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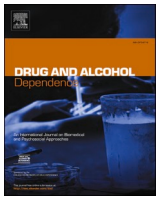

Review

Prevalence of chemsex and sexualized drug use among men who have sex with men: A systematic review and meta-analysis

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ABSTRACT

Background: Sexualized drug use (SDU), including chemsex, is prevalent within LGBTQI+ communities, particularly among men who have sex with men (MSM). This study conducts the first systematic review and meta-analysis to assess the global prevalence of SDU and chemsex among MSM.

Methods: A systematic search was performed in PubMed, Embase and Scopus with no language restrictions until April 1, 2024. We included studies that reported the prevalence of chemsex, overall SDU and SDU specifically regarding crystal methamphetamine, gamma hydroxybutyrate/ gamma butyrolactone (GHB/GBL), mephedrone, ketamine, cocaine, amphetamine, alkyl nitrites (poppers), ecstasy/MDMA and marijuana. Data were extracted independently by two researchers and analyzed using a random-effects model. Subgroup analyses were performed according to MSM population categories, region and time period of reporting.

Results: A total of 238 studies (380,505 participants) met inclusion criteria. The pooled prevalence of chemsex in MSM was 0.22 (95 % CI:0.19–0.25), while SDU had a pooled prevalence of 0.25 (95 % CI:0.23–0.28). Methamphetamine use for sex showed a pooled prevalence of 0.08 (95 % CI:0.07–0.10), GHB/GBL 0.13 (95 % CI:0.10–0.16), mephedrone 0.07 (95 % CI:0.05–0.10), and ketamine 0.04 (95 % CI:0.03–0.06). Cocaine use for sex demonstrated a pooled prevalence of 0.10 (95 % CI:0.08–0.13), alkyl nitrites 0.23 (95 % CI:0.19–0.27), amphetamine 0.05 (95 % CI:0.03–0.08), ecstasy/MDMA 0.09 (95 % CI:0.07–0.11), and marijuana 0.18 (95 % CI:0.15–0.20).

Conclusions: Our study demonstrates the high prevalence of chemsex and sexualized drug use among MSM, emphasizing the urgent need for comprehensive education on substance-related risks to encourage safer sex practices.

1. Introduction

Sexualized drug use (SDU), a longstanding cultural phenomenon within LGBTQI+ communities, involves the use of a wide range of psychoactive substances during sexual activities (Hibbert et al., 2021). Within this broader context, chemsex stands out as a distinct form of SDU, particularly common among men who have sex with men (MSM) (Bourne, 2015; Stuart, 2019). Chemsex is defined by the intentional use of specific drugs before or during sexual encounters, such as crystal methamphetamine, gamma-hydroxybutyric acid/gamma-butyrolactone (GHB/GBL), mephedrone, and, to a lesser degree, cocaine and ketamine (Bourne et al., 2014).

Several factors have been reported as to why individuals engage in SDU and chemsex, including increased libido, reduced inhibitions, enhanced intimacy, and coping with sexuality and human immunodeficiency virus (HIV) status (Lasco and Yu, 2023; Weatherburn et al., 2017). In addition, broader psychosocial interacting factors, such as social stigma, minority stress, and the desire to escape, have been highlighted as determinants of SDU, underlining the complex and multi-faceted nature of SDU and chemsex (Carrico et al., 2024). Moreover, social stigma, minority stress and the need to escape contribute greatly to these behaviors, emphasizing the multi-faceted nature of SDU

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and chemsex. Evidence suggests that SDU and chemsex are often linked to behaviors that carry a higher risk for acquiring HIV and other sexually transmitted infections (STIs), such as having multiple sexual partners, participating in group sex, transactional sex, unprotected anal intercourse and the sharing of injecting equipment (Maxwell et al., 2019; Troiano et al., 2018). Additionally, SDU and chemsex have been associated with a range of mental and physical health conditions, including depression, anxiety disorders, malnutrition, and dehydration, underscoring the multifaceted nature of this phenomenon (Herrijgers et al., 2020; Hibbert et al., 2021; Maxwell et al., 2019; Pichini et al., 2020). Recently, the United Nations Office on Drugs and Crime emphasized the importance of HIV prevention strategies, particularly among MSM who engage in SDU (HIV Prevention, Treatment, Care and Support for People Who Use Stimulant Drugs — Technical Guide, n.d.). Moreover, emerging evidence has suggested that MSM who engage in SDU or chemsex are more likely to experience reduced adherence to pre-exposure prophylaxis (PrEP), while MSM living with HIV often face challenges maintaining viral suppression, leading to elevated viral loads (Blair and Shoptaw, 2024; Viamonte et al., 2022); these factors can significantly compromise the effectiveness of biomedical HIV prevention strategies and may contribute to ongoing HIV transmission within this key population. Therefore, an urgent need for a comprehensive global analysis of the scale of this phenomenon among MSM has emerged.

To date, there has been no synthesis of the global prevalence of SDU and chemsex among MSM. This study represents the first systematic review and meta-analysis aimed at quantitatively assessing the prevalence of SDU and chemsex in this population. It also seeks to identify variations between different subgroups of MSM and across geographical regions.

2. Methods

2.1. Search strategy

This systematic review and meta-analysis followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA 2020) guidelines (Page et al., 2021); the PRISMA checklist is provided in Supplemental Table 1. The study protocol was registered in PROSPERO (Registration No: CRD42024603829). A comprehensive search was conducted across PubMed, EMBASE, and Scopus, with the search concluding on April 1, 2024, using combinations of population terms (MSM, gay, homosexual, queer), with substance use-related terms (chemsex, sexualized drug use, party and play, recreational drug, drug use, substance use, intravenous drug, methamphetamine, amphetamine, cocaine, illicit drug, mephedrone, GHB, gamma-hydroxybutyric acid, gamma hydroxybutyrate, poppers, alkyl nitrites, mdma, ecstasy, cannabis, ketamine). Detailed search algorithms for each database are included in the Supplemental Text. No language restrictions were imposed. Additionally, the reference lists of previously published systematic reviews and all eligible articles were systematically searched for relevant studies using a "snowball" method.

Citations from each database were imported into a reference manager (Zotero), where duplicates were removed. Following an initial screening of titles and abstracts, the full texts of selected studies were evaluated. Two authors independently selected studies, with any disagreements resolved by a senior author.

2.2. Eligibility

This systematic review and meta-analysis included studies focusing on adult MSM (including gay, bisexual, and other men or individuals assigned male at birth who have sex with men, regardless of sexual orientation or HIV status). For inclusion, a study needed to have at least 90 % of its participants identified as MSM, or it had to specifically report results for an MSM subgroup. Eligible studies included quantitative studies, namely randomized controlled trials, case-control studies, prospective cohorts, cross sectional studies as well as qualitative studies that stated an exact prevalence of the participants that engaged in SDU or chemsex. Qualitative studies with no quantitative data on prevalence were excluded. No limits by geographical location, settings, or other contexts were applied, in an effort to capture the global prevalence of SDU and chemsex and to ensure that no relevant data from any country were missed.

In this study, we differentiated between chemsex and SDU based on the substances involved. Chemsex was defined as the use of a core set of substances — crystal methamphetamine, GHB/GBL, and mephedrone — and, in some cases, cocaine and ketamine, before or during sexual activity. To be included in the chemsex category, studies had to define chemsex as involving at least three of these five substances, with a maximum of five, thereby reflecting the more specific and commonly accepted definition of chemsex in the literature (Bourne et al., 2014; Schifano et al., 2025; Stuart, 2019). On the other hand, SDU was used as a broader, umbrella term encompassing the use of any substances before or during sex that did not meet the stricter criteria for chemsex. This included studies that either used a wider range of substances; studies that referred to "chemsex" but included additional substances outside our predefined list — or defined it less specifically — were also categorized as SDU. Any study that included alcohol in its definition of either SDU or chemsex was excluded. Studies that discussed chemsex-related drug use but not specifically in sexual contexts were excluded because the drug use could not be clearly associated with sexual activity. We excluded studies that were conducted on overlapping cohorts to avoid duplication. Studies including only participants on chemsex or drug use were excluded to prevent selection bias. We also excluded studies that did not focus on MSM or had MSM less than 90 % in their sample, as our analysis targeted this population. Finally, studies reporting drug use by event (and not by participant) were excluded because their design did not allow for individual-based comparisons.

Furthermore, the analysis also sought prevalence rates for the use of specific substances before or during sex, including methamphetamine, GHB/GBL, mephedrone, cocaine, ketamine, MDMA/ecstasy, alkyl nitrates ("poppers"), marijuana, and amphetamine, as part of SDU.

2.3. Data extraction

Both researchers extracted the following study characteristics and outcomes: first author, publication year, location (grouped by continent), sample size, population details (MSM subgroups), participant age (mean, median, and range), SDU or chemsex definitions and prevalence. Any discrepancies in data extraction were addressed through discussion and consensus with a senior author. In the case of missing or incomplete data, the study authors were contacted via email to request the necessary information.

2.4. Quality and publication bias assessment

We assessed the risk of bias using the Newcastle-Ottawa Scale. In the analyses with 10 or more synthesized studies, publication bias was assessed with Egger's test and by constructing a funnel plot; for the interpretation of Egger's test, statistical significance was defined as $p < 0.1$.

2.5. Statistical analysis

We conducted analyses for the following outcomes: chemsex, SDU, crystal methamphetamine, GHB/GBL, mephedrone, cocaine, ketamine, amphetamine, alkyl nitrates "poppers", ecstasy and marijuana sexualized use prevalence. The pooled prevalences and 95 % confidence intervals were estimated with the random effects (DerSimonian-Laird) model, using a meta-analysis of proportions with the Freeman-Tukey arcsine transformation. Between-study heterogeneity was assessed by

estimating Q-test and I^2 statistic.

