Published in final edited form as:

J Pediatr. 2017 April ; 183: 147–152.e1. doi:10.1016/j.jpeds.2016.12.045.

A Computerized Sexual Health Survey Improves Sexually Transmitted Infection Testing In a Pediatric Emergency Department

Monika K Goyal, MD, MSCE¹, Joel A. Fein, MD, MPH², Gia M. Badolato, MPH¹, Judy A. Shea, PhD³, Maria E. Trent, MD, MPH⁴, Stephen J. Teach, MD, MPH¹, Theoklis E. Zaoutis, MD, MSCE², and James M. Chamberlain, MD¹

¹Pediatrics & Emergency Medicine, Children's National Health System, Washington, DC, United States

²Pediatrics, Children's Hospital of Philadelphia, Philadelphia, PA, United States

³Medicine, University of Pennsylvania School of Medicine, Philadelphia, PA, United States

⁴Pediatrics, Johns Hopkins School of Medicine, Baltimore, MD, United States

Abstract

Background and Objectives—Adolescents have the highest rates of sexually transmitted infections (STIs) and often use the emergency department (ED) for care, making the ED a strategic setting for STI screening. We studied if clinical decision support, using computerized STI risk assessments, results in increased STI testing of adolescents at high risk for STI.

Design/Methods—In a 2-arm randomized controlled trial conducted at a single, urban, pediatric ED, adolescents completed a computerized sexual health survey (SHS). For patients assigned to the intervention arm, attending physicians received decision support to guide STI testing based on the SHS-derived STI risk; in the usual care arm decision support was not provided. We compared STI testing rates between the intervention and usual care groups, adjusting for potential confounding using multivariable logistic regression.

Results—635 of 728 (87.2%) enrolled patients had evaluable data (323 intervention arm; 312 usual care arm). STI testing frequency was higher in the intervention group when compared to the usual care group (52.3% vs. 42.0%; aOR 2.0 [95% CI 1.1, 3.8]). This effect was even more pronounced among the patients who presented asymptomatic for STI (28.6 vs. 8.2%; aOR 4.7 [95% CI 1.4, 15.5]).

Corresponding author: Monika Goyal MD, MSCE, Children's National Health System, 111 Michigan Ave, NW, Washington, DC 20010, phone: 202-476-2869, fax: 202-476-2573, mgoyal@childrensnational.org.

Conflict of Interest: The authors have indicated they have no potential conflicts of interest to disclose.

The study sponsor (NIH) was not involved in: (1) study design; (2) collection, analysis, and interpretation of data; (3) the writing of the report; and (4) the decision to submit the paper for publication.

Dr. Monika Goyal was responsible for preparing the first draft of the manuscript. No honorarium, grant, or other form of payment was given to anyone to produce the manuscript.

Clinical Trial Registration: ClinicalTrials.gov; NCT02509572; <https://clinicaltrials.gov/ct2/show/NCT02509572>

Conclusions—Providing SHS-derived decision support to ED clinicians led to increased STI testing rates in adolescents at high risk for infection, particularly in those presenting asymptomatic for infection. Studies to understand potential barriers to decision support adherence should be undertaken to inform larger, multicenter studies to determine the generalizability of these findings and whether this process leads to increased STI detection.

Keywords

adolescent

Introduction

Adolescents are disproportionately affected by sexually transmitted infections (STIs).^{1–5} Of the 19 million new cases of STIs in the United States each year, over 9 million occur among adolescents.⁵ Emergency departments (ED) are a key point of access to care for many adolescents, as they account for 15.8% of all ED visits, or almost 15 million ED visits annually.^{6–9} More than one-third of adolescents do not report a source of primary care,^{10–13} and fewer than 15% of adolescents participate in yearly routine health maintenance exams.¹⁴ Furthermore, adolescents who seek care at EDs engage in riskier behaviors than those who access primary care services.^{12, 15} Early diagnosis and treatment of STIs can prevent serious reproductive morbidity and mortality, including pelvic inflammatory disease, ectopic pregnancy, infertility, and facilitation of transmission of Human Immunodeficiency Virus (HIV). Considering that one of the goals of Healthy People 2020 is increased STI screening for youth,¹⁶ the ED may serve as a strategic setting for the diagnosis and treatment of STIs, and may in fact be the only source of encounter with health care providers for this vulnerable population.

