

Geographic Distribution of Human Immunodeficiency Virus Markers in Parenteral Drug Abusers

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Abstract: Drug abuse treatment programs in six regions of the United States collaborated in a study aimed at monitoring trends in the seroprevalence of human immunodeficiency virus (HIV) antibodies. The wide disparities in HIV seroprevalence in the face of similarities in drug using behavior have important implications for prevention. In the New York City area (Harlem, Brooklyn), 61 per cent of samples (N=280) obtained in late 1986 were positive, up from 50 per cent of samples (N=585) in early 1985. In Baltimore, Maryland, 29 per cent of samples (N=184) representing 11 programs were positive. In contrast, samples from programs distant from the Northeast corridor had far lower rates: Denver, Colorado 5 per cent (N=100); San Antonio, Texas 2 per cent (N=106); Southern Cali-

fornia, 1.5 per cent (N=413); and Tampa, Florida, 0 per cent (N=102). Contrary to expectations, there was no corresponding difference in reported lifetime needle sharing experiences, which ranged from 70 per cent in New York to 99 per cent in San Antonio. HIV seropositivity was associated only with geographic location and ethnicity; however, because needle sharing is practiced by parenteral drug abusers in areas where seroprevalence is still relatively low, these areas are potentially vulnerable to the same catastrophic spread seen in the Northeast. A window of opportunity exists where prompt, vigorous, and aggressive efforts at prevention could have major impact. (*Am J Public Health* 1988; 78:443-446.)

Introduction

Parenteral drug abusers (PDAs) are a major reservoir for the transmission of human immunodeficiency virus (HIV), and this carrier pool constitutes the principal source for the vertical transmission of HIV infection and its introduction into previously low-risk populations. Recent seroprevalence surveys of PDAs for HIV antibodies have yielded varying results. It appears that the highest infection rates are in the New York City metropolitan area where seroprevalence rates as high as 50 per cent have been reported,^{1,2} while a recent survey of 281 heterosexual PDAs in metropolitan San Francisco demonstrated a seroprevalence rate of 10 per cent³ and a 1986 seroprevalence study of 720 PDAs in treatment in Los Angeles County yielded a rate of approximately 2 per cent (Battjes R, personal communication). Details regarding the penetration of HIV in PDAs residing elsewhere are less well defined.

No systematic effort has been made to delineate the differences in the seroprevalence rate between major geographic regions. Racial differences in infection rate have been reported in some locales, but it is not clear whether this is a uniform situation across the country. Needle sharing habits are believed to exhibit regional differences, possibly accounting for differences in infection rates, but this has not been systematically measured. Another difficulty with existing surveys is that they have been conducted in different time frames, on different

populations, employing different recruitment strategies, and utilizing various laboratory methodologies.

This investigation reports the prevalence of HIV antibodies and drug abuse patterns in samples of PDAs from six distinct geographic regions in the US. Subjects were of similar background and recruited in a standard fashion; data were collected consistently and concurrently, and laboratory and statistical methodology was constant throughout. As a result, more dependable geographic comparisons should be possible.

Methods

Site Selection

Six geographic regions were studied. Although additional sites were approached for participation, particularly within the central regions of the nation, only six, in total, agreed to collaborate within the time frame allowed for start-up. The sites selected, and the rationale for inclusion are as follows:

New York City—Even though New York has been extensively studied, that locality's participation in this study allowed for more extensive assessment of the Borough of Brooklyn and the Central and East Harlem neighborhoods of Manhattan. In addition to a current assessment of the seroprevalence rate, banked sera were available from the same treatment facility so as to allow for the evaluation of temporal changes.

Baltimore—Baltimore, Maryland was included because it is the site of the Addiction Research Center, the intramural division of the National Institute on Drug Abuse. The local prevalence rate had not been delineated, and it was anticipated that both seropositive and seronegative participants in this activity could be followed longitudinally.

Tampa/St. Petersburg—Since surveys were underway in the Dade and Broward County areas of Southeast Florida, a second Florida metropolitan area was approached in order to conduct intrastate comparisons. With input from that state's drug abuse personnel, the Tampa Bay area was chosen.

San Antonio—It had been anticipated that three centrally located metropolitan areas within the US would participate in this study, reflecting the South Central, Midwest, and Rocky Mountain regions. San Antonio, Texas was chosen as the South Central site because it provided the opportunity to include

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clients of Mexican American descent since this ethnic group comprises an appreciable proportion of the methadone maintenance population in the city's largest treatment program.

