Volume 13
Number 20
15 May 2003

CDR WEEKLY

Health Protection Agency

Main stories this week:

If you have any comments or encounter any problems with this website, please contact *cdr@phls.org.uk*

Published by:
Health Protection Agency
Communicable Disease
Surveillance Centre

News

Last updated: 15 May 2003
Next update due: 22 May 2003

Contents

Top |

Severe Acute Respiratory Syndrome – update

As of 14 May, 2003 the United Kingdom (UK) is currently reporting four probable cases of severe acute respiratory syndrome (SARS) all of whom have recovered, and been discharged from hospital. Of eight UK cases that were initially classified as probable, three have tested positive for influenza A, and one for mycoplasma: these four have therefore been declassified. Only one of the remaining four has so far tested positive for SARS coronavirus. A further 159 reports of possible cases of SARS in residents of the UK have been assessed by the Health Protection Agency (HPA) and none have been classified as probable cases.

Website updates on current guidance to health professionals

A new information sheet for employers who have staff who have recently returned from SARS affected areas has been published at <http://www.phls.org.uk/topics_az/SARS/employers_alert.pdf>. Information on the management of contacts, with particular reference to management of close contacts in special circumstances has been updated on the website of the former PHLS. The information is available at <http://www.phls.co.uk/topics_az/SARS/management_guidance.htm>. The website also includes UK travel advice in line with current World Health Organization (WHO) guidelines. The UK advice is available at <http://www.phls.co.uk/topics_az/SARS/travel_guidance.htm> and<http://www.phls.co.uk/topics_az/SARS/traveller_health_alert.pdf>. The UK case definitions have also been revised incorporating microbiological findings as defined by WHO <http://www.phls.co.uk/topics_az/SARS/case_definition.htm> (see below).

Global update

As of 13 May, WHO is currently reporting 7548 cases with 573 deaths <http://www.who.int/csr/sars/country/2003_05_13/en/>. China continues to report the majority of new cases with Beijing and Hebei accounting for a large number of these. Taiwan continues to report cases into double figures on a daily basis, while Hong Kong has seen a steady decline in cases over the last eight days, with daily reports remaining in single figures.

The changing situation in Taiwan first came to the attention of WHO when the number of cases nearly tripled over a ten day period at the end of April. In mid-April, most of the initially reported probable cases had been imported into the country from mainland China and Hong Kong. Several staff at a hospital then became infected at the end of April. Each year more than 4 million visits are made by the Taiwanese to mainland China and a large number of flights return via Hong Kong The Taiwanese

government is now employing strict quarantine laws on incoming travelers from affected areas.

On 7 May the Philippines was added to the list of affected areas although there is no current recommendation that people defer travel to this area of the world. The country is currently reporting ten cases with two deaths all linked to a single imported case who returned to the Philippines from Toronto, Canada.

Both Singapore and Hong Kong have been praised by the WHO for efforts in bringing the SARS epidemic under control. Singled out for attention were Hong Kong's vigorous approach to contact tracing through the innovative use of computer systems and Singapore for its new strict screening measures employed for all outgoing and selected incoming passengers. Singapore, a small city-state, has also asigned one of its hospitals specifically for managing SARS patients. Singapore has also managed to bring down the time from onset of symptoms to isolation for patients from three days to 1.4 days in the last week. The full WHO report can be found at <http://www.who.int/csr/sars/archive/2003_05_13/en/>.

Travel and affected areas

WHO has reclassified the areas reported with recent local transmission into areas defined as A, B, C, and 'uncertain' to grade the degree of local transmission <http://www.who.int/csr/sars/areas/2003_05_13/en/>. In category A and B, a single or more than one generation of cases has occurred, but all of whom have been traced as known contacts of SARS cases. Category C, which is the most serious category, refers to a situation where local probable SARS cases have not been previously identified as known contacts of probable SARS cases. This replaces the previous high (+++) medium (++) and low (+) categorisation.It is recommended to defer travel to countries classed as C (Beijing, Guangdong, Hong Kong, Shanxi, and Taipei). WHO has also produced a new table,<http://www.who.int/csr/sars/2003_05_13/en/> listing those countries where exit screening and/or postponement of travel is recommended for international travelers.

Case definitions for surveillance of SARS

On 13 May, WHO provided an update on case definitions which can be found at <http://www.who.int/csr/sars/casedefinition/en/>. Cases that meet the surveillance case definition for SARS should not be discarded on the basis of negative laboratory tests at this time. The reason for retaining the clinical and epidemiological basis for the case definitions is that at present there is no validated, widely and consistently available test for infection with the SARS coronavirus. It is also not yet possible to define the optimal specimen to be tested at any given stage of the illness. WHO stresses the need for appropriate quality control procedures for all laboratory methods being employed and expresses the hope that in the near future an accessible and validated diagnostic assay(s) will become available which can be employed with confidence at a defined, early stage of the illness.

WHO weekly epidemiological record

The *Weekly Epidemiological Record* of 9 May (Vol 19 No 78) summarises the epidemiological features of the outbreak in Singapore including the influence of super spreaders. The experience in Singapore has been similar to that of Hong Kong and Toronto in that the outbreak has, so far, been characterised by nosocomial transmission caused by persons who were not immediately recognized as having SARS. These cases either had atypical clinical presentations masking their infections or were otherwise not rapidly identified because of lack of an initial history of direct contact with a known SARS case. These patients then became hidden reservoirs of infections both in hospitals and the community. A common feature of the so-called 'super spreaders' has been nosocomial transmission (community super spreading incidents have also been documented), with hospitals serving as sources for disease amplification (76% of all probable infections were acquired in a healthcare facility). One modification to the WHO case definition was to expand the meaning of contact to include any healthcare setting. This was due to some transmissions resulting from undefined or limited contact, such as, using the same corridor used by a known probable case or visiting the same inpatient ward. Among the list of stated super spreaders was the original index case. A total of 172 probable cases out of 201 were linked through chains of transmission to this case. Further information on the natural history of infection is, however, required to fully understand this phenomenon, but the report concludes that transmission of SARS virus is highly

efficient in some circumstances. In contrast to the super spreaders, Singapore reports that 81% of probable SARS cases had no evidence of transmission to other people with clinically identifiable illness. This means that most of the disease was transmitted by only a few individuals. More information is available at <http://www.who.int/wer/pdf/2003/wer7819.pdf>.

