

Five-year antimicrobial resistance patterns of urinary *E. coli* at an Australian tertiary hospital

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Disclosure

- Ms Oyebola Fasugba, Prof Anne Gardner and A/Prof Brett Mitchell are members of ACIPC
- A/Prof Brett Mitchell is Interim Editor-in-Chief Infection, Disease and Health and Prof Anne Gardner is on the Editorial board
- A/Prof Brett Mitchell is a member of the scientific organising committee.
- Dr George Mnatzaganian has no conflicts of interests

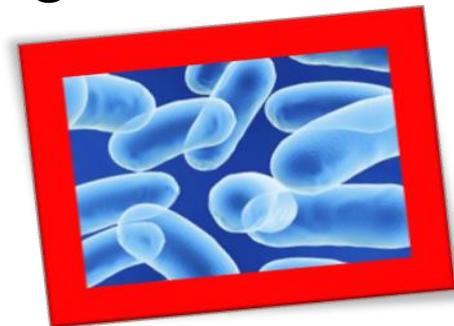
Introduction

- >80% of urinary tract infections (UTIs) caused by *Escherichia coli* (*E. coli*) (Nicolle, 2008)
- Community acquired (CA) or hospital acquired (HA) classification
- Standard treatment is antibiotics (Stuck et al., 2012)
- Treatment based on local susceptibility patterns (Teoh et al., 2013)
- Inappropriate treatment leads to emergence of resistant pathogens & recurrence of infection (Trautner, 2010)



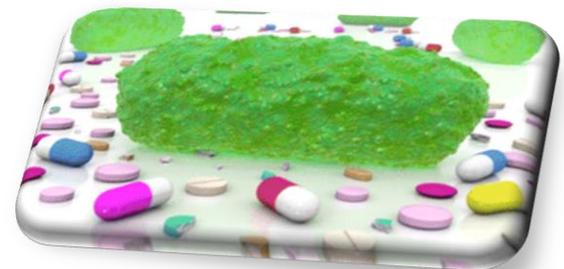
Introduction

- Evidence shows urinary *E. coli* is becoming increasingly resistant to common antimicrobials (WHO, 2014)
- Whilst prevalence rates for urinary *E. coli* resistance have been reported in Australia, available data do not adjust for age & sex
- To our knowledge there are no data comparing resistance patterns for CA and HA UTIs



Aims

- ❑ To describe the antimicrobial resistance patterns of *E. coli* UTI over five years (2009-2013) in patients at the Canberra Hospital
- ❑ Compare the prevalence of resistance in community-acquired and hospital-acquired *E. coli* UTI



Significance

- Expand understanding of antimicrobial resistance in urinary *E. coli* infections in Australia
- Contribute to ongoing surveillance data in the Australian Capital Territory (ACT)
- Potential for study findings to inform treatment decisions for UTI & influence therapy based on site of acquisition



Methods

- Ethics approval granted by ACT Health and ACU HREC
- Cross-sectional design
- Inclusions: Canberra Hospital samples; *E. coli* growth of $\geq 10^7$ cfu/L
- CA UTI: within 48 hours of admission; outpatients
- HA UTI: more than 48 hours after admission or within 48 hours of discharge



Methods

- Only the first positive *E. coli* culture per patient per year was included in analysis
- Overall 5-year and yearly antimicrobial resistance rates were calculated
- Rates compared between CA and HA UTIs
- Prevalence of Extended Spectrum Beta Lactamase (ESBL) producing *E.coli*
- Crude and adjusted time series analyses were conducted to assess resistance trends over the 5-year study period

Results

- 5346 positive *E. coli* UTIs belonging to 4744 patients
 - CA UTI → 84.3% (n=4505)
 - HA UTI → 15.7% (n=841)
- Mean age of all patients was 57.0 years (SD=27.6)
- 80.3% (n=3806) of patients were women
- Resistance highest for ampicillin (41.9%) & trimethoprim-sulphamethoxazole (32.7%)
- Resistance lowest for meropenem (0.1%) & gentamicin (4.0%)



