

# Effect of a Clinical Practice Improvement Intervention on Chlamydial Screening Among Adolescent Girls

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**C**HLAMYDIA TRACHOMATIS IS THE most commonly reported bacterial sexually transmitted disease (STD) in the United States, with 3 million to 4 million cases occurring annually.<sup>1</sup> The infection rate among female adolescents (2406/100 000) is 6 times higher than the national average for all women.<sup>2</sup> More than 75% of *C trachomatis* infections are asymptomatic.<sup>1,3</sup> If untreated, *C trachomatis* may lead to severe reproductive morbidity, such as pelvic inflammatory disease with its sequelae of infertility and ectopic pregnancy.<sup>1-3</sup> *Chlamydia trachomatis* infections cost the US health care system \$3 billion to \$4 billion annually.<sup>1</sup> Early detection coupled with treatment can significantly reduce the infection burden and reproductive sequelae.<sup>4,5</sup> Broad-based screening programs have successfully decreased the *C trachomatis* rate and pelvic inflammatory disease in young women by 60%,<sup>4</sup> lowered hospitalization rates,<sup>6</sup> and have been found to be cost-effective.<sup>7,8</sup> In response, most

**Context** *Chlamydia trachomatis* infection is a serious public health concern that disproportionately affects adolescent girls. Although annual *C trachomatis* screening of sexually active adolescent girls is recommended by health professional organizations and is a Health Employer Data and Information Set (HEDIS) performance measure, this goal is not being met.

**Objective** To test the effectiveness of a system-level, clinical practice improvement intervention designed to increase *C trachomatis* screening by using urine-based tests for sexually active adolescent girls identified during their routine checkups at a pediatric clinic.

**Design, Setting, and Participants** A randomized cluster of 10 pediatric clinics in the Kaiser Permanente of Northern California health maintenance organization, where adolescent girls aged 14 to 18 years had a total of 7920 routine checkup visits from April 2000 through March 2002.

**Intervention** Five clinics were randomly assigned to provide usual care and 5 to provide the intervention, which required that leadership be engaged by showing the gap between best practice and current practice; a team be assembled to champion the project; barriers be identified and solutions developed through monthly meetings; and progress be monitored with site-specific screening proportions.

**Main Outcome Measure** *Chlamydia trachomatis* screening rate for sexually active 14- to 18-year-old girls during routine checkups at each participating clinic.

**Results** The population of adolescents was ethnically diverse with an average age of 15.4 years. Twenty-four percent of girls in the experimental clinics and 23% in the control clinics were sexually active. Of the 1017 patients eligible for screening in the intervention clinic, 478 (47%) were screened; of 1194 eligible for screening in the control clinic, 203 (17%) were screened. At baseline, the proportion screened was 0.05 (95% confidence interval [CI], 0.00-0.17) in the intervention and 0.14 (95% CI, 0.01-0.26) in the control clinics. By months 16 to 18, screening rates were 0.65 (95% CI, 0.53-0.77) in the intervention and 0.21 (95% CI, 0.09-0.33) in the control clinics (time period by study group interaction,  $F_{6,60}=5.33$ ;  $P<.001$ ). The average infection rate for the experimental clinics was 5.8% (23 positive test results out of 393 total urine tests and a total of 3986 clinic visits) vs 7.6% in controls (12 positive test results out of 157 tests and 3934 clinic visits).

**Conclusions** Implementation of this clinical practice intervention in a large health maintenance organization system is feasible, and it significantly increased the *C trachomatis* screening rates for sexually active adolescent girls during routine checkups.

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professional organizations support annual universal *C trachomatis* screening for sexually active adolescent girls and young adult women.<sup>9-13</sup> Furthermore, the Health Plan Employer Data and Information Set (HEDIS) has set *C trachomatis* screening as a measure of the quality of services delivered by health maintenance organizations (HMOs).<sup>14</sup> Yet, only 20% of the eligible young women aged 15 to 25 years receiving health care through managed care organizations are screened.<sup>15</sup>

