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Laboratory surveillance of *Enterococcus* spp. bacteraemia in England, Wales and Northern Ireland: 2017

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These analyses are based on data relating to reports of *Enterococcus* spp. bacteraemia between 2010 and 2017 in England, Wales and Northern Ireland. Data for England were extracted on 23 November 2018 from Public Health England's (PHE) Second Generation Surveillance System (SGSS) voluntary surveillance database. Data for Wales and Northern Ireland were extracted separately (DataStore on 10 April 2018 and CoSurv on 6 November 2018, respectively).

The report includes analyses of the incidence trends, age and sex distribution and geographical distribution of cases of *Enterococcus* spp. bacteraemia in England, Wales and Northern Ireland, and antimicrobial susceptibility three-year trends for England and Northern Ireland. Rates of laboratory-reported bacteraemia were calculated using mid-year resident population estimates for the respective years and geography [1]. Geographical analyses were based on the residential postcode of the patient if known, otherwise the GP postcode or, failing that, the postcode of the reporting laboratory. Cases in England were assigned to one of nine local PHE Centres (PHECs), defined by administrative local authority boundaries. The data presented here may differ from previous publications due to inclusion of late reports. In England and Northern Ireland, there are links from the different laboratories to SGSS/CoSurv that report clinically significant isolates. Data from Wales are extracted from a single laboratory information system used by all microbiology laboratories and include positive blood cultures that may not be clinically significant. Data for England-only are provided as a [web appendix](#).

Key Points

- in 2017, the overall incidence of *Enterococcus* spp. bacteraemia in England, Wales and Northern Ireland was 13.1 per 100,000 population
- *Enterococcus* spp. bacteraemia rates in England, Wales and Northern Ireland in 2017 were 12.8, 15.9 and 15.8 per 100,000 population, respectively
- within England, the South West PHE Centre (PHEC) reported the highest rate (15.0/100,000 population) of *Enterococcus* spp. bacteraemia, while Yorkshire and Humber had the lowest (9.6/100,000 population); all PHECs reported an increase between 2013 and 2017
- 87% of enterococcal bacteraemia isolates were reported to species level in 2017
- the two most frequently isolated species within the genus in 2017 were *Enterococcus faecalis* (44%), and *Enterococcus faecium* (38%)
- incidence of *Enterococcus* spp. bacteraemia was highest among the elderly (≥ 75 years; 60.9/100,000) and infants (< 1 year; 44.8/100,000); and higher among males than females (16.4 and 9.6/100,000 respectively)
- there was a relatively low rate of *E. faecium* bacteraemia in infants (aged < 1 year) compared with *E. faecalis* bacteraemia (4.7 compared with 33.3/100,000)
- resistance to glycopeptides and linezolid was higher in *E. faecium* than in *E. faecalis*

