

Original Research

Prevalence of HIV infection, sexually transmitted diseases, and hepatitis and related risk behavior in young women living in low-income neighborhoods of northern California

Juan D Ruiz
California Department of
Health Services
Office of AIDS
HIV/AIDS Epidemiology
Branch
PO Box 942732
Sacramento, CA 94234-7320

Fred Molitor
University of California,
Davis
Center for Health Services
Research in Primary Care
Sacramento

Willi McFarland
City and County of San
Francisco
Department of Public Health
Seroepidemiology Branch

Jeffrey Klausner
City and County of San
Francisco
Department of Public Health
STD Prevention & Control
Section

George Lemp
University of California
Universitywide AIDS
Research Program
Oakland

Kimberly Page-Shafer
City and County of San
Francisco
Department of Public Health
Seroepidemiology Branch

Arti Parikh-Patel
California Department of
Health Services
Office of AIDS
HIV/AIDS Epidemiology
Branch

Scott Morrow
County of San Mateo
Department of Public Health
San Mateo, CA

Richard K Sun
California Department of
Health Services
Office of AIDS, HIV/AIDS
Epidemiology Branch for
the Young Women's
Survey Team
*The members of the Young
Women's Survey Team are
listed at the end of this
article*

Correspondence to:

Dr Ruiz
jruiz1@dhs.ca.gov

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ABSTRACT ● **Objective** To estimate the prevalence of human immunodeficiency virus (HIV) infection, sexually transmitted diseases, and hepatitis and the associated sexual and drug-using behavior among women residing in low-income neighborhoods in 5 northern California counties. ● **Methods** From April 4, 1996, to January 6, 1998, women aged 18 to 29 years were recruited door-to-door from randomly selected street blocks within 1990 census block groups below the 10th percentile for median household income for each county. ● **Results** Of 24,223 dwellings enumerated, contact was made with residents from 19,546 (80.7%). Within contacted dwellings, 3,560 eligible women were identified and 2,545 enrolled (71.5%). Weighted estimates for disease prevalence were HIV infection, 0.3% (95% confidence interval, 0.1%-0.4%); syphilis, 0.7% (0.3%-1.1%); gonorrhea, 0.8% (0.3%-1.3%); chlamydia, 3.3% (2.4%-4.8%); herpes simplex virus, type 1, 73.7% (71.6%-76.9%); herpes simplex virus, type 2, 34.4% (29.9%-39.0%); hepatitis A, 33.5% (28.3%-38.7%); chronic hepatitis B, 0.8% (0.3%-1.2%); and hepatitis C, 2.5% (1.4%-3.6%). Condom use at last sexual intercourse with a new partner was reported by 44.0% (33.9%-54.1%). Injection drug use in the last 6 months was reported by 1.8% (1.0%-2.7%). ● **Conclusions** The Young Women's Survey provided population-based estimates of the prevalence of 8 infectious diseases and related risk behavior within a population for whom data are often difficult to collect. Population-based data are needed for appropriate targeting and planning of primary and secondary disease prevention.

INTRODUCTION

Data from diverse sources—human immunodeficiency virus (HIV) and/or acquired immunodeficiency syndrome (AIDS) case reporting, the HIV Family of Surveys¹—point to an increasing burden of HIV disease and high potential for further transmission among women in the United States. Minority women who are economically disadvantaged are disproportionately affected by HIV.²⁻⁹ Similarly, the prevalence of sexually transmitted diseases, which are markers for HIV risk, is high among young women who reside in low-income areas throughout the United States.¹⁰⁻¹³

Few population-based estimates are available to assess the current prevalence of HIV infection or to gauge the potential of the epidemic to expand. Population-based data are also needed to appropriately target and plan primary and secondary prevention efforts. We report data collected from young women living in low-income neighborhoods in 5 counties of northern California using a single-stage cluster sampling method. This method was developed to provide a logistically feasible way of estimating the prevalence of HIV, sexually transmitted diseases, and other diseases and related risk factors for this hard-to-reach population.

