VI. HIV Infection among Women Entering the New York State Correctional System

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Introduction

Human immunodeficiency virus (HIV) infection is becoming a leading medical problem among prison inmates in the United States, especially in states where the infection is prevalent. By October 1988 a total of 3,136 AIDS cases had been reported among inmates in a survey of 70 federal, state, and local correctional systems.[1] In New York State, which has more AIDS cases than any other state,[2] 1,046 cases had been reported among inmates of the state system by September 30, 1989.[3]

Because of the continuous turnover of prisoners, it is difficult to determine the precise number of persons with AIDS in New York State prisons at any time. However, a survey by the New York State Department of Correctional Services estimated that in September 1989 there were more than 800 inmates with symptomatic HIV disease and that approximately 550 inmates were on zidovudine therapy (Dr. Robert Greifinger, New York State Department of Correctional Services, personal communication). AIDS and HIV-related illness became the leading causes of death among inmates in 1985 and accounted for 68 percent of inmate deaths in 1987.[4]

In addition to severe HIV disease, there is evidence that many New York inmates are asymptomatically infected with HIV. A 1987 study of men entering the main intake center found that 17.4 percent were HIV-seropositive, the highest rate reported in any blind seroprevalence study of prisoners.[1,5] For intravenous drug users the rate was 44 percent. This study suggested that approximately 2,200 of the 12,600 men who entered this center during 1988 were infected with HIV.

HIV infection is also a problem among female prisoners in New York. Females are 4 percent of all inmates and have accounted for 4 percent of all inmate cases (41 cases). Thus the cumulative incidence rate from 1981 through 1988 has been equal for male and female inmates (27 cases per 1,000 inmates).[4]

Although the prevalence of HIV infection among female prisoners had never been studied, the statewide newborn HIV seroprevalence data suggested a major HIV problem among women in New York. This study was initiated to assess the extent of and risk factors for HIV infection among women entering the state prison system. Secondary objectives were to determine the association of HIV infection with clinical markers for syphilis, hepatitis B, and tuberculosis and to compare the fertility of seropositive and seronegative women.

Background

The New York State correctional system is the third largest in the United States, with 56 facilities housing 44,637 inmates at the end of 1988 (Mr. Gerald Bala, New York State Department of Correctional Services, personal communication). Of the approximately 1,800 female inmates, 69 percent come from New York City and 8 percent from the four counties closest to New York City. Forty-seven percent of female inmates are Black, 34 percent Hispanic, and 19 percent White. Nearly half (46 percent) have been convicted of drug-related offenses. The median duration of incarceration for women is 24 months (range, 12 to 900 months).

During 1988 a total of 1,017 new female inmates entered the New York State system. All female inmates enter at one central processing facility, where a medical evaluation is completed. The intake process includes a complete medical history, physical examination, and routine laboratory screening tests. Through 1988,

TABLE VI-1—Characteristics of Women Entering New York State Prisons, by Study Inclusion Status, September-December 1988

Characteristics	Included in Study (N=480)	Excluded from Study (N=40)	Difference (95% Confidence Interval)
Mean Age (Years)	29.4 (479)*	29.6 (40)*	+ 0.2 (− 2.6, 2.2)
Mean Education (Years)	10.2 (472)	10.4 (40)	+ 0.2 (− 0.8, 0.4)
Race/Ethnicity			
% Black	44.8 (215/480)	52.5 (21/40)	+ 7.7 (− 8.4, 23.8)
% Hispanic	37.5 (180/480)	32.5 (13/40)	− 5.0 (−20.1, 10.1)
% White	17.7 (85/480)	15.0 (6/40)	− 2.7 (−14.3, 8.9)
% With Residence in New York City	74.6 (344/461)	84.6 (33/39)	+10.0 (− 2.0, 22.0)
% Intravenous Drug Users	28.6 (136/475)	47.6 (10/21)	+19.0 (− 2.8, 40.7)

*For mean age and education, the numbers in parentheses indicate the number of women with available information. Fractions in the parentheses for the other variables indicate the number of women with each characteristic over the total number for whom information was available.

inmates were tested for HIV antibodies only when there was a medical indication, such as clinical evidence of immunodeficiency. In 1989 the testing policy was broadened to encourage all inmates, especially those with known risk factors, to undergo voluntary testing, regardless of their clinical status, so that appropriate counseling and medical therapy could be provided. The system does not segregate inmates on the basis of their HIV serologic status.

