

Prevalence of Sexually Transmitted Infections and Associated Risk Factors among Populations of Drug Abusers

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A cross-sectional survey was conducted of sexually transmitted diseases (STDs) and risky behaviors among 407 drug abusers in treatment facilities in 1998. Infections with human immunodeficiency virus (HIV), hepatitis B virus (HBV), hepatitis C virus (HCV), herpes simplex virus type 2 (HSV-2), and syphilis were detected by testing serum antibody levels; chlamydia and gonorrhea were detected by testing nucleic acid levels in urine. Logistic regression analysis was performed to measure associations. Prevalences of antibodies were as follows: to HSV-2, 44.4%; to HCV, 35.1%; to HBV, 29.5%; to HIV, 2.7%. The prevalence of syphilis was 3.4%; of chlamydia, 3.7%; and of gonorrhea, 1.7%. Of the 407 subjects, ~62% had markers for 1 of the STDs. HIV infection was associated with African American race, use of smokable freebase (crack) cocaine, and STD history. HBV infection was associated with age >30 years, injecting drugs, needle sharing, a history of treatment for drug abuse, and African American race. HCV infection was associated with an age >30 years, injecting drugs, and needle sharing, and HSV-2 infection with an age >30 years, female sex, and African American race. Syphilis was associated with a history of STDs. High prevalences of STDs among drug abusers indicate the need for integration of STD screening and treatment into drug treatment programs.

Populations of drug abusers have been associated with epidemics of sexually transmitted infections or diseases (STDs), especially HIV infection (which is associated with injecting drugs, use of contaminated equipment for injecting drugs, and unsafe sex). The drug most associated with STDs is smokable freebase (crack) cocaine, because of increases in risky sexual behaviors. Studies of STDs in injection drug users have shown an increased frequency of STDs [1], but the increase is not as great as for crack cocaine users. There is a body of evidence supporting the close association between drug use and having STDs [2–4]. Studies have attributed the high prevalence of HIV infection, syphilis, and genital ulcer disease to unprotected sex fueled by the use of crack cocaine [2, 3]. In a study of female drug abusers who did not inject drugs, who were recruited from drug treatment centers and the community [4], use of crack

cocaine was the most significant predictor of syphilis, and more than one-third of the subjects had an STD.

It has been documented that HIV infection, genital ulcer disease, and use of crack cocaine are clustered in populations of heterosexual members of minority groups living in urban areas and are associated with trading sex for money or drugs [5–7]. In Houston, crack cocaine use was significantly associated with syphilis, HIV infection, female sex, and African American race [8]. In a review of 16 studies, Marx et al. [9] concluded that increasing rates of STDs and HIV infection were related to use of crack cocaine. Exchanging drugs for sex and sex for drugs was also associated with having STDs. The evidence suggests that once addiction is established, the behavior that links drug use and STDs is use of crack cocaine that is related to exchanging sex for money or drugs.

In a 1997 survey of blood samples from people who frequented crack houses (i.e., places where crack cocaine is sold and/or used) in Houston, Ross et al. [10] found a high prevalence of markers for STDs: 13% of samples had markers for syphilis; 61% for herpes simplex virus type 2 (HSV-2) infection; 11% for HIV infection; 53% for hepatitis B virus (HBV) infection; and 42% for hepatitis C virus (HCV) infection. In that study, it was suggested that STD treatment should be considered for such persons in the population of drug abusers (i.e., users of crack cocaine who frequent crack houses), as well as for drug abusers who fit the classical description of dual diagnosis (coexisting mental disorder and drug abuse). This suggestion is particularly important given the evidence that the risk of HIV infection is increased for patients with STDs.

To target STD diagnosis and treatment in populations of

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Informed consent was obtained from the participants in the study. The study followed the guidelines for human experimentation of the US Department of Health and Human Services and the institutions involved in this research. The study was approved by the relevant university human subjects review board and also by the individual drug treatment facility's review board.