Subgroup analyses by continent, MSM populations (Any MSM populations; Black MSM; Black MSM HIV positive; MSM with HCV; MSM HIV negative HCV positive; MSM HIV negative/unknown; MSM with HIV; MSM HIV positive HCV negative; MSM with HIV-HCV co-infection; MSM HIV positive with *S. sterocoralis*; MSM HIV positive with shigellosis; MSM HIV positive without shigellosis; MSM LGV negative; MSM LGV positive; MSM engaging in group sex; MSM who use alcohol; MSM with LGV; MSM with Mpox; MSM with *S. flexneri*; MSM with an STI; MSM with recent syphilis; MSM with shigellosis; MSM without an STI) and time period of reporting were performed. An additional subgroup analysis was carried out for ecstasy/MDMA, differentiating between its form as either MDMA, pill or non-specified.

Post hoc sensitivity analyses were conducted excluding results from studies that provided prevalences across different time periods of reporting, as well as studies that reported prevalences for different types of ecstasy/MDMA. The level of statistical significance was set at 0.05. Statistical analysis was performed with STATA/SE version 16 (Stata Corp., College Station, TX, USA).

3. Results

3.1. Description of eligible studies

Through our initial search we retrieved 8613 items (2143 from PubMed, 3520 from Embase and 2950 from Scopus). After removal of duplicates 4040 items were screened; all details for each successive step for the selection of eligible studies are provided in the supplemental material (Supplemental Figure 1 and Supplemental Table 2).

A total of 238 items were included, encompassing 380,505 participants. They were published between 1988 and 2024, had a median sample size of 513 (interquartile range: 214–1188), with individual sample sizes ranging from 7 to 64,655 participants.

Among the included items, 64 sought for chemsex, 131 for SDU, 78 for methamphetamine, 43 for mephedrone, 63 for GHB, 43 for ketamine, 56 for cocaine, 57 for alkyl nitrates, 25 for amphetamine, 48 for ecstasy/MDMA and 47 for marijuana. A full list of the included studies with references is provided in the supplemental text.

Regarding sampling methods, the vast majority of included studies (n = 218) relied on non-probability sampling, primarily convenience sampling (through online platforms, clinics, or community organizations) and snowball peer referrals. However, a subset of studies employed more structured approaches; 11 studies used respondent-driven sampling (RDS),(Cai and Lau, (2014); Fernandez-Rollan et al., (2019); Jain et al., (2021); Lambert et al., (2022); Mimiaga, Reisner, Cranston, et al., (2009); Mimiaga, Reisner, Tetu, et al., (2009); Morgan et al., (2016); Ober et al., (2009); Pitpitan et al., (2015); Rich et al., (2016); Voisin et al., (2017), five studies used time-location sampling (TLS) (Morineau et al., 2011; Pylli et al., 2014; van Griensven et al., 2010, van Griensven et al., 2013; Vaux et al., 2019), one study used a combination of RDS and TLS (Rosinska et al., 2018), one study combined RDS with convenience sampling (Garnett et al., 2018) and one study used a combination of TLS and convenience sampling (Van Tieu et al., 2014).

3.2. Results of the meta-analysis by substance and MSM populations

Regarding chemsex an overall pooled prevalence of 0.22 (95 % CI: 0.19 – 0.25, 66 studies, Fig. 1a) was noted; the highest prevalence was observed among MSM with shigellosis (0.33–0.79), MSM with HIV (up to 0.71, depending on comorbidities) and MSM with Mpox (0.35). In regard to SDU, a pooled effect prevalence of 0.25 (95 % CI: 0.23 – 0.28, 136 studies, Fig. 1b) was noted overall; MSM with HIV-HCV co-infection (0.73) and MSM with recent syphilis (0.47) exhibited the highest prevalence rates.

Concerning sexualized methamphetamine use, a pooled prevalence of 0.08 (95 % CI: 0.07 – 0.1, 82 studies, Fig. 1c) was observed; the highest prevalence rates were observed among lymphogranuloma venereum (LGV) positive MSM (0.54), MSM with HIV-HCV co-infection (0.29) and MSM who use alcohol (0.29). For sexualized GHB/GBL use, the overall pooled prevalence was 0.13 (95 % CI: 0.10 – 0.16, 67 studies, Fig. 1d), with the highest rates seen in MSM with HIV-HCV co-infection (0.48) and MSM with recent syphilis (0.29).

In the case of sexualized mephedrone use, a pooled prevalence of 0.07 (95 % CI: 0.05 – 0.10, 46 studies, Fig. 2a) was found, with MSM with recent syphilis (0.29) and MSM with HIV (0.16) reporting the highest rates. Sexualized ketamine use had an overall pooled prevalence of 0.04 (95 % CI: 0.03 – 0.06, 46 studies, Fig. 2b), MSM with HIV-HCV co-infection exhibiting the highest levels (0.37) followed by MSM with HIV (0.08).

In terms of sexualized use of cocaine, a pooled prevalence of 0.10 (95 % CI: 0.08 – 0.13, 56 studies, Fig. 2c) was noted, with the highest levels in MSM with HIV-HCV co-infection (0.41) and MSM with HCV (0.41). Regarding sexualized alkyl nitrates use, a pooled prevalence of 0.23 (95 % CI: 0.19 – 0.27, 60 studies, Fig. 2d) was observed, with the highest levels found in MSM with HIV-HCV co-infection (0.50).

Sexualized amphetamine use for sex was noted, with an overall pooled prevalence of 0.05 (95 % CI: 0.03 – 0.08, 27 studies, Fig. 3a), with MSM with HIV-HCV co-infection showing the highest levels (0.28), followed by MSM with HIV (0.13). Sexualized use of ecstasy/MDMA had an overall pooled prevalence of 0.09 (95 % CI: 0.07 – 0.11, 54 studies, Fig. 3b); MSM with HIV-HCV co-infection exhibited the highest levels (0.40).

Finally, the pooled prevalence of sexualized marijuana use was 0.18 (95 % CI: 0.15 – 0.20, 49 studies, Fig. 3c); MSM with HCV showed the highest levels (0.62), followed by MSM with HIV-HCV co-infection (0.38).

All results, including subgroup analyses by MSM population categories, are presented in Table 1.

3.3. Results of the meta-analysis by geographical region and time period of reporting

In regard to SDU, GHB/GBL, mephedrone, ketamine, cocaine, ecstasy/MDMA and alkyl nitrates, Europe consistently showed the highest rates. North America had the highest prevalence of methamphetamine, marijuana, and amphetamine use, whereas Asia showed the highest prevalence of chemsex. Nevertheless, most studies came from Europe, North America and Asia; paucity of data was noted regarding the remaining world regions.

Further subgroup analyses by geographical region, period of reporting and form of MDMA/ecstasy are detailed in Supplemental Table 5 and Supplemental Figures 2–24. The results persisted in the *post hoc* sensitivity analyses (Supplemental Figures 25–52).

3.4. Evaluation of quality of studies and risk of bias

The evaluation of the quality of the included studies is presented in Supplemental Table 6. The use of non-validated tools and the inability for a blind assessment of the outcomes compromised the overall quality of all the included studies. No significant publication bias was detected via Egger's test in the analysis on chemsex ($p < 0.001$), SDU ($p < 0.001$), methamphetamine ($p < 0.001$), GHB/GBL ($p < 0.001$), mephedrone ($p < 0.001$), ketamine ($p < 0.001$), cocaine ($p < 0.001$), alkyl nitrates ($p = 0.001$), ecstasy/MDMA ($p < 0.001$), amphetamine ($p < 0.001$)and marijuana ($p = 0.015$) (Supplemental Figures 53–63).

4. Discussion

In this systematic review and meta-analysis, a pooled prevalence of 22 % was observed regarding chemsex and 25 % regarding SDU. The pooled prevalence of sexualized substance use was 8 % for

