HHS Public Access

Author manuscript

Drug Alcohol Depend. Author manuscript; available in PMC 2017 February 22.

Published in final edited form as:

Drug Alcohol Depend. 2016 March 01; 160: 42–48. doi:10.1016/j.drugalcdep.2015.11.037.

Poppers use and risky sexual behaviors among men who have sex with men in Beijing, China

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Abstract

Background—Although poppers are increasingly popular among MSM in China, little is known about the patterns of poppers use. The objectives of this study were to describe the patterns of poppers use and examine its association with sexual behaviors and HIV infection among MSM in Beijing, China.

Methods—As part of a multi-component HIV intervention trial, 3588 MSM were surveyed between March 2013 and March 2014 in Beijing, China. Blood samples were collected and tested for HIV and syphilis. The questionnaire collected information about socio-demographic and behavioral characteristics. Univariate and multivariable logistic regression analyses were performed to evaluate the correlates of poppers use.

Results—Over a quarter of men (27.5%) reported having used at least one type of drugs in the past three months. Poppers were the most popular one (26.8%). Poppers use was correlated with a higher HIV prevalence [odds ratio (OR): 1.38, 95% confidence interval (CI): 1.11–1.70]. Demographic and sexual behavioral factors associated with poppers use included: younger age

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Conflict of interest

The authors have declared that there are no conflicts of interest in relation to the subject of this study.

Contributors

Sten H. Vermund, Yiming Shao, Han-Zhu Qian and Yuhua Ruan developed the investigation concepts, protocol and provided intellectual input on aspects of the research. Tao Teng, Hongyan Lu, Yuejuan Zhao, Lu Yin and Zheya Sun conducted participants recruitment, data collection and quality control. Heng Zhang and Yuhua Ruan conducted analysis of the data and participated in the writing of this manuscript. Xiong He assisted in the data analysis and writing of this manuscript. Hongjie Liu, Han-Zhu Qian and Yuhua Ruan contributed revision of the written manuscript. All authors have approved the final version of the manuscript.

[adjusted OR (AOR): 1.56, 95% CI: 1.25–1.94], higher education (AOR: 1.61, 95% CI: 1.33–1.96), alcohol use (AOR: 1.32, 95% CI: 1.10–1.60), seeking male partners mainly via the internet (AOR: 1.60, 95% CI: 1.28–2.00), multiple male sex partnership (AOR: 2.22, 95% CI: 1.90–2.60), and unprotected receptive anal intercourse (AOR: 1.52, 95% CI: 1.28–1.81).

Conclusions—In this study, poppers use was positively associated with HIV infection and unprotected anal intercourse. Intervention efforts should be devoted to promote safer sex and HIV testing and counseling among MSM who use poppers.

Keywords

Men who have sex with men; HIV; Popper; Unprotected anal intercourse; China

1. Introduction

Since 2007, sexual contact has surpassed injection drug use (IDU) as the primary risk factor for HIV infection in China. For example, in 2011, 81.6% of new HIV infections were caused by sexual transmission including heterosexual and homosexual contacts, while IDU only accounted for 18%. At the national level, the average HIV prevalence among Chinese men who have sex with men (MSM) steadily increased from less than 1% in 2003–4.9% in 2009 (Ministry of Health et al., 2011; Wu et al., 2013).

IDU is rare among Chinese MSM (Nehl et al., 2015); however, use of alcohol and recreational drugs is common (Lu et al., 2013; Xu et al., 2014a,b). Alcohol and recreational drug use may lead to sexual risk-taking behaviors (Jia et al., 2010; Li et al., 2012; Santos et al., 2013). There are two types of illicit drugs in Chinese market, which are associated with HIV infection in different mechanisms: (1) use of the traditional drugs of heroin and opium is associated with HIV risk mainly among injection drug users; and (2) use of recreational drugs or club drugs, which are commonly used for the purpose of increasing euphoria at social venues such as clubs, “raves”, and dance parties (Mansergh et al., 2001; Mattison et al., 2001), may increase HIV risk through increasing unprotected sex and/or number of sexual partners (Bao et al., 2015; Jerome et al., 2009; Yu et al., 2015).