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drug abusers, we conducted a cross-sectional study of the prevalence of STDs and the associated risk factors among drug abusers in treatment facilities in Texas. To our knowledge, this is the first study of populations of drug abusers in treatment facilities to examine the prevalence of 7 STDs (4 viral infections [HIV, HBV, HCV, and HSV-2 infections] and 3 treatable bacterial diseases [syphilis, gonorrhea, and chlamydial infection]) along with related drug use and sexual behaviors.

Subjects and Methods

Study population. Three treatment facilities were the sites for this cross-sectional survey of drug abusers: 2 major drug treatment clinics in Houston (Harris County: population, 3.2 million [the Houston 1 site]; metropolitan area: population, 4.3 million [the Houston 2 site]), and a drug treatment clinic in a west Texas city (Lubbock: population, 230,000). These facilities are funded by the State of Texas to provide treatment to indigent residents who are addicted to drugs and alcohol. Both outpatient and inpatient (weeks to months) treatment programs that use a multidisciplinary approach are available for men, women, and women with infants. Other additional services (such as mental health screening or referral, evaluation of social services, health education, job training, and employment assistance, etc.) help ensure treatment effectiveness and long-term success. In some long-term facilities, patients can go to work or visit family during the daytime. Our study population is representative of indigent drug abusers in both metropolitan and rural areas who voluntarily sought care or were sent for mandatory treatment.

Survey procedures. Consecutive patients were recruited as study subjects from both outpatient and inpatient facilities at the 3 chosen sites from August through November 1998. Patients from the Houston 2 site were recruited from both the outpatient and inpatient facilities; patients from the other sites were recruited only from inpatient facilities. The intent of the study was explained to every respondent along with the principles of confidentiality and anonymity. If a potential subject volunteered with informed consent, they were assigned a study identification number, the questionnaire was filled out, a urine sample was obtained, and a 10-mL blood sample was obtained. The brief (1.5 page) questionnaire used in this survey was the same as that used in a 1997 survey of people who frequented a crack house [10]. It included questions about demographic characteristics and the participant's history of drug abuse and risky sexual behaviors. Questions about sold and bought sex were added during the middle part of the study for the 2 Houston sites; therefore, data analysis in which these variables are used is based on smaller numbers.

Every person who attended the clinic or stayed in the hospital was asked to volunteer for the study. The response rate from study sites ranged from 70% to 95%. Almost everyone from the outpatient clinic participated. For inpatients, the most common reason for not participating was conflict with the schedule of their rehabilitation activities or work. Very few patients actively refused to participate in the study. The logs of personal names and study identification numbers were kept in the clinics to assure that confidentiality was not breached. In addition, the logs helped doc-

tors counsel, diagnose, and treat patients when the test results were sent back to the sponsor physicians at the clinics.

Because this study was designed to determine seroprevalence only, we did not investigate the number of active cases of syphilis. We reported all positive syphilis serological test results to the clinics and let those physicians report the cases to the local health department and evaluate and treat the patients. On the basis of the experience of the physician at the Houston 1 site, the proportion of patients with syphilis who received treatment at this clinic was very high.

According to the policy of the drug treatment clinics, syphilis testing for inpatients was also routinely offered, and treatment was given as needed. Testing for other STDs was based on the need for clinical diagnosis during initial physical examinations and was not routinely performed. Some inpatients might receive therapy for bacterial STD because of their clinical diagnosis. However, the Houston 2 site offered prophylactic antibiotic (erythromycin) treatment to every inpatient during the first week of admission, and doxycycline treatment was given if a syphilis serological test was positive. The policy of treating inpatients would affect the test results for gonorrhea and chlamydial infection, especially at the Houston 2 site.