Denver—Denver, Colorado was the Rocky Mountain metropolitan area selected, primarily because a comparable survey had been conducted there 18 months earlier, and it afforded the opportunity to delineate possible temporal trends in seroprevalence.

Southern California—Northern California, principally the San Francisco Bay Area, has been systematically studied. It was therefore desirable to assess the southern half of the state for a better understanding of regional and intrastate differences. The following regions were studied: metropolitan Los Angeles, Riverside, San Bernadino, Bakersfield, and Fresno; and the communities north of Los Angeles from Santa Monica to Paso Robles.

Subject Selection

Within the regions selected, the following criteria were used to select subjects from the drug treatment community: to be enrolled, a study subject had to meet the entrance criteria of the local treatment facility, to have a history of parenteral drug abuse of at least 12 months duration, and to have entered the drug treatment program since January 1, 1985. This would assure that some aspect of parenteral drug abuse would have occurred during the AIDS (acquired immunodeficiency syndrome) epidemic. Recruitment was conducted on a consecutive enrollment basis, and no stratification was done by age, race, or sex. The total number of entrants for each region varied to a certain extent so as to assure an appropriate cross-section of various indigenous ethnic groups and adequate representation from various local communities.

The largest drug treatment program in each participating location was approached regarding collaboration in this undertaking. A second clinic was approached if there was unwillingness to participate on the part of the first, or if it became necessary to supplement recruitment efforts. Following participation in an AIDS educational program, the voluntary participation of PDAs was solicited. Informed consent was obtained for blood drawing, AIDS antibody testing, and questionnaire completion. Recruitment and screening for five of the six clinics occurred between September 1986 and December 1986. Sera from Denver were obtained in January and February 1987. In addition, banked sera from the participating New York clinic that had been collected in early 1985 and stored at -70° C were tested.

Enrollees completed a standard questionnaire to provide demographic, drug use, medical, and behavioral information. Serum was collected from each subject and stored at -70° C prior to testing for HIV antibodies. Antibody testing was performed by enzyme-linked immunosorbent assay (ELISA) using commercially available test kits (Genetic Systems, Inc., Seattle, Washington) and according to methodology previously described.⁴ All repeatedly positive ELISA results were confirmed by Western Blot testing employing kits manufactured by DuPont Co. (Wilmington, Delaware). The results were scored by three observers using semiquantitative rating of the bands, and sera with bands at the p24 and/or gp41 regions were considered positive in accordance with established Centers for Disease Control (CDC) criteria. All questionnaires and serum tubes were coded, and only the medical or clinic directors knew subject identification. Subjects were given their test results and, when appropriate, aftercare referrals were made.

TABLE 1—Age, Gender, and Ethnic Group Composition of Parenteral Drug Abusers Studied in 1986–87

Parameter	New York	Baltimore	Denver	San Antonio	S. California	Tampa
N	280	184	100	106	413	102
Gender						
% Male	59	78	72	71	63	76
% Female	41	22	28	29	37	24
Ethnic Group						
% Black	41	53	10	3	2	67
% White	18	47	60	62	51	29
% Latino	41	—	24	34	45	4
% Other	—	—	6	1	2	—
Median Age (years)	34	32	33	32	33	27

Results

The sample consisted of 1,770 PDAs: 1,185 were recruited and studied in 1986–87 and, in addition, 585 sera that had been banked in the first quarter of 1985 were assayed. Table 1 shows the median age as well as the gender and ethnic group breakdown of PDAs studied in 1986–87 by geographic region. The median duration of intravenous (IV) drug use prior to entering treatment or participating in this study if on a waiting list was 14.5 years (± 3.5 years). It was the consensus of the participating clinic personnel that the ethnic group representation of the samples reflected the community's clients in treatment. Latino-surnamed PDAs were represented in all locations except Baltimore which does not have an appreciable Hispanic population. Ethnic groups designated under the "Other" category tended to be American Indians and Asians, the ratio between the two varying with clinic site. The refusal rate was very low, approximating 3 per cent in the majority of clinics.

