

## Preplanned Studies

# HIV Infection and Associated Factors Among Out-of-School MSM Aged 16–24 Years — 6 Cities and Tianjin Municipality, China, 2022–2023

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## Summary

### What is already known about this topic?

Approximately 80% of newly diagnosed human immunodeficiency virus (HIV) cases among individuals aged 15–24 years in China are attributed to out-of-school youth.

### What is added by this report?

This study presents findings on HIV prevalence and comprehensive insights into HIV service utilization, risky behaviors, and prevention knowledge among young out-of-school men who have sex with men (MSM) aged 16–24 years in China. This population exhibits a disproportionately high burden of HIV, with only 51.6% of HIV cases previously diagnosed.

### What are the implications for public health practice?

HIV services should be expanded to include these key populations. Tailored interventions are needed to remove barriers to regular HIV services faced by young key populations.

Globally, there were an estimated 350,000 new human immunodeficiency virus (HIV) infections among youth aged 15–24 years in 2022 (1). In China, the majority of young people living with HIV were out-of-school youth, accounting for 77.8% of newly diagnosed HIV cases in the 15–24 age group in 2020 (2). Out-of-school young men who have sex with men (MSM) face a higher risk of HIV infection compared to MSM among college students (3) and encounter barriers when accessing HIV-related services. To address the specific vulnerabilities and health needs of out-of-school young MSM (YMSM), a survey was conducted in 6 cities and Tianjin Municipality to estimate HIV prevalence. A total of 1,407 participants were recruited, with an HIV prevalence of 4.4% (62/1,407). Among the 62 participants living with HIV, 51.6% had been previously diagnosed. Participants who had a history of past or current

syphilis infection, inconsistent condom use during anal sex in the last 6 months, and a lack of awareness of post-exposure prophylaxis (PEP) had higher odds of HIV infection. These findings highlight the disproportionately high burden of HIV among out-of-school YMSM and the limited access they have to HIV preventive services. Improving access to HIV testing and care, as well as delivering tailored interventions for out-of-school YMSM, are urgently needed.

The survey was conducted between October 2022 and May 2023 in 7 major cities (Tianjin Municipality; Shenyang City, Liaoning Province; Fuzhou City, Fujian Province; Qingdao City, Shandong Province; Changsha City, Hunan Province; Shenzhen City, Guangdong Province; Haikou City, Hainan Province) with large populations of out-of-school YMSM and well-established community-based organizations (CBOs). Participants were recruited from MSM-visited venues, as well as online platforms such as WeChat and Microblog. To be eligible, YMSM had to have engaged in anal sex with a man in the past 6 months; be between the ages of 16 and 24, and not be currently enrolled as students. With the assistance of CBO staff, eligible participants completed an online, self-administered structured questionnaire that covered sociodemographic information, HIV knowledge, sexual behaviors, sexually transmitted infections (STIs), and utilization of HIV services. HIV knowledge was assessed using 8 questions from the “Chinese AIDS Sentinel Surveillance Implementation Plan”. A score of six or more correct answers was considered comprehensive knowledge of HIV. All consenting participants underwent on-site rapid HIV and syphilis testing using NewScen HIV antibody rapid test kits (NewScen Coast Bio-Pharmaceutical, Tianjin, China) and NewScen syphilis antibody rapid test kits (NewScen Coast Bio-Pharmaceutical, Tianjin, China), respectively, led by qualified staff. For participants who received a positive result on rapid HIV testing and self-reported no prior diagnosis, further confirmatory HIV

testing was conducted. As rapid syphilis testing cannot distinguish between past and current infections, participants with a positive result were categorized as having either a past or current syphilis infection.

Categorical variables were analyzed using descriptive statistics, including proportions and 95% confidence intervals (CIs). Univariable logistic regression was conducted to assess the association between biobehavioral factors and HIV infection. Variables with a *P*-value of  $\leq 0.10$  in the univariable model were included in the multivariable logistic regression, along with demographic variables to account for potential confounding factors. To address the potential influence of HIV diagnosis on behavior change among out-of-school YMSM, a separate multivariable logistic regression analysis was conducted excluding previously diagnosed HIV cases. All statistical analyses were performed using R software (version 4.3.1, R Foundation for Statistical Computing, Vienna, Austria).

A total of 1,407 eligible participants were recruited for our study from different cities in China (Table 1): 298 participants from Tianjin, 206 from Shenyang, 192 from Fuzhou, 186 from Changsha, 183 from Qingdao, 179 from Shenzhen, and 163 from Haikou. Among the participants, 692 (49.2%) were between the ages of 23 and 24. Furthermore, 761 (54.1%) had completed vocational college or higher education, and 1,106 (78.6%) were employed full-time. In terms of sexual orientation, 1,287 (91.5%) identified as homosexual, 94 (6.7%) as bisexual, 23 (1.6%) as unsure, and 3 (0.2%) as heterosexual. Additionally, 641 (45.6%) participants reported having disclosed their sexual orientation.

