

HIV Risk Behavior Among Methamphetamine Users Entering Substance Abuse Treatment in Cape Town, South Africa

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Published online: 12 February 2016
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Abstract South Africa is experiencing a growing methamphetamine problem, and there is concern that methamphetamine use may accelerate HIV transmission. There has been little research on the HIV prevention needs of methamphetamine users receiving substance abuse treatment in South Africa. This study assessed the prevalence and correlates of HIV risk behaviors among 269 methamphetamine users entering substance abuse treatment in two clinics in Cape Town. The prevalence of sexual risk behaviors was high among sexually active participants: 34 % multiple partners, 26 % unprotected intercourse with a casual partner, and 24 % sex trading for money/methamphetamine. The strongest predictor of all sexual risk behaviors was concurrent other drug use. Over half had not been HIV tested in the past year, and 25 % had never been tested, although attitudes toward HIV testing were overwhelmingly positive. This population of primarily heterosexual, non-injecting methamphetamine users is a high-risk group in need of targeted HIV prevention interventions. Substance abuse treatment is an ideal setting in which to reach methamphetamine users for HIV services.

Resumen Sudáfrica está experimentando un problema de metanfetamina en crecimiento, y hay la preocupación que la

metanfetamina pueda acelerar la transmisión de VIH. Ha habido poca investigación de las necesidades de prevención de VIH para los usuarios de metanfetamina recibiendo tratamiento de abuso de sustancias en Sudáfrica. Este estudio evaluó la prevalencia y correlatos de la conducta de riesgo de VIH entre 269 usuarios de metanfetamina que inician tratamiento por abuso de sustancias en dos clínicas en Ciudad del Cabo. La prevalencia de comportamientos sexuales de riesgo fue alta entre los participantes sexualmente activos: 34 % en múltiples parejas, el 26 % en relaciones sexuales sin protección con una pareja ocasional, y 24 % de comercio del sexo por dinero/metanfetamina. El predictor más fuerte de todos los comportamientos sexuales de riesgo fue el uso concomitante de otras drogas. Más de la mitad no había sido probado por el VIH en el último año, y el 25 % nunca había sido probado, aunque las actitudes hacia las pruebas de VIH fueron abrumadoramente positivas. Esta población de usuarios de metanfetamina no inyectables, principalmente heterosexuales, es un grupo de alto riesgo en la necesidad de intervenciones específicas de prevención del VIH. El tratamiento de abuso de sustancias es un escenario ideal en el que llega a los usuarios de metanfetamina los servicios de VIH.

Keywords South Africa · Drug abuse · Methamphetamine · Sexual risk behavior · Substance abuse treatment · HIV transmission

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Introduction

In many populations around the world, methamphetamine use has been linked with increased risk of HIV transmission [1–6]. Methamphetamine is a highly addictive stimulant that can increase sexual desire, self-confidence, and

sustained energy, while also decreasing inhibitions [7]. As a result of these physiological effects, methamphetamine users may be more likely to engage in HIV transmission risk behaviors, such as having multiple partners, not using condoms, and trading sex for money or drugs [8]. Community-based studies in South Africa confirm these risks, even compared to other substance users [9–13]. With 6.4 million adults living with HIV/AIDS in South Africa [14], there is concern that methamphetamine may accelerate HIV transmission in communities already burdened by high HIV prevalence [15].

South Africa is experiencing a growing problem with methamphetamine (known locally as “tik”), particularly in the Western Cape province. In this region, methamphetamine is generally smoked, which carries a high risk of dependence [16, 17]. The number of methamphetamine users in the Western Cape has increased rapidly since 2000 [18, 19], and a recent community-based study of methamphetamine users found a very high prevalence of dependence on the drug [20]. Among persons entering substance abuse treatment, the proportion reporting methamphetamine as their primary drug increased from 0.3 % in 2002 to 42.3 % in 2006; since then, methamphetamine has accounted for 40–50 % of admissions [21, 22]. Methamphetamine use in Cape Town is most common among “Coloured” persons, but the prevalence appears to be increasing among Black Africans (these terms originate from the apartheid era and are still used as demographic markers referring to people of mixed versus African ancestry, respectively). Among persons entering substance abuse treatment for methamphetamine in 2012, 84 % were Coloured and 8 % were Black [23]. By 2014, this proportion had shifted to 70 % Coloured and 17 % Black [24].