PARTICIPANTS AND METHODS

Overall design

The Young Women's Survey (YWS) was a 1-stage, cluster-sample, population-based, door-to-door, cross-sectional survey of the prevalence of HIV infection, sexually transmitted diseases, hepatitis A, B, and C, and related risk behavior. The YWS protocol was reviewed, approved, and monitored by the Committee for the Protection of Human Subjects for the State of California Health and Welfare Agency. Participants provided informed consent.

Study population

Eligibility criteria included female sex, age 18 to 29 years, fluency in English or Spanish, and residency in a low-income neighborhood in northern California. Residency was defined as staying at a dwelling the previous night and having no other home. Dwellings included permanent residencies and single resident occupancy units within hotels, makeshift shelters, and "squats" in abandoned buildings.

Sampling design

Five counties in northern California participated: Alameda, Contra Costa, San Francisco, San Joaquin, and San

Mateo. A study target area was defined as 1990 census block groups with median household income below the 10th percentile for each county. All street blocks in this target area were numbered. A simple random sample of street blocks was selected to conduct recruitment.

All women in the randomly sampled blocks who met the eligibility criteria were invited to participate. The enrollment and participation goals were 500 women per county, 2,500 women overall, greater than 80% household rate, and greater than 70% participation rate. For logistical planning, blocks were selected in several stages of simple random samples.

Household enumeration

Working in pairs, community health outreach workers created a map and systematically enumerated all dwellings in each sampled block. Workers used an enumeration form for each dwelling to record and monitor household contact attempts, successes, resident eligibility, enrollment, and refusals. Workers made at least 3 attempts to contact a resident of each dwelling.

Enrollment

Study eligibility was established by face-to-face interview. Eligible women were invited to participate and could enroll immediately or at a prearranged date. The option of completing the survey at a neutral location was offered, as was a \$50 stipend for participation.

In the final 2 months of the study, workers focused on increasing the contact and participation rates for all sampled blocks. In this phase, some women who initially refused to participate because of an expressed fear of needles decided to participate when given the option of the oral fluid HIV antibody test. In addition, the remuneration was increased to \$75 during this period, prompting some women to enroll who had previously refused.

Measures

The primary objective was to measure the prevalence of HIV among this population of young women. The prevalence of other sexually transmitted diseases, markers of hepatitis, and risky sexual and drug use behavior were also measured.

After obtaining informed consent, survey workers conducted 45-minute face-to-face structured interviews in a confidential setting. They recorded demographic characteristics, medical history, drug use, sexual behavior, and knowledge, attitudes, and beliefs around HIV transmission and prevention. The questionnaire was administered in either English or Spanish.

After the interview, a client-centered counseling session to assess risk of HIV and sexually transmitted disease was conducted. A blood specimen was drawn for HIV and syphilis in all 5 counties; for antibodies to hepatitis C and

Summary points

- Women of color, especially those living in economically depressed areas, are disproportionately affected by HIV
- Population-based surveys provide 1 of the best means for assessing the prevalence of HIV and the potential for expansion of the epidemic
- To estimate the prevalence of HIV, sexually transmitted diseases that are markers for HIV risk, and specific risk behaviors, 2,545 lower-income women aged 18 to 29 years were recruited from randomly selected street blocks within 5 California counties
- Weighted estimates are presented for prevalence of sexual and drug use behaviors and for 8 sexually transmitted infectious diseases

herpes simplex virus (HSV), types 1 and 2, in 4 counties; and for antibodies to hepatitis A and B virus in 3 counties. A urine specimen was collected for gonorrhea and chlamydia testing in 3 counties. The names of study participants were submitted with laboratory request forms for all tests except HIV, for which only a coded number linkable to the survey was submitted to preserve confidentiality.

