OPEN ACCESS

# Predictors of starting and stopping chemsex in men who have sex with men in England: findings from the AURAH2 prospective study

Robbie Hammond,[1] Valentina Cambiano,[2] Fiona C. Lampe,[2] David Asboe,[3] Amanda Clarke,[4] Richard Gilson ,[2] Graham J Hart,[2] Ada Rose Miltz ,[2] Nneka Nwokolo,[3] Anne M Johnson,[2] Andrew N Phillips,[2] Andrew Speakman,[2] Gary Whitlock,[5] Alison Rodger,[1,2] Janey Sewell [2]

[1]Department of Infectious Diseases, Royal Free London NHS Foundation Trust, London, UK
[2]Institute for Global Health, University College London, London, UK
[3]St Stephen's Centre, Chelsea and Westminster Healthcare NHS Trust, London, UK
[4]Department of Sexual Health, University Hospitals Sussex NHS Foundation Trust, Worthing, UK
[5]56 Dean Street, Chelsea and Westminster Healthcare NHS Trust, London, UK

**Correspondence to**
Dr Robbie Hammond, Royal Free London NHS Foundation Trust, London NW3 2QG, UK; robert.hammond1@nhs.net

Received 30 January 2023
Accepted 20 May 2023



**To cite:** Hammond R, Cambiano V, Lampe FC, *et al*. *Sex Transm Infect* Epub ahead of print: [*please include* Day Month Year]. doi:10.1136/sextrans-2023-055774

## ABSTRACT

**Background** Chemsex (the use of psychoactive drugs in sexual contexts) has been associated with HIV acquisition and other STIs, so there is benefit in identifying those most likely to start chemsex to offer risk reduction interventions such as pre-exposure prophylaxis (PrEP). To date, there have been no data from a longitudinal study analysing factors most associated with starting and stopping chemsex.

**Methods** The prospective cohort study, Attitudes to and Understanding Risk of Acquisition of HIV over Time (AURAH2), collected 4 monthly and annual online questionnaire data from men who have sex with men (MSM) from 2015 to 2018. We investigate the association of sociodemographic factors, sexual behaviours and drug use with starting and stopping chemsex among 622 men who completed at least one follow-up questionnaire. Poisson models with generalised estimating equations were used to produce risk ratios (RRs) accounting for multiple starting or stopping episodes from the same individual. Multivariable analysis was adjusted for age group, ethnicity, sexual identity and university education.

**Findings** In the multivariable analysis, the under 40 age group was significantly more likely to start chemsex by the next assessment (RR 1.79, 95% CI 1.12 to 2.86). Other factors which showed significant association with starting chemsex were unemployment (RR 2.10, 95% CI 1.02 to 4.35), smoking (RR 2.49, 95% CI 1.63 to 3.79), recent condomless sex (CLS), recent STI and postexposure prophylaxis (PEP) use in the past year (RR 2.10, 95% CI 1.33 to 3.30). Age over 40 (RR 0.71, 95% CI 0.51 to 0.99), CLS, and use of PEP (RR 0.64, 95% CI 0.47 to 0.86) and PrEP (RR 0.47, 95% CI 0.29 to 0.78) were associated with lower likelihood of stopping chemsex by the next assessment.

**Interpretation** Knowledge of these results allows us to identify men most likely to start chemsex, thus providing an opportunity for sexual health services to intervene with a package of risk mitigation measures, especially PrEP use.

### WHAT IS ALREADY KNOWN ON THIS TOPIC

⇒ Chemsex (the use of psychoactive drugs in sexual contexts) has been associated with HIV acquisition and other STIs, so there is benefit in identifying those most likely to start chemsex in order to offer risk reduction interventions such as pre-exposure prophylaxis (PrEP). We searched PubMed for longitudinal cohort studies in English that included men who have sex with men (MSM) published from database inception up to 14 October 2022, using key search terms including "chemsex", "MSM", "homosexual", "men who have sex with men", "gay", "longitudinal", "cohort" and "prospective". We identified 23 articles which included articles of clinical trials and cohort studies. Among these articles, there were studies about sexual behaviours, mental health, STIs and changes in chemsex participation over time. We identified two longitudinal prospective cohort studies which looked at engagement with chemsex over time: the Amsterdam Cohort Group, which looked at HIV acquisition risk levels over time, and an article from our research group (the Attitudes to and Understanding Risk of Acquisition of HIV and Attitudes to and Understanding Risk of Acquisition of HIV over Time study) that measured changes in the prevalence of sexual behaviours, including chemsex. To our knowledge, no data have been published from longitudinal cohort studies looking explicitly at predictors of starting or stopping chemsex.

## INTRODUCTION

Chemsex, or the use of psychoactive drugs such as mephedrone, crystal methamphetamine and γ-hydroxybutyrate/γ-butyrolactone (GHB/GBL) in sexual contexts,[1] has been of increasing clinical concern in recent years, with evidence suggesting that men who have sex with men (MSM) attending sexual health clinics in England who report current chemsex participation had around a fivefold increase in odds of a new HIV infection diagnosis and a fourfold increase in diagnosis of bacterial STIs.[2 3] Engagement in chemsex has also been found to be associated by a proportion of participants with a deterioration in interpersonal relationships and unwanted withdrawal side effects.[4]

Several qualitative studies have characterised motivating factors behind engaging in chemsex.[5 6] These include increasing the ability to

**WHAT THIS STUDY ADDS**

⇒ This study provides the first analysis of predictors of starting and stopping engagement in chemsex in HIV-negative MSM in England, based on data from a large prospective longitudinal cohort study. We find a number of factors associated with an increased likelihood of subsequently engaging in chemsex, such as younger age, unemployment, smoking, cocaine use, use of postexposure prophylaxis, condomless sex (CLS), group sex and recent STI diagnosis. We also found factors associated with an increased likelihood of stopping chemsex, such as younger age, not using PrEP and not engaging in CLS. This information should help clinicians with counselling of patients and risk mitigation measures.

**HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE OR POLICY**

⇒ Our findings should support clinicians in shared decision making with their patients, enabling them to identify those most likely to engage chemsex, and help them make best use of options available to protect themselves, such as PrEP or referral for psychosocial or similar services to explore health, well-being and lifestyle choices.

engage in desired sex, through increased libido and stamina, and enhancing the quality of desired sex.

A number of recent cross-sectional[4 7–9] and longitudinal studies[10] have investigated factors associated with chemsex. This evidence has shown that chemsex is strongly associated with sexual risk factors that may potentiate HIV acquisition[11 12] such as condomless sex (CLS), group sex and the occurrence of bacterial STIs.

Understandably, this has led to increasing interest by sexual health providers and public health authorities[13 14] on how to meet the health needs of those engaging in chemsex. A key knowledge gap to enable this is accurate prediction of (1) which individuals are likely to engage in chemsex in the short term and (2) the likelihood of individuals stopping their engagement in chemsex practices.

