







# Intention to use PrEP among men who have sex with men and engage in chemsex: an international descriptive study

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## Abstract

**Background:** Pre-exposure prophylaxis (PrEP) is a valuable tool in the response to the HIV epidemic, recommended for groups with a higher risk of HIV infection, such as men who have sex with men (MSM), particularly in the context of high-risk sexual behavior such as chemsex.

**Purpose:** This study aimed to analyze the prevalence and factors associated with the intention to use PrEP among MSM who engage in chemsex in Brazil and Portugal.

**Methods:** This was a cross-sectional study of a secondary dataset from a larger study conducted between January 2020 and May 2021 throughout Brazil and Portugal involving 1852 MSM who engage in chemsex. An initial descriptive analysis was performed to calculate the absolute and relative frequencies of independent variables related to the intention to use PrEP among MSM. A multivariate regression model was developed to identify factors independently associated with the intention to use PrEP.

**Results:** Although a high level of PrEP knowledge (85.75%) was observed among MSM who engage in chemsex, the prevalence of intention to use PrEP was only 59.07%. Five variables were associated with a higher prevalence of intention to use PrEP [engaging in double penetration – adjusted prevalence ratio (aPR): 1.56, 95% CI: 1.44–1.69; being assigned female sex at birth – aPR: 1.34, 95% CI: 1.12–1.61; cruising – aPR: 1.21, 95% CI: 1.06–1.38; not using condoms – aPR: 1.20, 95% CI: 1.05–1.36; and being an immigrant – aPR: 1.16; 95% CI: 1.07–1.25], while having knowledge of postexposure prophylaxis (aPR: 0.91; 95% CI: 0.84–0.98), having a casual sexual partner (aPR: 0.86 and 0.85; 95% CI: 0.74–0.99 and 0.74–0.98), and engaging in group sex (aPR: 0.81; 95% CI: 0.73–0.90) were associated with a lower intention to use PrEP.

**Conclusion:** The intention to use PrEP among MSM who engage in chemsex was high, and several factors were associated with this intention. Understanding the factors associated with the intention to use PrEP among MSM practicing chemsex is crucial for developing targeted interventions to increase PrEP uptake in this population. The results of this study suggest that tailored approaches are necessary to promote PrEP use in this population.

**Keywords:** chemsex, global health, HIV, men who have sex with men, pre-exposure prophylaxis, sexual behavior

## Introduction

Chemsex is internationally defined as the use of drugs before and/or during sexual experiences with the intention of facilitating sex, intensifying,

prolonging sexual interactions, or even improving sexual experience.<sup>1,2</sup> Chemsex may include various traditional psychoactive substances such as ecstasy, mephedrone, crystal methamphetamine, cocaine,

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$\gamma$ -hydroxybutyrate (GHB), or  $\gamma$ -butyrolactone (GBL), as well as other substances with potential psychoactive effects recently discovered, such as ketamine and speed.<sup>3,4</sup>

The pattern of use and the substances chosen may vary according to country, age, and socioeconomic status of the population. For instance, in the United Kingdom, chemsex is predominantly linked to the use of substances such as mephedrone and GHB/GBL, whereas in the United States, methamphetamine tends to exhibit greater prevalence.<sup>5-7</sup> Furthermore, age is a pivotal determinant capable of influencing both the prevalence and the nature of substances used. Younger individuals may show an increased inclination to experiment with diverse pharmacological agents, while their older counterparts might prefer substances with which they are more familiar.<sup>8,9</sup>

There has been an exponential increase in the association between the practice of chemsex and the population of men who have sex with men (MSM) in both developed and developing countries.<sup>10-13</sup> There are a series of health risks associated with this practice, particularly vulnerability to sexually transmitted infections, including HIV. Two literature reviews confirm evidence of the association between chemsex and increased risk of HIV infection among MSM<sup>14,15</sup> due to susceptibility to engage in sexual practice that increase HIV risk that include barebacking, having multiple casual/occasional partners, group sex, challenging/complex sexual engagement (i.e. fisting, footing, double penetration, and cruising),<sup>11,16</sup> and lack of combined prevention.<sup>17</sup> Therefore, providing various forms of HIV prevention to the population that practices chemsex is necessary and urgent. Due to the demonstrated risk of HIV acquisition associated with chemsex, recent methamphetamine use has been included in the HIV incidence risk index for MSM (HIRI – Index), a risk calculator to assess the recommendation of pre-exposure prophylaxis (PrEP) use, and chemsex has been included as an eligibility criterion for PrEP in the provincial guidelines of Québec, Canada.<sup>18</sup>