Back to top

Bacteraemia

Last updated: 15 May 2003
Next update due: 19 June 2003

Contents

Klebsiella, *Enterobacter*, *Serratia,* and *Citrobacter* spp bacteraemias, England, Wales, and Northern Ireland 2002

Key points:

- In 2002, there were 6984 laboratory reports of bacteraemias due to *Klebsiella*, *Enterobacter*, *Serratia*, and *Citrobacter* spp
- Reporting rates were higher in England than for Wales or Northern Ireland, except for reports of *Serratia* spp which were substantially lower in England
- Information on susceptibility to any one antibiotic was available in less than half of reports, with the exception of gentamicin and ciprofloxacin
- Reporting of susceptibility information improved for gentamicin, ciprofloxacin, ceftazidime, and imipenem/meropenem in 2002, compared to 2001, although this decreased for cefotaxime
- The proportion of reports indicating resistance to gentamicin, ceftazidime, and cefotaxime increased for all four genera
- Two *E. cloacae* isolates were reported as being multi-resistant to gentamicin, ciprofloxacin, ceftazidime, imipenem/meropenem, and cefotaxime

This report contains 2002 data on *Klebsiella*, *Enterobacter*, *Serratia*, and *Citrobacter* spp bacteraemias, with brief details on less common enterobacteriaceae. Data on bacteraemias attributed to other members of the enterobacteriaceae family have been published in a previous issue of the *CDR Weekly* in 2002 (1). Data come from routine laboratory reports indicating isolation of these bacteria from blood specimens. Rates were calculated using 2001 population denominators, and according to the geographical boundaries introduced in April 2002.

In 2002, there were 6984 reports of bacteraemias due to *Klebsiella*, *Enterobacter*, *Serratia*, and *Citrobacter* spp, of which 3695 reports (53%) were of *Klebsiella* spp bacteraemia (table 1). The majority (65%; 2418/3695) of *Klebsiella* spp bacteraemias were attributed to *Klebsiella pneumoniae* (table 1). *Klebsiella oxytoca* was the next most common species within this genus, accounting for 20% (753/3695). Four hundred and thirty-one reports (12%) were not identified to the species level.

Table 1 Laboratory reports of *Klebsiella*, *Enterobacter*, *Serratia*, and *Citrobacter* spp and related species bacteraemia, England, Wales, and Northern Ireland: 2002

	Number of reports
***Citrobacter* spp**	**505**
Citrobacter amalonaticus	4
Citrobacter freundii	261
Citrobacter koseri (*diversus*)	135
Citrobacter spp	105
***Edwardsiella* spp**	**–**
***Enterobacter* spp**	**1998**
Enterobacter aerogenes	224
Enterobacter amnigenus	9
Enterobacter cloacae	1438
Enterobacter gergoviae	7

Enterobacter intermedius	4
Enterobacter sakazakii	53
Enterobacter spp	263
Hafnia alvei	**19**
***Klebsiella* spp**	**3695**
Klebsiella ornithnolytica	26
Klebsiella oxytoca	753
Klebsiella ozenae	12
Klebsiella pneumoniae	2418
Klebsiella rhinoscleromatis	2
Klebsiella terrigena	53
Klebsiella spp	431
***Kluyvera* spp**	**21**
Leclercia adecarboxylata	**1**
***Pantoea* spp**	**93**
Pantoea agglomerans (*Erwinia herbicola*)	31
Pantoea spp	62
***Rahnella* spp**	**7**
***Serratia* spp**	**786**
Serratia ficaria	2
Serratia fonticola	9
Serratia liquefaciens	112
Serratia marcescens	526
Serratia odorifera	8
Serratia plymuthica	4
Serratia proteamaculas	1
Serratia rubidaea	4
Serratia spp	120
Total	**7125**

Enterobacter spp were the next most common among these genera (1998 reports; 29%), followed by 786 reports of *Serratia* spp (11%). Seventy-two per cent of *Enterobacter* spp reports were identified as *Enterobacter cloacae*, with 13% not giving the species. The two most common *Serratia* species were *S. marcescens* (526 reports; 67%) and *S. liquefaciens* (112 reports; 14%). All other *Serratia* species had fewer than ten reports each. One hundred and twenty reports (15%) of *Serratia* were not identified to the species level.

Of the main four genera covered in this report, *Citrobacter* was the least commonly reported (505 reports; 7%). Just over half (52%) of *Citrobacter* spp reports were identified as *Citrobacter freundii*, although in about 20% (105 reports) the species was not indicated. In addition, fewer than 100 reports were made for each of *Hafnia*, *Kluyvera*, *Leclercia*, *Pantoea*, and *Rahnella* spp. No reports of *Edwardsiella* spp bacteraemia were received in 2002.

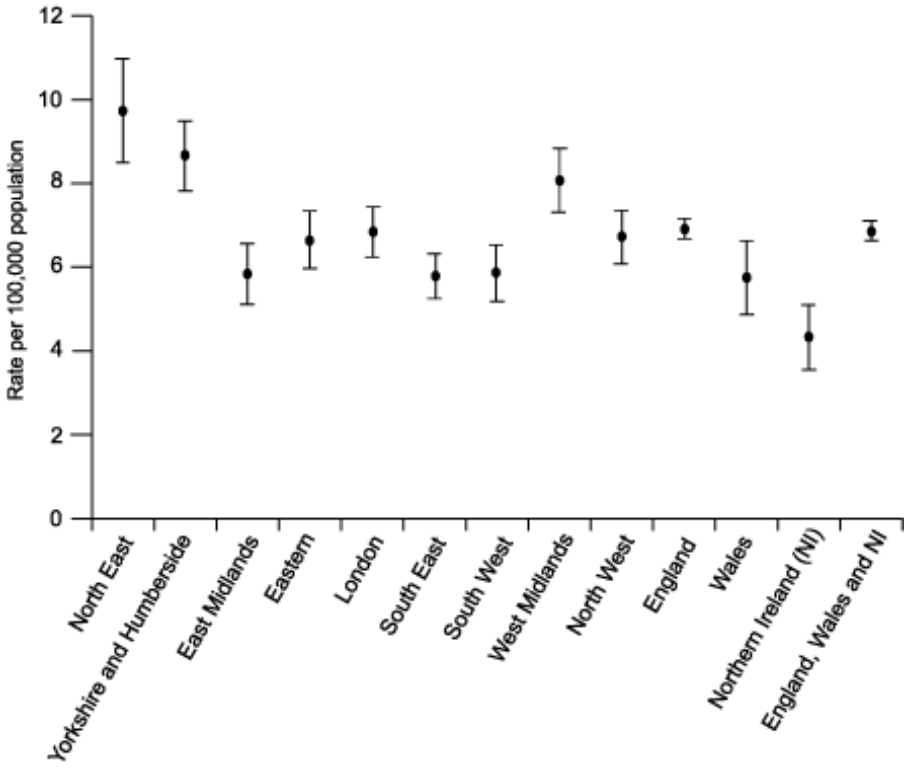
The overall rate of *Klebsiella* spp bacteraemia reports for England, Wales, and Northern Ireland was 6.87 per 100,000 population. Both Wales (5.75/100,000) and Northern Ireland (4.34/100,000) had lower rates of *Klebsiella* spp bacteraemia than any of the English regions; the overall rate for England was 6.92/100,000 population. Of the English regions, London (table 2) accounted for the greatest number of reports of *Klebsiella* spp bacteraemia (492 reports), although the North East had the highest rate (9.74/100,000 population) (figure 1).