Despite the high rates of STIs in adolescents and the ED often being the only source of health care access for many youth at risk for STIs, STI testing is not routinely conducted in the ED setting.^{17–19} Even when patients present with STI-related symptoms, sexual histories are not routinely obtained by clinicians,^{17, 19–21} and STI testing is not always conducted,^{18–20, 22} leading to under-diagnosis and under-treatment. Although adolescents are interested in receiving sexual health education and treatment in the ED setting,^{23,24} adolescent patients may be uncomfortable disclosing sensitive health information to clinicians in face-to-face interviews.^{25–30} Furthermore, patients may not recognize that their symptoms may be STI-related or that they are at risk for STIs, and therefore, may not disclose their sexual behavior unless prompted. Finally, the hectic pace and lack of privacy in the ED setting may make it difficult to provide sexual health care confidentially and efficiently.

To address these barriers, computerized screening may serve as an additional method to obtain sensitive information efficiently and accurately.^{29, 31–34} Therefore, we previously developed the sexual health screen, a computerized survey to efficiently and confidentially identify adolescents at risk for STIs.³⁵ The purpose of this study was to conduct a randomized trial to evaluate the effectiveness of decision support derived from the sexual health screen for targeted STI testing among adolescents at high risk for STIs. We

hypothesized that provision of decision support for targeted testing of adolescents assessed at high risk for STIs would result in significantly increased STI testing frequency when compared to usual care (e.g. non-receipt of the decision support).

Patients and Methods

Study Design and Setting

We performed a single-blind two-arm randomized controlled trial (NCT02509572) between October 2014 and July 2015 to determine if provision of decision support based on the sexual health screen resulted in increased STI testing of adolescents at high risk for STIs. Based on our prior work demonstrating differences in STI testing by gender and presence or absence of STI-related symptoms,³⁶ we purposefully oversampled females and asymptomatic patients. We ensured balanced allocation within groups by age, gender, and presence of STI-related symptoms in a 1:1 ratio. The randomization sequence was created by DatStat Illume (Seattle, WA), which hosted our computerized sexual health survey, using random permuted blocks, ranging in size from 2 to 6. The hospital's institutional review board approved the study protocol with a waiver of parental consent because adolescents are allowed to seek and receive confidential sexual health services in our jurisdiction.

Study Setting and Population

The study was conducted at a single, urban, pediatric ED located in a free-standing tertiary care, pediatric academic center with an annual ED visit volume of approximately 90,000, and within a city with the highest rate of STIs nationally.³⁷ During the study period, trained research staff approached patients aged 14–19 years for study participation during randomly selected 8-hour shifts from 7am–11pm daily. Because informed consent was required, we excluded patients who were critically ill, developmentally or neurocognitively delayed, in police custody, or presenting with altered mental status, a psychiatric emergency, or after an acute sexual assault. Because the survey was only available in English, patients who were not literate or did not understand English were ineligible. We also excluded patients from participation if they were under the clinical care of any of the study investigators.

Screening Tool

All enrolled patients completed the computerized sexual health screen (SHS), a sexual risk assessment tool developed and validated by the study investigators.³⁵ This survey was administered via a tablet-based computer with headphones provided for patients in an audio-computer-assisted self-interview format. Based on participant survey responses, patients were classified into 1 of 3 categories for STI risk. Patients were classified as *at high risk* for STIs if they disclosed being sexually active *and* having either the presence of STI-related symptoms or any of the following high risk behaviors: more than 1 sexual partner in the last 3 months, no condom use during last sex, prior history of STI. Patients were classified as *at risk* if they disclosed being sexually active but did not disclose having any STI-related symptoms or any high-risk sexual behaviors. Patients were classified as *at low risk* if they denied any history of sexual activity.

Intervention

For patients randomized to the intervention arm, the attending physician received decision support in the form of a printed report that included recommendations for gonorrhea and chlamydia testing based on the risk category derived from the sexual health screen. When patients were classified as *at high risk*, the attending received recommendations that STI testing was “highly recommended” and when they cared for patients who were classified as *at risk*, STI testing was “recommended”. When attending physicians cared for patients who were classified as *at low risk*, they received recommendations that STI testing “was not necessary at this time.” For patients in the usual care arm, the attending physician received no decision support.

