

# HIV Testing among Adolescents and Youth in the United States: Update from the 2009 Behavioral Risk Factor Surveillance System

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**Abstract:** *Objectives:* We examined the prevalence of HIV testing in a representative sample of US adolescents and youth, assessed the location and method of testing used during their last HIV testing, and compare the characteristics of those who had and had not been tested for HIV.

*Methods and Principal Findings:* Data on adolescents and youth who participated in the 2009 Behavioral Risk Factor Surveillance System (BRFSS) survey were analyzed. Of the 6,628 adolescents and youth who participated in the 2009 BRFSS, 54.4% were male, 59.1% were white, 37.4% graduated from high school, 29.6% live in the western states in the United States. Their mean age was 20.9 years ( $\pm$  2.07 SD). Of these participants, 31.8% had been tested for HIV. The majority of adolescents had been tested for HIV either at private physician offices (38%) or public clinics (31.7%) compared to HIV counseling and testing sites (3.1%). Only 30.5% of adolescents were tested using a rapid HIV antibody test. Being female, African-American, Asian or multiracial, divorced/widowed, and living in the Western and NorthEastern states in the United States were associated with a high probability of testing for HIV.

*Conclusions:* The low prevalence of adolescents who tested for HIV and the low proportion of those offered rapid HIV testing after the 2006 CDC's new guidelines about HIV testing raise serious concerns about the effectiveness of HIV prevention efforts particularly among adolescents. More innovative strategies are needed to increase the number of adolescents and youth who become aware of their HIV serostatus.

**Keywords:** Adolescents, HIV testing, location, method of testing and predictors.

## INTRODUCTION

The human immunodeficiency virus (HIV) epidemic remains a public health challenge among adolescents and young adults worldwide. One-third of the estimated 33 million people currently living with the HIV/AIDS globally are 15 to 24 years old and nearly half of all new HIV infections worldwide occur in this age group [1-3]. A quarter of all new HIV infections in the United States occur among adolescents and young adults less than 25 years [4]. The HIV/AIDS situation for adolescents requires urgent response.

During adolescence which is the transition period into adulthood, individuals aged 13 to 19 years and young adults (those aged 20 to 24 years) undergo significant physical and emotional changes marked by an increase in risky activities, from experimentation with alcohol, smoking, and drug use to unsafe sex [5]. Unless otherwise noted, we define adolescents and youth as persons who are 13-24 years of age. Results from the 2009 Youth Risk Behavioral Survey (YRBS) [6] indicated that, within the 30 days prior to the

survey, 41.8% of high school students drank alcohol, 19.5% smoked cigarettes, 20.8% used marijuana, 2.1% injected an illegal drug, and 34.2% were sexually active. Nearly 38.9% of the high school students who were sexually active did not use a condom during their last sexual intercourse. Although these risk behaviors are decreasing among high school students in the United States [7], their high prevalence underscores the need for periodic assessment of HIV infection in this population.

Early HIV testing among adolescents and youth presents substantial public health benefits. Given that testing can lead to changes in risky behaviors, it is the cornerstone for any HIV prevention program [8]. A growing body of evidence suggests that individuals who know their serostatus are likely to adopt or maintain safe behaviors, either to protect themselves from future infection if they are not infected or, if HIV-positive, to protect their partners from infection and be linked to health services [9]. Despite the lack of a HIV vaccine and curative treatment, combination antiretroviral therapy has been shown to inhibit viral replication and improve morbidity and mortality among HIV-positive individuals [10-12]. Moreover, young women who are HIV seropositive and pregnant can, by taking medications and/or having a cesarean delivery, reduce the risk of transmitting the virus to their infants to about 2% [13]. Furthermore, mathematical models suggest that universal voluntary testing

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coupled with wide-scale early antiretroviral therapy could halt the spread of the HIV epidemic in a community [14, 15].

To increase the number of adolescents who test for HIV, the CDC recommended that HIV testing becomes a routine part of medical care for all patients between the ages of 13 and 64, and advised that pre-test counseling and separate written consent for HIV testing no longer be required [16, 17]. Three years after the publication of these new HIV guidelines, we undertook this study to examine the prevalence of adolescents who had been tested for HIV in 2009, examine the location and method of testing used during their last HIV test, and compare the characteristics of those who had and had not been tested for HIV. A better understanding of factors associated with HIV testing in this age group may inform the development of effective strategies to improve HIV testing in this population.

