HIV Seroprevalence Among Homeless and Marginally Housed Adults in San Francisco

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Homeless and marginally housed persons in the United States are at high risk for HIV owing to high-risk sexual and drug-use behaviors.[1–6] These populations include high-risk groups such as former prison inmates,[7] crack and other cocaine users,[8,9] sex workers,[10] certain racial or ethnic minority groups,[11,12] and persons with major mental illness.[13–15]

Representative studies of HIV among homeless and marginally housed adults are rare,[3] and estimates of HIV infection and other health problems vary dramatically as a function of sampling strategy.[16] Since many indigent adults are unlikely to be included in traditional household or telephone surveys,[17] HIV estimates are often based on convenience samples of high-risk groups (injection drug users [IDUs], female sex workers) or samples from service, treatment, or institutional sites (shelters, medical clinics). Not surprisingly, HIV prevalence rates vary from 0% to 62%, depending on the target population, geographic area, recruitment site, and sampling strategy.[1–3,18–28] Estimates for the larger indigent urban populations are needed.

This report documents HIV seroprevalence, distribution, and risk factors for a large sample of indigent persons in San Francisco and provides the most comprehensive data on HIV among homeless and marginally housed adults to date. We expect the findings reported here to inform both new and existing HIV prevention efforts that serve these high-risk but hidden populations.

METHODS

Sampling Design

The sampling design was a multistage cluster sample with stratification. The target population was homeless and marginally housed adults in San Francisco, and data were collected over a 21-month period (starting in April 1996).

Objectives. We report HIV seroprevalence and risk factors for urban indigent adults.

Methods. A total of 2508 adults from shelters, meal programs, and low-cost hotels received interviews, blood tests, and tuberculosis screening.

Results. Seroprevalence was 10.5% overall, 29.6% for men reporting sex with men (MSM), 7.7% for non-MSM injection drug users (IDUs), and 5.0% for residual non-MSM/non-IDUs. Risk factors were identified for MSM (sex trade among Whites, non-White race, recent receptive anal sex, syphilis), non-MSM IDUs (syphilis, lower education, prison, syringe sharing, transfusion), and residual subjects (≥5 recent sexual partners, female crack users who gave sex for drugs).

Conclusions. HIV seroprevalence was 5 times greater for indigent adults than in San Francisco generally. Sexual behavior predicted HIV infection better than drug use, even among IDUs. (*Am J Public Health.* 2004;94:1207–1217)

To create a probability sample of homeless and marginally housed adults, we constructed a sampling frame of shelters and free-meal programs throughout the city and county of San Francisco. The sample was drawn from all 7 overnight shelters (housing a minimum of 50 adults per night) and 5 of 6 midday free-meal programs (serving ≥100 adults ≥3 days/week). The great majority of homeless adults in urban areas (usually >85%) are represented by similar sampling strategies.[29–32]

Additional marginally housed adults were recruited from a sampling frame of 83 residential hotels concentrated in low-income neighborhoods (i.e., Tenderloin, South of Market, and Mission districts). Criteria for selecting hotels included the following: a hotel operator's license;[33] rent of $400 per month or less; 20 or more "usually occupied" residential (nontourist) rooms; public availability; no in-house programs (e.g., health clinics); and location within census tracts with a high incidence of tuberculosis (TB) cases in US-born individuals, which excluded Chinatown. Hotels were selected with a probability proportionate to size, and subjects were recruited from 4734 usually occupied residential rooms in 26 hotels. For hotels with fewer than 100 eligible rooms, a geographically contiguous hotel was also selected into the cluster until at least 100 rooms were included.

Adults within hotels, meal programs, and shelters were selected by systematic random sampling.

Initial data collection occurred on Mondays (at or near sampling sites) and included an interview, HIV pretest counseling by certified counselors, a blood draw, and TB skin tests. A study identification number and a unique identifier (no names) were used to identify each subject. Shelter/meal program recruits received $10 cash and hotel recruits received $15 cash. Those who returned the following Friday for notification of HIV and TB test results, HIV posttest counseling, and medical referrals received $10.

The completion rate was 66.6% (75.6% in shelters, 74.1% in meal programs, and 62.1% in hotels). No significant gender or racial/ethnic differences were documented for refusals. The return rate for notification was 91.2%. Among 2905 subjects completing interviews and blood tests, 397 duplicates were deleted, for a final sample of 2508.

Data Collection

Serum specimens were screened for HIV-1 antibodies with a licensed enzyme-linked immunosorbent assay (ELISA) with Western Blot assay confirmation. TB was screened with a tuberculin skin test by the Mantoux method with 5-TU (tuberculin units) strength

of partial protein derivative. A positive tuberculin skin test was defined as 10 mm of induration or more for HIV-negative subjects and 5 mm or more for HIV-positive subjects. Subjects who clearly described a past positive TB result were counted among TB positives but not retested.

The structured interview averaged 45 minutes. Sex included oral, vaginal, or anal intercourse. Lifetime sexual risk factors included reported sex with men among biological males (i.e., men who have sex with men, or MSM), sex trade (giving sex for cash or drugs), and prior syphilis diagnosis by a doctor or nurse. Twelve-month factors included a history of receptive anal sex or sex with 5 or more partners.

Drug risk factors included lifetime use of crack, other cocaine, stimulants, or heroin or other opiates. Lifetime injection behaviors included injection drug use, sharing of syringes, and injection in a "shooting gallery" situation. ("Shooting gallery" is a slang term that usually refers to a hidden location within a neighborhood with a high rate of drug use, where multiperson use of injection equipment commonly occurs.)