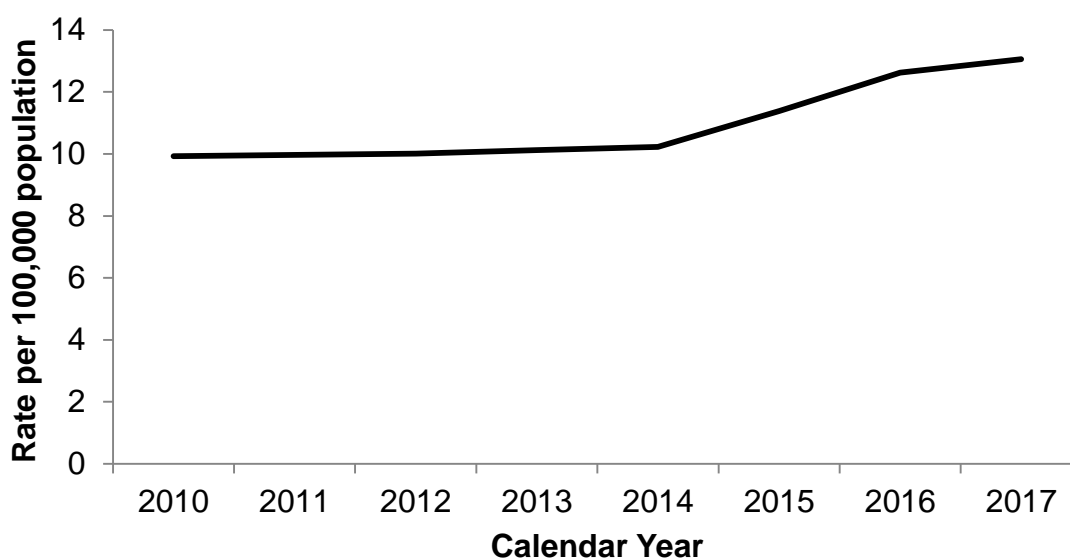
Trends in incidence

There has been an overall increase between 2010 and 2017 in the incidence of bacteraemia caused by *Enterococcus* spp., from 9.9 to 13.1 per 100,000 population in England, Wales, and Northern Ireland (Figure 1). The incidence rate was relatively stable between 2010 and 2014 (around 10/100,000 population).

The observed increase in *Enterococcus* spp. bacteraemia reports between 2014 and 2016 may be partly due to more extensive laboratory reporting to PHE following the switch from LabBase2 to SGSS in October 2014. Other relevant and potentially contributory changes include the widespread adoption by laboratories of MALDI-TOF, changes in PCR testing in several laboratories, and national policy changes and public health interventions resulting in an increase in blood cultures.

E. faecalis was the seventh most commonly identified organism reported in mono-microbial bacteraemias/fungaemias in 2017, comprising 1.9% of such infections. In addition, *E. faecalis* and *E. faecium* were the sixth and seventh most common organisms in poly-microbial bacteraemias/fungaemias (4.3% and 2.8% of such infections), respectively [2].

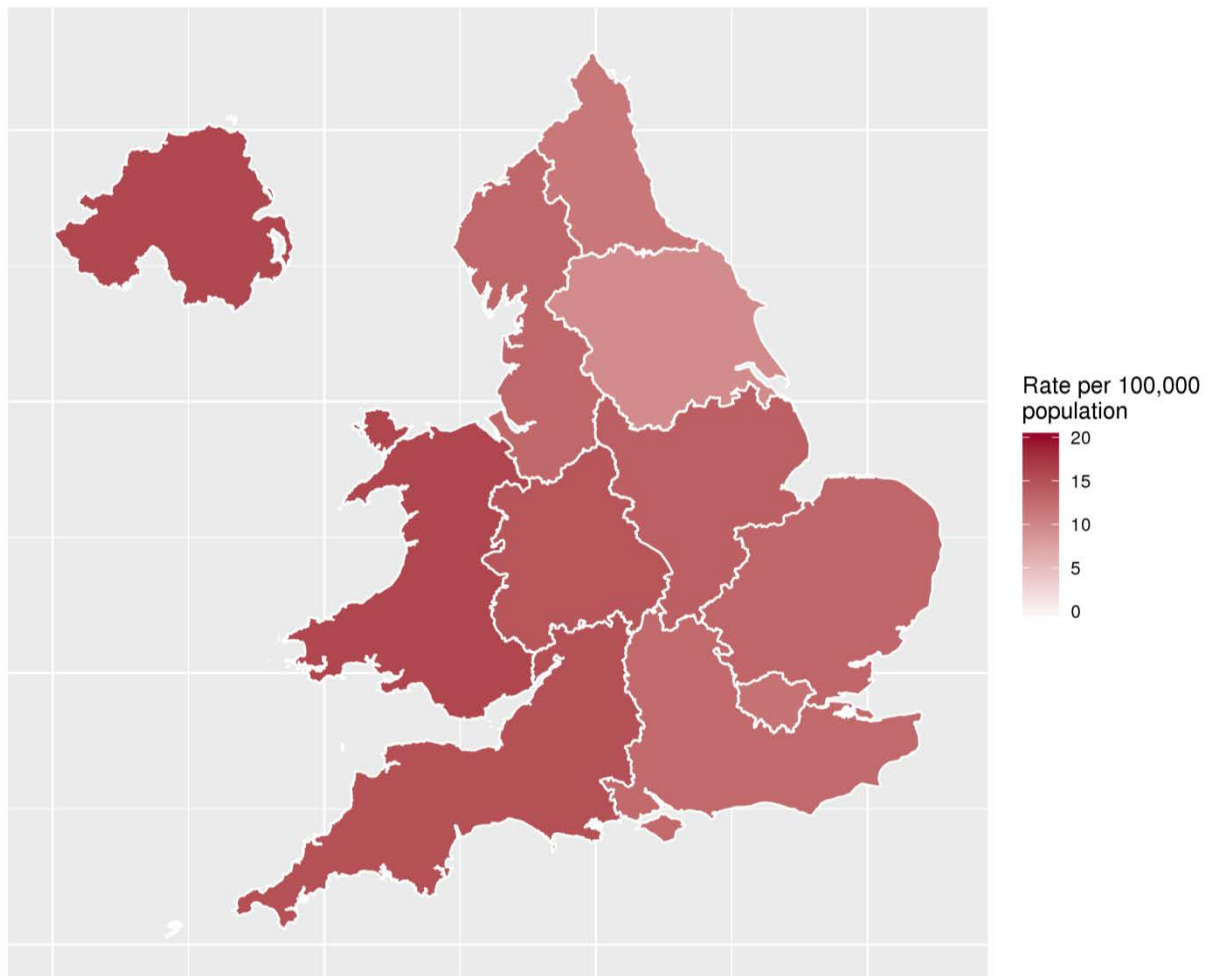
Figure 1. *Enterococcus* spp. bacteraemia per 100,000 population (England, Wales and Northern Ireland); 2010 to 2017