Figure 1 depicts the prevalence of HIV antibodies by geographic region studied and the lifetime needle sharing experience of the members of each sample. The highest seroprevalence rate detected was 61 per cent in the New

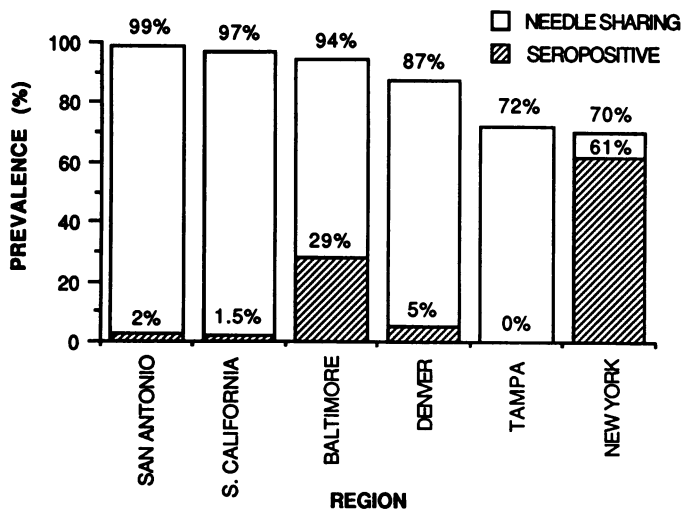


FIGURE 1—Lifetime Needle Sharing Experience and HIV Antibody Prevalence among Parenteral Drug Abusers in Six Regions of the US
 Note: Among the locations surveyed, HIV-antibody seroprevalence in 1986 ranged from a high of 61 per cent in the New York City metropolitan area to 0 per cent in the Tampa Bay area. Lifetime needle sharing experience was common in all areas, ranging between 99 per cent in San Antonio to 70 per cent in New York.

TABLE 2—Prevalence of HIV Antibodies by Ethnic Group, New York City, Baltimore, Denver, San Antonio, 1986–87*

Location	Black			White			Latino		
	No. Tested	No. Pos	% Pos	No. Tested	No. Pos	% Pos	No. Tested	No. Pos	% Pos
New York City**	38	24	63	16	6	37	39	24	62
Baltimore	97	44	45	76	7	9	0	—	—
Denver	10	2	20	60	3	5	24	0	—
San Antonio	3	0	—	63	1	2	35	1	3

*Note: California had six positives, 2 White, 2 Latino, and 2 Other. Totals in Table 2 are less than totals in Table 1 because of omitted data.

**Based on a random sample of 100 New York City subjects.

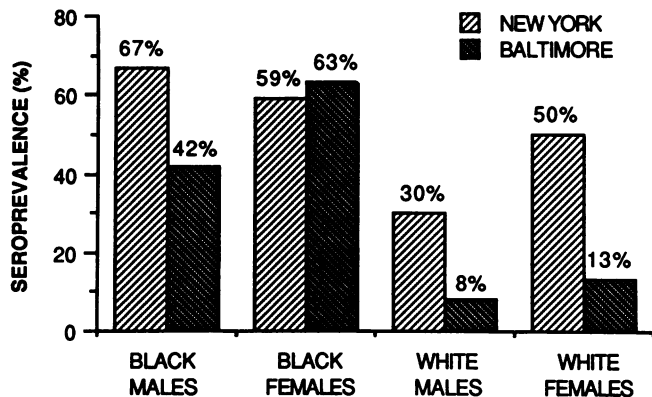


FIGURE 2—Prevalence of HIV Antibodies by Gender and Ethnic Group Among New York City and Baltimore Parenteral Drug Abusers

Note: Only New York City and Baltimore had sufficient numbers of HIV seropositives to permit analysis by both gender and ethnicity. In both locations, Blacks were more likely to be infected than were Whites, and there was no difference in the seroprevalence rate among Blacks between the two locations.

York metropolitan area, up from the 50 per cent rate observed in the same clinic in 1985. Of those surveyed, Tampa was the only region that did not have any seropositive PDAs in the sample. Needle sharing experience ranged from a high of 99 per cent in San Antonio to 70 per cent in New York. The data for each location were analyzed by gender; there were no differences by sex in any of the sites surveyed.

Ethnic group infection rates differed when New York, Baltimore, and Denver were compared (Table 2). The rates of HIV seropositivity were too low in the other areas to make any comparisons between ethnic group. In New York, Blacks and Latinos had comparable infection rates and were more likely to be seropositive than were Whites (Odds Ratio = 2.86, 95 per cent CI 0.83–9.80 for Blacks, and Odds Ratio = 2.67, 95 per cent CI 0.78–9.07 for Latinos, respectively). In Baltimore and Denver, Blacks were also more often seropositive than Whites (Baltimore: Odds Ratio = 8.18, 95 per cent CI 3.35–19.97; Denver: Odds Ratio = 4.58, 95 per cent CI 0.64–33.05). Figure 2 indicates the prevalence of HIV antibodies by both gender and ethnic group in New York and Baltimore. The highest rates were seen in black New York males (67 per cent) and black Baltimore females (63 per cent).

