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Correlates of HIV infection among patients with mental illness in Brazil

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People living with mental illness are at increased risk for HIV. There are scarce data on correlates and prevalence of HIV infection, and none with a nationally representative sample. We report on correlates of HIV infection from a cross-sectional national sample of adults receiving care in 26 publicly funded mental health treatment settings throughout Brazil. Weighted prevalence rate ratios were obtained using multiple log-binomial regression modeling. History of homelessness, ever having an STD, early age of first sexual intercourse before 18 years old, having suffered sexual violence, previous HIV testing, self-perception of high risk of HIV infection and not knowing one's risk were statistically associated with HIV infection. Our study found an elevated HIV seroprevalence and correlates of infection were not found to include psychiatric diagnoses or hospitalizations but instead reflected marginalized living circumstances and HIV testing history. These adverse life circumstances (history of homelessness, having suffered sexual violence, reporting a sexually transmitted disease, and early sexual debut) may not be unique to people living with mental illness but nonetheless the mental health care system can serve as an important point of entry for HIV prevention in this population.

Keywords: HIV prevalence; correlates of HIV infection; mental illness; risk behavior; Brazil; multicenter study

Introduction

Despite advances in prevention and treatment, human immunodeficiency virus (HIV) continues to affect the general population and more vulnerable subgroups worldwide (Vermund, 2011). There is consistent evidence that individuals with mental illness are at increased risk of sexually transmitted diseases (STDs), including HIV (Angelino, 2008; Carey, Ravi, Chandra, Desai, & Neal, 2007; Guimarães et al., 2009; Meade & Sikkema, 2007; Pirl, Greer, Weissgarber, Liverant, & Safren, 2005; Rosenberg et al., 2001), yet people with mental illness remain an understudied subgroup in the AIDS epidemic (Ngwena, 2011), creating an evidence vacuum from which to plan targeted interventions at the individual or health systems levels.

Correlates of HIV infection among people living with mental illness include gender, age, marital status, race-ethnicity, childhood sexual and non-sexual abuse, sexual and domestic violence, homelessness, type of psychiatric care received, severe mental illness (SMI), and substance use – both parenteral and non-parenteral (Carey et al., 2007; Collins, Holman, Freeman, & Patel, 2006; Cournos & McKinnon, 1997; Cournos et al., 1991; Himelhoch et al., 2007; Prince, Walkup, Akincigil, Amin, & Crystal, 2012; Rosenberg et al., 2001). However, studies are inconclusive due to small samples, lack of representativeness and other sampling biases, as well as difficulty in discerning the intricate relationships among the many potential explanatory variables. For instance, a recent longitudinal study among Puerto Rican women found a strong association between substance use, HIV infection, and mental disease (Loue, Sajatovic, & Mendez, 2011), though this study's sample size prevents disentangling complex associative relationships. In a study of Medicaid beneficiaries in eight US states, a substance use disorder (SUD) rather than diagnoses characterized as SMI was the main factor associated with new HIV diagnosis (Prince et al., 2012). Though the sample size was large, the findings were based solely on patients referred for HIV testing rather than on a representative sample of patients with SMI, and the authors were not able to adjust for risk behaviors (e.g., sexual risk, illicit drug and alcohol use, number of partners), important study design constraints which limit the usefulness of its findings for public health planning (Cournos, Guimarães, & Wainberg, 2012).

Brazil is one of the few low- or middle-income countries to focus significant resources on its psychiatric

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population. Rates of syphilis, hepatitis B and C, and HIV were shown to be higher among patients in psychiatric treatment than estimates for the general adult Brazilian population (Guimarães et al., 2009). High rates of unprotected sex, substance use, early sexual initiation, history of incarceration and homelessness, low HIV testing rates, and poor HIV/AIDS knowledge all were found in a representative sample of individuals living with mental illness under care throughout Brazil (Guimarães, McKinnon, Campos, Melo, & Wainberg, 2010; Melo et al., 2010; Melo, Machado, & Guimarães, 2011). In a smaller study of patients with mental illness in Rio de Janeiro, which has among the highest AIDS case rates in the country (Brazil, Ministério da Saúde, 2011), 42% of 98 patients engaged in vaginal or anal sex within the past three months; comorbid substance use disorder was significantly associated with sexual activity; only 22% of sexually active patients used condoms consistently, despite having better HIV knowledge than those who were sexually abstinent; 45% of patients reported not engaging in any HIV protective behaviors; and there were no reports of drug injection (Wainberg et al., 2008).