Geographic distribution

The overall rates of *Enterococcus* spp. bacteraemia in England, Wales and Northern Ireland in 2017 were 12.8, 15.9 and 15.8 per 100,000 population, respectively (Figure 2).

Figure 2. Geographical distribution of *Enterococcus* spp. bacteraemia per 100,000 population (England, Wales and Northern Ireland); 2017



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Between 2013 and 2017, reported *Enterococcus* spp. bacteraemia rates increased by 33% in England (9.6 to 12.8/100,000 population; Table 1) and 18% in Northern Ireland (13.4 to 15.8/100,000 population), with an 8% decrease reported in Wales (17.2 to 15.9/100,000 population).

Within England in 2017, incidence rates of *Enterococcus* spp. bacteraemia varied considerably, from 9.6 per 100,000 population in the Yorkshire and Humber PHEC to 15.0

per 100,000 in the South West PHEC. All PHECs in England reported increased rates of *Enterococcus* spp. bacteraemia between 2013 and 2017 (Table 1).

Table 1. *Enterococcus* spp. bacteraemia per 100,000 population by region (England, Wales and Northern Ireland); 2013 to 2017

Region	PHE Centre	Rate per 100,000 population				
		2013	2014	2015	2016	2017
North of England	North East	8.7	8.0	8.8	11.9	11.4
	Yorkshire and Humber	6.4	6.8	9.5	9.2	9.6
	North West	11.9	11.7	12.1	13.9	13.0
Midlands and East of England	West Midlands	12.1	12.4	12.4	13.2	14.6
	East Midlands	9.4	9.1	12.1	13.4	13.6
	East of England	9.1	10.1	10.5	12.4	13.1
London	London	9.8	10.4	10.2	11.4	11.9
South of England	South West	10.4	11.0	13.9	15.0	15.0
	South East	8.1	8.3	10.0	12.1	12.8
England		9.6	9.9	11.1	12.5	12.8
Wales		17.2	15.1	16.2	15.2	15.9
Northern Ireland		13.4	12.1	12.4	13.0	15.8
England, Wales and Northern Ireland		10.1	10.2	11.4	12.6	13.1

Species distribution

In 2017, 87% of *Enterococcus* spp. bacteraemia reports were identified to species level in England, Wales and Northern Ireland, an increase from 82% reported to species level in 2013 (Table 2). There was variation by country, with 86%, 94% and 99% of *Enterococcus* spp. bacteraemia reports identified to species level in England, Wales and Northern Ireland, respectively.

