Preplanned Studies

Psychoactive Substance Use and the Impact on the AIDS Epidemic Among the MSM Population: a Meta-Analysis — Worldwide, 2014–2023

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Summary

What is already known about this topic?

There is a correlation between psychoactive substance use and heightened human immunodeficiency virus (HIV) susceptibility in men who have sex with men (MSM) populations, although the precise impact on transmission risk remains unclear.

What is added by this report?

In MSM populations, rush poppers and amphetamines are widely used, with rates of 10.91% and 9.97%. In China, rush poppers usage is notably higher at 47.26%. For other regions and coutries, amphetamines (12.86%), rush poppers (3.62%), and GHB (3.34%) are most common. Overall, 17% of MSM use psychoactive substances, with higher HIV risk from amphetamines [Odds ratio (*OR*) 3.06] compared to rush poppers (*OR* 1.51) and general substances (*OR* 1.76).

What are the implications for public health practice?

This study supports the idea that targeting specific regions and types of psychoactive substances for reduction among MSM populations can help decrease HIV transmission as well as promote prevention strategies.

The prevalence of human immunodeficiency virus (HIV) among men who have sex with men (MSM) has surged in recent decades, drawing substantial public health attention (*1*). Research indicates that the MSM population has a 28-fold higher risk of HIV infection than the general adult male population. In China, 7,762 cases of HIV transmission via homosexual contact constituted 25% of all new HIV infections in the second quarter of 2023 among individuals living with HIV/acquired immune deficiency syndrome (AIDS), as indicated by a 2023 report from the China CDC (*2*–*3*).

Designer drugs, or psychoactive substances, have posed a significant challenge to global public health since their inception (*4*). Numerous studies have demonstrated their potential to cause escalating harm worldwide through neurotoxicity and psychiatric symptoms (*5*). In recent years, there's been increased attention on the impact of psychoactive substance abuse within MSM communities, particularly on HIV prevalence. Research indicates that psychoactive substance use can increase the risk of HIV infection among MSM by promoting unsafe sexual practices and compromising immune systems (*6*–*7*).

Although experimental studies have begun to investigate the link between psychoactive substance use and HIV prevalence among MSM cohorts, findings remain inconclusive. Therefore, this meta-analysis aims to synthesize high-quality research to determine the impact of psychoactive substance use on HIV prevalence in MSM communities.

We conducted a comprehensive search for relevant studies published from January 1, 2014 to December 31, 2023, across 4 Chinese databases (CNKI, WanFang, CQVIP, and SinoMed) and four English databases (PubMed, Web of Science, the Cochrane Library, and Embase). Our search strategy involved using both subject headings and keywords related to HIV, MSM, and psychoactive substances (such as amphetamines, ecstasy, ketamine, Rush, capsule 0, etc.). Please refer to Supplementary Material(available at https://weekly.chinacdc.cn/) for details on inclusion and exclusion criteria, data extraction, and assessment of study quality.

Statistical analyses were performed using Stata (version 17.0; Computer Resource Center, Chicago, US), with "metan," "metaninf," "metabias," and "metareg" commands. Results were depicted via forest plots, combining odd ratio (*OR*) values using the "Random [Mantel-Haenszel (M-H) heterogeneity]" method. Heterogeneity was assessed using I^2, where values <25% indicate low heterogeneity, 25% to 75% moderate heterogeneity, and >75% high heterogeneity.

Publication bias was evaluated using funnel plots and Egger's test. Subgroup analyses explored sources of heterogeneity, considering region, study type, psychoactive substance type, and year of data collection. Statistical significance was set at $P<0.05$ (2-tailed), with combinatorial stability assessed through dropout-by-dropout sensitivity analysis.

A total of 1,606 records were identified through literature search, from which 31 studies were screened for inclusion by the researcher, as depicted in Supplementary Figure S1 (available at https://weekly.chinacdc.cn/). Detailed search steps are presented in Supplementary Table S1 (available at https://weekly.chinacdc.cn/). Sensitivity analyses, following the sequential exclusion of individual studies, demonstrated no significant changes. The results were corroborated by Egger's test, which yielded a *P* value of 0.639, and the symmetry of the funnel plots, both of which suggest an absence of significant publication bias in the literature. These findings are graphically represented in Supplementary Figures S2 and S3 (available at https://weekly.chinacdc.cn/).

Supplementary Table S2 provides an overview of the characteristics of all included studies. The 31 studies encompassed 88,181 samples, yielding 8,437 HIV-positive patients. Among them, 29 studies were cross-sectional, while 2 were cohort studies. Statistics on the prevalence of individual psychoactive substance use in MSM populations were reported in 17 publications that incorporated multiple psychoactive substances. Figure 1 depicts the percentage of psychoactive substance use among the entire MSM population, within China, and across other regions and nations. Within the overall MSM population, rush poppers and amphetamine derivatives exhibited the highest rates of use, constituting 10.91% and 9.97%, respectively. Notably, in China, the utilization rate of rush poppers among MSM surpassed that of the entire MSM population, reaching 47.26%. Furthermore, in other regions and countries, amphetamine derivatives (12.86%), rush poppers (3.62%), and GHB (3.34%) exhibited high rates of utilization, ranking as the top 3 substances among psychoactive substances used within the MSM population.

Pooling data from the 31 studies involving 18,025 MSM populations using psychoactive substances revealed a prevalence of 17% [95% confidence interval (*CI*): 14%, 20%]. The I^2 index was 97.6%, with a Cochran Q-test significance of $P<0.001$, utilizing a random-effects model, as illustrated in Figure 2. In China, the prevalence was 16% (95% *CI*: 13%, 19%), while in other regions and countries, it was 19% (95% *CI*: 12%, 26%).

