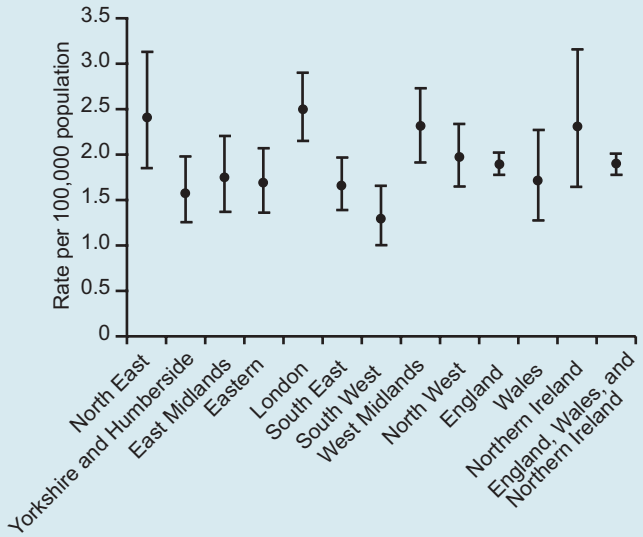
Acinetobacter spp and *Enterococcus* spp bacteraemia: England, Wales, and Northern Ireland, 2002

Key points:

- In 2002, 1025 reports of *Acinetobacter* spp and 5045 reports of *Enterococcus* spp bacteraemia were made in England, Wales, and Northern Ireland
- Resistance among *Acinetobacter* spp isolates varied according to the antimicrobial agent, species, and geographic location.
- Vancomycin and teicoplanin resistance were reported in 4% of *E. faecalis* isolates where the reports contained susceptibility information
- Among *E. faecium* isolates, 19% of reports with susceptibility information were reported as resistant to vancomycin, and 13% to teicoplanin
- The levels of reported resistance to ampicillin/amoxycillin suggest that some mis-identification or mis-reporting of enterococcal species is still occurring, although the situation is improving compared to previous years
- Six *Acinetobacter* spp, two alleged *E. faecalis,* and 12 *E. faecium* isolates were reported as resistant to four key antibiotics

This report describes *Acinetobacter* and *Enterococcus* spp (including Group D streptococci) isolated from blood specimens by laboratories in England, Wales, and Northern Ireland from specimens taken in 2002. Age and region-specific rates were calculated using 2001 mid-year resident population estimates. STATA statistical software* was used to calculate 95% confidence intervals. Where antibiotic resistance is given as a percentage, it is always as a percentage of reports including susceptibility information.

Figure 1 Region-specific rates* of *Acinetobacter* spp bacteraemia: England, Wales, and Northern Ireland, 2002



* rates calculated using 2001 mid-year resident population estimates

* StataCorp. *Stata statistical software: Release 8.0*. College Station, TX: Stata Corporation

Acinetobacter spp

There were 1025 reports made of *Acinetobacter* spp bacteraemia in England (936 reports), Wales (50), and Northern Ireland (39) in 2002 (table 1). Of these, almost half (48%; 490/1025) were not identified to the species level. Twenty-eight per cent of the reports indicated *A. baumannii* species, the most commonly reported, and 17% *A. lwoffii*. The remainder were *A. calcoaceticus*, *A. haemolyticus*, *A. johnsonii*, and *A. junii*.

In 2002, 18% of all reports across England, Wales, and Northern Ireland came from London (table 2). London also had the highest rate of *Acinetobacter* spp bacteraemias, at 2.50 per 100,000 population (figure 1). The overall rate

Table 1 Laboratory reports of *Acinetobacter* and *Enterococcus* spp bacteraemia England, Wales, and Northern Ireland, 2002

	Number of reports
***Acinetobacter* spp**	**1025**
Acinetobacter not fully identified	490
Acinetobacter baumannii	287
Acinetobacter calcoaceticus	35
Acinetobacter haemolyticus	17
Acinetobacter johnsonii	2
Acinetobacter junii	24
Acinetobacter lwoffii	170
***Enterococcus* spp**	**5045**
Enterococcus not fully identified	1664
Enterococcus avium	24
Enterococcus casseliflavus	22
Enterococcus durans	33
Enterococcus faecalis	2126
Enterococcus faecium	816
Enterococcus gallinarum	93
Enterococcus hirae	6
Enterococcus raffinosus	2
'Streptococci group D'	259

Table 2 *Acinetobacter* spp and *Enterococcus* spp bacteraemia laboratory reports, England, Wales, and Northern Ireland: 2002

	Acinetobacter spp		*Enterococcus* spp	
	no	(%)	no	(%)
North East	61	(6)	278	(6)
Yorkshire and Humberside	79	(8)	488	(10)
East Midlands	73	(7)	429	(9)
Eastern	91	(9)	485	(10)
London	180	(18)	727	(14)
South East	133	(13)	609	(12)
South West	64	(6)	445	(9)
West Midlands	122	(12)	611	(12)
North West	133	(13)	550	(11)
England	936	(91)	4622	(92)
Wales	50	(5)	231	(5)
Northern Ireland	39	(4)	192	(4)
England, Wales, and Northern Ireland	**1025**	**(100)**	**5045**	**(100)**

