



## Preliminary Estimates of Human Immunodeficiency Virus Prevalence and Incidence Among Cocaine Abusers of Porto Alegre, Brazil

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**ABSTRACT** *A sample of 193 southern Brazilian inner-city cocaine abusers was studied to assess the prevalence of human immunodeficiency virus (HIV) infection. Following the exclusion of those who were seropositive from the intake sample, a cohort of 138 HIV-negative cocaine abusers was followed for 18 months to assess seroincidence rates and the associated characteristics. HIV status, drug use, sexual risk behaviors, and presence and severity of medical and psychiatric symptoms were collected at intake using a Brazilian version of the Risk Assessment Battery, the Addiction Severity Index (ASI), Symptom Check List-90 (SCL-90), and Beck Depression Inventory (BDI); this was repeated at 6-, 12-, and 18-month intervals. The overall seroprevalence was 28.5%, and the variables associated with HIV seropositivity were age older than 25 years, being single, having less than 8 years of education, and having injected cocaine at least once. Although follow-up procedures were difficult to implement due to sample characteristics, we obtained data from 82.6% of the participants for at least one follow-up and for 57% at all follow-up windows. Most participants showed high scores on the Beck Depression Inventory (mean of  $20.6 \pm 13.9$ ) and Symptom Check List-90 (mean of  $106.4 \pm 91.9$ ). There were 8 seroconversions in the 18-month period, yielding an incidence rate of 5.03/100 (confidence interval [CI] 2.2–9.7) person-years at risk. None of the seroconverters reported recent cocaine injection, and only 14.5% of the overall sample reported ever injecting cocaine, which suggests that another significant mode of transmission via sexual behavior should be considered as well. Each of these findings has important implications for the design of preventive interventions.*

**KEYWORDS** *Cocaine abuse, Drug abuse, HIV/AIDS, Seroincidence, Seroprevalence.*

### INTRODUCTION

In the last decade, there has been significant growth in the total number of drug users worldwide.<sup>1</sup> Although the methods to assess trends in drug use have improved, there is need for better knowledge about this population, as well as a constant review of practical approaches for drug abuse prevention. These issues are very important in Brazil because little research has been done on persons who abuse drugs of any type. Among the many psychoactive substances, cocaine has raised

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particular concern since there has been tremendous growth of its consumption in the last decade.<sup>1</sup>

The 1990s also proved to be the decade in which the acquired immunodeficiency syndrome (AIDS) epidemic underwent rapid growth in Brazil, with an increase in the prevalence of human immunodeficiency virus (HIV) infection among persons who abuse drugs, particularly those who belong to the most unprivileged segments of the social strata.<sup>2,3</sup> Unlike the United States, where heroin use has been endemic for many years, there is relatively little heroin use in Brazil; thus, behaviors associated with cocaine abuse are likely to be major contributors to the spread of HIV and other infectious diseases, by either injecting or sharing drug paraphernalia or by associating with peers whose drug abuse lowers their concern and awareness of risky behaviors and sexually transmitted diseases.

Data from the STD-AIDS program of the Brazilian Ministry of Health show 540,000 people currently living with HIV and more than 190,000 reported AIDS cases since the beginning of the epidemic. Of these cases, approximately 35,000 have been caused by drug injection alone—with no report of heroin injection and with a steady growth of some 3,000 new cases attributable to drug injection each year for the last 10 years. It is assumed that these injection practices are cocaine related since there is no significant use of injectable amphetamines or drugs other than cocaine in Brazil.<sup>4</sup> The overall prevalence of HIV infection in Brazil is 11.2/100,000, and some estimates suggest that around 12% of the total HIV-positive cases come exclusively from cocaine<sup>2</sup> since heroin use by any manner is very uncommon in Brazil and is mentioned only in anecdotal reports in the form of single case studies at national conferences.