Lifetime, chronic, and current homelessness (spending the night in a shelter or "on the streets") were assessed. A positive screen for alcohol dependence was indicated with affirmative answers to at least 2 of 4 questions of the CAGE questionnaire.[34] Test-based knowledge of HIV status was collected during the interview, phlebotomy, and posttest counseling.

Biological sex was attributed by interviewers (or asked if unclear) as male or female. Classification as male-to-female transgender included biological males who self-identified as transgender or transsexual or who reported gender identification as women. Current sexual orientation was self-identified as heterosexual (straight), homosexual (gay or lesbian), or bisexual.

ANALYSIS

All analyses were weighted. Subject weights were calculated to adjust for probabilities of selection of stratum (hotel vs shelter/meal program), cluster (specific site), and individual within sites. Analyses were conducted with SPSS (SPSS Inc, Chicago, Ill). Chi-square tests were used for bivariate analysis. Logistic regression was used to identify risk factors independently associated with HIV infection for the total sample and for each of 3 mutually exclusive risk groups. Odds ratios and 95% confidence intervals are reported. Fit for each model was judged by the comparison of the −2 log likelihood of model improvement and Wald statistics of the β coefficients. Each multiple logistic regression initially included variables associated with HIV status ($P < 0.10$). Collinear variables and ones with small sample sizes were excluded.

RESULTS

Full Sample

The sample was 75% male, with a median age of 42 years. Blacks and Whites constituted most of the sample (Table 1). Most had lived in San Francisco for 1 year or longer (median = 12 years). About one quarter were veterans (30.5% of males, 3.2% of females; not shown). Most (97.4%) reported current (30-day) income; median income was $585 per month (not shown). Most subjects (72.4%) reported current (30-day) income from public entitlement programs (General Assistance, 40.1%; Supplemental Security Income/Social Security Disability Income, 30.3%; Aid to Families With Dependent Children, 2.6%) or employment (19.3%) (not shown). Only half (50.5%) reported medical coverage; 37.7% had Medicare or Medicaid (not shown).

The majority (78.1%) had experienced homelessness as adults (including 75.2% of hotel recruits and 92.3% of meal program/shelter recruits [not shown], demonstrating the high overlap between these populations). For the previous night, many (43.3%) were homeless, and half (48.1%) reported staying in a single-room occupancy hotel (not shown). Half of the sample reported chronic homelessness.

Current drug use (30 days; not shown) included crack (32.8%), other cocaine (6.9%), heroin (17.3%), and stimulants (12.9%). Nearly half (44.2%) reported current use of any of these drugs. About one third reported injection drug use (34.6%).

The prevalence of TB infection (not necessarily active disease) was 33.4%. TB positives were referred to the San Francisco Department of Public Health TB Clinic for evaluation.

HIV seroprevalence for the total sample. The weighted seroprevalence of HIV infection was 10.5% overall (Table 1). HIV was slightly higher for recruits from single-room occupancy hotels (11.1%) than for shelter and meal-program recruits (7.6%). By mutually exclusive risk groups, the burden of HIV infection was heaviest for men who reported lifetime histories of both sex with men and injection drug use (32% of positive cases), followed by (1) men and women with lifetime histories of injection drug use only (28%), (2) men and women with neither histories of injection drug use nor (for men) sex with men (24%), and (3) men who reported sex with men but did not report injection drug use (16%).

Forty-three percent of HIV-positive subjects disclosed test-based knowledge of their HIV status during the interview. Of these, 74.7% reported current care for HIV and 39.4% reported current HIV/AIDS-related medication. HIV-positive subjects underreported knowledge of HIV status during interviews; an additional 25% disclosed knowledge during phlebotomy or posttest counseling.

HIV seroprevalence in the full sample: bivariate analysis. HIV was significantly higher among males, Whites, younger subjects, longer-term San Francisco residents, TB-negative individuals, gay or bisexual men, bisexual women, and male-to-female transgender persons (Table 1). HIV was significantly higher among behavioral risk groups: MSM, sex traders, and subjects with prior syphilis, recent (12-month) receptive anal intercourse, or 5 or more recent (12-month) sex partners.

Drug use was highly prevalent, and HIV was significantly higher among lifetime IDUs and crack and stimulant users (Table 1). About half of the sample reported lifetime injection, and IDUs were about twice as likely as non-IDUs to be infected. HIV infection was significantly higher among subjects reporting risky injection (including lifetime syringe sharing and injecting in a shooting gallery) and use of a needle/syringe exchange.

TABLE 1—HIV Seroprevalence in Homeless and Marginally Housed Adults (n = 2508), by Risk Factors: San Francisco, 1996–1997

