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Sexualised drug use in the United Kingdom (UK): A review of the literature

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Abstract

Background

Sexualised drug use (SDU) refers to the use of drugs in a sexual context. This includes 'Chemsex'- the use of drugs (specifically crystal methamphetamine, GHB/GBL and mephedrone) before or during planned sexual activity to sustain, enhance, disinhibit or facilitate the experience. Here we aimed to synthesise available UK prevalence data for Chemsex, SDU and the use of Chemsex drugs in an undefined context (CDU) in men who have sex with men (MSM).

Methods

Papers published between January 2007 and August 2017 reporting Chemsex, SDU and/or Chemsex drug use (CDU) prevalence in MSM were identified through PubMed. Citations were searched for further eligible publications. We also conducted a review of national surveillance data, extracting prevalence data for Chemsex, SDU or CDU. Synthesized data were then assessed to determine the time at which these drugs were taken, in this case just prior to or during sexual activity (event-level).

Results

Our search identified 136 publications, of which 28 were included in the final data synthesis. Three of the four surveillance systems assessed provided SDU or CDU data in MSM. Few publications included event-level data for Chemsex (n=4), with prevalence estimates ranging from 17% among MSM attending sexual health clinics (SHC) to 31% in HIV-positive MSM inpatients. Prevalence estimates for SDU (n=7 publications) also varied considerably between 4% in MSM receiving HIV care to 41% among MSM attending SHC for HIV post-exposure prophylaxis (PEP). Eighteen publications provided data for CDU.

Conclusion

Prevalence estimates varied considerably due to differences in the definition used and population assessed. Standardised definitions and studies with representative national samples of MSM are required to improve our understanding of the extent of Chemsex and its associated risks. Longitudinal event-level data for SDU and Chemsex are needed to monitor impact of interventions.

Word Count: 287

Box 1: Glossary

BBV: Blood-borne viruses including Hepatitis B, Hepatitis C and HIV.

cAI: Condomless anal intercourse.

Chemsex: The use of drugs (particularly methamphetamine, GHB/GBL and mephedrone) before or during planned sexual activity to sustain, enhance, disinhibit or facilitate the experience.

Chemsex Drug Use (CDU): The use of any of the Chemsex drugs (mephedrone, methamphetamine, GHB/GBL) in an undefined context.

Club Drugs: Drugs that are usually taken in nightclubs or party environments. Club drugs include; scatty (MDMA), ketamine, cocaine, amphetamine and the Chemsex drugs, though definitions vary significantly.

GUMCAD surveillance system: GenitoUrinary Medicine Clinic Activity Dataset. A mandatory reporting system providing data on sexual health service provision and sexually transmitted infection diagnoses from all sexual health services in England.

Event-level Data: Data specific to the time at which the drugs were taken, in this case just prior to or during sexual activity.

LGBT: Lesbian, gay, bisexual or transgender individuals.

MSM: Men who have sex with men.

NDTMS: National Drug Treatment Monitoring System; collects data on the reported problematic substance use of clients attending to treatment for drug addiction.

Party and Play (PnP): Another term for Chemsex which is commonly used in Australia and the United States of America.

PEP: Post –exposure prophylaxis; any preventative medical treatment started immediately after exposure to HIV in order to prevent infection and development of disease.

PrEP: Pre-exposure prophylaxis; any preventative medical treatment taken prior to exposure to HIV in order to prevent infection and development of disease.

Recall Period: The period assessed for the involvement in Chemsex, SDU or CDU.

Sexualised Drug Use (SDU): The use of illicit drugs just before or during sexual activity.

Sexual Health Clinic (SHC): Clinics specializing in the prevention and treatment of sexually transmitted infections.

Slamming: The injection of Chemsex drugs during Chemsex, also known as 'Slamsex'.

STI: Sexually transmitted infection.

UAM Survey of PWID: Unlinked anonymous survey of people who inject drugs. A national survey monitoring BBV prevalence in people who inject drugs (PWID) recruited from England, Wales and Northern Ireland. This survey recruits individuals who have ever injected drugs, collecting data on injecting and non-injecting modes of drug use.

Introduction:

The relationship between sex and drug use is long established, however the use of drugs in sexual contexts (sexualised drug use) has potential implications for public health. Sexualised drug use (SDU) has been associated with risky sexual behaviours (Digiusto & Rawstorne, 2013; Hegazi et al., 2017; Nodin, Valera, Ventuneac, Maynard, & Carballo-Dieguez, 2011; Weatherburn, Hickson, Reid, Torres-Rueda, & Bourne, 2017), increasing the likelihood of participation in condomless sex (Weatherburn et al., 2017) and thus the risk of sexually transmitted infection (STI) or blood borne virus (BBV) transmission (Olufon & Cathcart, 2016; Ottaway, Finnerty, Amlani, et al., 2017; Page & Nelson, 2016). Although not all SDU is problematic, recently emerging patterns of SDU among men who have sex with men (MSM) are a cause for concern and have been identified as a public health priority in a number of countries (EMCDDA, 2017; Heiligenberg et al., 2012; Parsons, Lelutiu-Weinberger, Botsko, & Golub, 2014).

Patterns of drug use among MSM have changed over the past decade (Ahmed et al., 2016; Adam Bourne et al., 2015; Moncrief, 2014) with a notable shift from 'club drugs' such as cocaine and ecstasy to the use of drugs associated with 'Chemsex', namely mephedrone, GHB/GBL, methamphetamine, and to a lesser extent, ketamine. These drugs are often, though not exclusively, used in a sexual context as they act to increase sexual arousal and performance (Ahmed et al., 2016; Melendez-Torres & Bourne, 2016) whilst encouraging disinhibition. As a result, risk-reduction precautions and intentions to practise safer-sex can often be overruled (Knoops, Bakker, Bodegom, & Zantkuijl, 2015).

'Chemsex', the use of drugs (particularly methamphetamine, GHB/GBL and mephedrone) before or during planned sexual activity to sustain, enhance, disinhibit or facilitate the sexual experience, also referred to as 'Party and Play' (Melendez-Torres et al., 2016), has been linked to various health harms in a subset of MSM. Chemsex facilitates engagement in lengthy and condomless sex sessions with multiple partners often of unknown serostatus and unknown HIV treatment status, thereby increasing exposure to HIV and multiple STIs. Sexual behaviours such as fisting (ano-brachial intercourse), anilingus (ano-oral sex) and scat play (Gilbart et al., 2015) can place an individual at greater risk of BBVs and gastrointestinal (GI) infections. One such GI infection, *Shigella flexneri*

subtype 3a, has been linked with sexual transmission among MSM during a UK outbreak (Gilbart et al., 2015).

Although it is difficult to determine whether individuals engaged in Chemsex are just as likely to take sexual risks if they were not under the influence of the drugs (Race, Lea, Murphy, & Pienaar, 2016), there is some evidence of SDU and CDU's causal association with riskier sexual behaviours (Colfax et al., 2005; Melendez-Torres, Hickson, Reid, Weatherburn, & Bonell, 2017). MSM participating Chemsex were found to be five times more likely to report more than six sexual partners in the last three months, three times as likely to report use of post-exposure prophylaxis (PEP) and ten times as likely to report group sex, when compared to those not participating in Chemsex (Hegazi et al., 2017). As some Chemsex drugs can be injected, a practice referred to as "Slamming", there is the possibility for further exposure to BBVs via injection (Kirby & Thornber-Dunwell, 2013; Melendez-Torres & Bourne, 2016).

Among MSM in the United Kingdom (UK) SDU is well described, however few studies are designed solely for the collection of data for Chemsex. Internationally however the prevalence of Chemsex among MSM is difficult to determine. Although some data are available (Lea, Reynolds, & De Wit, 2011; Wei, Guadamuz, Lim, Huang, & Koe, 2012), these data are often not specific to drug use just prior to or during sexual activity ("event-level data") or the MSM population due in part to stigma and discrimination limiting collection of robust data (Melendez-Torres & Bourne, 2016). Data for Chemsex prevalence and associated health harms among other lesbian, gay, bisexual and transgender (LGBT) and heterosexual communities are less frequently captured, though some data are emerging (Beddoes, Sheikh, Khanna, & Francis, 2010; Moncrief, 2014).

Understanding the extent of the population at risk is essential for determining harms and developing best practice. We therefore aimed to synthesize available evidence in order to better understand the prevalence of Chemsex in MSM in the UK. Evidence was identified through a review of published evidence and examination of national surveillance data. In our review, we distinguish between three forms of substance use: SDU, Chemsex, and the context-independent reporting of Chemsex drug use (CDU) (Box 1). Due to the heterogeneous nature of SDU internationally, this review includes UK data only, to explore consistency of measurement and to highlight gaps in the available knowledge.

Methods:

Our review of available prevalence data for Chemsex, SDU and CDU in the UK consisted of two parts; a scoping literature review and synthesis of available national surveillance data.

Literature Review:

A scoping literature review was conducted using PubMed. We limited the search to identify studies published between January 2007 and 11th August 2017 (the date of this review) which contained UK data. Our review focused on MSM exclusively as, although participation in SDU is not limited to this group (Mayer, Colfax, & Guzman, 2006), MSM are noted to be at greater risk of the negative outcomes of SDU including transmission of BBVs (HIV and hepatitis B and C) (Ireland et al., 2017; Turner et al., 2006) particularly due to sexual risks.

