Substance use in sexual context among Spanish resident men who have sex with men

Consumo sexualizado de drogas entre hombres que tienen sexo con hombres residentes en España

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Abstract

We analysed patterns of sexualized drug use (SDU) and pinpointed the one with the highest risk for the acquisition/transmission of HIV/Sexually Transmitted Infections (STIs) in a sample of men who have sex with men (MSM) residing in Spain. Additionally, we also identified the most affected subpopulations by highest risk SDU pattern. In 2016, we promoted an online survey in gay dating apps. We estimated the prevalence of several HIV/STI risk indicators for each identified SDU pattern. We built two different Poisson regression models identifying factors associated to the pattern associated with the highest risk. All analyses were carried out by HIV status. Of 2,883 MSM, 21.9% self-reported SDU in the last 12 months. All patterns of SDU were more frequent in HIV+ MSM. Of the four SDU patterns identified (*chemsex*, recreational drugs, sexual performance enhancing drugs, and cannabinoids), the most frequent was *chemsex* (21.9% in HIV+ vs 6.6% in HIV-). It also comprised the highest risk profile for HIV/STI. Among HIV-, *chemsex* was associated with living in a city of > 1,000,000 inhabitants, living sexuality in an open way and having been paid for sex, having had unprotected anal intercourse (UAI) in the

Resumen

Analizar los patrones de consumo sexualizado de drogas (CSD) e identificar cual es el de mayor riesgo para la adquisición/transmisión del VIH y de otras infecciones de transmisión sexual (ITS) en una muestra de hombres que tienen sexo con hombres (HSH) residentes en España. Adicionalmente, también se identifican las subpoblaciones más afectadas por el patrón de CSD de mayor riesgo. En 2016, se realizó una encuesta online en app de contacto gay. Se identificaron los patrones de CSD y se estimaron las prevalencias de varios indicadores de riesgo para el VIH/ITS para cada uno. Se construyeron dos modelos multivariantes de Poisson identificando factores asociados al patrón de mayor riesgo. Todos los análisis se realizaron en función del estado serológico frente al VIH. De 2883 HSH, el 21,9% refirió CSD en los últimos 12 meses. Todos los patrones de CSD fueron más frecuentes en los VIH+. De los cuatro patrones identificados (*chemsex*, drogas recreacionales, drogas para mejorar el rendimiento sexual y cannabinoides) el más prevalente y de mayor riesgo, fue el *chemsex* (21,9% en VIH+ vs. 6,6% en VIH-). En los VIH- el *chemsex* se asoció con: ciudad de residencia > 1 000 000 habitantes, vivir la sexualidad abiertamente, haber cobrado por tener sexo, haber

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Received: July 2019; Accepted: March 2020.

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last 12 months and having ever received an STI diagnosis. Among HIV+, it was associated with being 30-49 years old, having paid for sex, having had UAI and having been diagnosed with an STI in the last 12 months. Given its high prevalence, especially among HIV positive individuals, and its association with subpopulations with high-risk behaviour, *chemsex* could be playing a relevant role in the acquisition/transmission of HIV and other STIs.
Keywords: Men who have sex with men; *chemsex*; drug use; HIV; STI.

mantenido relaciones anales desprotegidas (RAD) en el último año y haber sido diagnosticado de una ITS. En los VIH+ se asoció con: tener 30-49 años, haber pagado por tener relaciones sexuales, haber tenido RAD y haber sido diagnosticado de ITS en el último año. Dada su elevada prevalencia especialmente en VIH+ y a que se observa fundamentalmente en poblaciones con perfiles de alto riesgo, el *chemsex* podría estar jugando un papel relevante en la adquisición y/o transmisión del VIH y otras ITS.
Palabas clave: Hombres que tienen sexo con hombres; *chemsex*; consumo de drogas; VIH; ITS.

In some Western countries, the use of illicit drugs has been reported to be higher among men who have sex with men (MSM) and other sexual minority populations than that reported by the general population (Caputi, Smith, Strathdee & Ayers, 2018; Gómez-Gil et al., 2019; Lawn, Aldridge, Xia & Winstock, 2019) and is a recognized concern especially when it occurs in sexual contexts because it could be a driver of riskier sexual risk behaviour.

Drugs have been taken in sexual contexts for centuries but half a decade ago, "chemsex" rose as a phenomenon that has since caught the attention of both the community and the academia. This phenomenon grew in parallel with geo spatial networking apps that facilitate access to sexual activities involving chemsex drugs as well as the acquisition drugs easily and on demand (Dolengevich-Segal, Rodriguez-Salgado, Bellesteros-Lopez & Molina-Prado, 2017; Winstock, 2015). Although definitions vary, there is certain consensus that chemsex involves the use of mephedrone, GHB/GBL (Gamma hydroxybutyrate/Gamma butyrolactone) and/or methamphetamine (Abdulrahim, Whiteley, Moncrieff & Bowden-Jones, 2016; Edmundson et al., 2018; Redondo-Dominguez, Picazo, Docavo-Barrenechea-Moxo & Gonzalez Del Castillo, 2018). These drugs enhance and prolong sexual encounters by increasing arousal, stamina and pleasure (Frankis & Clutterbuck, 2017).