Recent studies have highlighted a higher prevalence of club drugs use among MSM, compared with their heterosexual counterparts (Cheng et al., 2010; Chow et al., 2012; Ford and Jasinski, 2006; Guo et al., 2011; McCabe et al., 2009; Reback et al., 2013; Talley et al., 2010; Tun et al., 2008). Moreover, certain club drugs such as methamphetamine, ecstasy, cocaine/crack, and poppers have been considered as the predictor of high-risk sexual behavior and HIV seroconversion among MSM (Colfax et al., 2005; Kelly et al., 2013; Rusch et al., 2004; Van Tieu and Koblin, 2009; Yu et al., 2015). Since MSM continue to bear the disproportionate disease burden of HIV due to a high probability of transmission for unprotected anal intercourse (UAI) per sexual act (Baggaley et al., 2010), the synergistic relationship between club drug use and risky sexual behavior may further fuel HIV epidemic among MSM (Macdonald et al., 2008). While the association between club drug use and risky sexual behavior has been established, the specific type of drugs and their link with risky sexual behavior are geographically different around the globe (Van Tieu and Koblin, 2009). Previous studies among Chinese MSM have shown that certain club drugs are more

popular than others, especially inhalant nitrites (poppers) (Nehl et al., 2015; Xu et al., 2014a,b).

Poppers belong to amyl, alkyl, or butyl nitrites which used to be a prescription drug applied to relieve angina pectoris due to the vasodilatory effect following the inhalation of its vapor (Haverkos et al., 1994; Romanelli et al., 2004). Poppers are now commonly used primarily by MSM to facilitate sexual intercourse, due to their mechanism of relaxing the anal sphincter and dilating capillaries. Research has documented that poppers use may increase HIV transmission through their engagement in high-risk sex behaviors among MSM (Phillips et al., 2014; Yu et al., 2015). Poppers are not listed as an illicit drug in China, and can be easily purchased through the internet or at adult stores. Although poppers are increasingly popular in MSM community in China, little is known about the patterns of poppers use. The objectives of this study were to describe the patterns of poppers use and examine its association with sexual behaviors and HIV infection among MSM in Beijing, China.

2. Methods

2.1. Study population

The present study was part of the multi-component HIV prevention intervention trial (MP3) among MSM in Beijing, China. The MP3 study consisted of two phases. Data for this analysis are from the Phase I, which was an intervention programe aiming at expanding HIV testing among MSM at the community level through short message service (SMS), community outreach, web advertisement and peer referral interventions. Phase I research was completed from March, 2013 to March, 2014. Participants were recruited by convenience sampling with four intervention measures mentioned above, and the inclusion criteria were: male, at least 18 years old, self-reported sex with men in the last 12 months, currently living in Beijing, and provision of written informed consent. The study protocol was reviewed and approved by the institutional review boards of Vanderbilt University, and National Center for AIDS/STD Control and Prevention (NCAIDS) of China Center for Disease Control and Prevention.

2.2. Questionnaire design

A total of 3588 eligible participants were enrolled into this study; each completed an interviewer-administered standard-structured questionnaire survey. The questionnaire collected the information about socio-demographic characteristics (e.g., age, ethnicity, marital status, education, occupation, personal monthly income, registered Beijing residency and health insurance status), alcohol and drug use (e.g., frequency and amount of alcohol use in the past three months); type and frequency of drugs (e.g., methamphetamine, ecstasy (MDMA), ‘rush’ (poppers), (a kind of processed tablets named in Thai which consist of amphetamine and caffeine), ketamine, cannabis or marijuana, cocaine, opium, heroin, morphine, others), sexual behaviors (e.g., age of sexual debut, venue for seeking male sex partner, lifetime number of sexual partners, number of receptive or insertive anal intercourse and condom use in the past three months), risk perception, and history of HIV testing (e.g., lifetime number of HIV testing, date of testing, testing result, and reasons for no testing).

