Factors Associated With HIV Testing Among HIV-Positive and HIV-Negative High-Risk Adolescents: The REACH Study

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ABSTRACT. *Objective.* **To describe human immunodeficiency virus (HIV) testing patterns among high-risk, uninfected adolescents and HIV-infected adolescents, and factors associated with testing.**

Methods. **HIV-infected adolescents (N = 246) and high-risk, uninfected adolescents (N = 141) at 15 sites nationwide were asked about the number of times they were tested for HIV, the type of agency at which testing occurred, and reasons for testing.**

Results. **The majority of participants reported being influenced to obtain testing by health care providers (53.1% of the HIV-infected group and 66.1% of the HIV-uninfected group, respectively). Female participants were somewhat more likely to have used a confidential or anonymous site for the most recent test, compared with male participants (73.5% and 67.5%, respectively). Among the HIV-infected group, feeling sick was the only factor associated with number of tests. Among the HIV-uninfected group, having more male partners, marijuana use in the past 3 months, white race, and having had same-gender partners in their lifetime (males only) were associated with number of tests. Multivariate analyses identified 2 significant models. Modeling the probability of having been tested 3 or more times, black participants were less likely to be tested than white participants (odds ratio [OR] = 0.4), and participants who felt sick were more likely to be tested than those who did not (OR = 1.7). Modeling the probability that the last test would be positive, black participants were more likely than white participants to test positive (OR = 2.3); those who were tested because they thought they might have gotten HIV from sex (OR = 3.0) or they felt sick (OR = 3.9) were more likely to test positive; participants who were tested because a health care professional recommended it were actually less likely (OR = 0.5) to test positive.**

Conclusions. **Overall, these findings highlight the importance of making HIV testing more routinely available to sexually active adolescents. More work needs to be done to normalize HIV testing among adolescents, and more innovative approaches need to be implemented on a wide scale.** *Pediatrics* **2002;110(3). URL: http://www.pediatrics.org/cgi/content/full/110/3/e36;** ***HIV, HIV testing, adolescence. comparative study, risk-taking.***

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ABBREVIATIONS. HIV, human immunodeficiency virus; STI, sexually transmitted infection; REACH, Reaching for Excellence in Adolescent Care and Health; SD, standard deviation; ACASI, audio computer assisted self-administered interview; OR, odds ratio.

Relatively little is known about adolescents' use of human immunodeficiency virus (HIV) testing services.[1,2] With estimates that 10 000 to 30 000 adolescents and upward of 100 000 youths younger than 25 years are infected with HIV in the United States,[3] only a fraction of these youths are aware of their infection.[3–5] It is important to understand how and why adolescents are participating in HIV testing.

A number of behavioral risk factors seem to be associated with adolescent decision making to undergo HIV testing. Miller et al[6] identified sexual risk behaviors associated with the decision to be tested among 470 adolescents and 18- to 35-year-old women. Having >1 sex partner and never using a condom in the past year were strong predictors of testing. Among 202 runaway and homeless adolescents,[7] 4 variables were found to predict obtaining an HIV test: history of sexually transmitted infections (STIs), 5 or more years of sexual activity, injection drug use, and older age. In a large study of youths who were counseled, of the 50% who subsequently requested HIV testing, gender differences were found for risk factors[8]: female participants who were tested more likely to report STIs and marijuana use, and male participants were more likely to report alcohol and cocaine use. Among 531 clients (mean age at entry: 19.1 year) enrolled in another testing program, being older, being white, having had sex with an HIV-infected partner, or having a substance abuse problem increased the likelihood of having had a previous HIV test.[2] Other studies have stressed the importance of medical symptoms and encouragement by health care providers in promoting HIV testing.[9,10]

Most adolescent HIV testing studies have been conducted with high-risk populations, and the focus has often been to engage adolescents in testing as a result of surveying risk, to survey attitudes toward testing, and to assess HIV knowledge. Similar to those studies, this study included a high-risk adolescent sample. However, this study also included an assessment of previous testing behaviors among adolescents who were infected with HIV. In this article,

we describe the patterns of HIV testing among young adolescents who eventually became infected compared with the pattern for high-risk youths who are not infected, and factors associated with testing.