Methods

All women entering the New York State correctional system from September through December 1988 were included in this study. During this period no woman entered the system more than once, ensuring that there were no duplicates. Demographic information was abstracted from computerized prison records, and selected information that was routinely collected at prison intake regarding medical history, fertility, intravenous drug use, and other HIV risk factors was abstracted from each woman's prison medical record by trained personnel from the State Departments of Health and Correctional Services. After routine screening for syphilis, hepatitis B, and tuberculosis was performed and the results were abstracted to the data collection forms, information that identified specific inmates was removed from the forms, and a unique random number was used to link each form with the blood samples for HIV serologic testing. This process assured that the HIV test results could not be linked to specific inmates.

Syphilis screening was performed with the rapid plasma reagin test and, for confirmation of reactive specimens, the fluorescent treponemal antibody-absorption (FTA-ABS) test. Hepatitis B surface antigen (HBsAG) was determined by radioimmunoassay. These tests were performed by standard techniques at a commercial laboratory. Tuberculosis screening was performed with the intradermal tuberculin purified protein derivative Mantoux skin test (5 tuberculin units). Induration of 10 mm or greater was considered a positive reaction.

HIV testing was performed by the New York State Wadsworth Center for Laboratories and Research. Specimens were first tested in a single standard HIV-1 enzyme-linked immunosorbent assay (ELISA) (DuPont). Specimens with color development less than test cutoff values were recorded as ELISA-negative and were not tested further. ELISA-positive specimens were examined in a standard Western blot confirmatory assay (DuPont), and seropositivity was determined according to criteria recommended by the Association of State and Territorial Public Health Laboratory Directors and the Centers for Disease Control.[6]

The data from the forms and results of HIV serologic testing were merged and analyzed with computer software from SAS Institute, Inc.,[7] BMDP Statistical Software, Inc.,[8] and the Centers for Disease Control.[9] Chi-square, Fisher exact, and *t* tests were applied to univariate analysis. Standard methodology was used to calculate the 95 percent confidence intervals for differences in proportions[10] and differences in means.[11] Multivariate analysis to assess risk factors for HIV seropositivity utilized logistic regression. For this analysis women who reported having had sex with an intravenous drug user, bisexual male, or persons with AIDS or HIV infection or who had exchanged sex for money or drugs were classified as having practiced high-risk sex. Potential confounding of the estimated mean difference of live births and pregnancies between seropositive and seronegative women was investigated with a one-variable and two-variable stratified analysis.[12]

Results

During the four-month study period, 520 women entered the New York State prison system through its central processing facility. Of these, 480 women comprised the study group, while 25 were excluded because of missing demographic and medical information and 15 because of insufficient blood for HIV testing. Compared with the study group, a greater proportion of the 40 excluded women were Black, residents of New York City, and/or intravenous drug users (Table VI-1).

HIV Status and Risk Behaviors of the Study Group

In the study group 90 (18.8 percent) women were seropositive by ELISA; all were confirmed positive by Western blot. Maximum and minimum seroprevalence rates were estimated for all 520 women. Serologic results were available for 25 of the 40 excluded women: four were confirmed positive, one was positive by ELISA but indeterminant by Western blot, and 20 were negative. Thus the maximum estimated number of seropositive women was 110 (21.2 percent) of the 520 entrants: 90 in the study group plus four seropositives, one indeterminant, and 15 with insufficient blood for testing in the excluded group. If the 15 women with insufficient blood for testing and the woman with indeterminant results are assumed to be seronegative, the minimum estimated number of seropositive women was 94 (18.1 percent).