Figure 3 presents the subgroup analysis results, depicting the impact of psychoactive substances on HIV prevalence in the MSM population by region. The analysis revealed a significant difference in the effect of psychoactive substances between China and other countries/regions, with an *OR* of 1.57 (95% *CI*: 1.42, 1.74) in China and 2.16 (95% *CI*: 1.72, 2.71) elsewhere. Furthermore, the effect of psychoactive substances on HIV prevalence in MSM populations by study type was examined. Although the difference in effect between study types was not significant, subgroups were delineated based on the use of rush poppers alone, amphetamine derivatives alone, and psychoactive substances (including various substances beyond rush poppers and amphetamine derivatives). Notably, significant differences were observed in the impact of psychoactive substance type on HIV prevalence, with an *OR* of 1.76 (95% *CI*: 1.53, 2.02) for the psychoactive substances group, 1.51 (95% *CI*: 1.23, 1.84) for the rush poppers group, and 3.06 (95% *CI*: 2.38, 3.93) for the amphetamine derivative group. In an effort to juxtapose data gathered in the last decade with earlier data, we encountered a challenge. Given that the majority of the research data spanned an extensive timeframe, and considering the collection dates of the included papers, we delineated the data into two cohorts: before 2015 and 2016 onward.

DISCUSSION

This meta-analysis, based on data from 31 studies involving 88,181 MSM, examined the prevalence of psychoactive substance use in MSM populations in different regions, the prevalence of HIV in MSM populations using such substances, and investigated the impact of these substances on HIV prevalence. The findings indicate a significant increase in HIV risk among MSM populations associated with the use of psychoactive substances.

Additionally, our study identifies regional variation in the effect of psychoactive substances on HIV prevalence among MSM. Specifically, the analysis reveals a notably lower effect size in China (1.57, 95% *CI*: 1.42, 1.74) compared to other regions or countries (2.16, 95% *CI*: 1.72, 2.71). One plausible explanation for the markedly diminished impact of novel psychoactive substance use on HIV prevalence among MSM in China compared to other regions or countries is the influence of distinct cultural, social, and legal

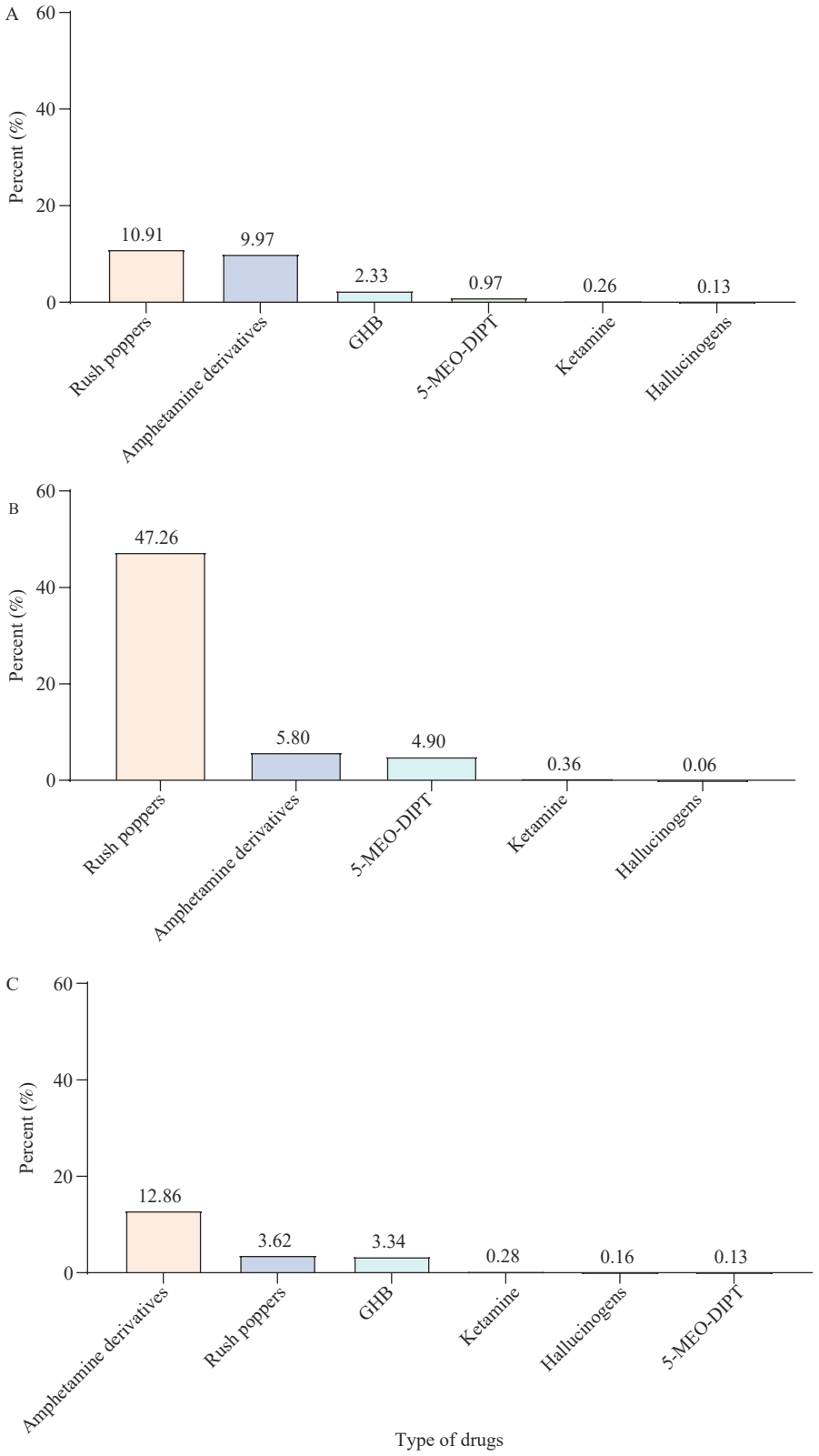


FIGURE 1. Percentage of psychoactive substance use in the full MSM population, China and other regions and countries.(A) All; (B) China; (C) Other regions and countries.
Note: All: All literature included in the study, from both China and other regions. China: All literature from China. Other regions and countries: Literature from regions and countries other than China..

