A Population-Based Study of HIV Testing Practices and Perceptions in 4 U.S. States

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OBJECTIVE: To evaluate testing practices and perceptions of HIV risk among a geographically diverse, population-based sample of sexually active adults who reported behaviors that could transmit HIV.

DESIGN: Secondary analysis of the Centers for Disease Control and Preventions Behavioral Risk Factor Surveillance System (BRFSS) 2000 survey.

PATIENTS/PARTICIPANTS: Sexually active adults less than 50 years old, who completed the Sexual Behavior Module of the BRFSS 2000 survey administered in 4 U.S. states.

MEASUREMENTS AND MAIN RESULTS: Nineteen percent of the study population reported one or more behaviors in the past year that increased their risk of HIV infection (men 23%; women 15%). In this subgroup at any increased risk of HIV infection, 49% reported having had an HIV test in the past year. For 71% of those tested, the HIV test was self-initiated. Younger age was the only factor independently associated with whether or not individuals with behaviors that increased their risk of HIV infection had had a recent HIV test. Among the 51% of individuals at risk who reported no recent HIV test, 84% perceived their risk as low or none.

CONCLUSIONS: In this study, about half of the individuals who reported behaviors that could transmit HIV had not been recently tested for HIV. Of those not tested, most considered their risk of HIV to be low or none. Interventions to expand HIV testing and increase awareness of HIV risk appear to be needed to increase early detection of HIV infection and to reduce its spread.

KEY WORDS: HIV; HIV risk perception; HIV risk behaviors; sexual behavior; testing practices.

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Despite advances in our understanding of HIV transmission and the vastly improved efficacy of HIV treatment, the overall incidence of HIV in the U.S. remained constant throughout the 1990s: approximately 40,000 people become newly infected by HIV each year with a stable rate of transmission at 4%.¹ Moreover, during the last decade, the demographics of HIV infection have changed. Heterosexual transmission of HIV is a rapidly growing source of new AIDS cases and is the leading cause of HIV infection in women. Between 1999 and 2002, the incidence of HIV has increased in women, young people of color,² Hispanics and NonHispanic Whites, as well as among men who have sex with men.³

Since people who become aware that they are infected with HIV may adopt behaviors to prevent transmission to others⁴⁻⁶ and can start treatment to improve their clinical

course,⁷ periodic testing to detect early HIV infection is an important public health intervention and has been a recommendation of the U.S. Preventive Services Task Force since 1996.^{8,9} However, of an estimated 800,000 to 900,000 persons in the U.S. infected with HIV, as many as 275,000 may still be unaware of their HIV status.¹⁰

In 2001, the Centers for Disease Control and Prevention (CDC) published new guidelines for HIV testing and a strategic plan to decrease the incidence of HIV in the U.S. by at least 50% by 2005.^{10,11} The CDC's guidelines emphasized early knowledge of HIV infection, and proposed testing strategies based on local HIV prevalence rates and population demographics.

The purpose of this study was to evaluate HIV testing practices, and perceptions of HIV risk, among a geographically diverse, population-based sample of sexually active adults who reported behaviors that could transmit HIV in 2000. This population includes many of those most likely to benefit from the new CDC recommendations for HIV testing.

METHODS

Data Source and Study Population

Data for analyses were obtained from the 2000 Behavioral Risk Factor Surveillance System (BRFSS) nationwide survey. The CDC administers this annual, cross-sectional telephone survey in collaboration with U.S. states and territories. The survey collects data on preventive health practices and risk behaviors for chronic diseases from a random sample of U.S. adults aged 18 years and older. A clustering sample design is used to account for differences in the probability of selection and nonresponse in order to accurately derive U.S. and state-based population estimates. Annual surveys consist of a core set of questions that are asked in all states. The HIV/AIDS questions used for this study were core questions.

