Individual QI projects from single institutions

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# Increasing *Trichomonas vaginalis* testing for high-risk adolescents a pediatric emergency department

*Kristin S. Stukus, MD*; Don Buckingham, MBOE†; Daniel M. Cohen, MD**

**Abstract**

**Background:** Trichomonas is a common sexually transmitted infection (STI) among adolescents, causing vaginal discharge, pelvic pain, and dysuria. Affected individuals have increased susceptibility to other STIs and may have pregnancy complications. A quality improvement project was developed to increase trichomonas testing among high-risk adolescent patients from 40% in July 2014 to 100% by December 31, 2014, and sustain over 6 months. **Methods:** An interdisciplinary team (providers and support staff) was assembled to address this objective. We collected 6 months of baseline data. Deploying the Institute for Healthcare Improvement Model for Improvement, we formulated an aim statement and identified key drivers. We used cause analysis to identify interventions for each problem area. Multiple Plan-Do-Study-Act cycles were undertaken, and results were monitored using control charts. Interventions included increasing awareness and education for clinical staff; changing computer order entry for the test; using order sets for STI; and adding a Licensed Professional Initiated Protocol to nurse ordering practice. These interventions were all done in conjunction with feedback to providers for individual missed cases. **Results:** Over 18 months, the trichomonas testing rate rose with each intervention: from 25% (January 2014) to 98% (December 2014), which we have sustained through June 2015. **Implications and Contributions:** This article demonstrates the successful use of quality improvement methodology to increase rates of *Trichomonas vaginalis* testing among at-risk adolescent patients. Increased testing results in increased detection and improved treatment and sexual health for our patients. **Conclusion:** Improving the trichomonas testing process in the pediatric emergency department results in higher screening rates among high-risk adolescent patients. *(Pediatr Qual Saf 2019;2:e140; doi: 10.1097/pq9.0000000000000140; Published online April 2, 2019.)*

## INTRODUCTION

Sexually transmitted infections (STIs) cause significant morbidity within the adolescent population. Adolescents are at high risk for contracting STIs due to unsafe sexual practices and lack of access to routine health care.[1] Adolescents at highest risk include African Americans and those with lower socioeconomic status.[2] These patient populations frequently utilize the emergency department (ED) for routine health care problems.[3,4]

In females, trichomonas infection can cause vaginal discharge, dysuria, and pelvic pain; however, in both males and females, most infections are asymptomatic.[5] Previous studies have demonstrated significant trichomonas infection prevalence among symptomatic adolescents.[6] Trichomonas infection increases the risk of contracting additional STIs, including human immunodeficiency virus, in both males and females.[7] Pregnant females infected with trichomonas are at increased risk for preterm labor and delivery.[8]

The development of a highly sensitive urine nucleic-acid amplification test (NAAT) allows quick and painless screening for trichomonas.[9,10] Offering urine NAAT testing to screen for STI, even among those without symptoms, is acceptable to most adolescents.[11] Before starting this project, we tested a very small percentage of patients at risk for STI (baseline of 25%) for trichomonas, despite the availability of a rapid, noninvasive urine test. Early in 2014, a combined urine NAAT test for *Chlamydia trachomatis*, *Neisseria gonorrhoeae*, and *Trichomonas vaginalis* became available, which increased test rate for eligible patients to 35%. Despite this change, it remained more common to order STI testing without trichomonas.

*From the *Nationwide Children's Hospital, Columbus OH Division of Emergency Medicine, Columbus, Ohio.; and †Nationwide Children's Hospital, Columbus OH Quality Improvement Services, Columbus, Ohio.*

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**Corresponding author. Address: Kristin S. Stukus, MD, Division of Emergency Medicine, Nationwide Children's Hospital, 700 Children's Drive, Columbus OH 43205 PH: (614)722–4386; Fax (614)722–4380 Email: kristin.stukus@nationwidechildrens.org*



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This specific aim of this project was to increase the percentage of adolescent and young adult patients (13–21 years old), at risk for STI, who were tested for trichomonas in the ED, from a baseline of about 35% to a goal of 100% within 6 months and to sustain for 6 months.

