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Running title: Profiles and willingness to change in Brazilian Open Drug Scenes

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Abstract

Introduction: Several major cities face public health challenges related to Open Drug Scenes (ODS), where illicit drugs are used and sold openly in public spaces. Despite the growing public and political attention attracted by ODS, quantitative studies exploring the profile of people who use drugs (PWUD) within ODS are lacking. This study aimed to: i) examine the profile of PWUD within ODS in three metropolitan cities of Brazil, and ii) explore potential profile factors associated with willingness to change and healthcare utilisation among PWUD within ODS.

Methods: Cross-sectional survey using time-location sampling method interviewed 489 PWUD at ODS across three Brazilian cities during 2021–22. Latent class analyses to identify homogeneous classes of PWUD based on ODS attendance patterns. Multinomial logistic regression models examined factors associated with willingness to change across profile classes.

Results: Two PWUD profiles in ODS were identified: Chronically Excluded (61.0%) and Self Excluded (39.0%). Both showed high levels of willingness to change, and it was associated

with physical health problems. Among the CE group, willingness increased with welfare benefits, emergency care for drug intoxication, and SUD treatment.

Conclusion: This study offers new insights into PWUD profiles in Brazil's ODS, showing high willingness to change across both profiles despite varying levels of social exclusion. The association between willingness to change and healthcare use underscores the need for brief interventions and improved referrals to specialised treatment within primary care services. To respond to the ODS challenge public policies must integrate social and healthcare models.

Keywords: open drug scenes, crack-cocaine, survey, Brazil.

1. INTRODUCTION

Several major cities worldwide face public health challenges posed by people who use drugs (PWUD) within Open Drug Scenes (ODS). ODS are broadly defined as public spaces where a high concentration of drug use and dealing occurs, often in urban areas such as parks, streets, central railway stations or neighbourhoods.[1,2] These scenes are commonly associated with marginalised populations, including individuals who are homeless, asylum seekers and others who have problems fitting into the societal structures.[3,4] While ODS vary across countries due to differences in type of drug availability, drug policies, law enforcement practices, social attitudes, and economic conditions, they are widely recognised for their social, public health, and safety implications.[2-5] As a result, ODS are considered public nuisance, with an international consensus that these scenes pose significant societal problems.[6-9]

In Brazil, ODS are a major problem in large cities, reflecting the country's wider social, economic and public health challenges.[10,11] The primary drug of use in these Brazilian's ODS is smoked crack/cocaine,[12-14] which differs from the opioid-dominated drug scenes more commonly seen in North America, Europe, and Africa.[15] However, similar to those regions, PWUD in Brazil's ODS often experiences a range of physical and mental health problems, including respiratory issues, cardiovascular problems, severe mental disorders and infectious diseases (i.e., HIV, hepatitis and C and tuberculosis).[10,16-18] Since the early 2000s, Brazil has introduced harm reduction initiatives to minimise the health risks associated with drug use in ODS (e.g., services like health check-ups, vaccinations, tuberculosis screenings and treatment referrals for infectious diseases) while making some efforts to address the social and structural challenges faced by people in these scenes (e.g.,

housing-first models).[19] However, despite some progress, these services remain limited in number and scale, and face challenges, especially regarding sustainability and funding.[20-22]

Evidence also indicates that while harm reduction services effectively minimise social and health-related harms within ODS,[23-26] they do not alone reduce the size and complexity of these scenes.[2] It is widely recognised that addressing the scale of ODS requires a comprehensive approach that tackles the underlying social, economic, and public health issues that drive their existence.[2] How countries approach and discuss the existence and challenges of ODS varies based on their specific drug policies.[27-30] In Brazil, two conflicting perspectives shape the national response to ODS. One frames addiction as a social and public health issue, while the other is rooted in restrictive policies that define drug use primarily as a criminal or public nuisance issue.[31,32] These opposing views contribute to barriers to reaching people in ODS who are highly disconnected from formal healthcare services, even when these services are made available within the scenes. [11,33,34]

For people in ODS, the gap between available services and their complex needs often reduces their willingness to change, which can hinder treatment engagement.[35] Developing and delivering interventions to motivate behaviour change in PWUD in ODS have unique challenges. As Bless and colleagues (1995) pointed out, ODS differ not only in size and location but also in the characteristics of the individuals frequenting them. These scenes are not static; they are fluid and dynamic, with populations often in flux.[1] Yet, much of the existing research considers PWUD in ODS as a homogeneous group, without recognising the diversity within this population. In Brazil, around 80% of crack-cocaine users consume the drug in public spaces (i.e., parks and streets), though not all are homeless.[13] A significant proportion of homeless crack-cocaine users began harmful drug use after experiencing a breakdown of social connections and exclusion from the labour market.[36] Long-term social exclusion is critical in accessing healthcare services and their motivation to seek change. Thus, understanding the willingness to change while considering the varied profiles of PWUD in ODS is essential for developing effective tailored support services.

