

# Variation in Outpatient Urine Testing Practices for Uncomplicated Urinary Tract Infections

Sonya Liu, MD<sup>1</sup>; Jahnvi Bongu, MPH<sup>2</sup>; Matthew Keller, MA<sup>2</sup>; Anne M. Butler, PhD, MS<sup>2</sup>; Margaret A. Olsen, PhD, MPH<sup>2</sup>; Michael J. Durkin, MD, MPH<sup>2</sup>

<sup>1</sup>Department of Internal Medicine, <sup>2</sup>Division of Infectious Diseases, Washington University School of Medicine, St. Louis, Missouri

Sonya Liu, MD  
s.y.liu@wustl.edu

## INTRODUCTION

- Urinary tract infections (UTIs) are some of the most common bacterial infections in outpatient settings. Evidence-based recommendations suggest empiric treatment of healthy female patients presenting with  $\geq 2$  classic symptoms of UTIs, rather than urine testing.
- It is unknown how often urine testing is ordered in the community, and if there are opportunities to reduce the number of unnecessary urine tests.
- This study aims to describe national urine testing practices for uncomplicated UTIs in outpatient settings.

## METHODS

- Using the 2009-2015 Truven Health Analytics MarketScan<sup>®</sup> database we extracted outpatient claims data for non-pregnant women aged 18-44 years who met criteria for an uncomplicated UTI or cystitis with antibiotic prescribed  $\pm 5$  days of diagnosis.
- Women with recent infections, hospitalizations, urological abnormalities, diabetes, chronic kidney disease, immune compromise, or other complicating factors were excluded.
- Urine laboratory tests coded within  $\pm 5$  days of index UTI were identified.
- We compared frequencies of urine testing types according to patient age, region, provider type, testing location, and residence in a metropolitan statistical area (MSA) using Chi-square tests.
- Urine testing type and testing locations were compared over time from 2009-2015 using Cochran-Armitage test of trend.

## RESULTS

- Of 848,798 eligible patients with uncomplicated UTI, 742,683 (88%) received at least 1 urine test.
- Of the patients who received at least 1 test, 366,208 (49%) patients received both a urinalysis (UA) and culture, 310,742 (42%) received a UA only, and 65,733 (9%) received culture only.
- Significant variation in testing was observed by patient age, region, MSA, provider type, and testing location (Table 1).
- Patients in the Northeast and in urban locations more frequently received both a UA and culture.
- Patients who received both UA and culture were more likely to have been seen by an OB/GYN, whereas patients treated empirically without testing were more likely to have been seen by emergency physicians. (Table 3).
- From 2009 to 2015, the ordering of both UA and culture increased (Fig 1). Urine testing increased at urgent care centers and decreased at offices (Fig 2).

## RESULTS

**Table 1: Characteristics of study population by type of testing at initial visit**

Characteristic	No Test <sup>1</sup> 12.5% (n=106,115)	Urinalysis (UA) only 36.6% (n=310,742)	Culture only 7.7% (n=65,733)	UA & Culture 43.1% (n=366,208)
<b>Age (yrs)</b>				
18-24 (270,124)	12.8 (34,565)	36.6 (98,821)	7.2 (19,489)	43.4 (117,249)
25-30 (157,426)	12.9 (20,356)	36.8 (57,936)	8.0 (12,623)	42.3 (66,511)
31-35 (137,901)	12.3 (17,018)	36.8 (50,697)	8.0 (11,004)	42.9 (59,182)
36-40 (154,354)	12.2 (18,753)	36.5 (56,384)	8.0 (12,294)	43.4 (66,923)
41-44 (128,993)	12.0 (15,423)	36.4 (46,904)	8.0 (10,323)	43.7 (56,343)
<b>Region</b>				
Northeast (121,936)	13.8 (16,793)	24.2 (29,554)	12.3 (14,966)	49.7 (60,623)
Midwest (192,961)	11.2 (21,680)	41.3 (79,767)	5.0 (9,606)	42.5 (81,908)
South (343,963)	12.4 (42,552)	39.2 (134,980)	8.0 (27,643)	40.4 (138,788)
West (173,045)	13.5 (23,287)	34.2 (59,219)	7.3 (12,642)	45.0 (77,897)
Unknown (16,893)	10.7 (1,803)	42.8 (7,222)	5.2 (876)	41.4 (6,992)
<b>Metropolitan Statistical Area<sup>2</sup></b>				
Rural (115,308)	12.3 (14,163)	45.2 (52,153)	4.8 (5,479)	37.7 (43,513)
Urban (716,958)	12.6 (90,275)	35.1 (251,456)	8.3 (59,401)	44.1 (315,826)

