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HIV TESTING IN RECENT COLLEGE STUDENTS: PREVALENCE AND CORRELATES

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Prevalence and correlates of HIV testing were examined in a sample of 957 unmarried recent college students in the United States. Participants were asked about HIV testing, past-six-months sexual activities, lifetime treatment for sexually transmitted infections (STI), past-year health service utilization, and DSM-IV criteria for alcohol and other drug (AOD) dependence during the 2008–2009 academic year. Two in five ($41.9\%_{wt}$) were ever tested for HIV. Holding constant demographics, HIV testing was positively related to AOD dependence, frequency of unprotected sex, number of sex partners, having a physical exam by a medical professional, number of visits to a health provider for physical health problems, and lifetime STI treatment. Women were more likely than men to be tested for HIV despite similar levels of risky sex. Results demonstrate the feasibility of achieving high HIV testing rates in a college population.

Human Immunodeficiency Virus (HIV) remains a major public health challenge worldwide and a persistent risk to young people. One-third of all new HIV infections occur among people under age 30 (Prejean, Song, An, & Hall, 2008), and the number of new infections annually has changed little since the late 1990s (Hall et al., 2008). Of major concern is that, of the 1.1 million individuals living with HIV in the United States, one in five does not know they are infected (Campsmith, Rhodes, Hall, & Green, 2008). HIV testing can increase the proportion of HIV-infected individuals who are aware of their serostatus, and thus remains an important preventive measure in reducing HIV transmission. To that end, in 2006 the Centers for Disease Control and Prevention (CDC) revised its HIV testing guidelines to recommend universal opt-out testing for all adults visiting a health care setting, while still targeting

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high-risk individuals for more frequent repeat testing (Branson et al., 2006). The new approach reflects the changing face of HIV infection, which increasingly includes individuals traditionally considered lower risk, such as youth under age 20 (Ruiz et al., 2000), and it has the advantage of promoting testing even in individuals who are unlikely to seek HIV testing due to their low perceived risk, thus enabling them to access treatment at an earlier stage of disease and take steps to avoid transmitting the virus to others. Despite these efforts, the CDC recently estimated that more than half (55%) of U.S. adults ages 18 to 64 had never been tested for HIV, and in young adults ages 18 to 24, 66% remain untested, despite having similar HIV diagnosis rates as other adults (Johnson et al., 2010).

College students' HIV testing behaviors are important to understand, given their high rates of risky sexual behaviors (American College Health Association, 2010) and epidemiologic evidence of increasing heterosexual transmission of HIV (Centers for Disease Control and Prevention, 2010). Among students surveyed at 57 post-secondary institutions, 24% were tested for HIV at least once in their lifetime (American College Health Association, 2010), yet HIV testing rates in various college samples have ranged between 10% and 58% (Bontempi, Mugno, Bulmer, Danvers, & Vancour, 2009; Buhi, Marhefka, & Hoban, 2010; Crosby, Miller, Staten, & Noland, 2005; Marelich & Clark, 2004; Scholly, Katz, Gascoigne, & Holck, 2005; Thomas et al., 2008; Trieu, Modeste, Marshak, Males, & Bratton, 2010).

The behavioral correlates of HIV testing in college students are similar to the general population, and they generally reflect the previously recommended approach of targeting high-risk individuals. Individuals engaging in high-risk sexual behaviors, such as having sex without condoms (Bontempi et al., 2009; Mattson, 2002), using condoms infrequently (Bontempi et al., 2009), and having a greater number of sexual partners (Crosby et al., 2005; Thomas et al., 2008) are more likely to get tested for HIV, and these associations have been replicated in racially diverse samples (Thomas et al., 2008; Trieu et al., 2010). Demographically, HIV testing is higher for women (Crosby et al., 2005), members of racial and ethnic minorities (Buhi et al., 2010; Crosby et al., 2005), older students (Crosby et al., 2005; Thomas et al., 2008), and those with more years of schooling (Thomas et al., 2008).