While several factors have been associated with low health service utilisation among PWUDs including poverty, unstable housing, frequent mobility, poor mental health and stigma,[37-39] less is known about potential factors associated with the willingness to change the drug use behaviour among PWUD in ODS. Understanding this is crucial, as the willingness to stop using drugs has been associated with better engagement in substance

use disorder treatment,[40,41] participation in harm reduction programs,[42,43] and long-term recovery outcomes.[44,45]

This study aimed to address gaps in current evidence by conducting a secondary analysis of a Brazilian national survey of PWUD in ODS. We first explored the profile of PWUD according to their involvement with ODS, and then we examined potential differences in levels of willingness to change drug use behaviour and receive treatment and factors associated with it according to PWUD profiles.

2. METHOD

This study utilised data collected from 2021–22 by the "*Levantamento de Cenas de Uso em Capitais (LECUCA)",* a cross-sectional survey conducted in three major cities in Brazil (São Paulo, Fortaleza and Brasília). The survey has been conducted yearly since 2016 in Sao Paulo and extended to Brasilia and Fortaleza in 2021.[46] LECUCA aims to monitor the population frequenting ODS including its size (number of people), demographic and psychosocial characteristics, physical health, types and patterns of substance use, and access to healthcare services. This study involved secondary data analysis of its fifth wave in São Paulo and its first in the other two capitals. Approval for the LECUCA was granted by the UNIFESP Research Ethics Committee (Brazil Platform registration numbers CAAE: 46249121.7.0000.5505).

2.1 Open Drug Scene (ODS) definition

ODS is defined in this study as a location where at least fifteen drug users congregate (not in transit) for at least three consecutive days to publicly consume drugs. In the city of Sao Paulo, eight ODS were identified in the region locally known as "*Cracolândia*" (Crack Land). In Fortaleza, four ODS were identified in the region locally known as "Oitão Preto" (Black Wall) and in Brasilia, five ODS were identified in the region locally known as "*Buraco do Rato*" (Rat Hole). Each ODS was geo-mapped with clearly defined starting and ending points for systematic scanning. This allowed interviewers to follow consistent routes during their fieldwork.

2.2 Sample

Given the transitory nature and constant fluctuation of users of ODS, the Time-Location Sampling (TLS) method was applied. Briefly, the TLS method is an extension of the Site-Based Sampling method, a probabilistic approach used to study rare populations gathering in specific locations.[47,48] TLS involves visiting predetermined locations at random times days and times.[49] The sampling also includes randomisation by location, determining the starting point of the recruitment. A single data collection protocol was applied for all the regions. A total of twenty data collection cycles were conducted in each capital, with independent interviewers walking through each ODS and approaching all eligible participants on predefined days and times. Individuals who were using substances at the time of approach, who were severely intoxicated, and who showed intense behavioural agitation or drowsiness were not eligible to participate. A total of 681 participants were interviewed, however, 102 participants were excluded due to answering less than 20% of the questionnaire and 96 participants were excluded from the analysis for reporting no drug use. As a result, data for this study came from 483 participants currently using drugs in an ODS.

2.3 Assessment

Detailed information about the questionnaire used in the LECUCA can be found at https://www.lecuca.uniad.org.br/sobre-o-levantamento/metodologia-do-estudo. In brief, data on age, biological sex, education level, access to public welfare benefits, and marital, working, and housing status were collected. Participants were also asked about their history of physical illness and infectious diseases including a history of being tested for Sexually Transmitted Infections (STIs). Healthcare utilisation was measured by a checklist of all types of health and social care services offered within and outside the ODS territory in the past year. Regarding their attendance patterns at the ODS, participants were asked about how frequently and for how long they went to the ODS including their habits regarding sleeping location and use of local shelters. Detailed information about their history of homelessness and previous social and family networks was obtained to comprehend the phenomenon of social exclusion throughout time.

Lastly the willingness to change was determined using a visual analogue scale modified from previous studies on smoking cessation.[50,51] A score of 0 indicated no willingness to change, while a score of 10 indicated a strong willingness to stop using drugs

and initiate treatment. For this study, an ordinal variable was created based on the following cut-off points: 0 (0, no willingness), 1 (1-3, low willingness), 2 (4-6, moderate willingness), 3 (7-9, high willingness), and 10 (fully willingness). Further information about each variable explored including missing value information is reported in the supplementary file (TS.1).

2.4 Analysis plan

The profiles of individuals attending ODS were identified by conducting latent class analysis (LCA). This probabilistic model approach identifies underlying homogeneous classes (clusters). The following variables were included in the LCA: frequent daily attendee of ODS, length of time attending ODS (less than one year/one to four years/five years or more), current residence status (living at home/living at homelessness accommodation/street homelessness) and history of street homeliness before attending ODS. Statistical fit indices and conceptual and clinical considerations guided decisions about the best fitting latent class model. The Akaike Information Criterion (AIC), [52] the Bayesian Information Criterion (BIC)[53] the sample-size-adjusted BIC (SSABIC)[54] the Lo–Mendel–Rubin Likelihood Ratio Test (LMR-LRT)[55] and entropy were used.[56] Lower values on the AIC, BIC and SABIC reflect a good-fitting latent class model. The entropy statistics ranging between 0 and 1 measure the accuracy of the classification of individuals into clusters according to their model-based posterior probabilities with higher values reflecting better classification of participants. The maximum likelihood estimation method was employed when analysing ordinal observed variables.