All study participants, including participants who screened *at low risk*, underwent STI testing for *Neisseria gonorrhoeae* and *Chlamydia trachomatis* via polymerase chain reaction (Abbott RealTime PCR; Illinois, USA). We did not specifically include HIV testing or trichomonas testing as study outcomes because our institution already has a well-established opt-out HIV screening program and because there are no current recommendations for asymptomatic trichomonas testing.³⁸ If study participants did not have STI testing ordered by the clinician, research assistants sent previously collected urine for STI testing at time of ED discharge under the research protocol. As part of the SHS, confidential phone numbers for result notification were collected from all enrolled patients. All patients with a positive test were notified of the results and prescribed or referred for treatment, either by clinical staff or the principal investigator.

Measures

The primary outcome measures were the difference in STI testing frequencies between the intervention and usual care arms for the entire cohort as well as for the asymptomatic participants who screened *at high risk* for STIs. We chose to focus on the asymptomatic population because we believe this group would be most likely to benefit most from improvements in screening, as they represent a group of patients at high risk for STIs who may not otherwise be identified. We chose STI testing as our primary outcome because the most proximate outcome for CDS is clinician decision to perform STI testing. We hypothesized that STI testing rates would be greater in the intervention arm compared to the usual care arm. With a baseline STI testing rate of 10%³⁶ and at an alpha of 0.05, a sample size of 600 would provide 90% power to detect a 10% absolute difference between the two arms. To address potential perceived barriers to future implementation, as a secondary measure, we determined whether study participation or randomization to the intervention group resulted in increased length of stay in the ED.

Data Analysis

We calculated the difference in STI testing frequency among patients at high risk for STIs assigned to decision support intervention arm compared to the non-decision support usual care arm. We also performed logistic regression to estimate difference in effect size between the intervention and usual care arms after adjustment for potential confounding variables, including age, gender, race/ethnicity, and insurance status. We derived estimates from our models and included odds ratios (OR) and risk differences (RD) with 95% confidence

intervals (95% CI), using an alpha of 0.05 for statistical significance. We used the Mann-Whitney-Wilcoxon test to compare differences in median ED length of stay between patients who enrolled and declined participation and between the intervention and usual care arms. We used Stata 12.0 (College Station, Tx) for all analyses.

Results

We approached 1075 eligible patients and 720 (67.0%) consented. The most commonly reported reasons for declining were: uninterested (42.8%), not feeling well (11%), did not want to/unable to provide a urine sample (6.2%). There were no demographic differences between patients who agreed to and those who declined study participation. Of the 720 enrolled, 367 were randomized to the intervention arm and 353 to the usual care arm, of which 323 and 312, respectively, had evaluable data (Figure 1). The mean age of participants was 16.2 years and the majority was female, of non-Hispanic black race/ethnicity, and had public insurance. Sixty percent of enrolled patients denied being sexually experienced (classified as *at low risk* for STIs) and 33% reported engaging in high-risk sexual behavior (classified as *at high risk* for STIs). There were no differences between the intervention and usual care groups with respect to demographics or sexual experience (Table 1).

Among the 211 patients who were classified *at high risk* on the sexual health screen within the entire cohort, 52.3% (58/111) in the intervention arm and 42.0% (42/100) in the usual care arm underwent clinician-ordered STI testing (OR 1.5 [95% CI 0.9, 2.6]; RD 10.3% [95% CI -3.2, 23.7]). After adjustment for age, gender, and presence of STI-related chief complaint, the odds of STI testing were higher among the intervention arm when compared to the usual care arm (aOR 2.0 [95% CI 1.1, 3.8]; aRD 10.9% [0.1, 21.8]). (Table 2).

Of the 435 patients who presented asymptomatic for STIs, 105 were classified as *at high risk* based on their sexual health screen responses. Within this group, 16 (28.7%) of the 56 randomized to the intervention arm underwent clinician-ordered STI testing compared to 4 (8.2%) of the 49 in the usual care arm (OR 4.5 [95% CI 1.4, 14.6]; RD 20.4% [95% CI 6.3, 34.5]). When adjusted for age and gender, significant differences in STI testing rates between the intervention and usual care arms remained (aOR 4.7 [95% CI 1.4, 15.4]; aRD 20.5% [95% CI 6.7, 34.4]). (Table 2).