Some types of substance abuse treatment, such as substitution therapies for opioid dependence and needle exchange for injection drug use, can effectively reduce drug-related HIV transmission [25–28]. However, there is less evidence of the ability for substance abuse treatment to reduce sexual risk behaviors [25, 29–31], which account for a large proportion of HIV transmissions among drug users [3, 32–35]. Nevertheless, substance abuse treatment programs provide an opportunity to reach all types of drug users for behavioral risk assessment, HIV testing, and risk reduction interventions. Much of the literature on substance abuse treatment as HIV prevention has been generated from countries with well-developed healthcare systems and widely available services. As new drug epidemics are emerging in low- and middle-income countries, it is important to understand HIV risks among drug users seeking treatment and to identify opportunities to leverage these programs for HIV prevention.

In response to the growing methamphetamine problem in the Western Cape of South Africa, the City of Cape

Town has launched six outpatient substance abuse treatment sites in existing primary healthcare clinics to service residents living in peri-urban township communities [22]. To date, HIV risk behaviors among methamphetamine users accessing these services has not been examined. This study aimed to describe the prevalence of HIV risk behaviors in two of these substance abuse clinics, and to identify factors that are correlated with sexual risk behaviors. Based on community-based studies of methamphetamine users in this setting [9–11, 36] and the global literature on HIV risk among people who abuse stimulant drugs [1, 37], we hypothesized that sexual risk behaviors would be associated with methamphetamine dependence, concurrent use of other drugs, history of sexual abuse, and depression.

Method

Setting

This study took place in two government-funded clinics that provide free outpatient substance abuse treatment based on the Matrix model, an evidence-based treatment for amphetamine use disorders [38]. The clinics were co-located at community health centers in Mitchells Plain and Delft, two densely populated communities located ~20 miles from the center of Cape Town. Mitchell’s Plain has >300,000 residents, most of whom are Coloured (91 %), while Delft has ~150,000 residents of both Coloured (52 %) and Black African (46 %) ethnicities [39]. Both communities are economically disadvantaged, with high rates of poverty, school dropout, unemployment, and drug-related crimes [40, 41].

Participants and Procedures

The sample included methamphetamine users who presented for substance abuse treatment at the Matrix clinics in Mitchell’s Plain ($n = 200$) and Delft ($n = 69$). The clinics accept new patients on a “walk-in” basis. Eligibility criteria for the current study were: ≥ 18 years of age, methamphetamine use in the past 30 days, and ability to provide informed consent. Clinic staff determined study eligibility based on the clinical intake form. Only one eligible patient declined participation after referral. The majority of participants ($n = 237$, 88 %) were enrolled in the study on the day of their intake; the remaining 32 were enrolled at a subsequent clinic visit.

Written informed consent was obtained by a trained research assistant or clinic staff. Participants then completed the computerized study survey. During the consent process, all enrolled participants agreed to a rapid HIV test,

which is a routine service offered as part of clinical care at Matrix. A certified HIV counselor conducted the HIV testing following the South African standard protocol [42]. Test results were recorded both in the participants' clinical records and on a case report form for study purposes.

Study procedures were approved by the Ethics Committees at the University of Cape Town and Duke University Health System.

Measures

Clinical Intake Form

As part of routine care, clinic staff administered a demographics form, followed by the alcohol, smoking, and substance involvement screening test (ASSIST) [43, 44]. For each substance [alcohol, marijuana, cocaine, opioids, amphetamines (including methamphetamine), inhalants, sedatives, hallucinogens, other], seven items assessed lifetime and current (past 3 months) use and symptoms of abuse and dependence. A specific substance involvement (SSI) score was computed for each substance by summing values for each item. For amphetamine and other drugs, risk levels were calculated as follows: low = 0–3, moderate = 4–26, and high = 27–42. For alcohol, risk levels were calculated as follows: low = 0–10, moderate = 11–26, and high = 27–42. Moderate risk is suggestive of substance abuse, while high risk is suggestive of substance dependence [43]. An additional item assessed lifetime and past 3-month injection drug use. Study staff extracted this data from participants' clinical records.

