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Annual STI Testing Among Sexually Active Adolescents

Nicole Liddon, PhD[a], **Sanjana Pampati, MPH**[a,b], **Richard Dunville, MPH**[c], **Greta Kilmer, MS**[a], **Riley J Steiner, MPH, PhD**[d]

[a]Divisions of Adolescent and School Health

[b]Oak Ridge Institute for Science and Education, Oak Ridge, Tennessee

[c]NORC at the University of Chicago, Chicago, Illinois

[d]Reproductive Health, Centers for Disease Control and Prevention, Atlanta, Georgia

Abstract

OBJECTIVES: National guidelines call for annual testing for certain sexually transmitted infections (STIs) among specific adolescent populations, yet we have limited population-based data on STI testing prevalence among adolescents. With inclusion of a new item in the 2019 national Youth Risk Behavior Survey, we provide generalizable estimates of annual STI testing among sexually active high school students.

METHODS: We report weighted prevalence estimates of STI testing (other than HIV) in the past 12 months among sexually active students ($n = 2501$) and bivariate associations between testing and demographic characteristics (sex, age, race and ethnicity, sexual identity, and sex of sexual contact). Multivariable models stratified by sex and adjusted for demographics examine the relationships between testing and sexual behaviors (age of initiation, number of sex partners, condom nonuse at last sexual intercourse, and substance use at last sexual intercourse).

RESULTS: One-fifth (20.4%) of sexually active high school students reported testing for an STI in the previous year. A significantly higher proportion of female (26.1%) than male (13.7%) students reported testing. Among female students, prevalence differed by age (≤15 years = 12.6%, age 16 = 22.8%, age 17 = 28.5%, or ≥18 years = 36.9%). For male students, there were no differences by demographic characteristics, including sexual identity, but most sexual risk behaviors were associated with increased likelihood of STI testing (adjusted prevalence ratios ranging from 1.48 to 2.47).

Address correspondence to Nicole Liddon, PhD, Division of Adolescent and School Health, Centers for Disease Control and Prevention, 8 Corporate Square Northeast, Corporate Square Office Park, Atlanta, GA 30329. nliddon@cdc.gov.
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Provides national prevalence estimates of annual sexually transmitted infection testing among sexually active high school students and discusses strategies to improve adherence to national guidelines.

CONCLUSIONS: Low prevalence of STI testing suggests suboptimal adherence to national guidelines, particularly for sexually active adolescent females and young men who have sex with men who should be tested for Chlamydia and gonorrhea annually.

It is estimated that young people aged 15 to 24 years acquire half of all new sexually transmitted infections (STI) annually and that 1 in 4 sexually active adolescent females in the United States has an STI.[1,2] Given the high rates of STIs among adolescents, serious consequences of infection, including pelvic inflammatory disease and infertility,[3-5] and cost effectiveness of *Chlamydia* screening,[6,7] the American Academy of Pediatrics, the United States Preventive Services Task Force, the Centers for Disease Control and Prevention (CDC), and the American College of Obstetricians and Gynecologists recommend some degree of STI screening for adolescents and young adults.[8-11] For example, the United States Preventive Services Task Force recommends annual screening for *Chlamydia* and gonorrhea for all sexually active women aged ≤25.[9] At least annual screening for *Chlamydia*, gonorrhea, and syphilis is recommended for young men who have sex with men, including every 3 to 6 months for those at increased risk.[10] Screening among young men who have sex with women is recommended on the basis of the type of STI, individual risk, and community prevalence.[11-13]

However, there are multiple barriers to testing adolescents for STIs, either as part of routine screening or symptom-based testing. Adolescents and young adults have historically had lower use of health care, in part because of confidentiality concerns, limited awareness of the need for screening, and logistical barriers (eg, transportation and cost).[14-17] Even when adolescents have preventive visits or receive care for acute issues, there may be missed opportunities for sexual history-taking and recommended screening because of provider discomfort, time constraints during the clinical visit, and misperceptions about adolescents' sexual activity, level of comfort, and honesty.[18-20]

