

***Pseudomonas* spp. and *Stenotrophomonas maltophilia* bacteraemia in England, Wales, and Northern Ireland, 2007 to 2011**

Introduction

This report contains data voluntarily reported to the Health Protection Agency for bacteraemias due to *Pseudomonas* spp., *Stenotrophomonas maltophilia* and other related species in England, Wales, and Northern Ireland from 2007 to 2011. These analyses are based on data extracted from our voluntary surveillance database on the 3rd July 2012. The data presented here may differ in some instances from data in earlier publications due to the addition of late reports to the database.

- *Pseudomonas* spp. accounted for 3.9-4.2% of all reported bacteraemias between 2007 and 2011, with *Stenotrophomonas* spp. contributing 0.5-0.8% during the same time period.
- From 2007 to 2011, there was a 6% decrease in the number of *Pseudomonas* spp. bacteraemias reported to the HPA (3,924 reports in 2007 compared with 3,687 reports in 2011). This decrease is similar to the 7% decrease in reports for all bacteraemia between 2007 (99,534 reports) and 2011 (92,351 reports). In 2011, 91% of *Pseudomonas* spp. isolates from bacteraemia were identified to species level (3,367 reports), with 92% of these identified as *P. aeruginosa*.
- For *S. maltophilia* bacteraemia, there was a 38% decrease in the number of bacteraemias reported to the HPA between 2007 and 2011 (471 reports in 2011 compared with 759 in 2007).
- The overall incidence in 2011 for *Pseudomonas* spp. bacteraemia was 6.5 cases/100,000 population in England, Wales and Northern Ireland. As the data were obtained via a voluntary surveillance system, this incidence figure is likely to be an underestimate of the true incidence. The data captured by the mandatory surveillance reporting systems for *S. aureus* and *E. coli* bacteraemia in England suggests that the voluntary surveillance system captures ~80% of all reports (Note: Wales and Northern Ireland do not take part in the English mandatory surveillance scheme). However, both mandatory and voluntary systems have demonstrated consistent trends in reporting between 2006-2010.¹
- Infections were reported significantly more among those aged 65 years and older, especially among male patients with a rate of 34.7 cases/100,000 population compared with 14.7 cases/100,000 for female patients among this age group. Reported cases of *Pseudomonas* spp. in children aged <1 year were the second highest group, with a rate of 12.5 and 9.2 cases/100,000 for males and females, respectively.
- The proportion of *P. aeruginosa* isolates that were resistant to piperacillin/tazobactam increased by 2% (from 5% to 7%) between 2007 and 2011, whereas resistance to imipenem (14%), meropenem (9%), ceftazidime (8%), ciprofloxacin (11%) and gentamicin (6%) remained static.
- The overall incidence in 2011 for *S. maltophilia* bacteraemia was 0.8 cases/100,000 population in England, Wales, and Northern Ireland. *S. maltophilia* was reported most frequently for male patients <1 year old and >64 years old. There were no significant changes in non-susceptibility to co-trimoxazole (5%).

Acknowledgements

These reports would not be possible without the weekly contributions from microbiology colleagues in laboratories across England, Wales, and Northern Ireland, without whom there would be no surveillance data. The support from colleagues within the Health Protection Agency, Antimicrobial Resistance and Healthcare Associated Infections Reference Unit, in particular, is valued in the preparation of the report. Feedback and specific queries about this report are welcome and can be sent to hcai.amrddivision@hpa.org.uk.

