

## Behavioral Risk Factors and Human Immunodeficiency Virus (HIV) Prevalence among Intravenous Drug Users in Puerto Rico

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This study reports on four empirical models likely to contribute to understanding the behaviors linked with human immunodeficiency virus (HIV) among intravenous drug users. The sample comprises 1,637 intravenous drug users recruited between May 1989 and June 1990 in San Juan, Puerto Rico. Adjusting for sociodemographics, four logistic regression models were constructed to assess the association of risk behaviors with HIV seropositivity. In model 1, the variables found to be significantly associated with HIV seropositivity were injecting four times a day, injection as the only route of consuming drugs, and years of injection. In model 2, the only risk behavior significantly associated with HIV seropositivity was injecting drugs in shooting galleries. In model 3, all sex risk variables failed to meet the adjusted level of significance. In model 4, pneumonia, hepatitis, and syphilis were significantly linked with HIV infection. In order to assess the individual effects of the significant variables in each one of the four models, a logistic regression analysis was performed simultaneously controlling for all of the variables. After adjustment for the Bonferroni correction, age group 25–34 years, injection as the only route of using drugs, number of years of injection, and syphilis were the only significant variables remaining. *Am J Epidemiol* 1992;135:531–40.

acquired immunodeficiency syndrome; HIV; HIV seropositivity; Puerto Rico

Assessment of the behavioral risk factors associated with the human immunodeficiency virus (HIV) among populations such as intravenous drug users is one of the first steps in designing effective measures to arrest the spread of the epidemic. Identifying these factors will offer health and drug treatment personnel specific points to target in their preventive and treatment programs. Empirically identified HIV infection risk factors will also greatly enhance the rele-

vance of policy development among health care and drug treatment organizations. In view of the absence of an effective vaccine or treatment, the prevention of HIV infection must rely on such programs to reduce risk behaviors.

Distinct from the United States, where the most important exposure factor to the acquired immunodeficiency syndrome (AIDS) is homosexual practices (1–3), on the island of Puerto Rico, the foremost exposure risk to AIDS is intravenous drug use (4). Since 1983, when the first AIDS case was diagnosed on the island, the number of AIDS cases has soared to 4,179, of which 58 percent are heterosexual intravenous drug users, 10 percent are homosexual/bisexual intravenous drug users, and 18 percent are homosexual/bisexual men (4). Rates of diagnosed cases of AIDS among intravenous drug users of different sexes show little difference, 60 percent men and 51 percent women (3). In Puerto Rico, as in the United

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Abbreviations: AIDS, acquired immunodeficiency syndrome; HIV, human immunodeficiency virus.

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States, intravenous drug users comprise a major source of heterosexual transmission and the main source of perinatal transmission of the illness (4).

According to Centers for Disease Control data, Puerto Rico occupies the second place, after Washington, DC, in AIDS incidence rates in the United States, 42.9 per 100,000 population (4). Puerto Rico not only ranks second in AIDS incidence among all the US states and territories, but Puerto Ricans comprise the Hispanic subgroup with the highest incidence of AIDS among all the US Hispanic subgroups. Selik et al. (5) report that, within each region in the United States, the cumulative incidence of AIDS was greater among Puerto Rican-born persons than persons born in Cuba, Mexico, or other Latin American countries. In the nation as a whole, Puerto Rican-born persons were the only Latin American-born persons in which most AIDS cases were heterosexual intravenous drug users (compared with 32 percent in the South, 52 percent in the West, and 61 percent in the Midwest and Northeast). Evidently, AIDS among Puerto Ricans is not only an Island problem but also a major health problem among Puerto Ricans living in different geographic regions of the United States.

Arresting HIV among intravenous drug users is of utmost importance because these groups of individuals place themselves, their sex partners, and their unborn children at risk for HIV infection. Thus, HIV among intravenous drug users is not only an individual health problem but also a family and societal health problem, which makes the need to understand the antecedents related to HIV among intravenous drug users an urgent one.

## MATERIALS AND METHODS

The Puerto Rico AIDS Prevention Project is a joint effort between the Research Institute of the Department of Anti-Addiction Services of the Commonwealth of Puerto Rico, and the Department of Health of the Municipality of San Juan. Funded and monitored by the National Institute on Drug

Abuse since October 1988, the study aims to assess an intervention program to arrest HIV infection among intravenous drug users. The Puerto Rico AIDS Prevention Project assessment instruments provide detailed information about HIV seroprevalence, modes of HIV transmission, sociodemographics, periods of incarceration, patterns of drug injection, sex behaviors, and life-styles that might dispose intravenous drug users at risk for HIV infection.

