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# Is on-Demand HIV Pre-exposure Prophylaxis a Suitable Tool for Men Who Have Sex With Men Who Practice Chemsex? Results From a Substudy of the ANRS-IPERGAY Trial

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**Background:** Chemsex—the use of psychoactive substances during sexual encounters—among men who have sex with men is a growing concern. On-demand HIV pre-exposure prophylaxis (PrEP) may be a suitable tool to prevent HIV transmission among “chemsexers.” We used the open-label extension study of the ANRS-IPERGAY trial to describe chemsexers and their PrEP use.

**Methods:** Among the 361 men who have sex with men enrolled in ANRS-IPERGAY’s open-label extension study, we selected the 331

with available data on drug use. A 2-monthly web questionnaire on sociobehavioral data was used to compare sexual behaviors between questionnaires where chemsex was reported and those where it was not. Using a generalized estimating equation logistic regression, we studied whether practicing chemsex was associated with correct PrEP use.

**Results:** Among the 331 participants, 30% reported chemsex practice at least once during follow-up and were considered chemsexers. Chemsex was reported in 16% of all questionnaires. Chemsexers were not significantly different from nonchemsexers regarding sociodemographic characteristics, although they reported greater use of anxiolytics and more sensation-seeking. Reporting chemsex was associated with more high-risk sexual practices and a higher perception of risk. After adjustment for other potential correlates, chemsex remained associated with correct PrEP use [odds ratio (95% confidence interval) = 2.24 (1.37 to 3.66)].

**Conclusions:** Our findings show that chemsexers were more likely to report high-risk sexual practices but also had a higher perception of risk. They were also more likely to use PrEP correctly when practicing chemsex. Consequently, PrEP may be a suitable tool to reduce HIV-risk transmission among chemsexers.

**Key Words:** chemsex, PrEP, HIV, harm reduction, gay, prevention (*J Acquir Immune Defic Syndr* 2018;79:e69–e75)

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The ANRS-IPERGAY Study Team is listed in Appendix 1.

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## INTRODUCTION

In recent decades, the HIV epidemic in high-income countries has mainly been driven by men who have sex with men (MSM).<sup>1,2</sup> Results from research in France,<sup>3</sup> Asia,<sup>4</sup> and Africa<sup>5</sup> show a recent and rapid rise of recombinant HIV-1 subtypes among MSM, highlighting the need for new prevention strategies. This epidemiological evolution is also due to high-risk behaviors in this highly stigmatized population.<sup>6</sup> One of these behaviors is “chemsex,” which is characterized by the use of psychoactive substance in a sexual context.<sup>7,8</sup> It has been described in studies conducted in France<sup>9</sup> and more generally in Europe.<sup>10</sup> Chemsex is associated with several complications linked to drug use and sexual practices. The psychoactive substances used during sex parties [amphetamine-like substances (eg, methamphetamine, synthetic cathinones) and dissociative drugs (eg, ketamine, GHB/GBL)] enhance sexual arousal and

eroticism,<sup>11,12</sup> but are highly addictive and are associated with many negative consequences such as intoxication, as well as physical and psychological harm.<sup>13</sup> In addition, intravenous drug use before sex, a practice called “slamming,” leads to the additional risk of HIV and hepatitis C virus (HCV) infection and transmission.<sup>14</sup> With respect to associated sexual practices, MSM “chemsexers” (ie, those practicing chemsex) are more likely to have high-risk behaviors<sup>15,16</sup> in terms of sexually transmitted infections (STI), acute bacterial STI, rectal STI,<sup>17</sup> and HCV incidence<sup>18</sup> than nonchemsexers. One of these behaviors is the nonsystematic use of condoms. Moreover, regarding the use of psychoactive substances, it is known that stimulant use could have a negative impact on adherence to ART among HIV-infected individuals,<sup>19,20</sup> whereas HIV-negative MSM stimulant use is associated with suboptimal pre-exposure prophylaxis (PrEP) adherence.<sup>21</sup> All these consequences on adherence to ART could lead to a higher risk of HIV transmission during risky sexual practices, for example, during chemsex parties.

The ANRS-IPERGAY trial recently demonstrated the efficacy of on-demand HIV PrEP as a prevention tool for MSM.<sup>22</sup> Although the rate of MSM seeking post-exposure HIV prophylaxis who report chemsex is increasing,<sup>23</sup> no study has yet demonstrated that PrEP may be a suitable prevention tool in MSM chemsexers. We used the open-label extension (OLE) study of the ANRS-IPERGAY trial to describe chemsexers, their use of PrEP, and adherence to PrEP when practicing chemsex.