Laboratory methods. Blood and urine specimens were divided into 5 aliquots in cryovials and frozen. Prevalences of HIV infection, HBV infection, HCV infection, HSV-2 infection, and syphilis were determined by testing for the presence of antibodies. A positive result indicates past infection and/or active chronic infection. Testing for antibody to HIV was performed by HIV-1 EIA (Abbott Laboratories, Chicago). Repeated reactivity was confirmed by western blot testing for antibody to HIV (Cambridge Biotech, Rockville, MD). Antibody to hepatitis B core antigen was detected by Corzyme EIA (Abbott Laboratories); antibody to HCV was detected by HCV-EIA 2.0 (Abbott Laboratories). Testing for antibody to HSV-2 was performed at a private laboratory (LabCorp, Raritan, NJ) by Cobas Core HSV-2 IgG EIA (Roche, Indianapolis, IN), which employs highly specific gG-s antigen directed at antibody to HSV-2. The nontreponemal rapid plasmin reagin test (Becton Dickinson, Sparks, MD) was used to detect syphilis. Reactive results were confirmed by Serodia particle agglutination test for antibodies to *Treponema pallidum* (Serodia TP-PA; Fujirebio, Tokyo). This test incorporates technology from the microhemagglutination assay-*T. pallidum*, which uses the same treponemal antigen. A test that reveals antibody to *T. pallidum* (e.g., a positive syphilis serological test) could indicate primary, secondary, or latent infection.

Chlamydial infection and gonorrhea were detected by ligase chain reaction assay (Abbott Laboratories), a test resembling PCR assay that determines nucleic acid levels in urine. There are 3 steps in this process: specimen preparation, amplification, and detection. A positive result indicates current infection with *Chlamydia* or *Neisseria gonorrhoeae*, depending on the test run.

Statistical analysis. Epi-Info (Centers for Disease Control and Prevention, Atlanta) and STATA (STATA, College Station, TX) were used to analyze data from the interview questionnaire and results of laboratory testing. The χ^2 test or χ^2 test for linear trend was used as a statistical test to determine *P* values (2-sided). ORs and 95% confidence intervals were used as measures of the strength of the association between each infection (dependent outcome var-

able) and demographic characteristics, drug use, and sexual behavior (independent variables). If the value of variables in the cell is zero, then the OR is estimated by adding 0.5 to the value in each cell in the univariate analysis. However, those variables are not included in the regression model for the multivariate analysis. Binomial logistic regression multivariate analysis was performed to determine the independent association of variables related to each infection. Regression models were constructed for each infection (outcome) by using variables significant in this binomial univariate analysis or variables considered biologically important to STDs. By comparing the univariate crude OR with the adjusted OR from the logistic regression model for each infection, we are able to identify confounding variables and assess the independent factors associated with each outcome.

Results

Tables 1, 2, and 3 show the prevalences of STDs by site, demographic characteristics, and risk factors for 407 drug abusers enrolled in drug treatment programs in metropolitan and rural Texas; the number of drug abusers was fairly evenly divided among the 3 clinics. As is typical for drug abusers in treatment facilities, there were more males (72%) than females (28%), and most were aged 25–44 years. Of the patients, 37% were white, 36% were African American, and 18% were Hispanic. More than one-half (56%) of the patients were unmarried, and three-fourths were unemployed. Over one-half (55%) of the patients had been in a drug treatment program previously, and 45% had a history of injecting drugs. Over one-third of the study subjects shared needles; however, of the injection drug users, 79% had shared needles. Cocaine (82%) and crack

(65%) were the most commonly used drugs, although stimulants (usually amphetamines; 51%), marijuana (62%), and alcohol (94%) were also commonly used. The drug of preference was cocaine or crack in more than one-half the cases.

Over one-third (38%) of the subjects reported a previous STD, of which gonorrhea and chlamydial infection followed by syphilis were the most common. Nearly 46% of the patients reported no sex partners in the last 4 weeks, and 5% reported >5 sex partners in the last 5 weeks; of 221 patients who reported sex partners in the last 4 weeks, 14% reported engaging in anal sex, and 23% reported always using condoms. About one-quarter (26%) of the patients reported selling sex for money or drugs, and nearly one-third (29%) reported buying sex with drugs or money.

