

**UNIVERSIDADE FEDERAL DE MATO GROSSO DO SUL  
FACULDADE DE CIÊNCIAS FARMACÊUTICAS, ALIMENTOS E NUTRIÇÃO**

**MILENA DA SILVA DE JESUS**

**HIV and Syphilis infections among People Who Use Crack-Cocaine in Mato  
Grosso do Sul**

**CAMPO GRANDE, MS  
2023**

MILENA DA SILVA DE JESUS

**HIV and Syphilis infections among People Who Use Crack-Cocaine in Mato Grosso do Sul**

Trabalho de conclusão de curso apresentado ao Curso de Farmácia da Faculdade de Ciências Farmacêuticas, Alimentos e Nutrição – FACFAN, da Universidade Federal de Mato Grosso do Sul – UFMS, como requisito parcial para a obtenção do título de Bacharel em Farmácia.

Orientadora: Prof.<sup>a</sup> Dra. Ana Rita Coimbra Motta de Castro

CAMPO GRANDE, MS  
2023

MILENA DA SILVA DE JESUS

**HIV and Syphilis infections among People Who Use Crack-Cocaine in Mato Grosso do Sul**

Trabalho de conclusão de curso apresentado ao Curso de Farmácia da Faculdade de Ciências Farmacêuticas, Alimentos e Nutrição – FACFAN, da Universidade Federal de Mato Grosso do Sul – UFMS, como requisito parcial para a obtenção do título de Bacharel em Farmácia.

Orientadora: Prof.<sup>a</sup> Dra. Ana Rita Coimbra Motta de Castro

Campo Grande, 01 de dezembro de 2023.

**BANCA EXAMINADORA**

\_\_\_\_\_  
Prof.<sup>a</sup> Dr. Ana Rita Coimbra Motta de Castro – UFMS – Orientadora

\_\_\_\_\_  
Dr. <sup>a</sup> Larissa de Melo Bandeira – UFMS

\_\_\_\_\_  
Me. Carolina Amianti – UFMS

CAMPO GRANDE, MS  
2023

## **AGRADECIMENTOS**

Começo agradecendo à Deus por me ajudar a chegar até aqui. Agradeço aos órgãos de fomento à pesquisa, instituições e organizações que ofereceram os recursos necessários para a realização desse projeto, à Fiocruz, Famed e Facfan, em especial ao Laboratório de Imunologia Clínica – LabImuno, à minha orientadora Dra. Ana Rita pela oportunidade de integrar a equipe e contribuir com os projetos do laboratório. Agradeço à Larissa e Carol, pela parceria, orientações e todos os ensinamentos ao longo desta jornada.

Não posso deixar de agradecer à minha mãe e todos os meus familiares, pelo apoio, carinho e cuidado constante. Aos meus amigos, agradeço por todo o suporte e por estarem comigo nos momentos mais difíceis da graduação. Este trabalho representa uma conquista coletiva, e guardo com carinho todas as boas lembranças e ensinamentos até aqui.

## HIV and Syphilis infections among People Who Use Crack-Cocaine in Mato Grosso do Sul

Milena da Silva de Jesus<sup>1</sup>, Carolina Amianti<sup>1</sup>, Rodrigo Ibañez Tiago<sup>1</sup>, Sandra Leone de Oliveira<sup>1</sup>, Sheila Araújo Teles<sup>3</sup>, Viviane de Oliveira Landgraf de Castro<sup>1</sup>, Ana Rita Coimbra Motta-Castro<sup>1,2</sup>

<sup>1</sup> *Universidade Federal de Mato Grosso do Sul, Campo Grande, MS, Brazil*

<sup>2</sup> *Fiocruz Mato Grosso do Sul, Fundação Oswaldo Cruz/ Ministério da Saúde/ Brasil*

<sup>3</sup>*Universidade Federal de Goiás, Goiânia, GO, Brazil*

**ABSTRACT:** The high consumption of crack in South America poses a significant public health challenge; Brazil presents an essential route for trafficking this drug. Individuals who use crack cocaine often exhibit risky behaviors, increasing the likelihood of contracting sexually transmitted infections (STIs). This study aimed to estimate the prevalence of syphilis, HIV, and coinfections, along with associated risk factors, in this population. A cross-sectional approach was employed, involving people who used crack cocaine (PWUCC) between November 2015 and July 2018. Blood samples underwent serological tests for syphilis, HIV, Hepatitis C, Hepatitis B and HTLV infections, revealing an HIV exposure prevalence of 5.0% (95% CI: 3.6 – 6.9) and *Treponema pallidum* exposure of 21.14% (95% CI: 18.3 – 24.3), with 44.6% (95% CI: 2.31 – 5.07), and associated risk behaviors such as a history of incarceration, low educational attainment, and coinfection with other STIs, resembling findings from other studies.

