Research paper

Poly drug use, chemsex drug use, and associations with sexual risk behaviour in HIV-negative men who have sex with men attending sexual health clinics

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A B S T R A C T

Background: Recreational drug use and associated harms continue to be of significant concern in men who have sex with men (MSM) particularly in the context of HIV and STI transmission.
Methods: Data from 1484 HIV-negative or undiagnosed MSM included in the AURAH study, a cross-sectional, self-completed questionnaire study of 2630 individuals from 20 sexual health clinics in the United Kingdom in 2013–2014, was analysed. Two measures of recreational drug use in the previous three months were defined; (i) polydrug use (use of 3 or more recreational drugs) and (ii) chemsex drug use (use of mephedrone, crystal methamphetamine or GHB/GBL). Associations of socio-demographic, health and lifestyle factors with drug use, and associations of drug use with sexual behaviour, were investigated.
Results: Of the 1484 MSM, 350 (23.6%) reported polydrug use and 324 (21.8%) reported chemsex drug use in the past three months. Overall 852 (57.5%) men reported condomless sex in the past three months; 430 (29.0%) had CLS with ≥2 partners, 474 (31.9%) had CLS with unknown/HIV+ partner(s); 187 (12.6%) had receptive CLS with an unknown status partner. For polydrug use, prevalence ratios (95% confidence interval) for association with CLS measures, adjusted for socio-demographic factors were: 1.38 (1.26, 1.51) for CLS; 2.11 (1.80, 2.47) for CLS with ≥2 partners; 1.89 (1.63, 2.19) for CLS with unknown/HIV+ partner(s); 1.36 (1.00, 1.83) for receptive CLS with an unknown status partner. Corresponding adjusted prevalence ratios for chemsex drug use were: 1.38 (1.26, 1.52); 2.07 (1.76, 2.43); 1.88 (1.62, 2.19); 1.49 (1.10, 2.02). Polydrug and chemsex drug use were also strongly associated with previous STI, PEP use, group sex and high number of new sexual partners. Associations remained with little attenuation after further adjustment for depressive symptoms and alcohol intake.
Conclusion: There was a high prevalence of polydrug use and chemsex drug use among HIV negative MSM attending UK sexual health clinics. Drug use was strongly associated with sexual behaviours linked to risk of acquisition of STIs and HIV.

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Introduction

Gay, bisexual, and other men who have sex with men (MSM) continue to be one of the highest risk groups for HIV in the UK and globally (Beyrer, Baral et al., 2012; Beyrer, Sullivan et al., 2012), and experience a significant burden of ill health and harm through the use of alcohol, recreational drugs and tobacco (Public

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Health England, 2015). Recreational drug use in MSM and the associations with sexual-risk behaviour has been documented on an international level (Colfax & Guzman, 2006; De Ryck, Van Laeken, Noestlinger, Platteau, & Colebunders, 2013; Drumright et al., 2007; Heiligenberg et al., 2012; McCarty-Caplan, Jantz, & Swartz, 2014; Pappas & Halkitis, 2011; Prestage et al., 2009; Santos et al., 2013) and is an important public health consideration in Western Europe (EMIS, 2010), particularly the UK (Bolding, Hart, Sherr, & Elford, 2006; Daskalopoulou et al., 2014; Hickson, Bonell, Weatherburn, & Reid, 2010; Home Office, 2013/14; Hunter, Dargan, Benzie, White, & Wood, 2014; Kirby & Thornber-Dunwell, 2013), where transmission of HIV and other sexually transmitted infections (STIs), remain high (Public Health England, 2014). A 2014 report described the use of psychoactive drugs in sexual settings among MSM in London (Bourne, Reid, Hickson, Torres Rueda, & Weatherburn, 2014). This has been termed 'chemsex' which relates to the use of certain sexually-disinhibiting recreational drugs before or during sex with the specific purpose of facilitating or enhancing sex; namely any combination of crystal methamphetamine, mephedrone and gammahydroxybutrate/gammabutyrolactone (GHB/GBL) (Bourne et al., 2014; Bourne, Reid, Hickson, Torres-Rueda, Steinberg et al., 2015; McCall, Adams, Mason, & Willis, 2015; Melendez-Torres & Bourne, 2016). By definition, chemsex differs from generic illicit/recreational drug use (Bourne et al., 2014); it is thought to be associated with higher-risk sexual activity, and linked to an increase in transmission of STIs (Melendez-Torres, Hickson, Reid, Weatherburn, & Bonell, 2016; Stuart & Weymann, 2015).

There is evidence that specific recreational drugs, are associated with facilitation of HIV (Buchacz et al., 2005; Macdonald et al., 2007; Plankey et al., 2007; Prestage et al., 2009; Ostrow et al., 2009) and STI (Hirshfield, Remien, Walavalkar, & Chiasson, 2004) transmission, increased sexual risk behaviour (Hoenigl et al., 2016; Mansergh et al., 2006; Colfax et al., 2004), and potential risk of serious overdose and death (Caldicott, Chow, Burns, Felgate, & Byard, 2004; Liechti & Kupferschmidt, 2004). There is limited recent information relating specifically to HIV negative or undiagnosed MSM and recreational drug use in the UK, particularly around chemsex drug use (Public Health England, 2014) and the associations with sexual behaviours which are linked to risk of acquiring HIV or other STIs. Information on prevalence of recreational drug use and potential associations with sexual risk behaviour is essential if targeted sexual health and HIV prevention policies are to be developed and delivered effectively to those that may benefit from them most. Changing trends in the popularity of certain recreational drugs in MSM, including an increase in use of chemsex drugs, has been suggested (Daskalopoulou et al., 2014; Stuart, 2013).

The aim of this study was to use data from a cross-sectional multi-centre study among HIV negative MSM attending UK GUM clinics, to assess prevalence and factors associated with polydrug use and chemsex drug use, and to explore the associations of drug use with sexual behaviour, in particular condomless sex.

Methods

AURAH (Attitudes to and Understanding of Risk of Acquisition of HIV) is a cross-sectional, clinic-based study that recruited HIV negative or undiagnosed participants from 20 GUM clinics across England between June 2013 and November 2014. Methodological details have been published elsewhere (Sewell et al., 2016). Participants completed a confidential, self-administered paper questionnaire that included items on demographics (gender, sexual orientation, age, ethnicity, UK birth, relationship status), socio-economic factors (education, employment, housing, money for basic needs), health and lifestyle factors (higher risk alcohol

use, ascertained by a shortened version of the WHO (AUDIT) questionnaire (Babor, Higgins-Biddle, Saunders, & Monteiro, 2001), symptoms of depression ascertained using the Patient Health Questionnaire 9 item scale (PHQ-9) (Kroenke, Spitzer, & Williams, 2001), symptoms of anxiety ascertained using the Generalized Anxiety Disorder 7-item scale (GAD-7) (Spitzer, Kroenke, Williams, & Lowe, 2006)), as well as recent sexual behaviour, and recent recreational drug use.