## METHODS

### *Setting*

We performed this project within the ED of an urban, pediatric, tertiary-care hospital. The staff of 27 fellowship-trained pediatric emergency medicine physicians, 10 general pediatricians, and 10 advanced nurse practitioners see approximately 85,000 patients annually, of whom approximately 17,000 (20%) are 13 years old or older. Patients were screened for STI according to chief complaint and clinical judgment of the provider. Patients were defined as high risk if they had any STI testing ordered during their ED visit. The decision to perform STI testing was at the discretion of the treating provider in the ED.

Trichomonas testing was performed both on urine samples by NAAT, and on vaginal or cervical secretions. The method of collection was recorded, but not distinguished in the reporting of data. Both the urine and cervical specimens were tested using the NAAT test by Aptima (Hologic, Marlborough MA), which has a positive predictive value of 85%–92.3% given the prevalence within our local population, with negative predictive value of 99.3%–99.7%.[12] This compares well with clinician-collected vaginal swabs within the same population, which shows positive predictive value of 74.1%–85.8% and negative predictive value of 100%. Test characteristics are improved among symptomatic patients, with a sensitivity of 95.8 and a specificity of 98.7% by urine testing, compared with 100% sensitivity and 98.8% specificity for clinician-collected vaginal swabs.[12]

### *Interventions*

During initial meetings, stakeholders developed an aim statement and key driver diagram, identified barriers to testing and discussed potential interventions to overcome these barriers (Fig. 1). The group included laboratory personnel, nurses, advanced nurse practitioners, and physicians all working primarily within the ED, and quality improvement (QI) specialists. Key interventions included the following: STI order set, nurse-initiated protocol, education/feedback, and subsequent order changes.

### *STI Order Set*

An existing order set was modified to include a combined NAAT test for trichomonas, *N. gonorrhoeae*/*C. trachomatis*, and pregnancy, human immunodeficiency virus, and syphilis testing. This order set was intended for use in those with concerns for sexual assault, and in any patient with a concern for STI. The order set also included empiric treatment for infections and emergency contraception options. It was made available for all practitioners within the ED, including nurse practitioners, resident physicians, and fellows.

### *Nurse-initiated Protocol*

Simultaneously, an intervention began to allow the triage nurse to order the urine test for *N. gonorrhoeae*/*C. trachomatis*/trichomonas during the initial evaluation for those adolescent and young adult patients meeting high-risk criteria (previously defined as chief complaint of dysuria, vaginal or penile discharge, history of STI with concerns for symptoms, or known exposure to infected