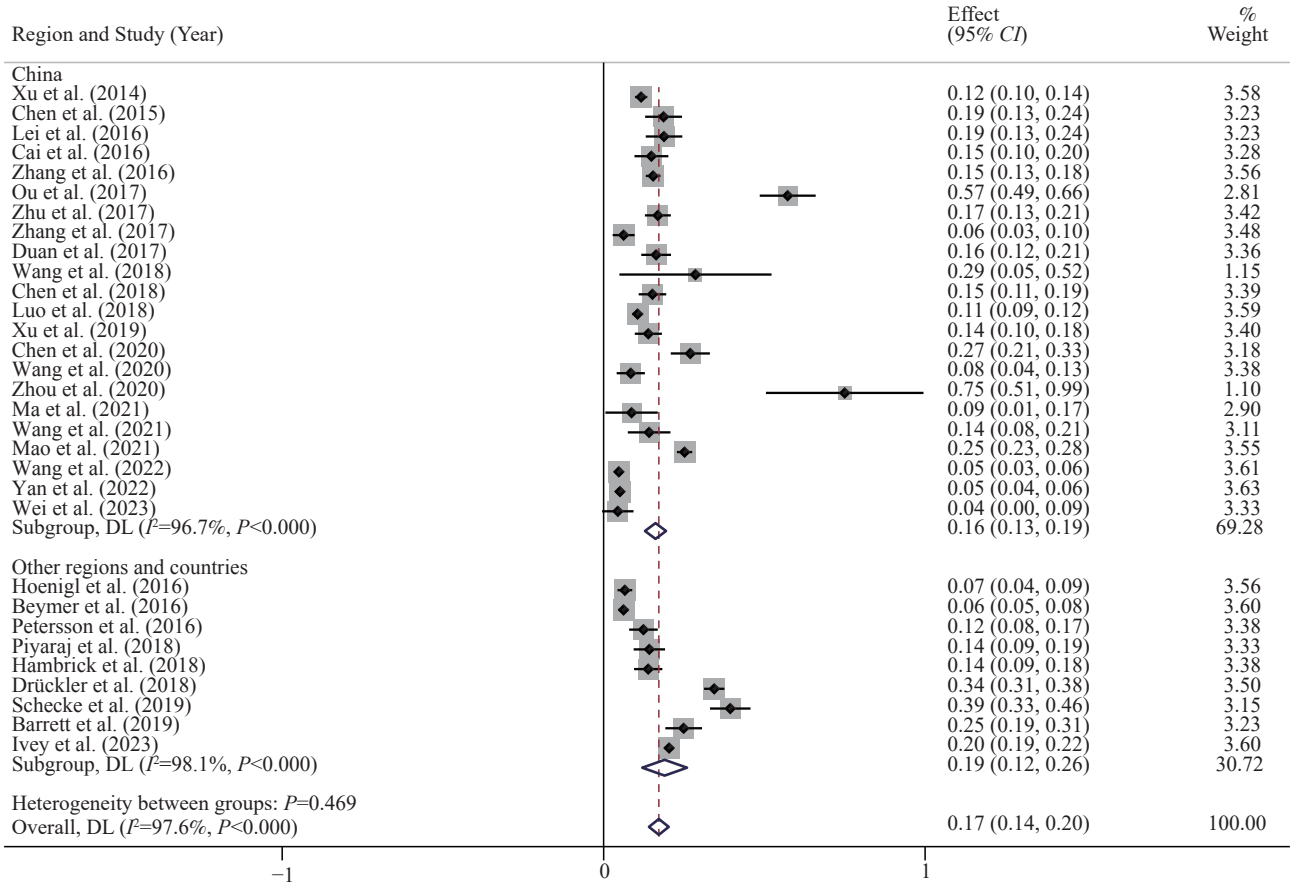
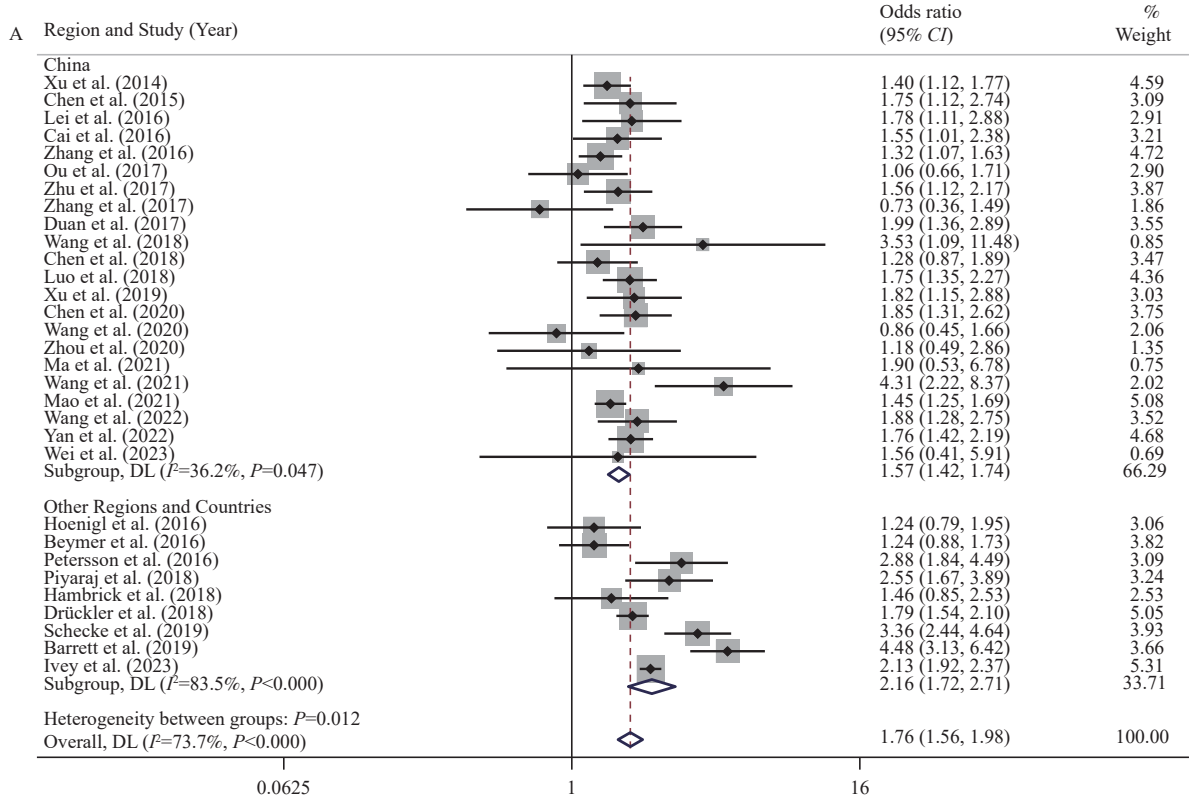