Of the 90 seropositive women in the study group, 53 were Hispanic, 31 Black, and six White. Eighty were between the ages of 20 and 39 years, and 82 reported New York City as their residence at the time of arrest. Sixty-one (67.8 percent) reported a history of intravenous drug use, and an additional six (6.7 percent) reported sexual contact with persons at risk for HIV infection. The remaining 23 reported no recognized risk behaviors for HIV infection, although six had a positive syphilis serology and another reported exchanging sex for money or drugs (suggesting prior high-risk sexual activity). An ad-

TABLE VI-2—HIV Seropositivity of Women Entering New York State Prisons by Demographic Characteristics, Potential Risk Factors, and Clinical Markers for Syphilis, Hepatitis B, and Tuberculosis, September-December, 1988.

Demographic, Risk Factor, and Clinical Marker Variables	Number Tested* (N=480)	Number HIV Positive (%) (N=90) (18.8%)	Odds Ratio** (95% Confidence Interval)
Demographic Characteristics			
Age (years)			
17–19	17	2 (11.8)	Referent
20–29	259	40 (15.4)	1.4 (0.3, 12.8)
30–39	160	40 (25.0)	2.5 (0.5, 23.4)
40–49	34	6 (17.6)	1.6 (0.2, 18.0)
50+	9	1 (11.1)	0.9 (0.0, 20.8)
Race/Ethnicity			
White, not Hispanic***	85	6 (7.1)	Referent
Black, not Hispanic	215	31 (14.4)	2.2 (0.9, 6.8)
Hispanic	180	53 (29.4)	5.5 (2.2, 16.3)
Education (years)			
≥13	14	1 (7.1)	Referent
10–12	313	52 (16.6)	2.6 (0.4, 112.2)
≤9	145	36 (24.8)	4.3 (0.6, 187.5)
Residence at Time of Arrest			
New York State, Excluding New York City	117	6 (5.1)	Referent
New York City	344	82 (23.8)	5.8 (2.4, 16.7)
Bronx	62	16 (25.8)	6.4 (2.2, 21.1)
Brooklyn	77	24 (31.2)	8.4 (3.1, 26.3)
Manhattan	120	32 (26.7)	6.7 (2.6, 20.4)
Queens	68	10 (14.7)	3.2 (1.0, 11.2)
Richmond	17	0 (0.0)	0 (0.0, 6.1)
Birthplace			
USA—Mainland	377	62 (16.4)	Referent
Caribbean	81	26 (32.1)	2.4 (1.3, 4.2)
South and Central America	15	2 (13.3)	0.8 (0.1, 3.6)
Potential Risk Factors			
Intravenous Drug Use			
No	339	27 (8.0)	Referent
Yes	136	61 (44.9)	9.4 (5.4, 16.4)
Sex with IVDU			
No	378	53 (14.0)	Referent
Yes	94	36 (38.3)	3.8 (2.2, 6.5)
Sex with Bisexual Male			
No	452	83 (18.4)	Referent
Yes	18	5 (27.8)	1.7 (0.5, 5.3)
Sex with Person with AIDS/HIV			
No	468	88 (18.8)	Referent
Yes	4	1 (25.0)	1.4 (0.0, 18.2)
Exchange of Sex for Money or Drugs			
No	426	75 (17.6)	Referent
Yes	47	13 (27.7)	1.8 (0.8, 3.7)
Blood Transfusion†			
No	469	85 (18.1)	Referent
Yes	9	5 (55.6)	5.7 (1.2, 28.9)
Evidence of Tattoo			
No	360	54 (15.0)	Referent
Yes	113	32 (28.3)	2.2 (1.3, 3.8)
Clinical Markers			
Syphilis Serology			
Negative	394	60 (15.2)	Referent
Positive	71	24 (33.8)	2.8 (1.6, 5.2)
Hepatitis B Surface Antigen			
Negative	420	78 (18.6)	Referent
Positive	10	3 (30.0)	1.9 (0.3, 8.5)
Tuberculin Skin Test			
Negative	401	77 (19.2)	Referent
Positive	65	13 (20.0)	1.1 (0.5, 2.1)

*Numbers do not always total to 480 due to missing information.
**Odds ratio for HIV seropositivity among women in each subgroup compared with the referent subgroup.
***Includes one Native American
†Since the dates of blood transfusions were not available, all women who had ever received a blood transfusion were considered to have this risk factor.

ditional 11 reported using street drugs nonintravenously, and two others had received tattoos. The remaining three did not report any of these behaviors nor have reactive syphilis serologies.

