Antimicrobial and Diagnostic Stewardship Targeting Urinary Tract Infections in the Emergency Department: A Pharmacist-Driven Quality Improvement Project at a Tertiary Military Treatment Facility

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BACKGROUND

- The Joint Commission Standards mandating Antimicrobial Stewardship in outpatient settings took effect in January 2020[1].
- In the United States, urinary tract infections (UTI) impact more than 10 million people yearly[2].
- With the increasing interest in ambulatory stewardship, we designed a quasi-experimental study as a quality improvement project to assess guideline-concordant antimicrobial and diagnostic stewardship practices targeting UTI in the Emergency Department (ED) of a Military Treatment Facility.

OBJECTIVES

Primary Objective:

- Assess changes in guideline-concordant practices before-and-after the intervention implementation phase.
  - Rate of inappropriate antibiotic selection, dose, frequency and duration of therapy (DOT)

Secondary Objectives:

- Diagnostic stewardship: Rate of diagnostic concordance, appropriateness of urine culture (UCx) orders and the downstream effects of inappropriate UCx.
- Rate of contaminated urine sample collection
- Types of pharmacist interventions

METHODS

- Study Design: IRB-approved, Quasi-Experimental (QE), prospective study
- Timeline: Two 3-month data collection periods, Phase 1 (P1) and Phase 2 (P2) including ED encounters that resulted in a urinalysis (UA), UCx, and antibiotics for UTI upon discharge (Figure I &II)
- One-month implementation period occurred between the two phases. Interventions included:
  - Provider education on national guidelines
  - Development of syndrome-specific local protocols
  - Revision of ED order-sets
  - Provision of instructions for midstream urine sample collection

Figure I: Study timeline and P1/P2 methods summary

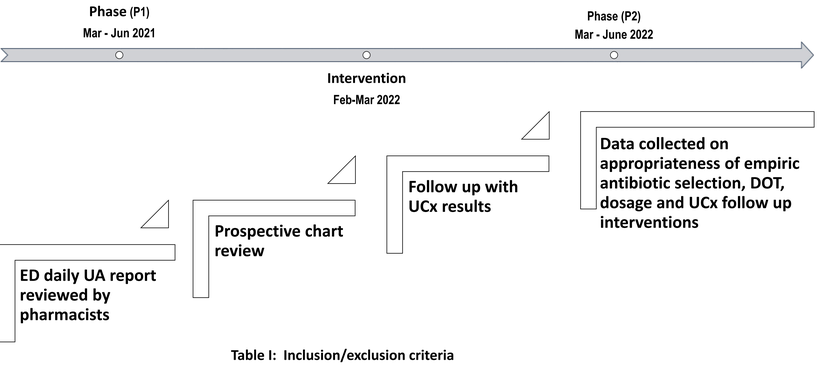

Table I: Inclusion/exclusion criteria

Inclusion Criteria	Exclusion Criteria
• ED encounter	• Peri-procedural
• UA/UCx ordered during ED encounter	• Complicated UTI requiring specialty consultation
• Age ≥ 18 years of age	• Age < 18 years of age
• Uncomplicated cystitis	• In-patient admission
• Uncomplicated pyelonephritis	• Co-infection at another site
• Discharged from the ED with antibiotics	• Recent (≤72 hours) or current antibiotic use
	• UA/UCx for other indications (e.g. sepsis)

RESULTS

Figure II: Encounters identified based on daily ED urinalysis report

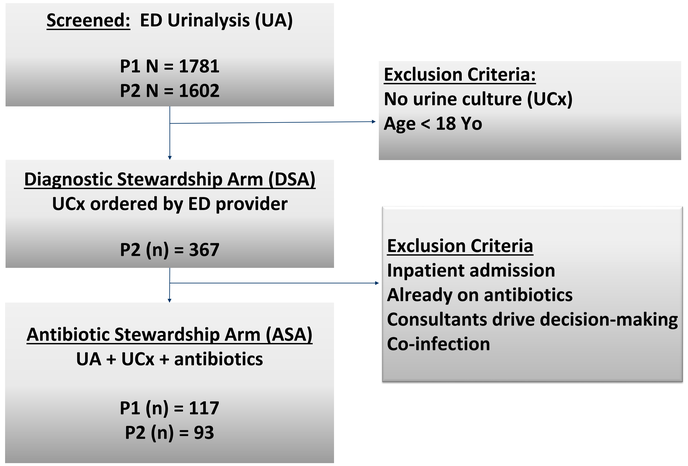

Table II: Patient demographics

Demographics, P2		
Gender	**(n)**	**%**
Male	139	37.5
Female	228	62.5
Age group (years)	**(n)**	**%**
18-35	77	21
36-65	127	34.6
>65	163	44.4

