**Age-related prevalence and twelve-month incidence of illicit drug use in a cohort of Australian gay and bisexual men: Results from the Flux Study**

Fengyi Jina Mohamed A. HammoudaLisa MaheraLouisa DegenhardtbAdam BournecToby LeadeStefanie VaccheraJeffrey GriersonfBridget HaireaGarrett P Prestagea

**Highlights**

• Over 80% of Australian gay and bisexual men reported lifetime illicit drug use.

• Approximately one in two men reported use of illicit drugs in the last six months.

• Recent drug use was mostly infrequent.

• Drug initiation rate was generally decreased with increasing age.

• Close to 3% of men initiated crystal meth in the first year regardless of age.

**Abstract**

**Background**

We report prevalence and incidence of drug use initiation in Australian gay and bisexual men (GBM) participating in an online cohort study.

**Methods**

Between September 2014 and June 2015, 1,710 GBM were enrolled in the Following Lives Undergoing Change Study and followed-up six monthly. Participants were asked about measures of lifetime use at baseline and recent use (last six months) at all visits. Drug use initiation was defined as men who reported having never used a specific drug prior to baseline and reported recent use at follow-up.

**Results**

Participants’ median age was 31 years (range: 16–81). Prevalence of lifetime use was significantly associated with older age for all individual drugs (p trend<0.001), and 84.1% reported lifetime use of any drugs. Just above half (51.9%) reported recent use at baseline, with the majority reporting occasional use (once or twice in the previous six-months). Among men who reported no history of drug use at baseline, drug initiation was highest for amyl nitrite, with an incidence of 10.5 per 100 person-years (95% CI 7.9–13.9), followed by cannabis (7.3 per 100 person-years, 95% CI 5.0–10.6) and ecstasy (5.0 per 100 person-years, 95% CI 3.6–7.0). Younger age was significantly associated with higher incidence of initiation of amyl nitrite, ecstasy, cocaine, ketamine, GHB, and LSD (p trend <0.05 for all).

**Conclusion**

Prevalence of lifetime illicit drug use is lower in younger GBM than in their older counterparts. However, incidence of drug use initiation is high among younger men, providing an opportunity for early intervention.

**Keywords**

Illicit drug use

Gay and bisexual men

Prevalence

Incidence

Cohort study

**1. Introduction**

Illicit drug use is more prevalent among gay and bisexual men (GBM) than heterosexual men in most industrialised countries (Cochran et al., 2004; Drabble et al., 2005; Roxburgh et al., 2016). While Bourne and Weatherburn attributed illicit drug use among GBM to: 1) enhancing a sense of belonging; 2) coping with everyday problems; and 3) enhancing pleasure (Bourne and Weatherburn, 2017), problematic drug use can lead to adverse health outcomes. In particular, the use of amphetamine-type stimulants is associated with condomless anal intercourse with casual partners (Prestage et al., 2007) and subsequent risk of HIV acquisition (Prestage et al., 2009). ‘Chemsex’ (the use of drugs to enhance sexual pleasure, particularly in the context of sex partying), has been increasingly reported in a minority of GBM in recent years and has been associated with transmission of HIV (Schmidt et al., 2016).

There are few data on the incidence of drug use initiation in high-risk populations, such as GBM, despite the recognition of early drug initiation as a risk factor for subsequent adverse health outcomes (Kecojevic et al., 2017). In this paper, we report age-specific patterns of drug use frequency and the incidence of twelve-month drug initiation in a cohort of GBM in Australia.

**2. Methods**

The *Following Lives Undergoing Change* (Flux) is an ongoing, online, observational cohort study among Australian GBM. The methods have been described in detail elsewhere (Hammoud et al., 2017). Men living in Australia aged 16.5 years and above were eligible if they self-identified as gay/homosexual or bisexual or reported sex with at least one man in the preceding 12 months.

Potential participants were approached via online advertising through social media with varying degrees of gay community engagement, including popular ‘dating’ sites and apps for gay and bisexual men looking for potential male sexual partners, including Squirt™, Manhunt™, and Grindr™, and Facebook. Once enrolled, participants were followed up with six-monthly online surveys. Participants provided informed consent and the study was approved by the Human Research Ethics Committee at UNSW Sydney (HC14075).