Laboratory methods

The presence of HIV antibodies was demonstrated by enzyme immunoassay (EIA; Organon Technika Corporation, Durham, NC; or the Abbott HIVAb HIV-1 EIA, Chicago, IL), and positive results were confirmed by immunofluorescent antibody (IFA; Waldheim Pharmazeutika GmbH, Vienna, Austria) and resolved, in the event of any discrepancy, by Western blot (Cambridge Biotech Corporation, Rockville, MD). Late in the study, some oral fluid specimens were tested for HIV antibody (Orasure; Organon Technika). Syphilis was detected by nontreponemal antibody tests (rapid plasma reagin or VDRL) and confirmed by treponemal antibody test (microhemagglutination assay for *Treponema pallidum* [MHA-TP]). Hepatitis A antibody was detected by the microparticle EIA (Abbott HAVAb; Abbott Laboratories, Abbott Park, IL). Hepatitis B core antibody was detected by a commercial EIA (Abbott Corzyme; Abbott Laboratories) and, if assay results were positive, for the presence of hepatitis B surface antigen by a monoclonal antibody EIA (Abbott Auszyme; Abbott Laboratories). Antibodies to hepatitis C virus (HCV) were detected by a commercial antigen EIA (Hepatitis C Encoded Antigen; recombinant c22-3, c200, NS5i, Ortho HCV EIA, Ortho Diagnostic Systems, Raritan, NJ). Specimens that tested positive were retested using the recombinant immunoblot assay (Chiron, Emeryville, CA; or Ortho Diagnostic Systems). Ligase chain reaction (LCX; Abbott Laboratories) was used to detect gonococcal and chlamydial DNA in urine specimens. A strip recombinant immunoblot assay (RIBA, HSV 1 and

2; Chiron) was used to differentiate HSV-1 and HSV-2 specific antibodies on recombinant antigen bands for glycoproteins gG1, gB1, gG2, and gD2.¹⁴

Counseling and referral services

Risk assessment counseling was conducted after the study interview and before specimens were collected. Participants were counseled on the disclosure of test results 2 weeks later at a venue designated by the study team, often the department of public health or a local community-based organization. The sexually transmitted disease control units of the local departments of public health provided treatment, follow-up, and partner notification for syphilis, chlamydia, and gonorrhea. Referrals for HIV care and services were also made at disclosure counseling. Referrals for hepatitis, other health services, and social needs were made during counseling sessions for risk assessment counseling, disclosure, or other follow-up visits.

Statistical analyses

Point prevalence and 95% confidence intervals (CIs) were calculated to account for the 1-stage, cluster sample design. Probability weights were constructed using the relative probability of being included in the sample and were based on the sizes of the target populations by county as estimated in the 1990 census. Probability weights adjust estimates to reflect the entire 5-county target population. Cluster weights reflect the level of homogeneity within primary sample units (street blocks) and affect the precision of estimates. Higher homogeneity within blocks (that is, greater similarity between women residing in the same block with respect to the measure) results in wider 95% CIs. Crude and weighted estimates for demographic characteristics, disease prevalence, and risk behavior are presented. Crude analysis was conducted using a commercially available statistical software (SAS-PC version 6.11; Statistical Analysis System for Personal Computers, Cary,

Table 1 Demographic characteristics of participants (n = 2,543)

