# HIV and Hepatitis B Infection and Risk Behavior in Young Gay and Bisexual Men

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## SYNOPSIS

**Objectives.** To estimate the prevalence of and identify risk factors for human immunodeficiency virus type 1 (HIV-1) and hepatitis B virus (HBV) infections and unprotected anal intercourse among young homosexual and bisexual men.
**Methods.** The authors performed a cross-sectional analysis of data from a prospective cohort of 508 young gay and bisexual men ages 18–29.
**Results.** HIV-1 seroprevalence was 2.4%, with five (1.3%) of 390 college students and seven (6.0%) of 117 non-students infected. After adjusting for confounders, HIV-1 infection was associated with having a history of a sexually transmitted disease other than HIV-1 or hepatitis B. The prevalence of hepatitis B markers in unvaccinated men was 12.9%. The presence of hepatitis B markers in unvaccinated men was significantly associated with Asian ethnicity, off-campus residence, and history of a sexually transmitted disease other than HIV-1 or hepatitis B and inversely associated with recent non-intravenous drug use. Eighteen percent of the participants reported having had sex with women during the previous 12 months, and 26.4% reported a history of unprotected anal intercourse during the previous six months. Men who reported unprotected anal intercourse were more likely to have at least one steady partner, to have met their partners in anonymous settings, and to be identified as probably alcohol dependent.
**Conclusions.** Although the prevalence of HIV-1 infection among young homosexual and bisexual men in Boston was relatively low, the high rates of unprotected anal intercourse suggest a potential for future HIV-1 and hepatitis B transmission. Interventions should focus on young men with histories of sexually transmitted diseases, alcohol abuse, and depression.

Studies have shown that the incidence of human immunodeficiency virus type 1 (HIV-1) infection and the occurrence of HIV-1 risk behaviors have slowed among homosexual and bisexual men.[1] More recent studies have suggested, however, that homosexual and bisexual men have not entirely eliminated high risk sexual behavior: high rates among young gay men of both episodic[2] and ongoing[3,4] unsafe sex have been reported. In fact, HIV-1 transmission continues among some well educated and highly motivated homosexual men in the United States, as demonstrated in a recent study of gay men that found an annual seroincidence rate of 2.3%.[5]

Many investigators have linked both episodic and ongoing unsafe sex and subsequent HIV-1 infection to substance use, particularly use of alcohol, nitrite inhalants, and cocaine.[6,7] Young college-aged adults, both homosexual and heterosexual, may be at high risk for infection with HIV-1 because of opportunities to experiment with both substances and sexuality.

HIV-1 seroprevalence studies among college populations indicate that the prevalence of HIV-1 infection has been 0.20% since 1990.[9,10] Reported HIV-1 seroprevalence rates among adolescents and young adults in non-college settings[11] vary from 0.2% among patients seen in adolescent medicine clinics, 0.3% among inmates of juvenile detention centers and correctional facilities, and 0.5% among adolescents and young adult seen in sexually transmitted disease (STD) clinics, to 1.1% among adolescents and young adults seen in five homeless youth centers. The higher rates of HIV-1 among young adults who are not in college suggest that more information is needed regarding specific behaviors that increase gay and bisexual college students' risk of exposure to infected partners.

Lemp et al.[3] and Osmond et al.[8] conducted nonblinded seroprevalence studies among young homosexual and bisexual men ages 17 to 29 in San Francisco. Lemp et al. found the prevalence of HIV-1 to be 9.7% while Osmond et al. found the prevalence to be 17.9%. No information was reported regarding student status.

The Gayle et al.[9] and Edlin et al.[10] seroprevalence studies of college students found that infection with HIV-1 was associated with male gender and being more than 25 years old.

Infection with the hepatitis B virus (HBV) is another major health concern in this population. In the United States, 240,000 people become newly infected each year with HBV while approximately 6500 people die annually of liver cancer or failure related to HBV infection.[12,13] Prior to the HIV-1 epidemic, the prevalence of HBV infection among homosexually active males was over 50% in urban areas.[14–16] Since the early 1980s cohort studies have found a marked decrease in HBV seroincidence among gay men, associated with both the adoption of safer sexual practices and the introduction of a hepatitis B vaccine.[17] Unfortunately, there has been a paucity of HBV seroprevalence data on younger gay men who may have become sexually active more recently.

The purpose of our study was twofold: (*a*) to estimate the prevalence of HIV-1 and hepatitis B (HBV) infection among young homosexual and bisexual men in Boston as well as the prevalence in this population of a specific high risk behavior, unprotected anal intercourse, and (*b*) to identify predictors of the risk for HIV-1, HBV, and unprotected anal intercourse among this group.