To identify the characteristics of the classes, each participant was classified into the class for which the probability of membership was the highest. Logistic regression models were run where the outcome was class membership and generated odds ratios (95% CI). Separate models were run for each predictor. Lastly, ordinal regression models were run to identify factors associated with willingness to change and receive treatment according to each class. Separate models were run for each predictor first unadjusted and then adjusted for potential confounders. Potential confounders selected were age, gender, and location of the ODS. Multiple imputations by chain equations (MICE)[57] were performed to preserve statistical power while accounting for missing data uncertainty in the ordinal regression analysis. Variables with completed cases were used for imputations, resulting in 40 plausible data versions. Prediction models for the ordinal regression analysis before imputation are

reported in the supplementary file (TS.2). All analyses were conducted using R version 2024.04.2 and STATA SE version 18.0.

3. RESULTS

3.1 Latent Class

To identify latent classes of profiles, four latent class models were estimated. The goodness-of-fit statistics to determine the best fitting model are shown in Table 1. There was a decrease in AIC, BIC and SSABIC from the one-class model to the two-class model and an increase for the further models. The highest entropy statistics were found in the two-class model. The non-significant LMR-LRT statistics (p> 0.05) in the third-class model suggested that this model is not favourable to the second-class model further supporting that the 2-class model was the best-fitting and most parsimonious model.

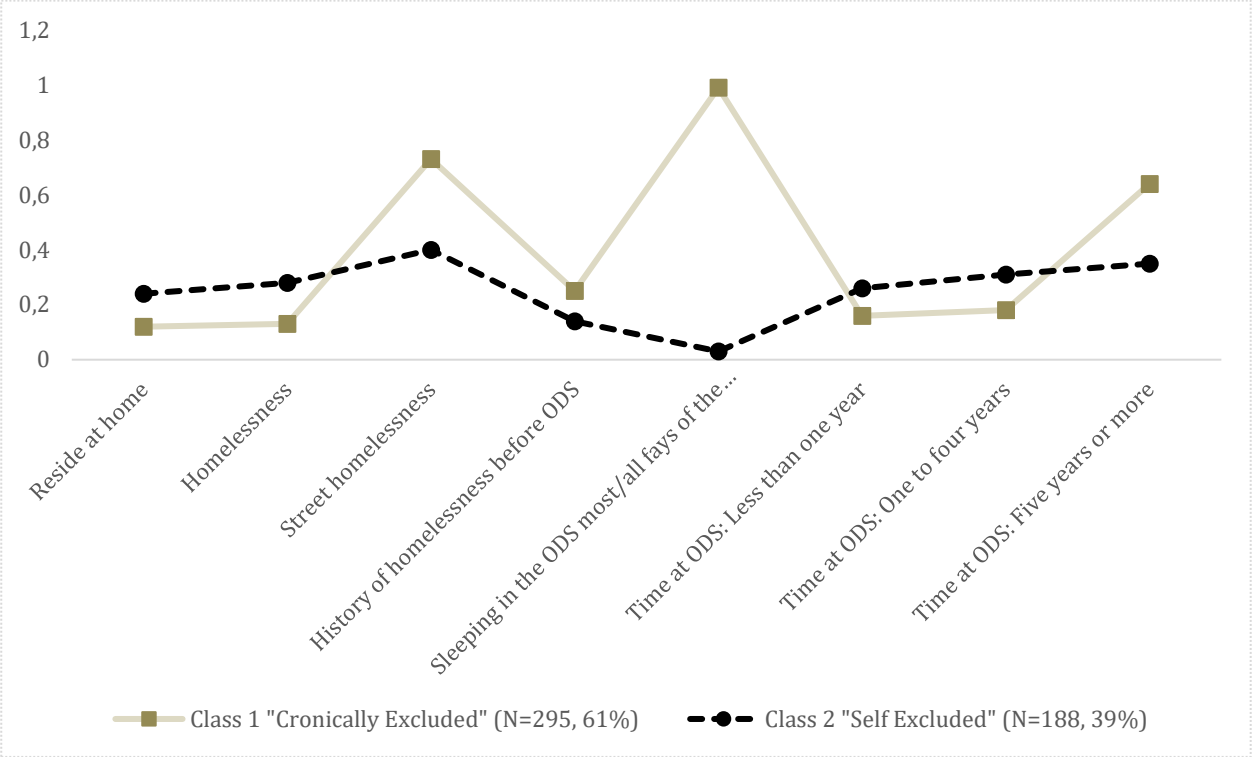
Table 1. Model fit criteria for latent class analysis (N = 483)

