

Correlates of HIV Testing Frequency in MSM Based on a Survey from 2011-2018: A Hint for Risk Reduction Strategy

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Research article

Keywords: HIV testing, HIV, Men who have sex with men, HIV testing frequency

Posted Date: November 18th, 2020

DOI: <https://doi.org/10.21203/rs.3.rs-108687/v1>

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Abstract

Background:

In recent years, HIV testing has become one of the effective strategies to reduce the risk of the disease. Frequent HIV testing can be cost effective. Therefore, an in-depth study of factors related to the testing behavior of men who have sex with men (MSM) were analyzed to optimize intervention strategies.

Methods:

From March 2011 to October 2018, the project was carried out in a Tianjin bathhouse, and 5165 MSM were surveyed using snowball sampling. Factors related to HIV testing behavior were analyzed by multi-level multiple logistic regression analysis after grouping according to testing frequency, and comprehensive analysis was performed.

Results:

The multivariate logistic analysis showed that 6 variables including young MSM (OR=0.67, 95% CI: 0.49-0.92, P=0.01), low-education MSM (OR=0.60, 95% CI: 0.47-0.76, P <0.0001), low AIDS knowledge (95% CI: 0.22-0.29, P <0.0001), marital status (OR = 1.30, 95% CI: 1.07-1.58, p = 0.007), acceptance of condom promotion and distribution (OR = 10.98, 95% CI: 8.33-14.47, p <0.0001), and frequency of condom use (p <0.05) could link to HIV testing behaviors.

Conclusions:

In order to achieve the 90-90-90 goal, targeted publicity and education and promote self-testing kit should be carried out to encourage frequent HIV testing, mainly including Young MSM (especially students), low-education people, married MSM and those who cannot keep using condoms during anal sex.

Background

Men who have sex with men (MSM) have been the focus of AIDS prevention and control of high-risk groups. According to the 2019 UNAIDS report[1], the proportion of homosexual transmission in new HIV infections is increasing year by year. The epidemiological evidence also suggests that the greatest priority in China's response to HIV is prevention programs targeting MSM[2]. Owing to a lack of widespread HIV testing, the majority of the infected population is not on effective antiretroviral therapy[3]. In addition, HIV testing is a key strategic tool in national AIDS prevention work. It has been reported in the literature that more frequent HIV testing in the MSM population can reduce expenditure costs and be more cost-effective[4]. Most of the recent HIV-related literature focus on analyzing the cost-effectiveness of testing, or on comparing different testing approaches to determine a better one. With the popularization of instant messaging technologies such as WeChat and Blue D, some sexual behaviors of MSM have gradually changed, and meanwhile, the ways and risks of HIV transmission among MSM have also increased. Although HIV testing and testing frequency have been addressed in the literature, the factors related to

testing frequency have not been well studied in conjunction with the behavioral changes of the target population.

The recent National HIV/AIDS Strategy (NHAS) has set a new goal: By 2020, 90% of all people living with HIV will know their HIV status, 90% of all people with diagnosed HIV infection will receive sustained antiretroviral therapy, 90% of all people receiving antiretroviral therapy will have viral suppression. The CDC has also suggested that high-risk groups should be tested for HIV at least once a year[5]. However, studies have shown that HIV testing in MSM is not as satisfactory as expected. The US CDC released a report saying that although the South Americans have a higher detection rate than whites and Latins, the proportion of people who have never received HIV testing can still reach more than 30%. In an MSM population survey in 20 US cities, more than 35% of the population did not have HIV testing within one year as recommended by the CDC[6]. A large Midwestern study in the United States (N = 12,596) found that only 1.8% of patients in primary care settings had regular HIV testing[7]. In China, a study showed that the proportion of undetected MSM population was as high as 57.4%[8]. A survey from Jinan, China, also found that less than 20% of MSM have been tested in the past year[9]. For those who have not been tested for HIV in one or more years, there is not much relevant literature, lacking sufficient data and in-depth analysis. After years of AIDS-related knowledge publicity, many people have understood the importance of testing, but the current testing status in MSM is still not optimistic, and there is a lack of understanding of those who do not maintain regular HIV testing. Therefore, how to grasp the key factors and promote the timely and regular HIV testing of the population is still a topic that needs to be discussed.