As shown in tables 1 and 2, the disease (or infection) with the highest prevalence was genital herpes (HSV-2 infection; 44.4%); HCV infection had the second highest prevalence (35.1%) followed by hepatitis B (29.5%). Prevalences of syphilis (3.4%), chlamydial infection (3.7%), gonorrhea (1.7%), and markers of HIV infection (2.7%) were all <5%. About 62% of the study population had ≥ 1 of these infections. There were significant differences between clinics in terms of prevalences of HSV-2, HCV, and HIV infections. Prevalences of gonorrhea and chlamydial infection may be lower than expected because at 1 clinic, prophylaxis was administered during the first week after admission.

When we stratified patients by demographic characteristics or risk factors and the presence of each infection, prevalences of HBV, HCV, and HSV-2 infections were significantly higher among females. African American race was significantly as-

Table 1. Prevalences of sexually transmitted infections or diseases (STDs) by study site and demographic characteristics, for 407 drug abusers in treatment programs in Texas.

Factor	No. (%)	Subjects with indicated infection, %						
		HIV	HBV	HCV	HSV-2	Syphilis	Gonorrhea	Chlamydial
Site attended								
Lubbock	123 (30)	0.8	30.1	43.9	31.6 ^a	1.6	2.4	4.3
Houston 1	145 (36)	6.2 ^a	28.3	23.5 ^a	50.0	4.8	2.8	2.1
Houston 2	139 (34)	0.7	30.2	39.6	49.6	3.6	0	4.3
Sex								
Male	294 (72)	2.4	23.8	31.3	33	2.4	1.0	3.0
Female	113 (28)	3.5	41.3 ^a	45.1 ^a	75 ^a	6.2	3.5	5.3
Race								
White	152 (37)	0	30.9	41.4	37.2	1.8	0.62	2.5
African American	146 (36)	7.5 ^a	31.5	26.0	63.6 ^a	6.2 ^a	2.7	4.1
Hispanic	75 (18)	0	29.3	42.7	27.4	2.7	2.7	4
Other	34 (9)	0	8.3	25	29.2	0	0	8.3
Age, y^b								
<20	27 (7)	0	3.7	3.7	14.8	0	3.7	0
20–29	113 (28)	1.8	15.9	16.8	23.2	1.8	1.8	9.7
30–39	143 (35)	3.5	32.2	40.6	58.6	2.8	2.1	2.1
≥ 40	120 (29)	3.3	45.8	54.2	56.6	6.7	0.8	0.8
Total	407 (100)	2.7	29.5	35.1	44.4	3.4	1.7	3.7
χ^2 test for linear trend		13.89	34.13	47.8	36.6	5.17		
<i>P</i>		0.0002	0.000	0.000	0.000	0.023		

NOTE. HBV, hepatitis B virus; HCV, hepatitis C virus; HSV-2, herpes simplex virus type 2.

^a Difference is statistically significant, $P < .05$.

^b Information about age was available for only 403 case patients.

Table 2. Prevalences of sexually transmitted infections or diseases (STDs) by risk of drug use behavior, for 407 drug abusers in treatment programs in Texas.

Factor	No. (%)	Subjects with indicated infection, %						
		HIV	HBV	HCV	HSV-2	Syphilis	Gonorrhea	Chlamydial
History of treatment for drug abuse								
Yes	225 (55)	3.4	38.7 ^a	40.9 ^a	50.5	4.0	4.0	1.8
No	182 (45)	1.7	18.1	28.0	36.9	2.8	3.3	1.7
Injection drug use								
Yes	185 (45)	2.2	48.1 ^a	65.4 ^a	48.3	4.3	1.1	4.3
No	222 (55)	3.2	14.0	9.9	41.3	2.7	2.3	3.2
Needle sharing								
Yes	147 (36)	2.0	53.7 ^a	70.8 ^a	47.1	3.4	0.7	2.7
No	260 (64)	3.1	15.8	15.1	42.8	3.5	2.3	4.3
Use of crack cocaine								
Yes	266 (65)	4.1 ^a	33.5 ^a	37.2	53.3 ^a	3.8	1.9	4.5
No	141 (35)	0	22.0	31.2	27.7	2.8	1.4	2.1
Total	407 (100)	2.7	29.5	35.1	44.4	3.4	1.7	3.7

NOTE. HBV, hepatitis B virus; HCV, hepatitis C virus; HSV-2, herpes simplex virus type 2.