The question about drug use including poppers was asked as ‘somepeople have tried or used a range of different types of drugs. Which of the following, if any, have you tried or used in the past 3 months and how often?’, and interviewers read out each of the drugs mentioned above, and then participants were asked to chose one of the options of frequency for each drug use—(1) Never; (2) monthly or less; (3) 2–4 times a month; (4) 2–3 times a week; (5) 4 or more times a week. Those who self-reported having ever used two or more drugs in the past three months were classified as “1” (polydrug user), while others were “0” (non-users).

2.3. Laboratory test

Each participant was finger pricked for HIV and syphilis rapid tests using One STEP Anti-HIV1/2 Test (HIV ELISA testing kit 1, Zhuhai Livzon Diagnostics Inc., Zhuhai, China) and One Step Syphilis Anti-TP (Shanghai Kehua Bioengineering Co., Shanghai, China), respectively. For those with positive rapid tests results, 5-mL blood specimens were collected and further screened using another enzyme-linked immunosorbent assay (ELISA) (Beijing Wantai Biological Pharmacy Enterprise Co., Ltd., Beijing, China). Specimens with a positive syphilis rapid test were further screened using toluidine red unheated serum test (TRUST) (Wantai Biological Pharmacy Enterprise Co., Ltd., Beijing, China) and confirmed by *Tre-ponemapallidum* particle assay (TPPA) (Fujirebio, Inc., Tokyo, Japan). Specimens with both positive TRUST and TPPA results were defined as syphilis positive. Specimens with HIV positive ELSIA results was shipped to the central lab for confirmatory test using HIV-1/2 Western blot immune assay (WB) (HIV blot 2.2 WB, MP Biomedicals Asia Pacific Pte., Ltd., Singapore).

2.4. Data analysis

Data were double entered and checked using Epi-data 3.1 (version 3.1; EpiData Association, Odense, Denmark) and analyzed using SAS software (version 9.2; SAS Institute Inc., Cary, NC, USA). We dichotomized the outcome variable, poppers use, to “1” (poppers user) if a participant self-reported having used it at least once in the past three months and “0” (non-user) if not. Chi-square tests were conducted to compare the difference in socio-demographics, alcohol use, sexual behaviors, HIV risk perception, HIV and syphilis infection by poppers use status. Factors associated with poppers use were evaluated using logistic regression analyses. Variables with P values less than 0.1 in the univariate analyses were entered in a multivariable stepwise logistic regression analysis model, and variables with P values less than 0.05 were retained in the final model. Adjusted odds ratios (AOR) were calculated along with 95% confidence intervals (CI). The relationship between poppers use and HIV infection was also evaluated using logistic regression.

3. Results

3.1. Characteristics of participants

A total of 3760 participants were recruited in the Phase I of MP3. Of all participants, 172 were excluded for the following reasons: repeated testing (126), previous positive (30), not MSM (5), no blood collection (5), invalid study identification (4), and lack of questionnaire (2). Of the 3588 eligible participants included in the analysis, the mean age was 30 years old (range 18–75), and the majority were Han ethnics (93.7%), never married (80.7%), had

attended college or higher (71.9%), had a full-time job (80.6%), and were migrants (without registered household in Beijing) (75.2%). Forty-three men (1.2%) reported polydrug use in the past three months. Compared with non-users, poppers users tend to be younger (86.6%), never married (88.1%), having a higher education (80.1%) and a higher monthly income (64.6%), and seeking male partners mainly through the internet (86.8%). All the 43 polydrug users except one reported using poppers (Table 1).

3.2. Drug use, risky sex, and HIV/syphilis infections

Among 3588 participants, about a quarter of men (27.5%) reported having used at least one type of drugs in the past three months. Of all participants, 26.8% (961) reported having used poppers at least once in the past three months, of whom 63.7% (612) used it 1–3 times, 27.8% (267) used it 2–3 times every month, and 8.5% (82) used it 2 or more times every week; and the proportions of using other drugs were 1.5% (53) for methamphetamine, 0.3% (10) for marijuana, 0.2% (8) for ecstasy, 0.2% (6) for ketamine, and 0.1% (3) for ‘magu’

Compared with non-users, poppers users were more likely to report drinking alcohol before sex (OR, 1.38; 95% CI, 1.16–1.64), having more than one male sex partners (OR, 2.13; 95% CI, 1.83–2.48), unprotected anal intercourse (UAI) (OR, 1.38; 95% CI, 1.18–1.60) especially unprotected receptive anal intercourse (URAI) (OR, 1.71; 95% CI, 1.45–2.02), but they were less likely to report having sex with female sex partners (OR, 0.51; 95% CI, 0.38–0.68; Table 2).