Most studies of psychiatric populations have been undertaken in high-income countries among patients with SMI or in mental health care facilities with an overrepresentation of SMI conditions. Thus, seroprevalence and behavioral correlates may be overestimated or lack representativeness, and precise measurement of prevalence is needed. Furthermore, studies of determinants of HIV seroprevalence among patients with a wider range of psychiatric conditions in both inpatient and outpatient care are still needed. The aim of the present study was to examine the association between HIV infection and sociodemographic, clinical, and risk behavior characteristics in a representative sample of adults living with mental illness in Brazil.

Methods

To examine correlates of HIV infection, we analyzed data obtained in a national cross-sectional study designed to estimate the seroprevalence of HIV, syphilis, and hepatitis B and C and to assess risk behaviors among adults (18 years or older) with mental illness under care in Brazil, previously described (Guimarães et al., 2009). Briefly, the study was conducted in 11 public psychiatric hospitals and 15 public mental health outpatient clinics, named Psychosocial Care Centers (CAPS) in 2006. Sample size was proportional to type of care (hospital or CAPS) and distribution of AIDS cases in the five main Brazilian regions. Two-stage probability sampling was used to select centers and individuals within each center. Only patients capable of providing written informed consent and of answering the questionnaire were included in the study. Inpatients recently admitted were contacted after a minimum seven-day period of hospitalization to allow for clinical stabilization. Recruitment and interviews occurred during the same one-month period for all centers. Clinics treating primary SUDs were excluded so as not to overestimate selected risk behaviors and/or prevalence rates. Ethical approval was obtained from each site, the Federal University of Minas Gerais (UFMG/ETIC 125/03) and the National Ethical Review Board (CONEP 592/2006). Written informed consent was obtained.

Exposure and event measurements

The event of interest in this analysis was HIV positivity. Blood samples for serology were collected using standard procedures, including pretest counseling, and processed and checked for quality control (Guimarães et al., 2009). HIV positivity was assessed by ELISA for Anti-HIV 1 and 2 and confirmed by Western Blot. Research staff members returned results to patients in each participating site following posttest counseling procedures. Patients who were positive were referred for medical care and follow-up.

A semistructured questionnaire was used by experienced and trained mental health care providers who conducted person-to-person interviews. The study protocol, questionnaires, and procedures were tested in a pilot study (Guimarães et al., 2008). Explanatory characteristics investigated included sociodemographic information, psychiatric conditions, and risk behaviors. Psychiatric diagnoses, established by psychiatrists, were obtained from medical charts and were grouped according to the *International Statistical Classification of Diseases and Related Health Problems*, 10th edition, (World Health Organization (WHO), 2004). When more than one psychiatric diagnosis was present, these were recorded hierarchically according to clinical severity as follows: (1) schizophrenia and other psychotic disorders, (2) bipolar disorder, (3) depression with psychotic symptoms, (4) depression, (5) anxiety, (6) substance use disorder, and (7) others. Because of small numbers, categories (1), (2), and (3) were grouped together as SMI and the remaining diagnoses were categorized as non-SMI. History of STDs was elicited by self-report regarding whether health professionals had ever informed patients that they had any STD. HIV knowledge was measured by a score rated on a 0–1 scale using 10 statements regarding HIV transmission and prevention; median value of correct answers was defined as the cut-off point (Melo et al., 2010). Current place of residence was defined as unstable (living in shelters, hostels, streets, rooms) and stable (living in houses or apartments), and unsafe sex was defined as not always using condoms.

