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2 have sex with men who inject drugs during sex (Slamsex): Data from the U-SEX
3 GESIDA 9416 Study.

4 **Short title:** Slamsex and psychopathological symptoms.

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38 **ABSTRACT**

39 **Objectives:** Intravenous sexualized drug use also known as slamsex seems to be
40 increasing among HIV-positive men who have sex with men (MSM). This practice may
41 entail severe consequences for physical and mental health in this population. Research
42 on the subject is scarce. The aim of our study was to describe the psychopathological
43 background of a sample of HIV positive MSM who practiced slamsex during the previous
44 year and compare the physical and psychological symptoms between these participants
45 and those who practiced sexualized drug use (SDU) or chemsex without slamsex.

46 **Design and Methods:** Participants (HIV-positive MSM) were recruited from the U-Sex
47 study in 22 HIV clinics in Madrid during 2016-17. All participants completed an
48 anonymous cross-sectional survey on sexual behaviour and recreational drug use. The
49 present analysis is based on HIV-positive MSM who had practiced SDU.

50 **Results:** The survey sample comprised 742 participants. Of all the participants who
51 completed the survey, 216 (29.1%) practiced chemsex, and of these, 34 (15.7%) had
52 practiced slamsex. Participants who practiced slamsex were more likely to have current
53 psychopathology (depression, anxiety and drug related disorders) than chemsex users.
54 In addition, participants who practiced slamsex had more high-risk sexual behaviours,
55 polydrug use and were more often diagnosed with sexually transmitted infections (STIs)
56 and hepatitis C than those who did not inject drugs. Compared with patients who did not
57 inject drugs, patients who engaged in slamsex showed more severe drug related
58 symptoms (withdrawal and dependence), symptoms of severe intoxication (loss of
59 consciousness), and severe psychopathological symptoms related to SDU, such as
60 paranoid thoughts and suicidal behaviour.

61 **Conclusion:** Slamsex (intravenous SDU) is closely associated with current psychiatric
62 disorders and severe drug-related and psychiatric symptoms.

63 **BACKGROUND**

64 Chemsex, or sexualized drug use (SDU), was first described in UK as the intentional use
65 of recreational drugs in order to enhance sexual relations between gay, bisexual and
66 other men who have sex with men (MSM), usually for long periods of time and often with
67 multiple partners (1). The main drugs involved in this practice are mephedrone, γ -
68 hydroxybutyrate/ γ -butyrolactone (GHB/GBL), and crystal-methamphetamine (Crystal-
69 Meth) (2), although other drugs have been also reported, like ketamine, other synthetic
70 cathinones, 3,4-methylenedioxymethamphetamine (MDMA), cocaine, poppers and
71 erectile-dysfunction drugs, (3). Other aspects of this phenomenon, such as the use of
72 geosocial networking applications to locate or participate in sex parties, should be taken
73 into consideration because of their relevance and implications (4). Intravenous use of
74 psychoactive substances, especially stimulants such as mephedrone and Crystal-Meth
75 in this context, is known as slamming or slamsex (2).

76 Some studies have suggested that the practice of injecting recreational drugs at sex
77 parties might be increasing among MSM (2,5–7). Both chemsex and slamsex have been
78 described as more prevalent in MSM living with human immunodeficiency virus (HIV-
79 positive) when compared to HIV-negative MSM. A recent UK study of HIV-positive MSM
80 reported that 3% of their sample had injected drugs related to sex in the previous 3
81 months(8) Similarly, the U-Sex study performed in Madrid showed that 4.5% of the
82 sample had practiced slamsex in the previous year (7).

83 Slamsex has been associated to sex in group, condomless sex with random partners or
84 fisting practices, which increase the frequency of sexually transmitted infections (STIs)
85 and the transmission of viral infections, such as those caused by HIV and hepatitis C
86 virus (HCV) (9).

87 Both Mephedrone and Crystal-Meth are potent central nervous system stimulants that
88 also act peripherally. The potency and half-life of mephedrone depends on the route of
89 administration, which varies from an onset of action of half an hour if it is taken orally,

90 with a mild high that can last from 3 to 5 hours, intranasal, with a potent high after 15
91 minutes and lasting 1-2 hours, and intravenously, with an almost immediate and very
92 potent high with a short duration of 30 to 45 minutes. The rapid onset of action and fast
93 dissipation of effects leads to a compulsive pattern of use and the need to re-dosify
94 almost every hour. Thus, high doses of mephedrone are used in sexual settings, with
95 the consequent risk of overdosing, with altered behaviors and delusive thoughts.

96 Crystal-Meth is different, as its potency is similar both inhaled or injected intravenously.
97 Either route of administration produces an immediate action of the drug, from 0 to 2
98 minutes, with a very potent high. If it is injected intravenously, its duration can be quite
99 long, almost 8 hours. Crystal-Meth produces an intense state of excitement, with
100 euphoria, self confidence and sociability. Its withdrawal syndrome is very unpleasant;
101 thus, its addictive potential is very high (10).

102 Both substances have been related to induced psychotic symptoms in diverse
103 populations (11,12). However, the emergence of psychiatric symptoms in relation to
104 slamsex is scarce, although there is evidence suggesting that mephedrone related to
105 slamsex can induce psychotic symptoms and suicidal conducts (13). Crystal-Meth also
106 has been related to high levels of addiction, psychotic symptoms and other psychiatric
107 disorders in the context of chemsex (14).

108 Mental health issues have been poorly studied among persons who engage in chemsex
109 and few data are available on the severity of drug-induced symptoms in HIV-positive
110 MSM who practice slamsex.

111 The aim of our study was to compare the physical and psychological patterns of HIV-
112 positive MSM who practiced slamsex with that of those who practiced chemsex without
113 intravenous injection of drugs. We also explored the presence of psychopathological
114 symptoms and symptoms of substance use disorders induced by drugs in the entire
115 sample, and their correlates. Patients were selected from the U-SEX GESIDA study (7).

116 **Materials and Methods**

117 The present analysis is nested in the U-SEX GESIDA 9416 study, which was conducted
118 in 22 HIV clinics in the Madrid area from June 2016 to March 2017. This study aimed to
119 calculate the prevalence of chemsex and its associated factors in a sample of HIV-
120 positive MSM in Spain. The inclusion criteria were; age ≥ 18 years, documented HIV
121 infection and being an MSM. All the participants confirmed to be gay or bisexual.
122 Infectious diseases physicians offered all the participants who met the inclusion criteria
123 the opportunity to participate and gave them a card with a unique code and a link with
124 access to an online survey. The survey was self-completed outside the hospital to ensure
125 anonymity and confidentiality

126 The online survey was designed “ad hoc” by the research team to evaluate various
127 domains: general sociodemographic data (age, occupational status, income, etc.), HIV
128 infection status (year of diagnosis, treatment, adherence, etc.), sexual behaviours
129 (condom use, receptive anal sex, fisting, etc.), diagnosis of STIs (including HCV),
130 diagnosed psychiatric disorders and history of drug use. If the participant reported any
131 kind of drug use, they were asked if these drugs were used before or during sexual
132 encounters. Chemsex was defined as the intentional use of mephedrone or other
133 cathinones, 3,4-methylenedioxy-N- methylamphetamine (MDMA), methamphetamine,
134 amphetamines GHB/GBL, ketamine, or cocaine during sex. This analysis included
135 participants who reported they had engaged in the practice of chemsex in the last 12
136 months. The survey evaluated the type of drugs used, the context in which they were
137 used, frequency, route of administration and other aspects referring to the practice of
138 chemsex.