In addition to the core questions, individual states may also include one or more optional modules consisting of sets of questions about specific topics (e.g., skin cancer, diabetes, oral health). The 2000 survey included an optional module of questions on sexual behaviors, which was administered in Florida, Montana, Ohio, and South Dakota. The present study used questions from this Sexual Behavior Module to assess subjects' sexual activity and other HIV risk behaviors.

The study population included all sexually active adults between the ages of 18 and 49 years who completed the Sexual Behavior Module administered in the 4 states (Fig. 1).

The authors have no conflicts of interest to report.

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FIGURE 1. Flow chart of the selection of the study population (Numbers are unweighted). *Includes only subjects with nonmissing responses for age, sex, race, marital status, and education. †These Behavioral Risk Factor Surveillance System (BRFSS) respondents were not eligible for the BRFSS Module on sexual behavior. ‡Sexual intercourse with ≥ 2 partners in the past year or used intravenous drugs, had a sexually transmitted disease or anal sex without a condom in the past year, or tested positive for having HIV.

Measures

Sexual Activity. The first question of the BRFSS Sexual Behavior Module was, “During the past 12 months, with how many people have you had sexual intercourse?” Subjects were considered to be sexually active if they answered this question with a nonzero response. Subjects who answered “none” were not administered the remainder of the module and were therefore excluded from analyses.

HIV Risk. Questions from the Sexual Behavior Module used to assess HIV risk behaviors are shown in Table 1. A composite measure of “any increased risk of HIV infection” was defined based on report of sexual intercourse with 2 or more partners in the past year or a positive response to Question 4, which asked participants to indicate if they had used intravenous drugs, had a sexually transmitted disease, or anal sex without a condom, in the past year, or ever tested positive for HIV. Four overlapping groups of subjects were defined based on their responses to the 4 Sexual Behavior Module Questions listed in Table 1. These 4 overlapping groups characterized subjects according to specific behaviors that conferred varying degrees of risk for HIV transmission: (1) sexual intercourse with 2 or more partners in the past year, (2) sexual intercourse with 2 or more *new* partners in the past year, (3) sexual intercourse with 2 or more partners in the past year, without condom use (last

Table 1. BRFSS HIV-Related Measures

CORE BRFSS QUESTIONS

HIV Testing Practices

- (1) Have you been tested for HIV in the past 12 mo? “yes/no”
- (2) What was the main reason you had your last test for HIV?

Response options: “For hospitalization or surgical procedure, to apply for health insurance, to apply for life insurance, for employment, to apply for a marriage license, for military induction or military service, for immigration, just to find out if you were infected, because of referral by a doctor, because of pregnancy, referred by your sex partner, because it was part of a blood donation process, for routine check-up, because of occupational exposure, because of illness, because I am at risk for HIV”

Self-Perception of HIV Risk

What are your chances of getting infected with HIV, the virus that causes AIDS?

“High, Medium, Low, None, Not applicable, Refused”

SEXUAL BEHAVIOR MODULE QUESTIONS

HIV Risk Behaviors

- (1) During the past 12 mo, with how many people have you had sexual intercourse? “any number”
- (2) Was a condom used the last time you had sexual intercourse? “yes/no”
- (3) How many new sex partners did you have during the past 12 mo? “any number”
- (4) I’m going to read you a list. When I’m done, please tell me if any of the situations apply to you. You don’t need to tell me which one.
 - You have used intravenous drugs in the past year.
 - You have been treated for a sexually transmitted or venereal disease in the past year.
 - You tested positive for having HIV, the virus that causes AIDS.
 - You had anal sex without a condom in the past year.

Do any of these situations apply to you? “yes/no”

BRFSS, Behavioral Risk Factor Surveillance System.

time), and (4) either intravenous drug use, a sexually transmitted disease, or anal sex without a condom, in the past year or ever tested positive for HIV. Note that the fourth category could not be further subdivided because Question #4 did not distinguish individual characteristics.