PrEP for HIV traditionally consists of a combination of two antiretroviral medications, emtricitabine, and tenofovir disoproxil fumarate, which can be taken daily or as needed.<sup>19</sup> Daily PrEP is taken once a day, every day, regardless of whether you have sexual intercourse or not. On the on

demand option, two pills are taken 2h before sexual activity, followed by one pill 24h later and another 48h after.<sup>20</sup> In addition to oral PrEP, there's also injectable PrEP, which is a long-acting form of PrEP administered once every 8 weeks. Although it's not yet as widely available as oral PrEP, it's a promising new option for individuals who might find it challenging to take oral PrEP daily.<sup>21-23</sup>

PrEP is an essential component of combined HIV prevention and is highly effective in preventing virus acquisition when taken correctly as prescribed. Its use is crucial to achieving the Sustainable Development Goals (SDGs) and ending the AIDS epidemic by 2030.<sup>13</sup> However, the lack of acceptance of PrEP in subgroups at high risk for HIV, such as those who practice chemsex, may hinder its optimization in the fight against HIV.<sup>24-26</sup>

Evidence on how chemsex and the use of other drugs impact adherence to PrEP is limited and sometimes conflicting in the literature. Some studies suggest that the use of typical chemsex drugs is associated with low adherence to PrEP.<sup>27</sup> In contrast, other studies have failed to establish any association between the practice of chemsex and adherence to PrEP. These findings suggest that other factors, such as individual motivation and support from healthcare professionals, might play significant roles in determining adherence to PrEP.<sup>28,29</sup> From this perspective, the implications of the practice of chemsex on the adoption of more vulnerable sexual behaviors for HIV infection and how these factors influence decisions on prevention strategies still present important gaps.

Therefore, the aim of this study was to analyze the prevalence and factors associated with the intention to use PrEP among MSM practicing chemsex residing in Brazil and Portugal.

## Methods

### *Study design*

This study reports a cross-sectional secondary analysis of data collected in Brazil and Portugal involving MSM from January 2020 to May 2021. This original dataset was collected through the project 'In PrEP' by an international consortium of public universities.<sup>30</sup>

### *Population, sample, and eligibility criteria*

MSM aged over 18 years who had lived in Brazil or Portugal, either natives of these countries or immigrants from any of the following nine Portuguese-speaking countries: Angola, Brazil, Cape Verde, Equatorial Guinea, Guinea-Bissau, Mozambique, Portugal, East Timor, and Saint Thomas and Prince were eligible for this study. A sample size calculation was performed using the G\*Power software (version 3.1.9.7; G\*Power software, Heinrich Heine University Düsseldorf, Germany, 2020), considering the population of Brazilian and Portuguese men aged 18 years and over in both countries, with a presumed prevalence of outcome of 50% (aiming to maximize the sample and considering that this is a phenomenon for which there was still no prevalence data), a tolerable standard error of 3%, and a confidence level of 95%.

### *Data collection procedures*

Participants included in this study self-identified as cisgender or transgender men, had lived in Brazil or Portugal for at least 3 months, and had engaged in sexual intercourse with another man in the past 12 months. Tourists, participants with a known HIV diagnosis, and participants already using PrEP were excluded. A rigorous participant recruitment process has been described in previous research and used two combined and validated strategies for other populations.<sup>31–33</sup>

The first consisted of intentional ‘snowball’ sampling, with adaptations to the virtual environment.<sup>31,32</sup> In this method, we intentionally selected the first 30 participants, called ‘seeds,’ and defined different characteristics to improve the ability to generalize the findings, dividing them according to age group (young adults and older adults), region or district of residence in each country, self-identified skin color (standardized as White/non-White), income, and educational level.

Thus, the participants themselves helped recruit other individuals in similar situations through their social networks and contacts by sending them an invitation to participate. To identify the seeds, two of our cisgender and MSM researchers, properly trained and calibrated, created a public profile with an open photo on two of the most popular location-based dating apps (Grindr and Hornet) in both countries, and through direct chat with online users, sent each participant a hyperlink to participate in the research, also instructing them to invite

other MSM from their social network until the required sample size was obtained.