## Methods

**Participants.** Men eligible for the study met the following criteria: *(a)* They reported having sex with men or identified themselves as homosexual. (*b*) They were enrolled in an accredited college in the Boston area and were younger than 30 years old or, if not students, they were 18 to 24 years old.

The student participants were recruited through outreach efforts targeted at college campuses in the greater Boston area. Specifically, all 23 area college campuses with 400 or more male students were contacted, and administrative permission or Institutional Review Board approval was obtained from 17 of these 23 schools. Staff members in the offices of the Deans of Students provided information on gay, lesbian, and bisexual organizations on campus, and one or more campus outreach workers were hired at each of the 17 campuses.

Additional participants were recruited by outreach staff members from the following sites: (*a*) the Fenway Community Health Center, a community health center that provides services primarily to homosexual and bisexual clients, and (*b*) seven local gay nightclubs found to be popular among gay young college men during focus group sessions. Specifically, study staff approached all male clients under the age of 25 seen at the Fenway Community Health Center from November 1, 1992, through January 31, 1994, and asked them to participate in the study. Study staff also approached all bar patrons at seven bars during selected evenings, explained the purpose of the study, and asked if they would be willing to participate. In both settings, any prospective eligible individual who expressed interest in the study were immediately scheduled for a study visit. In addition, advertisements for the study were placed in local newspapers oriented to the gay community.

At the study visit, all eligible and interested men signed an informed consent form. We used a modified snowball technique[18] to identify additional participants; once recruited, participants were offered incentives (a voucher worth ten dollars) to recruit other young men who met our study criteria.

**Data collection.** All participants were privately interviewed at the Fenway Community Health Center. We used a standardized questionnaire to obtain information regarding their sociodemographic characteristics, substance use, and sexual behavior. Information was collected regarding age, ethnicity (Asian, black, Hispanic, white, or "other"), student status (undergraduate or graduate student), years of education, college attended, type of housing (dormitory, fraternity, apartment, house), employment (full- or part-time), income, health insurance, and site of primary care. In addition, we used a scale developed by Fisher[19] to assess self-acceptance of homosexuality (a continuous measure) and, to identify depression, the Center for Epidemiologic Studies Depression (CES-D) scale.[20]

**Measures of substance use.** We asked about frequency of alcohol use, including average daily volume. To measure alcohol dependence, we used the CAGE questionnaire,[21] a

series of four questions (*C*ut down, *A*nnoyed, *G*uilty, *E*ye-opener). A person with two or more positive responses was coded "probably alcohol dependent." We also obtained self-reports of frequency of use during the previous six months of the following drugs: marijuana, nitrite inhalants, amphetamines, lysergic acid diethylamide (LSD), barbiturates and tranquilizers, cocaine (both powder and crack), ketamine hydrochloride ("Special K"), methylendioxyamphetamine ("Ecstasy"), and other inhaled or ingested substances as well as any history of drug injection. For the purpose of this analysis, we coded substance use during the previous six months as "any" or "none." In addition, participants were asked how many times they had ever injected drugs or substances (including steroids) under their skin or into their veins.

**Data on sexual practices.** Measures of sexual behavior included self-reported number of male and female partners in the previous six months, year, and lifetime; self-reported frequency of sex (defined as oral or anal penetration) with both steady and non-steady partners during the previous six months; self-reported monogamy or non-monogamy; and descriptions of partner meeting places.

Partners were defined as people with whom respondents had sexual encounters involving oral or anal penetration, not simply kissing or mutual masturbation. A steady partner was defined as someone with whom the respondent had sex three or more times during the previous six months. Partner meeting places were coded as "anonymous" or "other," with "anonymous" places defined as bathhouses, restrooms, gyms, bookstores, movies, parks, the street, or other public places, based on focus group discussions.

To further understand risk behaviors in the context of type of partner, we also specifically asked about unprotected insertive or receptive anal intercourse without a condom with steady and non-steady partners.

**History of sexually transmitted diseases (STDs).** Participants were asked if they had ever been diagnosed by a medical provider with the following STDs: syphilis, gonorrhea, venereal warts, herpes simplex, or chlamydia. A person giving a positive response was defined as having a history of the disease.

**Laboratory studies.** All participants were given HIV pre- and post-test counseling following Centers for Disease Control guidelines and were tested for the presence of antibodies to HIV-1 (Abbott Laboratories, North Chicago IL); samples found repeatedly seroreactive were confirmed by Western blot assay. Tests for hepatitis B markers (hepatitis B surface antigens and surface and core antibodies; Abbott Laboratories, North Chicago IL) and present and past syphilis infection (RPR Card Antigen Suspension; Hynson, Westcott & Dunning, Becton Dickinson and Company, Cockeysville MD) were performed on the 361 college students recruited from college campuses. Any participant who was determined to have antibodies to HIV-1 was referred to the HIV clinical service of the Fenway Community Health Center.

