ISSN 2096-7071
CN 10-1629/R1

CHINA CDC WEEKLY

Vol. 5 No. 13 Mar. 31, 2023

中国疾病预防控制中心周报

Preplanned Studies

Policy Notes

ISSN 2096-7071

China CDC Weekly

Cover Image: adapted from the US Centers for Disease Control and Prevention, https://www.cdc.gov/hiv/basics/whatishiv.html.

Preplanned Studies

Implementing Routine HIV Screening in Hospitals: An Effective Practice to Expand HIV Testing — Xishuangbanna Prefecture, Yunnan Province, China, 2019–2020

Yidan Wang[1,&]; Yanling Ma[2,&]; Qiyu Zhu[1]; Wenyue Xu[3]; Haolan Sun[4]; Dongmin Li[1]; Cong Jin[1,#]

Summary

What is already known about this topic?

Research evidence is insufficient to suggest whether routine human immunodeficiency virus (HIV) screening in healthcare settings is effective in promoting greater awareness of HIV-positive status.

What is added by this report?

This study found that, following the implementation of routine HIV screening in hospitals in Xishuangbanna Prefecture, Yunnan Province, there was a significant increase in the number of HIV screenings, positive results, and the positive rate of HIV screening in primary-level hospitals.

What are the implications for public health practice?

Routine hospital-based HIV screening is effective in identifying HIV infections in areas with concentrated epidemics.

Human immunodeficiency virus (HIV) testing is the gateway to antiretroviral treatment and behavior prevention; however, due to several real-world challenges and barriers, HIV testing in healthcare settings often falls short of desired uptake (*1*–*2*). Yunnan Province is a high HIV prevalence area in China (*3*). To further expand HIV testing services and help more HIV-infected individuals learn their status, a policy was implemented in January 2020 offering free opt-out HIV screening tests to all patients receiving bloodwork testing in hospitals. This study retrospectively analyzed the impact of this policy by incorporating HIV screening into routine services in hospitals in Xishuangbanna Prefecture, Yunnan Province, where the estimated HIV prevalence was 0.26% in 2019 (Unpublished data from Yunnan Provincial CDC). Results showed that following the implementation of routine HIV screening in Xishuangbanna Prefecture, the number of HIV screenings and positive results increased 2.08-fold and 1.88-fold, respectively, and the positive rate of HIV screening in primary-level hospitals increased significantly from 0.12% to 0.14%. To our knowledge, this is the first study in China to provide practice-based evidence of the effectiveness of implementing routine HIV testing in healthcare settings.

After implementing a policy of routine HIV screening in hospitals, patients were informed of a free opt-out HIV screening test provided in bloodwork testing. Prominently posted signs in the blood collection area stated that HIV testing was provided at no cost for all patients who received bloodwork testing and that those who did not wish to have HIV testing could refuse. This ensured that patients were fully informed about routine HIV testing in hospitals and that physicians did not require additional consultation or informed consent.

In this study, HIV testing data from all 43 public hospitals in Xishuangbanna, including 2 tertiary hospitals, 4 secondary hospitals, and 37 primary hospitals, were collected through an official survey organized by the health administration in Xishuangbanna from January 2019 to December 2020, with January to December in 2019 and 2020 as the reference and implementation periods, respectively. SPSS (version 22.0, IBM Corp., Armonk, NY.) was used for data analysis. The positive rate of HIV screening was compared using the Pearson chi-square test, and $P<0.05$ was considered statistically significant.

A total of 1,078,845 HIV screening tests were recorded from January 2019 to December 2020. During the 2020 implementation period, HIV screening and positive results increased 2.08-fold (728,331/350,514) and 1.88-fold (1,413/752), respectively, compared to the 2019 reference period. However, the overall positive rate of HIV screening decreased slightly but significantly from 0.21% to 0.19% ($P=0.026$) (Table 1).

According to the tiers of hospitals, HIV screening tests increased 1.82-fold (153,960/84,815), 1.25-fold (91,214/72,704), and 2.50-fold (483,157/192,995) in tertiary, secondary, and primary hospitals, respectively.

TABLE 1. Volumes and yields of routine HIV screening in 43 hospitals in Xishuangbanna Prefecture, Yunnan Province, January 2019 to December 2020.

Visit types	Reference period				Implementation period				*P* value§
	Screening *N*	Positive *N*	Positive rate % (95% *CI*)	*P* value*	Screening *N*	Positive *N*	Positive rate % (95% *CI*)	*P* value†	
Total	350,514	752	0.21 (0.20–0.23)		728,331	1,413	0.19 (0.18-0.20)		0.026
Hospital tiers				<0.001				<0.001	
Tertiary	84,815	314	0.37 (0.33–0.41)		153,960	488	0.32 (0.29–0.35)		0.031
Secondary	72,704	214	0.29 (0.25–0.33)		91,214	260	0.29 (0.26–0.33)		0.728
Primary	192,995	224	0.12 (0.11–0.14)		483,157	665	0.14 (0.13–0.15)		0.027

Abbreviation: HIV=human immunodeficiency virus; *CI*=confidence interval.
* *P* value of Chi-square test compares the positive rate of HIV screening among different hospital tiers in the reference period (January to December 2019).
† *P* value of Chi-square test compares the positive rate of HIV screening among different hospital tiers in the implementation period (January to December 2020).
§ *P* value of Chi-square test compares the positive rate of HIV screening for the same hospital tiers between the reference and implementation periods.