A total of 62 participants (4.4%, 95% CI: 3.4%–5.6%) out of 1,407 were confirmed to have HIV through laboratory testing. Among them, 32 participants (51.6%, 32/62) had previously been diagnosed with HIV (Table 2). The prevalence of current or past syphilis was 4.9% (95% CI: 3.9%–6.2%), and the co-infection rate of syphilis and HIV was 1.1% (15/1,407). Within the past 12 months, 78.4% of participants (1,103/1,407) reported using HIV-related services. These included HIV infection risk assessment (49.6%, 698/1,407), receiving free condoms (52.5%, 738/1,407), pre-exposure prophylaxis (PrEP) (22.5%, 317/1,407), PEP (21.3%, 299/1,407), and HIV counseling and testing (56.2%, 791/1,407). Additionally, 47.5% of participants (669/1,407) reported not having consistent condom use (CCU) during anal sex in the

TABLE 1. Sociodemographic characteristics of out-of-school young MSM aged 16–24 years in 6 Cities and Tianjin Municipality, China (N=1,407).

Characteristics	n	Percentage (95% CI)
Region		
Tianjin	298	21.2 (19.1, 23.4)
Shenyang	206	14.6 (12.9, 16.6)
Fuzhou	192	13.6 (11.9, 15.6)
Qingdao	183	13.0 (11.3, 14.9)
Changsha	186	13.2 (11.5, 15.1)
Shenzhen	179	12.7 (11.0, 14.6)
Haikou	163	11.6 (10.0, 13.4)
Age, years		
16–18	79	5.6 (4.5, 7.0)
19–20	183	13.0 (11.3, 14.9)
21–22	453	32.2 (29.8, 34.7)
23–24	692	49.2 (46.5, 51.8)
Education		
≤Junior high school	234	16.6 (14.7, 18.7)
Senior high/vocational/secondary	412	29.3 (26.9, 31.8)
≥Vocational college	761	54.1 (51.4, 56.7)
Monthly income (CNY)		
<1,000	101	7.2 (5.9, 8.7)
1,000–3,000	251	17.8 (15.9, 20.0)
3,001–5,000	615	43.7 (41.1, 46.4)
>5,000	440	31.3 (28.9, 33.8)
Employment status		
Employed full time	1,106	78.6 (76.4, 80.7)
Employed part time	161	11.4 (9.9, 13.2)
Unemployed	140	10.0 (8.5, 11.7)
Local living time		
<1 year	128	9.1 (7.7, 10.8)
1–2 year	184	13.1 (11.4, 15.0)
>2 year	1,095	77.8 (75.5, 80.0)
Living situation		
Family	366	26.0 (23.8, 28.4)
Alone	597	42.4 (39.8, 45.1)
Friends/roommates	239	17.0 (15.1, 19.1)
Partner	105	7.5 (6.2, 9.0)
Dormitory	100	7.1 (5.8, 8.6)
Sexual orientation		
Homosexual	1,287	91.5 (89.9, 92.9)
Bisexual	94	6.7 (5.5, 8.1)
Heterosexual	3	0.2 (0.1, 0.7)
Not sure	23	1.6 (1.1, 2.5)
Disclosure of sexual orientation	641	45.6 (42.9, 48.2)

Abbreviation: MSM=men who have sex with men; CI=confidence interval; CNY=Chinese Yuan.

TABLE 2. HIV, syphilis, service engagement, individual level risks, and HIV knowledge of out-of-school young MSM aged 16–24 years in 6 Cities and Tianjin Municipality, China (N=1,407).

