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Prevalence of unprotected anal intercourse and associated factors among male students who have sex with men in Qingdao, China

A cross-sectional study

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Abstract

The significant rise of human immunodeficiency virus (HIV) epidemic among young students has become a new feature of acquired immune deficiency syndrome in China, and unprotected anal intercourse (UAI) among male students who have sex with men (SMSM) played a central role in this process. The aim of this study was to investigate the prevalence of UAI, as well as analyze the factors associated with UAI among SMSM in Qingdao, China. From May 2021 to April 2022, men who aged 15 to 30, studied in a high school or college in Qingdao and had anal sex with men in the past 6 months were recruited through snowball method relying on the nongovernmental organization. An anonymous electronic questionnaire was administrated to collect information on socio-demographic characteristics, sexual behaviors, substance use before sex, HIV prevention services and self-esteem. Univariate and multivariate logistic regressions were used to assess factors related to UAI. Among the 341 SMSM included in the study, 40.5% engaged in UAI in the past 6 months. Being migrants from other provinces [odds ratios (OR) = 2.04, 95% confidence intervals (CI): 1.10–3.78], failing to use condoms for the first anal intercourse (OR = 3.38, 95% CI: 1.85–6.18), drinking alcohol before sex (OR = 2.31, 95% CI: 1.25–4.28) and being low level self-esteem (OR = 1.77, 95% CI: 1.09–2.87) were positively associated with UAI. SMSM who had homosexual intercourse more than once a week (OR = 1.76, 95% CI: 1.03–3.00) or had multiple male sex partners (OR = 1.99, 95% CI: 1.20–3.30) were more likely to engage in UAI. Received peer education in the past 12 months (OR = 0.48, 95% CI: 0.27–0.86) was associated with lower odds of UAI. The situation of UAI among SMSM in Qingdao was a public health issue of concern. It is necessary to take targeted measures, such as focusing on first-time sex, advancing sexual health education, expanding peer education, implementing alcohol use screening and maintaining the self-esteem of SMSM, so as to reduce the occurrence of high-risk behaviors among SMSM and curb the spread of HIV on campus.

Abbreviations: AIDS = acquired immune deficiency syndrome, CI = confidence intervals, CDC = center for disease control and prevention, HIV = human immunodeficiency virus, MSM = men who have sex with men, OR = odds ratios, SMSM = male students who have sex with men, UAI = unprotected anal intercourse.

Keywords: China, men who have sex with men, students, unprotected anal intercourse

1. Introduction

Men who have sex with men (MSM) is a priority population for human immunodeficiency virus (HIV) infection and prevention of HIV transmission in this population is a global challenge. For the past few years, the significant rise of HIV epidemic among young Chinese students has aroused widespread concern in the whole society, and it has also become a feature of acquired immune deficiency syndrome (AIDS) in China.[1,2] Statistics from the Chinese Center for Disease Control and Prevention (China CDC) revealed that from 2011 to 2015, the number of HIV newly diagnosed Chinese college students increased by 35% annually.[3] Among the college students infected with HIV, more than 80.0% were infected through male sex, which has become the most important way young students transmit and infect HIV.[2,4,5] Therefore, as a unique subgroup of MSM, male students who have sex with men (SMSM) has become a key group of people in China's HIV/AIDS prevention and control effort.[6]

Previous studies indicated that unprotected anal intercourse (UAI) had a central role in explaining the disproportionate disease burden in MSM worldwide.[7,8] The biological factors

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specific to anal sex and the gut tropism of HIV-1 promoted the high transmission efficiency of HIV infection for this practice.[9] UAI was considered as the main high-risk behavior for the spread of HIV and other sexually transmitted diseases among Chinese MSM.[10] A recent meta-analysis also showed that the high HIV infection rate was accompanied by the high incidence of risky sexual behaviors among MSM attending university in China.[11] These emphasize that UAI may have a fundamental impact on driving HIV epidemic in Chinese SMSM.

A multisite cross-sectional study in 7 major Chinese cities showed that MSM exhibited risky sexual behaviors such as having multiple sexual partners, use of recreational drugs and low rates of condom use, all of which made them involve in greater likelihood of HIV acquisition.[12] In addition, a previous study in Hunan Province, China reported that the use of HIV prevention education services was unsatisfactory among the sexually active SMSM who demonstrated inadequate knowledge of and improper behaviors in HIV prevention.[13] Previous studies also found that the occurrence of high-risk sexual behaviors in young MSM was often related to their mental health status, and negative psychological problems might increase the frequency of high-risk sexual behaviors.[14,15] Self-esteem was closely related to many other intraindividual psychological factors, and was considered as a core measure of psychosocial health problems.[16] However, studies examining the associations between self-esteem and UAI in MSM, especially SMSM, are rather limited in China.