Note: All p-values are <0.05. Row percentages are displayed. Columns are mutually exclusive. <sup>1</sup>No test- No UA or culture. <sup>2</sup>MSA was missing for 16,532 observations.

**Table 2: Urine testing type performed by location**

Location <sup>1</sup>	No Test 12.5% (n=106,115)	Urinalysis (UA) only 36.6% (n=310,742)	Culture only 7.7% (n=65,733)	UA & Culture 43.1% (n=366,208)
Office (675,409)	10.4 (70,145)	37.8 (255,371)	7.8 (52,525)	44.0 (297,368)
Urgent Care (64,090)	12.9 (8,283)	39.8 (25,511)	9.2 (5,875)	38.1 (24,421)
ED (97,616)	28.2 (27,527)	29.7 (28,963)	1.5 (1,487)	40.6 (39,639)
Lab (11,683)	1.4 (160)	7.7 (897)	50.0 (5,846)	40.9 (4,780)

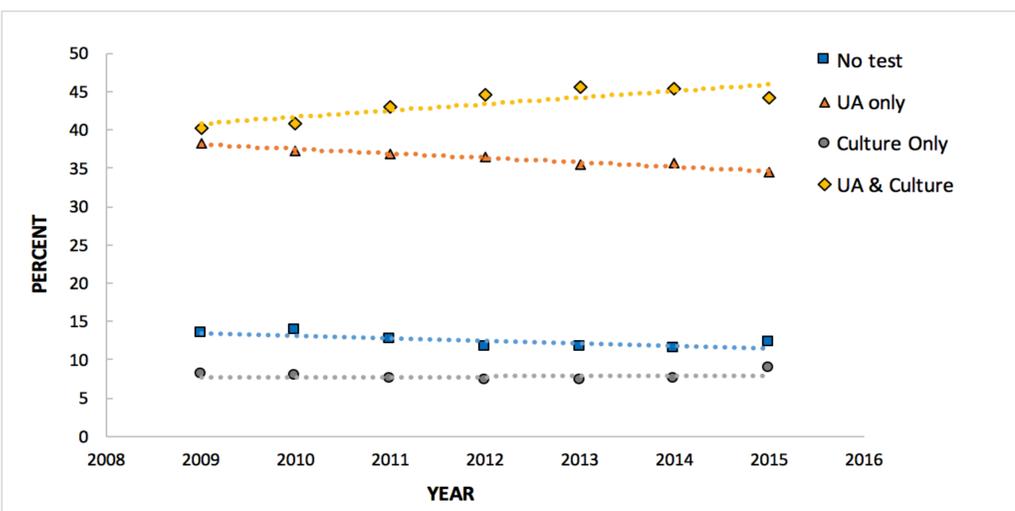
Note: All p-values are <0.05. Row percentages are displayed. Columns are mutually exclusive. ED=emergency department. <sup>1</sup>We used UTI diagnosis location when no test was ordered.