Three potentially important correlates of HIV testing in college students remain understudied. First, heavy involvement with alcohol and other drugs (AOD)—and consequent risky sexual behaviors—is common in college students, yet their relationship with HIV testing has not been studied. Annually, 11% of full-time college students engage in unprotected sex as a result of drinking (American College Health Association, 2010), and in 2009, 43.5% engaged in binge drinking and 22.7% used illicit drugs (Substance Abuse and Mental Health Services Administration, 2010). Second, under current universal testing guidelines, one would expect health service utilization to predict increased likelihood of HIV testing. One study of students at historically Black colleges and universities (HBCU) supported this association (Thomas et al., 2008), but it remains to be seen whether or not it persists in other college populations. Third, it is expected that college students being treated for sexually transmitted infections (STIs) would have high rates of HIV testing, because the presence of an STI both increases the potential for contracting or transmitting HIV (Eng & Butler, 1997) and signals a pattern of HIV-risk behaviors. Thomas and colleagues (2008) found that students with an STI in the past year were more than twice as likely to have been tested for HIV. However, in most survey research, HIV and other STI testing are assessed as one variable, despite evidence that college students

perceive HIV testing as more serious than STI testing (Barth, Cook, Downs, Switzer, & Fischhoff, 2002).

This study documents the prevalence of HIV testing in a sample of young adults recently in college and examines the demographic and behavioral correlates of HIV testing. Three measures of health risk behaviors (AOD dependence, number of sex partners, and frequency of unprotected sex) and three measures of health service utilization (past-year physical exam, number of provider visits for health problems, and history of STI treatment) are hypothesized to be associated with greater likelihood of HIV testing.

METHODS

Data were collected as part of the College Life Study, an ongoing longitudinal study of 1,253 young adults originally ascertained as incoming first-time, first-year college students, ages 17 to 19, in 2004, at a large public university in an urban region of the mid-Atlantic United States (Arria et al., 2008; Vincent et al., 2012). After screening 82% of all incoming first-time, first-year students ages 17 to 19 at summer orientation (n = 3,401), a representative sample was selected for the longitudinal study. Individuals who used illicit drugs or nonmedically used a prescription drug at least once in high school were purposively oversampled to ensure adequate statistical power for analyses on drug use (Arria et al., 2008). Participants completed a two-hour baseline assessment (n = 1,253; 87% response rate), consisting of a personal interview and self-administered questionnaires sometime during their first year of college, and similar follow-up assessments annually thereafter, regardless of continued college attendance. Eighty-one percent (n = 1,019) completed the Year 5 assessment (2008–2009), from which the present study emanates. Participants provided written informed consent and received cash payments for each assessment. University IRB approval and a federal Certificate of Confidentiality were obtained.

SAMPLE

Of the 1,019 Year 5 participants, 1,003 completed all self-administered items on HIV testing and sexual activity. Thirty individuals responding "don't know" to the item on HIV testing were excluded, plus another 16 married individuals whose sexual activities were unlikely to be comparable to the unmarried majority. The final analytic sample was 957 individuals (ages 21 to 24, 54.2% female, 71.3% White; see Table 1).

MEASURES

HIV testing. Self-administered questions asked if participants had ever been tested for HIV, and whether or not they intended to be tested in the next year. Participants were not asked their HIV status. One individual voluntarily disclosed being HIV-positive in response to interview questions about health conditions.

AOD dependence. Dependence on alcohol and/or marijuana during the past year was assessed via standard methods (Substance Abuse and Mental Health Services Administration, 2003), following DSM-IV definitions (American Psychiatric Association, 1994). Responses were later consolidated into one dichotomous variable indicating AOD dependent and non-dependent.

TABLE 1. Sample Characteristics, by Lifetime History of HIV Testing among 957 Unmarried Recent College Students