From the final sample of 635 participants, STI prevalence was 5.5% (95% CI 3.7, 7.3). STI prevalence increased with higher risk levels ($p<0.001$). Participants classified as *at low risk* had an STI prevalence of 1.3% (95% CI 0.2, 2.5). Participants classified as *at risk* had an STI prevalence of 2.2% (95% CI -2.2, 6.5). Participants classified as *at high risk* had an STI prevalence of 13.7% (95% CI 9.1, 18.4). Twenty (69%) of these patients had clinician-ordered STI testing: 11/15 (73.3%) in the intervention group compared to 9/14 (64.3%) in the usual care group.

There was no difference in median ED length of stay between eligible patients who enrolled and declined study participation (234.0 vs. 222.3 minutes; $p=0.2$). Additionally, there was no difference in median ED length of stay between enrolled patients assigned to the intervention and usual care arms (234.0 vs. 234.5 minutes; $p=0.4$).

Discussion

In this randomized trial, we found that provision of decision support through the use of a computerized sexual health screen for risk of STIs led to increased STI testing. These effects were more striking in those who presented asymptomatic for STIs. Participants asymptomatic for STIs who screened at high risk for STIs and whose physicians received decision support, had almost 5 times the odds of undergoing STI testing when compared to participants in the usual care arm. These findings suggest that use of a standardized, self-administered computerized sexual health screen was effective in guiding clinicians to perform targeted STI testing for adolescents at high risk for STIs. This effect occurred without increasing ED length of stay.

Although high rates of STIs have been found among adolescents presenting to the ED for care,^{39–42} STI screening is not universally performed in this setting. This may be in part due to the fact that the ED is not traditionally viewed as a venue for public health interventions and prevention. However, the notion that the ED may serve as a safety net for vulnerable populations has recently gained attention, and screening for high risk conditions such as HIV,⁴³ intimate partner violence,⁴⁴ and suicidality,⁴⁵ has started to become more widely practiced.⁴⁶ Both existing research and expert consensus support the need for research addressing the effectiveness, sustainability, and integration of ED-based STI screening programs.^{47, 48} Although the Centers for Disease Control and Prevention recommend universal screening for HIV in EDs,⁴³ there are currently no recommendations for ED-based STI screening. To overcome barriers to performing STI screening in the ED setting, we previously developed a computerized sexual health assessment tool to efficiently and confidentially identify adolescents at risk for STIs.³⁵

The difference in clinician-ordered STI testing frequency between the intervention and usual care arms highlights the efficacy of this self-administered assessment tool to provide decision support to clinicians. Our results support the findings of a prior study that used an interrupted time-series design to assess differences in STI testing rates before and after the introduction of decision support.⁴⁹ However, the prior study was not a randomized trial and therefore, unable to control for temporal trends.

The reasoning behind the greatest impact of the CDS leading to increased STI testing among asymptomatic patients is likely because this population of patients would otherwise not have been tested routine clinical care. Alternatively, when patients present to the ED with STI-related symptoms, clinicians may be more likely to obtain sexual histories, or order STI testing without even obtaining a sexual history and may not require decision support. In our study, asymptomatic patients classified at high risk for STIs whose attending physicians received decision support had almost 5 times the odds of being tested for STIs compared to the usual care arm. Our data suggest that through the sexual health screen-derived decision support process, many more youth may have the opportunity to be diagnosed and treated for an STI when compared to usual practice.

Although not our primary outcome, we found higher rates of clinician-detected STIs among patients assigned to the intervention arm compared to the usual care arm. In order to

properly conduct a study testing for statistically significant differences in STI detection rates, a sample size of more than 10,000 subjects would be required. However, the results of our study highlight the potential impact of this tool in downstream STI detection, treatment and prevention interventions, ultimately contributing to a decrease in adolescent STI rates and prevention of morbidity from untreated infection.