Associations of Risk Factors with HIV Seropositivity

HIV seroprevalence varied with demographic characteristics (Table VI-2). Women ages 30 to 39 years had the highest rate (25.0). Compared with the rate for Whites, seroprevalence was twice as high among Blacks and four times higher among Hispanics. Seroprevalence increased with decreasing levels of education. Women who resided in New York City at the time of arrest had higher rates than women from the rest of the state. Nearly one-third of women born in Caribbean countries were seropositive.

HIV seropositivity was associated with several potential risk factors for which information was available (Table VI-2). Of the 136 women who reported a history of intravenous drug use, 45 percent were HIV-seropositive, compared with 8 percent of the 339 women who denied intravenous drug use (odds ratio = 9.4). Seroprevalence was also strongly associated with a history of sex with an intravenous drug user, a history of blood transfusion, and evidence of a tattoo on physical examination.

Overall, of women with available test results, 15.3 percent had positive syphilis serology, 2.3 percent were positive for HBsAG, and 13.9 percent had positive tuberculin tests. Of these three clinical markers, a positive syphilis serology was most strongly associated with HIV seropositivity (Table VI-2).

For 472 women, information was available regarding their use or nonuse of specific street drugs (Table VI-3). Among the women denying any drug use, 7.5 percent were seropositive, compared with 8.2 percent of the women who used drugs nonintravenously and 45.9 percent of the women who admitted to intravenous drug use. Among intravenous drug users, those who used cocaine but not heroin had the lowest HIV seroprevalence (25.0 percent), users of heroin and not cocaine had an intermediate seroprevalence (43.6 percent), and users of both cocaine and heroin had the highest seroprevalence (51.3 percent). The corresponding percentages among drug users who denied intravenous use were lower but showed the same increasing trend from "cocaine, no heroin" to "cocaine and heroin."

TABLE VI-3—HIV Seropositivity of Women Entering New York State Prisons by History of Intravenous Drug Use and Type of Drug Used, September-December 1988.*

IV Drug Use Status and Type of Drug Used	Number Tested	Number HIV Positive (%)	Odds Ratio (95% Confidence Interval)
Women Denying any Drug Use	107	8 (7.5)	Referent
Women Using Drugs			
Non-Intravenously Only	232	19 (8.2)	1.1 (0.4, 2.9)
Cocaine, no Heroin	104	3 (2.9)	0.4 (0.1, 1.6)
Heroin, no Cocaine	30	5 (16.7)	2.5 (0.6, 9.4)
Cocaine and Heroin	19	4 (21.1)	3.3 (0.6, 14.1)
Drugs other than Cocaine and Heroin	79	7 (8.9)	1.2 (0.4, 3.9)
Women Using Drugs Intravenously	133	61 (45.9)	10.5 (4.5, 25.4)
Cocaine, no Heroin	16	4 (25.0)	4.1 (0.8, 18.2)
Heroin, no Cocaine	39	17 (43.6)	9.6 (3.4, 28.0)
Cocaine and Heroin	78	40 (51.3)	13.0 (5.3, 33.4)

*Eight women (three who admitted to intravenous drug use) were excluded because of incomplete or inconsistent information.