As shown in Table 3, poppers use was associated with a higher odds of HIV infection (OR, 1.38; 95% CI, 1.11–1.70), but was not associated with syphilis infection (OR, 1.06; 95% CI, 0.80–1.40). Polydrug use was associated with a higher odds of both HIV infection (OR, 4.64; 95% CI, 2.50–8.62) and syphilis infection (OR, 2.88; 95% CI, 1.32–6.26).

3.3. Demographic and sexual behavioral factors associated with poppers use

Multivariate logistic regression analysis showed that poppers use was significantly associated with younger age (18–34 compared to 35–75 years: AOR, 1.56; 95% CI: 1.25–1.94), higher education level (compared to lower than college: AOR, 1.61; 95% CI: 1.33–1.96), drinking alcohol before sex (AOR, 1.32; 95% CI, 1.10–1.60), using the internet as the most common venue for seeking male partners (AOR 1.60; 95% CI 1.28–2.00), multiple male sex partnership (AOR, 2.22; 95% CI, 1.90–2.60), URAI (AOR, 1.52; 95% CI, 1.28–1.81), and heterosexual partnership (AOR, 0.66; 95% CI, 0.49–0.89; Table 4).

4. Discussion

In this study, poppers were the most common drug used among MSM, and over a quarter of MSM reported having used them in the past three months. The prevalence is similar to those reported from other studies conducted in Beijing (28.3%; Wang et al., 2015) and Shenyang (26.5%; Xu et al., 2014b), but lower than the lifetime use rate (47.3%) and 1-year use rate (42.3%) among MSM in Beijing (Li et al., 2014). Previous studies in the United States, Canada and Brazil have reported that the most popular drugs used among MSM are methamphetamine, marijuana or ecstasy (Mansergh et al., 2006; Patterson et al., 2005; Rajasingham et al., 2012; Ramchand et al., 2013; Reback et al., 2013; Remy et al., 2013;

Rusch et al., 2004). The popularity of poppers use among Chinese MSM, instead of other drugs such as methamphetamine, might be because poppers are not illicit drugs in China and are widely available in adult stores or can be purchased through the internet. It is also possible that MSM underreported other drugs due to their illegal nature in China.

Poppers use, as a predictor of HIV infection, has been well documented in previous studies (Haverkos et al., 1994; Lampinen et al., 2007; Plankey et al., 2007). Our study also indicated poppers use was associated with a higher probability of HIV infection among MSM. MSM with younger age, higher education, and seeking male partners through the internet were more likely to use poppers. As younger and highly educated MSM may be more familiar with the internet and have easy access to poppers and broader social network through cyber connections, they are more likely to use poppers. Drug surveillance and intervention should be prioritized on this subgroup of MSM. In addition, nearly 80% of MSM reported the internet as the most common venue for seeking sexual partners, and using it for seeking sexual partners is also associated with more casual sex partners and unprotected anal intercourse (Lewnard and Berrang-Ford, 2014; Yu et al., 2015). Therefore, internet use may play an important role in facilitating poppers use and risky behaviors including UAI and multiple sex partners (Macdonald et al., 2008; Zou et al., 2010). On the other hand, since most of MSM have access to the internet, the use of the internet and other internet based social networks such as mobile apps (“Weibo”, QQ, “WeChat”, etc.) may be a promising way to deliver interventions for reducing the risks of substance use and HIV transmission.

