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Association Between HIV-Related Risk Behaviors and HIV Testing Among High School Students in the United States, 2009

Alexandra B. Balaji, PhD; Danice K. Eaton, PhD; Andrew C. Voetsch, PhD; Ryan E. Wiegand, MS; Kim S. Miller, PhD; Sonal R. Doshi, MS, MPH

Objective: To identify the human immunodeficiency virus (HIV)–related risk behaviors associated with HIV testing among US high school students who reported ever having sexual intercourse.

Design: Secondary analysis of a cross-sectional study.

Setting: The 2009 national Youth Risk Behavior Survey.

Participants: A total of 7591 US high school students who reported ever having sexual intercourse.

Main Exposures: Risk behaviors related to HIV.

Main Outcome Measure: Having ever been tested for HIV.

Results: Among the 7591 students who reported ever having sexual intercourse, 22.6% had been tested for HIV. Testing for HIV was most likely to be done among students who had ever injected any illegal drug (41.3%; adjusted odds ratio, 1.70; 95% CI, 1.14-2.56), had ever been physically forced to have sexual intercourse (36.2%; adjusted odds ratio, 1.43; 95% CI, 1.19 -1.72), did not use a condom the last time they had sexual intercourse (28.7%; adjusted odds ratio, 1.28; 95% CI, 1.08-1.51), and had sexual intercourse with 4 or more persons during their life (34.7%; adjusted odds ratio, 2.32; 95% CI, 1.98-2.73).

Conclusions: Most sexually active students, even among those who reported high-risk behaviors for HIV, have not been tested for HIV. New strategies for increasing HIV testing among the adolescent population, including encouraging routine voluntary HIV testing among those who are sexually active, are needed.

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As the human immunodeficiency virus (HIV) epidemic enters its fourth decade, adolescents continue to be a population at increased risk for acquiring the disease. In 2008, more than 7300 adolescents and young adults aged 13 to 24 years were diagnosed with HIV or AIDS, representing almost 18% of the individuals diagnosed that year.[1] Of particular concern are those in this age group who remain undiagnosed and therefore unaware that they are HIV infected. While adolescents and young adults composed 4.4% of the 1.1 million persons living with HIV in the United States in 2006, they accounted for 9.9% of the 232 700 undiagnosed HIV cases.[2] These findings represent missed opportunities for early diagnosis, treatment, and reduction in the number of new HIV transmissions.

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The sexual and drug-use activities of adolescents place them at increased risk for acquiring HIV and other sexually transmitted infections (STIs). Among US high school students in 2009, almost half had ever had sexual intercourse and 14% had 4 or more sexual partners. Of those identified as being currently sexually active, 39% did not use a condom the last time they had sexual intercourse and 22% drank alcohol or used drugs before the last time they had sexual intercourse.[3] In addition, issues around personal risk perception, communication with sexual partners, HIV transmission knowledge, and self-efficacy may influence the acquisition of HIV infection among adolescents.[4-6] Despite engaging in high-risk behaviors, many adolescents underestimate their personal risk for HIV and therefore do little to change their behavior.[7-9] This low perception of risk can be partially attributable to adolescent reliance on partner characteristics and relationship dynamics to effectively assess the likelihood of expo-

Author Affiliations: Centers for Disease Control and Prevention, Atlanta, Georgia.

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sure to HIV.[10-13] Partners who are familiar, trusted, and similar to oneself are deemed safer, irrespective of an individual's objective risk behavior and HIV status.[11,12,14] While a positive association has been found between communication about sex and safer sexual behaviors, many adolescents do not talk to their partners about HIV.[15-17] A Kaiser Family Foundation study[18] found that 56% of 15- to 17-year-old adolescents had never talked to a boyfriend or girlfriend about HIV or AIDS. The reasons attributed to this lack of communication included embarrassment, lack of HIV and AIDS knowledge, and concern about partner perception.