HIV-positive results increased 1.55-fold (488/314), 1.21-fold (260/214), and 2.97-fold (665/224) in the hospitals at tertiary, secondary, and primary levels, respectively. In both the reference period and implementation period, the positive rate of HIV screening showed statistical significance (χ^2_{2019}=205.07, P<0.001; χ^2_{2020}=238.55, P<0.001) in different tiers of hospitals. Following implementation of the policy, the positive rate of HIV screening in primary hospitals increased significantly from 0.12% to 0.14% (χ^2=4.89, P=0.027). In contrast, the positive rate of HIV screening in tertiary hospitals decreased significantly from 0.37% to 0.32% (χ^2=4.63, P=0.031) (Table 1).

When investigating the effect of routine HIV screening in specialized departments, we only used information from tertiary and secondary hospitals, as primary hospitals generally do not have many specialized departments. The positive rate of HIV screening varied among different departments (χ^2_{2019}=297.32, P<0.001; χ^2_{2020}=369.15, P<0.001) in both reference and implementation periods. The top four departments with high positive rates of HIV screening were the Dermatovenereal Department, Infectious Diseases Department, Rehabilitation Department, and Emergency Department. Following implementation of the policy, the positive rate of HIV screening in the Dermatovenereal Department decreased significantly from 1.57% to 0.90% (χ^2=10.06, P=0.002) (Table 2).

DISCUSSION

This retrospective study demonstrated a substantial increase in the number of HIV screenings and positive results within one year of implementing routine HIV screening in hospitals in Xishuangbanna. During the reference period, the hospital-provided HIV testing and counseling services in Yunnan mainly adopted a risk-based screening strategy (*3*). Under this strategy, HIV screening services in hospitals were targeted at key populations of patients at high risk of HIV infection, such as those with HIV/AIDS-related symptoms or HIV-related risk behaviors, those attending sexually transmitted disease clinics, and those prior to surgery or blood transfusion. After the implementation of routine HIV testing, free opt-out HIV screening tests were provided to all patients who received bloodwork testing in hospitals.

Hospitals are the most important resource to find HIV-infected people in China (*4*). Although the previous HIV testing services in hospitals had covered key populations in Xishuangbanna, there were still some HIV-infected people who could not be identified and missed the opportunity to be tested (*1–2*). Through integrating routine HIV screening in hospitals, these people who might have been missed before could be better identified. Consistent with this tremendous effort to expand HIV testing in hospitals, the estimated proportion of HIV-positive people who were aware of their status increased rapidly from 81.9% in 2019 to 90.8% in 2020 in Xishuangbanna (*5*). Yunnan Province took the lead in achieving the first aim of 90-90-90 targets for HIV/AIDS prevention and control by the end of 2020 (*3*,*6*).

The implementation of hospital-based routine HIV screening resulted in a stronger increase in the number of screenings in the primary hospitals than in the upper tiers of hospitals, likely due to the larger number of

TABLE 2. Volumes and yields of routine HIV screening in 6 secondary/tertiary hospitals in Xishuangbanna Prefecture, Yunnan Province, January 2019 to December 2020.

Visit types	Reference period				Implementation period				*P* value§
	Screening *N*	Positive *N*	Positive rate % (95% *CI*)	*P* value*	Screening *N*	Positive *N*	Positive rate % (95% *CI*)	*P* value†	
Total	157,519	528	0.34 (0.31–0.37)		245,174	748	0.31 (0.29–0.33)		0.097
Departments				<0.001				<0.001	
Internal medicine	35,270	128	0.36 (0.30–0.43)		48,318	148	0.31 (0.26–0.36)		0.159
Gynecology and obstetrics	31,377	42	0.13 (0.10–0.18)		40,184	60	0.15 (0.12–0.19)		0.587
Emergency	26,186	119	0.45 (0.38–0.54)		31,349	171	0.55 (0.47–0.64)		0.125
Medical examination	21,179	40	0.19 (0.14–0.26)		64,511	95	0.15 (0.12–0.18)		0.185
Surgery	19,320	52	0.27 (0.21–0.35)		29,250	104	0.36 (0.30–0.44)		0.100
Ophthalmology and otorhinolaryngology	5,944	18	0.30 (0.19–0.47)		6,086	17	0.28 (0.17–0.45)		0.811
Infectious diseases	5,115	54	1.06 (0.81–1.38)		2,070	32	1.55 (1.10–2.18)		0.084
Pediatric	4,536	9	0.20 (0.11–0.38)		3,633	8	0.22 (0.11–0.43)		0.830
Dermatovenereal	3,059	48	1.57 (1.19–2.08)		9,706	87	0.90 (0.73–1.11)		0.002
Traditional Chinese medicine	2,463	2	0.08 (0.02–0.29)		6,315	11	0.17 (0.09–0.31)		0.309
Rehabilitation	1,528	10	0.65 (0.35–1.19)		1,788	8	0.45 (0.23–0.88)		0.419
Other	1,542	6	0.39 (0.18–0.85)		1,964	7	0.36 (0.18–0.74)		0.874