One Brazilian study done in Sao Paulo found a prevalence of 22% among drug users; among the 85 cocaine injectors who were interviewed, there was a 60% overall prevalence.<sup>3</sup> A study done in Porto Alegre with a sample of 142 cocaine injectors found that 54% were seropositive.<sup>5</sup> Two other studies found that 44% of 129 persons who had injected cocaine at least once since 1980 were HIV positive,<sup>6</sup> and 16% of 331 noninjectors were positive.<sup>7</sup> Each of these studies was cross sectional; we could find no published studies about HIV incidence in Brazilian drug users.

Incidence studies published abroad have been done mainly with heroin-using injecting drug users (IDUs), many of whom were also injecting cocaine or smoking crack, and thus they did not focus on the relationship between injecting/snorting cocaine and HIV transmission and infection. Brazilian reality seems to be different, focusing mostly on cocaine use.<sup>2</sup> Since local anecdotal reports and clinical experience suggested that snorting was the most common means of cocaine use in southern Brazil, the authors designed a study with a special focus on this type of use, aiming at further understanding its potential association with the AIDS epidemic. Since some cocaine snorters also had reported injecting, cocaine injectors were included in the sample.

## OBJECTIVES

This article reports findings from a pilot study aimed at obtaining data on the prevalence and incidence of HIV infection in a sample of cocaine abusers from Porto Alegre, Brazil. A secondary goal was to describe the demographic characteristics of this sample with regard to drug use, risk behaviors, and presence and severity of medical and psychiatric problems. Such information can provide a profile of

cocaine-using individuals that may be useful in guiding interventions to prevent the spread of HIV in this population.

## METHOD

### Sampling

Approval for the use of human subjects was obtained from committees at the University of Pennsylvania (the collaborating US institution) and the Federal University of Rio Grande do Sul (UFRGS); all participants completed an informed consent procedure before entering the study. Between December 1996 and May 1998, we recruited 202 cocaine-abusing individuals. Recruitment took place via street outreach in downtown Porto Alegre and at two drug and alcohol treatment programs: Hospital de Clínicas of Porto Alegre (HCPA), a large teaching hospital connected to the UFRGS, and the Red Cross Outpatient Center, a public center for free HIV testing. Eligible volunteers were between 18 and 60 years of age and fulfilled *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition (DSM-IV)* criteria for cocaine abuse or dependence.<sup>8</sup> Patients were evaluated as meeting these criteria by a clinical interview performed by trained psychiatric interviewers with at least 3 years of training in psychiatry; the interviewers were supervised by a senior psychiatrist (F. P.).

### Data Collection

After giving informed consent and being judged eligible for the study, all participants received standard pretest counseling, provided blood for HIV testing at HCPA, and were scheduled to return for post-test counseling in a window of 7 to 10 days. Of 202 individuals who agreed to participate, we excluded those who did not complete the baseline HIV test (9 cases), yielding a final sample of 193.

Baseline and follow-up assessments included the Addiction Severity Index (ASI),<sup>9,10</sup> to assess the impact and severity of their drug use in different life areas (selected variables of the ASI were used for analysis); the Symptom Check List-90 (SCL-90),<sup>11</sup> which evaluates nine dimensions of psychiatric symptoms (for the purpose of this study, only the general score was utilized); the Beck Depression Inventory (BDI)<sup>12,13</sup>; and selected individual items of the Brazilian version of the Risk Assessment Battery (RAB),<sup>14-18</sup> a self-report instrument that measures drug use and sexual behaviors associated with HIV risk. The Brazilian version of the RAB that was used in this study did not have a specific section on injection practices since preliminary studies done when adapting the instrument to Brazil showed no heroin use and few cocaine injection practices.<sup>19</sup> Although this omission has been corrected for subsequent studies by adding more detailed questions about injection practices, analyses regarding cocaine injection in this study were done solely on the response to two items: "ever injecting cocaine in lifetime" and "injecting cocaine in the month prior to interview." Since some RAB questionnaires were incomplete, RAB data were analyzed with a total 143 subjects.