For standardization, each researcher approached the first available individuals online on each of the two dating apps that met the inclusion criteria, as recommended by previous studies,<sup>11,34</sup> to define the initial seeds. Given the subtle and often significant differences in terms, neologisms, and cultural nuances between the two studied countries, it was imperative to create two different forms to ensure the clarity and accuracy of the research data. This decision aimed to prevent misinterpretations and enhance the validity of the results. To ensure that the content and appearance of the survey truly resonated with the specific language and cultural nuances of both countries, we employed a method known as ‘face-content validation’, which involved:

- (1) Facial content validation with expert judges: In this phase, expert judges from each country were consulted to assess the survey. These judges had deep knowledge and experience on the research subject, as evidenced by their scientific output. Their role was to review the questions and format to ensure they were contextually accurate, culturally appropriate, and unambiguous. Feedback from these judges/experts led to refining the survey to better fit the linguistic and cultural context of each country.
- (2) Pretest with participants: After validation with expert judges, a pretest was conducted with a small sample – five participants from each country. This pretest served as a pilot phase, allowing real-time feedback from typical respondents. Pretest participants were asked to complete the survey and provide feedback on clarity, relevance, and any potential issues they encountered. Based on feedback from this phase, further refinements were made to ensure the survey was ready for broader distribution.

### *Data collection instruments*

The data collection form was divided into four sections. The first section was related to the social and demographic characterization of the participants. In the following sections, the variables related to sexual behavior and practices, perception of HIV risk, and knowledge about HIV prevention

methods, particularly postexposure prophylaxis (PEP), PrEP, and undetectable = untransmittable, were addressed. To assess the intention to use PrEP, we used the following sequence of questions: (1) Do you know about PrEP? (2) Have you used a PrEP regimen in the last 6 months? (3) If it were offered for free by your doctor, would you use PrEP? The last question was categorized as 'Yes', 'Maybe', or 'No'.

To define chemsex, participants were asked if they had consumed drugs immediately before and/or during sexual intercourse in the last 6 months.<sup>11,35</sup> For those who answered 'yes', they were asked to indicate the drugs consumed from a multiple-choice list. As there is still no universally accepted definition of which drugs make up the 'chemsex phenomenon',<sup>11,32,36,37</sup> as well as differences in consumption patterns between the countries in this study, we included the following illicit drugs: methamphetamine, amphetamine; mephedrone; poppers; GHB/GBL; crystal; cocaine; erectile dysfunction drugs; ketamine, and ecstasy.

To facilitate identification and distinction, some drugs were identified by other commonly used nomenclatures in the country. We also included an open category of 'other drugs' in which participants could specify the drug used if it was not included in the list provided, as suggested by other studies.

The subsequent practices were delineated drawing upon prior studies.<sup>30,32,38</sup>

- a. Double penetration (DP): The act of being simultaneously penetrated by two or more partners.
- b. Cruising: Voluntary and consensual anonymous encounters between men in public spaces such as parks, forests, beaches, or parking areas.
- c. Challenging/complex sexual engagement (CSE): Regular and simultaneous participation in two or three of the following practices: DP, fisting or footing, cruising, and group sex, determined by the specific circumstances in which they occur.
- d. Fisting or footing: Penetration using the hand formed into a fist or a foot, primarily in an anal context.

- e. Casual sexual partner: Occasional sexual partner with whom there is no prior familiarity or recurrence.

#### *Data analysis*

The data were organized in a Microsoft Excel spreadsheet and exported to the Statistical Package for the Social Sciences software, version 26.0 (SPSS Inc, Chicago, IL, USA) for statistical analysis. An initial descriptive analysis was conducted to calculate the absolute and relative frequencies of the independent variables related to the intention to use PrEP among MSM who engage in chemsex, such as sociodemographic and sexual behavior variables. A bivariate analysis was then performed using the Pearson chi-square test to select eligible variables for inclusion in the multivariate model, considering  $p < 0.20$ . Additionally, we calculated prevalence ratios (PRs) with their respective 95% confidence intervals (CIs) to measure the strength and direction of the association between the outcome and its explanatory variables. The PR was the chosen measure of association for our study because the frequency of the outcome of interest was  $>10\%$ . Thus, the use of odds ratios would tend to overestimate the strength of the associations.

