

## Research Brief

# Preventing unnecessary urine cultures at a Veteran's affairs healthcare system

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## Introduction

An overarching goal of diagnostic stewardship is to improve the value of care delivery while avoiding patient harm.<sup>1</sup> One strategy to decrease unnecessary urine cultures (UCx) is to implement conditional urine reflex culture (CURCx) for routine urinary tract infection (UTI) diagnosis.<sup>2</sup> Currently no single accepted set of criteria for CURCx exists, and recent surveys indicate significant heterogeneity in its use.<sup>3,4</sup> CURCx protocols have previously demonstrated success, primarily in inpatient settings, without evidence of harm.<sup>5,6</sup>

In this report, we sought to quantify the impact of a quality improvement project aimed at reducing unnecessary urine testing across the care spectrum at our center using an education intervention followed by electronic medical record (EMR) order menu revisions including a CURCx option; we hypothesized that we would only attain decreased urine testing to the latter. We explored whether these interventions impacted catheter-associated UTI (CAUTI) and ID e-Consult rates. This study was cleared by the VA Portland Institutional Review Board (#3301).

## Methods

### Setting

The VA Portland Health Care System (VAPORHCS) serves ~95,000 Veterans and is comprised of an acute care hospital with 160 licensed beds, a 76-bed community living center (CLC) providing inpatient rehabilitation and skilled nursing care, and 10 outpatient clinics.

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## Workgroup

We convened a multidisciplinary workgroup led by infection prevention which included stakeholders from infectious diseases (IDs), antibiotic stewardship, microbiology laboratory, and nephrology. In learning of insufficiently descriptive and haphazardly arranged EMR order menus in addition to that positive urinalyses (UAs) were always undergoing automatic reflex to UCx, the workgroup determined to implement an educational campaign coupled with revised EMR order menus and testing options; the interventions were separated primarily due to logistical challenges.

## Interventions

### Education (4/2018)

We disseminated a newly created VAPORHCS UTI testing algorithm, adapted from others' published work.<sup>7</sup> We distributed the algorithm to clinical staff via email, presented the project and algorithm to all clinicians at a Medical Staff Meeting, and placed the document on internal Sharepoint (Supplemental Figure 1).

### EMR/Testing revisions (9/2019)

We revised the inpatient, outpatient, and emergency department (ED) urine section(s) of the order menus (Supplemental Figures 2–4). Revisions included improved clarity and organization, addition of UA-only and CURCx test options, and placement of an embedded link to the UTI algorithm on Sharepoint. The new CURCx criteria required a positive nitrite, leukocyte esterase, or  $\geq 10$  WBC/hpf to reflex to culture. These changes were also broadly communicated to clinicians.

## Data analyses

We performed a retrospective, interrupted time-series analysis from 1/2017 to 5/2021 with two intervention time points (4/2018, 9/2019). We analyzed UCx results (beginning 1/2017) and the counts of all pertinent urine tests (beginning 6/2017)



**Table 1.** Monthly urine tests (cumulative), urine cultures, and percent positivity compared by one-way ANOVA with Tukey–Kramer HSD ordered differences

Setting	Measure	Period 1 <sup>a</sup>	Period 2 <sup>b</sup>	Period 3 <sup>c</sup>	Period 1 vs 2 ( <i>P</i> value)	Period 1 vs 3 ( <i>P</i> value)	Period 2 vs 3 ( <i>P</i> value)
Inpatient	Mean number of monthly urine tests	172	161	157	<i>P</i> = .39	<i>P</i> = .20	<i>P</i> = .87
	Mean number of monthly cultures	95	57	30	<i>P</i> < .0001	<i>P</i> < .0001	<i>P</i> < .0001
	Percent positivity (%)	22	22	32	<i>P</i> = 1.0	<i>P</i> = .02	<i>P</i> = .02
Emergency department	Mean number of monthly urine tests	641	552	446	<i>P</i> = .0007	<i>P</i> < .0001	<i>P</i> < .0001
	Mean number of monthly cultures	110	91	147	<i>P</i> = .22	<i>P</i> = .01	<i>P</i> < .0001
	Percent positivity (%)	39	44	55	<i>P</i> = .16	<i>P</i> = .0001	<i>P</i> < .0001
Outpatient	Mean number of monthly urine tests	2213	2102	1736	<i>P</i> = .44	<i>P</i> < .0001	<i>P</i> < .0001
	Mean number of monthly cultures	628	619	379	<i>P</i> = .93	<i>P</i> < .0001	<i>P</i> < .0001
	Percent positivity (%)	38	36	45	<i>P</i> = .43	<i>P</i> < .0001	<i>P</i> < .0001
Institution-wide	Mean number of monthly urine tests	3027	2814	2339	<i>P</i> = .10	<i>P</i> < .0001	<i>P</i> < .0001
	Mean number of monthly cultures	833	767	556	<i>P</i> = .03	<i>P</i> < .0001	<i>P</i> < .0001
	Percent positivity (%)	36	36	47	<i>P</i> = .94	<i>P</i> < .0001	<i>P</i> < .0001