Across England, Wales and Northern Ireland in 2017, 44% of *Enterococcus* spp. bacteraemia reports were identified as *E. faecalis* (3,522/7,917), 38% (2,986/7,917) as *E. faecium*. Over the past five years, the proportions of *Enterococcus* spp. bacteraemia caused by *E. faecalis* and *E. faecium* have remained constant, as has the proportion caused by other *Enterococcus* species.

Table 2. Reports of *Enterococcus* spp. bacteraemia by species (England, Wales and Northern Ireland); 2013 to 2017

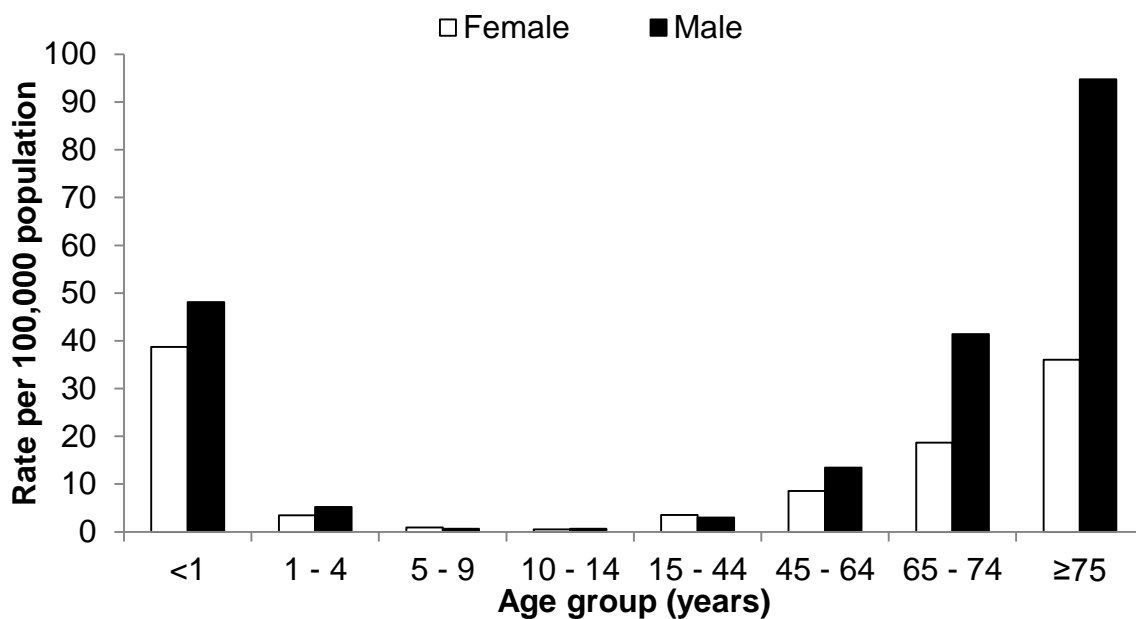
	2013		2014		2015		2016		2017	
	No.	%	No.	%	No.	%	No.	%	No.	%
<i>Enterococcus</i> spp.	5,948	100	6,060	100	6,801	100	7,606	100	7,917	100
<i>E. avium</i>	50	<1	56	<1	65	<1	54	<1	67	<1
<i>E. casseliflavus</i>	42	<1	57	<1	54	<1	71	<1	67	<1
<i>E. cecorum</i>	0	0	0	0	0	0	0	0	1	<1
<i>E. columbae</i>	0	0	0	0	0	0	0	0	1	<1
<i>E. durans</i>	23	<1	20	<1	21	<1	19	<1	29	<1
<i>E. faecalis</i>	2,476	42	2,517	42	2,831	42	3,268	43	3,522	44
<i>E. faecium</i>	2,120	36	2,264	37	2,547	37	2,919	38	2,986	38
<i>E. gallinarum</i>	112	2	85	1	88	1	100	1	94	1
<i>E. gilvus</i>	0	0	0	0	0	0	1	<1	1	<1
<i>E. hirae</i>	1	<1	5	<1	5	<1	6	<1	16	<1
<i>E. malodoratus</i>	0	0	0	0	0	0	1	<1	0	0
<i>E. mundtii</i>	0	0	0	0	0	0	1	<1	0	0
<i>E. raffinosus</i>	40	<1	35	<1	54	<1	47	<1	70	<1
<i>Enterococcus</i> spp., other named	39	<1	54	<1	36	<1	31	<1	36	<1
<i>Enterococcus</i> spp., species not recorded	1,045	18	967	16	1,100	16	1,088	14	1,027	13

Age and sex distribution

In line with previous years, the highest rates of *Enterococcus* spp. bacteraemia in England, Wales and Northern Ireland in 2017 were observed in those aged 75 years or older (60.9/100,000 population) and those under one year old (44.8/100,000 population) [3].