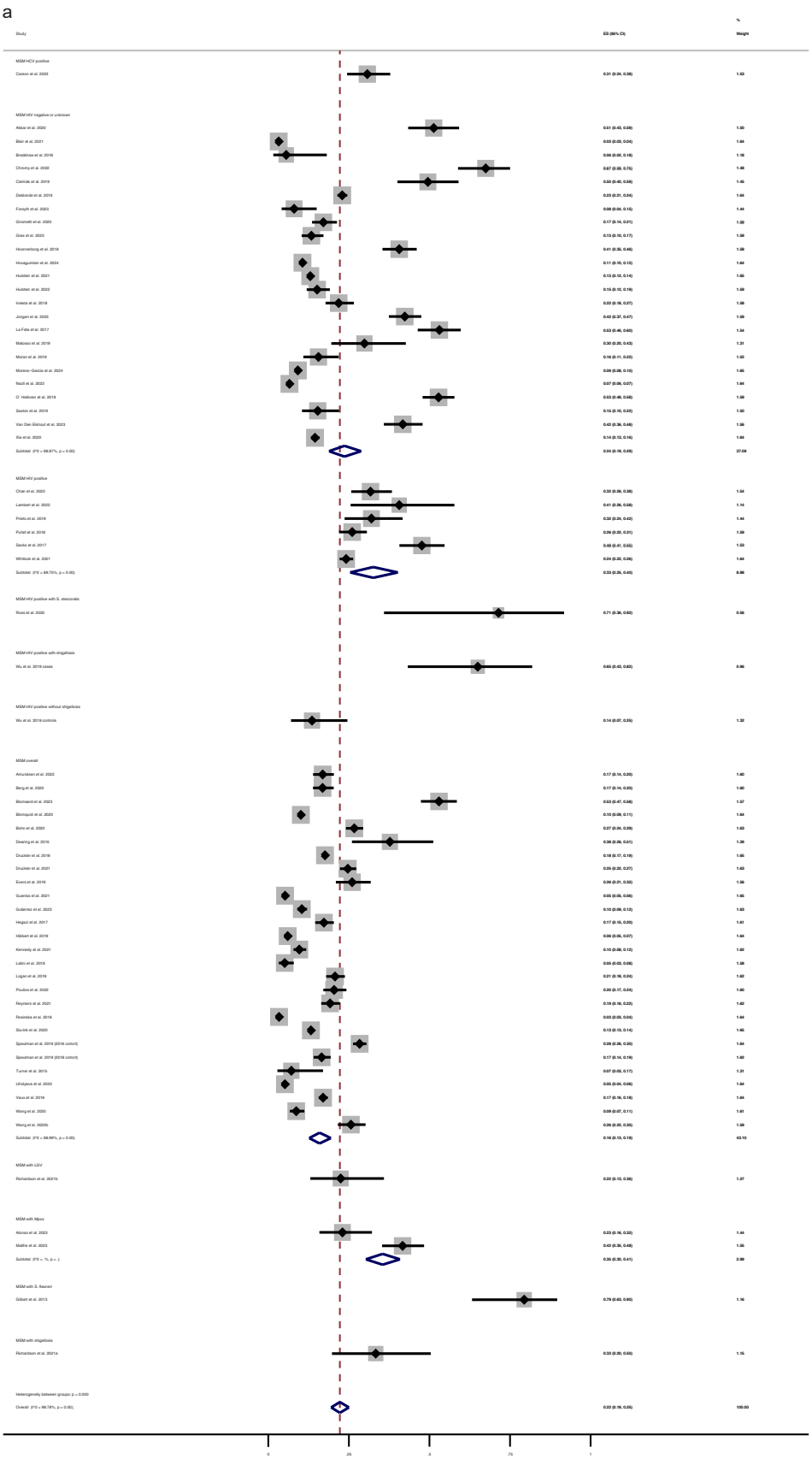
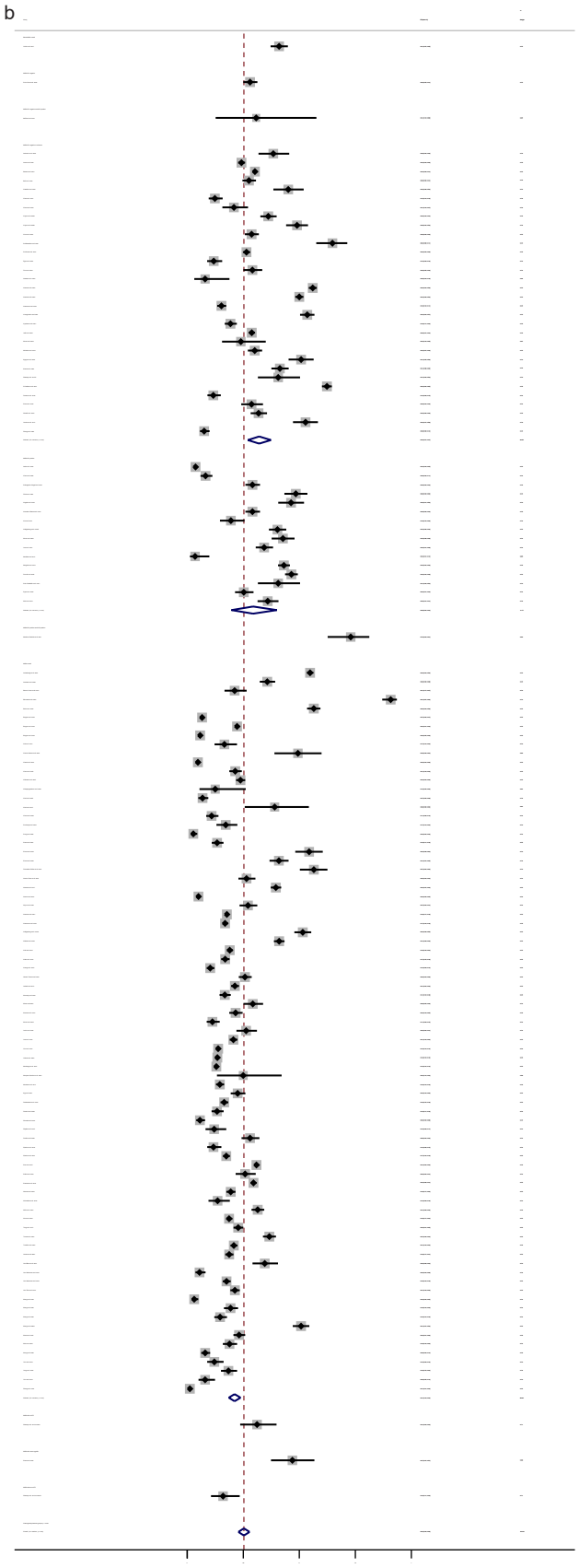


Fig. 1. Forest plot describing the prevalence of: a: Chemsex, b: SDU, c: Sexualized Crystal Methamphetamine use, d: Sexualized GHB/GBL use in MSM. Subgroup analyses by MSM populations is presented. CI: Confidence Interval; ES: Effect Size; MSM: Men who have sex with Men; HIV: Human Immunodeficiency Virus; HCV: Hepatitis C Virus; LGV: Lymphogranuloma Venereum; Mpox: Monkeypox; SDU: Sexualized Drug Use; STI: Sexually Transmitted Infection; GHB: Gamma-Hydroxybutyrate; GBL: Gamma-Butyrolactone.



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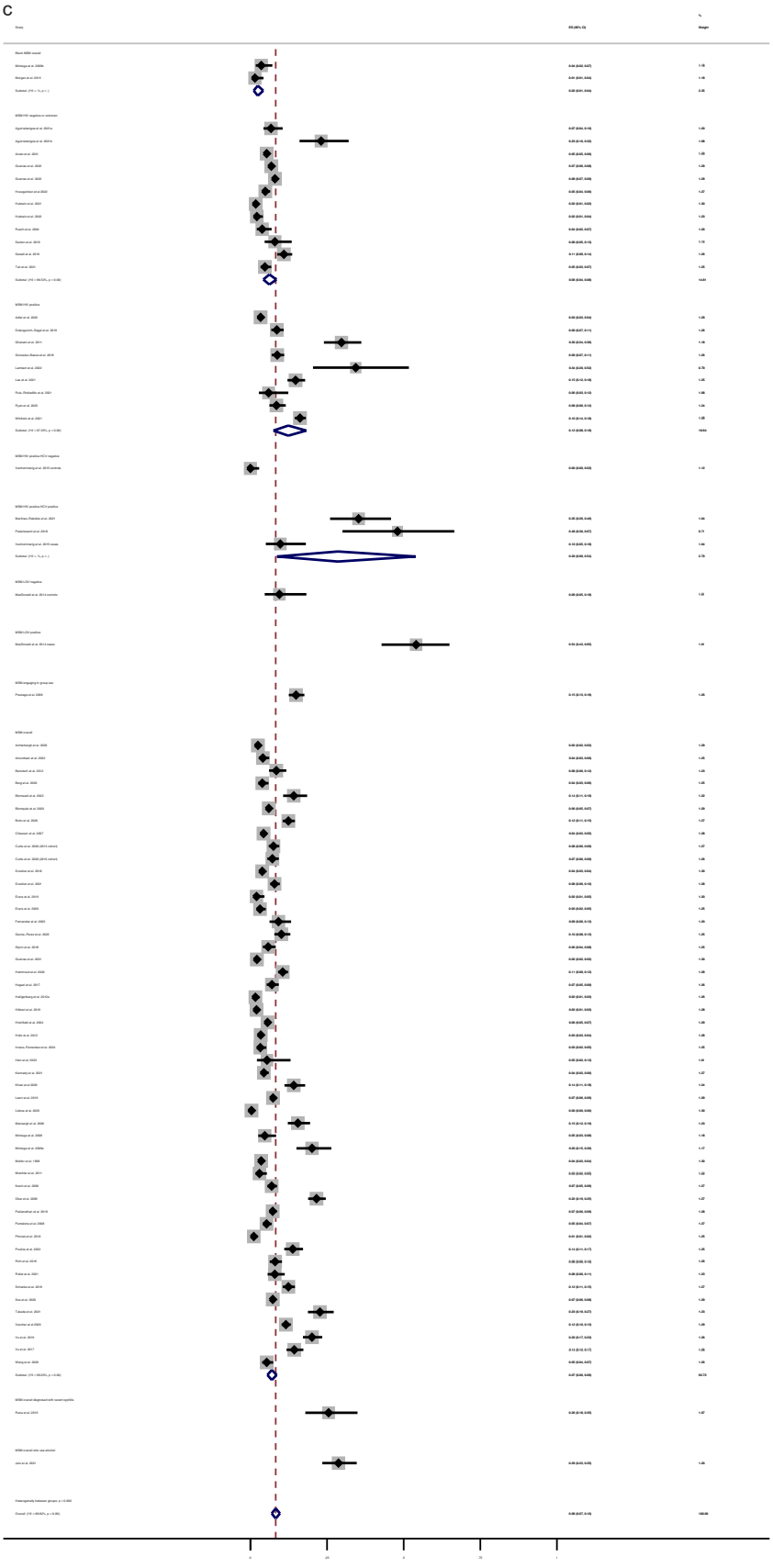

