How does implementation of a urine testing algorithm affect testing stewardship?

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Introduction

Positive urine cultures in the absence of signs or symptoms (S/Sx) of a urinary tract infection (UTI) often result in inappropriate antibiotic treatment. Antibiotics prescribed for asymptomatic bacteriuria (ASB) without a clear indication may compromise patient safety by increasing risk for colonization or infection with drug resistant pathogens and *Clostridium difficile*.
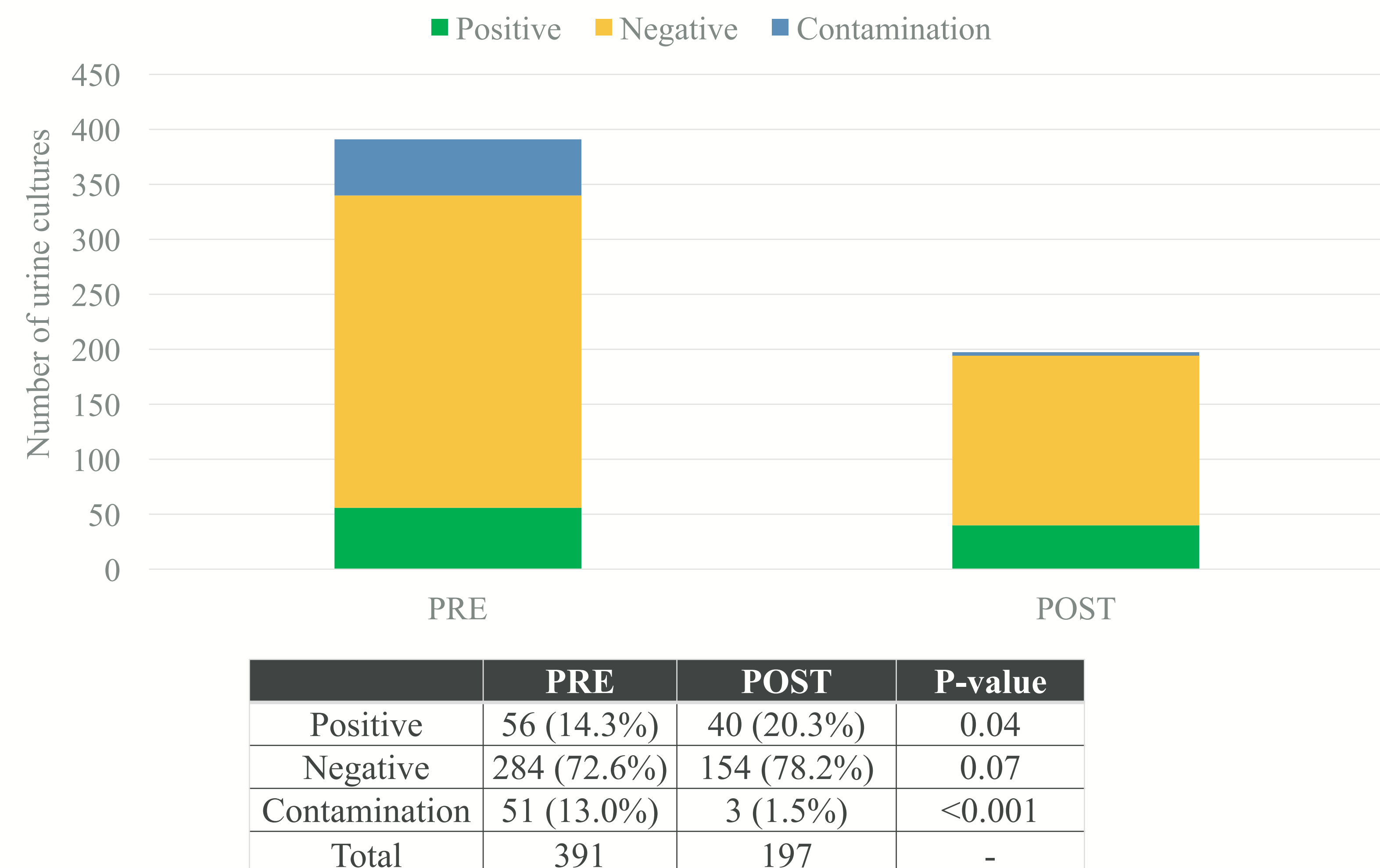
Hypothesis