Study Survey

The survey was administered as an audio computer administered self interview (ACASI) in a private room and took ~30 min to complete. To ensure privacy, participants were provided headphones. As the computer narrated items, each response option was highlighted to ensure that the participant knew where to click to select their choice. To further mitigate potential problems related to low computer literacy, participants were trained on using the study laptop and the ACASI program, and staff were available at all times to provide assistance as needed. The ACASI data was collected for study purposes only and did not become part of participants' clinical records.

Sexual Risk Behavior Participants completed a modified version of the sexual experiences and risk behavior assessment schedule [45]. In the current study, we assessed sexual activity in the past 3 months. Participants reported the number

of male and female sex partners, and they indicated whether or not they had a main partner with whom they had sex regularly. For those with a main partner, they indicated whether or not the partner was a spouse or a lover with whom they were in a committed relationship. All other partners were considered casual partners. For each gender and partner type, participants reported the partner's HIV status and use of methamphetamine, the total number of times they had vaginal and anal intercourse, the number of times they had vaginal and anal intercourse without a condom, and the frequency of sexual behaviors while under the influence of methamphetamine, other drugs, or alcohol. The survey also assessed whether they had traded sex for methamphetamine or money in the past 3 months, and the number of casual partners they considered to be one-off partners ("someone you had sex with once and are not sure if you will ever have sex with again").

HIV Testing Behavior and Attitudes Participants reported whether they had ever been tested for HIV, when their last test was (<3, 3–12, >12 months), and the result of their last test. Attitudes toward HIV testing were assessed with five items derived from previous studies conducted in similar peri-urban communities in South Africa [46, 47]. Using a five-point scale, from "strongly disagree" to "strongly agree," participants reported their level of agreement with each item (see Table 4 for items). For descriptive purposes, responses were dichotomized such that participants who selected "agree" or "strongly agree" were categorized as agreeing with that statement.

Depression The patient health questionnaire (PHQ-9) was used to assess depressive symptoms consistent with the nine DSM-IV-TR criteria for major depressive disorder [48]. Participants reported how frequently they experienced each symptom in the past 2 weeks (0 = "not at all", 3 = "nearly every day"). Responses were summed, with scores ranging from 0 to 27. A score of ≥ 10 is indicative of moderate/severe depression [48].

Intimate Partner Violence Select items from the physical assault and sexual coercion subscales of the internationally validated conflict tactics scale (CTS2) were used to assess violence with a sex partner [49, 50]. Individuals were categorized as having experienced recent intimate partner violence if they endorsed any of the following in the past 3 months: Has a sex partner threatened to hit or throw something at you? Has a sex partner hit, kicked, or beat you? Has a sex partner used a knife or gun against you? Has someone used force (like hitting, holding down, or using a weapon) to make you have sex with them? Has someone used threats to make you have sex with them?

Childhood Sexual Abuse In an adapted version of the childhood trauma questionnaire-short form [51, 52], participants reported whether as a child or teenager (<18 years old) they had been touched or made to touch someone in a sexual way, threatened to do something sexual, or been forced to have sexual intercourse. Participants who had any of these experiences were categorized as having childhood sexual abuse.

Data Analysis

Quantitative analysis was conducted using SPSS 21 (SPSS, Inc., Chicago, IL). First, we used descriptive analyses to characterize the sample on demographics, substance use, mental health, and sexual behaviors. Second, participants who were sexually active were compared to those who were not using t-tests for continuous variables and χ^2 -tests for categorical variables. Descriptive statistics were used to contextualize the sexual behaviors with main and casual partners. Third, among sexually active participants, we used a series of bivariate logistic regressions to identify correlates of three sexual risk behaviors: multiple partners, unprotected intercourse with a casual partner, and sex trading for money or methamphetamine. Predictor variables were: demographics (age, race, gender, marital status), substance use (methamphetamine SSI score, alcohol SSI score, any other drug use), and sexual violence and mental health (childhood sexual abuse, intimate partner violence, depression). A multivariate logistic regression model was run for each of the three sexual risk outcomes. Demographic factors were entered as covariates in a first step. Substance use and mental health variables that were associated with the outcome at $p < 0.10$ in the bivariate models were entered in a second step. Adjusted odds ratios and 95 % confidence intervals are presented. Finally, the prevalence of lifetime and past year HIV testing were computed, and participants with and without past year HIV testing were compared using t-tests and χ^2 -tests. Bivariate logistic regressions were then employed to determine whether past year HIV testing status was associated with attitudes towards HIV testing.