These challenges likely contribute to the low rates of annual STI testing among young people that have been reported in studies using clinic-based surveys and medical claims.[21-23] Data on STI testing from national samples of young people are limited, and little is known about population-level prevalence of STI testing specifically among adolescents, for whom certain barriers, such as confidentiality concerns, may be more pronounced. There is some evidence from the few population-based studies available that prevalence of testing among 15- to 19-year-olds is lower than prevalence among their young adult counterparts.[24,25]

The recent addition of a question about STI testing in the previous 12 months to the 2019 national Youth Risk Behavior Survey (YRBS) provides an opportunity to assess national prevalence of annual STI testing among sexually active high school students. We also identify demographic and behavioral correlates of STI testing to inform efforts to improve adherence to national screening recommendations.

METHODS

Data

As noted, data come from the 2019 national YRBS, a nationally representative, cross-sectional survey of public and private high school students in the United States. Details of the YRBS methodology have been reported elsewhere.[26] Briefly, this anonymous and voluntary survey is administered biennially using a multistage cluster sample design and participants complete a self-administered questionnaire during a regular class period. In 2019, school and student response rates were 75.1% and 80.3%, respectively. Data are weighted to adjust for school and student nonresponse and oversampling of Black and Hispanic students. Procedures for the national YRBS were reviewed and approved by CDC's institutional review board.

Measures

The primary outcome of interest was STI testing, which was assessed by asking: “During the past 12 months, have you been tested for an STD, other than HIV, such as chlamydia or gonorrhea” with response options of “Yes,” “No,” and “Not sure.” We combined the latter 2 options to create a dichotomous variable (yes versus no/not sure). Six sexual behavior indicators were also constructed: sexual intercourse before age 13, 4 or more lifetime sex partners, 2 or more recent sex partners (during the previous 3 months), use of alcohol or drugs before last sexual intercourse, and condom nonuse at last sexual intercourse. Demographic characteristics included age in years (≤15, 16, 17, ≥18), biological sex (female or male), race and ethnicity (non-Hispanic White, non-Hispanic Black, Hispanic, or other), sexual identity (heterosexual, lesbian/gay/bisexual, or unsure), and sex of lifetime sexual contacts (opposite sex only versus same sex or both sexes).

Analysis

The analytic sample was restricted to students who were currently sexually active (ie, those who reported having had sexual intercourse with 1 or more persons during the 3 months before the survey) and who answered the STI testing item ($n = 2501$). We present prevalence of STI testing in the past 12 months overall and stratified by biological sex given distinct recommendations for screening men and women.[4-7] Sex-stratified prevalence estimates of STI testing by demographic characteristics, sex of sexual contacts, and sexual behavior indicators are presented, and χ^2 tests were used to identify differences in STI testing by these characteristics. Prevalence estimates were suppressed if the unweighted numerator was <10 or the unweighted denominator was <30.

Finally, we ran sex-stratified unadjusted and adjusted logistic regression models with STI testing as the dependent variable and each sexual behavior indicator as an independent variable in separate models. Predicted marginals were used to produce prevalence ratios and adjusted prevalence ratios (APRs) with 95% confidence intervals (CIs). Adjusted models included age, race and ethnicity, and sexual identity.

Sensitivity analyses were conducted to test the robustness of our findings to potential misclassification errors in report of STI testing. These analyses grouped not sure responses with yes responses instead of no responses as done in the original analyses. Statistical tests were considered significant if *P* values were <.05, and all analyses were conducted using SAS-callable SUDAAN Version 9.4.