Abbreviation: HIV=human immunodeficiency virus; *CI*=confidence interval.

* *P* value of Chi-square test compares the positive rate of HIV screening among different hospital tiers in the reference period (January to December 2019).

† *P* value of Chi-square test compares the positive rate of HIV screening among different hospital tiers in the implementation period (January to December 2020).

§ *P* value of Chi-square test compares the positive rate of HIV screening for the same hospital tiers between the reference and implementation periods.

primary hospitals covering more local residents. In addition, the positive HIV screening rate increased significantly from 0.12% to 0.14% in primary hospitals. Because tertiary and secondary hospitals mainly focus on hard-to-treat patients, routine screening at primary-level medical institutions may help detect some HIV-infected individuals who go to local hospitals for minor illnesses, and this could be more effective in early detection of HIV infection.

In a similar study that evaluated the effect of offering HIV testing to all patients presenting to three hospitals as part of routine care between October 2011 and December 2016 in Vancouver, Canada (*7*), the researchers found that the number of HIV tests increased elevenfold and that of new diagnoses increased by 17% among inpatients. They also found that the average diagnostic yield decreased from nine to two diagnoses per 1,000 tests among inpatients, and the detection efficiency may be diluted by the increased HIV screening. The study in Vancouver showed that the routine HIV screening in the Emergency Department was effective in early diagnosis of HIV-infected individuals (*7*), while the study in Xishuangbanna showed that the HIV screening in the Emergency Department yielded a high positive rate of HIV screening. Notably, in this study, the Rehabilitation Department, which mainly helps elderly patients restore function, showed a high positive rate of HIV screening, which could be due to the increasing epidemic of HIV infection among the elderly in China (*8*).

This study has several limitations. First, the increase in HIV-positive results cannot exclude the effect of repeat testing. Second, the number of patients who opted out of HIV testing is unknown. Third, the characteristics of individuals with positive HIV screening results and the data of late diagnosis are not available. Lastly, people's health-seeking behaviors may have been affected to some extent by the coronavirus disease 2019 (COVID-19) epidemic in 2020, and a

study showed that non-pharmaceutical interventions were associated with a decrease in HIV testing in China (*9*). In this study, it is difficult to quantify the impact of COVID-19 epidemic because the data of weekly HIV testing were not collected. However, Xishuangbanna did not experience a major COVID-19 epidemic in 2020, and HIV testing volume still increased in this region, suggesting that this limitation would not affect the main findings of this study.

The findings of this study suggest that incorporating routine HIV testing into existing clinical services can effectively increase testing volumes and identify more infected individuals, without the need for additional clinical staff or a separate process. Hospital-based routine HIV screening should be recommended as an effective measure to expand HIV testing, particularly in regions with high HIV prevalence.

Conflicts of interest: No conflicts of interest.

Ethics statement: This study was reviewed and approved by the Ethics Committee of the National Center for AIDS/STD Control and Prevention of the Chinese Center for Disease Control and Prevention.

Funding: Supported by the China National Science and Technology Major Projects in Infectious Disease from the Ministry of Science and Technology [Grant no. 2017ZX10201101-002-003].

doi: 10.46234/ccdcw2023.051

[#] Corresponding author: Cong Jin, jinc@chinaaids.cn.

[1] National Center for AIDS/STD Control and Prevention, Chinese Center for Disease Control and Prevention, Beijing, China; [2] Yunnan Center for Disease Control and Prevention, Kunming City, Yunnan Province, China; [3] Xishuangbanna Center for Disease Control and Prevention, Xishuangbanna Prefecture, Yunnan Province, China; [4] School of Chemistry and Molecular Biosciences, University of Queensland, St Lucia, Australia.
[&] Joint first authors.