**Keywords:** HIV, Syphilis, prevalence, crack-cocaine, drugs, Central Brazil

### INTRODUCTION

In recent decades, South America, including Brazil, has witnessed a surge in the use of crack-cocaine, presenting a significant public health challenge [1]. South America is an important transit location for cocaine shipments, offering a high-volume flow of cocaine trafficking routes from Andean Countries, such as Colombia, Peru, and

Bolivia. The entry of drugs is a facility in Brazil because of its extensive borders. There are 11 states bordering ten countries, with Mato Grosso do Sul being one of them. It encompasses seven municipalities bordering Paraguay and Bolívia, among which Ponta Porã and Corumbá are cities that rank among the top five most populous in the state and form significant routes for drug trafficking [2]. (Figure 1).

People who use crack cocaine (PWUCC) demonstrate risk behaviors for infection with human immunodeficiency virus (HIV), syphilis, and other infections. Such behaviors include sharing materials for injectable substances and engaging in the exchange of sexual favors for drugs and money, as well as the irregular use of condoms during sexual relations. [1,3]

In Latin America, there has been an 8% increase in the number of new cases of HIV infection from 2010 to 2022. It is noteworthy that HIV prevalence in key populations is significantly higher than that in the general population. In Brazil, the estimated prevalence of HIV infection among adults is 0.5%, while among people who inject drugs (PWID), it is 1.5%, and among men who have sex with men (MSM), the prevalence is 9.5%. [3,5]

In Brazil, from 2011 to 2021, a total of 52,513 individuals aged 15–24 years with HIV progression to Aids [4]. There are still many cases of Aids-related death due to a lack of adherence to antiretroviral treatment. From 2007 to 2022, 5,863 new cases of HIV were reported only in the state of Mato Grosso do Sul. Despite the decrease in new cases in recent years, it is worth noting that owing to the COVID-19 pandemic, many cases may not have been reported [5].

In 2019, 152,915 cases of acquired syphilis were reported in Brazil, with 3,226 cases in the state of Mato Grosso do Sul. When comparing the detection rates of syphilis among the states in Brazil, Mato Grosso do Sul had the third-highest rate of syphilis cases, with similar data to the state of Espírito Santo, ranking only behind Rio Grande do Sul and Santa Catarina. Campo Grande has the third highest detection rate of acquired syphilis in Brazil, trailing only Curitiba and Vitória [6]. This indicates that compared to the national average, the incidence of syphilis in the state of Mato Grosso do Sul is high.

Syphilis and HIV infection share common risk factors like sharing of sharp objects particularly among patients who engage in injectable drugs and affect similar groups. Primary and secondary syphilis increase the risk of acquiring HIV infection because ulcers caused by syphilis are an entry point for HIV [7]. Furthermore, the

likelihood of a person living with HIV/AIDS (PLWHA) presenting with serological evidence of active or past syphilis is eight times higher than that of patients not living with HIV. [3]

Despite the easy treatment and cure of syphilis and the existence of an effective treatment for controlling HIV infection, these public measures do not reach the population most affected by the disease. Additionally, epidemiological studies to understand the profile of these populations and to develop more appropriate approaches that assist in implementing public policies aimed at this more vulnerable population are lacking.

This study aimed to investigate the epidemiological characteristics of *Treponema pallidum* and HIV infections among crack users in Mato Grosso do Sul as well as the factors associated with these infections. This study is particularly relevant given the lack of studies on this population, which is in a situation of high vulnerability.

## **METHODS**

### **Ethics Statement**

This study was approved by the Ethics Committee of the Federal University of Mato Grosso do Sul (protocol number CAAE: 12046213.9.0000.0021). All research was performed following relevant guidelines and regulations.

### **Study population**

A cross-sectional study was conducted among PWUCC from drug use treatment centers and the “drug scene” (streets) in three cities of Mato Grosso do Sul state (MS), Central Brazil, between November 2015 and July 2018.

The recruitment cities were Campo Grande, the state's capital, and the international border cities of Ponta Porã and Corumbá, which border Paraguay and Bolivia, respectively. The individuals were approached from institutions and streets. Participation consisted of an interview using a standardized questionnaire containing sociodemographics, drug use profiles, and sexual behavior information.

The inclusion criteria were regular crack cocaine use, defined by the CODAR criteria established by PAHO [8], corresponding to use for at least 25 days in the six months, and aged 18 years or older. In addition, they were not influenced by illicit drugs during their participation in the study. All participants provided written informed consent to

participate in the study. Participation was voluntary, and no compensation was provided.

### **Serological tests**

A serological test to detect anti-HIV-1/2 antibodies was performed using ECLIA, and RT-PCR confirmed all positive samples.