Table 2 Laboratory reports of *Klebsiella*, *Enterobacter*, *Serratia,* and *Citrobacter* spp by region, England, Wales and Northern Ireland: 2002

	NE	Y&H	EM	EA	L	SE	SW	WM	NW	England	Wales	Northern Ireland	England, Wales and, Northern Ireland
Citrobacter spp	22	42	52	70	58	53	52	83	41	473	19	13	505
Enterobacter spp	140	165	159	180	299	232	152	244	266	1837	103	58	1998
Klebsiella spp	245	430	244	359	492	463	290	425	454	3402	167	126	3695
Serratia spp	99	58	35	48	91	72	48	72	111	634	95	57	786
Total	506	695	490	657	940	820	542	824	872	6346	384	254	6984

NE = North East; Y&H = Yorkshire and Humberside; EM = East Midlands; EA = Eastern; L = London; SE = South East; SW = South West; WM = West Midlands; and NW = North West.

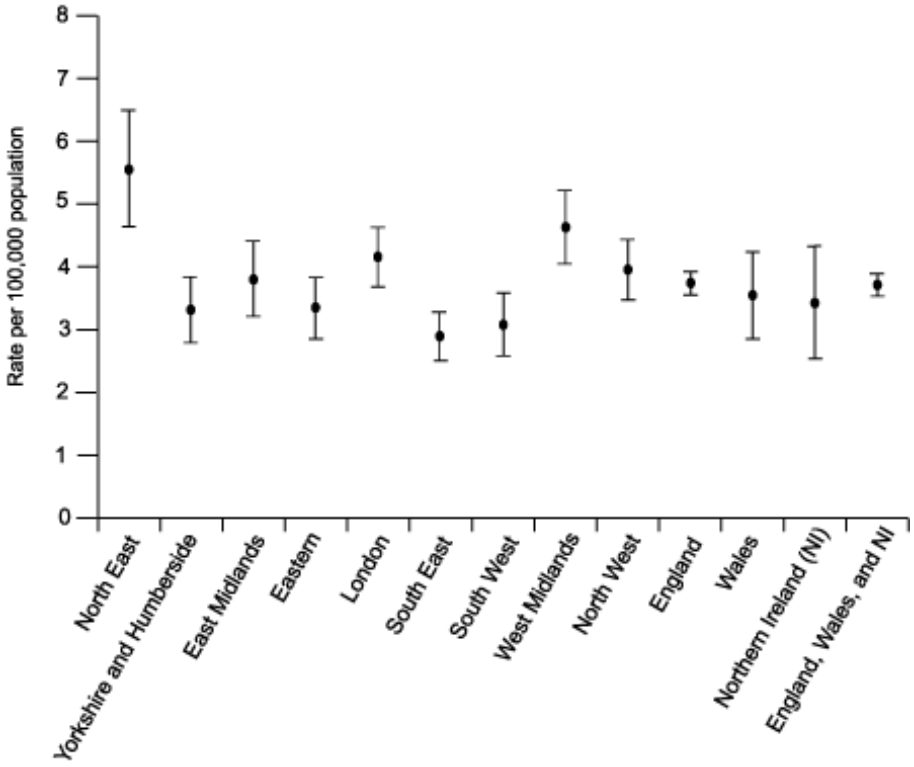
Figure 1 Region-specific rates* of *Klebsiella* spp bacteraemia: England, Wales, and Northern Ireland: 2002



* rates calculated using 2001 mid-year resident population estimates

The overall rate for *Enterobacter* spp bacteraemia in England, Wales, and Northern Ireland was 3.72/100,000. There was not as wide a variation in *Enterobacter* spp rates between England (3.74/100,000), Wales (3.55/100,000), and Northern Ireland (3.43/100,000) as for *Klebsiella* spp. The highest region-specific rate of *Enterobacter* spp bacteraemia (figure 2) was also seen in the North East (5.56/100,000), although the highest absolute number of reports was received from London. The lowest rate of 2.90/100,000 population was recorded by the South East region.

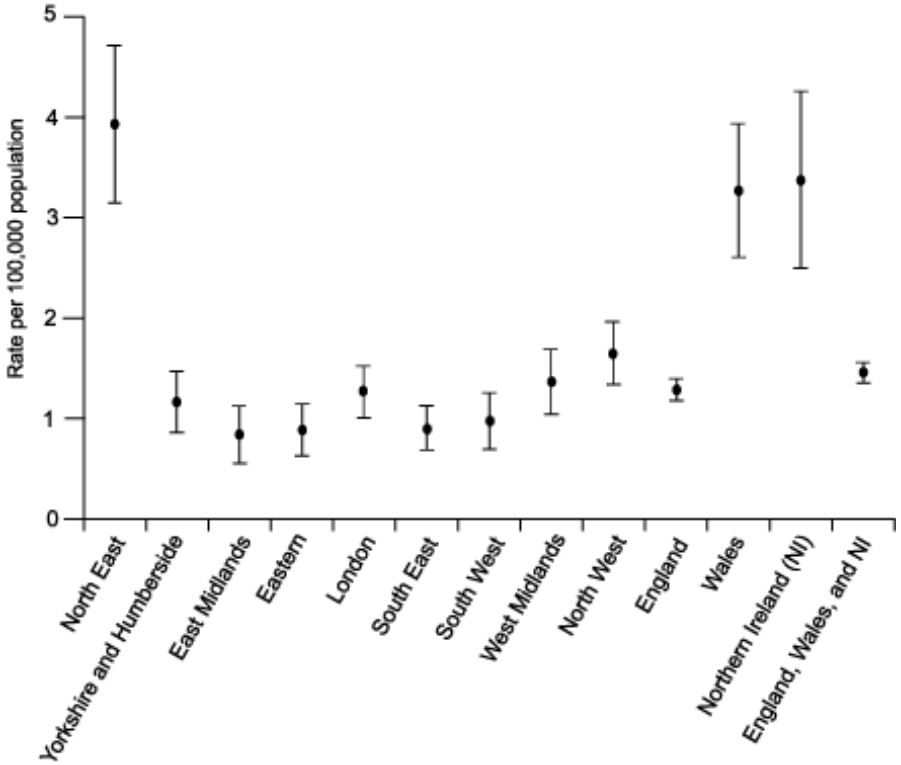
Figure 2 Region-specific rates* of *Enterobacter* spp bacteraemia: England, Wales, and Northern Ireland: 2002