Submitted: March 10, 2023; Accepted: March 27, 2023

REFERENCES

1. Delaney KP, DiNenno EA. HIV testing strategies for health departments to end the epidemic in the U.S. Am J Prev Med 2021;61(5 Suppl 1):S6-S15. http://dx.doi.org/10.1016/j.amepre.2021.06.002.
2. Elgalib A, Fidler S, Sabapathy K. Hospital-based routine HIV testing in high-income countries: a systematic literature review. HIV Med 2018;19(3):195 – 205. http://dx.doi.org/10.1111/hiv.12568.
3. Ma YL, Lou JC, Lao YF, Jia MH. Yunnan province realized AIDS prevention and control "90-90-90" strategy and effect. Chin J AIDS STD, 2022;28(8):884 – 7. http://dx.doi.org/10.13419/j.cnki.aids.2022.08.02. (In Chinese).
4. Han MJ, Jin C, Li JY, Zhong P, Pan XH, Wu GH, et al. Expert consensus on expanding HIV testing and promoting early HIV testing. Chin J AIDS STD 2021;27(11):1202 – 6. http://dx.doi.org/10.13419/j.cnki.aids.2021.11.03. (In Chinese).
5. The People's Government of Xishuangbanna Prefecture. Make concerted efforts to break through the dilemma of AIDS control and prevention. 2021. https://www.xsbn.gov.cn/wjw/57974.news.detail.dhtml?news_id=2165125. [2023-3-24]. (In Chinese).
6. UNAIDS. UNAIDS 2016-2021 strategy on the fast-track to end AIDS. 2015. https://www.aidsdatahub.org/resource/unaids-2016-2021-strategy-on-the-fast-track-to-end-aids. [2023-3-24].
7. Gustafson R, Demlow SE, Nathoo A, McKee G, MacDonald LE, Chu TX, et al. Routine HIV testing in acute care hospitals: changing practice to curb a local HIV epidemic in Vancouver, BC. Prev Med 2020;137:106132. http://dx.doi.org/10.1016/j.ypmed.2020.106132.
8. Ma KF, Zhang XT, Ge L, Chen FF, Cai C, Qin QQ, et al. Analysis on the late-diagnosis among newly detected HIV/AIDS cases aged 50 years or older in China from 2015 to 2019. Chin J AIDS STD, 2022;28(1):16 – 20. http://dx.doi.org/10.13419/j.cnki.aids.2022.01.04. (In Chinese).
9. Wu XS, Wu GH, Ma YM, Huang XJ, Yang YC, Cai YS, et al. The impact of COVID-19 non-pharmaceutical interventions on HIV care continuum in China: an interrupted time series analysis. Lancet Reg Health West Pac, 2022;29:100569. http://dx.doi.org/10.1016/j.lanwpc.2022.100569.

Preplanned Studies

Characteristics of Migration Among HIV-Positive MSM — Guangxi Zhuang Autonomous Region, China, 2005–2021

Wenxuan Hou[1,&]; He Jiang[2,&]; Qiuying Zhu[2]; Jinghua Huang[2]; Jianjun Li[2]; Xiuling Wu[2]; Xuanhua Liu[2]; Nengxiu Liang[2]; Shuai Tang[2]; Qin Meng[2]; Bo Li[2]; Dongni Ding[2]; Ni Chen[2,3]; Guanghua Lan[1,2,#]

Summary

What is already known about this topic?

Migration has a significant impact on the transmission of human immunodeficiency virus (HIV). To date, there have been few studies examining the characteristics of migration among HIV-positive men who have sex with men (MSM).

What is added by this report?

The prevalence of migrants among newly reported HIV-positive MSM in Guangxi Zhuang Autonomous Region increased from 2005 to 2021. Yulin Prefecture had the highest proportion of out-migrant MSM (12.6%), while Nanning Prefecture had the highest proportion of in-migrant MSM (55.9%). Risk factors associated with migration among MSM included being in the 18–24 age range, having a college education or higher, and being a student.

What are the implications for public health practice?

A complex prefecture-level network of HIV-positive MSM exists in Guangxi. To ensure effective follow-up management and antiretroviral therapy for migrant MSM, effective measures must be taken.

Migration is a major risk factor for the spread of human immunodeficiency virus (HIV) (*1*). In China, 7.8% of HIV-positive individuals moved inter-provincially after their first follow-up (*2*). Men who have sex with men (MSM) play a bridging role in HIV transmission, with an average prevalence of HIV among MSM in China of 5.7% [95% confidence interval (*CI*): 5.4%–6.1%] between 2001 and 2018 (*3*). Guangxi Zhuang Autonomous Region is one of the provincial-level administrative divisions (PLADs) with the largest number of HIV-positive individuals in China, and the proportion of MSM in newly confirmed HIV individuals increased from 0.93% to 6.53% between 2010 and 2017 (*4*). The migration network among HIV-positive MSM has facilitated HIV transmission in Guangxi (*5*). However, the current migration status of HIV-positive MSM in Guangxi is unknown. In this study, HIV-positive MSM aged 18 years or older and diagnosed between 2005 and 2021 were extracted from the National Integrated HIV/AIDS Control and Prevention Data System.