**Data analysis.** Three outcome measures of interest were evaluated: (*a*) infection with HIV-1, (*b*) hepatitis B serologic markers, and (*c*) self-reported unprotected insertive or receptive anal intercourse with steady *or* non-steady partners.

The exact binomial method[22] was used to calculate 95% confidence intervals (CIs) for estimates of the prevalence of HIV-1, hepatitis B, syphilis, and unprotected anal intercourse. Three sets of crude and adjusted analyses were performed to identify factors associated with HIV-1, hepatitis B, and unprotected anal intercourse. Odds ratios and their corresponding 95% CIs were calculated for the association of these outcomes with sociodemographic factors, educational status, substance use, and sexual behaviors. Chi square tests of homogeneity were used for variables with more than two categories. For continuous variables, such as average daily volume of alcohol consumed, t-tests were performed on raw, square root, or log-transformed data. Separate logistic regression models were developed for each outcome and included all variables related to the outcome at the $P \leq 0.10$ level in the crude analysis as well as additional known confounding variables (unprotected anal intercourse, history of a sexually transmitted disease) for HIV-1 and HBV infection. Adjusted odds ratios and their corresponding 95% CIs for hepatitis B markers and unprotected anal intercourse were estimated from the logistic regression analysis using the method of maximum likelihood. An additional adjusted analysis was repeated using the logit method with precision-based CIs.[23]

The role that depression and alcohol use play in unsafe sex is important from a prevention standpoint.

## Results

**Demographics.** A total of 508 men participated in the study between November 1992 and January 1994. The average age was 23.3 years (standard deviation [*s*] 3.0, range 18–29); most (393, or 77%) were white. There was no significant age difference between students and non-students.

Participants had an average of 15.6 ($s$=2.6) years of education. Most (390, or 76.4%) were full- or part-time students, of whom 388 were in an accredited degree program. Almost all (456, or 89.9%) had some form of health insurance.

Fifty-three percent (267) of the 598 respondents were recruited from college campuses. Fourteen percent (73) were recruited through nightclub outreach efforts, 10% (50) from the Fenway Community Health Center, and 8% (43) through advertisements. The remainder (15%) were enrolled through friends and acquaintances of study participants.

**Prevalence of HIV-1, hepatitis B, and syphilis.** Overall, the prevalence of HIV-1 was 2.4% (95% CI 1.0, 3.7). Assays for hepatitis B and syphilis markers were performed for 361 of the 390 college students. Excluding 44 men who had received the hepatitis B vaccine, the prevalence of hepatitis B markers in this subset was 12.9% (95% CI 9.2, 16.6); one person had a syphilis marker (0.3%, 95% CI 0.01, 1.70%). Among the 41 with hepatitis B markers, 23 (56%) were positive for core antibody, four (9.8%) were positive for both core antibody and surface antigen, nine (22%) were positive for surface antibody, and five were borderline positive for surface antibody (12.1%).

**Predictors of HIV-1 infection.** HIV-1 infection was associated with not being a student, having a history of at least one STD other than HIV-1 or hepatitis B, having more than 10 lifetime sexual partners, and non-intravenous drug use within the previous six months (Table 1). Variables that were not significantly associated with HIV-1 infection included year in school and meeting partners in anonymous places (Table 1). None of the six respondents who gave a history of injection drug use were infected with HIV-1.

Because of the relatively small number of HIV-1 infected people, a series of logit models was developed using the following variables: age, student status, history of an STD, recent non-injection drug use, and more than 10 lifetime sexual partners. After controlling for these confounders, we found that a history of an STD (odds ratio [OR]=11.91) was the only variable significantly associated with HIV-1 infection (Table 1). Student status (OR=3.19) was also associated with HIV-1 infection, although of borderline significance. Having engaged in unprotected anal intercourse in the past six months was not associated with HIV-1 infection.

**Predictors of HBV infection.** Table 2 includes the results of both the crude and adjusted analyses of factors associated with hepatitis B markers among college students. In the crude analysis, type of student residence (OR=2.35), Asian ethnicity (OR=4.78), a recent history of unprotected receptive anal intercourse (OR=2.44), a history of an STD other than hepatitis B (OR=2.24), and more than 10 lifetime sexual partners (OR=2.09, Table 2) were found to be associated with having antibodies to hepatitis B. In addition, recent non-intravenous drug use was found to be negatively associated with having hepatitis B markers (OR=0.42). After adjusting for confounders using logistic regression, we found that college students with hepatitis B markers were more likely to live in an apartment than in other types of housing (OR=2.43), to be of Asian ethnicity (OR=8.16, compared with non-Asian ethnic groups), to have a history of an STD (OR=3.11), or to have had more than 10 sexual partners in their lifetimes (OR=2.29); they were also significantly less likely to have used non-intravenous drugs in the previous six months (OR=0.29; see Table 2).

