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Rising ESBL Production and Ciprofloxacin Resistance in Invasive Enterobacteriaceae in the UK and Ireland

rreynolds@bsac.org.uk
Dr. Rosy Reynolds
Department of Medical Microbiology,
Southmead Hospital, Bristol, BS10 5NB, England.

R. Reynolds[1], R. Hope[2], M. Colman[2], N. Potz[2], D. Livermore[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

Methods

- The BSAC Bacteraemia Resistance Surveillance Programme[1] received 3999 non-duplicate Enterobacteriaceae isolates from 29 UK and Irish laboratories in 2001 - 2004.
- MICs were determined centrally by the BSAC agar dilution method and interpreted by BSAC criteria.
- ESBL production was inferred when ceftazidime, cefotaxime or cefepime MICs for resistant isolates were reduced ≥ 8-fold by clavulanate. *bla*$_{CTX-M}$ genes were sought by PCR.

[1]Reynolds, R., Potz, N., Colman, M. *et al.* (2004). Antimicrobial Susceptibility of the Pathogens of Bacteraemia in the UK and Ireland 2001 - 2002: the BSAC Bacteraemia Resistance Surveillance Programme. *JAC* 53, 1018-1032.

Results

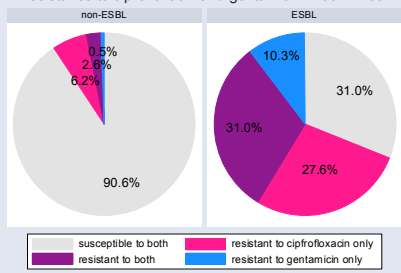
- ESBLs were detected in 89/961 *Klebsiella* isolates, 59/809 *Enterobacter*, 29/991 *E. coli*, 2/109 *Citrobacter*, 1/718 *Proteus,* and none of 115 *Morganella*, 256 *Serratia* or 39 other isolates.
- ESBL prevalence increased over time in *E. coli* and *Klebsiella*. The proportion of CTX-M increased in *E. coli*, *Klebsiella* and *Enterobacter*.
- Ciprofloxacin resistance increased over time in *E. coli*, *Klebsiella* and Proteeae. Gentamicin resistance increased in *Klebsiella*.
- Ciprofloxacin and gentamicin resistances were strongly associated with ESBL production ($p < 10^{-8}$).
- Most ESBL producers (89 - 100%) retained low MICs of imipenem (≤ 4 mg/L), ertapenem (≤ 2 mg/L) and tigecycline (≤ 2 mg/L).

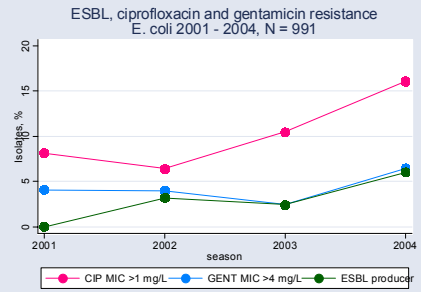
Conclusions

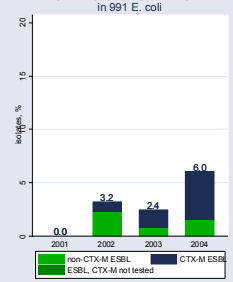
- The spread of CTX-M enzymes in the UK and Ireland has contributed to a sharp rise in ESBL-producing *E. coli* and *Klebsiella* from bacteremias.
- Ciprofloxacin resistance has also increased in these species.
- Imipenem, ertapenem and tigecycline retained good activity against most ESBL-producers.

Escherichia coli

E. coli at MIC shown (mg/L)		
	ESBL-negative	ESBL-positive
CIP >1	85 / 962 (8.8%)	17 / 29 (59%)
GEN >4	30 / 962 (3.1%)	12 / 29 (41%)
IPM >4	0 / 962	0 / 29
ETP >2	0 / 717	0 / 29
TGC >2	0 / 717	0 / 29

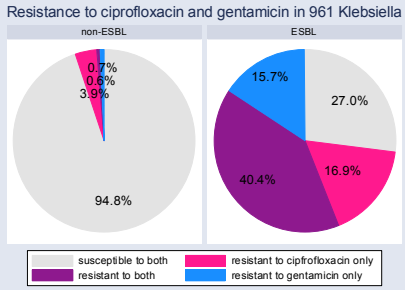


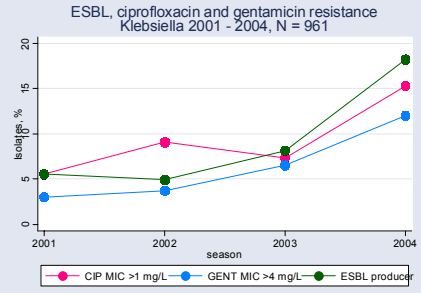


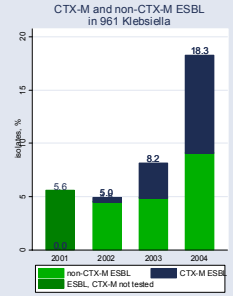


Klebsiella spp.

