*Infection Control & Hospital Epidemiology* (2020), **41**, 1344–1347
doi:10.1017/ice.2020.295

## Concise Communication

# Sustainably reducing device utilization and device-related infections with DeCATHlons, device alternatives, and decision support

Emil P. Lesho DO[1], Robert Clifford PhD[2], Kelly Vore PhD[3], Balazs Zsenits MD[4], Jose Alcantara MD[4], Bryan Gargano MD[5], Matthew Phillips MBA[4], Susan Boyd MS[6], Laura Eckert-Davis MS[7], Carlos Sosa BS[3], Roberto Vargas MD[8], Dawn Riedy MD[8], Deborah Stamps EdD[9], Hiloni Bhavsar MD[9], Jennifer Fede BSN[3], Maryrose Laguio-Vila MD[1] and Melissa Bronstein MPA[9]

[1]Infectious Diseases Unit, Rochester Regional Health, Rochester, New York, [2]Bioinformatics, Cavia Partners, Silver Spring, Maryland, [3]Infection Prevention, Rochester Regional Health, Rochester, New York, [4]Health Informatics, Rochester Regional Health, Rochester, New York, [5]Associate Chief Medical Officer, Rochester Regional Health, Rochester, New York, [6]Nursing, Rochester Regional Health, Rochester, New York, [7]Nursing, University of Rochester Medical Center, Rochester, New York, [8]Pathology Department, Rochester Regional Health, Rochester, New York and [9]Quality and Safety Institute, Rochester Regional Health, Rochester, New York

### Abstract

Engagement of frontline staff, along with senior leadership, in competition-style healthcare-associated infection reduction efforts, combined with electronic clinical decision support tools, appeared to reduce antibiotic regimen initiations for urinary tract infections ($P = .01$). Mean monthly standardized infection and device utilization ratios also decreased ($P < .003$ and $P < .0001$, respectively).

(Received 22 April 2020; accepted 8 June 2020; electronically published 30 June 2020)

Healthcare-associated infections (HAIs) are the most frequent adverse event in healthcare delivery worldwide, affecting up to 10% of patients on general medical-surgical wards and up to 30% of patients in intensive care units.[1] Annually, HAIs cost billions of dollars and cause an estimated 1.7 million infections and 99,000 associated deaths in the United States. Furthermore, 25% of all hospitalized patients have indwelling catheters,[2-4] and device-related HAIs, such as catheter-associated urinary tract infections (CAUTIs), are more likely to be caused by antibiotic-resistant bacteria.[5]

Reduction and prevention of HAIs, especially CAUTIs, which can account for up to one-third of all HAIs, are leading priorities for hospitals, regulators, and payors.[2,6,7] However, the US Center for Disease Control and Prevention's National Health Safety Network (CDC-NHSN) surveillance definition of CAUTI has limited clinical correlation; it does not fully reflect noninfectious harm related to the catheter.[2,7,8] Therefore, experts continue to debate and refine HAI surveillance metrics to best capture both catheter-related infectious harm and catheter-related non-infectious (CRNH) harm such as urethral trauma, immobility, pain, bleeding, and leakage. In fact, indwelling urinary catheters (IUCs) usually cause more noninfectious than infectious harm.[2,3,7]

The commonly used standardized infection ratio (SIR) does not fully capture CRNH or the impact of prevention efforts in all settings.[2,3,7] Alternatively, device utilization rates and ratios (DURs) do not reflect differences in other factors that may describe levels of device use.[8] Furthermore, DURs lose comparability over time and across settings, and they can mask truly effective interventions by selecting for a higher-risk group of catheterized patients.[8] Experts, including the CDC-NHSN, now support the use of the standardized utilization ratio (SUR).[8] However, a literature search revealed only 1 small, short-duration, single-center study that used the SUR as a metric.[9] Similarly, experts have criticized the quality of descriptions of interventions as "remarkably poor."[10] To address this, they encourage using the Template for Intervention Description and Replication (TIDieR) guidelines.[10] However, reports using the TIDieR format for CAUTI interventions are rare.

We implemented a multidimensional intervention capable of reducing IUC use and CAUTI across a 5-hospital healthcare system, totaling 1,056 acute-care beds. The intervention and outcomes are presented using the TIDieR guideline and the most recently recommended quality measure, namely the SUR.

## Methods

A before-and-after study was conducted at a 5-hospital healthcare system, totaling 1,692 acute-care beds from September 1, 2017, to October 1, 2019. Participants included all adult inpatients. The

**Author for correspondence:** Emil P. Lesho, E-mail: carolinelesho@yahoo.com

PREVIOUS PRESENTATION. These data were presented at the 2019 Spring SHEA Conference on April 24, 2019, in Boston, Massachusetts.