	Model 1	Model 2	Model 3	Model 4
Maximum log-likelihood	-1493.0	- 1465.9	-1461.2	-1458.3
AIC	2998.1	2957.8	2962.3	2970.5
BIC	3023.1	3012.1	3045.9	3083.4
SAABIC	3004.1	2970.9	2982.4	2997.7
Entropy	N/A	0.9	0.7	0.6
LMR-LRT (p-value)	N/A	54.3 (<.001)	9.5 (.220)	5.8 (.562)

AIC, Akaike Information Criterion; BIC, Bayesian Information Criterion; SSABIC, Sample-size adjusted Bayesian Information Criterion; LMR-LRT, Lo-Mendell-Rubin adjusted Likelihood Ratio Test; N/A, not applicable. Variables included in the models: frequent daily attendee of ODS, length of time attending ODS (less than one year/one to four years/five years or more), current residence status (living at home/living at homelessness accommodation/street homelessness) and history of street homeliness before attending ODS.

A profile plot for conditional probabilities in the 2-class model is shown in Figure 1. Class 1 (61.1%, *N*=295) was labelled the '*Chronically Excluded'* (CE) as the probability of sleeping in the ODS most/all days of the week was 99.0%, being street homeless 73.0%, frequenting the ODS for more than 5 years was 64% and had a history of street homelessness before frequenting the ODS was 25%. Class 2 (38.9%, N=188) was named the '*Self Excluded' (SE)* due to similar probabilities of living at home (24.0%) or in an institutional accommodation (28.0%), as well as similar probabilities of being newer to the ODS (25.0%) or frequenting it for five years or less (31.0%).

Figure 1. Item-response probabilities across the two classes.



Demographic, socioeconomic, health, and healthcare utilisation characteristics in the latent classes

3.2 Sociodemographic characteristics

According to Table 2, the average age of the sample was 37.1 years, and the majority were men, married/stable relationship and with no/primary schooling only (80.3%). The largest group of respondents were from ODS in Sao Paulo, followed by almost a quarter from Fortaleza and less than 10% from Brasilia. More than half of the participants had a lifetime history of incarceration. Homelessness was highly reported, with 63.7% of the sample living on the streets and 34.2% reporting not having any monthly income. Reports of a history of homelessness before ODS were common (21.9%). Over half of the sample indicated living/spending most days of the week in the ODS and frequenting the ODS for five years or more. With regards to the utilisation of health care services in the past 12 months, 36.5% were inpatients in general hospitals and just over one-quarter of the sample attended an emergency service due to drug intoxication and had received SUD treatment. Lastly, participants reported a high level of willingness to stop using drugs and initiate treatment (M=7.0 out of 10, SD 3.4), with 61.4 % reporting ‘willingness’ or ‘full willingness’ and 18.5% reporting ‘no willingness’ or ‘low willingness’.

Compared to those in the Self Excluded class, those in class Chronically Excluded class were more likely to be women (OR 0.5, p<0.05), not receiving any income (OR 0.5, p<0.05) and have received inpatient SUD treatment in the past 12 months (OR 0.5, p<0.05). Men was more likely to belong to the Self Excluded class (OR 1.81, p<0.05), be involved in paid activities (OR 2.0, p<0.05), and to receive welfare benefits (OR 1.5, p<0.05).

Table 2 - *Latent class profiles of people who use drugs (PWUD) within ODS*

	Total sample (N=483)	**Class 1 – Chronically Excluded (N=295)**	**Class 2 – Self Excluded (N=188)**	**OR (95%CI)**
Residence status [1]				
At home	83 (17.2%)	-	-	-
Homelessness	93 (19.2%|)	-	-	-
Street homelessness	307 (63.6%)	-	-	-
History of homelessness before ODS[1]	106 (21.9%)	-	-	-
Sleeping in the ODS most/all days of the week [1]	295 (61.1%)	-	-	-
Length of time at ODS[1]				
Less than one year	98 (20.3%)	-	-	-
One to four years	114 (23.6%)	-	-	-
Five years or more	271 (56.1%)	-	-	-
ODS location				
Sao Paulo	326 (67.5%)	202 (68.5%)	124 (66.0%)	1.00 (ref)
Brasilia	41 (8.5%)	27 (9.1%)	14 (7.4%)	0.8 (0.4-1.6)
Fortaleza	116 (24.0%)	66 (22.4%)	50 (26.6%)	1.2 (0.8-1.9)
Sociodemographic characteristics				
Age (Mean, SD)	37.4 (10.02)	37.1 (10.23)	37.8 (9.69)	1.1 (0.9-1.3)
Gender				
Men	343 (71.1%)	196 (66%)	147 (78.2%)	1.00 (ref)
Women	119 (24.6%)	86 (29.1%)	33 (17.5%)	0.5 (0.3-0.8)*
Married/Stable relationship	355 (73.5%)	225 (76.3%)	130 (69.1%)	0.7 (0.5-1.0)
No schooling/primary schooling only	388 (80.3%)	244 (82.7%)	144 (76.6%)	0.7 (0.4-1.1)
Current monthly income				
In paid activity	144 (31.4%)	71 (25.5%)	73 (40.3%)	2.0 (1.3-2.9)*
Receiving welfare benefits	199 (41.2%)	110(37.3%)	89 (47.3%)	1.5 (1.0-2.2)*
No income	162 (34.2%)	116 (40.4%)	46(25.9%)	0.5 (0.3-0.7)*
History of incarceration	256 (57.4%)	161 (60.1%)	95 (53.5%)	0.8 (0.5-1.1)
History of health diagnosis				
Physical health problems	105 (23.1%)	66 (24.0%)	39 (21.7%)	0.9 (0.6-1.3)
Sexually transmitted diseases	98 (32.2%)	58 (32.8%)	40 (31.5%)	0.9 (0.6-1.5)
Healthcare service utilisation in the past 12 months				
Emergency service due drug intoxication	130 (29.1%)	85 (30.9%)	45 (26.3%)	1.0 (0.7-1.3)
Inpatient in General Hospital	173 (36.5%)	112 (38.7%)	61(33.0%)	0.8 (0.5-1.5)
Received SUD treatment	139 (29.9%)	91 (32.3%)	47 (26.1%)	0.7 (0.5-1.1)
Inpatient treatment	78 (16.9%)	57 (20.2%)	21 (11.7%)	0.5 (0.3-0.9)*