139 In order to collect psychiatric disorders data, the survey asked general questions
140 regarding previously diagnosed psychiatric disorders and specific questions about “past”
141 or “current” psychiatric disorders diagnosed by a mental health specialist. To conduct the

142 present analysis, we only considered self-reported current psychiatric disorders
143 (diagnosed in the previous year), namely, depression, anxiety, personality, psychosis,
144 and drug-related disorders. Because the survey was self-completed, we used the term
145 “self-reported current psychiatric disorder”.

146 All participants were asked about dependence, withdrawal, and psychopathological
147 symptoms related to the drugs used in chemsex sessions. To determine drug
148 dependence symptoms, the survey asked about the following items: drugs used more
149 often or in a higher quantity than planned, severe craving, not fulfilling obligations
150 because of drug use, continuing drug use (even when this lead to physical or
151 psychological discomfort), need to increase doses to obtain the same effect and less
152 positive effects with same doses. The presence of 3 or more symptoms of drug
153 dependence during the previous year were considered in the analysis.

154 In order to collect data on symptoms of withdrawal we asked about the following: severe
155 craving, need to take medications/other drugs to compensate for discomfort, sleep
156 disturbances (insomnia, hypersomnia), agitation, depressive thoughts/feelings, paranoid
157 ideation, suicidal thoughts, suicide attempts, and the need to see a doctor for treatment
158 of discomfort. The presence of 3 or more symptoms of withdrawal/abstinence during the
159 last year were included in the analysis.

160 Finally, intoxication-related symptoms were assessed based on the following: sleep
161 disturbances, “things done to me that I would not have consented to without being on
162 drugs”, “more sexual risk practices that I don’t do when not on drugs”, unpleasant
163 physical feelings under the effects of drugs, anxiety/panic attacks, irritability, and
164 aggressiveness. Psychotic symptoms (mainly paranoid ideation), loss of consciousness,
165 suicidal thoughts and suicide attempts were considered severe intoxication symptoms.

166 Details of the study procedures have been previously published (7). In the present study,
167 to clarify the terminology applied when comparing participants, we used the following

168 terms: participants who engaged in slamsex when the SDU was intravenous and
169 participants who engaged in chemsex when the drugs were not consumed intravenously.

170 The study protocol was approved by the Ethics Committee of Hospital Universitario
171 Gregorio Marañón (HUIL 1606 96/16) and fulfilled the principles of the Declaration of
172 Helsinki (2008).

173 Study data were collected and managed using the data capture tool Research Electronic
174 Data Capture (REDCap) (15) hosted at “Asociación Ideas for Health”.

175 **Statistical Analysis**

176 Categorical variables were expressed as absolute and relative frequencies; continuous
177 variables were expressed as median (IQR). Baseline characteristics were compared
178 between participants who had engaged in slamsex and participants who had engage in
179 chemsex during the previous year, using the chi-square test for categorical variables and
180 the *t* test for continuous variables. Variables included in the comparisons were
181 sociodemographic variables, self-reported current psychiatric disorders, physical and
182 severe psychopathological symptoms related to drug use/abuse, sexual behaviors, and
183 medical variables such as, time since HIV diagnosis, self-reported adherence to
184 antiretroviral therapy or STDs diagnosis.

185 We conducted a logistic regression analysis to explore the association between slamsex
186 and both symptoms of drug use disorders and severe psychopathological symptoms.
187 We separately tested the association of slamsex with the presence of withdrawal (three
188 or more withdrawal symptoms), dependence (three or more dependence-related
189 symptoms), craving (strong need for consumption), paranoid ideation (during or after
190 drug use), suicidal behaviors (suicidal ideation and suicide attempts during or after drug
191 use) and loss of consciousness (during or after drug use).

192 The univariate analysis was conducted separately to evaluate the association between
193 symptoms of drug-related disorders or severe psychopathological symptoms in the
194 context of chemsex and, other drug-related variables or self-referred psychiatric current
195 disorders. The dependent variables included withdrawal symptoms, severe craving,
196 psychotic paranoid ideation, suicidal behaviours, and loss of consciousness.
197 Independent variables were categorized as the presence/absence of self-referred active
198 depression, self-referred active anxiety, polydrug use (three or more drugs used each
199 time), cathinone use during the previous year, ketamine use during the previous year,
200 GHB use during the previous year and inhaled Crystal-Meth use during the previous
201 year. Thereafter, bivariate logistic regressions were conducted to explore associations
202 regardless of the presence of slamsex. The presence/absence of slamsex was included
203 in the bivariate regression as an independent variable. Independent variables were
204 included in the bivariate analysis only if their p value was $\leq .10$ in the univariate analysis.

205 RESULTS

206 1.1. Baseline characteristics and comparison between slamsex and chemsex

207 Of a total of 742 HIV-positive MSM who completed valid surveys in the U-Sex Study, the
208 present analysis included all the participants who had engaged in chemsex during the
209 previous year (N=216). Participants in our sample were mainly Spanish born (71.3%),
210 middle aged (median=38; IQR: 33-44), and with a university education (63.9%). In
211 addition, 70.8% had a salary of more than 1000 euros per month, and 42% were in a
212 stable relationship. The median years with HIV diagnosis was 5 years (IQR: 2-11). More
213 than 90% were receiving antiretroviral therapy and of these, 3% reported having taken
214 less than 90% of doses (poor adherence). In our sample, thirty-four participants (15.7%)
215 had practiced slamsex during the previous year. A comparison with HIV-positive MSM
216 who did not engage in chemsex in our sample has been reported elsewhere (7).

217 When participants who had engaged in slamsex during the previous year were compared
218 with those who engaged in chemsex, no differences were found regarding
219 sociodemographic or medical variables. Compared with people who engaged in
220 chemsex, people who had engaged in slamsex were less likely to have a stable partner
221 (26.5 vs. 45.6%, $P=.039$) and tended to have more frequently poor adherence to
222 antiretroviral therapy (9.1 vs. 1.9%, $P=.061$).

223 Comparisons based on the type of drug used in both groups of participants are shown
224 in table 1. Participants who engaged in slamsex had higher rates of polydrug use (3 or
225 more drugs per session), use of mephedrone and other cathinones, Crystal-Meth,
226 ketamine, and intrarectal use of drugs. They also had higher rates of high-risk drug use
227 behaviours, such as sharing needles or other drug paraphernalia. Symptoms related to
228 drug abuse/dependence and severe psychopathological symptoms associated with the
229 practice of slamsex and chemsex are shown in table 2. Regarding the kind of drugs

230 injected intravenously, the most frequent were mephedrone or other cathinones (94.1%),
231 then ketamine (17.6%), Crystal-Meth (5.9%) and cocaine (5.9%).