Table 3 *Acinetobacter* spp bacteraemia laboratory reports, England, Wales, and Northern Ireland: 2002

	resistant	r as % r+s	sensitive	no information	% of total
A. baumanniil A. calcoaceticus (n=312)					
Gentamicin	43	(21)	160	109	(35)
Ciprofloxacin	64	(36)	116	132	(42)
Imipenem	7	(7)	96	209	(67)
Ceftazidime	68	(48)	74	170	(54)
A. lwoffii (n=166)					
Gentamicin	3	(3)	108	55	(33)
Ciprofloxacin	4	(4)	96	66	(40)
Imipenem	1	(2)	47	118	(71)
Ceftazidime	13	(19)	55	98	(59)

Figure 2 Gentamicin susceptibility data for *Acinetobacter* spp bacteraemia laboratory reports, England, Wales, and Northern Ireland: 2002

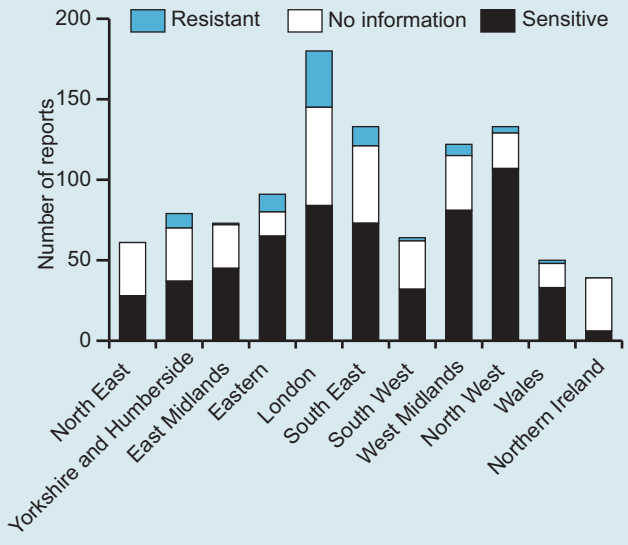
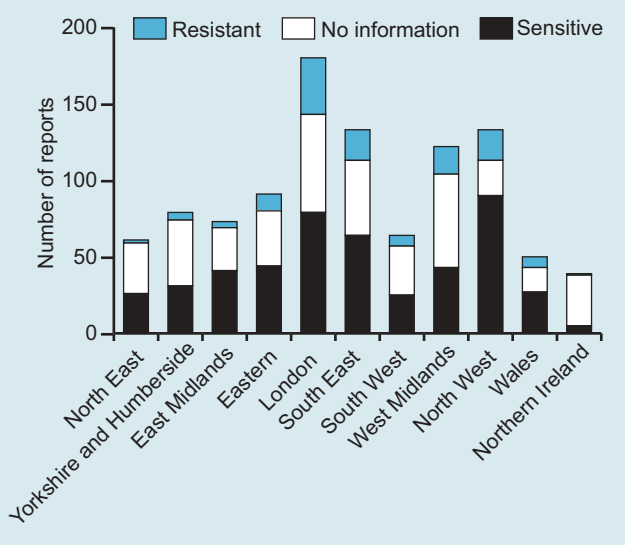


Figure 3 Ciprofloxacin susceptibility data for *Acinetobacter* spp bacteraemia laboratory reports, England, Wales, and Northern Ireland: 2002



for England, Wales, and Northern Ireland was 1.91/100,000, 1.90/100,000 for England, 1.72/100,000 for Wales, and 2.31/100,000 for Northern Ireland.

Antibiotic susceptibility

Gentamicin was the most commonly reported antibiotic, with 65% of reports containing information on susceptibility. Resistance was reported in 12% of reports where gentamicin susceptibility information was given, although resistance to gentamicin among *Acinetobacter* spp varied between 29% in London and 0% in the North East region and Northern Ireland (figure 2). The North East and Northern Ireland, however, were the only regions where over half of reports (54% and 85% respectively) did not contain information on susceptibility to gentamicin.

Fifty-eight per cent of reports contained information on susceptibility to ciprofloxacin. Resistance to ciprofloxacin was reported in 22% of reports containing susceptibility information. Again, reports from laboratories in the London region had the highest level of resistance at 32% and the North East the lowest at 7% (figure 3).

Sixty-eight per cent of reports did not contain information on susceptibility to imipenem, and in certain regions less than 10% of reports contained this information. As only 16 *Acinetobacter* spp isolates were reported as resistant to imipenem, the numbers in any one region were low (figure 4). No resistant isolates were reported in the North East, East Midlands, West Midlands, or Northern Ireland, and five resistant isolates were reported from London.