Being able to identify MSM most likely to start chemsex could enable service providers to offer appropriate individualised advice and risk mitigation strategies,[15 16] including HIV prevention strategies (such as pre-exposure prophylaxis (PrEP)), to maintain health and well-being while engaging in chemsex.

Understanding factors associated with stopping chemsex may help healthcare professionals in developing a person-centred approach[13] to identify and support individuals who are looking to reduce or to stop chemsex, including focussing interventions such as improving mental health or feelings of isolation.[17]

Our aim was to identify demographic, socioeconomic and behavioural factors associated with starting or stopping chemsex in HIV-negative or undiagnosed MSM in the prospective Attitudes to and Understanding Risk of Acquisition of HIV over Time (AURAH2) study.[18]

## METHODS

The AURAH2 prospective cohort study recruited HIV-negative or undiagnosed MSM from three sexual health clinics in London and Brighton (56 Dean Street Clinic, London; Mortimer Market Centre, London; and Claude Nicol clinic, Brighton) from November 2014 to April 2016. Methodological details for the AURAH2 study have been published elsewhere.[18]

Participants completed a baseline paper questionnaire in the clinic and subsequent 4 monthly online questionnaires from March 2015, for up to 3 years, until March 2018. Participants were also invited to complete a longer annual questionnaire.

At baseline, data collected included age, country of birth and ethnicity, sexuality, university education, employment status, housing status, money for basic needs, smoking, social support (adapted from Broadhead *et al*[19]) and outness (adapted from Meidlinger and Hope[20]).

In addition, the following data were collected both at baseline and in the annual online survey: relationship status, higher alcohol consumption (as defined by the first two questions of the WHO Alcohol Use Disorders Identification Test score of ≥6 (yes or no/missing)), depression symptoms (Nine-Item Patient Health Questionnaire score of ≥10) and anxiety symptoms (Seven-Item General Anxiety Disorder score of ≥10), and use of postexposure prophylaxis (PEP) and PrEP.

Four monthly online questionnaires (recall period of 3 months) included the sexual behaviour measures of any anal intercourse, any anal CLS, anal CLS with two or more partners (CLS >2), anal CLS with partners of unknown HIV status or HIV diagnosed partners (excluding long-term HIV diagnosed partners on treatment), self-reported diagnosis of an STI, group sex, recent HIV test and recreational drug use, including use of chemsex drugs (mephedrone, GHB/GBL and crystal methamphetamine). Use of the following drugs were also considered in this analysis: cannabis, cocaine, ecstasy, Viagra and poppers (as these were the five most used recreational drugs in our study population).

For the analysis, two variables were created related to chemsex: (1) starting (including starting for the first time or restarting chemsex) and (2) stopping or interrupting chemsex. For both variables, we used the question in the 4 monthly questionnaire 'Have you used drugs before or during sex (chemsex) in the last 3 months?', where the participant answered yes and selected mephedrone, GHB/GBL or crystal. If participants started/stopped chemsex multiple times in the study period, each change was included in the analysis. We excluded all final questionnaires and participants who only answered a single questionnaire, as these had no follow-up. We also excluded all participants who did not answer the chemsex question at their next questionnaire. With the remaining records, for 'starting chemsex', we included all questionnaires in which the participants replied that they were not having chemsex (as they were therefore 'at risk of starting') and looked at whether they reported chemsex or not at the next questionnaire. For 'stopping chemsex', we included all questionnaires in which the participants replied that they were having chemsex and determined that they stopped if they reported no chemsex at the next questionnaire.

### Statistical analysis

Pooled data from the baseline and online follow-up questionnaires were used. In the univariable analysis, we investigated the associations of sociodemographic factors and measures of sexual behaviour with the two outcomes, starting chemsex and stopping chemsex. In these and subsequent analyses, baseline values of demographic and socioeconomic variables were used throughout follow-up, as these were not collected subsequently. For all other variables, information from the relevant follow-up questionnaire was used. In the multivariable analysis, we considered each variable in a separate model and adjusted for sociodemographic factors that would not be influenced by chemsex: age group, ethnicity, sexual identity and university education.

In the univariable and multivariable analyses, we used a generalised estimating equation Poisson model with robust variance estimation, with an exchangeable covariance matrix to produce risk ratios (RRs), as each individual could potentially stop or start chemsex multiple times and therefore could be included more than once in each analysis. This modified Poisson regression analysis was used to produce unadjusted and adjusted RRs with 95% CIs.

All analyses were conducted in Stata statistical software V.13.

## RESULTS

Of the 1167 MSM who consented to and completed the AURAH2 study baseline questionnaire in the clinic, 622 (53.2%) went on to complete at least one online follow-up questionnaire for a total of 3277 observations (questionnaires). Of 622 MSM, 400 (64.3%) remained engaged with the study throughout (completed a questionnaire within the last 6 months of the study follow-up period).

The median age among participants who completed the baseline and at least one online questionnaire was 34 years; 579 (94.5%) identified as gay; and 34 (5.5%) identified as bisexual or other. Most (511, 83.8%) were of white ethnicity and over three-quarters (472 (76.7%)) were educated to university level (table 1). The prevalence of chemsex-associated drug use at baseline among MSM who had completed at least one online questionnaire was 32.3% (201 of 622). Of the 622 participants who completed at least one online questionnaire, 96 (15.4%) reported chemsex use in every completed questionnaire. Detailed cohort characteristics have been previously published.[21]

**Table 1** Sociodemographic, health and lifestyle characteristics from baseline questionnaire among men who have sex with men in the Attitudes to and Understanding Risk of Acquisition of HIV over Time study who completed at least one follow-up questionnaire

| Characteristics | Category | n (%) |
|---|---|---|
| Age (years) (n=610) | <25 | 132 (21.6) |
| | 25–29 | 86 (14.1) |
| | 30–34 | 121 (19.8) |
| | 35–39 | 89 (14.6) |
| | 40–44 | 69 (11.3) |
| | 45+ | 113 (18.5) |
| Born in the UK and white ethnicity (n=610) | Yes, white | 317 (52.0) |
| | Yes, non-white | 29 (4.7) |
| | No, white | 194 (31.8) |
| | No, non-white | 70 (11.5) |
| Money to cover basic needs (n=615) | All of the time | 509 (82.8) |
| | Most of the time | 81 (13.2) |
| | Sometimes/no | 25 (4.1) |
| University education (n=615) | Yes | 472 (76.7) |
| | No | 143 (23.2) |
| Employed (n=615) | Yes | 547 (88.9) |
| | No | 68 (11.1) |
| Housing status (n=606) | Homeowner | 200 (33.0) |
| | Renting | 328 (54.1) |
| | Unstable/other | 78 (12.9) |
| Sexual identity (n=610) | Gay | 579 (94.5) |
| | Bisexual/other | 34 (5.5) |
| Ongoing relationship (n=615) | Yes | 257 (41.8) |
| | No | 358 (58.2) |
| Higher-risk alcohol consumption (WHO AUDIT-C score ≥6) (n=615) | Yes | 80 (12.9) |
| | No/missing | 542 (87.1) |
| Clinically significant depressive symptoms (PHQ-9 score ≥10) (n=615) | Yes | 75 (12.1) |
| | No/missing | 547 (87.9) |
| Clinically significant anxiety symptoms (GAD-7 score ≥10) (n=615) | Yes | 57 (9.2) |
| | No/missing | 565 (90.8) |

AUDIT-C, Alcohol Use Disorders Identification Test for Consumption; GAD-7, Seven-Item General Anxiety Disorder; PHQ-9, Nine-Item Patient Health Questionnaire.