232 Participants who engaged in slamsex showed a significantly higher percentage of sexual
233 risk behaviours than those who practiced chemsex, as follows: fisting (73.5 vs. 38.5%,
234 $P=.001$), fisting without a glove (67.7 vs. 28%, $P=.001$), condom use in less than half of
235 sexual relations (93.1 vs. 48.3%, $P=.001$) and more than 20 sexual partners in the
236 previous 6 months (70 vs. 39.6%, $P=.002$). As for STDs, people who had engage in
237 slamsex more often had gonorrhoea (43.4 vs. 61.8%, $P=.049$), syphilis (62.6 vs. 88.2%,
238 $P=.004$) and hepatitis C (18.1 vs. 61.8%, $P=.000$) than people who engage in chemsex.

239 A self-reported current psychiatric disorder was more common among participants who
240 engaged in slamsex than in those who engaged in chemsex, with the conditions reported
241 as follows: depressive disorder (61.8 vs. 28%, $P=.0001$), anxiety disorder (47.1 vs.
242 23.1%, $P=.004$), and drug use disorders (drug-dependence) (38.2 vs. 15.4%, $P=.002$).

243 **1.2. Correlates of severe physical and psychopathological symptoms related to** 244 **drug use**

245 The simple logistic regression conducted to explore the association between slamsex
246 and the presence of symptoms of drug use disorders or severe psychopathological
247 symptoms related to drug use revealed a significant association. Compared with
248 participants who had engaged in chemsex, those who engaged in slamsex were five
249 times more likely to had experienced withdrawal symptoms (OR: 4.97 [2.13-11.57],
250 $P=.0001$) and seven times more likely to had experienced intense craving (OR: 7.03
251 [3.21-15.43], $P=.0001$). Moreover, during or after drug use they were three times more
252 likely to experience suicidal ideation (OR: 3.48 [1.48-8.10], $P=.004$), psychotic paranoid
253 ideation (OR: 3.38 [1.41-8.07], $P=.006$) and loss of consciousness (OR: 2.88 [1.22-6.79],
254 $P=.016$).

255 Figure 1 shows the associations between other drug-related variables or current self-
256 reported psychiatric diagnosis and, the presence of symptoms of drug related disorders
257 and severe physical and psychopathological symptoms related to drug use (suicidal
258 ideation, paranoid ideation and loss of consciousness), regardless of the presence of
259 slamsex. Patients who self-reported current depressive disorders more frequently had
260 withdrawal symptoms. Active anxiety, cathinone use and GHB use were also associated
261 with the presence of withdrawal symptoms. Moreover, participants who inhaled Crystal
262 Meth more frequently experienced severe craving, and, those who inhaled Crystal -Meth
263 or used multiple drugs were significantly more likely to present symptoms of drug-
264 dependence. Suicidal ideation was only associated with self-reported depression and
265 anxiety disorders; paranoid ideation was associated with anxiety disorders, polydrug
266 use, and inhaled Crystal-Meth. Finally, loss of consciousness was related to polydrug
267 use, GHB use, ketamine use, and inhaled Crystal-Meth (Fig 1).

268 **DISCUSSION**

269 The present study provides novel findings regarding the slamsex phenomenon in a
270 sample of HIV-infected MSM who engage in SDU. In our sample, 216 subjects engaged
271 in chemsex. From this sub-sample, 34 subjects (15.7%) engaged in slamsex during the
272 previous year. Compared with those who did not inject drugs, people who had engaged
273 in slamsex more frequently reported high risk sexual behaviours, had more frequently
274 been diagnosed with an STD, and had more frequently reported a current diagnosis of a
275 psychiatric disorder. In addition, compared with participants who engaged in chemsex,
276 participants who had engaged in slamsex in the previous year had more drug-related
277 adverse effects such as symptoms of withdrawal and dependence or severe physical
278 and psychopathological symptoms such as psychotic paranoid ideation, suicidal
279 behaviours and loss of consciousness.

280 There is some research regarding the prevalence of slamsex and associated high risk
281 behaviours among MSM. The Unlinked and Anonymous Monitoring (UAM) survey of
282 people who inject drugs reported that since 2000, the proportion of MSM who inject drugs
283 has increased significantly (4.4% in 2000/2001 to 8.1% in 2014/2015, $P<0.001$). They
284 also reported the presence of higher-risk behaviours associated with injecting such as
285 needle/syringe sharing (15% vs 11%, $P=0.07$) and having more than 10 sexual partners
286 among MSM who injected drugs than among MSM who did not inject drugs (25% vs.
287 4.0%, $P<0.001$) (6). A recent study from an Australian cohort of MSM reported a high life
288 prevalence of injecting drugs (10.3%); the prevalence of injection in the previous six
289 months was 4.7% in this population. The authors reported that injecting drugs was
290 associated with high-risk sexual practices such as having multiple sex partners, group
291 sex with casual partners and condomless anal intercourse with casual partners (16). In
292 the case of HIV-positive MSM, the ASTRA study (17) reported that of 2248 HIV-positive
293 sexually active MSM recruited in 2011-2012, 1138 (51%) had used recreational drugs in
294 the previous three months and the prevalence of injection drug use was 3% ($n=68$). The

295 Positive Voices Study reported that 105 of 392 sexually active HIV-positive MSM (29%)
296 had engaged in chemsex during the previous year. Among these, the prevalence of
297 slamsex was 33.3% (18). The prevalence of slamsex in our study could be directly
298 compared with the findings of the Positive Voice study only because of methodological
299 and sample similarities. While the rate of chemsex reported is similar to the rate we report
300 previously (29%) in the U-Sex Study (7), the authors found higher rates of slamsex
301 among their participants (33.3 vs. 15.6%). Therefore, we think that regional differences
302 in slamsex frequencies should be explored in future studies. Otherwise, the most
303 dangerous profiles of drug use and sexual practices found in the above mentioned
304 studies in samples of MSM who injected drugs are congruent with the higher rates of
305 polydrug use, rectal use of drugs, sharing drug paraphernalia, sexual risk behaviours
306 and STDs found among those who engaged in slamsex in the present study.