## METHODS

### Study Population

The ANRS-IPERGAY study was a double-blind randomized combined prevention trial conducted in France and Canada, which consisted in providing sexual activity-based PrEP to MSM to prevent HIV transmission. Briefly, the main inclusion criteria were as follows: HIV-negative males or transgender women having sex with men, aged 18 years or older, and at high risk of HIV acquisition (defined as unprotected anal sex with at least 2 different partners over the previous 6 months). The following PrEP dosage scheme was prescribed: 2 pills between 2 and 24 hours preceding a sexual encounter, followed by 1 pill 24 hours and another 48 hours after the first drug intake. Participants completed questionnaires at annual and biennial visits, which collected, respectively, data on participation and active attendance in community-based activities on prevention during the previous 12 months, together with psychosocial data, and data on sociodemographic and socioeconomic characteristics (age, educational level, and employment status). Participants also completed an online questionnaire every 2 months (follow-up), which collected data on sociodemographic characteristics, alcohol and recreational drug use, sexual behaviors, and PrEP adherence during their most recent sexual encounter. Molina et al (2015) provide a comprehensive description of the ANRS-IPERGAY trial’s methodology and results. In November 2014, all participants still being followed up (n = 336) were invited to voluntarily enroll in the OLE study of the ANRS-IPERGAY trial, which immediately followed the discontinuation of the

placebo-controlled randomized phase. As part of the OLE study, participants would have access to PrEP until its full approval by the French National Agency for Medicines and Health Products Safety (ANSM), which was set to occur before June 30, 2016 (in reality, full approval came in January 2016). Participants in the screening period (n = 33) who had not yet been randomly assigned were also eligible, as long as they met all the inclusion criteria for the double-blind trial. All participants in the OLE study (n = 361) provided oral informed consent, 353 (98%) of them also providing written informed consent.<sup>24</sup> Only the latter were retained for analysis. A total of 3046 questionnaires were available for analysis, accounting for 3450 visits. In July 2015, participants were asked to answer an additional section in the 2-monthly follow-up questionnaire, which addressed the use of an extended list of psychoactive substances during their most recent sexual encounter. This substudy included only retained participants in the OLE study with available data regarding their use of these psychoactive substances, during their most recent sexual encounter (n = 331, accounting for 1657 questionnaires).

## Variables

### Outcome: Correct PrEP Use During the Most Recent Sexual Encounter

Participants were asked about their use of PrEP in the hours preceding and/or following their most recent sexual encounter. According to their answers, a dichotomous outcome of self-reported “Correct PrEP use” was constructed. This variable was positive when participants used PrEP correctly (pills taken exactly as recommended by the protocol), in an acceptable fashion (at least one pill taken within 24 hours before and one pill within 24 hours after the sexual encounter), or when they overused PrEP (more pills taken than recommended by the protocol). The variable was negative when they did not take any pill (no pill taken within 48 hours before or 48 hours after the sexual encounter) or when they used PrEP in a suboptimal fashion (any other use of PrEP). An objective variable, based on pill counts during face-to-face interviews with care providers and an estimation of the number of taken pills per month since the previous follow-up visit, helped establish the robustness of this self-reported outcome.

### Explanatory Variable of Interest: Chemsex Practice During the Most Recent Sexual Encounter

Participants were asked about their use of psychoactive substances (ecstasy, cocaine, GHB/GBL, ketamine/Special K, and, as of July 2015, crack, heroin, methamphetamine-speed/crystal meth, LSD, or mephedrone/cathinone/PDPV/NRJ3/4MEC) during their most recent sexual encounter. Chemsex was defined as reporting to be under the effect of at least one of these substances during their most recent sexual encounter. The additional section of the follow-up questionnaire in July 2015 also collected information about whether or not participants had ever practiced “slamming,” ie, the injection of a psychoactive substance before sexual encounters, and if they had, about the frequency of slamming practices during the previous 2 months.

## Other Explanatory Variables

Data at the most recent annual and biennial visits (see above) were assessed by evaluating the consumption of psychotropic drugs (anxiolytics and antidepressants) during the previous 12 months, lifetime experience of depression, and participants' scores for the brief sensation seeking scale (BSSS-4).<sup>25</sup>

Data collected on sexual behaviors during participants' most recent sexual encounter included: type of partner (main partner, known or unknown casual partner, sex party); type of sexual practice (oral sex only, oral sex and/or insertive anal sex, oral sex and/or insertive anal sex and/or receptive anal sex); hardcore sexual practices (fisting, sadomasochistic practices, or other hard practices); high-risk HIV exposure (condomless anal sex or not); and HIV-risk perception (perceived level of risk using a 10-point visual scale).