Results

Participant Characteristics

The sample included 161 men and 108 women, ranging in age from 18 to 54 years ($M = 28.35$, $SD = 6.14$). The majority identified as Coloured (96 %), were currently single (74 %), had not completed high school (81 %), and

were unemployed (84 %). Eight (3 %) tested positive for HIV, and three of these were new diagnoses (one had never been tested, one was tested >1 year ago, and one was tested within the past year). Among the five participants with known HIV infection, dates of diagnoses were 1–7 years ago. For most participants (69 %), this was their first time seeking substance abuse treatment. All were current methamphetamine users, and the majority (74 %) screened positive for dependence on methamphetamine. Nearly half (45 %) reported daily or almost daily use of methamphetamine in the past 3 months. Concurrent use of alcohol (52 %) and other drugs (67 %) was common; the most commonly used other drugs were marijuana (57 %), methaqualone (44 %), and heroin (13 %). Among those who used each substance, the proportion who met criteria for abuse or dependence was 81 % for marijuana, 91 % for methaqualone, 77 % for heroin, and 25 % for alcohol. Injection drug use was rare (2 % lifetime, 1 % in past 3 months). Nearly a third reported childhood sexual abuse (30 %) and recent intimate partner violence (30 %), and 61 % endorsed symptoms consistent with moderate or severe depression. There were few differences by gender. Women were more likely to be a first time treatment seeker [78 vs. 63 %; $\chi(1)^2 = 6.81$, $p < 0.01$] and to have childhood sexual abuse [45 vs. 20 %; $\chi(1)^2 = 19.96$, $p < 0.001$], while men were more likely to endorse concurrent other drug use [81 vs. 46 %; $\chi(1)^2 = 34.65$, $p < 0.001$]. Participants from the two clinics were similar in most respects, except those in Delft were more likely than those in Tafelsig to be Black African [14 vs. 1 %; $\chi(1)^2 = 21.91$, $p < 0.001$], consistent with greater racial heterogeneity in Delft [39].

Description of Sexual Behaviors

In the past 3 months, 65 % of participants were sexually active, with no differences by gender. As described in Table 1, participants who were sexually active were significantly more likely to screen positive for methamphetamine dependence, to use methamphetamine daily or almost daily, and to report intimate partner violence. There were no other differences in demographic, substance use, or mental health variables.

Among the 174 sexually active participants, 71 % had a main partner with whom they were in a committed relationship, and 48 % had a casual partner, 20 % had both types of partners. Although most participants (87 %) reported sex with opposite sex partners only; 11 % of women and 15 % of men had same sex partners. It was common for participants to have partners who were also

Table 1 Sample characteristics by sexual activity in the past 3 months (N = 269)

	Sexually active N = 174	Not sexually activity N = 95	Statistics
Demographics			
Age in years, M (SD)	28.47 (5.97)	28.14 (6.46)	$t(267) = 0.43$
Male gender, n (%)	103 (59)	58 (61)	$\chi(1)^2 = 0.09$
Race: Coloured versus Black African, n (%)	168 (97)	89 (94)	$\chi(1)^2 = 1.19$
Currently single, n (%)	123 (71)	77 (81)	$\chi(1)^2 = 3.46$
High school education, n (%)	39 (22)	13 (14)	$\chi(1)^2 = 3.00$
Employed (part- or full-time), n (%)	31 (18)	12 (13)	$\chi(1)^2 = 1.23$
HIV-positive serostatus, n (%) ^a	5 (3)	3 (3)	$\chi(1)^2 = 0.03$
Substance use in past 3 months			
Methamphetamine use, n (%)	174 (100)	95 (100)	$\chi(1)^2 = 0.00$
Daily or almost daily use, past 3 months, n (%) ^b	87 (50)	35 (37)	$\chi(1)^2 = 4.29^*$
Dependence, past 3 months, n (%) ^b	137 (79)	62 (65)	$\chi(1)^2 = 5.79^*$
Alcohol use, n (%)	94 (54)	47 (50)	$\chi(1)^2 = 0.51$
Abuse or dependence, n (%)	26 (15)	9 (10)	$\chi(1)^2 = 1.62$
Other drug use, n (%)	116 (67)	64 (67)	$\chi(1)^2 = 0.01$
Marijuana, n (%)	104 (60)	50 (53)	$\chi(1)^2 = 1.28$
Methaqualone, n (%)	75 (43)	43 (45)	$\chi(1)^2 = 0.12$
Heroin, n (%)	21 (12)	14 (15)	$\chi(1)^2 = 0.39$
History of injection drug use, n (%)	4 (2)	2 (2)	$\chi(1)^2 = 0.01$
Sexual violence and mental health			
Childhood sexual abuse, n (%)	59 (34)	22 (23)	$\chi(1)^2 = 3.38$
Intimate partner violence, n (%)	68 (39)	13 (14)	$\chi(1)^2 = 18.83^{**}$
Moderate/severe depression, n (%)	109 (63)	54 (57)	$\chi(1)^2 = 0.87$