### Starting chemsex

Of the total of 3277 observations (questionnaires), 664 observations from 198 participants were excluded as they reported chemsex at current visit (and were therefore not at risk of starting). A total of 622 observations were excluded for being the participant's final questionnaire and thus having no follow-up. This meant a total of 1991 observations from 458 participants were included in the starting chemsex analysis, in which chemsex was started on 141 (7.1%) occasions by 116 participants.

In the multivariable analysis of demographic factors associated with starting chemsex (see figure 1), the over 40 age group were almost half as likely to start chemsex compared with those aged less than 40 (RR 0.56, 95% CI 0.35 to 0.89). Of note, there was a significant trend of reducing likelihood of chemsex initiation with older age in the multivariable analysis.

Other sociodemographic factors which showed significant association with starting chemsex in the multivariable analysis were being unemployed (RR 2.10, 95% CI 1.02 to 4.35) and being a current smoker (RR 2.49, 95% CI 1.63 to 3.79).

In addition, in the univariable analysis, unstable living situation (RR compared with homeowner 1.70, 95% CI 0.97 to 2.96), having less social support (RR 1.37, 95% CI 0.93 to 2.02) and being more out (groups 1–3 lower outness compared with higher RR 0.72, 95% CI 0.48 to 1.05) were associated with starting chemsex. Factors such as place of birth, ethnicity, sexuality, relationship status, alcohol consumption and depressive symptoms showed no association with risk of chemsex initiation.

Examining associations of sexual behaviour with initiation of chemsex (see figure 2), we found that all measures of CLS, STI diagnosis and PEP use were associated in the univariable analysis, with evidence of association for any sex and group sex. All of these associations remained in the multivariable analysis, with the strongest predictor being PEP use, with respondents using PEP in the previous year over twice as likely to start chemsex as those not using PEP (RR 2.10. 95% CI 1.33 to 3.30). PrEP use in the previous year and having an HIV test in the previous 3 months were not associated with starting chemsex.

Figure 3 shows associations of recreational drug use with chemsex initiation. In the univariable and multivariable analyses, cocaine (RR 2.99, 95% CI 1.62 to 5.51), Viagra (RR 4.20, 95% CI 1.84 to 9.57) and poppers (RR 4.33, 95% CI 2.42 to 7.76) were associated with a significant increase in risk of starting chemsex, while cannabis and ecstasy use showed no associations.

### Stopping chemsex

Of the total of 3277 observations (questionnaires) from the 622 participants who completed an online questionnaire, 2455 observations from 526 participants were excluded as they did not report chemsex at current visit (and were therefore not at risk of stopping). A total of 158 observations were dropped for being the participant's final questionnaire and thus having no follow-up. This meant a total of 664 observations from 225 participants were included in the stopping chemsex analysis, in

**Starting Chemsex**

| Factors | n/N (%) | Unadjusted RR (95% CI) | p value | Adjusted RR (95% CI)[3] | p value |
|---|---|---|---|---|---|
| **Age[4] (N = 1971)** | | | | | |
| <25 | 21/256 (8.2%) | 1 | 0.27 | 1 | 0.24 |
| 25-29 | 32/406 (7.9%) | 0.91 (0.54 – 1.55) | | 0.94 (0.55 – 1.59) | (test for trend 0.038) |
| 30-34 | 27/346 (7.8%) | 1.00 (0.57 – 1.77) | | 1.04 (0.58 – 1.85) | |
| 35-39 | 27/295 (9.2%) | 1.13 (0.62 – 2.06 | | 1.12 (0.61 – 2.06) | |
| 40-44 | 8/173 (4.6%) | 0.51 (0.21 – 1.22) | | 0.50 (0.20 – 1.23) | |
| 45+ | 25/495 (5.1%) | 0.63 (0.33 – 1.18) | | 0.60 (0.31 – 1.17) | |
| **Over/under 40 age[4] (N = 1971)** | | | | | |
| <40 | 107/1303 (8.2%) | 1 | 0.02 | 1 | 0.01 |
| 40+ | 33/668 (4.9%) | 0.59 (0.38 – 0.92) | | 0.56 (0.35 – 0.89) | |
| **Born in the UK and white ethnicity[1] (N = 1971)** | | | | | |
| Yes, white | 74/1092 (6.8%) | 1 | 0.87 | 1 | 0.88 |
| Yes, non-white | 9/98 (9.2%) | 1.20 (0.51 – 2.84) | | 1.00 (0.41 – 2.46) | |
| No, white | 43/616 (7.0%) | 1.04 (0.68 – 1.58) | | 1.02 (0.67 – 1.55) | |
| No, non-white | 14/165 (8.5%) | 1.28 (0.68 – 2.45) | | 1.31 (0.68 – 2.52) | |
| **Sexuality[1] (N = 1980)** | | | | | |
| Gay | 131/1684 (7.0%) | 1 | 0.74 | 1 | 0.94 |
| Bisexual/other | 8/95 (8.3%) | 1.13 (0.57 – 2.23) | | 1.03 (0.50 – 2.10) | |
| **Employment[1] (N = 1965)** | | | | | |
| Employed | 111/1566 (7.9%) | 1 | 0.002 | 1 | <0.001 |
| Unemployed | 13/97 (13.4%) | 1.88 (0.97 – 3.64) | | 2.10 (1.02 – 4.35) | |
| Education/training | 11/206 (5.3%) | 0.78 (0.51 – 0.36) | | 0.62 (0.27 – 1.42) | |
| Off sick | 3/7 (42.9%) | 4.79 (1.80 – 12.78) | | 5.55 (1.30 – 23.74) | |
| Retired | 2/89 (2.3%) | 0.30 (0.07 – 1.21) | | 0.17 (0.025 – 1.14) | |
| **Living status[1] (N = 1948)** | | | | | |
| Homeowner | 41/671 (6.1%) | 1 | 0.15 | 1 | 0.17 |
| Renting | 72/1043 (6.9%) | 1.10 (0.71 – 1.70) | | 0.81 (0.49 – 1.36) | |
| Unstable/other | 26/234 (11.1%) | 1.70 (0.97 – 2.96) | | 1.35 (0.72 – 2.52) | |
| **Money to pay the rent[1] (N = 1982)** | | | | | |
| Yes all the time | 113/1670 (6.8%) | 1 | 0.4 | 1 | |
| Most/some/no | 27/312 (8.7%) | 1.22 (0.77 – 1.95) | | 1.07 (0.63 – 1.79) | 0.81 |
| **Smoker[1] (N = 1982)** | | | | | |
| Yes | 40/260 (15.4%) | 1 | <0.001 | 2.49 (1.63 – 3.79) | <0.001 |
| No | 100/1722 (5.8%) | 2.58 (1.70 – 3.90) | | 1 | |
| **Social support group[1] (N = 1982)** | | | | | |
| 4-5 (high) | 85/1343 (6.3%) | 1 | 0.11 | 1 | 0.18 |
| 1-3 (low) | 55/626 (8.8%) | 1.37 (0.93 – 2.02) | | 1.32 (0.88 – 1.99) | |
| **Outness group[1] (N = 1982)** | | | | | |
| 4 (highest) | 87/1064 (8.2%) | 1 | 0.09 | 1 | 0.07 |
| 1-3 (lower) | 52/909 (5.7%) | 0.72 (0.48 – 1.05) | | 0.70 (0.47 – 1.03) | |
| **University education[1] (N = 1982)** | | | | | |
| Yes | 100/1520 (6.6%) | 1 | 0.24 | 1 | 0.17 |
| No | 40/462 (8.7%) | 1.27 (0.85 – 1.91) | | 1.35 (0.88 – 2.09) | |
| **In a relationship[2] (N = 1989)** | | | | | |
| Yes | 70/1013 (6.9%) | 1 | 0.92 | 1 | 0.85 |
| No | 71/976 (7.3%) | 1.01 (0.75 – 1.38) | | 0.97 (0.72 – 1.32) | |
| **Higher risk alcohol consumption[2] (N = 1982)** | | | | | |
| No | 120/1746 (6.9%) | 1 | 0.53 | 1 | 0.35 |
| Yes | 20/236 (8.5%) | 1.19 (0.70 – 2.01) | | 1.30 (0.75 – 2.25) | |
| **Clinically significant depressive symptoms[2] (N = 1982)** | | | | | |
| No | 123/1776 (6.9%) | 1 | 0.63 | 1 | 0.82 |
| Yes | 17/206 (8.3%) | 1.15 (0.66 – 1.97) | | 1.07 (0.61 – 1.88) | |
| **Clinically significant anxiety symptoms[2] (N = 1982)** | | | | | |
| No | 130/1822 (7.1%) | 1 | 0.62 | 1 | 0.44 |
| Yes | 10/160 (6.3%) | 0.83 (0.40 – 1.73) | | 0.74 (0.34 – 1.60) | |