Recognizing that knowledge of serostatus is an important component of HIV prevention activities, the Centers for Disease Control and Prevention (CDC) recommends that health care providers discuss HIV transmission and testing with all adolescent patients and encourage testing for those who are sexually active.[19] The Society for Adolescent Medicine[20] also recommends offering testing to sexually active adolescents, and the American College of Obstetricians and Gynecologists recommends HIV testing for girls younger than 19 years if they are sexually active.[21]

While current recommendations encourage HIV testing, little is known about the actual testing behaviors of adolescents who engage in HIV-related risk behaviors. Much of the previous research on HIV testing among adolescents used small, nonnationally representative samples and in most cases was restricted to higher-risk adolescent populations (eg, homeless and runaway youth, young men who have sex with men, injection drug users, and those engaging in other high-risk sexual behavior).[22-29] In those studies, the percentage of adolescents who had been tested for HIV ranged from 11.5% for a sample of Colorado high school students[24] to 62.5% for a sample of adolescents attending community-based agencies that serve youth at high risk for HIV in Los Angeles, California; San Francisco, California; and New York, New York.[25] In addition, 2 national surveys of lower-risk populations have been conducted. The 2000 National Survey of Teens on HIV/AIDS found that among adolescents aged 15 to 17 years, 10% overall and 27% of those who were sexually active reported ever being tested for HIV.[5] However, this study did not examine any other HIV-related risk behaviors. Using data from the National Longitudinal Study of Adolescent Health, Nguyen et al[30] found that 18.8% of sexually experienced persons aged between 18 and 26 years reported having been tested for HIV in the previous 12 months.

Many of these studies found that adolescents with known risk factors are more likely to be tested than those without documented risk factors.[22,24-27] In a study of San Francisco Bay area runaway and homeless adolescents, history of an STI, 5 or more years of sexual activity, and injection drug use were associated with HIV testing.[22] However, a study of adolescents attending family planning clinics found that those who reported HIV-related risk behaviors (eg, did not use condoms consistently, reported a history of STIs, and had unprotected sex with >1 partner in the same period) were not more likely than those who did not report risk behaviors to request HIV testing.[27] A community-based sample of adolescents who recently had unprotected sexual intercourse found mixed results; adolescents recently tested for HIV were more likely to have an STI diagnosis and not tell their partner that they wanted to use a condom, but they were less likely to use substances when having sex.[29]

This study extends the current literature by using data from the 2009 national Youth Risk Behavior Survey (YRBS) to determine the prevalence of HIV testing among high school students who reported ever having sexual intercourse and to assess the relationship between HIV testing and HIV-related risk behaviors in this group.

METHODS

PARTICIPANTS AND PROCEDURE

The national YRBS is conducted by the CDC and monitors the prevalence of priority health-risk behaviors among US high school students. In 2009, a 3-stage cluster-sample design was used to obtain a nationally representative sample of students in 9th through 12th grades who attended public and private schools. Black and Hispanic students were oversampled to enable a separate analysis of these populations. Following local procedures, parental permission was obtained before survey administration. Participation in the survey was anonymous and voluntary. Students completed the self-administered, 98-item questionnaire during 1 class period and recorded their responses directly on a computer-scannable booklet. The CDC's institutional review board approved the protocol for the national YRBS. The school response rate was 81%, the student response rate was 88%, and the overall response rate was 71%. Usable data were returned by 16 410 students. A weighting factor was applied to each student record to adjust for nonresponse and the oversampling of black and Hispanic students.[3] Additional details on the sampling strategy and administration procedures are available elsewhere.[3,31] As current recommendations encourage HIV testing among sexually active adolescents, the study sample for this analysis was restricted to the subset of students in grades 9 through 12 who reported ever having sexual intercourse (n=7591).

MEASURES

Student demographic characteristics included sex, self-reported race/ethnicity (non-Hispanic white, non-Hispanic black, Hispanic, and other [the options offered were American Indian or Native Alaskan, Asian, Native Hawaiian or other Pacific Islander, and multiracial]), and grade (9th, 10th, 11th, and 12th).

Testing for HIV was measured by the question, "Have you ever been tested for HIV, the virus that causes AIDS? (Do not count tests done if you donated blood.)" The response options were yes, no, and not sure. For this analysis, the 4.5% of students who responded not sure were combined with the no category. The HIV-related risk behaviors were assessed with the following 6 questions: (1) lifetime illegal injection drug use was assessed with the question, "During your life, how many times have you used a needle to inject any illegal drug into your body?" (responses were categorized as 0 times vs ≥ 1 time); (2) ever forced to have sexual intercourse was assessed by the question, "Have you ever been physically forced to have sexual intercourse when you did not want to?" (responses were yes or no); (3) did not use a condom during last sexual intercourse was assessed by the question, "The last time you had sexual intercourse, did you or your partner use a condom?" (responses were yes or no); (4) first sexual intercourse before age 13 years was assessed by the question, "How old were you when

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you had sexual intercourse for the first time?" (for this analysis, responses were collapsed into 2 categories, age <13 years and age ≥13 years); (5) sexual intercourse with more than 4 people was assessed by the question, "During your life, with how many people have you had sexual intercourse?" (for this analysis, responses were collapsed into 2 categories, <4 people and ≥4 people); and (6) alcohol or drug use before last sexual intercourse was assessed by the question, "Did you drink alcohol or use drugs before you had sexual intercourse the last time?" (responses were yes or no). **Table 1** summarizes the demographic characteristics and HIV-related risk behaviors of the study sample.