	% of Sample (n)	% HIV+	OR (95% CI)
All subjects	100.0 (2508)	10.5	…
Biological sex			
Male	74.8 (1958)	11.8***	1.9 (1.3, 2.7)
Female	25.2 (550)	6.6	1.0
Race/ethnicity (dichotomy)			
White	42.0 (1006)	12.0*	1.0
Non-White	58.0 (1496)	9.4	0.79 (0.6, 1.0)
Race/ethnicity (self-identified)			
White	42.0 (1006)	12.0	1.0
Black/African American	44.2 (1133)	9.7	0.79 (0.60, 1.0)
Latino/Hispanic	5.1 (147)	12.5	1.1 (0.60, 1.8)
Asian/Pacific Islander	4.8 (117)	4.1**	0.32 (0.1, 0.79)
Native American	3.1 (78)	6.4	0.50 (0.2, 1.3)
Other	0.8 (21)	16.7	1.5 (0.4, 5.2)
Age, y			
18–29	9.5 (238)	15.5*	1.5 (1.1, 2.1)
≥ 30	90.5 (2228)	10.0	1.0
Education completed			
< 12th grade	26.6 (659)	10.6	1.0 (0.8, 1.3)
≥ 12th grade	73.4 (1846)	10.5	1.0
Current sexual preference:			
Among males reporting (n = 1900)			
Heterosexual	80.8 (1568)	6.3	1.0
Gay/bisexual	19.2 (342)	33.8***	7.6 (5.6, 10.3)
Among females reporting (n = 533)			
Heterosexual	73.6 (396)	5.1	1.0
Bisexual	21.6 (110)	11.3*	2.4 (1.2, 4.7)
Lesbian	4.8 (27)	3.3	0.65 (0.08, 4.9)
Transgender male to female[a]			
Yes	2.1 (52)	25.0**	2.9 (1.5, 5.6)
No	97.9 (2456)	10.2	1.0
Prison, ever			
Yes	24.1 (600)	10.8	1.1 (0.8, 1.4)
No	75.9 (1887)	10.3	1.0
Psychiatric hospitalization, ever			
Yes	21.5 (555)	10.8	1.0 (0.8, 1.4)
No	78.5 (1951)	10.4	1.0
Currently homeless[b]			
Yes	14.0 (1084)	8.3	0.74 (0.49, 1.1)
No	86.0 (1419)	10.9	1.0
Chronic homelessness[c]			
Yes	49.6 (1301)	11.5	1.2 (0.9, 1.6)
No	50.4 (1141)	9.7	1.0
San Francisco resident ≥ 1 y			
Yes	89.2 (2087)	11.2**	2.3 (1.3, 3.9)
No	10.8 (320)	5.0	1.0

Continued

For analysis, the sample was divided into 3 mutually exclusive and exhaustive risk groups: the MSM group, which included all reported MSM (including those with a history of drug injection); the IDU group, which included the balance of reported IDUs; and the residual group, which comprised men and women who reported no history of injection drug use and men who reported no history of sex with other men.

HIV by Risk Group: Bivariate Analysis

HIV infection in the MSM group. MSM had an overall HIV infection rate of 29.6% (Table 2). MSM constituted 18.7% of the entire sample, and most of these (75.5%) self-identified as gay or bisexual. The majority of MSM also had a lifetime history of injection drug use, and HIV was significantly higher in this subgroup. MSM were twice as likely as all other subjects to be lifetime IDUs (58.2% vs 41.7% [$P<.001$]; odds ratio [OR] = 2.0; 95% confidence interval [CI] = 1.6, 2.4 [not shown]).

HIV among MSM was significantly higher for subjects who were younger (18–29 years), were San Francisco residents (≥ 12 months), were TB negative, had had transfusions, reported sexual risk factors (i.e., prior diagnosis of syphilis, lifetime sex trade, and recent [12-month] receptive anal intercourse), and reported drug risk factors (i.e., any injection drug use, stimulant injection, heroin injection, and crack use). Paradoxically, while HIV was higher among MSM with lifetime use of needle/syringe exchange (as part of a risk reduction program), HIV among MSMs was not associated with lifetime syringe sharing or use of shooting galleries.

HIV infection in the IDU group. For the IDU group (lifetime IDUs, excluding MSM), HIV prevalence was 7.7%, with almost identical rates for males and females. HIV was significantly higher among subjects who reported lifetime needle/syringe sharing, injecting drugs in a shooting gallery, previous syphilis infection, blood transfusion, prison stay, or lower education (Table 2). Stimulant users were significantly less likely to be HIV infected than other IDUs. Although 16% of female IDUs reported receptive anal sex in the previous year, their HIV rate was not

TABLE 1—Continued

TB-infected in lifetime[d]			
Yes	33.4 (791)	7.5**	1.0
No	66.6 (1496)	11.8	1.5 (1.2, 2.1)
Transfusion blood/products 1978–1985			
Yes	9.0 (187)	13.5	1.4 (0.9, 2.1)
No	91.0 (2291)	10.0	1.0
Drug use risk factors			
Injection drug use, ever[e]			
Yes	44.8 (1033)	14.3***	2.1 (1.6, 2.7)
No	55.2 (1475)	7.4	1.0
Injection of cocaine (not crack), ever			
Yes	26.5 (592)	12.1	1.3 (1.0, 1.7)
No	73.5 (1874)	9.7	1.0
Injection of stimulants, ever[f]			
Yes	27.7 (623)	15.9***	2.1 (1.6, 2.7)
No	72.3 (1848)	8.2	1.0
Injection of heroin, ever			
Yes	38.2 (835)	13.3***	1.7 (1.3, 2.2)
No	61.8 (1640)	8.4	1.0
Injection of speedballs or other heroin mixes, ever			
Yes	19.7 (376)	13.3*	1.5 (1.1, 2.0)
No	80.3 (1954)	9.4	1.0
Needle/syringe sharing, ever			
Yes	26.6 (591)	15.4***	1.9 (1.5, 2.5)
No	73.4 (1828)	8.6	1.0
Shooting gallery, ever			
Yes	12.6 (286)	16.4*	1.8 (1.3, 2.6)
No	87.4 (2130)	9.6	1.0
Needle exchange, ever			
Yes	26.0 (513)	15.5***	1.9 (1.5, 2.5)
No	74.0 (1995)	8.8	1.0
Crack cocaine use, ever			
Yes	63.2 (1535)	11.9***	1.7 (1.3, 2.3)
No	36.8 (941)	7.3	1.0
Stimulant use, ever			
Yes	46.2 (1130)	13.0***	1.7 (1.3, 2.2)
No	53.8 (1349)	8.0	1.0
Sexual risk factors			
MSM, ever[g]			
Yes	18.9 (475)	29.6***	6.4 (4.9, 8.4)
No	81.1 (2033)	6.1	1.0
≥ 5 sex partners, past 12 mo			
Yes	17.8 (454)	26.9***	1.8 (1.4, 2.5)
No	82.2 (2018)	16.8	1.0
Receptive anal sex, past 12 mo			
Yes	11.0 (285)	30.1***	4.9 (3.6, 6.6)
No	89.0 (2223)	8.1	1.0
Syphilis diagnosis, ever			
Yes	9.2 (211)	25.1***	3.4 (2.4, 4.7)
No	90.8 (2287)	9.0	1.0

Continued

significantly higher than that of other female IDUs (not shown).