At baseline, participants were asked about lifetime and recent (‘last six-month’) use of amyl nitrite, cannabis, ecstasy, meth/amphetamine (speed), cocaine, lysergic acid diethylamide (LSD), crystal methamphetamine (crystal), ketamine, gamma hydroxybutyrate (GHB), and heroin. To minimise the confusion between the terms ‘meth/amphetamine’ and ‘crystal methamphetamine’ among participants as both are different forms of methamphetamine, the former was referred to as “speed” and the latter “crystal” in study questionnaires, as per common usage in the study population in Australia. Frequency of recent drug use was measured as: occasional use (once or twice in the last six months), at least monthly use, weekly use and daily use. Participants were also asked at baseline at what age they first used cannabis, and at what age they first used any ‘party’ drugs, which referred to any use of meth/amphetamine (speed), crystal methamphetamine (crystal), ecstasy, cocaine, or GHB. Questions about recent use and frequency of use were repeated at each follow-up.

The twelve-month incidence of drug initiation was estimated among participants who completed at least one of the first two follow-up biannual surveys at six- and/or twelve-months after baseline interview. Twelve-month incidence of initiation was measured as: 1) overall drug initiation rates, with only those who reported having never used any drugs at baseline; and 2) drug-specific initiation rates, among those who reported having never used a specific drug prior to baseline. Incidence rates were calculated by dividing the number of those who initiated any drug use or use of a specific drug by total person-years of follow-up. Incidence per 100 person-years of follow-up is presented with associated 95% confidence intervals (95% CI). For overall drug initiation, due to small numbers of initiation observed for individual drugs, incidence rates were grouped into two categories of drugs; first, cannabis and amyl nitrite; and second, any of the ‘party drugs.’

Statistical analyses were carried out using Stata version 14.2 (College Station, Texas, USA). Age was categorised into roughly quartile groups (16.5–24, 25–29, 30–39, 40 and above). Univariable logistic regression was used to examine the trend associations between age groups and prevalence and frequency of drug use. Univariable Cox regression was used to examine the trend associations between age groups and drug initiation.

**3. Results**

Between September 2014 and June 2015, a total of 1710 men were enrolled. Most (97.4%) self-identified as gay or bisexual, while the majority of the remaining self-identified as queer (1.9%) The median age was 31 years (range:16–81), and 44 men (2.6%) were aged under 18 at the time of baseline survey. Nearly three quarters (n = 1,279, 74.8%) reported testing HIV-negative, 8.1% (n = 138) reported testing HIV-positive. The remaining 17.1% (n = 293) were unsure of their HIV status, mainly due to not having been tested (n = 275); a few recently tested participants had not yet received their test results at the time of the survey.

**3.1. Lifetime illicit drug use**

Overall, 1438 (84.1%) men reported lifetime use of any of the listed illicit drugs at baseline. Lifetime prevalence of illicit drug use was higher in men aged 40 years and older (90.5%) compared with those aged less than 25 years (70.9%, p < 0.001).

The prevalence of lifetime illicit drug use ranged from 72.1% for cannabis to 4.5% for heroin (Table 1). Prevalence of lifetime use increased significantly with increasing age for all drugs (p < 0.001 for all), although the highest prevalence was observed in those aged in their thirties for all drugs except amyl nitrite and heroin.

Table 1. Prevalence of lifetime and recent and twelve-month incidence of illicit drug use and their association with age in the study of Following Lives Undergoing Change.