Men were classified as MSM if they met at least one of the following criteria: (i) reported being gay or bisexual (including other plurisexual identity labels; pansexual, omnisexual, open, or queer, i.e. identities that are not explicitly based on attractions to one sex/gender (Galupo, Lomash & Mitchell, 2017)), (ii) reported anal sex with a man in the past three months, or (iii) reported having disclosed to their family, friends or workmates as being gay, bisexual and/or attracted to men..

Ascertainment of recreational drug use

All participants were asked to report whether they had used recreational drugs in the past three months and, if so, to select which drug or drugs from the following list of 18 options: acid, lysergic acid diethylamide (LSD), or magic mushrooms (all grouped as psychedelics); anabolic steroids; cannabis (marijuana, grass); cocaine (coke); crack; codeine; crystal meth (methamphetamine); ecstasy (MDMA or E); GHB (GBL or liquid ecstasy); heroin; ketamine (k); khat (chat); mephedrone; morphine; opium; poppers (amyl nitrites); speed (amphetamine); erectile dysfunction drugs (Viagra); and other (whereby participants were asked to specify the drug). Other drugs specified were coded to the above categories where appropriate (in most cases, participants specified one of the drug options under a different or street name). Participants were also asked whether they had injected recreational drugs in the past three months.

Recreational drug use definition

Two measures of recreational drug-use were defined: (i) poly drug use: use of three or more recreational drugs (from the above list of 18) in the past three months and (ii) chemsex drug use: use of one or more of mephedrone, methamphetamine or GHB/GBL in the past three months. It should be noted that the questionnaire did not ask about drug use during sex specifically.

Sexual behaviour questions

Eight self-reported sexual behaviour measures were derived from the questionnaire. Sex was defined throughout as anal sex with men, or vaginal or anal sex with women. Four measures of condomless (anal or vaginal) sex (CLS) in the past three months were defined: (i) CLS with one or more partners (ii) CLS with two or more partners, (iii) CLS with partners of an unknown or HIV positive status (men who reported no CLS partners of unknown HIV status, and only one HIV positive CLS partner who was a long-term partner and with whom they 'thought the risks of catching HIV were low because their partner was taking ART', were not counted) and (iv) receptive CLS with an HIV unknown status partner. The following additional measures were also investigated: (v) self-reported diagnosis with a bacterial STI in the past year (Gonorrhoea, Chlamydia, Syphilis, and/or Lymphogranuloma venereum, LGV) and (vi) post-exposure prophylaxis (PEP) use in the past year. Finally, two measures of partner numbers were investigated: (vii) report of eleven or more new sexual partners in the past year and (viii) group sex in the past three months. It is reported in Genitourinary Medicine Clinic Activity Dataset (GUMCAD) data that having a bacterial STI and use of PEP in the

previous year are associated with increased risk of HIV acquisition in MSM (GUMCAD, 2012).

Statistical analysis

To examine the associations of specific socio-demographic, health and lifestyle factors, with (i) poly drug use and (ii) chemsex drug use, we conducted univariable analyses using Pearson χ^2 tests and χ^2 tests for trend, and multivariable analysis using modified Poisson regression with robust error variances to produce adjusted prevalence ratios (PRs) (Zou, 2004). In adjusted models, each factor was considered in a separate model and adjusted for age (as a continuous variable), ethnicity (white; non-white), university education (yes; no or missing), self-reported sexual identity (gay; bisexual or straight), ongoing relationship (yes; no or missing) and study region (London; South; Midlands or Yorkshire and the Humber). The associations between the two measures of drug use and the eight sexual behaviour measures were assessed (i) unadjusted (ii) adjusted for age, ethnicity, education, sexual identity, relationship status and study region, and (iii) adjusted for the previous factors and clinically significant depressive symptoms (reporting a score of 10 or greater on PHQ-9) and higher risk alcohol cosumption (score of ≥ 6 on the first two questions of the WHO AUDIT-C questionnaire). Chi-squared tests were used to assess univariable associations and modified Poisson regression analysis was used to produce unadjusted and adjusted prevalence ratios. It should be noted that it is not appropriate to compare, across outcome measures of differing prevalence, the magnitude of prevalence ratios associated with drug use.

An additional analysis of the association of drug use measures with sexual behaviour was conducted among a restricted sample of MSM who reported anal and/or vaginal sex in the past three months, in order to specifically compare those having condom protected sex to those having CLS, when investigating recent measures of recreational drug use.

Results

Sample characteristics

In total, 2630 individuals participated in the AURAH study; the response rate was 60% (2630/4393). Of the 1954 male participants, 1484 were defined as MSM. Table 1 shows participant characteristics. The majority of MSM were of white ethnicity (n = 1196, 81.6%), 1313 (88.8%) self-identified as gay, 141 (9.5%) as bisexual and 25 (1.7%) as straight. The median age was 31.5 years. Overall, 1112 (74.9%) participants attended a clinic in London, 276 (18.6%) attended a clinic in the South and 96 (6.5%) attended a clinic in the Midlands/the North of England. The majority of men reported having enough money to cover basic needs (n = 1062 (71.8%)), two thirds were educated to university degree level (n = 990, 66.7%) and there was a high rate of employment (1182 (79.7%)) (Table 2).

Prevalence of recreational drug use

Of the 1484 included MSM, 812 (54.7%) reported use of one or more recreational drug(s) in the past three months. Overall, 300 (20.2%) men reported use of one drug, 162 (10.9%) reported use of two drugs, 93 (6.3%) reported use of three drugs, 64 (4.3%) reported use of four drugs and 193 (13.0%) reported use of five or more drugs in the past three months. Overall, 350 (23.6%) men reported poly drug use and 324 (21.8%) men reported use of at least one chemsex drug. Only 34 (2.3%) men reported injecting recreational drugs in the past three months.

Overall, the most commonly reported drug used was nitrites (32.8%) (Fig. 1). This was followed by cannabis (21.0%), cocaine

(19.4%), mephedrone (19.1%), erectile dysfunction drugs (17.7%), MDMA (13.0%), GHB/GBL (12.0%), ketamine (8.4%) and methamphetamine (6.4%). The other drugs had a prevalence of use of <5%.

Correlates of recreational drug use

Table 1 shows the association of socio-demographic, health and lifestyle factors with the two measures of recreational drug use, in the past three months.

In univariable analysis, younger age (age groups <45 years), non-university education, non-home ownership, not being in an ongoing relationship, attending a clinic in London or the South, higher risk drinking, and depressive symptoms were associated with poly drug use in the past three months. The prevalence of poly drug use also appeared to be higher among men of white ethnicity, although the association was of borderline statistical significance. After adjusting for socio-demographic factors (age, ethnicity, sexual identity, education, relationship status and study region), with the exception of non-home ownership, these associations with polydrug use remained. There was also evidence of an association between financial hardship and poly drug use after adjustment for socio-demographic factors.

