Full title: Patterns of sexualised recreational drug use and its association with risk behaviours and sexual health outcomes in men who have sex with men in London, UK: a comparison of cross-sectional studies conducted in 2013 and 2016

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ABSTRACT

Objective: London has one of the highest identified prevalence of chemsex (sexualised recreational drug use) among men who have sex with men (MSM) in Europe. We examine MSM's patterns of chemsex and its association with HIV/STI risk behaviours, STI diagnoses, and sexual healthcare-seeking behaviours, including if HIV testing behaviour met UK national guidelines (3-monthly if engaging in chemsex).

Methods: Cross-sectional survey data from 2013 (n=905) and 2016 (n=739) were collected using anonymous, self-administered questionnaires from MSM recruited in commercial gay venues in London, UK. Descriptive and multivariable analyses, stratified by self-reported HIV status, were conducted. Adjusted prevalence ratios (aPR) with 95% confidence intervals (CI) were calculated.

Results: Comparing the 2013 and 2016 surveys; chemsex prevalence in the past year remained stable, in both HIV-negative/unknown-status MSM (20.9% in 2013 vs 18.7% in 2016, p=0.301) and HIV-positive MSM (41.6% in 2013 vs 41.7% in 2016, p=0.992). Combined 2013-2016 data showed that compared to other MSM, those reporting chemsex were more likely to report HIV/STI risk behaviours, including condomless anal intercourse with serodifferent HIV-status partners (HIV-negative/unknown-status men: aPR 2.36, 95% CI 1.68-3.30; HIV-positive men: aPR 4.19, 95% CI 1.85-9.50), and STI diagnoses in the past year (HIV-negative/unknown-status men: aPR 2.10, 95% CI 1.64-2.69; HIV-positive men: aPR 2.56, 95% CI 1.57-4.20). 69.0% of HIV-negative/unknown-status men reporting chemsex attended sexual health clinics and 47.6% had tested for HIV more than once in the past year.

Conclusions: Chemsex in London MSM remained stable but high, particularly among HIV-positive men. Irrespective of HIV status, chemsex was associated with engagement in

HIV/STI risk behaviours. Frequency of HIV testing in the past year among HIV-negative/unknown-status men was below national recommendations. Promoting combination prevention strategies, including 3-monthly HIV/STI testing, access to PrEP/ART, and behavioural interventions among MSM reporting chemsex, remain vital to address sexual health inequalities in MSM.

[298 words]

Key Messages:

- Reported chemsex by men who have sex with men (MSM) in London remained stable but high between 2013 and 2016, particularly among HIV-positive men.
- Chemsex was associated with behaviours that enhance the risk of HIV and STI transmission among men of all HIV statuses.
- HIV testing in the past year among HIV-negative/unknown-status men was below national guidelines in men reporting chemsex.
- Our study shows the continued need for combination prevention interventions among London MSM including promotion of frequent HIV and STI testing, access to PrEP/ART, and behavioural interventions to address sexual health inequalities in MSM.

INTRODUCTION

In the United Kingdom (UK), men who have sex with men (MSM) bear a disproportionate burden of poor sexual health.[1] While gay and bisexual men in the UK have typically reported greater alcohol and recreational drug use than the general population,[2] recent years have seen increases in the sexualised use of recreational drugs, namely mephedrone, gamma-hydroxybutrate (GHB) or gamma-butyrolactone (GBL), methamphetamine (crystal meth) and ketamine, a practice commonly known as chemsex.[3]

Several UK studies have found MSM using these drugs report a higher prevalence of condomless sex,[4] greater numbers of sexual partners,[5 6] higher prevalence of sexually transmitted infection (STI) and hepatitis C (HCV) diagnoses,[6] and increased likelihood of being newly diagnosed with HIV.[6] Therefore, UK national guidelines not only recommend HIV/STI testing at least annually for all sexually-active MSM but also 3-monthly for men who engage in chemsex.[7] Among HIV-positive MSM in the UK, polydrug use (use of more than one drug within the same period) has also been associated with increased likelihood of antiretroviral treatment (ART) non-adherence, increasing the risk of poor HIV outcomes and onward HIV transmission to sexual partners.[5] Data from a survey of MSM across Europe in 2010 suggested that London, Brighton, and Manchester have the highest prevalence of chemsex among MSM in Europe.[8]