Of the 317 unvaccinated men, 41 (12.9%) had serological markers for hepatitis B. Of these 41 unvaccinated college students with markers for hepatitis B, 12 (29%) were of Asian ethnicity. Two reported a history of HBV infection, while for the remaining 10, it was impossible to determine if they had acquired the infection perinatally or from sexual contact. In a comparison of the 12 unvaccinated Asian men with hepatitis B markers and the 29 unvaccinated men of other ethnicities with hepatitis B markers, we found the Asian men to be significantly less likely to have a history of other STDs, less likely to have used non-injection drugs in the previous six months, more likely to be younger than 23, and less likely to meet their sexual partners in anonymous places. No significant differences were found between Asian men with and without markers for hepatitis B. Accordingly, we performed the logistic regression analysis excluding Asian men and found that the presence of hepatitis B markers continued to be associated with a history of other STDs (OR=2.99, 95% CI 1.08, 8.34) and negatively associated with recent non-injection drug use (OR=0.39, 95% CI 0.16, 0.95).

**Sexual behavior.** In all, 466 men (91.2%) reported having had one or more sex partners in the previous six months. Of these, 134 (26.4%, 95% CI 22.0, 30.0) reported a history of unprotected anal intercourse during the previous six months. These 466 men reported having had an average of 43 ($s$=165) male sexual partners in their lifetimes and 5.3 ($s$=10.3) male sexual partners in the previous six months. Ninety-two (18%) of the 508 participants reported having had sex with women during the previous 12 months; 55 (10.8%) said they had had sex with one or more women in the previous six months, with an average of 2.2 female partners in that time period. Sixteen percent said they were in a mutually monogamous relationship.

**Predictors of unprotected anal intercourse.** In the crude analysis, variables found to be significantly associated with self-reported unprotected anal intercourse in the previous six months included: not being a student (OR=2.11), recent cocaine use (OR=2.57), having at least one steady partner in the previous six months (OR=3.65), probable alcohol abuse (OR=1.95), depression as measured by the CES-D scale (OR=1.70), more than 10 lifetime sexual partners (OR=1.96), and meeting partners in anonymous settings (OR=1.64; see Table 3). In addition, men who said they had unprotected anal intercourse during the previous six months

**Table 1. Risk of HIV-1 infection, young homosexual and bisexual men, Boston, November 1992 to January 1994 (*N*=507)[a]**