Characteristics	n	Percentage (95% CI)
HIV and STI prevalence		
HIV positive	62	4.4 (3.4, 5.6)
Previously diagnosed	32	2.3 (1.6, 3.2)
Newly diagnosed	30	2.1 (1.5, 3.1)
Past or current syphilis	69	4.9 (3.9, 6.2)
HIV service engagement in the past 12 months		
HIV infection risk assessment	698	49.6 (47.0, 52.3)
Received free condoms	738	52.5 (49.8, 55.1)
PrEP	317	22.5 (20.4, 24.8)
PEP	299	21.3 (19.2, 23.5)
HIV counseling and testing	791	56.2 (53.6, 58.8)
Individual-level HIV risks		
Number of anal sex partners in the past 6 months		
1	456	32.4 (30.0, 34.9)
2–5	691	49.1 (46.5, 51.8)
≥6	260	18.5 (16.5, 20.6)
Condom use during anal sex in the past 6 months		
CCU	738	52.5 (49.8, 55.1)
Not CCU	669	47.5 (44.9, 50.2)
Group sex behavior in the past 6 months	123	8.7 (7.3, 10.4)
Condom use during group sex in the past 6 months (n=123)		
CCU*	71	57.7 (48.5, 66.5)
Not CCU	52	42.3 (33.5, 51.5)
Heterosexual behavior in past 6 months	62	4.4 (3.4, 5.6)
Number of heterosexual partners in past 6 months (n=62)		
1	30	48.4 (35.7, 61.3)
2–5	28	45.2 (32.7, 58.2)
≥6	4	6.5 (2.1, 16.5)
Condom use during heterosexual behavior (n=62)		
CCU	20	32.3 (21.3, 45.5)
Not CCU	42	67.7 (54.5, 78.7)
Any drug use in the past 12 months	832	59.1 (56.5, 61.7)
Suffered any STI symptoms in the past 12 months	72	5.1 (4.1, 6.4)
Diagnosed any STI in the past 12 months	77	5.5 (4.4, 6.8)
HIV knowledge		
Comprehensive knowledge of HIV	1,242	88.3 (86.4, 89.9)
PrEP awareness	1,095	77.8 (75.5, 80.0)
PEP awareness	1,137	80.8 (78.6, 82.8)

Abbreviation: HIV=human immunodeficiency virus; MSM=men who have sex with men; CI=confidence interval; STI=sexually transmitted infection; PEP=post-exposure prophylaxis; PrEP=pre-exposure prophylaxis; CCU=consistent condom use.

\* Consistent condom use and changing condoms between people.

past 6 months. Group sex behavior was reported by 8.7% of participants (123/1,407), which was nearly twice the prevalence of heterosexual behavior during the same period (4.4%, 62/1,407). Drug use within the past 12 months was reported by 59.1% of participants (832/1,407). Furthermore, 5.1% of participants (72/1,407) reported experiencing any symptoms of STIs within the past 12 months, while

5.5% (77/1,407) were diagnosed with an STI during the same period. The overall rate of comprehensive HIV knowledge was 88.3% (1,242/1,407), with 77.8% (1,095/1,407) and 80.8% (1,137/1,407) reporting awareness of PrEP and PEP, respectively.

In the multivariable analysis, we found that out-of-school YMSM with current or past syphilis infection had higher odds of HIV infection [adjusted odds ratio

TABLE 3. Adjusted logistic regression model of biobehavioral factors associated with HIV Infection and undiagnosed HIV infection among out-of-school young MSM aged 16–24 Years in 6 Cities and Tianjin Municipality, China.

Characteristics	HIV infection vs. HIV negative (N=1,407)			Undiagnosed HIV infection vs. HIV negative (N=1,375)		
	HIV infection n (%)	aOR (95% CI)*	P value	Undiagnosed HIV infection n (%)	aOR (95% CI)*	P value
Past or current syphilis						
No	47/1,338 (3.5%)	1 (ref)	–	21/1,312 (1.6%)	1 (ref)	–
Yes	15/69 (21.7%)	9.90 (3.86, 24.86)	<0.001	9/63 (14.3%)	19.70 (5.00, 80.08)	<0.001
HIV infection risk assessment in the past 12 months						
No	43/709 (6.1%)	1 (ref)	–	20/686 (2.9%)	1 (ref)	–
Yes	19/698 (2.7%)	0.54 (0.27, 1.06)	0.078	10/689 (1.5%)	0.63 (0.22, 1.71)	0.365
Received free condoms in the past 12 months						
No	43/669 (6.4%)	1 (ref)	–	19/645 (2.9%)	1 (ref)	–
Yes	19/738 (2.6%)	0.51 (0.25, 1.02)	0.062	11/730 (1.5%)	0.66 (0.23, 1.84)	0.425
PrEP in the past 12 months						
No	54/1,090 (5.0%)	1 (ref)	–	28/1,064 (2.6%)	1 (ref)	–
Yes	8/317 (2.5%)	1.03 (0.38, 2.53)	0.946	2/311 (0.6%)	0.37 (0.05, 1.71)	0.254
HIV counseling and testing in the past 12 months						
No	35/616 (5.7%)	1 (ref)	–	18/599 (3.0%)	1 (ref)	–
Yes	27/791 (3.4%)	0.94 (0.49, 1.80)	0.844	12/776 (1.5%)	1.77 (0.63, 5.10)	0.278
Condom use during anal sex in the past 6 months						
CCU	17/738 (2.3%)	1 (ref)	–	3/724 (0.4%)	1 (ref)	–
Not CCU	45/669 (6.7%)	3.06 (1.61, 6.01)	<0.001	27/651 (4.1%)	10.98 (3.08, 54.07)	<0.001
Group sex behavior in the past 6 months						
No	52/1,284 (4.0%)	1 (ref)	–	26/1,258 (2.1%)	1 (ref)	–
Yes	10/123 (8.1%)	1.66 (0.70, 3.63)	0.223	4/117 (3.4%)	1.21 (0.28, 4.10)	0.776
Suffered any STI symptoms in the past 12 months						
No	54/1,335 (4.0%)	1 (ref)	–	29/1,310 (2.2%)	1 (ref)	–
Yes	8/72 (11.1%)	1.78 (0.61, 4.70)	0.264	1/65 (1.5%)	0.51 (0.02, 4.10)	0.594
Diagnosed any STI in the past 12 months						
No	52/1,330 (3.9%)	1 (ref)	–	26/1,304 (2.0%)	1 (ref)	–
Yes	10/77 (13.0%)	0.66 (0.21, 1.96)	0.468	4/71 (5.6%)	0.48 (0.07, 2.60)	0.416
PrEP awareness						
No	20/312 (6.4%)	1 (ref)	–	15/307 (4.9%)	1 (ref)	–
Yes	42/1,095 (3.8%)	1.43 (0.64, 3.34)	0.397	15/1,068 (1.4%)	1.47 (0.41, 5.35)	0.554
PEP awareness						
No	24/270 (8.9%)	1 (ref)	–	18/264 (6.8%)	1 (ref)	–
Yes	38/1,137 (3.3%)	0.27 (0.12, 0.62)	0.002	12/1,111 (1.1%)	0.07 (0.02, 0.26)	<0.001