^a Difference is statistically significant, $P < .05$.

sociated with a higher prevalence of HIV infection, HSV-2 infection, and syphilis. Prevalences of viral STDs (HIV, HBV, HCV, and HSV-2 infections) increased significantly with increased age (χ^2 test for linear trend).

Injecting drugs, needle sharing, and a history of treatment for drug abuse were associated with HBV and HCV infections but not with other infections. Use of crack cocaine was associated with HIV, HBV, and HSV-2 infections. A history of STDs was significantly associated with all STDs except gonorrhea and chlamydial infection. A history of selling sex for money or drugs was significantly associated with HBV infection, HCV infection, HSV infection, and syphilis. Having >5 sex partners in the last 4 weeks was significantly associated with HBV infection and HSV-2. Engaging in anal sex or use of a condom in the last 4 weeks was not significantly associated with a higher prevalence of infection.

In summary, HBV and HCV infections were associated with injecting drugs. Having many sex partners and a history of selling sex for money or drugs were associated with syphilis and infection with HBV, HCV, and HSV-2. The nonsignificant results associated with gonorrhea and chlamydial infection might be attributable to low prevalences of these diseases among the study population. The low prevalences could be attributed to the only point at which the presence of the infectious agents (not serological markers) can be detected and the short periods of acute clinical infection, especially given the significant proportion of inpatient treatment among our study participants.

Results of logistic regression analysis of risk factors and HIV infection, HBV infection, HCV infection, HSV-2 infection, and syphilis are shown in table 4 (gonorrhea and chlamydial infection were not included in this analysis because they did not have a significant association with any of the risk factors). ORs and adjusted ORs were calculated in univariate and logistic regression multivariate analyses to measure the strength of the association. Regression models were constructed for each in-

fection (outcome) by using variables that were significant in the binomial univariate analysis or variables considered biologically important to these STDs. By comparing the univariate crude OR with the adjusted OR from the logistic regression model, we were able to identify confounding variables and assessed the independent factors associated with each outcome. The variables included in the model were age, female sex, African American race, injecting drugs, needle sharing, a history of treatment for drug abuse, a history of STDs, use of crack cocaine, a history of selling sex, and >5 sex partners in the last 4 weeks.

African American race (estimated OR, 44.5; 95% CI, 17.0–126.6), use of crack cocaine (estimated OR, 12.7; 95% CI, 5.0–35.4), and a history of STDs (estimated OR, 41.1; 95% CI, 16.1–114.2) were significantly associated with HIV infection. However, none of these variables were tested in the logistic regression model because the value of variables in their cells was zero. Female sex, injecting drugs, needle sharing, a history of treatment for drug abuse, and a history of selling sex were not significantly associated with HIV infection in both univariate and multivariate analyses.

HBV infection was independently associated with an age >30 years (adjusted OR, 2.8; 95% CI, 1.3–5.8), injecting drugs (adjusted OR, 2.7; 95% CI, 1.0–7.7), needle sharing (adjusted OR, 3.3; 95% CI, 1.2–9.1), a history of treatment for drug abuse (adjusted OR, 2.2; 95% CI, 1.1–4.1), and African American race (adjusted OR, 2.0; 95% CI, 1.0–4.2). Female sex, a history of STDs, use of crack cocaine, a history of selling sex, and >5 sex partners in the last 4 weeks were significantly associated with HBV infection in the univariate analysis (but not in the multivariate analysis), and apparently they were the confounding factors.

HCV infection was independently associated with an age >30 years (adjusted OR, 7.4; 95% CI, 3.1–17.9), injecting drugs (adjusted OR, 6.1; 95% CI, 2.2–13.2), and needle sharing (adjusted OR, 4.4; 95% CI, 1.6–12.9). The association of a history

Table 3. Prevalences of sexually transmitted infections or diseases (STDs) by risk of sexual behavior, for 407 drug abusers in treatment programs in Texas.

