Epidemiology and Resistance Patterns in Urinary Pathogens from Long-term Care Facilities and GP populations

Abstract:
Urinary tract infections (UTIs) are a major source of antimicrobial prescribing in the clinical setting and a potential reservoir for the emergence of resistant organisms. Although studies have been published on resistance rates for urinary pathogens from both hospital and general practitioner (GP) settings, there is little information from Long-term Care Facilities (LTCFs) in Ireland. This study aimed to document the epidemiology and resistance rates in urinary isolates, in the LTCF and GP setting, from samples submitted to a typical microbiology laboratory. In 2010, there were 963 urinary isolates from LTCFs and 1,169 urinary isolates from GPs, identified from patients 65 years and over, with cytology suggestive of infection. E. coli was the most common causative organism identified. There were significantly higher resistance rates to amoxicillin, co-amoxiclav, ciprofloxacin, nitrofurantoin, trimethoprim, piperacillin/tazobactam and piperacillin/tazobactam in the LTCF population compared to the GP population (e.g. for E. coli, 86%-v-69%; 30% -v- 21%; 58%-v-36%; 10%-v-3%; 68%-v-48%; 40% -v- 4% respectively). Isolates with resistance mechanisms to beta-lactams, were identified in both settings. Results presented in this paper demonstrate significant differences between resistance rates in LTCF and GP populations which suggest that there are implications for empiric antimicrobial prescribing for UTIs in the LTCF setting.

Introduction
The ability of pathogenic organisms to evolve mechanisms to resist antimicrobials has become a significant threat in recent years. Infection with antimicrobial resistant bacteria has been shown to increase patient morbidity and mortality, increase hospital length of stay and increase overall healthcare costs. Inappropriate antimicrobial prescribing and inadequate infection control measures have contributed to such increases in antimicrobial resistance (AMR). Urinary tract infections (UTIs) are a major source of antimicrobial prescribing in the clinical setting and therefore a potential reservoir for the emergence of resistant organisms. The most common organism identified from UTIs is the facultative anaerobe, Escherichia coli. Resistance of this organism to amoxicillin appears to be widespread in the hospital and general practice (GP) settings in Ireland. However, little has been documented regarding the resistance profiles of E. coli or other uropathogens in Long-term Care Facilities (LTCFs). Recently, guidelines for antimicrobial prescribing in primary care in Ireland were published. However, these guidelines for empiric therapy may not be adequate in LTCFs.

The aim of this study, therefore, was to identify if there are differences in resistance rates between GP and LTCF populations. In particular, the data were extracted from a typical microbiology laboratory, in this case University Hospital Cavan, a population of approximately 125,000 people. This study was part of an ongoing surveillance project on antimicrobial resistance in the HSE Dublin North East region and shall provide an indication of the epidemiology of antimicrobial resistance in UTIs in the LTCF or general nursing home setting.

Methods
The microbiology laboratory information system was interrogated on 13th May 2011 to identify all culture positive isolates from urine samples submitted to the laboratory by GPs and LTCFs between 1st January 2010 and 31st December 2010. Bacteriuria was identified by only including urine samples with a predominant growth culture of greater than 10,000 colony forming units per ml. As we were interested in comparing the resistance rates between the two populations, only isolates from patients aged 65 years and over were included in the analysis. Patient demographics were recorded. Isolates were assigned to a patient-episode group if they were from the same patient and collected on the same day.

Results
Demographics
In total for 2010, there were 2,132 culture positive urinary isolates from patients aged 65 years and over identified from LTCF and GP samples. Of these, 963 urinary isolates were identified from 22 LTCFs (96.5% of which were categorised as general nursing homes). There were 1,169 urinary isolates identified from 30 GP practices. For both the GP and LTCF population, isolates from females were more common (77.8% and 68.4%) however there was no significant difference in mean age between populations (Table 1). The most common organisms isolated from urine are presented in Table 1. E. coli accounted for the largest number of isolates identified in both LTCF and GP populations (57.6% and 69.6% respectively). When isolates were analysed by first isolate per patient per year there was a substantial drop in numbers of isolates for cumulative susceptibility profiling (i.e. analysis of resistance rates). A small number of urinary isolates from both populations were identified which harboured beta lactam resistance mechanisms. These included extended spectrum beta lactamases (ESBLs) and AmpC beta lactamasises. ESBLs were identified.