Figure III: Guideline concordance prescribing trends, P1 vs P2

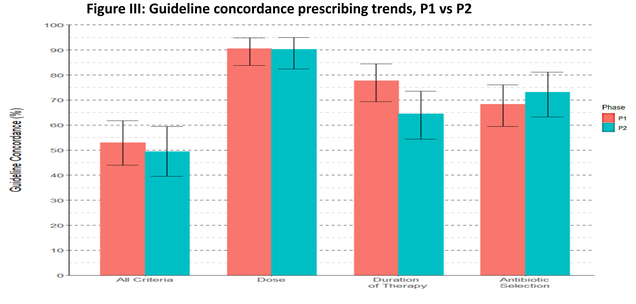

Table III: Characterization of antibiotic selection for the treatment of UTI, P1 vs P2

Antibiotic use by agent or class		
	P1 (%) N = 117	P2 (%) N = 93
Nitrofurantoin	39.3	45.2
Cephalosporins	23.1	21.5
Fluoroquinolones	19.7	12.9
TMP/SMX	14.5	10.8
Fosfomycin	3.4	8.6
Others	-	1.1

RESULTS

PRIMARY OUTCOMES

- There were no significant improvement in guideline-concordant prescribing or diagnostic practices between P1 and P2 (Figure III).
- **Inappropriate use:**
  - Antibiotic selection (P1 31.6% vs P2 26.9%, p = 0.54); attributable to a fluoroquinolone or cephalosporin use as a first-line treatment (Table III).
  - DOT (P1 22.2%, P2 35.5%, p = 0.04)
  - Dosage (P1 9.4%, P2 9.7%, p = 1)

SECONDARY OUTCOMES

Diagnostic stewardship

i. Rate of symptom concordance
- One-third of patients receiving antibiotics were asymptomatic, a majority of which had a positive UA (P1 68.4%, P2 74.2%).

ii. Appropriateness of UCx orders
- Across all P2 encounters, 51.4% of UCx orders were deemed inappropriate

iii. Downstream effects of inappropriate UCx orders
- Antibiotics were initiated in 39.5% patients with a positive UCx due to ED UCx collection in asymptomatic patients

Clean catch urine collection technique
- Rate of contaminated urine sample: (P1 25.6%, P2 17.2%, p = 0.19)

- The primary pharmacy intervention was discontinuation of therapy (P1 29.1%, P2 39.8%).

DISCUSSION

- We observed there is an overreliance on UA findings resulting in treatment of asymptomatic bacteriuria.
- UCx obtained in the setting of low pretest probability leads to the downstream effect of antibiotic initiation by the next care team or provider.
- Unintended consequences associated with inappropriate antibiotics use and duration of exposure include:
  - Increased risk for *Clostridioides difficile* infections
  - Antibiotic-related adverse effects
  - Driving of antimicrobial resistance
  - Increased healthcare cost
- Our data suggests continued promotion of standardized diagnostic and prescribing practices are required to:
  - Discourage UCx orders in asymptomatic patients
  - Reduce reliance on UA
  - Subsequent initiation of antibiotic therapy
- Limitations of our study included: Staff rotation and turnover, gap between P1 and intervention phase, susceptible to study-design-specific biases such as maturation and regression to the mean.

CONCLUSIONS

- Education and order-set modification alone are insufficient for a lasting impact on prescribing practices especially where there is a high rate of provider turnover.
- An EMR with embedded clinical tools such as alert-based decision support capabilities and active involvement of clinical pharmacists are likely necessary to make a sustained impact in curbing inappropriate treatment of asymptomatic bacteriuria.

REFERENCES

1. Joint Commission. Antimicrobial Stewardship in Ambulatory Health Care. R3 Report Issue 23, June 20, 2019.
2. Claeys, K, Trautner B, Leekha S, et al. Optimal Urine Culture Diagnostic Stewardship Practice-Results from an Expert Modified-Delphi Procedure. *Clinical Infectious Disease*. 2022;75(3):382–9