Enhancing intelligence on the prevalence of substance use including chemsex is one of the objectives of Public Health England's action plan for MSM, in order to promote their health and wellbeing and reduce inequalities.[9] A review of studies of chemsex conducted in the UK has shown that the majority of these were conducted among men attending sexual health clinics or only among HIV-positive MSM, and often do not specify whether these drugs were

used specifically in a sexual context.[10] In this paper, using data from the London Gay Men's Sexual Health Survey (LGMSHS), a community-based repeat cross-sectional survey of MSM, we examine changes in chemsex among MSM between 2013 and 2016 stratified by HIV status and identify sociodemographic factors associated with it. We also examine the association between chemsex and engagement in risk behaviours, sexual health service uptake, and sexual health outcomes.

METHODS

Study population and data collection

The survey methods have been described elsewhere.[11] Briefly, between February and August 2013, and between October and December 2016, trained fieldworkers visited 35-58 bars, clubs, and saunas frequented by MSM across Greater London, UK, and invited all men aged 18 and over to self-complete a short, anonymous questionnaire on demographic characteristics, HIV status, sexual behaviours and sexual healthcare-seeking behaviours. Survey questions remained largely the same between 2013 and 2016, with the 2016 survey also introducing questions about the use of post-exposure prophylaxis (PEP), pre-exposure prophylaxis (PrEP), and for HIV-positive men, use of antiretroviral medication and HIV viral load. Participants were also asked to indicate which, if any, of a specified list of recreational drugs they had used just before or during sex in the last year, and whether they had injected any of these drugs. Finally, participants were asked to provide a saliva sample for anonymous HIV testing (OraSure Technologies, Bethlehem, PA, USA), however refusal of this did not prevent participation in the study. Recruitment venues were similar between 2013 and 2016. Eligibility criteria for inclusion in this analysis were reporting sexual orientation as gay or bisexual, or reporting sex with another man in the last year. Verbal consent for the self-completion of questionnaires was obtained to ensure anonymity of participants. Ethical

approval for both years was granted by the London Harrow Research Ethics Committee (00/0158).

Statistical analysis

Chemsex was defined as reporting use of any of the following drugs just before or during sex: ketamine, GHB/GBL, mephedrone, and/or methamphetamine.[3 12] Condomless anal intercourse (CAI) was defined as reported active or passive anal intercourse without a condom. We defined a casual partner as a partner with whom the participant reported sex only once in the past year. Serodifferent partners were defined as partners of opposite or unknown (to the respondent) HIV status. All sexual behaviours and sexual health outcomes, including CAI, STI diagnoses, sexual health clinic attendance, and HIV testing (all in the past year), were based on self-reported data. Perceived current HIV status was based on participants' responses to the question "What do you believe to be your current HIV status?" Response options were "Negative", "Positive" and "Don't know". Employment status was defined as being in paid employment or not at the time of the survey.

For analysis men were stratified by perceived HIV status as it was believed to be more influential in determining participants' behaviour than actual HIV status as verified by anonymous testing. Men reporting their HIV status as negative or unknown were combined for analyses. All analyses were conducted using Stata version 15.0 (StataCorp. 2017. College Station, Texas, USA). We used chi-squared tests to examine differences in demographic characteristics of survey participants of each year, changes in drug use, and examine associations between sociodemographic characteristics and reported chemsex. We used modified Poisson regression with robust error variances to estimate unadjusted prevalence ratios (PRs) with 95% confidence intervals (CIs).[13] Age was assessed as both a continuous

and categorical variable. Factors significant at p<0.10 in univariate analyses were considered for inclusion in multivariate models, using log pseudo likelihoods to compare models. Characteristics with p<0.05 were retained in final models along with year of survey, and adjusted prevalence ratios (aPRs) were calculated.

In order to examine associations between chemsex and sexual risk behaviours, STI diagnoses, and sexual healthcare-seeking behaviours, we combined data from both surveys and restricted analysis to men who reported sex with another man in the previous year (n= 1,568). We used modified Poisson regression to first calculate unadjusted PRs with 95% CIs, and then calculate aPRs, adjusting for year of survey and sociodemographic characteristics found to be associated with chemsex (p<0.05).