The findings from this study should be considered in light of potential limitations. Despite demonstrating increased STI testing frequency among patients who were cared for by clinicians receiving decision support, screening recommendations were followed in only half of the visits. Lack of 100% adherence to recommendations may have been affected by delivery process of the decision support, which was provided in the context of a randomized controlled trial, rather than a quality improvement initiative. In a systematic review designed to understand decision support system features most important for improving clinical practice, features identified included integration with the electronic order entry system, request for documentation of reason for not following system recommendations, and provision of the decision support at time and location of decision making.⁵⁰ In our study, although study participants completed the sexual health screen via a computerized tablet, the decision support was provided to clinicians via a printed report rather than being integrated into the electronic health record, and therefore the process did not prompt electronic orders or ask for reasons for foregoing STI testing. In addition,, clinicians may have been provided the decision support while they were busy with other patients and thus, the decision support was not optimized for ED workflow. Furthermore, we implemented this process without any of the usual support measures provided in typical implementation or quality improvement studies, such as clinician education, a campaign to continuously remind clinicians of the intervention, coaching and support to reduce barriers, and audit and feedback to monitor clinician performance. Although we were unable to incorporate all these features in our pilot study, if these features were to be incorporated into a subsequent iteration of our SHS-derived decision support, we may see an even greater effect size and impact of the decision support on STI testing.

This study was conducted at a single, urban pediatric ED located in a city with the highest rates of *Chlamydia trachomatis* nationally, and participants were largely publicly insured minority youth. While the sample may not be generalizable to other populations, this represents an important target for STI prevention and intervention. Additionally, although this study was designed to overcome ED-related barriers to STI screening, many of these barriers may also be applicable to other clinical settings, including primary care. Furthermore, as a single-center pilot study, although we demonstrated a large effect size of our intervention, the wide confidence intervals reflect the small sample size of our cohort. Finally, although there were no demographic differences between participants and those who declined participation, there may be selection bias with unaccounted differences between those enrolled and our overall ED population.

In conclusion, providing sexual health screen-derived decision support resulted in increased STI testing among adolescents reporting high-risk sexual behaviors. We measured an even greater effect in STI testing frequency among patients asymptomatic for STIs. The intervention did not result in an increase in ED length of stay. The ease of administration,

efficient nature of obtaining sensitive information, and efficacy in identifying high-risk patients make the sexual health screen a highly useful tool in the ED for STI screening. Implementation of targeted STI screening strategies, such as the one studied, have the potential to decrease the societal burden of adolescent STIs and prevent morbidity associated with untreated infection. Future directions of this work should include larger multicenter effectiveness trials to evaluate generalizability of our tool, addition of other features of decision support to optimize uptake of this process, and to determine if this process ultimately results in increased STI detection.

Acknowledgments

Funding Source: This work has been supported by an NICHD K23 award (HD070910) (MKG). The funding source had no role in the design and conduct of the study; collection, management, analysis, or interpretation of the data; preparation, review, or approval of the manuscript.

