

# Factors associated with unprotected anal intercourse among male students who have sex with men in three Northern regions of China

De-Chuan Zhang<sup>1,2</sup>, Zun-You Wu<sup>1,2</sup>, Sarah Robbins Scott<sup>2</sup>

<sup>1</sup>Department of Epidemiology and Biostatistics, School of Public Health, Anhui Medical University, Hefei, Anhui 230032, China;

<sup>2</sup>National Center for AIDS/STD Control and Prevention, Chinese Center for Disease Control and Prevention, Beijing 102206, China.

## Abstract

**Background:** Unprotected anal intercourse (UAI) has previously been associated with human immunodeficiency virus (HIV) infection. Male students who have sex with men (SMSM) are at increased exposure to experience UAI. The aim of this study was to investigate the status of UAI and related factors among SMSM in three northern regions of China.

**Methods:** From November 2018 to January 2019, SMSM, 18 years or older, studying or living in Beijing, Tianjin, or Shijiazhuang, who had anal sex in the past 6 months were recruited by community-based organizations to participate in an unmatched, case-control study. Detailed demographic and behavioral information were collected via self-administrated electronic questionnaires and factors related to UAI were assessed using uni- and multivariate logistic regression analyses.

**Results:** Among the 511 SMSM included in the study, 210 (41.1%) reported UAI in the past 6 months. SMSM who had sexual partners at least 10 years older than themselves (odds ratio [OR] = 2.277, 95% confidence interval [CI]: 1.380–3.756), used vacant capsules before sexual activity (OR = 3.858, 95% CI: 1.472–10.106), had a self-perceived moderate-HIV risk (OR = 2.128, 95% CI: 1.403–3.227), and unprotected, first anal intercourse (OR = 2.236, 95% CI: 1.506–3.320) had increased odds of UAI.

**Conclusions:** Factors associated with increased odds of engaging in UAI in the past 6 months among SMSM included having older sexual partners, using vacant capsules, having a self-perceived moderate risk of HIV, and unprotected, first anal intercourse. Continuing education on risk reduction, including improving condom decision making in age-discordant relationships could help address the sexual risk behaviors among SMSM.

**Keywords:** Students; Men who have sex with men; Unsafe Sex; China

## Introduction

The prevalence of human immunodeficiency virus (HIV) infection among the general population of men who have sex with men (MSM) in China is increasing. The overall prevalence among MSM in the country increased from 0.9% in 2003<sup>[1]</sup> to 8.0% in 2015.<sup>[2]</sup> Male students who have sex with men (SMSM), a unique subgroup of MSM, were also found to have increasing HIV prevalence across China. The number of HIV infections among young students aged 15 years and over more than quadrupled in a 6-year period; rising from 527 cases in 2008 to 2695 cases in 2014. Male-to-male sexual transmission was found to be the main driver of these new cases.<sup>[3]</sup> A recent meta-analysis also showed that the prevalence of HIV infection among SMSM in China was on the rise, from 3.0% in 2003 to 2006, to 4.5% in 2007 to 2008,<sup>[4]</sup> and 5.2% in 2012 to 2016.<sup>[5]</sup> This increasing trend of HIV prevalence among young MSM

highlights a unique risk population, which may impact ongoing transmission of HIV in the country.

Beijing, Tianjin, and Shijiazhuang are home to a large proportion of colleges and universities in China, and subsequently, an extensive number of university students with a sizeable number of SMSM. As such, male to male sexual transmission of HIV among SMSM in these cities has recently been a topic of research. A previous study from Tianjin estimated that the number of SMSM in the city may be as high as 10,000 individuals,<sup>[6]</sup> with an HIV antibody positive detection rate increasing from 0.95% in 2012 to 4.03% in 2016.<sup>[7]</sup> In Beijing, more than 85% of newly diagnosed HIV-infected students were infected through male homosexual transmission in 2016.<sup>[8]</sup> Few studies exist in these cities, however, that aim to understand the factors associated with sexual risk behaviors, including unprotected anal intercourse (UAI), among SMSM.