| Variable | Total[b] | HIV positive n=12 | | Crude odds ratios | 95% CI | Adjusted[c] odds ratios | 95% CI |
|---|---|---|---|---|---|---|---|
| | | Number[b] | Percent of total | | | | |
| Age | | | | | | | |
| 18–22 | 172 | 0 | 0 | 1.00 | ... | 2.20 | 0.44,11.00 |
| 23–29 | 335 | 12 | 3.6 | 13.3 | 0.78,250 | ... | ... |
| Currently in school | | | | | | | |
| No | 117 | 7 | 6.0 | 4.90 | 1.69,14.08 | 3.19 | 0.88,11.60 |
| Yes | 390 | 5 | 1.3 | 1.00 | ... | ... | ... |
| Undergraduate | 215 | 2 | 0.9 | 1.00 | ... | ... | ... |
| Graduate | 175 | 3 | 1.7 | 1.86 | 0.31,10.99 | ... | ... |
| Type of residence | | | | | | | |
| Dormitory or fraternity | 132 | 2 | 1.5 | ... | ... | ... | ... |
| Apartment | 294 | 7 | 2.4 | ... | ... | ... | ... |
| House | 80 | 3 | 3.8 | ... | ... | ... | ... |
| Site for majority of health care | | | | | | | |
| Health center | 335 | 10 | 3.0 | ... | ... | ... | ... |
| Other | 115 | 2 | 1.7 | ... | ... | ... | ... |
| No care | 56 | 0 | 0.0 | ... | ... | ... | ... |
| Health insurance | | | | | | | |
| Private | 218 | 4 | 33.3 | ... | ... | ... | ... |
| HMO | 70 | 1 | 1.4 | ... | ... | ... | ... |
| Medicaid/no insurance | 61 | 4 | 6.6 | ... | ... | ... | ... |
| School health plan | 158 | 3 | 1.9 | ... | ... | ... | ... |
| Ethnicity | | | | | | | |
| Asian | 41 | 1 | 2.4 | ... | ... | ... | ... |
| Black | 19 | 1 | 5.3 | ... | ... | ... | ... |
| Hispanic | 34 | 0 | 0.0 | ... | ... | ... | ... |
| White | 393 | 9 | 2.3 | ... | ... | ... | ... |
| Other | 20 | 1 | 5.0 | ... | ... | ... | ... |
| Type of partners (*n*=465) | | | | | | | |
| Nonsteady only | 71 | 3 | 4.2 | 1.00 | ... | ... | ... |
| Steady only or both | 394 | 9 | 2.3 | 0.53 | 0.14,1.97 | ... | ... |
| Unprotected receptive anal sex within 6 months | | | | | | | |
| Yes | 97 | 3 | 3.1 | 1.42 | 0.38,5.33 | | |
| No | 410 | 9 | 2.2 | 1.00 | ... | ... | ... |
| Sexually transmitted disease | | | | | | | |
| Yes | 75 | 9 | 12.0 | 19.5 | 7.32,51.96 | 11.91 | 3.00,46.89 |
| No | 432 | 3 | 0.7 | 1.00 | ... | ... | ... |
| Drug use within 6 months | | | | | | | |
| Yes | 246 | 9 | 3.7 | 3.27 | 0.94,11.40 | 1.73 | 0.52,9.30 |
| No | 261 | 3 | 1.1 | 1.00 | ... | ... | ... |
| Number of male partners in lifetime (*n[HIV-positive]*=11) | | | | | | | |
| 1–10 | 246 | 0 | 0.0 | 1.00 | ... | ... | ... |
| More than 10 | 246 | 11 | 4.5 | 24.07 | 1.41,410.84 | 2.06 | 0.48,8.80 |
| Met partner(s) in anonymous places[d] | | | | | | | |
| Yes | 152 | 4 | 2.6 | 1.17 | 0.35,3.95 | ... | ... |
| No | 355 | 8 | 2.2 | 1.00 | ... | ... | ... |

[a]The sample size for this analysis is 507 because one respondent refused to be tested for HIV.

[b]Totals vary because some respondents did not answer every question.

[c]Calculations based on logit method.

[d]As suggested by focus groups, anonymous places were defined as bathhouses, restrooms, gyms, bookstores, movies, parks, the street, or other public places.

CI = confidence interval

HMO = health maintenance organization

**Table 2. Risk of hepatitis B infection, homosexual and bisexual male college students, Boston, November 1992 to January 1994 (*N*=317)[a]**

| Variable | Total[b] | HB positive from infection n=41 | | Crude odds ratios | 95% CI | Adjusted odds ratios | 95% CI |
|---|---|---|---|---|---|---|---|
| | | Number[b] | Percent of total | | | | |
| Age | | | | | | | |
| 18–22 | 116 | 13 | 11.2 | 1.00 | ... | ... | ... |
| 22–29 | 201 | 28 | 13.9 | 1.28 | 0.64,2.59 | ... | ... |
| Student status | | | | | | | |
| Undergraduate | 173 | 20 | 11.6 | 1.00 | ... | ... | ... |
| Graduate | 144 | 21 | 14.6 | 1.31 | 0.68,2.52 | ... | ... |
| Type of residence | | | | | | | |
| Dormitory or fraternity | 107 | 7 | 6.5 | ... | ... | ... | ... |
| Apartment | 169 | 29 | 17.2 | 2.35 | 1.17,4.72 | 2.43 | 1.04,5.70 |
| House | 40 | 5 | 12.5 | ... | ... | ... | ... |
| Site for majority of health care | | | | | | | |
| Health center | 215 | 27 | 12.6 | ... | ... | ... | ... |
| Other | 63 | 7 | 11.1 | ... | ... | ... | ... |
| No care | 39 | 7 | 17.9 | ... | ... | ... | ... |
| Type of health insurance | | | | | | | |
| Private | 138 | 14 | 10.1 | ... | ... | ... | ... |
| HMO | 26 | 1 | 3.9 | ... | ... | ... | ... |
| Medicaid/no insurance | 19 | 3 | 15.8 | ... | ... | ... | ... |
| School health plan | 134 | 23 | 17.2 | ... | ... | ... | ... |
| Ethnicity | | | | | | | |
| Asian | 34 | 12 | 35.3 | 4.78 | 2.26,10.08 | 8.16 | 2.92,22.75 |
| Black | 12 | 1 | 8.3 | ... | ... | ... | ... |
| Hispanic | 24 | 2 | 8.3 | ... | ... | ... | ... |
| White | 233 | 21 | 9.0 | ... | ... | ... | ... |
| Other | 14 | 5 | 35.7 | ... | ... | ... | ... |
| Type of partners (*n*=283) | | | | | | | |
| Nonsteady only | 49 | 3 | 6.1 | 1.00 | ... | ... | ... |
| Steady only or both | 234 | 34 | 14.5 | 2.61 | 0.80,8.53 | 2.49 | 0.64,9.60 |
| Unprotected receptive anal sex within 6 months | | | | | | | |
| Yes | 47 | 11 | 23.4 | 2.44 | 1.15,5.21 | 1.57 | 0.64,3.86 |
| No | 270 | 30 | 11.1 | 1.00 | ... | ... | ... |
| Other sexually transmitted disease | | | | | | | |
| Yes | 35 | 8 | 22.9 | 2.24 | 0.95,5.24 | 3.11 | 1.11,8.76 |
| No | 282 | 33 | 11.7 | 1.00 | ... | ... | ... |
| Drug use within 6 months | | | | | | | |
| Yes | 140 | 11 | 7.9 | 0.42 | 0.20,0.85 | 0.29 | 0.12,0.67 |
| No | 177 | 30 | 16.9 | 1.00 | ... | ... | ... |
| Number of male partners in lifetime (*n*=304; *n[HIV-positive due to infection]*=37) | | | | | | | |
| 1–10 | 132 | 22 | 16.7 | 1.00 | ... | ... | ... |
| More than 10 | 172 | 15 | 8.7 | 2.09 | 1.05,4.18 | 2.29 | 0.98,5.36 |
| Met partner(s) in anonymous places[b] | | | | | | | |
| Yes | 80 | 8 | 10.0 | 0.69 | 0.30,1.55 | ... | ... |
| No | 237 | 33 | 13.9 | 1.00 | ... | ... | ... |