Lack of *C trachomatis* screening success can be attributed to barriers involving the adolescent, the health care professional, the health care system, and the type of *C trachomatis* test used. For example, adolescents are reluctant to initiate care for their reproductive health due to embarrassment, lack of confidentiality, or concerns about a painful pelvic examination.<sup>8</sup> Many health care practitioners feel uncomfortable discussing sexuality with their adolescent patients,<sup>1,16</sup> and health care organizations may not provide a setting conducive to providing confidential care. Until recently, *C trachomatis* endocervical sampling was the standard means of diagnosis, resulting in the need for the often feared, invasive, and time-consuming pelvic examination. With the advent of urine-based *C trachomatis* nucleic acid amplification tests, a pelvic examination is no longer required to screen for *C trachomatis*. Such testing has been found to be acceptable to adolescents,<sup>17</sup> accurate,<sup>18-21</sup> and cost-effective.<sup>8</sup>

It is clear that no one solution will address all barriers at the many levels of health care delivery<sup>22,23</sup>; however, the most effective strategies to change clinical practice have used a systems approach to overcome barriers that keep health care professionals from changing their practice and to reduce external pressures to change, such as increased workload and lack of time. Successful examples of a systems approach have been found in the delivery of such childhood services as immunizations<sup>24</sup> and asthma care<sup>25</sup> through the creation of systems that are practical, easy to implement, and as automatic as possible due to the use of time-

saving technologies and tools to increase rates of preventive care.<sup>26,27</sup>

Building on previous research documenting effective methods to change clinical practice, this study developed a clinical practice improvement intervention to increase *C trachomatis* screening among sexually active adolescent girls during routine checkups at pediatric clinics in a large HMO.

## METHODS

### Setting

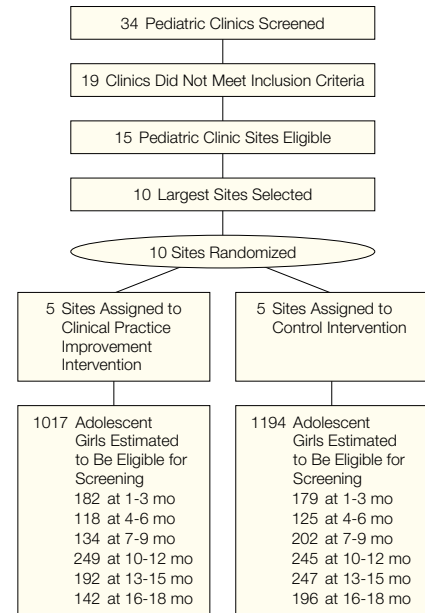
The study was undertaken at 10 of the 34 pediatric clinic sites in the Kaiser Permanente of Northern California HMO between April 2000 and March 2002. Adolescents and young adults make up 15% of the HMO's population, and it serves 1 in 3 adolescents in the Northern California region. All adolescents (up to age 18 years) are seen for primary care in the pediatric clinic setting. In a given year, approximately 48 600 (50%) of the 97 000 girls aged 14 to 18 years enrolled in the HMO made at least 1 visit to a pediatric clinic and a third (16 400) of these had a checkup.

The pediatric checkup is expected to occur every 1 to 3 years for adolescents and is either initiated by a clinician's recommendation when the adolescent comes in for an illness or injury or arranged for by the parent or guardian. No reminders are sent to parents or guardians. During the checkup, as a matter of standard practice, all pediatricians are expected to ask their adolescent patients whether they are sexually active.<sup>9,10</sup> If an adolescent girl is sexually active, pediatricians are expected to screen for *C trachomatis*. To assist in meeting professional guidelines including HEDIS,<sup>14</sup> the HMO made urine-based *C trachomatis* screening tests available for all pediatric practitioners as of March 2000 just before initiating the intervention.

### Design

This longitudinal study used a randomized cluster design in which 10 pediatric clinic sites were randomly assigned either to the experimental intervention or to serve as a control site (FIGURE 1). A clinic site was selected to participate