RESULTS

Of the 940 and 767 men recruited in the 2013 and 2016 surveys respectively, 905 (96.3%) and 739 (96.3%) were eligible for inclusion in analysis. The majority of men were HIV-negative (82.3% and 88.6%); 11.5% and 8.1% were HIV-positive, and 6.2% and 3.2% reported an unknown-status in 2013 and 2016 surveys respectively. The median age of men in the 2013 and 2016 surveys was 36 and 33 years respectively (Table 1). The majority of men in both surveys were of white ethnicity and identified as gay or homosexual.

Among HIV-negative/unknown-status men, between 2013 and 2016 there were significant increases in the proportions of men reporting CAI with at least one casual partner (33.8% to 45.3%; p<0.001), attendance at sexual health clinics (49.3% to 57.5%; p=0.002), testing for HIV at least once (61.9% to 72.6%; p<0.001), testing for HIV more than once (32.4% to 46.7%; p<0.001), and reported STI diagnoses (13.4% to 17.8%; p=0.019) (all in the past year). Self-reported diagnoses with chlamydia halved between 2013 and 2016 (5.1% to 2.4%;

p=0.006), however gonorrhoea diagnoses increased from 7.2% to 12.1% (p=0.002). Among HIV-positive men, the prevalence of CAI with casual partners increased from 44.9% to 65.4% between 2013 and 2016 (p=0.019), whereas sexual health clinic attendance in the past year remained high and unchanged (>80%). Reported STI diagnoses remained unchanged (31.1% and 41.7% respectively; p=0.171), though an increase in syphilis diagnoses among HIV-positive men was observed (4.8% to 21.7%; p=0.001).

Chemsex prevalence between 2013-2016

There was no change in reported chemsex between 2013 and 2016 for HIV-negative/unknown-status men (20.9% and 18.7% respectively) and HIV-positive men (approximately 42% in both years) (Table 1); however, reported chemsex was higher in HIV-positive men than in HIV-negative/unknown-status men (p<0.001) across both years.

Irrespective of HIV status, the uptake of chemsex drugs used between both surveys remained unchanged. Among HIV-negative/unknown-status men, mephedrone was the most commonly used drug in both years (16.0% in 2013, 13.8% in 2016), whereas methamphetamine (5.6% in 2013, 5.3% in 2016), ketamine (9.4%, 7.7%) and GHB (8.9%, 10.0%) were less commonly used. Few HIV-negative/unknown-status men reported injecting drugs (2.9% in 2013, 1.8% in 2016). Among HIV-positive men, mephedrone was also the most commonly used chemsex drug (27.7% in 2013, 31.7% in 2016), but they were equally likely to use methamphetamine (23.8%, 28.3%), ketamine (26.7%, 15.0%), and GHB (24.8%, 30.2%) in both years. Injection of drugs was reported by 12.1% and 22.0% of HIV-positive men in 2013 and 2016 respectively.

Table 1: Sample sociodemographics, risk behaviours, sexual healthcare-seeking and sexualised drug use in the past year by perceived HIV status, 2013-2016