Considering the age characteristics of SMSM and the rapid epidemic trend of HIV/AIDS in this population, it is urgent to explore the risk factors associated with UAI in this special group. Therefore, we conducted this study to describe the status of UAI among SMSM and related characteristics of sexual behaviors, substance use, HIV prevention services and self-esteem, thus assess factors that may contribute to the development of UAI. This study can help better understand the current situation of this young group and provide a reference for targeted HIV prevention publicity, education and behavior interventions.

2. Methods

2.1. Study design and participants

This cross-sectional study was conducted from May 2021 to April 2022 in Qingdao, the coastal city of Shandong Province in eastern China, which has a population of 10.2 million people. Qingdao is a comparatively economically prosperous port city with a high degree of opening to the outside world. There are 25 colleges and universities and 64 vocational schools in Qingdao, resulting in a large number of young students, thus including a sizeable number of SMSM.

With the support of Qingdao CDC, we selected the local nongovernmental organization Qingdao Qing tong which covered the largest number of MSM, snowball method was used to recruit the SMSM. In order to be comfortable and convenient to the participants, our study was conducted within HIV voluntary counseling and testing site that specifically serve the MSM community. Participants were eligible to participate in this study if they were male, aged 15 to 30 years, currently enrolled in a high school or college in Qingdao, self-reported anal sex with a male sexual partner in the past 6 months, and were able and willing to provide informed consent. Voluntary participation, anonymity and confidentiality were ensured for all participants. This study protocol and the consent procedure were approved by the Institutional Review Board of Qingdao Municipal CDC.

2.2. Data collection

An anonymous electronic questionnaire was administrated to collect information on socio-demographic characteristics (including age, nationality, registered permanent residence, marriage status, education level, local residence time, monthly income), sexual behaviors (including sexual orientation, sexual role with male partners, first anal intercourse, anal sex in the past 6 months, number of male anal sexual partners in the past 6 months, group sex in the past 6 months), substance use before sex in the past 6 months, HIV prevention services and self-esteem. In our study, UAI was defined as failure to consistently use a condom during anal sex with male partners in the past 6 months. Having multiple sexual partners was defined as having 2 or more male anal sexual partners in the past 6 months. Substance use before sex included alcohol and recreational drugs [rush poppers (nitrite inhalants), capsule zero (5-MEO-DIPT, foxy), GHB (gamma-hydroxybutyrate) and cannabis]. HIV prevention services included HIV self-testing and peer education in the past 12 months. Self-reported HIV diagnosis in the past 12 months was also collected in the survey.

The 10-item Rosenberg Self-Esteem Scale (RSES)[17] was used to measure participants perception of self-acceptance and self-worth. It consists of 5 positively worded items (e.g., "On the whole, I am satisfied with myself") and 5 negatively worded items (e.g., "I feel I do not have much to be proud of"). Participants were asked to rate each item on a Likert 4-point scale from 1 (strongly disagree) to 4 (strongly agree). Ratings on the negatively worded items were reversed before the total score being calculated. Higher scores indicated higher levels of self-esteem. The RSES is a reliable and valid tool to assess self-esteem and has been widely used in Chinese populations.[18–20] Cronbach alpha was 0.8 in this study.

2.3. Statistical analysis

Data was verified and cleaned by using Microsoft excel 2016. Statistical analysis was performed by using Stata15.0 (Stata Corporation, College Station, TX) software version. Descriptive statistics were expressed as frequencies and proportions for categorical variables, and means ± standard deviations for continuous variables.

Chi-square tests were used to compare the differences in socio-demographic characteristics, sexual behaviors, substance use before sex in the past 6 months, HIV prevention services and self-esteem between the SMSM with and without UAI. Univariate and multivariate logistic regression analyses were conducted to test the factors associated with UAI among SMSM. Variables with a P value < .05 during the univariate logistic regression analyses were forward-stepwise entered into the multivariate logistic regression model and variables significant at P value < .05 were retained in the final model. Odds ratios (ORs), adjusted ORs and the 95% confidence intervals (CIs) were calculated. A 2-tailed P value < .05 was considered statistically significant.