RESULTS

Overall, 20.4% of sexually active high school students reported having an STI test in the previous 12 months. Female students were more likely to be tested than male students (26.1%, CI = 22.4–30.2 vs 13.7%, CI = 11.0–17.0). The prevalence of STI testing by demographic characteristics for the entire sample and stratified by sex is shown in Table 1. For male students, we found no differences in STI testing by race and ethnicity, age, sexual identity, and sex of sexual contacts. Among female students, there were no differences in STI testing by race and ethnicity, sexual identity, or sex of sexual contacts, but prevalence differed by age (≤15 = 12.6%, CI = 7.8–19.8; 16 = 22.8%, CI = 16.9–30.0; 17 = 28.5%, CI = 22.1–35.8; ≥18 = 36.9%, CI = 30.6–43.8).

Figures 1 and 2 illustrate differences in STI testing by sexual behaviors for male and female students, respectively. With the exception of condom nonuse at last sexual intercourse, the prevalence of STI testing was higher among male students reporting each sexual behavior compared with male students who did not report the behavior, including having sex before age 13 (27.1%, CI = 17.5–39.5 vs 12.1%, CI = 9.7–15.1), having 2 or more recent sex partners (22.4%, CI = 16.7–29.2 vs 10.4%, CI = 8.3–13.1), having 4 or more lifetime sex partners (22.3%, CI = 17.3–28.2 vs 9.5%, CI = 7.3–12.3), and substance use at last sexual intercourse (19.2, CI = 13.4–26.6 vs 12.1, CI = 9.6–15.1). Compared with female students who did not report the behavior, prevalence of STI testing was higher among female students who reported condom nonuse at last sexual intercourse (34.1%, CI = 28.3–40.4 vs 18.2%, CI = 14.3–23.0), substance use at last sexual intercourse (32.0%, CI = 25.3–39.5 vs 24.7%, CI = 20.9–28.9), and having 4 or more lifetime sex partners (31.9%, CI = 25.3–39.3 vs 24.7%, CI = 21.0–28.9).

Sex-stratified adjusted and unadjusted APRs for associations between sexual behavior indicators and STI testing are presented in Table 2. For male students, in both unadjusted and adjusted analyses, all sexual behavior indicators were associated with an increased prevalence of STI testing, except for condom nonuse at last sexual intercourse. Significant APRs ranged in magnitude from 1.48 (95% CI = 1.06–2.05) for substance use at last sexual intercourse to 2.42 (95% CI = 1.69–3.48) for having 4 or more lifetime sex partners. For sexually active female students, those who reported condom nonuse at last sexual intercourse had higher prevalence of STI testing than those who reported condom use in both unadjusted and adjusted models (APR = 1.84, CI = 1.36–2.49). After adjustment, there were no significant differences in STI testing for sexually active females who reported having sex before age 13, having 2 or more recent sex partners, having 4 or more lifetime sex partners, or using substances before last sexual intercourse.

Sensitivity Analyses

In the previous 12 months, 4.1% of sexually active high school students reported they were not sure if they had an STI test (CI = 3.1–5.4). Recoding not sure respondents as yes for

STI testing resulted in some minor changes to findings (Supplemental Table 3). In this sensitivity analysis, differences in STI testing by race and ethnicity among male students were identified. Among female students, main and sensitivity analyses were consistent, except that female students who reported having sex before age 13 were more likely to report STI testing than those who did not (48.5% vs 28.8%, respectively). There were also no longer significant differences in STI testing among female students by having 4 or more lifetime sex partners.

DISCUSSION

These are the first national estimates of annual STI testing among a representative sample of US high school students. Our findings indicate that the prevalence of annual STI testing among sexually active adolescents in 2019 was low, at approximately 20%. Although higher for sexually active female students at 26%, this is still suboptimal considering national guidelines calling for annual Chlamydia and gonorrhea screening among this population. The relatively low prevalence of STI testing for both male and female students suggests that, going forward, there is a need to improve implementation of STI screening guidelines for all adolescents for whom testing is indicated. This conclusion takes on more urgent importance in the wake of the recent global coronavirus disease 2019 pandemic. These prevalence estimates were derived before the possible profound impacts of the pandemic on adolescent sexual behavior and access to and use of health care services. It is suggested from evidence of previous large-scale disruptions in the United States that the pandemic will have both immediate and long-term negative effects on adolescents and young people's sexual and reproductive health care needs, as well as their access to and use of sexual and reproductive health care services, including annual STI testing.[26,27] Adolescent and young adult sexual behaviors and subsequent health needs and usage should be monitored with particular attention to the impact of the coronavirus disease 2019 pandemic and any change in need or decline in use will need to be quickly addressed to ensure optimal adherence to the long-standing recommendations, which were not routinely implemented even before the pandemic.