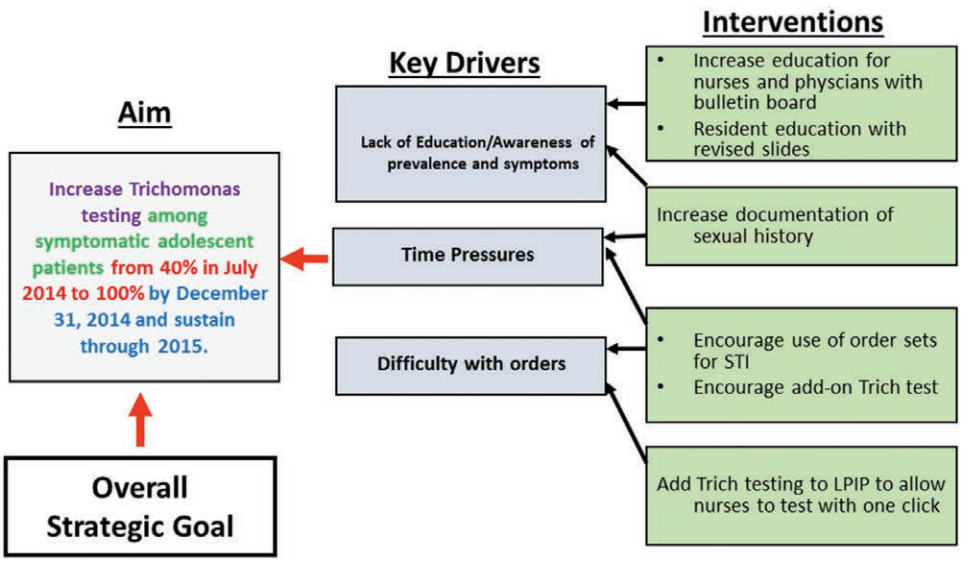


**Fig. 1.** Key driver diagram: trichomonas testing in the ED. Control *chart* showing the percentage of patients tested for gonorrhea/chlamydia and trichomonas, January 2014 to June 2015. Numbered arrows correspond to interventions of (1) combined order introduced, (2) STI order set available, (3) nurse-initiated protocol available, and (4) combined order only available from Epic ED order Preference List. LPIP, Licensed Practitioner-Initiated Protocol.

sexual partner). Our ED has several nurse-initiated protocols designed to facilitate ED through-put by ordering testing (x-rays, strep swab, or urinalysis (UA)) or medication administration before provider evaluation. The criteria for high risk for the nurse-initiated protocol is based on clinical criteria and different for the high-risk criteria of patients included in the QI initiative. The nurse-initiated protocol is intended for a rapid intervention based on chief complaint. The included patients in the QI initiative is broader because some patients may be at high risk for STI who do not reveal this in their chief complaint.

### *Education/Feedback*

We provided education to nursing staff and providers through staff meetings and weekly feedback. Resident physicians rotating through the ED reviewed a presentation covering the specifics of various QI projects, with an emphasis on the importance of including trichomonas testing for high-risk adolescent patients. As the QI project continued, we reviewed the weekly testing results, and those who ordered the *N. gonorrhoeae*/*C. trachomatis* test without trichomonas testing received an email reminding them of our QI project and efforts. These efforts continued into the 6-month maintenance phase to ensure sustainability.

### *Subsequent Order Changes*

Following the initial interventions, the option of ordering gonorrhea and chlamydia testing without trichomonas was removed from the ED preference list, leaving only the combined *N. gonorrhoeae*/*C. trachomatis*/trichomonas order visible. However, the *N. gonorrhoeae*/*C. trachomatis* order without trichomonas continued to be visible elsewhere in the facility because it was felt that there might be situations in other locations within the hospital where trichomonas testing is not clinically indicated.

### *Measures and Analysis*

Patient age, race/ethnicity, chief complaint, method of STI tests collected and results, and the ordering provider and whether an order set was used were all collected and compiled through our electronic data warehouse. Weekly testing rates were plotted over time using a control chart (P-chart using Excel macros designed and maintained by our institution's QI services). We also collected data on positive test result rates. Our balancing measure was the length of stay in the ED, when compared with all adolescent patients. We also examined ED return rates for those testing positive for trichomonas during our intervention period to avoid an increased burden on the ED providers or the system. Our initial goal was to increase the percentage of high-risk adolescent patients tested for trichomonas from a baseline of 35% when the project was initiated to 100% by 6 months and maintain for 6 months after achieving this goal. After discussing the barriers and potential interventions with the stakeholders, 100% was chosen as an achievable goal given the institution of permanent, consistent changes to the system. After the 6-month postimplementation period, this project has continued to be checked at regular intervals to determine if additional interventions are needed. The 2-proportion CI and test were used to interpret the difference between the baseline and intervention populations.