Our search included a combination of terms associated with; 'Chemsex' or 'sexualised drug use', 'men who have sex with men' and the main Chemsex drugs (see Appendix 1, 2 for search strategy). A full title screen was conducted removing irrelevant or duplicate articles. Shortlisted titles underwent an abstract review. Full papers were shortlisted and reviewed using the eligibility criteria below. Publications were included if they contained any prevalence data on Chemsex, SDU and/or the use of any Chemsex drug (mephedrone, GHB/GBL or crystal methamphetamine; CDU) (see Box 1). As poly-drug use is common among MSM reporting CDU (Li & McDaid, 2014), several other substances can be used alongside Chemsex drugs, the most common of these secondary drugs is ketamine (A. Bourne, Reid, Hickson, Torres-Rueda, & Weatherburn, 2014). Due to this, and ketamine's popularity among MSM internationally, ketamine prevalence data were included in the data synthesis despite the drug not being included in the current UK definition of Chemsex. Publications were excluded if they were; non-English language, non-human or based on non-UK data. Additional publications were found through reviewing citations of included papers.

National Surveillance Data:

Available data from Public Health England's national surveillance systems were extracted to provide a representative data source. National data were included in the synthesis if they contained any

prevalence data for Chemsex, SDU or CDU specific to MSM in England. National datasets reviewed included; a drug treatment monitoring surveillance system (Public Health England, 2017a), a survey monitoring BBV prevalence in people who inject drugs (Public Health England, 2017b), a pilot of an enhancement to the national sexually transmitted infection surveillance system (Public Health England, 2015a) and a survey collecting data on crime in England and Wales (Home Office Statistics, 2016).

Synthesis of Prevalence Data:

Prevalence data from eligible publications were extracted and reviewed to determine as to whether they were to event-level (see Box 1). Data were reported by data type (Chemsex, SDU or CDU) alongside details of the population assessed, urban/rural locality and recall period (e.g. use in the last month) (Table 1-4). In order to provide context to the data, the purpose of the included studies, the study design, Chemsex definition used and population assessed (sample size, average age, HIV status) were summarized (Appendix 3).

Results:

1. Literature review:

Our search identified 136 publications (Figure 1). From these 51 were excluded as they; were published >10 years ago (n=46) or were not written in English (n=5). Full texts were then assessed and 69 publications were excluded as they; contained no prevalence data (n=22), contained duplicate data already published elsewhere (n=2) and/or contained data not specific to MSM (n=2) or the UK (n=43).

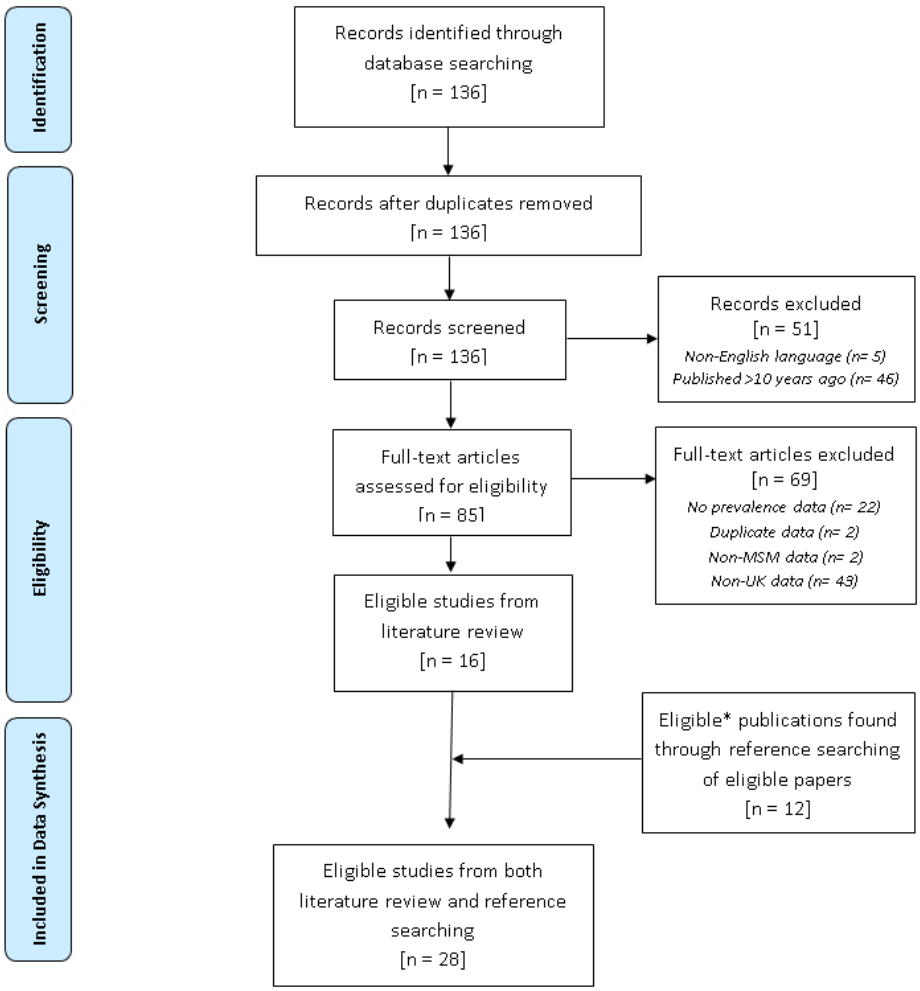

Figure 1: PRISMA flow diagram detailing the inclusion and exclusion process for this review of the literature.

*Eligibility criteria used were the same as those applied to publications identified through database searching.

Eligible publications identified in the literature search (n=16) were then included alongside any found through reviewing citations (n=12), into a final data synthesis from 28 eligible publications (Table 1-3).

Table 1 Summary of available data for the prevalence of sexualised drug use among MSM in the UK

Table 2 Summary of available data for the prevalence of Chemsex among MSM in the UK

Table 3 Summary of available data for the context independent prevalence of Mephedrone, Methamphetamine, GHB/GBL (CDU) and Ketamine[β] use among MSM in the UK

1.1 Overview of the available published data:

Of the 28 eligible publications, 7 reported data for SDU (Table 1), 4 for Chemsex (Table 2) and 23 for CDU (Table 3), the majority of data were cross-sectional from surveys or case-control studies, with only two studies providing longitudinal data (Appendix 3). Despite ketamine being included in the search criteria alongside the Chemsex drugs, no eligible publications reported prevalence data for the use of ketamine alone.

UK prevalence data captured through these 28 eligible publications were based on sample sizes ranging from 12 to 16,565 MSM (Appendix 3). For 16 of these publications, collection of prevalence data for Chemsex, SDU or CDU among MSM was reported to be the main aim of the study. The remaining studies (n=11) captured prevalence data as an aside to their main aim; to describe factors for BBV acquisition (HIV n=2, HCV n=2), to describe factors for STI acquisition (n=1), as a response to a Shigella outbreak (n=2), for service improvement (n=4) or to assess baseline characteristics for a intervention (n=1) (Appendix 3).

Most publications captured data on both HIV-positive and negative MSM (n=18), four studies focused on HIV–positive MSM and three on HIV-negative MSM alone. The majority of data were collected from urban areas (n=18), with the remainder providing data from both urban and rural localities. No studies collected data from exclusively rural locations. The majority of data were collected through clinic settings (n=19), spread between sexual health clinics (n=12), HIV clinics (n=1), joint HIV and sexual health clinics (n=4) and LGBT drug and alcohol clinics (n=2). Collection of data from community settings or outreach was in the minority (n=2), however online data collection was more common (n=7). Prevalence data were collected for a range of recall periods with some publications

providing data for multiple time frames or contexts. Recall periods assessed included both time frame (current involvement (n=3), participation in the last; week (n=1), two weeks (n=1), month (n=6), three months (n=6), year (n=8), and lifetime (n=9) or consistent (n=1) participation) and context driven (most recent CAI (n=1) or reason for clinic presentation (n=2)) periods (Table 1,2,3).

2. A review of the national surveillance data:

Four national surveillance systems were assessed for Chemsex, SDU or CDU prevalence data, three of which contained relevant data and were included in the synthesis. Annual data from the Crime Survey in England and Wales (Home Office Statistics) was excluded from the synthesis as sexuality data were not collected. Currently little prevalence data for either SDU (n=1) or CDU (n=3) among MSM is captured through national surveillance, with none of the surveillance systems capturing the prevalence of Chemsex in this population (Table 4).