To identify factors independently associated with the intention to use PrEP, we developed a multivariate regression model. All variables were tested for multicollinearity according to the parameters of tolerance coefficients and VIF (variance inflation factor). In addition to the statistical criteria for selecting variables investigated in the bivariate analysis ( $p < 0.20$ ), we also considered the theoretical relevance and best fit conditions for maintaining the variables in the final model. We adopted the generalized linear regression model of Poisson with robust variance estimation and log-linear link function to calculate adjusted PR (aPR) and their respective 95% CI. The Akaike Information Criterion, deviance, log-likelihood, omnibus test, and effect tests (Type III) were used as references for choosing the best-fitted model.

#### *Ethical considerations*

After completing the research, all participants received information on HIV prevention and had access to institutional websites to obtain



information on HIV/AIDS prevention. For those who expressed interest in using PrEP and provided their contact email, a list of centers capable of starting PrEP consultations in their state/region was sent.

## Results

We surveyed 8620 Portuguese-speaking MSM residing in Brazil and Portugal, of whom 2510 (29.12%) reported chemsex practice. Of these, 658 (26.21%) were excluded from the analysis as they were already using PrEP, since the study aimed to evaluate factors associated with intention to use PrEP among chemsex practitioners. Therefore, the final sample of the study consisted of 1852 participants (21.0%). The overall prevalence of intention to use PrEP was 59.07% ( $n=1094$ ). The characteristics of the study participants are described in Table 1. The sample was predominantly composed of cisgender men (96.65%), Brazilians (62.53%), residents in their country of origin (78.51%), young adults (77.0%), with education level of  $\geq 12$  years (74.46%), having casual/occasional sexual partners (67.66%), practicing receptive anal sex (38.07%), meeting  $\geq 2$  sexual partners through apps (45.03%), not disclosing their HIV serostatus on apps (86.18%), having  $\geq 2$  sexual partners in the last 30 days (48.16%), having undergone HIV testing in the last year (59.02%), having knowledge about PrEP (85.75%) and PEP (62.53%), not using condoms (88.34%), not engaging in group sex (66.74%), and not having had sex with an HIV+ partner (94.92%). Regarding CSE, half of the participants reported engaging in DP ( $n=926$ ).

In the bivariate analysis, of the 19 variables investigated, 5 were associated with a higher prevalence of intention to use PrEP ( $p < 0.05$ ): practicing DP [residing in Portugal (PR): 1.59; 95% CI: 1.46–1.72], practicing cruising (PR: 1.38; 95% CI: 1.20–1.57), having female sex assigned at birth (PR: 1.26; 95% CI: 1.06–1.50), being an immigrant (PR: 1.25; 95% CI: 1.15–1.35), and residing in Portugal (PR: 1.09; 95% CI: 1.01–1.17). On the other hand, engaging in group sex (PR: 0.81; 95% CI: 0.73–0.90) and having knowledge about PEP (PR: 0.91; 95% CI: 0.84–0.98) were associated with lower intention to use PrEP (Table 1).

In the multivariate analysis, 11 variables were included, but the final model consisted of 8 variables, adjusted by country of residence. After adjusting for confounding factors, five variables were associated with a higher prevalence of intention to use PrEP [DP – adjusted PR (aPR): 1.56, 95% CI: 1.44–1.69,  $p < 0.001$ ; assigned female at birth – aPR: 1.34, 95% CI: 1.12–1.61,  $p = 0.002$ ; cruising – aPR: 1.21, 95% CI: 1.06–1.38,  $p = 0.005$ ; not consistent use of condoms – aPR: 1.20, 95% CI: 1.05–1.36,  $p = 0.006$ ; and being an immigrant – aPR: 1.16; 95% CI: 1.07–1.25,  $p < 0.001$ ]. Conversely, having knowledge about PEP (aPR: 0.91; 95% CI: 0.84–0.98;  $p = 0.009$ ), having any type of casual sexual partner (aPR: 0.86 and 0.85; 95% CI: 0.74–0.99 and 0.74–0.98;  $p = 0.045$  and  $0.028$ ), and engaging in group sex (aPR: 0.81; 95% CI: 0.73–0.90;  $p < 0.001$ ) were associated with lower intention to use PrEP (Table 2).

## Discussion

The findings of our study allowed us to estimate the prevalence and identify the factors associated with the intention to use PrEP among a large sample of MSM practicing chemsex and residing in different continents (Americas and Europe). Understanding the behaviors and practices adopted by this population is fundamental for the planning of public policies for the prevention of HIV infection through the use of PrEP, as well as for healthcare professionals to offer patient-centered care, informed by evidence, with an empathetic and nonjudgmental approach to chemsex practitioners.

