Suitability of current routinely-generated data for surveillance of antimicrobial resistance of *Escherichia coli* and *Pseudomonas aeruginosa* in the UK and Ireland

R. Reynolds[1], N. Potz[2] and The BSAC Extended Working Party on Bacteraemia Resistance Surveillance[1]

[1]British Society for Antimicrobial Chemotherapy, Birmingham, B1 2JS [2]Health Protection Agency, London, NW9 5HT

Background, methods & conclusion

Introduction: Clinical laboratories' routine data are used in some surveillance systems for antimicrobial resistance, but:

- **Do routine tests detect resistance reliably?**
- **Is there selection bias for testing particular antibiotics?**

Methods. 29 UK and Irish laboratories contributed blood isolates of *E. coli* (EC) and *P. aeruginosa* (PA) and their routine results for these isolates to the BSAC Bacteraemia Resistance Surveillance Programme in 2001 and 2002. MICs were determined centrally by the BSAC agar dilution method. Local results for *E. coli* with AMP *or* AMX were used for comparison with central AMX results. Local results may be by BSAC disc, Stokes', NCCLS or automated methods. Abbreviations AMC amoxicillin/ clavulanate, AMP ampicillin, AMX amoxicillin, CAZ ceftazidime, CIP ciprofloxacin, CXM cefuroxime, GEN gentamicin, IPM imipenem, TZP piperacillin/ tazobactam

Results: See panels. (Note: AMX and AMC breakpoints for *E. coli* have changed since abstract submission and results have been re-analysed: the effect is to reduce apparent resistance rates and increase local detection of resistance.)

Conclusion: Routine susceptibility data on *E. coli* and *P. aeruginosa* can be useful for surveillance but there is some evidence of selection bias and under-detection of some resistances, so cautious interpretation is needed for some antimicrobials. Further efforts to increase reliability and standardisation are warranted.

Acknowledgements

Working Party Members (Dec 2003): A. MacGowan[1] (Chair), M. Allen[2], D. Brown[3], N. Deaney[4], I. Harding[5], D. Livermore[6], N. Potz[6], V. Reed[5], R. Reynolds[1], C. Thomson[7], G. Thorne[8], A. White[9], R. Wiltshire[10]

Organism ID and Susceptibility Testing: M. Colman[6], A. Williams[6].

[1]North Bristol NHS Trust; [2]Wyeth; [3]Addenbrookes Hospital, Cambridge; [4]Merck, Sharp & Dohme; [5]Micron Research Limited; [6]Health Protection Agency; [7]Bayer Pharmaceuticals; [8]Cubist Pharmaceuticals; [9]GlaxoSmithKline; [10]Pfizer.

Collecting Laboratories:Ashford HPA; Bangor HPA; Belfast City; City Birmingham; Bristol HPA; West Suffolk Hospital, Bury St Edmunds; Cambridge HPA; Cardiff HPA; Chelmsford HPA; Chester HPA; Cork University; Coventry HPA; Ninewells Dundee; Beaumont Dublin; Glasgow Royal; Victoria Kirkcaldy; Altnagelvin Londonderry; Manchester HPA; Middlesbrough HPA; Freeman Newcastle; Norwich HPA; Nottingham HPA; Sheffield HPA; Shrewsbury HPA; Southampton HPA; St Mary's London; Sunderland Royal; Truro HPA; UCH, London.

Sponsored by: Cubist, Merck, Sharp & Dohme, Pfizer, Wyeth

Supported by: BSAC

Central Laboratory: HPA, London

www.bsac.org.uk

Correspondence: Dr. R. Reynolds, BSAC Resistance Surveillance Co-ordinator Department of Medical Microbiology, Southmead Hospital, Bristol, BS10 5NB, England.