Interviewers were trained by senior staff to perform HIV counseling and to administer the ASI. The Brazilian coinvestigator (F. P.) was trained to use the ASI in Philadelphia; other interviewers were trained at the University of Pennsylvania/Philadelphia Veterans Affairs Medical Center for Studies of Addiction or in workshops that were conducted by the US investigators during a site visit to Porto Alegre.

Efforts were made to follow-up all participants at 6, 12, and 18 months, when the same serologic and behavior assessments were repeated. Volunteers were compensated in Brazilian reais for the time spent doing evaluations at a price equivalent of US \$5 on completion of the baseline interview. To provide incentives for completion of follow-up visits, participant payments increased by increments of US \$5 for each subsequent interview. Baseline interviews were done at the original testing sites, and volunteers were scheduled to return within their follow-up window, with a "grace" period of 1 month after the scheduled follow-up date.

Obtaining follow-up interviews was particularly challenging when subjects lived in *favelas* (shantytowns), where residents have no formal addresses, telephones, or automobiles to drive to the data collection site. To increase retention, interviewers kept track of subjects' addresses, acquaintances, and phone numbers (when available), and increased efforts were made to locate participants besides the use of the standard tracking procedures. These efforts included sending postcards to encourage returning during the follow-up windows, contacts with neighbors to identify possible "hangout" points that were not described by the respondent, as well as personal contact with friends who might know where the participant could be found. When subjects did not return for their follow-up assessment, the research team would try to locate them by visiting their home and "hot spots" where they were likely to be found. Sometimes, five or more visits were made to homes or local hangouts. At the data collection center, education and supportive counseling were increased, and free condoms, bleach kits, coffee, and candies were included in the package.

### Data Analysis

Chi-square and Fisher exact tests were used to analyze HIV prevalence according to demographics, drug use, and other characteristics of the sample at baseline. A crude odds ratio with 95% confidence intervals (CIs) also was calculated. The level of significance used in the chi-square test was less than .05. Adjusted odds ratios were calculated using a logistic regression model. Because of the low seroconversion rate, we could not include all study variables in the regression and thus chose the five most important based on bivariate analyses and risk characteristics reported in the literature. Incidence rates were calculated using person-time measures. Time of seroconversion was set at the midpoint between the last negative and the first positive HIV tests. All data were analyzed using SPSS 8.0 (SPSS, Inc., Chicago, IL).

## RESULTS

### Prevalence Data

Of the 193 subjects included in the study, 138 (71.5%) were seronegative, and 55 (28.5%) were seropositive at initial screening.

The majority (88%) of the sample was male, Caucasian (61%), single (79%), and younger than 25 years old (59%). With regard to work, 51% had a steady job, and 88% had monthly earnings of less than US \$250. Of the subjects, 62% had 8 or fewer years of school education (equivalent to sixth grade in the United States).

Sample characteristics, including age, gender, race, income, work, and schooling, as well as lifetime and alcohol and drug use in the last 30 days were compared to HIV status and are shown in Table 1. Statistically significant associations with

**TABLE 1. Selected baseline demographic characteristics, substance use, psychiatric symptomatology, and serostatus of the subjects (N = 93)**