Information on susceptibility to ceftazidime (figure 5) was available in 40% of reports, although again this varied between regions. The overall rate of resistance was 36%. There was also variation in the reported level of resistance from 63% in the West Midlands to 0% in Northern Ireland

Figure 4 Imipenem susceptibility data for *Acinetobacter* spp bacteraemia laboratory reports, England, Wales and Northern Ireland: 2002

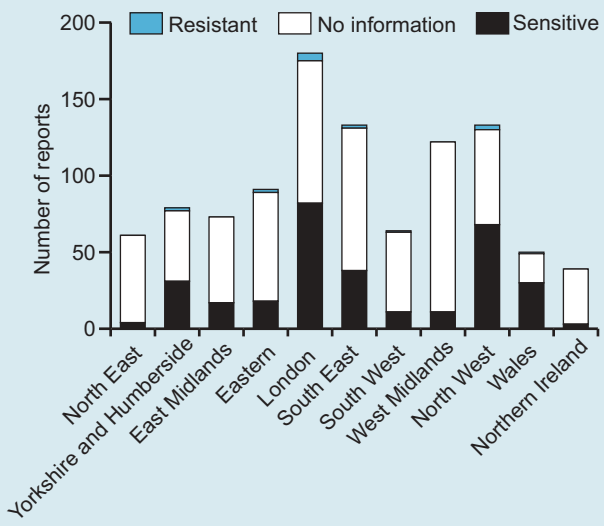


Figure 5 Ceftazidime susceptibility data for *Acinetobacter* spp bacteraemia laboratory reports, England, Wales,and Northern Ireland: 2002

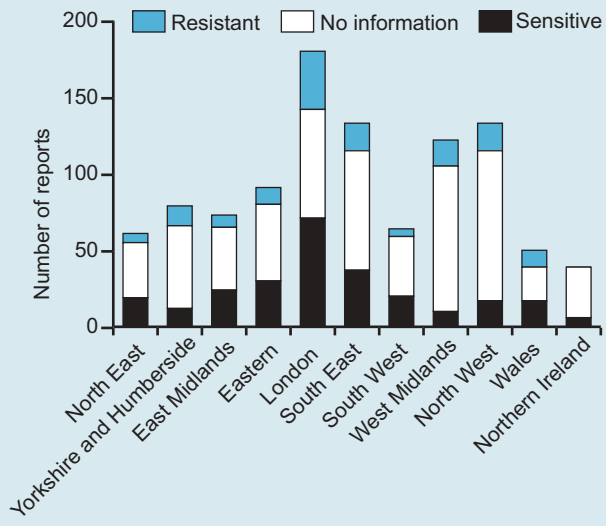


Table 4 Multiple antibiotic resistance patterns for *Acinetobacter* spp bacteraemia laboratory reports, England, Wales, and Northern Ireland: 2002

		Gentamicin				Ciprofloxacin				Imipenem				Ceftazidime				multiple-resistance*	
		resistant	%#	sensitive	no Info	resistant	%#	sensitive	no Info	resistant	%#	sensitive	no Info	resistant	%#	sensitive	no Info	%#	resistant
Gentamicin	resistant (n=83)					62	(89)	8	13	8	(15)	47	28	48	(77)	14	21	(16)	6/38
	sensitive (n=591)					65	(13)	452	74	7	(3)	254	330	86	(26)	247	258		
Ciprofloxacin	resistant (n=132)	62	(49)	65	5					9	(13)	63	60	72	(73)	26	34	(11)	6/56
	sensitive (n=475)	8	(2)	452	15					2	(1)	217	256	59	(21)	221	195		
Imipenem	resistant (n=16)	8	(53)	7	1	9	(82)	2	5					8	(100)	–	8	(75)	6/8
	sensitive (n=313)	47	(16)	254	12	63	(23)	217	33					83	(38)	137	93		
Ceftazidime	resistant (n=145)	48	(35)	89	8	72	(54)	62	11	8	(9)	84	53					(8)	6/80
	sensitive (n=263)	14	(5)	247	2	26	(11)	221	16	–	(–)	137	126						

* resistant to gentamicin, ciprofloxacin, imipenem and ceftazidime
\# as a percentage of reports with susceptibility information

(although the numbers were small).

The overall rates of resistance in *Acinetobacter* spp mask differences between the different species (table 3). *A. baumannii* and *A. calcoaceticus* were generally more resistant than *A. lwoffii*, as expected. Thus, resistance to gentamicin was indicated in 21% of reports (where susceptibility information was given) of *A. baumannii* and *A. calcoaceticus*, and only 3% of reports of *A. lwoffii*.

Table 4 shows the multiple resistance patterns for these four antibiotics. Six isolates were reported as resistant to gentamicin, ciprofloxacin, imipenem, and ceftazidime. Five of these were *A. baumannii* and the species was not identified for the sixth.

Age distributions

Differences between *Acinetobacter* species can also be seen in the age distributions of cases (figure 6). *A. baumannii* and *A. calcoaceticus* predominate in the older age groups, being highest in those aged over 75 years. In contrast, rates of *A. lwoffii* are three times higher in infants aged under one year than in those aged between 64 and 75 years, or for those aged over 75 years.

Enterococcus spp

In 2002, 5045 reports of *Enterococcus* spp bacteraemia were made from laboratories across England, Wales, and Northern Ireland (table 1). Forty-two per cent of these reports (2126) specified *E. faecalis* and 16% (816 reports) *E. faecium*. Thirty-three per cent of reports (1664 reports) were not identified to the species level. 'Group D streptococci' accounted for 5% of the total number of *Enterococcus* spp reports.

