

Enteric Carriage of Antibiotic-Resistant Bacteria in Care Homes in Wales: Preliminary results from the PAAD Study

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Introduction

Care home residents may play a significant role in the epidemiology of antibiotic resistance, particularly MDR Enterobacteriaceae. The PAAD Study (Probiotics for Antibiotic-Associated Diarrhoea) is examining the role of probiotics in Care Homes, and baseline stool samples are taken to assess the prevalence of faecal pathogens. We are analysing these samples to assess the prevalence of carriage of Gram negatives resistant to ciprofloxacin (CIP), cefotaxime (CTX), ceftazidime (CAZ), gentamicin (GEN), meropenem (MER), and vancomycin-resistant enterococci (VRE) among Care Home residents.

Table 1: Summary for Enterobacteriaceae carriage

Enterobacteriaceae (ENT)			
	Number positive by screening agar	Confirmed resistance	% Resistance carriage
CIP	113	105	44.5
CTX	27	22	9.3
CAZ	27	22	9.3
GEN	22	18	7.6
MER	1	0	0
VRE	3	3	1.3
Pseudomonas spp.			
MER	3	3	1.3

Methods

Following consent/assent, baseline stool samples were obtained from 236 residents from 11 care homes in South East Wales. Stool was suspended in water and 0.05ml inoculated using a spiral plater on various non-selective and selective agars; Blood agar (BA), VRE agar, Chromogenic UTI agar (CHROM), and Mueller-Hinton agar incorporating Vancomycin (VANC) (8mg/L) along with selective agents; (CIP (0.25 mg/L), CTX (2 mg/L), CAZ (2 mg/L), GEN (4 mg/L), MER (1 mg/L)) were incubated at 37° for 24hrs.

Colony counts on selective agars were compared with those on BA to determine the percentage of resistant isolates in total bacterial load.

On CTX/CAZ R isolates MICs to tigecycline (TIG), Meropenem, Mecillinam (MEC) and Colistin (COL) were performed using gradient strips and interpreted according to EUCAST breakpoints. ESBL/*ampC* was confirmed using ROSCO and PCR. On GEN R isolates amikacin (AMK) and tobramycin (TOB) MICs were performed.

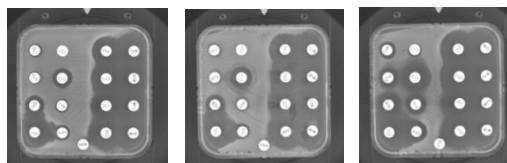
Table 2: Percentage resistant isolates in total faecal bacterial load

	Number of isolates	% Mean faecal bacterial load	% Faecal bacterial load Range
CAZ R ENT	22	9	0.02 – 54
CTX R ENT	22	9	0.02 – 71
CIP R ENT	105	38	0.01 – 100
GEN R ENT	18	27	0.02 – 88
MER R PAER	3	27	0.06 – 84
VRE	3	33	0.02 – 100

Table 3: MIC summary for resistant isolates

	Range	MIC ₅₀	MIC ₉₀
CAZ R ENT	1.5 - >256	16	96
CTX R ENT	16 - >32	>32	>32
CIP R ENT	0.75 - >32	>32	>32
GEN R ENT	6 - 256	32	48
MER R PAER	2 - 4	3	N/A
VRE	>256	>256	N/A

Figure 1: Phenotypic confirmation of ESBL



Results

Summary results for Enterobacteriaceae carriage are shown in table 1. Carriage of resistance was highest for CIP (44.5%) and lowest for MER (0%).

Carriage of CTX/CAZ and GEN resistant isolates were all less than 10%, whilst VRE were present in 1.3% of the patients, predominantly *E. faecalis* (Table 1). The percentage of CTX/CAZ resistant isolates in total faecal bacterial load is 9%. Whilst for CIP & GEN resistant isolates mean percentage is 38 and 27 respectively. VRE accounted for 33% of total faecal bacterial load (Table 2).

22 (86.4%) of CTX/CAZ resistant isolates exhibited resistant MICs to CTX & CAZ (Table 3) & were confirmed ESBL producers by phenotypic methods (Figure 1). All 22 isolates were CTX-M positive by PCR. Most CTX/CAZ resistant isolates were susceptible to MER, TIG, MEC & COL (Table 4a). No carbapenem-resistant Enterobacteriaceae were confirmed. Three carbapenem resistant *Pseudomonas* spp. were isolated (carriage 1.3%), conferred by *ampC* and porin loss. All CIP resistant isolates exhibited high MICs (Table 3) suggesting *gyrA* and *parC* mutations. Most GEN resistant isolates showed resistance to GEN & tobramycin but not amikacin, suggesting the presence of AAC enzyme (Table 4b).

Table 4: Further susceptibilities for CTX/CAZ (a) & GEN (b) resistant Enterobacteriaceae

(a)			(b)		
CTX/CAZ R	S	I/R	GEN R	S	I/R
Meropenem	22	0	TOB	2	16
Tigecycline	17	5	AMK	18	0
Mecillinam	21	1*			
Colistin	21	1*			

**M. morganii*

Conclusions

- The carriage of resistant organisms is significant in this patient group, particularly for CIP-resistant Enterobacteriaceae.
- Carriage of 3rd generation cephalosporin-resistance is higher than published resistance rates for urinary isolates in Wales (4.8%), and should be considered when selecting empiric therapy for these patients.