307 We found that the most common intravenous drugs used during slamsex were
308 mephedrone or other synthetic cathinones (94.1%), followed by ketamine (17.6%),
309 Crystal-Meth (5.9%) and cocaine (5.9%). To our knowledge, only a few reports discuss
310 the type of drug used by HIV-positive MSM during slamsex. The UAM Survey found high
311 frequencies of injected mephedrone and ketamine among MSM who injected drugs (12%
312 and 9.3%, respectively) (6). Furthermore, data from Antidote, a specialist drug clinic
313 aimed at the gay community in London, UK, showed that 75% of patients used
314 mephedrone in the chemsex context and of these, 80% injected the drug. Of this 80%,
315 75% were HIV-positive and 70% reported sharing needles (19). The recently published
316 FLUX study, a survey performed in Australian gay and bisexual men, found that of the
317 1995 respondents, 206 (10.3%) reported having injected drugs and 93 (4.7%) had
318 injected recently, most commonly Crystal-Meth (91.4%) and speed (9.7%), as well as
319 cocaine and ketamine, albeit in low percentages (16). Together with the data reported
320 above, our results suggest that the type of drugs injected in the chemsex context are
321 similar but that there may be regional differences. Drug use in the context of chemsex

322 and slamsex may be changing continuously, as a result of travel by MSM to different
323 countries for leisure, socialization and clubbing and to expand sexual experiences.

324 The participants in our sample who engaged in slamsex presented higher rates of drug
325 use related adverse symptoms than those who engaged in chemsex . Severe craving
326 and other withdrawal symptoms were more frequent, as was loss of consciousness. The
327 participants also showed higher rates of severe psychopathological symptoms such as
328 paranoid ideation and suicidal ideation or attempts.

329 Mephedrone and other synthetic cathinones were the main drugs “slammed” in our
330 sample, both as stimulants and as sexual enhancers. The intravenous use of
331 mephedrone has been related to compulsive use, intense craving, bingeing behaviours
332 and withdrawal symptoms (20). Diverse psychotic symptoms, mainly paranoid ideation,
333 have also been reported for mephedrone, especially if it is consumed intravenously
334 (21,22). In the context of slamming, one case in Spain has been reported in a young
335 HIV-positive man, who experienced persistent mephedrone-induced paranoid delusions,
336 intense anxiety and visual and kinaesthetic hallucinations (13).

337 Ketamine, cocaine and Crystal-Meth were also consumed in slamsex in our sample,
338 albeit at a lower frequency than cathinones. Injected Crystal-Meth has the potential to
339 induce psychotic symptoms and has been related to drug-related disorders such as
340 abuse or dependence. In slamsex, its potent stimulant effect has been related to high-
341 risk sexual behaviors, with an increased risk of infection by HIV or other STDs (10).

342 Traditionally, more frequent drug dependence and psychiatric symptoms have been
343 described during intoxication by or abstinence from some drugs if they are used
344 intravenously. Our novel data together with the few previously published findings support
345 the addictive potential and severe psychopathological consequences of drugs injected
346 in the chemsex context.

347 Other variables related to drug use might modulate the severity of physical and
348 psychopathological symptoms induced by drugs in the context of SDU. Regardless of
349 the presence of slamsex, use of inhaled Crystal-Meth, GHB use (oral), ketamine use,
350 polydrug use, and self-reported depression and anxiety disorders were associated with
351 more severe physical and psychopathological symptoms related to drug use in our sample
352 of HIV-infected MSM who engaged in chemsex. In particular, inhaled Crystal-Meth was
353 associated with higher rates of drug dependence and withdrawal symptoms. Moreover,
354 participants who used inhaled Crystal-Meth more frequently had psychotic paranoid
355 ideation and loss of consciousness experienced during or after drug use.

356 In addition to intravenous injection, inhaled Crystal-Meth has been used by MSM at sex
357 parties for quite some time. The potent disinhibiting effect of this drug has been related
358 to high-risk sexual behaviours and an increase in the frequency of STIs, particularly HIV
359 infection(23). Furthermore, drug-dependence has been described in MSM who inject
360 Crystal-Meth and who are also more prone to comorbid psychiatric disorders and suicidal
361 behaviour (10). Induced psychotic symptoms have been reported in other populations
362 (24), although other psychopathological symptoms induced by inhaled Crystal-Meth in
363 chemsex are scarcely known.

364 Loss of consciousness was also associated with GHB and ketamine use in our sample.
365 In addition, participants who used more than 3 drugs (polydrug use) had higher rates of
366 loss of consciousness and paranoid ideation and tended to show more pronounced
367 symptoms of drug dependence. This observation must be taken into account, because
368 GHB is usually consumed in combination with other drugs. GHB is frequently related to
369 loss of consciousness, owing to its depressive effect on the central nervous system and
370 because it accumulates over time (2). In addition, the combination of GHB with
371 mephedrone, Crystal-Meth and alcohol increases the risk of drug-drug interactions and
372 overdose, with loss of consciousness and respiratory depression (2). Although ketamine
373 is a dissociative anaesthetic that acts as a stimulant at low doses, with higher doses,

374 polydrug use and intravenous injection, it can increase the risk of loss of consciousness
375 and cardiovascular toxicity in recreational settings (25) such as chemsex, as reported in
376 the present study. Our results are congruent with the effects of these drugs (Crystal-
377 Meth, GHB, mephedrone) previously known. In our opinion this results help to
378 understand the role of each type of drug and route of administration in the severe
379 consequences that may be experienced by some people engaged in chemsex.

380 Finally, self-reported current diagnosed psychiatric disorders may have played a
381 significant role among the chemsex users in our sample. Regardless of the presence of
382 slamsex, those participants who self-reported current depression more frequently
383 experienced withdrawal symptoms and suicidal ideation during or after drug use.
384 Participants with current anxiety disorders also reported higher rates of withdrawal
385 symptoms, suicidal ideation and paranoid ideation in this context. Moreover, participants
386 who engaged in slamsex were more likely to have anxiety and depression.

387 While there is evidence that HIV-positive MSM frequently present mental health
388 problems such as depression, anxiety, suicidal behaviour and drug-related disorders,
389 there is little research on the effect of these variables on the health consequences of
390 chemsex practice in this population. The initial published data suggest that HIV-positive
391 MSM who practice chemsex had a higher frequency of depression and anxiety disorders
392 than HIV-positive MSM who did not (8) . Other studies on chemsex did not report
393 psychopathological diagnoses, but rather analysed emotional distress and psychological
394 discomfort associated with chemsex. It has been suggested that some vulnerability
395 factors related to problematic chemsex may be the so-called “minority stressors” such
396 as negative internalised homophobia, fear of disapproval, experience of discrimination
397 and a negative self-concept (26).

398 Therefore, according to the syndemic approach, mental health disorders in HIV-infected
399 MSM appear to increase vulnerability to develop drug abuse disorders and sexual risk

400 behaviours, acting in a syndemic framework by which disease outcomes and the social
401 conditions that contribute to their proliferation sustain each other (26). Consequently, a
402 multidisciplinary approach is necessary to address the situation appropriately. Although
403 our data do not enable us to speculate on causality, in our opinion, the presence of
404 depression and anxiety among HIV-positive MSM who engage in slamsex could indicate
405 vulnerability to develop more severe physical and psychopathological consequences.
406 Moreover, people with previous mental health problems may be more likely to start
407 chemsex and become involved in high-risk practices such as slamsex. We also found
408 that suicidal behaviour in slamsex users was associated with reported current depression
409 and anxiety. These findings can be interpreted in two ways: first, intravenous use of
410 particular drugs such as synthetic cathinones or other stimulants can trigger suicidal
411 ideation in vulnerable subjects; second, subjects with current depression or anxiety may
412 be more prone to use drugs intravenously. The presence of psychopathology along with
413 intravenous drug use can lead to suicidal ideation and suicide attempts, as well as
414 psychotic symptoms. More research is needed to know the causality and interaction
415 between these variables in people who had engaged in chemsex and slamsex.