Data analysis

Descriptive analysis was carried out and the chi-square test was performed for the analysis of categorical data. HIV-positive participants were compared to HIV-negative participants and the magnitude of the associations was estimated by the weighted prevalence rate ratio (PRR_w) with 95% confidence intervals using log-binomial regression for both univariate and multivariate analyses. Log-binomial method is based on the binomial distribution and it is an efficient way of obtaining prevalence rate ratios in cross-sectional studies (Petersen & Deddens, 2008). These estimates were proportionally weighted by the sample size of each site relative to its total population, i.e., number of beds or number of registered patients, considering the potential within-cluster correlation. All variables with *p*-values equal to or less than 0.20 obtained in the univariate analysis were used to start multivariate modeling. A backward deletion strategy was applied and only those variables with *p*-values equal to or less than 0.05 remained in final multivariate model. All analyses were carried out using SAS® (Spiegelman & Hertzmark, 2005).

Results

The final sample for this analysis consisted of 2237 patients who had both interviews and blood collected. Reasons for non-participation were mostly due to refusals (52%) and not being located (19%). There was no difference between participants and non-participants with regard to schooling, age, gender, or psychiatric diagnosis. However, hospital patients had a higher participation rate as compared to CAPS patients ($p < 0.01$).

Descriptive characteristics are shown in Table 1. Overall, most were recruited in CAPS, had SMI, and had at least one prior psychiatric hospitalization, but there was a low proportion of substance use as primary psychiatric diagnosis (7%). We should note the high proportion of markers of vulnerability to HIV in this population, including history of homelessness, incarceration, violence, STDs, substance use, and ever practicing unsafe sex. However, only 3% reported injection drug use ever. Also, most had never been tested for HIV despite the high proportion of self-perception of being at high risk or not knowing one's risk for HIV. In this sample, 0.7% were found to be HIV positive (Table 1). The univariate analysis showed that the following factors were statistically associated with HIV infection (Table 2): schooling at or above 5 years, current unstable housing, history of homelessness and STDs, previous HIV testing, age of first sexual intercourse before 18 years old, use of alcohol or drugs during sexual intercourse, partner's refusal to use condoms, condom use at last sexual intercourse, money/drugs exchanged for sex, more than one sexual partner ever, self-perception risk of HIV (both high and not knowing one's risk), ever use of alcohol and illicit drug, and having suffered verbal or sexual violence (Table 2).

The multivariate analysis (Table 3) indicated six factors remaining associated with HIV infection ($p < 0.05$): history of homelessness, history of STDs, age at first sexual intercourse before 18 years old, having suffered sexual violence, previous HIV testing, and self-perception risk of HIV (both high and not knowing one's risk).

Discussion

This is the first representative study to examine factors associated with HIV infection among patients with mental illness. Our results indicate that life circumstances (history of homelessness, having suffered sexual violence, reporting a sexually transmitted disease, and early sexual debut) are more robust independent correlates of HIV infection than psychiatric factors among people receiving treatment for a psychiatric condition in Brazil. The low proportion of injection drug users (3%) and SUD as a primary psychiatric diagnosis (7%), the absence of HIV infection in either group, and the lack of association between psychiatric diagnoses and prior hospitalization with HIV infection in our analysis reinforce this hypothesis, and provide evidence of high sexual risk for HIV among adults in psychiatric treatment in Brazil. Similar results have been found in India (Carey et al., 2007), South Africa (Henning, Krüger, & Fletcher, 2012), and Brazil (Wainberg et al., 2008), and they are consistent with the distribution of risk categories of reported AIDS cases in Brazil (68.7% and 15.5% are sexually or injection drug use related, respectively) (Brazil, Ministério da Saúde, 2011). Our findings are also consistent with prior studies in the USA (Carey, Carey, Maisto, Gordon, & Vanable, 2001; Cournos & McKinnon, 1997; Himelhoch et al., 2007; Prince et al., 2012; Rosenberg et al., 2001), with the exception of younger age at first sexual intercourse, a factor that has not been systematically addressed in prior studies.