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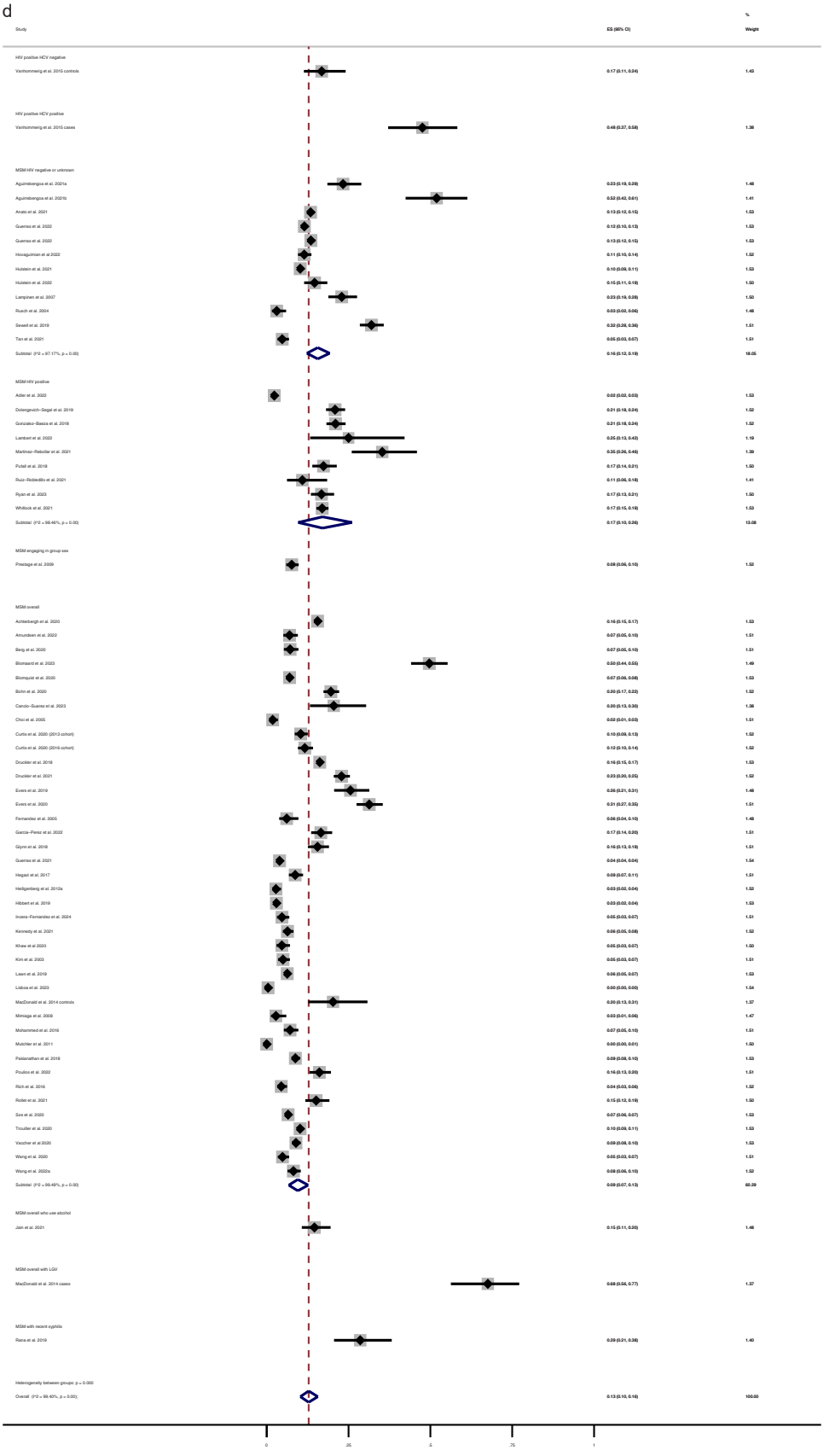

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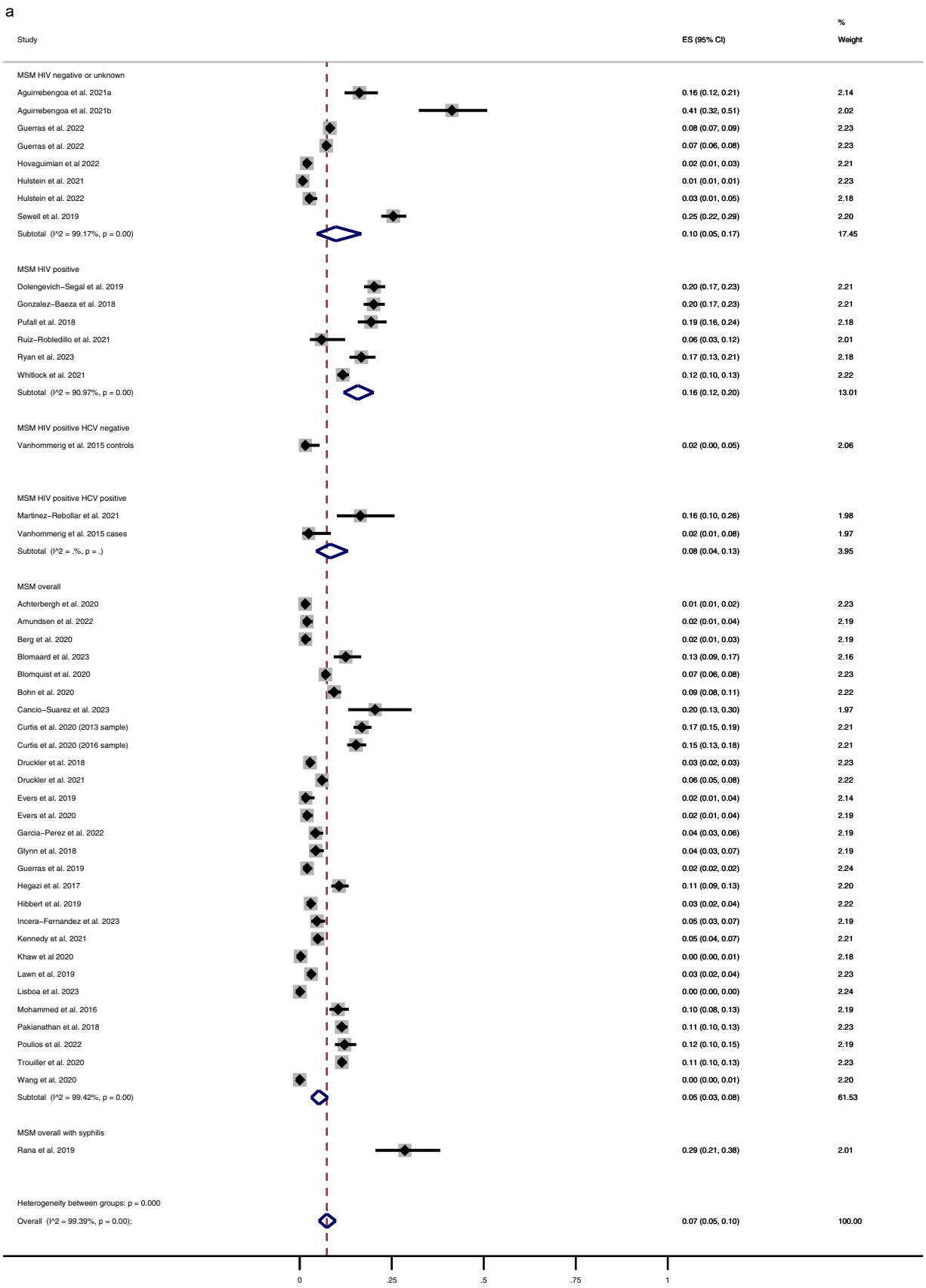
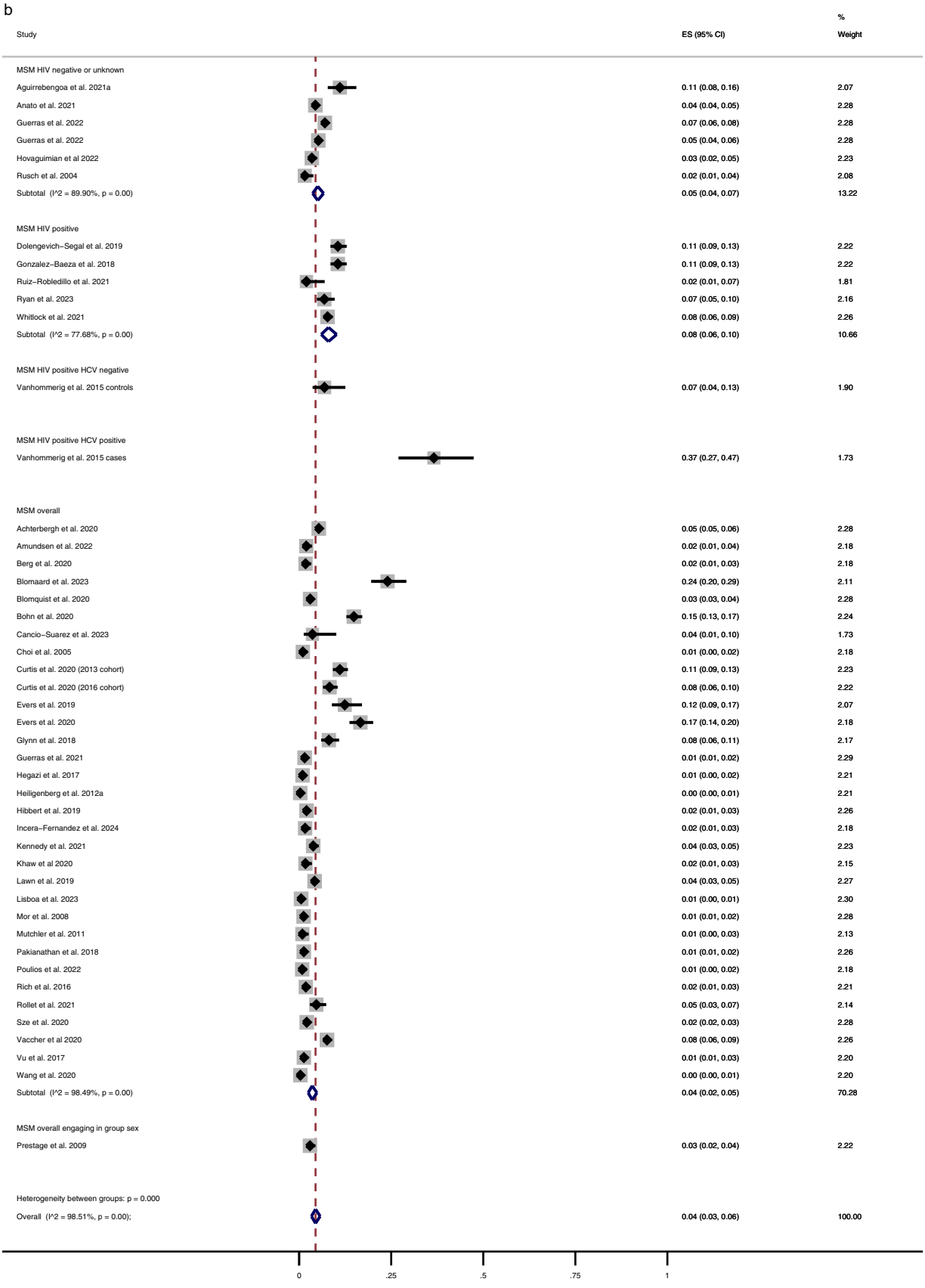


Fig. 2. Forest plot describing the prevalence of: a: Sexualized Mephedrone use, b: Sexualized Ketamine use c: Sexualized Cocaine use, d: Sexualized Alkyl Nitrate (poppers) use in MSM. Subgroup analyses by MSM populations is presented. CI: Confidence Interval; ES: Effect Size; MSM: Men who have Sex with Men; HIV: Human Immunodeficiency Virus; HCV: Hepatitis C Virus.