Resistance Rates
Comparison of resistance rates demonstrated significant differences between LTCF and GP populations for various antibiotics. In particular, in regards to E. coli, resistance rates were statistically significantly higher for all of the major therapeutic antibiotics in the LTCF setting compared to the GP setting (Table 2). Almost all E. coli isolates from the LTCF setting were resistant to amoxicillin (86%). Significant levels of resistance were also demonstrated for co-amoxiclav (30% -v- 21%), ciprofloxacin (58% -v- 26%), nitrofurantoin (10% -v- 3%), trimethoprim (68% -v- 48%) and piperacillin/tazobactam (10% -v- 4%) in the LTCF population compared to the GP population. In order to assess the impact of catheterisation on resistance rates in E. coli, the analysis was also performed on mid-stream urine (MSU) specimens only. This analysis subsequently anonymised prior to analysis.

* cathereter stream urine sample

AM: ampicillin; AMC: co-amoxiclav; CP: ciprofloxacin; FM: nitrofurantoin; TMP: trimethoprim; TPC: piperacillin/tazobactam; MSU: Mid-Stream Urine Specimen; CSU: Catheter Stream Urine Specimen

Resistance Mechanisms
A small number of urinary isolates from both populations were identified which harboured beta lactam resistance mechanisms. These included extended spectrum beta lactamases (ESBLs) and AmpC beta lactamasises. ESBLs were identified.
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Discussion

To the best of our knowledge, this paper describes for the first time a comparison of resistance rates for urinary pathogens from Irish LTCFs and GP populations. Significant differences between both populations were evident. In particular, there were higher levels of resistance to antibiotics in the LTCF setting for common urinary pathogens (E. coli, P. mirabilis) than in the GP setting. Furthermore, organisms with resistance mechanisms to beta lactams, i.e. ESBL, AmpC, were also identified in both populations. High levels of resistance of LTCF and GP isolates to trimethoprim (68% and 46% respectively in E. coli) is worrying especially in light of the fact that this antibiotic is considered one of the first line treatments for uncomplicated urinary tract infection. Therapeutic and prophylactic use of trimethoprim to such increased resistance rates in urinary pathogens should be investigated. The other recommended antibiotic for first-line treatment of UTI, nitrofurantoin, demonstrated overall low levels of resistance in E. coli in both LTCF and GP populations (10% and 3% respectively in E. coli) and would suggest that this antibiotic is a suitable first line choice.

Very high levels of resistance to ciprofloxacin were seen in the LTCF setting compared to the GP setting (58% and 26% respectively in E. coli). Not only is this an issue for the evolution of fluoroquinolone-resistant organisms, high prescribing rates for ciprofloxacin have been shown to be an important risk factor for C. difficile infection profiles for urinary pathogens in various Irish populations have been previously published. A recent national study on urinary pathogens in the non acute setting to trimethoprim and ampicillin in studies on E. coli reported low levels of resistance to nitrofurantoin is similar to that reported for the GP population in this study (ranging from 1%-18% levels of resistance to fluoroquinolones (>50%) in urine cultures have been reported internationally in the LTCF setting and there is concern about the evolution of multi-resistant antibiotic organisms from LTCFs).

In 2009, the Health Protection Surveillance Centre published guidelines for Antimicrobial Stewardship in Hospitals in Ireland which also made recommendations for non-acute residential healthcare institutions. Each facility should have an antimicrobial stewardship programme, antimicrobial audit/ intervention teams and access to advice from a consultant microbiologist or infectious disease physician and antimicrobial pharmacist. There are gaps in the area of antimicrobial stewardship in LTCFs so have been highlighted by a recent Irish study.

In 2011, the HSE published guidelines for Antimicrobial Stewardship in LTCFs as described in this paper, these recommendations need to be implemented to their full extent to protect against inappropriate use of antimicrobials.

This study has provided evidence for differences in antimicrobial resistance rates for urinary isolates from GP and LTCF populations in a region of Ireland and has highlighted a worrying level of resistance to various therapeutic agents, particularly in the LTCF setting. It would seem likely, in light of the fact that catherisation and age were not factors in the difference between rates, that exposure to antibiotics in these different settings, may significantly affect resistance rates. Such differences in rates have implications for empiric prescribing and suggest that analysis of local resistance patterns and specific antibiotic policies or guidelines for LTCFs are essential component of any long term antimicrobial stewardship plan.

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Acknowledgements

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References

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