Participants with follow-up addresses that differed from their baseline addresses were classified as prefecture-level migrants, while those with the same addresses were classified as non-migrants. The prefectures in the Guangxi Zhuang Autonomous Region included Nanning, Liuzhou, Guilin, Wuzhou, Beihai, Fangchenggang, Qinzhou, Guigang, Yulin, Baise, Hezhou, Hechi, Laibin, and Chongzuo. The temporal trend of the proportion was assessed using a simple linear regression model, and risk factors were analyzed using a multivariable logistic regression model. This study was approved by the Ethics Review Board of Guangxi Center for Disease Control and Prevention (Certificate No.: GXIRB2016-0047-1).

Among 5,621 HIV-positive MSM, 1,733 (30.8%) were migrants. Compared with non-migrant MSM, migrant MSM had distinct characteristics: 18–24 years of age (44.8% *vs.* 28.8%), unmarried status (86.4% *vs.* 72.2%), belonging to the Han ethnic group (69.3% *vs.* 62.6%), education level of college and above (63.9% *vs.* 39.6%), and being a student (25.8% *vs.* 9.8%) (Table 1).

The proportion of migrant HIV-positive MSM increased from 0% in 2005 to 33.3% in 2006 and 35.1% in 2021, with an average proportion of 27.2% (Figure 1). This showed an upward trend of the proportion of migrant HIV-positive MSM from 2009 to 2021 (R^2=0.608, P=0.002).

There was a complex network of migration among HIV-positive MSM in Guangxi. The prefectures with the highest number of out-migrant MSM in Guangxi

TABLE 1. Demographic characteristics of HIV-positive MSM categorized by prefecture-level migration status in Guangxi, China, 2005–2021.

Characteristic	Non-migrant MSM *N* (%) (*n*=3,888)	Migrant *N* (%) (*n*=1,733)	χ^2	*P*
Age (years)			195.543	<0.001
18–24	1,120 (28.8)	776 (44.8)		
25–49	2,377 (61.1)	915 (52.8)		
≥50	391 (10.1)	42 (2.4)		
Marital status			138.163	<0.001
Unmarried	2,807 (72.2)	1,496 (86.4)		
Married	799 (20.5)	155 (8.9)		
Divorced	282 (7.3)	82 (4.7)		
Ethnic group			38.130	<0.001
Han	2,435 (62.6)	1,200 (69.3)		
Zhuang	1,285 (33.1)	434 (25.0)		
Other	168 (4.3)	99 (5.7)		
Education background			327.517	<0.001
College and above	1,539 (39.6)	1,107 (63.9)		
Senior high school	1,028 (26.4)	376 (21.7)		
Junior middle school	1,042 (26.8)	211 (12.2)		
Primary school and below	279 (7.2)	39 (2.2)		
Occupation			418.293	<0.001
Student	381 (9.8)	447 (25.8)		
Domestic service and unemployed	996 (25.6)	413 (23.8)		
Private company employee	536 (13.8)	295 (17.0)		
Farming or factory worker	1,146 (29.5)	174 (10.0)		
Government employee	361 (9.3)	149 (8.6)		
Other	468 (12.0)	255 (14.8)		

Abbreviation: HIV=human immunodeficiency virus; MSM=men who have sex with men.

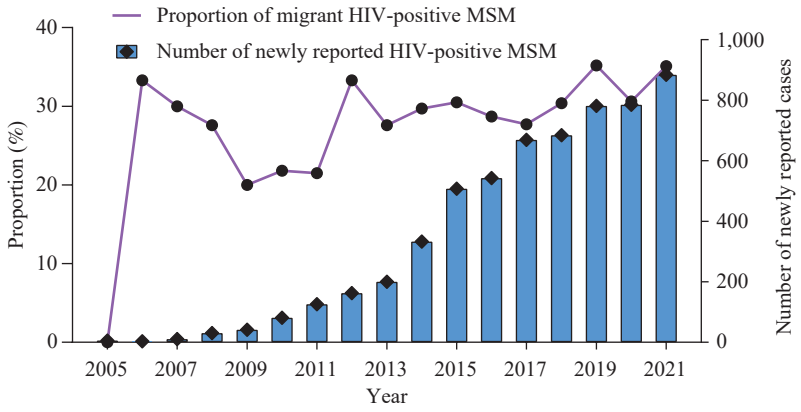

FIGURE 1. Temporal trend of the number of newly reported HIV-positive MSM and the proportion of migration in Guangxi from 2005 to 2021.
Abbreviation: HIV=human immunodeficiency virus; MSM=men who have sex with men.

were Yulin (219, 12.6%), followed by Baise (123, 7.1%), Guilin (116, 6.7%), Hechi (107, 6.2%), and Guigang (105, 6.1%). The total number of out-migrants from Guangxi to other regions of China was 468, accounting for 27%. The top five prefectures with the highest number of in-migrant MSM populations in Guangxi were Nanning (968, 55.9%), followed by Liuzhou (138, 8%), Guilin (125, 7.2%), Beihai (68, 3.9%), and Baise (26, 1.5%). The total number of in-migrants from other regions of China to Guangxi was 288, accounting for 16.6%. The risk factors of prefecture-level migration included those aged 18–24 years [compared with those aged ≥50 years, adjusted odds ratio (a*OR*)=2.718, 95% confidence interval (*CI*): 1.851–3.991], those aged 25–49 years (compared with those aged ≥50 years, a*OR*=2.292, 95% *CI*: 1.605–3.273), having college education level and above (compared with primary school education level and below, a*OR*=2.176, 95% *CI*: 1.499–3.159), and being a student (compared with other occupations, a*OR*=1.545, 95% *CI*: 1.231–1.939) (Table 2).