	Never been tested for HIV		Tested for HIV		Total	
	(*n* = 502)		(*n* = 455)		(*n* = 957)	
	n	% or *M* (*SD*)	*n*	% or *M* (*SD*)	*n*	% or *M* (*SD*)
PERSONAL CHARACTERISTICS						
Gender***						
Female	228	45.4%	291	64.0%	519	54.2%
Male	274	54.6%	164	36.0%	438	45.8%
Race/ethnicity**						
White	368	73.3%	314	69.0%	682	71.3%
Black	36	7.2%	55	12.1%	91	9.5%
Asian	58	11.6%	31	6.8%	89	9.3%
Other	22	4.4%	30	6.6%	52	5.4%
Hispanic	18	3.6%	25	5.5%	43	4.5%
Age						
21	21	4.2%	30	6.6%	51	5.3%
22	376	74.9%	335	73.6%	711	74.3%
23	103	20.5%	89	19.6%	192	20.1%
24	2	0.4%	1	0.2%	3	0.3%
Sexual orientation***						
Non-heterosexual	13	2.6%	34	7.5%	47	4.9%
Heterosexual	489	97.4%	421	92.5%	910	95.1%
College enrollment status						
Not in school	296	59.0%	283	62.2%	579	60.5%
Part-time undergraduate	21	4.2%	27	5.9%	48	5.0%
Full-time undergraduate	73	14.5%	70	15.4%	143	14.9%
Graduate school	112	22.3%	75	16.5%	187	19.5%
Neighborhood income[a]	499	74.8 (34.3)	451	71.0 (32.4)	950	73.0 (33.4)
Religiosity						
Not Important	155	31.1%	154	34.1%	309	32.5%
Slightly Important	116	23.2%	103	22.8%	219	23.1%
Moderately Important	143	28.7%	115	25.5%	258	27.2%
Extremely Important	85	17.0%	79	17.5%	164	17.3%
HEALTH RISK BEHAVIORS						
Had at least 1 same-sex partner, lifetime***	13	2.6%	45	9.9%	58	6.1%
Number of same-sex partners, lifetime	13	4.8 (5.4)	45	7.4 (16.5)	58	6.8 (14.7)
Age at first same-sex encounter	13	17.9 (3.1)	45	17.8 (3.1)	58	17.8 (3.1)
Had at least 1 same-sex partner, past 6 months***	8	1.6%	27	5.9%	35	3.7%
Number of same-sex partners, past 6 months	8	2.4 (2.0)	27	2.9 (3.3)	35	2.8 (3.0)
Number of unprotected same-sex encounters, past 6 months	8	7.9 (17.1)	27	17.5 (31.7)	35	15.3 (29.1)
Had at least 1 opposite-sex partner, lifetime***	402	80.1%	427	93.8%	829	86.6%

Number of opposite-sex partners, lifetime***	402	5.1 (5.5)	427	9.4 (8.8)	829	7.3 (7.7)
Age at first opposite-sex encounter***	402	17.7 (1.9)	426	16.9 (1.7)	828	17.3 (1.8)
Had at least 1 opposite-sex partner, past 6 months***	350	69.7%	386	84.8%	736	76.9%
Number of opposite-sex partners, past 6 months***	350	1.4 (1.0)	386	1.8 (1.4)	736	1.6 (1.2)
Number of unprotected opposite-sex encounters, past 6 months[b,***]	341	22.2 (31.0)	377	32.2 (37.1)	718	27.4 (34.7)
Dependent on alcohol and/or marijuana**	32	6.4%	56	12.3%	88	9.2%
HEALTH SERVICE UTILIZATION						
Physical exam by medical professional, past year***	276	55.0%	331	72.7%	607	63.4%
Number of visits for physical health problems, past year**	502	1.7 (3.0)	455	2.7 (7.5)	957	2.2 (5.6)
Treated for STI, lifetime***	31	6.2%	93	20.6%	124	13.1%
Intent to get HIV test within next year (% Yes/Probably Yes)***	78	15.5%	245	53.8%	323	33.8%

Note. Statistically significant differences between tested and untested groups denoted as ***$p < .001$, **$p < .01$, *$p < .05$. [a] The mean adjusted gross income for each participant's home ZIP code during their last year in high school, measured in ten thousands. [b] Excludes 16 outliers with >180 opposite-sex encounters in the past 6 months.

Number of sex partners. Sexual behavior items were adapted from standard surveys (Centers for Disease Control and Prevention, 1997) and expanded to include same-sex activities and capture counts rather than ranges. Self-administered questions asked about both opposite-sex (i.e., "vaginal sex between a male and a female") and same-sex activities (i.e., "oral or anal sex with a partner of the same sex as yourself"), regardless of sexual orientation. Separate questions captured the number of same-sex and opposite-sex partners during the participant's lifetime and past six months.