A striking finding was that HIV infection was nine times as likely among patients with sexual debut prior to age 18 compared to those with later debut. A nationally representative household survey in Brazil found that 61.6% of youth aged 16–19 had already had sex, and the average debut age was 14.9 years (Paiva, Calazans, Venturi, & Dias, 2008), whereas for youth in the US debut was 17.6 years (Santelli, Lindberg, Abma, McNeely, & Resnick, 2000). Given that in Brazil condom use is significantly lower among youth who are poor, minorities, and not-in-school (Paiva et al., 2008), the need to address youth in these circumstances with HIV prevention is urgent, including the provision of

Table 1. Descriptive analysis of selected variables, PESSOAS project 2006–2007 ($n = 2237$).

Characteristics	*n* (%)
Gender	
Male	1076 (48.1)
Female	1161 (51.9)
Age (years old)	
18–39	994 (44.4)
> 40	1243 (55.6)
Skin color	
White	1146 (51.2)
Non-white	1091 (48.2)
Marital status	
Single	1490 (66.6)
Married/in union	747 (33.4)
Knows how to read and to write	
Yes	1818 (81.5)
No	414 (18.5)
Schooling (years)	
≥ 5	1110 (49.6)
< 5	1127 (50.4)
Place of residence	
Unstable	280 (12.5)
Stable	1957 (87.5)
History of homelessness	
No	1834 (82.0)
Yes	403 (18.0)
Type of center of recruitment	
CAPS	1437 (64.2)
Hospital	800 (35.8)
Prior psychiatric hospitalization	
No	933 (41.9)
Yes	1296 (58.1)
Main psychiatric diagnosis	
Non-SMI	969 (43.7)
SMI	1268 (56.7)
History of STDs	
No	1676 (76.0)
Yes	530 (24.0)
Previous HIV testing	
No	1635 (73.0)
Yes	602 (27.0)
Age of first sexual intercourse (years old)	
≥ 18	801 (42.7)
< 18	1076 (57.3)
Alcohol/drug use during sexual intercourse	
No	1625 (73.1)
Yes	597 (26.9)
Partner's refusal in using condoms	
No	1377 (72.1)
Yes	534 (27.9)
Condom use in the last sexual intercourse	
No	1393 (74.6)
Yes	473 (25.4)
Money/drugs exchange for sex	
No	1635 (73.5)
Yes	589 (26.5)
Number of sexual partners (ever)	
> 1	1380 (65.3)
≤ 1	732 (34.7)
HIV knowledge	
Good	1210 (54.6)
Poor	1006 (45.4)
Self-perceived risk of HIV	
Did not know	647 (28.9)
Low	1191 (53.2)
High	399 (17.8)
History of incarceration	
No	1668 (74.6)
Yes	569 (25.4)
Illicit drug use (ever)	
No	1683 (75.2)
Yes	554 (24.8)
Injection drug use (ever)	
No	2159 (97.0)
Yes	66 (3.0)
Tobacco use (ever)	
No	639 (28.7)
Yes	1587 (71.3)
Alcohol use (ever)	
No	804 (35.9)
Yes	1433 (64.1)
Verbal violence	
No	688 (30.8)
Yes	1545 (69.2)
Physical violence	
No	938 (42.0)
Yes	1293 (58.0)
Sexual violence	
No	1783 (80.0)
Yes	442 (20.0)
Practiced unsafe sex (ever)	
No	428 (19.4)
Yes	1778 (80.6)
Anti-HIV	
Negative	2222 (99.3)
Positive	15 (0.7)

Notes: CAPS, psychosocial care center; SMI, schizophrenia, bipolar disorders, depression with psychotic symptoms.

HIV prevention services to adolescents with mental health disorders within the public health system of care or the public school system.

History of homelessness was strongly associated with HIV, with a three-fold increased risk compared to those who had never been homeless. Of note, 18% of the sample had been homeless as compared to estimates of 0.6–1.0% among the general population in Brazil (Direitos Humanos, 2005). As elsewhere, in Brazil high rates of homelessness have followed recent deinstitutionalization. With deinstitutionalization, community-based

Table 2. Univariate analysis of HIV seroprevalence, PESSOAS project 2006-2007 ($n = 2237$).