A similar pattern was observed for chemsex drug use, whereby, younger age (in particular the 30-39 year age groups), non-university education, not being in an ongoing relationship, attending a clinic in London or the South, financial hardship, higher risk drinking and depressive symptoms were found to be associated with use of chemsex drugs, including after adjustment for socio-demographic factors. Additionally, men who identified as gay were much more likely to report chemsex drug use in unadjusted and adjusted analysis compared to those who identified as bisexual or straight.

Prevalence of sexual behaviour measures

Of the 1484 MSM, over half reported having CLS within the past three months (n = 853; 57.5%, Table 2), of these men, 91.7% had CLS with men only, 3.9% had CLS with both men and women, and 4.5% had CLS with women only. Of the 33 men who reported CLS with both men and women, 18.2% (n = 6) reported anal CLS with a woman at least once, and of the 38 men who reported CLS with women only, 31.6% (n = 12) reported anal CLS at least once. Furthermore, 29.0% (n = 430) of the 1484 MSM reported CLS with ≥ 2 partners in the past three months, 31.9% (n = 474) of men reported CLS with unknown/HIV positive status partners (men who reported no CLS partners of unknown HIV status, and only one HIV positive CLS partner who was a long-term partner and with whom they 'thought the risks of catching HIV were low because their partner was taking ART', were not counted as positive for this measure), 12.6% (n = 187) of men reported receptive CLS with an HIV unknown status partner, 34.1% (n = 506) of men reported eleven or more new sexual partners in the past year and 35.5% (n = 527) reported group sex in the past three months. Overall 441 MSM (29.7%) self-reported a bacterial STI diagnosis in the past year. The most common bacterial STI reported was gonorrhoea (21.8%, n = 323) followed by chlamydia (14.0%, n = 208). Fourteen percent (n = 212) of all MSM reported using post-exposure prophylaxis (PEP) within the previous year. Participants were also asked whether they had ever taken PrEP and 4.5% reported that they had.

Relationship between recreational drug use and sexual behaviour

Comparing men who reported poly drug use in the past three months with men who did not, there was a significantly higher prevalence in the past three months of; CLS with one or more

Table 1
Unadjusted and adjusted associations of socio-demographic and lifestyle factors with measures of recreational drug use (past 3 months) among 1484 MSM.

N = 1484 MSM		N (%)	Poly drug use (use of 3 or more recreational drugs)		Use of least one 'chemsex' associated drug (crystal methamphetamine, mephedrone or GHB/GBL)	
			% p Value[a]	Adjusted PR[c] [95% CI] Overall p value	% p Value[a]	Adjusted PR[c] [95% CI] Overall p value
Age (years) (N = 1464)	<25	254 (17.3%)	25.6%	1.49 [1.04, 2.13]	20.9%	1.29 [0.88, 1.90]
	25–29	372 (25.4%)	20.7%	1.21 [0.85, 1.72]	18.8%	1.15 [0.80, 1.66]
	30–34	277 (18.9%)	29.6%	1.77 [1.26, 2.49]	28.9%	1.80 [1.27, 2.55]
	35–39	193 (13.2%)	27.5%	1.71 [1.18, 2.47]	25.9%	1.67 [1.14, 2.45]
	40–44	143 (9.8%)	21.0%	1.32 [0.86, 2.01]	21.7%	1.44 [0.94, 2.19]
	45+	225 (15.4%)	17.3%	1	16.0%	1
			0.011	0.005	0.005	0.003
			0.126[b]	0.166[b]	0.550[b]	0.753[b]
Born in the UK and white ethnicity (N = 1465)	Yes, white	759 (51.8%)	24.9%	1	22.0%	1
	Yes, non-white	97 (6.6%)	16.5%	0.60 [0.37, 0.97]	14.4%	0.67 [0.40, 1.14]
	No, white	437 (29.8%)	24.9%	0.96 [0.78, 1.17]	23.8%	1.01 [0.82, 1.26]
	No, non-white	172 (11.7%)	17.4%	0.70 [0.49, 1.00]	19.2%	0.91 [0.65, 1.27]
			0.058	0.062	0.185	0.464
Self-reported sexual identity (N = 1479)	Gay	1313 (88.8%)	24.1%	1	23.2%	1
	Bisexual[d]	141 (9.5%)	19.9%	0.90 [0.64, 1.27]	12.1%	0.56 [0.35, 0.88]
	Straight	25 (1.7%)	12.0%	0.59 [0.20, 1.73]	4.0%	0.20 [0.03, 1.48]
			0.204	0.540	0.001	0.013
Money to cover basic needs (N = 1480)	All the time	1062 (71.8%)	23.5%	1	21.6%	1
	Most of the time	311 (21.0%)	22.2%	0.92 [0.72, 1.16]	19.9%	0.95 [0.74, 1.22]
	Sometimes/no	107 (7.2%)	29.9%	1.38 [1.02, 1.87]	30.8%	1.71 [1.27, 2.30]
			0.258	0.057	0.056	0.001
			0.376[b]	0.287[b]	0.179[b]	0.027[b]
University education (N = 1484)	Yes	990 (66.7%)	21.5%	1	20.5%	1
	No/missing	494 (33.3%)	27.7%	1.39 [1.15, 1.67]	24.5%	1.34 [1.10, 1.63]
			0.008	0.001	0.080	0.004
Employment status (N = 1484)	Employed	1182 (79.7%)	23.4%	1	21.8%	1
	No/missing	302 (20.4%)	24.5%	1.07 [0.85, 1.34]	21.9%	1.04 [0.82, 1.33]
			0.674	0.590	0.992	0.742
Housing status (N = 1463)[e]	Home owner	421 (28.8%)	19.0%	1	18.3%	1
	Renting	832 (56.9%)	25.6%	1.16 [0.90, 1.50]	23.4%	1.16 [0.89, 1.50]
	Unstable/other	210 (14.4%)	24.3%	1.15 [0.81, 1.62]	22.4%	1.20 [0.84, 1.72]
			0.033	0.517	0.111	0.502
			0.047[b]	0.390[b]	0.114[b]	0.284[b]
Ongoing relationship (N = 1484)	Yes	640 (43.1%)	18.6%	1	15.9%	1
	No/missing	844 (56.9%)	27.4%	1.35 [1.11, 1.65]	26.3%	1.53 [1.24, 1.89]
			<0.001	0.003	<0.001	<0.001
Study region (N = 1484)	London	1112 (74.9%)	24.6%	1	23.4%	1
	South	276 (18.6%)	23.9%	0.90 [0.71, 1.14]	21.0%	0.83 [0.64, 1.08]
	Midlands & the North	96 (6.5%)	11.5%	0.42 [0.24, 0.73]	6.3%	0.25 [0.12, 0.55]
			0.015	0.008	<0.001	0.001
Higher risk alcohol consumption[f]	Yes	288 (19.4%)	36.1%	1.65 [1.37, 2.00]	31.9%	1.58 [1.29, 1.93]
	No/missing	1196 (80.6%)	20.6%	1	19.4%	1
			<0.001	<0.001	<0.001	<0.001
Clinically significant depressive symptoms (PHQ−9 score ≥ 10) (N = 1484)	Yes	185 (12.5%)	33.0%	1.46 [1.15, 1.85]	29.2%	1.45 [1.13, 1.87]
	No/missing	1299 (87.5%)	22.3%	1	20.8%	1
			0.001	0.002	0.010	0.004
Clinically significant anxiety symptoms (GAD−7 score ≥ 10) (N = 1484)	Yes	158 (10.6%)	26.6%	1.14 [0.86, 1.52]	22.0%	0.99 [0.71, 1.38]
	No/missing	1326 (89.4%)	23.2%	1	20.9%	1
			0.348	0.357	0.761	0.960