	Perceived current HIV status	
	HIV-negative/unknown-status	HIV-positive

	2013 (N=801)	2016 (N=679)		2013 (N=104)	2016 (N=60)	
	% (n)	% (n)	p value	% (n)	% (n)	p value
Age (years)			0.001			0.161
16-24	11.3 (88)	11.0 (74)		0.0 (0)	3.4 (2)	
25-34	37.4 (291)	46.4 (312)		24.2 (24)	30.5 (18)	
35-44	30.6 (238)	28.5 (192)		45.5 (45)	33.9 (20)	
>=45	20.7 (161)	14.1 (95)		30.3 (30)	32.2 (19)	
Ethnicity			0.368			0.914
White	80.7 (644)	78.8 (532)		87.3 (89)	86.7 (52)	
Non-white	19.3 (154)	21.2 (143)		12.8 (13)	13.3 (8)	
Sexual orientation			0.029			0.285
Gay/Homosexual	93.7 (703)	92.5 (608)		97.9 (94)	98.2 (56)	
Bisexual	5.7 (43)	5.9 (39)		2.1 (2)	0.0 (0)	
Straight/Heterosexual	0.4 (3)	0.2 (1)		0.0 (0)	0.0 (0)	
Other	0.1 (1)	1.4 (9)		0.0 (0)	1.7 (1)	
Years of education after 16			0.986			0.054
0-2 years	20.3 (161)	20.3 (137)		18.5 (19)	31.7 (19)	
3 years or more	79.7 (632)	79.7 (539)		81.5 (84)	68.3 (41)	
Employed			0.196			0.167
Yes	88.0 (703)	90.1 (610)		85.3 (87)	76.7 (46)	
No	12.0 (96)	9.9 (67)		14.7 (15)	23.3 (14)	
Number of male partners in the past year			0.116			0.899
0	3.62 (29)	2.6 (17)		7.7 (8)	5.3 (3)	
1	21.6 (173)	26.3 (170)		15.4 (16)	21.1 (12)	
2-4	21.6 (173)	20.4 (132)		10.6 (11)	10.5 (6)	
5-10	23.0 (184)	24.7 (160)		15.4 (16)	14.0 (8)	
>10	30.2 (242)	26.0 (168)		51.0 (53)	49.1 (28)	
Number of casual CAI partners in the past year			<0.001			0.035
0	76.2 (498)	54.7 (321)		55.1 (49)	34.6 (18)	
1	15.1 (99)	25.2 (148)		12.4 (11)	11.5 (6)	
2-4	5.7 (37)	11.2 (66)		4.5 (4)	15.4 (8)	
5+	3.0 (20)	8.9 (52)		28.1 (25)	38.5 (20)	
Diagnosed with STI in the past year			0.019			0.171
No	86.6 (679)	82.2 (557)		68.9 (71)	58.3 (35)	
Yes	13.4 (105)	17.8 (121)		31.1 (32)	41.7 (25)	
Specific STI diagnoses in the past year						
Chlamydia	5.1 (41)	2.4 (16)	0.006	12.5 (13)	6.7 (4)	0.238
Gonorrhoea	7.2 (58)	12.1 (82)	0.002	20.2 (21)	31.7 (19)	0.099
Syphilis	1.9 (15)	2.1 (14)	0.794	4.8 (5)	21.7 (13)	0.001
Lymphogranuloma venereum	0.6 (5)	0.6 (4)	1.000	0.0 (0)	1.7 (1)	0.366
Hepatitis C	0.1 (1)	0.2 (1)	1.000	0.0 (0)	1.7 (1)	0.366
Other STI[§]	0.8 (6)	1.9 (13)	0.047	1.9 (2)	0.0 (0)	0.533
Attended a sexual health clinic in the past year			0.002			0.178
No	50.6 (400)	42.5 (285)		9.7 (10)	16.9 (10)	

Yes	49.3 (390)	57.5 (385)		90.3 (93)	83.1 (49)	
Number of HIV tests in the past year			<0.001			
0	38.1 (294)	27.4 (181)				
1	29.4 (227)	25.9 (171)				
2+	32.4 (250)	46.7 (309)				
Sexualised use of drugs in the past year						
Ketamine	9.4 (73)	7.7 (52)	0.247	26.7 (27)	15.0 (9)	0.084
GHB/GBL	8.9 (69)	10.0 (68)	0.445	24.8 (25)	30.0 (18)	0.467
Mephedrone	16.0 (125)	13.8 (94)	0.245	27.7 (28)	31.7 (19)	0.595
Methamphetamine	5.6 (44)	5.3 (36)	0.777	23.8 (24)	28.3 (17)	0.520
Any chemsex*	20.9 (163)	18.7 (127)	0.301	41.6 (42)	41.7 (25)	0.992
Injected drug use	2.9 (22)	1.8 (12)	0.187	12.1 (12)	22.0 (13)	0.099

CAI, condomless anal intercourse; STI, sexually transmitted infection(s); GHB, gamma-hydroxybutrate; GBL, gamma-butyrolactone.

§Other STI reported include genital warts (5), genital herpes (4), pubic lice (4), non-specific urethritis (NSU) (3), scabies (1), or unspecified other STI (4). *Chemsex is defined as the use of any of the following drugs just before or during sex: ketamine, mephedrone, GHB/GBL or methamphetamine.