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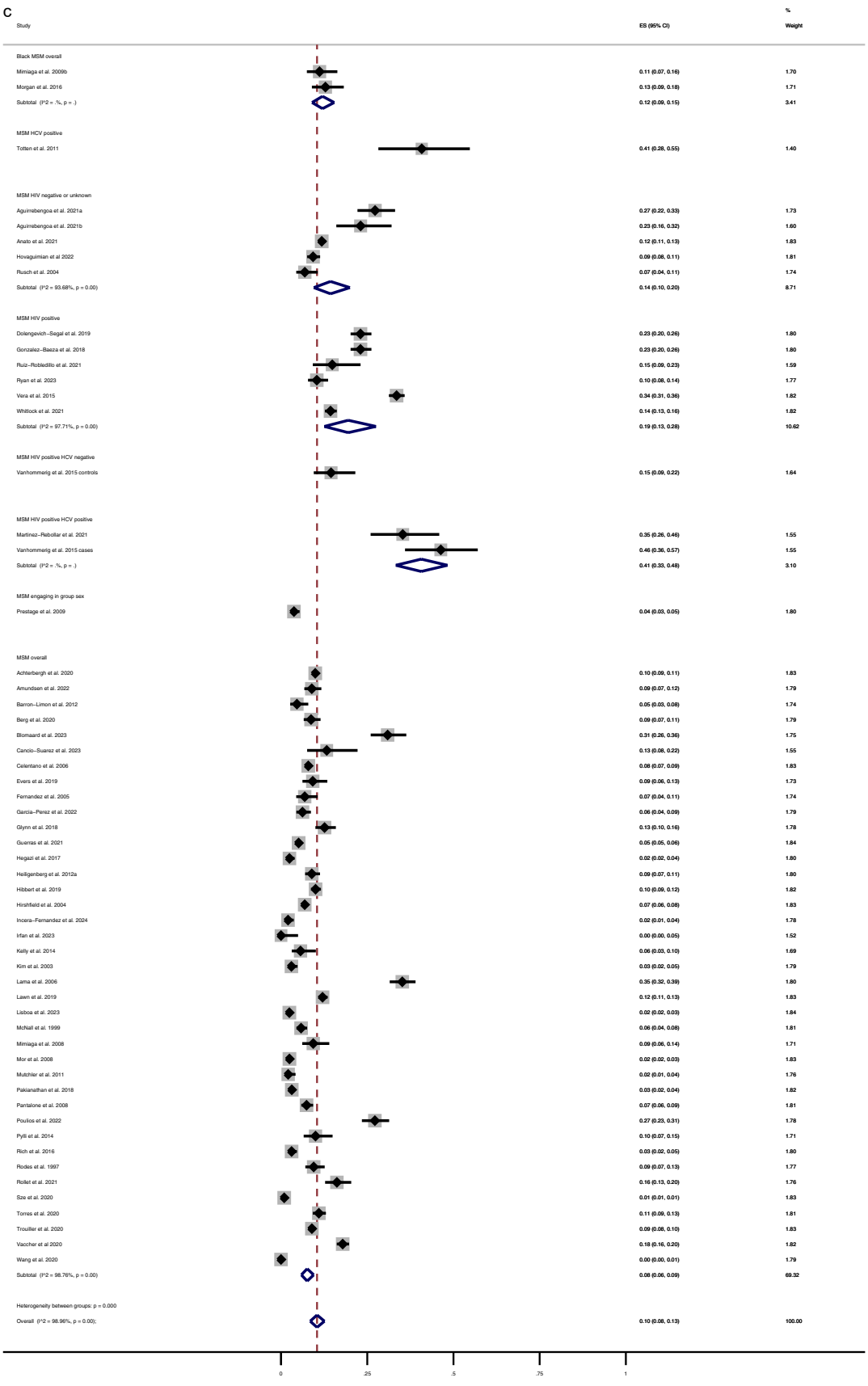

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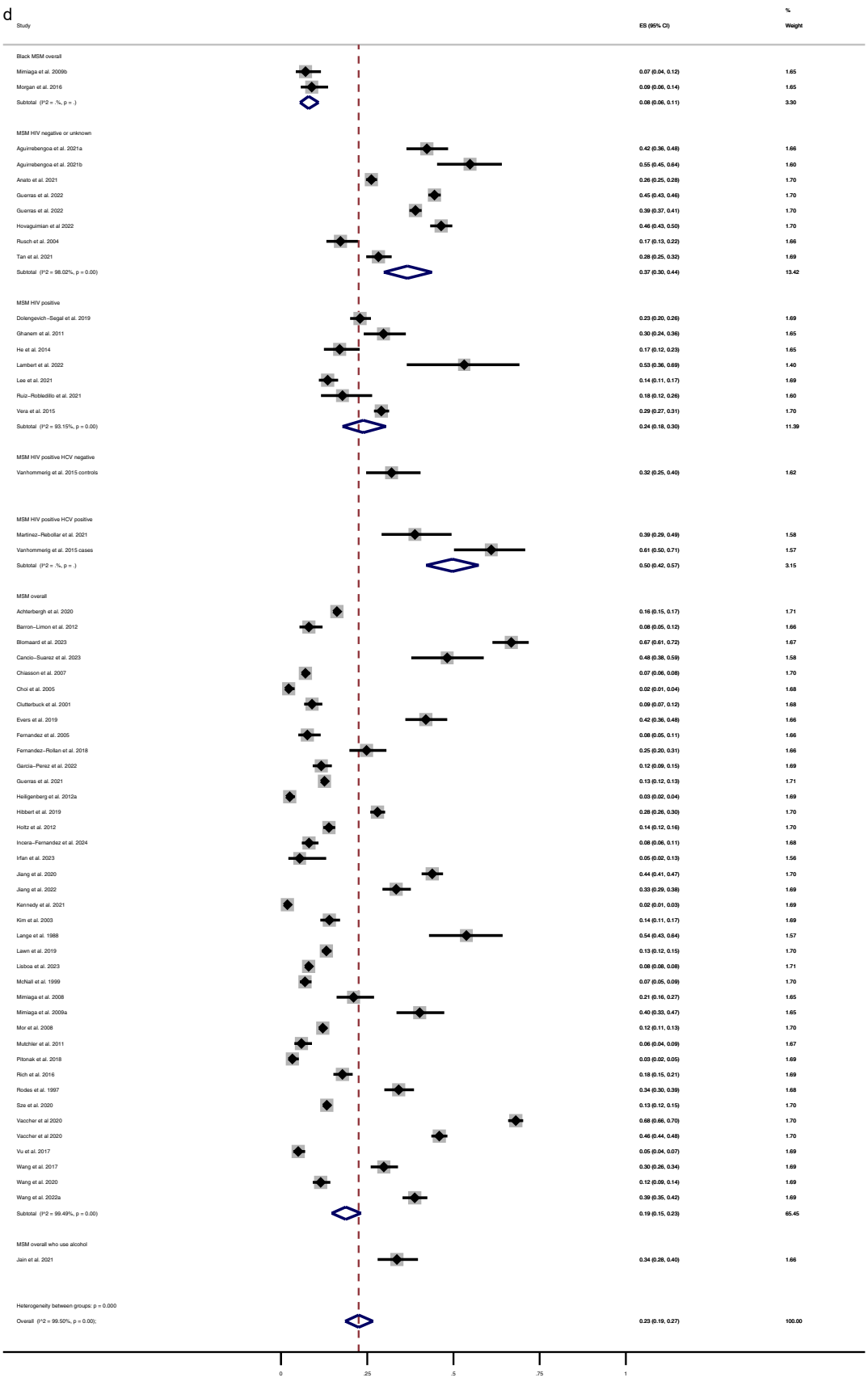