* rates calculated using 2001 mid-year resident population estimates

Rates of *Serratia* spp bacteraemia (figure 3) were substantially higher in the North East (3.93/100,000), Wales, and Northern Ireland (3.27/100,000 and 3.37/100,000 respectively). The genus *Serratia* was the only one, of the four reviewed for this report, where the bacteraemia rates in Wales and Northern Ireland were higher than the overall rate for England (1.29/100,000). For this genus, the other regions varied between 0.84/100,000 (East Midlands) and 1.65/100,000 (North West).

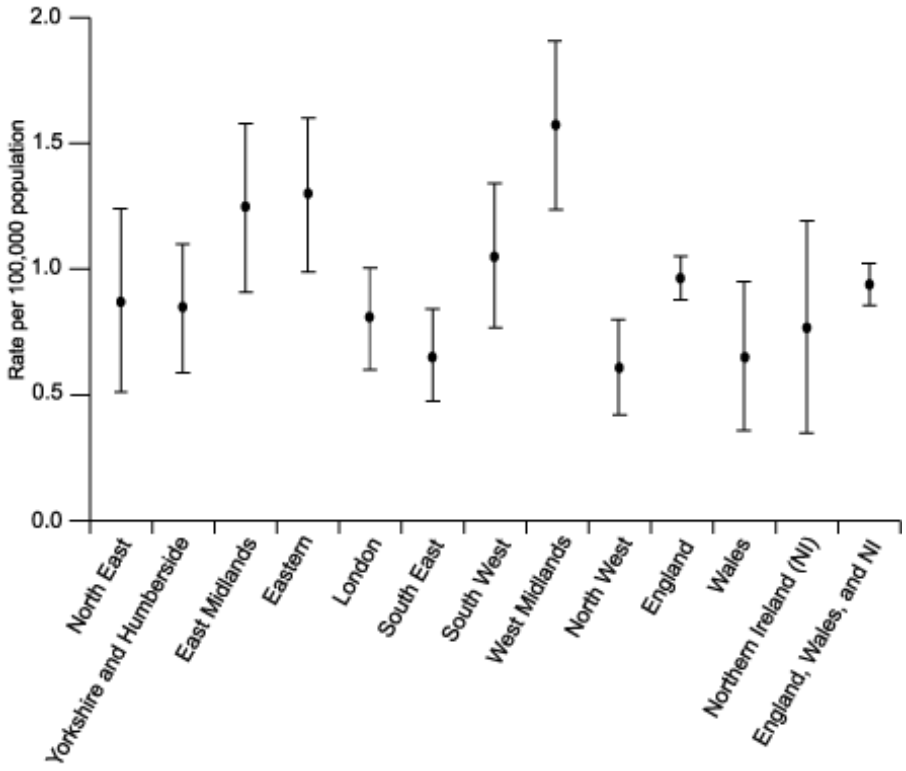
Figure 3 Region-specific rates* of *Serratia* spp bacteraemia: England, Wales, and Northern Ireland: 2002



* rates calculated using 2001 mid-year resident population estimates

The rate of *Citrobacter* spp bacteraemia in England (0.96/100,000), Wales (0.65/100,000), and Northern Ireland (0.77/100,000) and the combined rate was 0.94/100,000. *Citrobacter* was the only genus where the region-specific rate was not highest in the North East (figure 4). Rates ranged from 1.58/100,000 in the West Midlands to 0.61/100,000 in the North West.

Figure 4 Region-specific rates* of *Citrobacter* spp bacteraemia: England, Wales, and Northern Ireland: 2002



* rates calculated using 2001 mid-year resident population estimates

Antibiotic susceptibility

For all four genera reviewed here, gentamicin and ciprofloxacin were the only antibiotics for which susceptibility information was given in more than half of reports. Ceftazidime susceptibility information was given in just under half of the reports, varying between genera. Imipenem and/or meropenem susceptibility was reported in 42% to 48% of reports, and information on susceptibility to cefotaxime was given in less than 30% of reports.

The most commonly reported resistance, among *Klebsiella* spp bacteraemias was to ciprofloxacin (11% of reports that included susceptibility to that antibiotic) followed by ceftazidime (10%), cefotaxime (8%), and gentamicin (7%) (table 3). Six *Klebsiella* spp isolates were reported as showing resistance to imipenem and/or meropenem (0.4% of the number of reports including information on susceptibility to these antibiotics). No *Klebsiella* spp isolates were reported as being resistant to all five antibiotics (table 4), although only 16% (574/3695) of reports gave information on susceptibility to all five.

Table 3 Antibiotic susceptibilities for bacteraemia laboratory reports England, Wales, and Northern Ireland: 2002

	Sensitive	Resistant (%)*	No information (%)†
***Klebsiella* spp (n=3695)**			
Gentamicin	2391	176 (7%)	1128 (31%)
Ciprofloxacin	2071	248 (11%)	1376 (37%)
Ceftazidime	1518	174 (10%)	2003 (54%)
Imipenem/meropenem	1575	6 (0.4%)	2114 (57%)
Cefotaxime	927	77 (8%)	2691 (73%)
***Enterobacter* spp (n=1998)**			
Gentamicin	1240	147 (11%)	611 (31%)

Ciprofloxacin	1053	175 (14%)	770 (39%)
Ceftazidime	631	329 (34%)	1038 (52%)
Imipenem/meropenem	939	12 (1.3%)	1047 (52%)
Cefotaxime	369	186 (34%)	1443 (72%)
Serratia spp (n=786)			
Gentamicin	522	19 (4%)	245 (31%)
Ciprofloxacin	367	117 (24%)	302 (38%)
Ceftazidime	349	33 (9%)	404 (51%)
Imipenem/meropenem	342	2 (0.6%)	442 (56%)
Cefotaxime	148	54 (27%)	584 (74%)
***Citrobacter* spp (n=505)**			
Gentamicin	343	13 (4%)	149 (30%)
Ciprofloxacin	299	27 (8%)	179 (35%)
Ceftazidime	190	42 (18%)	273 (54%)
Imipenem/meropenem	211	1 (0.5%)	293 (58%)
Cefotaxime	115	30 (21%)	360 (71%)