## Statistical Analyses

Among the 331 participants of the study sample, those who reported chemsex and/or slamming in at least one follow-up visit were considered chemsexers. Bivariate analyses (comparing chemsexers with nonchemsexers) were performed to describe their sociodemographic, economic, and psychosocial characteristics at their most recent assessment, whereas sexual behaviors were compared between questionnaires reporting chemsex or not during the most recent sexual encounter.

To test whether chemsex was still associated with correct PrEP use even after adjustment for other potential correlates, univariable then multivariable logistic regressions were computed using a generalized estimating equation approach. Generalized estimating equation is a robust methodology that takes into account the intraindividual correlation of observations over time (here, self-reporting adherence to PrEP protocol during the most recent sexual encounter at each follow-up visit), thereby leading to greater precision in estimates of parameters and associated variances in the regression analyses.<sup>26</sup> Indeed, one of the main advantages of this model is that it accounts for the unknown correlation between outcomes when the data set has a longitudinal structure.<sup>27</sup> Potential correlates of correct PrEP use were tested for in the univariable analyses, including chemsex practice, sociodemographic, economic, and psychosocial characteristics at the most recent follow-up visit, and sexual behaviors at the most recent sexual encounter. Variables with a  $P$ -value  $\leq 0.25$  in the univariable analyses were considered eligible for the multivariable analysis, except for partner type, which although highly associated with correct PrEP use, was too closely correlated with practicing chemsex to be of use.

To test whether missing data on PrEP adherence at the most recent sexual encounter might have biased the estimations of the regression analyses, we used a 2-step Heckman model<sup>28</sup> adapted for longitudinal studies.<sup>29,30</sup> The first-stage equation applied to the whole sample of participants and was estimated as a random-effects probit model, to determine the factors associated with the absence of missing values regarding PrEP adherence. These factors included educational level, BSSS-4 and another sensation-seeking scale (SS2)

score at the most recent annual visit, active attendance in community-based or counseling activities on prevention during the previous 12 months, consumption of anxiolytics during the previous 12 months, having told someone about their participation in the IPERGAY trial, number of sexual encounters during the previous 4 weeks, and number of sexual partners during the previous 2 months. They also included—with respect to participants' most recent sexual encounter—HIV transmission risk perception, condomless anal sex, and sadomasochistic practices. In the second stage, we used the residuals of the first model to compute the inverse Mills ratio (IMR) and introduced this variable into the multivariable model (ie, factors associated with correct PrEP use). We used a random-effects probit model with bootstrapped standard errors (500 replications) to obtain normal-based bias-corrected 95% confidence intervals and  $P$ -values. The introduction of the IMR into the model allowed us to test and, if needed, to correct for any potential bias due to missing data.

In addition, to verify the robustness of our outcome, we tested for the bivariate association between correct PrEP use, based on self-reported PrEP adherence at the most recent sexual encounter, and the number of taken pills per month since the previous follow-up visit, based on clinical questionnaires.

All analyses were based on two-sided tests, with  $P \leq 0.05$  indicating statistical significance. A 2-step Heckman model was computed using Stata/SE 12.1 software for Windows (Stata Corp LP), whereas all the other analyses were conducted using SAS 9.4 software (SAS Institute, Cary, NC).

## RESULTS

### Characteristics of the Study Sample (Chemsexers Versus Nonchemsexers)

Among the 331 participants, the mean age was  $36 \pm 10$  years, 76% had a high-school certificate, and 86% reported being employed (Table 1). Ninety-five participants (29%) reported practicing chemsex during their most recent sexual encounter in at least one follow-up visit, and 24 (8%) reported having practiced slamming during the previous 2 months in at least one visit. Overall, 99 participants (30%) were considered chemsexers. Chemsexers were not significantly different from nonchemsexers regarding sociodemographic characteristics (Table 1). With respect to their psychological profile, they reported significantly more frequent consumption of anxiolytics during the previous 12 months ( $P \leq 0.001$ ) and had higher scores for the BSSS-4 sensation seeking scale ( $P \leq 0.001$ ).

### Description of Chemsex Practices

Chemsex was reported in 16% of all questionnaires (12% and 4%, respectively, with one and multiple partners) mainly involving the use of GHB/GBL (51%) and synthetic cathinones (46%) (Table 2).