Recent HIV Testing. The core BRFSS questionnaire included 2 questions about recent HIV testing (Table 1). Recent HIV testing was defined as self-report of having had an HIV test in the past year. HIV tests were then broadly grouped according to who initiated the testing. HIV tests were considered to have been initiated by others if they were conducted for hospitalization or surgical procedures, pregnancy, donation of blood, employment, military service, occupational exposure, or to apply for insurance or marriage license, or immigration. All other tests were considered to be “self-initiated.”

Self-Perceived HIV Risk. Subjects’ self-perception of HIV risk was based on their response to the core BRFSS question that asked: “What are your chances of getting infected with HIV, the virus that causes AIDS?” (Table 1). Responses were dichotomized into “high or medium” and “low or none” for these analyses.

Demographic Characteristics. The demographic characteristics of the study population were obtained from the BRFSS survey. Available information included subjects’ age, marital status (married/partnered, divorced/separated, widowed, never married), ethnicity (White, Black, Hispanic, Other), and education ($\leq$ High school/general education degree, at least some college).

Statistical Analysis

Using the study sample of sexually active men and women from the 4 states that administered the Sexual Behaviors Module (Fig. 1), we first described the demographic characteristics of those categorized as at “any increased risk of HIV infection” based on the composite measure defined above.

We then limited analyses to the group at “any increased risk of HIV infection”, and assessed the unadjusted association between demographic characteristics or specific behaviors that increased HIV risk, and recent HIV testing for the 4 states combined. To evaluate the effect of state HIV prevalence rates, we also compared HIV risk behaviors and testing practices in Florida, a state with a relatively high prevalence of HIV (207/100,000 in 2002) and Ohio, a state with a relatively low prevalence of HIV (79/100,000 in 2002).¹² South Dakota and Montana could not be included in state comparisons because of the small number of individuals who contributed to the study sample from those states. The χ^2 -test statistic was used for these analyses. Subsequently, the odds of having recently been tested for HIV were modeled in a multivariable logistic regression model, which included, as independent variables, measured demographic characteristics and specific behaviors known to increase risk of HIV transmission. Associations with *P*-values <.05 were considered statistically significant.

Secondary descriptive analyses were performed to understand self-perceptions of HIV risk among subjects who were classified as being at any increased risk of HIV infection, but reported no recent HIV test. Because of the relatively small numbers of subjects in various subgroups who had not had a recent HIV test, we were unable to adjust these secondary analyses for specific HIV risk behaviors.

Statistical analyses were performed using SUDAAN statistical software. This statistical program can account for the complex sampling design of BRFSS. All results have been weighted to account for selection probabilities and to reflect state population estimates.

RESULTS

Nineteen percent of the study population reported one or more behaviors in the past year that increased their risk of HIV infection, with more men than women reporting these behaviors (men 23% vs. women 15%). These respondents who were at “any increased risk of HIV infection” tended to be younger, less educated, and more likely to report both HIV testing and self-initiated HIV tests in the past year compared with those who reported no factors associated with increased risk of HIV infection (Table 2). Fourteen percent of the study population reported 2 or more sexual partners in the past year, including 8% who said they had 2 or more *new* sexual partners in the past year, and (an overlapping group) 6% who said they had 2 or more partners in the past year and did not use a condom the last time they had sexual intercourse. Men were significantly more likely than women to report 2 or more *new* sexual partners in the past year (men 13% vs. women 3%, $P<.001$), but men and women were equally likely to report 2 or more sexual partners in the past year and no condom use the last time they had sexual intercourse (6% for both men and women). Eight percent of the study population reported that they used injection drugs, were treated for a sexually transmitted disease, had anal sex without a condom in the past year, or were HIV positive.