## METHOD

### Data

Data from the 2009 Behavioral Risk Factor Surveillance System (BRFSS) survey were analyzed. The BRFSS is a federally funded cross-sectional telephone survey of the United States non-institutionalized civilian population aged 18 years and older. The BRFSS is conducted annually to track health-risk behaviors, clinical preventive practices, and health care access and use, primarily related to chronic diseases and injury. Methodology and validation of this cross-sectional survey are described in detail elsewhere [18]. Briefly, a disproportionate stratified sampling was used to increase the efficiency of telephone number screenings, while maintaining a valid probability sample of households with telephones. Sampling and interviewing were conducted during 2 weeks of every month throughout 2009. Within each household, one person aged 18 years or older was selected at random to be interviewed. Computer-assisted telephone interviews included standardized questions on demographic characteristics, health status, health care use, health habits, selected chronic conditions, and receipt of screening services. The median response rate among participating states was 34.93%.

### Study Variables

*Dependent variable.* The self-reported HIV-testing was our outcome of interest. Participants in the 2009 BRFSS survey were asked, "Have you ever been tested for HIV?" Do not count tests you may have had as part of a blood donation. Include testing fluid from your mouth, those who answered "Yes" were asked "Where did you have your last HIV test- at a private doctor or HMO, at a counseling and testing site, at a hospital, at a clinic, in a jail or prison, at a drug treatment facility, at home, or somewhere else? They were also asked to provide the month and year of their last HIV test if any. About the HIV test they ever had, they were asked "Was it a rapid test where you could get results within a couple of hours?"

*The independent variables.* The independent variables consisted of the following socio-demographic characteristics including sex, race, education, marital status, medical coverage (yes/no), employment status (yes/no), and the region of residence. The BRFSS defined response categories for the socio-demographic variables.

## Statistical Analysis

Participants who had been tested for HIV and those who had not were compared with regard to demographic characteristics. We used the chi-square test of independence to examine if the difference was statistically significant. Factors which were significant in bivariate analysis were entered into a multivariable logistic model to examine how each variable was independently associated with the outcome of interest after controlling for the other variables. The level of significance was set at 0.05. We used WesVar 4.2 (Westat, Inc, Bethesda, MD) to account for the complexity of the survey.

## RESULTS

Of the 6,628 adolescents who participated in the 2009 BRFSS, 54.4% were male (n=3090), 59.1% were white (n=3,888), 37.4% (n=2,469) graduated from high school, and 29.6% (n=1858) live in the Western states of the United States. Their mean age was 20.9 years ( $\pm 2.07$  SD).

Of these adolescents and youth, 31.8% had ever been tested for HIV (n=2,106), not counting tests done when donating blood. Of these participants, only 613 (29%) had their last HIV test in 2009. Regarding the location of the last HIV test, the majority of adolescents who had been tested accessed HIV testing at private physician offices (38%), public clinics (31.7%), or hospitals (15.6%) compared to 3.4% who were tested at HIV counseling and testing sites. With regard to the method of HIV testing used, only 30.5% of adolescents reported being tested with a rapid HIV antibody test.

Adolescents who had and those who had not been tested for HIV were compared with regards to selected socio-demographic characteristics (Table 1). Except for the education level and age at the time of the interview, the two groups differed with regard to all socio-demographic characteristics studied. The prevalence of HIV testing was higher among female (42.8%) than male (25.8%) adolescents. A high percentage of African-American adolescents (62.8%) had ever been tested for HIV compared to White (27.8%) or Hispanic (42.1%) adolescents. The prevalence of HIV testing was higher among those who were single (64.3%) compared with those who were married (30.2%) or divorced/widowed (50.9%). With regard to the region of residence, the prevalence of HIV testing was higher among adolescents living in the South (43.3%) and Northeast (37.6.0%) compared to those from the Midwest or West (29.8%). A high proportion of participants who were out of work (44.2%) or did not have medical coverage (38.5%) reported to have been tested for HIV.

The multivariate logistic regression model showing the independent association between each variable with the outcome of interest after controlling for the other independent variables is shown in Table 2. Female participants were significantly more likely than male participants to have tested for HIV (OR=1.79; 95% Confidence Interval (CI) 1.59 - 2.03). African American adolescents (OR: 3.08; CI: 2.14-4.56), those who were multiracial (OR: 3.29; 95% CI: 2.19-5.41) or from other racial background (such as Asian) (OR: 1.65; 95% CI: 1.16-2.56) were significantly more likely to have been tested for HIV compared to Caucasian adole-

**Table 1. Sociodemographic Characteristics of Adolescent Participants in the Behavioral Risk Factor Surveillance System, 2009, by History of Testing for HIV**