STATISTICAL ANALYSES

All analyses were performed on weighted data using SUDAAN version 10.0 (Research Triangle Institute), a software package that accounts for the complex sampling design of the YRBS. Prevalence estimates for HIV testing were calculated among students overall, by demographic subgroup, and by participation in each HIV-related risk behavior. Logistic regression was used to calculate crude odds ratios (ORs) and 95% CIs for each independent variable to assess its association with HIV testing. A multivariable logistic regression model was then constructed to assess the adjusted association of the demographic characteristics and the HIV-related risk behaviors with HIV testing. In preliminary analyses, we tested for effect modification by sex and race/ethnicity and none was found. Adjusted ORs (AORs) and their 95% CIs were used in interpreting the final model. Of the 7591 students who reported ever having sexual intercourse, 1062 (14.0%) were excluded from the logistic regression model because they did not provide a valid response to 1 or more of the analysis variables. Compared with students who were not excluded, the demographic distribution of students excluded because of missing values varied by race/ethnicity (χ^2_5=41.07; P<.001) and grade (χ^2_3=41.07; P<.001), where the likelihood of missing values was higher for nonwhite individuals and there was an inverse relationship between missing values and grade. In light of the number of students excluded because of missing data, we compared the results of the logistic regression models using complete case analysis with those using multiple imputation and found similar results.[32] We report only those from the complete case analysis. In all analyses, students not engaging in the HIV-related risk behavior were the reference group. The significance level was set at P<.05.

Table 1. Testing for HIV, Demographic Characteristics, and HIV-Related Risk Behaviors of High School Students Who Have Had Sexual Intercourse

Characteristic	Students, % (95% CI)[a]
Sex	
Male	52.0 (50.3-53.7)
Female	48.0 (46.3-49.7)
Race/ethnicity	
Non-Hispanic white	54.9 (49.3-60.4)
Non-Hispanic black	18.3 (14.9-22.3)
Hispanic	19.9 (17.0-23.1)
Other[b]	6.9 (4.9-9.6)
Grade	
9	19.1 (17.5-20.8)
10	23.3 (21.9-24.8)
11	27.2 (25.6-28.9)
12	30.4 (28.9-31.8)
Lifetime illegal injection drug use[c]	
No	96.3 (95.7-96.8)
Yes	3.7 (3.2-4.3)
Ever forced to have sexual intercourse	
No	86.1 (84.9-87.3)
Yes	13.9 (12.7-15.1)
Used a condom during last sexual intercourse	
Yes	63.8 (61.9-65.6)
No	36.2 (34.4-38.1)
First sexual intercourse before age 13 y	
No	87.2 (85.8-88.5)
Yes	12.8 (11.5-14.2)
Sexual intercourse with ≥4 persons during their life	
No	69.8 (67.9-71.6)
Yes	30.2 (28.4-32.1)
Alcohol or drug use before last sexual intercourse	
No	79.5 (78.0-81.0)
Yes	20.5 (19.0-22.0)
Tested for HIV	
No	77.4 (75.9-78.8)
Yes	22.6 (21.2-24.1)

Abbreviation: HIV, human immunodeficiency virus.
[a] Percentages were derived from weighing to yield national estimates from the sample of 7591 high school students who had ever had sexual intercourse.
[b] Includes American Indian or Native Alaskan, Asian, Native Hawaiian or other Pacific Islander, and multiracial.
[c] Used a needle to inject any illegal drug into their body 1 or more times.

RESULTS

The demographic characteristics of the study sample were as follows: 48.0% were female; 54.9% were non-Hispanic white, 18.3% were non-Hispanic black, 19.9% were Hispanic, and 6.9% were of other race/ethnicity. There were fewer participants in lower grades than higher ones (19.1% in 9th grade, 23.3% in 10th grade, 27.2% in 11th grade, and 30.4% in 12th grade). For the HIV-related risk behaviors, 3.7% of students had ever injected any illegal drug, 13.9% had ever been forced to have sexual intercourse, 36.2% did not use a condom during the last time they had sexual intercourse, 12.8% had sexual intercourse before age 13 years, 30.2% had sexual intercourse with 4 or more persons during their life, and 20.5% drank alcohol or used drugs before the last time they had sexual intercourse. Nationwide, 22.6% of students who had ever had sexual intercourse had been tested for HIV (Table 1).