## Access this article online

Quick Response Code:



Website:  
www.cmj.org

DOI:  
10.1097/CM9.0000000000000311

**Correspondence to:** Prof. Zun-You Wu, National Center for AIDS/STD Control and Prevention, Chinese Center for Disease Control and Prevention, 155 Changbai Road, Beijing 102206, China  
E-Mail: wuzy@263.net

Copyright © 2019 The Chinese Medical Association, produced by Wolters Kluwer, Inc. under the CC-BY-NC-ND license. This is an open access article distributed under the terms of the Creative Commons Attribution-Non Commercial-No Derivatives License 4.0 (CCBY-NC-ND), where it is permissible to download and share the work provided it is properly cited. The work cannot be changed in any way or used commercially without permission from the journal.

Chinese Medical Journal 2019;132(14)

Received: 16-03-2019 Edited by: Peng Lyu

Previous studies indicate that young men who have sex with men exhibit high risk-sexual behaviors, such as having multiple sexual partners, having older partners, and low rates of condom use, all of which have the potential to increase the spread HIV.<sup>[5,9-11]</sup> UAI with HIV-positive individuals has been found to be a main driver of HIV infection among SMSM.<sup>[7]</sup> A previous, unpublished study in Kunming, China reported that among the 104 SMSM sampled, the proportion of UAI in the last 6 months was as high as 70.1%.<sup>[12]</sup> As such, strategies that aim to curtail the ongoing occurrence of UAI among SMSM can help manage the potential transmission of HIV in this group. In the present study, we explore the status of UAI and related factors among SMSM in Beijing, Tianjin, and Shijiazhuang, so as to provide a basis for the development of targeted HIV prevention strategies for SMSM in China.

## Methods

### Ethical approval

The ethics committee of the National Centers for AIDS/ Sexually Transmitted Diseases Control and Prevention of the Chinese Center for Disease Control and Prevention (NCAIDS/CHINA CDC) (No. KX180810524) approved this study. Each eligible participant signed an online, informed consent form before starting an electronic questionnaire. The survey was anonymous and did not collect any personally identifiable information from participants.

### Study design and setting

This case-control study, based on a cross-sectional survey, was conducted from November 2018 to January 2019 in Beijing, Tianjin, and Shijiazhuang, China. Based on our preliminary investigation,<sup>[13]</sup> we identified 13 variables that may be associated with UAI among SMSM. Relevant exposure information for cases and controls was collected and compared to identify factors related to UAI in the past 6 months.

### Participants

Three non-governmental organizations (NGOs), which work closely with the MSM community in the three cities, recruited participants via convenience sampling. Potential participants were all students who met the following inclusion criteria. (1) biologically male; (2) aged  $\geq 18$  years; (3) full-time students; (4) had anal intercourse with a man in the last 6 months; (5) volunteered to participate in the online survey and complete the electronic informed consent form. Individuals who had previously been diagnosed with HIV were excluded from the study. Participants who self-reported UAI in the past 6 months were defined as a case, while participants who self-reported no UAI in the past 6 months were defined as a control.

### Data collection

The survey collected data on the occurrence of UAI in SMSM. In addition, socio-demographic characteristics (age, education level, self-reported sexual orientation, and

preferred sexual position), sexual behaviors in the past 6 months (number of anal sexual partners, whether had sex with older partners), substance use before sex in past 6 months (alcohol, poppers [psychoactive inhalants] and vacant capsules [a controlled substance which has been used to improve sexual pleasure]), self-perception of HIV risk, first anal intercourse (age at first anal intercourse, career and age of first anal sexual partner, and condom use) were also collected in the survey.

### Definitions

In this study, education was categorized as senior grade, middle grade (sophomore or junior), or junior grade (freshman or below). Older male partner was defined as a male sex partner who was at least 10 years older than the index participant. Substance use was coded as a dichotomous variable (yes/no). Not using condoms or using condoms but taking it off during intercourse were considered as UAI.

### Statistical analysis

All analyses were performed using SPSS 16.0 (SPSS Inc. Released 2007, SPSS for Windows, Chicago, IL, USA). First, descriptive statistics were summarized for demographic characteristics, drug use, sexual risk behaviors, and self-perception of HIV risk. Univariate and multivariate unconditional logistic regression analyses were used to identify the factors associated with UAI between the cases and controls. Variables selected in the multivariate analysis were based on their associations with the outcome variables in univariate analysis ( $P < 0.10$ ). The forward selection was used, retaining variables with  $P < 0.10$ . A two-sided  $P$ -value of  $< 0.05$  was considered as statistically significant.