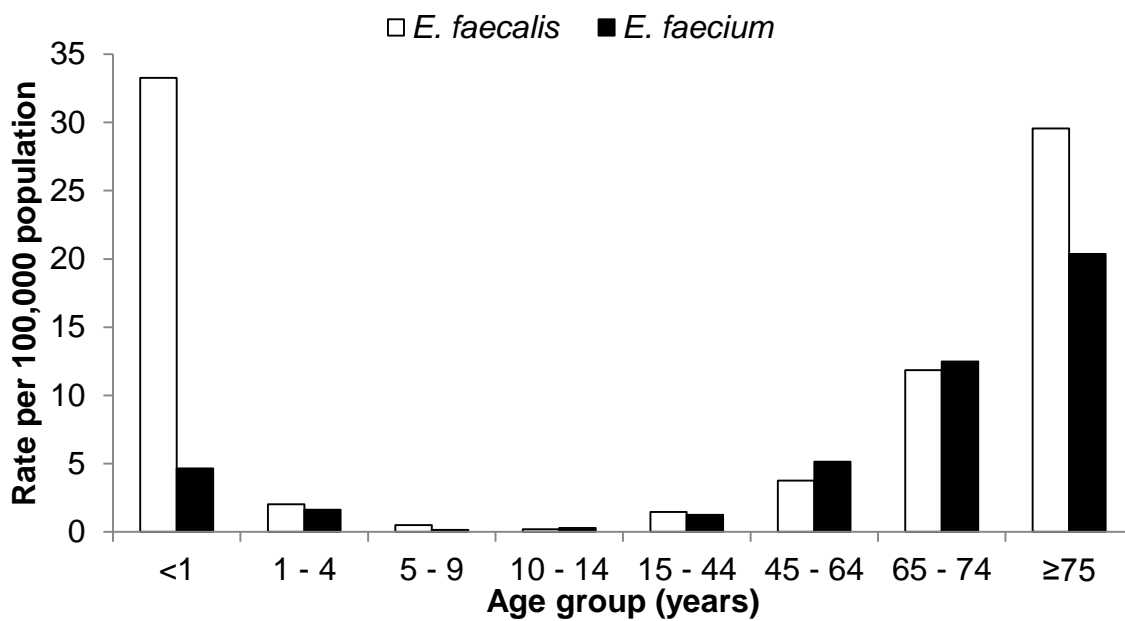
Variation in rates was also observed by gender, with higher rates noted in men (16.4/100,000 population) than women (9.6/100,000 population). The most striking differences were in those aged 75 years and over (males: 94.8/100,000 population; females: 36.1/100,000 population) and to a lesser extent in those aged between 65 and 74 years (males: 41.4/100,000 population; females: 18.7/100,000 population) (Figure 3).

Figure 3. *Enterococcus* spp. bacteraemia rates by age and sex (England, Wales and Northern Ireland); 2017



Of the enterococcal bacteraemias reported in infants under one year of age, 74% were identified as *E. faecalis* (236/318) and 10% as *E. faecium* (33/318). Infants under one year old had the highest incidence of *E. faecalis* bacteraemia (33.3/100,000 population), followed by those aged 75 years and over (29.6/100,000 population; Figure 4). In comparison, *E. faecium* was far less likely to cause bacteraemia in infants (4.7/100,000 population), whilst the rate in those aged 75 years and over was 20.4/100,000 population.