This study classifies the surveyed MSM according to the frequency of HIV testing, comprehensively discuss and compare factors affecting HIV testing behavior to identify key populations and characteristic behaviors, and propose targeted recommendations. According to the 2019 UNAIDS report, China lacks data on HIV testing, so this study can provide a reference and provide evidence to support more frequent HIV testing models in China.

Method

Survey sites and related agencies

This project has been carried out in a gay bathhouse in Tianjin, China, since March 31, 2011. This bathhouse is the earliest established in China, having a large and stable source of visitors and bringing together many MSM across China, so it can be a representative survey and intervention point for Chinese MSM. In addition, it is also the only AIDS investigation and prevention pilot in China jointly conducted by the China CDC AIDS Prevention and Control Center, the United States CDCGAP Project, and the Tianjin Centers for Disease Control and Prevention. The private MSM organization Deep Blue conducts surveys and education, and its employees are all professionally trained MSM.

Investigation process

Participants were men who claimed to be MSM or had sex with men within a year. After the participants signed the informed consent, professional investigators conducted a one-to-one survey and health education in a specially established compartment. Investigators collected participants' fingerprints to create an electronic file and record the number and survey date. Participants themselves used tablet computers to fill out electronic questionnaires. During the filling process, investigators would use jargon to communicate with participants. After the questionnaire was completed, the participants were quickly tested for blood or saliva. While waiting for the results, the investigators would combine the completed questionnaire to conduct a risk assessment of the participants and give targeted safety education and behavior recommendations. For participants with negative screening results, investigators informed the results and provided relevant counseling and education, and encouraged participants to mobilize their peers to go for testing. Participants with a positive result would send their real-name certification ID cards to the designated location (CDC in Tianjin) for Western blot diagnosis.

Questionnaire design

This questionnaire was mainly composed of basic personal information of the personnel, survey of AIDS knowledge level, sexual behavior, drug abuse, STD status, AIDS self-awareness, condom promotion, male sex workers (MSW) or not and HIV results. Personal information was mainly 8 questions including age, marital status, household registration, ethnicity, length of stay in Tianjin, education, frequency of bathhouses, and places for seeking sexual partners. Out of the eight AIDS-related knowledge questions, more than six correct answers would be judged as high level. Sexual behaviors included whether anal sex, group sex, commercial sex, heterosexual behavior have occurred in the past six months and condom use in the above scenes (The specific questionnaire is in the additional files).

Research design

Due to the particularity of MSM, this study adopted snowball sampling to obtain the survey population. From 2011 to 2018, the project surveyed a total of 5165 people. According to the purpose of this article, the population can be divided into three groups based on whether it has been tested for HIV before and whether it has been tested for HIV in the past year, that is, first-tested, not annually tested, and annually tested. This article analyzes from three groups of MSM, explores the factors that affect the HIV testing behavior of MSM with the frequency.

Data analysis

Multi-level multiple logistic regression was used for univariate and multivariate analysis. The regression model used the backward method, with $p = 0.05$ as the setting value for entering the model. Data were analyzed using SAS9.4.

Ethical approval

This study was reviewed and approved by the Institutional Review Board of the National Center for AIDS/STD Control and Prevention, China CDC [IRB approve number: X130205267]. It was supported by the President's Emergency Plan for AIDS Relief (PEPFAR) and the Humanities and Social Science Fund of the Ministry of Education, China [20YJAZH021]. All participants signed an informed consent form before the survey started.