These findings contribute to the limited literature available on past-year STI testing among adolescents in the United States, particularly from national population-based samples. Prevalence among sexually active women aged 15 to 21 surveyed in the 2006–2010 National Survey of Family Growth was about 40%, and a 2013 national web survey found that only 16.6% of sexually active females and 6.1% of sexually active males aged 15 to 25 had been tested in the past year.[20,24] We also found that prevalence was higher among sexually active females than males, but our actual estimates differ somewhat from these prior studies. Prevalence of STI testing documented here for sexually active females lies between the previously reported national estimates, and prevalence for males is about twice the 2013 study. Also of note, we found that about one-third of young men who have same-sex contact had been tested in the past year, whereas nearly half of young men who have sex with men participating in the 2015 National HIV Behavioral Surveillance, a large though not population-based study, had been tested.[28] All of our results should be considered in addition to other estimates of STI testing. Healthcare Effectiveness Data and Information Set measures indicate about half of sexually active women aged 16 to 24 enrolled in a commercial or Medicaid managed care organization have been screened annually (between 47% and 58% in 2019, depending on type of health plan). Discrepancies between our study and others may be because of differences in the population (eg, high school students versus adolescents and young adults; those engaged in health care versus a broader population including those who do not access health care), sampling methods (eg, school-based versus clinic-based), reporting (self-reported STI testing versus claims-based), and the specific STIs of interest. In particular, we focus specifically on high school students, who represent a younger group that face unique challenges and barriers to sexual and reproductive health services such as STI testing.[14]

Besides differences in testing between males and females , we found few demographic differences in STI testing within those groups. It is promising that racial and ethnic disparities in testing were not observed in the main analyses. Younger female students had lower rates of STI testing than older ones, despite being sexually active. Providers may assume that younger female patients are not sexually active and thus not offer testing or initiate conversations about sexual experience that would identify the need for STI testing. Because *Chlamydia* testing among sexually active 16 to 24-year-old females is a Healthcare Effectiveness Data and Information Set measure, providers may be using this operationalization as a prompt for clinical practice at certain ages and may be missing opportunities to provide needed services for younger patients.

Likewise, younger females may be less comfortable disclosing sexual activity to providers because of confidentiality concerns or developmental readiness. To this point, a recent study found that up to 25% of sexually active younger adolescents were not truthful with providers during a sexual history.[29] Our findings that younger sexually active female students less often receive requisite STI testing services reinforces the importance of identifying STI testing needs and providing services even in early adolescence, especially for sexually active females. Our research did not find differences in STI testing by sexual identity and sex of sexual contacts, which is concerning given guidelines recommend at least annual screening of young men who have sex with men for *Chlamydia*, gonorrhea, and syphilis. Null findings may be because of the small sample size of sexual minority male students. Future research that assesses adherence to guidelines for this population can consider pooling data as available, including future cycles of YRBS. Monitoring receipt of STI testing among sexual minority male students is especially important in the context of preexposure prophylaxis (PrEP) for HIV prevention. Routine STI screening coupled with sexual history-taking presents opportunities to discuss PrEP with youth at greater risk of HIV acquisition, given documented low knowledge and awareness of PrEP among adolescents in the United States.[30] Moreover, PrEP follow-up visits can facilitate routine STI screening on the basis of behavioral risks and be aligned with PrEP prescription guidelines.[31]