Abbreviations

STIs	sexually transmitted infections
ED	emergency department

References

1. Burstein GR, Gaydos CA, Diener-West M, Howell MR, Zenilman JM, Quinn TC. Incident Chlamydia trachomatis infections among inner-city adolescent females. *JAMA*. 1998; 280:521–6. [PubMed: 9707141]
2. Centers for Disease Control and Prevention. Sexually Transmitted Disease Surveillance 2009. Atlanta: Department of Health and Human Services; 2010.
3. Eng, TB. Wt Institute of Medicine. The hidden epidemic: confronting sexually transmitted diseases. National Academy Press; 1997.
4. Forhan SE, Gottlieb SL, Sternberg MR, Xu F, Datta SD, McQuillan GM, et al. Prevalence of sexually transmitted infections among female adolescents aged 14 to 19 in the United States. *Pediatrics*. 2009; 124:1505–12. [PubMed: 19933728]
5. Weinstock H, Berman S, Cates W Jr. Sexually transmitted diseases among American youth: incidence and prevalence estimates, 2000. *Perspect Sex Reprod Health*. 2004; 36:6–10. [PubMed: 14982671]
6. Al-Tayyib AA, Miller WC, Rogers SM, Leone PA, Gesink Law DC, Ford CA, et al. Health care access and follow-up of chlamydial and gonococcal infections identified in an emergency department. *Sex Transm Dis*. 2008; 35:583–7. [PubMed: 18418297]
7. McCaig LF, Nawar EW. National Hospital Ambulatory Medical Care Survey: 2004 emergency department summary. *Adv Data*. 2006:1–29.
8. Park MJ, Paul Mulye T, Adams SH, Brindis CD, Irwin CE Jr. The health status of young adults in the United States. *J Adolesc Health*. 2006; 39:305–17. [PubMed: 16919791]
9. Ziv A, Boulet JR, Slap GB. Emergency department utilization by adolescents in the United States. *Pediatrics*. 1998; 101:987–94. [PubMed: 9606224]
10. Grove DD, Lazebnik R, Petrack EM. Urban emergency department utilization by adolescents. *Clin Pediatr (Phila)*. 2000; 39:479–83. [PubMed: 10961820]
11. Lehmann CU, Barr J, Kelly PJ. Emergency department utilization by adolescents. *J Adolesc Health*. 1994; 15:485–90. [PubMed: 7811681]
12. Wilson KM, Klein JD. Adolescents who use the emergency department as their usual source of care. *Arch Pediatr Adolesc Med*. 2000; 154:361–5. [PubMed: 10768673]

13. Woodwell DA, Schappert SM. National Ambulatory Medical Care Survey: 1993 summary. *Adv Data*. 1995;1–20.
14. Dempsey AF, Freed GL. Health care utilization by adolescents on medicaid: implications for delivering vaccines. *Pediatrics*. 2010; 125:43–9. [PubMed: 19948567]
15. Mehta SD, Rothman RE, Kelen GD, Quinn TC, Zenilman JM. Clinical aspects of diagnosis of gonorrhea and Chlamydia infection in an acute care setting. *Clin Infect Dis*. 2001; 32:655–9. [PubMed: 11181134]
16. US Department of Health and Human Services, Office of Disease Prevention and Promotion. Healthy People 2020. Washington, DC: healthypeople.gov/2020/about/DisparitiesAbout.aspx [Accessed September 13, 2012]
17. Banas DA, Cromer BA, Santana M, Worley SE, Bena JF, McIntyre SL, et al. Comparison of clinical evaluation of genitourinary symptoms in female adolescents among primary care versus emergency department physicians. *J Pediatr Adolesc Gynecol*. 23:71–6.
18. Huppert JS, Goodman E, Khoury J, Slap G. Sexually transmitted infection testing and screening in hospital-based primary care visits by women. *Obstet Gynecol*. 2005; 105:390–6. [PubMed: 15684170]
19. Musacchio NS, Gehani S, Garofalo R. Emergency department management of adolescents with urinary complaints: missed opportunities. *J Adolesc Health*. 2009; 44:81–3. [PubMed: 19101462]
20. Goyal M, McCutcheon M, Hayes K, Mollen C. Sexual history documentation in adolescent emergency department patients. *Pediatrics*. 2011; 128:86–91. [PubMed: 21646260]
21. Torkko KC, Gershman K, Crane LA, Hamman R, Baron A. Testing for Chlamydia and sexual history taking in adolescent females: results from a statewide survey of Colorado primary care providers. *Pediatrics*. 2000; 106:E32. [PubMed: 10969116]
22. Goyal MHK, Mollen C. Racial disparities in testing for sexually transmitted infections in the emergency department. *Acad Emerg Med*. 2012; 19(5):604–7. [PubMed: 22594368]
23. Fine LC, Mollen CJ. A pilot study to assess candidacy for emergency contraception and interest in sexual health education in a pediatric emergency department population. *Pediatr Emerg Care*. 2010; 26:413–6. [PubMed: 20502389]
24. Miller MK, Hornberger L, Sherman AK, Dowd MD. Acceptability of sexual health discussion and testing in the pediatric acute care setting. *Pediatr Emerg Care*. 2013; 29:592–7. [PubMed: 23611917]
25. Ghanem KG, Hutton HE, Zenilman JM, Zimba R, Erbeling EJ. Audio computer assisted self interview and face to face interview modes in assessing response bias among STD clinic patients. *Sex Transm Infect*. 2005; 81:421–5. [PubMed: 16199744]
26. Gutierrez JP, Torres-Pereda P. Acceptability and reliability of an adolescent risk behavior questionnaire administered with audio and computer support. *Rev Panam Salud Publica*. 2009; 25:418–22. [PubMed: 19695131]
27. Julliard K, Vivar J, Delgado C, Cruz E, Kabak J, Sabers H. What Latina patients don't tell their doctors: a qualitative study. *Ann Fam Med*. 2008; 6:543–9. [PubMed: 19001307]
28. Meckler GD, Elliott MN, Kanouse DE, Beals KP, Schuster MA. Nondisclosure of sexual orientation to a physician among a sample of gay, lesbian, and bisexual youth. *Arch Pediatr Adolesc Med*. 2006; 160:1248–54. [PubMed: 17146022]
29. Paperny DM, Aono JY, Lehman RM, Hammar SL, Risser J. Computer-assisted detection and intervention in adolescent high-risk health behaviors. *J Pediatr*. 1990; 116:456–62. [PubMed: 2308041]
30. Sankar P, Jones NL. To tell or not to tell: primary care patients' disclosure deliberations. *Arch Intern Med*. 2005; 165:2378–83. [PubMed: 16287767]
31. Estes LJ, Lloyd LE, Teti M, Raja S, Bowleg L, Allgood KL, et al. Perceptions of audio computer-assisted self-interviewing (ACASI) among women in an HIV-positive prevention program. *PLoS One*. 2010; 5:e9149. [PubMed: 20161771]
32. Kissinger P, Rice J, Farley T, Trim S, Jewitt K, Margavio V, et al. Application of computer-assisted interviews to sexual behavior research. *Am J Epidemiol*. 1999; 149:950–4. [PubMed: 10342804]