In an unadjusted analysis (**Table 2**), being female compared with being male, being black compared with being white, and being in 11th or 12th grade compared with being in 9th grade were each associated with significantly greater odds of having been tested for HIV. The odds of HIV testing were significantly less for students of other race/ethnicity compared with white students. There were no other differences by race/ethnicity. For all of the HIV-related risk behaviors, students engaging in the behavior had significantly greater odds of having been tested for HIV than students not engaging in the behavior.

The results of the adjusted analysis (Table 2) show that the odds of HIV testing were higher among female students (AOR, 1.95; 95% CI, 1.64-2.32), non-Hispanic black students (AOR, 1.43; 95% CI, 1.04-1.95), and students in 11th grade (AOR, 1.43; 95% CI, 1.14-1.79) and 12th grade (AOR, 1.64; 95% CI, 1.26-2.13). For the HIV-

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Table 2. Characteristics Associated With Human Immunodeficiency Virus Testing Among High School Students Who Have Had Sexual Intercourse

Characteristic	Tested, % (95% CI)[a]	Unadjusted OR (95% CI)	AOR (95% CI)[b]
Sex			
Male	17.9 (16.3-19.6)	1 [Reference]	1 [Reference]
Female	27.5 (25.4-29.7)	1.74 (1.50-2.02)	1.95 (1.64-2.32)
Race/ethnicity			
Non-Hispanic white	21.4 (19.4-23.6)	1 [Reference]	1 [Reference]
Non-Hispanic black	28.8 (24.0-34.1)	1.48 (1.12-1.96)	1.43 (1.04-1.95)
Hispanic	21.5 (18.9-24.5)	1.01 (0.80-1.27)	1.00 (0.78-1.27)
Other[c]	16.4 (13.4-20.0)	0.72 (0.55-0.95)	0.64 (0.49-0.85)
Grade			
9	18.3 (15.4-21.7)	1 [Reference]	1 [Reference]
10	20.5 (18.6-22.6)	1.15 (0.91-1.45)	1.20 (0.94-1.54)
11	22.9 (20.8-25.2)	1.33 (1.06-1.66)	1.43 (1.14-1.79)
12	26.3 (23.2-29.6)	1.59 (1.25-2.03)	1.64 (1.26-2.13)
Lifetime illegal injection drug use[d]			
No	21.9 (20.4-23.4)	1 [Reference]	1 [Reference]
Yes	41.3 (34.4-48.6)	2.52 (1.82-2.69)	1.70 (1.14-2.56)
Ever forced to have sexual intercourse			
No	20.4 (19.1-21.8)	1 [Reference]	1 [Reference]
Yes	36.2 (31.8-40.8)	2.21 (1.82-3.47)	1.43 (1.19-1.72)
Used a condom during last sexual intercourse			
Yes	19.2 (17.6-20.9)	1 [Reference]	1 [Reference]
No	28.7 (26.4-31.1)	1.70 (1.46-1.96)	1.28 (1.08-1.51)
First sexual intercourse before age 13 y			
No	21.4 (20.2-22.7)	1 [Reference]	1 [Reference]
Yes	30.8 (26.1-35.8)	1.63 (1.32-2.00)	1.23 (0.97-1.55)
Sexual intercourse with ≥4 persons during their life			
No	17.3 (16.2-18.6)	1 [Reference]	1 [Reference]
Yes	34.7 (31.4-38.1)	2.53 (2.16-2.96)	2.32 (1.98-2.73)
Alcohol or drug use before last sexual intercourse			
No	21.3 (20.0-22.6)	1 [Reference]	1 [Reference]
Yes	27.7 (24.5-31.1)	1.42 (1.22-1.65)	1.11 (0.92-1.34)

Abbreviations: AOR, adjusted odds ratio; OR, odds ratio.
[a] Percentages were derived from weighting to yield national estimates from the sample of 7591 high school students who had ever had sexual intercourse.
[b] Adjusted for sex, race/ethnicity, age, and human immunodeficiency virus–related risk behaviors.
[c] Includes American Indian or Native Alaskan, Asian, Native Hawaiian or other Pacific Islander, and multiracial.
[d] Used a needle to inject any illegal drug into their body 1 or more times during their life.

related risk behaviors, the odds of HIV testing were higher among those who had ever injected any illegal drug (AOR, 1.70; 95% CI, 1.14-2.56), had ever been forced to have sexual intercourse (AOR, 1.43; 95% CI, 1.19-1.72), did not use a condom during the last time they had sexual intercourse (AOR, 1.28; 95% CI, 1.08-1.51), and had sexual intercourse with 4 or more persons during their life (AOR, 2.32; 95% CI, 1.98-2.73). After controlling for other HIV-related risk behaviors, the association of having first sexual intercourse before age 13 years and alcohol or drug use before the last time they had sexual intercourse with HIV testing was not significant.