	HIV + (n = 55) n (%)	OR (95% CI)	P
Age			
Equal to or less than 25	20 (37.0)	1	—
More than 25	34 (63.0)	3.5 (1.7–7.1)	<.001
Gender			
Male	50 (90.9)	1.4 (0.5–4.6)	.53
Female	5 (9.1)	1	—
Race			
Caucasian	34 (63.0)	1	—
Not Caucasian	20 (37.0)	0.9 (0.4–1.8)	.72
Education, years			
Equal to or less than 8	41 (74.5)	2.2 (1.03–4.6)	<.05
More than 8 years	14 (25.5)	1	—
Marital status			
Married	6 (10.9)	1	—
Not married	49 (89.1)	2.8 (1.03–7.9)	<.05
Employment			
Regular work	22 (40.0)	1	—
Irregular/no work	33 (60.0)	1.9 (0.96–3.8)	<.05
Income (monthly minimum wages)			
Less than 1	32 (58.2)	2.2 (0.6–8.3)	.44
1–3	19 (34.5)	1.8 (0.5–7.4)	
More than 3	4 (7.3)	1	—
Beck score*	20.6 ± 13.9		0.18†
SCL-90 score*	106.4 ± 91.9		0.26†
Used in the past month			
Alcohol for intoxication	25 (45.5)	0.96 (0.5– 1.9)	.91
Cocaine injection	22 (40.0)	7.0 (2.9–16.9)	<.001
Cannabis	40 (72.7)	1.3 (0.6– 2.8)	.41
Ever used			
Alcohol for intoxication	38 (69.1)	0.9 (0.4– 1.8)	0.64
Marijuana	52 (94.6)	2.0 (0.5– 9.1)	.22‡
Cocaine injection	26 (47.3)	5.3 (2.5–115)	<.001

95% CI, 95% confidence interval; OR, odds ratio.

\*Mean ± standard deviation.

†Student *t* test.

‡Fisher exact test.

being HIV positive were age older than 25 years, less than 8 years of education, being single, and having an irregular job or not having a job (marginal significance). The standard minimum wage used to calculate income corresponds to 136 Brazilian reais per month, the equivalent of US \$75 at the time of the study. The majority of the participants used cocaine by intranasal inhalation; crack, heroin, and hallucinogens were infrequently reported and therefore were not considered in the analyses. Being HIV positive was significantly associated with having injected cocaine in the

**TABLE 2. Risk behaviors and serostatus (N = 143)**

Risk behavior	HIV + (N = 42), n (%)	Odds ratio (95% CI)	P*
Man with four or more female partners	5 (11.9)	0.34 (0.11– 1.06)	<.05
Man with male partners	3 (7.1)	0.72 (0.15– 3.04)	.49
Woman with four or more partners	0 (—)	—	—
Never/almost never use condom	27 (64.3)	3.39 (1.5– 7.7)	<.01
Had sex with a potentially infected person	14 (33.3)	7.9 (2.5–25.7)	<.01
Received money to have sex	4 (9.5)	1.1 (0.3– 4.2)	.91
Received drugs to have sex	2 (4.8)	1.6 (0.2–12.7)	.60
Paid to have sex	4 (9.5)	0.6 (0.2– 2.1)	.39
HIV test more than two times in life	23 (54.8)	6.0 (2.5–14.5)	<.01
Injection drug user partner since 1980	7 (16.7)	2.1 (0.1– 7.8)	.12
Very concerned about			
Already being infected	18 (42.9)	2.7 (1.2– 6.3)	<.05
Will be infected in the future	22 (52.4)	1.2 (0.5– 2.6)	.68
Will transmit the virus	26 (61.9)	2.6 (1.2– 5.8)	<.05

95% CI, 95% confidence interval.

\*Chi-square test.

last 30 days and lifetime injection use of at least once since the beginning of the epidemic in 1980.

Risk behaviors for HIV infection and serostatus are shown in Table 2 and are based on the 143 subjects with valid responses. Variables significantly associated with being HIV positive were irregular or no condom use, having sex with a possible seropositive person, and paying for sex. Subjects that had been tested more than twice for HIV infection were also more likely to test positive, as were those who were more concerned about having or transmitting the virus (questions about pre-occupation with HIV status were local components added to the Brazilian version of the original RAB).<sup>19</sup>

Table 3 shows a logistic regression analysis of five variables from Table 1 with their adjusted odds ratios. All variables, except for work, still had significant adjusted odds ratios.