416 We think it is important to evaluate the mental health of HIV-positive MSM alongside
417 other routine evaluations conducted in HIV clinics. The detection of psychiatric disorders
418 and their appropriate treatment can prevent other mental and physical consequences of
419 drug use in this population. In addition, approaches such as reducing the harm caused
420 by drug-use can be more effective in people who are not willing to stop drug use in
421 relation to sex. It is necessary to create multidisciplinary approaches in the prevention
422 and treatment of the consequences of chemsex.

423 To our knowledge we provide for the first time a detailed analysis about drug-related and
424 severe psychopathological symptoms experienced in people engaged in slamsex . We
425 also report data that that increases knowledge about the role of different types of drugs,

426 routes of consumption and psychiatric disorders in drug addiction and psychopathological
427 consequences of chemsex practices among HIV-positive MSM.

428 Our study is subject to the limitations inherent to cross-sectional survey-based studies,
429 especially response bias. Although we used limited time periods in questions that
430 depended on memory, recall bias could distort the accuracy of the results. Furthermore,
431 we were unable to confirm causality because of the cross-sectional nature of the study.
432 Further longitudinal studies should be performed to compare our results in order to be
433 able to confirm that slamsex can be related to previous psychopathology and may have
434 drug-related and severe psychopathological symptoms in HIV-positive MSM. Another
435 limitation is that the psychiatric diagnosis or drug-related symptoms were self-reported.
436 Although the questionnaire specified previous or current diagnosed psychiatric disorders
437 diagnosed by a psychiatrist or other mental health specialist, the survey did not have
438 standardized diagnostic scales. The exploratory nature of this study led to the inclusion
439 of a large number of variables and the “ad hoc” design of the survey, using sometimes
440 particular slang of the phenomenon in Spain. However, questions about substance
441 dependence and withdrawal were elaborated following DSM-IV-rev criteria. Future
442 studies should include standardized screening scales for mental disorders, substance
443 use disorders, presence of craving or specific psychopathological symptomatology to
444 allow a detailed measurement of specific variables.

445 Our results suggest that slamsex is relatively common, although it does not appear to be
446 generalized among HIV-positive MSM who practice chemsex in Spain. People who
447 engage in slamsex appear to have high-risk practices associated with both drug use
448 and sexual behaviour in comparison with people who engage in chemsex. Also, people
449 who engage in slamsex, are more likely to experience drug-related induced
450 psychopathological symptoms and symptoms of drug dependence. Moreover, the non-
451 injected use of other substance such as Crystal-Meth, GHB/GBL or ketamine and the

452 presence of psychiatric disorders might also contribute to severe consequences for the
453 physical and mental health of persons who engage in chemsex.

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493 **REFERENCES**

- 494 1. McCall H, Adams N, Mason D, Willis J. What is chemsex and why does it matter?
495 BMJ. 2015 Nov;351:h5790.
- 496 2. Bourne A, Reid D, Hickson F, Torres-Rueda S, Steinberg P, Weatherburn P.
497 “Chemsex” and harm reduction need among gay men in South London. *Int J Drug*
498 *Policy*. 2015 Dec;26(12):1171–1176.
- 499 3. Schmidt AJ, Bourne A, Weatherburn P, Reid D, Marcus U, Hickson F, et al. Illicit
500 drug use among gay and bisexual men in 44 cities: Findings from the European
501 MSM Internet Survey (EMIS). *Int J Drug Policy*. 2016;38:4–12.
- 502 4. Dolengevich-Segal H, Rodríguez-Salgado B, Bellesteros-López J, Molina-Prado
503 R. Chemsex. An emergent phenomenon. *Adicciones*. 2017 Jun 28;29(3):207–9.
- 504 5. Gilbart VL, Simms I, Jenkins C, Furegato M, Gobin M, Oliver I, et al. Sex, drugs
505 and smart phone applications: findings from semistructured interviews with men
506 who have sex with men diagnosed with *Shigella flexneri* 3a in England and Wales.
507 *Sex Transm Infect*. 2015 Dec;91(8):598–602.
- 508 6. Glass R, Hope VD, Tanner C, Desai M. “Slamming” among men who have sex
509 with men accessing general drug services, in response to Schmidt, AJ et al.,
510 2016, Illicit drug use among gay and bisexual men in 44 cities: Findings from the
511 European MSM Internet Survey (EMIS). *Int J Drug Policy*. 2017;49:24–5.
- 512 7. González-Baeza A, Dolengevich-Segal H, Pérez-Valero I, Cabello A, Téllez MJ,
513 Sanz J, et al. Sexualized Drug Use (Chemsex) Is Associated with High-Risk
514 Sexual Behaviors and Sexually Transmitted Infections in HIV-Positive Men Who
515 Have Sex with Men: Data from the U-SEX GESIDA 9416 Study. *AIDS Patient*
516 *Care STDs*. 2018 Mar;32(3):112–8.
- 517 8. Pufall EL, Kall M, Shahmanesh M, Nardone A, Gilson R, Delpech V, et al.
518 Sexualized drug use (‘chemsex’) and high-risk sexual behaviours in HIV-positive
519 men who have sex with men. *HIV Med*. 2018 Jan;
- 520 9. Ottaway Z, Finnerty F, Amlani A, Pinto-Sander N, Szanyi J, Richardson D. Men
521 who have sex with men diagnosed with a sexually transmitted infection are
522 significantly more likely to engage in sexualised drug use. *Int J STD AIDS*. 2016
523 Aug;
- 524 10. Abdulrahim D, Bowden-Jones O. Guidance on the Management of Acute and
525 Chronic Harms of Club Drugs and Novel Psychoactive Substances. Novel
526 Psychoactive Treatment UK Network (NEPTUNE). Novel Psychoactive Treatment
527 UK Network (NEPTUNE).; 2015.
- 528 11. Darke S, Kaye S, McKetin R, Duflou J. Major physical and psychological harms of
529 methamphetamine use. *Drug Alcohol Rev*. 2008 May;27(3):253–62.
- 530 12. Kapitány-Fóvény M, Kertész M, Winstock A, Deluca P, Corazza O, Farkas J, et al.
531 Substitutional potential of mephedrone: an analysis of the subjective effects. *Hum*
532 *Psychopharmacol*. 2013 Jul;28(4):308–316.