Our study found that poppers users were more likely to engage in URAI but not unprotected insertive anal intercourse (UIAI). Two reasons may explain this result. First, men who take the receptive position in anal intercourse may be more likely to use poppers due to the effect of dilating the anal sphincter which reduce pains during intercourse. Furthermore, a receptive anal intercourse position is associated with less likelihood of condom use, since men who take the insertive position have more autonomy of determining condom use (Zhang et al., 2015). Second, like other club drugs, poppers also have the pharmacological and neurological effects on sexual behaviors such as promoting sexual desire, reducing sexual inhibition, modifying mental states, and decreasing physical experiences of pain (Drumright et al., 2006; Yang and Xia, 2010), which may further prevent poppers users from using condoms. Moreover, poppers have also been reported as a common drug in group sex (Prestage et al., 2011), which may also explain low condom use in these events (Phillips et al., 2014).

Alcohol use during sex has been acknowledged to be independently associated with sexual risk among MSM (Colfax et al., 2004; Folch et al., 2010; Hidaka et al., 2006). Our study showed that drinking alcohol before sex was more common among poppers users compared with non-users. However, as our study could not determine whether alcohol use and poppers use co-occurred in one sex context, further studies based on event-level of poly-substance use are needed to clarify the effects of their use on sexual risk. In our study, the prevalence of polydrug use was much lower (1.2%) compared with previous research among MSM in Asia, in which 10.6% reported polydrug use (Chow et al., 2013). However, our study consistently indicated its association with HIV and syphilis infection. Moreover, it should be noticed that almost all polydrug users also used poppers. Since poppers are widely available

in China, it is not surprising that polydrug users were more likely to use them as this group of men were also inclined to get access to more information about poppers. Significantly lower prevalence of reported polydrug use might be due to other drugs'illegal status in China, such as methamphetamine, ecstasy, or ketamine. Given that polydrug use was associated with HIV/syphilis infection, interventions should take into account poppers use as well as polydrug use among MSM and future researches are needed to clarify the context of polydrug use and its influence on the risk of HIV infection.

The strengths of this study include large sample size and community sample. However, it has some limitations. First, we measured poppers use and sexual behaviors in three months instead of in each sex act. We did not collect event-level data and asked the participants whether poppers were used during a specific sexual incident. Therefore, even though the temporal co-occurrence of poppers use and sexual behavior can be assumed as previous research has shown that poppers are usually used in the context of anal sex (Colfax and Guzman, 2006), the concurrency of poppers use and risky sexual behaviors cannot be determined in this study. In addition, cross-sectional and observational data are insufficient to directly conclude the causal relationship between popper use and unsafe sex. Finally, social desirability and recall bias might both lead to under-report of poppers use and risky sex behavior, while the non-differential under-report might lead to under-estimation of the association between poppers use and risky sex behaviors, and differential under-report might lead to over-estimation or under-estimation of the effect.

In conclusion, our study indicated that poppers were the most popular drug used among MSM in Beijing, which was correlated with a higher HIV prevalence, and their use was positively associated with high risk sex behavior such as URAI and multiple sex partners, which may further aggravate the epidemic of HIV among this group. Furthermore, given the fact that it is not listed as an illicit drug and widely available in China, it is imperative for interventionists to take into account poppers use patterns and its association with risky sex behaviors among MSM. Interventions that target factors and mechanism (e.g., stress, arousal, self-efficacy) of poppers use and sexual risk should be more effective. Future studies based on event-level method are also urgently needed to develop a more comprehensive picture of the co-occurrence of poppers or other substance use and sex behavior and their interactions, which will provide improved measurement models to inform substance use and HIV intervention.

Acknowledgments

Role of funding source

Nothing declared.

This work was supported by grants from the U.S. National Institute of Allergy and Infectious Diseases of the National Institutes of Health (R01AI094562 and R34AI091446), the National Natural Science Foundation of China (11471336), the Ministry of Science and Technology of China (2012ZX10001-002) and the International Development Research Center of Canada (104519-010).

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Table 1

Comparison of characteristics among MSM in Beijing by poppers using status in the past three months.