A number of studies have associated chemsex with high risk sexual behaviours (Daskalopoulou et al., 2014; Glynn et al., 2018; Gonzalez-Baeza et al., 2018; Hammoud et al., 2018; Ottaway et al., 2017; Pufall et al., 2018; Sewell et al., 2017; Weatherburn, Hickson, Reid, Torres-Rueda & Bourne, 2017), diagnosis of sexually transmitted infections (STI) (Carey et al., 2009; Glynn et al., 2018; Gonzalez-Baeza et al., 2018; Hegazi et al., 2017; Ottaway et al., 2017; Pakianathan et al., 2018; Pufall et al., 2018; Rosinska et al., 2018; Sewell et al., 2017; Tomkins, George & Kliner, 2018), injecting drug use (Hegazi et al., 2017; Pakianathan et al., 2018; Rosinska et al., 2018) and has been reported to be especially common among HIV positive individuals (Carey et al., 2009; Daskalopoulou et al., 2014; Edmundson et al., 2018; Hammoud et al., 2018; Melendez-Torres et al., 2018; Pakianathan et al., 2018; Rosinska et al., 2018; Schmidt et al., 2016). Some authors have also suggested that chemsex could interfere with patients' adherence to highly active antiretroviral therapy among those who live with HIV (Bracchi et al., 2015). This could also be the case for those taking pre-exposure prophylaxis. As a consequence of all the above, it could be an important driver of the HIV and other STIs epidemics (McCall, Adams, Mason & Willis, 2015). Additional negative outcomes include increased risk of overdose deaths by GHB/GBL (Corkery, Loi, Claridge, Goodair & Schifano, 2018; Hockenhull, Murphy & Paterson, 2017), and mental health problems (Gonzalez-Baeza et al., 2018; Hirshfield et al., 2015; Kirby & Thornbern-Dunwell, 2013; Pakianathan, Lee, Kelly & Hegazi, 2016; Prestage et al., 2018; Pufall et al., 2018). In Europe, most of the studies about chemsex have been carried out in the UK but, in other European countries it is largely under-researched. The few studies we have found are focused on populations recruited in very large urban areas and in clinical settings (Glynn et al., 2018; Gonzalez-Baeza et al., 2018; Rosinska et al., 2018).

Additionally, the assessment of Sexualized Drug Use (SDU) has mostly been restricted to chemsex. The use that MSM make of other illicit drugs in sexual contexts is unknown (Knight, 2018). There are very few studies that have assessed the particular configurations of sexualized substance use other than chemsex. Thus, the existence and the magnitude of other SDU patterns remains unknown and we also do not know if they have distinct behavioural risk profiles.

In the present study, we identify the different patterns of SDU reported by a sample of online recruited MSM resident in Spain, quantify their size by HIV serostatus and describe the prevalence of several sexual risk behaviours, HIV infection and history of STI diagnosis. We also perform two multivariate analysis in MSM HIV positive and of HIV negative or unknown serostatus to identify subpopulations more affected by chemsex.

Methods

Between April and December 2016, we performed an online cross-sectional survey in 8 European countries (Belgium, Denmark, Germany, Greece, Portugal, Romania,

Slovenia and Spain). The analysis of the present paper is restricted to participants recruited in Spain.

Data collection instrument

We designed an online questionnaire that included sections assessing sociodemography, sexual risk behaviours, testing history for HIV, HIV serostatus, STI history and SDU. The latter included our main outcome that was assessed with the following question: *In the LAST 12 MONTHS, have you taken recreational drugs immediately preceding and/or during sex?* Those who answered "yes" were asked to select the drugs used from a list of drugs that included: Mephedrone/Methylone, Methamphetamine, Cocaine, Ecstasy/MDMA, Ketamine, GHB/GBL, Amphetamines, Poppers, Viagra, and Cannabis. We also included an open ended "other drugs" category where participants were able to specify what drug they used if they felt it was not included in the list provided.

The survey was anonymous and confidential. No variables allowing personal identification were collected. The study was approved by the Researchs Ethics Committee of the Institute of Health Carlos III (CEI PI52_2015-v2) and the Hospital Germans Trias i Pujol (CEI PI-14-106).

Recruitment procedures and inclusion/exclusion criteria

Participants were invited to participate through mailing lists, personal messages and promotional banners distributed mainly through gay dating websites but also in gay oriented websites and Facebook events. Those who decided to click on the study banner or link were directed to a screen where they were informed about the aim and content of the survey. To participate, the participants needed to click on the "I have read and understood the above information, in the country I live in I am old enough to legally have sex and I want to participate" box. No retribution was offered to participants in exchange for participation. More details of the questionnaire and the recruitment procedures can be found elsewhere (Hoyos et al., 2017).