Characteristic	Crude prevalence		Weighted prevalence	
	No. (%)	95% CI	%	95% CI
Total*	2,543 (100.0)	—		
<i>Race or ethnicity</i>				
Latina	955 (37.6)	35.7-39.5	34.1	29.1-39.1
African American	851 (33.5)	31.6-35.3	38.7	31.8-45.5
White	414 (16.3)	14.9-17.8	15.1	12.1-18.1
Asian	95 (3.7)	3.0-4.6	3.4	2.3-4.3
Pacific Islander	51 (2.0)	1.5-2.6	2.3	1.3-3.3
Native American	12 (0.5)	0.3-0.8	0.4	0.3-0.7
Caribbean/West Indian	3 (0.1)	0-0.4	0.2	<0.1-0.3
Mixed	98 (3.9)	3.2-4.7	3.5	2.6-4.3
Other or missing	64 (2.5)	2.0-3.2	2.4	1.6-3.2
<i>Country of birth</i>				
United States	1,718 (67.6)	65.7-69.4	69.6	64.6-74.5
Mexico	552 (21.7)	20.1-23.4	19.2	15.4-23.1
Other	272 (10.7)	9.5-12.0	11.2	8.9-13.5
<i>Education</i>				
Less than high school	1,112 (43.7)	41.8-45.7	41.6	37.8-45.3
More than high school	751 (29.5)	27.8-31.4	30.7	27.5-34.0
High school graduate	673 (26.5)	24.8-28.2	27.7	24.6-30.8
<i>Income last month, \$</i>				
<\$1,000	1,462 (57.5)	55.5-59.4	57.1	53.3-60.9
\$1,000 to \$4,999	920 (36.2)	34.3-38.1	36.7	33.2-40.3
≥\$5,000	39 (1.5)	1.1-2.1	1.9	1.2-2.5
Unknown, refused, or missing	122 (4.8)	4.0-5.7	4.3	3.4-5.2
<i>Marital status</i>				
Single/never married	1,436 (56.5)	54.5-58.4	59.5	55.8-63.3
Married	605 (23.8)	22.2-25.5	21.6	8.9-24.3
Members of unmarried couple	260 (10.2)	9.1-11.5	9.6	7.9-11.3
Separated	138 (5.4)	4.6-6.4	5.4	4.4-6.5
Divorced	78 (3.1)	2.4-3.8	2.9	2.2-3.7
Widowed	7 (0.3)	0.1-0.6	0.2	0.1-0.4
Other, refused, or missing	19 (0.8)	0.5-1.2	0.6	0.3-1.0
<i>Median age, yr 23.9</i>				

CI = confidence interval.

*Totals do not always add up to 2,543 because of missing data.

Table 2 Prevalence of markers for infectious diseases among participants in the Young Women's Survey

Disease, disease marker	No. screened* No.	Crude prevalence		Weighted prevalence	
		(%)	95% CI	%	95% CI
HIV	2,543	7 (0.3)	0.1-0.6	0.3	0.1-0.4
Syphilis	2,424	16 (0.7)	0.4-1.1	0.7	0.3-1.1
Gonorrhea	1,336	10 (0.8)	0.4-1.4	0.8	0.3-1.3
Chlamydia	1,370	42 (3.1)	2.2-4.2	3.3	2.4-4.8
Hepatitis A antibody	1,247	425 (34.1)	31.4-36.7	33.5	28.3-38.7
Hepatitis B core antibody	1,337	117 (8.8)	7.3-10.4	8.7	7.1-10.4
Hepatitis B surface antigen	1,337	9 (0.7)	0.4-1.1	0.8	0.3-1.2
Hepatitis C antibody	1,709	40 (2.3)	1.7-3.2	2.5	1.4-3.6
Herpes simplex type 1	1,663	1,256 (75.5)	73.4-77.6	73.7	71.6-76.9
Herpes simplex type 2	1,663	544 (32.7)	30.5-35.0	34.4	29.9-39.0

HIV = human immunodeficiency virus; CI = confidence interval.

*Specimens were screened for HIV and syphilis in all 5 counties; 4 counties screened for hepatitis C and herpes simplex virus types 1 and 2; and 3 counties screened for gonorrhea, chlamydia, hepatitis A, and hepatitis B. The total number screened does not always equal the total number of women enrolled because of refusal to provide specimens or insufficient quantity of specimen remaining.

NC). Another software package (Stata version 6.0; Stata-Corp, 1997, College Station, TX) was used for the weighted analysis.

RESULTS

Between April 4, 1996, and January 6, 1998, we enumerated 24,223 inhabited dwellings within 448 randomly selected blocks in the 5-county target area. Contact was made with a resident of 19,546 (80.7%) dwellings. Within these dwellings, 3,560 eligible women were identified, and 2,545 (71.5%) agreed to participate. The most common reasons offered for not wishing to participate were not interested (65.6%), had tested recently (9.4%), did not have time (8.4%), and preferred own health care provider to do the testing (6.3%).