Syphilis infection was defined according to the Clinical Protocol and Therapeutic Guidelines for Comprehensive Care for People with Sexually Transmitted Infections published by the Brazilian Ministry of Health. [4] To detect syphilis infection, a treponemal test (ELISA anti-T. pallidum) was used, and positive samples were confirmed with a non-treponemal test (VDRL). Patients with clinically or serologically active syphilis were appropriately treated and monitored by repeated VDRL testing.

Furthermore, all blood samples were screened for HBV serological markers (HBsAg, total anti-HBC, and anti-HBs) using enzyme-linked immunosorbent assay (Bioelisa, Biokit, Barcelona, Spain) and HCV (Murex anti-HCV 4.0, DiaSorin, Saluggia, Italy).

Serological analyses for anti-HTLV-1/2 were performed using a commercial enzyme-linked immunosorbent assay (ELISA) kit for the presence of anti-HTLV-1/2 antibodies (Murex HTLV I + II – DiaSorin), following the manufacturer's instructions. Positive samples were repeatedly tested and subjected to further confirmation through the HTLV-1/2 Western Blot (WB) assay (MP Diagnostics HTLV BLOT 2.4, Singapore). HTLV infection was defined as repeatedly positive ELISA and positive WB results.

### **Data analysis**

The variables were analyzed using the Stata software (version 13.0; Stata Corporation LP, College Station, TX, USA). The interview data and the results of serological tests are presented as categorical variables with absolute and percentage frequencies. Continuous variables were expressed as medians and ranges. All missing data were excluded from the analysis. The prevalence and 95% confidence intervals (95% CI) of any evidence of HIV infection (defined as positive for anti-HIV-1/2) or syphilis infection (anti-T. pallidum), and co-infections were calculated. Chi-square tests or Fisher's exact tests were used to evaluate differences between proportions and determine p-values (two-tailed). Odds ratios (ORs) and 95% confidence intervals (CI) were used to verify the potential predictors of HIV and syphilis infection. A p-value  $\leq 0.20$  was used to

select variables that were included in a multivariate logistic regression model. Statistical significance was defined as a p-value <0.05. The variables for the final model were selected stepwise according to the number of events per variable (EPV). The Hosmer–Lemeshow test was used to assess goodness-of-fit by choosing the best regression equation.

## RESULTS

The median age of the 700 participants in the study was 32 years (IQR: 25 – 39 years). Most of them were from Campo Grande (74.9%), were men (84.7%), had no steady partner (78.8%), were not white (68.1%), and had a low education level (5 to 8 years, 45.8%). Most of the participants had tattoos (64.8%), had a history of incarceration (58.4%), and a minority had ever worked as a drug dealer (19.2%). The profile of reported sexual behavior was that most never worked as a sex worker (92.4%) and never had STI (64.9%).

The majority were recruited in institutions (76.3%), did not use any injected drugs in life (85.7%), and used cocaine (52.0%); of these, a minority injected this drug (4.4%), and most used a subproduct of cocaine (*crack/pasta base*) (79.4%). Most reported use of marijuana (68.6%), 60.1% shared a smoking pipe with crack cocaine, and 43.1% had mouth wounds. The reported profile of this group indicates that it is vulnerable to STI transmission, such as syphilis and HIV.

The prevalence rate of HIV exposure was 5.0% (95% CI: 3.6 – 6.9), followed by men (80.0%), with a median age of 33 years (IQR: 26 – 42), and the majority were from Campo Grande (94.3%). The majority had low educational levels (54.3%), no steady partner (77.1%), were not white (74.3%), and were institutionalized (57.1%). Most of them had tattoos (57.1%), and only 11.8% worked as sex workers; 60.0% reported not having sexually transmitted infection. A minority only worked as drug dealers (20.6%) and had a history of incarceration (30.8%). Considering drug use, only 20.0% IDU, but the majority of them (73.9%) shared needles for IDU use, 28.1% shared smoking pipes, and 34.3% had mouth wounds. (Table 1)

Risk factors associated with HIV infection have also been identified. One of them was that individuals who were not institutionalized, meaning they were recruited from the street, had 9.76 times higher odds of being infected with HIV (95% CI: 2.13 – 44.83). Additionally, individuals who had an STI in their lifetime had 5.48 times higher odds of being infected with the virus (95% CI: 1.62 – 18.52). (Table 1)

The overall prevalence of exposure to *T. pallidum* in this population was 21.14% (95% CI: 18.3 - 24.3), and among these, 44.6% (95% CI: 36.7 – 52.8) had VDRL titers  $\geq 1/8$ . Among individuals positive for syphilis, the majority were male (73.6%), with a median age of 34 years (IQR: 26–42), single (79.1%), residents of Campo Grande (67.6%), non-white (71.0%), and institutionalized (67.6%).