Outpatient treatment	97 (20.7%)	59 (20.6%)	38 (20.7%)	1.0 (0.6-1.6)
Outreached	123 (26.3%)	77 (27.0%)	46(25.8%)	0.9 (0.6-1.4)
Desire to change				
Average scores (Mean, SD)	7.0 (3.4)	6.9 (3.4)	7.2 (3.4)	1.1 (0.9-1.3)
No desire (score 0)	41 (8.9%)	25 (8.8%)	16 (9.1%)	1.1 (0.9-1.3)
Low desire (scores 1 to 3)	44 (9.6%)	28(9.9%)	16 (9.1%)	
Moderate desire (scores 4 to 6)	92 (20.1%)	63 (22.3%)	29 (16.5%)	
High desire (scores 7 to 9)	91 (19.9%)	58 (20.6%)	33 (18.7%)	
Fully desire (score 10)	190 (41.0%)	108 (38.3%)	82 (46.5%)	

Note: Reported % of completed data

[1] Variables included in the latent class analysis; *p<0.05

3.3 Willingness to change and treatment history

Results of the univariate analysis in Table 3 suggested that for the Chronically Excluded class, greater scores in willingness to stop using drugs and initiate treatment were associated with receiving welfare benefits, attending an emergency department due to drug intoxication and have received treatment for SUD in the past 12 months. However, when looking at the type of SUD treatment received, only inpatient treatment remained statistically associated with greater scores in willingness to change. For both classes, the scores on willingness to change decreased for those from Fortaleza and increased for those who had a physical health problem. Differences in the mean scores on the willingness to change did not differ significantly across classes (t (482) =-1.1, p=0.869).

Table 3. Factors associated with willingness to quit and initiate treatment according to the latent class group

	Class 1 – Chronically Excluded		**Class 2 – Self Excluded**	
	Unadjusted OR (95%CI)	**Adjusted[1] OR (95%CI)**	**Unadjusted OR (95%CI)**	**Adjusted[1] OR (95%CI)**
ODS location (others = 0)				
Sao Paulo	1.5 (0.9-2.5)	1.5 (0.97-2.45)	1.5 (0.8-2.1)	1.5 (0.82-2.72)
Brasilia	1.6 (0.7-3.7)	1.8 (0.76-4.12)	2.2 (0.6-8.7)	2.1 (0.53-8.43)
Fortaleza	0.5 (0.3-0.8)*	0.5 (0.28-0.78)*	0.5 (0.3-0.9)*	0.5 (0.27-0.98)*
Sociodemographic characteristics (no = 0)				
Age	0.8 (0.7-1.1)	0.8 (0.67-1.07)	1.1 (0.8-1.5)	1.1 (0.8-1.5)
Gender (Men = 0)	0.9 (0.6-1.5)	1.0 (0.63-1.58)	1.1 (0.5-2.1)	1.0 (0.5-2.0)
Married/Stable relationship	0.8 (0.5-1.3)	0.7 (0.42-1.16)	0.8 (0.4-1.4)	0.7 (0.4-1.4)
No schooling/ primary schooling only	1.1 (0.6-1.8)	1.1 (0.63-1.92)	1.2 (0.6-2.2)	1.1 (0.6-2.1)
Current monthly income (no = 0)				
In paid activity	0.9 (0.6-1.5)	1.0 (0.62-1.68)	0.9 (0.5-1.6)	0.9 (0.5-1.7)
Receiving welfare benefits	1.6 (1.1-2.5)*	1.7 (1.10-2.67)*	1.3 (0.7-2.2)	1.2 (0.7-2.2)