Table 1 presents crude and weighted demographic characteristics of participants. African American women represented the largest ethnic group (38.7%), and most women (69.6%) were born in the United States. Less than a third of the women (27.7%) were high school graduates, and the median household income was less than \$1,000 per month.

The prevalence of markers for 8 diseases is presented in table 2. Notably, genital herpes was the most common sexually transmitted disease in women from all counties tested. Reported sexual behaviors relevant to HIV and sexually transmitted diseases are presented in table 3; reported drug use in the preceding 6 months is outlined in table 4.

DISCUSSION

The population-based YWS successfully achieved a targeted sample size of more than 2,500, a household contact rate of more than 80%, and a participation rate of more than 70%. The YWS measured the point prevalence of markers for 8 infectious diseases and related sexual and drug use behavior. For most measures, the weighted and crude estimates did not suffer greatly by point estimate or confidence interval. This is likely due to a high degree of

heterogeneity within sampled clusters (street blocks) and the large number of clusters sampled ($n = 448$). Without great loss in precision, the study and sampling design afforded efficiency in the field by concentrating promotion, enumeration, and recruitment efforts on a limited number of blocks. Many young minority and low-income women at high risk for HIV and sexually transmitted diseases enrolled in the study, received client-centered HIV counseling and testing and health education, and were screened and treated for sexually transmitted diseases.

The overall prevalence of HIV infection (0.3%) is high considering the young age of participants (<30 years) and estimates from other studies. Participants have a greater than 4-fold higher prevalence of HIV than is estimated for California women overall (0.06%).¹⁵ HIV seroprevalence

Table 3 Prevalence of sexual behavior among sexually active participants only ($n = 2,439$)

Characteristic	Weighted prevalence	
	%	95% CI
Ever had sex ($n = 2,439$*)		
Oral	52.7	49.3-56.1
Vaginal	99.9	99.7-100.0
Anal	21.7	19.5-24.0
Used a condom last time having vaginal sex		
With steady partner ($n = 2,012$)	29.9	26.6-33.2
With casual partner ($n = 317$)	51.4	43.8-58.9
With new partner ($n = 219$)	44.0	33.9-54.1
Used a condom last time having anal sex		
With steady partner ($n = 226$)	14.1	8.9-19.9
With casual partner ($n = 68$)	28.8	15.5-42.1
With new partner ($n = 58$)	26.9	13.8-40.0
Ever had sex with		
A person who injects nonprescription drugs	10.4	8.5-12.3
A man who has sex with other men	5.4	3.8-7.0
A person with AIDS or known to be HIV-positive	1.4	0.9-1.8
Ever received money or drugs for sex	10.8	7.9-13.8

CI = confidence interval; AIDS = acquired immunodeficiency syndrome; HIV = human immunodeficiency virus.

*Denominators other than 2,439 are shown when applicable.

Table 4 Prevalence of drug use (n = 2,543)

Drug	Ever used		In last 6 months			
	weighted %	95% CI	Used drug weighted %	95% CI	"High" during sex weighted %	95% CI
Alcohol	78.0	75.2-80.8	58.3	55.4-61.1	28.3	25.6-31.1
Marijuana	53.3	49.0-57.4	34.5	30.7-38.2	20.6	17.9-23.3
Cocaine	16.4	13.1-19.5	7.4	5.1-9.7	4.6	2.5-6.6
Speed	12.6	10.1-15.0	4.9	3.7-6.2	2.7	2.0-3.5
LSD	11.7	8.4-13.8	2.7	1.7-3.6	1.0	0.5-1.4
Heroin	4.4	3.0-5.7	1.8	1.1-2.3	1.2	0.6-1.8
PCP	1.8	1.3-2.4	0.3	0.1-0.6	0.2	<0.1-0.4
Prescribed methadone	1.0	0.6-1.5	0.6	0.2-0.9	0.3	0.1-0.5
Nonprescribed methadone	0.3	<0.1-0.5	0.2	0-0.3	<0.1	<0.1-0.1
Other drugs	3.7	2.4-4.9	1.7	1.1-2.4	0.4	0.2-0.7
Any injected drug	3.4	2.3-4.5	1.8	1.0-2.7	1.4	0.7-2.1