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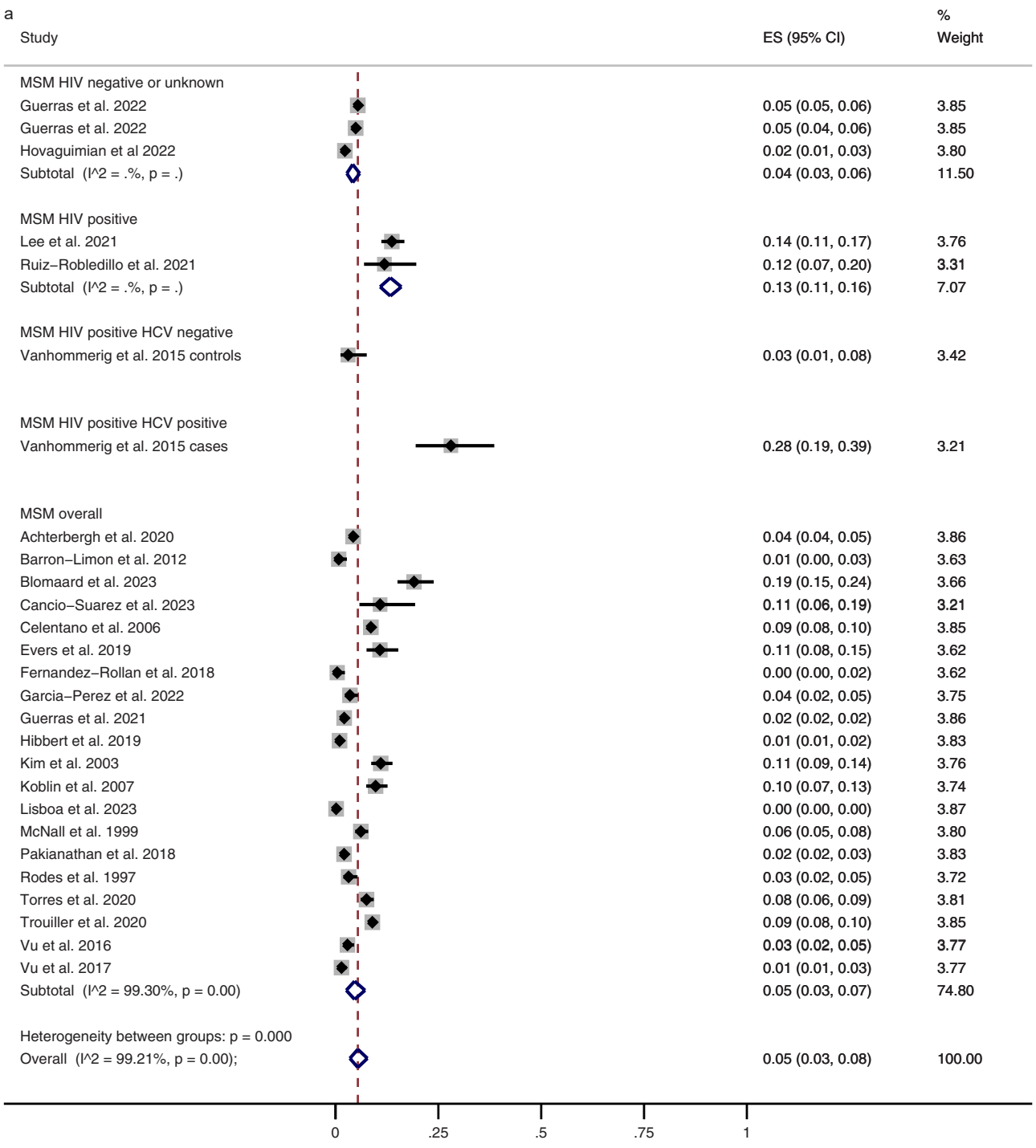
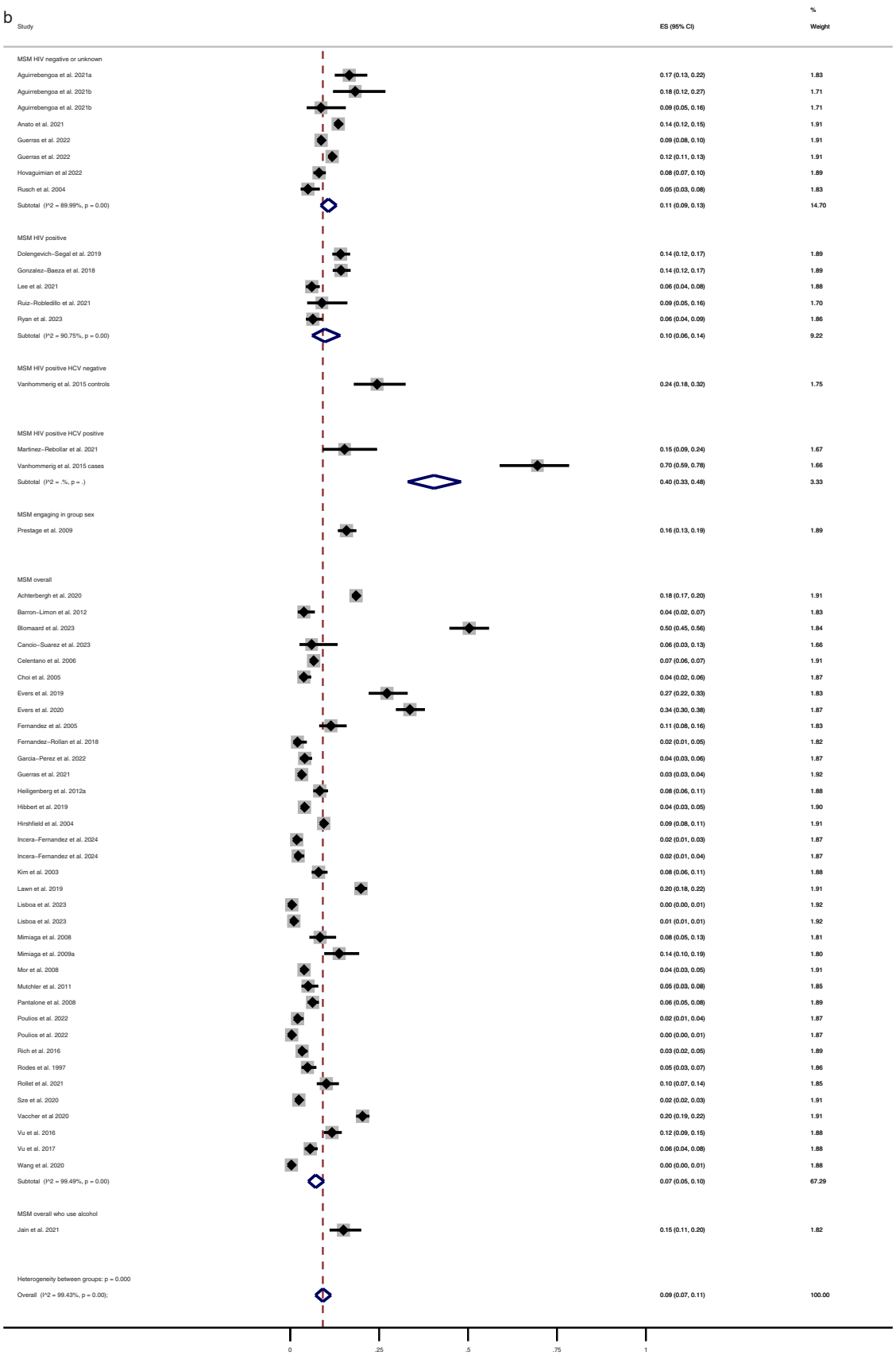


Fig. 3. Forest plot describing the prevalence of: a: Sexualized Amphetamine use, b: Sexualized Ecstasy/MDMA use c: Sexualized Marijuana use in MSM. Subgroup analyses by MSM populations is presented. CI: Confidence Interval; ES: Effect Size; MSM: MSM: Men who have Sex with Men; HIV: Human Immunodeficiency Virus; HCV: Hepatitis C Virus.



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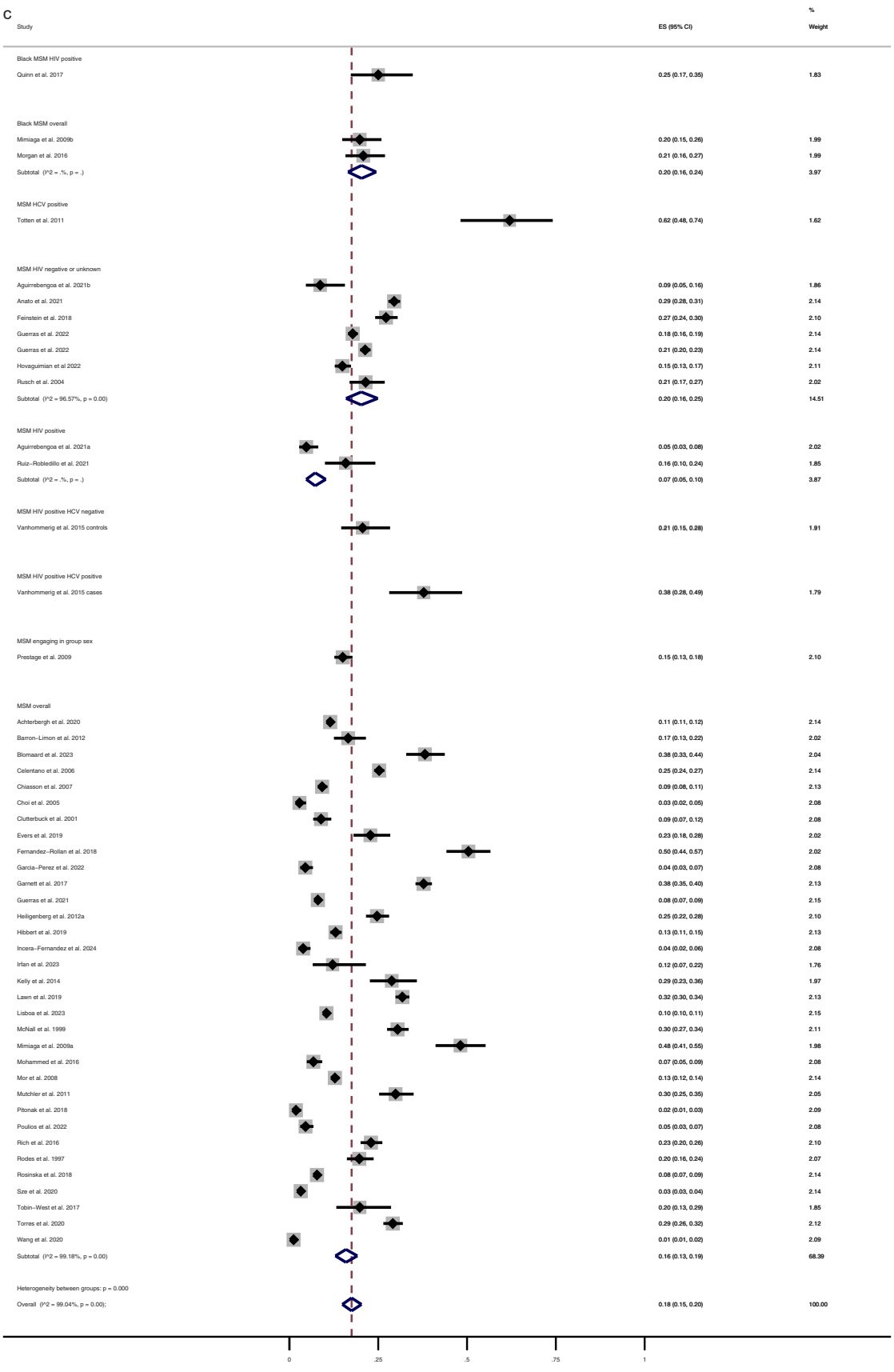

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Table 1
Results of the meta-analyses regarding the prevalence of chemsex, SDU, crystal methamphetamine, GHB/GBL, mephedrone, ketamine, cocaine, alkyl nitrates, amphetamine, ecstasy/MDMA and marijuana use for sex. Subgroup analyses by the type of MSM population are presented.

