Infection Control & Hospital Epidemiology (2024), **45**, 1015–1018
doi:10.1017/ice.2024.44

SHEA

Research Brief

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

Chad D. Nix MSc, CIC[1], William B. Messer MD, PhD[2,3,4], Amy Boda[5], Kimberly T. MacKay PharmD[5,6], Jennifer Holmquist MS, RN, CNS, CIC[5], La'Tonzia L. Adams MD, MS[7], Eric Gladwin MLS(ASCP)[7] and Christopher D. Pfeiffer MD, MHS[4,5]

[1]School of Medicine, Oregon Health & Science University, Portland, OR, USA, [2]Department of Molecular Microbiology and Immunology, School of Medicine, Oregon Health and Science University, Portland, OR, USA, [3]Program in Epidemiology, Oregon Health & Science University-Portland State University (OHSU-PSU) School of Public Health, Portland, OR, USA, [4]Division of Infectious Diseases, Department of Medicine, Oregon Health and Science University, Portland, OR, USA, [5]Division of Hospital and Specialty Medicine, VA Portland Health Care System, Portland, OR, USA, [6]Department of Pharmacy, VA Portland Health Care System, Portland, OR, USA and [7]Pathology and Laboratory Medicine Service, VA Portland Health Care System, Portland, OR, USA

Introduction

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

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.

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.[7] 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 ≥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) 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

Corresponding author: Christopher D. Pfeiffer; Email: Christopher.Pfeiffer2@va.gov
Cite this article: Nix CD, Messer WB, Boda A, *et al.* Preventing unnecessary urine cultures at a Veteran's affairs healthcare system. *Infect Control Hosp Epidemiol* 2024. 45: 1015–1017, doi: 10.1017/ice.2024.44

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

[a]July 2017 to March 2018 (urine tests) and January 2017 to March 2018 (urine cultures and percent positivity), preintervention.
[b]May 2019 to August 2020, mid-intervention (ie, between interventions; March, April, and May 2020 excluded from analysis).
[c]October 2020 to May 2021, postintervention.

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.

Acknowledgments. We thank Tonya Dirkx, MD, Nephrology, VAPORHCS, for assistance and advice in updating the UTI order menus.

Financial support. None reported.

Competing interests. Dr. Pfeiffer reports grants from Pfizer and Department of Defense/MedPace, outside the submitted work.

References

1. Fabre V, Davis A, Diekema DJ, *et al.* Principles of diagnostic stewardship: A practical guide from the Society for Healthcare Epidemiology of America Diagnostic Stewardship Task Force. *Infect Control Hosp Epidemiol* 2023; 44:178–185. doi: 10.1017/ice.2023.5
2. Morgan DJ, Malani P, Diekema DJ. Diagnostic Stewardship-Leveraging the Laboratory to Improve Antimicrobial Use. *JAMA* 2017;318:607–608. doi: 10.1001/jama.2017.8531

3. Ling D, Seidelman J, Dodds-Ashley E, *et al.* Navigating reflex urine culture practices in community hospitals: Need for a validated approach. *Am J Infect Control* 2020;48:1549–1551. doi: 10.1016/j.ajic.2020.06.218
4. Sullivan KV, Morgan DJ, Leekha S. Use of diagnostic stewardship practices to improve urine culturing among SHEA Research Network hospitals. *Infect Control Hosp Epidemiol* 2019;40:228–231. doi: 10.1017/ice.2018.325
5. Claeys KC, Zhan M, Pineles L, *et al.* Conditional reflex to urine culture: Evaluation of a diagnostic stewardship intervention within the Veterans' Affairs and Centers for Disease Control and Prevention Practice-Based Research Network. *Infect Control Hosp Epidemiol* 2021;42:176–181. doi: 10.1017/ice.2020.400
6. Lynch CS, Appleby-Sigler A, Bork JT, *et al.* Effect of urine reflex culturing on rates of cultures and infections in acute and long-term care. *Antimicrob Resist Infect Control* 2020;9:96. doi: 10.1186/s13756-020-00762-1
7. Naik AD, Skelton F, Amspoker AB, Glasgow RA, Trautner BW. A fast and frugal algorithm to strengthen diagnosis and treatment decisions for catheter-associated bacteriuria. *PLoS One* 2017;12:e0174415. doi: 10.1371/journal.pone.0174415

Testing residual chloramine levels in tap water across sink locations in a US academic hospital setting

