

Gaps in primary care management of urinary tract infections in Singapore

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Dear Editor,

Urinary tract infection (UTI) is a common presentation in primary care, but gaps of care have not been well established in Singapore. UTIs are one of the most common bacterial infections worldwide,¹ constituting around 1% of all ambulatory clinic visits.² The healthcare burden of UTIs remains highly significant, with billions per year lost in societal costs (e.g. healthcare costs and time missed from work) alone.² In Singapore, genitourinary infections were the second most common group of conditions for which antibiotics were prescribed in 2021.³

Appropriate antibiotic prescribing is key to prevent resistance. Although international guidelines recommend clinical diagnosis of UTI based on typical symptoms of dysuria, urgency, frequency and the absence of vaginal discharge,⁴ in Singapore, only 26% of UTIs were diagnosed clinically without the aid of urinary investigations.⁵ With the potential for significant number of care gaps, we conducted a study to examine these gaps to improve practice, management and patient safety.

Random sampling of 280 adult patients with visit diagnosis of UTI from July to December 2021 was performed, with 40 patients selected from each of the 7 National University Polyclinics in Singapore. Case notes review was conducted by trained primary care physicians to identify and classify gaps in history, documentation, examination, investigations, diagnosis, labelling, management, follow-up and antibiotic prescriptions.

To determine antibiotic appropriateness, we reviewed international guidelines for acute uncomplicated cystitis, including the European Association of Urology (2022),⁶ National Institute for Health and Care Excellence Guidelines (2018)⁷ and Infectious Diseases Society of America Guidelines (2010).⁸ This was paired with local antibiograms, expert

opinions and published recommendations in Singapore. The list of antibiotics and doses considered appropriate were:

- Amoxicillin/clavulanate 625 mg 2 to 3 times a day (BD-TDS) for 3 to 7 days
- Cephalexin 500 mg 2 to 4 times a day (BD-QDS) for 5 to 7 days (while several guidelines recommend higher dosage, i.e. 500 to 1000 mg BD-QDS, newer studies suggest equal efficacy in twice-daily versus 4-times-daily dose)⁹
- Co-trimoxazole 2 tablets 2 times a day (BD) for 3 days
- Nitrofurantoin 50 to 100 mg 4 times a day (QDS) for 3 to 7 days

Statistical analyses were performed with IBM SPSS Statistics version 28.0 (IBM Corp, Armonk, NY, US). Descriptive statistics was used to showcase prevalence data, chi-square test to compare relationship between categorical variables and fixed effects Poisson regression to analyse factors affecting number of gaps per UTI visit.

A total of 280 patients were reviewed, with a mean age of 50.7 years (Table 1). Majority were female, largely premenopausal. Among patients with uncomplicated UTIs, 18.2% were recurrent. The most common cause of complicated UTIs were in males (69.5%). There were 12 patients (4.3%) who were inaccurately coded as UTI; 85% of patients had urine tests performed to guide diagnosis of UTI. The most common antibiotic prescribed is amoxicillin-clavulanate (50%). There were 41.4% of patients who had no gaps of care during their visit for UTI, with a mean number of gaps per patient at 0.81. The greatest number of gaps were present in history and documentation (31.6%). Significant number of gaps were also found in antibiotic prescriptions (22.4%), of which excessive antibiotic duration formed the majority (45.1%).

Patients who presented with uncomplicated UTIs were found to be significantly associated

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Table 1. Characteristics of patients with visit diagnoses labelled as urinary tract infections (UTIs).

Study characteristics	Total (n=280)
Mean age, (SD), years	50.7 (18.8)
Sex, no. (%)	
Female	239 (85.4)
Pre-menopausal	133 (55.6)
Post-menopausal	106 (44.4)
Male	41 (14.6)
UTI type	
Uncomplicated UTIs	207 (73.9)
Episodic UTI	171 (82.6)
Recurrent UTI	36 (17.4)
Complicated UTIs	59 (21.1)
Male UTIs	40 (67.8)
Suspected pyelonephritis	8 (13.6)
Known urethral or bladder abnormalities	4 (6.8)
Partially treated UTI	4 (6.8)
Previous nephrolithiasis	3 (5.1)
Not UTIs	14 (5.0)
Urine microscopy utilisation rate in UTI diagnosis, no. (%)	238 (85.0)
Antibiotic prescribed	
Amoxicillin-clavulanate	140 (50.0)
Nitrofurantoin	63 (22.5)
Ciprofloxacin	31 (11.1)
Co-trimoxazole	22 (7.9)
Cephalexin	14 (5.0)
No antibiotic prescribed	10 (3.6)
Mean no. of gaps per patient (SD)	0.81 (0.86)
No. of gaps per patient, no. (%)	n=228
0	116 (41.4)
1	114 (40.7)
2	40 (14.3)
3	6 (2.1)
4	4 (1.4)
Distribution of gaps, no. (%)^a	
Gaps in history and documentation	72 (31.6)
Last menstrual period not documented	68 (94.4)