**Cite this article:** Lesho EP, *et al.* (2020). Sustainably reducing device utilization and device-related infections with DeCATHlons, device alternatives, and decision support. *Infection Control & Hospital Epidemiology*, 41: 1344–1347, https://doi.org/10.1017/ice.2020.295

intervention occurred from August 15, 2018, to September 14, 2018, and consisted of 3 major features. The first feature was an interactive educational campaign comprising one-on-one engagements between infection preventionists and frontline nurses and providers. This campaign was combined with an Olympic-style competition among units rewarding overall participation, device utilization, clandestinely monitored hand hygiene, and CAUTI rates. Both were collectively referred to as the 'DeCATHlon' (Supplemental Table 1 online). The second feature was making sure device alternatives, in the form of female external urinary collection devices and male custom-fitted condom catheters, were available to all units, and practitioners were trained in the indications and capabilities of the noninvasive devices. The third feature consisted of increasing the urinalysis reflex to culture threshold from >5 to ≥10 WBCs, and electronic prompts or computerized decision support (CDS) for ordering urine cultures for patients with intrauterine contraceptives (IUCs), and for encouraging device alternatives and catheter removal (Fig. 1). In addition to the 3 main components, weekly unit-specific device utilization reports were sent to each ward or patient care location. Monthly, quality department representatives discussed unit-level DURs with managers, who then reviewed patient-level device use at daily informal meetings with physicians and advanced practice providers. Executives, including the chief medical officer, also provided feedback to units and individual providers, especially those considered to be performance outliers. Supplemental Table 1 (online) details the intervention based on the TIDIER checklist.

The significance of differences between pre intervention and postintervention metrics was determined using the R statistical package. We performed 2 tests: the Student *t* test, which is optimized for normally distributed data, and the Kolmogorov-Smirnov test, which makes no assumptions about data distribution.

## Results

For the 2-year study period, the combined average daily census for all hospitals was 87% of capacity, the combined average length of stay was 6.8 days, the average infection prevention staff (IPS) to inpatient bed ratio was 1 IPS per 175 beds, and the average hand hygiene compliance rate was 74%. We noted no significant changes in length of stay, occupancy, staffing levels or hand hygiene compliance during the study period. In the postintervention period, a left ventricular-assist device (LVAD) service was launched. One year after the intervention, CAUTI rates, the SIR, device days, the SUR, and antibiotic prescriptions initiated for inpatient urinary tract infections (UTIs) significantly decreased. Orders for device alternatives and device-alternative days increased. Orders for IUCs significantly decreased (Supplemental Fig. 1 online), and orders using decision-support prompts for IUCs and urine cultures also significantly increased (Table 1). All major quality measures significantly improved in the postintervention period, and the results achieved significance, whether the parametric *t* test for normally distributed data or the nonparametric Kolmogorov-Smirnov test was used. Similarly, infection-related complications were reduced, regardless of denominator used, infection per device day, or infection per patient day (Table 1).[6] These improvements were comparable across all facilities and were proportional to the facility size.

## Discussion

These findings are noteworthy for several reasons. First, the LVAD service, launched in the postintervention period, became the second-busiest program of its type in the United States, and it identified a group of patients at high risk of IUC use and infection in the postintervention period who were absent in the preintervention period. Second, the improvements in the quality measures have been sustained beyond the end of the formal postintervention period (until early 2020, when COVID-19 overwhelmed infection prevention efforts). The mean monthly SIR and of 2019 was 1.06 (SD, 0.184) and the SUR for the last quarter was 0.91 (SD, 0.026); these values were not significantly different from those in the postintervention period ($P = 0.25$ and $P = 0.18$, respectively). Third, CAUTI interventions described using the TIDieR guideline are scarce. Fourth, despite numerous reports of interventions for reducing CAUTI, we were unable to locate large published studies that had used the recently recommended SUR as the main quality measure.[9]

This study had several limitations. The study had a quasi-experimental design, and we were unable to capture data pertaining to catheter-related bacteriuria and CAUTI-specific antibiotic usage. The initial stages of this approach are education based and time intensive, and the effect can be lost with staff turnover. However, the DeCATHlon stage is a crucial first step necessary for achieving buy-in, esprit de corps, and ownership, which ultimately fostered sustainability. Increased automation and CDS (an additional 90 hours) are also important for maintaining long-term impact. Last, we were unable to perform a cost analysis, but the DeCATHlon was done as part of everyone's regular hours and as part of their routine nursing, infection prevention, and leadership responsibilities at no extra cost.