* $p < 0.05$; ** $p < 0.01$

^a N = 265 (4 participants did not have an HIV test)

^b N = 268 (1 participant refused to answer methamphetamine-related questions on the ASSIST)

current methamphetamine users and to have sex while under the influence of methamphetamine or other drugs. Table 2 provides contextual descriptors of these main and casual partners.

Among sexually active participants, 34 % had multiple sex partners, 26 % had unprotected sex with a casual partner, and 24 % traded sex for methamphetamine or money, with no significant differences by gender. There was significant overlap across the sexual risk behaviors. For example, participants with multiple partners were also more likely than those with one partner to engage in unprotected sex with a casual partner [48 vs. 16 %; $\chi(1)^2 = 20.28$, $p < 0.001$] and sex trading [46 vs. 13 %; $\chi(1)^2 = 22.80$, $p < 0.001$]. Two of the eight HIV-positive participants (one with known HIV infection, one with a new diagnosis) reported high levels of HIV transmission risk behavior, including unprotected sex with sero-discordant partners and sex trading. The other six HIV-positive participants reported either recent sexual abstinence or consistent condom use.

Correlates of Sexual Risk Behaviors

Table 3 summarizes the bivariate and multivariate logistic regression models predicting the three sexual risk behaviors. In the multivariate models, participants who were single were 2.60 times more likely to have multiple partners and 3.19 times more likely to have unprotected intercourse with a casual partner. For all three sexual risk behaviors, other drug use (in addition to methamphetamine) was a significant predictor of sexual risk outcomes in the multivariate models. Individuals who used other drugs were 3.12 times more likely to have multiple sex partners, 2.54 times more likely to have unprotected intercourse with a casual partner, and 5.31 times more likely to trade sex for methamphetamine or money. While childhood sexual abuse, intimate partner violence, and depression were significantly associated with sex trading in the bivariate models, they were no longer significant in the multivariate model. Age, gender, and race were not associated with any of the sexual risk behaviors.

Table 2 Contextual descriptors of sexual behaviors with main and casual partners (N = 174)

	Main partner N = 123	Casual partner(s) N = 84
Partner characteristics		
Uses methamphetamine, n (%)	56 (46.3) ^a	52 (61.9)
One-off, n (%)	N/A	47 (56.0)
Definitely/probably HIV-positive, n (%)	5 (4.0)	11 (13.1)
Sex while under the influence of		
Methamphetamine, n (%)		
All of the time	10 (8.1)	22 (26.2)
Most of the time	33 (26.8)	19 (22.6)
About half the time	29 (23.6)	11 (13.1)
Occasionally	40 (32.5)	19 (22.6)
Never	11 (8.9)	13 (15.5)
Other drugs, n (%)		
All of the time	6 (4.9)	11 (13.1)
Most of the time	14 (11.4)	13 (15.5)
About half the time	13 (10.6)	10 (11.9)
Occasionally	25 (20.3)	17 (20.2)
Never	65 (52.8)	33 (39.3)
Alcohol, n (%)		
All of the time	1 (0.8)	1 (1.2)
Most of the time	5 (4.1)	7 (8.3)
About half the time	6 (4.9)	4 (4.8)
Occasionally	37 (30.1)	23 (27.4)
Never	74 (60.2)	49 (58.3)
Engaged in sex trading with partner, n (%)	17 (13.8)	43 (51.2)

