

HIV Seroprevalence among Street-Recruited Injection Drug and Crack Cocaine Users in 16 US Municipalities

ABSTRACT

Objectives. This study determined human immunodeficiency virus (HIV) seroprevalence and factors associated with HIV infection among street-recruited injection drug users and crack cocaine smokers.

Methods. An analysis was performed on HIV serologies and risk behaviors of 6402 injection drug users and 3383 crack smokers in 16 US municipalities in 1992 and 1993.

Results. HIV seroprevalence was 12.7% among injection drug users and 7.5% among crack smokers. Most high-seroprevalence municipalities (>25%) were located along the eastern seaboard of the United States. In high-seroprevalence municipalities, but not in others, HIV seroprevalence was higher for injection drug users than for crack smokers. Among injection drug users, cocaine injection, use of speedballs (cocaine or amphetamines with heroin), and sexual risk behaviors were independently associated with HIV infection. Among crack smokers, sexual risk behaviors were associated with HIV infection.

Conclusions. Injection drug users and crack smokers are at high risk for HIV infection. (*Am J Public Health*. 1998;88:108-113)

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Introduction

Injection drug use is a major risk factor for human immunodeficiency virus type 1 (HIV-1) transmission in North America and elsewhere.¹⁻³ In the United States, 128 696 (25%) of the 506 538 cases of acquired immunodeficiency syndrome (AIDS) diagnosed among adults and adolescents through December 1995 occurred among heterosexual injection drug users, and an additional 51 905 cases (10%) were related to injection drug use (occurring, for example, among persons who had heterosexual sex with a drug user).⁴ Overall, the composition of AIDS cases is changing, reflecting decreasing numbers of gay men⁵ and increasing numbers of injection drug users, their sexual partners, and their children.^{6,12}

The use of cocaine in smokable form (crack) is also a risk factor for infection with HIV⁷⁻¹² and other sexually transmitted diseases.¹³⁻¹⁷ Crack use continues to be prevalent in North American cities.^{18,19} Crack use has been associated with sexually transmitted diseases, including HIV infection, because the sexual behaviors of crack smokers include having multiple sex partners, exchanging sex for drugs, and using condoms infrequently.²⁰⁻²²

Existing seroprevalence and surveillance research on injection drug users has been based primarily on subjects recruited from drug treatment centers and correctional institutions.^{23,24} However, only 15% of the estimated 1.2 million injection drug users in the United States are thought to be enrolled in drug treatment at any given time.²⁵ Consequently, these studies may not be generalizable to noninstitutionalized, nonclinical populations.²⁶ This study is one of the first national assessments of HIV infection among injection drug users and crack cocaine smokers recruited outside of drug treatment programs, prisons, or other institutionalized settings.

Methods

Sample

Between January 1992 and December 1993, the National Institute on Drug Abuse

(NIDA) Cooperative Agreement Consortium collected risk behavior information and HIV serology on injection drug users and crack smokers in 16 cities in the United States. Targeted sampling techniques²⁷⁻²⁹ were used to recruit drug users in neighborhoods selected for high concentrations of drug users on the basis of local indicators (e.g., treatment admissions, police arrests, direct observation, and ethnographic studies). Recruitment was not carried out at drug treatment programs, homeless shelters, or correctional facilities. Persons were eligible for the study if they were at least 18 years of age, were not enrolled in drug treatment, and had used injection drugs within the 30 days prior to interview or crack within the 48 hours prior to interview. Drug use was verified through urinalysis for morphine, cocaine, and amphetamine metabolites (negative tests rendered the data ineligible), by physical examination for evidence of recent venipuncture, or both. Informed consent was obtained. Respondents were interviewed with the Risk Behavior Assessment questionnaire, a standard risk inventory assessing behaviors in the 30 days prior to the interview. Reliability and validity assessments of the questionnaire support its adequacy as a research tool with this population.³⁰ For this study we excluded from analysis men who had had sex with men in the 30 days prior to interview or who self-identified as gay (n =

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268), respondents with indeterminate HIV test results ($n = 42$), and respondents with missing data on injection or crack use variables ($n = 190$). Respondents with missing data were not statistically different from the overall sample demographically. The resulting sample size was 9785. Participants were classified as crack smokers if they reported smoking crack in the 30 days prior to interview but had not injected drugs during that period. They were classified as injection drug users if they had injected drugs in the 30 days prior to interview, regardless of crack use.