Results

Demographic characteristics of participants

There were 849 previously unknown HIV testing behaviors, and a total of 4316 were included, of which 1297 were never tested, 410 were previously tested but not tested within one year, and 2609 were tested within one year. Most of MSM are over 24 years old (69.25%), have no partner (54.72%), non-Tianjin household registration (97%), and about 58.75% of MSM have lived in Tianjin for more than two years. The proportion of high school education is the highest (37.88%), followed by university education (32.02%). In the survey, the majority of MSM's means of seeking sexual partners are bathhouses (60.50%), followed by the Internet at about 32%, and other venues such as parks and bars are rare. Among the MSM surveyed, there were 216 MSW (5.01%), with the highest proportion among annual testers (6.48%). (Table 1)

Table 1
Demographic characteristics of different testers in MSM attending bathhouse

variable	total	First-tested	Non-annual	Annually-tested
		N (%)	N (%)	N (%)
Age				
<24	1327(30.75)	116(8.94)	108(26.34)	1103(42.28)
≥24	2989(69.25)	1181(91.06)	302(73.66)	1506(57.72)
Marital status				
Single	1773(54.72)	658(50.73)	171(53.94)	944(58.06)
Non-single	1467(45.28)	639(49.27)	146(46.06)	682(41.94)
Household register				
Local	131(3.04)	42(3.24)	17(4.15)	72(2.76)
Non-local	4183(96.96)	1255(96.76)	393(95.85)	2535(97.24)
Time living in Tianjin				
≤2 year	1247(41.25)	532(41.11)	119(40.75)	596(41.48)
>2 years	1776(58.75)	762(58.89)	173(59.25)	841(58.52)
Level of education				
Junior school or below	975(30.10)	467(36.03)	90(28.39)	418(25.71)
High school	1227(37.88)	481(37.11)	114(35.96)	632(38.87)
College and above	1037(32.02)	348(26.85)	113(35.65)	576(35.42)
Method of seeking sexual partners				
bathhouse	2229(60.50)	668(51.50)	207(52.41)	1354(67.97)
internet	1180(32.03)	488(37.63)	163(41.27)	529(26.56)
other	275(7.46)	141(10.87)	25(6.33)	109(5.47)
Male sex worker				
yes	216(5.01)	35(2.70)	12(2.93)	169(6.48)
no	4099(94.99)	1262(97.30)	398(97.03)	2439(93.52)
HIV infection				
yes	353(8.18)	102(7.86)	54(13.17)	197(7.55)
no	3963(91.82)	1195(92.14)	356(86.83)	2412(92.45)

HIV infection

Among HIV infections, the prevalence of non-annual testers was the highest, reaching 13.17%, followed by never tested (7.86%) and annual testers (7.55%). (Table 1)

Sexual characteristics and HIV-related knowledge differences

In the past six months, vast majority of people have had anal sex with men (94.46%). Most of the annual testers always use condoms (54.51%), while the first-tested and non-annual testers tend to use them occasionally (66.31% and 56.92%). Overall, most people used condoms during their last anal sex (80.07%). The proportion of group sexual encounters (GSEs) is highest among non-annual testers (23.9%) and lower among those who were never tested (10.73%). 1460 MSM (33.83%) had sexual intercourse with a female within six months, and among non-annual and first-tested groups, the proportion reached over 37%. The proportion of people who have received the promotion among the annual testers can reach 88.42%, followed by the non-annual testers (32.68%) and untested MSM (17.66%). Similarly, annual testers have the highest level of knowledge (80.87%), and non-annual testers (60.24%) and first-tested MSM (51.81%) are lower. (Table 2)

Table 2
HIV and AIDS knowledge and high-risk sexual behaviors of different testers