DISCUSSION

The two primary findings of the study were that the proportion of HIV-positive MSM who had migrated was increasing, and that the risk factors associated with migration were age, educational background, and occupation.

This study found that young adults were the dominant subgroup in Guangxi (33.7%), which was lower than the national data findings from 2006 to 2010 (54.6%) (*6*). Unmarried individuals with a high level of education were in a sexually active period, with an open sexual attitude, and their frequent migration facilitated the spread and transmission of HIV.

TABLE 2. Logistic regression analysis of associated factors influencing prefecture-level migration among HIV-positive MSM in Guangxi, China, 2005–2021.

Characteristic	*OR* (95% *CI*)	*P*	*aOR* (95% *CI*)	*P*
Age (years)				
18–24	6.444 (4.628–8.974)	<0.001	2.718 (1.851–3.991)	<0.001
25–49	3.581 (2.581–4.967)	<0.001	2.292 (1.605–3.273)	<0.001
≥50	1		1	
Marital status				
Unmarried	2.744 (2.285–3.296)	<0.001	1.187 (0.959–1.469)	0.115
Divorced	1.499 (1.110–2.024)	0.008	1.299 (0.949–1.778)	0.103
Married	1		1	
Ethnic group				
Han	0.836 (0.646–1.082)	0.174	0.887 (0.675–1.166)	0.391
Zhuang	0.572 (0.436–0.750)	<0.001	0.626 (0.469–0.834)	0.001
Other	1		1	
Education background				
College and above	5.161 (3.659–7.278)	<0.001	2.176 (1.499–3.159)	<0.01
Senior high school	2.626 (1.841–3.746)	<0.001	1.346 (0.923–1.963)	0.123
Junior middle school	1.452 (1.007–2.095)	0.046	1.028 (0.704–1.502)	0.885
Primary school and below	1		1	
Occupation				
Student	2.132 (1.750–2.596)	<0.001	1.545 (1.231–1.939)	<0.001
Farming or factory worker	0.276 (0.223–0.342)	<0.001	0.419 (0.333–0.525)	<0.001
Government employee	0.750 (0.591–0.951)	0.018	0.699 (0.546–0.895)	0.004
Domestic service and unemployed	0.752 (0.626–0.903)	0.002	0.775 (0.643–0.935)	0.008
Other	0.988 (0.802–1.217)	0.909	1.033 (0.835–1.278)	0.765
Private company employee	1		1	

Abbreviation: MSM=men who have sex with men; *OR*=odd ratio; a*OR*=adjusted odds ratio; *CI*=confidence interval.

Sexually active MSM moved to other prefectures of the country, creating a bridging role in the spread of HIV to their male and female partners, making HIV prevention and control difficult (*7*). College students should be a target population for HIV prevention and control in MSM (*8*). HIV/AIDS-related education and intervention services should be promoted on campus, increasing the uptake of antiretroviral therapy and the proportion of condom use among younger MSM (*9*). The number and migration proportion of newly reported HIV-positive MSM in Guangxi have been increasing, and migration at the prefecture level is complicated. The dominant in-migration prefectures were Nanning, the provincial capital of Guangxi, followed by Liuzhou and Guilin, all of which have strong economies and convenient transportation. The dominant out-migration prefectures were Yulin and Baise. The migrations of MSM were mainly within the prefectures as internal migration. Therefore, there is an urgent need for Nanning and Liuzhou to implement preventive measures among prefecture-level migrant MSM. Additionally, a considerable proportion of MSM migrate between prefectures in other PLADs and Guangxi. Outside Guangxi, the migration was mainly concentrated in Guangdong, Zhejiang, and Beijing. MSM from southwest China mainly traveled to eastern coastal prefectures, where China's coastal economy is more developed. The web of social interactions is becoming increasingly intricate. Therefore, inter-provincial follow-up management and antiretroviral therapy referral services should be considered. Enhancing community participation in the supervision of the prefecture-level migration and dissemination of comprehensive HIV/AIDS information is essential to ensure the prevention and adequate management of HIV spread. In addition, it is necessary to enhance HIV programs, such as local medical insurance policies, and access to comprehensive antiretroviral therapy services in medical institutions.