Serology and Statistics

Specimens were analyzed for HIV antibodies by enzyme immunoassay; repeat positive specimens were confirmed by Western blot assay. The criterion for a positive Western blot result was the presence of reactive bands at p24 or gp41 and gp120/160, as described by the Centers for Disease Control.³¹

TABLE 1—HIV Seroprevalence Rates in 16 US Cities, by Drug Intake Route, 1992 through 1993

| | Injection Drug Users, % (Total n) | Crack Smokers, % (Total n) | Overall % (Total n) |
|-------------------------|--------------------------------------|-------------------------------|------------------------|
| San Juan, Puerto Rico | 45.5 (646) | 12.2 (288) | 35.2 (934)* |
| New York, NY | 46.7 (150) | 17.2 (163) | 31.3 (313)* |
| Hartford, Conn | 29.5 (129) | 12.5 (16) | 27.6 (145) |
| Miami, Fla | 48.3 (89) | 23.3 (490) | 27.1 (579)* |
| Oakland/Richmond, Calif | 16.5 (952) | 0.0 (5) | 16.4 (957) |
| Detroit, Mich | 10.3 (532) | 5.5 (200) | 9.0 (732)** |
| Philadelphia, Pa | 10.0 (320) | 5.6 (125) | 8.8 (445) |
| New Orleans, La | 7.5 (319) | 6.3 (347) | 6.9 (666) |
| Houston, Tex | 6.5 (446) | 3.4 (233) | 5.4 (679) |
| Long Beach, Calif | 4.3 (561) | 2.0 (297) | 3.5 (858) |
| Denver, Colo | 3.5 (342) | 2.0 (248) | 2.9 (590) |
| Tucson, Ariz | 2.6 (507) | 0.0 (92) | 2.2 (599) |
| Flagstaff, Ariz | 1.0 (99) | 2.6 (115) | 1.9 (214) |
| Anchorage, Alaska | 1.8 (223) | 1.8 (449) | 1.8 (672) |
| Portland, Ore | 1.5 (595) | 1.1 (89) | 1.5 (684) |
| Columbus/Dayton, Ohio | 1.1 (492) | 1.3 (226) | 1.1 (718) |
| Overall | 12.7 (6402) | 7.5 (3383) | 10.9 (9785)* |

*Mantel-Haenszel chi-squared $P < .0001$.

**Mantel-Haenszel chi-squared $P < .05$.

TABLE 2—Selected Characteristics and HIV Status of Injection Drug Users ($n = 6402$) and Crack Cocaine Smokers ($n = 3383$) in 16 US Municipalities, 1992 through 1993