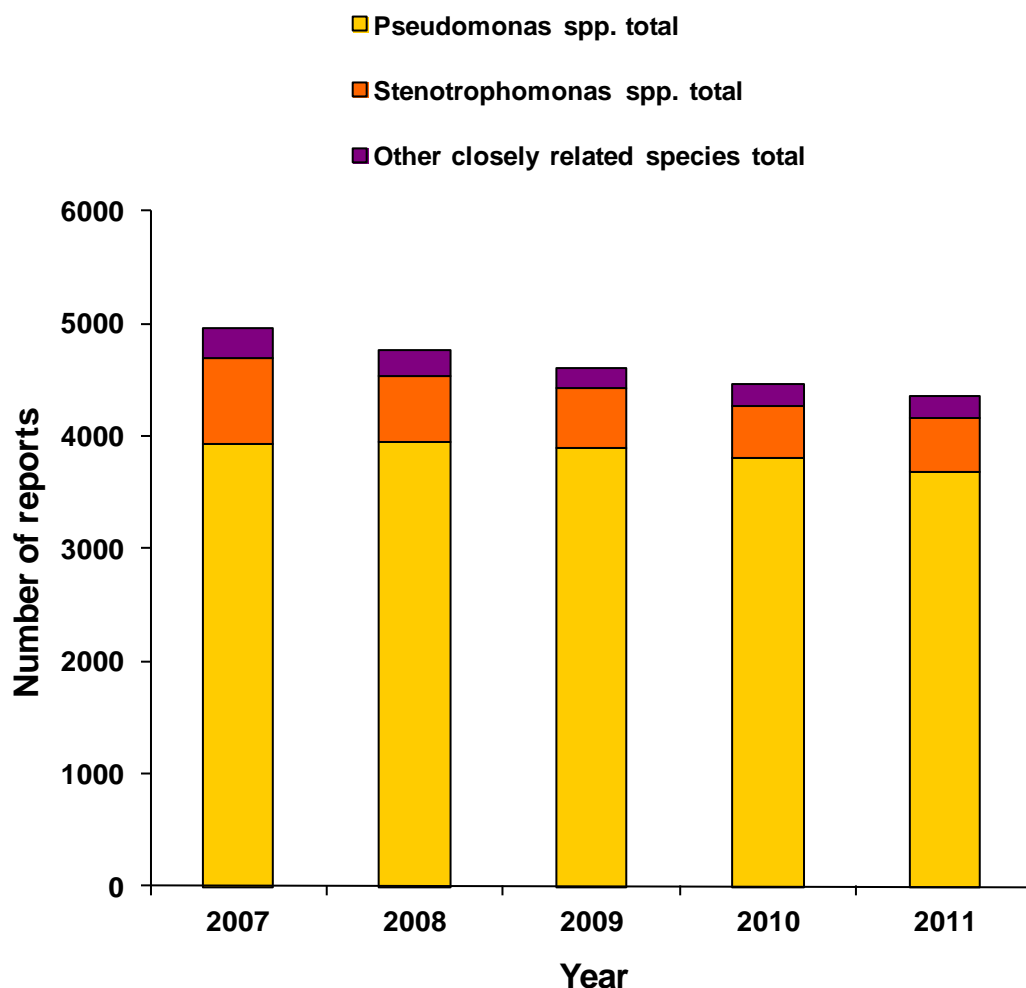
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Trends in reports

There has been a 3% decrease in the total bacteraemia reports of *Pseudomonas* spp., *S. maltophilia*, and other closely related genera (Figure 1) reported in 2011 (4,351 reports), compared to 2010 (4,472 reports) via the voluntary surveillance scheme. This decrease is in comparison to the 1% increase in reports for all bacteraemia from 2010 to 2011.

In terms of the 5-year trend from 2007 to 2011, there has been a 6% decrease in reports of bacteraemia with *Pseudomonas* spp., *Stenotrophomonas maltophilia* and related species from 4,955 to 4,351 reports respectively. This decrease is similar to the 7% decrease in reports for all bacteraemia seen between 2007 and 2011 (99,534 to 92,351) via the voluntary surveillance scheme during the same time period. Reports for 2011 are provisional as of 3rd July, 2012 and the number of reported cases of bacteraemia will almost certainly increase slightly as late reports are received.

Figure 1. *Pseudomonas* spp. and *S. maltophilia* and other related species⁺ bacteraemia reports: 2007 to 2011*



⁺ *Brevibacterium* spp., *Brevundimonas* spp., *Burkholderia* spp., *Comamonas* spp., *Flavimonas* spp., *Ralstonia* spp., *Shewanella* spp., *Sphingomonas* spp.

* Data extracted 3 July, 2012

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Completeness of laboratory reports

The number of laboratories voluntarily reporting data for *Pseudomonas* spp. and *S. maltophilia* bacteraemia has decreased from 181 in 2007 to 174 in 2011 (Table 1). This may reflect factors such as laboratory mergers which will result in a decrease in numbers of laboratories reporting data. The percentage of laboratories reporting drug susceptibility data increased from 92% in 2007 to 95% in 2011.