Fifty percent of these individuals had 5–6 years of education. At the same time, 29.0% reported having nine or more years of study, and a minority (21.0 %) reported having an educational level of less than five years. Most of them had tattoos (63.3%) and only 11.6% worked as sex workers. Having had an STI at some point in their lives was reported by 47.4% of the participants, 52.5% shared smoking pipes and injectable drug use by 14.8%, and 57% said that the sharing of paraphernalia was associated with this practice. Only 17.7% reported working as a drug dealer and the majority presented a history of incarceration (57.5%).

As risk factors associated with *T. pallidum* infection, individuals recruited from the street had 3.59 times higher odds of being infected by the bacterium (95% CI: 1.83 – 7.05). Being male posed a risk 0.30 times higher than females (95% CI: 0.16 – 0.56). Having any STI throughout life presented 2.43 times higher odds of acquiring the infection (95% CI: 1.49 – 3.97), and sharing needle pipes presented a risk 0.53 times higher of acquiring the infection (95% CI: 0.33 – 0.86).

For those co-infected with HIV and syphilis, the prevalence was 3.43% (95% CI: 2.31 - 5.07), among which 41.7% presented a VDRL titer  $\geq 1/8$ , suggesting active syphilis and a high potential for *T. pallidum* transmission. Additionally, 12.5% tested positive for HBsAg, 12.5% tested positive for anti-HCV antibodies, indicating exposure to hepatitis C virus, and 4.2% were co-infected with HTLV-1. (Figure 2)

Of the total co-infected patients, 58.3% were recruited in institutions and 62.5% were below the age of 35 years. Furthermore, 83.3% were male, most participants (75.0%) reported being single, and 66.7% self-identified as non-white. Regarding income, 45.8% of the participants declared income ranging from two to three salaries, 29.9% earned up to one salary, and only 25.0% earned more than three salaries. Regarding educational attainment, 45.8% reported having completed five to eight years of formal education, 20.8% of individuals reported having nine or more years of education, and 33.3% reported having up to four years of education. All participants were residents of Campo Grande.

As risk factors associated with coinfections, having a history of incarceration showed a risk 0.10 times higher risk of coinfection (95% CI: 0.02 – 0.48) of coinfection. Additionally, another significant risk factor was the presence of the hepatitis B virus infection marker HBsAg, which presented a risk 11.92 times higher (95% CI: 2.41 – 58.98 for coinfections. (Table 3).

## DISCUSSION

The prevalence of HIV in this population (5.0% [95% CI: 3.6 – 6.9]) was higher than that among people who use drugs (1.5%), as reported by UNAIDS in Latin America. [7]. A study conducted on individuals with chemical dependence treated at CRATOD in São Paulo estimated an HIV prevalence among cisgender women and men of 5.9% and 3.6%, respectively, like the findings in the population of Mato Grosso do Sul.[9]

Sharing needles is an important factor in the increased prevalence of HIV [7], but individuals who use crack-cocaine exhibit other behaviors that further contribute to the increase in new HIV cases, such as sharing pipes, having a history of incarceration, and the low educational attainment of this group. [10]

Regarding syphilis, a study conducted in Goiânia, the central region of Brazil, among women who used crack, estimated the prevalence of active syphilis to be 14% (95% CI: 8.35 – 22.46). [11]. This prevalence was lower than that found in our study [44.6% (95% CI: 36.7 – 52.8)], and male sex was associated with a higher risk of *T. pallidum* infection. However, the prevalence of HIV infection in these women was 6.5% (95% CI: 3.0 – 13.37), data like to that found in our research [5.0% (95% CI: 3.6 – 6.9)].[11]

A study conducted in the northern region of Brazil identified an estimated prevalence of syphilis and HIV coinfection of 9.8 (95% CI: 7.2 – 12.7) with findings related to risk behavior similar to our study. [12]. Lower income, less than one minimum wage [2.4 (1.8 – 3.2)], was identified as a risk factor for coinfections, as well as low educational attainment [1.9 (95% CI: 1.4 – 2.7)], exposure to HBV, statistically significant variables in both studies. [12]

Having had other STIs also contributes to new cases of HIV and syphilis because other infections serve as gateways for new infections. It is possible to observe that the prevalence of coinfection between syphilis and HIV was 3.43% (95% CI: 2.31 - 5.07), and having markers of active hepatitis B infection (HBsAg) significantly contributes to the increased risk of STI coinfections.[7, 12]. Because the transmission route for all the mentioned STIs is the same, individuals who use cracks are equally exposed.

