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Original
Contributions



SEXUALLY TRANSMITTED INFECTION HISTORY AMONG ADOLESCENTS PRESENTING TO THE EMERGENCY DEPARTMENT

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Abstract—Background: Adolescents and young adults account for about half of the annual diagnoses of sexually transmitted infections (STI) in the United States. Screening and treatment for STIs, as well as prevention, are needed in health-care settings to help offset the costs of untreated STIs. **Objective:** Our aim was to evaluate the prevalence and correlates of self-reported STI history among adolescents presenting to an emergency department (ED). **Methods:** Over two and a half years, 4389 youth (aged 14–20 years) presenting to the ED completed screening measures for a randomized controlled trial. About half (56%) reported lifetime sexual intercourse and were included in analyses examining

sexual risk behaviors (e.g., inconsistent condom use), and relationships of STI history with demographics (sex, age, race, school enrollment), reason for ED presentation (i.e., medical or injury), and substance use. **Results:** Among sexually active youth, 10% reported that a medical professional had ever told them they had an STI (212 females, 35 males). Using logistic regression, female sex, older age, non-Caucasian race, not being enrolled in school, medically related ED chief complaint, and inconsistent condom use were associated with increased odds of self-reported STI history. **Conclusions:** One in 10 sexually active youth in the ED reported a prior diagnosed STI. Previous STI was significantly higher among females than males. ED providers inquiring about inconsistent condom use and previous STI among male and female adolescents may be one strategy to focus biological testing resources and improve screening for current STI. © 2015 Elsevier Inc.

Keywords—emergency department; sexually transmitted infections; adolescents; risk behaviors

INTRODUCTION

In the United States, it is estimated that there are nearly 20 million new sexually transmitted infections (STI)

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diagnosed annually and adolescents and young adults aged 15–24 years account for half of these cases, despite being only 25% of the sexually experienced population (1–5). Furthermore, women, African Americans, and Hispanics are disproportionately affected (6–8). Additionally, STIs result in approximately \$16 billion in direct and indirect health-care expenses (9,10). Among women, STIs, such as chlamydia, can cause long-term health consequences, such as pelvic inflammatory disease, infertility, and perinatal complications (11–14). Among males, STIs, particularly chlamydia, have been implicated in chronic and acute infections (e.g., urethritis, epididymitis, epididymo-orchitis), as well as infertility (15).

Prior STI during adolescence or emerging adulthood predicts risk for future STI and human immunodeficiency virus (HIV) infection and recurrence rates are concerning (16,17). For example, a cohort study found that when comparing adolescents who never had an STI to those who had (where chlamydia was most common), HIV risk doubled among those with any past STI (16). In addition, research with emerging adults suggests that a past-year diagnosis of herpes is associated with increased odds of past-year diagnoses of chlamydia, gonorrhea, and genital warts (18). Further, a recent review found recurrence rates for genital warts of up to 110 per 100,000 among females and up to 163 per 100,000 among males, in addition to a peak in incidence during emerging adulthood (19). Thus, identifying individuals with a prior STI may be clinically important to health-care providers in identifying those at future risk.

Several factors put adolescents at risk for STIs, including multiple and concurrent sexual partners, lack of consistent and proper use of barrier protection, and increased biologic susceptibility to infection (1,5,20,21). For many adolescents, engaging in sexual risk behaviors increases from adolescence into emerging adulthood (22–24). In addition, high-risk behaviors, including alcohol and other substance abuse, tend to occur with or precede sexual risk behaviors among young people (24–29). Protective factors have also been identified, such as parental disapproval of sex and high grade-point average (30–32).

Adolescents are frequently without a primary care physician and they often present to the emergency department (ED) for their medical care (2,20,33,34). Also, many older adolescents do not receive health maintenance examinations, limiting the opportunity for screening and preventive medicine (35). Research also demonstrates that adolescents receiving care in the ED are more likely to engage in risky behaviors compared to those presenting in primary care (36). Further, female

adolescents frequently present to the ED with gynecologic symptoms contributing to the estimated 171,000 patients who present to the ED yearly for evaluation for STIs (20,37,38). However, as many STIs are asymptomatic and under-diagnosed, this is likely an underestimate of the disease burden, especially among male adolescents who are less likely to seek ED care for nonurgent problems and are less likely to undergo health maintenance screening (7,35,39). For example, studies involving point-of-care testing have shown that about 11% of youth in EDs tested positive for chlamydia or gonorrhea (39,40).