### *Ethical Considerations*

Evaluating adolescent patients for STI risk factors and symptoms is fraught with concerns for respecting patient autonomy and confidentiality. Ohio state law allows for minors to seek confidential medical care for sexual health concerns, including testing and treatment of an STI and obtaining contraception, without parental knowledge or approval.[13] Test results are also confidential, with diagnosis disclosed only to the patient. However, billing practices are not always anonymous, unless the minor patient chooses to be responsible for the cost of treatment.[13] Practitioners are encouraged, as a general rule, to discuss sexual health concerns with the patient alone, without parental involvement. However, this is not always possible. Patients are not always notified that they are being tested for STI if they present with vague complaints or deny sexual activity. Follow-up phone calls for positive test results are performed daily by outreach nurses within the ED; these results are released to patients only. We do not inform their parents of test results. At the time of this QI project, we did not collect adolescent cell phone data. If parents were reached, they were asked to have the patient call the outreach nurse for test results. There are no known accidental disclosures of test results to parents. However, our system has since changed, and adolescents are now contacted directly to give results. This project was deemed QI research and not human subjects research. Therefore, reviewed and approved by our institutional review board was not required.

## RESULTS

In the 6-month "baseline period" from January to June 2014, before beginning our interventions, there were 7,935 ED visits for patients 13–21 years old, with 581 (7.3%) patients categorized as high risk, having STI studies performed. During the intervention period (July–December 2014), there were 9,099 patients in this age group, with STI testing performed on 583 (6.4%). In the 6-month maintenance phase from January to June 2015, there were 659 STI tests performed of 8,699 patients (7.6%) in this age group (Table 1). There was no difference in the age distribution or race/ethnicity of patients during the study periods.

Multiple successive Plan-Do-Study-Act cycles were successful in increasing the rate of adolescents tested for trichomonas within the ED. There was an improvement in trichomonas testing from 35% to 97% during the intervention period. We identified several interventions as

**Table 1. Demographic Data for Patients Seen During Preintervention, Intervention, and Postintervention Period**

| | Preintervention (N = 595) January–June 2014 | Intervention Period (N = 606) July–December 2014 | Postintervention (N = 684) January–June 2015 |
|---|---|---|---|
| Age, n (%) | | | |
| 13 | 30 (5.0) | 25 (4.1) | 39 (5.7) |
| 14 | 53 (8.9) | 52 (8.6) | 61 (8.9) |
| 15 | 81 (13.6) | 77 (12.7) | 105 (15.3) |
| 16 | 100 (16.8) | 115 (19.0) | 112 (16.4) |
| 17 | 108 (18.2) | 122 (20.1) | 138 (20.2) |
| 18 | 109 (18.3) | 80 (13.2) | 109 (15.9) |
| 19 | 62 (10.4) | 74 (12.2) | 74 (10.8) |
| 20 | 37 (6.2) | 39 (6.4) | 28 (4.1) |
| 21 | 15 (2.5) | 22 (3.6) | 18 (2.6) |
| Race, n (%) | | | |
| Black/African American | 293 (49.2) | 324 (53.4) | 360 (52.6) |
| White | 241 (40.5) | 214 (35.3) | 261 (38.2) |
| Biracial/Multiracial | 25 (4.2) | 39 (6.4) | 30 (4.4) |
| Latino/Hispanic | 12 (2.0) | 11 (1.8) | 16 (2.3) |
| Asian/Pacific Islander | 9 (1.5) | 5 (0.8) | 6 (0.9) |
| Other/Not available | 15 (2.5) | 13 (2.1) | 11 (1.6) |
| Chief complaint, n (%) | | | |
| Abdominal pain | 198 (33.3) | 206 (34.0) | 181 (26.4) |
| Sexual assault/abuse | 53 (8.9) | 43 (7.1) | 99 (14.5) |
| Possible STI | 42 (7.1) | 49 (8.1 | 52 (7.6) |
| Dysuria | 40 (6.7) | 35 (5.8) | 30 (4.4) |
| Vaginal bleeding/discharge | 41 (6.9) | 47 (7.8) | 46 (6.7) |
| Scrotal/Penile pain | 21 (3.5) | 17 (2.8) | 19 (2.8) |