The 1986 New York sample reflected relatively small differences in seroprevalence between Harlem (53 per cent) and the Borough of Brooklyn (65 per cent). In Southern California, the seroprevalence rate was approximately 2 per cent in both the Greater Los Angeles metropolitan area and

TABLE 3—Odds Ratios and 95% Confidence Intervals for Variables Included in the Multiple Logistic Regression

Variable	Odds Ratio	95% CI
Gender	1.10	0.90–1.33
Ethnic Group		
White	1.00	
Black	13.96	10.68–18.25
Latino	2.65	1.98–3.54
Needle Sharing	0.76	0.57–1.03
Nitrite Use	0.53	0.40–0.69
Prostitution	1.23	0.98–1.54
Homosexuality	1.57	0.94–2.60
Geographic Region		
S. California	1.00	
New York City	141.32	86.49–230.90
Baltimore	33.89	21.01–54.65
Tampa	0.00	
San Antonio	1.56	0.68–3.65
Denver	4.25	2.23–8.08

in the immediate northwest corridor extending from Santa Monica to Oxnard, and was highest in Fresno (6 per cent); however, only 36 PDAs were tested in the latter community. No seropositive clients were detected in the other California communities studied.

Table 3 depicts the odds ratios and their corresponding 95 per cent confidence intervals for a multiple logistic regression analysis which was conducted on the pooled data. Geographic region was the strongest predictor of seropositivity, with PDAs in the New York City metropolitan area having an odds-ratio in excess of 141 as compared to PDAs in Southern California. Ethnic group membership was also a major predictor of HIV infection, with Blacks being nearly 14 times more likely to be infected than Whites.

This study did not detect an association between HIV seropositivity and needle sharing. Table 4 indicates the prevalence of HIV antibodies by age of client at the time of the study for both New York and Baltimore. There were no age differences between seropositive and negative members of the sample; however, within that component which was HIV-antibody positive, age differences did exist. In Baltimore, the 25–29 year-old age group had the highest rate at 33 per cent, while in New York, the highest rate (72–73 per cent) was between the ages of 25–29 and 30–34.

Discussion

We found that the HIV seropositivity rate among PDAs varied by geographic region. Because our samples were not random, subjects may not be representative of the entire IV

TABLE 4—Prevalence of HIV Antibodies by Age Group, New York and Baltimore, 1986

Age Group (years)	New York City			Baltimore		
	No. Tested	No. Pos	% Pos	No. Tested	No. Pos	% Pos
<25	7	4	57	15	3	20
25-29	18	13	72	40	13	33
30-34	30	22	73	58	17	29
35-39	24	13	54	42	12	29
40+	13	2	15	22	6	27

drug-using population in the regions studied; however, we have no indication that individuals at increased risk of HIV infection either preferentially volunteered for or avoided this study.

Multiple logistic regression analysis found that geographic location and ethnicity were by far the most important indicators of HIV seropositivity. It is known that whereas the majority of Whites with AIDS (78 per cent) are homosexual, the majority of other racial ethnic groups (43 per cent) are PDAs.⁵ In the inner-city sections of large metropolitan areas, it has been reported that up to 85 per cent of patients with AIDS are not White, and that up to 70 per cent of such persons have a history of intravenous drug abuse.⁶ HIV infection has appreciably penetrated Baltimore's addict community, and the seroprevalence rate in Blacks is comparable to that observed of non-Whites in New York City. The overall rate in Baltimore (29 per cent) approximates that of New York City in 1979 (27 per cent), where the rate subsequently jumped to 58 per cent by 1984.⁷ Eighteen months prior to this survey in Denver, a similar investigation was conducted at the same treatment program, and a seroprevalence rate of 1-2 per cent was detected. The current rate of 5 per cent is substantially higher (Odds Ratio = 2.58, 95 per cent CI 0.36-18.60).

On the East Coast, it has been observed that bands of decreasing seroprevalence can radiate from a major epicenter such as the New York/Newark area. The extent to which similar regions of decreasing seroprevalence radiate from major urban areas occur is unknown, but a comparable phenomenon has been observed in Sonoma, California outside of San Francisco.⁸ It is interesting that Fresno, a community midway between Los Angeles and San Francisco, had a seroprevalence rate that was also midway between the rates observed in the two major cities mentioned. Whether or not this is coincidental requires further study.