* as a percentage of reports with susceptibility information

† as a percentage of total reports

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

	Gentamicin			Ciprofloxacin			Ceftazidime			Imipenem/ meropenem			Cefotaxime			Multi-res.*
	R (%†)	S	N	R (%†)	S	N	R (%†)	S	N	R (%†)	S	N	R (%†)	S	N	R (%†)
Gentamicin																
resistant (n=176)				109 (68%)	51	16	96 (71%)	39	41	2 (1%)	147	27	36 (61%)	23	117	–/46 (–)
sensitive (n=2391)				127 (6%)	1950	314	70 (5%)	1453	868	4 (0.3%)	1402	985	33 (4%)	858	1500	
Ciprofloxacin																
resistant (n=248)	109 (46%)	127	12				111 (58%)	82	55	2 (1%)	201	45	45 (51%)	44	159	–/62 (–)
sensitive (n=2071)	51 (3%)	1950	70				48 (3%)	1363	660	3 (0.2%)	1269	799	22 (3%)	805	1244	
Ceftazidime																
resistant (n=174)	96 (58%)	70	8	111 (70%)	48	15				3 (2%)	148	23	52 (91%)	5	117	–/50 (–)
sensitive (n=1518)	39 (3%	1453	26	82 (6%)	1363	73				1 (0.1%)	1125	392	8 (1%)	659	851	
Imipenem/meropenem																
resistant (n=6)	2 (33%)	4	–	2 (40%)	3	1	3 (75%)	1	2				1 (33%)	2	3	–/2 (–)
sensitive (n=1575)	147 (9%)	1402	26	201 (14%)	1269	105	148 (12%)	1125	302				61 (9%)	630	884	
Cefotaxime																
resistant (n=77)	36 (52%)	33	8	45 (67%)	22	10	52 (87%)	8	17	1 (2%)	61	15				–/52 (–)
sensitive (n=927)	23 (3%)	858	46	44 (5%)	805	78	5 (1%)	659	263	2 (0.3%)	630	295				

R: resistant; S: sensitive; N: No information; Multi-res.: multiple-resistance

* resistant to gentamicin, ciprofloxacin, ceftazidime, imipenem/meropenem, and cefotaxime

† as a percentage of reports with susceptibility information

Resistance to ceftazidime and cefotaxime was indicated in over one-third (34%) of the *Enterobacter* spp bacteraemia reports including susceptibility information on those antibiotics. Ciprofloxacin resistance was indicated in 14% of such reports, and gentamicin resistance in 11% of reports. Imipenem/meropenem resistance was reported in 12 isolates (1%). Of these twelve, only six included information on susceptibility to gentamicin, ciprofloxacin, ceftazidime, and cefotaxime (table 5). Of these six, two were reported as resistant to all five antibiotics. Both were *E. cloacae*. Of the 1998 reports of *Enterobacter* spp bacteraemia received in 2002, 350 (18%) contained susceptibility information for these five antibiotics.

Table 5 Multiple antibiotic resistance patterns for *Enterobacter* spp bacteraemia laboratory reports, England, Wales, and Northern Ireland: 2002

	Gentamicin			Ciprofloxacin			Ceftazidime			Imipenem/ meropenem			Cefotaxime			Multi-res.*
	R (%†)	S	N	R (%†)	S	N	R (%†)	S	N	R (%†)	S	N	R (%†)	S	N	R (%†)
Gentamicin																
resistant (n=147)				68 (57%)	52	27	86 (79%)	23	38	6 (5%)	119	22	40 (69%)	18	89	2/33 (6)
sensitive (n=1240)				103 (10%)	980	157	238 (29%)	597	405	5 (1%)	804	431	143 (29%)	345	752	
Ciprofloxacin																
resistant (n=175)	68 (40%)	103	4				100 (70%)	43	32	7 (5%)	137	31	63 (72%)	24	88	2/59 (3)
sensitive (n=1053)	52 (5%)	980	21				199 (26%)	552	302	5 (1%)	704	344	107 (24%)	334	612	
Ceftazidime																
resistant (n=329)	86 (27%)	238	5	100 (33%)	199	30				9 (3%)	253	67	126 (93%)	10	193	2/110 (2)
sensitive (n=631)	23 (4%)	597	11	43 (7%)	552	36				2 (0.4%)	480	149	15 (5%)	271	345	
Imipenem/ meropenem																
resistant (n=12)	6 (55%)	5	1	7 (58%)	5	–	9 (82%)	2	1				6 (86%)	1	5	2/6 (33)
sensitive (n= 939)	119 (13%)	804	16	137 (16%)	704	98	253 (35%)	480	206				145 (34%)	283	511	
Cefotaxime																
resistant (n= 186)	40 (22%)	143	3	63 (37%)	107	16	126 (89%)	15	45	6 (4%)	145	35				2/118 (2)
sensitive (n= 369)	18 (5%)	345	6	24 (7%)	334	11	10 (4%)	271	88	1 (0.4%)	283	85				

R: resistant; S: sensitive; N: No information; Multi-res.: multiple-resistance
* resistant to gentamicin, ciprofloxacin, ceftazidime, imipenem/meropenem, and cefotaxime
† as a percentage of reports with susceptibility information

Resistance to cefotaxime was indicated in 27% of *Serratia* spp reports with susceptibility information, and resistance to ceftazidime reported in 9% of isolates. At 4%, gentamicin resistance was less commonly reported than for *Klebsiella* or *Enterobacter* spp bacteraemias, although the level of ciprofloxacin resistance (24%) was highest for *Serratia* spp. Two isolates (0.6%) were reported as being resistant to imipenem/meropenem. Of the 136 (17%) isolates, that were reported as having been tested against all five antibiotics, no isolate was reported as being resistant to all five (table 6).