variable	total	First-tested	Non-annual	Annually-tested
		n(%)	n(%)	n(%)
Frequency of going to the bathhouse				
Once a month	3575(97.04)	1272(98.07)	390(98.73)	1913(96.03)
Once a week	60(1.63)	13(1.00)	4(1.01)	43(2.16)
Twice or more a week	49(1.33)	12(0.93)	1(0.25)	36(1.81)
Had anal intercourse(AI) in the last six months				
yes	4077(94.46)	1202(92.68)	383(93.41)	2492(95.52)
no	239(5.54)	95(7.32)	27(6.59)	117(4.48)
The latest AI condom use				
yes	3274(80.07)	918(75.99)	281(73.18)	2075(83.10)
no	815(19.93)	290(24.01)	103(26.82)	422(16.90)
Frequency of condom use				
never used	112(2.74)	56(4.65)	14(3.66)	42(1.68)
sometimes	2109(51.68)	799(66.31)	218(56.92)	1092(43.80)
always used	1860(45.58)	350(29.05)	151(39.43)	1359(54.51)
Had group sex in the past six months				
yes	650(15.06)	139(10.73)	98(23.90)	413(15.83)
no	3665(84.94)	1157(89.27)	312(76.10)	2196(84.17)
Had AI with commercial male sex partner(s)				
yes	423(9.80)	75(5.78)	37(9.02)	311(11.92)
no	3892(90.20)	1222(94.22)	373(90.98)	2297(88.08)
Had sex with any female partner(s)				
yes	1460(33.83)	488(37.63)	152(37.07)	820(31.43)
no	2856(66.17)	809(62.37)	258(62.93)	1789(68.57)
Accept condom promotion in the past year				

variable	total	First-tested	Non-annual	Annually-tested
		n(%)	n(%)	n(%)
yes	2669(61.85)	229(17.66)	134(32.68)	2306(88.42)
no	1646(38.15)	1068(82.34)	276(67.32)	302(11.58)
HIV-related knowledge				
<7	1334(30.91)	672(51.81)	163(39.76)	499(19.13)
≥ 7	2982(69.09)	625(48.19)	247(60.24)	2110(80.87)

Factors related to HIV testing behavior

Univariate analysis results

Low-education (OR = 0.58, 95% CI:0.49-0.69, $p < 0.0001$) and non-bathhouse MSM ($p < 0.05$) showed annual testing less likely. Young MSM (OR =4.81, 95% CI: 4.13-5.61, $p < 0.0001$), single MSM (OR = 1.31, 95% CI: 1.15-1.50, $p < 0.0001$), male sex workers (MSW) (OR = 2.42, 95% CI: 1.75-3.35, $p < 0.0001$), those who received condom promotion (OR = 24.61, 95% CI: 21.07-28.74, $p < 0.0001$), visited the bathhouse frequently (OR = 2.22, 95% CI: 1.19-4.12, $p = 0.01$), got high score of knowledge about AIDS (OR = 3.95, 95% CI: 3.47-4.50, $p < 0.0001$), had group sex in the past six months (OR = 1.29, 95% CI: 1.09-1.54, $p = 0.003$), had anal intercourse(AI) with commercial male sex partners (OR = 1.97, 95% CI: 1.57-2.46, $p < 0.0001$), had Sexually transmitted diseases(OR = 1.58, 95% CI: 1.13-2.22, $p = 0.008$), always used condoms during anal sex in the last six months($p < 0.05$) and used condoms last time (OR = 1.53, 95% CI: 1.32-1.78, $p < 0.0001$) tend to undergo annual testing. (Table 3)

Table 3
Univariate and Multivariate analysis on factors associated with HIV testing

Variable	Univariate		Multivariate	
	OR(95CI)	p value	OR(95CI)	p value
Age				
≤24	4.81(4.13-5.61)	<0.0001	0.67 (0.49-0.92)	0.01
>24	1.00		1.00	
Marital status				
Single	1.31(1.15-1.50)	<0.0001	1.30(1.07-1.58)	0.007
Non-single	1.00		1.00	
Place of residence				
local	1.00			
Non-local	1.20(0.85-1.69)	0.30		
Level of education				
Junior school or below	0.58(0.49-0.69)	<0.0001	0.60(0.47-0.76)	<0.0001
High school	0.82(0.70-0.97)	0.02	0.72(0.58-0.90)	0.004
College and above	1.00		1.00	
Frequency of going to the bathhouse				
Once a month				
Once a week	2.15(1.23-3.75)	0.007		
Twice or more a week	2.22(1.19-4.12)	0.01		
Method of seeking sexual partners				
bathhouse	1.00			
internet	0.56(0.49-0.64)	<0.0001		
other	0.41(0.32-0.52)	<0.0001		
HIV-related knowledge				
<7	1.00	<0.0001	0.25(0.22-0.29)	<0.0001
≥ 7	3.95(3.47-4.50)		1.00	
The latest AI condom use				