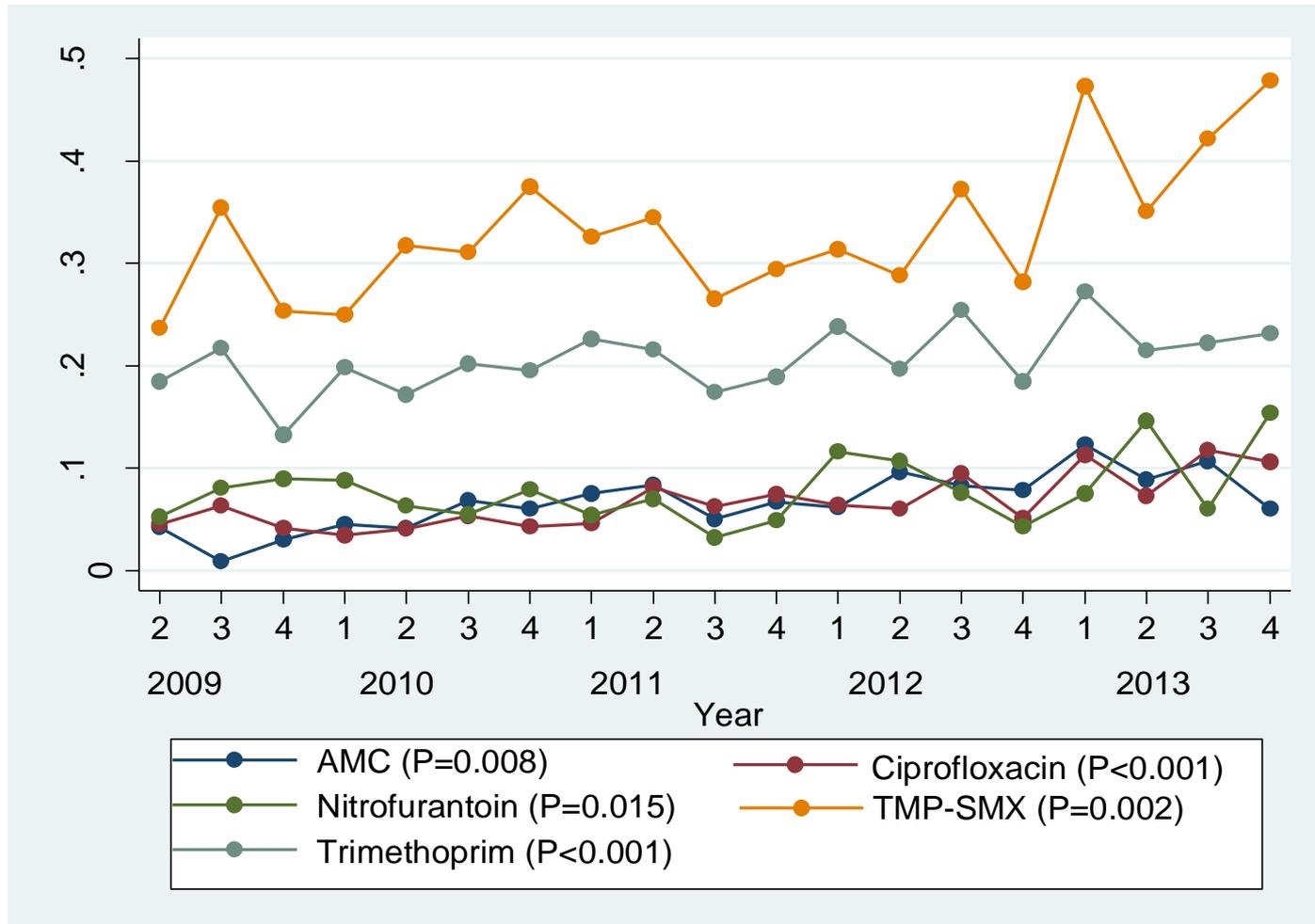
Antimicrobial	5-year resistance %
Ampicillin	41.9
Trimethoprim-sulphamethoxazole	32.7
Trimethoprim	20.7
Norfloxacin	16.2
Ceftriaxone	13.5
Cephazolin	10.6
Piperacillin-tazobactam	10.3
Nalidixic acid	8.4
Nitrofurantoin	7.8
Amoxicillin-clavulanic acid	6.7
Ciprofloxacin	6.5
Gentamicin	4.0
Meropenem	0.1