HIV infection in the residual group. HIV seroprevalence was 5.0% for the residual group (history of neither injection drug use nor [among men] of sex with other men) (Table 2). In bivariate analysis, HIV rates were significantly higher among subjects who were Black compared with Whites, had prior syphilis, had 5 or more recent (12-month) sexual partners, or had ever traded sex. HIV was also significantly higher for bisexual women than for other women in the group. HIV was significantly lower for veterans (3.6% vs 6.6% for non-veterans; OR = 0.54; 95% CI = 0.29, 1.0 [not shown]) and subjects with lifetime psychiatric hospitalization. While 11% of women in the residual group reported recent (12-month) receptive anal sex, none of them were HIV positive (not shown). For the total sample, most women infected with HIV were non-IDUs.

Multivariate Analysis of HIV Infection

Logistic regression was used to identify risk factors that independently predicted HIV infection for the overall sample and then for each of 3 risk groups (Table 3). For the total sample, MSM were 4.6 times more likely to be infected than non-MSM. Other significant predictors included previous syphilis infection, interaction between lifetime injection drug use and White race/ethnicity, blood transfusion, non-White race/ethnicity, lifetime sex trade, and recent (12-month) receptive anal sex.

For the MSM group, sexual risk factors were stronger predictors of HIV infection than high-risk drug use. The strongest predictor was an interaction term for White sex traders, who were 5.9 times more likely than other MSM to be infected. Compared with other MSM, those of non-White race/ethnicity were 3.4 times more likely to be HIV infected, and those who reported recent (12-month) receptive anal sex or lifetime syphilis were twice as likely to be HIV infected. Despite the high prevalence of drug use in the MSM group, drug use variables (including lifetime injection drug use and stimulant use) did not independently predict HIV among MSM.

TABLE 1—Continued

Sex trade, ever			
Yes	29.7 (679)	18.7***	3.2 (2.5, 4.2)
No	70.3 (1757)	6.6	1.0
Sex for cash, ever			
Yes	26.0 (596)	18.7***	2.9 (2.3, 3.8)
No	74.0 (1857)	7.2	1.0
Sex for drugs, ever			
Yes	14.5 (369)	23.9***	3.6 (2.7, 4.8)
No	85.5 (2079)	8.0	1.0

Note. OR = odds ratio; CI = confidence interval; TB = tuberculosis. Percentages, ORs, and CIs are based on weighted data; sample sizes are unweighted data.

[a]Two female-to-male transgender persons in the sample were not included here; both were HIV negative.
[b]Spent the previous night in a shelter or "on the streets," a set of nonconventional living sites.
[c]Total time accumulated as homeless since age 18 was 12 months or longer.
[d]Positive tuberculin skin test, but not necessarily active disease.
[e]Injection of illicit drugs.
[f]"Speed," "uppers," "crank," amphetamines, methamphetamine, "crystal meth," or "ice."
[g]Men who reported ever having oral or anal sex with another man.
*P<.05; **P<.01; ***P<.001.

For the IDU group (lifetime injection drug use, excluding MSM), previous syphilis infection was the strongest independent predictor of HIV (3.3 times higher risk of infection), followed by low education, prison stay, syringe sharing, and blood transfusion (each associated with at least a twofold risk of infection). In this group of IDUs, having syphilis was a stronger predictor of HIV infection than syringe sharing.

Compared with others in the residual group, female lifetime crack users with histories of trading sex for drugs were 6.1 times more likely to be infected, and those with 5 or more recent (12-month) sex partners were 2.9 times more likely to be infected.

DISCUSSION

In this study, HIV seroprevalence was 10.5% overall, 8.3% among the currently homeless, and 10.9% among marginally housed adults in San Francisco. After adjustment for other risk factors, non-Whites were 1.8 times more likely than Whites to have HIV infection. Recruits from single-room occupancy hotels (11.1%) had higher rates of HIV infection than among those from shelters/meal programs (7.6%). The rate for shelters and meal programs (i.e., excluding the hotel sample) is similar to that of an earlier study (8.5%).[3]

Lifetime histories of injection drug use or (among men) sex with other men put *more than half* of the sample at risk for HIV infection. While more than half of all HIV-infected persons were lifetime IDUs, high-risk sexual activity and its surrogates were stronger predictors of HIV infection than high-risk drug use, even among IDUs.