A cross-sectional survey of 61 prefectures in China reported that the characteristics of the migrant population among MSM were unmarried (77.5%), aged 18–24 (47.5%), and having a college education or higher (41.1%) (*10*). This is similar to the results of this study. According to Li YZ et al.'s previous studies, the prevalence of HIV among MSM students increased from 1.1% to 26.9% between 2003 and 2010 (*7*), which is also consistent with the trend reported in this study. A study conducted in Kenya showed that there was an association between past two-year internal migration and having higher-risk sexual partners and baseline HIV infection (*5*). Thus, the migrant population of MSM is a bridge for HIV transmission and a key population for HIV prevention and universal treatment.

Although the initial findings showed the characteristics of the migration network among MSM, some limitations remain. For example, the National Integrated HIV/AIDS Control and Prevention Data System only collects baseline address codes and follow-up codes, and the definition of migration according to these codes may overlook the fact that some people have migrated from their place of birth to their place of residence. As a result, the proportion of migration may have been overestimated, as they may have acquired HIV at their residence. Further research could use a questionnaire based on this study to obtain more accurate results.

In conclusion, a complex migration network exists among HIV-positive MSM in Guangxi. Thus, relevant departments are recommended to take the following measures to reduce the infection rate of immigrant MSM: first, strengthening the communication among follow-up departments in different prefectures and improving the information system for the migrant population. Second, timely follow-up management and antiretroviral therapy services should be provided for the prefecture-level migrant population by local medical institutions. Third, schools and communities should strengthen HIV education awareness among MSM and their partners to reduce the secondary transmission of HIV.

Funding: The National Natural Science Foundation of China (82160636).

doi: 10.46234/ccdcw2023.052

[#] Corresponding author: Guanghua Lan, lgh605@163.com.

[1] Guangxi University of Chinese Medicine, Nanning City, Guangxi Zhuang Autonomous Region, China; [2] Guangxi Key Laboratory of AIDS Prevention and Control and Achievement Transformation, Guangxi Center for Disease Prevention and Control, Nanning City, Guangxi Zhuang Autonomous Region, China; [3] Youjiang Medical University for Nationalities, Baise City, Guangxi Zhuang Autonomous Region, China.
[&] Joint first authors.

Submitted: November 02, 2022; Accepted: March 22, 2023

REFERENCES

1. Grabowski MK, Lessler J, Bazaale J, Nabukalu D, Nankinga J, Nantume B, et al. Migration, hotspots, and dispersal of HIV infection in Rakai, Uganda. Nat Commun 2020;11(1):976. http://dx.doi.org/10.1038/s41467-020-14636-y.

2. Han J, Li J, Zang CP, Liu YF. Analysis of the interprovincial movement of HIV/AIDS cases after the first follow-up and the effectiveness of antiretroviral therapy in China, 2016-2018. Chin J Epidemiol 2021;42(1):126-30. https://rs.yiigle.com/CN112338202101/1307710.htm. (In Chinese).
3. Dong MJ, Peng B, Liu ZF, Ye QN, Liu H, Lu XL, et al. The prevalence of HIV among MSM in China: a large-scale systematic analysis. BMC Infect Dis 2019;19(1):1000. http://dx.doi.org/10.1186/s12879-019-4559-1.
4. Ge XM, Yang WM, Zhu QY, Wu XL, Shen ZY, Zhu JH, et al. Epidemiological characteristics of HIV/AIDS in Guangxi Zhuang Autonomous Region, 2010-2017. Chin J Epidemiol 2019;40(3):315 – 21. http://dx.doi.org/10.3760/cma.j.issn.0254-6450.2019.03.011. (In Chinese).
5. Camlin CS, Akullian A, Neilands TB, Getahun M, Eyul P, Maeri I, et al. Population mobility associated with higher risk sexual behaviour in eastern African communities participating in a Universal Testing and Treatment trial. J Int AIDS Soc 2018;21(S4):e25115. http://dx.doi.org/10.1002/jia2.25115.
6. Hei FX, Wang L, Qin QQ, Wang L, Guo W, Li DM, et al. Epidemic characteristics of HIV/AIDS among men who have sex with men from 2006 to 2010 in China. Chin J Epidemiol 2012;33(1):67-70. http://chinaepi.icdc.cn/zhlxbx/ch/reader/view_abstract.aspx?file_no=20120116&flag=1. (In Chinese).
7. Li YZ, Xu JJ, Reilly KH, Zhang JM, Wei HY, Jiang YJ, 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(7):e69137. http://dx.doi.org/10.1371/journal.pone.0069137.
8. Wohlfeiler D. Structural and environmental HIV prevention for gay and bisexual men. AIDS 2000;14 Suppl 1:S52-6. http://dx.doi.org/10.1097/00002030-200006001-00008.
9. Kobrak P, Remien RH, Myers JE, Salcuni P, Edelstein Z, Tsoi B, et al. Motivations and barriers to routine HIV testing among men who have sex with men in New York City. AIDS Behav 2022;26(11):3563 – 75. http://dx.doi.org/10.1007/s10461-022-03679-5.
10. Wu ZY, Xu J, Liu EW, Mao YR, Xiao Y, Sun XH, et al. HIV and syphilis prevalence among men who have sex with men: a cross-sectional survey of 61 cities in China. Clin Infect Dis 2013;57(2):298 – 309. http://dx.doi.org/10.1093/cid/cit210.