33 participants had both main and casual partners

^a N = 121 (2 participants refused to answer)

In a post hoc analysis, we found that participants who had sex while under the influence of other drugs were significantly more likely to report multiple partners [OR = 2.84 (1.49–5.43)], unprotected intercourse with a casual partner [OR = 2.45 (1.23–4.87)], and sex trading [OR = 3.26 (1.58–6.72)]. However, sex while under the influence of methamphetamine and sex under the influence of alcohol were both unrelated to the sexual risk behaviors (all $p > 0.10$).

HIV Testing Behaviors and Attitudes

Excluding the five participants with an established HIV diagnosis prior to study enrollment, 52 % had not been tested for HIV in the past year, and 25 % had never been tested. Participants who were tested in the past year were younger than those who had not been tested [27.53 (5.28) vs. 29.10 (6.84); $t(262) = 2.08$, $p = 0.039$], and they were less likely to have used marijuana in the past 3 months [51 vs. 64 %; $\chi(1)^2 = 4.70$, $p = 0.030$]. HIV testers were also more likely to have histories of childhood sexual abuse [42 vs. 20 %; $\chi(1)^2 = 15.47$, $p < 0.001$], to be sexually active

[75 vs. 55 %; $\chi(1)^2 = 11.39$, $p = 0.001$], to have unprotected intercourse with a casual partner [24 vs. 10 %; $\chi(1)^2 = 9.04$, $p = 0.003$], and to have traded sex [23 vs. 12 %; $\chi(1)^2 = 5.53$, $p = 0.019$]. As shown in Table 4, attitudes toward HIV testing were overwhelmingly positive, but participants who were tested in the past year were less likely to believe that people who test positive should feel comfortable telling others about their status.

Discussion

This is the first study to report on sexual risk behaviors among methamphetamine users seeking substance abuse treatment in South Africa, a country with a persistent HIV epidemic and growing problem with drug abuse and addiction. We identified a high prevalence of risky sexual behaviors, including multiple sex partners, unprotected intercourse with casual partners, and sex trading. Many participants had partners who also used methamphetamine, and the vast majority had sex while under the influence of drugs. This data underscores concerns about increasing

Table 3 Logistic regression models predicting sexual risk behaviors in past 3 months among sexually active participants (N = 174)

	Multiple sex partners		Unprotected intercourse with a casual partner		Sex trading for money or methamphetamine	
	Unadjusted OR (95 % CI)	Adjusted AOR (95 % CI)	Unadjusted OR (95 % CI)	Adjusted AOR (95 % CI)	Unadjusted OR (95 % CI)	Adjusted AOR (95 % CI)
Demographics						
Age (years)	1.02 (0.97–1.07)	1.05 (0.99–1.11)	0.97 (0.92–1.03)	1.00 (0.94–1.07)	0.96 (0.90–1.02)	1.00 (0.93–1.07)
Coloured race	1.03 (0.18–5.78)	1.25 (0.21–7.58)	0.34 (0.07–1.77)	0.53 (0.10–2.92)	0.30 (0.06–1.56)	0.26 (0.05–1.50)
Female gender	0.80 (0.42–1.53)	0.97 (0.45–2.08)	0.55 (0.27–1.12) [†]	0.77 (0.35–1.68)	1.64 (0.82–3.30)	2.11 (0.89–5.01) [†]
Currently single	2.33 (1.09–4.97)*	2.60 (1.14–5.94)*	3.61 (1.42–9.18)**	3.19 (1.21–8.40)*	2.05 (0.88–4.81) [†]	1.66 (0.64–4.31)
Substance use						
Methamphetamine severity (SSI)	1.01 (0.97–1.06)	–	1.01 (0.96–1.05)	–	1.03 (0.98–1.08)	–
Alcohol severity (SSI)	1.01 (0.97–1.06)	–	1.00 (0.95–1.05)	–	1.01 (0.97–1.06)	–
Any other drug use	3.02 (1.42–6.41)**	3.12 (1.38–7.10)**	3.05 (1.31–7.06)**	2.54 (1.04–6.22)*	3.90 (1.54–9.91)**	5.31 (1.85–15.25)**
Sexual violence and mental health						
Childhood sexual abuse	1.75 (0.91–3.37) [†]	1.81 (0.83–3.96)	1.20 (0.59–2.43)	–	2.47 (1.21–5.05)*	2.05 (0.87–4.86)
Intimate partner violence	1.37 (0.72–2.59)	–	1.00 (0.50–2.00)	–	2.67 (1.31–5.43)**	2.15 (0.93–4.95) [†]
Depression (PHQ-9)	1.05 (1.00–1.10) [†]	1.04 (0.98–1.09)	1.02 (0.97–1.07)	–	1.06 (1.01–1.11)*	1.01 (0.95–1.08)

