Increasing Vaginal *Chlamydia Trachomatis* Testing in Adolescent and Young Adults

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**OBJECTIVE:** The Centers for Disease Control and Prevention recommend testing for *Chlamydia trachomatis* in sexually active female patients <25 years old using nucleic-acid amplification tests (NAAT) from a vaginal swab. Our providers were typically testing using the less sensitive urine NAATs. We aimed to increase the percentage of urogenital *C trachomatis* NAATs performed by using vaginal swabs in adolescent female patients ages 10 through 20 years from 1.4% to 25%.

**METHODS:** We implemented 3 interventions at 3 pediatric practices over 12 months including education, process standardization, and cross-training. We used statistical process control to analyze the effect of interventions on our primary outcome: the percentage of urogenital *C trachomatis* tests performed with a vaginal swab. Our balance measure was the total number of urogenital *C trachomatis* tests.

**RESULTS:** There were 818 urogenital *C trachomatis* tests performed: 289 before and 529 after the first intervention. Of urogenital *C trachomatis* tests in the preintervention time period, 1.4% were performed by using vaginal swabs. We surpassed our aim of 25% 6 weeks after the first intervention. We noted sustained improvement after the second intervention, with an average of 68.3% of tests performed by using vaginal swabs for the remaining postintervention period. There was no difference in the overall number of urogenital *C trachomatis* tests pre- and postintervention.

**CONCLUSIONS:** Using quality improvement methodology and implementing easily replicable interventions, we significantly and sustainably increased use of vaginal swabs. The interventions standardizing processes were associated with a higher impact than the educational intervention.

*Chlamydia trachomatis* is the most common reported sexually transmitted infection in the United States,1 with a disproportionate burden of disease in adolescent and young adult women.2,3 In Massachusetts, the incidence of *C trachomatis* in female patients ages 15 through 19 is >3 times the overall statewide rate for all ages, and *C trachomatis* reporting has increased by 60% from 2007 to 2016.3 *Chlamydia* is a significant public health problem because untreated *C trachomatis* infections can lead to pelvic inflammatory disease, chronic pelvic pain, ectopic pregnancy, and infertility.2,4–6

The Centers for Disease Control and Prevention (CDC) and the US Preventive Services Task Force both recommend annual screening for *C trachomatis* in sexually active female patients <25 years old.1,7 The


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Dr Brigham conceptualized and designed the study, conducted the initial analyses, drafted the initial manuscript, and reviewed and revised the manuscript; Mr Peer conceptualized and designed the study, abstracted the data from the electronic medical record, conducted the initial analyses, and reviewed and revised the manuscript; Drs Ghoshhajra and Co provided guidance and feedback while the study was being designed and implemented and critically reviewed the manuscript for important intellectual content, and all authors approved the final manuscript as submitted and agree to be accountable for all aspects of the work.

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CDC-preferred method of testing for urogenital C. trachomatis in female patients is a vaginal swab nucleic-acid amplification test (NAAT). Vaginal swabs are as sensitive as cervical swabs, whereas first-catch urine NAATs have up to 10% lower sensitivity than vaginal swabs.  

Unfortunately, pediatricians do not always follow best practices with regard to sexual health in adolescents. In one study of annual physicals, physicians of adolescents spend an average of 36 seconds on sex and sexuality topics, and one-third of these visits had no mention of sex or sexuality. Many medical providers find sex and sexuality difficult and potentially embarrassing to discuss, and this embarrassment may carry over to discussions of vaginal swabs. In addition, some providers may have concerns that vaginal swabs are more invasive than urine, but a speculum examination is not necessary, making vaginal swabs relatively noninvasive. Patients also can be given the option of either a provider-collected or self-collected swab. Studies have shown that adolescents find vaginal swabs to be an acceptable means of testing. 