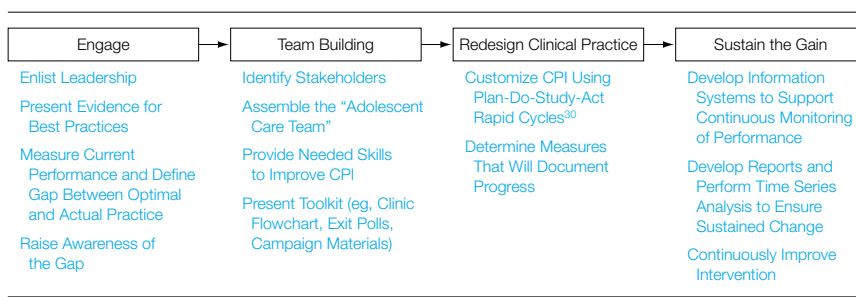
Figure 1. Flow Diagram



if (1) it had no adolescent-specific clinic (to maximize reaching providers whose usual practice was not, for the most part, adolescent medicine); (2) it recorded a minimum of 500 sexually active 14- to 18-year-old female patients undergoing routine checkups each year; (3) it served an ethnically diverse population (ie,  $\geq 2$  distinct racial or ethnic minorities representing a minimum of 10% of the population); and (4) its pediatric site chief agreed to allow the clinic to participate. The goal was to have sufficient power to detect a difference in screening between groups from baseline to a year after the intervention. In particular, we wanted to be able to detect a change from 10% screened to 50% screened in the intervention group and a change from 10% screened to 20% screened in the control group. Standard sample-size calculations for time-by-group interactions using arc sine-square root transformations of screening rates<sup>28</sup> indicated that samples of 5 intervention clinics and 5 control clinics would have power greater than 90% to detect the alternative of interest with an  $\alpha$  of .05.

Fifteen pediatric sites fulfilled the criteria. Recruitment occurred between March and April 2000. Since all pedi-

**Figure 2.** Model for Clinical Practice Improvement Initiative



CPI indicates clinical practice initiative.

ric chiefs agreed to participate and be randomized, we chose the 10 largest clinics for randomization. Participants were blind to the study conditions and were informed that the study was evaluating 2 types of interventions that varied by intensity. The staff at the control sites received an hour-long introduction to the epidemiology of *C trachomatis* in adolescents and a review of the current *C trachomatis* screening recommendations and treatment strategies,<sup>29</sup> followed by a question-and-answer period. Those at the experimental sites received the same training plus an introduction to the intervention's methods. Based on monthly interviews with chiefs at all sites and monitoring discussions at the regional adolescent medicine specialists' quarterly meetings, we believe participants remained blind to their assignment.

Human subject use review boards at both at the University of California, San Francisco, and Kaiser Permanente approved this study. Since the intervention focused on complying with current preventive service guidelines and meeting HEDIS *C trachomatis* screening requirements and because researchers used only extracted extant data with no identifiers to measure outcomes, the institutional review boards did not require that patients provide written consent.

**Intervention**

The intervention development was based on the model outlined in FIGURE 2. Part of the theoretical framework was based on a strategy to change practice discussed by Langley et al.<sup>30</sup>

**Engage.** The first step of the intervention involved enlisting the HMO leadership by presenting evidence showing a gap between current and best practice for *C trachomatis* screening. The research team raised awareness among all clinic staff and with a brief introduction to the intervention and to team-building concepts.

**Team Building.** The research team and site chiefs of pediatrics departments identified individuals particularly interested in adolescent health and local site leadership who would form the adolescent care team to act as champions for the project. The research team facilitated clinic staff training. The adolescent care team, which consisted of administrators, medical assistants, nurses, and practitioners, completed a 1.5-hour workshop that emphasized skill building in a group process, implementation of the Plan-Do-Study-Act rapid change model,<sup>30</sup> and the development of a practice toolkit. Practice tools were developed to facilitate the incremental change process and included the following components: customized clinic flowchart, exit polls, and the Y2P (Why to Pee!) campaign materials. The customized clinic flow chart summarized information from the previsit chart review and clinic registration to the patient-practitioner encounter and urine specimen collection and laboratory protocol. The flowchart helped team members identify barriers to and solutions for changing their practice. The exit poll, an 8-item anonymous survey that asked about age, race or ethnicity, and sexual activity status, was administered to all adolescents after their checkup to pro-

vide a more accurate estimate of the site-specific sexual activity rate. This information provided the denominator for measuring *C trachomatis* screening rates. The Y2P campaign is a marketing initiative designed to raise awareness and enthusiasm about screening adolescent girls. The reminder campaign included the Y2P logo on stickers that were used to cue charts, on buttons worn by staff, and on pens and posters throughout the experimental clinic sites.