This study has some limitations, among which the collection of sociodemographic and behavioral information through self-reports stands out. Despite the absence of drug influence during the interviews as an inclusion criterion, it is valid to emphasize that participants may provide incomplete or inaccurate reports on some questions. As a cross-sectional study, the exposure and outcome were assessed simultaneously. Therefore, it is impossible to infer causality because a temporal sequence cannot be established. Despite these limitations, the results of this study contribute relevant data on the prevalence of HIV, syphilis, and their coinfections in this vulnerable population, presenting unique information that can guide the planning of STI control and prevention strategies.

## **REFERENCES**

[1] BASTOS, Francisco Inácio; BERTONI, Neilane. Pesquisa Nacional sobre o Uso de Crack. Rio de Janeiro: ICICT/ FIOCRUZ, 2014.

[2] CNM, 2016. Os Municípios na Faixa de Fronteira e a Dinâmica das Drogas. Brasília, Bras. 0–31.

[3] Karp G, Schlaeffer F, Jotkowitz A, Riesenberk K. Syphilis and HIV co-infection. Eur J Intern Med. 2009;20(1):9-13. doi:10.1016/j.ejim.2008.04.002

[4] BRASIL. Ministério da Saúde. Protocolo Clínico e Diretrizes Terapêuticas para Atenção Integral às Pessoas com Infecções Sexualmente Transmissíveis. Brasília, 2015.

[5] BRASIL. Ministério da Saúde. Secretaria de Vigilância em Saúde. Boletim Epidemiológico HIV/AIDS. Brasília, 2020.

[6] BRASIL. Ministério da Saúde. Secretaria de Vigilância em Saúde. Boletim Epidemiológico. Sífilis. Brasília, 2020.

[7] The path that ends AIDS: UNAIDS Global AIDS Update 2023. Geneva: Joint United Nations Programme on HIV/AIDS; 2023. Licence: CC BY-NC-SA 3.0 IGO

[8] Pan American Health Organization (PAHO). Encuestas de Comportamiento en Consumidores de Drogas con Alto Riesgo (CODAR). Available at: [http://www.paho.org/hq/index.php?option=com\\_content&view=article&id=853%3A2009-encuestas-comportamiento-consumidores-drogas-alto-riesgocodar&catid=745%3Asurveillance-monitoring-evaluation&lang=en](http://www.paho.org/hq/index.php?option=com_content&view=article&id=853%3A2009-encuestas-comportamiento-consumidores-drogas-alto-riesgocodar&catid=745%3Asurveillance-monitoring-evaluation&lang=en)

[9] Ribeiro A, Trevizol AP, Bosso RA, et al. The Interactions Between Vulnerabilities for HIV and Syphilis among Cisgender and Transgender People Who Use Drugs. *Arch Sex Behav.* 2023;52(2):733-740. doi:10.1007/s10508-022-02460-y

[10] Burton MJ, Olivier J, Mena L. Characteristics of hepatitis C virus coinfection in a human immunodeficiency virus-infected population with lower reported rates of injection drug use. *Am J Med Sci.* 2009;338(1):54-56. doi:10.1097/MAJ.0b013e31819e2ad8

[11] Pinheiro RS, Carneiro MAS, Martins RMB, et al. Hepatitis B, HIV, and Syphilis in Female Crack Cocaine Users in Central Brazil. *J Assoc Nurses AIDS Care.* 2017;28(3):438-442. doi:10.1016/j.jana.2017.02.002

[12] Baia KLN, Cordeiro ACC, Frade PCR, et al. Syphilis and Coinfections with HIV-1, HBV, and HCV among People Who Use Crack-Cocaine in Northern Brazil. *Pathogens.* 2022;11(9):1055. Published 2022 Sep 16. doi:10.3390/pathogens11091055

## **ACKNOWLEDGMENTS**

This study was supported by Fundação de Apoio ao Desenvolvimento do Ensino, Ciência e Tecnologia do Estado do Mato Grosso do Sul, FUNDECT-MS (59/300.110/2015/PRONEM). This study was financed in part by the Coordenação de Aperfeiçoamento de Pessoal de Nível Superior, Brasil (CAPES), Finance Code 001. This study was conducted with the support of the Federal University of Mato Grosso do Sul, UFMS/MEC, Brazil.

## **AUTHOR CONTRIBUTIONS**

Conceptualization: V.O.L.C, A.R.C.M.C; Methodology: V.O.L.C, S.V.O, S.L.O, A.R.C.M.C.; Data analysis: M.S.J and A.R. C. M.; contributed reagents/materials/analysis tools: A.R.C.M.C; writing – original draft preparation, review, and editing: M.S.J., C.A, R.I.T, and A.R.C.M.C; supervision: A.R.C.M.C. All the authors have read and agreed to the published version of the manuscript.