Table 6 Multiple antibiotic resistance patterns for *Serratia* spp bacteraemia laboratory reports, England, Wales, and Northern Ireland: 2002

	Gentamicin			Ciprofloxacin			Ceftazidime			Imipenem/ meropenem			Cefotaxime			Multi-res.*
	R (%†)	S	N	R (%†)	S	N	R (%†)	S	N	R (%†)	S	N	R (%†)	S	N	R (%†)
Gentamicin																
resistant (n=19)				7 (44%)	9	3	2 (12%)	15	2	– (–%)	14	5	2 (50%)	2	15	–/3 (–)
sensitive (n=522)				108 (24%)	350	64	31 (9%)	327	164	2 (1%)	322	198	52 (27%)	144	326	
Ciprofloxacin																

resistant (n=117)	7 (6%)	108	2		14 (15%)	80	23	1 (1%)	85	31	42 (70%)	18	57	–/47 (–)
sensitive (n=367)	9 (3%)	350	8		14 (6%)	240	113	1 (0.5%)	220	146	10 (7%)	125	232	
Ceftazidime														
resistant (n=33)	2 (6%)	31	–	14 (50%)	14	5		1 (3%)	28	4	13 (100%)	–	20	–/12 (–)
sensitive (n=349)	15 (4%)	327	7	80 (25%)	240	29		1 (0.4%)	241	107	39 (26%)	112	198	
Imipenem/ meropenem														
resistant (n=2)	– (–%)	2	–	1 (50%)	1	–	1 (50%)	1	–		–	–	2	–/– (–)
sensitive (n 342)	14 (4%)	322	6	85 (28%)	220	37	28 (10%)	241	73		49 (32%)	105	188	
Cefotaxime														
resistant (n=54)	2 (4%)	52	–	42 (81%)	10	2	13 (25%)	39	2	– (–%)	49	5		–/46 (–)
sensitive (n=148)	2 (2%)	114	32	18 (13%)	125	5	– (–%)	112	36	– (–%)	105	43		

R: resistant; S: sensitive; N: No information; Multi-res.: multiple-resistance
* resistant to gentamicin, ciprofloxacin, ceftazidime, imipenem/meropenem, and cefotaxime
† as a percentage of reports with susceptibility information

Among *Citrobacter* spp bacteraemias, the most commonly reported resistance was to cefotaxime (21%) and ceftazidime (18%), followed by ciprofloxacin (8%), and gentamicin (4%). *Citrobacter* spp vary in their susceptibility to cephalosporins; 34 out of the 42 reports indicating resistance to ceftazidime were *C. freundii*, in seven reports the species was not given, and one report was of *C. koseri* (*diversus*). Only one isolate was reported as being resistant to imipenem/meropenem, and this isolate was reported as being sensitive to gentamicin, ciprofloxacin, ceftazidime, and cefotaxime (table 7). This means that, none of the 80 *Citrobacter* spp reports with susceptibility information on all five antibiotics indicated multiple resistance to all of these antibiotics.

Table 7 Multiple antibiotic resistance patterns for *Citrobacter* spp bacteraemia laboratory reports, England, Wales, and Northern Ireland: 2002

	Gentamicin			Ciprofloxacin			Ceftazidime			Imipenem/ meropenem			Cefotaxime			Multi-res.*
	R (%†)	S	N	R (%†)	S	N	R (%†)	S	N	R (%†)	S	N	R (%†)	S	N	R (%†)
Gentamicin																
resistant (n=13)				6 (24%)	6	1	6 (67%)	3	4	– (–%)	11	2	4 (57%)	3	6	–/5 (–)
sensitive (n=343)				19 (6%)	286	38	35 (16%)	186	122	1 (1%)	198	144	24 (18%)	111	208	
Ciprofloxacin																
resistant (n=27)	6 (24%)	19	2				10 (59%)	7	10	– (–%)	21	6	7 (64%)	4	16	–/5 (–)
sensitive (n=299)	6 (2%)	286	7				26 (13%)	177	96	1 (1%)	177	121	23 (18%)	107	169	
Ceftazidime																
resistant (n=42)	6 (15%)	35	1	10 (28%)	26	6				– (–%)	31	11	22 (96%)	1	19	–/15 (–)
sensitive (n=190)	3 (2%)	186	1	7 (4%)	177	6				1 (1%)	146	43	2 (2%)	81	107	
Imipenem/ meropenem																
resistant (n=1)	– (–%)	1	–	– (–%)	1	–	– (–%)	1	–				– (–%)	1	–	–/1 (–)
sensitive (n=211)	11 (5%)	198	2	21 (11%)	177	13	31 (18%)	146	34				20 (20%)	78	113	
Cefotaxime																
resistant (n=30)	4 (14%)	24	2	7 (23%)	23	–	22 (92%)	2	6	– (–%)	20	10				–/17 (–)

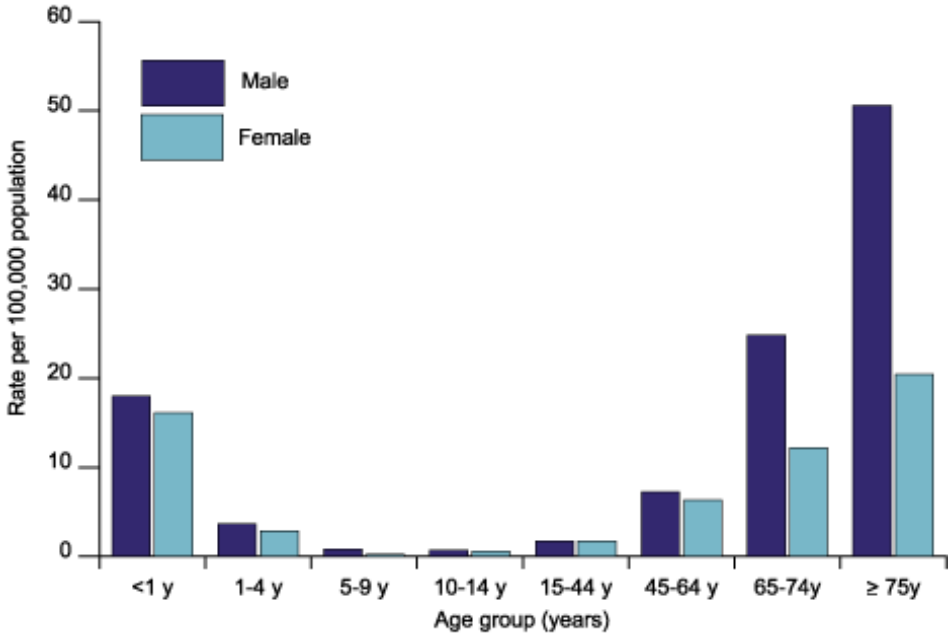
sensitive (n=115)	3 (3%)	111	1	4 (4%)	107	4	**1 (1%)**	81	33	1 (1%)	78	36

R: resistant; S: sensitive; N: No information; Multi-res.: multiple-resistance
* resistant to gentamicin, ciprofloxacin, ceftazidime, imipenem/meropenem and cefotaxime
† as a percentage of reports with susceptibility information

Age distributions

Age-specific rates of *Klebsiella* spp bacteraemia were highest in those aged 75 years and over, for both males and females (figure 5). The second highest rates were seen in the under one year group for females, and the 65 to 74 years age group in males. For females, the lowest rate was in the 5 to 9 years age group, and for males in the 10 to 14 years age group. Reporting rates in males were higher for those in females, substantially so in those aged 75 years and over where they were more than double (50.54 and 20.43 per 100,000 population).