Characteristics	*N*	*n* (%)	$(\%)_W$	PRR_W (95% CI)	χ^2 (*p*-value)
Gender					
Male	1076	7 (0.65)	(0.43)	1.14 (0.53–2.42)	
Female	1161	8 (0.69)	(0.38)	1.0	0.11 (0.74)
Age (years old)					
18–39	995	7 (0.70)	(0.52)	1.50 (0.71–3.17)	
≥40	1243	8 (0.64)	(0.34)	1.0	1.10 (0.29)
Skin color					
White	1147	7 (0.61)	(0.41)	1.0	
Non-Black	1091	8 (0.73)	(0.41)	0.99 (0.47–2.09)	0.00 (0.98)
Marital status					
Single	1491	13 (0.87)	(0.47)	1.85 (0.68–5.05)	
Married/in union	747	2 (0.27)	(0.25)	1.0	1.46 (0.23)
Knows how to read/write					
Yes	1824	13 (0.71)	(0.46)	1.87 (0.61–5.71)	
No	414	2 (0.48)	(0.24)	1.0	1.19 (0.27)
Schooling (years)					
≥5	1111	10 (0.90)	(0.60)	1.0	
<5	1127	5 (0.44)	(0.26)	0.43 (0.20–0.94)	4.45 (0.03)
Place of residence					
Unstable	291	2 (0.69)	(0.53)	3.38 (1.09–10.5)	
Stable	1947	13 (0.67)	(0.16)	1.0	4.42 (0.03)
History of homelessness					
No	1835	8 (0.44)	(0.22)	1.0	
Yes	403	7 (1.74)	(1.10)	4.93 (2.31–10.5)	17.08 (<0.001)
Type of center of recruitment					
CAPS	1438	7 (0.49)	(0.48)	1.0	
Hospital	800	8 (1.00)	(0.36)	0.75 (0.36–1.60)	0.53 (0.47)
Prior psychiatric hospitalization					
No	934	6 (0.64)	(0.37)	1.0	
Yes	1296	9 (0.69)	(0.44)	1.19 (0.55–2.62)	0.21 (0.65)
Main psychiatric diagnosis					
Non-SMI	978	4 (0.41)	(0.31)	1.0	
SMI	1260	11 (0.87)	(0.48)	1.55 (0.69–3.49)	1.13 (0.29)
History of STDs					
No	1677	6 (0.36)	(0.16)	1.0	
Yes	530	9 (1.70)	(1.36)	8.24 (3.67–18.5)	26.1 (<0.001)
Previous HIV testing					
No	1635	3 (0.18)	(0.06)	1.0	
Yes	603	12 (1.99)	(1.24)	10.18 (4.11–25.2)	25.2 (<0.001)
Age of first sex (years old)					
≥ 18	802	1 (0.12)	(0.06)	1.0	
< 18	1081	14 (1.30)	(0.86)	15.5 (2.47–97.3)	8.57 (0.003)
Alcohol/drug use during sex					
No	1640	7 (0.43)	(0.91)	1.0	
Yes	598	8 (1.34)	(0.23)	3.93 (1.82-8.49)	12.14 (<0.001)
Partner's refusal in using condoms					
No	1377	7 (0.51)	(0.34)	1.0	
Yes	535	8 (1.50)	(0.98)	2.87 (1.36–6.09)	7.63 (0.006)
Condom use in the last sexual intercourse					
No	1393	7 (0.50)	(0.41)	1.0	
Yes	474	8 (1.69)	(0.93)	2.26 (1.06–4.84)	4.42 (0.04)
Money/drug exchange for sex					
No	1649	6 (0.36)	(0.19)	1.0	
Yes	589	9 (1.53)	(0.99)	5.29 (2.37–11.79)	16.56 (<0.001)

Table 2. (*Continued*)