Variable	Univariate		Multivariate	
	OR(95CI)	p value	OR(95CI)	p value
yes	1.53(1.32-1.78)	<0.0001		
no	1.00			
Had group sex in the past six months				
yes	1.29(1.09-1.54)	0.003		
no	1.00			
Had AI with commercial male sex partner(s)				
yes	1.97(1.57-2.46)	<0.0001		
no	1.00			
Had Sexually transmitted diseases				
yes	1.58(1.13-2.22)	0.008		
no	1.00			
Accept condom promotion and distribution in the past year				
yes	24.61(21.07-28.74)	<0.0001	14.50(12.02-17.49)	<0.0001
no	1.00		1.00	
Male sex worker				
yes	2.42(1.75-3.35)	<0.0001		
no	1.00			
Frequency of condom use during anal sex in the last six months				
never	0.23(0.16-0.33)	<0.0001	0.50(0.29-0.86)	0.01
sometimes	0.39(0.34-0.45)	<0.0001	0.69(0.57-0.83)	0.0001
always	1.00		1.00	
HIV infection				
yes	1.12(0.90-1.39)	0.30		
no	1.00			

Multivariate analysis

The multivariate logistic analysis showed that 6 variables including age, education level, AIDS knowledge, marital status, acceptance of condom promotion and distribution, and frequency of condom use could link to HIV testing behaviors.

Adolescents under the age of 24 (OR=0.67, 95% CI: 0.49-0.92, P = 0.01), low-education MSM (OR=0.60, 95% CI: 0.47-0.76, P <0.0001) and people with low AIDS knowledge (95% CI: 0.22-0.29, P <0.0001) are less likely to undergo annual testing.

Those who always use condoms during anal intercourse (p <0.05), received condom promotion and distribution within one year (OR = 10.98, 95% CI: 8.33-14.47, p <0.0001) and single MSM (OR = 1.30, 95% CI: 1.07-1.58, p = 0.007) are likely to have undergone annual testing. (Table 3)

Discussion

The HIV infection results in this study, to some extent, reflect the number of long-term hidden infections in MSM. Results suggest 29% of the HIV-infected people had never been tested for HIV before, and 15% had not tested for HIV within a year, while the HIV infection rate among non-annual testers reached 13.17%, the highest among the three groups. In conclusion, at least 44% of people with long-term potential HIV infections had not undergone regular testing. The transmission rate of those who do not know their infection is estimated to be three times that of those who are aware of their infection[10]. Lack awareness of HIV testing, negative emotions such as the inconvenience of detection, low perceived service quality, and inferiority about worrying about disease disclosure may cause MSM to fail HIV testing for long time[11].

It was known that young MSM and low-educated MSM are the target population for HIV testing. Science's survey report shows that HIV infections are spiking among young gay Chinese[12]. Young MSM have strong sexual desire and are more likely to contact gay groups and have male sexual intercourse with the convenience of online communication [13]. However, lack of HIV knowledge and fear of positive results may discourage young people from testing[14]. HIV education was associated with significant additional reductions in sexual risk behaviors among Young MSM[15]. It is important to adopt various online forms to strengthen the knowledge related to AIDS and improve the deficiencies in youth promotion[16]. Low-education MSM tend not to test for HIV, which is consistent with previous reports[17]. Educational level is related to work and occupation and leisure occasions, while low-education groups such as farmers and workers need to intervene with appropriate methods, such as using easy-to-understand pictures or promoting free HIV testing in places they access routinely[18]. Low-education people have a low concept of AIDS transmission, and there is a high probability that they will marry women and further expand the scope of transmission and even endanger the next generation. In addition, this survey is based on bathhouses, requires lower consumption, and has the potential for group sex.