[a] χ^2 test.
[b] Test for trend.
[c] Each factor considered in a separate model adjusted for age (as a continuous variable), ethnicity (white or non-white), sexual identity (gay or bisexual/straight), education, ongoing relationship status and study region.
[d] Includes 131 men who identified as bisexual and ten men who reported other plurisexual identity labels including queer, pansexual, omnisexual, open, and bi-curious.
[e] Renting includes from a private landlord or council or housing association. Unstable includes temporary accommodation (hostel, shelter, bed and breakfast, squat), staying with partner/friend(s)/family and homeless.
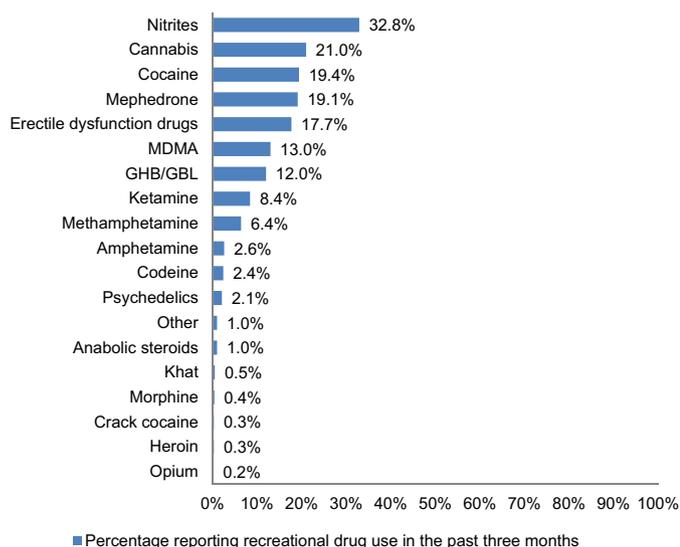[f] Higher-risk drinking is based on the first two questions of the WHO AUDIT questionnaire. Higher risk drinking is indicated by a score of ≥6 (Babor et al., 2001).

Table 2
Prevalence of sexual behaviours among 1484 MSM.

	All MSM [N = 1484] n (%) (95% CI)
CLS with one or more partners (past 3 months)	853 (57.5%) (54.9%, 60.0%)
CLS with two or more partners (past 3 months)	430 (29.0%) (26.7%, 31.4%)
CLS with unknown/HIV positive status partner(s)[a] (past 3 months)	474 (31.9%) (29.6%, 34.4%)
Receptive CLS with unknown HIV status partner(s) (past 3 months)	187 (12.6%) (11.0%, 14.4%)
Self-reported bacterial STI diagnosis (past year)	441 (29.7%) (27.4%, 32.1%)
PEP use (past year)	212 (14.3%) (12.5%, 16.2%)
Eleven or more new sexual partners (past year)	506 (34.1%) (31.7%, 36.6%)
Group sex (past 3 months)	527 (35.5%) (33.1%, 38.0%)

[a] Excludes men who reported no CLS partners of unknown HIV status, and only one HIV positive CLS partner who was a long-term partner and with whom they 'thought the risks of catching HIV were low because their partner was taking ART'.

N=1484 MSM attending sexual health clinics across the UK

Drug	%
Nitrites	32.8%
Cannabis	21.0%
Cocaine	19.4%
Mephedrone	19.1%
Erectile dysfunction drugs	17.7%
MDMA	13.0%
GHB/GBL	12.0%
Ketamine	8.4%
Methamphetamine	6.4%
Amphetamine	2.6%
Codeine	2.4%
Psychedelics	2.1%
Other	1.0%
Anabolic steroids	1.0%
Khat	0.5%
Morphine	0.4%
Crack cocaine	0.3%
Heroin	0.3%
Opium	0.2%

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

■ Percentage reporting recreational drug use in the past three months

Fig. 1. Prevalence of individual recreational drug use in the past three months among 1484 MSM.

partners (71.4% vs. 53.2%), CLS with two or more partners (47.4% vs. 23.3%), CLS with unknown/HIV positive status partner(s) (49.7% % vs. 26.5%), receptive CLS with an unknown status partner (16.0% vs. 11.6%), bacterial STI diagnosis (47.4% vs. 24.3%), PEP use (24.0% vs. 11.3%), report of eleven or more new sexual partners (56.3% vs. 27.3%) and group sex (66.0% vs. 26.1%); all χ^2 p values <0.001 (with the exception of receptive CLS with an unknown status partner; χ^2 p = 0.028).

The results were similar for chemsex drug use. Compared to men who did not use chemsex drugs, those who did had a higher prevalence of; CLS with one or more partners (80.0% vs. 53.7%), CLS with two or more partners (47.5% vs. 23.8%), CLS with unknown/ HIV positive status partner(s) (50.0% vs. 26.9%), receptive CLS with an unknown status partner (17.0% vs. 11.4%), bacterial STI diagnosis (53.4% vs. 23.1%), PEP use (29.0% vs. 10.2%), report of eleven or more new sexual partners (57.7% vs. 27.5%) and group sex (69.8% vs. 26.0%); all χ^2 p values <0.001 (with the exception of receptive CLS with an unknown status partner; χ^2 p = 0.007).

Fig. 2a and b shows the strong associations found between poly drug and chemsex drug use respectively, with the sexual behaviour outcomes. The prevalence ratios are shown as (i) unadjusted, (ii) adjusted for socio-demographic factors (age, ethnicity, education, sexual identity, relationship status, and study region) and (iii) adjusted for socio-demographic factors plus higher risk drinking and depressive symptoms. Poly drug use remained strongly associated with the sexual behaviour measures after adjustment for socio-demographic factors (CLS with one or more partners [Prevalence Ratio 1.38 95% CI: 1.26, 1.51], CLS with ≥2 partners [PR 2.11 95% CI: 1.80, 2.47], CLS with unknown/HIV+ partner(s) [PR 1.89 95% CI: 1.63, 2.19], receptive CLS with an unknown status partner [PR 1.36 95% CI: 1.00, 1.83], STI diagnosis [PR 1.85 95% CI: 1.58, 2.16], PEP use [PR 2.06 95% CI: 1.59, 2.67], ≥11 new sex partners [PR 1.99 95% CI: 1.74, 2.28], and group sex [PR 2.59 95% CI: 2.29, 2.94]). After adjusting additionally for higher risk drinking and depressive symptoms, most associations were slightly attenuated but remained strong.