Although the Centers for Disease Control and Prevention (CDC) recommend routine STI screening for sexually active youth, particularly for females < 26 years, this screening occurs about half of the time (2,5,41). A national survey that included adolescents and adults showed that emergency physicians are less likely than other physicians to screen for STIs and suggested lack of time, follow-up, appropriate counseling, and reimbursement as primary barriers (42,43). ED practitioner compliance with CDC guidelines for treatment of STIs and related clinical presentations, such as pelvic inflammatory disease (PID), is poor in samples of adolescents and adults (20,44). For example, among adolescent women attending EDs for STIs or PID, full compliance with guidelines occurred in around one-third of cases (20,45). Despite this low compliance with recommendations, research has shown that sexually active youth, compared to non-sexually active peers, are willing to engage in discussions of STIs with providers (46).

Thus, the ED may be a crucial location for STI testing, intervention, referrals, and treatment efforts among youth, especially young men who may be asymptomatic carriers of STIs. In order to inform such efforts, research is needed to identify characteristics of those youth presenting to the ED setting who may be at highest risk for STIs to focus limited resources for point of care testing, as universal testing may not be feasible in every setting. Although youth with prior STI may have different characteristics than youth with current STI, given the relationship between past STI and future risk for STI and HIV infection and the concerning recurrence rates, information on the prevalence and characteristics of youth in the ED with prior STI is needed to identify those at risk in order to inform screening, prevention, and treatment efforts to provide an alternative to universal biologic testing (16–19,39,40). The aims of this study are to determine the prevalence of prior STI among sexually active males and females between 14 and 20 years of age in the ED and then to determine correlates of prior STI among this cohort.

MATERIALS AND METHODS

Study Design and Setting

The present study included secondary analysis of data from youth screened for inclusion in an ED-based randomized controlled trial (RCT) for underage drinking (47,48). Recruitment procedures and computer-based screening took place at the University of Michigan, Department of Emergency Medicine, an academic, Level I trauma center comprising a main ED, urgent care, and a pediatric ED; all attending physicians are board-certified in emergency medicine/pediatric emergency medicine. The total annual census is approximately 85,000 patients (25,000 seen in pediatric ED, about 6000 are aged 14–20 years) from the local suburban community and affiliated university. Approximately 15% of adolescents presenting to this ED are African American and 55% are female. Study protocol and materials received approval from the Institutional Review Board at the University of Michigan; we obtained a Certificate of Confidentiality from the National Institutes of Health. The RCT was funded by the National Institutes on Alcohol Abuse and Alcoholism, which had no direct role in the present study design, collection, analysis, interpretation, or writing of this manuscript.

Patient Sample and Recruitment

Patients between the ages of 14 and 20 years who presented to the medical ED were identified using an electronic medical record and approached by research assistants (RAs) in waiting rooms or treatment spaces. If patients were too medically unstable to recruit and were admitted to the hospital, they were approached during the next 72 h if they stabilized. Exclusion criteria are detailed in other publications but comprised conditions precluding informed consent (insufficient cognition/unconscious, parent/guardian unavailable for minor), presenting in police custody, or presenting for acute sexual assault (47–49). Recruitment of patients occurred 7 days a week (except major holidays) from September 2010 through March 2013 primarily on evening shifts (approximately 2 PM–12 AM). Initial sampling during day shifts and midnight shifts was reduced during the course of the study due to low yield.

Screening Procedure

As part of a larger RCT for underage drinking patients (or guardians) provided written, informed consent (if under age 18 years, assent was obtained) and then self-administered screening questionnaires using a touch-screen tablet computer. RAs asked that parents or others

accompanying the participants allow the patient privacy during survey administration. RAs paused the survey during medical examinations and procedures (e.g., x-ray studies). At survey completion, participants chose a gift (\$1.00 value; e.g., lotion, deck of cards).