No income	0.8 (0.5-1.2)	0.6 (0.37-1.04)	1.1 (0.6-2.1)	1.1 (0.6-2.4)
History of incarceration	1.1 (0.7-1.7)	1.1 (0.70-1.76)	1.1 (0.6-1.8)	1.1 (0.6-2.0)
History of physical health diagnosis (no = 0)				
Physical health problems	1.85 (1.1-3.1)*	2.04 (1.20-3.46)*	2.3 (1.1-4.8)*	2.5 (1.2-5.3)*
Sexually transmitted diseases	1.35 (.8-2.3)	1.47 (0.81-2.69)	1.6 (0.8-3.1)	1.6 (0.7-3.4)
Healthcare utilisation in the past 12 months (no = 0)				
Emergency service due drug intoxication	2.1 (1.3-3.4)*	1.91 (1.14-3.19)*	1.5 (0.8-1.8)	1.7 (0.8-3.3)
Inpatient in General Hospital	1.8 (1.2-2.9)*	1.86 (1.17-2.93)*	1.2 (0.7-2.2)	1.2 (0.6-2.1)
Received SUD treatment (no = 0)	2.1 (1.3-3.3)*	2.01 (1.3-3.4)*	1.0 (0.5-1.8)	0.9 (0.5-1.8)
Inpatient treatment (no = 0)	2.3 (1.3-4.1)*	2.4 (1.4-4.3)*	1.2 (0.5-3.0)	1.3 (0.5-3.1)
Outpatient treatment (no = 0)	1.5 (0.9-2.5)	1.5 (0.9-2.5)	1.1 (0.5-2.0)	1.0 (0.5-2.0)
Outreached services (no=0)	1.2 (0.7-1.9)	1.2 (0.7-1.9)	1.6 (0.8-2.9)	1.5 (0.8-2.9)

Note: [1]Adjusted by age, gender and location of the ODS. *p <.05

4. DISCUSSION

Our study replicates findings from studies conducted in different countries that point to the high marginalisation due to homelessness, poverty, mental health challenges and limited access to healthcare among PWUD in ODS[3,17,19] but add to the existing by pointing out that the degree of social exclusion vary and depend on a set of circumstances including prior and current history of street homeliness, frequency and length of time in the ODS. Furthermore, this study was able to identify latent class profiles of PWUD in ODS and the factors associated with their willingness to change. Two profiles were identified: *Chronically Excluded* and *Self Excluded.* The two profiles varied in gender, receipt of monthly income and inpatient SUD treatment. Levels of willingness to change were high and similar across profiles. However, we observed that, even though rates of physical health problems (including testing positive for STIs) and need for emergency care due to drug intoxication were similar among the two profiles, the rates of SUD inpatient treatment among the chronically excluded class were almost twice the rates among the self excluded profile. Higher levels of willingness to change were associated with accessing both inpatient SUD treatment and emergency departments for drug intoxication in the chronically excluded class. This finding aligns with the perception that individuals in this profile are better adapted to the ODS context. They tend to be more familiar with the available services and how to navigate them, especially when compared to PWUD who have arrived at the ODS more recently and may lack such awareness or adaptation.

Our findings show a high degree of willingness to change among participants to stop taking drugs and receive treatment, which was consistent across profile groups. Determining

whether this finding is representative of ODS is difficult because no comparable data exist in the literature. We do know however, that homelessness can be a motivating factor for the intention to stop taking drugs[40] and seeking SUD treatment.[41] To this point, more than half of our sample has not received treatment, yet among those who did, their willingness to change was positively influenced by this experience. This perspective is also confirmed by the higher associations of willingness to change with healthcare utilisation among the PWUD from the chronically excluded group, as they are more likely to have a history of homelessness before moving to the ODS.

The positive association between receiving welfare benefits and willingness to change have been seen elsewhere[58], and suggests that reach out interventions that can assist individuals on how to get public social support (i.e., welfare benefits) and access to health care, can increase the willingness to stop using drugs and initiate treatment among individuals in the chronically excluded class. While our study does not explore specific SUD treatment characteristics and outcomes, it might be that although these services have not directly altered individual drug behaviour, they might have fostered some elements of motivation. These elements could include the potential for reconnecting with society, which may be especially meaningful for those who are highly socially disconnected. The chronically excluded class in our study represent the most worrisome group from a social perspective as they represent a vulnerable population with long and more stable-term connections to the scenes. Their history of social deprivation is likely to both drive and reinforce their involvement in the ODS, perpetuating cycles of marginalisation and entrenching them further within the scenes. While both identified classes may be similarly disadvantaged and experiencing and causing similar harms, for individuals in the chronically excluded class, leaving the scenes and breaking the cycle of addiction might require a greater focus on interventions addressing broader social and structural issues. In this context, the first essential step for change may not involve drug treatment but rather ensuring meaningful pathways to socially reengage with society.[59,60] For instance, receiving public assistance might also enhance this group's feelings of reconnection.

Similarly, our findings suggest that emergency services can play a role in fostering social reconnection. These services are well-positioned to refer individuals to SUD treatment and social supports like housing and welfare resources. Emergency practitioners equipped to make referrals can have a significant impact on the substance use crisis. However, such referrals during crises like overdoses are sometimes viewed as burdensome or outside the

scope of practitioners' responsibilities.[61,62] Additionally, practitioners' stigma toward PWUD and associated interventions can delay timely referrals. Although directly changing these behaviours and views may be challenging, it is possible to increase practitioners' motivation and intention to make referrals.[63,64] To support this effort, we highlight the importance of training emergency practitioners on local resources and referral pathways for PWUD in ODS areas. Closer partnerships with services led by individuals with lived/living experiences may also enhance the development of these pathways.