Factor (<i>n</i>)	No. (%)	Subjects with indicated infection, %						
		HIV	HBV	HCV	HSV-2	Syphilis	Gonorrhea	Chlamydial
History of STDs (407)								
Yes	153 (38)	7.2 ^a	41.2 ^a	42.5 ^a	65.5 ^a	7.2 ^a	2.0	4.6
No	254 (62)	0	22.4	30.7	31.9	1.1	1.6	3.2
History of selling sex (284)								
Yes	73 (26)	5.5	45.2 ^a	43.8 ^a	74.0 ^a	8.2 ^a	1.4	5.5
No	211 (74)	2.8	23.7	27.0	41.3	2.8	1.4	2.4
History of buying sex (276)								
Yes	80 (31)	3.4	36.4	35.2	54.6	4.6	1.1	3.4
No	196 (69)	3.6	26.0	29.6	47.6	4.1	1.6	3.1
No. of sex partners in the last 4 w (407)								
0	186 (46)	3.8	25.3	33.9	37.9	3.2	0.5	3.8
1–5	199 (49)	2.0	30.7	35.7	48.7	2.5	2.5	3.0
>5	22 (5)	0	54.6 ^a	40.9	61.9 ^a	13.6	4.6	9.1
Engaged in anal sex in the last 4 w (221)								
Yes	32 (14)	3.1	37.5	50	50.0	6.3	0	6.3
No	189 (86)	1.6	32.3	33.9	50.0	3.2	3.2	3.2
Condom use in the last 4 w (221)								
Always	51 (23)	5.9 ^a	29.4	21.6	42.9	3.9	7.8	3.9
No or sometimes	170 (77)	0.6	34.1	40.6	52.0	3.8	1.2	3.5

NOTE. HBV, hepatitis B virus; HCV, hepatitis C virus; HSV-2, herpes simplex virus type 2.

^a Difference is statistically significant, $P < .05$.

of STDs, a history of selling sex, female sex, and a history of treatment for drug abuse with HCV infection disappeared after adjustment in the multivariate analysis. Use of crack cocaine, African American race, and >5 sex partners in the last 4 weeks were not significantly associated with HCV infection in both univariate and multivariate analyses.

HSV-2 infection was independently associated with an age >30 years (adjusted OR, 4.8; 95% CI, 2.4–9.4), female sex (adjusted OR, 4.5; 95% CI, 2.1–9.6), and African American race (adjusted OR, 3.6; 95% CI, 1.8–7.1). Use of crack cocaine, a history of STDs, and a history of selling sex were not significantly associated with HSV-2 infection in the logistic regression analysis ($P < .1$). Injecting drugs, needle sharing, and a history of treatment for drug abuse were not significantly associated with HSV-2 infection in both univariate and multivariate analyses. Having >5 sex partners in the last 4 weeks was excluded from the regression model because of its colinearity with a history of selling sex and female sex.

Only a history of STDs (adjusted OR, 11.7; 95% CI, 1.3–101) was significantly associated with syphilis in the logistic regression analysis. However, counting both previous STDs and positive results of current syphilis serological tests as cases of syphilis may overestimate the ORs. African American race, a history of selling sex, and >5 sex partners in the last 4 weeks were not independently significant factors for syphilis in the multivariate analysis.

In summary, an age >30 years was associated with HBV, HCV, and HSV-2 infections, female sex was independently associated with HSV-2 infection, and African American race was associated with HBV and HSV-2 infections; injecting drugs or needle sharing increased the ORs for HBV and HCV infections.

A history of STDs was associated with syphilis. Because there were no cases of HIV infection among study participants who were not African American, those who did not use crack cocaine, and those with no history of STDs, we could not perform regression analysis to conclude whether these factors were independently associated with HIV infection. Small numbers of cases of HIV infection and syphilis also limited the power of this study to observe a statistically significant finding. HIV infection was associated with other STDs (OR, 2–3), but this association was only significant with HSV-2 infection (OR, 2.8; 95% CI, 1.1–8.0).