TABLE VI-4—Variables Associated with HIV Seropositivity by Logistic Regression Analysis* for Women Entering New York State Prisons, September-December 1988

Independent Variables	Adjusted Odds Ratio** (95% Confidence Interval)
Intravenous Drug Use	9.4 (4.8, 18.3)
Race/Ethnicity	
Hispanic	5.8 (1.8, 18.0)
Black	3.3 (1.0, 10.6)
Positive Syphilis Serology	3.2 (1.6, 6.7)
New York City Residence	3.2 (1.1, 9.2)
Blood Transfusion***	2.3 (0.4, 14.5)
Evidence of Tattoo	1.6 (0.8, 3.1)
High Risk Sex†	1.3 (0.7, 2.6)

*The regression model included the seven variables shown, as well as age, as a continuous variable.
**The referent group for Hispanic and Black women was White women, and for women with New York City residence was women with residence in New York State excluding New York City.
***Since the dates of blood transfusions were not available, all women who had ever received a blood transfusion were considered to have this risk factor.
†Women who reported having had sex with an intravenous drug user, bisexual male, person with AIDS or HIV infection, or who exchanged sex for money or drugs were classified as having practiced high risk sex.

TABLE VI-5—Fertility of Women Entering New York State Prisons by HIV Serologic Status, September-December 1988

Measure of Fertility	HIV Positive Women	HIV Negative Women
Mean Number of Pregnancies/Woman* (range)	2.7 (0–8)	2.7 (0–13)
Mean Number of Live Births/Woman (range)	1.8 (0–6)	1.7 (0–8)
Fraction of Women Nulliparous (%)	20/90 (22.2)	118/390 (30.3)

*Two seropositive and 15 seronegative women with incomplete pregnancy histories were excluded from this analysis.

Multivariate analysis identified five factors associated with HIV seropositivity (Table VI-4): women who were intravenous drug users, of Hispanic or Black race/ethnicity, with a positive syphilis serology, or residents of New York City were more likely to be seropositive than women without these factors. There were no interaction effects among any of the variables.

Fertility

Of 21 women who were known to be pregnant, two (9.5 percent) were HIV positive. The mean number of pregnancies, the mean number of live births, and the percentage of women who were nulliparous were similar for HIV-positive and HIV-negative women (Table VI-5). Stratified analysis to control for differences in age, racial composition, and intravenous drug use between seropositive and seronegative women did not change these findings (data not shown).

Discussion

This study, as well as an earlier study of male prison entrants,[5] was crucial in defining the magnitude of the HIV epidemic among New York State prisoners, describing its epidemiology, and promoting increased public health attention to address the epidemic in this high-risk population.

HIV seroprevalence was higher among male (17.4 percent) and female (18.8 percent) entrants to New York State prisons than has been previously reported in any mass screening program or blind epidemiologic study among prisoners in the United States.[1] The seroprevalence among all 520 female entrants during the study period may have actually been closer to our maximum estimate of 21 percent, because many of the excluded women with insufficient blood samples for HIV testing may have had scarred veins from intravenous drug use and been at increased risk for HIV infection. Most seroprevalence rates reported among prisoners in other jurisdictions have been less than 3 percent, with the notable exception of high rates for males (7.0 percent) and females (15.4 percent) entering Maryland State prisons in 1985.[1] The Maryland study found that seroprevalence among male entrants was constant from 1985 to 1987.[13] Follow-up studies of New York State inmates are planned to determine trends in seroprevalence with time.

The blinded design of our study precluded collection of extensive risk infor-

mation, and the cross-sectional design prevented assessment of temporal associations between HIV infection and risk factors or other infectious diseases. However, the high rate of HIV seropositivity among female inmates is consistent with their relatively high frequency of known risk behaviors, especially intravenous drug use, and the fact that most of them come from New York City, where HIV infection is prevalent. In addition to intravenous drug use, we found that a positive syphilis serology was strongly associated with HIV positivity. Of the 23 HIV-positive women who denied any known risk behavior, six had a positive syphilis test. The association between genital ulcer disease and HIV infection has been previously reported.[14–16] Genital ulcer disease may be a marker for prior high-risk sexual activity and may increase the risk of HIV transmission by disrupting the vaginal or cervical mucosa.

Although HIV infection has not been shown to be associated with tattooing,[17,18] HIV transmission through tattoo needles is biologically plausible, and the possible spread of HIV by this route to prisoners has been reported.[19] In our study, women with tattoos were twice as likely to be HIV-seropositive as women without tattoos (Table VI-2). However, when other possible exposures were controlled in the multivariate analysis, tattoos were not associated with HIV positivity, suggesting that tattooing was not a major factor for transmission in this population.