**TABLE 3. Logistic regression model predicting HIV prevalence at baseline**

Variable	Crude OR	Adjusted OR
More than 25 years old	3.5 (1.7 – 7.1)	3.4 (1.5– 7.3)
Less than 8 years of study	2.2 (1.03– 4.6)	2.6 (1.1– 5.8)
Not married	2.8 (1.03– 7.9)	3.9 (1.7– 8.9)
Irregular/no work	1.9 (0.96– 3.8)	1.2 (0.6– 2.6)
Cocaine injection—lifetime	7.0 (2.9 –16.9)	3.9 (1.3–11.4)

OR, odds ratio.

### Incidence Data

Of the 193 seronegative participants at baseline, 151 (78%) had at least one follow-up, and 42 (22%) had none. We compared these two groups according to gender, age, education years, drug injection, HIV test result, and BDI and SCL-90 scores. Being female was the only significant variable that showed better follow-up rates.

Of the 138 seronegative participants who completed baseline assessments, 87 (63%) were interviewed for the first follow-up, 93 (67%) for the second follow-up, and 95 (69%) for the third follow-up. Attempts were made to follow-up all individuals, even if they were lost to follow-up at any window. Using this procedure, 114 (83%) of those who were initially seronegative had at least one follow-up during the 18-month period; 65 (47%) were interviewed at all three follow-ups, 33 (24%) at two follow-ups, and 16 (12%) at only one follow-up. Overall, a total of 159 person-years at risk were accrued.

During the 18-month study period, there were 8 seroconversions, yielding an incidence rate of 5.03/100 person-years at risk (CI 2.2–9.7). Of these 8 individuals, 4 became infected during the first follow-up period, 3 in the second follow-up, and 1 during the third. Table 4 describes selected sociodemographic variables and drug injection history of these subjects, as well as their SCL-90 and BDI scores. Two individuals had few depression symptoms according to their baseline Beck Scale (Beck score  $\leq 12$ ). Scores on the BDI and SCL-90 were high for most of the sample, and there were no differences between scores for seroconverters and for those who did not convert. There were trends for higher incidence rates among those who were single and who had no regular work. Although lifetime intravenous use was associated with being HIV positive at baseline, lifetime history of IDU was not reported among any of the seroconverters.

Seroconverters were compared to those who remained seronegative on the ASI composite scores, and the converters were found to have a lower alcohol score at baseline. The RAB scores were not statistically different, being  $11.4 \pm 4.7$  for seronegatives and  $8.9 \pm 2.9$  for seroconverters.

### DISCUSSION

To the best of our knowledge, this is the first Brazilian study on the incidence of HIV among cocaine abusers. Although it may not represent the overall population of cocaine abusers of Porto Alegre, it provides a closer look at the risky behaviors and HIV epidemiology of those who participate in the parts of the health system that include drug abuse treatment centers and HIV test sites. The first important finding is the high HIV prevalence at baseline, which is consistent with our perceptions that cocaine abusers in Porto Alegre are at very high risk for HIV infection and transmission. In addition, it appears that many who are infected do not know it since 54% received their first HIV test as participants in this study.

Some demographic characteristics—such as belonging to an older age group, having less than 8 years of education, being single, and not having a regular job—were consistently associated with HIV infection in the bivariate analyses (although employment had a marginal confidence interval value of 0.96; see Table 1). It is likely that the association of older age with seropositivity is an expression of duration of exposure to the virus (simply being involved in more risky behaviors), as well as having less access to preventive information, which has been typical in Brazil during the last two decades, particularly the 1980s.<sup>20</sup> It is also likely that belonging to the lower socioeducational strata accounts for the overall high proportion of