3. Results

3.1. Socio-demographic characteristics

A total of 341 eligible SMSM were recruited by MSM nongovernmental organization and completed the survey. The average age of all the participants was 22.0 ± 2.3 years. About 48.4% of the participants were natives, while 30.2% and 21.4% were migrants from other cities in Shandong and other provinces, respectively. Among the 341 SMSM, 51.3% of them had lived in Qingdao city for more than 3 years. The majority of study participants were Han nationality (94.1%), only children (68.0%), unmarried and living alone (82.4%) and had monthly individual income less than CNY 2000 (60.7%). About half of the participants were college students (48.1%), whereas senior high school and lower, junior college and postgraduate students accounted for 6.7%, 38.7% and 6.5%, respectively (Table 1).

Table 1

Socio-demographic characteristics among Qingdao male students who have sex with men by unprotected anal intercourse status (N = 341).

Characteristics	n (%)	UAI in P6M (n, %)	No UAI in P6M (n, %)	*P* value
Age (yr)				
17–21	157 (46.0)	54 (39.1)	103 (50.8)	.025
22–26	171 (50.2)	81 (58.7)	90 (44.3)	
27–30	13 (3.8)	3 (2.2)	10 (4.9)	
Nationality				
Han	321 (94.1)	130 (94.2)	191 (94.1)	.965
Others	20 (5.9)	8 (5.8)	12 (5.9)	
Only child				
Yes	232 (68.0)	92 (66.7)	140 (69.0)	.655
No	109 (32.0)	46 (33.3)	63 (31.0)	
Registered permanent residence				
Qingdao city	165 (48.4)	62 (45.0)	103 (50.8)	.075
Other cities in Shandong province	103 (30.2)	38 (27.5)	65 (32.0)	
Outside Shandong province	73 (21.4)	38 (27.5)	35 (17.2)	
Living in qingdao				
<1 yr	40 (11.7)	16 (11.6)	24 (11.8)	.644
1–3 yr	126 (37.0)	55 (39.9)	71 (35.0)	
>3 yr	175 (51.3)	67 (48.5)	108 (53.2)	
Marriage status				
Unmarried and living alone	281 (82.4)	115 (83.3)	166 (81.8)	.960
Unmarried cohabitation	35 (10.3)	13 (9.4)	22 (10.8)	
Married	9 (2.6)	4 (2.9)	5 (2.5)	
Others	16 (4.7)	6 (4.4)	10 (4.9)	
Education level				
Senior high school and lower	23 (6.7)	10 (7.3)	13 (6.4)	.338
Junior college	132 (38.7)	57 (41.3)	75 (36.9)	
College	164 (48.1)	66 (47.8)	98 (48.3)	
Master and higher	22 (6.5)	5 (3.6)	17 (8.4)	
Monthly income (CNY)				
<1000	32 (9.4)	8 (5.8)	24 (11.8)	.073
1000–2000	175 (51.3)	68 (49.3)	107 (52.7)	
>2000	134 (39.3)	62 (44.9)	72 (35.5)	

CNY = Chinese yuan, P6M = past 6 months, UAI = unprotected anal intercourse.

3.2. Sexual behaviors, substance use and HIV prevention services

Overall, most (83.0%) of the eligible participants claimed to be homosexual, and over 2-thirds (68.6%) of the participants reported their sexual orientation was not known by their parents. Twenty-nine-point six percentage of the respondents reported their age at the first anal intercourse was under 18 years, about 3 to 4th (73.9%) reported that the partner of the first anal intercourse was a student, and about 1 to 5th (19.6%) did not use condoms during the first anal intercourse. Among the 341 SMSM, over 1 quarter (26.7%) had homosexual intercourse at least once a week in the past 6 months. The proportion of SMSM reporting multiple male sex partners and group sex in the past 6 months was 62.2% and 11.4%, respectively. In addition, about 1 to 5th (18.8%) and 2 to 5th (39.6%) of the participants reported that they had used alcohol and recreational drugs before sex in the past 6 months, respectively. In this study, about 1 quarter (27.0%) of the SMSM had received peer education in the past 12 months. Furthermore, 83.6% of the participants had used HIV self-testing kits before, and 3.5% reported being diagnosed with HIV in the past 12 months (Table 2).

3.3. Self-esteem

The total RSES score in this study ranged from 10 to 40, with average score of 29.40 ± 4.88. The participants mean score of 29 was used to differentiate between low and high self-esteem. It was notable that 42.8% of the SMSM had RSES scores <29, an indication of lower levels of self-esteem (Table 2).

3.4. Factors associated with UAI

Among the 341 SMSM, 40.5% engaged in UAI in the past 6 months. Univariate analyses showed that being migrants from other provinces, monthly income more than CNY 2000, early and unprotected first anal intercourse, having multiple male sex partners or relatively frequent homosexual intercourse, drinking alcohol or using recreational drugs before sex, receiving no peer education in the past 12 months and being low level self-esteem were found to be significant associated with UAI in the past 6 months (Table 3).