Following the implementation of a urine culture testing algorithm, we will observe a significant decrease in urine cultures sent, and out of those resulting positive, an increased proportion will be associated with a patient exhibiting S/Sx of a UTI.
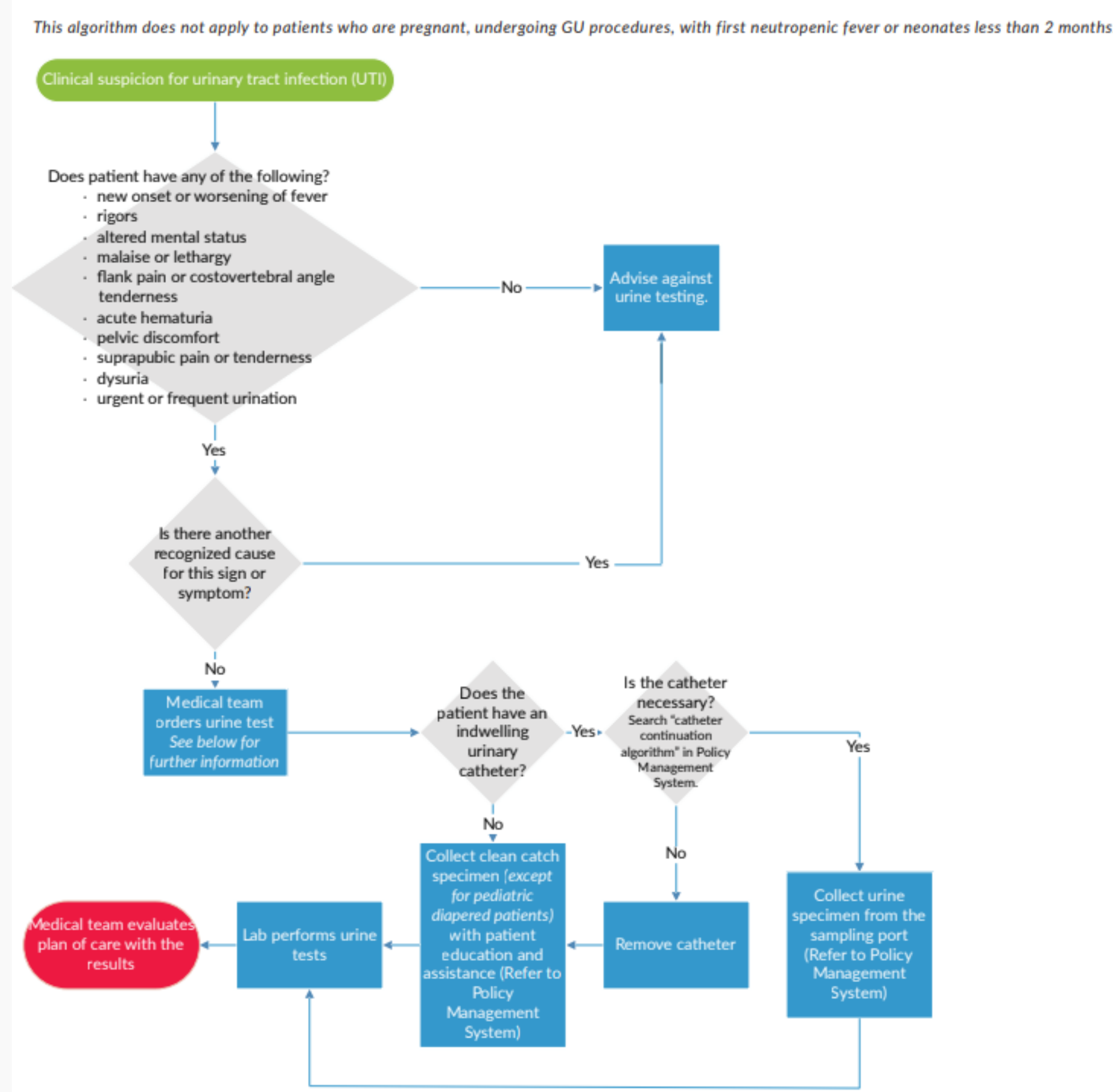
Methods

- As part of an initiative to decrease catheter-associated urinary tract infections (CAUTI) and inappropriate treatment of ASB at a university hospital, an algorithm was introduced to guide urine culturing on all inpatient units from April 2016 to April 2017
- Jobs aides were distributed for proper collection of urine specimens
- Urine culture data was collected from the electronic medical record for a 31 day period before and after algorithm implementation
- February 1-March 2, 2016 was defined as the pre-intervention (PRE) time period and May 2017 as the post-intervention (POST) time period
- A positive urine culture was defined as the growth of ≥100K colony forming units (CFU) of bacteria per milliliter
- Using a standardized data abstraction process, we conducted chart reviews on a random subset of patients to determine the presence of UTI S/Sx 24 hours before specimen collection
- T-tests were used to compare urine culture algorithm compliance with culture results, pre and post implementation

Results

Figure 1. A 49.6% decrease in overall urine culturing was observed following algorithm implementation.