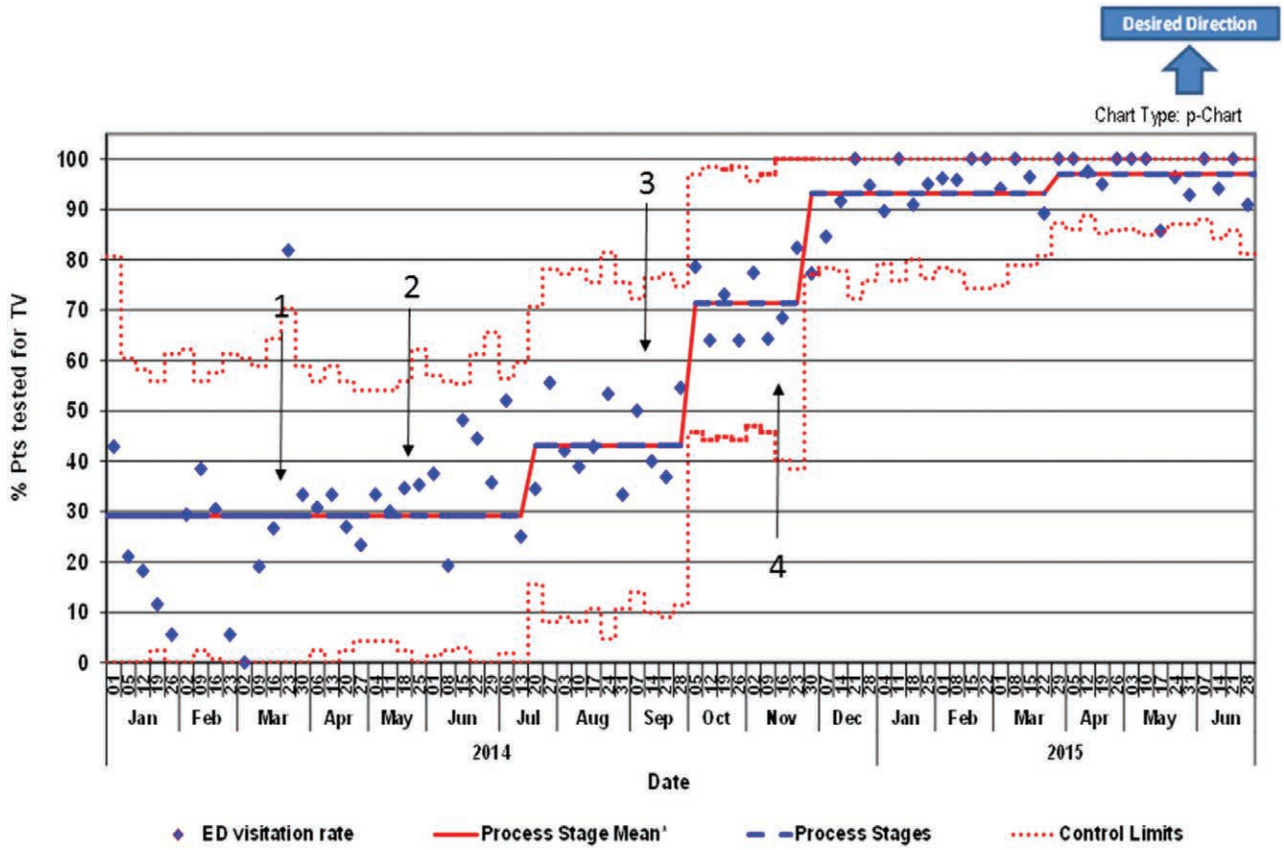


**Fig. 2.** *T. vaginalis* testing of adolescent patients. Numbers of *C. trachomatis*/*N. gonorrhoeae* testing compared with *T. vaginalis* testing during the intervention period. The green line shows the number of missed tests declining over the intervention period. *Centerlines reflect defined process stages. Some defined stages have excluded ≥1 outlier points from centerline (and control limit) calculations. Pts, patients.