In the final multivariate logistic regression model, being migrants from other provinces (OR = 2.04, 95% CI: 1.10–3.78), failing to use condoms for the first anal intercourse (OR = 3.38, 95% CI: 1.85–6.18), drinking alcohol before sex (OR = 2.31, 95% CI: 1.25–4.28) and being low level self-esteem (OR = 1.77, 95% CI: 1.09–2.87) were positively associated with UAI in the past 6 months. In addition, the participants who had homosexual intercourse more than once a week (OR = 1.76, 95% CI: 1.03–3.00) or had multiple male sex partners (OR = 1.99, 95% CI: 1.20–3.30) were more likely to engage in UAI compared with those did not have. Those who had received peer education in the past 12 months (OR = 0.48, 95% CI: 0.27–0.86) were associated with lower odds of UAI in the past 6 months (Table 3).

4. Discussion

The present study explored the prevalence of UAI and factors that might contribute to the development of it among SMSM in Qingdao, China. In this study, 40.5% of SMSM reported

Table 2

Sexual behaviors, substance use before sex, human immunodeficiency virus prevention services and self-esteem among Qingdao male students who have sex with men by unprotected anal intercourse status (N = 341).

Characteristics	n (%)	UAI in P6M (n, %)	No UAI in P6M (n, %)	*P* value
Sexual orientation				
Homosexual	283 (83.0)	122 (88.4)	161 (79.3)	.047
Bisexual	40 (11.7)	13 (9.4)	27 (13.3)	
Heterosexual/uncertain	18 (5.3)	3 (2.2)	15 (7.4)	
Sexual orientation known by parents				
Yes	71 (20.8)	33 (23.9)	38 (18.7)	.176
No	234 (68.6)	95 (68.8)	139 (68.5)	
Uncertain	36 (10.6)	10 (7.3)	26 (12.8)	
Role in homosexual intercourse				
Insertive	105 (30.8)	38 (27.5)	67 (33.0)	.558
Receptive	93 (27.3)	39 (28.3)	54 (26.6)	
Versatile	143 (41.9)	61 (44.2)	82 (40.4)	
Age at the first anal intercourse with male				
≥18	240 (70.4)	87 (63.0)	153 (75.4)	.014
<18	101 (29.6)	51 (37.0)	50 (24.6)	
Partner of the first anal intercourse				
Student	252 (73.9)	106 (76.8)	146 (71.9)	.313
Nonstudent	89 (26.1)	32 (23.2)	57 (28.1)	
Condom use for the first anal intercourse				
Yes	274 (80.4)	95 (68.8)	179 (88.2)	<.001
No	67 (19.6)	43 (31.2)	24 (11.8)	
Frequency of homosexual intercourse in P6M				
<Once a wk	250 (73.3)	87 (63.0)	163 (80.3)	<.001
≥Once a wk	91 (26.7)	51 (37.0)	40 (19.7)	
Multiple male sex partners in P6M				
No	129 (37.8)	37 (26.8)	92 (45.3)	.001
Yes	212 (62.2)	101 (73.2)	111 (54.7)	
Group sex in P6M				
No	302 (88.6)	117 (84.8)	185 (91.1)	.071
Yes	39 (11.4)	21 (15.2)	18 (8.9)	
Ever drunk alcohol before sex in P6M				
No	277 (81.2)	101 (73.2)	176 (86.7)	.002
Yes	64 (18.8)	37 (26.8)	27 (13.3)	
Ever used recreational drugs in P6M				
No	206 (60.4)	70 (50.7)	136 (67.0)	.003
Yes	135 (39.6)	68 (49.3)	67 (33.0)	
Ever used HIV self-testing kits before				
No	56 (16.4)	21 (15.2)	35 (17.2)	.620
Yes	285 (83.6)	117 (84.8)	168 (82.8)	
Ever received peer education in P12M				
No	249 (73.0)	109 (79.0)	140 (69.0)	.041
Yes	92 (27.0)	29 (21.0)	63 (31.0)	
Diagnosed with HIV in P12M				
No	329 (96.5)	131 (94.9)	198 (97.5)	.237
Yes	12 (3.5)	7 (5.1)	5 (2.5)	
Self-esteem				
High-level	195 (57.2)	70 (50.7)	125 (61.6)	.047
Low level	146 (42.8)	68 (49.3)	78 (38.4)	

HIV = human immunodeficiency virus, P12M = past 12 months, P6M = past 6 months, UAI = unprotected anal intercourse.