Despite these limitations, the methods and findings are generalizable to other hospitals and any healthcare system that has an electronic medical record and supportive leadership. An approach using DeCATHlons, invasive device alternatives, and electronic clinical decision support is easily customizable to any infection, device, or diagnostic test. For example, we achieved comparable outcomes using a nearly identical but slightly less intense approach for reducing hospital-onset *Clostridioides difficile*. In the future, we plan to use this approach for central-line–associated blood stream infections, and to evaluate its feasibility for surgical site infections.

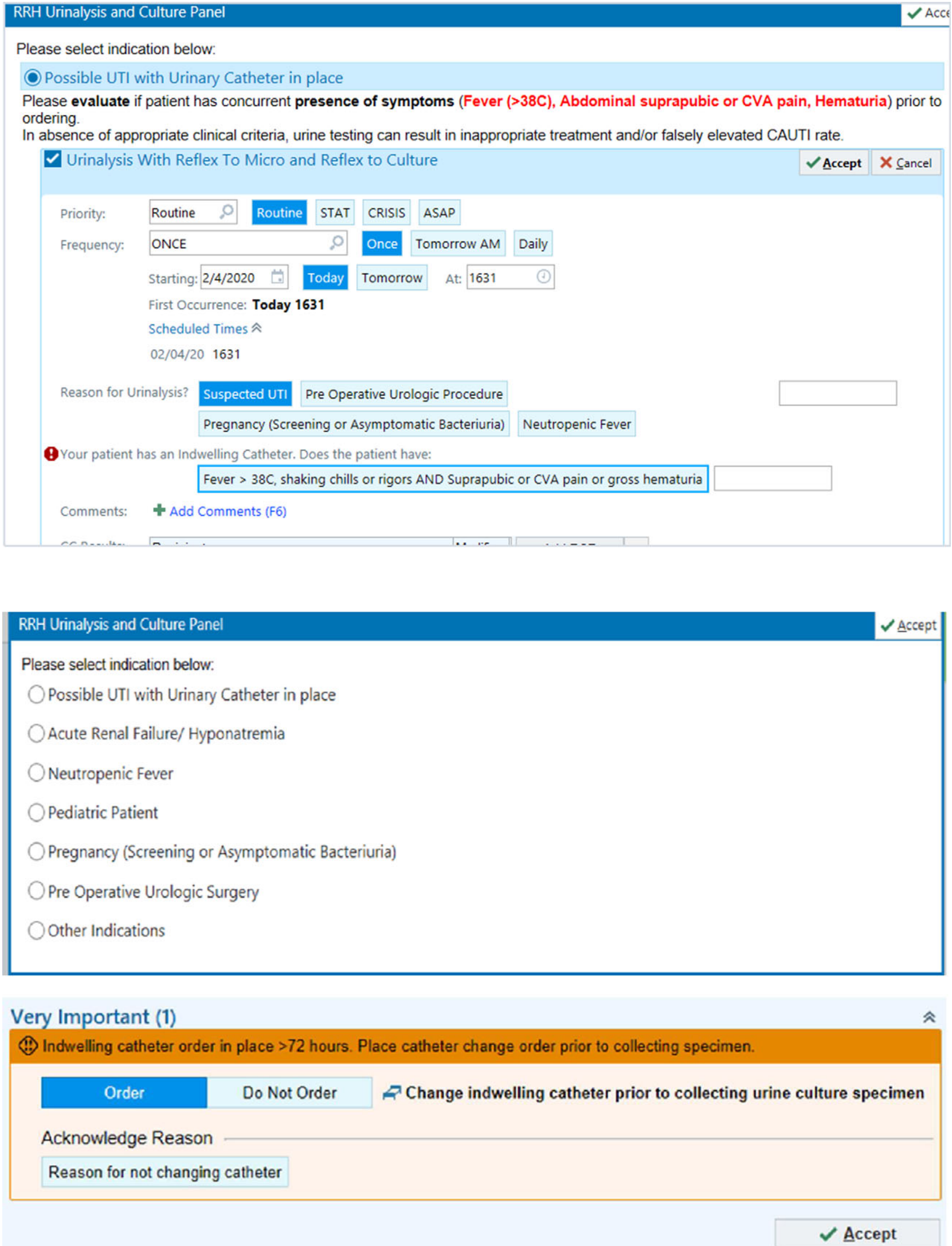


**Fig. 1.** Electronic prompts or clinical decision support for ordering urine cultures on patients with indwelling urinary catheter, and for encouraging device alternatives and catheter removal.

https://doi.org/10.1017/ice.2020.295 Published online by Cambridge University Press