Frequency of unprotected sex. Individuals with at least one same-sex partner in the past six months were asked how many times they had sex with any same-sex partner in the past six months, and in how many of those same-sex encounters a condom or other barrier was used. Frequency of unprotected same-sex encounters was later computed as the difference between protected and total encounters. Frequency of unprotected opposite-sex encounters was computed in a similar fashion. Sixteen individuals reporting greater than 180 opposite-sex encounters in the past six months were excluded from analyses as outliers.

Health service utilization. Interview questions assessed past-year physical examination by a medical professional (yes vs. no) and past-year number of visits to a medical health professional for physical health problems. Lifetime treatment for any STI (yes vs. no) was self-administered.

Personal characteristics. Sexual orientation, age at first sexual encounter, and religiosity (How important is religion in your life?; Sher & Rutledge, 2007) were self-reported. Gender was coded as observed. As a proxy for neighborhood income, the mean adjusted gross income for each participant's home ZIP code (i.e., parents' home) during the last year the participant was in high school was abstracted from

publicly available data (MelissaDATA, 2003). Current school enrollment status was asked for by interviewers. Race and ethnicity were self-reported, with multiple response options permitted. A five-level race/ethnicity variable was later created: Hispanic (regardless of race), White, Black, Asian, and "Other," which encompassed 52 non-Hispanic individuals endorsing either multiple (n = 26) or no available race/ethnicity options (n = 26). Age at interview was computed from date of birth.

STATISTICAL ANALYSES

Because individuals who used illicit drugs in high school were purposively oversampled (see above), it was necessary to statistically weight our prevalence estimates for HIV testing (denoted by $\%_{wt}$) so that they would be generalizable to the original target population. To that end, sampling weights were computed within each race-sex-drug use cell as the number of individuals in the sampling frame divided by the number of individuals in the sample. All remaining analyses were conducted using unweighted data to avoid artificially inflating statistical power. First, characteristics of individuals who were and were not tested for HIV were compared, and comparisons were evaluated for statistical significance using chi-square and one-way ANOVA, including the six hypothesized predictors of HIV testing (AOD dependence, unprotected sex, number of sex partners, past-year physical exam, number of provider visits in the past year, and lifetime STI treatment). Intercorrelations of gender and race/ethnicity with each of the six hypothesized predictors were examined. Next, a series of six multiple logistic regression analyses were conducted testing the associations between each of the six hypothesized predictors and HIV testing, holding constant gender, race/ethnicity, neighborhood income, and sexual orientation. (Due to the potential for multicollinearity amongst the six hypothesized predictors, they were never entered simultaneously in a combined model.) For any significant bivariate intercorrelations between the six hypothesized predictors and gender or race/ethnicity (as identified in the preceding step), the corresponding first-order interaction was also entered into the logistic regression model. Small cell sizes necessitated creating a combined Hispanic/Other category for use in the logistic regression modeling. Due to the small number of individuals engaging in same-sex activities, data on opposite- and same-sex activities were summed to compute overall variables on number of sex partners and unprotected sexual encounters.

RESULTS

SAMPLE CHARACTERISTICS

In Year 5, one in five participants was still in college, either full-time (14.9%) or part-time (5.0%; Table 1). Another 19.5% were in graduate school. The vast majority were heterosexual (95.1%). Most (76.9%) were sexually active with opposite-sex partners in the past six months. Few had sex with same-sex partners (6.1% lifetime, 3.7% past six months). Fewer men than women had lifetime same-sex experience (3.9% vs. 7.9%, $p < .01$), but their same-sex involvement in the past six months was similar (3.2% vs. 4.0%; Table 2). Notably, 110 individuals (11.5%) reported never having sex, several of whom had been tested for HIV (n = 15, 13.6%; not shown in table).