**Stopping Chemsex**

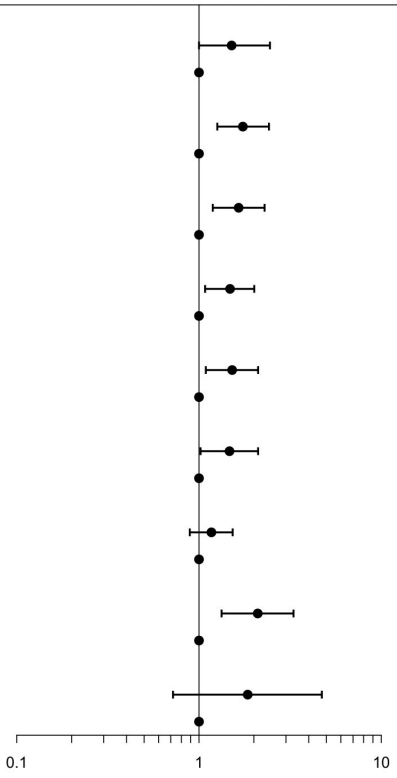
| Factors | n/N (%) | Unadjusted RR (95% CI) | p value | Adjusted RR[3] (95% CI) | Adjusted RR[3] (95% CI) | p value |
|---|---|---|---|---|---|---|
| **Age[4] (N = 658)** | | | | | | |
| <25 | 28/72 (39.9%) | 1 | 0.02 | | 1 | 0.04 |
| 25-29 | 40/103 (38.9%) | 1.03 (0.72- 1.47) | | | 1.08 (0.76 – 1.55) | (test for trend <0.001) |
| 30-34 | 30/106 (28.3%) | 0.82 (0.55 - 1.22) | | | 0.90 (0.60 – 1.34) | |
| 35-39 | 36/147 (24.5%) | 0.65 (0.43 – 0.98 | | | 0.72 (0.48 – 1.08) | |
| 40-44 | 15/109 (13.8%) | 0.43 (0.24 – 0.77) | | | 0.46 (0.26 – 0.80) | |
| 45+ | 31/121 (25.6%) | 0.43 (0.50 – 1.20) | | | 0.79 (0.51 – 1.22) | |
| **Under/over 40 age[4] (N = 658)** | | | | | | |
| <40 | 134/428 (31.3%) | 1 | 0.06 | | 1 | 0.04 |
| 40+ | 46/230 (20%) | 0.73 (0.53 – 1.01) | | | 0.71 (0.51 – 0.99) | |
| **Born in the UK and white ethnicity[1] (N = 657)** | | | | | | |
| Yes, white | 96/332 (28.9%) | 1 | 0.17 | | 1 | 0.37 |
| Yes, non-white | 11/25 (44.0%) | 1.44 (0.79, 2.57) | | | 1.20 (0.64 - 2.20) | |
| No, white | 50/220 (22.7%) | 0.77 (0.56, 1.06) | | | 0.78 (0.57 – 1.08) | |
| No, non-white | 23/81 (28.4%) | 0.88 (0.61, 1.26) | | | 0.88 (0.59 – 1.32) | |
| **Sexuality[1] (N = 654)** | | | | | | |
| Gay | 169/626 (27.0%) | 1 | 0.34 | | 1 | 0.88 |
| Bisexual/other | 10/28 (35.7%) | 1.28 (0.77 – 2.14) | | | 1.04 (0.61 – 1.79) | |
| **Employment[1] (N = 658)** | | | | | | |
| Employed | 143/554 (25.8%) | 1 | 0.2 | | 1 | 0.42 |
| Unemployed | 16/42 (38.1%) | 1.34 (0.87 – 2.06) | | | 1.55 (0.95 – 2.53) | |
| Education/training | 15/36 (41.2% | 1.55 (1.03 – 2.33) | | | 1.13 (0.71- 1.18) | |
| Off sick | 2/5 (40.0%) | 1.51 (0.60 – 3.81) | | | 1.53 (0.60 -3.90) | |
| Retired | 4/21 (19.1%) | 0.98 (0.35 – 2.70) | | | 0.91 (0.24 – 3.38) | |
| **Living status[1] (N = 657)** | | | | | | |
| Homeowner | 60/269 (22.3%) | 1 | 0.1 | | 1 | 0.17 |
| Renting | 91/312 (29.2%) | 1.24 (0.91 – 1.67) | | | 1.06 (0.73 – 1.54) | |
| Unstable/other | 28/76 (36.7%) | 1.55 (1.03 – 2.33) | | | 1.24 (0.77 – 1.99) | |
| **Money to pay the rent[1] (N = 660)** | | | | | | |
| Yes all the time | 151/572 (26.4%) | 1 | 0.32 | | 1 | 0.74 |
| Most/some/no | 30/88 (34.1%) | 1.17 (0.85 – 1.62) | | | 1.05 (0.77 – 1.45) | |
| **Smoker[1] (N = 660)** | | | | | | |
| Yes | 57/176 (32.3%) | 1.11 (0.85 - 1.46) | 0.44 | | 1.04 (0.78 - 1.37) | 0.79 |
| No | 124/484 (25.6%) | 1 | | | 1 | |
| **Social support group[1] (N = 660)** | | | | | | |
| 4-5 (high) | 111/456 (24.3%) | 1 | 0.06 | | 1 | 0.41 |
| 1-3 (low) | 70/204 (34.3%) | 1.28 (0.99 – 1.66) | | | 1.12 (0.85 – 1.48) | |
| **Outness group[1] (N = 653)** | | | | | | |
| 4 (highest) | 115/381 (30.2%) | 1 | 0.2 | | 1 | 0.22 |
| 1-3 (lower) | 65/272 (23.9%) | 0.83 (0.63 – 1.10) | | | 0.83 (0.62 – 1.12) | |
| **University education[1] (N = 660)** | | | | | | |
| Yes | 123/493 (24.9%) | 1 | 0.06 | | 1 | 0.09 |
| No | 58/167 (34.7%) | 1.30 (0.99 - 1.70) | | | 0.93 (0.72 – 1.20) | |
| **In a relationship[2] (N = 660)** | | | | | | |
| Yes | 82/296 (27.7%) | 1 | 0.84 | | 1 | 0.57 |
| No | 96/364 (26.4%) | 0.97 (0.76 – 1.26) | | | 1.27 (0.96 – 1.68) | |
| **Higher risk alcohol consumption[2] (N = 660)** | | | | | | |
| No | 159/558 (28.5%) | 1 | 0.27 | | 1 | 0.42 |
| Yes | 22/102 (21.6%) | 0.78 (0.50 – 1.21) | | | 0.84 (0.55 – 1.29) | |
| **Clinically significant depressive symptoms[2] (N = 660)** | | | | | | |
| No | 156/598 (26.1%) | 1 | 0.04 | | 1 | 0.26 |
| Yes | 25/62 (40.3%) | 1.41 (1.01 – 1.95) | | | 1.24 (0.86 – 1.78) | |
| **Clinically significant anxiety symptoms[2] (N = 660)** | | | | | | |
| No | 171/629 (27.2%) | 1 | 0.91 | | 1 | 0.98 |
| Yes | 10/160 (6.3%) | 0.83 (0.40 – 1.73) | | | 0.74 (0.34 – 1.60) | |