METHODS

Participants

The primary Reaching for Excellence in Adolescent Care and Health (REACH) study objectives address biomedical outcomes, requiring physical examination and specimen collection. Therefore, recruitment was restricted to adolescents who were engaged in primary care. In the HIV-infected subgroup, only adolescents who were infected through sex or drug-taking behaviors were eligible for study participation (older children infected through perinatal transmission or contaminated blood products were excluded). In the high-risk noninfected subgroup, only adolescents who were at risk for HIV were eligible for study participation; participants were selected on the basis of a history of high-risk behaviors that increase the possibility of exposure to HIV. A description of the national REACH study objectives and procedures can be found in Rogers et al.[11]

Data for this analysis were from the baseline visits of participants in the REACH cohort. At the time of analysis, the REACH cohort consisted of 550 adolescent participants, 528 of whom had completed the necessary forms at the baseline visit. The racial/ethnic breakdown of the sample is as follows: 71.8% black/African-American, 20.1% Hispanic and other or mixed race, and 8.1% white. The mean age of the sample was 16.8 years (standard deviation [SD]: 1.2; range: 12–19). In the HIV-infected sample, the mean $CD4^+$ T-cell count at baseline was 510.9 (SD: 260.8, range: 0–1449); 8.8% of these participants had a $CD4^+$ T-cell count of <200.

Procedures

Informed Consent

Some institutional review boards required parental permission for participation of youths in this study, whereas others did not; requirements were followed at each site. Informed consent was obtained from all adolescents who participated in the study.

Assessment Interview

Data used in the present study were obtained from 3 sources: direct face-to-face interview, audio computer assisted self-administered interview (ACASI), and laboratory testing. For the ACASI section of the interview, questions on the computer screen were read to the participant through earphones by an audio component to assist individuals who had low reading-level skills. Responses were highlighted on the screen as they were read aloud to the participant, to minimize error response. Data were encrypted automatically and transferred to the REACH data center. ACASI was used for assessment of all sensitive and illegal behaviors, including sexual history, current sexual behavior, and substance use, as well as for obtaining previous HIV testing history.

Assessment Measures

Demographics

Participant descriptive variables of age, gender, race/ethnicity, and education level were assessed and recorded during the face-to-face interview at the baseline visit.

Sexual Behaviors

All sexual behavioral questions were collected through ACASI. Sexual activities that were examined included number of lifetime partners, whether male participants had same-gender contacts during their lifetime, self-report of sexual orientation, and age of sexual initiation.

Drug and Alcohol Use Behaviors

Three drug use variables that were examined regarding marijuana use included 1) participant's self-reported admission that he or she had used marijuana in the past 3 months, 2) participant's self-reported admission that he or she had ever used marijuana, and 3) marijuana urinalysis results. This information was collected through ACASI.

Urinalysis was also conducted. Urine samples were tested for marijuana at a certified laboratory using the enzyme-multiplied immunoassay technique. The urinalysis test had a detection sensitivity for cannabinoids of 100 ng/mL, generally applicable to specimens collected within 24 hours of drug use. Conditional kappas for self-report of marijuana use and urinalysis were good.[12]

Problem drinking and alcohol dependence were assessed using a CAGE score based on a participant's self-reported alcohol use.[13,14] Participants were categorized as a "problem drinker" when they indicated yes for at least 2 of the following 4 questions: 1) Ever felt that you should cut down on your drinking? 2) People ever annoyed you by criticizing you about your drinking? 3) Ever felt bad or guilty about your drinking? 4) Ever had a drink first thing in the morning to steady nerves or get rid of a hangover?

HIV Testing History

Participants were asked a series of questions through ACASI regarding their HIV testing history before entering the REACH study. Questions focused on the number of times that the participant had been tested, the reason(s) for being tested, and the type of location where the participant had been last tested. (To be accepted into the REACH study, participants were required to have had at least 1 HIV test before enrolling in the study. Study inclusion required either a current test or on-site documented evidence at anytime in the past for HIV-positive participants and within the previous year for HIV-negative participants.)

Participants were asked to review 7 potential reasons for why HIV testing was initiated. These included concern over feeling sick or engaging in high-risk sexual or drug behaviors; concern over the results of positive HIV tests for people close to the participant, such as friends or even their own infant; testing conducted because of a recommendation by a health professional; and requirement for a job, insurance, or the military. The places at which participants were tested included 5 location categories: 1) a hospital or emergency department, 2) a confidential clinic or testing place where one gives a name but the HIV test is kept secret, 3) an anonymous testing place where one does not have to give a name, 4) the job corps or military, or 5) a place where one gives or sells blood.