OR odds ratio

[†] p < 0.10; * p < 0.05; ** p < 0.01

Table 4 Attitudes toward HIV testing by HIV testing history in the past year (N = 264)

Proportion who agreed with each statement	HIV testing N = 128	No HIV testing N = 136	Unadjusted odds ratio (95 % Confidence interval)
It is better for people to know if they have HIV, n (%)	119 (93)	130 (96)	0.51 (0.16–1.55)
Getting tested for HIV helps:			
The person feel better, n (%)	120 (94)	124 (91)	1.45 (0.57–3.68)
Prevent the spread of HIV, n (%)	119 (93)	131 (96)	0.61 (0.21–1.77)
People who test positive for HIV should:			
Be supported by people in their community, n (%)	124 (97)	135 (99)	0.23 (0.03–2.08)
Feel comfortable telling others about their status, n (%)	106 (83)	126 (93)	0.38 (0.17–0.84)*

This analysis excluded five participants with an established HIV-positive diagnosis prior to enrollment

* p < 0.05

HIV transmission in high prevalence communities. While the HIV seroprevalence of 3 % was lower than expected—and comparable to the estimated national HIV prevalence in Coloured persons [53]—the relatively young age of the sample suggests that individuals who relapse following treatment may continue to be at risk for HIV infection due to methamphetamine-related sexual risk behaviors. With the increasing availability and use of illicit drugs in South Africa and other parts of Africa, this region is in need of HIV prevention interventions that are tailored specifically to meet the needs of non-injection drug users.

In this sample of methamphetamine users, concurrent use of other drugs was strongly associated with each of the

sexual risk behaviors examined. Results were the same when the models were repeated with marijuana, methaqualone, and heroin entered as separate predictors. This finding is consistent with a growing literature that highlights the association between poly-substance use and HIV risk behavior [54–57]. It is not clear whether these other drugs contribute directly to sexual risk behavior, or whether individuals who abuse multiple drugs have higher trait impulsivity that lead them to engage in multiple risky behaviors. Post-hoc analyses revealed that sex while under the influence of other drugs contributed uniquely to sexual risk behaviors (i.e., sex while under the influence of methamphetamine or alcohol was not related). Future

research utilizing in-depth qualitative interviews could provide insight into the psycho-social context in which poly-drug use and risky sex is occurring. In contrast to other research in South Africa [58], hazardous alcohol was not associated with sexual risk behaviors, possibly due to the relatively low use of alcohol in the sample. This data underscores the importance of comprehensive clinical assessment, including use of other substances, to identify methamphetamine users who may require additional interventions to reduce HIV risk behavior.

History of sexual violence was common, with a third reporting childhood sexual abuse and a third reporting recent intimate partner violence. This is consistent with community-based studies of methamphetamine users in South Africa [11, 59], and may suggest that some individuals use methamphetamine to cope with previous traumas and/or are in situations where they are vulnerable to traumatic experiences. Additionally, the majority had symptoms consistent with moderate/severe depression. Previous qualitative work in Cape Town has documented the severity of mental health problems, including suicidal ideation and attempts, in this population [60]. Substance abuse treatment services are important sites to conduct screening and referrals for trauma histories and mental health problems, particularly given that these issues can interfere with the success of substance abuse treatment [61–64]. Sexual violence and depression were associated with sex trading in bivariate models, but did not retain significance in the multivariate model. Previous studies in South Africa [65, 66] and elsewhere [67–70] have found that these factors impact sexual risk behaviors, and this relationship should be investigated further among methamphetamine users in this context.