TABLE 2. Intercorrelations of Gender and Race/Ethnicity with Health Risk Behavior and Service Utilization Variables

	Gender			Race/Ethnicity					
	Women	Men	*p*	White	Black	Asian	Hispanic	Other	*p*
	(*n* = 519)	(*n* = 438)		(*n* = 682)	(*n* = 91)	(*n* = 89)	(*n* = 43)	(*n* = 52)	
Had at least 1 same-sex partner, past 6 months,[a] %	4.0%	3.2%	.485	2.9%	7.7%	2.2%	9.3%	3.8%	.047
Number of same-sex partners, past 6 months, *Mean (SD)*	1.7 (1.2)	4.4 (4.1)	.006	2.8 (3.3)	3.3 (3.4)	1.0 (0.0)	16.5 (16.1)	1.5 (.7)	.914
Number of unprotected same-sex encounters, past 6 months, *Mean (SD)*	19.0 (33.4)	9.8 (21.0)	.368	23.3 (36.0)	3.3 (5.3)	1.0 (1.4)	10.5 (16.5)	1.5 (.7)	.462
Had at least 1 opposite-sex partner, past 6 months,[b] %	79.2%	74.2%	.068	79.9%	65.9%	60.7%	72.1%	88.5%	<.001
Number of opposite-sex partners, past 6 months, *Mean (SD)*	1.6 (1.1)	1.7 (1.3)	.314	1.6 (1.2)	1.8 (1.2)	1.4 (.7)	1.6 (1.0)	1.6 (1.6)	.497
Number of unprotected opposite-sex encounters, past 6 months, *Mean (SD)*	27.4 (33.1)	27.4 (36.8)	.998	29.0 (35.6)	17.4 (25.1)	23.5 (35.3)	30.2 (35.5)	25.5 (32.7)	.130
Dependent on alcohol and/or marijuana, %	7.3%	11.4%	.029	9.2%	6.6%	4.5%	14.0%	17.3%	.079
Physical exam by medical professional, past year, %	70.5%	55.0%	< .001	61.6%	69.2%	62.9%	69.8%	73.1%	.271
Number of visits for physical health problems, past year,[c] *Mean (SD)*	2.6 (6.9)	1.6 (3.4)	.007	2.0 (3.9)	2.2 (4.9)	1.6 (2.8)	4.6 (19.2)	2.8 (5.0)	.034
Treated for STI, lifetime,[d] %	17.7%	7.6%	< .001	12.0%	15.7%	5.6%	27.9%	23.1%	<.001

Note. Count variables are restricted to individuals who had that type of partner in the past six months. [a] No pairwise comparisons by race/ethnicity were significant at $p < .05$. [b] Whites and Others were significantly different from both Blacks and Asians (all $p < .05$). [c] Whites and Asians were significantly different from Hispanics (both $p < .05$). [d] Whites were significantly different from Hispanics, and Asians were significantly different from Hispanics and Others (both $p < .05$).

PREVALENCE OF HIV TESTING

Nearly half the sample (n = 455, 47.5%) had been tested for HIV at least once in their life. After statistically adjusting for the sampling design, the corresponding weighted estimate was 41.9%$_{wt}$. HIV testing was more prevalent in women (49.8%$_{wt}$) than men (32.9%$_{wt}$), and non-heterosexuals (77.7%$_{wt}$) than heterosexuals (39.8%$_{wt}$). HIV testing was similarly high for Blacks (59.7%$_{wt}$), Hispanics (59.1%$_{wt}$), and Others (52.3%$_{wt}$), and lower for Whites (40.3%$_{wt}$) and Asians (28.3%$_{wt}$).

CORRELATES OF HIV TESTING

HIV testing was significantly related to gender, race/ethnicity, sexual orientation, lifetime and recent same-sex and opposite-sex activity, AOD dependence, having a physical exam in the past year, number of past-year provider visits for physical health problems, lifetime STI treatment, and plans to get tested for HIV in the next year (Table 1). For opposite-sex activities, HIV testing was significantly associated with earlier sexual debut, greater number of sex partners, and more unprotected sexual encounters. For same-sex activities, power was insufficient to detect significant differences. HIV testing was unrelated to age, neighborhood income, religiosity, and college enrollment status.

GENDER DIFFERENCES

Among those who engaged in same-sex activities during the past six months, men had more same-sex partners than women (4.4 vs. 1.7, p = .006; Table 2). No other gender differences were observed on the sexual behavior measures we tested. Women consistently differed from men on health service utilization variables, with more provider visits (2.6 vs. 1.6, p = .007), greater likelihood of lifetime STI treatment (17.7% vs. 7.6%, p < .001), and greater likelihood of a past-year physical exam (70.5% vs. 55.0%, p < .001). Men were more likely than women to exhibit AOD dependence (11.4% vs. 7.3%, p = .029).