We did identify notable sexual behavior correlates for annual STI testing, as well as important differences in these correlates between male and female students. In adjusted models, STI testing for male students was associated with almost all sexual behaviors, except condom nonuse, whereas, among sexually active female students, condom nonuse was the only behavior associated with testing. On one hand, the general lack of associations between behaviors and testing for females and the opposite for males may reflect some level of adherence to annual screening for sexually active females and risk-based annual screening of young men who have sex with women, aligning with professional guidelines.[11-13] However, the contrary findings for males and females specific to condom nonuse are a bit more difficult to interpret without a deeper dive into facilitators of both condom use and STI testing. Our findings may speak less to provider practices than to an adolescent's perceptions of individual risk and reasons for getting tested, both of which may be tied to relationship power dynamics and control in condom use decisions and STI testing.[32] There is a need to confirm and understand the relationship between condom use and STI testing among young people to develop effective intervention and communication.

It is worthwhile to consider how measurement issues may affect our understanding of adolescent STI testing. Although evidence suggests that adolescent self-report of preventive health services can produce valid estimates,[33,34] there are some limitations of using this approach to measure STI testing. Some young people may be tested for STIs without realizing it, and in our study, about 4% of respondents indicated they were not sure if they had been tested in the past year. When we reclassified those who answered not sure with those who said yes versus those who responded no, we found some minor differences, suggesting the potential for misclassification bias.

Additionally, evidence suggests adolescents may not be aware of which specific STIs they are tested for,[35] which is why our measure asks broadly about receipt of any STI testing. We are thus unable to differentiate between testing behaviors for specific STIs, yet STI screening recommendations are based on type of infection. Although using insurance claims data would address these issues, this data source has other limitations. In particular, claim-based data may underestimate testing of young people who do so outside of insurance reporting because of confidentiality concerns or who get tested in large-scale testing programs such as school-based testing where billing may not be pursued.

Beyond possible issues with reliance on adolescent self-report of STI testing, our analyses suffer from some limitations. These data cannot be used to directly assess adherence to Chlamydia and gonorrhea screening recommendations for many reasons related to the available STI testing measure, which does not: differentiate among testing for specific STIs (for reasons noted above), align timing of sexual activity (in the past 3 months) to timing of testing (in the past 12 months), or examine if testing was delivered as asymptomatic screening or for diagnostic reasons. Our findings are also only generalizable to high school students and may not reflect the experiences of out-of-school youth, who may have different levels of need and access to services such as STI testing.

Despite these limitations, findings underscore the importance of improving implementation of STI testing services. Several strategies can be effective at addressing barriers to testing at varying levels, including individual behaviors and clinical practices. We are unable to examine if the low prevalence of STI testing results from limited access to health care more generally or missed opportunities for STI screening when adolescents present for routine or acute care. Future research should consider this important distinction to inform programmatic efforts. In general, though, there is a need to both increase adolescent access to preventive health services, as well as to ensure youth receive quality health care when at the clinic so as to reduce missed opportunities. Regarding improving access, raising adolescents' awareness of the need for testing, location of services, and rights to self-consent for confidential services, as well as addressing concerns about stigma, can help connect young people to STI testing services. More specifically, there are opportunities for promoting STI and pregnancy prevention online, as well as in school classrooms.[36,37] A systematic review of sexual health campaigns identified several that led to increases in STI testing and condom use among adolescents and young adults.[38] More recently, an adapted "GYT: Get Yourself Tested" social marketing campaign in a high school setting increased testing for HIV and STIs at a local clinic, as well as student awareness of available services and intentions to get tested.[39]