**Redesign Clinical Practice.** The adolescent care team, with guidance from the research team facilitator, customized the intervention to maximize *C trachomatis* screening. This was accomplished in incremental steps. The team members met once a month, typically during their lunch hour, to review monthly data (ie, site-specific *C trachomatis* screening rates and data summarized from chart reviews that assessed the practitioners' documentation of their encounters with the adolescents) and to assess effectiveness of prior incremental improvements on screening rates. The team members also discussed the type of barriers impeding screening and developed strategies to overcome these barriers. All participating sites decided that the most effective way to ensure confidential collection of urine and *C trachomatis* screening during checkups was to institute universal urine specimen collection from all adolescents at registration, prior to their examination. Urine specimens for sexually active adolescents (as determined confidentially by the practitioner) were transported to the HMO's regional laboratory in Oakland, Calif, while maintaining the specimens at 4°C from specimen collection to laboratory delivery by routine transporters. The urine was processed according to the manufacturer's specifications by laboratory technicians using the Strand Displacement Amplification (Becton Dickinson, Sparks, Md) technique for direct qualitative detection of *C trachomatis*.<sup>18</sup> Urine samples not sent for testing were discarded. Adolescents whose test results came back positive received treatment after they were contacted in accordance with each clinic's confidential

follow-up protocol. Their partners were treated whenever possible. Positive *C trachomatis* test results were reported to the public health department.

**Sustain the Gain.** Finally, the research and adolescent care teams developed performance indicators (number of visits and *C trachomatis* screening rates) and a customized information infrastructure to assist in monitoring performance progress.

## Data

We developed a program to extract the following data from the patient encounter and laboratory databases: patient age at visit, type of visit, and *C trachomatis* testing information. Test results were linked with the checkup if they occurred at the same clinic site, department, and within 3 days of the checkup. Because there were fewer than 10 duplicate checkup reports during the study period and because these duplicates occurred within the time when re-screening would be advised, all checkups were included in our analyses.

Because *C trachomatis* screening is required only for adolescents who are sexually active, we needed site-specific sexual activity rates for adolescent girls who came for their checkups. We found that the participating HMO clinicians were inconsistent in asking about and recording their patients' sexual activity status. Consequently, we determined site-specific sexual activity rates from a short anonymous survey (exit poll) in which adolescents self-reported their sexual activity status. The survey was administered during the first 3-month period of data collection of the project in each clinic site with a response rate of 70%. The survey information was used to determine a site-specific sexual activity rate and then used in the actual site-specific *C trachomatis* screening rate calculation.

The principal outcome measure was the proportion of sexually active adolescent girls aged 14 to 18 years screened for *C trachomatis* during their checkups. We used the following calculation to determine this proportion: *C trachomatis* screening rate = No. of *C trachom*

**Table 1.** Sample Characteristics at Baseline of Adolescent Girls Seen for Routine Checkup

Variable	Experimental Clinic Group		Control Clinic Group		P Value*
	Mean (SD)	Median (Range)	Mean (SD)	Median (Range)	
Sexual activity rate, %†	24 (0.60)	23 (18-34)	23 (10.9)	19 (16-43)	.35
Age, y	15.41 (1.18)	15 (14-18)	15.35 (1.19)	15 (14-18)	.69
Checkups	479 (175)	483 (216-708)	468 (329)	286 (217-1009)	>.99
Baseline urine <i>Chlamydia trachomatis</i> screening rates, %‡	5 (7)	0 (0-13)	14 (9)	19 (0-23)	.15

\*Based on Mann-Whitney nonparametric tests.

†Based on anonymous teen survey.

‡These are baseline screening rates for the first void urine-based *C trachomatis* screening test.

*matis* tests done / (No. of girls seen for checkups × sexual activity rate).