Initially, we included MSM who were male at birth, >=18 years of age and who reported having lived in Spain for most of the last 12 months (N=4,123). For the present analysis, we excluded 1,240 who did not answer the question assessing our main outcome (main characteristics can be found as additional information). Thus, our final sample was comprised by 2,883 MSM.

Statistical analysis

We first performed a descriptive analysis of the main characteristics of our sample stratifying it in three groups according to their self-reported HIV serostatus and previous testing history: never tested, last HIV test with a negative result (hereafter HIV negative) and HIV positive.

Table 1. Additional information. *General characteristics of excluded participants due to missing data in the question assessing Sexualised Drug Use (N=1,240).*

	N = 1240	
	n	%
Age		
‹ 29	415	33.5
30-39	350	28.2
40-49	303	24.4
› 50	172	13.9
Place of birth		
Spain	1085	87.5
Latin America	46	3.7
Europe and other countries	94	7.6
Number of inhabitants in place of residence		
≥ 1 000 000	435	35.1
500.000-999.000	123	9.9
50.000-499.999	406	32.7
‹ 50 000	267	21.5
Education		
No university education	605	49.0
University education	629	51.0
Lives sex life with men...		
Openly	450	36.3
Not openly	789	63.6
Sex of sex partners (ever)		
Only men	704	56.8
Mainly men	293	23.6
Equally or less with men	243	19.6
HIV Serostatus/ Testing history		
Never tested	374	30.2
Last HIV test negative › 12 months	264	21.3
Last HIV test negative ≤ 12 months	410	33.1
HIV positive	41	3.3

Differences were assessed using the chi-square test for categorical variables.

Secondly, we described the different patterns of SDU. To do so, substances were categorized into 3 groups: 1) sexual performance enhancing drugs: poppers (amyl nitrites) and erectile dysfunction medications, 2) party drugs: ecstasy, cocaine, amphetamine and ketamine 3) chemsex drugs: mephedrone, methamphetamine, GHB/GBL. Cannabis was treated independently.

Based on these 3 groups and the use of cannabis, we created a 5 mutually-exclusive category variable to reflect relevant patterns of SDU: 1) No drugs, 2) ONLY cannabis, 3) Sex performance enhancing drugs and/or cannabis use, 4) Presence of party drugs but no chemsex drugs (with or without cannabis or sex performance enhancing drugs use), 5) Presence of chemsex drugs (with or without the presence of the rest of drugs).

For each pattern we estimated the prevalence of several sexual risk indicators during the last 12 months: having given money or any kind of goods for sex (has paid for sex hereafter), having received money or other goods in exchange for sex (has been paid for sex hereafter), having received an STI diagnosis and having had ≥ 5 unprotected anal intercourses (UAI). This analysis was stratified by testing history/HIV serostatus: 1) participants with a self-reported HIV positive serostatus and 2) HIV negative/never tested individuals.

Two multivariable Poisson robust variance regression models were built to identify engagement in chemsex: one for HIV negative/never tested individuals and the other one for HIV positive. For each model, we calculated both crude and adjusted Prevalence Ratios (cPR and aPR) and 95% Confidence Intervals (CI95%). Variables with a significance level of <0.20 in the single variable analysis were introduced in each multivariable model. We used the Akaike information criteria values to perform model comparisons and select the optimal model.

Results

Main characteristics of the sample

The main characteristics of the participants by testing history and HIV serostatus can be found in table 2.

Of the 2,883 MSM included in the analysis, 22.8% had never been tested for HIV, 64.7% reported that their last test was negative and 12.5% that it was positive. Some 61.3% were under 40 years of age (76.7% among never tested MSM (p<0.001)). Some 87.6% had been born in Spain although among HIV+ participants we observed a higher proportion of Latin Americans (13.1%; p<0.001) (table 2).

Some 32.4% lived in cities ≥ 1.000.000 inhabitants, with never testers presenting a lower proportion (21.5%). Over half had finished university studies (57.1%) and had a comfortable economic situation (59.1%). Among HIV positive individuals, 61.1% reported living their sexuality openly vs. 47.9% among HIV negative individuals and 23.9% in never testers (p<0.001). Some 61.3% reported having ever had sex exclusively with men (table 2).

Regarding sexual risk behaviours, HIV positive MSM reported more frequently having paid (p <0.001) or being paid for sex (p<0.002) than the other two groups. The proportion of HIV positive participants that reported having had >5 UAI in the last 12 months (30.3%) was also higher than in the other two groups (p<0.001); as well as having been diagnosed with an STI (26.7%; p<0.001) (table 2).

Overall, the proportion of SDU in the previous 12 months was of 21.9% and was higher among HIV positive MSM (45.1%) than in HIV negative (21.9%) or never testers (9.1%) (p<0.001). The most frequent pattern of SDU was the one comprised by chemsex associated substances (7.5%) which was higher among HIV positive (21.9%) than among HIV negative (6.6%) and never tested (2.1%). In fact, in the other two groups, the most frequent SDU pattern was the one comprised by sexual performance enhancing drugs (table 2).