Our study showed an association between high HIV seroprevalence and Black or Hispanic ethnicity. This association has been described previously among intravenous drug users and attributed to differences in the social setting of drug use and specific drug use behaviors for persons of different ethnic backgrounds.[20–22] Our results may have been affected by these factors, as well as by other unmeasured risk behaviors, such as sexual contact with a person not recognized as being at high risk for HIV infection.

Although other studies have found that intravenous cocaine use is more strongly associated with HIV infection than heroin use,[21,23] our results suggested the opposite (Table VI-3). However, the small number of women in our study limited its power to detect differences by drug use. In any case, caution is needed in interpreting these results, since we had no information on the frequency, quantity, or pattern of intravenous drug use, or on the frequency of high-risk sexual activity.

HIV-positive women in our study reported the same number of pregnancies and live births as the seronegative women, and similar percentages of each group were nulliparous (Table VI-5), even after controlling for differences in age, race, and intravenous drug use between the two groups. These findings suggest that HIV infection did not affect fertility, but because we had no information on the timing of HIV seroconversion relative to the reported pregnancies, the exact relationship between HIV infection and fertility was impossible to assess. Our results are consistent with those of a study among New York City intravenous drug users which found that asymptomatic HIV infection was not associated with a decreased pregnancy rate or an increased risk of adverse pregnancy outcomes.[24] Another study of 136 pregnancies among British women also found no evidence that HIV infection affected the outcome of pregnancy, although there were more spontaneous abortions among the seropositive women.[25]

Determining the impact of HIV infection on fertility would provide important information for interpreting the blind HIV newborn seroprevalence studies that are being conducted widely. These studies provide nearly complete testing of all newborns and therefore are useful measures of HIV-infection among women giving birth and, by extrapolation, among all women.[26] However, if HIV infection substantially reduces fertility, infected women would be less likely to deliver babies, and newborn seroprevalence studies would underestimate infection rates among women. Current evidence suggests that asymptomatic HIV infection may not reduce fertility, but additional studies are needed.

After our study, funding was increased to enable four teams of counselors to provide prisoner education regarding HIV infection and to encourage all prisoners to consider HIV antibody testing. Our study and the earlier study of male inmates[5] also helped to quantify the need for increased medical services for HIV-infected prisoners. Applying the seroprevalence rates from these two studies to the number of entrants at the two prison centers, we estimate that in 1988 approximately 2,200 men and 200 women entered New York State prisons with HIV infection. In addition to routine medical care, these inmates need medical evaluation for newly approved therapies for asymptomatic HIV infection and adequate follow-up of other associated medical conditions, especially tuberculosis, which has shown an alarming increase in association with HIV infection.[27] The problem of perinatal transmission in prison was also apparent from our study, since two of the 21 pregnant women were HIV positive. To address these needs, provision for increased medical care is being planned in New York State prisons; additional seroprevalence studies will be conducted to monitor the HIV epidemic among prisoners in the future.

Summary

Human immunodeficiency virus infection is the leading medical problem among prison inmates in several states. In 1988 a blinded seroprevalence study was conducted on 480 New York female prison entrants to determine the prevalence of and risk factors for HIV infection in this population. Ninety (18.8 percent) women were HIV-seropositive. Seroprevalence was highest among women ages 30–39 (25.0 percent) and varied by ethnicity (Hispanics, 29.4 percent; Blacks, 14.4 percent; Whites, 7.1 percent) and residence (New York City, 23.8 percent; Upstate, 5.1 percent). Nearly half (44.9 percent) of the 136 acknowledged intravenous drug users and one-third (33.8 percent) of the 71 women with a positive syphilis serology were HIV-seropositive. There was no difference in fertility histories between seropositive and seronegative women, and two of 21 pregnant women were seropositive. This study led to increased clinical and prevention services for this high-risk population. □

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