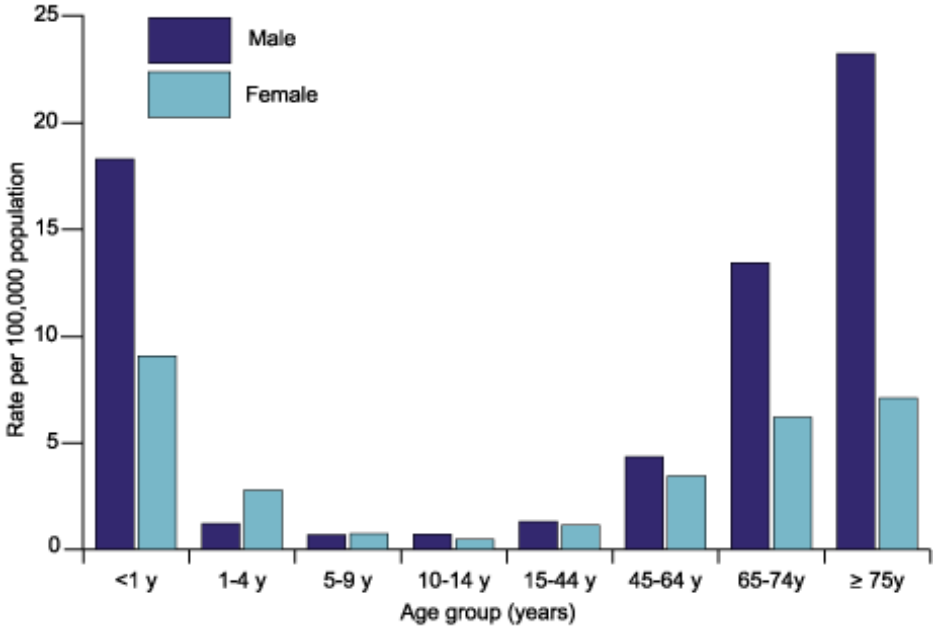
Figure 5 Age-specific rates* of *Klebsiella* spp bacteraemia reports: England, Wales, and Northern Ireland: 2002



* rates calculated using 2001 mid-year resident population estimates

The highest rates of *Enterobacter* spp bacteraemia were reported for those aged 75 years and over for males, and those aged less than one year age group for females (figure 6). Rates in females were only higher than in males for the 1 to 4, and 5 to 9 years age groups where the absolute number of reports was low, but in those aged less than one year and the 65 to 74 years age groups, the rate in males was over twice that for females. In those aged 75 years and over, the rate in males was three times higher than in females.

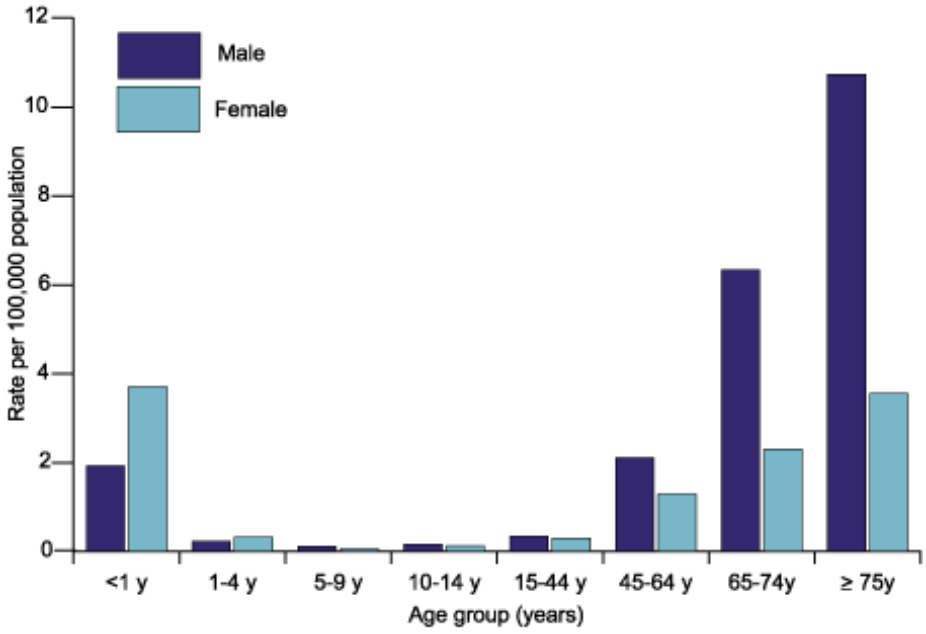
Figure 6 Age-specific rates* of *Enterobacter* spp bacteraemia reports: England, Wales, and Northern Ireland: 2002



* rates calculated using 2001 mid-year resident population estimates

As with *Enterobacter* spp, the rates of *Serratia* spp bacteraemias (figure 7) were highest in males in the oldest age groups, and in females in the youngest age group. In those aged 75 years and over, the rate in males (10.72/100,000) was more than three times that in females (3.55/100,000). In those aged less than one year, rates were higher in females than males, unlike *Klebsiella*, *Enterobacter*, and *Citrobacter* spp.

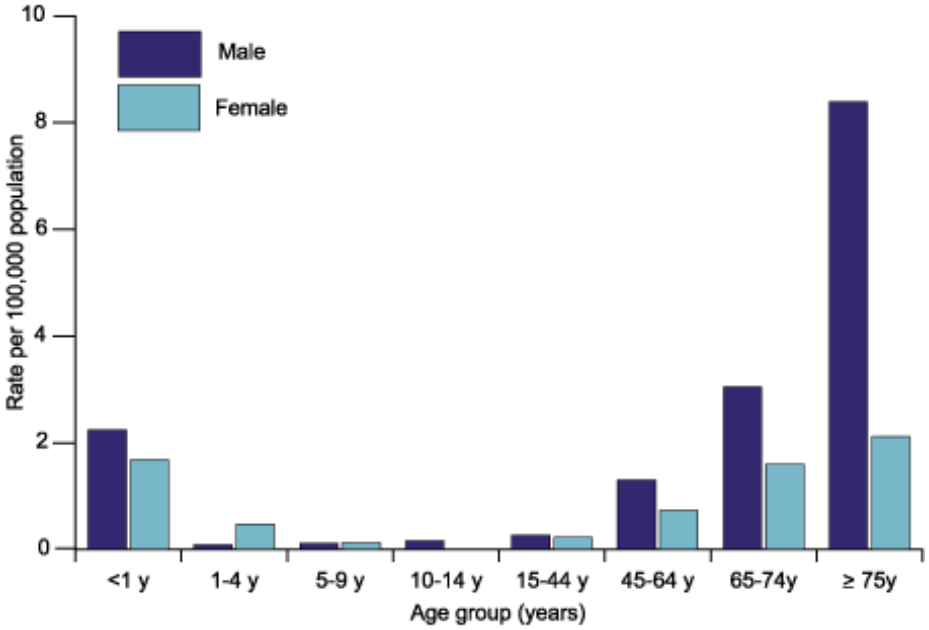
Figure 7 Age-specific rates* of *Serratia* spp bacteraemia reports: England, Wales, and Northern Ireland: 2002