Characteristics	*N*	*n* (%)	$(\%)_W$	PRR_W (95% CI)	χ^2 (*p*-value)
Number of sexual partners (ever)					
≤ 1	732	2 (0.27)	(0.17)	1.0	
> 1	1380	12 (0.87)	(0.61)	3.63 (1.24–10.64)	5.51 (0.02)
HIV knowledge					
Good	1211	9 (0.74)	(0.47)	1.0	
Poor	1006	6 (0.60)	(0.37)	0.79 (0.38–1.69)	0.35 (0.55)
Self-perceived risk of HIV					
Low	1191	4 (0.34)	(0.20)	1.0	
Did not know	647	7 (1.08)	(0.52)	2.61 (1.01–6.76)	9.39 (<0.01)
High	399	4 (1.00)	(0.92)	4.68 (1.74–12.56)	3.93 (0.04)
History of incarceration					
No	1669	9 (0.54)	(0.31)	1	
Yes	569	6 (1.05)	(0.65)	2.08 (0.98-4.42)	3.65 (0.06)
Illicit drug use (ever)					
No	1684	6 (0.36)	(0.19)	1	
Yes	554	9 (1.62)	(1.17)	6.21 (2.83–13.59)	20.84 (<0.001)
Injection drug use (ever)					
No	2159	15 (0.69)	(0.43)	–	–
Yes	66	0 (0.0)	(0.0)		
Tobacco use (ever)					
No	639	4 (0.63)	(0.36)	1	
Yes	1588	11 (0.69)	(0.43)	1.17 (0.47-2.93)	0.12 (0.73)
Alcohol use (ever)					
No	804	2 (0.25)	(0.15)	1	
Yes	1434	13 (0.91)	(0.57)	3.65 (1.25–10.67)	5.60 (0.02)
Verbal violence					
No	688	1 (0.15)	(0.07)	1	
Yes	1545	14 (0.91)	(0.61)	8.79 (1.81–42.61)	7.29 (0.01)
Physical violence					
No	938	4 (0.43)	(0.24)	1	
Yes	1294	11 (0.85)	(0.54)	2.25 (0.94–5.39)	3.32 (0.07)
Sexual violence					
No	1784	8 (0.45)	(0.23)	1	
Yes	442	7 (1.58)	(1.10)	4.72 (2.22–10.04)	16.28 (<0.001)
Practiced unsafe sex (ever)					
No	428	2 (0.47)	(0.21)	1	
Yes	1779	13 (0.73)	(0.48)	2.27 (0.71–7.28)	1.91 (0.17)

Notes: *N*, number of participants in each category; *n* (%), number and unweighted HIV prevalence for each category; $(\%)_W$, weighted HIV prevalence for each category; PRR_W, weighted prevalence rate ratio; CI, confidence interval; CAPS, psychosocial care center, SMI, schizophrenia, bipolar disorders, depression with psychotic symptoms.

treatment is expected to absorb the patient population, yet many remain engaged in treatment without ever achieving stable housing (Angelino, 2008). Studies from developed countries of HIV-infection rates among homeless psychiatric populations had small and/or nonrepresentative samples. Nonetheless, US data show HIV seroprevalence among homeless, substance-using persons with mental illness, of 12% (Rahav, Nuttbrock, Rivera, & Link, 1998) and a rate of 6.4% among homeless psychiatric inpatients without primary SUDs (Empfield et al., 1993). Besides psychosocial services, interventions for street youth, and targeting HIV prevention, substance use and psychiatric disorders are required.

In our study, sexual violence was an independent predictor of HIV infection. Numerous studies have shown positive associations between being at risk for or having acquired HIV infection and being a victim of sexual violence (Andersson, Cockcroft, & Shea, 2008). A host of factors appear to mediate this relationship including early sexual debut, psychiatric hospitalization, STD history, and illicit drug use, among others (Andersson et al., 2008; Oliveira, Machado, & Guimarães, 2012).

The association of HIV infection with previous HIV testing is of individual and public health concern. As concerning is that STD history conferred a three-fold increase in risk for HIV infection in our sample.

Table 3. Multivariate analysis of HIV seroprevalence, PESSOAS project 2006–2007 ($n = 2237$).