COMMENT

In this nationally representative sample of US high school students who had ever had sexual intercourse, students with known additional risk factors were more likely to have been tested for HIV. However, most students, including those at higher risk for HIV, had not been tested. These findings suggest that current testing practices are falling short of making HIV testing a normal part of medical care for sexually active adolescents.

Several factors are likely contributing to the relatively low percentages of sexually active adolescents who are being tested for HIV. First, effective communication about HIV testing is hindered by characteristics of both health care providers and their adolescent patients. Many health care providers are not comfortable discussing their adolescent patients' sexual behavior or taking a sexual history.[33-37] In turn, adolescents may not always acknowledge their engagement in higher risk behaviors or simply do not perceive themselves at risk.[7,38,39] Second, some adolescents do not know where to obtain testing services. The Kaiser Family Foundation's National Survey of Teens on HIV/AIDS in 2000 found that more than two-thirds of adolescents aged 15 to 17 years were not certain about where to get tested for HIV.[5] Finally, some adolescents do not have regular contact with the health care system, creating an additional barrier to HIV testing.[40-42]

This study has several limitations. First, because the study design is cross-sectional and students were only asked if they had ever been tested for HIV, the temporal relationship between testing and HIV-related risk behaviors cannot be determined. Such information would be beneficial in revealing both the motivations for HIV test-

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ing among adolescents and the effect of testing on subsequent risk behaviors. Second, these data are self-reported and may therefore have associated biases. However, a reliability study of the YRBS questionnaire indicated that students generally report consistent health-risk behavior information.[43] Third, the national YRBS does not ask about same-sex behavior. Because young men who have sex with men are at elevated risk for HIV, the lack of such data from the YRBS and other data sources makes it difficult to adequately address the prevention and diagnosis needs of this population.[44,45] Finally, these results apply only to those adolescents attending high school. In 2007, of persons aged 16 and 17 years in the United States, approximately 4% were not enrolled in a high school program and had not completed high school.[46]

As HIV testing is essential to reducing the incidence of HIV infection, the expansion of routine HIV testing among sexually active adolescents in health care settings, as recommended by the CDC,[19] would increase the proportion of adolescents who are tested. Such a strategy requires that health care providers play a central role in encouraging sexually active adolescents to be tested. Research has found that adolescents want health care providers to talk to them about HIV-related topics, and health care provider recommendations have been found to be an important influence on an adolescent's decision to obtain HIV testing.[22,26,47,48] Samet et al[26] found that adolescents who discussed AIDS with a doctor were 2.6 times as likely to have been tested for HIV. Health care providers need to be able to assess adolescent sexual risk for HIV and other STIs so that, in addition to testing, appropriate prevention messages can be offered. Unfortunately, a number of studies have shown that health care providers for adolescents (eg, pediatricians, providers of adolescent medicine, family practitioners, internists, physician assistants, and nurse practitioners) are uncomfortable with assessing their patients' sexual risk taking or talking to them about HIV.[33-37,49-52] Therefore, prevention efforts should include interventions designed to enhance communication between health care providers and their adolescent patients. The health care settings in which adolescent HIV testing occurs should also be taken into consideration when trying to increase testing in this population. Emphasis ought to be placed on providing access to confidential, convenient, respectful, youth-oriented testing sites.[28,53] Not all adolescents routinely have contact with health care providers; therefore, innovative approaches outside the health care setting must also be pursued. This should include HIV education and testing in school-linked health centers; peer, family, and community outreach efforts; and HIV-prevention social marketing campaigns that include a testing component.[47,54] Regardless of the setting in which they occur, prevention programs targeting adolescents must address the barriers that deter this population from being tested for HIV, including the underestimation of personal HIV risk, the lack of communication between sexual partners, and deficiencies in HIV and AIDS knowledge.[55] In addition, interventions to improve health care provider adherence to CDC recommendations for making HIV testing among sexually active adolescents a routine part of medical care are also needed.[56,57]

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Correspondence: Alexandra B. Balaji, PhD, Centers for Disease Control and Prevention, 1600 Clifton Rd NE, MS E-46, Atlanta, GA 30333 (dvi7@cdc.gov).
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