FIGURE 2. Forest plots for HIV prevalence among MSM using psychoactive substances.
Note: Weights and between-subgroup heterogeneity test are from random-effects model.

contexts shaping MSM behavioral dynamics. In China, legal constraints prohibit group sexual activities and hinder the growth of the erotic industry. Additionally, China enforces stricter control over psychoactive substances, further limiting their use. Consequently, the probability of MSM engaging in multiple sexual partnerships and using psychoactive substances is reduced compared to counterparts in certain other nations and regions. This, in turn, contributes to a relatively lower risk of HIV transmission among MSM in China. However, due to the limited scope of existing research, further investigation is needed to validate this finding. In addition to regional factors, different types of psychoactive substances may exert varying effects on the immune system and sexual behavior (*8*–*9*). Studies have shown that amphetamines exert a notable influence on the immune system, while poppers might be considered less harmful than other psychoactive substances. Subgroup analyses reveal an *OR* of 1.76 (95% *CI*: 1.53, 2.02) in the psychoactive substances group, 1.51 (95% *CI*: 1.23, 1.84) in the rush poppers group, and 3.06 (95% *CI*: 2.38, 3.93) in the amphetamine derivative group, suggesting that the use of amphetamine derivatives may make individuals more susceptible to HIV infection, possibly due to their immunosuppressive effects. This finding aligns with existing literature. In this context, factors such as the baseline prevalence of HIV among MSM in China and other regions and countries, the availability of medical resources and services, and the level of public education and health awareness may also contribute to the variation in the impact of psychoactive substances on HIV infections among MSM in China and other regions and countries.

This study, however, has several limitations. First, while studies were categorized to explore various types of new psychoactive substances, most investigations discussing individual drugs focused solely on rush poppers and amphetamines, particularly within China. Conversely, numerous studies examined multiple psychoactive substances simultaneously, without isolating the effects of each drug. Consequently, drug categorization lacked specificity for individual substances. Future research could explore the distinct

impacts of various new psychoactive substances on HIV transmission. Second, the limited number of studies within certain subgroups may have compromised the representativeness and statistical robustness of the aggregated estimates, warranting cautious generalization of the findings. For example, within the drug subgroup analysis, there was a scarcity of non-Chinese studies on amphetamines, potentially



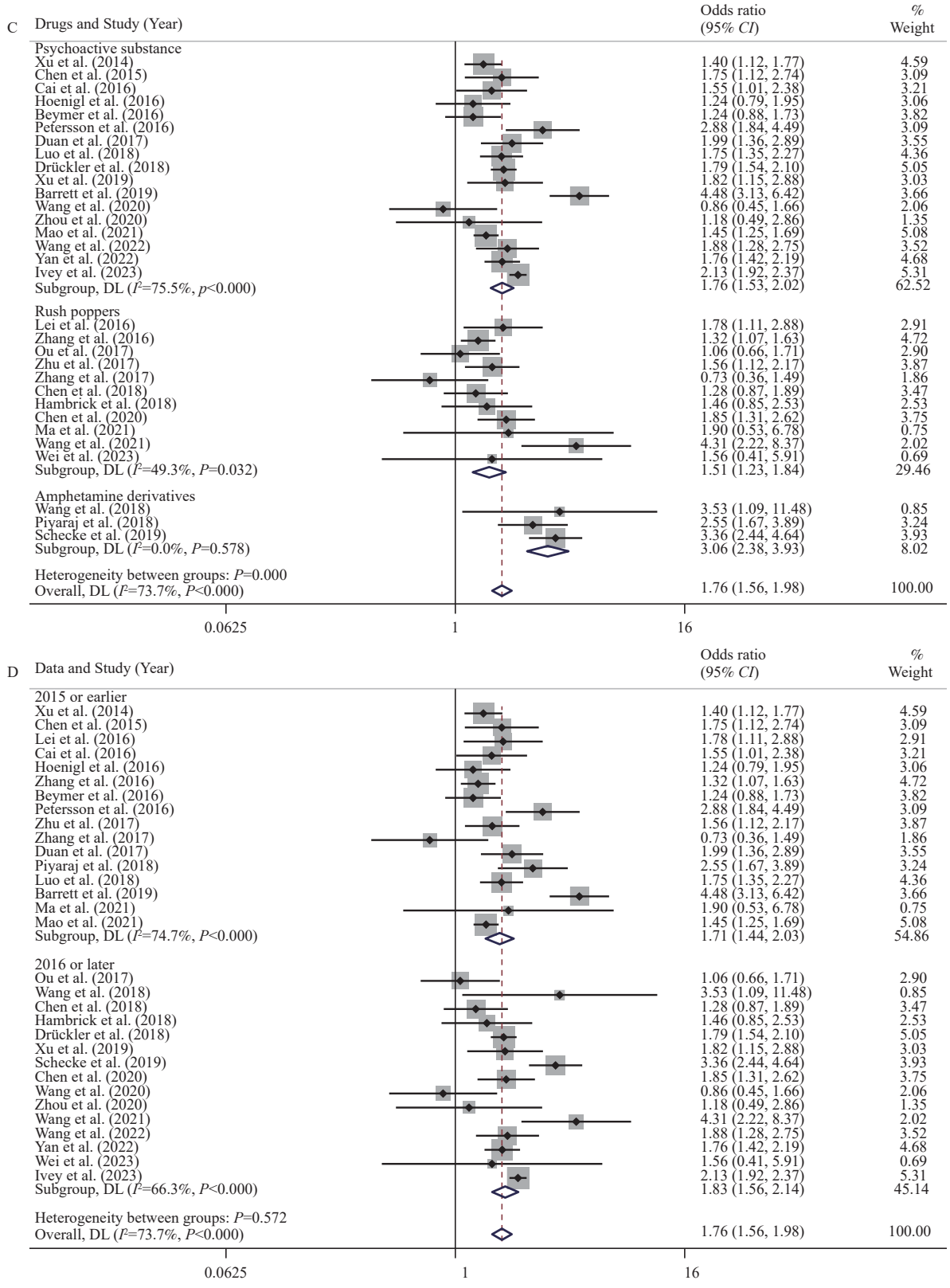


FIGURE 3. Forest plots for impact of psychoactive substances on HIV prevalence in the MSM population (A) by region (B) by design (C) by drugs (D) by data.
Note: Psychoactive Substance: Both rush poppers and amphetamine derivatives were used in the study. Weights and between-subgroup heterogeneity test are from random-effects model.

