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Analysis of risk factors associated with an outbreak of NDM-producing CPE in a London hospital

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Background: The prevalence of carbapenemase-producing Enterobacteriaceae (CPE) is increasing worldwide. CPE risk factors include advanced age, reduced functional status, invasive procedures, and recent use of antibiotics. We report an analysis of risk factors associated with outbreak cases of CPE.

Material/Methods: 40 CPE NDM outbreak cases and 121 controls were compared. Controls were chosen randomly in a 3 control :1 case ratio matched by organism (carbapenem-susceptible *K. pneumoniae*), ratio of clinical isolates to screens, and time period (April 2015 to October 2015). Logistic regression was used to examine associations between the following hypothesised clinical risk factors and cases: age, gender, number of comorbidities, antibiotic therapy and number of course of antibiotics in the 12 months prior to the specimen date, specialty, and in-hospital mortality in the 12 months after the specimen date. All descriptive and comparative analysis was conducted in STATA v12.0

Results: Ward specialty was strongly associated with cases; a higher proportion of cases were reported in vascular, renal or cardiovascular wards. There was a suggestion that case patients were older, more likely to suffer 12-month in-hospital mortality, have had antibiotics prior to their specimen, and had more courses of antibiotics. There was no significant difference in the number of co-morbidities between the two groups.

Clinical risk factor	Control (carbapenem-susceptible <i>K. pneumoniae</i>) n=121	Case (NDM-producing <i>K. pneumoniae</i>) n=40	Odds ratio (95% CI)	p-value
Age (mean, SD)	62.3 (19.8)	65.0 (17.9)	1.01 (0.97 to 1.10)	0.40
Gender (n, %)				
- Male	78 (64)	28 (57)		
- Female	43 (36)	17 (43)	1.34 (0.65 to 2.78)	0.40
Number of co-morbidities (mean, SD)	11 (7)	11 (8)	1.0 (0.9 to 1.1)	0,94
Antibiotic use in the previous 12 months (n, %)				
- Yes	66 (64)	19 (50)		
- No	37 (36)	19 (50)	1.78 (0.84 to 3.78)	0.13
Antibiotic course in the previous 12 months (median, range) ¹	3 (1 to 17)	4 (1 to 34)	1.37 (0.76 to 2.47)	0.28
Specialty				
- Other	45 (37)	3 (8)	REF	
- ICU	18 (15)	4 (10)	3.33 (0.67 to 16.41)	0.14
- Cardiac	13 (11)	7 (18)	8.07 (1.82 to 35.72)	<0.01
- Renal	37 (30)	16 (40)	6.48 (1.75 to 23.88)	<0.01
- Vascular	8 (7)	10 (25)	18.75 (4.21 to 83.48)	<0.001

Conclusions:

Risk factors including age, number of co-comorbidities, and antibiotic therapy were not associated with case CPE patients when compared to controls matched by having a carbapenem-susceptible *K. pneumoniae*. CPE was not associated with in-hospital mortality in this analysis; the control group of patients had a high level of co-morbidity, which may explain this finding. Specialty was significant risk factor, reflecting the wards involved in the outbreak. Further work focusing on the type and duration of antibiotic therapy is planned.