Variable	Total (*n*, %)	Poppers users (*n*, %)	Non-users (*n*, %)	*P* value
Total	3588 (100.0)	961 (26.8)	2627 (73.2)	
Age (year)				<0.001
18–34	2838 (79.2)	831 (86.6)	2007 (76.5)	
35–75	747 (20.8)	129 (13.4)	618 (23.5)	
Ethnicity				0.008
Han	3361 (93.7)	883 (91.9)	2478 (94.3)	
Other	227 (6.3)	78 (8.1)	149 (5.7)	
Current marital status				<0.001
Single	2896 (80.7)	847 (88.1)	2049 (78.0)	
Married, divorced or widowed	692 (19.3)	114 (11.9)	578 (22.0)	
Living situation				<0.001
Cohabiting with female partner	254 (7.1)	42 (4.4)	212 (8.1)	
Cohabiting with male partner	639 (17.8)	168 (17.5)	471 (17.9)	
Living alone	2695 (75.1)	751 (78.2)	1944 (74.0)	
Education				<0.001
Lower than college	1009 (28.1)	191 (19.9)	818 (31.1)	
College or higher	2579 (71.9)	770 (80.1)	1809 (68.9)	
Occupation				<0.001
Employed full time	2893 (80.6)	812 (84.5)	2081 (79.2)	
Student	388 (10.8)	98 (10.2)	290 (11.0)	
Part time, unemployed, or retired	307 (8.6)	51 (5.3)	256 (9.7)	
Monthly income (CNY)				<0.001
<5000	1698 (47.3)	340 (35.4)	1358 (51.7)	
≥5000	1890 (52.7)	621 (64.6)	1269 (48.3)	
Birth place				<0.001
Big city	903 (25.2)	269 (28.0)	634 (24.1)	
Middle or small city	1534 (42.8)	439 (45.7)	1095 (41.7)	
Village or town	1151 (32.1)	253 (26.3)	898 (34.2)	
Registered Beijing residency				0.607
Yes	889 (24.8)	244 (25.4)	645 (24.6)	
No	2699 (75.2)	717 (74.6)	1982 (75.5)	
Most common venue for seeking male partners				<0.001
Internet	2838 (79.1)	834 (86.8)	2004 (76.3)	
Other	750 (20.9)	127(13.2)	623(23.7)	
Perceived risk of HIV from male-to-male sex contacts				<0.001
None	220 (6.1)	28(2.9)	192(7.3)	
Small	1906 (53.1)	498(51.8)	1408(53.6)	
Moderate	1131 (31.5)	322(33.5)	809(30.8)	
Great	331 (9.2)	113(11.8)	218(8.3)	

Variable	Total (*n*, %)	Poppers users (*n*, %)	Non-users (*n*, %)	*P* value
Frequency of HIV tests in lifetime				0.038
Never	1054 (29.4)	255(26.5)	799(30.4)	
1–3	1377 (38.4)	397(41.3)	980(37.3)	
4–	1157 (32.3)	309(32.2)	848(32.3)	
Polydrug use				<0.001 *
Yes	43 (1.2)	42 (4.4)	1 (0.0)	
No	3545 (98.8)	919 (95.6)	2626 (100.0)	

* Fisher exact probability.

Table 2

Comparison of risky behaviors among MSM in Beijing by poppers using status in the past three months.