**Table 3: Urine testing type performed by provider specialty**

Ordering Provider	No Test 12.5% (n=106,115)	Urinalysis (UA) only 36.6% (n=310,742)	Culture only 7.7% (n=65,733)	UA & Culture 43.1% (n=366,208)
Internist (130,573)	13.6 (17,793)	36.1 (47,119)	6.3 (8,208)	44.0 (57,453)
Family Medicine (320,250)	9.1 (29,067)	40.6 (129,993)	5.7 (18,223)	44.6 (142,967)
Emergency Medicine (70,513)	24.7 (17,388)	32.9 (23,165)	2.4 (1,724)	40.0 (28,236)
Ob-Gyn (77,132)	8.2 (6,357)	20.9 (16,121)	16.6 (12,782)	54.3 (41,872)
MD, other (57,923)	12.2 (7,071)	39.4 (22,840)	5.7 (3,311)	42.6 (24,701)
PA & NP (48,462)	14.0 (6,766)	46.6 (22,592)	3.9 (1,884)	35.5 (17,220)
Other (132,262) <sup>1</sup>	16.3 (21,513)	36.3 (48,015)	10.4 (13,755)	37.0 (48,979)
No Provider <sup>2</sup> (11,683)	1.4 (160)	7.7 (897)	50.0 (5,846)	40.9 (4,780)

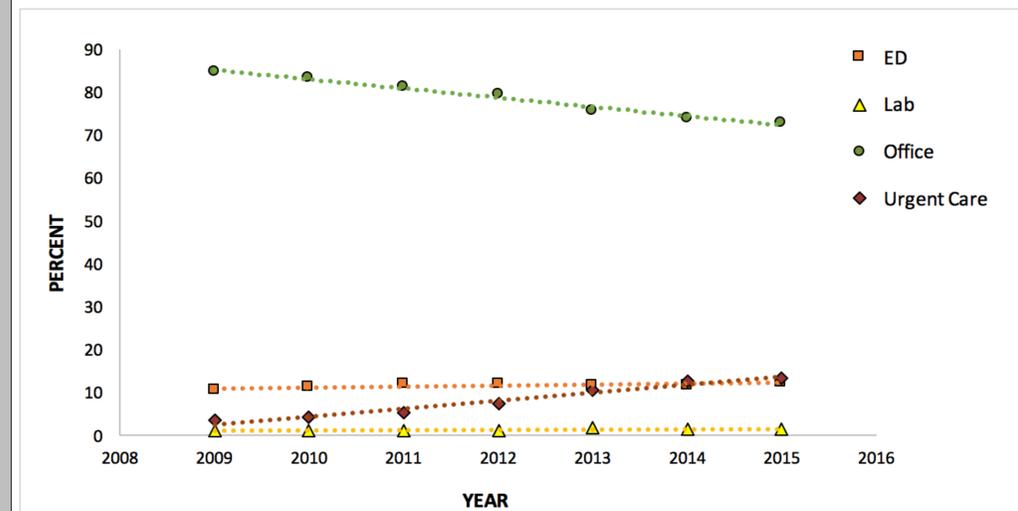
Note: All p-values are <0.05. Ordering provider is based on the provider type associated with the closest office visit. <sup>1</sup>Other consists of providers not otherwise listed or providers with missing specialty information. <sup>2</sup>No ordering provider represents laboratory claims without accompanying visit.

**Figure 1: Urine testing trends from 2009-2015**



Note: All p-values are <0.0001 except for Culture Only (p=0.007) by Cochran-Armitage test for trend.

**Figure 2: Testing location trends from 2009-2015**



Note: All p-values are <0.0001 by Cochran-Armitage test for trend.

## CONCLUSIONS

- In contrast to evidence-based recommendations for empiric treatment, the vast majority of patients with uncomplicated UTI received at least one urine test.
- We observed variation in urine testing practices by demographic and clinical factors. We observed temporal trends in urine testing. Specifically, ordering of UA and culture increased, while urine testing increased at urgent care centers and decreased at offices.
- Our results suggest that diagnostic testing stewardship opportunities exist for outpatients with UTIs.

## FUNDING

- Michael Durkin - WU Institute of Clinical and Translational Sciences (ICTS) grant UL1TR000448, sub award KL2TR00450
- Center for Administrative Data Research - WU ICTS grant UL1 TR002345 from the National Center for Advancing Translational Sciences (NIH) and grant R24 HS19455 from the Agency for Healthcare Research and Quality