Prevalence of drug use in the last 12 months by type of SDU pattern

Poppers were the commonest substance (17.1%) and it was used by almost all those included in the sex performance enhancing drugs pattern (98.1%); those who reported using party drugs but no chemsex drugs (68.6%) and those using chemsex drugs (85.7%). Of all party drugs, cocaine was the most frequently reported substance (9.1%). It was used by 79.7% of those who used party drugs but no chemsex drugs and by 64.8% of those included in the chemsex pattern. Finally, GHB/GBL was the commonest chemsex drug (5.6%) and it was reported by 74.1% of those included in the chemsex pattern (table 3).

Sexual risk behaviours and STI diagnosis by SDU pattern and HIV serostatus

The prevalence of all three sexual risk behaviours assessed (having been paid for sex, having paid for sex and ≥ 5 UAI) as well as of STI diagnosis in the last 12 months, was higher among HIV positive (Figure 1). The pattern was very similar in both serostatus groups; with comparable prevalence of all indicators assessed among those reporting no SDU and cannabis users which gradually grew peaking in the chemsex group (p<0.001) (Figure 1).

Factors associated with chemsex

In the multivariable analysis for HIV negative/never tested individuals, chemsex was independently associated with living in a city of ≥1,000,000 inhabitants (aPR 1.6; CI95% 1.2-2.3), living sex life openly (aPR 1.5; CI95% 1.1-2.1), having been paid for sex in the last 12 months (aPR 3.5; CI95% 2.3-5.2), having had 1-4 (aPR 1.7; CI95% 1.1-2.6) or ≥ 5 UAI (aPR 4.5; CI95% 2.7-7.6) in the last 12 months and having been diagnosed with an STI >12 months or <12 months ago (aPR 2.1; CI95% 1.5-3.1; aPR 2.1; CI95% 1.3-3.3, respectively). Among HIV positive MSM chemsex was associated with being between 30-39 years of age (aPR 2.3; CI95% 1.2-4.5) or 40-49 (aPR 2.2; CI95% 1.1-4.2); having

Table 2. *General characteristics of the study participants by sexualized drug use, during last 12 months, in Spain.*

	Never tested		HIV negative		HIV positive		Total		chi square *p*-value
	N = 657 22.8%		N = 1865 64.7%		N = 361 12.5%		N = 2883 100%		
	n	%	n	%	n	%	n	%	
Age									‹ .001
‹ 29	351	53.4	498	26.7	65	18.0	914	31.7	
30-39	153	23.3	579	31.0	121	33.5	853	29.6	
40-49	95	14.5	497	26.6	98	27.1	690	23.9	
› 50	58	8.8	291	15.6	77	21.3	426	14.8	
Place of birth									‹ .001
Spain	611	93.3	1609	87.1	284	79.3	2504	87.6	
Latin America	26	4.0	146	7.9	47	13.1	219	7.7	
Europe and other countries	18	2.8	92	5.0	27	7.5	137	4.8	
Number of inhabitants in place of residence									‹ .001
≥ 1 000 000	141	21.5	652	35.0	140	38.8	933	32.4	
500.000-999.000	60	9.1	211	11.3	44	12.2	315	10.9	
50.000-499.999	249	37.9	625	33.6	104	28.8	978	34.0	
‹ 50 000	207	31.5	374	20.1	73	20.2	654	22.7	
Education									‹ .001
No university education	345	52.7	712	38.2	176	48,9	1233	42.9	
University education	310	47.3	1150	61.8	184	51.1	1644	57.1	
Economic status									.012
Comfortable	370	57.5	1115	60.8	184	52.7	1669	59.1	
Uncomfortable	273	42.5	718	39.2	165	47.3	1156	40.9	
Lives sex life with men...									‹ .001
Openly	157	23.9	892	47.9	220	61.1	1269	44.0	
Not openly	500	76.1	972	52.1	140	38.9	1612	56.0	
Gender of sex partners (ever)									‹ .001
Only men	393	59.8	1136	60.9	237	65.7	1766	61.3	
Mainly men	105	16.0	567	30.4	113	31.3	785	27.2	
Equally or less with men than women	159	24.2	162	8.7	11	3.1	332	11.5	
Has paid or given any kind of goods in exchange for sex (last 12 months)	31	4.7	162	8.7	38	10,6	231	8.0	‹ .001
Has received money or other goods in exchange for sex (last 12 months)	31	4.7	110	5.9	36	10.1	177	6.2	.002
Number of unprotected anal intercourses (last 12 months)									‹ .001
None	312	47.8	687	37.2	121	34.0	1120	39.2	
1	205	31.4	604	32.7	59	16.6	868	30.4	
2-4	97	14.9	370	20.0	68	19.1	535	18.7	
≥ 5	39	6.0	188	10.2	108	30.3	335	11.7	
History of sexually transmitted infections diagnosis (ever)									‹ .001
No STI diagnosis	580	89.6	1036	56.1	98	27.8	1714	60.2	
STI diagnosis › 12 months ago	53	8.2	607	32.9	160	45.5	820	28.8	
STI diagnosis in the last 12 months	14	2.2	204	11.0	94	26.7	312	11.0	
HIV serostatus/ testing history									
Never tested	657	100.0					657	22.8	
Last HIV test negative › 12 months			666	35.8			666	23.1	
Last HIV test negative ≤ 12 months			1194	64.2			1194	41.5	
HIV positive					361	100.0	361	12.5	