Factors associated with reported chemsex, stratified by HIV status

Among HIV-negative/unknown-status men, univariate analysis showed no associations between ethnicity or employment status and reported chemsex (Table 2). Although, chemsex was reported by men in all age groups, it was most common in men aged 25-34 (22.4%) and 35-44 years (20.3%), and less common in men with 3 or more years of education after age 16 (18.7%). In multivariate analysis, after adjusting for year of survey, age group and education level remained independently associated with reported chemsex. Compared to men aged 45 years or older, higher likelihoods of reporting chemsex were estimated for men aged 25-34 years (aPR=1.68, 95% CI 1.18-2.38) and men aged 35-44 years (aPR=1.52, 95% CI 1.05-2.19). Men with ≥3 years of education after age 16 were less likely to report chemsex than men with <3 years of education after age 16 (aPR=0.78, 95% CI 0.61-0.99).

Among HIV-positive men, there was no variation in prevalence of chemsex according to ethnicity, education or employment status; however, it was highest in men aged 25-34 years

(65.9%) and lowest in men aged 45 years or older (25.0%). After adjusting for year of survey, HIV-positive men aged 25-34 years were more than twice as likely as men aged 45 years or older to have reported chemsex in the past year (aPR=2.64, 95% CI 1.54-4.52).

Table 2: Factors associated with reported chemsex in the past year, stratified by perceived HIV status

	Reported chemsex in 1,480 HIV-negative/unknown-status men			Reported chemsex in 161 HIV-positive men*		
	% (n/N)	PR (95% CI)	aPR§ (95% CI)	% (n/N)	PR (95% CI)	aPR† (95% CI)
Year of survey						
2013	20.9 (163/781)	1.00	1	41.6 (42/101)	1	1
2016	18.6 (126/678)	0.89 (0.73 - 1.10)	0.83 (0.67, 1.03)	41.7 (25/60)	1.00 (0.69-1.46)	0.97 (0.67, 1.1)
p value	-	0.302	0.092	-	0.992	0.882
Age (years)						
16-24	17.6 (28/159)	1.28 (0.81, 2.02)	1.32 (0.83, 2.08)	50 (1/2)	n/a	n/a
25-34	22.4 (132/595)	1.62 (1.15, 2.28)	1.68 (1.18, 2.38)	65.9 (27/41)	2.63 (1.54, 4.51)	2.64 (1.54, 4.52)
35-44	20.3 (86/424)	1.47 (1.02, 2.11)	1.52 (1.05, 2.19)	39.1 (25/64)	1.56 (0.88, 2.79)	1.56 (0.87, 2.78)
>=45	13.8 (35/254)	1.00	1.00	25.0 (12/48)	1.00	1.00
p value	-	0.040	0.032	-	0.0003	0.0003
per year (age as continuous variable)		0.98 (0.97, 0.99)			0.96 (0.94, 0.99)	
p value (age as continuous variable)	-	0.001		-	0.002	
Ethnicity						
White	19.5 (226/1161)	1.00		41.3 (57/138)	1	
Non-white	21.6 (63/292)	1.11 (0.86-1.42)		47.6 (10/21)	1.15 (0.70-1.89)	
p value	-	0.416		-	0.571	
Years of education after 16						
0-2 years	23.8 (70/294)	1.00	1.00	36.8 (14/38)	1	
3 years or more	18.7 (217/1155)	0.79 (0.62-1.00)	0.78 (0.61, 0.99)	43.4 (53/122)	1.18 (0.74-1.88)	
p value	-	0.050	0.045	-	0.487	
Employed						
Yes	20.4 (264/1297)	1.00		40.8 (53/130)	1	
No	15.7 (25/159)	0.77 (0.53-1.12)		44.8 (13/29)	1.10 (0.70-1.73)	
p value	-	0.178		-	0.683	

PR, prevalence ratio; aPR, adjusted prevalence ratio.

*Due to low numbers, HIV-positive men aged 16-24 years were excluded from analysis. §Adjusted for year of survey, age group, and education. †Adjusted for year of survey and age group.

