

INTRODUCTION

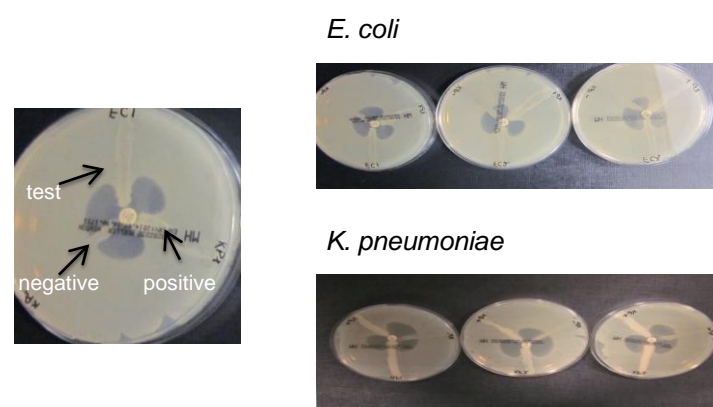
- Gram-negative bacteria such as *Klebsiella pneumoniae* and *Escherichia coli* survive on inanimate surfaces for long periods and may potentially be a risk to patients.
- Carbapenem-resistant (CR) *K. pneumoniae* and *E. coli* are a threat to patients as carbapenems are last resort antibiotics.
- We reported more frequent recovery of ESBL *K. pneumoniae* than *E. coli* from hospital surfaces but the reasons for this are unclear.

AIMS

To compare the survival of CR *K. pneumoniae* and CR *E. coli* on surfaces found in hospitals

To investigate bacterial properties that may contribute to their enhanced survival in the hospital environment.

Fig. 1 Confirmation of CR phenotype



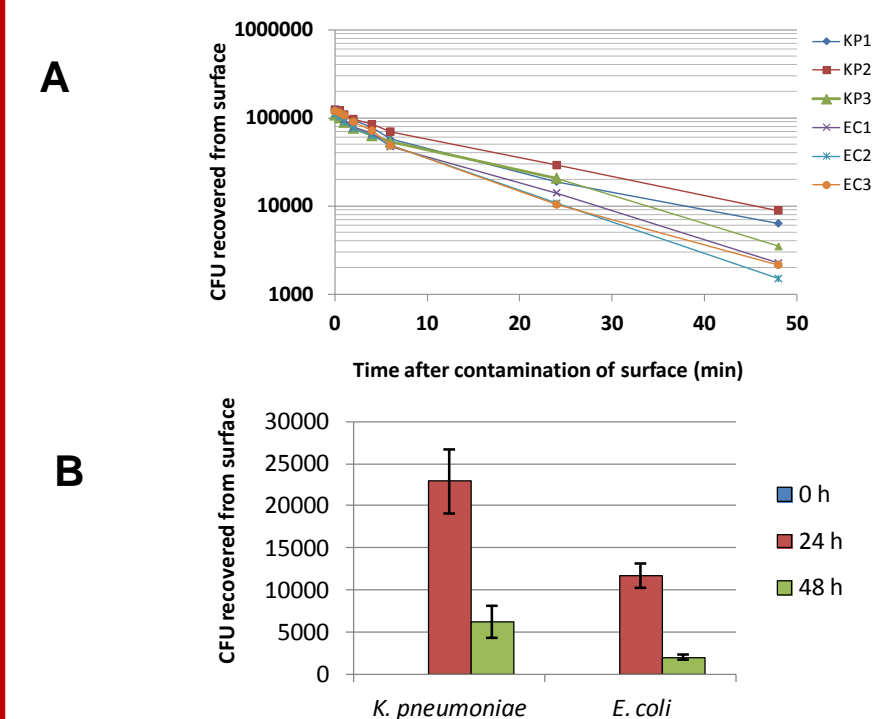
Modified Hodge test. Left panel shows the clover-leaf shaped zone of inhibition around the central carbapenem disk created by positive, negative and test isolates.

METHODS

- CR *K. pneumoniae* and *E. coli* were recovered from infected patients in Beaumont Hospital. The CR phenotype was confirmed using the Modified Hodge test
- Mattress sections were contaminated with 1×10^5 colony forming units (CFU) of bacterial isolate in 3 % human serum. Surviving bacteria were counted at 30 min, 1 h, 3 h, 24 h and 48 h.
- Hypochlorite susceptibility was determined by growing on Mueller-Hinton agar containing hypochlorite (500, 1000 and 2000 ppm).
- *In-vitro* biofilm formation was determined in RPMI medium.