inflating the observed *OR* values. Additionally, different sexual minority groups have been identified as a significant factor influencing the correlation between psychoactive substance use and HIV prevalence (*10*). However, due to limitations in the designs of the existing studies, these influences were not addressed. Lastly, although subgroup analyses were conducted to explore potential sources of heterogeneity, the substantial heterogeneity observed in the included studies was primarily constrained by the original study designs, precluding analysis of other pertinent sources.

In conclusion, the relationship between psychoactive substance use and HIV prevalence is multifaceted and requires consideration of numerous factors. Future research and interventions should comprehensively explore the interplay of these factors to develop more effective HIV prevention and control strategies, ultimately advancing the global goal of ending HIV transmission.

Conflicts of interest: No conflicts of interest.

doi: 10.46234/ccdcw2024.223

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Submitted: May 22, 2024; Accepted: October 09, 2024

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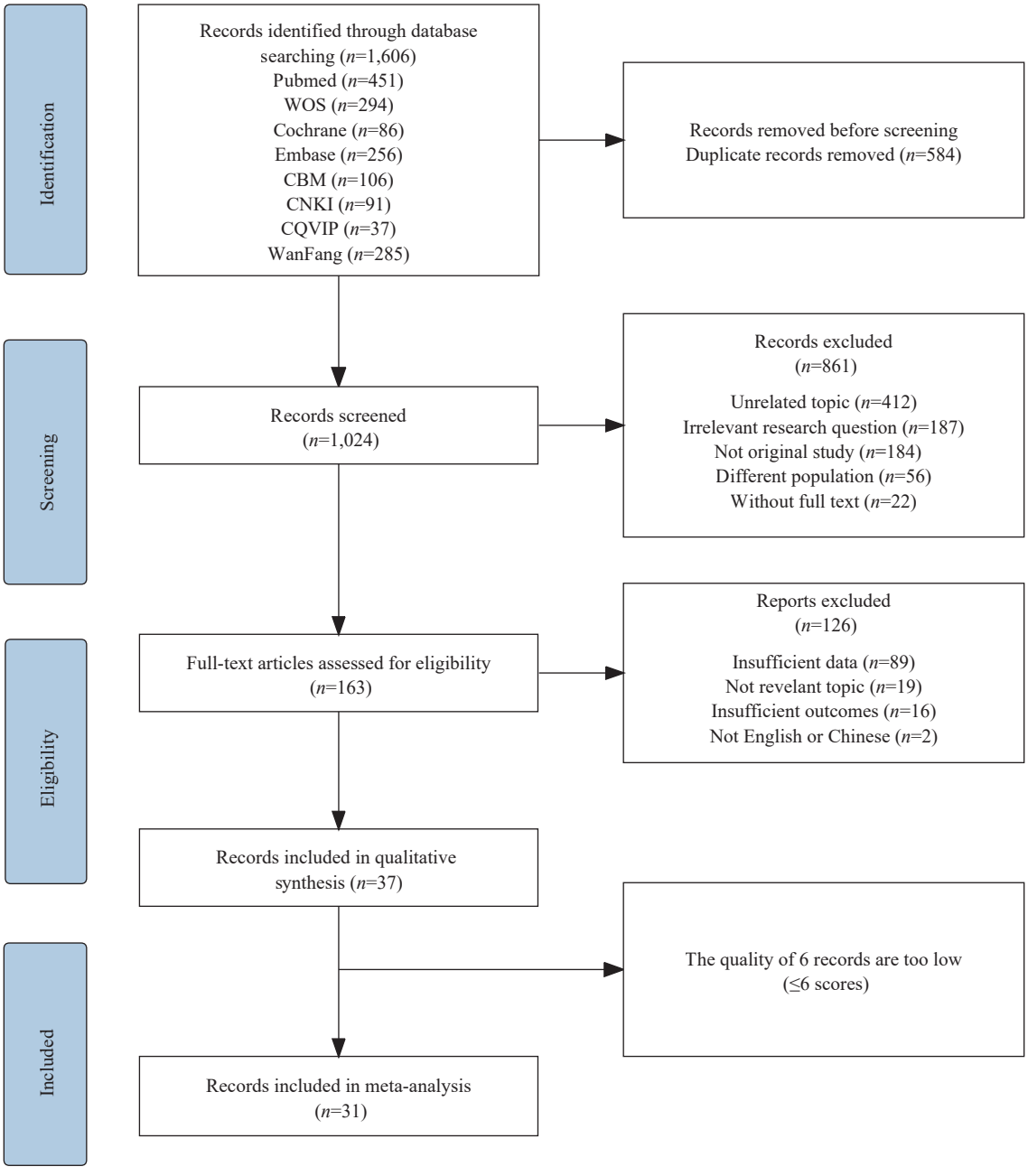
SUPPLEMENTARY MATERIAL

Inclusion and Exclusion Criteria

Inclusion criteria for study selection encompassed: 1) studies involving men who have sex with men; 2) participants within the same study cohort, either using or not using psychoactive substances; 3) outcomes reported as either HIV-negative or positive; 4) publication dates falling within the specified timeframe; and 5) observational study designs. Exclusion criteria comprised: 1) studies lacking information on psychoactive substances use; 2) studies involving exclusively HIV-positive participants; 3) articles with evident data discrepancies or omissions; 4) non-empirical articles such as case reports, reviews, letters, reports, conferences, opinions, etc.; and 5) literature not published in Chinese or English.