Despite CDC guidelines and adolescent acceptance of vaginal swabs, our baseline data from an urban, tertiary-care institution’s pediatric practices showed low use of the vaginal swab and high use of urine samples for C. trachomatis testing. Using the Model for Improvement, we designed this continuous quality improvement (CQI) project to identify and overcome factors that contribute to pediatric providers not using vaginal swabs to test for Chlamydia. Our aim was to increase the percentage of urogenital C. trachomatis NAATs performed on vaginal swabs from 1.4% to 25% in adolescent female patients ages 10 through 20 who were seen at 3 affiliated practices.

**METHODS**

**Context**

This CQI project was conducted as part of the Partners HealthCare Clinical Process Improvement Leadership Program (CPIP), which was designed to teach process improvement tools to employees of Partners HealthCare System, a nonprofit health care system in Eastern Massachusetts that includes Massachusetts General Hospital (MGH), which was the location of this project. This project was led by the 2 CPIP participants (K.S.B. and M.J.P.) with mentoring from 2 physicians with experience in CQI (B.B.G. and J.P.T.C.).

**Planning the Interventions**

Multiple pediatric clinics affiliated with MGH were contacted to gauge interest, with 3 being chosen. Site 1 is a primary care pediatric clinic at MGH’s urban central campus, Site 2 is a primary care pediatric clinic at an MGH community health care center; and Site 3 is a high school–based clinic affiliated with a second MGH community health care center. We created multidisciplinary teams of providers (physicians and nurse practitioners) at the 3 sites. We offered Maintenance of Certification Part IV credit to participating physicians.

We created a cause-and-effect diagram and a process map (Fig 1) of C. trachomatis testing to brainstorm barriers to using vaginal swabs, which informed the creation of an online provider survey. Thirty-three of 45 providers (73%) responded to the survey. We used the survey results to create a Pareto chart (Fig 2) to focus interventions on the most common barriers.

**Interventions**

Three interventions were performed over 12 months. Initially, each team had an in-person meeting to review CDC recommendations and results from their clinic’s Pareto chart and determine the first intervention. Subsequently, each team had conference calls to review the statistical process control (SPC) charts and determine the next 2 interventions. Every month, we sent the teams overall and site-specific SPC charts to review their progress.

**Intervention 1: Education**

The most common barrier identified was a lack of awareness of vaginal testing as an option, so the first intervention was an educational intervention addressing this. We created a double-sided, one-page handout explaining CDC guidelines as well as how to obtain both provider-obtained and self-collected vaginal swabs, stressing that neither a speculum nor a bimanual examination were required. The handout also showed how to order this in the electronic order entry system and included a link to a video teaching providers how to counsel patients on patient-obtained swabs (https://youtu.be/p56kIv6shmQ). We provided each provider in the clinic with a copy of this handout. Site 3 also needed to order the swabs; Sites 1 and 2 already had the swabs.

**Intervention 2: Standardization of Processes**

The next most common barriers identified by the Pareto chart were time concerns and supply issues. The second intervention addressed these concerns by standardizing the process of stocking of the examination rooms to make clinic visits more efficient by ensuring that vaginal swabs were readily available. Each site had an individual approach: Site 1 added the swabs to the list the medical assistants use when stocking examination rooms; Site 2 stocked the rooms with the swabs, created a process to have the swabs properly labeled and transported to the laboratory, and added the order for vaginal swabs to their clinic’s electronic order set “favorites”; and...
Site 3 created a dedicated location in their examination rooms for the swabs to be placed.

**Intervention 3: Cross-Training**

To continue to work on the time concerns of the providers, Sites 1 and 2 decided to train the medical assistants to instruct patients on how to obtain self-collected swabs. Site 3 did not feel the need to perform any new interventions at that time.

**Study of the Interventions**

We abstracted data from our electronic health record (Epic; Verona, WI) monthly. All urine, vaginal, or cervical *C. trachomatis* NAATs with finalized laboratory results for female patients ages 10 through 20 years ordered from any of the 3 sites’ electronic health record locations were included. To verify accuracy of the data, we conducted a chart review of the first 3 months of data and found that the specimen source listed in the abstracted data agreed 100% of the time with the body source listed in the electronic medical record. The baseline period was September 2016 through March 2017, and the intervention period was April 2017 through March 2018.