While methamphetamine is known to increase sexual drive [8, 71], much of the literature on methamphetamine and HIV risk has focused on men who have sex with men [72]. In this sample of primarily heterosexual men and women, nearly a third reported that they were not sexually active in the 3 months prior to seeking substance abuse treatment. While it is possible that there may have been underreporting of sexual activity due to intersecting stigmas related to both methamphetamine and HIV in South Africa [73], participants also may have reduced sexual risk behaviors prior to seeking treatment (e.g., the treatment admission may have been prompted by methamphetamine causing problems in intimate relationships). Participants with more severe methamphetamine addiction and who used the drug more frequently were more likely to be sexually active. Moreover, while the use of depressant drugs like heroin and methaqualone may reduce sexual activity, their combination with methamphetamine appeared to increase risk behavior. In addition, participants who experienced intimate partner violence were more

likely to be sexually active, highlighting the potential synergistic impacts of substance abuse, violence, and HIV risk [74].

The World Health Organization recommends that individuals of high-risk groups, including drug users, be tested for HIV at least annually [75]. In our sample, half of participants had not been HIV tested in the past year, and a quarter had never been tested. A recent community-based study of methamphetamine users in South Africa had similar findings for HIV testing [47]. Together, these studies highlight the importance of developing and evaluating novel approaches to reach methamphetamine users for HIV testing. Our results suggest that offering HIV testing as part of substance abuse treatment may be an effective strategy for increasing uptake of HIV testing, and it was encouraging that participants overwhelmingly had positive attitudes toward HIV testing. However, the vast majority of methamphetamine users in South Africa do not seek substance abuse treatment services [20], and attitudes toward HIV testing in community-based samples have been less favorable [47]. On a positive note, participants who were sexually active and engaged in risky sexual behaviors were more likely to have been HIV tested in the past year, suggesting that the riskiest sub-group is receiving regular testing.

This study had several limitations that should be noted. First, self-report data is subject to recall and social desirability bias. While we used ACASI to minimize biased reporting of potentially stigmatizing behaviors such as HIV risks [76–80], some of our participants were not computer literate and may have felt distrustful of the survey. However, previous research has demonstrated the feasibility of using ACASI for HIV risk assessment in resource-limited settings around the world, including with persons who have low literacy [81]. Second, because our sex trading items asked specifically about methamphetamine and money, we may have missed occasions of sex trading that occurred in exchange for other types of substances. Finally, individuals who seek treatment for substance abuse may differ from the larger population of methamphetamine users in South Africa. Thus, results may not generalize to the community or to other regions of the world. At the same time, this study had many strengths, including a relatively large sample size of primarily heterosexual, non-injecting methamphetamine users.

In conclusion, this study identified a high prevalence of sexual risk behaviors among methamphetamine users seeking substance abuse treatment in South Africa. In the context of a persistent HIV epidemic, methamphetamine users are in need of targeted HIV prevention interventions. Future studies should evaluate the effectiveness of substance treatment in reducing sexual risk behaviors, the need for adjunctive behavioral risk reduction interventions, and

the importance of integrating mental health care to address the psychological and behavioral sequelae of sexual violence. Substance abuse treatment provides an opportunity to reach methamphetamine users for HIV testing and HIV prevention. At the same time, since only a minority of methamphetamine users seek substance abuse treatment, community outreach is also necessary to engage high-risk methamphetamine users in substance abuse treatment and HIV prevention.

Acknowledgments This study was funded by a Grant from the Duke University Center for AIDS Research (P30-AI064518, with additional support from Grants awarded by the National Institute on Drug Abuse (K23-DA028660, R03-DA033828). The content is solely the responsibility of the authors and does not necessarily represent the official views of the United States National Institutes of Health. A scholarship from the Duke Global Health Institute provided Ryan Lion with funds for travel and living expenses in South Africa and a stipend to work on the study at Duke. We thank Ms. Sadieqa Barodien, Ms. Robyn Human, and other clinic staff for their assistance with data collection.

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