* rates calculated using 2001 mid-year resident population estimates

Rates of *Citrobacter* spp bacteraemias were highest in those aged 75 years and over, for both males and females (figure 8). Rates were higher in males than females in all adult age groups; the greatest difference was in those aged 75 years and over, where the rate in males was nearly four times higher than in females.

Figure 8 Age-specific rates* of *Citrobacter* spp bacteraemia reports: England, Wales, and Northern Ireland: 2002



* rates calculated using 2001 mid-year resident population estimates

Discussion

The data for Northern Ireland, which was not reported in 2001, the number of reports of specimens for the four main genera of bacteria, presented here in 2002, increased considerably from 2001. Using the data from only England and Wales for comparison with 2001 (2), *Citrobacter* spp increased by 8%, *Klebsiella* spp by 11%, *Enterobacter* spp by 12%, and *Serratia* spp by 13%. This does not seem to be due to an increase in the numbers within any particular species. The number of reports without information on the species remained fairly static between 2001 and 2002, and therefore decreased as a proportion of the total number of reports.

For *Klebsiella*, *Enterobacter,* and *Citrobacter* spp bacteraemias, the rate in England was higher than in Wales or Northern Ireland, although this was reversed among *Serratia* spp bacteraemias. The rate of *Serratia* spp bacteraemia in Wales was also high in 2001 (2) witha greater number of reports from one area indicating a local problem. Of the English regions, the North East had the highest rate for *Klebsiella*, *Enterobacter* and *Serratia* spp bacteraemias.

Reporting of susceptibility information for gentamicin, ciprofloxacin, ceftazidime, and imipenem/meropenem improved for all four genera in 2002 compared to 2001. In 2002, however, a smaller proportion of reports contained information on susceptibility to cefotaxime than 2001, for all four genera. Between 2001 and 2002 the proportion of reports indicating resistance to gentamicin increased for all four genera, from 5% to 7% among *Klebsiella* spp, from 9% to 11% among *Enterobacter* spp, and from 3% to 4% for both *Serratia* and *Citrobacter* spp. Resistance to ciprofloxacin remained at 8% among *Citrobacter* spp and increased from 9% to 11% for *Klebsiella* spp. Ciprofloxacin resistance, however, fell from 15% to 14% among *Enterobacter* spp, and from 27% to 24% among *Serratia* spp.

Betwen 2001 and 2002, reported resistance to ceftazidime rose by 2% in *Klebsiella* spp, *Enterobacter* spp and *Citrobacter* spp, but more than doubled in *Serratia* spp, from 4% to 9% of isolates with susceptibility information. Similarly, *Klebsiella* and *Enterobacter* spp bacteraemia reports both indicated a 2% rise in resistance to cefotaxime, but *Citrobacter* and *Serratia* spp reports indicated increases of 5% and 7% respectively.

Twenty-one reports were received in 2002 that indicated resistance to imipenem and/or meropenem, twelve of which were for *Enterobacter* spp. Imipenem and meropenem resistance is still thought to be rare in these genera, so it may be that this is an overestimate of the number of cases. Occasional isolates, however, are genuinely resistant to carbapenems, with resistance resulting either from carbapenemases (3) or, more often, from other mechanisms (4). For this reason, laboratories are encouraged to report apparent imipenem or meropenem resistance in any of these four genera to the Antimicrobial Resistance Monitoring and Reference Laboratory in Colindale, London.

As in 2001, there were two reports of isolates with multiple-resistance to gentamicin, ciprofloxacin, ceftazidime, imipenem/meropenem, and cefotaxime, although in 2002 both isolates were *Enterobacter* spp, rather than one *Enterobacter* and one *Klebsiella* spp.

Age-specific rates of the four genera were very similar between 2001 and 2002. Rates were strikingly higher in males compared to females, up to almost four times higher for *Citrobacter* spp among those aged 75 years and over. Rates also tended to be higher in older age groups compared to younger age groups.

Acknowledgements

These reports would not be possible without the enduring weekly contributions from microbiology colleagues in laboratories across England, Wales, and Northern Ireland, without which there would be no surveillance data. Laboratory reporting is the bedrock of national surveillance. This is your data, so please tell us what you would like done with it. Feedback is welcome, and should be addressed to Georgia Duckworth, (email: georgia.duckworth@hpa.org.uk). In addition, the support from colleagues within the Health Protection Agency, Specialist and Reference Microbiology Laboratory in particular, is valued in the preparation of the reports.

References

1. PHLS. *Escherichia coli*, *Proteus* spp, *Morganella morganii* and *Providencia* spp bacteraemias, England, Wales, and Northern Ireland: 2002. *Commun Dis Rep CDR Wkly* [serial online] 2003 [cited 14 May 2003];**13** (8): Bacteraemia. Available at <http://www.phls.org.uk/publications/cdr/PDFfiles/2003/cdr0803.pdf>

2. PHLS. *Klebsiella* spp, *Enterobacter* spp, *Serratia* spp, and *Citrobacter* spp from bacteraemias, England and Wales 2001. *Commun Dis Rep CDR Wkly* [serial online] 2002 [cited 14 May 2003];**12** (20): Bacteraemia. Available at <http://www.phls.org.uk/publications/cdr/PDFfiles/2002/cdr2002.pdf>

3. Livermore DM. The impact of carbapenemases on antimicrobial development and therapy. *Curr Opin Investig Drugs* 2002; **3**: 218-24.

4. Bornet C, Chollet R, Mallea M, Chevalier J, Davin-Regli A, Pages JM, *et al*. Imipenem and expression of multidrug efflux pump in *Enterobacter aerogenes*. *Biochem BiophysRes Commun* 2003; **301**: 985-90.