Klebsiella spp. at MIC shown (mg/L)		
	ESBL-negative	ESBL-positive
CIP >1	39 / 872 (4.5%)	51 / 89 (57%)
GEN >4	11 / 872 (1.3%)	50 / 89 (56%)
IPM >4	0 / 872	0 / 89
ETP >2	0 / 652	1 / 76 (1%)
TGC >2	24 / 652 (3.7%)	4 / 76 (5%)

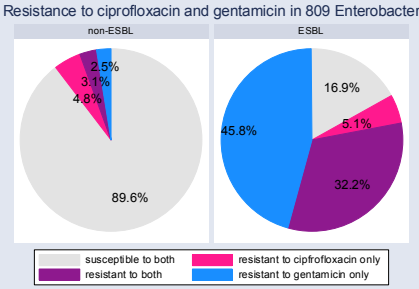


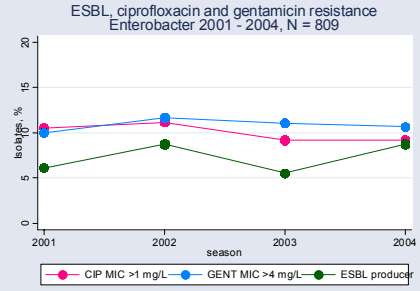




Enterobacter spp.

Enterobacter spp. at MIC shown (mg/L)		
	ESBL-negative	ESBL-positive
CIP >1	59 / 750 (7.9%)	22 / 59 (37%)
GEN >4	42 / 750 (5.6%)	46 / 59 (78%)
IPM >4	2 / 750 (0.3%)	0 / 59
ETP >2	5 / 581 (0.9%)	0 / 48
TGC >2	20 / 581 (3.4%)	5 / 48 (10%)





Working Party Members (August 2005): A. MacGowan[1] (Chair), M. Allen[2], S. Barrière[3], D. Brown[4], N. Deaney[5], I. Harding[6], R. Hennings[7], R. Hope[8], D. Lewis[9], D. Livermore[8], V. Reed[6], R. Reynolds[1], C. Thomson[10], A. White[11], R. Wiltshire[12].

Organism ID and Susceptibility Testing: M. Colman[8], R. Hope[8], N. Potz[8].

[1]North Bristol NHS Trust; [2]Wyeth; [3]Theravance; [4]Addenbrookes Hospital, Cambridge; [5]Merck, Sharp & Dohme; [6]Micron Research Limited; [7]Chiron Biopharmaceuticals; [8]Health Protection Agency, London; [9]HPA South West; [10]Bayer Pharmaceuticals; [11]consultant ; [12]Pfizer.

Central Laboratory: HPA, Centre for Infections, London.

Collecting Laboratories: *England*: William Harvey Hosp., Kent; Birmingham City Hosp.; Bristol Royal Infirmary; West Suffolk Hosp.; Addenbrooke's Hosp., Cambridge; Chelmsford HPA; Countess of Chester Hosp.; Coventry & Warwickshire Hosp.; Royal Infirmary, Leicester; St Mary's Hosp., London; University College Hosp., London; Wythenshawe Hosp., Manchester; Freeman Hosp., Newcastle; Norfolk & Norwich Hosp., University Hosp., Nottingham; Northern General Hosp., Sheffield; Royal Shrewsbury Hosp.; Southampton General Hosp.; Sunderland Royal Hosp.; Treliske Hosp., Truro. *Ireland*: Cork University Hosp.; Beaumont Hosp., Dublin. *N. Ireland*: Belfast City Hosp.; Altnagelvin Area Hosp., Londonderry. *Scotland*: Ninewells Hosp., Dundee; Glasgow Royal Infirmary; Victoria Hosp., Kirkcaldy. *Wales*: Ysbyty Gwynedd, Bangor; University Hosp. of Wales, Cardiff

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