It is striking that these indigent adults were 5 times more likely to be infected than others in San Francisco,[35] a city with relatively high HIV estimates for the United States. While the number of HIV-infected indigent adults is unknown, the number of homeless persons among all new cases of AIDS in San Francisco has increased each year since 1990 (from 1% to 15%).[35] Our findings, and this trend, are consistent with studies that report HIV and AIDS incidence to be inversely associated with economic resources, even across gender and racial/ethnic groups.[2,36–39]

Sex Drives HIV Infection Among Indigent MSM

HIV was widespread among MSM in this study: 29.6% overall, 34.8% among MSM with lifetime histories of injection, and 22.4% among MSM with no history of injection. The HIV rate for MSM overall is consistent with the 1997 San Francisco Department of Public Health estimate for MSM generally (30%),

but high compared with the results of a 1997 San Francisco household survey of MSM (20%).[17] Our prevalence estimates for MSM IDUs (34.8%) and MSM aged younger than 30 years (40.9%) are also close to HIV rates estimated for these groups of MSM in San Francisco generally.[40,41]

Over half (58.3%) of all MSM had lifetime histories of injection drug use. While MSM IDUs were more likely to be infected than non-IDUs, injection drug use did not independently predict HIV infection among MSM. Rather, HIV among MSM was predicted by sexual risk factors, including previous syphilis diagnosis, recent receptive anal sex, sex trade among Whites, and non-White race/ethnicity.

Consistent with previous literature,[42–44] MSM who reported recent (12-month) receptive anal sex or prior syphilis were more than twice as likely as other MSM to be HIV infected. Syphilis, a marker for unprotected sex, has been identified as a predictor of HIV seroconversion,[45] and its presence may increase the transmissibility of HIV.[45,46] Recent outbreaks of syphilis among MSM in California may suggest a resurgence of unprotected sex and a potential increase in HIV incidence.[47] In one study, identifying and treating cases of syphilis and other sexually transmitted diseases decreased the incidence of HIV without changing sexual behavior.[48] Such efforts targeting indigent urban adults may have a similar effect.

Sex trade was prominent among MSM in this study, with half reporting lifetime sex trade for cash or drugs. White sex traders were almost 6 times more likely to be HIV infected than other MSM. Similarly, Canadian researchers have found that sex trade independently predicts both HIV incidence and prevalence among young gay and bisexual men.[49] Sex trade among MSM in this study may owe in part to economic necessity or severe drug abuse (since HIV was more prevalent among those who traded sex for drugs than among those who traded it for cash).

Consistent with previous studies of MSM in San Francisco and other cities,[17,40,50,51] non-White MSM (mostly Blacks) were 3.4 times more likely to be infected than White MSM, after adjustment for other risk factors. Among US MSM, Blacks are burdened with the highest HIV and AIDS incidence and prevalence, the highest HIV-related mortality,

TABLE 2—HIV Seroprevalence Among Homeless and Marginally Housed Adults (n=2508), by Risk Factors, by Risk Groups: San Francisco, 1996–1997

	Risk Groups (Mutually Exclusive)								
	MSM Group[a] (All MSM)			IDU Group (Non-MSM IDUs)			Residual Group (Non-MSM, Non-IDUs)		
	% (n)	% HIV+	OR (95% CI)	% (n)	% HIV+	OR (95% CI)	% (n)	% HIV+	OR (95% CI)
All subjects	(475)	29.6		(772)	7.7		(1261)	5.0	
Biological sex									
Male	100.0 (475)			64.4 (554)	7.8	1.0 (0.61, 1.8)	72.3 (929)	4.7	.80 (0.45, 1.4)
Female				35.6 (218)	7.6	1.0	27.7 (332)	5.8	1.0
Race/ethnicity (dichotomy)									
White	60.4 (262)	28.9	1.0	45.7 (360)	8.0	1.0	32.0 (384)	3.4	1.0
Non-White	39.6 (213)	30.6	1.1 (0.80, 1.4)	54.3 (410)	7.6	.95 (0.60, 1.5)	68.0 (873)	5.7	1.7 (0.91, 3.2)
Race/ethnicity (self-identified)									
White	60.4 (262)	28.9	1.0	45.7 (360)	8.0	1.0	32.0 (384)	3.4	1.0
Black/African American	26.9 (153)	31.0	1.1 (0.70, 1.7)	40.1 (296)	8.2	1.0 (0.61, 1.7)	54.1 (684)	6.2*	1.9 (0.99, 3.6)
Latino/Hispanic	6.8 (32)	34.4	1.3 (0.60, 2.8)	6.8 (61)	8.6	1.1 (0.41, 2.9)	3.2 (54)	0.0	
Asian/Pacific Islander	0.5 (6)	66.7	4.9 (0.44, 55.1)	2.4 (16)	0.0		8.2 (95)	3.1	.90 (0.25, 3.2)
Native American	5.2 (18)	20.8	.65 (0.23, 1.8)	3.9 (30)	0.0		1.8 (30)	0.0	
Other	0.2 (4)	0.0		1.1 (7)	0.0		.8 (10)	33.3**	14.1 (3.2, 62.8)
Age, y									
18–29	14.5 (65)	40.9*	1.8 (1.0, 3.0)	6.5 (54)	1.8	.21 (0.03, 1.5)	9.6 (119)	7.1	1.5 (0.71, 3.3)
≥30	85.5 (404)	28.0	1.0	93.5 (709)	8.2	1.0	90.4 (1115)	4.7	1.0
Education completed									
<12th grade	22.3 (102)	23.8	.76 (0.52, 1.1)	31.0 (231)	13.6	2.7 (1.7, 4.2)	25.2 (326)	3.3	0.61 (0.31, 1.2)
≥12th grade	77.7 (373)	31.2	1.0	69.0 (541)	5.1***	1.0	74.8 (932)	5.5	
Current sexual preference									
Among males reporting (n = 1900)									
Heterosexual	24.5 (127)	13.3	1.0	97.9 (547)	8.0		99.8 (894)	4.2	
Gay/bisexual	75.5 (340)	33.9***	3.4 (1.9, 6.0)	2.1 (7)	0.0		0.2 (2)	0.0	
Among females reporting (n = 533)									
Heterosexual				63.8 (138)	6.7	1.0	82.9 (258)	4.2	1.0
Bisexual				31.7 (69)	9.4	1.8 (0.99, 3.3)	11.7 (41)	16.2*	4.4 (1.5, 12.7)
Lesbian				4.5 (10)	7.1	1.0 (0.13, 8.0)	5.4 (17)	0	
Transgender male to female[b]									
Yes	10.7 (49)	26.0	0.82 (0.42, 1.6)	0.0 (1)			0.2 (2)	0.0	1.0
No	89.3 (426)	30.0	1.0	100.0 (771)	7.7		99.8 (1259)	5.0	
Prison, ever									
Yes	16.2 (93)	26.7	0.86 (0.49, 1.5)	40.4 (282)	12.0***	2.6 (1.6, 4.4)	15.5 (184)	2.2	0.41 (0.15, 1.2)
No	83.8 (381)	29.8	1.0	59.6 (486)	4.9	1.0	84.5 (1051)	5.2	1.0
Psychiatric hospitalization, ever									
Yes	31.2 (154)	28.8	.95 (0.62, 1.5)	26.6 (201)	6.6	0.82 (0.55, 1.5)	14.0 (200)	0.6**	.10 (0.01, 0.73)
No	68.8 (320)	29.8	1.0	73.4 (570)	8.0	1.0	85.0 (1061)	5.7	
Currently homeless[c]									
Yes	11.7 (184)	20.0	0.6 (0.28, 1.1)	13.3 (339)	9.7	1.3 (0.68, 2.6)	15.3 (561)	3.3	0.62 (0.26, 1.5)
No	88.3 (291)	30.7	1.0	86.7 (433)	7.4	1.0	84.7 (695)	5.3	1.0
Chronic homelessness[d]									
Yes	56.6 (261)	31.9	1.3 (0.87, 2.0)	50.7 (402)	7.5	0.88 (0.53, 1.5)	46.1 (638)	4.5	0.87 (0.51, 1.5)
No	43.4 (207)	26.4	1.0	49.3 (348)	8.0	1.0	53.9 (586)	5.2	1.0