Similarly, chemsex drug use remained strongly associated with the sexual behaviour measures after adjustment for socio-demographic factors (CLS with one or more partners [Prevalence Ratio 1.38 95% CI: 1.26, 1.52], CLS with ≥2 partners [PR 2.07 95% CI: 1.76, 2.43], CLS with unknown/HIV+ partner(s) [PR 1.88 95% CI: 1.62, 2.19], receptive CLS with an unknown status partner [PR 1.49 95% CI: 1.10, 2.02], STI diagnosis [PR 2.22 95% CI: 1.91, 2.58], PEP use [PR 2.78 95% CI: 2.16, 3.58], ≥11 new sex partners [PR 1.94 95% CI: 1.69, 2.22], and group sex [PR 2.73 95% CI: 2.41, 3.09]). Again, after adjusting additionally for higher risk drinking and depressive symptoms, some associations were slightly attenuated but all remained strong.
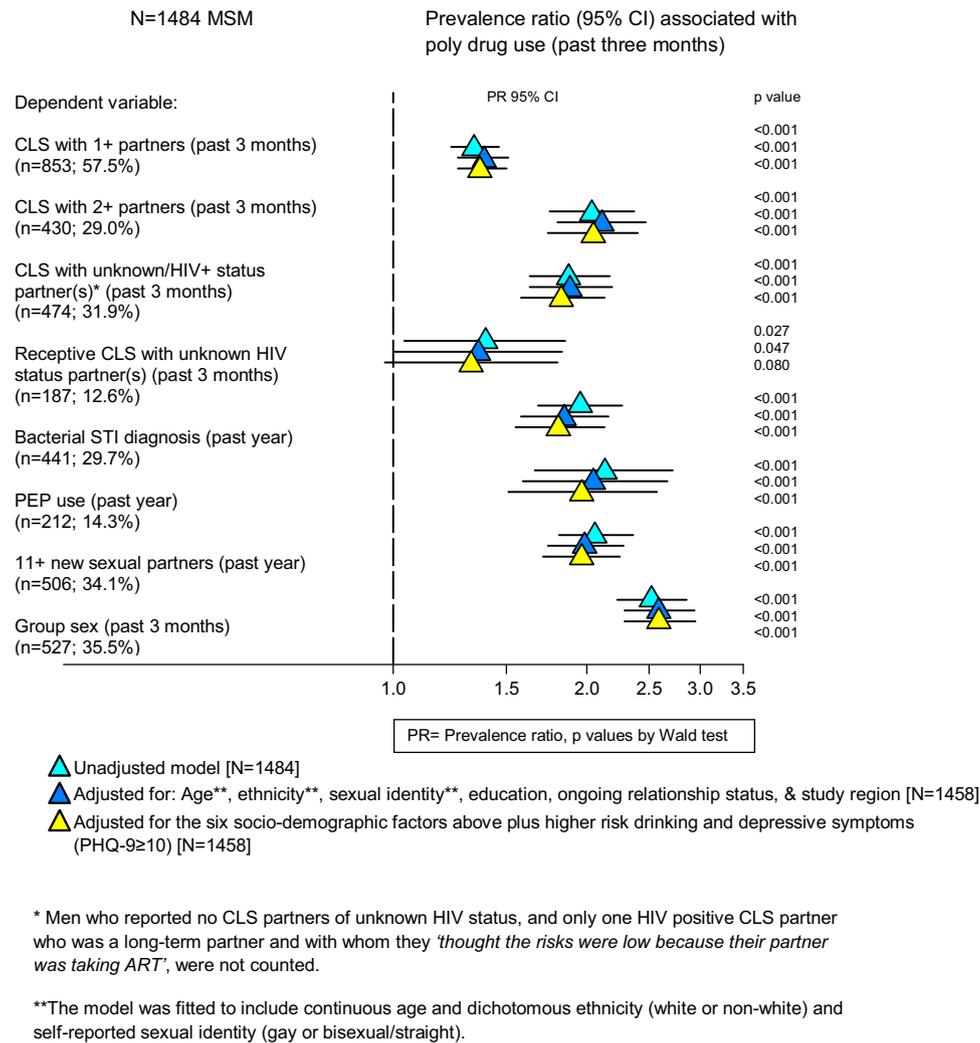
The associations of poly drug use and chemsex drug use with the sexual behaviour measures remained strong for most of the sexual behaviour measures in the subgroup of 1340 MSM who had anal or vaginal sex in the past three months, as shown in Table 3.

Discussion

Our results demonstrate that over half (54.7%) of the HIV negative MSM attending sexual health services during the study period (2013–14) had reported use of one or more recreational drugs in the past three months. Nearly a quarter (23.6%) of these men reported use of three or more drugs, and over a fifth (21.8%) reported use of at least one chemsex drug (though use of chemsex drugs does not necessarily equate to engaging in chemsex). There was a striking association between the two measures of recreational drug use and measures of CLS, these associations were only slightly attenuated when adjusted for socio-demographic factors (age, ethnicity, education, sexual identity, relationship status, study region), and most remained after additional adjustment for alcohol use and symptoms of depression.

The prevalence of recreational drug use in our clinic-based study is higher than that found by the third National Survey of Sexual Attitudes and Lifestyles (NATSAL-3) which included a small sample of MSM recruited from a general population study

(a)

N=1484 MSM

Prevalence ratio (95% CI) associated with poly drug use (past three months)

Dependent variable:	PR 95% CI	p value
CLS with 1+ partners (past 3 months) (n=853; 57.5%)		<0.001 <0.001 <0.001
CLS with 2+ partners (past 3 months) (n=430; 29.0%)		<0.001 <0.001 <0.001
CLS with unknown/HIV+ status partner(s)* (past 3 months) (n=474; 31.9%)		<0.001 <0.001 <0.001
Receptive CLS with unknown HIV status partner(s) (past 3 months) (n=187; 12.6%)		0.027 0.047 0.080
Bacterial STI diagnosis (past year) (n=441; 29.7%)		<0.001 <0.001 <0.001
PEP use (past year) (n=212; 14.3%)		<0.001 <0.001 <0.001
11+ new sexual partners (past year) (n=506; 34.1%)		<0.001 <0.001 <0.001
Group sex (past 3 months) (n=527; 35.5%)		<0.001 <0.001 <0.001

1.0   1.5   2.0   2.5   3.0   3.5

PR= Prevalence ratio, p values by Wald test

△ Unadjusted model [N=1484]
▲ Adjusted for: Age**, ethnicity**, sexual identity**, education, ongoing relationship status, & study region [N=1458]
▲ Adjusted for the six socio-demographic factors above plus higher risk drinking and depressive symptoms (PHQ-9≥10) [N=1458]

* Men who reported no CLS partners of unknown HIV status, and only one HIV positive CLS partner who was a long-term partner and with whom they 'thought the risks were low because their partner was taking ART', were not counted.