## Results

### Characteristics of participants

A total of 511 SMSM living or studying in the Beijing, Tianjin, and Shijiazhuang metropolitan areas were included in the present analysis. There were 168 (32.88%) participants from Beijing, 194 (37.96%) from Tianjin, and 149 (29.16%) from Shijiazhuang. As seen in Table 1, of the 511 participants, the mean age was 20.00 ( $20.07 \pm 1.95$ ) years. About 305 (59.7%) participants were in middle grade, 469 (91.8%) reported being homosexual, and 333 (65.2%) had two or more sexual partners in the past 6 months. More than two-thirds of participants (331, 64.8%) never had sex with an older partner, while 93 (18.2%) reported having intercourse with an older partner in the past 6 months. Less than half (210, 41.1%) of participants reported having UAI in the past 6 months. The proportion of SMSM with unprotected sexual behaviors in Beijing, Tianjin and Shijiazhuang was 43.5% (73/168), 43.8% (85/194), and 34.9% (52/149), respectively.

### Correlates of unprotected anal intercourse

According to the preliminary investigation, 13 variables were related to UAI and selected for the univariate

**Table 1: Characteristics of student men who have sex with men from Beijing, Tianjin, and Shijiazhuang reporting protected and unprotected anal intercourse.**

Parameters	UAI (n = 210)	Non-UAI (n = 301)	Total (n = 511)
Age (years)	20.02 ± 1.95	20.11 ± 1.95	20.07 ± 1.95
Education			
Junior grade	27 (12.86)	32 (10.63)	59 (11.55)
Middle grade	133 (63.33)	172 (57.14)	305 (59.69)
Senior grade	50 (23.81)	97 (32.23)	147 (28.77)
Sexual identify			
Gay	191 (90.95)	278 (92.36)	469 (91.78)
Bisexual	17 (8.10)	20 (6.64)	37 (7.24)
Unsure	2 (0.95)	3 (1.00)	5 (0.98)
Sexual position			
Insertive	35 (16.67)	61 (20.27)	96 (18.79)
Receptive	58 (27.62)	76 (25.25)	134 (26.22)
Versatile	117 (55.71)	164 (54.59)	281 (54.99)
Number of male partners in the last 6 months (≥2)	141 (67.14)	192 (63.79)	333 (65.17)
Sex with an older male partner			
Never had	110 (52.38)	221 (73.42)	331 (64.77)
Had in a lifetime but not in the last 6 months	46 (21.90)	41 (13.62)	87 (17.03)
Had in last 6 months	54 (25.71)	39 (12.96)	93 (18.20)
Substance use before sex in the past 6 months (yes)			
Alcohol	14 (6.67)	16 (5.32)	30 (5.87)
Poppers	111 (52.86)	142 (47.18)	253 (49.51)
Vacant capsules	22 (10.48)	6 (1.99)	28 (5.48)
Self-perceived HIV-infection risk			
No/low risk	102 (48.57)	198 (65.78)	300 (58.71)
Medium risk	84 (40.00)	71 (23.59)	155 (30.33)
High risk	24 (11.43)	32 (10.63)	56 (10.96)
Age at first anal intercourse with a man (<18 years)	67 (31.90)	83 (27.57)	150 (29.35)
Career of first anal intercourse partner			
Non-student	97 (46.19)	113 (37.54)	210 (41.10)
Student	113 (53.81)	188 (62.46)	301 (58.90)
First anal sexual partner was older partner (yes)	11 (5.24)	23 (7.64)	34 (6.65)
First anal intercourse were unprotected (yes)	98 (46.67)	79 (26.25)	177 (34.64)

Data are shown as mean ± standard deviation or *n* (%). HIV: Human immunodeficiency virus; UAI: Unprotected anal intercourse.

analyses. As shown in Table 2, univariate analyses indicated that having older sexual partners in the past 6 months, using vacant capsules, self-perceiving moderate HIV risk, and unprotected, first anal intercourse were associated with increased odds of UAI. In the adjusted model, multivariate analysis demonstrated that having an older sexual partner in the past 6 months (odds ratio [OR] = 2.277, 95% confidence interval [CI]: 1.380–3.756), using vacant capsules (OR = 3.858, 95% CI: 1.472–10.106), self-perceiving moderate HIV-infection risk (OR = 2.128, 95% CI: 1.403–3.227), and unprotected first anal intercourse (OR = 2.236, 95% CI: 1.506–3.320) were independent factors of UAI in the past 6 months [Table 2].