Measures

Sexually transmitted infections and sexual history. The primary outcome was participants' report of past STI diagnosis as measured by an item modified from the National Longitudinal Study of Adolescent Health (AddHealth; "Have you ever been told by a doctor or nurse that you had a sexually transmitted disease (such as chlamydia, gonorrhea, herpes, genital warts, trichomonas [trich], or other STDs)?") (50–52). Response options were: yes or no. Items assessing lifetime sexual intercourse and past-year sexual risk behaviors (e.g., number of sexual partners, condom use, and use of alcohol or drugs before sex) were also adapted from AddHealth and the Youth Risk Behavior Surveillance Survey (50,53). Responses to these sexual risk behavior items were dichotomized to reflect zero or one partners vs. two or more partners, using condoms all the time vs. less than all the time (i.e., "inconsistent condom use"; those who had zero partners in the past year were coded as using condoms all the time), and never using alcohol/drugs before sex vs. ever using alcohol/drugs before sex. Using an item from the Flint Adolescent Study, participants were also asked about the sex of their sexual partners with response options: all males, mostly males, half males and half females, mostly females, and all females (54).

Other correlates and demographics. To assess alcohol use (including binge drinking) during the past year, we used items from a modified Alcohol Use Disorders Identification Test-Consumption (AUDIT-C) based on Chung et al.'s adaptation of the AUDIT for adolescents. Illicit drug use (e.g., cannabis, methamphetamines, cocaine, street opioids, inhalants, hallucinogens) during the past year was assessed by the Alcohol, Smoking, and Substance Involvement Screening Test (ASSIST) (55–58). We used items from national surveys to collect demographic characteristics, including gender, age, education status, and race (50,59). Following established recommendations, RAs were trained by an emergency medicine physician to abstract reasons for the ED visit from the electronic medical record and this information was coded as medical (e.g. fever, abdominal pain) vs. injury (60). To ensure reliability of the chart review data, research staff were blind to the study outcome measure and abstracted data onto a standardized form. Chart reviews were audited regularly (5% of charts per coder) to maintain reliability using established

criteria. Discrepancies were assessed by two reviewers and a final decision was made by an emergency physician.

Data Analysis

Analyses were performed using the subset of patients ($n = 2456$) who reported ever having had sexual intercourse on the item asking “Have you ever had sexual intercourse” (response options yes/no). We calculated descriptive statistics (e.g., means, standard deviations, proportions) for variables of interest. For males and females separately, we calculated the prevalence of sexual risk behaviors by STI history and computed unadjusted odds ratios. Given that prior research supports the link between substance use and sexual risk behaviors, primary analyses focused on evaluating relationships of demographics (sex, age, race [due to distribution, dichotomized into Caucasian vs. non-Caucasian], education status [in school vs. not in school]), alcohol use (yes/no), binge drinking (yes/no), illicit drug use (yes/no), and inconsistent condom use (yes/no) with STI history at the bivariate level. Significant variables were then entered into a logistic regression (multicollinearity and model fit indices were acceptable) using STI history as the dependent variable.

RESULTS

Sample

During recruitment, 9228 patients aged 14–20 years old presented to the ED and 6629 (70.8%) met eligibility criteria for screening, while 2696 (29.2%) were excluded. The most frequent reasons for exclusion were insufficient cognitive orientation (31.6%) or not having a parent/guardian present if the patient was a minor (15.1%). Among screening-eligible patients, 1436 (21.9%) were missed and RAs approached 5096 (78.0%) of whom 707 (13.9%) refused participation, and 4389 (86.1%) completed the screening surveys. Using chi-square analyses, missed participants were compared to screened participants on both sex and age group (14- to 17-year-olds vs. 18- to 20-year-olds). Missed participants were significantly more likely to be younger (27.6%) rather than older (22.3%; $\chi^2 = 21.05$; $p < 0.001$) and males (28.7%) rather than females (21.4%; $\chi^2 = 40.88$; $p < 0.001$). Screened patients and those who refused were not significantly different in terms of sex or age distribution.

Of the 4389 patients screened, 2462 (56.1%) reported ever having had sex and were included in further analyses. Slightly more than half of these participants were female (60.8%), 69.5% were Caucasian, and 78.4% were currently enrolled in school. Mean age was

18.4 years (standard deviation = 1.6). Most youth presented to the ED with a medical complaint (70.9%) as opposed to an injury, and 83.2% were discharged from the ED on the day of sampling.