Analysis Procedures

Comparisons were made separately between HIV-infected and HIV-uninfected participants for selected variables versus categorizations of the number of times that a participant was tested. Analyses were also conducted to compare participants who were categorized further by gender within HIV status. The χ^2 test was primarily used as the significance test for comparisons, whereas the Fisher exact test was used for comparisons in which only small numbers were available for a given attribute.

RESULTS

Number of Times Tested

Among 256 HIV-infected female participants, the mean number ($\pm$SD) of HIV tests was 3.0 ($\pm$0.3) compared with 2.7 ($\pm$0.3) in 141 uninfected female participants. Male participants had lower HIV test frequencies than did female participants: 2.1 $\pm$ 0.2 among 87 HIV-infected male participants and 2.4 $\pm$ 0.4 among 44 HIV-uninfected male participants. In all 4 groups (gender $\times$ HIV status), the median number of HIV tests was 2. Seventeen (3.2%) of 528 adolescents reported having >10 HIV tests in their lifetimes. The relative odds of a female participant (16 [4.3%] of 368) having had this high number of tests compared with an male participant (1 [0.9%] of 116) was 5.2 (95% confidence interval: 0.69–39.85; $P = .08$).

Reasons for Being Tested

One of the main reasons for getting tested among both the HIV-infected and the HIV-uninfected groups was the concern that they may have contracted HIV through sexual behavior (73.8% and 43.1%, respectively). Health care recommendations also influenced testing: 53.1% of the HIV-infected group and 66.1% of the HIV-uninfected group cited this as a reason for being tested. The reasons for being tested differed only slightly for female and male participants. Among both HIV-infected and -uninfected adolescents who were tested before entering the REACH study, male participants were more likely (35 [30.2%] of 116) to be tested because of feeling sick than were female participants (69 [25.7%] of 368; $P = .01$). Few differences were noted comparing HIV-infected and -uninfected adolescents. Male participants who had >6 sexual partners in their lifetime and some or all of the partners were male were significantly more likely to be tested than other male participants because they thought that they had gotten HIV from sex ($P = .007$). In contrast, this same high-risk group of male participants was not found to have been tested more than other male participants when a health care professional thought that it would be a good idea ($P = .84$).

Place of HIV Testing

Differences in the last HIV testing venue were noted comparing male and female participants (Table 1). Female participants were more likely (269 [73.5%] of 368) to have used a confidential or anonymous test site for their most recent HIV test compared with male participants (77 [66.4%] of 116; $P = .04$), who were tested in more diverse settings. Few differences were noted comparing HIV-infected and -uninfected adolescents.

Comparison of HIV Testing Frequency on Covariates

HIV testing frequency was categorized as 0, 1 to 2, or 3 or more to assess whether sociodemographic and risk characteristics were associated with testing frequency. Within the strata of HIV-infected and -uninfected adolescents, a number of factors were assessed. Among the HIV-infected group, only feeling sick as a reason for being tested for HIV was significantly associated with having had multiple HIV tests performed ($P = .004$). No significant differences were noted among HIV-infected participants for high-risk behaviors such as having had more male partners ($P = .09$), marijuana use in the past 3 months ($P = .08$), or having had same-gender partners in their lifetime ($P = .08$). Participants who had had a greater number of male sexual partners (>6) were more likely to have been tested >2 times ($P = .02$). For male participants only, those who had a report of any lifetime same-gender sexual contact were more likely to have been tested >2 times, whereas participants who reported having had no same-gender contact were more likely to have never been tested previously ($P = .007$). Finally, an examination of race/ethnic differences showed that HIV-negative white adolescents were more likely to have been tested a higher number of times (≥3) than black and other or mixed-race participants ($P = .03$; see Table 2).

Multivariate Analyses

Multivariate analyses were performed using logistic regression modeling with backward stepwise regression. Separate analyses were performed to predict 3 different outcome variables, including the number of times that a participant was tested, a participant's HIV status, and the location where a participant was last tested. Models were adjusted with predictor variables of gender, race, and age at baseline, as well as reasons for a participant's being tested. For the backward stepwise regression approach, all variables were initially included in the model in which the least significant was removed after each run. The process continued until all variables that remained in the model had a significance level of ≤.05.