## Discussion

This serves as one of the rare studies, to our knowledge, to assess sexual risk behaviors, particularly factors associated with UAI, among SMSM in three cities of China. In this study, 41.1% of SMSM reported UAI in the past 6 months.

Findings from this study indicate that while less than 10% SMSM reported that their first sexual partner was more than 10 years older than them, 35.2% of SMSM had at least one older partner during their lifetime and 18.2% of SMSM had anal intercourse with an older partner in the last 6 months. Another study from China found similar rates of intercourse with an older partner. The study, among young men who have sex with men in Shanghai, China, reported that more than 40% of young MSM had sex with an older male partner in their lifetime and more than 20% reported sex with an older male partner in the last 3 months.<sup>[14]</sup> The desire for stable, emotionally mature relationships and integrating into the larger gay community have been cited as reasons for why young MSM engage with older sexual partners.<sup>[15]</sup> However, age-discordant couples have been associated with higher sexual risk behaviors. Previous studies have shown that MSM with older sexual partners may also have an increased risk of HIV infection,<sup>[14,16]</sup> as older partners are more likely to be HIV positive compared to their younger MSM partners.<sup>[16]</sup> MSM with older sexual partners are also more likely to engage in UAI.<sup>[14]</sup> Our study indicated that while the majority (64.8%) of SMSM reported they had

**Table 2: Univariate and multivariate logistic regression analysis of factors associated with UAI in the past 6 months among student men who have sex with men from Beijing, Tianjin, and Shijiazhuang.**

Parameters	Unadjusted OR (CI)	P	Adjusted OR (CI)	P
Education				
Junior grade	1.000		–	
Middle grade	0.916 (0.524–1.604)	0.760	–	–
Senior grade	0.611 (0.330–1.130)	0.117	–	–
Sexual identify				
Gay	1.000		–	
Bisexual	1.237 (0.632–2.423)	0.535	–	–
Unsure	0.970 (0.161–5.862)	0.974	–	–
Sexual position				
Insertive	1.000		–	
Receptive	1.330 (0.777–2.278)	0.299	–	–
Versatile	1.243 (0.771–2.006)	0.372	–	–
Number of male partners in the last 6 months ( $\geq 2$ )	1.16 (0.800–1.682)	0.434	–	–
Sex with an older male partner				
Never had	1.000		1.000	
Had in lifetime but not in the last 6 months	2.254 (1.396–3.639)	0.001	1.853 (1.118–3.073)	0.017
Had in last 6 months	2.782 (1.737–4.456)	<0.001	2.277 (1.380–3.756)	0.001
Substance use before sex in the past 6 months (yes)				
Alcohol	1.272 (0.607–2.667)	0.524		
Poppers	1.255 (0.882–1.787)	0.207		
Vacant Capsules	5.754 (2.291–14.452)	<0.001	3.858 (1.472–10.106)	0.006
Self-perceived HIV-infection risk				
No/low risk	1.000		1.000	
Medium risk	2.297 (1.545–3.413)	<0.001	2.128 (1.403–3.227)	<0.001
High risk	1.456 (0.815–2.602)	0.205	0.983 (0.526–1.840)	0.958
Age at first anal intercourse with a man (<18 years)	1.231 (0.837–1.808)	0.291	–	–
Career of first anal intercourse partner				
Non-student	1.000		–	
Student	1.428 (0.999–2.043)	0.051	–	–
First anal sexual partner was older partner (yes)	0.668 (0.318–1.402)	0.286	–	–
First anal intercourse were unprotected (yes)	2.459 (1.693–3.572)	<0.001	2.236 (1.506–3.320)	<0.001

–: No data; CI: Confidence interval; HIV: Human immunodeficiency virus; OR: Odd ratio; UAI: Unprotected anal intercourse.

never had sex with an older partner, SMSM who did report having older partners in last 6 months had 2.2 times increased odds of UAI compared with SMSM who never had older partners. Additionally, those reporting ever having sex with an older partner were also at increased odds of UAI [Table 2]. Qualitative research has shown that older sexual partners are more likely to engage in UAI because they think condom use may affect their sexual function.<sup>[13]</sup> More so, they assume SMSM to be at low risk for acquiring HIV.<sup>[13]</sup> Younger SMSM also have poorer agency in relationship decision making, lacking the ability to refuse UAI, often due to the emotional and material support provided by older partners.<sup>[13]</sup> Future interventions should incorporate the mental health needs of SMSM, promoting their agency and decision making skills in these relationships. More so, efforts to clarify the risk of HIV in age-discordant couples could increase related knowledge and help reduce the proportion of risky sexual behaviors among this group.