Associations between chemsex and sexual health

In HIV-negative/unknown-status men reporting chemsex, the proportions of men reporting behaviours that risk HIV/STI transmission and acquisition, STI diagnoses, and sexual healthcare-seeking behaviours in the past year were significantly higher than in men not reporting chemsex, and remained so after adjusting for year of survey, age group, and education (Table 3). Men reporting chemsex were more likely to report having more than ten male sexual partners (48.4% vs. 23.1%; aPR=2.11, 95% CI 1.79-2.50), CAI with at least one partner (77.3% vs. 69.0%; aPR=1.10, 95% CI 1.02-1.19), CAI with a casual partner (47.4% vs 32.9%; aPR=1.43, 95% CI 1.21-1.68) and CAI with a serodifferent partner (25.6% vs 11.1; aPR=2.36, 95% CI 1.68-3.30) in the past year. Of the 127 HIV-negative/unknown-status men reporting chemsex in 2016, 14.2% (n=18) of men reported having used PrEP in the past year compared to 3.8% (n=20) of those who did not report chemsex. Compared to men not engaging in chemsex, those reporting chemsex were more likely to report sexual health clinic attendance (68.6% vs 50.8%; aPR=1.34, 95% CI 1.21-1.48), HIV testing (76.2% vs 65.6%; aPR=1.15, 95% CI 1.06-1.25), and repeat HIV testing (47.6% vs 38.0%; aPR=1.27, 95% CI 1.10-1.46), and to report STI diagnoses (27.5% vs 13.1%; aPR=2.10, 95% CI 1.64-2.69) in the past year.

In HIV-positive men, chemsex was associated with a higher likelihood of reporting at-risk behaviours and STI diagnoses. Compared to HIV-positive men not reporting chemsex, those reporting chemsex were more likely to report having more than ten male partners (75.8% vs 36.6%; aPR=2.21, 95% CI 1.60-3.04), CAI with at least one partner (92.5% vs 69.1%; aPR=1.32, 95% CI 1.13-1.55), CAI with a casual partner (75.5% vs 45.3%; aPR=1.62,95% CI 1.18-2.20), CAI with a serodifferent partner (51.3% vs 14.3%; aPR=4.19, 95% CI 1.85-9.50), and STI diagnoses (58.2% vs 20.5%; aPR=2.56, 95% CI 1.57-4.20). Clinic attendance was high

among all HIV-positive men, and only 4.5% (n=3) of HIV-positive men reporting chemsex had not attended a clinic in the past year. Of the 25 HIV-positive men reporting chemsex in 2016, 80% (n=20) reported being on ART and 56% (n=14) reported having an undetectable viral load (UVL) (with the remaining men not providing an answer), compared to 91% (n=29) and 75% (n=24) among those not reporting chemsex reporting being on ART and having UVL respectively (p=0.252; p=0.131).

Table 3: Associations between chemsex and risk behaviours, sexual healthcare-seeking behaviours and sexual health outcomes in the past year, by perceived HIV status, 2013 & 2016 data combined

	Perceived current HIV status					
	HIV-negative/unknown-status			HIV-positive		
	% (n/N)	PR (95% CI)	aPR* (95% CI)	% (n/N)	PR (95% CI)	aPR** (95% CI)
More than 10 male partners in the past year						
No chemsex in the past year	23.1 (251/1089)	1.00	1.00	36.6 (30/82)	1.00	1.00
Chemsex in the past year	48.4 (136/281)	2.10 (1.79, 2.47)	2.11 (1.79, 2.50)	75.8 (50/66)	2.07 (1.51, 2.84)	2.21 (1.60, 3.04)
p value		<0.0001	<0.0001		<0.0001	<0.0001
CAI in the past year						
No chemsex in the past year	69.0 (747/1083)	1.00	1.00	69.1 (58/84)	1.00	1.00
Chemsex in the past year	77.3 (218/282)	1.12 (1.04, 1.21)	1.10 (1.02, 1.19)	92.5 (62/67)	1.34 (1.14, 1.57)	1.32 (1.13, 1.55)
p value		0.003	0.011		0.0003	0.0005
CAI with a casual partner in the past year						
No chemsex in the past year	32.9 (306/930)	1.00	1.00	45.3 (34/75)	1.00	1.00
Chemsex in the past year	47.4 (111/234)	1.44 (1.22, 1.70)	1.43 (1.21, 1.68)	75.5 (40/53)	1.66 (1.24, 2.23)	1.62 (1.18, 2.20)
p value		<0.001	<0.001		0.0007	0.003
CAI with serodifferent or unknown HIV serostatus partner in the past year						
No chemsex in the past year	11.1 (77/697)	1.00	1.00	14.3 (8/56)	1.00	1.00
Chemsex in the past year	25.6 (46/180)	2.31 (1.67, 3.21)	2.36 (1.68, 3.30)	51.3 (20/39)	3.59 (1.76, 7.33)	4.19 (1.85, 9.50)
p value		<0.0001	<0.0001		0.0005	0.0006
STI diagnosis in the past year						
No chemsex in the past year	13.1 (144/1099)	1.00	1.00	20.5 (17/83)	1.00	1.00
Chemsex in the past year	27.5 (77/280)	2.10 (1.64, 2.68)	2.10 (1.64, 2.69)	58.2 (39/67)	2.84 (1.77, 4.55)	2.56 (1.57, 4.20)
p value		<0.0001	<0.0001		<0.0001	0.0002
Sexual health clinic attendance in the past year						
No chemsex in the past year	50.8 (555/1093)	1.00	1.00	84.3 (70/83)	1.00	1.00
Chemsex in the past year	68.6 (194/283)	1.35 (1.22, 1.49)	1.34 (1.21, 1.48)	95.5 (64/67)	1.13 (1.02, 1.26)	1.12 (0.99, 1.26)
p value		<0.0001	<0.0001		0.022	0.083
HIV test in the past year						