Table 1. Laboratories reporting *Pseudomonas* spp., and *S. maltophilia* bacteraemia (England, Wales and Northern Ireland): 2007 to 2011*

	2007	2008	2009	2010	2011
Number of reporting laboratories	181	179	180	176	174
Laboratories identifying to species level	100%	99%	99%	99%	100%
Laboratories reporting susceptibility data	92%	94%	96%	96%	95%
Laboratories identifying to species level and reporting susceptibility data	92%	93%	95%	96%	95%

* Data extracted 3 July, 2012

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Species-specific data

Table 2 gives a breakdown of numbers of reports by species from 2007 to 2011:

- From 2007 to 2011, there was a 6% decrease in the number of *Pseudomonas* spp. bacteraemias reported to the HPA (3,924 reports in 2007 compared with 3,687 reports in 2011). In 2011, 91% of *Pseudomonas* spp. isolates from bacteraemia were identified to species level (3,367 reports), with 92% of these identified as *P. aeruginosa*.
- The number of *S. maltophilia* reports decreased by 38% from 759 in 2007 to 471 in 2011. This decrease was seen across all regions.
- Of the related genera in 2011, bacteraemia were most frequently reported for *Sphingomonas* spp. (68 reports), and *Burkholderia* spp. (45 reports).

Table 2. Bacteraemia reports of *Pseudomonas* spp, *S. maltophilia*, and other related genera, England, Wales, and Northern Ireland: 2007-2011*

	2007	2008	2009	2010	2011
<i>Pseudomonas aeruginosa</i>	3090	3142	3248	3192	3108
<i>Pseudomonas fluorescens</i>	67	73	65	64	40
<i>Pseudomonas putida</i>	67	75	56	66	69
<i>Pseudomonas stutzeri</i>	89	83	73	62	81
<i>Pseudomonas</i> spp., other named	58	69	53	49	69
<i>Pseudomonas</i> spp., species not recorded	553	515	405	375	320
<i>Pseudomonas</i> spp. total	3924	3957	3900	3808	3687
<i>Stenotrophomonas maltophilia</i>	759	571	519	453	471
<i>Stenotrophomonas</i> spp., species not recorded	10	2	3	0	5
<i>Stenotrophomonas</i> spp. total	769	573	522	453	476
<i>Brevibacterium</i> spp. total	15	16	15	21	19
<i>Brevundimonas</i> spp. total	48	45	25	28	26
<i>Burkholderia</i> spp. total	46	29	35	45	45
<i>Comamonas</i> spp. total	19	25	19	19	22
<i>Flavimonas</i> spp. total	19	12	9	5	3
<i>Ralstonia</i> spp. total	16	15	8	17	2
<i>Shewanella</i> spp. total	4	6	5	2	3
<i>Sphingomonas</i> spp. total	95	81	76	74	68

* Data extracted 3 July, 2012

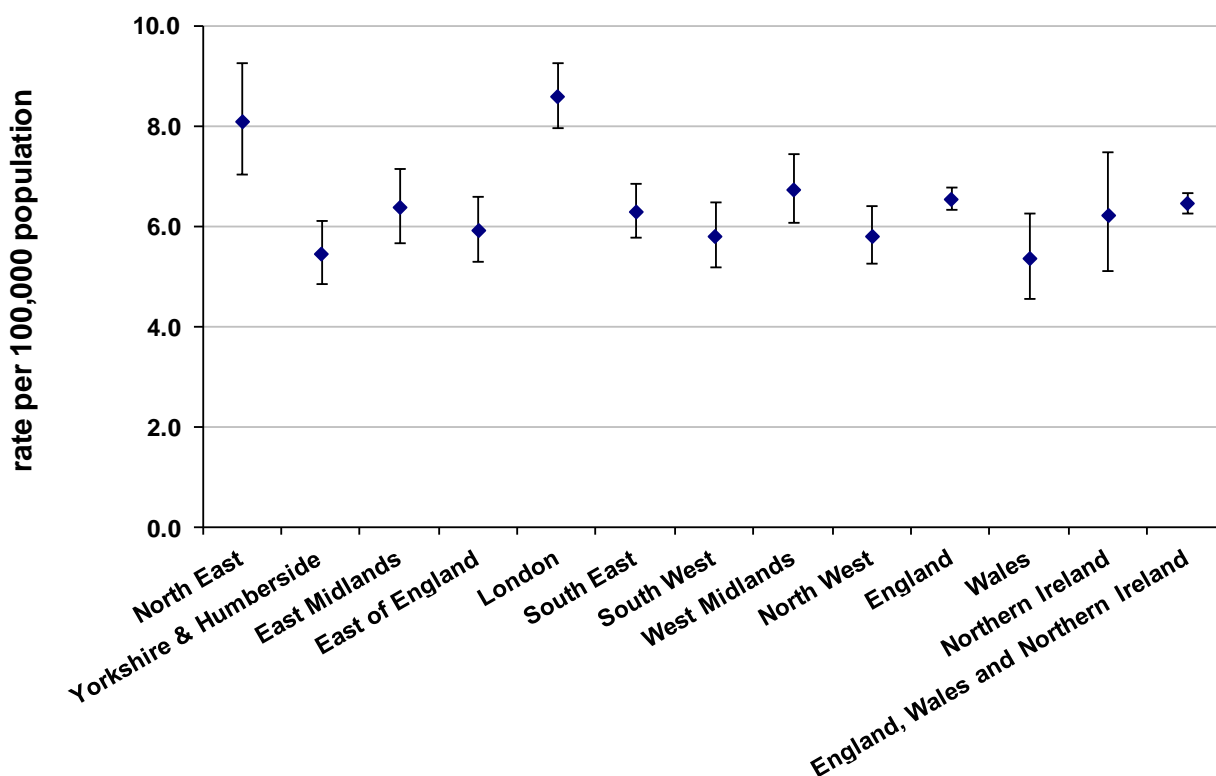
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Distribution by region