[a]Totals vary because some respondents did not answer every question.

[b]As suggested by focus groups, anonymous places were defined as bathhouses, restrooms, gyms, bookstores, movies, parks, the street, or other public places.

**Table 3. Unprotected anal intercourse, young homosexual and bisexual men, Boston, November 1992 to January 1994 (*N*=508)**

| Variable | Total[b] | Unprotected anal sex n=134 | | Crude odds ratios | 95% CI | Adjusted[c] odds ratios | 95% CI |
|---|---|---|---|---|---|---|---|
| | | Number[b] | Percent of total | | | | |
| Age | | | | | | | |
| 18–22 | 173 | 49 | 28.3 | 1.00 | ... | ... | ... |
| 23–29 | 335 | 85 | 25.4 | 0.86 | 0.57,1.30 | ... | ... |
| Currently in school | | | | | | | |
| No | 117 | 45 | 38.5 | 2.11 | 1.37,3.28 | 1.53 | 0.94,2.47 |
| Yes | 391 | 89 | 22.7 | 1.00 | ... | ... | ... |
| Undergraduate | 216 | 54 | 25.0 | 1.00 | ... | ... | ... |
| Graduate | 175 | 35 | 20.0 | 0.75 | 0.46,1.21 | ... | ... |
| Type of residence | | | | | | | |
| Dormitory or fraternity | 133 | 30 | 22.6 | ... | ... | ... | ... |
| Apartment | 294 | 82 | 27.9 | ... | ... | ... | ... |
| House | 80 | 22 | 27.5 | ... | ... | ... | ... |
| Site for majority of health care | | | | | | | |
| Health center | 336 | 98 | 29.2 | ... | ... | ... | ... |
| Other | 115 | 23 | 20.0 | ... | ... | ... | ... |
| No care | 56 | 12 | 21.4 | ... | ... | ... | ... |
| Type of health insurance | | | | | | | |
| Private | 218 | 53 | 24.3 | ... | ... | ... | ... |
| HMO | 70 | 21 | 30.0 | ... | ... | ... | ... |
| Medicaid/no insurance | 61 | 26 | 42.6 | ... | ... | ... | ... |
| School health plan | 159 | 34 | 21.4 | ... | ... | ... | ... |
| Ethnicity | | | | | | | |
| Asian | 42 | 12 | 28.6 | ... | ... | ... | ... |
| Black | 19 | 7 | 36.8 | ... | ... | ... | ... |
| Hispanic | 34 | 8 | 23.5 | ... | ... | ... | ... |
| White | 393 | 102 | 25.9 | ... | ... | ... | ... |
| Other | 20 | 5 | 25.0 | ... | ... | ... | ... |
| Used cocaine within 6 months | | | | | | | |
| Yes | 37 | 17 | 45.9 | 2.57 | 1.33,4.98 | ... | ... |
| No | 471 | 117 | 24.8 | 1.00 | ... | ... | |
| Type of partners | | | | | | | |
| Nonsteady only | 71 | 8 | 11.3 | 1.00 | ... | ... | ... |
| Steady only or both | 395 | 125 | 31.6 | 3.65 | 1.77,7.53 | 4.62 | 1.92,11.11 |
| Alcohol problems | | | | | | | |
| Yes | 122 | 45 | 36.9 | 1.95 | 1.26,3.01 | 1.80 | 1.12,2.89 |
| No | 373 | 86 | 23.1 | 1.00 | ... | ... | ... |
| Depression | | | | | | | |
| Yes | 224 | 72 | 32.1 | 1.70 | 1.14,2.52 | 1.44 | 0.93,2.24 |
| No | 284 | 62 | 21.8 | 1.00 | ... | ... | ... |
| Number of male partners in lifetime | | | | | | | |
| 1–10 | 247 | 51 | 20.6 | 1.00 | ... | ... | ... |
| More than 10 | 246 | 83 | 33.7 | 1.96 | 1.31,2.93 | ... | ... |
| Met partners in anonymous places[b] | | | | | | | |
| Yes | 152 | 54 | 35.5 | 1.90 | 1.26,2.87 | 1.66 | 1.07,2.60 |
| No | 356 | 80 | 22.5 | 1.00 | ... | ... | ... |