RACE/ETHNICITY DIFFERENCES

Few significant race/ethnicity differences were found for sexual behaviors in the past six months. Blacks (65.9%) and Asians (60.7%) were less likely than either Whites (79.9%) or Others (88.5%, all p's < .05) to have had an opposite-sex partner, but among those who did, they had similar numbers of partners and unprotected encounters. The only race/ethnicity differences in health service utilization were that Hispanics had significantly more provider visits (4.6) than Whites (2.0) or Asians (1.6; both p < .05) and were more likely to have had STI treatment (27.9% vs. 12.0% and 5.6%, respectively; both p < .05).

LOGISTIC REGRESSION PREDICTING HIV TESTING

Men were half as likely as women to have been tested for HIV (*AOR* = .48, *95% CI* = .37–.62, p < .001; Table 3), controlling for race/ethnicity, sexual orientation, and neighborhood income. Both Blacks (*AOR* = 2.46, *95% CI* = 1.31–4.63, p = .005) and Hispanics/Others (*AOR* = 2.30, *95% CI* = 1.25–4.25, p = .008) were more than twice as likely as Asians to have been tested for HIV, and heterosexuals were one-third as likely as non-heterosexuals (*AOR* = .34, *95% CI* = .17–.66, p = .001). All other variables tested were significantly associated with greater likelihood of HIV testing, even holding constant sexual orientation, gender, neighborhood income, and race/ethnicity). AOD dependent individuals were 2.33 times as likely as non-dependent individuals to have been tested for HIV (*95% CI* = 1.45–3.75, p =

TABLE 3. Results of Logistic Regression Testing the Association of HIV Testing with Six Hypothesized Behavioral Predictor Variables, Holding Constant Personal Characteristics

	Bivariate		Multivariate	
	OR (95% CI)	*p*	*AOR (95% CI)*[a]	*p*[a]
PERSONAL CHARACTERISTICS				
Gender = Male	.47 (.36-.61)	< .001	.48 (.37-.62)	< .001
Race/ethnicity (Reference = Asian)				
Black	2.86 (1.56-5.24)	.001	2.46 (1.31-4.63)	.005
Hispanic/Other	2.57 (1.42-4.67)	.002	2.30 (1.25-4.25)	.008
White	1.60 (1.01-2.53)	.047	1.59 (.987-2.55)	.057
Race/ethnicity (Reference = White)				
Hispanic/Other	1.61 (1.04-2.49)	.031	1.45 (.93-2.27)	.103
Asian	.63 (.40-.99)	.047	.63 (.39-1.01)	.057
Black	1.79 (1.15-2.80)	.011	1.55 (.97-2.48)	.065
Heterosexual	.33 (.17-.63)	.001	.34 (.17-.66)	.001
BEHAVIORAL VARIABLES				
Dependent on alcohol and/or marijuana	2.06 (1.31-3.25)	.002	2.33 (1.45-3.75)	.001
Number of unprotected sexual encounters, past 6 months (in units of 10)	1.14 (1.09-1.19)	<.001	1.15 (1.10-1.20)	< .001
Number of sex partners, past 6 months	1.47 (1.31-1.66)	<.001	1.47 (1.30-1.67)	< .001
Physical exam by medical professional, past year	2.19 (1.67-2.87)	<.001	1.97 (1.48-2.61)	< .001
Number of visits for physical health problems, past year	1.06 (1.02-1.10)	.005	1.04 (1.01-1.08)	.027
Treated for STI, lifetime	3.92 (2.55-6.02)	<.001	3.09 (1.99-4.81)	< .001

Note. [a] Multivariate results for personal characteristics are adjusted for neighborhood income (not shown) and all other personal characteristics shown. Multivariate results for each behavioral variable are adjusted for neighborhood income (not shown) and all personal characteristics shown. Neighborhood income was not related to HIV testing in either bivariate or multivariate analyses.