**TABLE 4. Risk factors for HIV seroconversion among cocaine users (univariate associations)**

Risk factor	Person-years at risk	Seroconverters n	Rate of seroconversion per 100 PY	Relative incidence	95% Confidence interval
Overall	159.14		5.03		(2.2– 9.7)
Age, years					
Younger than 25	100.75	5	4.96	1.00	(0.2– 4.2)
25 or older	60.54	3	4.96	1.00	
Gender					
Male	130.82	6	4.58	1.00	
Female	23.16	2	8.63	1.88	(0.4– 9.3)
Race					
White	99.07	4	4.03	1.00	
Not white	61.59	4	6.49	1.61	(0.4– 6.4)
Education, years					
8 years or less	82.79	4	4.83	1.00	
More than 8 years	76.25	4	5.25	1.14	(0.3– 4.3)
Marital Status					
Married	38.26	1	2.61	1.00	
Not married	120.38	7	5.82	2.22	(0.3–18.1)
Employed					
Regular work	89.90	3	3.34	1.00	
Irregular/no work	69.62	5	7.18	2.15	(0.5– 9.0)
Income					
Less than 1 mw	74.64	4	5.36	0.92	(0.2– 5.0)
1–3 mw	53.88	2	3.73	0.64	(0.1– 4.5)
More than 3 mw	34.27	2	5.83	1.00	
Beck score					
Less than 12	46.03	2	6.52	1.00	
12 or above	109.45	8	4.57	0.70	(0.2– 2.9)
SCL-90					
Less than 40	37.65	1	5.31	1.00	
40 or above	115.80	7	5.18	0.98	(0.2– 4.8)
History of IDU					
Yes	21.43	0	0		
No	134.06	8	5.98	—	—

IDU, injection drug use; mw, monthly minimum wage; PY, person-years.

HIV-positive individuals since the Brazilian government has only made a serious effort to provide preventive education to members of this strata in the last few years.<sup>21</sup>

Having injected cocaine, either in the month prior to interview or at some prior time, was the only drug-specific finding that was significantly associated with being HIV positive. This finding is consistent with US studies among heroin addicts and the Brazilian literature showing that cocaine is readily available and commonly used by seropositive individuals.<sup>22–24</sup> These findings are also consistent with other studies that used similar sampling methods in Porto Alegre, where there was a



significant association between seropositivity and being older, having fewer years of education, being of lower socioeconomic status, and having ever injected cocaine.<sup>25</sup> Looking specifically at the 142 cocaine injectors from that previous study, 64% had only 8 years of education, 39% were unemployed, and 51% reported receiving financial aid from family members.<sup>26</sup> Among the 31% of participants who were tested for HIV, 54.5% were positive. In this sense, these data provide a reasonably sharp picture of the poor, uneducated cocaine abusers seen at treatment centers in Porto Alegre.

The items related to exposure via sexual behavior, condom use, and concern about the virus and its transmission were obtained from the Brazilian version of the RAB. Bivariate analyses showed that statistically significant odds ratios for HIV infection at baseline were associated with high levels of concern about exposure to HIV or transmitting the virus. Significantly stronger associations were found between seropositivity and having sex with a potentially HIV-positive partner in the last 6 months, being tested more than twice in lifetime for HIV, and irregular condom use. No significant association was found between having an IDU partner, which suggests that the seroconverters did not become infected through the use of contaminated injection equipment, but rather via unprotected sexual activity with a non-IDU partner.

When the significant variables were analyzed by logistic regression, all remained strongly associated with increased risk of seropositivity, with the exception of irregular work. This confirms the preliminary idea that older, single, uneducated individuals who have injected cocaine at least once are at a higher risk of being infected when compared to the rest of the sample, therefore justifying specific preventive approaches. These approaches would probably include harm-reduction techniques associated with counseling for the development of social skills, administered in a nonthreatening environment, and utilizing behavior change, instead of giving emphasis to educational activities that could be difficult to understand and implement due to low educational levels.

We were also interested in the relationship between depressive and general psychiatric symptoms and HIV status. Although BDI and SCL-90 scores were higher among seropositive participants at baseline, we found no significant difference between the scores for HIV converters and nonconverters. The finding of high scores in the sample as a whole is consistent with literature from the United States on cocaine and crack abusers who are seeking treatment.<sup>27,28</sup> The absence of an association between psychiatric symptoms and seroconversion may have been associated with the small sample size, as could the absence of an association with intravenous use.