Although we observed a high level of knowledge about PrEP (85.75%) among MSM who practice chemsex, the prevalence of intention to use PrEP was relatively low (59.07%). In contrast to our findings, a 2018 study among Chinese MSM reported knowledge of PrEP by 50.9% of participants, of whom 84.9% expressed willingness to use it,<sup>39</sup> while a study conducted in Mexico reported a prevalence of PrEP knowledge of 81.3% with an intention to use of 34.2%.<sup>40</sup>

On the other hand, a study conducted among MSM in Benin reported a low prevalence of PrEP knowledge of 50.7%, with a prevalence of intention to use of 90%, higher than that found in our

**Table 1.** Bivariate analysis of factors associated with the intention to use PrEP among MSM who practice chemsex from Brazil and Portugal, 2021.

Variables	Intention to use PrEP				PR (95% CI)	p Value
	Yes (n = 1094)		No (n = 758)			
	N	%	n	%		
Social and demographic characteristics						
Biological sex						
Male [ref]	1060	96.89	745	98.28	1.26 (1.06–1.50)	0.010
Female	34	3.11	12	1.58		
Immigrant						
Yes	278	25.41	120	15.83	1.25 (1.15–1.35)	<0.001
No [ref]	816	74.59	638	84.17		
Age						
<35years	838	76.60	588	77.57	0.98 (0.89–1.07)	0.622
≥35years [ref]	256	23.40	170	22.43		
Education						
<9 years [ref]	15	1.37	6	0.79	–	–
9–12 years	296	27.06	156	20.58	0.917 (0.69–1.21)	0.917
≥12 years	783	71.57	586	77.31	0.79 (0.60–1.05)	0.795
Country of residence						
Portugal	432	39.49	262	34.56	1.09 (1.01–1.17)	0.029
Brazil [ref]	662	60.51	496	65.44		
Sexual partnerships						
Type of sexual partners						
Steady/usual [ref]	69	6.31	33	4.35	–	–
Casual/occasional	736	67.28	517	68.21	0.87 (0.75–1.00)	0.051
Steady + casual	289	26.42	208	27.44	0.86 (0.74–1.00)	0.053
Partners who had sex, mediated by dating apps in the last 6 months						
None [ref]	176	16.09	128	16.89	–	–
1	407	37.20	307	40.50	0.99 (0.88–1.11)	0.791
≥2	511	46.71	323	42.61	1.06 (0.95–1.18)	0.313

(Continued)

**Table 1.** (Continued)

Variables	Intention to use PrEP				PR (95% CI)	p Value
	Yes (n = 1094)		No (n = 758)			
	N	%	n	%		
Do you declare your HIV status on dating apps?						
Yes	147	13.44	109	14.38	0.97 (0.86–1.08)	0.570
No [ref]	947	86.56	649	85.62		
Number of partners in the last 30 days						
None [ref]	136	12.43	90	11.87	–	–
1	426	38.94	308	40.63	0.96 (0.85–1.09)	0.883
≥2	532	48.63	360	47.49	0.99 (0.88–1.12)	0.563
HIV testing in the last 12 months						
Yes	638	58.32	455	60.03	0.97 (0.90–1.05)	0.461
No [ref]	456	41.68	303	39.97		
Knowledge about PrEP						
Yes	932	85.19	656	86.54	0.96 (0.86–1.06)	0.402
No [ref]	162	14.81	102	13.46		
Knowledge about PEP						
Yes	660	60.33	498	65.70	0.91 (0.84–0.98)	0.017
No [ref]	434	39.67	260	34.30		
Sexual practices						
Preferred sex position						
Oral [ref]	28	2.56	31	4.09	–	–
Insertive	286	26.14	179	23.61	1.22 (0.93–1.61)	0.159
Receptive	372	34.00	251	33.13	1.26 (0.96–1.66)	0.103
Versatile	408	37.29	297	39.18	1.30 (0.98–1.71)	0.067
Consistent condom use (with all sexual intercourse) in the past 6 months						
Yes [ref]	116	10.60	100	13.19	1.11 (0.98–1.27)	0.106
No	978	89.40	658	86.81		
Group sex (three or more)						
Yes	208	19.01	208	27.44	0.81 (0.73–0.90)	<0.001
No [ref]	886	80.99	550	72.56		

(Continued)