Results showed that two models had significant

TABLE 1. Demographic Characteristics Versus Place of HIV Testing*

	Hospital or Emergency Room	Confidential or Anonymous Place	Job Corps or Military	Place Where One Gives or Sells Blood	*P*
HIV status					NS
Positive	71 (22.1%)	229 (71.4%)	18 (5.6%)	3 (0.9%)	
Negative	34 (21.4%)	117 (73.6%)	4 (2.5%)	4 (2.5%)	
Gender					.04
Female	75 (20.5%)	269 (73.5%)	18 (4.9%)	4 (1.1%)	
Male	30 (26.3%)	77 (67.5%)	4 (3.5%)	3 (2.6%)	
Race					NS
Black	77 (22.4%)	246 (71.5%)	16 (4.6%)	5 (1.4%)	
Other/mixed	20 (20.8%)	70 (72.9%)	5 (5.2%)	1 (1.0%)	
White	8 (20.0%)	30 (75.0%)	1 (2.5%)	1 (2.5%)	
Age					NS
≤17	74 (23.6%)	221 (70.4%)	14 (4.5%)	5 (1.6%)	
>17	31 (18.7%)	125 (75.3%)	8 (4.8%)	2 (1.2%)	
No. of times tested					NS
1–2 times	64 (21.0%)	219 (72.0%)	15 (4.9%)	6 (2.0%)	
≥3 times	41 (23.4%)	126 (72.0%)	7 (4.0%)	1 (0.6%)	

NS indicates not significant.
* χ^2 test of significance.

TABLE 2. Demographic Characteristics Versus Frequency of Testing*

	Infrequent (0–2 Times)	Frequent (≥3 Times)	*P*
HIV status			NS
Positive	231 (68.1%)	108 (31.9%)	
Negative	118 (63.8%)	67 (36.2%)	
Gender			NS
Female	258 (65.3%)	137 (34.7%)	
Male	91 (70.5%)	38 (29.5%)	
Race			NS
Black	263 (70.0%)	113 (30.0%)	
Other/mixed	66 (62.9%)	39 (37.1%)	
White	20 (46.5%)	23 (53.5%)	
Age			NS
≤17	238 (69.0%)	107 (31.0%)	
>17	111 (62.0%)	68 (38.0%)	

NS indicates not significant.
* χ^2 test of significance.

TABLE 3. Logistic Regression Modeling Results: Adjusted ORs for Independent Effects of Covariates in Predicting Likelihood of Having Been Tested for HIV

Covariates for Multivariate Analyses	Tested 3 or More Times	
	Adjusted OR (95% CI)	*P*
HIV status		
HIV + vs HIV−	0.7 (0.4–1.0)	.049
Race		
Black vs white	0.4 (0.2–0.8)	.007
Other/mixed vs white	0.5 (0.2–1.0)	NS
Tested because participant felt sick		
Yes vs no	1.7 (1.1–2.8)	.02

CI indicates confidence interval; NS, not significant.

TABLE 4. Logistic Regression Modeling Results: Adjusted ORs for Independent Effects of Covariates in Predicting Likelihood of Having Been HIV-Positive at Last Test

Covariates For Multivariate Analyses	HIV+ at Last Test	
	Adjusted OR (95% CI)	*P*
Race		
Black vs white	2.3 (1.1–4.8)	.002
Other/mixed vs white	1.2 (0.5–2.7)	NS
Tested because participant thought he or she might have gotten HIV from sex		
Yes vs no	3.0 (2.0–4.5)	<.001
Tested because participant felt sick		
Yes vs no	3.9 (2.1–7.2)	<.001
Tested because health care professional thought it would be a good idea		
Yes vs no	0.5 (0.3–0.8)	.002

NS indicates not significant.

findings (Tables 3 and 4). The first multivariate model in Table 3 indicates that when modeling the probability that participants were tested 3 or more times, the adjusted odds ratios (ORs) revealed several significant findings. These findings included the following: HIV-infected participants were less likely to have been tested than HIV-uninfected participants (OR: 0.7; $P = .049$), black participants were less likely to have been tested than white participants (OR: 0.4; $P = .007$), and participants who felt sick were more likely to have been tested than those who did not feel sick (OR: 1.7; $P = .02$). Table 4 indicates that when modeling the probability that a participant's last test would be positive (assuming that once a participant tested positive he or she was no longer tested), significant adjusted ORs were found for race and for several reasons for being tested. These findings included that black participants were more likely than white participants to have tested positive at their last testing (OR: 2.3; $P = .002$). In addition, participants who had been tested because they either thought that they might have gotten HIV from sex (OR: 3.0; $P < .001$) or felt sick (OR: 3.9; $P < .001$) were more likely to have tested positive at their last visit, whereas participants who were tested because a health care professional thought that it might be a good idea were actually less likely (OR: 0.5; $P = .002$) to have tested positive at their last visit.