|  | **Lifetime use (N = 1710)** | **Recent (last 6-month) use (N = 1710)** | **Twelve-month incidence** |
| --- | --- | --- | --- |
|  | **n** | **%** | **95% CI** | **P value for trend** | **n** | **%** | **95% CI** | **P value for trend** | **n** | **Person-years** | **Incidence(per 100 person-years)** | **95% CI** | **P value for trend** |
| ***Cannabis*** | ***1233*** | ***72.1*** | ***69.9-74.2*** | ***<0.001*** | ***521*** | ***30.5*** | ***28.3-32.7*** | ***<0.001*** | ***28*** | ***384.2*** | ***7.3*** | ***5.0-10.6*** | ***0.059*** |
| **16-24 years** | 304 | 60.7 |  |  | 171 | 34.1 |  |  | 12 | 121.9 | 9.8 |  |  |
| **25-29 years** | 229 | 75.1 |  |  | 115 | 37.7 |  |  | 5 | 72.3 | 6.8 |  |  |
| **30-39 years** | 330 | 79.1 |  |  | 123 | 29.5 |  |  | 9 | 86.5 | 10.4 |  |  |
| **≥40 years** | 370 | 76.0 |  |  | 112 | 23.0 |  |  | 2 | 102.6 | 2.0 |  |  |
|  |
| ***Amyl nitrite*** | ***1127*** | ***65.9*** | ***63.6-68.2*** | ***<0.001*** | ***577*** | ***33.7*** | ***31.5-36.0*** | ***<0.001*** | ***48*** | ***458.1*** | ***10.5*** | ***7.9-13.9*** | ***<0.001*** |
| **16-24 years** | 211 | 42.1 |  |  | 115 | 23.0 |  |  | 33 | 187.8 | 17.6 |  |  |
| **25-29 years** | 203 | 66.6 |  |  | 111 | 36.4 |  |  | 7 | 87.6 | 8.0 |  |  |
| **30-39 years** | 314 | 75.3 |  |  | 169 | 40.5 |  |  | 5 | 107.3 | 4.7 |  |  |
| **≥40 years** | 399 | 81.9 |  |  | 182 | 37.4 |  |  | 3 | 75.5 | 4.0 |  |  |
|  |
| ***Ecstasy*** | ***880*** | ***51.5*** | ***49.1-53.9*** | ***<0.001*** | ***328*** | ***19.2*** | ***17.3-21.1*** | ***0.090*** | ***34*** | ***683.5*** | ***5.0*** | ***3.6-7.0*** | ***0.004*** |
| **16-24 years** | 149 | 29.7 |  |  | 87 | 17.4 |  |  | 19 | 224.8 | 8.5 |  |  |
| **25-29 years** | 169 | 55.4 |  |  | 86 | 28.2 |  |  | 7 | 128.7 | 5.4 |  |  |
| **30-39 years** | 277 | 66.4 |  |  | 85 | 20.4 |  |  | 5 | 146.9 | 3.4 |  |  |
| **≥40 years** | 282 | 58.5 |  |  | 70 | 14.4 |  |  | 3 | 183.0 | 1.6 |  |  |
|  |
| ***Meth/amphetamine (Speed)*** | ***732*** | ***42.8*** | ***40.4-45.2*** | ***<0.001*** | ***109*** | ***6.4*** | ***5.3-7.6*** | ***0.014*** | ***17*** | ***819.8*** | ***2.1*** | ***1.3-3.3*** | ***0.078*** |
| **16-24 years** | 104 | 20.8 |  |  | 33 | 6.6 |  |  | 10 | 259.3 | 3.9 |  |  |
| **25-29 years** | 135 | 44.3 |  |  | 34 | 11.2 |  |  | 3 | 160.5 | 1.9 |  |  |
| **30-39 years** | 242 | 58.0 |  |  | 24 | 5.8 |  |  | 1 | 180.2 | 0.56 |  |  |
| **≥40 years** | 251 | 51.5 |  |  | 18 | 3.7 |  |  | 3 | 219.8 | 1.4 |  |  |
|  |
| ***Cocaine*** | ***695*** | ***40.6*** | ***38.3-43.0*** | ***<0.001*** | ***229*** | ***13.4*** | ***11.8-15.1*** | ***0.344*** | ***36*** | ***838.9*** | ***4.3*** | ***3.1-6.0*** | ***0.003*** |
| **16-24 years** | 98 | 19.6 |  |  | 42 | 8.4 |  |  | 20 | 254.4 | 7.9 |  |  |
| **25-29 years** | 141 | 46.2 |  |  | 61 | 20.0 |  |  | 6 | 154.9 | 3.9 |  |  |