As for *Acinetobacter* spp, the greatest number of reports from any one region was from London: 727 reports, or 14%

Figure 6 Age-specific rates of *Acinetobacter* spp bacteraemia per 100,000 population: England, Wales, and Northern Ireland: 2002

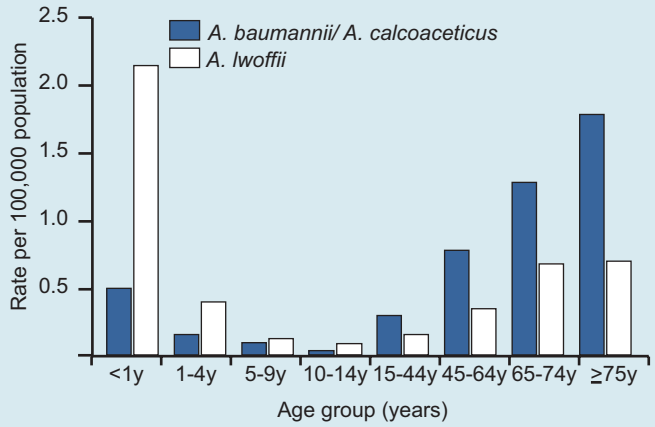
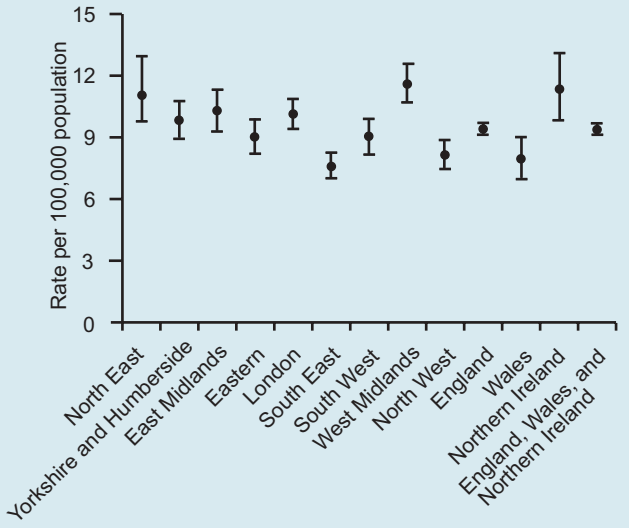


Figure 7 Region-specific rates* of *Enterococcus* spp bacteraemia: England, Wales, and Northern Ireland, 2002



* rates calculated using 2001 mid-year resident population estimates

of the total (table 2). The rates for England, Wales, and Northern Ireland were 9.40/100,000, 7.96/100,000, and 11.37/100,000 respectively. For England, Wales, and Northern Ireland combined, the rate was 9.38/100,000. The English region with the highest rate of *Enterococcus* spp bacteraemia was the West Midlands, at 11.60/100,000 population (figure 7). The lowest rate was in the South East (7.61/100,000).

Antibiotic susceptibility

Ampicillin/amoxycillin susceptibility information was available in 73% of *E. faecalis* and 69% of *E. faecium* reports (table 5). For England, Wales, and Northern Ireland combined, 6% of *E. faecalis* reports with susceptibility information indicated resistance to ampicillin/amoxycillin, although it is likely that this reflects some mis-identification. There was, however, noticeable regional variation from zero reports of resistance in Northern Ireland to 19 in Yorkshire and Humberside (14% of the reports with susceptibility information in this region)(figure 8). Similarly for *E. faecium* isolates, resistance varied from all reports with susceptibility information indicating resistance in the East Midlands to 63% resistance in Yorkshire and Humberside (figure 9). Overall, resistance was reported in 85% of *E. faecium* isolates with susceptibility information for this antibiotic.

Vancomycin susceptibility information was not available for about a third of reports of either species. Four per cent of *E. faecalis* reports (63 reports), and 19% of *E. faecium* reports (104 reports) indicated that the isolate was resistant to vancomycin. Reports from Wales indicated the highest level of vancomycin resistance for both *E. faecalis* (23%) and *E. faecium* (55%)(figures 10 and 11).

There was a similar discrepancy between the species in terms of reported level of resistance to teicoplanin, although a greater proportion of reports did not contain susceptibility information (62% of *E. faecalis* and 59% of *E. faecium* reports). Resistance to teicoplanin was reported in 4% of *E. faecalis* isolates (30 reports; figure 12) and 13% of *E. faecium* isolates (44 reports; figure 13).