Table 2 (cont.). *General characteristics of the study participants by sexualized drug use, during last 12 months, in Spain.*

	Never tested		HIV negative		HIV positive		Total		chi square *p*-value
	N = 657		N = 1865		N = 361		N = 2883		
	22.8%		64.7%		12.5%		100%		
	n	%	n	%	n	%	n	%	
Time since HIV diagnosis									
≤ 3 months					136	37.8			
4-6 months					66	18.3			
7-12 months					30	8.3			
1-2 years ago					34	9.4			
2-5 years ago					33	9.2			
›5 years ago					61	16.9			
Pattern of sexualized drug use									‹ .001
No drugs	597	90.9	1457	78.1	198	54.9	2252	78.1	
ONLY cannabis	10	1.5	36	1.9	10	2.8	56	1.9	
Sex performance enhancing drugs (1)*	19	2.9	140	7.5	47	13.0	206	7.2	
Party drugs (2) but NO chemsex drugs (3)**	17	2.6	109	5.8	27	7.5	153	5.3	
Chemsex drugs with or without party drugs**	14	2.1	123	6.6	79	21.9	216	7.5	

Note.
(1) Sex performance enhancing drugs: poppers, erectile dysfunction medications.
(2) Party drugs: ecstasy, cocaine, amphetamine, ketamine.
(3) Chemsex drugs: mephedrone, methamphetamine, GHB/GBL.
*Independently if they have used cannabis.
**Independently if they have used cannabis, poppers or erectile dysfunction medications.

Table 3 . *Prevalence and kind of drugs used for sex in the last 12 months, by pattern of sexualized drug use, in Spain.*

	TOTAL	ONLY cannabis	ONLY Sex performance enhancing drugs (1)*	Party drugs (2) but NO chemsex drugs (3)**	Chemsex drugs with or without party drugs**
		1.9%	7.2%	5.3%	7.5%
	N = 2883	N = 56	N = 206	N = 153	N = 216
	(%)	(%)	(%)	(%)	(%)
Cánnabis	10.7	100.0	38.4	48.4	46.3
Sexual performance enhancing drug	17.7				
Poppers	17.1		98.1	68.6	85.7
Erectile dysfunction medications	7.1		15.1	26.1	62.0
Party drugs	11.0				
Ecstasy	3.9			22.9	35.2
Cocaine	9.1			79.7	64.8
Amphetamine	3.2			20.3	28.7
Ketamine	2.3			8.5	24.1
Chemsex drugs	7.5				
Mephedrone	3.4				45.8
Methamphetamine	3.0				40.3
GHB/GBL	5.6				74.1

Note.
(1) Sex performance enhancing drugs: poppers, erectile dysfunction medications.
(2) Party drugs: ecstasy, cocaine, amphetamine, ketamine.
(3) Chemsex drugs: mephedrone, methamphetamine, GHB/GBL.
* Independently if they have used cannabis.
** Independently if they have used cannabis, poppers or erectile dysfunction medications.

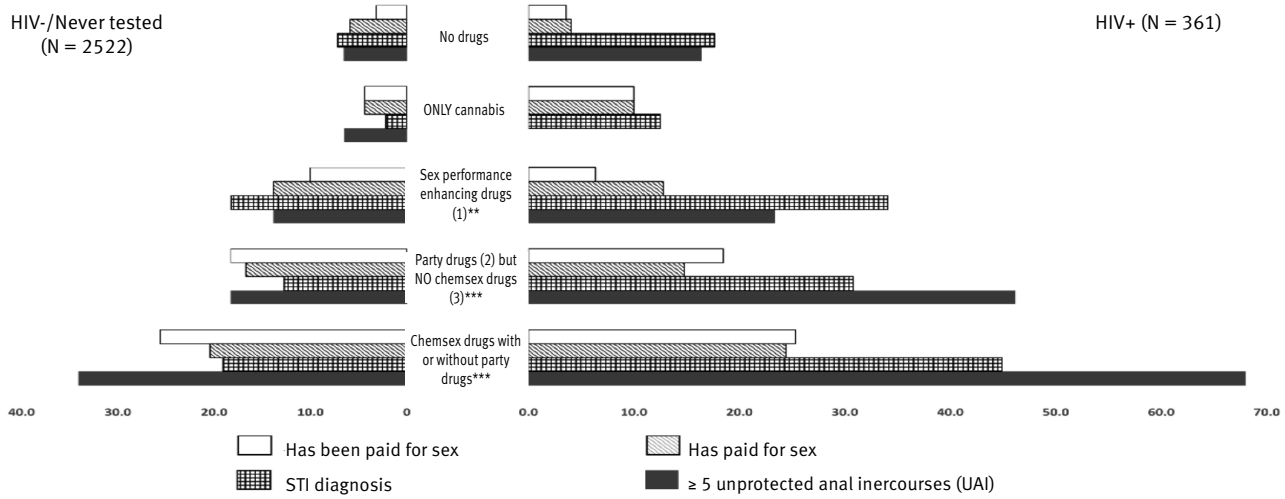

Figure 1. Prevalence of sexual risk indicators* and diagnosis of sexually transmitted infections (STI)* by type of sexualized drug use pattern* in HIV-/never tested and HIV+ MSM.