| **30-39 years** | 224 | 53.7 |  |  | 75 | 18.0 |  |  | 5 | 196.4 | 2.5 |  |  |
| **≥40 years** | 232 | 47.6 |  |  | 51 | 10.5 |  |  | 5 | 233.2 | 2.1 |  |  |
|  |
| ***Crystal methamphetamine (Crystal)*** | ***507*** | ***29.7*** | ***27.5-31.9*** | ***<0.001*** | ***224*** | ***13.1*** | ***11.6-14.8*** | ***<0.001*** | ***27*** | ***1005.6*** | ***2.7*** | ***1.8-3.9*** | ***0.240*** |
| **16-24 years** | 53 | 10.6 |  |  | 25 | 5.0 |  |  | 12 | 285.6 | 4.2 |  |  |
| **25-29 years** | 79 | 25.9 |  |  | 49 | 13.1 |  |  | 5 | 204.9 | 2.4 |  |  |
| **30-39 years** | 184 | 44.1 |  |  | 75 | 18.0 |  |  | 2 | 242.1 | 0.83 |  |  |
| **≥40 years** | 191 | 39.2 |  |  | 84 | 17.3 |  |  | 8 | 273.1 | 2.9 |  |  |
|  |
| ***Ketamine*** | ***422*** | ***24.7*** | ***22.7-26.8*** | ***<0.001*** | ***74*** | ***4.3*** | ***3.4-5.4*** | ***0.651*** | ***23*** | ***1073.3*** | ***2.1*** | ***1.4-3.2*** | ***0.003*** |
| **16-24 years** | 46 | 9.2 |  |  | 16 | 3.2 |  |  | 12 | 294.6 | 4.1 |  |  |
| **25-29 years** | 66 | 21.6 |  |  | 22 | 7.2 |  |  | 7 | 211.9 | 3.3 |  |  |
| **30-39 years** | 153 | 36.7 |  |  | 22 | 5.3 |  |  | 1 | 261.8 | 0.38 |  |  |
| **≥40 years** | 157 | 32.2 |  |  | 14 | 2.9 |  |  | 3 | 305.0 | 0.98 |  |  |
|  |
| ***Gamma hydroxybutyrate (GHB)*** | ***388*** | ***22.7*** | ***20.7-27.8*** | ***<0.001*** | ***132*** | ***7.7*** | ***6.5-9.1*** | ***0.007*** | ***19*** | ***1106.4*** | ***1.7*** | ***1.1-2.7*** | ***0.003*** |
| **16-24 years** | 47 | 9.4 |  |  | 20 | 4.0 |  |  | 6 | 295.9 | 2.0 |  |  |
| **25-29 years** | 72 | 23.6 |  |  | 30 | 9.8 |  |  | 5 | 199.2 | 2.5 |  |  |
| **30-39 years** | 145 | 34.8 |  |  | 40 | 9.6 |  |  | 3 | 274.1 | 1.1 |  |  |
| **≥40 years** | 124 | 25.5 |  |  | 42 | 8.6 |  |  | 5 | 337.2 | 1.5 |  |  |
|  |
| ***Lysergic acid diethylamide (LSD)*** | ***500*** | ***29.2*** | ***27.1-31.5*** | ***<0.001*** | ***72*** | ***4.2*** | ***3.3-5.3*** | ***0.018*** | ***23*** | ***1008.4*** | ***2.3*** | ***1.5-3.4*** | ***0.001*** |
| **16-24 years** | 79 | 15.8 |  |  | 26 | 5.2 |  |  | 15 | 268.5 | 5.6 |  |  |
| **25-29 years** | 85 | 27.9 |  |  | 18 | 5.9 |  |  | 2 | 192.6 | 1.0 |  |  |
| **30-39 years** | 161 | 38.6 |  |  | 16 | 3.8 |  |  | 5 | 256.2 | 2.0 |  |  |
| **≥40 years** | 175 | 35.9 |  |  | 12 | 2.5 |  |  | 1 | 291.1 | 0.34 |  |  |
|  |
| ***Heroin*** | ***77*** | ***4.5*** | ***3.6-5.6*** | ***<0.001*** | ***3*** | ***0.2*** | ***0.03-0.5*** | ***0.270*** | ***0*** | ***1373.2*** | ***0.0*** | ***0.0-0.3*** | ***---*** |
| **16-24 years** | 6 | 1.2 |  |  | 0 | 0.0 |  |  | --- | --- | --- |  |  |
| **25-29 years** | 11 | 3.6 |  |  | 1 | 0.3 |  |  | --- | --- | --- |  |  |
| **30-39 years** | 25 | 6.0 |  |  | 0 | 0.0 |  |  | --- | --- | --- |  |  |
| **≥40 years** | 35 | 7.2 |  |  | 2 | 0.4 |  |  | --- | --- | --- |  |  |