Gentamicin resistance was reported in 47% of *E. faecalis* isolates and 48% of *E. faecium* isolates (figures 14 and 15). Of the 1747 *Enterococcus* spp reports containing information on gentamicin susceptibility, just over half

Table 5 *Enterococcus* spp bacteraemia laboratory reports, England, Wales and Northern Ireland: 2002

	resistant	r as % r+s	sensitive	no information	% of total
E. faecalis (n=2126)					
Ampicillin/ amoxycillin	88	(6)	1457	581	(27)
Vancomycin	63	(4)	1358	705	(33)
Teicoplanin	30	(4)	778	1318	(62)
Gentamicin	344	(47)	383	1399	(66)
E. faecium (n=816)					
Ampicillin/ amoxycillin	477	(85)	87	252	(31)
Vancomycin	104	(19)	458	254	(31)
Teicoplanin	44	(13)	294	478	(59)
Gentamicin	140	(48)	152	524	(64)

(914) indicated high-level resistance to gentamicin, and the rest did not indicate whether the resistance was high or low level. With enterococci it is important to distinguish between high and low-level resistance to gentamicin, as enterococci are inherently resistant to low-level gentamicin.

Two *E. faecalis* isolates (table 6) were resistant to ampicillin/amoxycillin, vancomycin, teicoplanin, and gentamicin (it was not indicated whether this was high-level or low-level resistance), although the presence of resistance to ampicillin/amoxycillin may indicate that these bacteria were misidentified. Twelve *E. faecium* isolates were resistant to these four antibiotics (table 7), of which tenindicated that they had high-level resistance to

Figure 8 Ampicillin/amoxycillin susceptibility data for *Enterococcus faecalis* bacteraemia laboratory reports, England, Wales, and Northern Ireland: 2002

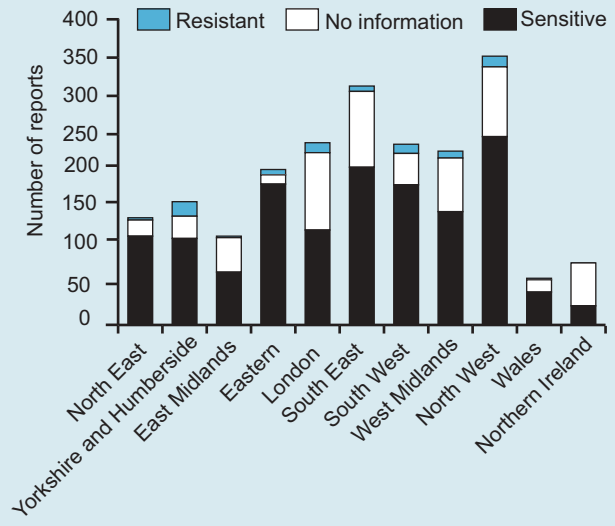


Figure 9 Ampicillin/amoxycillin susceptibility data for *Enterococcus faecium* bacteraemia laboratory reports, England, Wales,and Northern Ireland: 2002

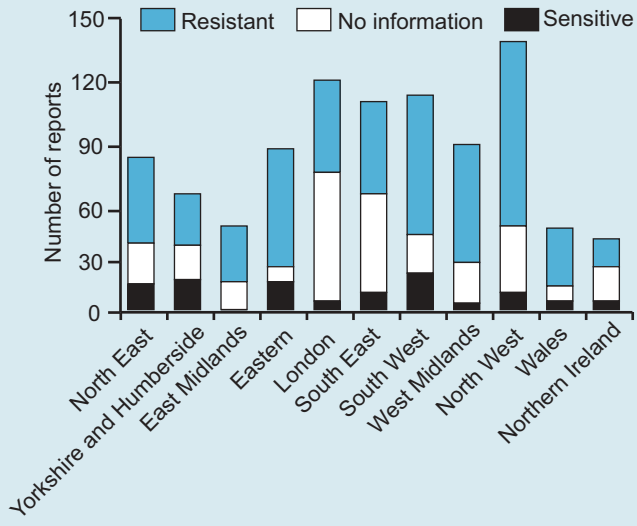


Figure 10 Vancomycin susceptibility data for *Enterococcus faecalis* bacteraemia laboratory reports, England, Wales, and Northern Ireland: 2002

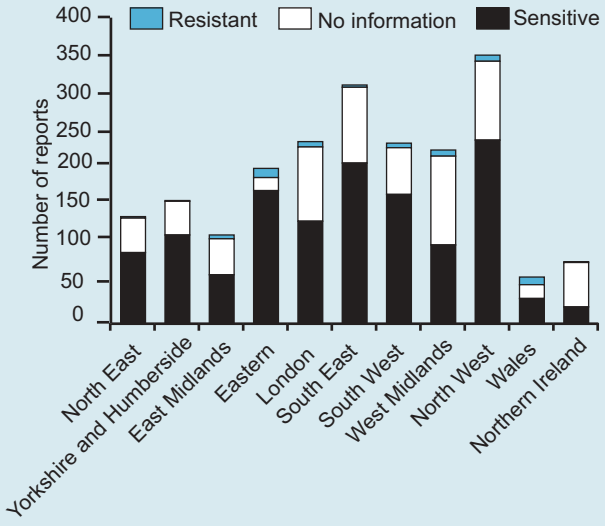
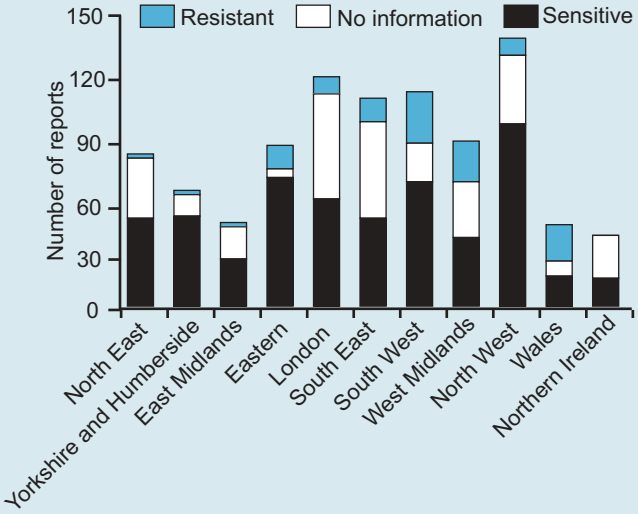