To align clinical practice with current recommendations to screen sexually active young women, several strategies are possible. New CDC guidelines state that providers may consider opt-out screening, recognizing that such a strategy can improve screening rates and result in cost savings.[10] Opt-out screening strategy does not, however, eliminate the need for a patient–provider conversation about sexual activity. Sexual history-taking is an essential clinical practice in identifying a range of needed preventive health services beyond just STI testing. To help achieve discussions about sexual health, young people would benefit from increased private time with providers during preventive care visits to ensure quality adolescent health services, including both sexual history-taking and screening for STIs. This may be done in numerous ways, including clinic-based quality improvement efforts. For example, an initiative that modified clinic workflows for *Chlamydia* screening increased the rate of screening, identification of positivity, and treatment.[40] Learning collaboratives that focus on provider training have also been associated with improvements in sexual history-taking and *Chlamydia* screening rates.[41]

These clinic-based efforts, as well as those in schools, communities, and other settings, can be supported by implementation science research that considers how to improve adolescent access to health services more broadly and ensure delivery of quality care. The addition of the question about STI testing in the past 12 months to the 2019 and forthcoming YRBS data collection efforts will allow for continued monitoring of the population-level impact of concerted efforts to improve STI testing.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

ABBREVIATIONS

APR	adjusted prevalence ratio
CDC	Centers for Disease Control and Prevention
CI	confidence intervals
PrEP	preexposure prophylaxis
STI	sexually transmitted infection

YRBS	Youth Risk Behavior Survey

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WHAT'S KNOWN ON THIS SUBJECT:

The American Academy of Pediatrics and others recommend annual *Chlamydia* and gonorrhea screening for all sexually active women aged ≤25 and certain young men. Little is known about population-level prevalence of STI testing among adolescents, for whom barriers may be substantial.

WHAT THIS STUDY ADDS:

Using the recent addition of a question about annual STI testing to the 2019 national Youth Risk Behavior Survey, we assess national prevalence estimates of annual STI testing among sexually active high school students.

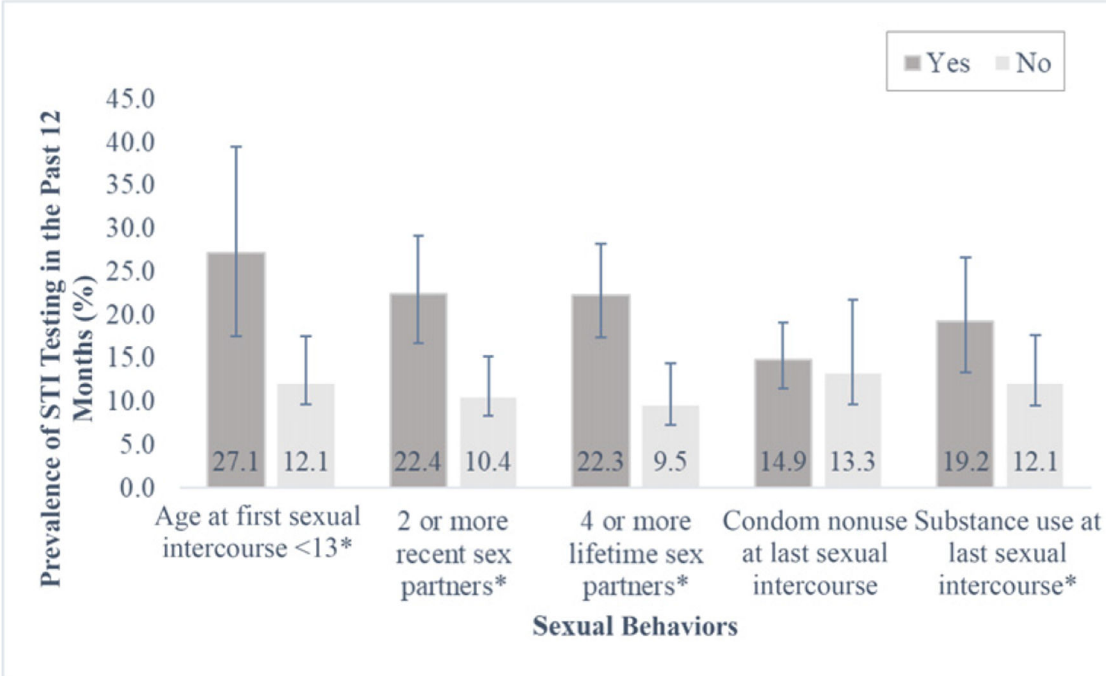

FIGURE 1.