Continued

TABLE 2—Continued

San Francisco Resident ≥1 y									
Yes	89.9 (405)	31.1*	2.4 (1.1, 5.1)	92.9 (674)	7.6	.66 (0.20, 2.2)	86.2 (1008)	5.6	2.2 (0.81, 6.0)
No	10.1 (13.0)	13.0	1.0	7.1 (71)	5.2	1.0	13.8 (191)	2.6	1.0
TB-infected in lifetime[e]									
Yes	24.6 (122)	1.2	1.0	38.6 (275)	6.0	1.0**	33.1 (394)	5.4	1.0
No	75.4 (311)	33.3	1.7 (1.1, 2.6)	61.4 (429)	7.8	1.3 (0.75, 2.2)	66.9 (756)	4.9	0.91 (0.53, 1.6)
Transfusion blood/products 1978–1985									
Yes	5.6 (28)	53.8**	3.1 (1.4, 7.0)	15.1 (88)	12.5*	1.9 (1.1, 3.5)	5.9 (71)	1.4	0.26 (0.04, 1.9)
No	94.4 (442)	27.1	1.0	84.9 (679)	7.0	1.0	94.1 (1170)	5.4	
Drug use risk factors									
Injection drug use, ever[f]									
Yes	58.3 (261)	34.8**	1.8 (1.2, 2.8)						
No	41.7 (214)	22.4	1.0						
Injection of cocaine (not crack), ever									
Yes	29.1 (138)	33.1	1.3 (0.84, 2.0)	61.0 (454)	6.6	0.66 (0.40, 1.1)			
No	70.9 (336)	27.7	1.0	39.0 (314)	9.7	1.0			
Injection of stimulants, ever[g]									
Yes	46.4 (202)	34.6*	1.6 (1.1, 2.4)	55.4 (421)	7.2	0.85 (0.51, 1.4)			
No	53.6 (273)	25.1	1.0	44.6 (346)	8.5	1.0			
Injection of heroin, ever									
Yes	42.1 (186)	34.5*	1.5 (1.0, 2.3)	88.5 (649)	7.7	0.93 (0.43, 2.0)			
No	57.9 (288)	25.7	1.0	11.5 (121)	8.2	1.0			
Injection of speedballs or other heroin mixes, ever									
Yes	19.3 (71)	33.8	1.3 (0.80, 2.3)	52.2 (305)	9.2	1.3 (0.77, 2.2)			
No	80.7 (353)	27.5	1.0	47.8 (340)	7.2	1.0			
Needle/syringe sharing, ever									
Yes	35.2 (151)	31.8	1.2 (0.79, 1.8)	62.0 (440)	10.2**	2.5 (1.3, 4.7)			
No	64.8 (293)	27.9	1.0	38.0 (274)	4.3	1.0			
Shooting gallery, ever									
Yes	14.6 (72)	37.5	1.5 (0.88, 2.7)	30.8 (214)	11.2*	1.7 (1.0, 2.8)			
No	85.4 (373)	28.1	1.0	69.2 (496)	7.0	1.0			
Needle exchange, ever									
Yes	30.9 (126)	39.3**	1.9 (1.3, 2.9)	59.6 (387)	8.7	1.5 (0.85, 2.5)			
No	69.1 (349)	25.3	1.0	40.4 (385)	6.1	1.0			
Crack cocaine use, ever									
Yes	64.9 (318)	33.7**	2.0 (1.3, 3.1)	87.2 (666)	7.8	1.1 (0.50, 2.3)	48 (551)	5.0	1.3 (0.74, 2.3)
No	35.1 (155)	20.2	1.0	12.8 (104)	7.3	1.0	55.2 (682)	3.9	1.0
Stimulant use, ever[g]									
Yes	67.2 (309)	32.0	1.4 (0.93, 2.2)	69.0 (553)	6.3*	0.54 (0.33, 0.90)	21.1 (268)	4.5	1.0 (0.52, 2.0)
No	32.8 (166)	24.7	1.0	31.0 (218)	11.0	1.0	78.9 (965)	4.4	1.0
Sexual risk factors									
≥5 sex partners, previous 12 mo									
Yes	32.0 (159)	30.0	1.1 (0.70, 1.6)	17.8 (139)	5.3	0.6 (0.29, 1.3)	12.0 (156)	10.9***	3.3 (1.8, 6.2)
No	68.0 (311)	28.7	1.0	82.2 (630)	8.3	1.0	88.0 (1077)	3.6	1.0
Receptive anal sex, past 12 mo									
Yes	43.2 (212)	39.4***	2.3 (1.5, 3.4)	4.9 (34)[h]	7.1	0.91 (0.27, 3.0)	3.0 (37)[h]	0.0	
No	56.8 (263)	22.1	1.0	95.1 (738)	7.8	1.0	97.0 (1025)	4.7	