## Study sample

The study focuses on intravenous drug users not in treatment. The study sample comprises 1,308 men (79.9 percent) and 329 women (20.1 percent) recruited from four major urban catchment areas of the city of San Juan: Rio Piedras, Bayamón, Cataño, and Puerta de Tierra. These communities have some of the highest rates of intravenous drug use on the island (Data Bank on Treatment Admission, Research Institute, Puerto Rico Department of Anti-Addiction Services, Second Report, 1987 (unpublished)). To obtain a sample that would provide representation from varied segments of each one of the catchment areas, subjects were recruited from formal organizations such as social welfare programs, judiciary detention centers, and other HIV prevention service organizations and programs serving intravenous drug users, homosexuals and pregnant women, including sexually transmitted disease and outpatient health clinics, emergency services of health care centers and hospitals serving the various catchment areas, as well as from shooting galleries, street corners, bars, brothels, and billiard rooms.

## Data

Data were gathered by trained interviewers using the AIDS Initial Assessment questionnaire at the assessment center. This structured questionnaire was designed by a team of researchers under the auspices of the National Institute on Drug Abuse and Nova Research Company (6), to collect in-

formation on the National AIDS Demonstration Research and AIDS Targeted Outreach Model projects. The AIDS Initial Assessment questionnaire was translated into Spanish and adapted to local vernacular in order to make it more comprehensible to intravenous drug users. Data were collected on participants' history with treatment programs and incarceration experience. Information was also assembled on participants' drug injection activities and sexual practices, including frequency and patterns of these behaviors during the 6 months prior to the interview.

The primary dependent variable of interest was laboratory confirmed HIV seropositivity. Antibodies to the human T-lymphotropic virus type III were screened by the Du Pont ELISA Test (Du Pont Company, Wilmington, Delaware). Specimens found to be repeatably reactive in the ELISA were submitted to a specific test using the Biotech/Du Pont HIV Western Blot kit. A positive result was defined as the presence of the following bands: p24 or p31 and either gp41 or gp120 or gp160. A blot with no bands was defined as negative; otherwise, any bands other than those in the criteria for positive were considered indeterminate. Indeterminate results for 27 cases (1.6 percent) and nonavailable blood specimens for 38 cases (2.2 percent) were treated as missing data and excluded from the analysis.

## Models

Although no widely accepted theoretical model of HIV risk behaviors has been developed in epidemiology or social sciences, researchers in these fields have been able to develop various sets of antecedents or domains likely to be associated with HIV infection. Empirical studies on life-styles, drug use, and sexual behaviors among the already identified risk groups, such as intravenous drug users, prostitutes, and homosexuals, have identified factors most likely to place these groups at risk of HIV infection (7-13). We have identified four domains of variables to be tested as separate regression models in our analysis.

Model 1 incorporates drug injection variables as the domain of interest, including frequency of injection, drug use patterns, and number of years injecting drugs. Model 2 encompasses needle use risk behaviors, that is, with whom, where and how participants inject drugs, which includes injecting in shooting galleries and abandoned buildings, renting, borrowing and sharing needles, and sharing of cookers (utensils where drugs are mixed, usually a bottle cap or spoon). Model 3 entails sex risk behaviors as the category of interest, which includes no sexual activity, no sex risk activity, one risk activity, and two or more sex risk activities. Anal sex, sex with another intravenous drug user, no use of condoms, and more than one sex partner were the various sex practices used to design the above sex risk measurement. Model 4 subsumes self-reported illnesses and is constructed with the following health variables: pneumonia, hepatitis, gonorrhea, and syphilis.

We recognize that these four domains of variables are not mutually exclusive. Previous work has shown that history of sexually transmitted diseases (domain 4) may seem to be an extension of history of sex practices (domain 3). The aforesaid domains have been posited as convenient and useful groupings of a set of mutually correlated variables in order to better understand the association between an array of behavioral risk factors and HIV infection. In the assignment of a variable to a particular domain, when a variable could be ascribed to more than one domain, we have been guided both by the theoretical link of the variable with other variables in the domain as well as the reliability of its measurement.