Table 4 Summary of available national surveillance data for Chemsex, SDU or CDU among MSM in the UK

2.1 Data Sources:

i) National Drug Treatment Monitoring System (NDTMS):

A national surveillance system monitoring problematic drug use in those attending treatment for drug dependency (Public Health England, 2017a) captures data on the proportion of those presenting to treatment citing problematic use of GHB/GBL and amphetamines, as well as self-reported sexual orientation. Prior to the 2016-2017 reporting period sexuality was not a mandatory field, so completion varied substantially between regions according to local practice. As this data is not currently collected to event-level, it can only be utilised to determine the prevalence of CDU among gay and bisexual men and not Chemsex or SDU specifically.

ii) Genitourinary Medicine Clinic Activity Dataset (GUMCAD) pilot:

A pilot of a behavioural enhancement to routine STI surveillance through GUMCAD was conducted for a consecutive 8-week period at each of 5 sexual health clinics (SHCs) across England in 2015 and

2016 (Public Health England, 2015a). This provided data on SDU to event-level during last sex as well as CDU prevalence. Data were collected on self-reported sexual risk (same- or different sex partners). The anticipated national rollout for this new version of GUMCAD is in 2018. Once established, this enhanced surveillance system will allow for longitudinal monitoring of behaviour and associated biological outcomes.

iii) Unlinked Anonymous Survey of People Who Inject Drugs :

Data from a national survey monitoring trends in injecting drug use among drug service attendees (Public Health England, 2017b) were collated to determine prevalence of specific drug use and injection, namely mephedrone and ketamine, among male participants reporting to; 1) have ever injected a drug 2) have had sex with a man (MSM) in the last year. Historic data are available since the addition of mephedrone to the survey in 2013. As this survey collects data on both injecting and non-injecting drug use among people reporting to have ever injected drugs, it provides insight into the prevalence of CDU and injected CDU and allows monitoring of trends over time. This survey did not capture any data on the use of other Chemsex drugs (GHB/GBL and methamphetamine) and did not capture drug use to event-level at the time of this review however recent adaptations mean that this data will be available from 2018 onwards.

3. Data Synthesis:

Prevalence estimates for the extent of SDU, Chemsex and CDU varied considerably depending on the location, timeframe and population assessed (Table 1, 2, 3 and 4, Appendix 3). Prevalence estimates for SDU, Chemsex and CDU are presented separately below, as is the extent of this data which is available to event-level (see Box 1).

3.1 Sexualised drug use prevalence:

Seven of the 28 eligible publications and only one of the national surveillance systems (GUMCAD) reported SDU data to event-level. The majority of these recruited both HIV-positive and negative MSM (n=5) from clinic settings (n=6) in exclusively urban areas (n=5). Prevalence estimates for SDU

among MSM were mainly collected prospectively (n=4) and range from 4% to 43% depending on the population assessed (Table 1, Appendix 3).

Across the four publications and single national surveillance system reporting routine SHC attendances by both HIV-positive and HIV-negative MSM, the median prevalence of reported SDU in was 23%, however data captured were based on different recall periods (Table 1). One study found that of the 1,000 MSM routinely attending six SHCs in England, 12% reported SDU in the last 3 months. Cross-sectional data captured through two studies recruiting MSM attending to SHCs in North West England found similar proportions of MSM attendees reporting SDU in the last year (23% and 24%). A retrospective case-control study of 247 MSM attending to SHC in South East England found a similar proportion (23%) reported current SDU. However when this study accounted for a current STI diagnosis as a marker of risk behaviour, SDU prevalence in this population rose from 16% (no STI) to 31% (STI diagnosis). National surveillance during the 2015-16 GUMCAD pilot captured a higher prevalence of SDU in routine SHC attendances, with 43% of the 152 MSM reporting any illicit drug use in the last three months disclosing SDU during their last sexual encounter (event-level).

When reporting the prevalence of SDU among MSM attending to SHC for post-exposure prophylaxis (PEP), a high prevalence of SDU was identified through a case note review. This study found that 41% of men attending in 2015 reported SDU during the PEP risk event, an increase from 18% in 2013-14, however the size of the sample reviewed was limited (2015: n=101, 2013-14: n=51). Lifetime reporting of SDU amongst HIV-positive MSM was found to be much lower at just 4% in a retrospective case note review of attendees to a joint HIV and SHC, though this too was limited by a small samples size (n=85) and may be subject to bias due to the retrospective nature of data collection.

Encounter level data were collected through a yearlong community based survey, where MSM were asked to report their last condomless anal intercourse (cAI) session with only one sexual partner in five waves of online data collection. Of the 6,714 encounters reported by the 2,142 MSM surveyed, 43% involved SDU.

3.2 Chemsex prevalence:

Limited event-level data were available for Chemsex prevalence (n=4), with only three cross-sectional and one case control study reporting Chemsex prevalence data (Table 2, Appendix 3) and none of the national surveillance systems (Table 4). As the majority of the control group in the case control study were non-MSM, only prevalence data from the cases were included in the data synthesis. Of the included publications, two captured data on MSM attendees to London based HIV and SHCs and two interviewed MSM diagnosed with *Shigella* spp., across England and Wales during two outbreak periods.

Prevalence estimates for current Chemsex range from 17% among MSM attending SHC to 31% in HIV positive MSM admissions to a London clinic. A higher proportion was noted in MSM recently diagnosed with Shigella (62% & 75%), however, as data were collected as a result of a Shigella outbreak, sample sizes were small (n= 34, n=12) and findings may be bias by the distinct population addressed. There was variation in the Chemsex definition used in these studies (Appendix 3), with two studies including secondary drugs such as ketamine and cocaine in their definition for Chemsex.

3.3 Chemsex drug use prevalence:

Twenty three studies and three national data sources reported participants' use of various drugs associated with Chemsex, not necessarily in a sexual context, which can be used as a proxy for Chemsex behaviour.

Mephedrone appeared to be the most common Chemsex drug reported by MSM in the UK, with GHB/GBL only becoming more popular when HIV-positive MSM are exclusively or disproportionately recruited. Similarly, mephedrone remained the most popular drug used in the last 3 months (36%) among HIV-negative MSM recruited through a trial for the HIV PrEP ("PROUD" study), followed by GHB/GBL (31%) and finally methamphetamine which was reported by the fewest number of men (18%). The prevalence of ketamine use varied between studies, with nine studies finding it to be the most frequently reported and four studies listing it as the least frequently reported when compared to the three Chemsex drugs.

During the 2015-16 reporting period, NDTMS found 22% of gay and bisexual men presenting to treatment for drug addiction reported problematic use of GBL and 34% reported problematic use of

amphetamine. Reported problematic use of these drugs was higher in gay or bisexual men when compared to heterosexuals (where 2% reported problematic GBL use and 6% problematic amphetamine use), as was the reported rate of injecting among those using non-opiate drugs (19% in gay or bisexual men vs 2% in heterosexual men). Among MSM who reported illicit drug use in the last three months 16% reported mephedrone, 16% GHB/GBL and 9% Methamphetamine use. The Unlinked Anonymous Survey of People Who Inject Drugs collects information on non-injecting and injecting use of mephedrone and ketamine in people attending general drug services who report ever injecting drugs: during 2013-2016 non-injecting use of mephedrone and ketamine in the last month was 15% and 10% respectively among men reporting sex with a man in the last year (injected use estimates are reported in section 3.4 below).

Although the preference for mephedrone seemed to be consistent geographically, regional variations were seen in the reported use of any of the Chemsex drugs and ketamine. UK data extracted from a large international study of over 160,000 MSM, found that within the UK sample (n= 8,291), MSM recruited in London were more likely to report the CDU in the last four weeks than those recruited outside of London (methamphetamine: 3% vs 1%, GHB/GBL: 6% vs 2%, Mephedrone: 5% vs 3%, Ketamine: 6% vs 4%). Further analysis of this data assessed methamphetamine, mephedrone, ketamine and GHB/GBL use by MSM across 44 European cities, and found past four week use to be highest in Brighton (16%), Manchester (16%) and London (13%) relative to other European cities. Further regional disparity was noted in the Gay Men's Sex Survey which found methamphetamine use among MSM in London to be five times that of outside London (5% vs 1%), with the regional variation (London vs outside London) in reported mephedrone and GHB/GBL only slightly less than this (mephedrone: 12% vs 3% and GHB/GBL: 8% vs 2%).

3.4 Injection of Chemsex drugs:

Few publications contained event level prevalence data for the injection of Chemsex drugs amongst MSM prior to or during sex (Slamming/Slamsex) (n=3) and no event level data for Chemsex drug injection were captured through national surveillance. Prevalence estimates for the injection of Chemsex drugs at event level range between 12% in HIV positive MSM and 24% in MSM recently

diagnosed with Shigella. When comparing this latter study to a prior Shigella outbreak amongst MSM during 2009-10, the prevalence of event level Chemsex drug injection appears to have increased from 16% to 24% (during a 2012-13 outbreak), though both studies were limited by their small sample size. One study provided event level data for the injection of the individual Chemsex drugs among MSM attending to 6 SHCs in England. In this study, methamphetamine proved the most commonly injected Chemsex drug (2%) when compared to mephedrone (0.8%). Non-event-level data for the prevalence of 'club drug' injection were captured in 2 publications, with prevalence estimates ranging from 25% in MSM recruited at four settings in Brighton to 49% in MSM attendees to a London LGBT drug and alcohol service.