**Measures**

**Outcome Measure**

Our outcome measure was percentage of urogenital *C. trachomatis* tests in female patients ages 10 through 20 at the 3 study sites that were performed using a vaginal swab. Our goal was to increase the percentage of urogenital *C. trachomatis* tests using vaginal swabs performed to 25%. We chose a relatively modest goal because we were concerned that pediatricians might be apprehensive about changing from a noninvasive urine test to a slightly more invasive vaginal swab.

**Process Measure**

The process measure was the percentage of clinicians at each site who received the educational handout in the first intervention. We provided handouts to the sites that were addressed to every clinician at each site, and team members at each site confirmed delivery.

**Balance Measure**

We used the total number of urogenital *C. trachomatis* tests as a balance measure to assess whether the slightly more invasive nature of the vaginal swab discouraged providers from testing altogether.

**Analysis**

We assessed differences in demographic variables between the preintervention and intervention
periods using 2-tailed \( t \) tests for continuous variables and \( \chi^2 \) tests for comparing frequencies between groups (QI Macros; KnowWare International, Inc, Denver, CO). We used SPC charts and Institute for Healthcare Improvement rules to assess the impact of the intervention over time on both the outcome and balance measure, also using QI Macros. Control limits were set at 3\( \sigma \).

**Ethical Considerations**

This project was undertaken as a quality improvement initiative at MGH and as such was not formally supervised by the institutional review board, per their policies.

**RESULTS**

During the entire study, a total of 818 urogenital *C. trachomatis* tests were performed at the 3 sites. The demographics of the patients in the preintervention and postintervention time periods were not statistically significantly different with respect to mean age, race, or ethnicity of the patient (Table 1). There was no significant difference in the relative proportion of total tests ordered from the 3 sites or in the sex or type of provider in the preintervention and postintervention periods.

**Outcome Measure**

During the preintervention period, only 1.4% of all urogenital *C. trachomatis* tests at the 3 sites were performed on vaginal swabs (Fig 3). During the first intervention period, 100% of the providers were given the educational handout (process measure). In the time immediately after the first intervention, there were small signals of improvement; it was modest and well below the aim of 25%.

We noted a more robust improvement in performance after the second intervention: standardization of processes. We felt that this second intervention was likely to be both the driver of this improvement and sustainable over time, so we reset the mean at the time of initiation of the second intervention. Subsequently, a mean of 68.3% of all urogenital *C. trachomatis* NAATs were performed by using vaginal swabs. This improvement was maintained through the third intervention: cross-training.

We examined the site-specific data on a monthly basis rather than a biweekly basis because the number of tests at each site was relatively low (Fig 4). Site 1’s data tended to be the least stable because it had the lowest volume of testing of the 3 sites. Site 1 achieved the aim of 25% of urogenital tests performed by using vaginal...
swabs after the first intervention, whereas Sites 2 and 3 achieved the aim after the second intervention. All 3 sites were able to maintain the aim of 25% for the remaining months.

Balance Measure

The number of urogenital *Chlamydia* tests performed per time period was stable throughout the preintervention and postintervention periods, with a mean of 21.5 urogenital *C. trachomatis* tests performed per time period (Fig 5).

DISCUSSION

Summary

Using CQI methodology, we were able to successfully change the testing patterns of pediatric providers from urine tests to the more sensitive vaginal swab in just a few weeks using simple, replicable interventions. We surpassed our aim in the second month of our postintervention period, and this progress was sustained for the subsequent 10 months. There was no decrease in the number of tests done during the period of our project.

Interpretation

The first intervention, based on the change concept of giving people access to information,21 only yielded a modest change. This is consistent with quality improvement literature showing that passive education is a relatively weak intervention.23 However, 24 of 33 providers surveyed did not realize that vaginal swabs were an option, so without first educating providers that this was not only an option but the CDC’s preferred testing modality, it seems unlikely that the interventions taken in the second and third cycles would have been effective.