**DATA AVAILABILITY STATEMENT:** All relevant and original data presented in the study are included in this article.

**CONFLICT OF INTEREST:** The authors declare no conflicts of interest.

## TABLES

**Table 1.** Uni-and multiple analyses of the investigated variables among 35 HIV-positive individuals who used crack cocaine, Brazil Central.

Variable	N (%)	Odds ratio (95% CI)	p	Adjusted Odds ratio (95% CI)	p
<i>Age (years)</i>					
18 - 35	20 (57.1)	Reference			
36 - 90	15 (42.9)	1.37 (0.69 – 2.72)	0.37		
<i>Recruitment</i>					
Institution	20 (57.1)	Reference			
Street	15 (42.9)	2.55 (1.28 – 5.11)	<0.01	9.76 (2.13-44.83)	<.0.01
<i>Gender</i>					
Female	7 (20.0)	Reference			
Male	28 (80.0)	0.71 (0.30 – 1.66)	0.43	3.23 (0.32-32.71)	0,32
<i>Marital status</i>					
Stead partner	8 (22.9)	Reference			
Single	27 (77.1)	0.90 (0.40 – 2.03)	0.81		
<i>Place</i>					
Border	2 (5.7)	Reference			
Campo Grande	33 (94.3)	5.85 (1.39 – 24.62)	0.02	4.88(0.85 - 27.88)	0,07
<i>Ethnicity</i>					
White	9 (25.7)	Reference			
Not White	26 (74.3)	1.38 (0.63 – 2.99)	0.42		
<i>Study years</i>					
>9	7 (20.0)	Reference			
5-8	19 (54.3)	2.25 (0.93 – 5.44)	0.07	1.38 (0.37 – 5.05)	0.63
0-4	9 (25.7)	2.83 (1.03 – 7.80)	0.04	1.87(0.34 –10.13)	0.48

<i>Tattoo</i>						
No	15 (42.9)	Reference				
Yes	20 (57.1)	0.71 (0.36 – 1.42)	0.33			
<i>Sex work</i>						
	*					
No	30 (88.2)	Reference				
Yes	4 (11.8)	1.66 (0.56 – 4.92)	0.36			
<i>STI</i>						
	*					
No	8 (40.0)	Reference				
Yes	12 (60.0)	2.88 (1.16 – 7.18)	0.02	5.48(1.62-18.52)	<0,01	
<i>IDU</i>						
	*					
No	12 (80.0)	Reference				
Yes	3 (20.0)	1.51 (0.42 – 5.48)	0.53			
<i>Share needles (IDU)</i>						
	*					
No	6 (26.1)	Reference				
Yes	17 (73.9)	2.83 (1.04 – 7.66)	0.04		*	
<i>Share smoking pipe</i>						
	*					
No	23 (71.9)	Reference				
Yes	9 (28.1)	0.24 (0.11 – 0.53)	<0.01	0.62 (0.19-2.01)	0.43	
<i>Drug dealer</i>						
	*					
No	27 (79.4)	Reference				
Yes	7 (20.6)	1.09 (0.47 – 2.57)	0.84			
<i>History of incarceration</i>						
	*					
No	18 (69.2)	Reference				
Yes	8 (30.8)	0.30 (0.13 – 0.71)	<0.01	0.31 (0.09 - 1.04)	0.06	

CI: 95% confidence interval; STI: sexually transmitted infections; IDU: injected drug use; (\*) Variables that had missing values

**Table 2:** Uni-and multiple analyses of the investigated variables among 148 individuals positive for syphilis among the participants who used crack cocaine, Brazil Central.

Variable	N (%)	Odds ratio (95% CI)	p	Adjusted Odds ratio (95% CI)	p
<b>Age (years)</b>					
18 - 35	81 (54.7%)	Reference			
>36	67 (45.3%)	1.66 (1.15 - 2.40)	<0.05	1.42 (0.88 – 2.29)	0.15
<b>Recruitment</b>					
<b>Institution</b>					
Street	48 (32.4%)	1.59 (1.07-2.36)	0.02	3.59 (1.83 – 7.05)	<0.01
<b>Gender</b>					
Female	39 (36.2%)	Reference			
Male	109 (73.6%)	0.39 (0.25 - 0.61)	<0.05	0.30 (0.16 – 0.56)	<0.01
<b>Marital status</b>					
Stead partner	31 (20.9%)	Reference			
Single	117 (79.1%)	1.02 (0.65 - 1.59)	0.93		
<b>Place</b>					
Campo Grande	100 (67.6%)	Reference			
Border	48 (32.4%)	1.59 (1.07 - 2.36)	0.02	1.11 (0.66 – 1.86)	0.69
<b>Ethnicity</b>					
White	43 (29.1%)	Reference			
Not White	105 (70.9%)	1.19 (0.80 - 1.77)	0.39		
<b>Study years</b>					
>9	43 (29.1%)	Reference			
5-8	74 (50.00%)	1.50 (0.98 - 2.27)	0.06	1.19 (0.71 – 2.02)	0.50
0-4	31 (20.9%)	1.69 (1.00 - 2.85)	0.05	1.15 (0.58 – 2.25)	0.69
<b>Tattoo</b>					
	*				
No	54 (36.7%)	Reference			
Yes	93 (63.3%)	0.92 (0.63 - 1.34)	0.66		
	*				
<b>Sex work</b>					
No	130 (88.4%)	Reference			
Yes	17 (11.6%)	1.86 (1.01 - 3.42)	<0.05	1.28 (0.53 – 3.09)	0.58
<b>STI</b>					
	*				
No	61 (51.6%)	Reference			
Yes	55 (47.4%)	1.93 (1.27 - 2.92)	<0.05	2.43 (1.49 – 3.97)	<0.01