Prevalence data for the injection of drugs used in Chemsex were captured through one national surveillance system; however this data was not captured to event level. National monitoring at general drug services through the Unlinked Anonymous Monitoring Survey of People Who Inject Drugs (UAM Survey of PWID) found the injection of mephedrone and ketamine in the last month to be 12% and 6% respectively among MSM attendees during 2013 to 2016, which was higher than the injected use of mephedrone and ketamine among non-MSM attendees (5% and 2%) (Heinsbroek, Glass, Tanner, Hope, & Desai, *in press*). Since 2000, an increase in the proportion of males recruited in the survey who reported sex with men has been observed (4.4% in 2000/01 to 8.4% in 2014/15), as well as altered drug use patterns with increasing stimulant injection and decreasing opiate injection among MSM, suggesting 'slamming' is now evident among MSM accessing general drug services (Glass, Hope, Tanner, & Desai, 2017).

Discussion

Nationally, subgroups of MSM are participating in Chemsex and SDU, potentially heightening their risk of STI or BBV acquisition and other health harms. Understanding the prevalence of Chemsex and SDU in MSM is essential in order to better target interventions and monitor their impact. This review found that prevalence estimates for Chemsex among MSM in the UK varied greatly, were mainly London or urban focused and from clinic settings or as part of an outbreak response. The majority of data were limited by the differing definitions and recall periods used, and by a focus on sampling

small samples from subgroups of MSM rather than the population as a whole (Table 2, Appendix 3). Event-level prevalence estimates for SDU in UK MSM also varied greatly and were mainly from urban and clinic based studies (Table 1). Little national representative data is available for SDU among MSM, and Chemsex remains uncaptured in any of the national surveillance systems (Table 4). In order to establish the true extent of Chemsex and SDU among MSM, there is requirement to have a sample representative both in terms of risk and geography, data which is currently lacking.

The majority of data related to the extent of Chemsex in the UK MSM population is from studies collecting data for CDU as a proxy for Chemsex (Table 3); however the use of these drugs, particularly mephedrone, will not always be related to sex. Although CDU has been found to be significantly associated with an STI diagnosis in the last year (Sewell et al., 2017), it is worth noting that not all SDU or Chemsex is problematic and it is possible for participation to be non-detrimental to health and wellbeing if appropriate precautions are made.

To our knowledge, this is the first review of its kind, aiming to summarise available data for the prevalence of Chemsex among MSM in the UK and highlight gaps which limit its comparability and synthesis. It provides a basis from which to build a better understanding of the extent of Chemsex and SDU among MSM and advises as to how best to target future data collection.

Throughout the published literature we found significant variations in the Chemsex definitions used (Appendix 3). Chemsex and SDU were frequently referred to interchangeably, with Chemsex sometimes being incorrectly defined as ‘sex under the influence of any illicit drug’ (MacRae, Lord, Forsythe, & Sherrard, 2017; Melendez-Torres et al., 2017; Mohammed et al., 2016). Variations were seen in the drugs included; sometimes solely Chemsex drugs, but often other illicit drugs, such as ketamine, cocaine and/or ecstasy (Chan, Wood, & Dargan, 2015; Gilbart, Simms, Gobin, Oliver, & Hughes, 2013; Hegazi et al., 2017; Schmidt et al., 2016).

Chemsex drugs were also included as ‘Club Drugs’, for which definitions were equally as broad and inconsistent (Daskalopoulou et al., 2014; Drumright, Patterson, & Strathdee, 2006; Keogh et al., 2009), with some including LSD, nitrites (poppers), Rohypnol and Viagra in their definition (Drumright et al., 2006). Use of a non-standardised definition allows studies to capture poly-drug use, as other drug and substances are often used alongside the three Chemsex drugs when engaging in Chemsex (A. Bourne et al., 2014). In order to overcome this distorting effect, studies often collated data on

individual drug use. However, this limits comparability as individuals may have reported the use of more than one Chemsex drug, making the prevalence estimate for involvement in Chemsex as a whole difficult to determine.

Future data collection should utilise a standardised definition in order to build a strong and comparable knowledge base. For this review we drew upon Public Health England's definition of Chemsex; "the use of drugs before or during planned sexual activity to sustain, enhance, disinhibit or facilitate the experience. Chemsex commonly involves crystal methamphetamine, GHB/GBL and mephedrone, and sometimes the injecting these drugs as slamming)"(Public Health England, 2015b). This definition highlights the key Chemsex drugs and their use at event-level (i.e. prior to or during sex), providing the specificity and clarity required to form a strong knowledge base. This definition however does not include secondary drugs such as ketamine. This is because the drugs used in Chemsex, and related forms of SDU such as Party and Play (Box 1), vary from country-to-country, reflecting the availability of substances locally. Therefore, whilst our suggested definition works well in the UK, it is likely that definitions for other countries will need to be reflective of local patterns of drug use and thus may include different drugs. Further work is therefore required in order to establish a unifying definition for international comparisons.

Comparison between event-level prevalence estimates was hampered by variation the recall periods assessed (Table 1-4). Surveys included in this synthesis of UK data used seven different temporal or context driven (e.g. last PEP/cAI episode) recall periods. A larger quantity of event-level SDU prevalence data was found, however this too is subject to a broad range of prevalence estimates due, in part, to variations in the recall periods addressed.

In the absence of Chemsex or SDU event-level data, CDU can be utilised as a direct proxy for Chemsex, though it is worth noting that CDU is not limited to sexual contexts and Chemsex drugs are used in a range of other settings. Mephedrone was the most popular of the Chemsex drugs used among MSM in the UK potentially due to its availability, low cost and reliable quality (A. Bourne et al., 2014), although recent data suggests potential for a recent decline in use (Public Health England, 2017c). Similar reasons for use are suggested for GHB/GBL, which was more popular in surveys where HIV-positive MSM were exclusively or disproportionately recruited. This is especially worrying due to the recent observed rise in the number of GHB-associated deaths in London (Hockenhull,

Murphy, & Paterson, 2016). Ketamine appeared to be as popular if not more popular than mephedrone in some studies, however this may reflect the use of both of these drugs being common in non-sexual contexts, when compared to the GHB/GBL and methamphetamine. Methamphetamine use was markedly lower possibly due to its highly addictive nature and association with slamming, although use was higher in London than outside of London and amongst HIV positive individuals.

The majority of the available event-level data were collected through one-off cross-sectional surveys, providing a snap shot of prevalence in the surveyed population at one point in time. Event level data were frequently based on small sample sizes and specific sub-populations of MSM, limiting its generalisability to the population as a whole. Time-series data or repeated cross-sectional surveys using robust measures over time are needed to better understand risks and inform responses. This would also allow exploration of the temporal relationship between Chemsex and other risk behaviours and a fuller assessment of the relationship between Chemsex or SDU and infections such as HIV or STIs.

Little representative national data for SDU and Chemsex were found, however forthcoming adaptations to a national surveillance system of attendees to SHCs (Public Health England, 2015a) will allow for the collection of event-level data for SDU, and the monitoring of attendee's sexual health over time. Adaptations to another national surveillance system monitoring individuals attending to treatment for drug addiction (Public Health England, 2017a) will mandate the reporting of sexuality, allowing for more easily comparable data over time. Together these will help address the current gaps in data from the UK.

The available prevalence data for Chemsex, SDU and CDU were almost exclusively urban and clinic focused. On the occasion that data from rural localities were captured, it was never reported independently. London appeared to be the focus for data collection, with seven studies reporting exclusively London data and five recruiting from London alongside other urban centres. Data suggest Chemsex is more prevalent in London, Manchester and Brighton (Schmidt et al., 2016), however anecdotal reports and recent evidence suggesting use of drugs associated Chemsex is common across the UK, has resulted in calls for a targeted sexual health response across the UK (Moncrief, 2014; Wiggins, Mebrahtu, Sullivan, Field, & Hughes, 2016).

Available Chemsex and SDU prevalence data was often specific to subpopulations of MSM; some assessed MSM engaging in risky sexual behaviours (e.g. cAI), some HIV-positive, some HIV-negative and some a mixture of the above. Although determining Chemsex and SDU prevalence in these sub-groups is important when assessing risk and clinical practice, their diversity and biases make it difficult to synthesise data and assess the overall extent of Chemsex.

Estimates for Chemsex were notably higher in HIV-positive MSM and MSM participating in high risk behaviours (cAI) than in those who attended to SHCs. When comparing London based studies, recent participation in Chemsex was found to be more prevalent amongst HIV-positive MSM inpatient admissions when compared to MSM attending two SHCs (31% vs 17%). Higher prevalence of Chemsex in HIV-positive MSM can also be noted in unpublished data (Hibbert et al., In Press; Pufall et al., 2016). The high levels of Chemsex among these sub-groups is of concern in the context of the possible impact on ART adherence, drug interactions and the subsequent effect on viral load and onwards transmission.

There were several limitations to this scoping review. Firstly, the scope of this review is potentially limited by only having searched a single database. Though measures were taken to capture key publications by reviewing citations in eligible papers, some publications may have been overlooked and therefore not included in the data synthesis. However, as the studies found were heterogeneous and subject to bias, it is unlikely that further studies identified through alternative database searching would have been sufficient to have overcome these limitations and make a full synthesis possible. Secondly, as this was a scoping and not a systematic review, no formal quality assessment was conducted on the identified publications. Finally only one reviewer screened and assessed articles for eligibility, therefore the inclusion of studies could also have been affected by reviewer bias or subjective views.