| Characteristic (No. Missing Cases) | Injection Drug Users | | Crack Smokers | |
|------------------------------------|----------------------|--------------------|---------------|--------------------|
| | % HIV+ | Crude OR (95% CI) | % HIV+ | Crude OR (95% CI) |
| Sex (0) | | | | |
| Male | 12.9 | 1.08 (0.90, 1.28) | 6.5 | 0.69 (0.53, 0.91) |
| Female | 12.1 | 1.00 | 9.1 | 1.00 |
| Race/ethnicity (38) | | | | |
| White | 2.8 | 1.00 | 1.9 | 1.00 |
| African American | 12.5 | 4.89 (3.49, 6.86) | 8.0 | 4.47 (1.99, 12.44) |
| Caribbean Hispanic | 43.2 | 26.10 (18.5, 37.1) | 13.8 | 8.21 (3.45, 23.69) |
| Central/South American | 2.4 | 0.85 (0.48, 1.49) | 1.8 | 0.96 (0.15, 4.56) |
| Other | 3.1 | 1.12 (0.48, 2.51) | 1.4 | 0.73 (0.07, 4.15) |
| Age (0) | | | | |
| <31 y | 12.0 | 1.00 | 6.9 | 1.00 |
| 31-40 y | 13.6 | 1.15 (0.93, 1.43) | 8.1 | 1.19 (0.89, 1.61) |
| 41-50 y | 12.5 | 1.05 (0.83, 1.31) | 6.8 | 0.99 (0.64, 1.51) |
| >51 y | 8.5 | 0.68 (0.46, 1.01) | 6.5 | 0.94 (0.33, 2.22) |
| Currently employed (7) | | | | |
| Yes | 5.4 | 0.35 (0.26, 0.46) | 4.7 | 0.55 (0.38, 0.81) |
| No | 14.1 | 1.00 | 8.2 | 1.00 |
| Education (8) | | | | |
| High school or higher | 10.6 | 0.65 (0.56, 0.75) | 6.0 | 0.60 (0.46, 0.78) |
| Less than high school | 15.5 | 1.00 | 9.6 | 1.00 |
| Considers self homeless (64) | | | | |
| Yes | 11.2 | 0.83 (0.70, 0.99) | 8.6 | 1.25 (0.94, 1.65) |
| No | 13.3 | 1.00 | 7.0 | 1.00 |
| Ever in drug treatment (5) | | | | |
| Yes | 13.4 | 1.20 (1.03, 1.41) | 7.2 | 0.94 (0.71, 1.22) |
| No | 11.4 | 1.00 | 7.7 | 1.00 |
| Ever in jail (217) | | | | |
| Yes | 12.3 | 0.88 (0.72, 1.09) | 7.6 | 1.15 (0.85, 1.56) |
| No | 13.7 | 1.00 | 6.7 | 1.00 |

(Continued)

TABLE 2—Continued

| Characteristic (No. Missing Cases) | Injection Drug Users | | Crack Smokers | |
|------------------------------------------------------------------|----------------------|---------------------|---------------|-------------------|
| | % HIV+ | Crude OR (95% CI) | % HIV+ | Crude OR (95% CI) |
| Monthly income (68) | | | | |
| ≥\$500 | 11.7 | 0.86 (0.74, 1.00) | 7.5 | 1.00 (0.76, 1.31) |
| <\$500 | 13.3 | 1.00 | 7.5 | 1.00 |
| Recruited in high-prevalence city ^a (0) | | | | |
| Yes | 43.9 | 10.76 (9.11, 12.72) | 18.7 | 7.31 (5.46, 9.80) |
| No | 6.8 | 1.00 | 3.1 | 1.00 |
| Self-reported history of syphilis (17) | | | | |
| Yes | 20.0 | 1.86 (1.49, 2.32) | 16.5 | 2.90 (2.12, 3.96) |
| No | 11.8 | 1.00 | 6.3 | 1.00 |
| Received condom/latex from outreach workers (16) | | | | |
| Yes | 15.7 | 1.40 (1.19, 1.65) | 10.1 | 1.52 (1.12, 2.06) |
| No | 11.7 | 1.00 | 6.9 | 1.00 |
| Ever traded sex for money/drugs (9) | | | | |
| Yes | 15.8 | 1.43 (1.21, 1.69) | 9.8 | 1.56 (1.19, 2.06) |
| No | 11.6 | 1.00 | 6.5 | 1.00 |
| Ever received HIV test result (0) | | | | |
| Yes | 9.7 | 0.63 (0.54, 0.75) | 7.5 | 1.01 (0.75, 1.36) |
| No | 14.4 | 1.00 | 7.5 | 1.00 |
| Injection drug use in past 30 days (injection users only) | | | | |
| >30 injections (0) | | | | |
| Yes | 16.0 | 2.30 (1.94, 2.74) | 1.00 | 1.00 |
| No | 7.6 | 1.00 | 1.00 | 1.00 |
| Shared syringes (123) | | | | |
| Yes | 10.5 | 0.70 (0.60, 0.82) | 1.00 | 1.00 |
| No | 14.4 | 1.00 | 1.00 | 1.00 |
| Shared injection supplies (58) | | | | |
| Yes | 11.5 | 0.80 (0.69, 0.93) | 1.00 | 1.00 |
| No | 13.9 | 1.00 | 1.00 | 1.00 |
| Injected cocaine (7) | | | | |
| Yes | 14.1 | 1.38 (1.18, 1.62) | 1.00 | 1.00 |
| No | 10.6 | 1.00 | 1.00 | 1.00 |
| Injected speedball (heroin + coke/speed) (6) | | | | |
| Yes | 18.3 | 2.74 (2.33, 3.21) | 1.00 | 1.00 |
| No | 7.6 | 1.00 | 1.00 | 1.00 |
| Used crack cocaine (0) | | | | |
| Yes | 11.6 | 0.83 (0.71, 0.96) | 1.00 | 1.00 |
| No | 13.7 | 1.00 | 1.00 | 1.00 |