Paradoxically, men who had four or more sexual partners in the 6 months prior to interview had a lower prevalence of HIV infection, suggesting that having multiple sex partners was a protective factor for HIV infection. We can think of three possible explanations for this unexpected finding: (1) the confidence interval was marginally significant (0.11–1.06; see Table 2), suggesting an error in interpretation of the findings (beta error); (2) individuals who were HIV positive before responding to the questionnaire had already lowered their number of sex partners, which could then appear in the data as a “protective factor”; or (3) the finding could be a function of an age differential between the infected and uninfected since older drug users would tend to have fewer partners than younger ones. Due to the small sample size, none of these possible explanations can be confirmed.

When discussing the findings related to the seroincidence study, it is important to consider the retention rates we achieved. This is a pioneering study in our milieu,

if we consider follow-up studies of new HIV infections among drug users in Brazil. There were immense difficulties in locating subjects and completing assessments within the follow-up windows, mainly because many subjects lived in *favelas*, and there was minimal prior experience, based only on related studies by Inciardi and coworkers,<sup>29</sup> to guide us in locating them. During data collection, many addresses could not be confirmed simply because there were no formal streets and blocks; in a great proportion of cases, there were no telephones (among either participants or their collaterals) to make contact and accurately check for locator information. Advice from the US collaborators encouraged the local team to expand the number of collaterals, which helped locate many individuals. Other adaptations were needed, such as the extension of follow-up windows, to provide more time for locating subjects, as well as an increased number of attempts before considering an individual unreachable. In the end, we were able to locate 83% of the individuals initially interviewed, but not at all three follow-up interviews; thus, we could not obtain sufficient power to assess other potential correlates of seroconversion, such as psychiatric or other behavioral features.

However, our results compare well with other follow-up studies of drug users. For example, studies<sup>15,30-33</sup> with a similar design of drug users have been conducted in a number of cities outside Brazil, with 1-year follow-up completion rates ranging from 74% to 91%. Although our ability to detect statistically significant risk factors was limited, we identified some aspects that deserve further study, such as the high seroincidence estimate of 5.03/100 person-years at risk. This finding was not associated with the selected demographic variables and risk factors shown in Table 4. Interestingly, there was no lifetime history of injection drug use in this group, which suggests that the mode of risk behavior responsible for seroconversion was unprotected sex.

One important aspect to mention is that the participants were recruited through convenience sampling, and the data collection sites were either placed in suburban areas where people come to seek treatment, referral, HIV testing or some central spots of the city's downtown area. There was no media campaign or recruitment strategy other than word of mouth, which was used in a type of "snowball" or "chain referral" approach based on similar strategies used in Rio de Janeiro and elsewhere.<sup>31</sup> We assume that this recruitment strategy excluded individuals who had less access to the health system and was more likely to include individuals who felt motivated, for whatever reason, to seek help for their drug problem or obtain free HIV testing. Since we had no collateral information from other sources (family members, medical charts) to compare with our data, we typically had to rely on the subject's perception of his or her problems to ascertain the information obtained. We probably also included the most severe cases who urgently needed drug treatment, which is shown in the high rates of psychiatric symptoms in the sample—both in seroconverters and in the overall sample as well.

An important by-product of this work was the adaptation of US research methodology to Brazilian culture, which we hope will contribute to generating continuing collaboration between US and Brazilian sites in the future. Perhaps most important, these data suggest that sexual and intravenous transmission of HIV are occurring among cocaine users in Brazil. This finding is similar to those of recent US studies<sup>34</sup> and has important implications for the design of prevention interventions. In view of the clear evidence for sexual transmission as well as parenteral transmission of HIV, meaningful sexual risk-reduction strategies for men and women drug users need to be developed, implemented, and evaluated. More robust

studies, with an increment in sample size and utilizing refinements of the same methodology, are needed as well.

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