The second intervention, although somewhat different at each site, involved standardization of processes,21 whereas the third intervention involved cross-training.21 These focused more on the process rather than the individual, which is known to be a successful strategy.23 By standardizing the availability of vaginal swabs in each clinic and training medical assistants to counsel patients on patient-obtained swabs, this made the clinical encounter more efficient for the provider. A previous study that failed to improve rates of *C. trachomatis* screening identified lack of time for

TABLE 1 Demographic Characteristics of Patients and Providers

<table>
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<tr>
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<th>Preintervention</th>
<th>Postintervention</th>
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<tbody>
<tr>
<td>N</td>
<td>289</td>
<td>529</td>
<td></td>
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<tr>
<td>Age of patient, y, mean</td>
<td>17.9</td>
<td>17.8</td>
<td>.87</td>
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<tr>
<td>Race of patient, n (%)</td>
<td></td>
<td></td>
<td>.80</td>
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<td>Asian American</td>
<td>12 (4.2)</td>
<td>17 (3.2)</td>
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<td>Black or African American</td>
<td>22 (7.6)</td>
<td>43 (8.1)</td>
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<tr>
<td>Hispanic or Latino</td>
<td>14 (4.8)</td>
<td>16 (3.0)</td>
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<tr>
<td>White</td>
<td>70 (24.2)</td>
<td>129 (24.4)</td>
<td></td>
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<tr>
<td>Other</td>
<td>140 (48.4)</td>
<td>267 (50.5)</td>
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<tr>
<td>Declined or unknown</td>
<td>31 (10.7)</td>
<td>57 (10.8)</td>
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<tr>
<td>Ethnicity of patient, n (%)</td>
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<tr>
<td>Hispanic</td>
<td>155 (53.6)</td>
<td>274 (51.8)</td>
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<tr>
<td>Non-Hispanic</td>
<td>81 (28.0)</td>
<td>162 (30.6)</td>
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<tr>
<td>Declined or unavailable</td>
<td>53 (18.3)</td>
<td>93 (17.8)</td>
<td></td>
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<tr>
<td>Total No. <em>Chlamydia</em> tests per location, n (% of total of all 3 sites)</td>
<td></td>
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<tr>
<td>Site 1</td>
<td>55 (19.0)</td>
<td>88 (16.6)</td>
<td>.18</td>
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<tr>
<td>Site 2</td>
<td>115 (39.8)</td>
<td>246 (46.5)</td>
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<tr>
<td>Site 3</td>
<td>119 (41.2)</td>
<td>155 (36.8)</td>
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<td>Sex of provider, n (%)</td>
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<td>Female</td>
<td>269 (93.1)</td>
<td>488 (92.2)</td>
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<tr>
<td>Male</td>
<td>20 (6.9)</td>
<td>41 (7.8)</td>
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<td>Provider type, n (%)</td>
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<td>169</td>
<td>334</td>
<td></td>
</tr>
<tr>
<td>NP</td>
<td>120</td>
<td>195</td>
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MD, medical doctor; NP, nurse practitioner; —, not applicable.
the provider and lack of readily available testing kits as 2 barriers to screening; our results are consistent with that because we achieved success by addressing both of these issues. Additional factors that likely led to our success included multiple interventions with frequent feedback to providers, multidisciplinary teamwork, and a variety of interventions addressing multiple barriers; these are all strategies that have been identified in the literature to successfully produce change.

We were concerned that if providers were uncomfortable with the vaginal swab, they might forgo *C trachomatis* testing altogether rather than use the less sensitive but still acceptable urine test. Many providers are uncomfortable discussing sexual health, so it is possible that providers might find it difficult to counsel patients about vaginal swabs. Fortunately, potential unease with sexual matters did not discourage these providers from testing patients for *C trachomatis* because the total number of urogenital *C trachomatis* tests sent per time period was stable throughout.

Interestingly, the rules for special cause were achieved before the first intervention. It is worth noting that because the baseline rate was so low before starting this project, the use of just 4 vaginal *C trachomatis* tests in the 3 months immediately preceding the first intervention led to this finding. It is possible that forming teams around this project goal raised awareness of the vaginal swab, leading to a few providers using vaginal swabs before the first intervention.