The majority of SMSM in this study did not report using alcohol or vacant capsules before anal intercourse, while almost half reported using poppers in the last 6 months. Rates of drug and alcohol use before anal intercourse have

varied among SMSM throughout China.<sup>[12,17,18]</sup> Surprisingly, though more individuals reported using poppers, we found no association between use of poppers and UAI. However, the small proportion that did report vacant capsule use was at an almost four times increased odds of UAI. Vacant capsules cause both excitation and hallucination,<sup>[19]</sup> which may reduce condom awareness during sexual activity. Additionally, the neurotoxicity of vacant capsules can lead to insomnia, anxiety, and even death from acute heart failure,<sup>[19]</sup> which are of great harm to the physical and mental well-being of SMSM. Therefore, continued education on the associated harm of vacant capsules and other drugs is needed to reduce the increased risk of UAI associated with these drugs.

Previous studies have suggested that HIV infection risk perception is related to high-risk sexual behaviors of YMSM.<sup>[20]</sup> MSM who have unprotected receptive anal intercourse are more likely to report moderate/high perceived HIV risk.<sup>[21]</sup> In this study, those assuming a medium level of risk were associated with a higher proportion of UAI in the last 6 months than those assuming high risk. This could be due to other co-factors and co-linearity between the two variables. For example,



participants using condoms perceived themselves to be low risk for HIV because they were regularly using condoms. Similarly, more participants who assumed they were high risk for HIV infection reported protected anal intercourse. This may also be due to co-linearity between the two variables, in which overestimating their own risk, SMSM reduced their risky sexual behaviors. Those with medium HIV risk, however, may recognize their own risk, but it may not be enough of a motivator to instigate behavior change. According to the health belief model,<sup>[22]</sup> realizing susceptibility is helpful for HIV-negative people to accept various interventions to reduce the risk of becoming infected with HIV. Therefore, in the future, it is necessary to strengthen the risk awareness education of SMSM and promote condom use regardless of self-perceived risk. Additionally, our study indicated that SMSM who did not use a condom or took it off during their first anal intercourse had a 2.2 times increased odds of UAI compared with SMSM who used condoms. The first intercourse experience may affect beliefs about sexual self-efficacy, sexual attitude, subsequent sexual development, and later sexual adjustment.<sup>[23]</sup> Age of first sexual experience and characteristics of first sexual partners both influence subsequent risky sexual behavior.<sup>[24]</sup> One study in young migrant MSM found that a lack of condom use during first anal intercourse was a risk factor for current UAI.<sup>[25]</sup> Since regular condom use is a habit that may develop early in a student's lifetime,<sup>[26]</sup> improving comprehensive sexual education, including promotion of habitual condom usage, will be important for future HIV interventions.

The results from this study should be interpreted in light of several limitations. First, our study used a convenience sample of SMSM, which may affect the generalizability of the findings and limit the extrapolation of results to the larger SMSM population. However, we aimed to sample a diverse set of students, recruiting participants from multiple cities from different venues. Second, the factors discussed in this study were determined based on general MSM studies and preliminary survey interviews. Therefore, we can only discuss the correlation between these factors and UAI. Other relevant factors may have been excluded. In addition, since the data in the study were self-reported, the responses were subject to reporting bias. However, no personally identifiable information was collected and the NGOs responsible for recruitment during the study were well integrated into the SMSM community, thus promoting trust of the participants and reducing such bias. Lastly, this was a retrospective study with limited ability to validate a causal relationship between risk factors and outcomes. Future prospective studies are needed to further determine the association between these factors and UAI.