**TABLE 1.** Sociodemographic, Economic, and Psychosocial Characteristics at the Most Recent Follow-up Assessment, Attendance at Counseling Activities, and Experience of Chemsex and/or Slamming (ANRS-IPERGAY OLE Substudy, n = 331 Participants)

Participants	All (N = 331)		Practiced Chemsex or Slamming at Least Once During Follow-Up				P†
	N	%	No (70%) N = 232		Yes (30%) N = 99		
Age (yr) (19; 61)—mean (SD)	331	36 (10)	232	36 (10)	99	36 (9)	0.79
Educational level							
≤High school	79	24	61	26	18	18	0.11
>High school	252	76	171	74	81	82	
Active employment							
No	45	14	31	13	14	14	0.85
Yes	286	86	201	87	85	86	
Consumption of anxiolytics during the previous 12 mo							
No	247	75	188	81	59	60	***
Yes	84	26	44	19	40	40	
Consumption of antidepressants during the previous 12 mo							
No	282	85	198	85	84	85	0.91
Yes	49	15	34	15	15	15	
Experienced depression in lifetime							
Yes, during the previous 12 mo	70	21	48	21	22	22	0.92
Yes, before	92	28	64	28	28	28	
Never	169	51	120	52	49	49	
BSSS-4 score at the most recent assessment (4; 20)—mean (SD)‡	321	12 (4)	226	11 (4)	95	13 (4)	***
Attended community- based activities on prevention during the previous 12 months							
No	205	61.93	144	62.07	61	62	0.94
Yes	126	38.07	88	37.93	38	38	

† $\chi^2$  tests for categorical variables, *t* test for continuous variables. \*\*\* $P \leq 0.001$ .

‡Ten missing values.

§Scale constructed according to (Stephenson et al, 2003).

**TABLE 2.** Characteristics of Chemsex Practices at the Most Recent Sexual Encounter (ANRS-IPERGAY OLE Substudy, n = 331 Participants, 1657 Questionnaires)

Follow-up Questionnaires	N = 1657	%
Chemsex at most recent encounter		
No	1400	85
Yes:	257	16
With one partner	195	12
With multiple partners	62	4
Psychoactive substances involved in chemsex at the most recent assessment (among 257 questionnaires)		
GHB/GBL	132	51
Mephedrone/cathinone/PDPV/NRJ3/4MEC	118	46
Cocaine	57	22
Ecstasy	38	15
Methamphetamine (speed/crystal meth)	36	14
Ketamine/Special K	14	5
Crack	5	2
Heroin	2	1
LSD	2	1

higher monthly pill consumption ( $P \leq 0.001$ ). Chemsex was also associated with more frequent receptive anal sex ( $P \leq 0.001$ ), with a higher risk of HIV exposure ( $P \leq 0.001$ ) and hardcore sexual practices ( $P \leq 0.001$ ), with a higher likelihood of casual partner(s) ( $P \leq 0.001$ ), and with a higher level of HIV transmission risk perception ( $P \leq 0.001$ ).

### Factors Associated With Correct PrEP Use

After multiple adjustment for other potential correlates and confounders, participants who practiced chemsex were significantly more likely to report correct PrEP use during their most recent sexual encounter [adjusted odds ratio (95% confidence interval) = 2.24 (1.37 to 3.66), Table 4]. Participants who reported attendance in community-based activities on prevention during the previous 12 months and those who had higher levels of HIV transmission risk perception were also more likely to report correct PrEP use. Although age, active employment, and condomless anal sex at the most recent sexual encounter were all significantly associated with correct PrEP use in the univariable analyses ( $P \leq 0.25$ ), this relationship was no longer significant in the multivariable analysis.

The results of the selection model showed no significant selection bias due to missing values regarding correct PrEP use at the most recent sexual encounter (IMR:  $\beta = 0.68$ ,  $P = 0.32$ ). Regarding the robustness of our outcome, correct PrEP use was significantly associated with higher monthly pill consumption ( $P \leq 0.001$ ).