In addition, we found that having another physical health problem was associated with a higher willingness to stop using drugs and initiate treatment in both classes. Such findings are aligned with previous literature suggesting that health problems and concerns can be an important motivator for seeking treatment[65]. For instance, over 80% of homeless adults in hospitals cited health concerns as motivation to stop taking drugs, with 73.4% mentioning a fear of death as a motivating factor.[41] No specific factor was found to be uniquely linked to a willingness to change in the self excluded class. This lack of specific predictors highlights the need for further exploration of different profiles within ODS populations. One potential factor to be explored is how family ties might motivate change and prevent those self excluded individuals from becoming homeless.

Lastly, PWUD in ODS in Fortaleza were more likely to report a lower desire to change than those in Sao Paulo and Brasilia across both profiles. While the reasons for this are unclear, it highlights the heterogeneity of PWUD in ODS and the importance of including different ODS to better understand this population.

4.1 Strengths and Limitations

Strengths of this study include the large sample size, the nature of the data that is both novel (we are aware of no other study using this method in this population) and representative of a population of PWUD in ODS. Some limitations should also be noted. First, 102 interviewed participants (15.0% of our sample) were excluded due to answering less than 20% of the questionnaire. Such attrition may have impacted our findings, which may not be representative of these individuals. Second, there is a lack of data on mental health disorders. This limitation is intrinsic to the nature of this study due to the restrictions in assessing these disorders while participants are either under the effect of drugs or experiencing abstinence syndrome. Third, given the cross-sectional nature of the study, temporal relationships and causal effects cannot be inferred. Fourth, data is based on self-

reported information, which is at risk of social desirability bias. For example, this may involve participants overreporting socially desirable traits, such as a history of treatment engagement or a willingness to change. Lastly, the measure used to assess willingness to change combined two concepts (to stop using drugs and initiate treatment). While both are important indicators of motivation, combining them may obscure differences between individuals who are ready to seek treatment but not necessarily prepared to cease use, or vice versa. This may limit the precision of the construct and affect the interpretation of the findings. Additionally, the scale has not been previously validated for PWUD and requires further evaluation.

5. CONCLUSION

This study identified two distinct profiles of Brazilians who use drugs in ODS. The findings underscore the critical importance of understanding the social connections within these populations and how these connections influence their willingness to change. For those who are chronically excluded, the initial step toward change may not necessarily involve drug treatment but rather the creation of meaningful pathways toward a fulfilling and socially integrated life. Furthermore, the results highlight the need to incorporate early interventions into primary healthcare services to ensure that windows of opportunity are effectively utilised by healthcare professionals across the national public healthcare system (SUS). Such efforts can prevent substance use problems from escalating to the point where PWUD are driven to ODS and significantly enhance the chances of recovery for both profiles identified in this study: the chronically excluded and the self excluded. Further research is necessary to ascertain whether willingness to stop using drugs and initiate treatment can impact actual behaviour change.

Declaration of generative AI and AI-assisted technologies in the writing process

During the preparation of this work the author(s) used Chat GPT in order to improve language. After using this tool/service, the authors reviewed and edited the content as needed and take full responsibility for the content of the published article.

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Declaration of interests

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Supplementary Table 1 Information about variables value, coding and number and percentage of missing values (N=483)

Variable	Value	Description of how was defined	Missing Values
Housing situation	Live at home = 0 / Homelessness = 1 / Street homelessness = 2	Homelessness: sleeping in shelter accommodation most days of the week	-
History of homelessness before ODS	No = 0 / Yes = 1		
Sleeping in the ODS most/all days of the week	No = 0 / Yes = 1	Live and sleep most days of the week or live but sleep sporadically in the week / spend days but never sleep or go to the ODS only to buy drugs	-
Length of time at ODS	Less than one year = 0 / One to four years = 1 / Five years or more =3	In years	-
Age		Years old	46 (9.5%)
Gender	Men = 0/Women =1		3 (0.6%)
ODS location	Sao Paulo/ Brasilia/ Fortaleza		
Married/Stable relationship	No = 0 / Yes = 1	Marital status	-
No schooling/primary schooling only	No = 0 / Yes = 1	Highest level of education attained	-
In paid activity	No = 0 / Yes = 1	currently in formal employment or involvement in remunerated work activity	10 (2.07%)
Receiving welfare benefits	No = 0 / Yes = 1		10 (2.07%)
No income	No = 0 / Yes = 1	No other form of income (e.g., work/military pension, rental, investments)/no paid work activity/ no welfare benefits to identify those with no income	10 (2.07)
History of incarceration	No = 0 / Yes = 1		37 (7.66%)
Physical health problems	No = 0 / Yes = 1	History of suffering from at least one of the following health conditions: diabetes, heart attack, problems with the liver or kidney, epilepsies, stroke, cerebral vascular accident and tuberculosis	25 (5.17%)
Sexually transmitted diseases	No = 0 / Yes = 1	History of been positively tested with at least one of the following conditions: HIV, syphilis, hepatitis B and/or C	179 (37.06%)
Emergency service due drug intoxication	No = 0 / Yes = 1		37 (7.66%)
Inpatient in General Hospital	No = 0 / Yes = 1		9 (1.83%)
Inpatient SUD treatment	No = 0 / Yes = 1	Psychiatric hospital, Therapeutic Communities	21 (4.35%)
Outpatient SUD treatment		Centro de Atencao Psicosocial (CAPS) Adult and Addiction	14 (2.90%)
Outreached	No = 0 / Yes = 1	Serviço Integrado de Acolhida Terapêutica II and III, Centro de Referência de Álcool, Tabaco e Outras Drogas (CRATOD), Hub de Cuidados em	16 (3.31%)