<sup>a</sup>July 2017 to March 2018 (urine tests) and January 2017 to March 2018 (urine cultures and percent positivity), preintervention.

<sup>b</sup>May 2019 to August 2020, mid-intervention (ie, between interventions; March, April, and May 2020 excluded from analysis).

<sup>c</sup>October 2020 to May 2021, postintervention.

pre-, mid-, and postintervention and stratified by location: inpatient (including acute care and CLC), ED, and outpatient. Because growth of any amount could prompt antibiotic use, a positive UCx was defined as a culture that yielded any bacterial growth. We counted the number of ID e-Consults for bacteriuria and UTI and obtained the quarterly institutional CAUTI counts and rate. The intervention months (and quarters for CAUTI) were omitted. After initial data review, to account for the most obvious impact of the COVID-19 pandemic when clinical operations were curtailed, data from 3/2020–5/2020 were additionally excluded. One-way ANOVA with Tukey–Kramer honest significant difference (HSD) ordered differences was used to compare the three time periods for all variables using GraphPad Prism version 9.0 (San Diego, CA, USA).

## Results

The average number of urine tests ordered per month decreased by 23% from pre- to postintervention (*P* < .001) and 17% from mid- to postintervention (*P* < .001) (see Table 1 and Supplementary Figure 5). Of 39,770 postintervention urine tests ordered, 24,558 (62%) were CURCx or direct UCx while 15,212 (38%) were UA-only. Postintervention, UA-only orders comprised 31% of inpatient, 13% of ED, and 41% of outpatient total urine testing orders.

The monthly average number of UCx performed decreased by 33% from pre- to postintervention (*P* < .0001) and 28% mid- to postintervention (*P* < .0001). Notably, unlike the inpatient and outpatient settings, UCx orders increased 34% in the ED between the pre- to postintervention time periods (*P* = .01). Also, % positivity of UCx increased from pre- and mid-intervention (36%) to postintervention (47%; *P* < .0001) (see Table 1 and Supplemental Figure 6). The CAUTI rate and number of ID e-Consults were not statistically impacted (see Supplementary Tables 3 and 4).

## Discussion

Our study was unique in that we were able to assess the impact of urine testing interventions to improve diagnostic stewardship across the care spectrum in a healthcare system. We found a

clinically important 23% decrease in cumulative monthly urine tests and 33% decrease in the number of UCxs performed between pre- and postintervention periods. These changes were primarily driven by the bundled EMR/testing revisions, as nicely demonstrated by the UA-only option comprising 38% of postintervention urine test orders. In the stratified analyses, the decrease of monthly UCx was driven both by the inpatient (68% decrease) and outpatient settings (40% decrease); the reasons behind the unexpected 34% increase in the ED is a topic demanding further exploration. Additionally, while no identifiable change in CAUTI rate or ID e-Consults were seen, the absolute numbers of these events were small. Limitations of this study include its single-center, descriptive nature and the influence of the COVID-19 pandemic beyond the initial shut-down on ordering patterns including the paradigm shift to virtual care. In summary, this study demonstrated a clinically relevant and statistically significant impact of a multidisciplinary diagnostic stewardship project to reduce unnecessary urine tests at a large VA healthcare system.

**Supplementary material.** The supplementary material for this article can be found at <https://doi.org/10.1017/ice.2024.44>.

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