## Analysis

Data analyses were performed using the Statistical Analysis System Software (SAS Institute, Inc., 1987. Version 5.0. Cary, North Carolina). Bivariate tests of independence were carried out for the five domains of variables: sociodemographics, injection patterns, needle risk behaviors, sex risk behaviors, and illnesses, to assess bivariate as-

sociation among them. For ordered categorical variables with more than two levels, the Armitage-Cochran test for trend (14) was employed using StatXact (Cytel Software Corp., 1989, Cambridge, Massachusetts). The SAS LOGISTIC Procedure was employed to construct logistic regression models entailing different domains of variables. To include frequency of injection, years of injection and perception of health, various sets of dummy variables were created representing each category. All analyses were adjusted for sociodemographic variables to assess the statistical significance of independent variables. The experimentwise error rate was set at  $\alpha = 0.05$  and, after Bonferroni's adjustment, a  $t$  or  $F$  value for each comparison had to exceed the critical value of  $\alpha/k$ , where  $k$  is the number of coefficients in the model (15).

## RESULTS

### Sample profile

Table 1 presents seroprevalence among intravenous drug users by sociodemographic characteristics. HIV infection is more prevalent among men ( $p = 0.018$ ), although the high prevalence of 41.6 percent among women was unexpected. Prevalence rates

increased significantly with age; the test for linear trend on age group was highly significant ( $p < 0.001$ ). Intravenous drug users not living with children had higher prevalence than those living with children ( $p < 0.001$ ).

### Bivariate analysis

Table 2 presents results of bivariate analysis related to the four domains of behavior and illness variables. The prevalence rate increased significantly with increase in the frequency of injection ( $p < 0.001$ ) and years of injection ( $p < 0.001$ ). One-fifth of intravenous drug users injecting drugs during the last 5 years were already carriers of HIV, and this rate more than doubled within 6 to 10 years of injecting drugs. Further, intravenous drug users using injection as the only route of administration had significantly higher seropositivity rate ( $p < 0.001$ ).

Seropositive rates were higher among intravenous drug users injecting drugs at shooting galleries ( $p < 0.001$ ), abandoned buildings ( $p = 0.004$ ), or sharing cookers ( $p = 0.046$ ). Sharing, renting, and borrowing needles failed to show statistically significant associations with HIV infection. Further, seropositivity was not associated with any

TABLE 1. HIV\* seropositivity among intravenous drug users in San Juan, Puerto Rico, by sociodemographic characteristics, May 1989–June 1990

Sociodemographics	No.	Seropositivity		p value
		No.	%	
Sex				
Male	1,308	640	48.9	0.018
Female	329	137	41.6	
Age (years)†				
<25	255	60	23.5	<0.001
25–34	763	364	47.7	
≥35	610	352	57.7	
Trend			Z = 8.757	
Children living with you‡				
No	1,029	521	50.6	<0.001
Yes	605	253	41.8	
Catchment area				
Bayamón	521	221	42.4	0.005
Cataño	329	155	47.1	
Rio Piedras	477	230	48.2	
Puerta de Tierra	310	171	55.2	

\* HIV, human immunodeficiency virus.

† Data missing for nine subjects.

‡ Data missing for three subjects.

**TABLE 2. HIV\* seropositivity among intravenous drug users in San Juan, Puerto Rico, by variables in domains of drug injection, needle behaviors, sex behaviors, and illnesses, May 1989–June 1990**