Sexual Risk Behaviors, Sex, and STI History

A total of 247 (10.1%; 212 females and 35 males) reported history of an STI. During the past year, among all participants, 45.7% had one partner and 51.2% had at least two sexual partners (only 3.2% had no sexual partners during the past year). Among those who had sex in the past year, 62.7% reported inconsistent condom use and 48.2% used alcohol or drugs before intercourse at least some of the time. The majority of men (94.3%; 89% of those with past STI) and women (89.5%; 83% of those with past STI) reported having only opposite-sex partners and only 2.4% of men and 0.5% of women reported having only same-sex partners. The remaining 10.0% of women and 3.3% of men indicated having sexual partners of both sexes.

Among females, past-year inconsistent condom use was associated with increased odds of STI history (unadjusted odds ratio [OR] = 3.87; 95% confidence interval [CI] 2.55–5.89) and having past-year multiple sexual partners (unadjusted OR = 2.27, 95% CI 1.67–3.08), but substance use before sex was not related to STI history, as shown in Table 1. Among males, inconsistent condom use was also associated with increased odds of STI history (unadjusted OR = 2.77; 95% CI 1.25–6.17), but multiple partners and substance use before sex were not (Table 1).

Associations of Patient Characteristics with STI History

Among both male and female ED patients in this sample who reported previous sexual activity, the bivariate analyses (Table 2) revealed that those reporting a history of STI were more likely to be female, older, non-Caucasian, not currently in school, presenting to the ED for a medical reason, and to have inconsistently used condoms in the past year. Alcohol use and illicit drug use as measured in the past year were not associated with STI history, but, bivariate, those in the STI group were slightly less likely to report past-year binge drinking. These relationships persisted in the multivariate analysis except that that binge drinking was no longer associated with self-reported STI history (Table 3).

DISCUSSION

Adolescence is a high risk time for transmission of STIs, which can lead to longstanding medical consequences. Prior research found that nearly 10% of asymptomatic

Table 1. Prevalence of Sexual Risk Behaviors by Sex and Sexually Transmitted Infection History among Youth Ever Having Sex

	No Past STI, n (%)	Past STI, n (%)	Total Sample (by Sex), n (%)	Unadjusted OR (95% CI) for Past STI
Females	1281 (85.8)	212 (14.2)	1493	
Inconsistent condom use**	817 (63.9)	185 (87.3)	1002 (67.2)	3.87 (2.55–5.90)
Multiple partners**	591 (46.1)	140 (66.0)	731 (49.0)	2.27 (1.67–3.08)
Any sex after substance use	572 (44.7)	110 (51.9)	682 (45.7)	1.34 (1.00–1.78)
Males	928 (54.2)	35 (3.6)	963	
Inconsistent condom use*	509 (54.9)	27 (77.1)	536 (55.7)	2.77 (1.25–6.17)
Multiple partners	503 (54.3)	23 (65.7)	526 (54.7)	1.62 (0.80–3.29)
Any sex after substance use	476 (51.4)	23 (65.7)	499 (51.9)	1.82 (0.89–3.69)

CI = confidence interval; OR = odds ratio; STI = sexually transmitted infection.

* $p < 0.01$.

** $p < 0.001$.

18- to 30-year-olds in the ED test positive on urine screen for gonorrhea or chlamydia (61,62). Improved detection and screening is needed and recommended by the CDC, yet strategies are needed to focus testing and treatment reach.

To guide such strategies, this study provides practical data regarding characteristics of sexually active females and males presenting to the ED who report having a history of STI. Although urine-based STI screening is feasible and acceptable by patients in the ED, it may not be practical for all EDs to universally screen youth in this way. These data highlight characteristics associated with reporting a prior diagnosis of STI among teens in the ED, which may be helpful in guiding future targeted testing for STI among youth with elevated risk, given the increasing trajectories of sexual risk during adolescence and emerging adulthood (22,23,63).

Specifically, we suggest that if providers ask teens about use of condoms and prior STI diagnoses or symptoms as part of routine history and physical on

non-injury-related visits and then order biologic urine testing for those with positive responses to either, then broad public health efforts to stem STIs and individual patient care and future morbidity could be improved.