Prevalence Rates			
	n[§]	**ES (95 %CI:)**	**Heterogeneity I^2, p**
Chemsex			
Overall Analysis	**66**	**0.22 (0.19–0.25)**	**98.78 %, p < 0·001**
Subgroups by MSM Population			
Any MSM populations	27	0.16 (0.13–0.19)	98.99 %, p < 0.001
MSM HIV negative/unknown	24	0.24 (0.19–0.29)	98.87 %, p < 0.001
MSM with HIV	6	0.33 (0.25–0.40)	89.75 %, p < 0.001
MSM with HCV	1	0.31 (0.24–0.38)	NC
MSM with LGV	1	0.22 (0.13–0.36)	NC
MSM with Mpox	2	0.35 (0.30–0.41)	NC
MSM with *S. flexneri*	1	0.79 (0.63–0.90)	NC
MSM HIV positive with shigellosis	1	0.65 (0.43–0.82)	NC
MSM HIV positive without shigellosis	1	0.14 (0.07–0.25)	NC
MSM with shigellosis	1	0.33 (0.20–0.50)	NC
MSM HIV positive with *S. sterocoralis*	1	0.71 (0.36–0.92)	NC
SDU			
Overall analysis	**136**	**0.25 (0.23–0.28)**	**99.5 %, p < 0.001**
Subgroups by MSM Population			
Any MSM populations	81	0.21 (0.19–0.24)	99.49 %, p < 0.001
MSM HIV negative/unknown	33	0.32 (0.27–0.37)	99.04 %, p < 0.001
MSM with HIV	16	0.29 (0.20–0.40)	99.18 %, p < 0.001
Black MSM	1	0.41 (0.37–0.45)	NC
MSM with HIV/HCV co-infection	1	0.73 (0.63–0.81)	NC
MSM HIV negative HCV positive	1	0.31 (0.13–0.58)	NC
MSM with an STI	1	0.31 (0.24–0.40)	NC
MSM without an STI	1	0.16 (0.11–0.23)	NC
MSM with recent syphilis	1	0.47 (0.37–0.57)	NC
Methamphetamine			
Overall analysis	**82**	**0.08 (0.07–0.1)**	**98.82 %, p < 0.001**
Subgroups by MSM Population			
Any MSM populations	50	0.07 (0.06–0.09)	99.03 %, p < 0.001
MSM HIV negative/unknown	12	0.06 (0.04–0.08)	96.53 %, p < 0.001
MSM with HIV	9	0.12 (0.08–0.18)	97.32 %, p < 0.001
Black MSM	2	0.02 (0.01–0.04)	NC
MSM with HIV/HCV co-infection	3	0.29 (0.09–0.54)	NC
MSM HIV positive HCV negative	1	0.00 (0.00–0.03)	NC
MSM LGV positive	1	0.54 (0.43–0.65)	NC
MSM LGV negative	1	0.09 (0.05–0.18)	NC
MSM engaging in group sex	1	0.15 (0.13–0.18)	NC
MSM with recent syphilis	1	0.26 (0.18–0.35)	NC
MSM who use alcohol	1	0.29 (0.23–0.35)	NC
GHB/GBL			
Overall analysis	**67**	**0.13 (0.10–0.16)**	**99.4 %, p < 0.001**
Subgroups by MSM Population			
Any MSM populations	40	0.09 (0.07–0.13)	99.49 %, p < 0.001
MSM HIV negative/unknown	12	0.16 (0.12–0.19)	97.17 %, p < 0.001
MSM with HIV	9	0.17 (0.10–0.26)	98.46 %, p < 0.001
MSM with HIV/HCV co-infection	1	0.48 (0.37–0.58)	NC
MSM HIV positive HCV negative	1	0.17 (0.11–0.24)	NC
MSM LGV positive	1	0.15 (0.11–0.20)	NC
MSM engaging in group sex	1	0.08 (0.06–0.10)	NC
MSM with recent syphilis	1	0.29 (0.21–0.38)	NC
MSM who use alcohol	1	0.15 (0.11–0.20)	NC
Mephedrone			
Overall analysis	**46**	0.07 (0.05–0.10)	99.39 %, p < 0.001
Subgroups by MSM Population			
Any MSM populations	28	0.05 (0.03–0.08)	99.42 %, p < 0.001
MSM HIV negative/unknown	8	0.10 (0.05–0.17)	99.17 %, p < 0.001
MSM with HIV	6	0.16 (0.12–0.20)	90.97 %, p < 0.001
MSM with HIV/HCV co-infection	2	0.08 (0.04–0.13)	NC
MSM HIV positive HCV negative	1	0.02 (0.00–0.05)	NC
MSM with recent syphilis	1	0.29 (0.21–0.38)	NC
Ketamine			
Overall analysis	**46**	0.04 (0.03–0.06)	98.51 %, p < 0.001
Subgroups by MSM Population			
Any MSM populations	32	0.04 (0.02–0.05)	98.49 %, p < 0.001
MSM HIV negative/unknown	6	0.05 (0.04–0.07)	89.9 %, p < 0.001
MSM with HIV	5	0.08 (0.06–0.10)	77.68 %, p < 0.001
MSM with HIV/HCV co-infection	1	0.37 (0.27–0.47)	NC
MSM HIV positive HCV negative	1	0.07 (0.04–0.13)	NC
MSM engaging in group sex	1	0.03 (0.02–0.04)	NC
Cocaine			
Overall analysis	**57**	0.10 (0.08–0.13)	98.96 %, p < 0.001
Subgroups by MSM Population			
Any MSM populations	38	0.08 (0.06–0.09)	98.76 %, p < 0.001
MSM HIV negative/unknown	5	0.14 (0.10–0.20)	93.68 %, p < 0.001
MSM with HIV	6	0.19 (0.13–0.28)	97.71 %, p < 0.001
Black MSM	2	0.12 (0.09–0.15)	NC
MSM with HCV	1	0.41 (0.28–0.55)	NC
MSM with HIV/HCV co-infection	2	0.41 (0.33–0.48)	NC

(*continued on next page*)

Table 1 (*continued*)

Prevalence Rates			
MSM HIV positive HCV negative	1	0.15 (0.09–0.22)	NC
MSM engaging in group sex	1	0.04 (0.03–0.05)	
Alkyl Nitrates			
Overall analysis	**60**	0.23 (0.19–0.27)	99.5 %, $p < 0.001$
Subgroups by MSM Population			
Any MSM populations	39	0.19 (0.15–0.23)	99.49 %, $p < 0.001$
MSM HIV negative/unknown	8	0.37 (0.30–0.44)	98.02 %, $p < 0.001$
MSM with HIV	7	0.24 (0.18–0.30)	93.15 %, $p < 0.001$
Black MSM	2	0.08 (0.06–0.11)	NC
MSM with HIV/HCV co-infection	2	0.50 (0.42–0.57)	NC
MSM HIV positive HCV negative	1	0.32 (0.25–0.40)	NC
MSM who use alcohol	1	0.34 (0.28–0.40)	NC
Amphetamine			
Overall analysis	**27**	0.05 (0.03–0.08)	99.21 %, $p < 0.001$
Subgroups by MSM Population			
Any MSM populations	20	0.05 (0.03–0.07)	99.3 %, $p < 0.001$
MSM HIV negative/unknown	3	0.04 (0.03–0.06)	NC
MSM with HIV	2	0.13 (0.11–0.16)	NC
MSM with HIV/HCV co-infection	1	0.28 (0.19–0.39)	NC
MSM HIV positive HCV negative	1	0.03 (0.01–0.08)	NC
Ecstasy/ MDMA			
Overall analysis	**54**	0.09 (0.07–0.11)	99.43 %, $p < 0.001$
Subgroups by MSM Population			
Any MSM populations	36	0.07 (0.05–0.10)	99.49 %, $p < 0.001$
MSM HIV negative/unknown	8	0.11 (0.09–0.13)	89.99 %, $p < 0.001$
MSM with HIV	5	0.10 (0.06–0.14)	90.75 %, $p < 0.001$
MSM with HIV/HCV co-infection	2	0.40 (0.33–0.48)	NC
MSM HIV positive HCV negative	1	0.24 (0.18–0.32)	NC
MSM engaging in group sex	1	0.16 (0.13–0.19)	NC
MSM who use alcohol	1	0.15 (0.11–0.20)	NC
Marijuana			
Overall analysis	**49**	0.18 (0.15–0.20)	99.04 %, $p < 0.001$
Subgroups by MSM Population			
Any MSM populations	33	0.16 (0.13–0.19)	99.18 %, $p < 0.001$
MSM HIV negative/unknown	7	0.20 (0.16–0.25)	96.57 %, $p < 0.001$
MSM with HIV	2	0.07 (0.05–0.10)	NC
Black MSM	2	0.20 (0.16–0.24)	NC
Black MSM with HIV	1	0.25 (0.17–0.35)	NC
MSM with HCV	1	0.62 (0.48–0.74)	NC
MSM with HIV/HCV co-infection	1	0.38 (0.28–0.49)	NC
MSM HIV positive HCV negative	1	0.21 (0.15–0.28)	NC
MSM engaging in group sex	1	0.15 (0.13–0.18)	NC

MSM: Men who have Sex with Men; ES: Effect Size; CI: Confidence Interval; HCV: Hepatitis C Virus; LGV: Lymphogranuloma Venereum; NC: Not Calculated; Mpox: Monkeypox; S. flexneri: Shigella flexneri; S. sterocoralis: Strongyloides stercoralis; SDU: Sexualized Drug Use; GHB/GBL: Gamma-Hydroxybutyric Acid/Gamma-Butyrolactone; MDMA: 3,4-Methylenedioxymethamphetamine; STI: Sexually Transmitted Infection; p: p-value; I2: I-squared statistic; int.: intercourse; 3 m: past 3 months; 6 m: past 6 months; 12 m: past 12 months; 30d: past 30 days; last int.: last intercourse.