Figure 11 Vancomycin susceptibility data for *Enterococcus faecium* bacteraemia laboratory reports, England, Wales, and Northern Ireland: 2002



gentamicin.

Age distribution

Age-specific rates of *E. faecalis* and *E. faecium* showed a similar distribution with the highest rates in those aged 75 years and over, and a secondary peak in infants aged under one year (figure 16).

Discussion

The number of reports of *Acinetobacter* spp bacteraemia, excluding Northern Ireland, increased by 8% between 2001 and 2002, a smaller rate of increase than between 2000 and 2001, which saw a 23% increase (1). Between 2001 and 2002, the rate increased from 1.72 to 1.91 per 100,000 population.

Between 2001 and 2002, the proportion of *Acinetobacter* spp reports without information on antimicrobial susceptibility fell for all four antibiotics reviewed here. The proportion of reports without information on susceptibility to gentamicin fell from 41% to 34%. The proportion of resistant isolates remained at 12%, although the rates for individual regions varied between the years. For ciprofloxacin, the proportion of reports without susceptibility information fell from 48% to 41%, and the level of resistance fell from 25% to 22%. London still had the highest level of resistance in 2002 (32% of reports with susceptibility information), but this was lower than 2001 (41%).

The number of isolates reported as resistant to imipenem doubled from eight in 2001 to 16 in 2002, accompanied by an increase in the percentage

Table 6 Multiple antibiotic resistance patterns for *E. faecalis* bacteraemia laboratory reports: England, Wales, and Northern Ireland, 2002

		Ampicillin/amoxycillin				Vancomycin				Teicoplanin				Gentamicin				multiple-resistance*	
		resistant	%#	sensitive	no Info	resistant	%#	sensitive	no Info	resistant	%#	sensitive	no Info	resistant	%#	sensitive	no Info	%#	resistant
Ampicillin/ amoxycillin	resistant (n=88)					8	(11)	68	12	5	(11)	39	44	22	(52)	20	46	(10)	2/20
	sensitive (n=1457)					46	(4)	1233	178	24	(3)	701	732	301	(46)	352	804		
Vancomycin	resistant (n=63)	8	(15)	46	9					21	(68)	10	32	23	(66)	12	28	(13)	2/16
	sensitive (n=1358)	68	(5)	1233	57					8	(1)	725	625	300	(47)	345	713		
Teicoplanin	resistant (n=30)	5	(17)	24	1	21	(72)	8	1					11	(58)	8	11	(11)	2/19
	sensitive (n=778)	39	(5)	701	38	10	(1)	725	43					198	(48)	216	364		
Gentamicin	resistant (n=344)	22	(7)	301	21	23	(7)	300	21	11	(5)	198	135					(1)	2/195
	sensitive (n=383)	20	(5)	352	11	12	(3)	345	26	8	(4)	216	159						

* resistant to ampicillin/amoxycillin, vancomycin, teicoplanin and gentamicin
\# as a percentage of reports with susceptibility information

Figure 12 Teicoplanin susceptibility data for *Enterococcus faecalis* bacteraemia laboratory reports, England, Wales, and Northern Ireland: 2002