In conclusion, a little less than half of the male students who have sex with men in Beijing, Tianjin, and Shijiazhuang reported UAI in the past 6 months. Drug use, specifically vacant capsule use, having sex with a partner at least 10 years older, assuming a moderate risk of HIV, and unprotected, first anal intercourse were found to be associated with an increased odds of UAI in the past 6 months among SMSM. Efforts aimed at promoting the

agency of SMSM in relationships, reducing drug use, and improving HIV knowledge could help reduce the burden of risky sexual behaviors in this group.

### Acknowledgements

The authors thank the "Hebei Tongxing," Beijing "Hongshiliu," and Tianjin "Shenlan" for help with implementing the survey. They also thank all study participants for their time.

### Funding

This study was supported by grants from the National Science and Technology Major Project on Prevention and Treatment of Major Infectious Diseases including AIDS and Viral Hepatitis via the National Health Commission of China (No. 2012ZX10001007 and No. 2018ZX10721102).

### Conflicts of interest

None.

### References

1. Wang L, Wang L, Norris JL, Li DM, Guo W, Ding ZW, *et al*. HIV prevalence and influencing factors analysis of sentinel surveillance among men who have sex with men in China. *Chin Med J* 2012;125:1857–1861. doi: 10.3760/cma.jissn.0366-6999.2012.11.003.
2. Wu Z. HIV/AIDS in China Beyond the Numbers. People's Medical Publishing House, Beijing 2016;155–156.
3. Wu Z. AIDS prevention and control situation and strategies in Chinese schools [in Chinese]. *Chin J Sch Health* 2015;36:1604–1605. doi: 10.16835/j.cnki.1000-9817.2015.11.004.
4. Li Y, Xu J, Reilly KH, Zhang J, Wei H, Jiang Y, *et al*. Prevalence of HIV and syphilis infection among high school and college student MSM in China: a systematic review and meta-analysis. *PLoS One* 2013;8:e69137. doi: 10.1371/journal.pone.0069137.
5. Shi AX, Zhang ZH, Wang J, Zhu XF, Zhao Y, Wang W, *et al*. Meta analysis of the high risky behaviors and detection rate of HIV infection among MSM students in the mainland of China [in Chinese]. *Chin J Sch Health* 2018;39:702–708. doi: 10.16835/j.cnki.1000-9817.2018.05.018.
6. Gong H, Yu MH, Zhou N, Wang P. Analysis on gay dating software usage and user estimates among college students in Tianjin [in Chinese]. *Chin J AIDS STD* 2017;23:129–131. doi: 10.13419/j.cnki.aids.2017.02.11.
7. Bai JY, Liu Y, Liu ZQ, Guo Y, Zhou N. Behavior characteristics and HIV/syphilis infection status among MSM students in Tianjin from 2012 to 2016 [in Chinese]. *Chin J AIDS STD* 2018;4:58–61. doi: 10.13419/j.cnki.aids.2018.01.16.
8. Wang J, He SF, Lu HY, Li Y, Zhao YJ. AIDS epidemic situation of students aged 15-24 in Beijing during 2010-2016 [in Chinese]. *Chin J Sch Health* 2017;38:1426–1428. doi: 10.16835/j.cnki.1000-9817.2017.09.047.
9. Dong Z, Xu J, Zhang H, Dou Z, Mi G, Ruan Y, *et al*. HIV incidence and risk factors in Chinese young men who have sex with men: a prospective cohort study. *PLoS One* 2014;9:e97527. doi: 10.1371/journal.pone.0097527.
10. Newcomb ME, Mustanski B. Developmental change in the effects of sexual partner and relationship characteristics on sexual risk behavior in young men who have sex with men. *AIDS Behav* 2016;20:1284–1294. doi: 10.1007/s10461-015-1046-6.
11. Zhang W, Xu JJ, Zou H, Zhang J, Wang N, Shang H. HIV incidence and associated risk factors in men who have sex with men in Mainland China: an updated systematic review and meta-analysis. *Sexual Health* 2016;13:373–382. doi: 10.1071/SH16001.
12. Wang YM. The situation of sexual features and HIV influence factors among college students men who have sex men [in Chinese]. Kuming Medical University 2016.

