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

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Disclosure

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- 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

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- >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)

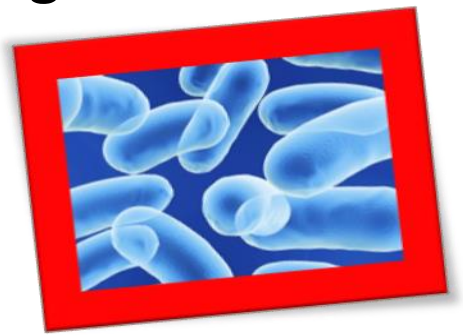


Introduction

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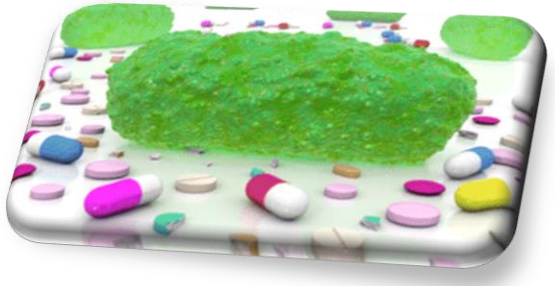
- Evidence shows urinary *E. coli* is becoming increasingly resistant to common antimicrobials (WHO, 2014)
- Whilst prevalence rates for urinary *E. coli* resistance have been reported in Australia, available data do not adjust for age & sex
- To our knowledge there are no data comparing resistance patterns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



Aims

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- 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

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- 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

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- 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

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- 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

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- 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
Amoxycillin-clavulanic acid	6.7
Ciprofloxacin	6.5
Gentamicin	4.0
Meropenem	0.1

Results

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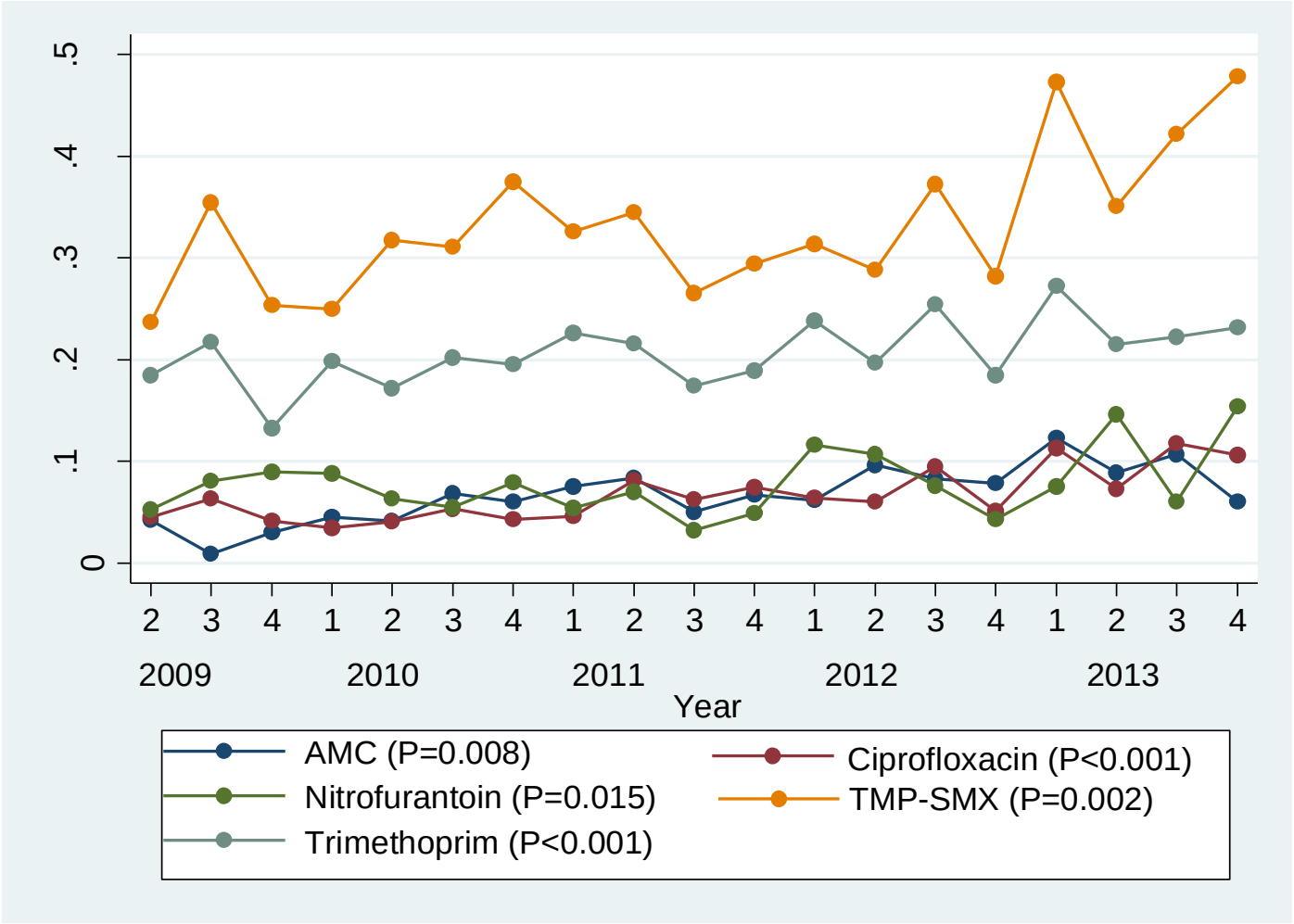
- Significantly higher resistance (P<0.05) in HA compared to CA UTI for:
  - ✓ amoxycillin-clavulanate
  - ✓ cephazolin
  - ✓ gentamicin
  - ✓ piperacillin-tazobactam
- ESBL-producing *E. coli* significantly higher (P=0.01) in HA (3.0%; n=25) compared with CA UTI (1.7%; n=75)



Results

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

Results

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- 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

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- 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

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- 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
- Amoxycillin-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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