	PRE	POST	P-value
Positive	56 (14.3%)	40 (20.3%)	0.04
Negative	284 (72.6%)	154 (78.2%)	0.07
Contamination	51 (13.0%)	3 (1.5%)	<0.001
Total	391	197	-

Collaborative Decision Support: Urine Culture Testing

This algorithm does not apply to patients who are pregnant, undergoing GU procedures, with first neutropenic fever or neonates less than 2 months.

Appropriate Urine Culturing at OHSU

IMPERATIVE (WHY? WHAT IS DRIVING THIS?)

Currently, urine cultures are ordered for a wide variety of reasons, some of which are not consistent with the current evidence, including:

Evidence **does not support** ordering cultures based on these criteria **alone**:
- ☐ Foul smelling and/or cloudy with increased sediment without symptoms.
- ☐ Patient who has a urinary catheter reporting a sense of urgency or pain/dysuria
- ☐ Fever work up (true urinary tract infections are rarely the source of fevers in those with indwelling catheters, even if the culture is positive and believable. There is generally another source of those fevers).

Inappropriate testing has significant risks to patients and healthcare affordability
- ☐ Inappropriate antibiotic use, which can lead to unnecessary medication, side effects, increased risk of *Clostridium difficile* and increased risk of the development of multidrug resistant organisms.
- ☐ A falsely elevated rate of catheter-associated UTIs can reduce reimbursement.
- ☐ Overutilization of lab resources.
- ☐ Increased cost to patients.

RISK FACTORS FOR URINARY TRACT INFECTION
- ☐ Indwelling urinary catheter   ☐ Female sex   ☐ Age > 65 years

DESIRED FUTURE STATE

Urine testing is based on consistent, evidence-based criteria.
Clinical Decision making is guided by a clinician approved OHSU algorithm.

URINE TESTING OPTIONS
- ☐ Urinalysis (UA) = tests for leukocyte esterase or nitrites in the urine
- ☐ Urine microscopy (Micro) = tests for white blood cells or organisms in the urine
- ☐ Urine screen to culture = UA; if presence of any leukocyte esterase or nitrites, urine culture is performed automatically
- ☐ Urine culture = tests for growth of organisms. Amount reported in colony forming units
- ☐ Adult UTI panel = UA and Micro; if presence of any leukocyte esterase, nitrites, bacteria, yeast or white blood cells ≥ 5, urine culture is performed automatically by the laboratory

CALL TO ACTION
- ☐ Use the Urine Culture Algorithm when you suspect a UTI (except if the patient is pregnant, undergoing GU procedures, or has their first neutropenic fever).
- ☐ Use the Urine Culture Algorithm in conjunction with the Job Breakdown Sheets for Obtaining Urine Sample with and without a urinary catheter (O2: Search "HAI Prevention"; select CAUTI site).

RESOURCES

Additional resources about urine testing, urinary catheter insertion, maintenance or removal, or OHSU CAUTI surveillance data:

O2: Infection Prevention and Control / HAI Prevention / *Catheter Associated Urinary Tract Infection.*