Variable	Total (*n*, %)	Popper users (*n*, %)	Non-users (*n*, %)	*P* value	OR (0.95% CI)
Total	3588 (100.0)	961 (26.8)	2627 (73.2)		
Drinking alcohol before sex					
No	2850 (79.4)	725 (75.4)	2125 (80.9)		
Yes	738 (21.6)	236 (24.6)	502 (19.1)	<0.001	1.38 (1.16–1.64)
Number of male sex partners					
≤1	1879 (52.4)	372 (38.7)	1507 (57.4)		
≥2	1709 (47.6)	589 (61.3)	1120 (42.6)	<0.001	2.13 (1.83–2.48)
Any unprotected anal intercourse					
No	2181 (60.8)	530 (55.2)	1651 (62.9)		
Yes	1407 (39.2)	431 (44.9)	976 (37.2)	<0.001	1.38 (1.18–1.60)
Unprotected receptive anal intercourse					
No	2743 (76.4)	663 (69.0)	2080 (79.2)		
Yes	845 (23.6)	298 (31.0)	547 (20.8)	<0.001	1.71 (1.45–2.02)
Unprotected insertive anal intercourse					
No	2706 (75.4)	722 (75.1)	1984 (75.5)		
Yes	882 (24.6)	239 (24.9)	643 (24.5)	0.809	1.02 (0.86–1.21)
Male commercial sex					
No	3488 (97.2)	930 (96.8)	2558 (97.4)		
Yes	100 (2.8)	31 (3.2)	69 (2.5)	0.334	1.24 (0.80–1.90)
Oral sex with any HIV positive male sex partner					
No	3500 (97.5)	940 (97.8)	2560 (97.5)		
Yes	88 (2.5)	21 (2.2)	67 (2.6)	0.531	0.85 (0.52–1.40)
Receptive anal sex with any HIV positive male sex partner					
No	3539 (98.6)	947 (98.5)	2592 (98.7)		
Yes	49 (1.4)	14 (1.5)	35 (1.3)	0.776	1.10 (0.59–2.04)
Insertive anal sex with any HIV positive male sex partner					
No	3521 (98.1)	944 (98.2)	2577 (98.1)		
Yes	67 (1.9)	17 (1.8)	50 (1.9)	0.792	0.93 (0.53–1.62)

Variable	Total (*n*, %)	Popper users (*n*, %)	Non-users (*n*, %)	*P* value	OR (0.95% CI)
Sex with female sex partners					
No	3213 (89.5)	899 (93.6)	2314 (88.1)		
Yes	375 (10.5)	62 (6.5)	313 (11.9)	<.0001	0.51 (0.38–0.68)

Table 3

Prevalence of HIV/syphilis infections among MSM in Beijing by poppers and polydrug using status in the past three months.

	Poppers				
	Total (*n*, %)	**users (*n*, %)**	**Non-users (*n*, %)**	***P* value**	**OR (95% CI)**
	3588 (100.0)	961 (26.8)	2627 (73.2)		
HIV infection					
Yes	455 (12.7)	148(15.4)	307(11.7)	0.003	1.38 (1.11–1.70)
No	3133 (87.3)	813 (84.6)	2320(88.3)		
Syphilis infection					
Yes	269 (7.5)	75(7.8)	194(7.4)	0.673	1.06 (0.80–1.40)
No	3319 (92.5)	886(92.2)	2433(92.6)		
	Polydrug				
	3588 (100.0)	43 (1.2)	3545 (98.8)		
HIV infection					
Yes	455 (12.7)	17 (39.5)	438 (12.4)	<0.0001	4.64 (2.50–8.62)
No	3133 (87.3)	26 (60.5)	3107 (87.6)		
Syphilis infection					
Yes	269 (7.5)	8 (18.6)	261 (7.4)	0.009*	2.88 (1.32–6.26)
No	3319 (92.5)	35 (81.4)	3284 (92.6)		

*Fisher exact probability.

Table 4

Multivariable logistic regression analysis of factors associated with poppers use in the past three months among MSM in Beijing, China.

Variable	β	Wald x^2	AOR (95% CI)	*P* value
Age (years)				
35–75			1.00	
18–34	0.44	15.22	1.56 (1.25–1.94)	<0.001
Education				
Lower than college			1.00	
College or higher	0.48	22.95	1.61 (1.33–1.96)	<0.001
Drinking alcohol before sex				
No			1.00	
Yes	0.28	8.78	1.32 (1.10–1.60)	0.003
Most common venue for seeking male partners				
Other venues			1.00	
Internet	0.47	17.10	1.60 (1.28–2.00)	<0.001
Number of male sex partners				
≤1			1.00	
≥2	0.80	99.83	2.22 (1.90–2.60)	<0.001
Any unprotected receptive anal intercourse				
No			1.00	
Yes	0.42	22.45	1.52 (1.28–1.81)	<0.001
Sex with female sex partners				
No				
Yes	− 0.42	7.49	0.66 (0.49–0.89)	0.006