Discussion

This study demonstrated a high prevalence of STDs (especially HSV-2 and HCV infections) among a population of drug abusers (indigent residents from metropolitan and rural areas in Texas). However, the prevalence of STDs was lower than in a previous study of crack cocaine users [10]. The results of this study must be interpreted cautiously. First, this was a purposive consecutive sample, and these clinics may not be typical of other clinics or populations of drug abusers in treatment facilities in other parts of the United States. Second, the policy at the Houston 2 site was to give antibiotic prophylaxis to inpatients at admission, which probably significantly reduced the levels of gonorrhea and chlamydial infection.

Nearly 8% of the study population in these drug treatment clinics had a treatable STD (syphilis, gonorrhea, and chlamydial infection). Given the fact that >20% of patients had ≥ 2 sex partners in the 4 weeks before the study, there is potential for a clinically significant lower rate of STDs. Furthermore,

Table 4. Results of logistic regression analysis of risk factors and sexually transmitted infections or diseases (STDs) for 407 drug abusers in treatment programs in Texas.

Factor	Adjusted OR (95% CI), by type of infection				
	HIV	HBV	HCV	HSV-2	Syphilis
Age >30 y	2.0 (0.4–9.6)	2.8 (1.3–5.8) ^a	7.4 (3.1–17.9) ^a	4.8 (2.4–9.4) ^a	1.7 (0.3–9.3)
Female sex	1.3 (0.3–6.2)	1.2 (0.6–2.8)	1.2 (0.5–2.8)	4.5 (2.1–9.6) ^a	0.7 (0.1–4.0)
African American race	— ^b	2.0 (1.0–4.2) ^a	1.1 (0.5–2.4)	3.6 (1.8–7.1) ^a	3.2 (0.7–15.2)
Injection drug use	0.7 (0.1–6.2)	2.7 (1.0–7.7) ^a	6.1 (2.2–13.2) ^a	1.9 (0.6–5.5)	2.8 (0.4–17.9)
Needle sharing	0.7 (0.1–7.3)	3.3 (1.2–9.1) ^a	4.4 (1.6–12.9) ^a	0.5 (0.2–1.5)	0.3 (0.0–2.4)
History of treatment for drug abuse	1.6 (0.4–6.5)	2.2 (1.1–4.1) ^a	1.1 (0.5–2.1)	1.0 (0.5–1.8)	0.9 (0.2–3.3)
History of STDs	— ^b	1.6 (0.8–3.0)	1.3 (0.7–2.7)	1.7 (0.9–3.13)	11.7 (1.3–101.0) ^a
Use of crack cocaine	— ^b	1.0 (0.5–2.3)	1.0 (0.4–2.3)	1.6 (0.8–3.3)	0.5 (0.1–3.0)
History of selling sex	1.7 (0.4–8.7)	1.3 (0.6–2.9)	1.0 (0.4–2.5)	1.9 (0.9–3.1)	1.7 (0.3–9.6)
>5 Sex partners in the last 4 w	— ^b	1.6 (0.5–5.4)	0.7 (0.2–3.2)	—	2.6 (0.5–14.1)

NOTE. HBV, hepatitis B virus; HCV, hepatitis C virus; HSV-2, herpes simplex virus type 2.

^a $P < .05$.

^b Because of a zero-containing cell, the OR is estimated in univariate analysis by adding 0.5 in each cell. Estimated ORs (95% CI) are as follows: for African American race, 44.5 (17.0–126.6); for STD history, 41.1 (16.1–114.2); for crack use, 12.7 (5.0–35.4); and for >5 sex partners in the last 4 weeks, 0.7 (0.3–1.9).

the reported frequency of previous STDs (particularly bacterial STDs) among the study population suggests that incorporation of STD screening into drug abuse treatment is clinically and epidemiologically appropriate. Reported previous STDs are likely to be significantly underestimated, since they usually include only clinically obvious disease [1, 11]. Cases identified by a physician are common in populations of drug abusers: over one-third of men and over one-half of women report having had at least 1 physician-diagnosed STD in their lifetime [11]. The present study had similar findings.