Note.
* In the last 12 months.
Chi square test for linear trend in both groups: has been paid for sex p ‹ 0,001; has paid for sex p ‹ 0,001; diagnosis of STI p ‹ 0,001; ≥ 5 UAI p ‹ 0,001.
(1) Sex performance enhancing drugs: poppers, erectile dysfunction medications. (2) Party drugs: ecstasy, cocaine, amphetamine, ketamine (3) Chemsex drugs: mephedrone, methamphetamine, GHB/GBL.
** Indedendent of cannabis use.
*** Independently if they have used cannabis, poppers or erectile dysfunction medications.

Table 4. *Use of chemsex drugs in the last 12 months in Spain by sociodemographic, behavioural and clinical correlates. Crude and adjusted Poisson analysis.*

	Chemsex drugs* in last HIV test negative and never tested MSM (N = 2522)					**Chemsex drugs* in HIV positive MSM (N = 361)**				
	%	cPR[a]	(95% CI[b])	aPR[c]	(95% CI[b])	%	cPR[a]	(95%CI[b])	aPR[c]	(95% CI[b])
Age										
‹ 29	4.8	1.1	.6-2.0	1.3	.7-2.3	16.9	1.4	.6-3.3	1.9	.9-4.1
30-39	6.2	1.4	.8-2.5	1.5	.9-2.6	24.8	2.1	1.1-4.2	2.3	1.2-4.5
40-49	6.1	1.4	.8-2.5	1.4	.8-2.4	29.6	2.5	1.3-5.0	2.2	1.1-4.2
› 50	4.3	1.0		1.0		11.7	1.0		1.0	
Place of birth										
Spain	5.5	1.0				20.8	1.0			
Other country	5.3	1.0	.6-1.6			25.7	1.2	.8-1.9		
Number of inhabitants in place of residence										
≥ 1 000 000	8.3	1.9	1.3-2.7	1.6	1.2-2.3	27.1	1.7	1.1-2.6		
50.000-999.999	4.5	1.0		1.0		16.2	1.0			
100-49.999	3.4	.8	.5-1.3	.8	.5-1.4	23.3	1.4	.8-2.5		
Education										
University education	4.9	1.0				20.7	1.0			
No university education	6.2	1.3	.9-1.8			23.3	1.1	.8-1.7		
Economic status										
Comfortable	4.7	1.0				17.4	1.0			
Uncomfortable	6.6	1.4	1.0-2.0			27.9	1.6	1.1-2.4		
Lives sex life with men...										
No openly	3.8	1.0		1.0		17.1	1.0			
Openly	7.7	2.0	1.5-2.8	1.5	1.1-2.1	25.0	1.5	.9-2.2		
Sex of sex partners (ever)										
Only men	6.0	1.0				19.0	1.0			
Men and women	5.6	.9	.6-1.2			27.4	1.4	1.0-2.1		

Tabla 4 (cont.). *Use of chemsex drugs in the last 12 months in Spain by sociodemographic, behavioural and clinical correlates. Crude and adjusted Poisson analysis.*

	Chemsex drugs* in last HIV test negative and never tested MSM (N = 2522)					Chemsex drugs* in HIV positive MSM (N = 361)				
	%	cPRa	(95% ICb)	aPRc	(95% ICb)	%	cPRa	(95% ICb)	aPRc	(95% ICb)
Has pad or given any kind of goods in exchange for sex (last 12 months)										
No	4.7	1.0				18.3	1.0		1.0	
Yes	14.5	3.1	2.1-4.6			50.0	2.7	1.8-4.0	1.9	1.3-2.8
Has received money or other goods in exchange for sex (last 12 months)										
No	4.3	1.0		1.0		18.4	1.0			
Yes	24.8	5.8	4.1-8.2	3.5	2.3-5.2	55.6	3.0	2.1-4.4		
Number of unprotected anal intercourses (last 12 months)										
None	2.5	1.0		1.0		5.0	1.0		1.0	
1-4	5.0	2.0	1.3-3.2	1.7	1.1-2.6	15.0	3.0	1.2-7.3	2.7	1.1-6.3
≥ 5	20.3	8.1	5.1-12.9	4.5	2.7-7.6	49.1	9.9	4.4-22.1	6.6	2.8-15.5
History of sexually transmitted infections diagnosis (ever)										
No STI diagnosis	3.0	1.0		1.0		7.1	1.0		1.0	
STI diagnosis › 12 months ago	9.2	3.0	2.1-4.4	2.1	1.5-3.1	22.5	3.1	1.5-6.8	2.0	.9-4.2
STI diagnosis in the last 12 months	11.9	3.9	2.5-6.2	2.1	1.3-3.3	37.2	5.2	2.4-11.2	2.6	1.2-5.8
Time since last test HIV										
Never tested	2.1	.6	.2-1.8							
≤ 3 months	10.7	3.1	1.1-8.3							
4-6 months	5.6	1.6	.6-4.6							
7-12 months	4.1	1.2	.4-3.5							
1-2 years	6.6	1.9	.7-5.3							
2-5 years	5.1	1.4	.5-4.4							
› 5 years	3.5	1.0								
Time since HIV diagnosis										
≤ 3 months						23.5	1.0	.6-1.8		
4-6 months						22.7	1.0	.5-1.9		
7-12 months						16.7	.7	.3-1.8		
1-2 years						23.5	1.0	.5-2.2		
2-5 years						15.2	.7	.3-1.7		
› 5 years						23.0	1.0			