UAI in the past 6 months, which was lower than UAI rate (50.7%) in Tai'an, Shandong Province[21] and 3-month UAI rate (40.6%) in 4 metropolises elsewhere in China.[22] Recently, an updated meta-analysis summarized that the overall UAI rate among MSM attending university in China was 54.7% (95% CI: 47.3%–62.1%), which is higher than the proportion of our current survey in Qingdao.[23] However, this study found that the incidence of UAI among SMSM has been rising over time. Given the fact that pre-exposure prophylaxis is not widely available among SMSM in Qingdao,[24–26] HIV prevention measures specifically developed to reduce UAI behavior among SMSM are quite essential.

Our study found that SMSM who did not use a condom during their first anal intercourse were 3.4 times more likely to have UAI compared to SMSM who used a condom. One possible explanation was that the first sexual intercourse experience and sexual self-efficacy might have a potential impact on later sexual adjustment.[27] Nearly 1-third of the SMSM in this study had their first anal intercourse when they were minors, but they did not have sufficient relevant health knowledge and self-protection concepts. A prospective cohort study from Beijing, China suggested that early sexual debut could have a profound and long-term effect on individuals sexual attitudes.[28] Teenage MSM tended to have older partners and adopt receptive roles in anal sex at early stages of their sex life, which might facilitate HIV transmission from older to younger cohorts of MSM.[29] Previous studies showed that the first sexual encounter of young MSM might help establish the pattern of future sexual experiences.[21,30] These reflect the necessity of carrying out sexual health education early and timely, while promoting condoms among students, more attention should be paid to cultivate their habit of regular condom use.

Additionally, several studies have demonstrated that MSM who had multiple male sex partners and frequent homosexual

Table 3

Factors correlated with unprotected anal intercourse in the past 6 months among Qingdao male students who have sex with men (N = 341).

	Univariate analysis		Multivariate analysis	
Factors	**OR (95% CI)**	***P* value**	**aOR (95% CI)**	***P* value**
Registered permanent residence				
Qingdao city	1		1	
Other cities in Shandong province	0.97 (0.58–1.62)	.911	1.23 (0.70–2.15)	.468
Outside Shandong province	1.80 (1.03–3.15)	.038	2.04 (1.10–3.78)	.023
Monthly income (CNY)				
<1000	1			
1000–2000	1.91 (0.81–4.49)	.140		
>2000	2.58 (1.08–6.16)	.032		
Age at the first anal intercourse with male				
≥18	1			
<18	1.79 (1.12–2.87)	.015		
Condom use for the first anal intercourse				
Yes	1		1	
No	3.38 (1.93–5.90)	<.001	3.38 (1.85–6.18)	<.001
Frequency of homosexual intercourse in P6M				
<Once a wk	1		1	
≥Once a wk	2.39 (1.46–3.90)	<.001	1.76 (1.03–3.00)	.039
Multiple male sex partners in P6M				
No	1		1	
Yes	2.26 (1.42–3.61)	.001	1.99 (1.20–3.30)	.008
Ever drunk alcohol before sex in P6M				
No	1		1	
Yes	2.39 (1.37–4.15)	.002	2.31 (1.25–4.28)	.008
Ever used recreational drugs in P6M				
No	1			
Yes	1.97 (1.27–3.07)	.003		
Ever received peer education in P12M				
No	1		1	
Yes	0.59 (0.36–0.98)	.042	0.48 (0.27–0.86)	.013
Self-esteem				
High-level	1		1	
Low level	1.56 (1.01–2.41)	.047	1.77 (1.09–2.87)	.020

aOR = adjusted odds ratio, CI = confidence interval, CNY = Chinese Yuan, OR = odds ratio, P12M = past 12 months, P6M = past 6 months.

sex were more likely to engage in UAI,[13,31] and a similar result was found in this study. Like other countries, many Chinese SMSM attending university were sexually active and more likely to take risks in the pursuit of sexual stimulation.[32] After attending university, MSM were suddenly exposed to a larger number of peers, a freer environment without parents supervision and increasingly convenient social networking, which in part prompted them to have sex with various sexual partners more frequently than before. However, due to the lack of awareness of the current serious HIV/AIDS epidemic situation and self-protection, risky sexual behaviors including inconsistent use of condoms with casual sex partners have also become more frequent among SMSM.[33] Given the situation that most Chinese students curriculum lacked detailed knowledge about sexuality and unprotected sex, future school-based HIV/AIDS education should include more integrated and specific HIV prevention information, especially the UAI-warning education and the promotion of safe sex.