The mean age of first cannabis use was 18.7 years (SD = 5.20; median = 18), whereas the mean age at first use of any ‘party drugs’ was 21.6 years (SD = 6.63; median = 20). The majority of those who had ever used any ‘party drugs’ (58.8%) indicated first using ecstasy.

**3.2. Recent illicit drug use**

At baseline, approximately one in two men (51.9%) reported using illicit drugs in the previous six months. Men aged less than 25 years were slightly less likely to report recent use than older men (46.3% vs 54.2%, p = 0.003).

Prevalence of recent use of specific drugs ranged from 33.7% for amyl nitrite to 0.3% for heroin (Table 1). Among participants who reported lifetime use of a certain drug, the proportion of recent use was highest for amyl nitrite, for which 51.2% of the 1127 men who reported lifetime use of amyl nitrite also reported use in the last six months. This was followed by crystal methamphetamine (crystal) at 44.2%, cannabis at 42.3%, and ecstasy at 37.3%.

The association between the prevalence of recent drug use and age was not consistent. Recent use of amyl nitrite (p < 0.001), crystal methamphetamine (crystal, p < 0.001), and GHB (p = 0.007) were significantly associated with increasing age. There was an inverse association with age for recent use of cannabis (p < 0.001), speed (p = 0.014), and LSD (p = 0.018) (Table 1).

Among men who reported recent use at baseline, the majority reported occasional use, except for amyl nitrite, for which 51.8% of recent users reported at least monthly use. Older men were significantly more likely to report at least monthly use of amyl nitrite (p < 0.001, Fig. 1). In contrast, younger men were significantly more likely to report at least monthly use of ecstasy (p < 0.001).



Fig. 1. The association between age and frequency of recent illicit drug use in the study of Following Lives Undergoing Change.

Just over three-quarters (77.5%) of men completed the six-month follow-up survey and 71.3% completed the 12-month survey. Participants lost to follow-up after baseline (17.4%) were similar to those who continued in the study with respect to socio-demographic characteristics, drug use and self-reported HIV serostatus. However, those who only completed the baseline survey were significantly younger (mean age 29.6 vs 34.4 years, p < 0.001) than those who provided follow-up data.

**3.3. Overall drug use initiation**

A total of 219 men who reported at baseline that they had never used illicit drugs completed at least one biannual follow-up survey. Just above half (n = 110, 50.2%) were aged under 25 years, 37 (16.9%) were aged between 25 and 29 years, 34 (15.5%) were aged between 30 and 39 years, and 38 (17.4%) were above 40 years. Among them, 24 reported using cannabis or amyl nitrite during follow-up. The overall incidence of initiation of these two drugs was 11.4 per 100 person-years (95% CI 7.6–17.0). Very few men (n = 6) with no history of illicit drug use at baseline initiated any of the ‘party drugs’, with an incidence rate of 2.8 per 100 person-years (95% CI 1.2-6.1). All six men who initiated any of the ‘party drugs’ also initiated cannabis or amyl nitrite.

**3.4. Drug-specific incidence**

The drug-specific initiation rate was highest for amyl nitrite, with an incidence of 10.5 per 100 person-years (95% CI 7.9–13.9, Table 1). This was followed by cannabis and ecstasy, with an incidence of 7.3 (95% CI 5.0–10.6) and 5.0 (95% CI 3.6-7.0) per 100 person-years, respectively. Incidence of crystal methamphetamine (crystal) was 2.7 per 100 person-years (95% CI 1.8-3.9). No cases of initiation of heroin use were observed in the first 12 months of follow-up.

The incidence of initiation was inversely associated with increasing age for almost all drugs except crystal methamphetamine (crystal, Table 1). This inverse association with increasing age was statistically significant for amyl nitrite (p < 0.001), ecstasy (p = 0.004), cocaine (p = 0.003), ketamine (p = 0.003), GHB (p = 0.003), and LSD (p = 0.001).

**4. Discussion**

Illicit drug use was common in this sample of Australian GBM, although most recent use was infrequent. Age was a strong predictor of lifetime, recent and incident use. While prevalence of illicit drug use was generally associated with increasing age, this association with age reversed for recent use of cannabis, speed and LSD. The incidence of initiation was generally inversely associated with increasing age, with the exception of crystal methamphetamine (crystal).