This scoping review focused on the use of Chemsex drugs among MSM due to particular concerns regarding infection risk in this population. The prevalence of Chemsex in other groups such as women who have sex with women, female sex workers or HIV positive or high risk heterosexuals has therefore not been examined, even though SDU has been noted in these populations (Marquez, Mitchell, Hare, John, & Klausner, 2009; Moncrief, 2014; Paxton, Williams, Bolden, Guzman, & Harawa, 2013).

Future event-level data specific to the prevalence of Chemsex are required to better understand the extent among MSM and other LGBT populations. Use of a standardised Chemsex definition and assessment of recency of drug use rather than a specific recall period will allow for easier comparison between studies and subpopulations. Robust time-series data from either longitudinal or repeated cross-sectional studies are needed in order to better estimate prevalence data, detect changes in patterns of drugs use and behaviour over time and monitor the impact of interventions. Future collection of data through national surveillance systems should collect or disaggregate data by sexuality so as to provide a national and representative data source.

In conclusion, the extent of sexualised drug use and Chemsex among MSM in the UK remains poorly understood with little published national data available. Evidence for the prevalence of Chemsex and SDU at event-level is lacking and limited by reliance on clinic or community cross-sectional surveys with differing definitions and sampling methodologies, making comparison difficult. However prevalence estimates for both SDU and Chemsex seem to vary considerably both by HIV status, risk behaviour and region.

A standardised definition and use of recency of drug use instead of a specific recall period would strengthen data collection to allow for a better understanding of the extent of Chemsex, its associated risks and the impact of any future interventions.

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Table 1 Summary of available data for the prevalence of sexualised drug use among MSM in the UK

Study	Population assessed	HIV status	Location	Recall Period	Prevalence		
					SDU	Slamsex	Event-level
Ireland 2017 (Ireland et al., 2017)	Self-complete questionnaire given to MSM attending to 4 SHCs between Feb to Dec 2013	Both	Urban/Rural (Greater Manchester)	Last year	23% (432/1920)	.	Yes: SDU
MacRae 2017 (MacRae et al., 2017)	Retrospective case note audit of MSM attending for routine HIV care at an integrated HIV and SHC during 2015	HIV Positive	Urban (Oxford)	Ever	4% (3/85)	.	Yes: SDU
Melendez-Torres 2017 (Melendez-Torres et al., 2017)	Five waves of online data collection between 2011 to 2012 recruiting MSM through dating websites or as completed previous survey	Both	Urban/Rural (online- England only)	During most recent cAI session	43%[$] (2881/6714)	.	Yes: SDU
Mohammed 2016 (Mohammed et al., 2016)	National surveillance of MSM attending to 6 SHCs across England, August 2013 to April 2014	Both	Urban (London [n=4], Southend, Bristol, Bedford)	Last 3 months	12%[*] (127/1049)	.	Yes: SDU, CDU and injection of individual drugs.
Ottaway 2017 (a) (Ottaway, Finnerty, Amlani, et al., 2017)	Cross sectional case-control study including 260 MSM SHC attendees during a 6 month period in 2015. Cases were individuals with a diagnosed STI. Controls were age matched individuals with no STI diagnosis.	Both	Urban (Brighton)	Current	23% (58/247)	.	Yes: SDU
Ottaway 2017 (b) (Ottaway, Finnerty, Buckingham, & Richardson, 2017)	Local case note audit of MSM attending to a SHC for PEP over two 4 month periods (Nov 2013 to Feb 2014 and Mar 2015 to Jun 2015)	HIV Negative	Urban (Brighton)	During PEP episode	2013-14: 18% (9/51) 2015: 41% (41/101)	.	Yes: SDU
Ward 2014 (Ward & Lee, 2014)	Self -complete questionnaire given to all MSM attending to a SHC between April to June 2014	Both	Urban (Manchester)	Last year	24% (115/471)	.	Yes

[*] *All MSM attending to clinic.*
[$] *Data provided is encounter level, 2142 MSM reporting on drug use in 6742 sexual encounters.*

Abbreviations: *Men who have sex with men (MSM), Sexualised drug use (SDU), Chemsex drug use (CDU), Condomless anal intercourse (cAI), Post Exposure Prophylaxis for Sexual Exposure (PEP), Sexual health clinics (SHCs)*

Table 2 *Summary of available data for the prevalence of Chemsex among MSM in the UK*

Study	Population assessed	HIV status	Location	Recall Period	Prevalence		
					Chemsex	Slamsex	Event-level
Elliot 2017 (Elliot, Singh, Tyebally, Gedela, & Nelson, 2017)	Opt-out physician administered survey completed by all MSM admissions to a HIV inpatient unit between Oct 2014 to Jan 2015	HIV Positive	Urban (London)	Current	31% (13/42)	12% (5/42)	Yes: Chemsex & Slamsex
Gilbart 2013 (Gilbart et al., 2013)	MSM interviewed after diagnosis with Shigella during 2009-11 outbreak	Both	Urban/Rural (across England & Wales)	Use during sexual encounters	75% (9/12)*	16% (2/12)**	Yes: Chemsex & Slamsex
Gilbart 2015 (Gilbart et al., 2015)	Sexually active MSM diagnosed with Shigella between Oct 2012 to May 2013, face to face semi structured interviews	Both	Urban/Rural (across England & Wales)	The two weeks prior to Shigella episode	62% (21/34)	24% (8/34)	Yes: Chemsex & Slamsex
Hegazi 2017 (Hegazi et al., 2017)	Retrospective case note review for MSM attendees to two SHCs June 2015 to Jan 2016	Both	Urban (London)	Current	17%*** (113/655)	.	Yes: Chemsex

** Ketamine is included in the utilised Chemsex definition*
*** Slamsex prevalence not specific to Chemsex drugs, defined as the injection of any drug*
**** Inclusion of cocaine and ketamine in the utilised Chemsex definition*

Abbreviations: *Sexual health clinics (SHCs), Men who have sex with men (MSM).*

Table 3 Summary of available data for the prevalence of Mephedrone, Methamphetamine, GHB/GBL (CDU) and Ketamine[β] use among MSM in the UK

Study	Population assessed	HIV status	Location	Recall Period	Prevalence				
					Chemsex drug use			Slamsex	Event-level
Bonell 2009 (Bonell, Hickson, Weatherburn, & Reid, 2009)	MSM participating in a self-complete survey distributed through 107 community based agencies or available online through 2007	Both	Urban/Rural (England, Wales, Scotland, Northern Ireland)	Last Year: London [*] Out of London [**]	Mephedrone	.	.	.	No
					Methamphetamine	8% [*] 5% [**]	(155/1986) [*] (290/6155) [**]		
					GHB/GBL	.	.		
					Ketamine [β]	.	.		
Bourne 2014 (A. Bourne et al., 2014)	Secondary analysis of EMIS data: an online survey recruiting MSM through gay dating and social networking sites across 38 countries during the summer of 2010	Both	Urban (London: Lewisham, Southwark and Lambeth (LSL) boroughs)	LSL: Ever Last year Last four weeks / Use in the last four weeks: London [§] Out of London [¥]	Mephedrone	27% 14% 10% 5% [§] 3% [¥]	(308/1135) (154/1135) (114/1135) (200/3837) [§] (447/15423) [¥]	.	No
					Methamphetamine	24% 14% 5% 3% [§] 1% [¥]	(274/1133) (160/1133) (57/1133) (155/3837) [§] (108/15423) [¥]		
					GHB/GBL	30% 20% 11% 6% [§] 2% [¥]	(337/1124) (225/1124) (124/1124) (211/3837) [§] (247/15423) [¥]		
					Ketamine [β]	41.9% 7% 5% 6% [§] 4% [¥]	(474/1132) (76/1132) (55/1132) (226/3837) [§] (586/15423) [¥]		
Daskalopoulou 2014 (Daskalopoulou et al., 2014)	MSM attending 8 HIV outpatient clinics between Feb 2011to Dec 2012 completed a self-administered questionnaire	HIV Positive	Urban (Brighton, Eastbourne, Manchester, London)	Last 3 months	Mephedrone	7%	(162/2248)	.	No
					Methamphetamine	8%	(175/2248)		
					GHB/GBL	10%	(220/2248)		
					Ketamine [β]	13%	(280/2248)		

[¥] *Data from the larger UK wide EMIS sample used as a comparator to this London focused analysis.*

[β] *Ketamine is not included in Public Health England's definition of Chemsex, however prevalence data for ketamine are reported here for international comparison.*