Corroborating previous findings,[34,35] a history of alcohol use was found to be associated with increased condomless anal sex in our study. A previous survey showed that young MSM had higher odds of reporting excessive alcohol consumption compared to other young people.[36] One potential reason was that many MSM utilized alcohol as a coping mechanism to mitigate stress from discrimination and lead to social disinhibition.[37] However, alcohol use could weaken young MSM's decision making and self-control, which might increase their possibility of high-risk behaviors, especially for those with casual sexual partners.[30,38] As such, reduction of excessive alcohol consumption and corresponding alcohol use screening should be included in the future HIV prevention interventions targeting SMSM. We also found that migrant students from other provinces were associated with a higher proportion of UAI in the past 6 months than the native students. One possible explanation was that young male migrants were more likely to engage in risky sexual behaviors due to the weakened constraints from their families and hometown communities.[30] Therefore, it is necessary to strengthen sexual health education and screening activities for floating population of SMSM in the future.

Further, the current study revealed that SMSM who had received peer education were less likely to practice UAI than otherwise. Considering the SMSM was a relatively closed and hard-to-reach hidden group, they were more inclined to information from their MSM peers, so that they could discuss sensitive topics without inhibitions.[39] Peer-implemented education could reduce their social pressure, deliver sexual health messages adapted to the needs of individual MSM and promote them to receive HIV counseling and testing. A recent systematic review also showed that peer education was a useful tool with long-term effects for behavior change among high-risk groups of HIV and might be particularly suitable in developing countries.[40] However, it was reported that the coverage of HIV prevention service was generally lower among young MSM than older MSM.[41] In our study, only 27% of the SMSM had received peer education in the past 12 months, indicating that peer education pathways were underutilized in the current environment. Hence, it is necessary to transform the unprotected sex

behaviors among SMSM through scaling up the coverage and intervention effort of peer education service on campus.

Under the strong influence of Confucianism and deep-rooted traditional moral, MSM in Shandong faced widespread social stigma and discrimination, some even felt ashamed of their sexual orientation or behavior, and their self-identity was at a low level.[42] Additionally, a previous study showed that most Chinese college students held an implicit prejudice against homosexuals.[43] Therefore, Chinese SMSM could be a subgroup especially vulnerable to psychological problems which might affect high-risk behaviors. Our results were consistent with the published literature regarding low-self-esteem being associated with higher proportion of condomless sex,[44,45] unlike studies that did not establish a relationship between the 2 variables[46,47] or that considered it a risky factor.[48] MSM with lower self-esteem might experience higher sexual minority stress and were more depressed, they were less likely to cherish themselves or protect their health, resulting in more negative coping strategies of sexual behavior.[49] This serves as one of the rare studies, to our knowledge, to assess association between self-esteem and UAI among SMSM in China. Further work is needed to elucidate the ways in which multiple and interlocking forms of sexual minority stress heighten risk for UAI among Chinese SMSM. Meanwhile, Chinese society needs to control the MSM related stigma as effectively as possible, strive to create a more friendly and tolerant environment for MSM individuals, giving them more respect, understanding and humanistic care.

5. Limitations

Several potential limitations should be addressed in this study. Firstly, since SMSM was a secretive and conservative population, the research subjects we recruited could not fully represent this group, so there was a certain selection bias. Secondly, the study collected sensitive information such as monthly income, drug use and sexual behaviors, and social desirability bias might exist. However, in this study, the anonymous questionnaire was adopted, and MSM investigators assisted in filling and reviewing the questionnaire, which ensured the authenticity of the results to a certain extent. Furthermore, self-reported sexual behaviors could have taken place several months ago, thus the results might be influenced by recall bias. Lastly, due to the cross-sectional study design, our results could only reflect the relationship between variables, but could not infer causality. Future work needs to collect more longitudinal data to further confirm and explore its mechanism.

6. Conclusion

The situation of UAI among SMSM in Qingdao remained a public health issue of concern, targeted interventions should be given to strengthen early sex education, advocate safe sex including implementing alcohol use screening, expanding peer education and promoting mental health thus reduce the occurrence of high-risk sexual behaviors among SMSM, so as to effectively contain the further spread of HIV on campus.