**Figure 1** Unadjusted and adjusted (for demographic factors) RRs of sociodemographic measures with starting chemsex in the Attitudes to and Understanding Risk of Acquisition of HIV over Time study. RR, risk ratio.

## Starting Chemsex

| Factors | n/N (%) | Unadjusted RR (95% CI) | p value | Adjusted RR[1] (95% CI) | Adjusted RR[1] (95% CI) | p value |
|---|---|---|---|---|---|---|
| **Any anal intercourse (N = 1991)** | | | | | | |
| Yes | 128/1694 (7.6%) | 1.49 (0.96 - 2.32) | 0.07 | | 1.51 (1.00 – 2.45) | 0.05 |
| No | 13/297 (4.4%) | 1 | | | 1 | |
| **CLS (N = 1991)** | | | | | | |
| Yes | 106/1231 (8.6%) | 1.69 (1.23 - 2.34) | 0.001 | | 1.74 (1.26 – 2.42) | 0.001 |
| No | 35/760 (4.6%) | 1 | | | 1 | |
| **CLS 2 or more partners (N = 1991)** | | | | | | |
| Yes | 56/542 (10.3%) | 1.55 (1.13 - 2.14) | 0.006 | | 1.65 (1.19 – 2.29) | 0.003 |
| No | 85/1449 (5.9%) | 1 | | | 1 | |
| **CLS partners unknown/HIV diagnosed status^ (N = 1991)** | | | | | | |
| Yes | 43/465 (9.3%) | 1.34 (0.99 - 1.81) | 0.05 | | 1.48 (1.08 – 2.01) | 0.01 |
| No | 98/1526 (6.4%) | 1 | | | 1 | |
| **Self-reported bacterial STI diagnosis~ (N = 1991)** | | | | | | |
| Yes | 23/207 (11.1%) | 1.48 (1.06 - 2.07) | 0.02 | | 1.52 (1.09 – 2.11) | 0.01 |
| No | 118/1784 (6.6%) | 1 | | | 1 | |
| **group sex (N = 1991)** | | | | | | |
| Yes | 34/345 (9.8%) | 1.39 (0.97 - 1.99) | 0.07 | | 1.47 (1.02 – 2.11) | 0.04 |
| No | 107/1646 (6.5%) | 1 | | | 1 | |
| **recent HIV test (<3 months) (N = 1879)** | | | | | | |
| Yes | 82/1091 (7.5%) | 1.19 (0.92 - 1.56) | 0.18 | | 1.17 (0.89 -1.53) | 0.25 |
| No | 44/788 (5.6%) | 1 | | | 1 | |
| **PEP use past year (N = 1982)** | | | | | | |
| Yes | 33/258 (12.8%) | 2.08 (1.36 – 3.20) | 0.001 | | 2.10 (1.33 – 3.30) | 0.001 |
| No | 107/1724 (6.2%) | 1 | | | 1 | |
| **PrEP use past year (N = 1982)** | | | | | | |
| Yes | 6/56 (10.7%) | 1.50 (0.61 – 3.67) | 0.38 | | 1.85 (0.72 – 4.72) | 0.2 |
| No | 134/1926 (7.0%) | 1 | | | 1 | |