33. Kurth AE, Martin DP, Golden MR, Weiss NS, Heagerty PJ, Spielberg F, et al. A comparison between audio computer-assisted self-interviews and clinician interviews for obtaining the sexual history. *Sex Transm Dis.* 2004; 31:719–26. [PubMed: 15608586]
34. Turner CF, Ku L, Rogers SM, Lindberg LD, Pleck JH, Sonenstein FL. Adolescent sexual behavior, drug use, and violence: increased reporting with computer survey technology. *Science.* 1998; 280:867–73. [PubMed: 9572724]
35. Goyal MK, Shea JA, Hayes KL, Badolato G, Chamberlain JM, Zaoutis T, et al. Development of a Sexual Health Screening Tool for Adolescent Emergency Department Patients. *Academic Emergency Medicine.* 2016; 23(7):809–15. [PubMed: 27126128]
36. Tuchman, LHK., Robinson, K., Badolato, G., Goyal, MK. Factors Associated with Sexually Transmitted Infection Screening in a Pediatric Emergency Department. *Pediatric Academic Societies Annual Meeting 2014; Vancouver, BC.* 2014;
37. Centers for Disease Control and Prevention. [Accessed June 8, 2015] <http://www.cdc.gov/std/stats13/tables/2.htm>
38. Workowski KA, Bolan GA. Sexually transmitted diseases treatment guidelines, 2015. *MMWR Recommendations and reports : Morbidity and mortality weekly report Recommendations and reports/Centers for Disease Control.* 2015; 64:1–137.
39. Goyal M, Hayes K, Mollen C. Sexually transmitted infection prevalence in symptomatic adolescent emergency department patients. *Pediatr Emerg Care.* 2012; 28:1277–80. [PubMed: 23187982]
40. Miller MK, Dowd MD, Harrison CJ, Mollen CJ, Selvarangan R, Humiston SG. Prevalence of 3 sexually transmitted infections in a pediatric emergency department. *Pediatr Emerg Care.* 2015; 31:107–12. [PubMed: 25654676]
41. Schneider K, FitzGerald M, Byczkowski T, Reed J. Screening for Asymptomatic Gonorrhea and Chlamydia in the Pediatric Emergency Department. *Sexually transmitted diseases.* 2016; 43:209–15. [PubMed: 26967296]
42. Goyal MK, Teach SJ, Badolato GM, Trent M, Chamberlain JM. Universal Screening for Sexually Transmitted Infections among Asymptomatic Adolescents in an Urban Emergency Department: High Acceptance but Low Prevalence of Infection. *J Pediatr.* 2016; 171:128–32. [PubMed: 26846572]
43. Branson BM, Handsfield HH, Lampe MA, Janssen RS, Taylor AW, Lyss SB, et al. Revised recommendations for HIV testing of adults, adolescents, and pregnant women in health-care settings. *MMWR Recomm Rep.* 2006; 55:1–17. quiz CE1–4.
44. O'Doherty L, Hegarty K, Ramsay J, Davidson LL, Feder G, Taft A. Screening women for intimate partner violence in healthcare settings. *Cochrane Database Syst Rev.* 2015; 7:CD007007.
45. Boudreaux ED, Camargo CA Jr, Arias SA, Sullivan AF, Allen MH, Goldstein AB, et al. Improving Suicide Risk Screening and Detection in the Emergency Department. *American journal of preventive medicine.* 2016; 50:445–53. [PubMed: 26654691]
46. McKay MP, Vaca FE, Field C, Rhodes K. Public health in the emergency department: overcoming barriers to implementation and dissemination. *Academic Emergency Medicine.* 2009; 16:1132–7. [PubMed: 20053233]
47. Finelli L, Schillinger JA, Wasserheit JN. Are emergency departments the next frontier for sexually transmitted disease screening? *Sex Transm Dis.* 2001; 28:40–2. [PubMed: 11196045]
48. Haukoos JS, Mehta SD, Harvey L, Calderon Y, Rothman RE. Research priorities for human immunodeficiency virus and sexually transmitted infections surveillance, screening, and intervention in emergency departments: consensus-based recommendations. *Acad Emerg Med.* 2009; 16:1096–102. [PubMed: 20053228]
49. Ahmad FA, Jeffe DB, Plax K, Collins KK, Schechtman KB, Doerhoff DE, et al. Computerized self-interviews improve Chlamydia and gonorrhea testing among youth in the emergency department. *Annals of emergency medicine.* 2014; 64:376–84. [PubMed: 24612901]
50. Kawamoto K, Houlihan CA, Balas EA, Lobach DF. Improving clinical practice using clinical decision support systems: a systematic review of trials to identify features critical to success. *Bmj.* 2005; 330:765. [PubMed: 15767266]