Figures 2 and 3 show regional distributions of *Pseudomonas* spp. and *S. maltophilia* bacteraemia in 2011, respectively.

For *Pseudomonas* spp., the overall reported incidence for England, Wales, and Northern Ireland was 6.5 cases/100,000 population. The region with the highest incidence was London (8.6/100,000 population). Low incidences were noted for Wales (5.4/100,000) and Yorkshire & Humberside (5.5/100,000). As data collection is based on a voluntary reporting system, it is important to note that regional incidence rates are affected by completeness of regional reporting.

Figure 2. Region-specific rates of *Pseudomonas* spp. bacteraemia: England, Wales, and Northern Ireland, 2011*



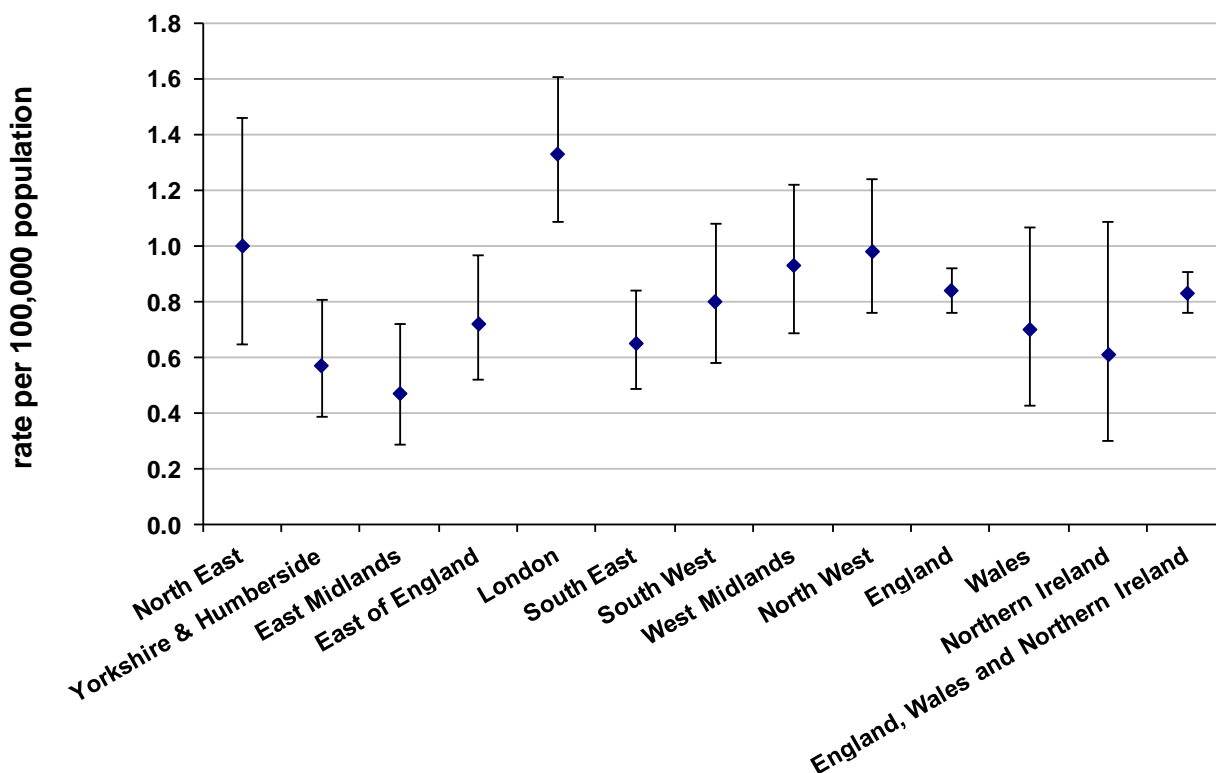
* Data extracted 24 June, 2011; rates are calculated using 2010 mid-year resident population estimates based on the 2001 census for England, Wales, and Northern Ireland.