Note. OR = odds ratio; CI = confidence interval.

^aOne of the four cities in our sample that had HIV prevalence rates above 25% among drug users (San Juan, New York, Hartford, and Miami).

Univariate relationships were examined with the chi-squared test of proportions or Fisher's Exact Test and odds ratios with 95% confidence intervals. Nonhierarchical multivariate logistic regression was used to identify factors independently associated with HIV status.³² All possible interactions between main effects were tested.³² Data analysis was performed with SPSS.³³

Results

Selected demographic characteristics of the population were as follows: 70% were male, 54% were African American, 18%

were White, 13% were Caribbean Hispanic, and 10% were of Central American, South American, or Mexican descent. Forty-five percent were between the ages of 31 and 40.

The prevalence of HIV infection among injection drug users and crack smokers was 12.7% and 7.5%, respectively (Table 1). All high-prevalence cities (above 25%) were located in the eastern part of the United States (including San Juan, Puerto Rico), while low-prevalence cities (below 10%) were located in the Midwest or West. HIV prevalence in Oakland/Richmond, Calif, was 16.4%. In high-prevalence cities, HIV seroprevalence was higher among injection drug users than among crack smokers. With

the exception of Detroit, there were no significant differences in HIV prevalence rates between injection drug users and crack smokers in low-prevalence cities.

Bivariate relationships between HIV infection and demographic and behavioral characteristics of injection drug users and crack smokers are shown in Table 2. Of particular note, HIV-seropositive injection drug users were less likely to have shared syringes or injection paraphernalia (cookers, cotton, rinse water) than were HIV-seronegative users.

Among injection drug users, eight factors were independently associated with HIV infection in logistic regression analysis

TABLE 3—Results of Logistic Regression Models Predicting HIV Seropositivity

| | Adjusted Odds Ratio | 95% Confidence Interval |
|---------------------------------------------------------------------------------------------------------|---------------------|-------------------------|
| Independent variables predicting HIV infection among injection drug users (n = 6310)^a | | |
| Race/ethnicity | | |
| White | 1.00 | 1.00 |
| African American | 1.74 | 1.42, 2.13 |
| Caribbean Hispanic | 7.26 | 5.78, 9.11 |
| Central/South American | 0.37 | 0.25, 0.55 |
| Other | 0.48 | 0.27, 0.85 |
| No. times respondent injected speedball in past 30 days | 1.00 | 1.00, 1.01 |
| Residence in high-prevalence city ^b | 1.84 | 1.48, 2.29 |
| No. times respondent received HIV test results | 0.89 | 0.85, 0.93 |
| Received condom/latex from outreach workers in past 30 days | 1.56 | 1.29, 1.89 |
| Ever traded sex for money | 1.47 | 1.21, 1.77 |
| Self-reported history of syphilis | 1.51 | 1.18, 1.93 |
| No. days respondent injected cocaine in past 30 days | 1.01 | 1.00, 1.02 |
| Independent variables predicting HIV infection among crack smokers (n = 3373)^c | | |
| Residence in high-prevalence city ^b | 7.43 | 5.54, 9.98 |
| African-American race | 1.90 | 1.61, 2.62 |
| Self-reported history of syphilis | 1.62 | 1.16, 2.28 |
| Ever traded sex for money | 1.50 | 1.12, 2.01 |
| High school completion | 0.70 | 0.54, 0.93 |

^aData missing for 92 of the 6402 subjects.