Domains of variables	HIV antibody status		p value
	No.	%	
Domain 1. Drug injection			
Frequency of Injection†			
Less than daily	302	37.4	
Once a day	148	39.9	
2–3 times a day	520	47.7	
≥4 times a day	666	53.4	
Trend	Z = 4.983		<0.001
Pattern of use			
Noninjected/injected drugs	825	38.7	
Injected drugs only	812	56.4	<0.001
Years of Injection‡			
0–5	413	21.1	
6–10	333	46.5	
11–15	286	55.6	
≥16	595	62.9	
Trend	Z = 12.86		<0.001
Domain 2. Needle risk behaviors			
Injection settings			
Shooting gallery§			
No	313	38.0	
Yes	1,322	49.7	<0.001
Abandoned building			
No	855	44.1	
Yes	779	51.2	0.004
Sharing practices			
Share needles			
No	756	48.0	
Yes	881	46.9	0.679
Borrow needles			
No	936	46.7	
Yes	701	48.5	0.467
Rent needles			
No	1,157	46.4	
Yes	480	50.0	0.186
Share cooker/cotton			
No	353	42.8	
Yes	1,284	48.8	0.046
Domain 3. Sex risk behaviors			
Sex			
No	1,040	43.1	
Yes	597	55.1	<0.001
Sex, no risk activity			
No	1,269	48.1	
Yes	368	45.4	0.363
Sex, one risk activity			
No	1,295	49.6	
Yes	342	39.5	<0.001
Sex, 2 or more risk activities			
No	1,307	48.3	
Yes	330	44.2	0.190
Domain 4. Illnesses (self reported)			
Pneumonia¶			
No	1,451	46.5	
Yes	181	56.4	0.012
Hepatitis**			
No	1,202	44.7	
Yes	433	55.2	<0.001
Gonorrhea††			
No	1,281	45.0	
Yes	353	56.7	<0.001
Syphilis‡‡			
No	1,480	45.3	
Yes	174	65.5	<0.001

\* HIV, human immunodeficiency virus.

Data missing for: † one subject; ‡ 10 subjects; § two subjects; || three subjects; ¶ five subjects; \*\* two subjects; †† three subjects; ‡‡ three subjects.

one of the sexual risk behaviors. However, intravenous drug users had significantly higher seropositivity rates, exceeding well over 50 percent, if they had been diagnosed with hepatitis ( $p < 0.001$ ), syphilis ( $p < 0.001$ ), gonorrhea ( $p < 0.001$ ), or pneumonia ( $p = 0.012$ ).

**Multivariate analysis.** Adjusting for sociodemographics, four logistic regression models were developed to assess the association between the four domains of variables related with HIV seropositivity (table 3). Injecting four times a day, injection as the only route of consuming drugs, and injecting 6 or more years were significantly associated with HIV seropositivity in model 1. In model 2, the needle risk domain, the only risk behavior significantly associated with HIV seropositivity was injecting drugs in shooting galleries. Needle sharing, needle borrowing, and renting needles failed to reach the significance level. No sex risk variables were statistically significant in model 3. Pneumonia, hepatitis and syphilis were the variables significantly linked with HIV infection in model 4.

In order to assess the individual effects of the significant variables in each one of the four models, we performed a logistic regression analysis simultaneously controlling for all the variables found to be significant in each individual domain (table 4). Age group 25–34 years, injection as the only route of using drugs, 6 or more years of injection, and syphilis were the only significant categories after adjustment for Bonferroni correction. Although being 35 years of age or more and use of shooting galleries did not reach significance levels after Bonferroni's correction, both variables were significant at the 0.05 level.

## DISCUSSION

The high prevalence of HIV infection and HIV risk behaviors among intravenous drug users in our sample is consistent with other investigations among similar populations in other geographic areas (16–19). We failed to identify significant needle use and sex risk behaviors; however, there are some significant trends in the data. These trends are of

**TABLE 3. Results of four multiple logistic regression models for antibody to human immunodeficiency virus by separate domains of variables after adjusting for sociodemographics, among intravenous drug users in San Juan, Puerto Rico, May 1989–June 1990**

Model	Adjusted odds ratio	95% CI*
<i>Model 1. Drug injection, n = 1,624</i>		
Frequency of injection		
Less than daily†		
Once a day	1.03	0.66–1.59
2–3 times a day	1.10	0.80–1.51
≥4 times a day	1.39	1.01–1.90
Pattern of use		
Injected/noninjected drugs‡		
Injected drugs only	1.55	1.24–1.92
Years of injection		
0–5†		
6–10	2.86	2.05–3.97
11–15	3.60	2.52–5.14
≥16	5.06	3.48–7.36
<i>Model 2. Needle risk behaviors, n = 1,631</i>		
Injection settings		
Shooting gallery‡	1.51	1.14–2.00
Abandoned building‡	1.12	0.89–1.39
Shared needles‡	0.92	0.70–1.21
Borrowed needles‡	0.95	0.69–1.30
Rented needles‡	1.04	0.78–1.40
<i>Model 3. Sex risk behaviors, n = 1,634</i>		
Sex, no risk activity†		
No sex	1.19	0.90–1.58
Sex, one risk activity	0.80	0.59–1.09
Sex, two or more risk activities	0.92	0.67–1.26
<i>Model 4. Illnesses (self reported), n = 1,625</i>		
Pneumonia‡	1.45	1.05–2.02
Hepatitis‡	1.31	1.04–1.66
Gonorrhea‡	1.24	0.96–1.60
Syphilis‡	1.92	1.35–2.72

\* CI, confidence interval.