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Distribution by region (continued)

For *S. maltophilia*, the overall reported incidence for England, Wales, and Northern Ireland was 0.8 cases/100,000 population. Regions with high incidence include London (1.3/100,000), the North East (1.0/100,000) and the North West (1.0/100,000). Low incidences were noted for the East Midlands (0.5/100,000) and the Yorkshire & Humberside (0.6/100,000).

Figure 3. Region-specific rates of *S. maltophilia* bacteraemia: England, Wales, and Northern Ireland, 2011*



* Data extracted 3 July, 2012; rates are calculated using 2010 mid-year resident population estimates based on the 2001 census for England, Wales, and Northern Ireland.

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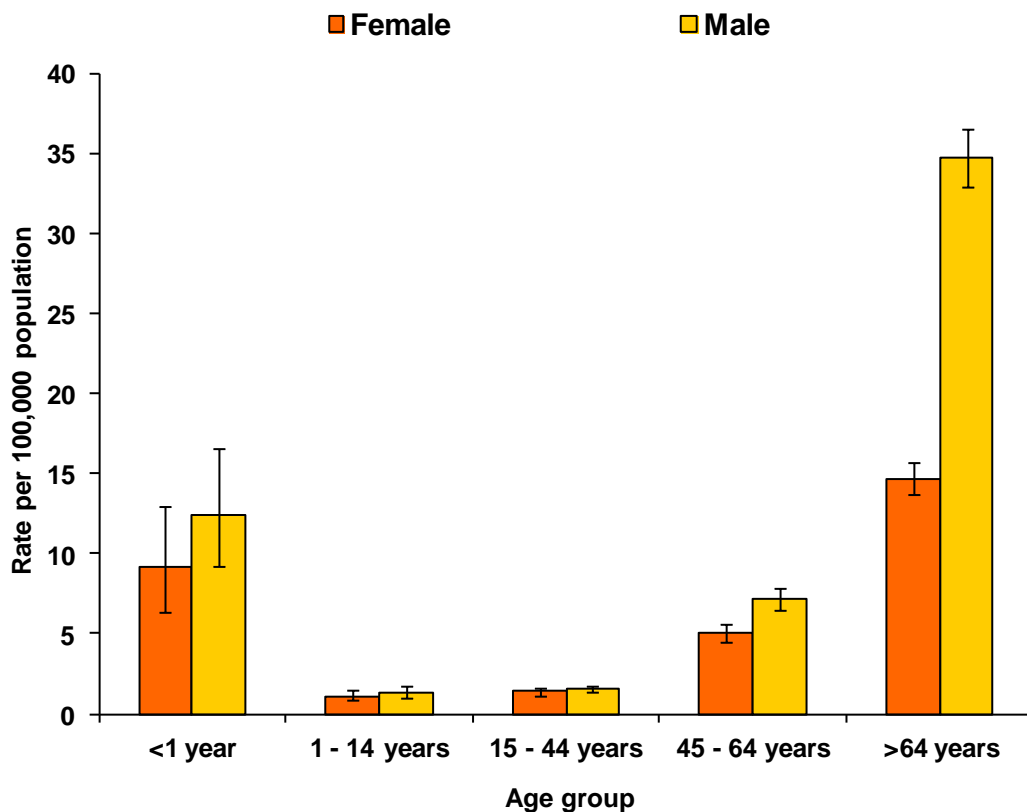
Age and sex distribution

Figures 4 and 5 show the age and sex distribution (incidence/100,000 population) of bacteraemia reports for *Pseudomonas* spp. and *S. maltophilia*, respectively.