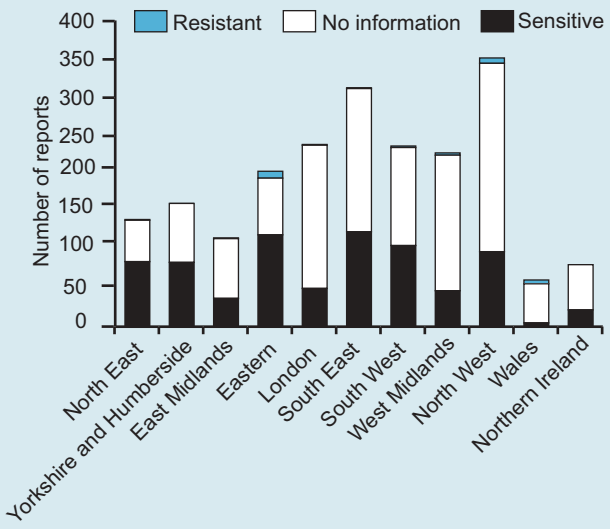
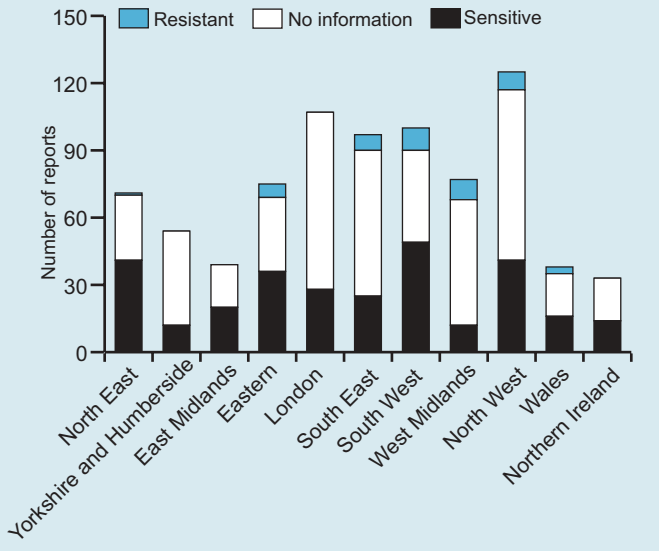


Figure 13 Teicoplanin susceptibility data for *Enterococcus faecium* bacteraemia laboratory reports, England, Wales, and Northern Ireland: 2002



resistance from 3% to 5% of reports with susceptibility information. Ceftazidime resistance also fell, from 45% of reports with susceptibility information in 2001 to 36% in 2002. The number of isolates resistant to all four antibiotics increased from two in 2001 to six in 2002. An epidemic strain of *A. baumannii* resistant to a number of antibiotics has been identified by the Laboratory of HealthCare Associated Infection (LHCAI) and is reported on the front page of this issue of *CDR Weekly*, Vol 13 No 29, 17 July 2003 (2).

The number of reports of *Enterococcus* spp (excluding Northern Ireland) increased by 19% between 2001 and 2002, similar to the 17% increase seen in 2001 from 2000 (1). Between 2001 and 2002, there was an increase in the number of reports of *Enterococcus* spp that were not identified to the species level, from 25% to 33%. In 2002, there were a few reports of two *Enterococcus* spp that were not reported in 2001: *E. hirae* and *E. raffinosus*.

Between 2001 and 2002, the reported level of resistance in *E. faecalis* isolates decreased from 9% to 6% for ampicillin/amoxycillin and from 61% to 47% for gentamicin. Reported vancomycin resistance increased slightly from 3% to 4%, and teicoplanin resistance remained at 4%. The decrease in the level of resistance to ampicillin/amoxycillin may indicate improvement in the identification of *E. faecalis*.

Reported ampicillin/amoxycillin resistance in *E.faecium* isolates remained at 85% between the two years; the level of vancomycin resistance was also unchanged, at 19%. The proportion of isolates reported as resistant to teicoplanin and gentamicin fell from 16% to 13% for teicoplanin and 60% to 48% for gentamicin.

Table 7 Multiple antibiotic resistance patterns for *E. faecium* bacteraemia laboratory reports, England, Wales, and Northern Ireland, 2002

		Ampicillin/amoxycillin				Vancomycin				Teicoplanin				Gentamicin				multiple-resistance*	
		resistant	%#	sensitive	no Info	resistant	%#	sensitive	no Info	resistant	%#	sensitive	no Info	resistant	%#	sensitive	no Info	%#	resistant
Ampicillin/ amoxycilin	resistant (n=477)					92	(21)	354	31	40	(14)	236	201	113	(50)	111	253	(9)	12/136
	sensitive (n=87)					4	(5)	74	9	2	(5)	37	48	20	(36)	35	32		
Vancomycin	resistant (n=104)	92	(96)	4	8					39	(59)	27	38	32	(62)	20	52	(36)	12/33
	sensitive (n=458)	354	(83)	74	30					5	(2)	245	208	101	(45)	123	234		
Teicoplanin	resistant (n=44)	40	(95)	2	2	39	(89)	5	–					15	(56)	12	17	(46)	12/26
	sensitive (n=294)	236	(86)	37	21	27	(10)	245	22					72	(49	75	147		
Gentamicin	resistant (n=140)	113	(85)	20	7	32	(24)	101	7	15	(17)	72	53					(15)	12/79
	sensitive (n=152)	111	(76)	35	6	20	(14)	123	9	12	(14)	75	65						

* resistant to ampicillin/amoxycillin, vancomycin, teicoplanin, and gentamicin
\# as a percentage of reports with susceptibility information

Figure 14 Gentamicin susceptibility data for *Enterococcus faecalis* bacteraemia laboratory reports, England, Wales, and Northern Ireland: 2002