^bOne of the four cities in our sample that had HIV prevalence rates above 25% among drug users (San Juan, New York, Hartford, and Miami).

^cData missing for 10 of the 3383 subjects.

(Table 3). The following factors were predictive of HIV infection: number of times respondent injected speedballs (cocaine or amphetamines with heroin); number of days respondent injected cocaine; having ever received money for sex; self-reported history of syphilis; having received condoms or latex from outreach workers; Caribbean Hispanic race; African-American race; and residence in a high-seroprevalence city. The number of times that the respondent had previously received HIV test results was a protective factor, as was Central American, South American, Mexican-American, White, or "other" race.

Among crack smokers, five factors were independently associated with HIV infection in logistic regression analysis (Table 3). Predictive of HIV were self-reported history of syphilis, previous commercial sex work, African-American race, and residence in one of the four high-prevalence cities. Completion of high school was a protective factor.

Discussion

This is the largest HIV seroprevalence study of street-recruited injection drug users

and crack smokers to date. We found the highest rates of HIV infection in San Juan, Puerto Rico, and in cities located along the eastern seaboard. In the high-seroprevalence cities, HIV rates were higher among injection drug users than among crack smokers, whereas in the low-seroprevalence cities, rates were statistically similar in both groups. We were not able to examine why the rates for injection drug users and crack smokers were similar in low-seroprevalence cities; this finding suggests a need for further analysis of social networks and inquiry into the relative risks associated with behaviors of injection drug users and crack smokers.

The association of speedball and cocaine injections with HIV infection in the multivariate model for injection drug users has been reported in previous epidemiological studies.^{24,34,35} Moreover, previous studies have shown that cocaine use enhances the replication of HIV.^{36,37} Expansion of substance abuse treatment services for stimulant users, including nutritional therapies with precursor loading in conjunction with support groups and case management, seems warranted. Also included in the injection drug user model was a negative association between number of previous HIV test

results and HIV infection. This suggests a need for further investigation into the role of HIV testing and counseling as a prevention strategy with this population.

In multivariate analyses both for injection drug users and for crack smokers, we found two sex-related variables that were independently associated with HIV infection. Self-reported history of syphilis, a marker for high-risk sexual behavior, has been associated with HIV infection in other studies.^{21,38,39} Commercial sex work, a marker for multiple sex partners, has also been associated with HIV infection.^{11,20,21} Diaz and Chu found that crack smokers continue to engage in risky sex practices after learning that they are HIV positive.⁴⁰ On the other hand, injection drug users in this study who had received condoms or latex protection from outreach workers were more likely to be HIV seropositive. This association suggests that outreach workers are effective at reaching high-risk and HIV-positive injection drug users.

There are numerous studies showing higher rates of HIV infection among African-American and Hispanic persons.^{21,41-45} Only recently have epidemiological studies paid attention to differences among subgroups of Hispanics in the United States.^{41,45} We found a significantly higher seroprevalence rate among Caribbean Hispanics than among Hispanics of Central American, South American, or Mexican descent.

We felt it important to include a variable in both models that accounted for respondents recruited in cities with the highest seroprevalence rates.⁴⁶ This variable accounts for site-specific confounding with respect to seroprevalence rates. There was no significant interaction between this variable and any other variable in either model.