**Table 1.** (Continued)

Variables	Intention to use PrEP				PR (95% CI)	p Value
	Yes (n = 1094)		No (n = 758)			
	N	%	n	%		
Engaged in sexual activity with an HIV+ person						
Yes	57	5.21	37	4.88	1.03 (0.87–1.21)	0.747
No [ref]	1037	94.79	721	95.12		
Engages in fisting/footing						
Yes	102	9.32	72	9.50	0.99 (0.87–1.13)	0.899
No [ref]	992	90.68	686	90.50		
Engages in cruising						
Yes	45	4.11	11	1.45	1.38 (1.20–1.57)	0.001
No [ref]	1049	95.89	747	98.55		
Engages in double penetration						
Yes	671	61.33	255	33.64	1.59 (1.46–1.72)	<0.001
No [ref]	423	38.67	503	66.36		

MSM, men who have sex with men; PR, prevalence ratio; PrEP, Pre-exposure prophylaxis.

**Table 2.** Multivariate analysis of factors associated with the intention to use PrEP among MSM who practice chemsex from Brazil and Portugal, 2021.

Variables	$\beta$	aPR	95% CI		p Value
			Lower	Superior	
Engages in double penetration	0.443	1.56	1.44	1.69	<0.001
Female biologic sex	0.294	1.34	1.12	1.61	0.002
Engages in cruising sex	0.191	1.21	1.06	1.38	0.005
Consistent use of condoms	0.179	1.20	1.05	1.36	0.006
Immigrant	0.150	1.16	1.07	1.25	<0.001
Knowledge on PEP	-0.098	0.91	0.84	0.98	0.009
Habitual and casual sexual partners	-0.153	0.86	0.74	0.99	0.045
Casual sexual partners	-0.156	0.85	0.74	0.98	0.028
Practicing group sex	-0.208	0.81	0.73	0.90	<0.001

Adjusted by country of residence. Omnibus test ( $p < 0.001$ ).  
aPR, adjusted prevalence ratio; CI, confidence interval; MSM, men who have sex with men; PrEP, pre-exposure prophylaxis.



study.<sup>41</sup> Finally, our results do not differ much from a systematic review and meta-analysis involving 156 articles with 228,403 MSM, in which the pooled proportions of MSM aware of PrEP and willing to use PrEP were 50.0% (95% CI: 44.8–55.2) and 58.6% (95% CI: 54.8–62.4), respectively.<sup>42</sup>

The differences in the prevalence values of intention to use PrEP are due to various factors such as sample size, type and diversity, geographic location, study period, and methods used to measure the intention to use PrEP.<sup>42,43</sup> Therefore, we included the country of residence as an adjustment variable in our final model since there are differences between the health systems in Brazil and Portugal that may result in different opportunities for access to PrEP and other methods of HIV prevention. Furthermore, a series of factors may affect this prevalence in a population such as awareness and knowledge of PrEP, perceived risk of HIV infection, access to services and health-care, as well as resources and cultural or social attitudes toward HIV, sexual health, and stigma related to prevention methods.<sup>30</sup>

In our population, it is important to consider the additional vulnerability marker related to ‘being a chemsex practitioner’, as this stigmatized behavior may hinder recruitment of participants for health services, censuses, and research studies, as well as influence their willingness to disclose information about their sexual behavior, making them more invisible.<sup>11,34,44,45</sup> On the one hand, there is a shortage of studies providing an analysis of how chemsex practice may influence the intention to use PrEP, as well as its relationship with physical, social, cultural, and sexual factors present in the affective and sexual relationships of MSM. On the other hand, existing research on this topic provides limited and often conflicting data.<sup>46–48</sup>

Contributing to this scenario, we identified a series of factors associated with a higher prevalence of intention to use PrEP among MSM practicing chemsex. Among social and demographic factors, two important markers of vulnerability, being a transgender man and being an immigrant, increased the prevalence of intention to use PrEP. Although they were a minority in our sample, individuals whose sex assigned at birth was female, that is, transgender men practicing chemsex, showed a higher prevalence of intention to

use PrEP. This finding is consistent with research conducted in Brazil in 2020 which suggests that being a transgender man is significantly associated with practicing chemsex, and that these individuals also have a higher inclination or intention to use PrEP.<sup>49</sup>

A series of factors may explain this finding. Firstly, transgender individuals are marginalized, vulnerable, and discriminated against, obtaining less social support, low psychological well-being, lack of access to resources and health services, and exposure to specific stressors in addition to daily stressors, leading them to greater involvement with drug use, including in a sexual context, as a coping mechanism.<sup>8,49</sup> Furthermore, it is usually difficult for trans people to access traditional sexual health services, leading to a greater need for self-efficacy to prevent themselves, as well as greater dependence on self-care, including the use of PrEP.<sup>8,49</sup>