- 533 13. Dolengevich-Segal H, Rodríguez-Salgado B, Gómez-Arnau J, Sánchez-Mateos
534 D. Severe Psychosis, Drug Dependence, and Hepatitis C Related to Slamming
535 Mephedrone. *Case Rep Psychiatry*. 2016;2016:8379562.
- 536 14. Lea T, Mao L, Hopwood M, Prestage G, Zablotska I, de Wit J, et al.
537 Methamphetamine use among gay and bisexual men in Australia: Trends in
538 recent and regular use from the Gay Community Periodic Surveys. *Int J Drug*
539 *Policy*. 2016 Mar;29:66–72.
- 540 15. Harris PA, Taylor R, Thielke R, Payne J, Gonzalez N, Conde JG. Research
541 electronic data capture (REDCap)—a metadata-driven methodology and workflow
542 process for providing translational research informatics support. *J Biomed Inform*.
543 2009 Apr;42(2):377–81.
- 544 16. Bui H, Zablotska-Manos I, Hammoud M, Jin F, Lea T, Bourne A, et al. Prevalence
545 and correlates of recent injecting drug use among gay and bisexual men in
546 Australia: Results from the FLUX study. *Int J Drug Policy*. 2018 Feb;
- 547 17. Daskalopoulou M, Rodger A, Phillips AN, Sherr L, Speakman A, Collins S, et al.
548 Recreational drug use, polydrug use, and sexual behaviour in HIV-diagnosed men
549 who have sex with men in the UK: results from the cross-sectional ASTRA study.
550 *Lancet HIV*. 2014 Oct;1(1):e22-31.
- 551 18. Pufall EL, Kall M, Shahmanesh M, Nardone A, Gilson R, Delpech V, et al.
552 Sexualized drug use ('chemsex') and high-risk sexual behaviours in HIV-positive
553 men who have sex with men. *HIV Med*. 2018 Apr;19(4):261–70.
- 554 19. EMCDDA. 'Perspectives on drugs' (PODs) series, launched alongside the annual
555 European Drug Report, these designed-for-the-web interactive analyses aim to
556 provide deeper insights into a selection of important issues [Internet]. 2016 May.
557 Available from: [http://www.emcdda.europa.eu/topics/pods/controlling-new-](http://www.emcdda.europa.eu/topics/pods/controlling-new-psychoactive-substances)
558 [psychoactive-substances](http://www.emcdda.europa.eu/topics/pods/controlling-new-psychoactive-substances)
- 559 20. German CL, Fleckenstein AE, Hanson GR. Bath salts and synthetic cathinones:
560 an emerging designer drug phenomenon. *Life Sci*. 2014 Feb 27;97(1):2–8.
- 561 21. Van Hout MC, Bingham T. "A costly turn on": patterns of use and perceived
562 consequences of mephedrone based head shop products amongst Irish injectors.
563 *Int J Drug Policy*. 2012 May;23(3):188–97.
- 564 22. Kapitány-Fövény M, Mervó B, Kertész M, Corazza O, Farkas J, Kökönyei G, et al.
565 Is there any difference in patterns of use and psychiatric symptom status between
566 injectors and non-injectors of mephedrone? *Hum Psychopharmacol*. 2015
567 Jul;30(4):233–243.
- 568 23. Rajasingham R, Mimiaga MJ, White JM, Pinkston MM, Baden RP, Mitty JA. A
569 systematic review of behavioral and treatment outcome studies among HIV-
570 infected men who have sex with men who abuse crystal methamphetamine. *AIDS*
571 *Patient Care STDs*. 2012 Jan;26(1):36–52.
- 572 24. Grant KM, LeVan TD, Wells SM, Li M, Stoltenberg SF, Gendelman HE, et al.
573 Methamphetamine-associated psychosis. *J Neuroimmune Pharmacol Off J Soc*
574 *Neuroimmune Pharmacol*. 2012 Mar;7(1):113–39.

- 575 25. Corazza O, Assi S, Schifano F. From “Special K” to “Special M”: the evolution of
576 the recreational use of ketamine and methoxetamine. *CNS Neurosci Ther.* 2013
577 Jun;19(6):454–60.
- 578 26. Deimel D, Stover H, Hosselbarth S, Dichtl A, Graf N, Gebhardt V. Drug use and
579 health behaviour among German men who have sex with men: Results of a
580 qualitative, multi-centre study. *Harm Reduct J.* 2016 Dec;13(1):36.
- 581

Table 1. Comparisons between Participants who practiced Chemsex and Participants who practiced Chemsex in terms of type of drug used in the previous year.

	Entire sample (N=216)	Chemsex (n=182)	Slamsex (n=34)	P value
Polydrug No. (%)	98(45.4)	70(38.5)	28(82.4)	.000
Poppers No. (%)	170 (78.7)	140 (76.9)	30 (88.2)	.139
Mephedrone or other cathinones No. (%)	150 (69.4)	116 (63.7)	34 (100)	.000
Cocaine No. (%)	171 (79.1)	146 (80.2)	25 (73.5)	.378
MDMA No. (%)	105 (48.6)	87 (47.8)	18 (52.9)	.582
GHB No. (%)	155 (71.7)	128 (70.3)	27 (79.4)	.280
Crystal methamphetamine No. (%)	64 (29.6)	47 (25.8)	17 (50)	.005
Ketamine No. (%)	78 (36.1)	57 (31.3)	21 (61.8)	.001
Rectal use of drugs No. (%)	44(20.4)	24(13.2)	20(58.8)	.000
High-risk drug use No. (%)	168 (77.8)	135 (74.2)	33 (97.1)	.003

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Table 2. Self-reported psychiatric symptoms during or after chemsex and slamsex.