<b>IDU</b> *						
No	109 (85.2%)	Reference				
Yes	19 (14.8%)	1.06 (0.61 - 1.83)	0.84			
<b>Share needles (IDU)</b> *						
No	16 (42.1%)	Reference				
Yes	22 (57.9%)	1.25 (0.59 - 2.64)	0.55			
<b>Share smoking pipe</b> *						
No	66 (47.5%)	Reference				
Yes	73 (52.5%)	0.67 (0.46 - 0.98)	0.04	0.53 (0.33 – 0.86)	0.01	
<b>Drug dealer</b> *						
No	121 (82.3%)	Reference				
Yes	26 (17.7%)	0.88 (0.55 - 1.41)	0.59			
<b>History of incarceration</b> *						
No	59 (42.4%)	Reference				
Yes	80 (57.6%)	0.96 (0.66 - 1.40)	0.83			

CI: 95% confidence interval; STI: sexually transmitted infections; IDU: injected drug use; (\*) Variables that had missing values.

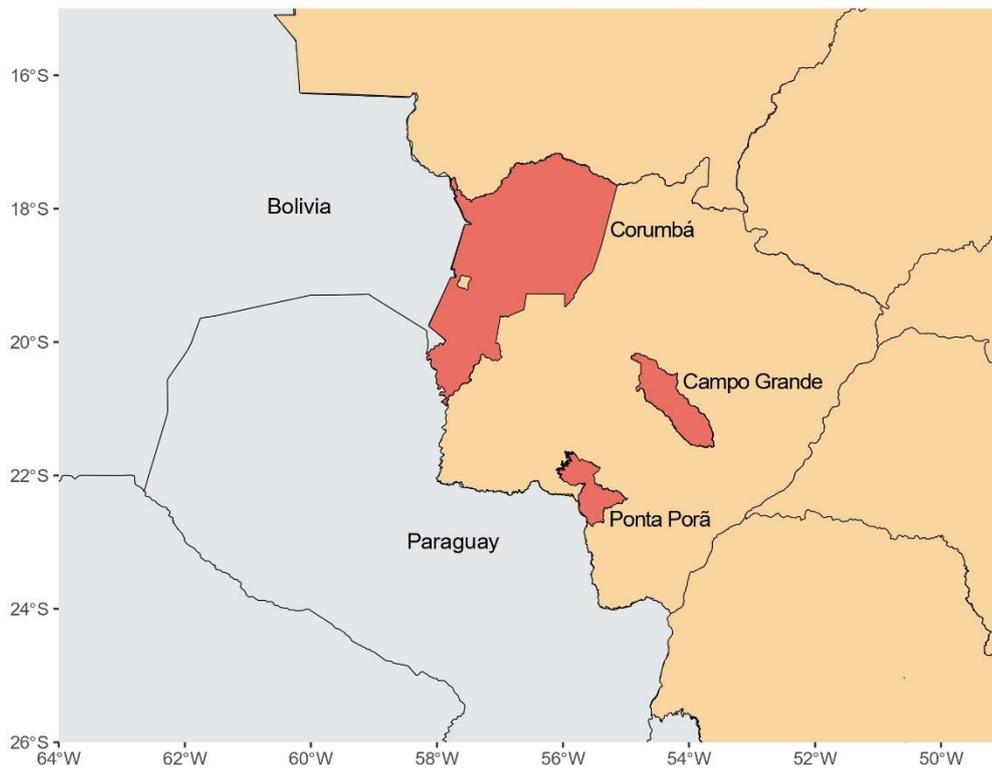
**Table 3:** Descriptive analysis of the 24 individuals co-infected with syphilis and HIV among the participants who used crack-cocaine, Brazil Central.