Regarding the immigrant population, similar markers of vulnerability are identified. In general, immigrants may have a higher likelihood of engaging in high-risk sexual behaviors, including chemsex, due to factors such as social isolation, distance from health services, access to HIV prevention care, and economic vulnerability.<sup>46,50–52</sup> However, even in the face of these additional barriers to accessing health care and preventive measures, there are several studies indicating a greater awareness of the need for additional HIV prevention in immigrants, which increases their likelihood of seeking and accepting PrEP.<sup>25,47,48,53,54</sup>

Regarding sexual practices, DP and cruising were identified as factors that increased the likelihood of intention to use PrEP. These practices can be combined and are considered as Complex Sexual Behaviors, a term that refers to the intricate dynamics and specific circumstances in which they take place. These dynamics might pose additional risks for HIV and other sexually transmitted infections.<sup>30,38</sup>

However, studies<sup>11,30,38,54,55</sup> indicate that those who engage in these practices tend to have a greater perception/awareness of the risk of STIs due to increased exposure to bodily fluids and the potential for unprotected sex, which can lead to a greater intention to use PrEP. Additionally, a study by O’Halloran and collaborators<sup>47</sup> found

that positive attitudes toward PrEP were associated with regular use among MSM who engage in chemsex, regardless of specific sexual practices involved. Surprisingly, group sex was associated with lower prevalence for intention to use PrEP among individuals who engage in chemsex. This observation can be explained by the difference between group sex practices and DP and cruising practices. In the case of group sex, it is common for participants to negotiate beforehand about expectations regarding sexual acts and those involved,<sup>33,56</sup> which allows for greater discussion about the use or nonuse of condoms and, consequently, reduces the perception of the need for PrEP. This can be explained by the possibility that, during negotiations, participants establish their preferences and limits, thus reducing the risk of infection transmission.

Inconsistent condom use in all sexual relationships was also identified as a factor that may increase the intention of MSM who engage in chemsex to use PrEP. Among the possible explanations for this, the awareness of risk, the desire to minimize or mitigate the possibility of infection associated with recurring bareback sex, and the previous history of other STIs may lead individuals to healthcare services, sensitizing them to the importance of this strategy, and motivating them to consider the use of PrEP as a preventive measure.<sup>32</sup>

An unexpected finding in this study was that individuals with knowledge of PEP demonstrated a lower intention to use PrEP. Given that both are closely related prevention strategies, it was anticipated that familiarity with PEP would increase the intention to use PrEP. A likely explanation for this is that those who are aware of PEP may have already used it due to a past exposure. Individuals who have used PEP may hesitate to use another medication such as PrEP due to concerns about side effects or long-term health effects,<sup>57</sup> may not fully understand the difference between PEP and PrEP or may have misconceptions about how PrEP works or the stigma associated with the sexual behavior that led them to use PEP, influencing their intention to use PrEP.<sup>58,59</sup>

Finally, it is also surprising to find that having a casual partner decreases the likelihood of intending to use PrEP. In general, having multiple sexual partners increases the tendency to use PrEP due to the higher frequency of high exposure

sexual behaviors, which can lead individuals to perceive themselves at greater risk of acquiring HIV.<sup>56</sup> However, the literature points out that partner trust can influence this perception of risk, leading some MSM who have high trust in their partners to adopt prevention measures with little or no effectiveness, such as interrupted coitus, questioning the history of STIs, relying on the partner's physical appearance, or asking about serological status.<sup>30,32</sup> In addition, there is evidence that indicates that, although chemsex occurs more frequently with casual partners, these partners are not always unknown.<sup>11,34,60</sup>

This is due to the greater difficulty in finding partners who share the same type of drug for sex, which can create a sense of closeness and trust even with casual partners.<sup>32,56</sup> Access to health and support services is an important and facilitating factor for PrEP use among MSM who practice chemsex. This is partly due to the complexity of behaviors and sexual practices associated with chemsex, which can have negative impacts on individuals' quality of life, physical and mental health. In this sense, access to health and support services can help mitigate these risks and facilitate the use of PrEP among MSM who practice chemsex, as mental health services can provide support for dealing with issues related to mental health and drug use, as well as help develop effective strategies to reduce the risk of transmission of STIs, while consultations and counseling can provide information about PrEP, as well as prescribe and monitor adherence to treatment, which can increase the likelihood of PrEP use among individuals who practice chemsex.<sup>44</sup>