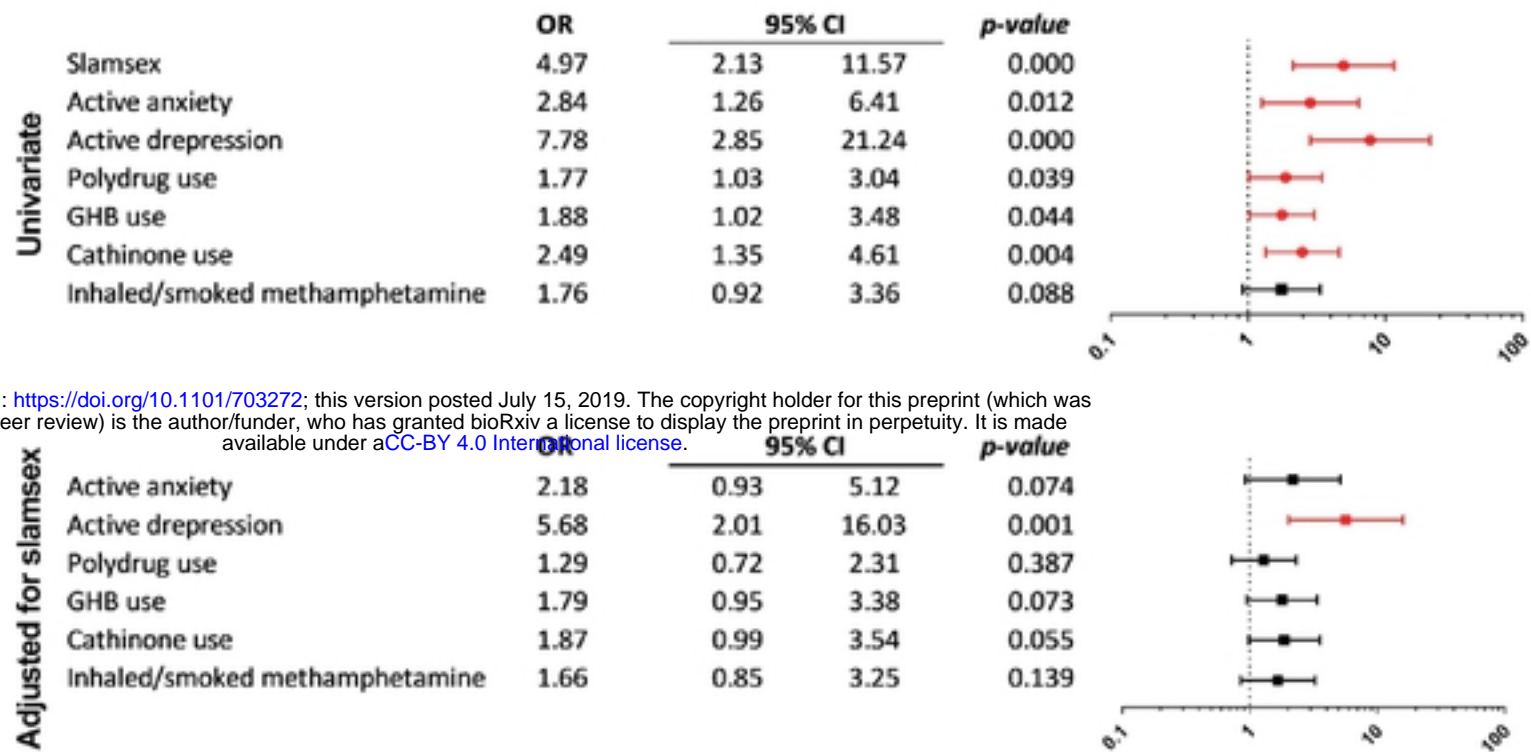
	Entire sample (N=216)	Chemsex (n=182)	Slamsex (n=34)	P value
3 or more dependence symptoms No. (%)	60(27.8)	40(22)	20(58.8)	.000
3 or more withdrawal symptoms No. (%)	98(45.8)	72 (39.6)	26 (76.5)	.000
Intense craving. No. (%)	55 (25.5)	34 (18.5)	21 (61.8)	.000
Interference with work, social or family life No. (%)	68 (31.5)	46 (25.3)	22 (64.7)	.000
Paranoid ideation No. (%)	30 (15.3)	20 (11)	10 (29.4)	.004
Suicidal ideation No. (%)	33 (15.3)	22 (12.1)	11 (32.4)	.003
Suicide attempt No. (%)	30 (13.8)	19 (10.4)	11 (32.4)	.001
Loss of consciousness. No. (%)	33 (15.3)	23 (12.6)	10 (29.4)	.013

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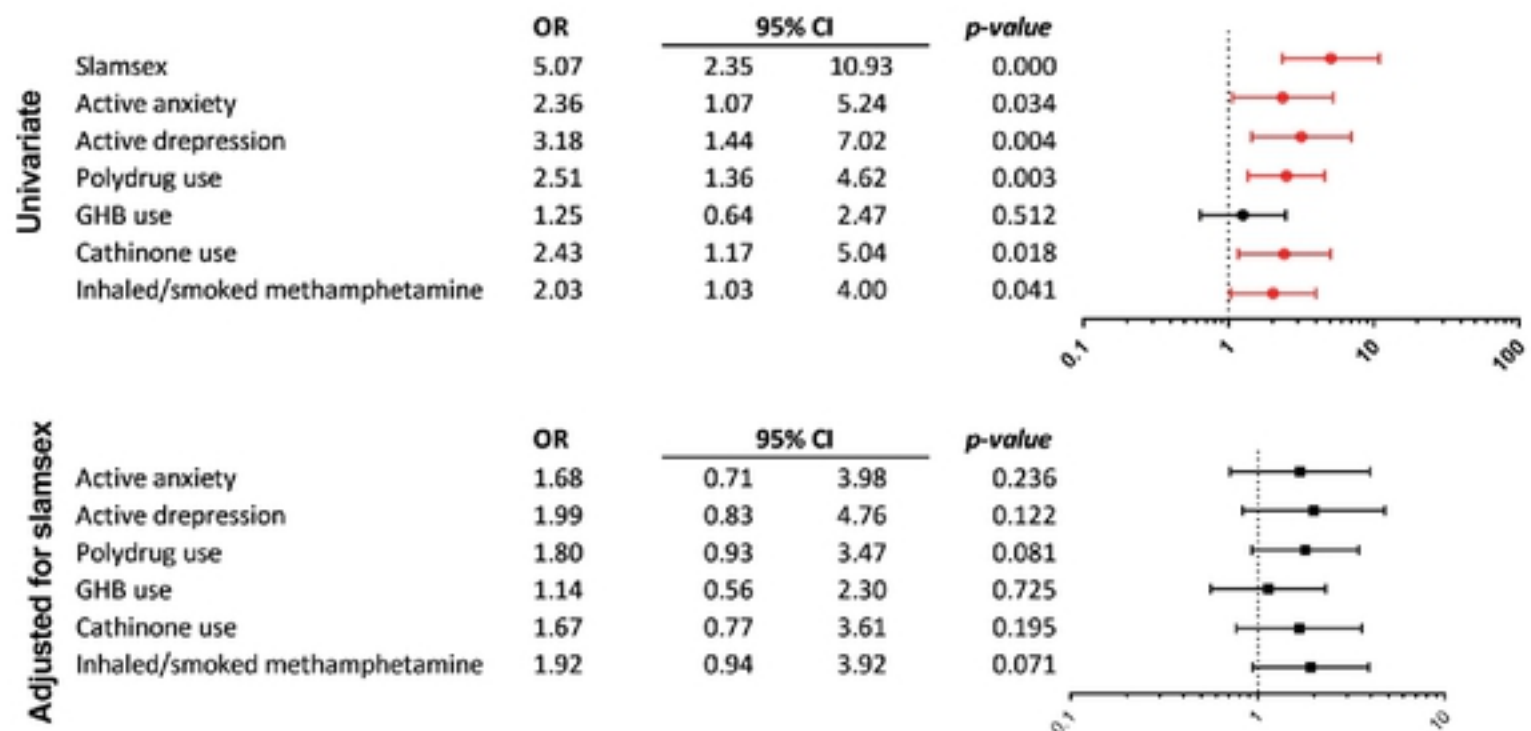
Figures