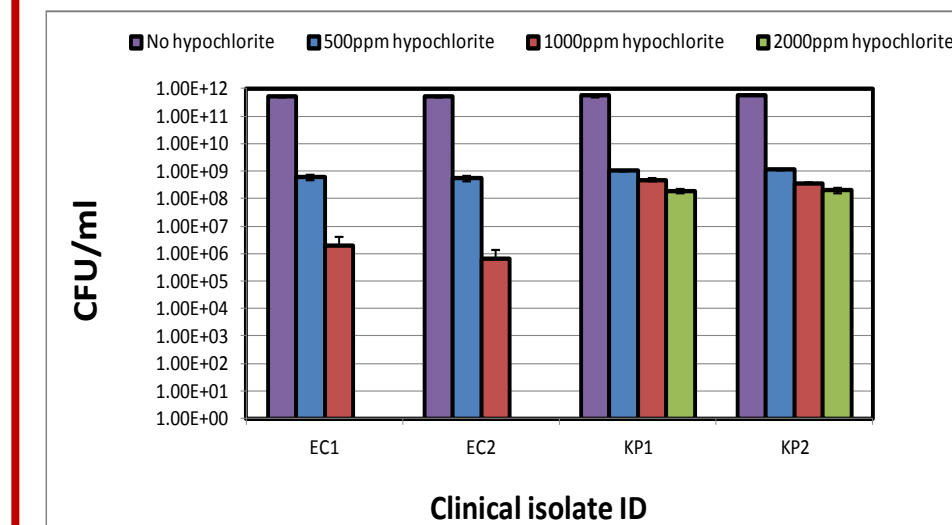
RESULTS

Fig 2 Carbapenem-resistant *K. pneumoniae* survive for longer than CR *E. coli* on mattress fabric.



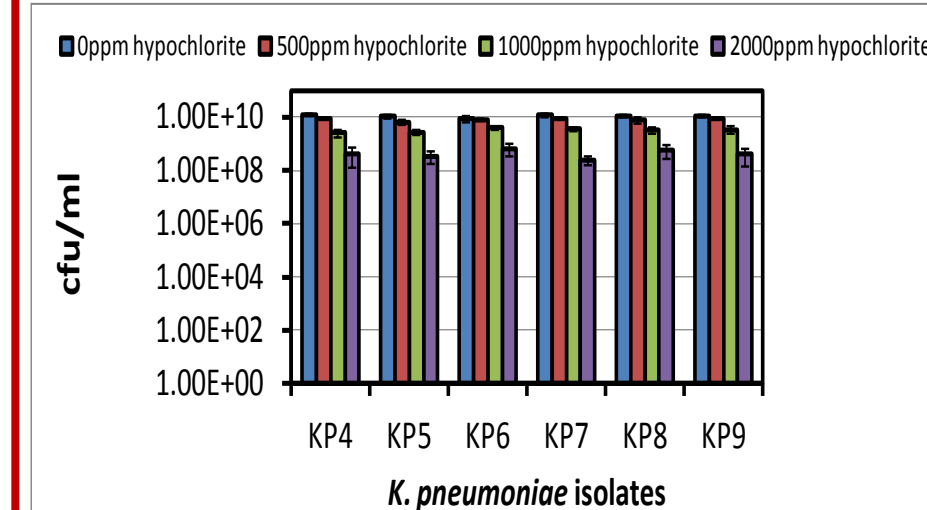
Survival kinetics of three CR *K. pneumoniae* and three CR *E. coli* over 48 h on mattress fabric (A). Greater numbers of *K. pneumoniae* than *E. coli* were recovered after 24 and 48 h (B).

Fig 3. Carbapenem-resistant *K. pneumoniae* has enhanced resistance to hypochlorite disinfectant



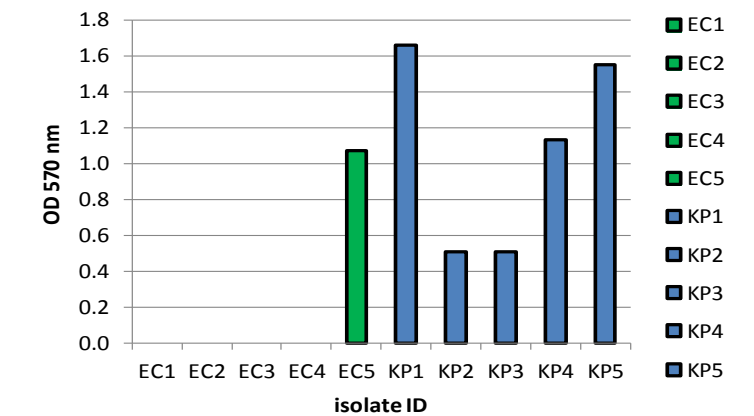
Concentration-dependent reduction in bacterial numbers was shown when *E. coli* was grown in the presence of hypochlorite with a 5 log reduction at 1000 ppm hypochlorite and 10 log reduction at 2000 ppm. However *K. pneumoniae* showed enhanced survival showing only a 3 log reduction at 1000 ppm and 2000 ppm.

Fig.4. enhanced survival in hypochlorite was found in a further six CR *K. pneumoniae* isolates.



Hypochlorite susceptibility tests on six further CR *K. pneumoniae* isolates showed similar enhanced survival in the presence of hypochlorite.

Fig. 5. *In-vitro* biofilm assay results in enhanced biofilm production by *K. pneumoniae*.



Inter-isolate differences in biofilm production were found, but *K. pneumoniae* formed stronger biofilms than *E. coli* under the assay conditions used

CONCLUSIONS

- The enhanced survival of carbapenem-resistant *K. pneumoniae* helps to explain outbreaks
- Disinfections protocols for hospital surface cleaning may not be adequate to effectively reduce CR *K. pneumoniae* on surfaces.
- Further research on the mechanisms that facilitate surface survival of *K. pneumoniae* will inform infection prevention and control strategies to reduce the transmission of CR *K. pneumoniae*.

We gratefully acknowledge funding to the following individuals;

CO, the RCSI Undergraduate Research Summer School Student Fund, RCSI Alumni, The Charitable Infirmary Charitable Trust and the Association of Physicians of Great Britain & Ireland.

FN, RCSI School of Pharmacy.