We found that bloodborne transmissible agents such as HBV and HCV were more likely to be associated with unsafe injection drug use, as have other investigations [12, 13]. Injection drug use is clearly an important confounder to be kept in mind when HBV or HCV infection is examined in the setting of sexual transmission. Parenteral exposure is the most effective way to transmit HBV and HCV and, to a somewhat less extent, HIV, as reported here and also by Garfein et al. [14]. Most injection drug users in our study were also users of crack cocaine; therefore, the significant risk of crack use disappeared when we adjusted for injection drug use. This study demonstrated that a history of having STDs and currently having STDs (detected by testing for biomarkers), especially HSV-2 infection and syphilis, were strongly associated with HIV infection. This observation confirmed findings from other reports that HIV infection is associated with genital ulcer disease [5–9], which implies that HIV transmission was sexual rather than through unsafe injecting. This implication tends to reinforce the arguments of Ross et al. [10] that among drug abusers, transmission of HIV by sexual routes may be as important as transmission by unsafe injection practices.

This study, as well as other investigations, demonstrated that female sex or African American race was associated with most STDs, especially HIV, HBV, and HSV-2 infections [8, 9]. Both HBV infection and HSV-2 infection were also associated with a history of selling sex for money or drugs and with having

many sex partners. These findings reinforce that STDs and drug abuse are integral parts of a single problem and that treatment of one should be accompanied by screening and treatment of the other. The nonsignificant association observed between drug abuse, chlamydial infection, gonorrhea, and syphilis may be due to insufficient power because our sample was small the prevalences of these diseases are low. No association between HCV infection and variables that were highly associated with other STDs such as female sex, race, a history of STDs, use of crack cocaine, a history of selling sex, and multiple sex partners supports the observations of the low efficiency of sexual transmission of HCV [15, 16].

Ross et al. [10] argued that because STDs have a high prevalence and a history of buying or selling sex for money or drugs is common among populations of drug abusers (one-third of the population in this study), STDs should be considered by discussing triple diagnoses for drug abusers: drug dependence or addiction, mental health disorders, and STDs. They supported this argument by demonstrating a high prevalence of STDs among a population that frequented a crack house. The present study has further demonstrated that, although prevalences are lower among drug abusers (most of whom prefer cocaine or crack), there is still a clinically significant STD problem that warrants incorporation of STD screening into drug abuse programs. Further, there is clear evidence that ulcerative and mucosal STDs very significantly increase HIV transmission. It is biologically plausible that this may also be the case for HBV and HCV infections. This study clearly supported the federal recommendation of screening for infectious diseases in substance abusers from the Center for Substance Abuse Treatment, US Department of Health and Human Services [17].

There were limitations to the cross-sectional study design we used to assess risk factors associated with infection. The generalizability of our findings is limited because participants were from only 3 clinic sites and were voluntary and self-selected. The power to observe statistically significant findings

is limited because the study included only small numbers of cases of HIV infection and syphilis. Behavior histories are less valid than biological measures; therefore, self-reported STDs may underestimate infection, since many STDs are clinically silent. Further, counting both previous STDs and positive current syphilis serological tests as cases of syphilis may overestimate ORs. However, the important findings from this study did provide strong support for the need for STD screening and treatment for this population. Our data confirm that the sexual behaviors in populations of drug abusers in treatment facilities do put them at risk for STDs and that prevalences of STDs in this population are not extremely high but are at a clinically significant level.

The present one-time study of >400 people receiving drug abuse treatment at 3 sites in Texas identified >30 cases of treatable bacterial STDs (~8% of the population screened). Even though prevalences of STDs among in-treatment populations are significantly lower than prevalences in a population that frequented a crack house in the same geographic area, the present evidence suggests that control of infectious pathogens in populations of drug abusers in treatment programs should be considered a priority and that routine STD screening is justified.

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