#### *Recommendations for the implementation of public policies*

In general, public policies should aim to create a supportive environment that encourages the acceptance of PrEP among the community of MSM who engage in chemsex. This can be achieved through a combination of health education strategies, harm reduction, peer support, stigma reduction, and public investments in increasing PrEP availability. Incorporating addiction services into the framework can address the intertwined challenges of drug use and HIV prevention. Additionally, offering integrated care that combines PrEP with other sexual health services such as testing and treatment for STIs may

increase PrEP acceptance among individuals who engage in chemsex.

Furthermore, providing PrEP to MSM who engage in chemsex can be seen as a global health priority as it aligns with the UN SDGs by contributing to the goal of ending the HIV epidemic and reducing the number of new infections; collaborating with the objective of ensuring universal health coverage, including access to essential medicines and vaccines; and promoting the right to health and well-being as a fundamental human right.<sup>61</sup>

### Limitations

Our research has limitations that must be considered. The observational design of the study did not allow us to identify possible causal relationships between independent variables and the intention to use PrEP. Using the ‘snowball’ methodology to reach the sample limited our results and does not allow for generalization to the general MSM population in these countries. The use of an electronic form limits the sample to MSM with higher income due to the need for access to a smartphone/computer and internet. The period during which the research was conducted, during the COVID-19 pandemic when isolation and social distancing measures were in place, may have affected the behavior of participants, as well as their willingness and intention to use PrEP.

### Conclusion

Although we observed a high level of knowledge about PrEP in our sample of MSM who engage in chemsex, the prevalence of intention to use it was relatively low. The main variables that increased the likelihood of PrEP use intention were related to sexual practices and sexual behaviors that increase risk of HIV acquisition. Additionally, the presence of social factors such as immigration and sex assigned at birth were also associated with a greater intention to use PrEP. On the other hand, behavioral factors such as knowledge about PrEP, having casual sexual partners, and engaging in group sex were associated with a lower intention to use PrEP.

These results highlight the importance of educational strategies aimed at sensitizing and educating MSM who engage in chemsex about the

importance of PrEP and its advantages, particularly in relation to sexual practices that pose a higher risk of HIV infection. Additionally, these findings have important implications for the formulation of global public health policies, as PrEP can be an important tool for reducing the incidence of HIV in high-risk groups. It is essential that governments and international organizations invest in public health policies that promote access to PrEP and other preventive technologies for MSM who engage in chemsex to reduce the global burden of the HIV epidemic.

### Declarations

#### *Ethics approval and consent to participate*

The study was approved by the Ethics Committee of the Ribeirão Preto School of Nursing, Brazil, under opinion number 4,163.084, and by the Research Ethics Board of the Institute of Hygiene and Tropical Medicine of the University of Lisbon, Portugal, with opinion number 12.19. Participants gave their free and informed consent online.

#### *Consent for publication*

Not applicable.

#### *Author contributions*

**Álvaro Francisco Lopes de Sousa:** Conceptualization; Writing – original draft; Writing – review & editing.

**Caíque Jordan Nunes Ribeiro:** Conceptualization; Investigation; Validation; Visualization; Writing – original draft; Writing – review & editing.

**Guilherme Reis de Santana Santos:** Conceptualization; Writing – original draft; Writing – review & editing.

**Layze Braz de Oliveira:** Conceptualization; Writing – original draft; Writing – review & editing.

**Emerson Lucas Silva Camargo:** Conceptualization; Visualization; Writing – original draft.

**Shirley Verônica Melo Almeida Lima:** Conceptualization; Writing – original draft; Writing – review & editing.

**Inara Viviane de Oliveira Sena:** Conceptualization; Data curation; Writing – original draft; Writing – review & editing.

**Márcio Bezerra-Santos:** Conceptualization; Writing – original draft; Writing – review & editing.

**Odinéa Maria Amorim Batista:** Conceptualization; Writing – original draft; Writing – review & editing.

**Anderson Reis de Sousa:** Methodology; Writing – original draft; Writing – review & editing.

**Isabel Amélia Costa Mendes:** Conceptualization; Data curation; Visualization; Writing – original draft.

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#### Competing interests

The authors declare that there is no conflict of interest.

#### Availability of data and materials

Available upon request to the corresponding author.

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