Author contributions

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References

[1] Li G, Jiang Y, Zhang L. HIV upsurge in China's students. Science. 2019;364:711.
[2] Zunyou W. Characteristics of HIV sexually transmission and challenges for controlling the epidemic in China. Chin J Epidemiol. 2018;39:707–9.
[3] Liyan W, Qianqian Q, Zhengwei D, et al. Current situation of AIDS epidemic in China. Chin J AIDS STD. 2017;23:330–3.
[4] Zheng S. The growing threat of China's HIV epidemic. Lancet Public Health. 2018;3:e311.
[5] Chang C, Houlin T, Fangfang C, et al. Characteristics and trends of newly reported HIV infection in young students in China, 2010-2019. Chin J Epidemiol. 2020;41:1455–9.
[6] Li Y, Xu J, Reilly KH, 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.
[7] Patel P, Borkowf C, Brooks J, et al. Estimating per-act HIV transmission risk: a systematic review. AIDS. 2014;28:1509–19.
[8] Zhang J, Xu J, Leuba S, et al. Increasing condomless anal intercourse and HIV prevalence among men who have sex with men who have never been tested for HIV before: a serial cross-sectional study in Shenyang, China from 2012 to 2016. AIDS Behav. 2020;24:2918–26.
[9] Beyrer C, Baral S, van Griensven F, et al. Global epidemiology of HIV infection in men who have sex with men. Lancet. 2012;380:367–77.
[10] Wu J, Hu Y, Jia Y, et al. Prevalence of unprotected anal intercourse among men who have sex with men in China: an updated meta-analysis. PLoS One. 2014;9:e98366.
[11] Fan S, Yang Z, Hou F, et al. HIV and syphilis and sexual risk behaviors among men who have sex with men attending university in China: a systematic review and meta-analysis. Sex Health. 2019;16:554–65.
[12] Xu J, Tang W, Zou H, et al. High HIV incidence epidemic among men who have sex with men in china: results from a multi-site cross-sectional study. Infect Dis Poverty. 2016;5:82.
[13] Xu H, Xie J, Xiao Z, et al. Sexual attitudes, sexual behaviors, and use of HIV prevention services among male undergraduate students in Hunan, China: a cross-sectional survey. BMC Public Health. 2019;19:250.
[14] Hatzenbuehler M, O'Cleirigh C, Mayer K, et al. Prospective associations between HIV-related stigma, transmission risk behaviors, and adverse mental health outcomes in men who have sex with men. Ann Behav Med. 2011;42:227–34.
[15] Lelutiu-Weinberger C, Gamarel K, Golub S, et al. Race-based differentials in the impact of mental health and stigma on HIV risk among young men who have sex with men. Health Psychol. 2015;34:847–56.
[16] Taylor SE, Brown JD. Illusion and well-being: a social psychological perspective on mental health. Psychol Bull. 1988;103:193–210.
[17] Rosenberg M. Society and the Adolescent Self-Image. Princeton: Princeton University Press; 1965:1780–90.
[18] Hu J, Hu J, Huang G, et al. Life satisfaction, self-esteem, and loneliness among LGB adults and heterosexual adults in China. J Homosex. 2016;63:72–86.
[19] Wu Y, Zuo B, Wen F, et al. Rosenberg self-esteem scale: method effects, factorial structure and scale invariance across migrant child and urban child populations in China. J Pers Assess. 2017;99:83–93.
[20] Yan H, Li XY, Li JJ, et al. Association between perceived HIV stigma, social support, resilience, self-esteem, and depressive symptoms among HIV-positive men who have sex with men (MSM) in Nanjing, China. AIDS Care. 2019;31:1069–76.
[21] Aiping F, Ling C, Dongfang Y, et al. Prevalence of HIV and related sexual behaviors among male college students who have sex with men in Taian. Chin J Sch Health. 2017;38:819–822 + 825.
[22] Disi G, Jing W, Yifei H, et al. Research of the multiple sexual partners and condom use of men who have sex with men among college students in four cities of China. Chin J AIDS STD. 2019;25:1120–1124 + 1152.
[23] Xiameng Z, Xiangeng Z, Qin L, et al. Meta-analysis of high-risk behavior characteristics of MSM among college students in China. Chin J Sch Health. 2019;40:1009–12.
[24] Jiahuan G, Wenting K, Tongtong L, et al. Willingness of pre-exposure prophylaxis and influencing factors among different subgroups of men who have sex with men. Chin J AIDS STD. 2022;28:1375–80.