Prevalence of both lifetime and recent use of any illicit drug in the Flux Study is substantially higher than that reported among GBM in a 2013 Australian population-based household survey, which found that 58.7% reported lifetime use and 35.9% reported use in the last 12 months (Roxburgh et al., 2016). While these differences could be attributable to different sampling strategies between the two studies, the higher prevalence observed in the current study, at 84.1% for lifetime use and 51.9% for recent use, may also reflect changes over time in drug use patterns among Australian GBM (Lea et al., 2016). Behavioural surveillance conducted among GBM in Sydney and Melbourne in 2016 indicates that approximately 65% of men report using recreational drugs in the previous six months, which also included the use of steroids and erectile dysfunctional medications (Hull et al., 2017; Lee et al., 2017). Internationally, a large survey of 174,209 men who have sex with men from 44 European cities conducted in 2010 reported slightly lower prevalence of lifetime and of recent use of illicit drugs, but wide variations in drug use existed across cities (Schmidt et al., 2016). Nevertheless, between Sydney and Melbourne, the patterns of recent recreational drug use were more similar.

While it is not surprising that the prevalence of lifetime drug use was strongly associated with increasing age, a distinctive pattern emerged in the prevalence of recent use in association with age. Recent use of amyl nitrite, crystal methamphetamine (crystal), and GHB were associated with increasing age, but this association with age reversed for recent use of cannabis and speed. This might suggest the existence of age-based social networks among GBM who use drugs.

To the best of our knowledge, this is the first study to report on the incidence of initiation of a comprehensive range of illicit drugs among GBM. Being a large-scale prospective cohort study, Flux benefited from its design being entirely online, with high retention (71.3%) at 12 months (Hammoud et al., 2017). In men who had never used illicit drugs prior to study enrolment, the 12-month incidence of ‘party’ drugs was much lower than initiation of cannabis and amyl nitrite use. This suggests that most drug naïve GBM may initiate use of cannabis or amyl nitrite before using other drugs. This is also supported by the younger age at initiation of cannabis (18.7 years) compared with ‘party’ drugs (21.6 years) reported by participants at baseline, indicating a temporal sequence between the initiation of cannabis and other illicit drugs.

Our study has limitations. Flux targeted younger men in whom the prevalence of lifetime illicit drug use was expected to be lower, aiming to maximise the likelihood of capturing events of drug initiation during the study. To achieve this, just under 30% of study participants were under 25 years when recruited, higher than previous studies among GBM in Australia (Jin et al., 2010; Lea et al., 2016). Being an entirely online cohort study, participants were predominantly recruited from online social network sites (Hammoud et al., 2017). These characteristics could limit the generalisability of study results. The study was widely advertised through gay-friendly online sources and through gay community organisations in Australia, and thus results could be more representative of men engaged in gay community. Participants’ geographic distribution and other characteristics were similar to samples recruited in previous studies conducted by the research team. Longer follow-up of the cohort will facilitate the understanding of factors associated with some individuals becoming problematic drug users, which is of great public health importance to this marginalised population.

Illicit drug use is common among GBM in Australia. Although younger GBM are less likely to report lifetime drug use than their older counterparts, a marked proportion of younger men experience high incidence of drug initiation in their adulthood, which might provide an opportunity for early intervention. Importantly, incidence of crystal methamphetamine (crystal) use, a drug whose use has been linked to incident HIV infection, was high in men aged above 40, indicating a need for targeted harm reduction efforts.

**Role of the funding source**

The Following Lives Undergoing Change (Flux) Study is funded by an Australian Research Council Discovery Project (DP 140102483). The Kirby Institute and the Centre for Social Research in Health are affiliated with UNSW Sydney and funded by the Australian Government Department of Health. The National Drug and Alcohol Research Centre, UNSW is supported by funding from the Australian Government under the Substance Misuse Prevention and Service Improvements Grants Fund. Lisa Maher is supported by an Australian National Health and Medical Research Council (NHMRC) Senior Research Fellowship. Louisa Degenhardt is supported by a NHMRC Principal Research Fellowship. Toby Lea is supported by an Alexander von Humboldt Postdoctoral Research Fellowship.

The views expressed in this publication do not necessarily represent the position of the Australian Government.

**Contributors**

GPP, LM, LD and FJ conceptualised the Flux cohort. GPP, MAM, and FJ developed the study analysis plan. FJ drafted the manuscript. All authors commented on the draft and approved the final version of the manuscript.