Prevalence of STI testing in the past 12 months by self-reported sexual behaviors among currently sexually active male US high school students, 2019 (n = 1178). Currently, sexually active is defined as those who had sexual intercourse with at least 1 person during the 3 months before survey administration. *χ^2 test P value <.05. STI, sexually transmitted infection.

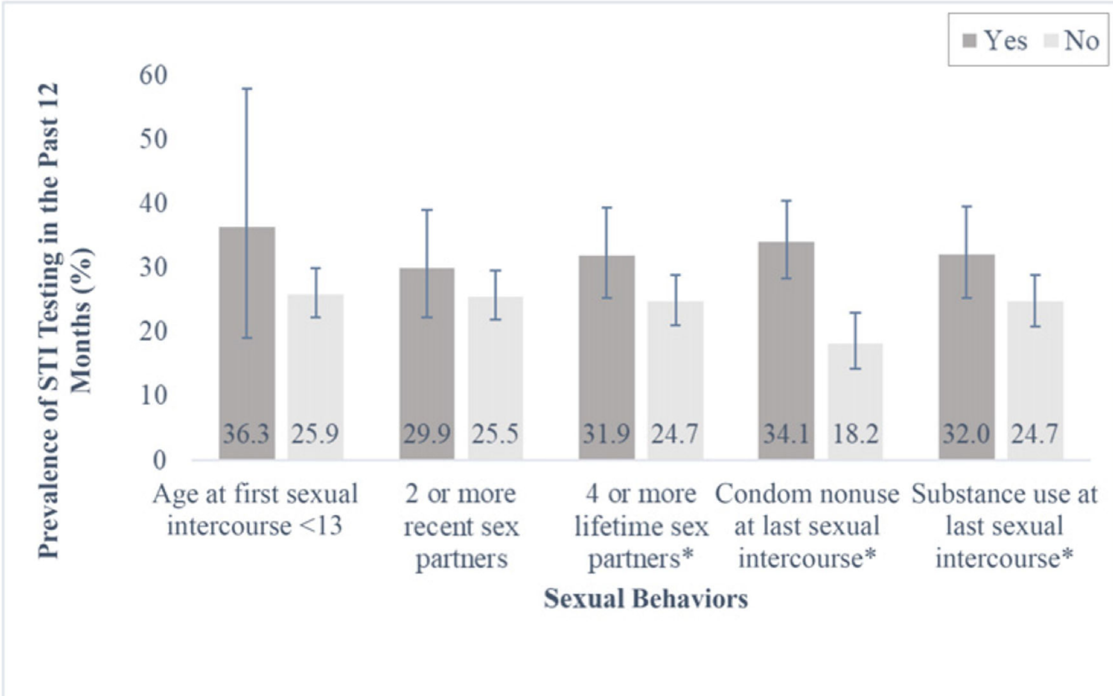

FIGURE 2.

Prevalence of STI testing in the past 12 months by self-reported sexual behaviors among currently sexually active female US high school students, 2019 (n = 1301). Currently, sexually active is defined as those who had sexual intercourse with at least 1 person during the 3 months before survey administration. *χ^2 test P value <.05. STI, sexually transmitted infection.