In general, there are few recent data characterizing the overall prevalence of STIs in the adolescent ED population, given limitations in surveillance and variations in which types of STIs are queried (40,62). However, we found that, among adolescents in the ED who had ever been sexually active, 10% self-reported a prior STI and more than half engaged in high-risk sexual behaviors. This finding complements prior research in ambulatory and ED settings that reported infection rates of 9.7%–16.4% for gonorrhea and chlamydia among adolescents (39,40,62,64–67). However these samples varied in terms of history of sexual activity and which STIs were assessed. Given these rates among young ED patients, the ED may serve as an important first line for screening and treating STIs among youth, as well as providing behavioral prevention interventions to those who may not be reached in other settings.

Table 2. Bivariate Associations of Patient Characteristics with Sexually Transmitted Infection History among Youth Ever Having Sex

Patient Characteristics	No Past STI (n = 2209 [89.9%])	Past STI (n = 247 [10.1%])	Total (N = 2456)	Unadjusted OR (95% CI) for STI
Female,** n (%)	1281 (58.0)	212 (85.8)	1493 (60.8)	4.39 (3.04–6.34)
Age,** mean (SD)	18.3 (1.6)	19.0 (1.2)	18.4 (1.6)	2.39 (1.25–2.55)
Caucasian (vs. non-Caucasian),** n (%)	1611 (72.9)	96 (38.9)	1707 (69.5)	0.24 (0.18–0.31)
In school,** n (%)	1780 (80.6)	145 (58.7)	1925 (78.4)	0.34 (0.26–0.45)
Medical ED chief complaint (vs. injury),** n (%)	1526 (69.1)	214 (86.6)	1740 (70.9)	2.66 (1.87–3.80)
Used alcohol in past year (vs. no), n (%)	1607 (72.8)	177 (71.7)	1784 (72.6)	0.95 (0.71–1.27)
Binge drank in past year (vs. no),* n (%)	1105 (50.0)	107 (43.3)	1212 (49.4)	0.76 (0.59–1.00)
Illicit drug use in past year (vs. no), n (%)	1144 (51.8)	143 (57.9)	1287 (52.4)	1.28 (0.98–1.67)
Inconsistent condom use (vs. no),** n (%)	1326 (60.1)	212 (85.8)	1538 (62.7)	4.01 (2.78–5.81)

CI = confidence interval; ED = emergency department; OR = odds ratio; SD = standard deviation; STI = sexually transmitted infection. Total numbers for each row range from 2453 to 2456 due to missing data points.

* $p < 0.05$.

** $p < 0.001$.

Table 3. Logistic Regression Analysis Evaluating Correlates of Past Sexually Transmitted Infections Among Youth Ever Having Sex

	Adjusted OR	95% CI
Female**	3.80	2.56–5.63
Age**	1.29	1.15–1.45
Caucasian (vs. non-Caucasian)**	0.24	0.18–0.32
In school**	0.44	0.33–0.60
Medical ED chief complaint (vs. injury)*	1.68	1.12–2.53
Any binge drinking	1.00	0.75–1.35
Inconsistent condom use**	2.68	1.82–3.95

CI = confidence interval; ED = emergency department; OR = odds ratio.

* $p < 0.05$.

** $p < 0.001$.

Similar to prior literature and research from other samples, those with history of STI were more likely to be female and racial minorities, highlighting the health disparities that continue to exist in STI diagnosis and treatment (1,30,68). The finding regarding race warrants further exploration, given that the racial variability of this sample was limited, however, it may be that these results reflect differences in beliefs about condom use or other socioeconomic or risk-related variables associated with STI that may occur more frequently in minority groups (69,70).

Not surprisingly, female youth were more likely to report a past STI diagnosis, potentially reflecting the result of prior testing as part of routine gynecologic care (35). The majority of females with a history of STI in this sample report only male partners, and most would have contracted the STI from a male partner who likely was asymptomatic and not treated. This highlights that males may remain asymptomatic carriers of STI without broader screening efforts. As adolescent males are less likely than adolescent females to have outpatient health-care visits (35), the ED represents an important health-care location for screening both males and females for STIs.