Strengths of this project were the CQI model of using data to inform the interventions, frequent feedback to the study sites, and use of multidisciplinary teams at each site to tailor interventions to local needs. An additional strength is that this was

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**FIGURE 4**

Site-specific outcome measure: percentage of urogenital *Chlamydia* tests performed by vaginal swabs at each site, SPC charts annotated with improvement interventions, and site-specific medians with data from September 2016 through March 2018.
a multisite study using different locales where adolescents and young adults access health care: 1 at a tertiary-care center’s primary care clinic, 1 at a community health care center’s primary care clinic, and 1 at a high school–based clinic. These 3 clinics have different patient populations and logistic concerns, yet all 3 were able to demonstrate significant improvement over the course of this study.

**Limitations**

Limitations include that this project was performed in clinics affiliated with an academic medical center where CQI projects are routine, so results may not be generalizable to clinics where CQI is not part of the culture. It is possible that the enticement of Maintenance of Certification credit increased interest in the project beyond what might be seen had there not been an incentive. However, the interventions chosen were not time or labor intensive, complex, or expensive, so this should be relatively easy to replicate at other clinics.

Our data used the body source as listed in the laboratory order. It is possible that some of the swabs were ordered incorrectly and were actually cervical swabs because the same swabs are used for vaginal and cervical swabs. However, we think this is unlikely because most patients <21 years old do not routinely have speculum examinations required to obtain cervical swabs, and current guidelines recommend the first Papanicolaou test be performed at age 21 years. It has been demonstrated that pediatricians underscreen for *C trachomatis*. Studies have also shown a decrease in *C trachomatis* screening in adolescents and young adults <21 years old after the recommendation that the first Papanicolaou test be performed at age 21 years. Therefore, an important next step is to implement CQI projects to ensure that all adolescent female patients are asked about sexual activity and screened for sexually transmitted infections according to evidence-based guidelines. Another step is to promote use of the vaginal swab NAAT in other locations where adolescents and young women obtain health care, such as emergency rooms and urgent care clinics, because many adolescents do not routinely see primary care providers.

**CONCLUSIONS**

This study did not address the more difficult issue of whether providers are screening all adolescent and young adult female patients appropriately for risk factors for *C trachomatis*. Many barriers to testing in primary care settings have been identified and it has been demonstrated that pediatricians underscreen for *C trachomatis*. Studies have also shown a decrease in *C trachomatis* screening in adolescents and young adults <21 years old after the recommendation that the first Papanicolaou test be performed at age 21 years. Therefore, an important next step is to implement CQI projects to ensure that all adolescent female patients are asked about sexual activity and screened for sexually transmitted infections according to evidence-based guidelines. Another step is to promote use of the vaginal swab NAAT in other locations where adolescents and young women obtain health care, such as emergency rooms and urgent care clinics, because many adolescents do not routinely see primary care providers.

![FIGURE 5](https://www.aappublications.org/news/2020/08/08/pediatrics-chlamydia-cqis-2020/Figure5.png)

**Balance measure: total number of urogenital *Chlamydia* tests per time period and SPC c-chart (5σ)** annotated with improvement interventions. Data are from September 2016 through March 2018. LCL, lower control limit, 5σ; UCL, upper control limit, 5σ.

This study shows that pediatric providers can successfully change their testing patterns for sexually transmitted diseases despite potential discomfort with matters of a sexual nature. These changes were sustained by addressing aspects of the process rather than by solely educating the providers about the importance of the change. Given that *C trachomatis* rates are increasing steadily nationwide, it is vital that providers use the most sensitive test available to detect, treat, and prevent further spread of this common sexually transmitted infection. Early detection and treatment will lead to fewer young women developing the potentially life-altering and costly sequelae of *Chlamydia*. 
ACKNOWLEDGMENTS

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ABBREVIATIONS

CDC: Centers for Disease Control and Prevention
CPIP: Clinical Process Improvement Leadership Program
CQI: continuous quality improvement
MGH: Massachusetts General Hospital
NAAT: nucleic-acid amplification test
SPC: statistical process control

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