Table 2. Characteristics of Sexually Active Adults from the 4 Participating States

	No HIV risk behaviors <i>N</i> =4,371,998* (80.7%) %	At least 1 HIV risk behavior <i>N</i> =1,042,596* (19.3%) %
Women	54.6	42.0
Age (y)		
18–29	30.5	56.3
30–39	42.8	28.4
40–49	26.7	15.4
Ethnicity		
White	71.8	62.1
Black	10.4	21.3
Hispanic	15.4	15.1
Other	2.4	1.5
Marital status		
Married/partnered	69.5	22.6
Divorced/Separated	12.6	24.8
Widowed	0.7	0.6
Never	17.2	51.9
Education		
≤ High school/GED	39.8	52.2
At least some college	60.2	48.8
HIV test in past year		
No test	65.2	51.2
Self-initiated HIV test	16.2	36.6
HIV test initiated by others	18.6	12.2

*Weighted estimate for the 4 U.S. States that administered the BRFSS Sexual Behavior Module.

BRFSS, Behavioral Risk Factor Surveillance System; GED, general education degree.

The remainder of the analyses was limited to those at any increased risk of HIV infection (19% of study population). In this subpopulation, 49% reported having had an HIV test in the past year, and 71% of those tests were self-initiated (Fig. 2). When asked about their main reason for getting an HIV test, 49% of those who had a self-initiated HIV test reported they did it “just to find out,” 34% said it was part of a routine check-up, 4% said it was because they were “at risk for HIV,” and 13% offered other reasons. Rates of reporting a recent HIV test varied by age. Over half (56%) of 18 to 29 year olds at any increased risk of HIV infection reported a recent HIV test, compared with only 33% of those aged 40 to 49 years. Sexually active subjects at any increased risk of HIV infection from Florida and Ohio did not differ significantly in their HIV testing practices. In Florida, 49% reported a recent HIV test with 76% being self-initiated, whereas in Ohio, 48% reported a recent HIV test, with 74% being self-initiated.

Bivariate analyses revealed that of the 19% of respondents at any increased risk of HIV infection, younger age ($P=.017$) and having 2 or more *new* sexual partners in the past year ($P=.014$) were significantly associated with having had a recent HIV test. In multivariable logistic regression analyses, younger age was the only factor independently associated with having had a recent HIV test after adjusting for other measured demographic characteristics and specific behaviors known to increase the risk of HIV infection (adjusted OR 0.95, 95% CI 0.92 to 0.99). No specific HIV risk behavior was significantly associated with having had a recent HIV test.

Fifty-one percent of sexually active adults in the 4 study states who were at any increased risk of HIV infection reported no HIV test in the past year. Among these individuals, 84%

FIGURE 2. Recent HIV testing by age among sexually active adults at any increased risk for HIV infection.

perceived their HIV risk to be low or none. Perception of HIV risk among those with no recent HIV test did not vary according to sexual behaviors in the past year. In addition, there were no significant associations between HIV risk perception and age, gender, state (Florida vs. Ohio), or other reported HIV risk behaviors in this subsample.

DISCUSSION

Nearly a quarter of sexually active men and 15% of sexually active women reported behaviors that could transmit HIV in this population-based study. Of those who reported one or more behaviors that could transmit HIV in the past year, approximately half reported not having had an HIV test in the past year. Rates of reporting a recent HIV test did not differ according to specific types of HIV risk behaviors. Younger adults were more likely to be tested than those in their forties. However, younger adults also made up the largest proportion of persons at risk for HIV infection who had not had a recent HIV test. Most individuals who reported HIV risk behaviors and also reported no recent HIV test perceived their risk as being low or none (84%).

Several limitations of the present study are noteworthy. First, the study population included only the 4 U.S. states that administered the BRFSS Sexual Behavior Module in 2000. Although the inclusion of these 4 states lends geographic variability, this study population is not representative of the entire U.S. population and does not include representation from the West Coast and Northeast. Further, the lack of significant differences in HIV testing practices between Florida and Ohio might reflect the relatively small sample of individuals with HIV risk behaviors in each state. Second, the BRFSS questions about HIV risk behaviors did not ask about the HIV risk factors of respondents' sexual partners. Knowledge of their partners' HIV status and risk behaviors could impact respondents' perception of their own HIV risk and this study could not take such knowledge into account. Third, since testing positive for HIV was one of the response options for Question 4 (Table 1), some respondents categorized as being at increased risk for HIV infection based on this question were already infected. These individuals could not be separated from the rest of the respondents who answered "yes" to this question, but when evaluating perception of HIV risk it would have been desirable to exclude HIV-positive individuals. Nevertheless, their specific risk behaviors remain relevant since they are at risk for transmitting HIV. A previous study, however, estimated that these individuals had negligible effect on results.¹³ Finally, as with all observational studies that rely on self-report, subjects