Figure 1.
Enrollment Diagram

Table 1

Demographics of Study Population

		All (n=635)	Intervention (n=367)	Usual Care (n=353)
Mean Age (+/-SD)		16.17 (1.6)	16.17 (1.5)	16.17 (1.6)
Female Gender		444 (69.9%)	230 (71.2%)	214 (68.6%)
Race/Ethnicity	White, NH	29 (4.6%)	17 (5.3%)	12 (3.9%)
	Black, NH	472 (74.7%)	240 (75.0%)	232 (74.4%)
	Hispanic	108 (17.1%)	52 (16.3%)	56 (18.0%)
	Other	23 (3.6%)	11 (3.4%)	12 (3.9%)
Insurance Status	Private	143 (22.5%)	81 (25.1%)	62 (19.9%)
	Public	484 (76.2%)	238 (73.7%)	246 (78.9%)
	Uninsured	8 (1.3%)	4 (1.3%)	4 (1.3%)
STI-related Chief Complaint		160 (25.2%)	82 (25.4%)	78 (25.0%)
Derived STI Risk	Low Risk	378 (59.3%)	185 (57.3%)	193 (61.9%)
	At Risk	46 (7.4%)	27 (8.4%)	19 (6.1%)
	High Risk	211 (33.2%)	111 (34.4%)	100 (32.1%)

Table 2

STI Testing of Patients at High Risk for STI by Study Arm

	Intervention Arm (n=111)	Usual Care Arm (n=100)	Odds Ratio (95% CI)	Adjusted Odds Ratio (95% CI)
Entire Cohort (n=211)	58/111 (52.5%)	42/100 (42.0%)	1.5 (0.9, 2.6)	2.0 (1.1, 3.8)
Asymptomatic Cohort (n=105)	16/56 (28.7%)	4/49 (8.2%)	4.5 (1.4, 14.6)	4.7 (1.4, 15.4)