[a]Totals vary because some respondents did not answer every question.

[b]As suggested by focus groups, anonymous places were defined as bathhouses, restrooms, gyms, bookstores, movies, parks, the street, or other public places.

CI = confidence interval

HMO = health maintenance organization

were less likely to have accepted their homosexuality (Fisher scale score of 32.4 versus 34.6, $P \leq 0.05$). In an initial logistic regression model using all of the significant predictors listed above, cocaine use (OR=1.36) and a history of 10 or more sexual partners (OR=1.46) were no longer found to be statistically significant. After excluding these two variables from the model, we found that having had at least one steady partner in the previous six months (OR=4.62), probable alcohol dependency (OR=1.80), meeting partners in anonymous settings (OR=1.66), and low acceptance of homosexuality remained significantly associated with recent unprotected anal intercourse (Table 3). Non-students (OR=1.53) and depressed people (OR=1.44) were also somewhat more likely to have had unprotected anal intercourse during the previous six months, although these effects were not statistically significant (Table 3).

## Discussion

In this study of young homosexual and bisexual men in Boston, we found that although the prevalence of HIV-1 infection was relatively low, hepatitis B serologic markers and self-reported unprotected anal intercourse were quite prevalent. The pattern we observed suggests that lifetime measures of sexual risk (such as a history of an STD or more than 10 lifetime sexual partners) are associated with HIV-1 and HBV markers. Current risky behavior (unprotected anal intercourse) was associated in this group with not being a college student, anonymous meeting places, having had at least one steady sexual partner, probable alcohol abuse, and depression. Having at least one steady sexual partner not only is associated with unprotected anal intercourse but also may provide a false sense of security since only 16% believed they were in a mutually monogamous relationship. Intervention programs to reduce the spread of HIV-1 and HBV should address both the risk factors associated with transmission and the psychosocial factors associated with unprotected anal intercourse.

Men who were less accepting of their homosexuality or bisexuality were more likely to have had unprotected intercourse.

The lack of association between unprotected anal intercourse in the past six months and HIV-1 infection should not raise doubts about the risk of this form of sexual activity. This finding is more likely to be a reflection of the lack of sensitivity of recent risky behaviors in identifying HIV-1 infection since it may take six or more months to test positive on an HIV test. Twenty-six percent of the cohort reported having had unprotected anal intercourse, and those who were sexually active reported an average of five sexual partners in the previous six months. These results suggest that the potential for acquisition of HIV-1 in this population of young gay men is high.

Our findings complement the previous work on the prevalence of HIV infection among college students by Edlin and coworkers,[10] who found that the blinded seroprevalence of HIV-1 among students was low (0.19%). They found that HIV-1-infected students were more likely to be male and 25 years old or older, but they did not collect data on specific risk behaviors. Our finding that the prevalence of HIV among homosexual and bisexual men was lower in college-enrolled (1.3%) than non-college-enrolled men (6.0%) (Table 1) supports previous research suggesting that the prevalence of HIV is substantially lower among college students than among non-students.[11,24] However, in an urban environment where college campuses, bars, and anonymous meeting places are all located on the same city block, there may be a high potential for future HIV spread.