Sharing of contaminated needles or "works" has generally been considered to be a principal factor leading to the exposure to and infection by the HIV agent in PDAs. Needle sharing is exceedingly common among PDAs, and ranged between 70-99 per cent within the groups studied. Another report has indicated that at least 68 per cent of PDAs engage in needle sharing, and that they may do so in up to 40 per cent of their drug use episodes.⁹ A survey conducted in California

reported that 80 per cent of addicts seeking treatment in that state had shared needles or other drug paraphernalia.¹⁰ Even though the present study did not demonstrate an association between needle sharing and HIV infection, there is clinical evidence that the greater the needle sharing, the more likely repeated exposure to the HIV agent will occur, and that such repeated exposure will result in a greater probability of infection occurring.¹¹ One possible explanation for the lack of such an association in this study is that in some regions where needle sharing is common, the HIV agent has not yet been introduced for subsequent transmission to take place.

Nevertheless, needle sharing is an ubiquitous activity which is extensively practiced by PDAs in areas where the HIV antibody seroprevalence rate is still relatively low. These areas appear vulnerable to the same catastrophic spread of HIV transmission that has been observed in the Northeast. A window of opportunity exists where prompt, vigorous, and aggressive efforts at prevention could have major impact. One obvious strategy that would require no change in the law regarding the possession of needles or injection equipment would be the more widespread dissemination of information relative to the inactivation of HIV by the use of commonly available materials such as dilute household bleach to disinfect IV drug paraphernalia.¹²

REFERENCES

1. Robert-Guroff M, Weiss SH, Giron JA, *et al*: Prevalence of antibodies to HTLV-I, -II, and -III in intravenous drug abusers from an AIDS endemic region. *JAMA* 1986; 255:3133-3137.
2. Drucker E: AIDS and addiction in New York City. *Am J Drug Alcohol Abuse* 1986; 12:165-181.
3. Chaisson RE, Moss AR, Onishi R, Osmond D, Carlson JR: Human immunodeficiency virus infection in heterosexual intravenous drug users in San Francisco. *Am J Public Health* 1987; 77:169-172.
4. Ragni MV, Lewis JH, Bracken M, Toth R, Stokes J, Steffensen DO: Detection of acquired immunodeficiency syndrome (AIDS) retrovirus antibody by lymphadenopathy-associated virus (LAV) enzyme immunoassay in low- and high-risk populations. *Transfusion* 1986; 26:299-301.
5. Bakeman R, Lumb JR, Jackson RE, Smith DW: AIDS risk-group profiles in whites and members of minority groups. *N Engl J Med* 1986; 315:191-192.
6. Maayan S, Wormser GP, Hewlett D, *et al*: Acquired immunodeficiency syndrome (AIDS) in an economically disadvantaged population. *Arch Intern Med* 1985; 145:1607-1612.
7. Novick D, Kreek MJ, DesJarlais DC, *et al*: Abstract of clinical and research findings: Therapeutic and historical aspects. *In*: Harris L (ed): Proceedings of the 47th annual scientific meeting, Committee on Problems of Drug Dependence (1985), National Institute on Drug Abuse, Rockville, MD, 1986; 318-320.
8. Horwitz N: AIDS in San Francisco exurbia, not New York City exurbia. *Medical Tribune*, April 1, 1987, 28:6.
9. Black JL, Dolan MP, DeFord HA, *et al*: Sharing of needles among users of intravenous drugs. *N Engl J Med* 1986; 314:446-447.
10. Levy N, Carlson JR, Hinrichs S, Lerche N, Schenker M, Gardner MB: The prevalence of HTLV-III/LAV antibodies among intravenous drug users attending treatment programs in California: a preliminary report. *N Engl J Med* 1986; 314:446.
11. Marmor M, DesJarlais DC, Friedman SR, Lyden M, El-Sadr W: The epidemic of acquired immunodeficiency syndrome (AIDS) and suggestions for its control in drug users. *J Substance Abuse Treat* 1984; 1:237-247.
12. Jain S, Flynn N, Keddie E, *et al*: Disinfection of IV drug paraphernalia using commonly available materials: Hope for controlling spread of HIV among IV drug users? Presented at the III International Conference on AIDS, Washington, DC, June 1987.