Variable	N (%)	Odds ratio (95% CI)	p	Adjusted Odds ratio (95% CI)	p
<b>Age (years)</b>					
18 - 35	15 (62.5)	Reference			
>36	9 (37.5)	1.08 (0.46 - 2.50)	0,86		
<b>Recruitment</b>					
Institution	14 (58.3)	Reference			
Street	10 (41.7)	2.38 (1.04 – 5.46)	0.04	2.20 (0.67 - 7.25)	0.19
<b>Gender</b>					
Female	4 (16.7)	Reference			
Male	20 (83.3)	0.90 (0.30 – 2.68)	0.84		

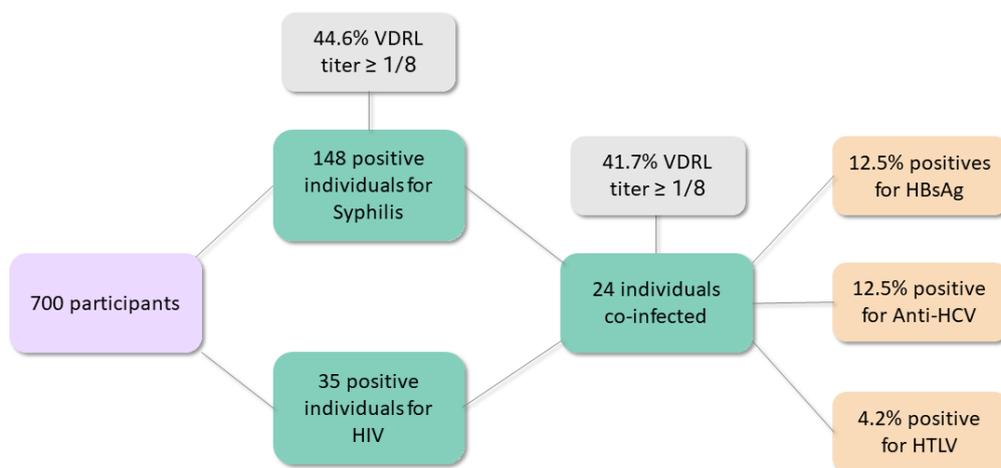
<b>Marital status</b>					
Stead partner	6 (25.0)	Reference			
Single	18 (75.0)	0.80 (0.31 – 2.05)	0.64		
<b>Income</b>					
>3 salary	6 (25.0)	Reference			
<1 salary	7 (29.2)	0.33 (0.11 - 1.0)	0.05	0.32 (0.06 - 1.67)	0.18
≥ 2 and ≤ 3 salary	11 (45.8)	0.50 (0.18 - 1.40)	0.18	0.45 (0.09 - 2.30)	0.34
<b>Ethnicity</b>					
White	8 (33.2)	Reference			
Not White	16 (66.7)	0.94 (0.39 – 2.22)	0.88		
<b>Study years</b>					
>9	5 (20.8)	Reference			
5-8	11 (45.8)	1.79 (0.61 – 5.23)	0.28	1.84 (0.43 - 7.87)	0.41
0-4	8 (33.4)	3.52 (1.13 – 11.0)	0.03	4.59(0.88 - 23.81)	0.07
<b>VDRL titer</b>					
0	8 (33.3)	Reference			
1/1; ½ or 1/4	6 (25.0)	0.71 (0.22 - 2.26)	0.55		
≥ 1/8	10 (41.7)	0.74 (0.26 - 2.05)	0.56		
<b>HBsAg</b>					
non-reactive	21 (87.5)	Reference			
reactive	3 (12.5)	6.75 (1.80 - 25.30)	<0.01	11.92(2.41-58.98)	<0.01
<b>Anti-HCV</b>					
non-reactive	21 (87.5)	Reference			
reactive	3 (12.5)	2.97 (0.84 - 10.50)	0.09		
<b>History of incarceration</b>					
No	13 (86.7)	Reference			
Yes	2 (13.3)	0.10 (0.02 - 0.47)	<0.01	0.10 (0.02 - 0.48)	<0.01

CI: 95% confidence interval; OR: odds ratio; STI: sexually transmitted infections; IDU: injected drug use; VDRL: Venereal Disease Research Laboratory; (\*) Variables that had missing values; Average of Brazilian minimum wage equals BRL 945 (equivalent to approximately USD 257)

## FIGURES



**Figure 1:** Map of the cities that border Paraguay and Bolívia, where 700 individuals who used crack cocaine were recruited.



**Figure 2:** Flowchart of the main co-infections in the project. HIV: Human immunodeficiency virus; VDRL: Venereal Disease Research Laboratory; HTLV: Human T-Lymphotropic Virus.