**The model was fitted to include continuous age and dichotomous ethnicity (white or non-white) and self-reported sexual identity (gay or bisexual/straight).
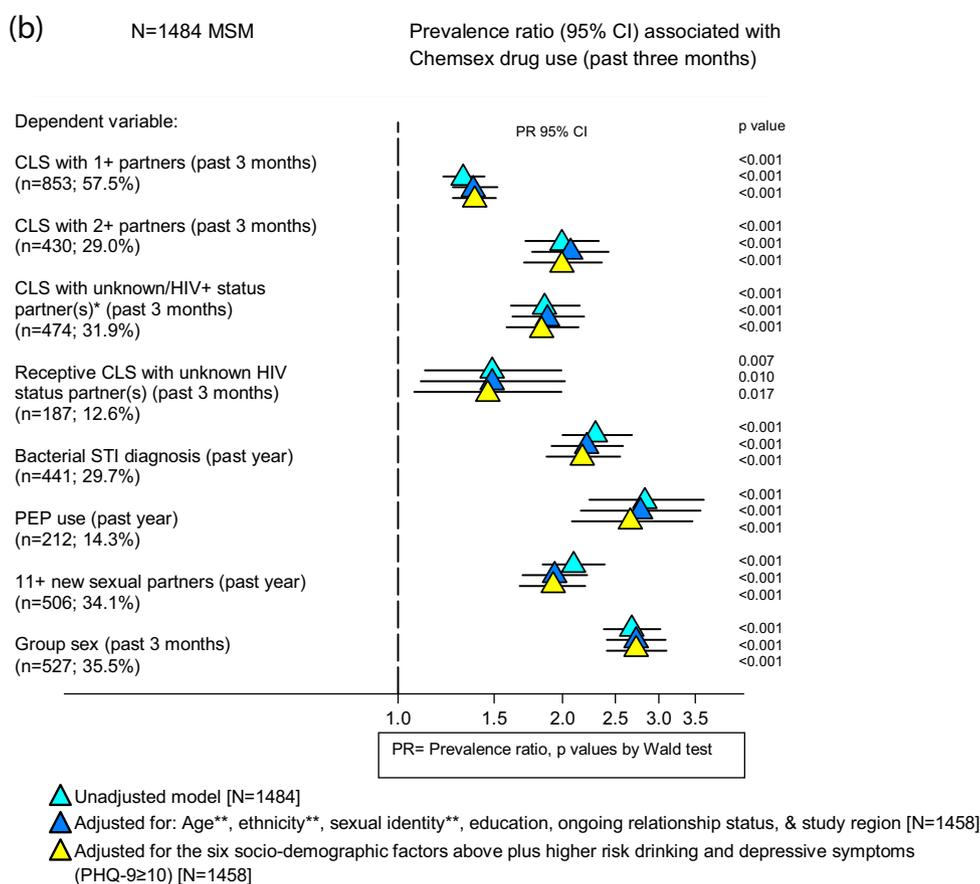
Fig. 2. (a) Associations of poly drug use in the past three months with sexual behaviour measures among 1484 MSM. (b) Associations of chemsex drug use in the past three months with sexual behaviour measures among 1484 MSM.

(n = 190) (Mercer et al., 2016), and demonstrated that 36% of all MSM had reported any recreational drug use in the past year. Our estimated prevalence of recreational drug use is also higher than that reported by the Crime Survey for England and Wales (CSEW) 2013/2014 (Home Office, 2013/14) which demonstrated that gay or bisexual men were the group most likely to have taken any illicit drug in the past year (33.0%). Differences in sampling frame (recruited through STI clinics) and the younger average age of the AURAH participants may account for the higher prevalence of recreational drug use among MSM in the AURAH study.

In AURAH, the most commonly used recreational drug was nitrites which have been found to be associated with increased risk of HIV transmission (Macdonald et al., 2007; Plankey et al., 2007). Overall 32.8% of MSM reported use of nitrites within the past three months. This is similar to the UK prevalence of nitrite use in the past month (29%) found in the European MSM Internet Sex Survey (EMIS), a European-wide (38 countries) volunteer online sample of MSM in 2010, in which the UK had the second highest prevalence of nitrite use (the overall prevalence was 19% and 28.3% in the Western Europe sub-region) (EMIS, 2010). EMIS also presented the prevalence of other drug composites in the

past month, in the Western Europe sub-region (Belgium, France, Netherlands, United Kingdom, and Republic of Ireland) these included; cannabis or LSD at 13.8%, heroin or crack at 0.4% and 'party drugs' (MDMA, amphetamines, methamphetamine, mephedrone, GHB/GBL, ketamine or cocaine) at 10.6% (17% in the UK) (EMIS, 2010). For the equivalent composite measures in AURAH, the prevalence was the same at 0.4% for heroin or crack use in the past three months and higher at 33.1% for 'party drug' use in the past three months. The higher prevalence for the latter measure may not be surprising given the differences in recall periods of drug use between the studies. In the AURAH study, men were asked about LSD use as part of a group of other psychedelic drugs, prohibiting comparison with the cannabis/LSD measure investigated in EMIS.

The Gay Men's Sex Survey (GMSS) is an annual community-based survey for MSM that (since 2003) collects data from volunteer convenience samples of men using gay community and commercial websites (as well as snowball sampling). The most recent survey was carried out from July–October 2014 in England (N = 15360) (Hickson, Reid, Hammond, & Weatherburn, 2016). HIV diagnosed individuals were included in the sample (9%). Data were collected on recreational drug use; in the past six months,

(b) N=1484 MSM — Prevalence ratio (95% CI) associated with Chemsex drug use (past three months)

Dependent variable:

Dependent variable	PR 95% CI	p value
CLS with 1+ partners (past 3 months) (n=853; 57.5%)		<0.001 / <0.001 / <0.001
CLS with 2+ partners (past 3 months) (n=430; 29.0%)		<0.001 / <0.001 / <0.001
CLS with unknown/HIV+ status partner(s)* (past 3 months) (n=474; 31.9%)		<0.001 / <0.001 / <0.001
Receptive CLS with unknown HIV status partner(s) (past 3 months) (n=187; 12.6%)		0.007 / 0.010 / 0.017
Bacterial STI diagnosis (past year) (n=441; 29.7%)		<0.001 / <0.001 / <0.001
PEP use (past year) (n=212; 14.3%)		<0.001 / <0.001 / <0.001
11+ new sexual partners (past year) (n=506; 34.1%)		<0.001 / <0.001 / <0.001
Group sex (past 3 months) (n=527; 35.5%)		<0.001 / <0.001 / <0.001

PR= Prevalence ratio, p values by Wald test

△ Unadjusted model [N=1484]
▲ Adjusted for: Age**, ethnicity**, sexual identity**, education, ongoing relationship status, & study region [N=1458]
▲ Adjusted for the six socio-demographic factors above plus higher risk drinking and depressive symptoms (PHQ-9≥10) [N=1458]

* Men who reported no CLS partners of unknown HIV status, and only one HIV positive CLS partner who was a long-term partner and with whom they *'thought the risks were low because their partner was taking ART'*, were not counted.