[25] Xiaoning L, Jie L, Tianjun J, et al. Status and influencing factors of knowledge awareness of HIV/AIDS pre-exposure drug prophylaxis (PrEP)of MSM among college students. Mod Prev Med. 2021;48:2079–83.
[26] Anxia S, Don O, Zhihua Z, et al. Needs of pre-exposure prophylaxis for HIV infection and related barriers among men who have sex with men. Chin J Epidemiol. 2020;41:343–8.
[27] Reissing E, Andruff H, Wentland J. Looking back: the experience of first sexual intercourse and current sexual adjustment in young heterosexual adults. J Sex Res. 2012;49:27–35.
[28] Mao H, Ma W, Lu H, et al. High incidence of HIV and syphilis among migrant men who have sex with men in Beijing, China: a prospective cohort study. BMJ Open. 2014;4:e005351.
[29] Zou H, Prestage G, Fairley C, et al. Sexual behaviors and risk for sexually transmitted infections among teenage men who have sex with men. J Adolesc Health. 2014;55:247–53.
[30] Liu Y, Li X, Zhang L, et al. 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;17:219–28.
[31] Cheng W, Tang W, Zhong F, et al. Consistently high unprotected anal intercourse (UAI) and factors correlated with UAI among men who have sex with men: implication of a serial cross-sectional study in Guangzhou, China. BMC Infect Dis. 2014;14:696.
[32] Zou H, Tucker JD, Fan S, et al. Learning about HIV the hard way: HIV among Chinese MSM attending university. Lancet Infect Dis. 2018;18:16–8.
[33] Sun X, Liu X, Shi Y, et al. Determinants of risky sexual behavior and condom use among college students in China. AIDS Care. 2013;25:775–83.
[34] Nehl E, Wong F, He N, et al. Prevalence and correlates of alcohol use among a sample of general MSM and money boys in Shanghai, China. AIDS Care. 2012;24:324–30.
[35] Santos G, Rowe C, Hern J, et al. Prevalence and correlates of hazardous alcohol consumption and binge drinking among men who have sex with men (MSM) in San Francisco. PLoS One. 2018;13:e0202170.
[36] Gamarel K, Brown L, Kahler C, et al. Prevalence and correlates of substance use among youth living with HIV in clinical settings. Drug Alcohol Depend. 2016;169:11–8.
[37] Martinez O, Wu E, Levine E, et al. Syndemic factors associated with drinking patterns among Latino men and Latina transgender women who have sex with men in New York City. Addict Res Theory. 2016;24:466–76.
[38] Mustanski B, Byck G, Newcomb M, et al. HIV information and behavioral skills moderate the effects of relationship type and substance use on HIV risk behaviors among African American youth. AIDS Patient Care St. 2013;27:342–51.
[39] Medley A, Kennedy C, O'Reilly K, et al. Effectiveness of peer education interventions for HIV prevention in developing countries: a systematic review and meta-analysis. AIDS Educ Prev. 2009;21:181–206.
[40] He J, Wang Y, Du Z, et al. Peer education for HIV prevention among high-risk groups: a systematic review and meta-analysis. BMC Infect Dis. 2020;20:338.
[41] Bowring A, Ketende S, Rao A, et al. Characterising unmet HIV prevention and treatment needs among young female sex workers and young men who have sex with men in Cameroon: a cross-sectional analysis. Lancet Child Adolesc Health. 2019;3:482–91.
[42] Steward W, Miège P, Choi K. Charting a moral life: the influence of stigma and filial duties on marital decisions among Chinese men who have sex with men. PLoS One. 2013;8:e71778.
[43] Wanna L, Lijun M, Jiajie L. Comparison study of college students' implicit attitude and explicit attitude to homosexuality. China J Health Psychol. 2010;18:1494–6.
[44] Batchelder AW, Ehlinger PP, Boroughs MS, et al. Psychological and behavioral moderators of the relationship between trauma severity and HIV transmission risk behavior among MSM with a history of childhood sexual abuse. J Behav Med. 2017;40:794–802.
[45] Amola O, Grimmett MA. Sexual identity, mental health, hiv risk behaviors, and internalized homophobia among black men who have sex with men. J Couns Dev. 2015;93:236–46.
[46] Tobin KE, Yang C, King K, et al. Associations between drug and alcohol use patterns and sexual risk in a sample of African American men who have sex with men. AIDS Behav. 2016;20:590–9.
[47] Mimiaga MJ, Biello KB, Sivasubramanian M, et al. Psychosocial risk factors for HIV sexual risk among Indian men who have sex with men. AIDS Care. 2013;25:1109–13.
[48] Morell-Mengual V, Gil-Llario MD, Fernadez-Garcia O, et al. Factors associated with condom use in anal intercourse among Spanish men who have sex with men: proposal for an explanatory model. AIDS Behav. 2021;25:3836–45.
[49] Wang Y, Wang ZZ, Jia MM, et al. Association between a syndemic of psychosocial problems and unprotected anal intercourse among men who have sex with men in Shanghai, China. BMC Infect Dis. 2017;17:46.