Variables	N	Had Ever been Tested for HIV		p
		Yes %	No %	
<b>Sex</b>				
Male	2832	25.8	74.2	<.001
Female	3216	42.8	57.2	
<b>Race</b>				
White	3585	27.8	72.2	<.001
African American	721	62.8	37.2	
Hispanic	1034	42.1	57.9	
Others	422	24.2	75.8	
Multiracial	240	42.1	57.9	
Age (mean in years)	21.6 (sd:± 1.9)	20.5 (sd: ± 2.1)		
<b>Education Level</b>				
Graduated from college	890	34.9	65.1	.25
Attended college	2162	33.9	66.1	
Graduated from high school	2223	34.7	65.3	
Did not graduate from high sch.	766	37.9	62.1	
<b>Marital Status</b>				
Married/Unmarried couple	4768	30.2	69.8	<.001
Divorced/Widowed	1161	50.9	49.1	
Never married	98	64.3	35.7	
<b>Medical Coverage</b>				
Yes	4433	34.2	65.8	<.001
No	1498	38.5	61.5	
<b>Employment</b>				
Employed	3142	37.5	62.5	<.001
Students	1867	25.3	74.7	
Unable to work/Out of work	1011	44.2	55.8	
<b>Region</b>				
Northeast	1456	27.3	24.5	<.001
Midwest	1157	17.2	21.9	
West	1690	25.0	32.0	
South	1412	30.5	21.6	

scents. However, Caucasian adolescents were more likely to have been tested compared to Hispanic adolescents.

Compared to adolescents and youth with at least a high school level of education, those with no level of education or did not graduate from high school (OR: .1.37, 95% CI: 1.13 - 1.65) were more likely to have been tested for HIV, the difference was statistically significant.

Adolescents who were divorced or widowed (OR: 2.52; 95% CI: 1.60 - 3.97) were almost 3 times more likely to have been tested for HIV than those who were married; whereas those who were single (never married) (OR: 1.51; 95% CI: .95 - 2.40) were slightly more likely to have tested for HIV than those who were married, but the difference was not statistically significant.

Adolescent who were not employed (OR:1.78; 95% CI: 1.47 - 2.15) and students (OR=1.45, 95% CI: 1.23 - 1.73) were significantly more likely to have been tested for HIV than those who were employed. Those who did not have medical coverage (OR:1.02; 95% CI: .89 - 1.18) were slightly more likely to have been tested for HIV than those who had medical coverage, but the difference was not statistically significant

**Table 2. Multivariable Model of Predictors of HIV Testing in Adolescent Participants in the Behavioral Risk Factor Surveillance System, 2009**

Variables	OR	95% CI	p value
<b>Sex</b>			
Male		1	
Female	1.79	1.58 - 2.03	<.001
<b>Race</b>			
White	1		
African American	.08	2.14 - 4.56	<.001
Hispanic	.66	.44 - .98	.05
Others	1.65	1.16 - 2.56	<.001
Multiracial	3.23	2.19 - 5.41	<.001
<b>Age</b>	<b>0.78</b>	<b>.75 - .81</b>	<b>&lt;.001</b>
<b>Education Level</b>			
High school+	1		
No education or Did not graduate from high sch	1.37	1.13 - 1.65	<.001
<b>Marital Status</b>			
Married/Unmarried couple	1		
Divorced/Widowed	2.52	1.60 - 3.97	<.001
Never married	1.51	.98 - 2.46	.05
<b>Employed</b>			
Employed	1		
Students	1.45	1.23 - 1.72	<.001
Out of work	1.78	1.47 - 2.15	<.001
<b>Medical Coverage</b>			
Yes	1		
No	1.02	.89 - 1.18	.25
<b>Region</b>			
Northeast	1		
Midwest	0.97	.82 - 1.16	.07
West	1.39	1.17 - 1.68	<.01
South	1.27	1.05 - 1.47	<.01

CI, confidence interval; OR, odds ratio.  
\*This model contains all variables.

Compared to adolescents who live in the South, those from the MidWest (OR: .97; 95% CI: .83-1.16) were less likely to have been tested for HIV; whereas those living in

the West (OR: 1.39; 95% CI: 1.17-1.68) and NorthEast (OR: 1.27; 95% CI: 1.05-1.47) were significantly more likely to have been tested for HIV.

**DISCUSSION**

Three years after the publication of the 2006 new CDC HIV guidelines, the prevalence of HIV testing among adolescents remains low in the United States. Only 31% of adolescents who participated in the 2009 BRFSS had ever been tested for HIV. Our result confirms those from previous studies [19-21]. In a survey of 567 sexually active Massachusetts adolescents, Samuel *et al.* [22] reported that only 22% had ever been tested for HIV.

In order to understand how to improve testing rates, it is important to identify barriers to testing among adolescents. The National Survey of Teens on HIV/AIDS [23] reported that, while youth are generally aware of the modes of HIV transmission, many of them don't think they are at risk. Some of them believe they need their parents' permission to get tested [20]. In addition, youth are very concerned about the breach of confidentiality. They fear that either their parents may question them about their sexual behavior and their relationships or that their peers will laugh at them and spread the news to others. Furthermore the stigma and discrimination associated with HIV/ AIDS are common barriers to seeking HIV services among adolescents [24].