Note. (a) cPR, crude prevalence ratio; (b) CI, confidence interval; (c) aPR, adjusted prevalence ratio.
*Mephedrone, methamphetamine or GHB/GBL. Independently if they have used the rest of drugs.

paid for sex (aPR 1.9; CI95% 1.3-2.8), having had 1-4 (aPR 2.7; CI95% 1.1-6.3) or ≥ 5 UAI (aPR 6.6; CI95% 2.8-15.5) and having been diagnosed with an STI in the last 12 months (aPR 2.6; CI95% 1.2-5.8) (table 4).

Discussion

SDU was reported by a relevant proportion of the study participants, especially among those who self-reported being HIV positive. The most prevalent pattern of SDU

was chemsex, mainly due to the high rates reported by HIV positive individuals. The chemsex pattern presented higher prevalence of sexual risk behaviours and previous STI history than two of the other SDU patterns assessed: "Only sexual performance enhancing drugs" and "Party drugs but no chemsex drugs". Nevertheless, those pertaining to any of these two patterns also presented significantly higher rates of all risk indicators than participants who did not report SDU or only consumed cannabis. Having received an STI diagnosis, reporting having paid or having been paid for sex and reporting UAI in the last 12 months increased the probabilities of reporting chemsex in both HIV positive and non-positive participants. Among HIV positive individuals, chemsex was especially prevalent among those between 30 and 49 years of age and in non-HIV positive individuals, among those living in large urban areas and those living their sex life with other men openly.

Comparing overall self-reported SDU with other published studies is difficult because definitions vary depending on the drugs included in the different data collection instruments and the time reference used. We did find a study that assessed overall SDU in an online recruited sample of UK-resident MSM which included the same list of drugs and the same time reference (last 12 months) as we did (Hibbert, Brett, Porcellato & Hope, 2019). In this sense, SDU in our study was less than half than that reported by this study. Overall SDU was also assessed in a study that recruited their sample of MSM from a London sexual health clinic and differences were even higher in this case, especially if we take into account that they assessed SDU in the last 3 months (vs.12 months) (Rana et al., 2019).

To our knowledge, no one in Europe has assessed sexual risk behaviours and STI acquisition among individuals involved in SDU other than chemsex. In our study, we identified 3 different patterns outside of drugs related to chemsex and all of them were consistently more frequent among HIV positive individuals than among never tested or HIV negative participants. In two of these three patterns (sex performance drugs and party drugs but no chemsex drugs), the prevalence of all sexual behaviours and of previous STI acquisition was higher than among participants who reported not having used drugs immediately before or during sex. The only exception was observed among those who only used cannabis. They comprised the smallest group and presented similar or even lower percentages of sexual risk behaviours and past STI diagnosis than those who reported not using drugs. Although cannabis has been associated to several health problems (Degenhardt et al., 2013) it appears that, in our sample, its role in the transmission of HIV and other STIs could be very limited. Things, however, begin to change when we focus on those who conformed the other two SDU patterns. Those who reported only using sexual performance enhancing drugs conformed the second most frequent drug pattern. It has been described that sexual performance enhancing drugs are commonly used among MSM in Europe (Daskalopoulou et al., 2014; Hibbert et al., 2019; Rosinska et al., 2018) but until now we did not know whether using them alone without other drugs could also be associated with sexual risk behaviours and STI acquisition as appears to be the case in this study. Thus, our results are in line with cohort studies conducted in the US that present strong associations between the use of amyl nitrites and erectile dysfunction drugs with increased risk of unprotected anal intercourse and higher seroconversion rates among those using these substances (Dutta et al., 2017; Swartz & McCarty-Caplan, 2018). The next pattern in the "risk ladder" was the one comprised by what has been called "party drugs". Individuals pertaining to this group presented an even higher prevalence of risk indicators than participants of the "sex performance enhancing drugs" category. However, the same did not happen with STI acquisition and those in the "party drugs" category presented a lower self-reported pervious STI history than those in the "sex performance enhancing drugs "category. Very few studies have assessed the use of party drugs immediately before or during sex among MSM (Hibbert et al., 2019; Rosinska et al., 2018) but as far as we know this is the first time that persons that only use these drugs (and not chemsex) have been characterized in terms of sexual risk behaviours and STI prevalence. In this sense, the sole use of substances of this nature appears to be strongly associated with sexual risk behaviours and STI acquisition.