having a positive impact on the percentage of patients tested. The initial intervention of changing the STI order set led to a modest increase in trichomonas testing, from a baseline of 35% to 47% (Fig. 2). The subsequent introduction of nurse-initiated protocol order led to another increase in testing to nearly 70%. Removing the *C. trachomatis*/*N. gonorrhoea* test from the ED order list resulted in the largest gains in trichomonas testing,

from a baseline of 70% to well over 95%. At the end of the postintervention phase, the baseline for trichomonas testing is 97% of adolescents who receive STI testing (Fig. 2). In late July 2014, we began 8 consecutive weeks of testing rates above the baseline rate, with subsequent change in the centerline. Comparison of the baseline data with this intervention period shows a difference of –0.66 (95% CI, –0.69 to –0.62; $P \leq 0.0001$). We also saw centerline shift in October and again in December indicating special cause variation. Although our testing rates for *C. trachomatis*/ *N. gonorrhoeae* remained stable in the baseline, intervention, and postintervention periods, we saw a steady increase in *T. vaginalis* testing rates from October 2014 to January 2015 (Fig. 3). Our interventions resulted in increased reliability within our testing system, with improvement from <50% to 94.9% (35 missed of 680 potential patients) trichomonas testing rates during the maintenance period. As we have continued to monitor our testing rates beyond the postintervention phase, we have been able to maintain trichomonas testing rates at ≥95% of high-risk adolescent patients.

There were 70 positive tests detected during the 18-month study period, with an overall incidence of 6.36%. During the same 18-month period, the incidence of chlamydia was 219 of 1,823 (12.01%), whereas the incidence of gonorrhea was 72 of 1,823 (3.95%). During the baseline period, the rate of chlamydia was 14.1%, the rate of gonorrhea was 3.3%, and the rate of trichomonas was 11.2%. During the intervention period (July–December 2014), the rate of chlamydia infection was 12.3%, gonorrhea was 5.0%, and trichomonas was 6.5%. In the postintervention period, we detected chlamydia in 10.2% of tested patients, gonorrhea in 3.7% of patients, and trichomonas in 4.9% of tested patients. Although *T. vaginalis* infection rates declined with increased testing, the overall number of infections detected increased by 40% when compared with preintervention rates. Combining the intervention and maintenance periods, the overall incidence of infection was 5.5%. With the increase in testing during the period, the number needed to test to detect on positive trichomonas test result was 17. Overall, we tripled the number of patients tested for trichomonas in the maintenance period compared with the baseline period.

We did not detect any increase in ED visits for positive trichomonas test results. We were able to contact patients by phone and have outpatient antibiotics prescribed. There was no accidental disclosure of test results detected. There was no change in the rate of nurse-initiated test ordering during the study period.

| Month | CT | GC | TV | %TV |
|---|---|---|---|---|
| Jan-14 | 92 | 92 | 12 | 13.04% |
| Feb-14 | 84 | 84 | 22 | 26.19% |
| Mar-14 | 75 | 75 | 19 | 25.33% |
| Apr-14 | 105 | 106 | 31 | 29.52% |
| May-14 | 120 | 120 | 39 | 32.50% |
| Jun-14 | 105 | 105 | 36 | 34.29% |
| Jul-14 | 100 | 100 | 40 | 40.00% |
| Aug-14 | 81 | 81 | 33 | 40.74% |
| Sep-14 | 94 | 94 | 34 | 36.17% |
| Oct-14 | 111 | 111 | 70 | 63.06% |
| Nov-14 | 99 | 99 | 73 | 73.74% |
| Dec-14 | 98 | 98 | 86 | 87.76% |
| Jan-15 | 102 | 102 | 93 | 91.18% |
| Feb-15 | 87 | 87 | 81 | 93.10% |
| Mar-15 | 129 | 129 | 116 | 89.92% |
| Apr-15 | 121 | 121 | 113 | 93.39% |
| May-15 | 102 | 102 | 96 | 94.12% |
| Jun-15 | 118 | 118 | 106 | 89.83% |