.001), and individuals with STI treatment history were 3.09 times as likely (*95% CI* = 1.99–4.81, $p < .001$). The statistical effects of sexual orientation, gender, neighborhood income, and race/ethnicity were essentially unchanged regardless of inclusion of each behavioral variable, with the sole exception that when frequency of unprotected sex was held constant, the Black vs. White contrast became significant (*AOR* = 1.82, *95% CI* = 1.13–2.93, $p = .015$; not shown in table). Neighborhood income was the only variable tested that was not related to HIV testing (not shown in table).

Two significant first-order interactions were found. First, gender moderated the statistical effect of AOD dependence ($p = .005$) on HIV testing, such that dependence was more strongly associated with HIV testing in women than men. The estimated probability of HIV testing in dependent and non-dependent women was .94 and .66, respectively ($p < .001$), compared with .56 and .50 in men ($p = .386$). Second, gender interacted with STI treatment ($p < .001$) such that the estimated probability of HIV testing in men with and without a history of STI treatment was .91 and .43, respectively ($p < .001$), whereas in women the difference was less pronounced (.77 and .63, $p = .006$). Race/ethnicity did not interact significantly with any of the six behavioral variables tested.

DISCUSSION

In this study of young adults recently enrolled in college, 41.9%$_{wt}$ had been tested for HIV at some point in their lifetime, considerably more than previous estimates from national data on either college students (American College Health Association, 2010) or young adults (Johnson et al., 2010), but less than in one large study of HBCU (Thomas et al., 2008). These inconsistencies could be attributable to methodological differences or institutional differences in access to campus-based health services. As in previous studies, participants engaging in higher-risk sexual behaviors—including earlier sexual debut, more sexual partners, and more unprotected sex—were more likely to be tested for HIV. Results suggest modest success in adopting traditional HIV-testing strategies targeting high-risk individuals in this sample.

The finding that contact with health care providers—for either physical examination or STI treatment—was associated with greater likelihood of HIV testing adds to the small body of evidence that individuals who seek health services, especially campus health services, are more likely to be tested (Thomas et al., 2008). Another important contribution is the finding that HIV testing was positively associated with AOD dependence, which is not surprising given prior evidence that substance use and high-risk sexual behaviors are highly correlated (Brown & Vanable, 2007; Wechsler, Dowdall, Davenport, & Castillo, 1995). To the extent that HIV testing services were in higher demand among AOD-dependent individuals than their non-dependent counterparts—whether due to greater perceived susceptibility to contracting HIV, greater acceptability of HIV testing, or other reasons—findings suggest that AOD treatment programs might be an important setting for providing routine HIV testing, especially for women. Prior studies indicate that the availability of HIV testing (Chriqui, Terry-McElrath, McBride, & Eidson, 2008; Knudsen & Oser, 2009) and testing rates (Pollack & D'Aunno, 2010) are relatively low within these settings, yet one study of alcohol treatment clients documented high levels of sexual risk-taking and HIV infection, even in the absence of injection drug use (Woods et al., 2000). Further study is needed to understand the specific settings in which college students seek HIV testing.

Race/ethnicity differences were largely consistent with prior studies. By some measures, Blacks appeared to be at lower risk for HIV than Whites, such as by being less likely than Whites to have had an opposite-sex partner and having fewer unprotected sexual encounters. On the other hand, Blacks were more likely to have had a same-sex partner and to have a history of STI treatment or HIV testing. This apparently conflicting pattern of differences echoes prior findings from the most recent national study of college students, wherein Blacks had higher rates of HIV testing and STI, yet also had higher rates of protective behaviors like condom use (Buhi et al., 2010). Nationally, as in our sample, both Blacks and Hispanics are more likely than Whites to be tested for HIV (Duran, Beltrami, Stein, Voetsch, & Branson, 2008), whereas Asians remain less likely to be tested (Zaidi et al., 2005). Further research is needed to understand the factors underlying this association, such as possible race-related differences in attitudes and beliefs about HIV testing.