## Data Analysis

We compared baseline characteristics between the experimental and control clinics using Mann-Whitney tests. To assess the differences in changes in urine-based *C trachomatis* screening proportions over time between the intervention and control sites, we used repeated measures analysis of variance<sup>31</sup> and the mixed procedure in the SAS statistical software version 8 (SAS Inc, Cary, NC). The 18-month intervention period was divided into six 3-month periods to provide more stable estimated screening proportions. The screening proportions at the end of each period were compared with baseline screening rates from a 2-month period that began when the urine-based tests were available in the HMO. Thus, the data consist of 7 repeated measurements for each of the 10 study sites. The analysis of variance model contained interaction terms that assessed the differences in changes between groups and provided estimates of their magnitudes. We assessed the statistical significance of the time by group effect using an F test. We calculated predicted screening rates by time and intervention group along with associated 95% confidence intervals using the analysis of variance results to illustrate the magnitude of treatment effects. Statistical significance was  $P < .05$ .

## RESULTS

Of the 1595 exit surveys collected from patients after their checkups, we found no differences between the experimen-

tal and control clinics in the patients' baseline characteristics (TABLE 1). The clinics served an ethnically diverse population: 16% black, 17% Asian, 16% Latina, 38% white, 11% multiethnic, and 2% other.

Over the entire study period, 478 (47%) of 1017 eligible adolescent girls were screened for *C trachomatis* in the experimental clinics vs 203 (17%) of 1194 eligible at the control clinics. The estimated proportions of sexually active adolescent girls screened for *C trachomatis* during routine checkups by period and study group are presented in FIGURE 3 and TABLE 2. At baseline the mean screening proportions were not statistically different at 0.14 for the control and 0.05 for the experimental clinics. But they were distinct by 4 to 6 months at 0.18 and 0.53. The means at months 16 to 18 were 0.65 in the intervention group and 0.21 in the control group. The F test of the time period by study group interaction effect was significant ( $F_{6,60} = 5.33$ ;  $P < .001$ ) indicating that the changes in urine-based *C trachomatis* screening rates differed between the intervention and control sites.

The *C trachomatis* infection rate was calculated at the beginning of the 2nd postintervention period through the 18th month because this period approached a more consistent screening proportion in the experimental group. The *C trachomatis* infection rate for the experimental clinics was 5.8% (23 positive test results out of 393 urine tests and 3986 checkups). In contrast, the infection rate was 7.6% in the control clinics (12 positive test results out of 157 urine tests taken and 3934 checkups).

**COMMENT**

Our intervention significantly increased *C trachomatis* screening rates among sexually active adolescent girls coming in for routine checkups at pediatric clinics of a large HMO. To our knowledge, this is the first successful randomized clinical trial evaluating a systems intervention approach applied to STD screening. Interestingly, the *C trachomatis* infection rate was lower in the experimental sites than it was in the control sites (5.8% vs 7.6%). This may in part reflect the intervention's success in increasing the screening rate among eligible healthy young women, resulting in a relative dilution of positive test results; the higher rate in control clinics where only a small minority was screened is most likely due

to selective screening that targets high-risk individuals.

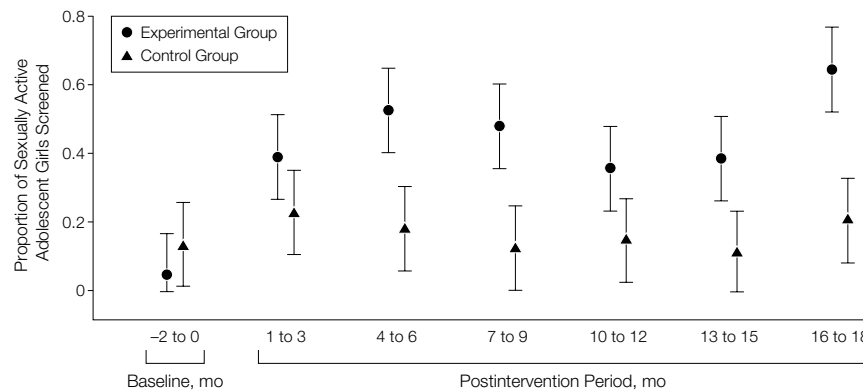
Three important changes in the approach to *C trachomatis* infections in young women have taken place recently. The first was the identification of the *C trachomatis* epidemic among sexually active adolescent females by the Centers for Disease Control and Prevention through its analysis of age-specific STD rates.<sup>32</sup> The second was the development of evidence-based practice guidelines that recommended universal *C trachomatis* screening among sexually active adolescent girls and young adult women and were disseminated by a number of professional organizations in the 1990s.<sup>9-13,15,33</sup> The third was the development of a user friendly, noninvasive, accurate screening test

for *C trachomatis*, using nucleic acid amplification urine-based test systems,<sup>18-21</sup> which provided patients a more acceptable alternative to providing specimens than pelvic examination.