No chemsex in the past year	65.6 (724/1104)	1.00	1.00	
Chemsex in the past year	76.2 (218/286)	1.16 (1.08, 1.26)	1.15 (1.06, 1.25)	
p value		0.0001	0.0005	
2+ HIV tests in the past year				
No chemsex in the past year	38.0 (409/1077)	1.00	1.00	
Chemsex in the past year	47.6 (131/275)	1.25 (1.08, 1.45)	1.27 (1.10, 1.46)	
p value		0.002	0.001	

PR, prevalence ratio; aPR, adjusted prevalence ratio; CAI, condomless anal intercourse; STI, sexually transmitted infection(s).
Denominators may vary due to missing data. *Adjusted for year of survey, age group and education. **Adjusted for year of survey and age group.

DISCUSSION

We report that the self-reported chemsex prevalence among HIV-negative/unknown-status and HIV-positive MSM recruited from commercial venues in London remained unchanged between 2013 and 2016. However, a significant proportion of men in our sample, especially HIV-positive men, engaged in chemsex. Regardless of HIV status, chemsex was independently associated with age, with younger men being more likely to engage in chemsex than older men. Additionally, in HIV-negative/unknown-status men chemsex was more common in men with lower levels of education. Overall, we found increases between 2013 and 2016 in reporting behaviours known to increase the risk of HIV/STI acquisition and transmission including CAI and CAI with casual partners. Moreover, irrespective of HIV serostatus, chemsex was associated with reporting greater engagement in HIV/STI risk behaviours, including higher partner numbers, and CAI with casual partners or partners of serodifferent status. Unsurprisingly, reporting chemsex was associated with an increased likelihood of reporting STI diagnoses in the past year. Nearly a quarter of HIV-negative/unknown-status men reporting chemsex reported not testing for HIV in the past year, and less than half reported frequent testing (i.e. testing more than once) in the past year, as recommended by the national guidelines.[7]

The heterogeneity in study populations and diversity in measurement of drug use, especially sexualised drug use, in MSM in the UK[10] and elsewhere[14] makes comparisons between studies challenging. Chemsex prevalences reported in our paper are greater than those reported in a recent study of UK MSM (8.3% in HIV-negative/unknown-status men and 24.1% in HIV-positive men) potentially due to its wider geographic focus.[15] Our finding of stable chemsex prevalence over time contrasts with a study of a cohort of sexual health clinic-attending HIV-negative men in London and Brighton, which found that use of these drugs had reduced from 2015 to 2018, suggesting that engagement with sexual health services may reduce problematic drug use.[16] Our data also accords with studies from the UK and elsewhere in Europe, which have found higher prevalence of chemsex among HIV-positive men.[8 17] The reported use of mephedrone among both HIV-positive and HIV-negative/unknown-status men in our sample, as well as the greater use of GHB/GBL and methamphetamine among HIV-positive men, accords with data presented in a systematic review of UK studies.[10] Data on the prevalence of chemsex among MSM attending sexual health clinics in the UK, available from 2020 via GUMCAD, an STI surveillance system in England,[18 19] will help to understand chemsex trends among sexual health clinic attending-MSM in the future.