There are inherent limitations in the targeted sampling technique we used to recruit respondents. Owing to the clandestine nature of drug use, no sampling technique can draw drug users at random, making it impossible to generalize our findings to the overall drug-using population in these cities. It is also not possible to derive true refusal rates, since much of the refusal takes place informally, outside the research venues. Another limitation concerns biases of self-reported drug use and risk behavior data owing to social desirability, recall, psychological functioning, and intoxication.⁴⁷ However, previous multicenter survey research has shown high validity of self-reports among drug users recruited outside clinical settings.⁴⁸ There are possible misclassification biases in the operational definition of injection drug users and crack smokers, since

a high percentage of injection drug users (48%) also smoked crack, and injection drug use prior to the 30-day cutoff was not assessed among crack smokers.

Injection drug users and crack cocaine smokers are at high risk for HIV infection. These populations are important targets for HIV/AIDS prevention efforts. Risk reduction counseling should explicitly discuss realistic goals for safer sex and drug-using practices. Services for HIV-positive drug users are especially needed in East Coast municipalities with high seroprevalence. Risk reduction counseling with HIV-positive drug users should include a discussion of the role of cocaine in HIV disease progression. □

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ABSTRACT

Objectives. This study compared history of substance use and episodic use in terms of HIV seroconversion.

Methods. A sample of 337 baseline HIV-negative gay men was followed for 6 years. Bivariate and survival analyses were used to compare 39 converters with nonconverters on substance use behaviors.

Results. Seroconverters were consistently more likely to report use of marijuana, nitrite inhalants, amphetamines, and cocaine than nonconverters. Consistent use of nitrite inhalants and amphetamines increases the relative risk of seroconversion, while episodic use does not. Both patterns of cocaine use increase seroconversion risk.

Conclusions. There are three potential mechanisms for an increased risk of conversion due to consistent substance use. (*Am J Public Health*. 1998;88:113-116)

Histories of Substance Use and Risk Behavior: Precursors to HIV Seroconversion in Homosexual Men

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Introduction

Nonintravenous substance use has been implicated as a predictor of HIV seroconversion in gay men.¹⁻⁴ Of the drugs implicated, amphetamines, cocaine, and amyl nitrite⁵ appear to have the strongest association with HIV seroconversion. Recent research suggests an upsurge in amphetamine use among gay men, particularly younger gay men (G. M. Crosby et al., unpublished data, 1997).⁶

Despite evidence implicating nonintravenous substance use in HIV seroconversion, specific mechanisms underlying this relationship have not been identified.⁷ Previous research has focused on substance use and anal sex near time of exposure or as a baseline predictor but has not considered the potential effect of continued substance use over an extended period of time. In this brief report, we evaluate the relationship between ongoing substance use and seroconversion over 6 years, using longitudinal data from the San Francisco Men's Health Study.

Methods

Sample

A subsample of gay and bisexual men was drawn from the San Francisco Men's Health Study cohort. Detailed descriptions of sampling, assessments, and laboratory procedures are available elsewhere.^{8,9} Every 6 months, blood was drawn for HIV testing, and subjects were interviewed to assess risk behaviors, alcohol use, and substance use.¹⁰ The analysis was limited to subjects who were HIV negative at baseline and who had data available for at least two thirds of the interviews or "waves," up to the wave of seroconversion (for converters), or

for their last available wave of data (for nonconverters). As a result of attrition in 1992, only data for the first 12 waves (1985 through 1991) were used. The resulting sample consisted of 337 subjects, 39 of whom seroconverted after baseline.

Measures

Alcohol use. At baseline, subjects reported levels of alcohol use in the previous 12 months. Six-month intervals were used at follow-up assessments. Because most subjects (95%) reported occasional alcohol use at baseline, subjects were assigned a binary code indicating presence or absence of heavy alcohol use (defined as five or more drinks at a time on at least a weekly basis).¹¹

Substance use. Subjects reported frequency of use, over the previous 6 months,¹¹ of marijuana, nitrites, cocaine, methamphetamine, hallucinogens, barbiturates, ethyl chloride, opiates, and amphetamines. MDA and amphetamine use were combined as "amphetamines," and ethyl chloride and nitrite inhalant were combined as "inhalants." Subjects were assigned a binary code indicating any use of these substances in the previous 6 months.

In a survival analysis of the effects of a substance use history on time to HIV seroconversion, we tested for differences

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