Another barrier to effectiveness of HIV testing is not returning to access test results, which could have been addressed through the use of rapid HIV testing. The approval by the United States Food and Drug Administration (FDA) of the first rapid test for clinical use in 2002 raised great expectations about HIV testing among public health practitioners. Rapid tests would promote the opportunity to test more clients and provide them with their test results in a single session, thereby dramatically increasing the number of individuals who are aware of their status [25-29].

Our results show that only 30.5% of adolescents and youth who get tested, had a rapid test during their last HIV testing. This low proportion of adolescents who had a rapid test suggests that the health care system in the United States has been slow in embracing rapid HIV screening. Minniear, Gilmore, Arnold *et al.* [30] surveyed health care providers and their patients in Tennessee regarding their knowledge and beliefs about routine HIV screening. Of the 118 health care providers surveyed, 78% were unaware of the revised HIV testing guidelines and 58% predicted that routine screening would fail because of patient or guardian refusal. Of the 5399 patients who qualified for routine screening, only 37% were offered opt-out HIV screening. The national survey of HIV testing practices in hospitals by the Health Research & Educational Trust showed that nearly half of all hospitals surveyed had policies prohibiting routine emergency departments (ED)-based screening [31]. Possible impediments to the implementation of routine HIV testing may include increased work burden imposed on already overcrowded facilities, limited ability of EDs to provide linkages to follow-up care, concern for privacy and confidentiality, and conflicting state legislations about HIV testing to list a few [32]. In addition, HIV testing is not routinely reimbursed making funding a major issue in the implementation of routine testing [33]. The delay in

implementing routine HIV screening has affected the ability of health care professionals to make more adolescents aware of their serostatus and to link those who are infected to treatment. It is imperative for federal and state health officials to investigate the reasons for the slow use of rapid HIV test and address them promptly in order to optimize the benefits for early HIV testing and treatment.

Private physician offices (38%) and public clinics (31%) were the most commonly used sites for HIV testing among adolescents who participated in the 2009 BRFSS. Klein and Wilson [34] reported that adolescents view their primary care providers as important sources for health information and are willing to discuss confidential issues with them. However, many primary care providers miss opportunities to provide adolescents with STI, HIV, and pregnancy preventive services [35]. Efforts must be made to educate health care providers to offer age-appropriate care to adolescents.

Educational attainment influences one's ability to understand and act on promotional health messages. Furthermore economic and lifestyle changes that accompany educational attainment influence one's access to health care services. Higher education (or more years of formal schooling) is widely associated with healthy choices and better health. The lack of significant difference in HIV testing among the different levels of education is puzzling. Extant studies on the relationships between education level and HIV testing revealed mixed and conflicting results [36-40]. More studies are needed to clarify the relationship between educational attainment and HIV testing among adolescents.

Women were twice as likely as men to have been tested for HIV. Gender differences in HIV testing may be explained, in part, by the fact that women come into contact with voluntary counseling and testing (VCT) sites at antenatal clinics and other reproductive health services. Traditional masculine roles cast men as risk takers who do not need or seek help or health services [41]. Such perceptions delay access to health care including HIV prevention services among men [42].

The racial difference in seeking HIV testing is worth mentioning. While African Americans and Hispanics are known to be disproportionately affected by the HIV epidemic in the United States, it is disturbing to note that Hispanics were significantly less likely than Caucasians to have been tested for HIV and the latter were less likely than African Americans to have been tested for HIV. This finding is in line with previous studies which showed that Hispanics were significantly less knowledgeable about the availability of antiretroviral treatment than White Americans and more likely to delay seeking HIV testing and care than the other ethnic groups [43-46]. The demographic importance of the Hispanic ethnic group and its vulnerability to HIV underscore the need for more studies to identify and address the root causes for delaying HIV testing.

This study has some limitations. Data on HIV testing were self-reported by participants without any attempts to validate the report through medical record review. How truthful will an adolescent be to an unknown interviewer over the phone? Like in many such surveys, recall bias

constitutes a big concern. Furthermore, only households with a telephone were eligible to participate in this survey; considering the low participation rate of 34%, there is a big concern about selection bias. Finally, since the BRFSS survey interviewed only people 18+ the results cannot be generalized to all adolescents.

## CONCLUSION

The low prevalence of adolescents who had been tested for HIV as well as the low proportion of those who had a rapid HIV test underscores the need for new interventions to address these issues. It is imperative for federal and state health officials to investigate and quickly address the impediments to the use of rapid HIV antibody test around the country in order to optimize its benefits.

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