Our results are partly consistent with the findings of a recent study of young homosexual and bisexual men in San Francisco[3] that showed somewhat higher rates of HIV (9.4%), hepatitis B markers (19.8%), and unprotected anal intercourse (32.7%) in a population younger than 25. Other studies[3,4,6–8] have found that older age, more than 10 lifetime sexual partners, and a lifetime history of other STDs were risk factors for HIV and that substance use (particularly the use of alcohol and nitrites [data not shown]) was a risk factor for unprotected anal intercourse. Our study adds unique information regarding the student life of young homosexual and bisexual men, including their type of residence, site of primary care, and type of health insurance; these data may be useful in developing effective clinical interventions for young homosexual and bisexual students. In particular, our findings that alcohol abuse and depression were strongly associated with unsafe sex in an environment in which students have a high level of access to primary care suggest that student health centers may be in an ideal position to develop outreach and intervention programs to reduce HIV risk.

We identified risks for serologic markers for hepatitis B—a previous history of STDs and more than 10 lifetime partners—that were consistent with previous published work.[12,25] Twelve Asian men had hepatitis B markers. Although some of them had engaged in risky behaviors, most were at lower risk, suggesting probable perinatal transmission. We did not obtain information on country of birth so we could not ascertain whether they came from countries

in which hepatitis B is endemic. Finally, our finding that the presence of hepatitis B markers was associated with a decreased likelihood of recent non-intravenous drug use is difficult to understand. Perhaps people who develop a clinical illness such as hepatitis B may reduce their subsequent drug use.

After adjusting for confounding by several variables, we found a number of independent predictors of unprotected anal intercourse. Our findings that men who were less accepting of their own sexuality were more likely to have had recent unprotected anal intercourse supports previous research suggesting that social networks and peer support are important predictors of safer sex among young gay men.[3] Men who are less accepting of their sexuality are likely to be isolated from these social networks.

The role that depression and alcohol use play in unsafe sex is also important from a prevention standpoint. HIV education and prevention efforts should pay particular attention to college-aged homosexual and bisexual men who are depressed or are problem drinkers, or both. The specific role of alcohol use and unsafe sex is complex and is the subject of more intensive research.[26] In addition, our finding that unprotected anal intercourse is associated with meeting partners in anonymous settings is particularly important in urban environments. Efforts to reduce the spread of HIV on college campuses should address the possibility that partners met in non-campus settings are more likely to be HIV-infected than college students.

Interpretations of the results of our study should recognize a number of limitations. First, this sample was not a random sample of all young homosexual and bisexual men. To reduce the potential effect of selection bias on our study, we attempted to obtain as diverse a sample as possible by recruiting the majority of our subjects from more than 25 locales in the Boston area. Although we were able to enroll a very diverse cohort, the largest cohort to date of young gay and bisexual men, we cannot be sure that the characteristics of this group are representative of the characteristics of all young gay and bisexual men.

Another important limitation to our results is the level of reliability and validity of self-reported data, in particular the reliability of responses from persons who are heavy substance users. In our previous work, we found that, among homosexual couples, the level of corroboration regarding sexual behavior was extremely high (Spearman's $r$=0.78–0.79, $P$<0.001, kappa = 0.76–0.88, $P$<0.001),[24] with the exception of couples in which one or both partners were heavy alcohol users; in such couples the heavier user tended to underreport the frequency of sexual activity.

Our findings suggest a few simple guidelines to aid in developing interventions to reduce the spread of HIV-1 and HBV. First, clinicians should be sensitive to the elements of a medical history that may suggest high risk for HIV, especially in gay and bisexual men—specifically, a history of STDs, substance use, and depression; identifying such risk factors presents an important opportunity to intervene and reduce future HIV infections. Our finding that 89% of participants do have a primary care site (Table 1) suggests that one potentially effective outreach strategy is to urge providers to raise HIV risk issues with their clients and to encourage them to participate in HIV counseling, testing, and prevention programs. The relatively high rate of hepatitis B markers (12.9%) among this population suggests that primary care providers need to address the health risks associated with unprotected anal intercourse. Second, intervention programs should address both the risk factors associated with transmission of HIV-1 and the psychosocial factors associated with recent risky behavior, including alcohol abuse, depression, and anonymous meeting places. Prevention programs should focus on ameliorating depression and substance abuse and on developing self-acceptance of homosexuality.

In conclusion, our findings show that while the prevalence of HIV infection among homosexual and bisexual college students in Boston was relatively low, high rates of unprotected anal intercourse suggest the potential for future HIV transmission. Interventions should focus in particular on young people with histories of sexually transmitted diseases, depression, and alcohol abuse.

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