Continued

TABLE 2—Continued

Syphilis diagnosis, ever									
Yes	15.8 (67)	47.3***	2.5 (1.5, 4.2)	9.3 (69)	17.7***	3.0 (1.6, 5.8)	6.6 (75)	11.5**	2.8 (1.3, 5.8)
No	84.2 (406)	26.1	1.0	90.7 (702)	6.6	1.0	93.4 (1179)	4.5	1.0
Sex trade, ever									
Yes	49.7 (242)	40.5***	3.0 (2.0, 4.6)	36.5 (258)	8.9	1.4 (0.82, 2.3)	16.7 (196)	7.9*	2.2 (1.2, 4.1)
No	50.3 (226)	18.4	1.0	63.5 (499)	6.6	1.0	83.3 (1024)	3.8	1.0
Sex for cash, ever									
Yes	43.4 (214)	39.9***	2.5 (1.6, 3.7)	31.7 (210)	8.7	1.3 (0.76, 2.2)	14.8 (172)	8.9**	2.5 (1.4, 4.8)
No	56.6 (256)	21.1	1.0	68.3 (550)	6.8	1.0	85.2 (1051)	3.7	1.0
Sex for drugs, ever									
Yes	26.2 (139)	46.7***	2.9 (1.9, 4.5)	18.9 (148)	11.3	1.7 (0.97, 3.1)	6.6 (82)	13.3***	3.9 (1.9, 8.1)
No	73.8 (330)	23.0	1.0	81.1 (610)	6.9	1.0	93.4 (1139)	3.8	1.0

Note. OR = odds ratio; CI = confidence interval; MSM = men who have sex with men; IDU = injection drug user; TB = tuberculosis. Percentages, ORs, and CIs are based on weighted data; sample sizes are unweighted.

[a] Men who reported ever having anal or oral sex with a man.
[b] Two female-to-male transgender persons in the sample were not included here; both were HIV negative.
[c] Spent the previous night in a shelter or "on the streets," a set of nonconventional living sites.
[d] Total time accumulated as homeless since age 18 was 12 months or longer.
[e] Positive tuberculin skin test, but not necessarily active disease.
[f] Injection of illicit drugs.
[g] "Speed," "uppers," "crank," amphetamines, methamphetamine, "crystal meth," or "ice."
[h] These are all women.
*P < .05; **P < .01; ***P < .001.

and the greatest number of years of potential life lost.[40]

Many MSM (10.7%) self-identified as male-to-female transgender persons; they were no more likely to be HIV infected than other MSM. Their HIV rate was low (26%) compared with that reported in a recent community-based study of transgender persons in San Francisco (35%).[52] Indigent urban male-to-female transgender persons may require highly tailored interventions.

Although sexual risk factors were the best predictors of HIV among MSM, HIV was still more prevalent among MSM IDUs than among MSM non-IDUs. At the bivariate level, HIV infection among MSM was higher among stimulant and heroin injectors, but not among syringe sharers. While the literature suggests that methamphetamine use among MSM is associated with increased risk taking and HIV seroconversions,[42–44] the link between HIV and the use of other drugs by MSM (such as noninjected heroin and crack) is less clear. While drug treatment may decrease sexual risk taking among gay men with substance use disorders,[53] effective treatment options for indigent adults are scarce.[16] Despite widespread injection and noninjection drug use among indigent MSM, HIV interventions targeting this group should reinforce the focus on sexual risk.

Sex Drives HIV Infection Among Indigent IDUs

Almost half of the sample (44.9%) reported lifetime injection drug use, and among all IDUs (including MSM and non-MSM), the HIV rate was 14.3%. This is somewhat higher than the 8.7% reported for IDUs recruited from 2 neighborhoods in San Francisco.[20]

Among the non-MSM IDUs, HIV prevalence was 7.7%, with virtually equivalent rates for men and women (as observed elsewhere[54]). The HIV rate for non-MSM IDUs was lower than those reported in previous studies in San Francisco (10.0%–14.2%)[28,55–58] and nationally (12.7%).[54] The lower rate is probably owing to recruitment of a population-based probability sample that included non-MSM IDUs, rather than a targeted sample of non-MSM IDUs.