## DISCUSSION

This is the first study to show that MSM reporting chemsex are almost twice as likely to use PrEP correctly as those who do not. In a context where chemsex among MSM is a growing concern and where harm reduction interventions

During follow-up, reporting chemsex during one's most recent encounter was significantly associated with a higher frequency of correct PrEP use ( $P \leq 0.001$ , Table 3) and with

**TABLE 3.** Bivariate Associations Between Chemsex and Other Sexual Behaviors at the Most Recent Sexual Encounter (ANRS-IPERGAY OLE Substudy, n = 331 Participants, 1657 Questionnaires)

At Most Recent Sexual Encounter:	Chemsex at the Most Recent Sexual Encounter						P†
	All (N = 1657)		No (84%)		Yes (16%)		
	N	%	N	%	N	%	
Type of partner							
Main partner	502	30	471	34	31	12	***
Casual partner	996	60	832	59	164	64	
Sex party	159	10	97	7	62	24	
Sexual practices‡							
Oral sex	239	15	218	<b>16</b>	21	8	***
Insertive anal sex and/or oral sex	554	34	505	<b>37</b>	49	20	
Receptive anal sex and/or insertive anal sex and/or oral sex	834	51	655	48	179	<b>72</b>	
High-risk HIV exposure: condomless anal sex§							
No	486	30	435	<b>32</b>	51	20	***
Yes	1142	70	943	68	199	<b>80</b>	
Hardcore sexual practices (eg, fisting, sadomasochistic practices)							
No	1458	89	1289	<b>93</b>	169	67	***
Yes	183	11	98	7	85	<b>33</b>	
HIV transmission risk perception (0; 10)—mean (SD)	1657	3 (3)	1400	3 (3)	257	<b>4 (3)</b>	***
Correct PrEP use¶							
No	435	49	395	52	40	31	***
Yes	451	51	363	48	88	69	
No. of pills taken per month since previous visit#							***
0 or missing data	345	21	298	<b>21</b>	47	18	
1–4	91	5	83	<b>6</b>	8	3	
5–9	205	12	187	<b>13</b>	18	7	
10–18	260	16	221	<b>16</b>	39	15	
19–25	285	17	237	17	48	<b>19</b>	
26–30	471	28	374	27	97	<b>38</b>	

†χ<sup>2</sup> test for categorical variables, *t* test for continuous variables. \*\*\**P* ≤ 0.001.

‡Thirty missing values.

§Twenty-nine missing values.

||Sixteen missing values.

¶Seven hundred seventy-one missing values.

#On the basis of clinical questionnaires.

Bold form means *P* ≤ 0.05.

are still lacking, PrEP could be effective in reducing HIV transmission among chemsexers. This result corroborates those of a recent online survey conducted in Australia among MSM showing that willingness to use PrEP was associated with reporting higher risk practices<sup>31</sup> and those of a study showing that PrEP adherence was higher among MSM and transgender women who reported more risk behaviors.<sup>32</sup>

As already seen in other studies,<sup>18,33</sup> we found that chemsex was associated with high-risk HIV exposure and hardcore sexual practices. However, it was also associated with higher HIV-risk perception. These results may explain why chemsexers are more likely to use PrEP correctly and suggests that tailor-made prevention strategies may be effective in this population.

We also found that exposure to community-based prevention interventions was associated with correct PrEP use. The role of community-based associations is crucial in delivering this preventive tool, and because undiagnosed HIV-infected MSM are more likely to seek access to PrEP,<sup>34</sup> this could be a great opportunity to also provide them with HIV screening.

Interestingly, chemsex was not associated with a specific sociodemographic profile in this population and may concern any MSM profile. This is relevant with respect to the possibility of future banalization of this practice, a sociological function that tends to manifest itself in all groups of MSM categorized by different types of recreational drug use<sup>35</sup> and that extends to very heterogeneous profiles of MSM.<sup>36</sup>

However, MSM who practice chemsex have a more vulnerable psychological profile because they are more likely to report consumption of anxiolytics. Chemsex mainly involves the use of psychostimulants, specifically cathinones and GHB/GBL, which are known to have a negative impact on mental health, especially with new psychoactive drugs.<sup>37</sup> A recent study conducted among users of new psychoactive substances showed that the main problems reported were depression and anxiety.<sup>38</sup> Furthermore, it has been shown that MSM who practice chemsex report experiencing discrimination because of their sexual orientation.<sup>39</sup> Stigma in MSM has also been associated with depressive and anxious symptoms.<sup>40</sup>

In addition, discrimination or “sexual minoritization” has been often associated with drug and alcohol use as an experimental response to social marginalization.<sup>41,42</sup> Interestingly, in our study, those who practiced chemsex had higher sensation-seeking scores. This is important because several recent qualitative studies have shown that motivations for practicing chemsex include pleasure, sensations, stamina, and other feelings that can enhance sexual experience.<sup>12</sup>