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Dolling 2016 (Dolling et al., 2016)	Sexually active MSM recruited through 13 SHCs across England to complete a self-compete questionnaire during the PROUD PrEP trial Nov 2012 to April 2014	HIV Negative	Urban (London, York, Sheffield, Manchester, Brighton & Birmingham)	Last 3 months	Mephedrone	36%	(197/540)	.	No
					Methamphetamine	18%	(98/540)		
					GHB/GBL	31%	(169/540)		
					Ketamine [β]	16%	(89/655)		
					Use of ≥1 Chemsex drug[≠]	44%	(231/525)		
Elliot 2017 (Elliot et al., 2017)	Opt out physician administered survey completed by all MSM admissions to a HIV inpatient unit between Oct '14 to Jan '15	HIV Positive	Urban (London)	Current	Mephedrone	17%	(7/42)	12% (5/42)	Yes: Chemsex & Slamsex
					Methamphetamine	21%	(9/42)		
					Ketamine [β]	5%	(2/42)		
					GHB/GBL	19%	(8/42)		
Fox 2009 (Fox et al., 2009)	All newly diagnosed HIV positive MSM attending to SHC Jan 2002 to Jan 2004 who completed a structured electronic questionnaire at baseline & at 12 week follow up	HIV Positive	Urban (London)	In previous 12 weeks	Mephedrone	.	.	.	No
					Methamphetamine	8%	(8/98)		
					GHB	29%	(28/98)		
					Ketamine [β]	43%	(42/98)		
					GBL	.	.		
Hegazi 2017 (Hegazi et al., 2017)	Retrospective case note review for MSM attendees to two SHCs June 2015 to Jan 2016	Both	Urban (London)	Current use	Mephedrone	11%	(70/655)	.	Yes: Chemsex
					Methamphetamine	7%	(46/655)		
					Ketamine [β]	1%	(6/655)		
					GHB/GBL	9%	(57/655)		

[≠] *Drugs included mephedrone, GHB/GBL or methamphetamine*

[β] *Ketamine is not included in Public Health England's definition of Chemsex, however prevalence data for ketamine are reported here for international comparison.*

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Hickson 2016 (Hickson F, 2014)	MSM completing the Gay Men's Sex Survey 2014: an online open access survey completed July to October 2014	Both	Urban/Rural	Ever Last Year Last four weeks / Use in the last four weeks: London[§] Out of London[¥]	Mephedrone	17% 11% 5% 12% [§] 3% [¥]	(2534/15360) (1674/15360) (814/15360) (458/3951)[§] (365/11409)[¥]	.	No
					Methamphetamine	8% 5% 2% 5% [§] 1% [¥]	(1275/15360) (737/15360) (307/15360) (194/3951)[§] (114/11409)[¥]	.	No
					GHB/GBL	13% 7% 3% 8% [§] 2% [¥]	(1920/15360) (998/15360) (492/15360) (324/3951) [§] (171/11409)[¥]	.	No
					Ketamine [β]	20% 8% 2% . [§] . [¥]	(2995/15360) (1152/15360) (276/15360) . [§] . [¥]		
					Use of any of above in last 4 weeks	7%	(979/14833)		
Hunter 2014 (Hunter, Dargan, Benzie, White, & Wood, 2014)	Self-complete questionnaire given to MSM attending a SHC in 2 London hospitals over a 3 month period, July to Sept 2011	Both	Urban (London)	Ever / Last month	Mephedrone	24% 3%	(50/254) (4/254)	.	No
					Methamphetamine	17% 1%	(34/254) (3/254)		
					GHB	23% 2%	(48/254) (6/254)		
					GBL	16% 3%	(29/254) (8/254)		
					Ketamine [β]	34% 4%	(80/254) (9/254)		
Ireland 2017 (Ireland et al., 2017)	Self-complete questionnaire given to MSM attending to four SHCs between Feb to Dec 2013.	Both	Urban/Rural (Greater Manchester)	In the last year	Mephedrone	6%	(125/2030)	.	Yes: SDU
					Methamphetamine	2%	(45/2030)		
					GHB	5%	(100/2030)		
					GBL	.	.		
					Ketamine [β]	.	.		

[β] *Ketamine is not included in Public Health England's definition of Chemsex, however prevalence data for ketamine are reported here for international comparison.*

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Keogh 2009 (Keogh et al., 2009)	MSM completing the Gay Men's Sex Survey 2007: online completion and questionnaire distribution by community healthcare workers	Both	Urban/Rural	Ever Last Year	Mephedrone	.	.	.	No
					Methamphetamine	10% 5%	(585/6155) (289/6155)		
					GHB/L	13% 7%	(800/6155) (430/6155)		
					Ketamine [β]	21% 12%	(1293/6155) (739/6155)		
Kurka 2015 (Kurka, Soni, & Richardson, 2015)	MSM attending to four clinical settings: SHC, HIV clinic, local NGO and a walk in primary care clinic in Brighton, January to March 2014.	Both	Urban/Rural (Brighton)	Ever / Last month	Mephedrone	38% 19%	(94/246) (47/246)	25%[∞] (62/245)	No
					Methamphetamine	10% 3%	(25/246) (7/246)		
					GHB/GBL	24% 11%	(59/246) (27/246)		
					Ketamine [β]	.	.		
					Use of Club drugs[^]	53%	(124/246)		
Macdonald 2008 (Macdonald et al., 2008)	MSM attending to 7 SHCs between Sept 2002 to Oct 2004 were assigned to a case/control group based on their HIV status then asked to complete a computer assisted self-interview	Both	Urban (London, Manchester, Brighton)	Ever	Mephedrone	.	.	.	No
					Methamphetamine	13%	(29/232)		
					GHB	18%	(42/232)		
					GBL	.	.		
					Ketamine [β]	38%	(88/232)		
Macdonald 2014 (Macdonald et al., 2014)	MSM attendees (rLGV cases and random controls) to HIV or MSM specialist clinics of 6 hospitals between Aug 2008 to Dec 2010, who participated in a computer assisted self-interview	Both	Urban (London Brighton Glasgow)	Last 3 months	Mephedrone	.	.	.	Yes: Sex under the influence of CDU
					Methamphetamine	26%	(60/227)		
					GHB/GBL	37%	(86/227)		
					Ketamine	.	.		
MacRae 2017 (MacRae et al., 2017)	Retrospective case note audit of MSM attending for routine HIV care at an integrated HIV and SHC during 2015.	HIV Positive	Urban (Oxford)	Ever	Mephedrone	6%	(4/63)	.	Yes: SDU
					Methamphetamine	1%	(1/63)		
					GHB/GBL	.	.		
					Ketamine [β]	.	.		

[^] Ever use of club drugs "such as" mephedrone, GBL/GHB or methamphetamine

[∞] Ever injection of club drugs "such as" mephedrone, GBL/GHB or methamphetamine

[β] Ketamine is not included in Public Health England's definition of Chemsex, however prevalence data for ketamine are reported here for international comparison.

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Melendez-Torres 2016 (Melendez-Torres et al., 2016)	MSM completing the Gay Men's Sex Survey 2014: an online open access survey available during the summer of 2014	Both	Urban/Rural	Ever Last Year Last four weeks Last week	Methamphetamine	8% 5% 2% 1%	(1310/16,565) (747/16,565) (316/16,565) (161/16,565)	.	No
Melendez-Torres 2017 (Melendez-Torres et al., 2017)	Five waves of online data collection between 2011-12 recruiting MSM through dating websites or as completed previous survey.	Both	Urban/Rural (online-England only)	During most recent cAI session[$]	Mephedrone[$] Methamphetamine[$] GHB[$] GBL[$] Ketamine [β $]	. 1% 1% . 1.4%	. (72/6455) (94/6714) . (92/6623)	.	Yes: SDU
Mohammed 2016 (Mohammed et al., 2016)	MSM attending to 6 national surveillance pilot SHCs across England, August 2013 to April 2014	Both	Urban (London, Southend, Bristol, Bedford)	Last 3 months	Mephedrone[^] Methamphetamine[^] GHB/GBL[^] Ketamine [β]	10% 4% 7% .	(54/519) (19/519) (37/519) .	0.8%[^] (4/519) 2%[^] (8/519) . .	Yes: SDU, CDU and slamming of individual drugs.
Moncrief 2014 (Moncrief, 2014)	All clients* attending to Antidote, a London based LGBT drug and alcohol support service during 2013/14	.	Urban (London)	Reason for presentation at clinic	Mephedrone Methamphetamine GHB/GBL Ketamine [β]	64% 51% 46% 6%	461/720 373/727 334/726 44/758	49% (239/490) **	No
Schmidt 2016 (Schmidt et al., 2016)	EMIS: Anonymous online self-complete questionnaire completed by MSM across 38 countries during June - August 2010	Both	Urban/Rural (online)	Last 4 weeks	Use of any of the four Chems***: Brighton Manchester London Birmingham UK Comparison	 16% 16% 13% 3% 4%	 (47/290) (91/586) (631/4816) (10/338) (340/8291)	.	No

[$] *Data provided is encounter level, 2142 MSM reporting on drug use over 6742 encounters.*

[^] *MSM attendees with >1 sexual partner in the last 3 months*

[β] *Ketamine is not included in Public Health England's definition of Chemsex, however prevalence data for ketamine are reported here for international comparison.*

** Data based on all SHC attendees, not specific to MSM however 94% of the sample who specified gender were gay/bisexual men*

*** Club drug injection, not to event-level. Drugs included in 'club drug' definition unspecified*

**** 'Four Chems' drug category includes ketamine, GHB/GBL, mephedrone and methamphetamine*

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Sewell 2017 (Sewell et al., 2017)	MSM attending to 20 SHCs across England between June 2013 to Nov 2014 were asked to complete a self-administered questionnaire	HIV Negative or undiagnosed	Urban/Rural	Last 3 months	Mephedrone	19%	(283/1484)	.	No
					Methamphetamine	6%	(95/1484)		
					GHB/GBL	12%	(178/1484)		
					Ketamine [β]	8%	(125/1484)		
					Use of ≥1 Chemsex drug*	22%	(324/1484)		
Stuart 2013 (Stuart, 2013)	All clients attending to Antidote, a London based LGBT drug and alcohol support service during 2012	.	Urban (London)	Reason for presentation at clinic	Mephedrone	.	.	.	No
					Methamphetamine	.	.		
					GHB	.	.		
					GBL	.	.		
					Ketamine	.	.		
					Use of ≥1 Chemsex drug*	85%	.		
Thurtle 2016 (Thurtle et al., 2016)	All MSM attending to 2 SHCs in central London between Dec 2013 to March 2014 were asked to participate in a self-complete survey	.	Urban (London)	Ever	Mephedrone	.	.	.	No
					Methamphetamine	15%	(52/339)		
					GHB	19%	(64/339)		
					GBL	13%	(44/339)		
					Ketamine [β]	27%	(92/339)		

** Chemsex drugs defined as mephedrone, GHB/GBL or methamphetamine*
[β] Ketamine is not included in Public Health England's definition of Chemsex, however prevalence data for ketamine are reported here for international comparison.