Katie Gravagna MSc[1], Sharon C. Thompson MT(ASCP)[2], Emily Sickbert-Bennett PhD[1,2,3] and David J. Weber MD[1,2,3] for the CDC Prevention Epicenters Program

[1]Department of Epidemiology, Gillings School of Global Public Health, University of North Carolina at Chapel Hill, Chapel Hill, NC, USA, [2]Department of Infection Prevention, University of North Carolina Medical Center, Chapel Hill, NC, USA and [3]Division of Infectious Diseases, Department of Medicine, University of North Carolina at Chapel Hill, Chapel Hill, NC, USA

Introduction

Flushing sinks is a useful tactic to mitigate the buildup of opportunistic premise plumbing pathogens (eg, *Legionella*) present in tap water by providing higher levels of disinfectant.[1] This strategy is often included in facilities' water management plans.[2,3] However, there is not a consensus in the literature about how long sinks should be flushed, and protocols for sink flushing appear to vary by study and institution. Therefore, the objective of this study was to test and compare residual chloramine levels at different hospital sinks before, during, and after multiple minutes of flushing.

Methods

This longitudinal study was done as part of a quality improvement project. No chloramine supplementation or routine testing was done at the study facility. Local water is treated with chloramine for 11 months and treated with chlorine in March annually. Eleven sinks were chosen for sampling across the hospital to achieve a distribution of water service line distances and plumbing designs and ages: one ground floor, six fourth floor, two fifth floor, and two sixth floor sinks were sampled. Hospital units sampled in this study included the MRI department, the cardiothoracic stepdown unit (CTSU), the cardiothoracic intensive care unit (TICU), the burn intensive care unit (BICU), 6 West, and 6 Neuroscience Hospital (6NSH). When available, both room and bathroom sinks were sampled (total locations sampled = 9; room/bathroom pairs = 2).

Water samples were collected in 1-liter glass containers. Prior to sample collection, these containers were soaked in a dilute bleach solution (1 mL of commercial bleach to 1 liter of deionized water) for 1 hour and rinsed with deionized water. Equal amounts of hot and cold water were collected from each sink by simultaneously opening both taps to the furthest point when sampling began. Water samples were collected in individual containers at zero (directly from the tap when first turned on), 1, 2, and 3 minutes of simultaneous flushing for each sink. Following these results, additional samples were collected at 0, 15, 30, and 45 seconds to determine if there was a minimum time for flushing to raise residual chloramine levels. Normal drinking water chloramine residual levels range from 1.0 to 4.0 mg/L.[4]

Residual chloramine levels for 5 mL water samples were measured using the HACH DR300 colorimeter total chlorine protocol. Samples were analyzed immediately after collection. Chlorine standards were used for quality control before each series of residual chloramine measurements. The 5-mL sample cuvettes were rinsed three times with deionized water before and after each water sample was tested. Two 10-mL DPD Total Chlorine Reagent Powder Pillows were added to each 5 mL sample cuvette and allowed to dissolve for 20 seconds. After 3 minutes, the sample was placed in the HACH DR300 reader for residual chloramine measurement.

Results

For the first series of samples, the average residual chloramine level at 0 minutes of flushing was 2.01 mg/L and ranged from 1.3 mg/L in the CTSU (fourth floor) to 2.9 mg/L found in the TICU (fourth floor). One minute of flushing brought all sinks to 2.9 mg/L of residual chloramine or above (Figure 1A). No notable increase in residual chloramine levels was observed past 1 minute of flushing.

When the same sinks were flushed for 15-second intervals in the second stage of the study, 30 seconds of flushing was sufficient to raise all sinks to above 2.5 mg/L of residual chloramine (Figure 1B). The average residual chloramine level at 0 seconds of flushing for this series of samples was 2.06 mg/L.

Discussion

This study demonstrated that 1 minute of flushing was sufficient to raise residual chloramine levels to levels considered highly acceptable for disinfection, as 100% of sinks reached high levels (2.9 mg/L residual chloramine or higher) after 1 minute of flushing, even though residual chloramine levels measured before flushing occurred were highly variable across sinks. Smaller intervals of

Corresponding author: Katie Gravagna; Email: kgrava@unc.edu

Cite this article: Gravagna K, Thompson SC, Sickbert-Bennett E, Weber DJ. Testing residual chloramine levels in tap water across sink locations in a US academic hospital setting. *Infect Control Hosp Epidemiol* 2024. 45: 1017–1018, doi: 10.1017/ice.2024.34