† Reference category

‡ Reference category, no.

importance when interpreted within the sociocultural environment of Puerto Rico. Our drug injection model was able to contribute the most to explain HIV seropositivity and intravenous drug use. After Bonferroni adjustment, self-reported syphilis was the only variable to meet this restrictive significance criterion in model 4. Undoubtedly, seropositive intravenous drug users in our study group are chronic addicts with many years of injecting drugs, who inject frequently every day, and who use shooting galleries to inject drugs. All these behaviors have been found to be significantly associated with HIV infection (17, 19–21).

The cumulative effect of years of injection

on HIV status in other studies is inconsistent. Vlahof et al. (22) noted a tendency toward increasing HIV-1 seroprevalence with more recent initiation of persistent shooting gallery use and persistent needle sharing. Franceschi et al. (23) reported the lack of a trend of increasing HIV seropositivity with increasing duration of drug use. However, Friedman et al. (24) reported a strong relation between length of injection history and the likelihood of infection with HIV. Our findings also show a significant trend of increase in seroprevalence with increased years of injection ( $p < 0.001$ ). These conflicting findings might be linked to factors embedded in the different social con-



**TABLE 4. Results of multiple logistic regression analysis for human immunodeficiency virus incorporating all previously significant variables among 1,615 intravenous drug users in San Juan, Puerto Rico, May 1989–June 1990**

Variables by domains	Adjusted odds ratio	95% CI*
<b>Sociodemographics</b>		
Sex		
Female†		
Male	0.89	0.66–1.19
Age		
<25†		
25–34	1.87	1.31–2.68‡
≥35	1.58	1.03–2.43
Catchment area		
Bayamón†		
Cataño	1.15	0.85–1.57
Rio Piedras	1.11	0.85–1.46
Puerta de Tierra	1.34	0.98–1.84
Children living with you§	0.84	0.67–1.05
<b>Domain 1. Drug injection</b>		
Frequency of injection		
Less than daily†		
Once a day	1.04	0.67–1.62
2–3 times a day	1.09	0.79–1.51
≥4 times a day	1.36	0.99–1.87
Pattern of use		
Injected/noninjected drugs†		
Injected drugs only	1.51	1.21–1.87‡
Years of injection		
0–5†		
6–10	2.73	1.96–3.81‡
11–15	3.45	2.41–4.94‡
≥16	4.67	3.20–6.82‡
<b>Domain 2. Needle risk behaviors</b>		
Injection settings		
Shooting gallery§	1.34	1.01–1.77
<b>Domain 3. Illnesses</b>		
Pneumonia§	1.29	0.92–1.83
Hepatitis§	1.18	0.93–1.51
Syphilis§	1.74	1.22–2.49‡

\* CI, confidence interval.

† Reference category.

‡ Significant at  $p \leq 0.0027$  after Bonferroni adjustment.

§ Reference category, no.

texts in which the intravenous drug users interact. Franceschi et al. (23) explained their findings in northeast Italy in terms of the time in which the HIV epidemic entered Italy. Vlahof et al. (22) suggested that a survival bias may have been operating in their study subjects, whereby HIV seropositives with longer duration of high-risk behaviors were unable to participate in the

study. They also alluded to the fact that their findings might be related to the specific ways in which injection initiators in Baltimore participate in the intravenous drug user networks in the early phase of their drug injection careers.

Analysis of stored serologic samples from New York City shows that Puerto Ricans who were injecting drugs during the period 1978–1983 were more likely to be HIV seropositive than their white counterparts (25). Continuous circular migration between the island and the northeast coast has been suggested as an explanation for the spread of the HIV virus in Puerto Rico (HIV seroprevalence among IV drug users in Puerto Rico: A comparative perspective. Research Institute, Puerto Rico Department of Anti-Addiction Services, unpublished manuscript). Thus, there is the possibility that HIV infection reached Puerto Rican intravenous drug users on the island in the early stage of the introduction of the virus. Therefore, a cumulative effect may reasonably explain the relation of HIV prevalence with years of injection among our study subjects. However, the circumstances under which migratory experience influences HIV risk behaviors or HIV infection among intravenous drug users in Puerto Rico need to be clarified in further research.