## Stopping Chemsex

| Factors | n/N (%) | Unadjusted RR (95% CI) | p value | Adjusted RR[1] (95% CI) | Adjusted RR[1] (95% CI) | p value |
|---|---|---|---|---|---|---|
| **Any anal intercourse (N = 664)** | | | | | | |
| Yes | 177/649 (27.3%) | 1.07 (0.49 - 2.37) | 0.86 | | 1.02 (0.46 – 2.25) | 0.96 |
| No | 4/15 (26.6%) | 1 | | | 1 | |
| **CLS (N = 664)** | | | | | | |
| Yes | 155/567 (27.3%) | 1.05 (0.71 - 1.55) | 0.82 | | 1.01 (0.67 – 1.51) | 0.98 |
| No | 26/97 (26.8%) | 1 | | | 1 | |
| **CLS 2 or more partners (N = 664)** | | | | | | |
| Yes | 106/439 (24.1%) | 0.77 (0.60 - 0.98) | 0.04 | | 0.73 (0.57 – 0.94) | 0.02 |
| No | 75/225 (33.3%) | 1 | | | 1 | |
| **CLS partners unknown/HIV diagnosed status^ (N = 664)** | | | | | | |
| Yes | 83/330 (25.2%) | 0.87 (0.69 - 1.11) | 0.28 | | 0.82 (0.64 – 1.05) | 0.11 |
| No | 98/334 (29.3%) | 1 | | | 1 | |
| **Self-reported bacterial STI diagnosis~** | | | | | | |
| Yes | 38/181 (20.9%) | 0.74 (0.57 - 0.96) | 0.02 | | 0.73 (0.55 – 0.96) | 0.03 |
| No | 143/483 (29.6%) | 1 | | | 1 | |
| **Group sex** | | | | | | |
| Yes | 86/383 (22.5%) | 0.70 (0.54 - 0.90) | 0.006 | | 0.71 (0.55 – 0.92) | 0.01 |
| No | 95/281 (33.8%) | 1 | | | 1 | |
| **Recent HIV test (<3 months) (N = 664)** | | | | | | |
| Yes | 129/484 (26.6%) | 0.87 (0.69 - 1.10) | 0.25 | | 0.91 (0.71 - 1.16) | 0.45 |
| No | 47/145 (32.4%) | 1 | | | 1 | |
| **PEP use past year (N = 664)** | | | | | | |
| Yes | 45/216 (20.8%) | 0.65 (0.47 – 0.89) | 0.006 | | 0.64 (0.47 – 0.86) | 0.003 |
| No | 136/444 (30.6%) | 1 | | | 1 | |
| **PrEP use past year (N = 664)** | | | | | | |
| Yes | 7/46 (15.2%) | 0.47 (0.26 – 0.83) | 0.01 | | 0.47 (0.29 – 0.78) | 0.003 |
| No | 174/440 (28.3%) | 1 | | | 1 | |

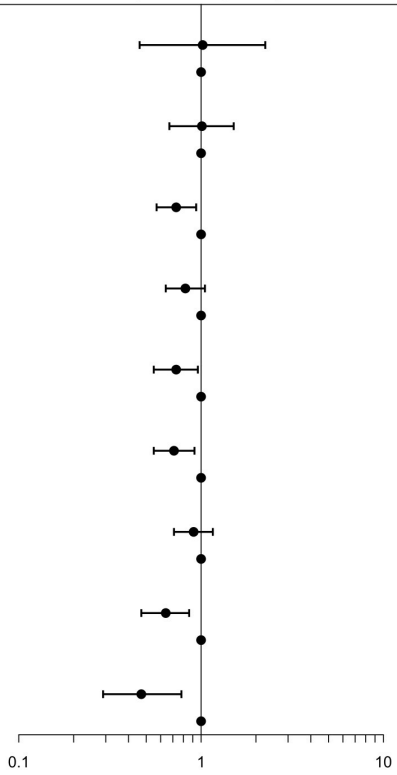
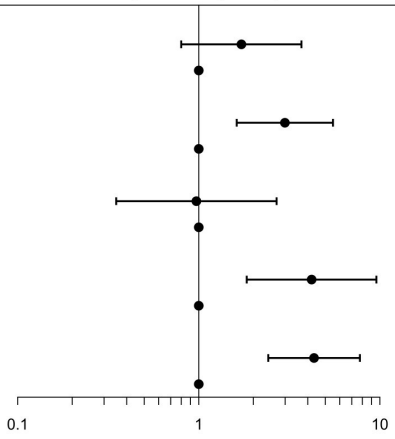



**Figure 2** Unadjusted and adjusted (for demographic factors) RRs of sexual behaviours with starting chemsex in the Attitudes to and Understanding Risk of Acquisition of HIV over Time study. CLS, condomless sex; PEP, postexposure prophylaxis; PrEP, pre-exposure prophylaxis; RR, risk ratio.

## Starting Chemsex

| Factors | n/N (%) | Unadjusted RR (95% CI) | p value | Adjusted RR[1] (95% CI) | P value |
|---|---|---|---|---|---|
| **Cannabis (N = 583)** | | | | | |
| Yes | 8/62 (12.9%) | 1.75 (0.81 – 3.78) | 0.15 | 1.72 (0.80 – 3.69) | 0.16 |
| No | 36/521 (6.9%) | 1 | | 1 | |
| **Cocaine (N = 583)** | | | | | |
| Yes | 15/75 (20%) | 3.20 (1.82 – 5.62) | <0.001 | 2.99 (1.62 – 5.51) | <0.001 |
| No | 29/508 (5.7%) | 1 | | 1 | |
| **Ecstasy (N = 583)** | | | | | |
| Yes | 4/49 (8.2%) | 0.99 (0.38 – 2.59) | 0.99 | 0.97 (0.35 – 2.69) | 0.35 |
| No | 40/534 (7.5%) | 1 | | 1 | |
| **Viagra (N = 583)** | | | | | |
| Yes | 6/20 (30%) | 3.79 (1.80 – 7.98) | <0.001 | 4.20 (1.84 – 9.57) | 0.001 |
| No | 38/563 (6.8%) | 1 | | 1 | |
| **Poppers (N = 583)** | | | | | |
| Yes | 15/58 (25.9%) | 4.36 (2.45 – 7.75) | <0.001 | 4.33 (2.42 – 7.76) | <0.001 |
| No | 29/525 (5.5%) | 1 | | 1 | |




## Stopping Chemsex

| Factors | n/N (%) | Unadjusted RR (95% CI) | p value | Adjusted RR[1] (95% CI) | p value |
|---|---|---|---|---|---|
| **Cannabis (N = 166)** | | | | | |
| Yes | 15/50 (30%) | 1.22 (0.67 – 2.20) | 0.52 | 1.10 (0.56 – 2.13) | 0.78 |
| No | 28/116 (24.1%) | 1 | | 1 | |
| **Cocaine (N = 166)** | | | | | |
| Yes | 21/86 (24.4%) | 0.82 (0.52 – 1.32) | 0.42 | 0.74 (0.43 – 1.28) | 0.28 |
| No | 22/80 (27.5%) | 1 | | 1 | |
| **Ecstasy (N = 166)** | | | | | |
| Yes | 11/54 (20.4%) | 0.72 (0.40 – 1.28) | 0.27 | 0.63 (0.35 – 1.13 | 0.13 |
| No | 32/112 (28.6%) | 1 | | 1 | |
| **Viagra (N = 166)** | | | | | |
| Yes | 24/106 (22.6%) | 0.74 (0.46 – 1.20) | 0.23 | 0.87 (0.51 – 1.48) | 0.6 |
| No | 19/60 (31.7%) | 1 | | 1 | |
| **Poppers (N = 166)** | | | | | |
| Yes | 26/107 (24.3%) | 0.78 (0.49 – 1.25) | 0.31 | 0.85 (0.50 – 1.44) | 0.54 |
| No | 17/59 (28.8%) | 1 | | 1 | |

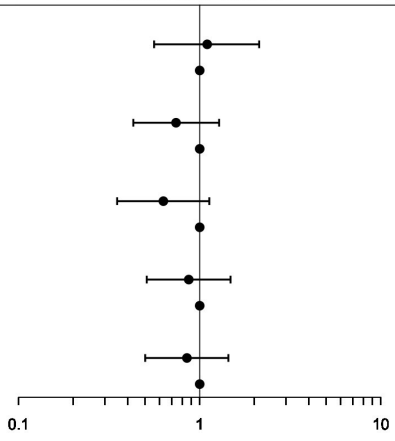



**Figure 3** Unadjusted and adjusted (for demographic factors) RRs of drug use with starting and stopping chemsex in the Attitudes to and Understanding Risk of Acquisition of HIV over Time study. RR, risk ratio.

which chemsex was stopped on 181 (27.2%) occasions by 145 participants.