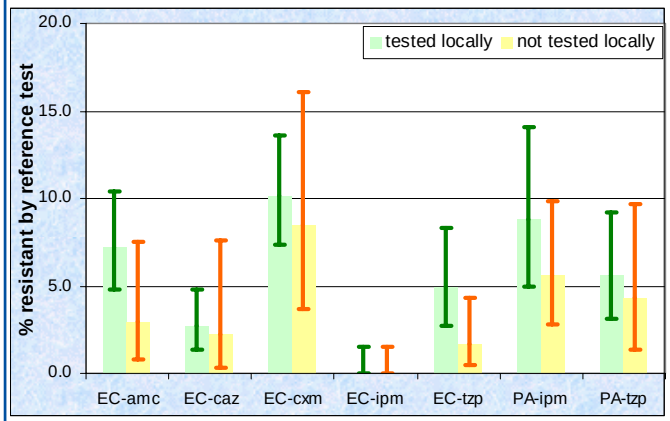
14th ECCMID, Prague, 1 - 4 May 2004, P1100 rosy.reynolds@btinternet.com

Selection bias?

species & drug	# tested, not tested locally	% tested locally
EC AMX	475, 20	96
EC AMC	361, 134	73
EC CAZ	403, 92	81
EC CIP	479, 16	97
EC CXM	401, 94	81
EC GEN	489, 6	99
EC IPM	246, 249	50
EC TZP	262, 233	53
PA CAZ	342, 25	93
PA CIP	361, 6	98
PA GEN	362, 5	99
PA IPM	171, 196	47
PA TZP	250, 117	68

There was little scope for selection bias in *E. coli* with AMX/AMP, CIP or GEN or for *P. aeruginosa* with CAZ, CIP or GEN since over 90% of isolates were tested locally against these agents. Otherwise, locally tested isolates were more likely than others to prove resistant on central testing. Risk ratios ranged from 1.1 (EC-AMC) to 2.9 (EC-TZP), but confidence intervals were wide as resistance rates were low, so the differences were not statistically significant.

Combinations with <90% testing rates are shaded blue.



In ***E. coli*** there was no clear evidence that isolates locally found resistant to AMX (AMP), CIP or GEN were more likely to be tested against other agents, although this was the general tendency and e.g. TZP was tested in 68% of locally CIP-resistant isolates vs. 53% of locally CIP-susceptible (p=0.15).

In ***P. aeruginosa*** there was clear evidence that isolates locally found resistant to GEN were more likely than those found not resistant to be tested against IPM (83 vs. 44% tested, RR=1.9, p=0.001) and TZP (94 vs 67% tested, RR= 1.4, p=0.017).

Detection of resistance?

species & drug	susceptibility breakpoint S <= mg/L	susceptibility local detection	resistance breakpoint R >= mg/L	resistance local detection
EC AMX	16	181/209 = 87%	32	248/266 = 93%
EC AMC	16	287/335 = 86%	32	21/26 = 81%
EC CAZ	2	385/392 = 98%	4	5/11 = 45%
EC CIP	1	441/443 = 100%	2	32/36 = 89%
EC CXM	8	331/360 = 92%	16	19/41 = 46%
EC GEN	1	428/435 = 98%	2	19/54 = 35%
EC IPM	4	246/246 = 100%	8	none resistant
EC TZP	16	246/249 = 99%	32	6/13 = 46%
PA CAZ	8	310/330 = 94%	16	8/12 = 67%
PA CIP	1	308/313 = 98%	8	23/26 = 88%
PA GEN	1	201/203 = 99%	8	15/23 = 65%
PA IPM	4	151/156 = 97%	8	10/15 = 67%
PA TZP	16	224 / 236 = 95%	32	4/14 = 29%

Combinations with <70% detection of resistance are shaded blue.

Susceptibility was detected reliably: >85% in all combinations and >95% in most. **Resistance** was detected reliably for EC-AMX (>90%), and for EC-AMC, EC-CIP and PA-CIP (>80%). In other combinations, resistance was not reliably detected (<70%).

Undetected resistance in *E. coli*

AMC, CXM - all isolates with undetected resistance had MICs within one or two dilutions of the resistance breakpoint.

CIP, GEN - most isolates with undetected resistance had MICs within one or two dilutions of the resistance breakpoint (but 1/2 with GEN MIC 256 mg/L and 1/5 with CIP MIC 16 mg/L also escaped detection).

AMX - the majority of resistant isolates (253/266) had MICs of ≥512 mg/L and 10 of these (4%) escaped detection.

CAZ, TZP - resistance detection rates were low at all MIC levels e.g. 1/2 with CAZ and 1/3 with TZP MIC of ≥512 mg/L were not identified as resistant.

Undetected resistance in *P. aeruginosa*

all agents - most isolates with undetected resistance had MICs within one or two dilutions of the resistance breakpoint (but 1/1 with TZP MIC 256 mg/L and 1/1 with GEN MIC 64 mg/L also escaped detection).