Figure 2. The percentage of samples in compliance with urine culture testing algorithm.
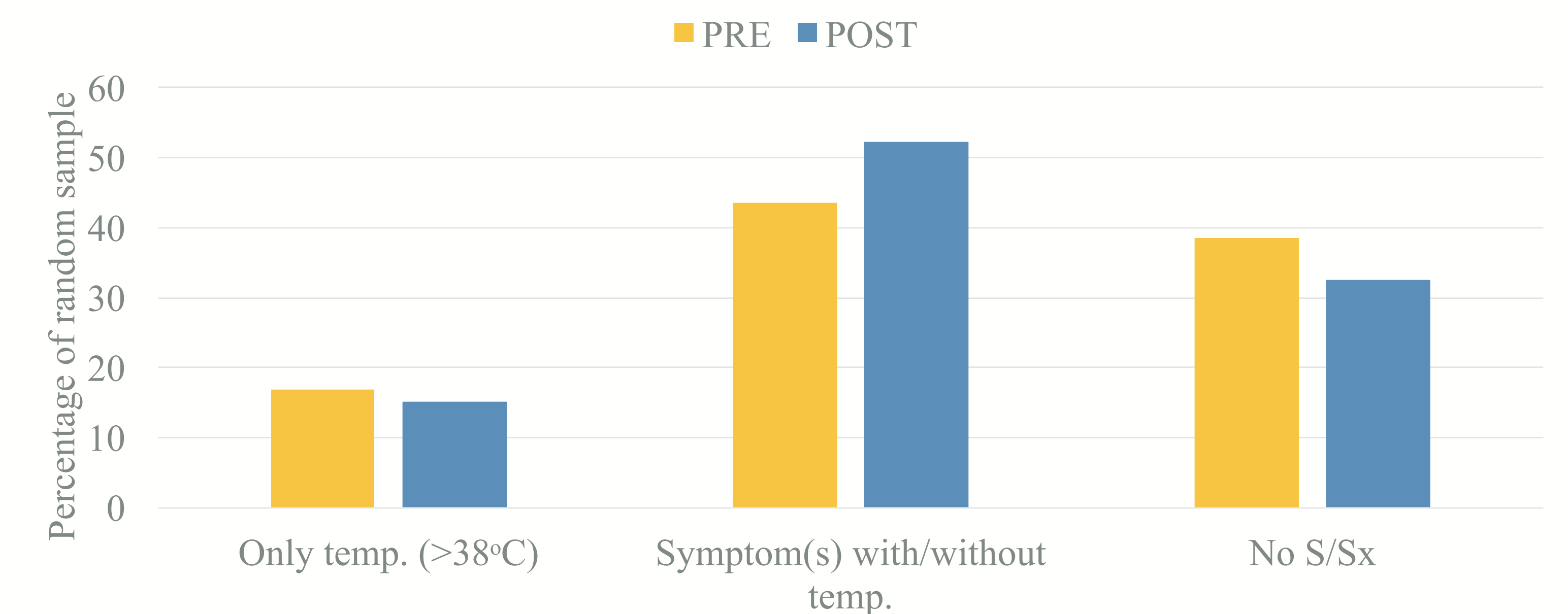
	PRE		POST	
	Meets	Does not meet	Meets	Does not meet
Positive	8 (7.9%)	7 (6.9%)	7 (15.2%)	2 (4.3%%)
Negative	50 (49.5%)	28 (27.7%)	24 (52.2%)	13 (28.3%)
Contamination	4 (4.0%)	4 (4.0%)	0 (0%)	0 (0%)
Total	62 (61.4%)	39 (38.6%)	31 (67.4%)	15 (32.6%)

Conclusion

Despite an overall decrease in the quantity of tests sent, and a significant increase in the proportion resulting positive, the random sample only showed a slight increase in urine culturing meeting algorithm criteria and a slight decrease in positive cultures without a S/Sx (i.e. ASB). It appears that even with the dissemination of best practice, urine cultures continue to be sent without a S/Sx of a UTI. This is thought to be due to a continued lack of understanding of testing options and the lab's current protocol; reflexing to culture is often leading to unintentional culturing. There was however a significant reduction in contaminated urine specimens. This is thought to be due to the distribution of job aides on proper urine collection technique. As we know, UTIs are rarely the cause of new fevers. There may an opportunity to reduce culturing in the setting of this sign only.

Next steps

➢ Identify individuals and/or groups who send urine cultures off-algorithm most frequently, then conduct focus groups with these providers to identify obstacles to following the algorithm
➢ Simplify lab testing options
➢ Provide clarification to increase understanding of urine testing options
➢ Investigate inappropriate antibiotic use for ASB and associated cases of *C. difficile* infection post algorithm implementation
➢ Consider suppression of results when a reflex to culture occurs to reduce treatment of ASB

References

Hooton, Thomas M., et al. Diagnosis, Prevention, and Treatment of Catheter-Associated Urinary Tract Infection in Adults: 2009 International Clinical Practice Guidelines from the Infectious Diseases Society of America | Clinical Infectious Diseases. *OUP Academic*, Oxford University Press (March 2010).

Urinary Tract Infection (Catheter-Associated Urinary Tract Infection [CAUTI] and Non-Catheter-Associated Urinary Tract Infection [UTI]) and Other Urinary System Infection [USI]) Events. Center for Disease Control and Prevention (January 2018).

No conflicts of interest to disclose