Figure 1 shows that in the multivariable analysis of sociodemographic factors associated with stopping chemsex, there was a significant trend of decreasing likelihood of stopping with older age, and MSM over 40 were less likely to stop (RR 0.71, 95% CI 0.51 to 0.99). In the univariable analysis, being in full-time education/training and having an unstable living situation, and clinically significant depressive symptoms were all significantly associated with stopping chemsex; these associations were attenuated in the multivariable analysis.

In figure 2, sexual behaviours associated with lower likelihood of stopping chemsex in the multivariable analysis were CLS with two or more partners (RR 0.73, 95% CI 0.57 to 0.94), self-reported bacterial STI diagnosis (RR 0.73, 95% CI 0.55 to 0.96) and group sex (RR 0.71, 95% CI 0.55 to 0.92). Both use of PEP (RR 0.64, 95% CI 0.47 to 0.86) and PrEP (RR 0.47, 95% CI 0.29 to 0.78) in the past year were also significantly associated with lower likelihood of stopping chemsex in the multivariable analysis. No individual drugs were associated with stopping chemsex in our analysis, including Viagra and poppers (see figure 3).

## DISCUSSION

This paper provides the first quantitative analysis of risk factors for starting and stopping chemsex, drawing from longitudinal analysis of a large cohort of HIV-negative or undiagnosed MSM. We have found that younger age, PEP use, recent CLS, recent STI, unemployment, smoking and cocaine use were all associated with chemsex initiation, while older age, higher-risk sexual behaviours, and PEP and PrEP use were associated with decreased likelihood of stopping chemsex.

Perhaps unsurprisingly, there are strong links between the measures of CLS and starting chemsex, which has also been the case when directly examining factors associated with engaging in chemsex in cross-sectional analysis.[21] These strong links may represent shared root causes, such as the structural factors we have found also associated with chemsex initiation, like unemployment and unstable accommodation, or factors not measured such as minority stress.[22] Interestingly, there was a strong association with PEP use and subsequent chemsex initiation. While PEP use is clearly not a risk factor in itself, it likely represents a marker for sexual risk behaviour. An association was not present with PrEP use (although it should be noted the period of this study is before widespread PrEP use[23]), suggestive that

healthcare providers may have scope to provide useful advice and strategy regarding PrEP use, such as rapid transition to PrEP post PEP use.[24]

There was a clear link between younger age (<40) and increased likelihood of both starting and stopping chemsex. It seems that older service users may be more fixed in their behaviours, while our findings tally with developmental neuroscience understanding that younger people are more open to novel experiences and more likely to engage in risky behaviours,[25] making them possibly a more suitable group for intervention.

Other factors which are often associated with younger age, such as unemployment[26] and unstable accommodation,[27] were also associated with chemsex initiation. Other factors associated with chemsex initiation were smoking, cocaine use, as well as drugs more commonly associated with sexual behaviours such as Viagra and poppers. There were other factors which showed some evidence of association, without reaching statistical significance in this cohort, such as lower social support and increasing outness.

Interestingly, some factors which were associated with increased risk of engaging in chemsex in the same study group,[12 21] such as single relationship status, increased alcohol consumption and depressive symptoms, did not show any association with risk of starting chemsex in this analysis. This may be due to a lack of power in our analysis or could be that these factors are less predictive of initiation and stopping.

In terms of age, there are similarities between those at highest likelihood of stopping chemsex with those most likely to start. Those most likely to stop were younger than those continuing but interestingly were less likely to be engaging in PEP/PrEP use. In the univariable but not multivariable analysis, unstable living situation, lower social support and clinically significant depressive symptoms were also associated with stopping chemsex; these associations were in part accounted for by age. It has previously been suggested that recreational drug use in MSM may relate to the feelings of being in a minority and the stresses this brings,[28] which our results may reflect, given the lack of social support these participants report. This may make their engagement in chemsex especially risky for HIV acquisition, further emphasising the importance of recognising and supporting these vulnerable individuals and ensuring equity of access to PrEP for all individuals at risk of HIV acquisition.

Those least likely to stop chemsex in our analysis are older participants, who are already engaging in risk mitigation strategies such as PEP and PrEP use, with stronger social support and who are engaging in various other sexual behaviours continuously. Although interventions such as monitoring for STIs and PrEP adherence may still be beneficial in these individuals, they may already be engaging in a degree of risk mitigation.

The AURAH2 study has a number of strengths; primarily, these relate to the large sample size and regular follow-up questionnaires, allowing analysis of relatively infrequent events such as chemsex initiation. Study limitations include the need to extrapolate data from the baseline questionnaires that may vary over follow-up such as that detailing social support and 'outness', and a lack of detailed psychosocial assessment in generating our variables. A final limitation includes recruitment of MSM already using sexual health clinics, which may mean that findings are not generalisable to all MSM engaged in chemsex or at risk of starting chemsex.

Overall, our study results identify associations between social and behavioural factors, and chemsex initiation and stopping. After recent calls for greater understanding of chemsex as a practice to help develop harm reduction models,[13] our findings may enable identification of men most at risk of initiation of chemsex. Factors such as living situation, social support and depressive symptoms may not necessarily be asked about in sexual health consultations, yet our results show that a more holistic history from the patient could inform risk judgements. This could provide an opportunity for sexual health services to intervene with a package of risk mitigation measures, especially PrEP use, which is now well established as being highly protective against HIV acquisition in real-world settings,[29] and other measures such as safer sex guidance, mental health support, HIV and STI testing, ongoing engagement in sexual healthcare and support discontinuation of chemsex use in men who wish to.

**Handling editor** Adam Huw Bourne

**Contributors** AR, AP, FL, JS, AS, NN, DA, RG, GJH, AJ, GW and AC conceived, designed and managed the data collection in the AURAH2 study. NN, VC, JS and ARM conducted data cleaning and variable derivation. RH and JS did all analyses and RH drafted the manuscript. All authors contributed to the conception of this analysis and participated in the interpretation of data, revision and final approval of the manuscript. AR is the guarantor of this research.

**Funding** The Attitudes to and Understanding Risk of Acquisition of HIV over Time study was funded by the National Institute for Health Research (NIHR) under its Programme Grants for Applied Research Programme (RP-PG-1212-20006, URL funder: https://www.nihr.ac.uk/). AR holds the grant from the NIHR.