Even with all these changes, the proportion of the target population being screened remained low. Among managed care organizations, which emphasize preventive health care, only 20% of the target population was being screened.<sup>15</sup> It is clear that the identification of the problem,<sup>3</sup> the availability of accurate and easy-to-administer screening tests,<sup>17</sup> and the promulgation of guidelines<sup>34,35</sup> are necessary but not sufficient to ensure adherence to a recommended practice of universal *C trachomatis* screening for adolescent girls. The only documented successes to date have involved the implementation of universal screening programs in well defined, often residential populations of adolescent girls and young adult women, such as in youth detention centers, the job corps,<sup>36</sup> and the military.<sup>37-39</sup> Screening efforts have also been described in other sites including schools,<sup>40,41</sup> emergency departments, and selected private practices,<sup>42</sup> but most studies outside of residential communities represent convenience samples and not true universal screening efforts.

In developing our intervention, we recognized that to implement changes in screening practices successfully, it was necessary to couple the *C trachomatis* screening guidelines and advanced *C trachomatis* testing capabilities with a mul-

**Figure 3.** Estimated Urine-Based *Chlamydia trachomatis* Screening Rates for Sexually Active Adolescent Girls



The error bars indicate 95% confidence intervals. The 14- to 18-year-old girls were identified as being sexually active by an anonymous survey taken after their routine checkups.

**Table 2.** Estimated Urine-Based *Chlamydia trachomatis* Screening Rates Among Adolescent Girls

Review Period, mo	Experimental Clinics			Control Clinics		
	No. of Screens Performed (Range)*	Median (Range) of Sexually Active Adolescents†	Screening Rate (95% CI)	No. of Screens Performed (Range)*	Median (Range) of Sexually Active Adolescents†	Screening Rate (95% CI)
Baseline, -2 to 0	4 (0-2)	32 (6-41)	0.05 (0.00-0.17)	12 (0-6)	13 (7-126)	0.14 (0.01-0.26)
1-3	85 (3-32)	40 (22-58)	0.39 (0.27-0.51)	46 (3-24)	28 (10-99)	0.23 (0.11-0.35)
4-6	72 (4-25)	27 (11-42)	0.53 (0.41-0.65)	23 (1-18)	12 (10-80)	0.18 (0.06-0.30)
7-9	81 (3-31)	38 (8-41)	0.48 (0.36-0.60)	41 (0-36)	14 (11-149)	0.13 (0.00-0.25)
10-12	101 (5-30)	61 (19-83)	0.36 (0.24-0.48)	37 (0-31)	18 (13-142)	0.15 (0.03-0.27)
13-15	73 (12-23)	41 (26-56)	0.39 (0.27-0.51)	33 (0-30)	32 (9-158)	0.11 (0.00-0.23)
16-18	66 (3-20)	32 (16-46)	0.65 (0.53-0.77)	23 (0-14)	20 (13-128)	0.21 (0.09-0.33)

\*The number of screens performed is the total across all sites for the specified period. The range represents the lowest and highest parameters among sites.

†The denominator, those patients who were eligible to be screened, is based on the number of checkups multiplied by estimated sexual activity rate. CI indicates confidence interval.

tifaceted, systems-level intervention that addressed the needs of the health care professional and the patient,<sup>43</sup> and targeted barriers at all levels of clinical practice. Such a multifaceted approach has shown to be more effective than single interventions.<sup>22,23,44</sup> In designing this intervention, effective strategies described in the quality improvement literature were used. We actively sought the commitment of opinion leaders within the HMO to champion the project and ensure the effective implementation of practice change strategies among their colleagues and within the larger system, and we established stretch goals and performance measures that were endorsed and promulgated by clinical and administrative leaders who were integrally involved in frequent monitoring of the improvement process. When combined, these factors created a campaign within the organization that raised awareness, allocated the appropriate resources, and rewarded and celebrated success by providing lunch for practitioners and other clinical staff during progress meetings, distributing commendation letters for staff who played key roles in the project, and sending e-mail announcements from site chiefs noting the good work of the providers and staff.<sup>30,45</sup>