Results must be interpreted in light of certain limitations. All data were subject to self-report bias, and despite excellent follow-up rates, we cannot rule out the possibility of attrition bias. Participants were recruited from one university, so generalizability to other populations is limited. Although the overall sample was large, cell sizes were insufficient to permit comparisons amongst some minority groups, such as non-heterosexuals. Sexual risk behavior is a notoriously complex and difficult

construct to operationalize, and while we are confident in the validity of our measures, we must acknowledge their limitations. Because we had no information about sex partners' HIV status or testing behaviors, we could not account for differences in the relative HIV transmission risk associated with each partner or encounter, and therefore counted all sex partners and unprotected sexual encounters equally. We did not ask about all possible types of opposite-sex encounters (i.e., oral, anal) and cannot say how much we might have underestimated the number of opposite-sex partners or encounters in which vaginal sex did not occur.

Even with these limitations, this study has important strengths. Our method of measuring sexual behavior in self-reported numbers of encounters, both protected and unprotected, provides more precision and flexibility than many other standard methods that capture condom use frequency in subjectively defined ranges (e.g., "sometimes," "always") and permits meaningful comparisons between individuals having sex at very different frequencies. Other strengths include the large overall sample size and ability to examine the possible moderating effects of gender on the relationships between HIV testing and health risk behaviors and service utilization. Last, this study examines AOD dependence within the college population, a previously understudied correlate of HIV testing.

CONCLUSIONS

The finding that nearly half of our college-educated sample had been tested for HIV is encouraging and demonstrates the feasibility of achieving high rates of HIV testing in a college population. This finding reflects positively on the efforts of campus-based health services. The sample had broad access to HIV testing during the years they were enrolled: their campus health center was providing confidential testing via both rapid and traditional testing methods for a small fee on a walk-in basis at the lab during normal business hours, and interaction with a health care provider was not required. There is some evidence that access to testing on a college campus may increase testing rates. In one study of individuals seeking voluntary testing at a college health center, 73.1% said they would not have sought a HIV test had it not been offered on campus (Anastasi, Sawyer, & Pinciaro, 1999).

Despite this apparent success, the feasibility of achieving universal HIV testing on a college campus remains to be seen. The present sample had high levels of health service utilization, and although we did not ask participants if they ever opted-out of HIV testing when it was offered to them, it seems unlikely that this could account for a substantial proportion of the untested individuals. Moreover, the health center's standard practice was to conduct risk-based rather than universal HIV testing. The American College Health Association's (ACHA) most recent guidance on HIV prevention strategies (Hoban, Ottenritter, Gascoigne, & Kerr, 2003) was published before the CDC recommendation and makes no mention of universal testing. Yet HIV infection in young people remains a grave public health concern, with one in 1,000 young adults already infected according to recent estimates (Campsmith et al., 2008; Morris et al., 2006). Revision of ACHA guidance on HIV testing and enhanced provider outreach might be needed to encourage college health center providers to implement universal testing. Further study of college students' attitudes about HIV testing is also needed to inform the design of testing campaigns (Boshamer & Bruce, 1999).

In this study women were more likely than men to be tested for HIV, even controlling for their higher health service utilization, which extends prior evidence from college-student and young-adult populations (Buhi et al., 2010; Thomas et al., 2008; Ward, Barnes, Freeman, & Schiller, 2010). Considering that men account for 73% of new HIV infections nationally (Prejean et al., 2008), this finding underscores the need for continued outreach to increase HIV testing in young men. Present findings point to the importance of STI treatment settings in promoting HIV testing for men, especially considering that men tend to have less contact with health care providers in general relative to women, and therefore fewer opportunities for HIV testing. It is also likely that men might benefit from alternative outreach strategies that provide HIV testing outside medical settings.

A considerable proportion of our sample (17.7% of women, 7.6% of men) had undergone STI treatment, and while most of them (75%) were tested for HIV, it is surprising that so many were not. The American College of Physicians recognizes patients presenting for STI testing and treatment as a high-risk population for targeted HIV testing (Qaseem, Snow, Shekelle, Hopkins, & Owens, 2009), so any college student who does not undergo HIV testing while in care for STI treatment represents an important missed opportunity. Extrapolating to the entire U.S. population of 18.7 million undergraduate students in the U.S. (United States Department of Education, 2007), this figure translates to more than 600,000 untested individuals at high risk for HIV. Further research may be needed to understand the barriers to HIV testing in STI treatment situations.

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