The results of this study indicate that the annual testing behavior of married MSM is not as good as that of single MSM. A study in China showed that under parental or social pressure, nearly half (48.9%) of men who had sex with men chose to marry women, and 91% of them reported that they would practice homosexual behavior after marriage[19]. This behavior may expand the spread of HIV from MSM to the general population or the next generation. In order to avoid this situation, it is necessary to take actions to increase the frequency of testing in married MSM, such as making HIV testing a routine item or promoting self-test kits. In addition, provision of frequent HIV testing to married MSM may contribute in promoting HIV testing among their sexual partners and in facilitating safer sexual decisions.

Certainly, possessing a high level of HIV knowledge and receiving condom promotion and distribution can foster better HIV testing awareness, thereby promoting regular HIV testing behaviors among MSM. The proportion of condom promotion and advanced AIDS knowledge received in this study is about 60%-70%, suggesting that continued expansion and strengthening of HIV-related advocacy in MSM may lead to better progress. In addition, the awareness of condom use is also closely related to frequent HIV testing. Compared with MSM who has always used condoms during anal sex for the past six months, people who never use or occasionally use condoms lack the initiative and awareness of annual testing. Strategies to strengthen the promotion of condom use and safe sexual behaviors warrants further consideration as countries develop annual HIV testing programs.

Organizations can consider promoting the benefits and policies of HIV testing in MSM's ways of frequently seeking sexual partners such as bathhouses and the Internet, or vigorously promote self-testing kit to remind potential HIV-infected people to perform frequent HIV testing in safety and dignity[20]. In addition, it is also necessary for the testing agency to ensure a friendly and non-discriminatory HIV testing environment for the testers[21].

Limitations

1. Snowball sampling is biased, but due to the particularity of the target population, this approach is more reasonable. The Tianjin bathhouse is the earliest gay bathhouse in China, with long opening-time, large passenger flow and from all parts of China. Therefore, participants can be viewed as representatives for MSM in China.
2. The information in the questionnaire is self-reported and there may be information bias. To overcome this shortcoming, the survey was conducted by professionally trained MSM to better communicate with the participants.
3. More issues need to be addressed, such as occupation, position during intercourse, income, etc.

Conclusion

In order to achieve the 90-90-90 goal, relevant departments should carry out targeted publicity and education and promote self-tests to encourage the population to carry out frequent HIV testing, mainly

including Young MSM (especially students), low-education people, married MSM and people who have not always used condoms.

List Of Abbreviations

MSM: Men who have sex with men

STD: Sexually Transmitted Disease

MSW: male sex worker

UNAIDS: The Joint United Nations Programme on HIV/AIDS

NHAS: The recent National HIV/AIDS Strategy

GSEs: Group sexual encounters

AI: Anal intercourse

Declarations

Ethics approval and consent to participate

This study was reviewed and approved by the Institutional Review Board of the National Center for AIDS / STD Prevention and Control of the Chinese Centers for Disease Control and Prevention [IRB approve number: X130205267], and sponsored by the President's Emergency Plan for AIDS Relief (PEPFAR) and the Humanities and Social Science Fund of the Ministry of Education, China. All participants signed an informed consent form before the survey started.

Consent for publication

Not applicable.

Availability of data and materials

The datasets used and analyzed during the current study are available from the corresponding author on reasonable request.

Competing interests

The authors declare that they have no competing interests in the findings of the study.

Funding

This work was supported by Outcome Evaluation of the Tianjin Bathhouse-based Health Center Program, 2011-2018, PEPFAR (President's Emergency Plan For Aids Relief, PEPFAR, USA), NU2GGH001153. It was also supported by The Humanities and Social Science Fund of the Ministry of Education, China, 20YJAZH021.

Acknowledgements

The authors appreciate support for this study from China CDC AIDS Prevention and Control Center, the United States CDCGAP Project, and the Tianjin Centers for Disease Control and Prevention; and the excellent data collection by MSM organization Deep Blue. We thank all the men who generously shared their time and insights for this study.

Authors' contributions

YJ collected data. ZTT, YTT and SDS organized the database. LZQ and CY wrote the manuscript and analyzed data. XJ reviewed the manuscript. YMH and LYY contributed to discussion. LCP, CZ, LZJ and MJ contributed to the research ideas of this study. And all authors have read and approved the final manuscript.

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