In implementing our intervention, significant barriers to screening were identified by the site team at monthly meeting at several stages during the adolescent encounter. Many of these barriers were common to all study sites. For example, all sites lacked specific clinical protocols outlining a method to obtain first-void urine specimens from the target population confidentially. In this case, all clinics participating in the intervention group decided independently to introduce routine universal collection of specimens from the target population at clinic registration and have the clinician consistently determine the sexual activity status during the checkup and therefore the need for screening. Another identified barrier was that many primary care pediatricians felt poorly prepared to obtain sexual histories from their adolescent

patients. Such a barrier is not unique to our clinicians or to pediatricians. Previous studies have shown that only 20% to 68% of physicians state that they ask their adolescent patients about sexual activity.<sup>16,46-48</sup> Some have a misconception that their young patients are not sexually active or would not be exposed to the disease, even though 65% of women have had intercourse by the time they reach age 18 years.<sup>29</sup> Further research shows that only 1 in 4 adolescents said they had ever discussed their sexual history with their health care practitioners during their regular checkups and less than a third had received any information about birth control or STD testing from their health care practitioners.<sup>49</sup> To address this problem, our clinicians voluntarily participated in a 1-hour, lunchtime workshop led by the investigators (C.W., A.T., M.A.B.S.) to increase their skills in taking histories from adolescents. In addition, clinics adopted as routine that the parent or guardian would not be allowed to stay for the entire checkup, so the clinician could obtain a confidential sexual history.

There were several other examples of barriers identified and overcome during the intervention process, such as the lack of awareness by clinicians that *C trachomatis* is a significant problem among adolescent girls in their practice, low level of knowledge about urine-based *C trachomatis* screening, and reluctance by some check-in clerks and nursing staff to be involved with screening adolescents for STDs. Solutions to overcoming these barriers included providing data showing the prevalence of *C trachomatis* among patients and providing information about urine-based screening initiating universal collection of urine samples at check in by the clerk or medical assistant, "in case the doctor needs it." The strength of our system's intervention approach is its adaptability to each clinic. Each clinic site was able to customize its approach to screening to meet the particular needs of its setting, its clinicians, and its patients. This customization has been shown to enhance the outcome of a clinical intervention.<sup>30</sup>

Two limitations of this study should be mentioned. First, we were unable to link specific individual sexual history with actual *C trachomatis* testing; as a result, we used a proxy measure for sexual activity based on anonymous exit polls, which may be a potential threat to the validity of our findings. Second, this study focused on pediatric practitioners who serve adolescents in a large HMO system. Generalizability to other settings remains unknown. However, the intervention methods used in this study are not specific to an HMO setting or to the problem we addressed, *C trachomatis* screening. Our intervention's inherent rapid change component provides flexibility in its design and application, which may be generalizable to other practice settings, populations, and types of health care organizations.

There are 3 primary next steps for this research. The first is to train pediatric personnel within the HMO to implement the intervention in all clinic settings, especially in urgent care. Initial studies have shown that only about half of all adolescents schedule annual checkups<sup>50</sup> and the *C trachomatis* prevalence in urgent and emergent care settings appears to be significant.<sup>51</sup> The second is to conduct a cost-effectiveness evaluation. Although broad-based screening programs have been found to be cost-effective,<sup>7,8</sup> models to evaluate cost-effectiveness of our intervention using a number of different scenarios, including the impact of different *C trachomatis* prevalence rates, need to be developed. We identified only 11 more *C trachomatis* infections (representing a 50% increase in identification among adolescents at our experimental clinics than at our control clinics), and the development and initial evaluation phase of such a large quality improvement project was costly, as was expected. Hopefully, the dissemination and adoption of the technique at the other institutions would be much less expensive since the methodology has already been developed as part of our research. Finally, it is possible that the intervention method and clinic teams that were established could be applied to other

clinical problems as well as in other settings to improve clinical outcomes on an ad hoc or continuous basis.

**Author Contributions:** *Study concept and design:* Shafer, Tebb, Pantell, Wibbelsman, Neuhaus, Tipton, Kunin, Bergman.

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