**The model was fitted to include continuous age and dichotomous ethnicity (white or non-white) and self-reported sexual identity (gay or bisexual/straight).

Fig. 2. (Continued)

34.6% of all men reported using nitrites, 19.0% erectile dysfunction drugs, 19.9% cannabis, 11.5% MDMA, 3.8% methamphetamine, 0.3% heroin, 4.6% ketamine, 1.1% psychedelics, 12.7% cocaine, 0.7% crack cocaine, 8.5% mephedrone, and 5.2% GHB/GBL. Although the recall period for drug use in AURAH (past three months) was half that of the GMSS 2014, the prevalence of reported use of methamphetamine (6.4%), ketamine (8.4%), cocaine (19.4%), mephedrone (19.1%), and GHB/GBL (12.0%) was higher. For all other drugs, the prevalence was similar or slightly lower in the AURAH study. Again, this may be affected by age differences between the two studies (although the median ages were similar and the GMSS 2014 included men aged 16 years or older instead of 18 years or older in AURAH), the inclusion of men with diagnosed HIV (although a small proportion of the sample were positive), or more likely the fact that AURAH was a sample of GUM clinic service users, who may report different patterns of behaviour to men recruited online.

In the current study, younger age groups (in particular the 30–39 year age groups), markers of lower socio-economic status (non-university degree education and financial insecurity), not being in an ongoing relationship, attending a study clinic in London, higher risk drinking and report of clinically significant depressive symptoms, were found to be associated with poly drug use and chemsex drug use. There is little information from quantitative studies on factors associated with recreational drug use among HIV negative MSM in the UK. In GMSS 2014, living in London and having diagnosed HIV were found to be associated with chemsex drug use (methamphetamine, mephedrone and/or GHB/GBL—men were not asked whether drug use occurred before or during sex). Europe-wide data from EMIS found that younger age was associated with use of 'party drugs' in the past month (adjusted for factors including recruitment online site, education, settlement size, HIV status, outness, European sub-region, gay community/commercial venue attendance and CLS with a man) (EMIS, 2010). In AURAH, men who identified as gay were more likely to report chemsex drug use than men who did not, and this is in line with the findings described in UK qualitative work on chemsex drug use (Bourne et al., 2014; Bourne, Reid, Hickson, Torres-Rueda, Steinberg et al., 2015; Bourne, Reid, Hickson, Torres-Rueda, & Weatherburn, 2015).

In general, it has been suggested that MSM's use of recreational drugs is potentially part of coping with minority and other stressors (Meyer, 1995; Wolitski, Stall, & Valdiserri, 2008). Worry, stigma and victimization associated with a sexual minority status (as described in minority stress theory) may lead to high levels of psychological distress (including depression, anxiety and PTSD). The 'gay scene' (including clubs, bars, pubs, saunas etc.) can represent a culturally endorsed 'time-out' from stresses common

Table 3

Associations of poly drug use and chemsex drug use with measures of sexual behaviour measures among 1340 MSM who reported having anal or vaginal sex in the past three months.

N = 1340 MSM reporting anal/vaginal sex in the past three months Sexual behaviour/risk outcome measure	Poly drug use (past three months)			Chemsex drug use (past three months)		
	Unadjusted PR[95% CI] p Value[*]	Adjusted model (i) PR[95% CI] p Value[*]	Adjusted model (ii) PR[95% CI] p Value[*]	Unadjusted PR[95% CI] p Value[*]	Adjusted model (i) PR[95% CI] p Value[*]	Adjusted model (ii) PR[95% CI] p Value[*]
CLS with one or more partners (past three months)	1.21 [1.12, 1.32] <0.001	1.26 [1.16, 1.36] <0.001	1.25 [1.15, 1.35] <0.001	1.21 [1.12, 1.32] <0.001	1.28 [1.17, 1.39] <0.001	1.27 [1.16, 1.38] <0.001
CLS with two or more partners (past three months)	1.84 [1.58, 2.14] <0.001	1.90 [1.63, 2.22] <0.001	1.84 [1.57, 2.15] <0.001	1.83 [1.57, 2.13] <0.001	1.89 [1.61, 2.21] <0.001	1.82 [1.55, 2.14] <0.001
CLS with unknown/HIV positive status partner[a] (past three months)	1.70 [1.48, 1.96] <0.001	1.70 [1.47, 1.97] <0.001	1.65 [1.42, 1.91] <0.001	1.70 [1.48, 1.96] <0.001	1.72 [1.48, 1.99] <0.001	1.67 [1.44, 1.94] <0.001
Receptive CLS with unknown status partner (past three months)	1.25 [0.94, 1.67] 0.126	1.22 [0.91, 1.65] 0.184	1.19 [0.87, 1.61] 0.275	1.37 [1.02, 1.82] 0.033	1.36 [1.01, 1.84] 0.045	1.33 [0.98, 1.81] 0.070
Bacterial STI diagnosis (past year)	1.87 [1.61, 2.18] <0.001	1.79 [1.53, 2.09] <0.001	1.75 [1.49, 2.05] <0.001	2.25 [1.94, 2.60] <0.001	2.18 [1.87, 2.54] <0.001	2.14 [1.83, 2.50] <0.001
PEP use (past year)	2.00 [1.56, 2.57] <0.001	1.93 [1.48, 2.50] <0.001	1.83 [1.41, 2.39] <0.001	2.73 [2.14, 3.48] <0.001	2.64 [2.04, 3.40] <0.001	2.53 [1.95, 3.27] <0.001
Eleven or more new sexual partners (past year)	1.98 [1.73, 2.27] <0.001	1.91 [1.66, 2.18] <0.001	1.87 [1.63, 2.15] <0.001	2.02 [1.77, 2.31] <0.001	1.86 [1.62, 2.14] <0.001	1.83 [1.59, 2.10] <0.001
Group sex (past three months)	2.45 [2.16, 2.78] <0.001	2.50 [2.20, 2.84] <0.001	2.50 [2.19, 2.84] <0.001	2.62 [2.31, 2.96] <0.001	2.65 [2.33,3.01] <0.001	2.64 [2.32, 3.01] <0.001

Adjusted model (i): age (as a continous variable), ethnicity (white or non-white), sexual identity (gay or bisexual/straight), university education, ongoing relationship status and study region.

Adjusted model (ii): age (as a continuous variables), ethnicity (white or non-white), sexual identity (gay or bisexual/straight), university education, ongoing relationship status, study region, higher risk drinking, and depressive symptoms (PHQ—9 ≥ 10).

[a] Men who reported no CLS partners of unknown HIV status, and only one HIV positive CLS partner who was a long-term partner and with whom they 'thought the risks of catching HIV were low because their partner was taking ART', were not counted as positive for this measure.