3 or more withdrawal symptoms

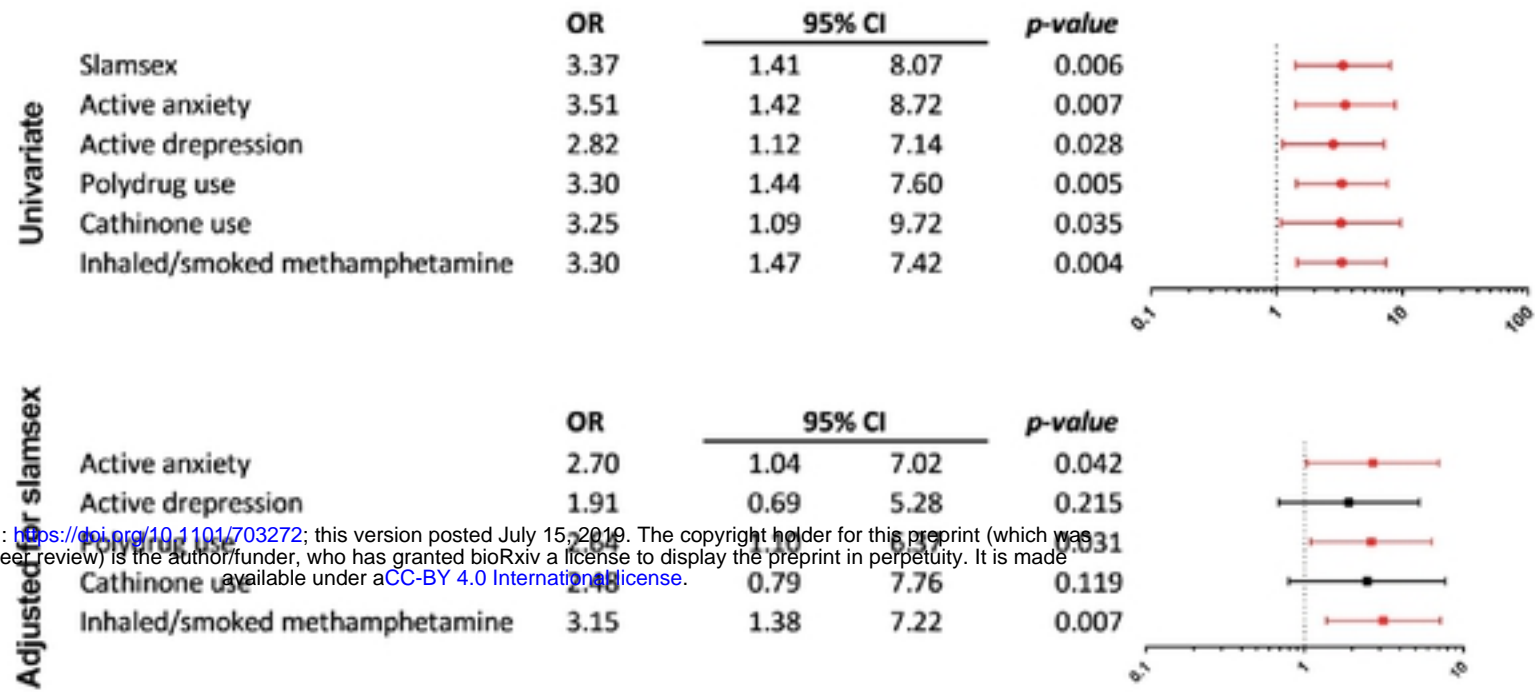


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3 or more drug dependence symptoms

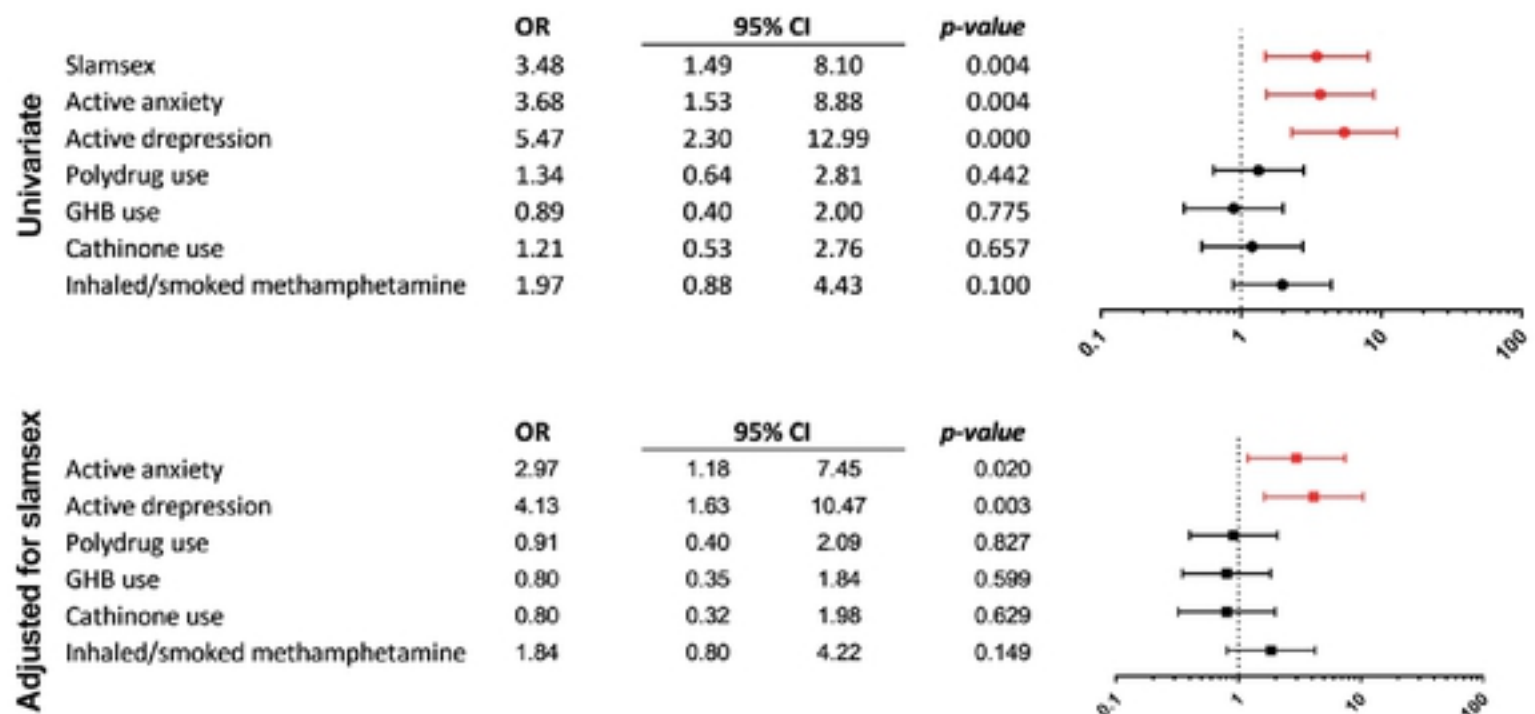


Psychotic symptoms



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Suicidal ideation or attempt



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