Because chemsexers not only face complications arising from their risky sexual practices, but also other intrinsic vulnerabilities, using PrEP to prevent HIV transmission may also be an interesting entry point for them to other prevention interventions and comprehensive care strategies. First, HCV incidence is high in this population and HCV recontamination appears to be a major issue.<sup>18</sup> Second, providing PrEP could be a way to offer HCV testing, new HCV treatments, and prevention messages regarding HCV risk practices. In addition, in MSM chemsexers, PrEP could act as a bridge for psychosocial follow-up, and constitutes a key element in a combined prevention strategy among high-risk MSM.<sup>43</sup>

Some study limitations have to be acknowledged. First, the data used came from the IPERGAY trial, which only selected MSM who reported HIV high-risk behaviors. Second, because those included were motivated to participate in the trial, they are not representative of the general

**TABLE 4.** Factors Associated With Correct PrEP use at the Most Recent Sexual Encounter (ANRS-IPERGAY OLE Substudy, n = 331 Participants, 1657 Questionnaires, Results From Generalized Estimating Equation Logistic Regressions)

At Most Recent Sexual Encounter	Correct PrEP use (Ref. No)†		
	Univariable (n = 886)		Multivariable (n = 882)
	Odds Ratio (95% Confidence Interval)	P	Adjusted Odds Ratio (95% Confidence Interval)
Age (19; 61)	1.01 (1.00 to 1.02)	0.11	1.02 (1.00 to 1.04)
Educational level (ref. ≤High school)		0.63	
>High school	1.11 (0.73 to 1.66)		—
Active employment (ref. No)		0.12	
Yes	1.52 (0.90 to 2.56)		1.31 (0.79 to 2.17)
Experienced depression in lifetime		0.26	
Yes, during the previous 12 mo	0.70 (0.44 to 1.11)		—
Yes, before	0.79 (0.51 to 1.21)		—
BSSS-4 score at the most recent assessment (4; 20)—mean (SD)	1.01 (0.98 to 1.03)	0.65	—
Attended community-based activities on prevention during the previous 12 months (ref. no)		*	
Yes	<b>1.56 (1.11 to 2.19)</b>		<b>1.57 (1.10 to 2.23)</b>
At most recent sexual encounter:			
Type of partner		***	
Casual partner	<b>4.88 (3.26 to 7.30)</b>		—
Sex party	<b>9.91 (5.28 to 18.60)</b>		—
Sexual practices (ref. Oral sex)		0.40	
Insertive anal sex and/or oral sex	1.14 (0.72 to 1.80)		—
Receptive anal sex and/or insertive anal sex and/or oral sex	1.32 (0.86 to 2.02)		—
High-risk HIV exposure: condomless anal sex (ref. no)		0.08	
Yes	1.34 (0.96 to 1.87)		1.01 (0.70 to 1.46)
HIV transmission risk perception (0; 10)	<b>1.06 (1.04 to 1.09)</b>	***	<b>1.18 (1.10 to 1.27)</b>
Chemsex (ref. no)		***	
Yes	<b>2.39 (1.52 to 3.77)</b>		<b>2.24 (1.37 to 3.66)</b>

\*P ≤ 0.05, \*\*\*P ≤ 0.001.

†Seven hundred seventy-one missing values regarding PrEP adherence at the most recent sexual encounter.

Scale constructed according to (Stephenson et al, 2003).

Bold form means P ≤ 0.05.

population of MSM. However, the population studied here may constitute the most suitable MSM subgroup for receiving PrEP to prevent HIV transmission. Third, our findings are based on self-reported data, which are known to be subject to desirability bias. However, in terms of drug use, it has been shown that self-reported questionnaires are reliable.<sup>44</sup> Moreover, regarding self-reported adherence, we used an objective measurement based on PrEP pill count, which we found to be associated with practicing chemsex, although it cannot be considered an exact measure of adherence. Finally, because of the high proportion of missing data, we had to use a Heckman model to test for potential selection bias. As the IMR was not significant, it means that our results are not biased by missing data on self-reported correct PrEP use.

To conclude, our findings showed that chemsexers are more likely to report high-risk sexual practices but also have a higher perception of HIV risk. Furthermore, they are also more likely to use PrEP correctly when practicing chemsex. Not only is PrEP a suitable tool to reduce HIV-risk transmission among chemsexers, it also provides a unique opportunity to concomitantly offer other prevention interventions in this key at-risk population.

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## APPENDIX 1. The ANRS-IPERGAY Study Team

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