**Competing interests** None declared.

**Patient consent for publication** Not applicable.

**Ethics approval** This study involves human participants and was approved by NRES Committee London–Hampstead (ref: 14/LO/1881) in November 2014. The participants gave informed consent to participate in the study before taking part.

**Provenance and peer review** Not commissioned; externally peer reviewed.

**Data availability statement** Data are available upon reasonable request.



**ORCID iDs**
Richard Gilson http://orcid.org/0000-0002-9572-193X
Ada Rose Miltz http://orcid.org/0000-0003-2771-7880
Janey Sewell http://orcid.org/0000-0001-7148-2391

## REFERENCES

1 Bourne A, Reid D, Hickson F, *et al*. *The Chemsex study: drug use in sexual settings among gay and bisexual men in Lambeth, Southwark and Lewisham*. London: Sigma Research, London School of Hygiene & Tropical Medicine, 2014. Available: https://researchonline.lshtm.ac.uk/id/eprint/2197245/
2 Hanum N, Cambiano V, Sewell J, *et al*. Trends in HIV incidence between 2013–2019 and association of baseline factors with subsequent incident HIV among gay, bisexual, and other men who have sex with men attending sexual health clinics in England: a prospective cohort study. *PLOS Med* 2021;18:e1003677.
3 Pakianathan M, Whittaker W, Lee MJ, *et al*. Chemsex and new HIV diagnosis in gay, Bisexual and other men who have sex with men attending sexual health clinics. *HIV Med* 22, 2018.
4 Whitlock GG, Protopapas K, Bernardino JI, *et al*. Chems4Eu: Chemsex use and its impacts across four European countries in HIV-positive men who have sex with men attending HIV services. *HIV Med* 2021;22:944–57.
5 Smith V, Tasker F. Gay men's Chemsex survival stories. *Sex Health* 2018;15:116–22.
6 Weatherburn P, Hickson F, Reid D, *et al*. Motivations and values associated with combining sex and illicit drugs ('Chemsex') among gay men in South London: findings from a qualitative study. *Sex Transm Infect* 2017;93:203–6.
7 Drückler S, van Rooijen MS, de Vries HJC. Chemsex among men who have sex with men: a sexualized drug use survey among clients of the sexually transmitted infection outpatient clinic and users of a gay dating app in Amsterdam, the Netherlands. *Sex Transm Dis* 2018;45:325–31.
8 Glynn RW, Byrne N, O'Dea S, *et al*. Chemsex, risk Behaviours and sexually transmitted infections among men who have sex with men in Dublin, Ireland. *Int J Drug Policy* 2018;52:9–15.
9 Tomkins A, George R, Kliner M. Sexualised drug taking among men who have sex with men: a systematic review. *Perspect Public Health* 2019;139:23–33.

10 Sewell J, Cambiano V, Miltz A, *et al*. Changes in recreational drug use, drug use associated with Chemsex, and HIV-related behaviours, among HIV-negative men who have sex with men in London and Brighton, 2013-2016. *Sex Transm Infect* 2018;94:494–501.
11 Pufall EL, Kall M, Shahmanesh M, *et al*. Sexualized drug use ('Chemsex') and high-risk sexual Behaviours in HIV-positive men who have sex with men. *HIV Med* 2018;19:261–70.
12 Sewell J, Miltz A, Lampe FC, *et al*. 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. *Int J Drug Policy* 2017;43:33–43.
13 Strong C, Huang P, Li C-W, *et al*. HIV, Chemsex, and the need for harm-reduction interventions to support gay, bisexual, and other men who have sex with men. *Lancet HIV* 2022;9:e717–25.
14 Varney J, Guerra L, Watson S, *et al*. PHE action plan 2015-16: promoting the health and wellbeing of gay, bisexual and other men who have sex with men. 2015.
15 Herrijgers C, Poels K, Vandebosch H, *et al*. Harm reduction practices and needs in a Belgian Chemsex context: findings from a qualitative study. *Int J Environ Res Public Health* 2020;17:9081.
16 Ma R, Perera S. Safer 'Chemsex': GPs' role in harm reduction for emerging forms of recreational drug use. *Br J Gen Pract* 2016;66:4–5.
17 Evers YJ, Hoebe CJPA, Dukers-Muijrers NHTM, *et al*. Sexual, addiction and mental health care needs among men who have sex with men practicing Chemsex – a cross-sectional study in the Netherlands. *Prev Med Rep* 2020;18:101074.
18 Sewell J, Speakman A, Phillips AN, *et al*. Attitudes to and understanding of risk of acquisition of HIV over time: design and methods for an Internet-based prospective cohort study among UK men who have sex with men. *JMIR Res Protoc* 2016;5:e128.
19 Broadhead WE, Gehlbach SH, de Gruy FV, *et al*. The Duke–UNC functional social support questionnaire: measurement of social support in family medicine patients. *Med Care* 1988;26:709–23.
20 Meidlinger PC, Hope DA. Differentiating disclosure and concealment in measurement of outness for sexual minorities: the Nebraska Outness scale. *Psychology of Sexual Orientation and Gender Diversity* 2014;1:489–97.
21 Sewell J, Cambiano V, Speakman A, *et al*. Changes in Chemsex and sexual behaviour over time, among a cohort of MSM in London and Brighton: findings from the AURAH2 study. *Int J Drug Policy* 2019;68:54–61.
22 Pollard A, Nadarzynski T, Llewellyn C. Syndemics of stigma, minority-stress, maladaptive coping, risk environments and littoral spaces among men who have sex with men using Chemsex. *Cult Health Sex* 2018;20:411–27.
23 Hanum N, Cambiano V, Sewell J, *et al*. Use of HIV pre-exposure prophylaxis among men who have sex with men in England: data from the AURAH2 prospective study. *Lancet Public Health* 2020;5:e501–11.
24 Cockbain B, Whitlock G, Dean Street Collaborative Group. Immediate prep when accessing PEP: a service evaluation. *HIV Med* 2022;23:1108–12.
25 Steinberg L. A social neuroscience perspective on adolescent risk-taking. *Dev Rev* 2008;28:78–106.
26 Powell A, Francis-Devine B, Clark H. Youth unemployment statistics. 2022. Available: https://commonslibrary.parliament.uk/research-briefings/sn05871/
27 Clarke A. The prevalence of rough sleeping and sofa Surfing amongst young people in the UK. *SI* 2016;4:60–72.
28 Wolitski R, Valdiserri R, Stall R. Health disparities affecting gay and Bisexual men in the United States: an introduction. In: *Unequal opportunity: health disparities affecting gay and bisexual men in the United States*. New York: Oxford Academic, 2007.
29 McCormack S, Dunn DT, Desai M, *et al*. Pre-exposure prophylaxis to prevent the acquisition of HIV-1 infection (PROUD): effectiveness results from the pilot phase of a pragmatic open-label randomised trial. *Lancet* 2016;387:53–60.