CI = confidence interval; PCP = phencyclidine.

in the survey was 2.5-fold higher than that among women delivering infants in 1995 (the last year of the Survey of Childbearing Women)¹⁶ (0.1%) and 25-fold higher than that among female civilian applicants for the US military (0.01%).¹⁷ HIV seroprevalence estimated in this study is similar to that for female US Job Corps entrants (0.3%) from 1990 through 1996¹⁸ and to a population-based survey conducted in similar neighborhoods in San Francisco in 1989 (0.4%).¹⁹

Prevalences of other sexually transmitted diseases point to the potential for future expansion of HIV transmission among women in the target population. Studies have found HSV-2 seropositivity correlated with markers of high-risk sexual behavior, such as lifetime number of partners, years of sexual activity, and history of other sexually transmitted diseases.^{4,6,7,13,20} The high prevalence of HSV 2 in the YWS population is of particular concern in light of the possibly strong association between genital herpes and the transmission of HIV.^{21,22}

Other sexually transmitted diseases are also thought to be causally associated with HIV transmission.²³ Other sexually transmitted diseases detected in the YWS, including syphilis, gonorrhea, and chlamydia, may have otherwise gone undiagnosed, indicating a need for better screening measures for these diseases.

Risk behavior reported points to the potential for further expansion of the HIV/AIDS epidemic among low-income women. The rate of condom use is low, injection drug use remains a significant risk, and many women know little about the risk behavior of their sexual partners.

Interpretations of the results of this study are subject to limitations. The most serious threat to validity is whether women declining to participate were more or less likely to be HIV-positive. The possible nonparticipation bias is exacerbated by the 19.3% no-contact rate (of dwellings) and the 28.5% refusal-to-participate rate. The direction of this possible bias is unknown. Nonetheless, the consistency of our estimates with studies in similar popula-

tions^{16,18,19,24} points to the plausibility of our findings.

No data are available for making comparisons between women enrolled in the YWS survey and eligible women who refused participation. The reasons basic demographics for refusers, as well as reasons for refusal, were not recorded are 2-fold: procedures required to obtain informed consent were not feasible, and data related to age and race or ethnicity based on refusers' appearance could not be collected with any acceptable level of accuracy.

Other possible limitations include the inability to collect or insufficient quantity of some specimens to conduct all tests and reliance on self-reported information for sensitive questions on risk behavior. To minimize the potential for underestimation from face-to-face interview, survey workers were female, came from similar backgrounds as participants, and spent time developing rapport and gaining trust within the community and among eligible young women in particular.

Despite these limitations, the YWS found evidence of continuing risk for transmitting HIV and sexually transmitted diseases in the target population. Data point to geographic areas and populations in which these infections are likely to be most prevalent and risk behavior to target for primary prevention interventions. Population-based data such as the YWS have an important place in the spectrum of epidemiologic tools to monitor the HIV/AIDS epidemic and enhance and validate other methods including AIDS or HIV reporting and sentinel HIV surveillance.

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The Young Women's Survey Team includes (in alphabetical order) Ms Geneva Bell-Sanford, San Joaquin County; Dr Barbara Cahoon-Young, Alameda County; Ms Cynthia Cossen, California Department of Health Services; Ms Viva Delgado, City and County of San Francisco; Ms Carla

Dillard Smith, Oakland; Ms Maria Hernandez, City and County of San Francisco; Ms Tanya Holmes, Alameda County; Mr Martin Lynch, Contra Costa County; Dr Juan Reardon, Contra Costa County; Ms Charlotte Smith, San Mateo County; Ms Hipolita Villa, San Joaquin County; and Mr Francis Wisner, San Mateo County.

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