Inconsistent condom use was also associated with increased likelihood of self-reported past STI for both men and women separately in the unadjusted analyses, as well as an independent risk factor in the multivariate analyses. Consistent condom use is a particularly important prevention strategy among adolescents. Previous research indicates that adolescent males are more likely to use condoms with sex than adolescent females (71,72). Having multiple partners was also associated with STI among females, but not males, which may also reflect the higher likelihood of consistent condom use among males compared to females. Additionally, those not in school and older youth were more likely to report a past STI, suggesting the need for sexual risk

reduction interventions in non-school-based settings, such as the ED.

Among this sample, alcohol and illicit drug use were not significantly associated with STI history. In the bivariate analysis, binge drinking was associated with lower odds of reporting a past STI, although this relationship was no longer significant in multivariate analyses controlling for other factors. Previous research has shown that substance use is associated with sexual risk behaviors among youth (26,28,29,73–77). In considering this finding, we examined correlations and found that, in our data, binge drinking was positively associated with inconsistent condom use. Thus, the lack of association with STI may reflect the fact that binge drinking was also positively associated with male sex and men are less likely to report a prior STI as described here. These findings underscore the complexity of factors associated with STIs with sexually active youth in the ED being an at-risk population.

Furthermore, youth with medical complaints were more likely to report a prior STI compared to those with injury-related complaints, which supports the need for screening and intervention during medical care for these youth. A high percentage of these ED patients were discharged, thus they do not get the benefit of screening and prevention services that may be afforded to inpatients. Finally, many youth without prior STIs are also engaging in high-risk sexual behaviors and STI prevention messages delivered at the point of ED care may be a logical next step in preventing STIs.

Limitations

The present data and analyses are subject to several limitations. Specifically, data are retrospective and cross-sectional, limiting causal inferences. It is an important limitation that the factors associated with prior STI diagnosis may not fully predict future STI incidence, however, prior STI is an important variable to understand, given prior research supporting associations between STI diagnoses over 1 year and known relationships between adolescents' prior STI and future HIV or STI diagnosis (16,18). Another potential limitation is that these data are based on self-report, which may be subject to recall or social desirability biases; however, this limitation is tempered by research that supports the reliability and validity of youths' reports of sensitive behaviors through self-administered computer surveys, as used in this study (78–85). As many STIs are asymptomatic, self-report is likely an underestimate of the prevalence, and further studies should consider universal testing to understand the current trends in true prevalence of STI among youth presenting to the ED. Also, determining whether alcohol/drugs were involved in the particular

events that led to STI transmission was beyond the scope of the study. As participants were drawn from a single university-affiliated ED in a suburban area, replication, is required before generalizing these findings to other populations of youth.

CONCLUSIONS

One in 10 sexually active youths seeking care in the ED report a prior STI diagnosis, and 50% have recently engaged in high-risk sexual behaviors that warrant improved testing, diagnosis, treatment, and prevention messages. Although women are more likely to report a prior STI diagnosis, potentially due to the occurrence of symptoms or receipt of routine gynecologic care, it is important to note that men also report high rates of sexual risk behaviors associated with risk for STI. Thus, ED providers should consider asking all sexually active youth seeking care for a medical complaint about prior STI and recent inconsistent condom use as a guide for further biologic testing at the point of care. However, future research should be conducted to help determine cost-effectiveness of such screening and to further determine the steps needed to reduce the overall economic and public health burden, and future morbidity associated with STIs in young men and women.

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ARTICLE SUMMARY

1. Why is this topic important?

Half of sexually transmitted infections (STIs) are accounted for by adolescents and young adults. Identification, screening, and testing those at risk in health-care settings can help address this problem.

2. What does this study attempt to show?

This study identifies demographic and risk behaviors related to STI history among 14- to 20-year-old emergency department (ED) patients.

3. What are the key findings?

One in 10 sexually active youth in the ED reported a prior diagnosed STI. Female sex, older age, non-Caucasian race, not being enrolled in school, medically related ED chief complaint, and inconsistent condom use were associated with increased odds of self-reported STI history.

4. How is patient care impacted?

ED providers inquiring about inconsistent condom use and previous STI among male and female adolescents may be one strategy to focus biologic testing resources and improve screening for current STI.