2013 were 18%, 10-11% and 10%, respectively.

The increase in the number of laboratory reports across England, Wales and Northern Ireland, coupled with the public health impact of *E. coli* confirms that it should remain a priority. There is also a need for continued surveillance and interventions to prevent the spread of *E. coli* producing ESBLs, particularly CTX-M types and emergent carbapenem-resistant strains (e.g. with NDM-1, VIM, OXA-48 and KPC enzymes) which are frequently associated with multiple antibiotic resistance.

References

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Acknowledgements

We are grateful to our microbiology colleagues in laboratories across England, Wales and Northern Ireland for their data contributions. The support from colleagues in Public Health England's Antimicrobial Resistance and Healthcare Associated Infections Reference Unit, in particular, is valued in the preparation of this report. Feedback and specific queries about this report are welcome and can be sent to hcai.amrdepartment@phe.org.uk