Willingness to change	0 (0, no willingness), 1(1-3, low willingness), 2(4-6, moderate willingness), 3(7-9, high willingness), and 10 (full willingness)	Crack e Outras Drogas, Sevicos de Atencao Especialisada (SAE) – HIV/Sexual Transmitted Infections	25 (5.18%)

Supplementary Table 2 Factors associated with willingness change according to the latent class group (models without imputed data)

	Class 1 Chronically Excluded		**Class 2 Self Excluded**	
	Unadjusted OR (95%CI)	**Adjusted* OR (95%CI)**	**Unadjusted OR (95%CI)**	**Adjusted* OR (95%CI)**
Sociodemographic characteristics				
Age	.85 (.68, 1.07)	.84 (.66, 1.07)	1.12 (.84, 1.50)	1.09 (.81, 1.48)
Gender (Male = 0)	.95 (.61, 1.48)	.66 (.14, 3.23)	1.08 (.56, 2.08)	.97 (.13, 7.20)
ODS location (others = 0)				
Sao Paulo	1.56 (.98, 2.49)	2.23 (1.30, 3.81)	1.42 (.79, 2.58)	1.78 (.93, 3.41)
Brasilia	1.54 (.61, 3.92)	1.77 (.76, 4.12)	4.43 (.90, 21.76)	3.81 (.76, 19.00)
Fortaleza	**.50 (.27, .93)***	**.45 (.26, .76)***	**.47 (.28, .78)***	.56 (.29, 1.08**)**
Married/Stable relationship	.75 (.46, 1.24)	.64 (.37, 1.12)	.72 (.39, 1.33)	.91 (.47, 1.75)
No schooling/primary schooling only	1.02 (.59, 1.77)	.99 (.54, 1.81)	1.18 (.63, 2.20)	1.06 (.54, 2.06)
Current monthly income				
In paid activity	.94 (.57, 1.54)	1.06 (.62, 1.82)	.89 (.50, 1.58)	.85 (.46, 1.55)
Receiving welfare benefits	**1.59 (1.03, 2.47)***	**1.62 (1.01, 2.64)***	1.28 (.74, 2.20	1.09(.61, 1.94)
No income	.76 (.49, 1.18)	.57 (.33, 1.01)	1.11 (.59, 2.09)	1.42 (.67, 3.03)
History of incarceration	1.08 (.69, 1.67)	1.07 (.75, 1.76)	1.06 (.61, 1.85)	1.09 (.59, 2.02)
History of physical health diagnosis				
Physical health problems	**1.75 (1.05, 2.92)***	**1.92 (1.09, 3.35)***	**2.33 1.14, 4.79)***	**2.42 (1.12, 5.24)***
Sexually transmitted diseases	1.43 (.67, 3.05)	1.47 (.81, 2.69)	1.49 (.72, 3.08)	2.61 (.98, 6.79)
Healthcare service utilisation in the past 12 months				
Emergency service due drug intoxication	**2.46 (1.04, 2.04)***	1.41 (.97, 2.09)	1.20 (.82, 1.78)	1.36 (.90, 2.06)
Inpatient in General Hospital	**1.86 (1.19, 2.91)***	**2.24 (1.36, 3.69)***	1.35 (.74, 2.46)	1.34 (.70, 2.58)
Received SUD treatment	**2.16 (1.35, 3.46)***	**2.09 (1.30, 3.37)***	.93 (.50, 1.75)	.94 (.50, 1.78)
Inpatient treatment	**2.43 (1.39, 4.26)***	**3.20 (1.67, 6.10)***	1.24 .52, 3.02)	1.16 (.41, 3.29)
Outpatient treatment	1.48 (.88, 2.51)	**2.01 (1.11, 3.65**)*	1.06 (.54, 2.09)	1.11(.53, 2.33)
Outreached services	1.23 (.77, 1.97)	1.26 (.76, 2.12)	1.57 .83, 2.95)	1.25 (.63, 2.49)

Note: [1]Adjusted by age, gender and location of the ODS. *p <.05