Characteristics	PRR_W (95% CI)	*p*-value
History of homelessness	3.17 (1.50–6.70)	<0.01
History of STDs	3.16 (1.39–7.19)	<0.01
Age in the first sexual intercourse (< 18 years old)	9.76 (1.55–61.47)	0.02
Sexual violence	2.56 (1.21–5.40)	0.01
Previous HIV testing	6.47 (2.56–16.32)	<0.01
Self-perceived risk of HIV		
Low	1.0	
Did not know	2.72 (1.02–7.52)	0.046
High	3.66 (1.42–9.42)	<0.01

Notes: PRR_W, weighted prevalence rate ratio; CI, confidence interval.

Although, HIV testing is a critical gateway to care, it is not a routine procedure in mental health services in Brazil; only patients thought to be at high risk of infection are tested. In our study, like in most, only 27% of the sample had prior HIV testing (Melo et al. 2011). Under-testing in this population has been demonstrated and reasons may include individual choice, fear, stigma associated with positive results, and poor or no availability of HIV testing in mental health treatment settings (Aguiar & Iriart, 2012; Centers for Disease Control and Prevention (CDC), 2003; Mimiaga, Goldhammer, Belanoff, Tetu, & Mayer, 2007; Senn & Carey, 2009). Referral for treatment is poorly established for this population (Melo, Acurcio, Cherchiglia, Veloso, & Guimarães, 2007). Public health benefits accrue because antiretroviral therapy reduces infectiousness and knowledge of infection status motivates risk reduction (Senn & Carey, 2009).

It is not surprising that perception of being at higher HIV risk was also independently associated with HIV infection in our study. This may represent an accurate understanding of one's risk, but is then of concern that those who were not able to assess their own risk were also at increased risk of HIV infection. Lack of access to testing and treatment must be examined in more detail given the likelihood that referrals between mental health and medical care facilities may not be well navigated by those with psychiatric disorders, those with low income who cannot afford to travel for regular care, and those whose health care providers may not deem them ready or appropriate for intensive STD/HIV treatment and follow-up. The effective integration of STD treatment and HIV prevention and care programs for patients with mental illness is long overdue. Structural health care system improvements have been successful to screen, diagnose, perform contact tracing, and treat STDs, including HIV infection.

Prevention programs for high-risk persons, like commercial sex workers, injection drug users, migrant laborers, clients of sex workers, and men who have sex with men are designed with a strategic focus toward risk and harm reduction (Sahasrabuddhe & Vermund, 2007), yet to date such strategies have not widely been put into practice for psychiatric patients despite the evidence that compromised mental health is linked to high-risk sex, diminished sexual health, substance use, homelessness, and sexual violence (Erbelding, Hutton, Zenilman, Hunt, & Lyketsos, 2004).

There are limitations to our study. There was a higher participation of patients recruited in hospitals, but we do not think this has biased the results, since the distribution of patients according to type of care (64% for CAPS and 36% for hospitals) was similar to the national distribution (62% for CAPS and 38% for hospitals), as expected by our sampling size design. Furthermore, the estimates were weighted according to sizes of centers, minimizing within cluster correlation. We relied on chart review to obtain data on psychiatric diagnoses as registered by psychiatrists within the treatment system. We could not fully examine the association of psychiatric diagnoses or symptoms to HIV seropositivity and further studies are still needed. We should also note that clinics treating primary SUDs were excluded from the study, potentially underestimating the proportion of SUD. However, we intentionally aimed at obtaining a wider representation of adult patients with mental illness, and the distribution of diagnoses is similar to the general Brazilian psychiatric populations under care. Furthermore, the cross-sectional design of our study does not allow direct causal inference, and, as shown, the association between elevated levels of mental health symptoms and elevated risky sexual behavior may not hold over time (Comulada et al., 2010). Finally, because the event was rare considerations of statistical power should be noted, although log-binomial regression is a sound and efficient method for estimating prevalence rate ratios.

In conclusion, this national cross-sectional study among adults with mental illness in Brazil found correlates of HIV infection which reflected marginalized living circumstances (history of homelessness, reporting a sexually transmitted disease, history of sexual violence, and early sexual debut) as well as HIV testing histories that may not be unique to those with mental illness but nonetheless may be targeted by the mental health care system as points of entry for HIV prevention.

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