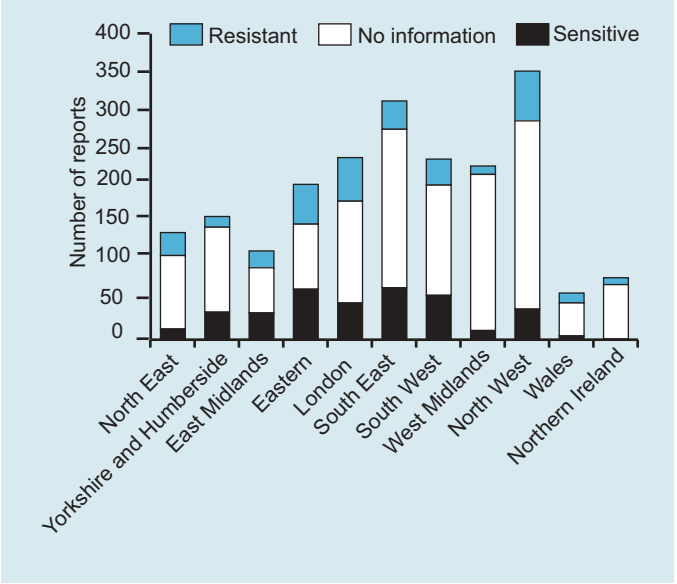
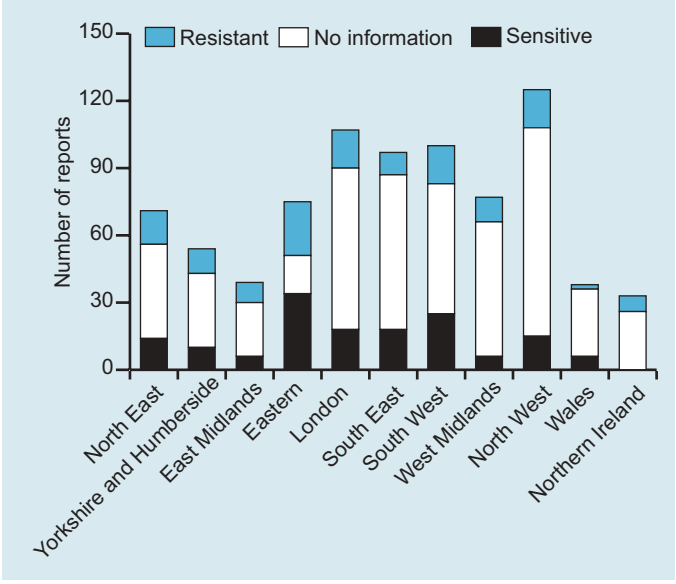


Figure 15 Gentamicin susceptibility data for *Enterococcus faecium* bacteraemia laboratory reports, England, Wales, and Northern Ireland: 2002

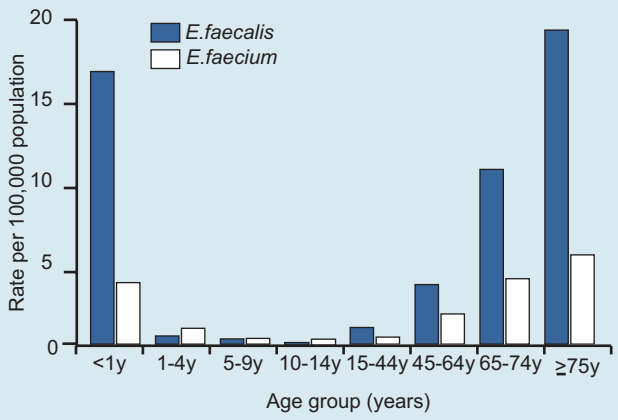


For both *E. faecalis* and *E. faecium*, the proportion of reports without susceptibility information fell for all four antibiotics reviewed here. In particular, the number of reports without information on gentamicin susceptibility fell from 93% to 66% of *E. faecalis* reports and 90% to 64% of *E. faecium* reports. Another improvement is the inclusion of information on high-level resistance to gentamicin. Of the 1747 reports with information on gentamicin susceptibility, 52% (914 reports) indicated that this information referred to high-level gentamicin. Enterococci are inherently resistant to gentamicin at low levels, so it is important to distinguish between this and high-level susceptibility to gentamicin. Only high-level susceptibility should be reported.

In contrast to 2001, for which no isolates were reported as resistant to ampicillin/amoxycillin, vancomycin, teicoplaninm and gentamicin, two *E. faecalis* and 12 *E. faecium* isolates were reported as resistant to all four antibiotics in 2002. This reflects the generally higher levels of resistance in *E. faecium* isolates compared to *E. faecalis*. The multiple antibiotic resistance patterns for *E. faecalis* (table 6) shows eight isolates that were apparently resistant to teicoplanin, but sensitive to vancomycin. This phenotype, however, has never been confirmed in enterococci: current BSAC interpretative criteria for teicoplanin and enterococci may lead to false reporting of resistance.

The importance of surveillance of resistance in *Enterococcus* spp was highlighted by a recent communication from the Chief Medical Officer (3-5). This announced that reporting of bacteraemias due to glycopeptide-resistant enterococci (GRE) will form the next phase of the mandatory HCAI surveillance initiative for England, to be initiated this autumn. Further information about the developments set out in this letter will be

Figure 16 Age-specific rates of *Enterococcus* spp bacteraemia per 100,000 population: England, Wales, and Northern Ireland, 2002



distributed by the regional Health Protection Units.

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