Nevertheless, the most frequent pattern and the one that had the highest proportion of all three sexual risk behaviours and STI prevalence for both HIV positive and negative/never tested individuals was the one comprised by chemsex associated drugs. The prevalence of chemsex reported by our participants was substantially lower than that reported by several studies carried out in the UK (Rana et al., 2019; Sewell et al., 2019; Sewell et al., 2017). In fact, three studies used "last 3 months" as a reference period (vs. "last 12 months") which makes differences even more striking. Another study conducted in a sexual health clinic in Amsterdam (Druckler, van Rooijen & de Vries, 2018) also found a higher prevalence of chemsex than the one reported by our participants. Part of the difference is probably derived from the fact that their samples were recruited in sexual health clinics based in London, Brighton and Amsterdam, where the use chemsex substances has been reported to be especially high (Schmidt et al., 2016). In our case, more than half of the sample we recruited pertained to small-very small

municipalities which has been a factor traditionally associated with lower chemsex frequency (EMIS Network, 2013). This is a strength of our study which included a sample not exclusively comprised by MSM from urban settings and probably more representative of the overall MSM population. When we compare our data to studies similar to ours in terms of recruitment strategy, differences level out and present similar figures (Hibbert et al., 2019).

In our study, the number of UAI and having been diagnosed with an STI was associated with chemsex among both HIV positive and HIV negative/never tested MSMs. This is in line with previous studies who also reported more frequent UAI and higher rates of STI among those involved in chemsex (Glynn et al., 2018; Gonzalez-Baeza et al., 2018; Pufall et al., 2018; Rosinska et al., 2018). Additionally, among HIV positive individuals, chemsex was found to be independently associated with being between 30-49 years of age and having been paid for sex. The latter association has never been described before as far as we know and could suggest that the use of chemsex drugs is especially present at contexts where transactional sex is occurring. The association between chemsex and having been paid for sex among HIV negative/never tested participants also points toward this direction. Also, among HIV negative never tested individuals, chemsex was significantly higher in residents of cities of ≥ 1,000,000 inhabitants reflecting the concentration of chemsex in very large urban areas (Frankis & Clutterbuck, 2017). Similarly, the increased rates of chemsex among those who lived their sex life with other men openly could also be related to the fact that they have access to larger networks where the use of chemsex drugs is more common.

The results of this study need to be interpreted in light of several limitations. There was a high number of participants that could not be included in the analysis due to non-response of the question assessing SDU. This question was introduced towards the end of a long questionnaire and is probably the reason or the high number of missing values. Our rate of missing data is actually very similar to the rates of a large scale international online survey among MSM (EMIS Network, 2013). In this study, seven of ten of participants made it to the last page of the questionnaire. Non-response was probably due to "response fatigue" and virtually all that made it to the question assessing SDU had answered the other questions used in our analysis. The questionnaire was totally anonymous and confidential. No IP or cookies were collected and therefore we were not able to ascertain the existence of participants answering the survey more than one time. However, given the length of the questionnaire and that fact that no retribution was given in exchange for participation, the occurrence of "double participation" is highly unlikely.

Although we were able to recruit a large sample, the results do not necessarily represent the overall MSM population. Geospatial apps and online dating sites are widespread among MSM but certain subpopulations might not be included in the study because they choose not to use these methods to meet new partners. Due to the cross-sectional nature of the study, we could not assess the causal directionality of sexual risk behaviours, STI acquisition and the different patterns of SDU. This is also relevant for HIV positive participants as we cannot establish whether substance use occurred before or after seroconversion.

In this online sample of Spanish resident MSM, we found that all forms of SDU were a minority. However, given the high prevalence of sexual risk behaviours and high presence of STI especially among HIV positive individuals involved in SDU, preventive efforts need to be considered in order to control the possible negative effects that SDU can have in this population. This is especially true with chemsex which, not only was the most prevalent pattern, but also the one with the highest risk profile. In this sense, geospatial network apps and gay dating represent an ideal opportunity to conduct preventive and informative interventions focused on MSM who are taking illicit drugs in sexual contexts.

Acknowledgements

This study was supported by Consumers, Health and Food Executive Agency (CHAFEA: 20131101) and Acción Estratégica en Salud (AESI: PI17CIII/00037) and of the Delegación del Gobierno para el Plan Nacional sobre Drogas(2019 I 017).

We would like to thank especially Planet Romeo for their collaboration and effort in the recruitment process free of cost. We would also like to thank the Telemedicine department of the Institute of Health Carlos III and the following websites, companies and institutions who collaborated in the recruitment with no cost: Barebackcity, Chico Onírico, COBATEST network, Fiesta en el Jardín, Fundación Triángulo and Scruff.

Conflict of interests

The authors declare that they have no conflict of interest.

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