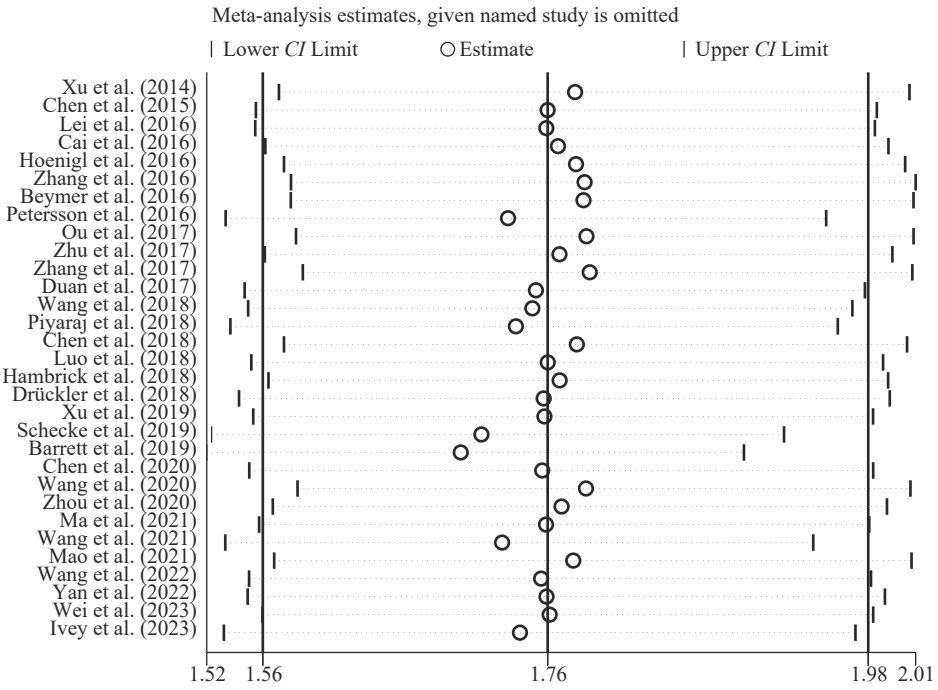
SUPPLEMENTARY FIGURE S1. PRISMA flow diagram.

Data Extraction

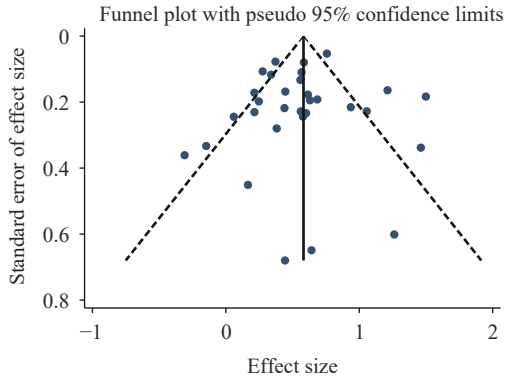
Two researchers independently extracted basic information from the selected literature, including study details, year of publication, study design, drug categories, HIV status among drug users and non-users, HIV status among all men who have sex with men, data collection methods, demographic characteristics, and other pertinent details. Disagreements were resolved through consensus reached via discussion or consulting the full text (Supplementary Table S2).

Assessment of Study Quality

Cohort studies were evaluated using the Newcastle-Ottawa Scale (NOS), while cross-sectional studies were assessed using the Agency for Healthcare Research and Quality (AHRQ) Evaluation Criteria. Studies achieving NOS scores of 7–9 were deemed high quality, while those scoring below 7 were considered low to moderate quality. Similarly, studies with AHRQ scores of 8–11 were classified as high quality, whereas scores below 7 were indicative of low to moderate quality. Only studies scoring 6 or higher were included in the analysis. Regarding the quality assessment, seven studies were rated as high quality, while 24 were considered moderate quality. Detailed



SUPPLEMENTARY FIGURE S2. Sensitivity analysis for case-by-case elimination.



SUPPLEMENTARY FIGURE S3. Funnel plot.

SUPPLEMENTARY TABLE S1. Total search terms.

No.	Search terms
#1	"MSM"[All Fields] OR "money boy"[All Fields] OR "gay"[All Fields] OR "men who have sex with men"[All Fields]
#2	"Methamphetamine"[MeSH Terms] OR "methamphetamine"[All Fields] OR "Desoxyephedrine"[All Fields] OR "Metamfetamine"[All Fields] OR "Methylamphetamine"[All Fields] OR "N-Methylamphetamine"[All Fields] OR "N Methylamphetamine"[All Fields] OR "Deoxyephedrine"[All Fields] OR "Desoxyn"[All Fields] OR "Methamphetamine Hydrochloride"[All Fields] OR "Hydrochloride, Methamphetamine"[All Fields] OR "Ketamine"[MeSH Terms] OR "ketamine"[All Fields] OR "2-(2-Chlorophenyl)-2-(methylamino)cyclohexanone"[All Fields] OR "CI-581"[All Fields] OR "CI 581"[All Fields] OR "CI581"[All Fields] OR "Ketalar"[All Fields] OR "Ketaset"[All Fields] OR "Ketanest"[All Fields] OR "Calipsol"[All Fields] OR "Kalipsol"[All Fields] OR "Calypsol"[All Fields] OR "Ketamine Hydrochloride"[All Fields] OR "mephedrone"[Supplementary Concept] OR "mephedrone"[All Fields] OR "4-methylmethcathinone"[All Fields] OR "bk-4-methylmethamphetamine"[All Fields] OR "Rush"[All Fields] OR "Rush Poppers"[All Fields] OR "Poppers"[All Fields] OR "5-methoxy-N,N-diisopropyltryptamine N-oxide"[Supplementary Concept] OR "Cyclic N-Oxides"[All Fields] OR "5-Methoxytryptamine/analogs and derivatives"[All Fields] OR "GHB"[All Fields] OR "GBL"[All Fields]
#3	"HIV"[MeSH Terms] OR "HIV"[All Fields] OR "Human Immunodeficiency Virus"[All Fields] OR "Immunodeficiency Virus, Human"[All Fields] OR "Immunodeficiency Viruses, Human"[All Fields] OR "Virus, Human Immunodeficiency"[All Fields] OR "Viruses, Human Immunodeficiency"[All Fields] OR "Human Immunodeficiency Viruses"[All Fields] OR "Human T Cell Lymphotropic Virus Type III"[All Fields] OR "Human T-Cell Lymphotropic Virus Type III"[All Fields] OR "Human T-Cell Leukemia Virus Type III"[All Fields] OR "Human T Cell Leukemia Virus Type III"[All Fields] OR "LAV-HTLV-III"[All Fields] OR "Lymphadenopathy Associated Virus"[All Fields] OR "Lymphadenopathy Associated Virus"[All Fields] OR "Virus, Lymphadenopathy-Associated"[All Fields] OR "Viruses, Lymphadenopathy-Associated"[All Fields] OR "Human T Lymphotropic Virus Type III"[All Fields] OR "Human T-Lymphotropic Virus Type III"[All Fields] OR "AIDS Virus"[All Fields] OR "AIDS Viruses"[All Fields] OR "Virus, AIDS"[All Fields] OR "Viruses, AIDS"[All Fields] OR "Acquired Immune Deficiency Syndrome Virus"[All Fields] OR "Acquired Immunodeficiency Syndrome Virus"[All Fields] OR "HTLV-III"[All Fields]
#4	#1 AND #2 AND #3