When a participant's location of testing was examined as the outcome variable, no significant results were found. In addition, all models were tested for interaction effects and no significant findings were identified.

DISCUSSION

This article describes the number of times that high-risk adolescents were tested for HIV, the type of agency at which testing occurred, and the reasons for testing comparing HIV-uninfected, at-risk adolescents and those who were HIV-infected. Only a few factors were associated with the number of times an adolescent returned for HIV testing. Among the HIV-infected group, feeling sick was the only factor associated with a greater number of tests. This is consistent with previous research indicating that the appearance of symptoms in adolescents acts as a trigger for HIV testing by the adolescents and by their providers.[10] However, because the majority of HIV-infected who are adolescents enrolled in the REACH study are asymptomatic,[15] relying on symptoms for HIV testing will miss a significant number of HIV-infected adolescents. Among the high-risk adolescents, having had more male partners, marijuana use in the past 3 months, white race, and having had same-gender partners in their lifetime (male participants only) were associated with number of tests. Therefore, the HIV-uninfected, high-risk group seems to have more accurately judged their need for HIV testing on the basis of their health risk behaviors than did the adolescents who became HIV-infected.

Consistent with some of the previous investigations of adolescent testing (eg, [6,7]), one of the main reasons for getting tested among both the high-risk uninfected and HIV-infected groups was the concern that they may have contracted HIV through sexual behavior. Among the HIV-infected participants and the high-risk uninfected participants, 73.8% and 43.1%, respectively, said that this was a reason for testing. As might be expected, this particular sample of adolescents—all being engaged at a primary care site—were also influenced by health care recommendations to seek an HIV test. Of the HIV-infected group, 53.1% said that they were tested because it was suggested by a health care professional, and an

even greater percentage (66.9%) of the high-risk group cited this as a reason for testing. This is consistent with reports that found youths willing to consider testing when physicians initiate discussions about HIV risk with them.[9]

One of the limitations of this investigation is that it was a retrospective study, and it could be argued that recall may have been difficult for participants. However, HIV testing is a very salient occurrence for most adolescents, and the median time since the adolescents had found out their HIV status was only 0.7 years (mean: 1.2 years; SD: 1.3 years). In addition, because adolescents who tested positive for HIV will not secure additional HIV tests, the inferences about the number of tests done will not be directly comparable between HIV-infected and -uninfected individuals. We do not believe that this has distorted our findings, however, given the very close age grouping of our overall study population, as well as the categorical approach that we took to characterizing the number of tests obtained.

We know that a significant number of adolescents in the United States who are HIV-infected are not identified as such because they are not tested, and the vast majority of HIV-infected youths remain unaware of their infection.[3] HIV testing of sexually active youths is not routine practice in the United States.[16] In a nationally representative sample of 1500 adolescents, only 27% of those who were sexually active reported that they had been tested.[17] In this study, the majority of the adolescents were tested at clinics that offer confidential testing (66.7% of the HIV-positive group; 67.3% of the HIV-negative group). The only other testing site at which a large percentage of the sample was tested was a hospital or emergency department (22.1% of the HIV-positive group; 21.4% of the HIV-negative group). This indicates a need for increasing routine testing by health care providers at clinics who see any adolescents presenting for STI treatment and adolescents who are sexually active. This seems especially important for black adolescents because they were less likely to have been tested than white participants but were more likely than white participants to have tested positive at the last test than were white participants. Interventions designed to normalize HIV testing among these adolescents may also be needed. A policy statement has been issued from the American Academy of Pediatrics recommending that sexually active adolescents and adolescents engaged in substance abuse should be encouraged to be tested for HIV.[16] Adult studies confirm that HIV testing is more likely when health care providers initiate discussion and emphasize the benefits of testing.[18]

Routine testing at clinics, however, will not reach the many adolescents who are not engaged in health care. More innovative approaches need to be implemented on a wide scale throughout the United States to identify HIV-infected adolescents, including social marketing approaches, acceptance of school-based testing resources, peer outreach by youths who are informed about HIV, noninvasive testing methods, and neighborhood and community mobilization.

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