[*] p Value by Wald test.

to the gay community (and other sexual minority men). Drug use often plays a key role in escaping self-awareness of social and sexual norms. For many men, the 'scene' is an important social nexus (Crowe & George, 1989; McKirnan, Ostrow, & Hope, 1996) where gay sexuality is sanctioned and celebrated (Crowe & George, 1989).

The transmission of STIs and HIV among MSM are facilitated by, or in the case of HIV largely due to CLS. A modelling study suggested that for HIV, the majority of transmissions are due to CLS with a casual, rather than long-term, partner (Phillips et al., 2013). One UK study, the SALLEE study in 2009 (online sample of 691 MSM), has presented an adjusted OR (controlling for socio-demographic factors; age, education, nationality, language of questionnaire, time spent in UK, living in London and recruitment site, health and lifestyle factors; HIV status and injection drug use, and sexual behaviour measures; having been paid for sex in the UK) for the association between any recreational drug use in the past year and sexual risk behaviour. Men who reported drug use were found to be more likely to report CLS with a casual partner in the past year (AOR 2.07 95% CI: 1.40, 3.06; $p < 0.001$), than men who did not. This study was restricted to MSM who self-identified as migrants from one of the ten Central and Eastern European Countries (Evans et al., 2011).

Of note, chemsex is a newly emerging and fast developing phenomenon in the UK. Qualitative work (2013–2014) among a volunteer sample of MSM (promotion via a gay social networking app, and a London gay 'scene' publication, and referral from gay/bisexual charities) suggests that serosorting practices are common among HIV positive men who engage in chemsex (i.e. seeking CLS with partners of the same, HIV positive status, to themselves). At the same time, it suggested that a number of men whose last HIV test was negative had unintentional CLS as a direct result of 'chem' use (Bonell, Hickson, Weatherburn, & Reid, 2010; Bourne, Reid, Hickson, Torres-Rueda, Steinberg et al., 2015; Bourne, Reid, Hickson, Torres-Rueda, Weatherburn et al., 2015).

In addition to the association between drug use and CLS, there is some evidence to suggest that the HIV transmission risk associated with CLS may be enhanced by substance use (Ostrow et al., 2009). Recreational drug use may also impact on other aspects of physical and psychological health and wellbeing. The use of chemsex drugs such as GHB/GBL alone and in combination with other drugs such as mephedrone pose a risk of serious overdose (Galicia, Nogue, & Miro, 2011) and death (Aromatario, Bottoni, Santoni, & Ciallella, 2012), and studies have reported on the potential harmful effects of psychoactive substances in highly sexual circumstances (Bourne, Reid, Hickson, Torres-Rueda, Weatherburn et al., 2015; Melendez-Torres et al., 2016). However, in discussing the risk associated with recreational drug use, it is important to emphasise that some individuals may perceive positive benefits from drug (and alcohol) use, whether or not they experience any negative consequences. We did not ask in this study about individuals' perceptions or experiences of drug use, whether positive or negative, though this has been explored in other studies (Bourne, Reid, Hickson, Torres-Rueda, Steinberg et al., 2015; Weatherburn, Hickson, Reid, Torres-Rueda, & Bourne, 2016). It is important that sexual health services recognise the motivations for gay men engaging in chemsex, often described as facilitating sexual self-confidence or self-esteem, as well as discussing the potential harms of drug use.

Recent advances in HIV prevention, including results from the PROUD (McCormack et al., 2016) and IPERGAY (Molina et al., 2015) studies, which both demonstrated the highly protective effect (86%) of pre-exposure prophylaxis (PrEP) for HIV negative MSM, are highly relevant to MSM who report recreational drug use. As previous research has demonstrated that drug use among MSM is generally episodic rather than continuous (McCarty-Caplan et al., 2014) and, given the strong association between measures of recreational drug use and increased sexual risk behaviour among HIV negative MSM demonstrated in the AURAH study, identification of MSM using particular drugs associated with chemsex could

help to identify those that are most likely to benefit from access to PrEP.

Strengths and limitations

AURAH is the largest published study of recreational drug use among HIV negative or undiagnosed MSM attending sexual health clinics in the UK. A limitation of the study is that the reporting of use of chemsex drugs does not necessarily equate to engagement in chemsex; for example mephedrone use may be associated with clubbing or other social activity. In addition, AURAH did not collect information on personality traits associated with sensation seeking and compulsivity, or on factors such as childhood sexual abuse and intimate partner violence – factors that may be associated with drug use and with sexual risk behaviour (Jie, Ciyong, Xueqing, Hui, & Lingyao, 2012; Parsons, Grov, & Golub, 2012; Singer & Clair, 2003; Singer et al., 2006). Furthermore, although potential causal mechanisms between certain drugs and associations with HIV/STIs have been identified (Drumright et al., 2006), causality cannot be determined in this cross-sectional study and it is recognised that both recreational drug use and sexual risk behaviour may be part of pre-disposition to risk (Drumright et al., 2006). Whatever the direction of association, exposure to HIV and STIs remains a serious risk among HIV negative MSM who use recreational drugs, and there is a need for further longitudinal and qualitative studies to allow us to develop better understandings of the motivations for recreational drug use among HIV negative MSM, and the link with sexual behaviour.

Conclusions

The high prevalence of poly drug, and chemsex drug use reported by HIV negative MSM in the AURAH study points to a clear need for cross-agency collaboration to provide non-judgemental, tailored services that are accessible to HIV negative MSM through sexual health services. Active identification of MSM at increased risk of HIV acquisition who would benefit from potential HIV prevention interventions is vital, and consideration should be given to all MSM that report recreational drug use, and particularly those that report use of multiple or chemsex drugs. Among MSM, particularly in London, engagement with sexual health services is generally high (Bourne et al., 2014), which places these services in an opportune position to offer education, screening and interventions for different types of drug use. In addition, identification of recreational drug use within the sexual health setting may also highlight the need for opportune assessment by psychology or mental health teams that may be of benefit to individuals. Greater consideration should be given to the impact of recreational drug use on HIV and STI prevention strategies and allocation of funding and research to allow existing services to integrate harm reduction strategies into patient care.

Ethics approval and participant consent

The study received ethics approval from: NRES committee London-Hampstead, ref.: 13/LO/0246 in April 2014. Based on these documents, the study subsequently received permission for clinical research at all participating National Health Service sites. All participants provided written, informed consent before taking part.

Author contributions

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Role of the funder/sponsor

Data access

JS and AM had full access to all of the data (including statistical reports and tables) in the study and are responsible for the integrity of the data and the accuracy of the data analysis.

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Conflict of interest

Professor Andrew Phillips has received payments for presentations made at meetings sponsored by Gilead in spring 2015.

Dr Nneka Nwokolo has received support for attendance at conferences, speaker fees and payments for attendance at advisory boards from Gilead Sciences, Viiv Healthcare, Janssen Pharmaceuticals and Bristol Myers Squibb and a research grant from Gilead Sciences.

Dr Valentina Cambiano has received payment for lecturing by Merck Sharp & Dohmed Limited.

Dr David Asboe has served on the advisory board for Gilead in January 2016.

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