For *Pseudomonas* spp. the proportion of reports was higher in males than in females among all patient age groups, with the highest rates recorded for males aged 65 and over (34.7/100,000 population).

In comparison to *Pseudomonas* spp., bloodstream infection with *S. maltophilia* was less common, but was also reported more frequently for male patients aged <1 year, 45-64 years and 65 and over.

Figure 4. *Pseudomonas* spp. bacteraemia reports in 2011 by age and sex*

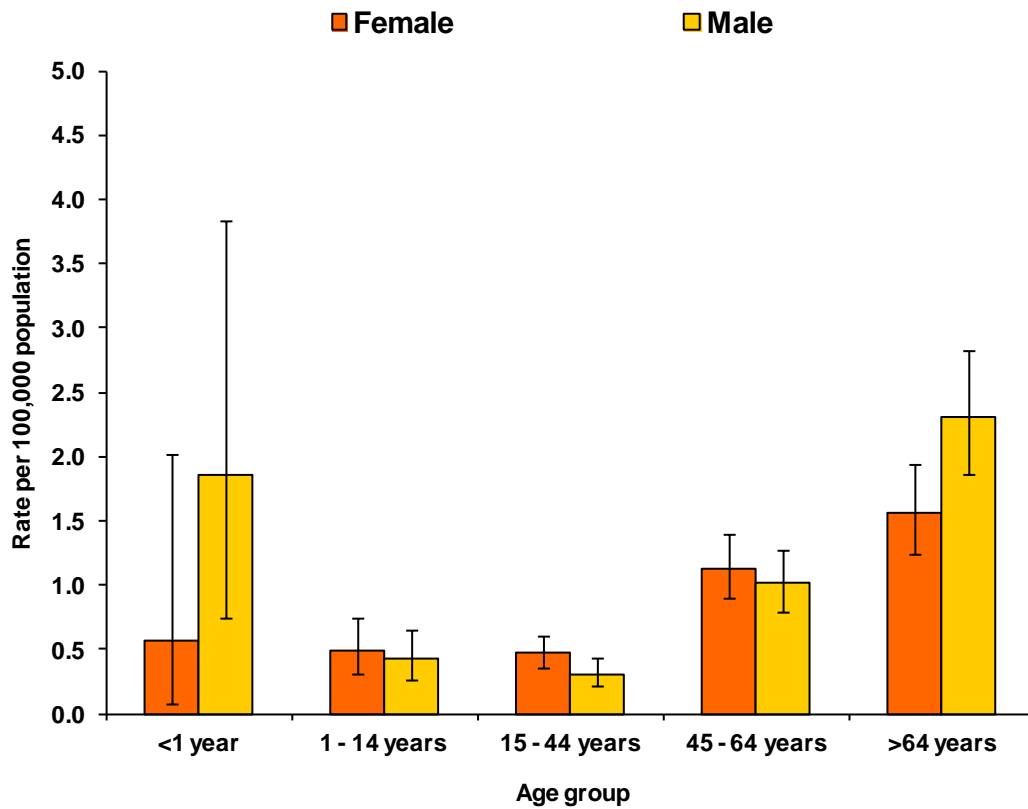


* Data extracted 3 July, 2012

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Age and sex distribution (continued)

Figure 5. *S. maltophilia* bacteraemia reports in 2011 by age and sex*



* Data extracted 3 July, 2012

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Antimicrobial susceptibility

Tables 3 and 4 present antibiotic susceptibility data for *Pseudomonas aeruginosa*, and for *Stenotrophomonas maltophilia*, respectively.

The proportion of *P. aeruginosa* isolates that were resistant to piperacillin/tazobactam increased by 2% (from 5% to 7%) between 2007 and 2011; this increase was statistically significant at the 5% level ($p=0.01$). Resistance to all the other antimicrobials listed in table 3 remained stable during the period 2007-2011; imipenem (14%), meropenem (9%), ceftazidime (8%), ciprofloxacin (11%) and gentamicin (6%). Ascertainment of susceptibility results for meropenem has increased from 45% in 2007 to 71% in 2011.