**Table 1.** Preintervention and Postintervention Results

| Variable | Preintervention[a] | Postintervention[b] | *P* Value *T* test | *P* Value Kolmogorov-Smirnov Test |
|---|---|---|---|---|
| Total mean daily census | 897 | 809 | .4931 | ... |
| Mean monthly CAUTIs (SD) | 6.69 (1.97) | 3.08 (2.02) | .0002 | .0063 |
| Mean monthly SIR (SD) | 1.31 (0.41) | 0.70 (0.49) | .0029 | .0034 |
| Mean monthly patient days (SD) | 27,071 (1,150) | 26,879 (961) | .6544 | .9864 |
| CAUTI/10,000 patient days (SD) | 2.49 (0.77) | 1.15 (0.76) | .0002 | .0034 |
| Mean monthly orders for indwelling catheter (SD) | 1,402 (64.6) | 1,012 (125) | <.0001 | |
| Mean monthly device days (SD) | 4582 (430) | 3837 (357) | .0001 | .0002 |
| CAUTI/1,000 device days (SD) | 1.47 (0.45) | 0.80 (0.55) | .0035 | .0126 |
| Mean monthly SUR (SD) | 1.05 (0.09) | 0.85 (0.07) | <.0001 | .0003 |
| Mean monthly orders for device- alternatives (SD) | 23.11 (25.4) | 135.8 (22.5) | <.0001 | <.001 |
| Mean monthly device-alternative days (SD) | 108 (177) | 541 (34) | <.0001 | <.0001 |
| Mean monthly orders for indwelling catheters that were CDS supported | 0 (0) | 258 (94) | <.0001 | <.001 |
| Mean monthly orders for urine cultures (SD) | 903 (48.1) | 277.5 (274) | <.0001 | <.001 |
| Mean monthly urine culture orders that were CDS-supported (SD) | (0) | 335.8 (153) | <.0001 | <.001 |
| Antibiotic starts for UTI | 819.6 (82.2) | 739 (74.5) | .01 | ... |

Note. SD, standard deviation; SIR, standardized infection ratio; CAUTI, catheter-associated urinary tract infection; CDS, computerized decision support; UTI, urinary tract infection.
[a]September 1, 2017, to September 14, 2018.
[b]September 15, 2018, to September 30, 2019.

**Acknowledgments.** None.

**Financial support.** No financial support was provided relevant to this article.

**Conflicts of interest.** All authors report no conflicts of interest relevant to this article.

**Supplementary material.** To view supplementary material for this article, please visit https://doi.org/10.1017/ice.2020.295

## References

1. Healthcare-associated infections fact sheet. World Health Organization website. https://www.who.int/gpsc/country_work/gpsc_ccisc_fact_sheet_en.pdf. Accessed April 22, 2020.
2. Advani SD, Fakih MG. The evolution of catheter-associated urinary tract infection (CAUTI): is it time for more inclusive metrics? *Infect Control Hosp Epidemiol* 2019;40:681–685.
3. Hollingsworth JM, Rogers MAM, Krein SL, *et al.* Determining the noninfectious complications of indwelling urethral catheters: a systematic review and meta-analysis. *Ann Intern Med* 2013;159:401–410.
4. Gokula RR, Hickner JA, Smith MA. Inappropriate use of urinary catheters in elderly patients at a midwestern community teaching hospital. *Am J Infect Control* 2004;32:196–199.
5. Weiner-Lastinger LM, Abner S, Edwards JR, *et al.* Antimicrobial-resistant pathogens associated with adult healthcare-associated infections: summary of data reported to the National Healthcare Safety Network, 2015–2017. *Infect Control Hosp Epidemiol 2020*;41:1–18.
6. Wright M, Kharasch M, Beaumont JL, Peterson LR, Robicsek A. Reporting catheter-associated urinary tract infections: denominator matters. *Infect Control Hosp Epidemiol* 2011;32:635–640.
7. Fakih MG, Gould CV, Trautner BW, *et al.* Beyond infection: device utilization ratio as a performance measure for urinary catheter harm. *Infect Control Hosp Epidemiol* 2016;37:327–333.
8. The NHSN standardized utilization ratio (SUR). Centers for Disease Control and Prevention website. https://www.cdc.gov/nhsn/pdfs/ps-analysis-resources/nhsn-sur-guide-508.pdf. Accessed April 22, 2020.
9. Mueller, C. Finally! An external female catheter device for women! *Am J Infect Control* 2019;47:S13.
10. Hoffmann TC, Glasziou PP, Boutron I, *et al.* Better reporting of interventions: template for intervention description and replication (TIDieR) checklist and guide. *BMJ* 2014;348:g1687.