Among non-MSM IDUs, prior syphilis was a stronger predictor of HIV infection than lifetime syringe sharing. This finding adds to the literature on non-MSM IDUs that identifies sexual risk as a more important risk factor for HIV infection than drug-use behaviors.[54,55,59–62] Similarly, in a study of urban IDUs that included MSM, Kral and colleagues found that sexual behavior predicts HIV seroconversion better than drug use behavior among both men and women.[62]

Consistent with other studies of non-MSM IDUs,[54] HIV was not related to trading sex for money, cocaine use, or cocaine injection. In contrast to other studies of non-MSM IDUs,[11,55,58–60,63] HIV infection in our study was not related to Black race once we controlled for behavioral risk factors.

Among non-MSM IDUs, those with lower education were 2.5 times more likely to be infected than others, which is consistent with previous studies of HIV seroconversion among non-MSM IDUs.[64,65] Lower education may be a marker for lower socioeconomic status and longer injection careers.

HIV seroprevalence in US prisons is high,[66,67] and there is considerable overlap between the populations of former inmates and the homeless. One quarter of the total

TABLE 3—Logistic Regression Models[a,b] Predicting HIV Infection Among Homeless and Marginally Housed Adults in San Francisco, by Risk Group

Risk Group	Risk Factors	AOR	(95% CI)
Total sample	MSM	4.6	(3.3, 6.4)
	Syphilis, diagnosis ever	2.2	(1.5, 3.3)
	White IDUs (interaction)	2.0	(1.3, 3.3)
	Transfusion	1.8	(1.1, 2.8)
	Non-White race	1.8	(1.1, 2.8)
	Sex trade[c]	1.8	(1.3, 2.4)
	Receptive anal sex, past 12 mo	1.6	(1.1, 2.4)
MSM group (all MSM)	White sex traders[c] (interaction)	5.9	(3.2, 11.1)
	Non-White race	3.4	(1.8, 6.2)
	Receptive anal sex, past 12 mo	2.1	(1.3, 3.3)
	Syphilis, diagnosis ever	2.0	(1.1, 3.5)
IDU group (Non-MSM IDUs)	Syphilis, diagnosis ever	3.3	(1.7, 6.6)
	Less than 12th-grade education	2.6	(1.5, 4.4)
	Prison	2.3	(1.3, 4.0)
	Needle/syringe sharing	2.1	(1.1, 4.0)
	Transfusion (1978–1985)	2.1	(1.1, 3.9)
Residual group (non-MSM/Non-IDUs)	Female crack users × sex for drugs (interaction)	6.1	(2.4, 15.5)
	≥5 sex partners. past 12 mo	2.9	(1.5, 5.5)

Note. AOR = adjusted odds ratio; CI = confidence interval; MSM = men who have sex with men; IDU = injection drug user. Analyses are based on weighted data; sample sizes are unweighted.
[a]When interaction terms in logistic regression models were tested, all covariates were kept in the model regardless of each individual contribution. For the sake of economy, nonsignificant variables were removed from the final models.
[b]All models are adjusted for age (dichotomous), race (White/non-White), and biological sex. Unless otherwise indicated, all variables are lifetime measures.
[c]Sex trade includes ever giving sex for either cash or drugs.

sample reported spending time in prison. Forty percent of non-MSM IDUs reported being in prison, and these were more than twice as likely as other non-MSM IDUs to be HIV infected. In multivariate analysis of non-MSM IDUs, histories of prison and syringe sharing both independently predicted HIV infection, suggesting that prison is not merely a marker for injection drug use or severe drug abuse. Counseling and testing prison inmates may be a cost-effective way to prevent HIV transmission among inmates[68] and may be an important long-term effort to reduce HIV among the urban poor.

Sex Drives HIV Infection Among Other Indigent Adults.

The residual group (no reported history of injection drug use or [among men] of sex with other men) constituted about half of the sample and had a 5.0% HIV prevalence rate. The women's infection rate (5.8%) was high, and more HIV-infected women were in the residual group than in the IDU group. Bisexual women had significantly higher rates (16.2%) of HIV than other women. In multivariate analysis, female crack users who had ever traded sex for drugs were 6 times more likely to be infected than were all others in the residual group, a finding that is consistent with reported high HIV risk for women who trade sex.[10,69] Having 5 or more recent (12-month) sexual partners was also an independent predictor of HIV.

Bisexual women (IDUs and non-IDUs) were more likely to be HIV infected than heterosexual or lesbian women (although only marginally more likely among IDUs.) This finding suggests that besides injection behavior, bisexual women's sexual activity may increase their risk of contracting HIV and requires additional study.

CONCLUSIONS

Findings should be interpreted in light of the study's limitations. Data are cross-sectional, and reporting bias cannot be ruled out.[63] While the demographic profile here closely resembles that of the homeless adults in a recent national survey,[70] findings about general HIV rates and risk factors for infection (e.g., the high prevalence of MSM) may not generalize outside San Francisco or beyond indigent adults who used shelters, meal programs, or low-cost single-room occupancy hotels in San Francisco during the study period.

Despite limitations, it is evident that much of the HIV epidemic in San Francisco is concentrated in a population with numerous complex problems such as extreme poverty, social marginalization, and drug abuse. Indigent urban adults are the "new faces" of HIV in the United States who will carry the heaviest burden of the HIV epidemic into its third decade. Broad structural factors such as poverty, class, racism, and homophobia should be studied to better inform interventions. ■

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tion and fieldwork implementation. A. R. Moss was principal investigator and participated in all aspects of the study, including concept, design, data collection, and analysis.

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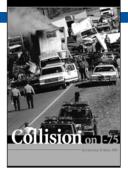10. Jones DL, Irwin KL, Inciardi J, et al. The high-risk sexual practices of crack-smoking sex workers recruited from the streets of three American cities. *Sex Transm Dis.* 1998;25:187–193.

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