Our findings concur with those of previous studies conducted among MSM in the UK and elsewhere in Europe which found that MSM reporting chemsex are more likely to report condomless sex,[4 17] condomless sex with serodifferent partners,[6 20 21] and increased STI diagnoses,[6 17 20-22] suggesting that men engaging in chemsex are at greater risk of HIV/STI transmission. Therefore reducing the risk of HIV acquisition in HIV-negative MSM through the use of PrEP,[23] and in HIV-positive men early diagnosis and initiation of suppressive ART to reduce community viral load and thus transmission of HIV remains vital.[24] The prevalence

(5.7%) of PrEP use by HIV-negative/unknown-status men in our 2016 survey, although lower than that found in a separate study of men attending London sexual health clinics in 2015-2016,[25] potentially reflects the limited availability of PrEP in England at that time. Nevertheless, analysis of 2016 data showed an association among HIV-negative men between reporting chemsex and use of PrEP,[26] highlighting the significance of promoting PrEP interventions among HIV-negative men who report chemsex. The high prevalence of injecting drug use in HIV-positive men and of condomless sex in men of either HIV status is likely to increase their risk of HCV acquisition and transmission,[2727] emphasising the need for behavioural interventions to promote safer practices among MSM who engage in chemsex.

Similar to previous studies,[20 28] we found high uptake of HIV testing and sexual health clinic attendance in HIV-negative/unknown-status men who reported chemsex. However, our findings highlight that HIV testing in the past year among MSM engaging in risky behaviours including chemsex is below current UK national guidelines.[7] Recent evidence also indicates that MSM in the UK engaging in high risk sexual activity including chemsex do not test for STIs as per UK national guidelines.[15] This highlights the need to continue promoting at least annual HIV/STI testing (including HCV), and 3-monthly HIV/STI testing among MSM engaging in risky behaviours including chemsex.

Our study is subject to several limitations. Analyses are based on self-reported data with a 12 month recall period, so are subject to social desirability and recall biases. All outcomes are based on occurrence in the past year, rather than being event-specific, thus although participants reported on drug use before/during sex, it is not possible to confirm whether events such as condomless sex took place during chemsex. Our samples were recruited in gay bars, clubs and saunas; however, the ease with which both hook-ups and the purchasing

of drugs can be arranged using mobile geospatial networking applications (apps) may mean men engaging in chemsex may not use such venues.[29] Therefore, our study may underestimate the prevalence of chemsex in MSM in London. However, in sampling men attending gay commercial venues, we collected information from participants who may have been underrepresented in previous studies of chemsex, which primarily recruited men from STI clinics.[5 6 20 21] Our surveys are anonymous meaning we are unable to identify which, if any, individuals participated in both surveys in 2013 and 2016. Whilst this does not cause any bias in the estimates we present, it may have affected the standard errors and p-values somewhat, because we cannot account for the correlation over time within individuals. For analysis, we have combined men reporting their HIV status as negative or unknown, because there were too few men of unknown status (56 in 2013, 24 in 2016) to conduct analysis separately. Adjusting for a participant's knowledge of their HIV status in sensitivity analysis, we found this had negligible impact on effect estimates for the combined group of HIV-negative/unknown-status men.

In conclusion, a significant proportion of MSM, especially HIV-positive men, in London continue to engage in chemsex. Irrespective of HIV status, chemsex was associated with engagement in HIV/STI risk behaviours. Frequency of HIV testing in the past year among HIV-negative/unknown-status men was below UK national recommendations. Thus, offering combination prevention strategies to MSM reporting chemsex, such as clinic and community-based interventions to promote ART and/or PrEP uptake and adherence, frequent HIV/STI (including HCV) testing, and behavioural interventions including offering support for problematic drug use,[9 12 30] remain crucial to reduce health inequalities in MSM in the UK. The rollout of PrEP in the UK, the provision of which mandates regular in-clinic monitoring, offers an opportunity to increase STI/HIV testing among HIV-negative men.[31]

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Contributors

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Competing Interests

None

Ethics approval

Both years of this survey were approved by the London Harrow Research Ethics Committee (Ref: 00/0158).