

# Prevalence of Antimicrobial Resistance in Bacteremia Isolates from Teaching and Non-Teaching Hospitals in the UK and Eire

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**Background:** It has been suggested that teaching hospitals may have elevated rates of antimicrobial resistance, possibly due to the selective pressure exerted on their local pathogens by the more intensive treatments undertaken in these centres.

**Methods:** In 2001 and 2002, 29 laboratories throughout the UK and Eire collected a total of 483 isolates of *S. aureus*, 475 *Klebsiella* spp. and 386 *Enterobacter* spp. from blood as part of the BSAC Bacteraemia Resistance Surveillance Programme. MICs were determined and interpreted by BSAC methodology in a central laboratory. Resistance rates were compared between 20 laboratories predominantly serving teaching hospitals and 9 serving exclusively non-teaching hospitals by the exact binomial method, corrected for multiple tests.

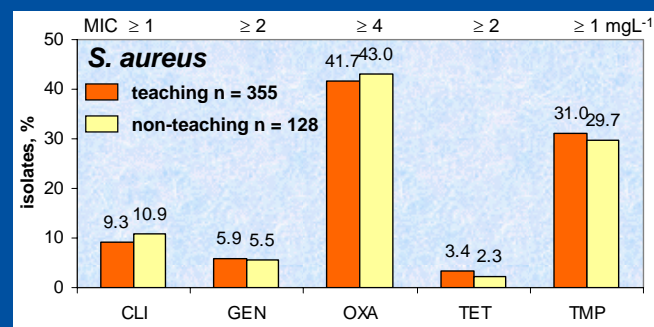
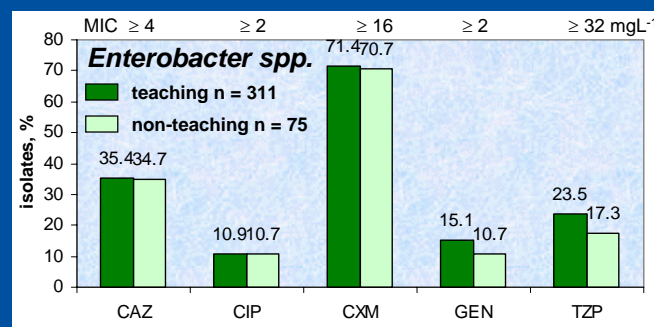
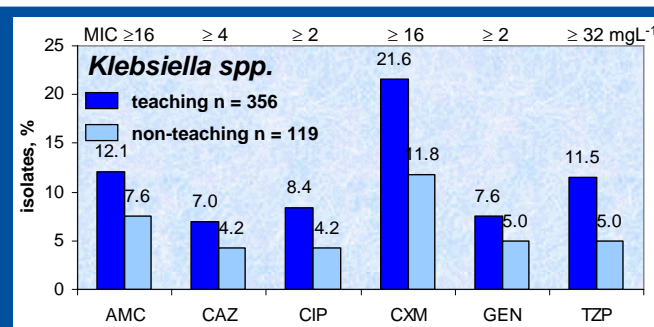
**Results:** Percentage resistance rates (shown in the charts) were very similar for all agents in *S. aureus* and for all but GEN and TZP in *Enterobacter* spp.. Resistance rates in *Klebsiella* spp. were considerably higher in teaching centres for all agents, and the difference was significant overall (adjusted  $p = 0.002$ ), although not for any individual drug.

Other differences between *Klebsiella* isolates from teaching and non-teaching hospitals are shown in the table. The smaller proportion from patients  $\geq 75$  years in teaching than in non-teaching hospitals was also seen for *S. aureus* (29.0 vs. 37.5%) and *Enterobacter* (18.0 vs. 33.3%) so is unlikely to account for the difference in resistance rates.

The greater proportion of presumed hospital-acquired isolates (HAI, from patients in hospital more than 48 hours) in teaching hospitals does not explain the difference either. Looking only at HAI, the difference in resistance rates is generally increased for *Klebsiella* and remains insignificant for the other two species.

The higher proportion in teaching hospitals of *Klebsiella* isolates from surgical and hematology/oncology departments may be significant. This difference, like that in resistance rates, was more pronounced in HAI: 25.9% of *Klebsiella* were from surgery and 24.4% from hematology/oncology in teaching hospitals ( $n = 193$ ) vs. 14% and 12% respectively in non-teaching hospitals ( $n = 43$ ).

**Conclusion:** Teaching hospitals have elevated resistance rates in *Klebsiella* spp. but not in *S. aureus* or, for most drugs, in *Enterobacter* spp. The causes of increased resistance in teaching hospitals are not known but clearly do not affect all species equally. The contribution of clonal outbreaks to the burden of resistance in different species is a possible relevant factor.



**Abbreviations:** AMC amoxicillin-clavulanate, CAZ ceftazidime, CIP ciprofloxacin, CLI clindamycin, CXM cefuroxime, GEN gentamicin, OXA oxacillin, TET tetracycline, TMP trimethoprim, TZP piperacillin-tazobactam

Demographics		
Percentage of <i>Klebsiella</i> spp. isolates from patients who were	teaching n = 356	non-teaching n = 119
Male	56.5	53.8
Aged:		
0 - 4	5.3	1.7
5 - 24	2.5	3.4
25 - 49	14.0	9.2
50 - 74	49.4	44.5
$\geq 75$	28.4	40.3
In hospital more than 48 hours	54.2	36.1
In the care of:		
ICU	3.4	1.7
hematology/oncology	18.3	10.1
surgery	20.5	16.0
general medicine	19.7	26.9
other/unknown	38.2	45.4

Resistance ratios								
teaching / non-teaching hospitals								
<i>Klebsiella</i>			<i>Enterobacter</i>			<i>S. aureus</i>		
	all	HAI		all	HAI		all	HAI
AMC	1.6	2.9				CLI	0.8	0.9
CAZ	1.7	1.3	CAZ	1.0	0.9	GEN	1.1	0.7
CIP	2.0	4.2	CIP	1.0	0.7	OXA	1.0	1.0
CXM	1.8	2.7	CXM	1.0	0.9	TET	1.4	N/A
GEN	1.5	1.3	GEN	1.4	1.0	TMP	1.0	1.1
TZP	2.3	2.8	TZP	1.4	1.1			

HAI = presumed hospital-acquired infections (>48 hours after arrival)  
(Ratio > 1 means more resistance in teaching than in non-teaching hospitals)

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**Organism ID and Susceptibility Testing:** M. Colman<sup>6</sup>, A. Williams<sup>6</sup>.  
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**Central Laboratory:** HPA, London



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