Table 3. Antibiotic susceptibility for *P. aeruginosa* bacteraemia reports, England, Wales and Northern Ireland, 2007-2011*

<i>P. aeruginosa</i>		2007	2008	2009	2010	2011
Total reports:		3090	3142	3248	3192	3108
Piperacillin/ Tazobactam	% Non-susceptible	5%	6%	8%	7%	7%
	Reports with susceptibility data	2324	2489	2509	2570	2542
Imipenem	% Non-susceptible	12%	9%	13%	12%	14%
	Reports with susceptibility data	1147	1111	1172	1038	924
Meropenem	% Non-susceptible	9%	10%	11%	9%	9%
	Reports with susceptibility data	1396	1713	1785	2017	2210
Ceftazidime	% Non-susceptible	8%	7%	8%	8%	8%
	Reports with susceptibility data	2514	2483	2461	2530	2524
Ciprofloxacin	% Non-susceptible	12%	11%	11%	10%	11%
	Reports with susceptibility data	2646	2656	2709	2696	2701
Gentamicin	% Non-susceptible	5%	4%	4%	5%	6%
	Reports with susceptibility data	2754	2784	2778	2812	2808

* Data extracted 3 July, 2012

- Most imipenem-resistant *P. aeruginosa*, have reduced permeability (specifically, via loss of OprD porin), whereas those with meropenem and doripenem resistance have a combination of reduced permeability and up-regulated efflux, particularly of the MexAB-OprM pump.
- However, the HPA's Antimicrobial Resistance and Healthcare Associated Infections (AMRHAI) Reference Unit* receives a steady influx of *P. aeruginosa* and, in smaller numbers, other *Pseudomonas* spp. in which resistance to carbapenems is mediated by carbapenem-hydrolyzing metallo- β -lactamases ('metallo-carbapenemases'; MBLs).
- Unlike the mutations that cause porin loss or increased efflux, carbapenemase production involves acquired genes, which may be transferred between strains.
- From 2007-2011, AMRHAI confirmed 219 MBL-producing *Pseudomonas* isolates (from any source, not just blood culture); 35 in 2007, 30 in 2008, 41 in 2009, 76 in 2010 and 37 in 2011. These included 197 (90%) *P. aeruginosa* isolates.

* AMRHAI is a new Reference Unit within HPA Microbiology Services - Colindale, formed by the merger of the Antibiotic Resistance Monitoring and Reference Laboratory (ARMRL) and the Laboratory of Healthcare Associated Infections (LHCAI).

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- Most of the carbapenemase-producing *P. aeruginosa* had VIM-type MBLs (184 isolates, 93%), though a minority had IMP-types (13, 7%).
- MBL-producing *P. aeruginosa* are a nationally scattered problem although several UK hospitals have had persistent strains causing infections over several years, rather than classic outbreaks.
- The carbapenemase producers are from a variety of clinical settings though **none of the isolates has been from cystic fibrosis (CF)**, where *P. aeruginosa* with complex mixtures of mutational resistances continue to dominate.
- Many of these MBL-producing isolates are resistant to multiple antibiotic classes besides carbapenems, with only colistin remaining active against >90%.

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Antimicrobial susceptibility (continued)

It is difficult to determine the true susceptibility of *S. maltophilia* to aminoglycosides and polymyxins as temperature and medium can influence the results and cause resistant isolates to appear susceptible at 37°C. However, the favoured treatment option for this species is co-trimoxazole and provides more stable results for interpretation when tested.²

Although there were no significant changes in non-susceptibility of *S. maltophilia* to co-trimoxazole (5%) between 2007 and 2011, ascertainment of susceptibility results increased from 32% in 2007 to 58% in 2011.

Table 4. Antibiotic susceptibility for *S. maltophilia* bacteraemia reports, England, Wales and Northern Ireland, 2007-2011*

<i>S. maltophilia</i>	2007	2008	2009	2010	2011
Total reports:	759	571	519	453	471
Co-trimoxazole					
% Non-susceptible	4%	4%	7%	5%	5%
Reports with susceptibility data	243	223	230	248	272

* Data extracted 3 July, 2012

¹ HPA. Health Protection Report: Voluntary reporting of *Staphylococcus aureus* bacteraemia in England, Wales and Northern Ireland, 2010. Published 19 August 2011, Volume 5 Number 33. Available: http://www.hpa.org.uk/webc/HPAwebFile/HPAweb_C/1313155060238 [accessed 3rd July 2012]

² British Society of Antimicrobial Chemotherapy, (2010). *Susceptibility Testing - BSAC Standardized Disc Susceptibility Testing Method, Additional Methodology, Stenotrophomonas maltophilia* [online]. Available: <http://www.bsac.org.uk/Resources/BSAC/steno.pdf> [accessed 3rd July 2012]