information on the quality assessment is available in Supplementary Table S3.

Sensitivity Analysis

Sensitivity analyses of the literature included in this study were conducted using the one-by-one exclusion method. The pooled results indicated overall stability across the literature, as depicted in Supplementary Figure S2. Egger's test (P=0.639) did not indicate significant bias, with symmetrical funnel plot sides and good literature stability demonstrated, as illustrated in Supplementary Figure S3.

SUPPLEMENTARY TABLE S2. Study Characteristics

Study	Year	Region	Design	Drug	Drug use		No drug use		All MSM		Data collection	Age, years	Single, *n*	Homosexual, *n*
					HIV (+) (*n*=2,579), *n*	All (*n*=18,025), *n*	HIV (+) (*n*=6,058), *n*	All (*n*=66,709), *n*	HIV (+) (n=8,437), *n*	All (*n*=88,181), *n*				
Xu et al. (*1*)	2014	China	Cross sectional	Psychoactive substances	125	1,072	229	2,758	354	3,830	2012.6–2013.6	30.5	2,769	NA
Chen et al. (*2*)	2015	China	Cross sectional	Psychoactive substances	33	177	69	649	102	826	2009.8–11	28 (±8.1)	146	110
Lei et al. (*3*)	2016	China	Cross sectional	Rush poppers	34	181	45	427	81	608	2014.4–12	28.2 (±6.4)	486	370
Cai et al. (*4*)	2016	China	Cross sectional	Psychoactive substances	26	175	317	3,311	343	3,803	2010–2015	31.17 (±8.61)	149	99
Hoenigl et al. (*5*)	2016	US	Cross sectional	Psychoactive substances	30	454	60	1,125	454	1,639	2008.4–2014.7	NA	NA	NA
Zhang et al. (*6*)	2016	China	Cross sectional	Rush poppers	148	961	307	2,627	455	3,588	2013.3–2014.3	NA	2,896	NA
Beymer et al. (*7*)	2016	US	Cohort	Psychoactive substances	53	855	111	2,218	167	3,111	2009.1–2014.6	NA	NA	2,527
Petersson et al. (*8*)	2016	Sweden	Cross sectional	Psychoactive substances	26	210	120	2,787	146	2,997	2010.6–8	NA	NA	NA
Ou et al. (*9*)	2017	China	Cross sectional	Rush poppers	71	124	41	76	112	312	NA	27.0 (±5.2)	5	183
Zhu et al. (*10*)	2017	China	Cross sectional	Rush poppers	56	332	150	1,389	206	1,721	2014.4–6、10–12, 2015.4–6	30.0 (±10)	1,301	1,075
Zhang et al. (*11*)	2017	China	Cross sectional	Rush poppers	12	193	26	307	38	500	2012.4–8	29.7 (±8.1)	376	425
Duan et al. (*12*)	2017	China	Cross sectional	Psychoactive substances	40	245	139	1,690	179	1,935	2015.3–12	29.3 (±8.4)	1,606	NA
Wang et al. (*13*)	2018	China	Cross sectional	Amphetamine derivatives	4	14	27	334	31	379	2015.9–2017.6	20.7 (±2.3)	NA	277
Piyaraj et al. (*14*)	2018	Thailand	Cohort	Amphetamine derivatives	28	197	187	3,357	212	3,554	2006.4–2010.12	NA	NA	NA
Chen et al. (*15*)	2018	China	Cross sectional	Rush poppers	41	270	101	852	142	1,122	2016.7–9	30.0 (±9.0)	869	796
Luo et al. (*16*)	2018	China	Cross sectional	Psychoactive substances	132	1,249	114	1,886	246	3,135	2015.7–9	NA	2,404	NA
Hambrick et al. (*17*)	2018	France	Cross sectional	Rush poppers	33	238	25	264	58	502	2016.1	NA	378	487
Drückler et al. (*18*)	2018	the Netherlands	Cross sectional	Psychoactive substances	298	866	653	3,406	951	4,925	2016.7–12	NA	NA	NA
Xu et al. (*19*)	2019	China	Cross sectional	Psychoactive substances	36	259	47	617	130	1,493	2016.4–7	29.3 (±9.3)	736	604
Schecke et al. (*20*)	2019	Germany	Cross sectional	Amphetamine derivatives	91	231	96	819	187	1,506	2018.9–12	NA	NA	121
Barrett et al. (*21*)	2019	Ireland	Cross sectional	Psychoactive substances	55	221	97	1,746	152	3,090	2015	NA	NA	2,411
Chen et al. (*22*)	2020	China	Cross sectional	Rush poppers	55	204	138	947	193	1,151	2019.3–2020.2	30.44 (±9.35)	989	768
Wang et al. (*23*)	2020	China	Cross sectional	Psychoactive substances	13	154	40	409	53	603	2017.1–8	NA	NA	NA
Zhou et al. (*24*)	2020	China	Cross sectional	Psychoactive substances	9	12	183	288	12	300	2018.4–8	32.18 (±8.87)	158	269
Ma et al. (*25*)	2021	China	Cross sectional	Rush poppers	4	46	7	153	11	199	2015.7–12	35.63 (±9.21)	112	178
Wang et al. (*26*)	2021	China	Cross sectional	Rush poppers	15	106	27	823	42	929	2019.5–2020.5	27.76 (±7.00)	770	589
Mao et al. (*27*)	2021	China	Cross sectional	Psychoactive substances	321	1,275	559	3,221	444	4,496	2012.6–2013.6	30.20 (±5.60)	2,379	NA
Wang et al. (*28*)	2022	China	Cross sectional	Psychoactive substances	47	993	66	2,620	113	3,613	2021.4–7	32.70 (±9.33)	2091	3,126
Yan et al. (*29*)	2022	China	Cross sectional	Psychoactive substances	204	4,013	150	5,205	354	9,218	2017.9–2020.12	NA	NA	NA
Wei et al. (*30*)	2023	China	Cross sectional	Rush poppers	3	68	9	318	15	386	2023.4–7	NA	291	212
Ivey et al. (*31*)	2023	US	Cross sectional	Psychoactive substances	536	2,630	1,918	20,080	2,454	22,710	2017–2020	NA	NA	NA