Table 1. Characteristics of patients with visit diagnoses labelled as urinary tract infections (UTIs). (Cont'd)

Study characteristics	Total (n=280)
Gaps in examination	1 (0.4)
Gaps in investigation	45 (19.7)
Urine culture not sent in complicated UTIs	27 (60.0)
Urine culture sent in uncomplicated UTIs	15 (33.3)
Gaps in diagnosis	22 (9.6)
Urine microscopy clear, still treated with antibiotics	6 (27.3)
Gaps in labelling	7 (3.1)
Gaps in management/follow-up	30 (13.2)
Male UTI not referred to urologist	13 (43.3)
Gaps in antibiotic prescription	51 (22.4)
Antibiotic prescribed for excessive duration	23 (45.1)
Ciprofloxacin prescribed for uncomplicated UTIs	13 (25.5)
Nitrofurantoin prescribed for elderly	11 (21.6)

SD: standard deviation

^a Total number of gaps may not tally as each patient encounter may have multiple number of gaps.

with increased gaps in history and documentation ($P<0.001$). Patients with uncomplicated UTIs were more likely to have gaps in history or documentation (odds ratio [OR] 4.32, 95% CI 1.88–9.92).

For our Poisson regression, the variance for number of gaps was 0.74. The goodness-of-fit test value divided by degree of freedom was 0.91 and the omnibus test was $P<0.05$. After adjusting for sex and clinic characteristics, patients with complicated UTIs or non-UTIs had a significantly increased incidence of care gaps (risk ratio [RR] 2.20, 95% CI 1.57–3.09), compared to those with uncomplicated UTIs. The incidence rate of gaps in care decreased by 1.6% (RR 0.984, 95% CI 0.977–0.992) for each 1-year increase in age.

This study had 2 main findings. First, history constituted majority of the gaps, especially among young female patients with uncomplicated UTIs, pertaining to documentation of their last menstrual period. This highlighted a potential antibiotic safety issue, as ciprofloxacin and co-trimoxazole are not recommended for use in pregnant women. Secondly, patients presenting with complicated UTIs or non-UTIs had more frequent care gaps.

Our study identified significant lapse in antibiotics prescribed for UTI, accounting for more than one fifth of all lapses identified. Dosing errors were mostly mitigated locally due to electronic dosing

recommendations. However, antibiotic duration was left to the discretion of physicians. A fixed, pre-programmed medication order including recommended dose, frequency and duration will reduce prescription gaps and improve medication safety.

Ciprofloxacin prescription for uncomplicated UTIs was also an issue. In Singapore, increasing ciprofloxacin resistance has been found in urinary *Escherichia coli*, which translates to increased treatment failure rate in uncomplicated UTIs.⁵ Ciprofloxacin was also found to be inappropriately used for the treatment of multiple outpatient infections, contributing to the development of multidrug resistant organisms. Guidelines can mitigate its usage, which was also listed as an antibiotic in the WATCH group (antibiotics that should be monitored by health authorities to prevent spread and further emergence of antibiotic resistance), according to the World Health Organization Access, Watch, and Reserve classification.

Our study also found that patients with complicated UTIs or non-UTIs had more frequent gaps in care. This echoed what was found in other settings internationally, where errors occurred in special groups of patients with asymptomatic bacteriuria, such as the elderly; patients with diabetes, urinary catheter in-situ, urinary tract dysfunction; and patients after transplantation. While major guidelines adequately covered diagnosis and management of uncomplicated UTIs, management of complicated UTIs and non-UTIs were less emphasised. Therefore, it would be prudent to continue education of physicians in this area to bridge these gaps.

We acknowledge that clinical practices are constantly evolving and geographically dependent, hence limiting the generalisability of this study probably to the primary care context in Singapore. Future studies with larger sample size could be replicated across all 3 public primary care institutions to reduce risk of type 1 error.

With the Singapore guideline for uncomplicated UTIs in place since November 2023,¹⁰ our attention can turn to addressing complicated UTIs and masquerades. By doing so, we can improve physicians' confidence in managing UTIs, reduce inappropriate antibiotic use, and deliver high-quality and safe care to all patients.

Declaration

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Institutional Review Board Approval

The study was conducted according to the guidelines of the Declaration of Helsinki, and approved by the Institutional Review Board of the National Healthcare Group (2023/00275) on 1 June 2023.

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