Abbreviations: *Men who have sex with men (MSM), Sexualised drug use (SDU), Chemsex drug use (CDU), Condomless anal intercourse (cAI), Post Exposure Prophylaxis for Sexual Exposure (PEP), Sexual health clinic (SHC), Rectal Lymphogranuloma Venereum (rLGV)*

Table 4 Summary of available national surveillance data for Chemsex, SDU or CDU among MSM in the UK

National data source	Description	Sexuality measure	Location	Population assessed	Recall period	Prevalence Measure					
						SDU	Chemsex	CDU		Injection of Chemsex drugs	Event-level
National Drug Treatment Monitoring Service (NDTMS) (Public Health England, 2017a)	Captures data on individuals entering into treatment for drug addiction. Data presented for 2015-2016 reporting period.	Self-reported sexuality: Homosexual or Bisexual men	Drug treatment services	Gay or bisexual men attending to treatment for drug addiction	Self-report of problematic substance use	.	.	Amphetamine	34%* (470/1,363)	.	No
								GHB/GBL	22%* (297/1,363)		
GUMCAD v3 Pilot (Public Health England, 2015a)	Pilot of an enhancement of routine STI surveillance to include behavioural and partner notification data at 5 SHCs across England (July 2015 to June 2016 for 8 consecutive weeks at each pilot clinic).	Self-reported sexuality	SHC	MSM attending to pilot clinics who had a GUMCADv3 record submitted and reported using at least one recreational drug in the last 3 months.	Last sexual encounter [€] Last 3 months [±]	43% [€] (65/152)	.	Mephedrone	16% [±] (24/152)	.	Yes
								Methamphetamine	9% [±] (14/152)		
								GHB/GBL	16% [±] (24/152)		
								Ketamine [β]	9% [±] (13/152)		
Unlinked Anonymous Survey of People Who Inject Drugs (UAM Survey of PWID) (Heinsbroek et al., *in press;* Public Health England, 2017b)	An annual national monitoring survey collating data on the prevalence of BBV's in people who inject drugs. Data presented for 2013-2016.	Men reporting sex with another man in the last year	Drug and Alcohol Services	MSM attending drug services who have ever injected drugs	Last Month	.	.	Mephedrone	15%** (40/264)	12% (28/237)	No
								Ketamine [β]	10%** (25/264)	6% (16/237)	

** Proportions are of all gay or bisexual men attending to treatment for drug addiction during the 2015-2016 reporting period.*

*** Non injecting CDU in MSM who report ever injecting drugs during the 2013-16 survey periods.*

[β] Ketamine is not included in Public Health England's definition of Chemsex, however prevalence data for ketamine are reported here for international comparison.

Abbreviations: *Sexual Health Clinic's (SHCs), Men who have sex with men (MSM), Blood borne viruses (BBV)*

Appendix

Appendix 1: PICO Search Strategy for the Chemsex Scoping review

Search Question: What is the prevalence of Chemsex and sexualised drug use among men who have sex with men in the United Kingdom?

P	Population	Men who have sex with men	Gay, MSM, Homosexual
I	Intervention or Exposure	Chemsex Sexualised drug use (SDU) Slamming Slamsex	Sexualised drug use, slamming, Slamsex, GHB/GBL, mephedrone, methamphetamine, amphetamine, ketamine
C	Comparison	None used	.
O	Outcome	- Synthesize available evidence for the prevalence of Chemsex and SDU in MSM - Identify gaps in the available evidence	.

Appendix 2: PubMed Search strategy

Sexual*

AND

(men who have sex with men OR MSM OR homosexual* OR gay)

AND

(GHB OR GBL OR Ketamine OR Mephedrone OR Amphetamine OR Methamphetamine)

OR

(Chemsex OR Sexualis* drug use OR Sexualiz* drug use OR Recreational drug OR Slamming OR Slamsex)

AND

(men who have sex with men OR MSM OR homosexual* OR gay)

Appendix 3: *Study Characteristics*

Study	Study Design	Purpose of Study	Setting	Population	Chemsex Definition[$]
Bonell 2009 (Bonell et al., 2009)	Cross sectional	Describe the prevalence and pattern of methamphetamine use among MSM both inside and outside London	Online and community distributed (England)	n= 6155 (MSM) Age range: 14-50+ HIV positive: 86/620 (14%)	.
Bourne 2014 (A. Bourne et al., 2014)	Cross sectional	Describe the context, harms and motivations for SDU among MSM resident in Lambeth, Southwark and Lewisham (LSL), London	Online	n=1142 (MSM) Median age: 36 years (range: 17-76) HIV positive: 224/1135 (20%) (comparator UK EMIS data n = 15423)	Engaging in sexual activities while under the influence of drugs. Drugs most commonly associated with Chemsex are crystal methamphetamine (hereafter referred to as 'crystal meth'), GHB/GBL, mephedrone and, to a lesser extent, cocaine and ketamine.
Daskalopoulou 2014 (Daskalopoulou et al., 2014)	Cross sectional	Describe the prevalence and pattern of illicit drug use in HIV positive MSM and the effects these drugs have on sexual behaviour.	8 HIV outpatient clinics, UK	n= 2248 (MSM) Median age 46 years (IQR 39-51) All HIV positive	Use of methamphetamine, mephedrone, and GHB, solely for facilitating sex (known as Chemsex).
Dolling, 2016 (Dolling et al., 2016)	Randomised Case Control	Describe the baseline characteristics of MSM recruited onto the PROUD study, exploring the real world effectiveness of PrEP	13 SHCs in England	n= 540 (MSM) Median age 35 (IQR: 29-43) All HIV negative	ChemSex: Drugs commonly associated with drug use in a sexual context (mephedrone, GHB/GBL or crystal methamphetamine).
Elliot 2017 (Elliot et al., 2017)	Case- Control*	Characterise illicit drug use in new admissions to HIV clinic (case) and compare with illicit drug use in general admissions to medical acute assessment unit (controls)*.	London Hospital	n=59 (cases) Median age 47 (IQR:34-55) HIV positive: 59/59 (100%) MSM 42/49 (86%) **	*(The...)* use of drugs for the purpose of sexual enhancement ("Chemsex"), particularly methamphetamine, mephedrone and GBL/GHB.

[$]*Definition reported as published.*

** Our synthesis included data from the cases alone as the majority of the control population were non-MSM.*

*** All Chemsex and CDU prevalence data are based on data from MSM only.*

Abbreviations: *Sexual Health Clinic's (SHCs), Men who have sex with men (MSM), Interquartile range (IQR), European MSM internet survey (EMIS), Pre-exposure prophylaxis (PrEP), gamma butyrolacetone (GBL), gamma hydroxybutyrate (GHB), United Kingdom (UK) Not reported (NR).*

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Fox 2009 (Fox et al., 2009)	Longitudinal	Assess the impact of a HIV diagnosis on HIV transmission risk behaviour in MSM	HIV clinic, London	n=98 (MSM) Median age:33 year (range 20-59) All HIV positive	.
Gilbart 2013 (Gilbart et al., 2013)	Cross sectional	To investigate the shigellosis epidemic in MSM in the UK.	UK	n= 12 (MSM) HIV Positive: 9/12 (75%) HIV Positive: 225 (19.7%)*	Mephedrone, ketamine, crystal methamphetamine, and GBL… during sexual encounters
Gilbart 2015 (Gilbart et al., 2015)	Cross sectional	To inform control strategies undertaken as part of a Shigella outbreak among MSM.	Shigella outbreak response. Case follow-up interviews at a flexible location.	n=34 (MSM) Median age: 37.5 years (range 21 to 59) HIV Positive: 20/32 (63%)	Chemsex is the intentional use of drugs that includes mephedrone, crystal methamphetamine (crystal meth), GBL and GHB. These are taken before or during planned activity to sustain, enhance, disinhibit and/or facilitate sexual experience.
Hegazi 2017 (Hegazi et al., 2017)	Cross sectional	Analyse associations between SDU, STI diagnoses and sexual behaviour in MSM accessing SHCs to better inform clinical pathways.	2 SHCs, London	n= 655 (MSM) Median age: 33 years (range 14-83) HIV positive: (7/655)	Chemsex refers to the use of mephedrone, crystallised methamphetamine or GHB/GBL and to a lesser extent cocaine and ketamine to facilitate sex.
Hickson 2016 (Hickson, Reid, Hammond, & Weatherburn, 2016)	Cross sectional	A needs assessment for gay or bisexual men and MSM, assessing their alcohol and drug use.	Online: England	n=15360 (MSM) Average age: 34.9 years (SD: 13.1) HIV Positive: 1382/15360 (9%)	Three drugs have recently become closely associated with sex between men – mephedrone, GHB/GBL and crystal meth. Combining sex with use of these drugs has become known as Chemsex.