Results

- Significantly higher resistance ($P < 0.05$) in HA compared to CA UTI for:
 - ✓ amoxicillin-clavulanate
 - ✓ cephalazolin
 - ✓ gentamicin
 - ✓ piperacillin-tazobactam
- ESBL-producing *E. coli* significantly higher ($P = 0.01$) in HA (3.0%; $n = 25$) compared with CA UTI (1.7%; $n = 75$)



Results



1=Summer
2=Autumn
3=Winter
4=Spring

Results

- Significant increase in resistance trend noted for all five antimicrobials ($P < 0.05$)
- Seasonal resistance pattern only significant for Trimethoprim ($P = 0.0056$)
- Regression analysis indicated a possible association between ciprofloxacin resistance and trimethoprim-sulphamethoxazole resistance with older age

Discussion

- Resistance rates lower than reported for single site studies in other countries (Ma et al., 2012; Perrin et al. 1999)
- High levels of ampicillin and trimethoprim-sulphamethoxazole resistance question their use as suitable empirical agents in the management of UTI in this population
- Differences in resistance for HA and CA UTI comparable with findings reported previously (Ma et al., 2012)



Discussion

- Presence of ESBL-producing *E. coli* in both HA and CA UTI pose significant public health concern
- Evidence to support findings of increase in resistance over time
- Seasonal trimethoprim resistance should be explored further
- Association between increasing age and antimicrobial resistance consistent with published literature (Blaettler et al. 2009)

Implications and Conclusion

- While resistance rates are lower than other studies, there is need for continuous resistance surveillance in the ACT
- Amoxicillin-clavulanate and nitrofurantoin still effective in this population
- Study findings will help inform UTI treatment guidelines
- Also provide baseline resistance data for future comparison and inform future interventions that can be evaluated



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References

- Blaettler, L., Mertz, D., Frei, R., Elzi, L., Widmer, A., Battegay, M., & Flückiger, U. (2009). Secular trend and risk factors for antimicrobial resistance in *Escherichia coli* isolates in Switzerland 1997–2007. *Infection*, 37(6), 534-539.
- Bouchillon, S. K., Badal, R. E., Hoban, D. J., & Hawser, S. P. (2013). Antimicrobial susceptibility of inpatient urinary tract isolates of Gram-negative bacilli in the United States: Results from the Study for Monitoring Antimicrobial Resistance Trends (SMART) Program: 2009– 2011. *Clinical therapeutics*, 35(6), 872-877.
- Ma, K. L., & Wang, C. X. (2013). Analysis of the spectrum and antibiotic resistance of uropathogens in vitro: Results based on a retrospective study from a tertiary hospital. *American journal of infection control*, 41(7), 601-606.
- Nicolle, L. E. (2008). Uncomplicated urinary tract infection in adults including uncomplicated pyelonephritis. *Urologic Clinics of North America*, 35(1), 1-12.
- Perrin M, Donnio P, Heurtin-Lecorre C, Travert M, Avril J-L. Comparative antimicrobial resistance and genomic diversity of *Escherichia coli* isolated from urinary tract infections in the community and in hospitals. *Journal of Hospital Infection*. 1999;41(4):273-9.
- Stuck, A. K., Täuber, M. G., Schabel, M., Lehmann, T., Suter, H., & Mühlemann, K. (2012). Determinants of quinolone versus trimethoprim-sulfamethoxazole use for outpatient urinary tract infection. *Antimicrobial Agents and Chemotherapy*, 56(3), 1359-1363.
- Teoh, P., Basarab, A., Pickering, R., Ali, A., Hayes, M., & Somani, B. K. (2013). Changing trends in antibiotic resistance for urinary *E. coli* infections over five years in a university hospital. *Journal of Clinical Urology*.
- Trautner, B. W. (2010). Management of catheter-associated urinary tract infection (CAUTI). *Current opinion in infectious diseases*, 23(1), 76.
- World Health Organisation. (2014). *Antimicrobial resistance: global report on surveillance*.

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