Figure Legends

methamphetamine, 13 % for GHB, 7 % for mephedrone, 4 % for ketamine, 10 % for cocaine, 23 % for alkyl nitrates, 5 % for amphetamine, 9 % for ecstasy/MDMA, and 18 % for marijuana. As a rule, MSM with HIV-HCV co-infection displayed the highest rates. Geographically, Europe reported the highest rates for SDU, GHB/GBL, mephedrone, ketamine, cocaine, ecstasy/MDMA, and alkyl nitrates, whereas North America ranked first in methamphetamine, amphetamine, and marijuana use, and Asia had the highest prevalence of chemsex.

Research has highlighted multiple factors driving engagement in SDU and chemsex; curiosity, enhanced sexual arousal, intensified sensation, heightened orgasmic response, and improved sexual performance are frequently cited by individuals who engage in these practices as primary motivators (Chartier et al., 2009; Deimel et al., 2016; Drysdale et al., 2020; Graf et al., 2018; Leyva-Moral et al., 2023; Nimbi et al., 2021; Santoro et al., 2020; Weatherburn et al., 2017). SDU and chemsex often serve a dual role, enhancing social experiences while fostering a sense of acceptance, inclusion, emotional connection, self-worth, and attractiveness through access to social networks (Weatherburn et al., 2017). This dynamic is particularly relevant in environments where societal pressures emphasize certain body types, appearances, and masculine norms. Within some MSM communities, these pressures can negatively impact self-esteem, which SDU and chemsex appear to mitigate by providing a sense of relief and validation (Evans, 2019; Gertzen et al., 2024).

Qualitative studies have also highlighted SDU and chemsex as a coping mechanism for managing painful emotions and life stressors, including breakups, the guilt or stress related to same-sex encounters, the challenges of coming out, or the pressure to maintain a heteronormative persona within highly stigmatized communities, as well as navigating HIV diagnoses, bereavement, and professional stress (Ahmed et al., 2016; Jerome and Halkitis, 2009). In environments where stigma toward homosexuality is pervasive, SDU and chemsex can function as a way to cope, allowing individuals to manage stress while preserving their sense of identity amid social marginalization (Jaspal, 2021; Lasco and Yu, 2023; Lunchenkov, Rinne-Wolf, et al., 2024; Palmer et al., 2023; Tan et al., 2018). SDU and chemsex might offer not only relaxation and relief from stigma but also the freedom to push sexual boundaries, an act often seen as a response to internalized homonegativity (Lunchenkov, Cherchenko, et al., 2024; Lunchenkov, Rinne-Wolf, et al., 2024; Meyer and Frost, 2013; Palmer et al., 2023; Tan et al., 2018).

Our study identified a higher prevalence of SDU and chemsex among MSM living with HIV and HCV and MSM with other STIs. Prior research has linked SDU and chemsex with an increased prevalence of HIV (Hibbert et al., (2021); Pakianathan et al., (2018); Strong et al., (2022). The prolonged, intense nature of SDU and chemsex sessions, combined with the disinhibitory, libido- and energy-enhancing effects of substances, as well as reduced pain perception, can increase mucosal trauma and thereby susceptibility to STIs (Bourne et al., 2015; Giorgetti et al., 2017; Weatherburn et al., 2017). However, establishing causality in regard to HIV infection remains challenging, as SDU and chemsex rates have also been observed to increase following an HIV diagnosis, complicating the understanding of cause and effect (Bourne et al., 2014).

Regarding geographical variability, SDU and chemsex are socially constructed, with specific substances varying across cultures and MSM sub-populations (Lunchenkov, Cherchenko, et al., 2024). For instance,

our meta-analysis highlighted that sexualized use of crystal methamphetamine was more prevalent in North America, whereas sexualized use of GHB/GBL, mephedrone and cocaine was more prevalent in Europe; these findings underscore the influence of regional and cultural contexts on SDU and chemsex practices (Maxwell et al., 2019; Wang et al., 2023).

The findings of this study align partially with prior meta-analyses in the field. A 2023 meta-analysis of studies from East and Southeast Asia estimated the prevalence of recent SDU among MSM at 13 % (95 % CI: 10–16 %) (Nevendorff et al., 2023), a rate lower than the prevalence observed in our analysis. In the same year, another meta-analysis focused on chemsex prevalence among MSM in Asia, estimating an overall pooled prevalence of 0.19 (95 % CI: 0.15–0.23) (Wang et al., 2023), also lower than our findings. The aforementioned meta-analysis additionally assessed specific substances, revealing pooled prevalence rates for methamphetamine use at 0.16 (95 % CI: 0.09–0.22), GHB/GBL at 0.15 (95 % CI: 0.03–0.12), ketamine at 0.08 (95 % CI: 0.04–0.22), and cocaine at 0.01 (95 % CI: 0.00–0.03) (Wang et al., 2023). With the exception of cocaine, the aforementioned prevalence rates were higher than those observed in our study. A 2024 meta-analysis of studies conducted in Europe reported a chemsex prevalence of 16 % (95 % CI: 11.1–20.9 %), lower than what we observed, but included only eight studies that measured both chemsex and sexual behaviors (e.g., partner count, condomless sex) (Coronado-Muñoz et al., 2024).

Interpreting the findings of this meta-analysis requires consideration of several limitations. First, drug use remains a stigmatized and often criminalized behavior, which may have led MSM who engaged in SDU to be hesitant about participating in studies or disclosing their practices, driven by concerns around confidentiality and potential repercussions. Moreover, the geographic distribution of the included studies was uneven, with most originating from Europe, North America, and Asia. The limited representation of data from Africa and Oceania highlights the need for further research in underrepresented regions. Social desirability bias might have been introduced, potentially leading participants to underreport drug use behaviors. Also, there was notable variation in study contexts, differences in timeframes, regions, MSM populations and in SDU and chemsex definitions. Although we attempted to standardize outcomes by applying rigorous criteria for inclusion, inconsistencies in definitions across studies might have affected the overall estimates. Regional differences were particularly pronounced in substance use patterns. As mentioned above, sexualized methamphetamine use was more prevalent in studies from North America, whereas GHB/GBL, mephedrone, and cocaine were more commonly reported in European contexts. Moreover, the phenomenon itself is variably named and culturally framed across regions—for instance, referred to as "Party and Play" (PnP) in the United States, "Chemsex" in Europe, "Hi Fun" in Southeast Asia (Halkitis, 2019; Witzel et al., 2023). These terms reflect not only linguistic variation but also distinct social and legal environments surrounding drug use and sexual behavior. Consequently, the marked heterogeneity observed may indicate the existence of regionally distinct “epidemics” rather than a single, uniform global phenomenon; as such, the global prevalence estimate presented here should be interpreted with caution. Furthermore, we synthesized data from 47 studies on sexualized marijuana use, where participants explicitly reported using is before or during sex, although marijuana is not traditionally considered a “sex-drug”.

Additionally, a limitation of this systematic review and meta-analysis pertains to the heavy reliance on convenience sampling in the included studies, which raises concerns about the external validity of prevalence estimates. Convenience samples, while logistically feasible, might overrepresent individuals with higher access to services or stronger engagement with MSM networks. This limitation is particularly relevant in research on SDU and chemsex, where participation may be influenced by stigma, trust, or subcultural affiliation. Although true probability-based sampling of MSM populations was not performed in the included studies, some of them adopted more structured approaches such as RDS and TLS. Another notable limitation of the current evidence base is the lack of systematic assessment for substance use disorders. Of the 238 studies included, only 5 assessed for substance use disorders; of them, three used the Drug Use Disorders Identification Test (DUDIT) (Hoornenborg et al., (2018); Ryan et al., (2023); van den Elshout et al., (2023), one employed the WHO Alcohol, Smoking and Substance Involvement Screening Test (ASSIST) (Torres et al., 2020) and one using a non-standardized method (Dolengevich-Segal et al., 2019). This limits the understanding of the severity of chemsex-related drug use among MSM. While many individuals may engage in SDU or chemsex to enhance sexual pleasure with few apparent negative consequences, there could be a subset for whom use becomes problematic, particularly with methamphetamine and GHB/GBL (Hsu et al., 2024). Future research should also incorporate validated screening tools for substance use disorders in order to better inform targeted prevention and treatment interventions. Finally, regarding potential determinants of SDU/-chemsex, subgroup analyses highlighted the role of STI history, HIV status, and geographical regions. There is a clear need for future research to explore the broader range of biomedical, social, and behavioral correlates of SDU/chemsex to better understand risk pathways and inform targeted public health interventions.

This study has several notable strengths. Primarily, it is the first meta-analysis to date to examine SDU and chemsex within a global context. With a substantial sample size of 380,505 participants across 238 studies, our analysis provides a comprehensive examination of SDU and chemsex among MSM. Furthermore, we analyzed 11 distinct prevalence rates related to chemsex, SDU, and specific substances of SDU, offering an in-depth and unique perspective on these behaviors. In addition, we conducted subgroup analyses based on MSM populations, geographic regions, and timeframes of reporting. Importantly, we imposed no restrictions on language or publication year, allowing us to capture the phenomenon in its full context and across a broad spectrum.

Our study demonstrated that SDU and chemsex are prevalent practices among MSM, underscoring the critical need for harm reduction strategies to mitigate the associated risks. Recent research has highlighted a concerning link between the prevalence of chemsex and the absence of targeted harm reduction interventions (Pozo-Herce et al., 2024). Developing and implementing effective chemsex-specific strategies could help reduce the incidence of sexually transmitted infections and mental health issues, while also promoting improvements in physical, sexual, and psychological well-being (Pozo-Herce et al., 2024). It is essential, in this context of widespread SDU, to provide MSM with comprehensive education on the nature and potential harms of commonly used substances and encourage safer sex measures, including pre-exposure prophylaxis and condom use.

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The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at doi:10.1016/j.drugalcdep.2025.112800.

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