**Authors note that this HIV prevalence is higher than that in the rest of London and UK.*

Abbreviations: *Sexual Health Clinic's (SHCs), Men who have sex with men (MSM), Interquartile range (IQR), gamma butyrolacetone (GBL), gamma hydroxybutyrate (GHB), United Kingdom (UK), Sexually transmitted infection (STI), sexualised drug use (SDU), Not reported (NR).*

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Hunter 2014 (Hunter et al., 2014)	Cross sectional	Investigate the pattern of illicit drug use in patients and compare drug use between MSM and non MSM patients.	2 hospital SHCs, London	n= 254 (MSM) Mean age*: 31 years (SD: 9 years) HIV status: NR	.
Ireland 2017 (Ireland et al., 2017)	Cross sectional	Determine the prevalence of newly diagnosed hepatitis C virus (HCV) and associated risk behaviours among MSM.	4 SHCs, Manchester	n= 2030 (MSM) Median age: 33 years (IQR: 27-42 years) 39% HIV positive	.
Keogh 2009 (Keogh et al., 2009)	Cross sectional	Assess drug and alcohol use in gay/ bisexual men and MSM, their resulting needs and how these can be met.	Internet and community based survey: England	n= 6155 Median Age: 33 years (range: 14-87) HIV Positive= 10/6155 (16%)	.
Kurka 2015 (Kurka et al., 2015)	Cross sectional	Evaluate the improvement of services for MSM who use illicit drugs.	4 clinical settings, Brighton	n= 246 (MSM) Age: NR 13% HIV positive	Club drugs such as mephedrone, GBL/ GBH and crystal meth... are associated with high risk sexual behaviour (Chemsex)
Macdonald 2008 (Macdonald et al., 2008)	Unmatched case control	To detect and quantify current risk factors for HIV seroconversion among gay men seeking repeat tests at sexual health clinics.	Interviews at 7 SHCs in England	n= 232** [cases (recent HIV diagnosis) n= 75] [controls (recent HIV negative) n= 157]	.
Macdonald 2014 (Macdonald et al., 2014)	Unmatched case control	To identify risk factors for rectal lymphogranuloma venereum (rLGV) in men who have sex with men (MSM).	SH, HIV and dedicated MSM clinics at 6 hospitals, England and Scotland	n= 233** [cases (rLGV positive diagnosis) n= 90] [controls (rLGV negative diagnosis) n= 143] Median age: 39 years (range 22 to 56) HIV Positive: 156/233 (67%)	.

**Mean age is for both MSM and Non MSM (entire sample), mean age of MSM alone NR. Prevalence data for MSM sample alone was included in the data synthesis.*

***For the purpose of determining Chemsex prevalence, the case and control groups were combined.*

Abbreviations: *Sexual Health Clinic's (SHCs), Sexual health (SH), Men who have sex with men (MSM), Interquartile range (IQR), gamma butyrolacetone (GBL), gamma hydroxybutyrate (GHB), United Kingdom (UK), Sexually transmitted infection (STI), Not reported (NR).*

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MacRae 2017 (MacRae et al., 2017)	Cross sectional	To determine through a retrospective case note review if national guidelines for taking sexual histories, including illicit drug use and STI screening were being met.	Integrated HIV and SH clinic, Manchester	n= 85 (MSM) Age: NR All HIV positive	'Chemsex': engaging in sexual activities while under the influence of drugs
Melendez-Torres 2016 (Melendez-Torres et al., 2016)	Cross sectional	Characterise demographic and socio-sexual risk factors for crystal meth use in a national sample of UK MSM.	Internet and community based survey: England	n= 16565 Median age: 35.1 (SD 13.2) HIV positive: 9%	Chemsex is the intentional combining of illicit drugs ('chemicals') with sex in order to facilitate or enhance both experiences. The drugs most commonly associated with Chemsex in the UK include crystal meth, mephedrone and GHB sometimes taken as GBL.
Melendez-Torres 2017 (Melendez-Torres et al., 2017)	Longitudinal	Examine the association between SDU and cAI at encounter level.	Online survey: England.	n=2142 (MSM) 6742 cAI encounters Average age: 42.5 years (SD: 11.9) HIV status: NR	'Chemsex' the strategic combining of sex with drug use to enhance sexual performance and sensation.
Mohammed 2016 (Mohammed et al., 2016)	Cross sectional	Explore the extent of SDU in MSM attending to SHCs.	6 SHCs, England	n= 519 (MSM) Age: NR HIV status: NR	'Chemsex', the use of recreational drugs during sex in MSM.
Moncrief, 2014 (Moncrief, 2014)	Cross sectional	Examine how drug and alcohol treatment services could better meet the needs of LGBT people.	LGBT drug and alcohol support service, London	n= 758 Age: NR HIV status: NR	'Chemsex', the sexualised use of drugs by gay, bisexual, and other MSM. The three main presenting drugs are now mephedrone, crystal methamphetamine and GHB/GBL
Ottaway 2017 (a) (Ottaway, Finnerty, Amlani, et al., 2017)	Cross sectional Case-Control	Evaluate and determine the relationship between current SDU and STI acquisition locally.	SHC, Brighton	n= 260 (MSM)** [Cases (STI diagnosis) n=130] [Controls (no STI diagnosis) n=130] Median age: 46 years HIV Positive: 40%	The sexualised use of drugs such as Mephedrone, GHB/GBL and crystal methamphetamine, generally known as 'Chemsex'.
Ottaway 2017 (b) (Ottaway, Finnerty, Buckingham, et al., 2017)	Cross sectional	Local audit evaluating completeness of recreational drug history records for MSM accessing PEP during two time periods.	SHC, Brighton	n= 152 (MSM) [2013 -14 period: n=51] [2015 period: n=101] Median age: 31 year (IQR 25-41 years) HIV status: NR	Chemsex or sexualised recreational drug use.

***For the purpose of determining Chemsex prevalence, the case and control groups were combined.*

Abbreviations: *Sexual Health Clinic's (SHCs), Sexual health (SH), Men who have sex with men (MSM), Interquartile range (IQR), gamma butyrolacetone (GBL), gamma hydroxybutyrate (GHB), United Kingdom (UK), Sexually transmitted infection (STI), Post exposure prophylaxis (PEP), lesbian, gay, bisexual & trans people (LGBT), Not reported (NR).*

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Schmidt 2017 (Schmidt et al., 2016)	Cross sectional	Compare patterns of illicit drug use among MSM in 44 European urban centres (EMIS).	Online: 44 European cities	Whole EMIS sample (all countries): n= 160952 Age: NR HIV Positive: 12.5% UK EMIS data only: n= 8291* Age/HIV status: NR	Combining sex and illicit drugs (an activity referred to as 'Chemsex'), in particular GHB/GBL, ketamine, crystal meth, or mephedrone (here called 4-chems)
Sewell 2017 (Sewell et al., 2017)	Cross sectional	Assess the prevalence and factors associated with poly-drug and Chemsex drug use, exploring associations with sexual behaviour.	20 SHCs, UK	n= 1484 (MSM) Median age: 31.5 years All HIV negative or undiagnosed	'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 GHB/GBL.
Stuart, 2013 **(Stuart, 2013)**	Cross sectional	Highlight recent changes in drugs use by MSM	Substance misuse service, London	n= >8000** (MSM) Age: NR HIV status: NR	Sexualised use of crystal methamphetamine, mephedrone and GHB/GBL by MSM populations.
Thurtle 2016 (Thurtle et al., 2016)	Cross sectional	Provide an overview of illicit drug use among SHC attendees in London and compare this to existing datasets.	2 SHCs, London	n= 1472 (all attendees) Mean age: 30.6 years (SD 9 years- all attendees) HIV status: NR n=339 (MSM)***	.
Ward 2014 (Ward & Lee, 2014)	Cross sectional	We looked at HCV antibody testing and HCV risk assessment in all MSM clinic attenders as part of a Public Health England initiative.	SHC, Manchester	n= 471 (MSM) Median age 34 (range 18-71) 54% HIV positive	.

**Our synthesis included data from the UK EMIS sample alone.*
***Exact sample size NR.*
**** Our synthesis included prevalence data from this MSM sample alone*

Abbreviations: *Sexual Health Clinic's (SHCs), Sexual health (SH), Men who have sex with men (MSM), Interquartile range (IQR), gamma butyrolacetone (GBL), gamma hydroxybutyrate (GHB), United Kingdom (UK), Sexually transmitted infection (STI), Post exposure prophylaxis (PEP), lesbian, gay, bisexual & trans people (LGBT), European MSM internet survey (EMIS), Not reported (NR).*