13. Zhang DC, Chen ZH, Ma Y, Wu ZY. Qualitative study on unprotected sexual behaviors among male students who have sex with men in Beijing [in Chinese]. *Chin J Prev Med* 2018;52:1234-1238. doi: 10.3760/cma.j.issn.0253-9624.2018.12.008.
14. Ding Y, Zhou Y, Liu C, Liu X, He N. Sex with older partners, condomless anal sex and unrecognized HIV infection among chinese men who have sex with men. *Aids Care* 2018;30:305-311. doi: 10.1080/09540121.2017.1349275.
15. Arrington-Sanders R, Leonard L, Brooks D, Celentano D, Ellen J. Older partner selection in young African-American men who have sex with men. *J Adolesc Health* 2013;52:682-688. doi: 10.1016/j.jadohealth.2012.12.011.
16. Chamberlain N, Mena LA, Geter A, Crosby RA. Is sex with older male partners associated with higher sexual risk behavior among young black MSM? *Aids Behav* 2017;21:2526-2532. doi: 10.1007/s10461-017-1699-4.
17. Fan AP, Cheng L, Yang DF, Sun T, Zhang RQ, Hou PQ, *et al.* Prevalence of HIV and related sexual behaviors among male college students who have sex with men in Taian [in Chinese]. *Chin J Sch Health* 2017;38:819-822. doi: 10.16835/j.cnki.1000-9817.2017.06.007.
18. Lei YX, Wang HH, Xiao XL, Chen J, Li XH. Status and influencing factors of rush poppers use and HIV infection among men who have sex with men in Changsha [in Chinese]. *Chin J Prev Med* 2016;50:148-152. doi: 10.3760/cma.j.issn.0253-9624.2016.02.009.
19. Tittarelli R, Mannocchi G, Pantano F, Romolo FS. Recreational use, analysis and toxicity of tryptamines. *Curr Neuropharmacol* 2015;13:26-46. doi: 10.2174/1570159X13666141210222409.
20. Alexovitz KA, Merchant RC, Clark MA, Liu T, Rosenberger JG, Bauermeister J, *et al.* Discordance of voluntary HIV testing with HIV sexual risk-taking and self-perceived HIV infection risk among social media-using black, Hispanic, and white young-men-who-have-sex-with-men (YMSM). *Aids Care* 2018;30:81-85. doi: 10.1080/09540121.2017.1381327.
21. Wilton J, Kain T, Fowler S, Hart TA, Grennan T, Maxwell J, *et al.* Use of an HIV-risk screening tool to identify optimal candidates for PrEP scale-up among men who have sex with men in Toronto, Canada: disconnect between objective and subjective HIV risk. *J Int AIDS Soc* 2016;19:20777. doi: 10.7448/IAS.19.1.20777.
22. Rosenstock IM, Strecher VJ, Becker MH. The health belief model and HIV risk behavior change. In: DiClemente RJ, Peterson JL. *Preventing AIDS Prevention and Mental Health* Boston, MA, US: Springer; 1994. doi: org/10.1007/978-1-4899-1193-3\_2.
23. Reissing ED, Andruff HL, Wentland JJ. Looking back: the experience of first sexual intercourse and current sexual adjustment in young heterosexual adults. *J Sex Res* 2012;49:27-35. doi: 10.1080/00224499.2010.538951.
24. Liu Y, Qian HZ, Amico KR, Liu H, Yin L, Ruan Y, *et al.* Subsequent sexual risks among men who have sex with men may differ by sex of first partner and age at sexual debut: a cross-sectional study in Beijing, China. *AIDS Behav* 2017;21:2913-2923. doi: 10.1007/s10461-017-1677-x.
25. Liu Y, Li X, Zhang L, Li S, Jiang S, Stanton B. Correlates of consistent condom use among young migrant men who have sex with men (MSM) in Beijing, China. *Eur J Contracept Reprod Health Care* 2012;17:219-228. doi: 10.3109/13625187.2012.662544.
26. Štulhofer A, Baćak V, Ajduković D, Graham C. Understanding the association between condom use at first and most recent sexual intercourse: an assessment of normative, calculative, and habitual explanations. *Soc Sci Med* 2010;70:2080-2084. doi: 10.1016/j.socscimed.2010.02.030.

---

**How to cite this article:** Zhang DC, Wu ZY, Scott SR. Factors associated with unprotected anal intercourse among male students who have sex with men in three northern regions of China. *Chin Med J* 2019;132:1639-1644. doi: 10.1097/CM9.0000000000000311