SUPPLEMENTARY TABLE S3. Quality scores of included studies (*n*=31).

Study	Cross sectional												
	Year	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	10	11	All
Xu et al. (*1*)	2014	Yes	Yes	Yes	Yes	Yes	Yes	Unclear	Yes	No	Yes	Unclear	8
Chen et al. (*2*)	2015	Yes	Yes	Yes	Yes	Yes	Yes	Unclear	Unclear	No	Yes	Unclear	7
Lei et al. (*3*)	2016	Yes	Yes	Yes	Yes	Yes	Yes	Unclear	Unclear	No	Yes	Unclear	7
Cai et al. (*4*)	2016	Yes	Yes	Yes	Yes	Yes	Yes	Unclear	Unclear	No	Yes	Unclear	7
Hoenigl et al. (*5*)	2016	Yes	Yes	Yes	Yes	Yes	Yes	Unclear	Unclear	No	Yes	Yes	8
Zhang et al. (*6*)	2016	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Unclear	9
Petersson et al. (*8*)	2016	Yes	Yes	Yes	Yes	Yes	No	Unclear	Yes	No	Yes	Unclear	7
Ou et al. (*9*)	2017	No	Yes	Yes	Yes	Yes	No	Unclear	Yes	No	Yes	Unclear	6
Zhu et al. (*10*)	2017	No	Yes	Yes	Yes	Yes	No	Unclear	Yes	No	Yes	Unclear	6
Zhang et al. (*11*)	2017	Yes	Yes	Yes	Yes	Yes	Yes	Unclear	Yes	No	Yes	Unclear	8
Duan et al. (*12*)	2017	Yes	Yes	Yes	Yes	Yes	Yes	Unclear	Unclear	No	Yes	Unclear	7
Wang et al. (*13*)	2018	Yes	Yes	Yes	Yes	Yes	Yes	Unclear	Unclear	No	Yes	Unclear	7
Chen et al. (*15*)	2018	Yes	Yes	Yes	Yes	Yes	Yes	Unclear	Unclear	No	Yes	Unclear	7
Luo et al. (16)	2018	Yes	Yes	Yes	Yes	Yes	Yes	Unclear	Unclear	No	Yes	Unclear	7
Hambrick et al. (*17*)	2018	Yes	Yes	Yes	Yes	Yes	No	Unclear	Unclear	No	Yes	Unclear	6
Drückler et al. (*18*)	2018	Yes	Yes	Yes	Yes	Yes	Yes	Unclear	Unclear	No	Yes	Unclear	7
Xu et al. (*19*)	2019	Yes	Yes	Yes	Yes	Yes	Yes	Unclear	Unclear	No	Yes	Unclear	7
Schecke et al. (*20*)	2019	Yes	Yes	Yes	Yes	Yes	Yes	Unclear	Unclear	No	Yes	Unclear	7
Barrett et al. (*21*)	2019	Yes	Yes	Yes	Yes	Yes	Yes	Unclear	Yes	No	Yes	Unclear	8
Chen et al. (*22*)	2020	Yes	Yes	Yes	Yes	Yes	Yes	Unclear	Yes	No	Yes	Unclear	8
Wang et al. (*23*)	2020	No	Yes	Yes	Yes	Yes	No	Unclear	Yes	No	Yes	Unclear	6
Zhou et al. (*24*)	2020	Yes	Yes	Yes	Yes	Yes	Yes	Unclear	Unclear	No	Yes	Unclear	7
Ma et al. (*25*)	2021	Yes	Yes	Yes	Yes	Yes	Yes	Unclear	Unclear	No	Yes	Unclear	7
Wang et al. (*26*)	2021	Yes	Yes	Yes	Yes	Yes	Yes	Unclear	Unclear	No	Yes	Unclear	7
Mao et al. (*27*)	2021	Yes	Yes	Yes	Yes	Yes	Yes	Unclear	Unclear	No	Yes	Unclear	7
Wang et al. (*28*)	2022	Yes	Yes	Yes	Yes	Yes	Yes	Unclear	Unclear	No	Yes	Unclear	7
Yan et al. (*29*)	2022	Yes	Yes	Yes	Yes	Yes	Yes	Unclear	Unclear	No	Yes	Unclear	7
Wei et al. (*30*)	2023	Yes	Yes	Yes	Yes	Yes	Yes	Unclear	Unclear	No	Yes	Unclear	7
Ivey et al. (*31*)	2023	Yes	Yes	Yes	Unclear	Yes	Yes	Unclear	Yes	No	Yes	Unclear	7
Beymer et al. (*7*)	2016	Yes	Yes	Yes	No	Yes	Yes	Yes	No				6
Piyaraj et al. (*14*)	2018	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No				7

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