**Fig. 3.** Rates of *C. trachomatis*, *N. gonorrhoeae*, and *T. vaginalis* testing during the baseline (January–June 2014), intervention (July–December 2014), and postintervention (January–June 2015) periods.

## DISCUSSION

Using QI methodology, the percentage of high-risk patients tested for trichomonas was increased to nearly 100%, although maintaining a consistent rate of testing for *C. trachomatis* and *N. gonorrhoeae*. As a result, *T. vaginalis* detection increased by 40%. Our interventions, especially changes to the way in which STI testing was ordered on the computer, led to increased reliability and reproducibility.

There have been previous reports of increased screening for high-risk sexual practices and STIs. DiVasta et al[14] used QI methods to improve screening for high-risk sexual practices and chlamydia testing within primary care settings. Huppert et al[15] demonstrated that point-of-care testing improved the accuracy of STI treatment. A study by Territo et al[16] showed that point-of-care testing could increase trichomonas testing rates, detection, and successful treatment. Our study demonstrates the ability to attain nearly 100% screening for trichomonas in the ED setting when testing for other STIs, even in the setting of a busy, academic ED.

Improving care through staff and physician education alone presents a major challenge within a high-volume, academic ED, and is unlikely to be successful or sustainable. Although the nursing staff, attending physicians, and fellows are consistent throughout the year, the residents, who do the bulk of the ordering, rotate throughout the year. They may not spend more than a month in our system. For this reason, interventions aimed at changing the system rather than relying on physician and staff

education proved most successful. To this end, changing the computer ordering display was most successful in increasing the percentage of patients tested for trichomonas to nearly 100%. Our reliability in correctly ordering trichomonas testing improved from $<10^{-1}$ to nearly $10^{-2}$ during the baseline period through the implementation of standardization and duplication strategies.[17]

This study showed the feasibility of increasing *T. vaginalis* testing within a busy, urban pediatric ED. However, there may be limitations in the applicability to other clinical settings or even similar settings that are resourced differently. Also, there is an increased cost associated with changing from *N. gonorrhoeae*/chlamydia only testing to *N. gonorrhoeae*/*C. trachomatis*/*T. vaginalis*.

Further studies are needed to determine the costs and benefits associated with increased testing and studies to help define and target the highest risk population. With 17 patients needed to test to detect 1 case of trichomonas, some institutions may determine that the cost of testing outweighs the benefit. In our ED, outreach nurses were able to contact patients testing positive for trichomonas to prescribe outpatient treatment. Although increased testing rates did not result in increased ED utilization, further studies are needed to look at the work of test follow-up.

This study looked only at the implementation of a testing program within a pediatric ED for those patients getting testing for chlamydia and gonorrhea. These interventions did not attempt to increase the overall number of patients tested for STI. Further QI efforts could seek to increase the percentage of patients with and without symptoms of STI who are tested for *C. trachomatis*, *N. gonorrhoeae*, and *T. vaginalis*. Current Centers for Disease Control (CDC) recommendations advise testing for *T. vaginalis* in symptomatic patients and screening in high prevalence settings and asymptomatic patients at high risk of infection.[18] Previous studies have shown high rates of STI among patients presenting to the ED without symptoms of STI.[19] Improving our screening techniques may help us redefine which patients are truly at highest risk for STI. By improving diagnostic testing and increasing rates of STI treatment, we can positively impact the sexual health of our adolescent patients.

## DISCLOSURE

The authors have no financial interest to declare in relation to the content of this article.

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