TABLE 1

Prevalence of STI Testing Other Than HIV Testing in the Past 12 Months by Demographic Characteristics Among Currently Sexually Active US High School Students by Sex, 2019

	Prevalence of STI Testing in Past 12 Mo		
	Total, % (95% CI) (*N* = 2501)[a]	**Males % (95% CI) (*n* = 1178)[a]**	**Females, % (95% CI) (*n* = 1301)[a]**
Total[b]	20.4 (17.5–23.6)	13.7 (11.0–17.0)	26.1 (22.4–30.2)
Race and ethnicity			
Non-Hispanic White	19.3 (16.2–23.0)	9.9 (7.1–13.7)	27.0 (22.3–32.2)
Non-Hispanic Black	23.8 (16.7–32.7)	17.5 (10.6–27.7)	31.8 (22.7–42.6)
Hispanic	19.7 (13.8–27.3)	15.0 (9.1–23.6)	23.7 (17.0–32.1)
Other[c]	25.3 (17.0–36.0)	24.8 (15.5–37.2)	24.9 (14.4–39.4)
Age, y[d]			
≤15	13.0 (9.2–18.0)	12.4 (7.9–18.9)	12.6 (7.8–19.8)
16	17.8 (13.2–23.5)	12.0 (7.5–18.6)	22.8 (16.9–30.0)
17	22.7 (17.8–28.4)	15.4 (10.8–21.4)	28.5 (22.1–35.8)
≥18	25.4 (21.7–29.4)	14.5 (10.2–20.2)	36.9 (30.6–43.8)
Sexual identity			
Heterosexual	19.2 (16.4–22.4)	12.9 (10.6–15.7)	25.8 (21.4–30.8)
Lesbian, gay, bisexual	27.7 (21.1–35.4)	26.6 (10.5–52.8)	28.1 (21.7, −35.4)
Unsure	22.6 (12.6–37.1)	—	—
Sex of sexual contacts			
Same sex or both sex	29.2 (22.2–37.3)	29.8 (13.8–53.1)	29.0 (22.1–37.2)
Opposite sex only	19.0 (16.3–22.0)	12.8 (10.5–15.6)	25.3 (21.4–29.7)

Currently, sexually active is defined as those who had sexual intercourse with at least 1 person during the 3 months before survey administration. STI, sexually transmitted infection; —, prevalence estimate suppressed because of insufficient sample size.

[a] Sample *n* is unweighted; percentage is weighted.

[b] Differences between males and females at $P < .05$.

[c] Other race category includes American Indian/Alaska Native, Asian American, Native Hawaiian/other Pacific Islander, and multiple non-Hispanic.

[d] χ^2 test statistic used to identify differences by STI testing status had a P value <.05 for females.

TABLE 2

Associations Between Sexual Behaviors and STI Testing Other Than HIV Testing Among Currently Sexually Active US High School Students Stratified by Sex, 2019

	Tested for STIs in the Past 12 Mo			
	Males		Females	
	PR (95% CI)	APR[a] (95% CI)	PR (95% CI)	APR[a] (95% CI)
Had sexual intercourse before age 13	2.24 (1.49–3.37)**	2.08 (1.38–3.14)**	1.40 (0.80–2.47)	1.72 (0.94–3.15)
Had sexual intercourse with 2 or more persons during the previous 3 mo	2.14 (1.56–2.94)***	2.22 (1.64–3.00)***	1.17 (0.91–1.52)	1.11 (0.83–1.48)
Had ≥4 lifetime sexual partners	2.35 (1.72–3.21)***	2.42 (1.69–3.48)***	1.29 (1.05–1.59)*	1.14 (0.91–1.43)
Did not use a condom at last sexual intercourse	1.12 (0.76–1.64)	1.08 (0.73–1.60)	1.87 (1.39–2.52)***	1.84 (1.36–2.49)***
Used alcohol or drugs before last sexual intercourse	1.58 (1.12–2.25)*	1.48 (1.06–2.05)*	1.29 (1.04–1.61)*	1.26 (1.00–1.58)

Currently, sexually active is defined as those who had sexual intercourse with at least 1 person during the 3 mo before survey administration. PR, prevalence ratio; STI, sexually transmitted infection.

[a]Adjusted models control for race and ethnicity, age, and sexual identity.

*$P < .05$

**$P < .01$

***$P < .001$; asterisks indicate any finding that is significant at $P < .05$.