may have under- or over-reported their HIV risk behaviors and HIV testing practices. Given the sensitive nature of HIV risk behavior questions, subjects may have provided socially desirable responses leading to under-reporting of HIV risk behaviors. Consequently, this study may have underestimated the prevalence of HIV risk behaviors in the 4 study states. However, anonymous telephone surveys have been shown to collect sensitive data more accurately than face-to-face interviews.¹⁴ The strengths of the rigorous standardized administration of the BRFSS questionnaire also minimize bias.

Comparison of the results of this study with the findings of previous studies is complex because of different definitions of HIV risk behaviors and different study populations. Only one recent study and 2 older studies have utilized population-based survey data to estimate prevalence rates of HIV testing in populations at increased risk of HIV infection. Berrios et al. utilized the National AIDS Behavioral Survey in 1990 to 1991 to assess HIV risk and testing practices in several "high-risk" U.S. cities. In that study, approximately one-third of heterosexuals at risk (at least 2 sexual partners in the last 12 months and did not always use a condom during the last 6 months) reported having ever been tested for HIV, compared with 49% in the present study.¹⁵ Anderson et al.¹⁶ analyzed data from three nationally representative surveys, conducted from 1987 to 1996, that included questions about HIV. They found that, in general, rates of recent HIV testing were increased among those reporting HIV risk behaviors. However, testing rates among those at risk remained low, ranging from 17% to 34% depending on the year and the specific HIV risk behavior. Our higher rate of testing in 2000 (49%) might reflect changes over time, but also likely reflects differences in measures of risk and study population. Holtzman et al.¹³ used 1997 BRFSS data from 25 U.S. states to estimate the prevalence of HIV risk behaviors and their association with self-perception of risk, but did not assess recent HIV testing. The prevalence of HIV-related risk behaviors in that study was generally lower than in the present study since the former included subjects who were not sexually active, and perhaps as a consequence, perception of risk was correlated with estimates of actual risk based on self-reported behaviors.

The results of the present study, based on data from 2000, also update our knowledge regarding HIV testing practices and self-perception of risk and can thereby help guide current and future public health strategies. As noted above, despite public health efforts,^{17,18} the incidence of HIV infection in the U.S. has remained constant, HIV infection is still primarily diagnosed late in its course, and a large proportion of asymptomatic individuals who are infected with HIV do not know their HIV serostatus. Furthermore, the epidemiology of HIV infection has broadened beyond the traditional high-risk populations that have been targeted in the past. The present study found that most individuals who report behaviors that increase their risk for HIV do not consider themselves to be at risk and have not been recently tested. These findings suggest that more education is needed to increase awareness of HIV risk behaviors and the value of periodic HIV testing.

The results of this study also lend support for a potentially more important role that primary care providers may have in curbing the incidence of HIV in the U.S. While many individuals at increased risk for HIV infection receive primary care, previous studies have suggested that most primary care providers do not routinely assess patients' HIV risk.^{19,20} Primary

care providers may assume that those at risk for HIV infection will ask for HIV testing if they have not already obtained testing. Findings from this study suggest otherwise. Many individuals at risk of transmitting or contracting HIV infection had not been tested and in fact did not appear to recognize their HIV risk. This study therefore supports strategies that encourage health care providers to either routinely assess patients' behavioral risks for HIV or to routinely offer HIV testing as part of preventive health care. Since primary care providers are often patients' only contact with the health care system, such routine assessment could play a significant role in identifying patients who might otherwise unknowingly transmit HIV to others and in identifying HIV infection early in its course.

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