Figure 4. *E. faecalis* and *E. faecium* bacteraemia rates by age (England, Wales and Northern Ireland); 2017



Antimicrobial resistance: England and Northern Ireland

Glycopeptide (vancomycin/teicoplanin) resistance of *Enterococcus* spp. has been identified by the Department of Health Advisory Committee for Antimicrobial Prescribing, Resistance and Healthcare Associated Infections (APRHAI) as a key drug-bug combination and is included in the English Surveillance Programme for Antimicrobial Utilisation and Resistance (ESPAUR) annual report [4,5].

A 2016 UK public health alert recommended that laboratories perform linezolid susceptibility tests on all *Enterococcus* spp. isolates from blood (and other sterile sites) because potentially transferable oxazolidinone (linezolid and tedizolid) resistance mediated by the *optrA* gene has been detected in *E. faecalis* in the UK [6]. The level of linezolid test reporting in 2017 was 77% for *E. faecalis*, and 81% for *E. faecium*.

Antimicrobial resistance among *E. faecalis* isolates was rare in 2017 ($\leq 2\%$ for each of ampicillin/amoxicillin, vancomycin, teicoplanin and linezolid) (Table 3a) and has remained stable since 2015.

The proportion of isolates of *E. faecium* resistant to each antibiotic was much higher than reported for *E. faecalis*. In 2017, the proportion of *E. faecium* from blood specimens resistant to ampicillin/amoxicillin was 92%, vancomycin 23%, teicoplanin 25% and linezolid 1% (Table 3b). Ampicillin/amoxicillin resistance in *E. faecium* is intrinsic and likely related to overproduction of lower affinity PBP5 in this species [7]. For vancomycin and teicoplanin this represents small decreases since 2015 (from 26% to 23% for vancomycin; 27% to 25% for teicoplanin) (Table 3b).

It is important to identify enterococcal bacteraemia episodes to species level and perform all relevant antimicrobial susceptibility tests; this knowledge is especially important for infection control and limitation of potential outbreaks, the concern being that acquired resistance is transferrable between organisms [8]. Patients yielding linezolid-resistant enterococci should be isolated, as a precaution, to prevent onward transmission.

Table 3a. Antimicrobial susceptibility* for *E. faecalis* bacteraemia (England and Northern Ireland); 2015 to 2017

Antimicrobial agent	2015			2016			2017		
	S (%)	I (%)	R (%)	S (%)	I (%)	R (%)	S (%)	I (%)	R (%)
Ampicillin/Amoxicillin	98	0	2	98	<1	2	98	<1	2
Vancomycin	99	<1	1	99	0	1	99	0	1
Teicoplanin	98	<1	2	98	0	2	98	0	2
Linezolid	100	0	<1	100	0	<1	99	<1	<1

* S = susceptible; I = intermediate (reduced susceptibility); R = resistant

Table 3b. Antimicrobial susceptibility* for *E. faecium* bacteraemia (England and Northern Ireland); 2015 to 2017

Antimicrobial agent	2015			2016			2017		
	S (%)	I (%)	R (%)	S (%)	I (%)	R (%)	S (%)	I (%)	R (%)
Ampicillin/Amoxicillin	9	<1	91	9	<1	91	8	<1	92
Vancomycin	74	0	26	77	0	23	77	0	23
Teicoplanin	73	0	27	75	0	25	75	0	25
Linezolid	99	0	1	99	0	1	99	0	1

* S = susceptible; I = intermediate (reduced susceptibility); R = resistant

Microbiology services

In 2017, the proportion of reports of enterococcal bacteraemia in which the organism was not fully identified decreased slightly to 13%. Precise species identification of isolates would improve the monitoring of trends in emerging enterococci, in addition to assisting with instigating appropriate treatment and control mechanisms locally [9].

Laboratories are requested to send any enterococcal isolates with suspected linezolid or tigecycline resistance and isolates which show resistance to teicoplanin but not vancomycin to AMRHAI for further investigation (amrhai@phe.gov.uk) [10]. AMRHAI will also examine isolates with suspected high-level daptomycin MICs, although it should be noted that there are no EUCAST breakpoints and that MICs for *E. faecium* are typically 2-4 mg/L. For advice on treatment of antibiotic-resistant infections due to these opportunistic pathogens, laboratories should contact the Medical Microbiologists at PHE's Bacteriology Reference Department at Colindale on colindalemedmicro@phe.gov.uk.

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