**Conflicts of interest**

The authors declare no conflicts of interest.

**Acknowledgements**

The authors thank all the participants of the Flux Study.

**References**

Bourne and Weatherburn, 2017

A. Bourne, P. Weatherburn**Substance use among men who have sex with men: patterns, motivations, impacts and intervention development need**

Sex. Transm. Infect., 93 (2017), pp. 342-346

Cochran et al., 2004

S.D. Cochran, D. Ackerman, V.M. Mays, M.W. Ross**Prevalence of non-medical drug use and dependence among homosexually active men and women in the US population**

Addiction, 99 (2004), pp. 989-998

Drabble et al., 2005

L. Drabble, L.T. Midanik, K. Trocki**Reports of alcohol consumption and alcohol-related problems among homosexual, bisexual and heterosexual respondents: results from the 2000 National Alcohol Survey**

J. Stud. Alcohol., 66 (2005), pp. 111-120

Hammoud et al., 2017

M.A. Hammoud, F. Jin, L. Degenhardt, T. Lea, L. Maher, J. Grierson, B. Mackie, M. Pastorelli, C. Batrouney, N. Bath, J. Bradley, G.P. Prestage**Following lives undergoing change (Flux) study: implementation and baseline prevalence of drug use in an online cohort study of gay and bisexual men in Australia**

Int. J. Drug Policy, 41 (2017), pp. 41-50

Hull et al., 2017

P. Hull, L. Mao, T. Lea, L. Lee, J. Kolstee, T. Duck, L. Feeney, G. Prestage, I. Zablotska, J. De Wit, M. Holt**Gay Community Periodic Survey: Sydney 2017**

Jin et al., 2010

F. Jin, G.P. Prestage, G. Matthews, I. Zablotska, P. Rawstorne, S.C. Kippax, J.M. Kaldor, A.E. Grulich**Prevalence, incidence and risk factors for hepatitis C in homosexual men: data from two cohorts of HIV-negative and HIV-positive men in Sydney, Australia**

Sex. Transm. Infect. (86) (2010), pp. 25-28

Kecojevic et al., 2017

A. Kecojevic, C.H. Basch, S.E. Lankenau**Early initiation of substance use as an indicator of problematic substance use among young men who have sex with men (YMSM)**

Subst. Use Misuse, 53 (2017), pp. 51-58

Lea et al., 2016

T. Lea, L. Mao, M. Hopwood, G. Prestage, I. ZabLOTSKA, J. De Wit, M. Holt**Methamphetamine use among gay and bisexual men in Australia: trends in recent and regular use from the gay community periodic surveys**

Int. J. Drug Policy, 29 (2016), pp. 66-72

Lee et al., 2017

E. Lee, L. Mao, T. Lea, T. McKenzie, C. BAtrouney, B. Allan, M. West, G. Prestage, I. Zablotska, J. De Wit, M. Holt**Gay Community Periodic Survey: Melbourne 2017**

Centre for Social Research in Health, UNSW, Sydney (2017)

Prestage et al., 2007

G. Prestage, L. Degenhardt, F. Jin, A. Grulich, J. Imrie, J. Kaldor, S. Kippax**Predictors of frequent use of amphetamine type stimulants among HIV-negative gay men in Sydney, Australia**

Drug Alcohol Depend., 91 (2007), pp. 260-268

Prestage et al., 2009

G. Prestage, F. Jin, S. Kippax, I. Zablotska, J. Imrie, A. Grulich**Use of illicit drugs and erectile dysfunction medications and subsequent HIV infection among gay men in Sydney**

Australia. J. Sex. Med., 6 (2009), pp. 2311-2320

Roxburgh et al., 2016

A. Roxburgh, T. Lea, J. De Wit, L. Degenhardt**Sexual identity and prevalence of alcohol and other drug use among Australians in the general population**

Int. J. Drug Policy, 28 (2016), pp. 76-82

Schmidt et al., 2016

A.J. Schmidt, A. Bourne, P. Weatherburn, D. Reid, U. Marcus, F. Hickson, E.M.I.S. Network**Illicit drug use among gay and bisexual men in 44 cities: findings from the European MSM Internet Survey (EMIS)**

Int. J. Drug Policy, 38 (2016), pp. 4-12