Abbreviation: HIV=human immunodeficiency virus; MSM=men who have sex with men; aOR=adjusted odds ratio; CI=confidence interval; CCU=consistent condom use; STI=sexually transmitted infection; PEP=post-exposure prophylaxis; PrEP=pre-exposure prophylaxis.

\* Adjusted for region, age, education, monthly income, employment status, local living time, living situation, and disclosure of sexual orientation.

(aOR)=9.90, 95% CI: 3.86–24.86]. Additionally, YMSM who reported inconsistent condom use during anal sex within the past 6 months also had higher odds of HIV infection (aOR=3.06, 95% CI: 1.61–6.01). On the other hand, YMSM who were aware of PEP had lower odds of HIV infection (aOR=0.27, 95% CI: 0.12–0.62) (Table 3). A sensitivity analysis, excluding data from previously diagnosed HIV cases, revealed no significant difference in the identified risk factors.

## DISCUSSION

This study aims to provide a comprehensive analysis of HIV knowledge, risky behaviors, engagement with HIV services, and the prevalence of HIV among out-of-school YMSM in China. The study found that the HIV prevalence among participants was 4.4%. Higher odds of HIV infection were observed among participants who were infected with syphilis, reported inconsistent condom use during anal sex, and lacked awareness of PEP. The study also identified significant gaps in HIV detection and coverage of prevention services. Therefore, addressing the needs of out-of-school YMSM and removing barriers to HIV services should be a priority to control HIV transmission.

In a previous study that utilized meta-analysis, the pooled HIV prevalence among high school and college student MSM in China was calculated to be 3.8% (4). This prevalence was slightly lower than the 4.4% prevalence observed in this current study among out-of-school YMSM. Furthermore, only half of the participants living with HIV had previously been diagnosed, indicating a big gap compared to the first target of the 95-95-95 testing and treatment strategy (51.6% *vs.* 95%). The low detection rate may be attributed to limited engagement in HIV services, as only 56.2% (791/1,407) of participants reported undergoing HIV counseling and testing in the past 12 months. Consistent with other research studies (5–6), our findings suggest the use of a dual HIV and syphilis testing strategy, as participants infected with syphilis are more likely to be infected with HIV. Furthermore, participants who were aware of PEP exhibited lower odds of HIV infection, underscoring the importance of HIV prevention knowledge education. The proportion of participants with comprehensive knowledge of HIV was 88.3%, slightly below the 90% target for key populations (7). Given that a significant number of out-of-school youth do not continue their education beyond middle school, it is crucial to initiate curriculum-based HIV education no later than middle

school.

This study has several limitations. First, there may be selection bias present in this survey. Our participants were recruited through on-site and online platforms of CBOs, which means that out-of-school YMSM that were not affiliated with CBOs were not included in the study. Second, the design of the study was cross-sectional, which means that we cannot infer causality from the results. Third, due to the limited availability of syphilis testing in CBOs, we were unable to conduct additional tests to determine the prevalence of past or current syphilis infection.

This study highlights the disparity in HIV services for out-of-school YMSM and emphasizes the significance of the HIV prevention cascade. Urgent action is required to implement innovative testing strategies to meet the first of the three 95 targets (8). Additionally, priority should be given to interventions that target this marginalized population to address risky behaviors. It is crucial to develop and implement evidence-based HIV programs that cater to their complex needs.

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