Another factor to be considered is the survival rate of our study participants. Studies in New York show that Puerto Ricans have a shorter survival time subsequent to AIDS diagnosis than whites (26). Researchers cite as an explanation the lack of access to adequate medical care and other social service facilities to minority groups. However, Puerto Ricans residing on the Island do not have a minority status and enjoy free access to medical and health care facilities. Puerto Rico has a complex public health care system comprising a network of well-staffed health care centers in each one of the small towns and rural areas. Sexually transmitted disease clinics operate in most of the centers and outreach activities for sexually transmitted disease surveillance comprise a principal activity of the health care system. Recent studies on the island have shown

that a large number of Puerto Ricans, and specially the poor, tend to use health services which are accessible free of cost (27) (Need and mental health care utilization among the poor in Puerto Rico. Center for Evaluation and Sociomedical Research, School of Public Health, University of Puerto Rico, unpublished manuscript). In addition, Puerto Rican intravenous drug users are embedded within a family system comprising children, parents and other relatives (28). Thus, it seems that access to health care services as well as the family provide the intravenous drug users with strong social support systems. There is a substantial empirical evidence suggesting the positive effect of social support on convalescence from physical and mental illness, stressful events and prolongation of life (29–36). Therefore, it may well be the case that availability of health care services and social support from the family protect the intravenous drug users from early disability and mortality.

Although needle sharing has been identified as a major risk behavior associated with HIV transmission among intravenous drug users (37, 38), in this analysis these variables failed to show statistical significance ( $\alpha = 0.05$ ). There is a possibility that our needle risk variables failed the test of statistical association with HIV seropositivity due to the fact that HIV was prevalent in drug user networks long before our 6-month period of recall. However, it is essential to ensure that the measurement instruments used in sero-epidemiologic surveys are culturally appropriate to accurately assess relevant risk behaviors. Page et al. (39) reported that in Miami, needle pooling (where needles are kept in a coffee can or a pouch from where needles are given to the users) is more prevalent than needle sharing. They further commented that intravenous drug users in shooting galleries dip needles into previously used water and draw drugs from the same heated cap for drug mixing and drug sharing. These specific risk behaviors, not directly addressed by our needle risk behavior measures, may explain the HIV seropositivity among those intravenous drug users who did not report sharing needles.

We were unable to establish a link between HIV status and sex risk behaviors among intravenous drug users, confirming a finding by McCusker et al. (40). As in the case of needle risk behaviors, the explanation may lie in the cross-sectional study design. For many of the participants in the study, HIV infection may have occurred prior to the recent 6 months in which risk behaviors were measured. Also to be taken into account is the possibility of denial of risky sexual behaviors. Observations among homosexual men and prostitutes attending sexually transmitted disease clinics showed that a positive serologic test for syphilis and a history of genital ulcers were each linked with HIV infection (41). The association with syphilis suggests there are behavioral patterns which we have failed to measure but of which the respondents were well aware.

Three caveats should be added to these conclusions. First, the reliability of self-reported data is always of major concern in these type of studies, specifically when we do not have additional information to confirm the self-reported information of study participants. Second, the reliability of risk behavior data could be affected by the time elapsed between the actual behaviors and the interview. In our study, the time elapsed was 6 months before the interview. Third, although the population surveyed cannot be assumed to be representative of all intravenous drug users out of treatment in Puerto Rico, following McCusker et al. (40), Koblin et al. (21), and Lange et al. (42), we have endeavored to reduce this bias by using multiple recruitment sites.

Our findings clearly demonstrate that AIDS prevention programs need to target subpopulations of intravenous drug users, especially those out of treatment, before they become chronic drug injectors. Primary and secondary prevention for HIV should be added more forcefully to drug treatment programs, sexually transmitted disease clinics, health centers, jails, and institutions that are most likely to work with intravenous drug users and their sex partners. Moreover, in depth understanding of the daily lives of



different ethnic groups of intravenous drug users is needed to be able to design effective measurement instruments to assess such private behaviors as needle sharing and sex practices in specific sociocultural groups.

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