Preplanned Studies

Analysis of Knowledge Level and Use of Antiretroviral Pre-Exposure and Post-Exposure Prophylaxis Among MSM — China, 2019–2022

Jiahuan Guo[1]; Wenting Kang[2]; Tongtong Liu[3]; Jie Xu[1]; Houlin Tang[1]; Fan Lyu[1]; Guang Zhang[1,#]

Summary

What is already known on this topic?

Men who have sex with men (MSM) in China have a high rate of human immunodeficiency virus (HIV) infection. Pre-exposure prophylaxis (PrEP) and post-exposure prophylaxis (PEP) have been shown to be effective in preventing HIV, which may help to contain the HIV epidemic among MSM.

What is added by this report?

This study found that knowledge and usage of PrEP were low among MSM, indicating that this population is at high risk for HIV infection. Promotion of PrEP and PEP among MSM is necessary to reduce the risk of HIV infection in this population.

What are the implications for public health practice?

PrEP and PEP are novel HIV prevention strategies that have been demonstrated to be effective and safe. To further reduce HIV transmission among MSM in China, it is necessary to promote the use of PrEP and PEP.

Men who have sex with men (MSM) have a high HIV infection rate, with more than one-fifth of newly infected people having sex with men (*1*). The overall national prevalence of HIV among MSM during the period of 2001 to 2008 was estimated to be 5.7% (*2*). Prevention and control of HIV epidemics among MSM are challenging. Pre-exposure prophylaxis (PrEP) and post-exposure prophylaxis (PEP) can effectively prevent HIV infection among MSM, and have been promoted and implemented in many countries with guidelines developed by the World Health Organization (WHO) (*3*). To learn about the cognition and use of PrEP and PEP among MSM in China, we conducted cross-sectional surveys in 2019, 2021, and 2022, respectively.

This study revealed that knowledge and utilization of PrEP and PEP among MSM were relatively low. To reduce the risk of HIV infection among MSM, more publicity and education should be employed to increase awareness of PrEP and PEP and to promote their use.

This study was conducted by MSM community organizations in the survey areas from March to April 2019 in Beijing Municipality and Shenzhen and Kunming cities; January to March 2021 in Beijing Municipality and Shenzhen, Chengdu, Jinan, and Nanjing cities; and April to June 2022 in 22 cities and municipalities, including Tianjin, Chengdu, and Hangzhou. The cross-sectional studies of 3 years were approved by the Ethics Committee of the National Center for AIDS/STD and Prevention, China CDC. An anonymous WeChat-based questionnaire was distributed and accessed by respondents via a code scan. Each internet protocol (IP) address was only allowed for one enrollment. The local survey leader sent the questionnaire to eligible MSM as a seed, and then used an online snowballing method to invite them to answer the questionnaire and share it with their eligible peers.

The questionnaire included sociodemographic information, behavioral information, basic knowledge and use of PrEP and PEP for participants who met the inclusion criteria of being biological males aged 18 or older, having had sex with a male at least once in the past 12 months, and being HIV negative. Over the three-year period, 3,337, 5,313, and 15,758 MSM were enrolled, respectively.

Awareness of PrEP knowledge is defined as understanding the role of PrEP, the population for whom PrEP is intended, the methods of taking PrEP medications, and that PrEP does not replace condom use (*4*). Answering correctly the role and methods of taking PrEP, as well as the fact that PrEP does not replace condom use, is considered evidence of PrEP knowledge (*5*).

SAS (version 9.4, SAS Institute Inc., Cary, NC, USA) was used for statistical analysis. Spearman rank

correlation was used to analyze the correlation between variables, with correlation coefficients (R) representing positive and negative correlations between variables. *P*-value of <0.05 (two-tailed) was considered statistically significant.

In this study, most of the participants were over 25 years old; this age group accounted for 73.6% (2,457/3,337), 78.5% (4,175/5,313), and 62.4% (9,835/15,758) of the total participants in 2019, 2021, and 2022, respectively. Most of the participants had college education or above, accounting for 73.1% (2,439/3,337), 69.2% (3,676/5,313), and 76.4% (12,036/15,758), respectively.

In the survey of the three years, the proportion of MSM who had sex in the past 6 months was higher than 60%, indicating that MSM had active sexual behaviors. More than 5% of MSM in the 3 years survey had HIV-positive sexual partners, and about 10% of MSM in the 3 years had concurrent sexual partners. On average, more than 25% of MSM used new drugs to increase sexual pleasure (Table 1). In general, MSM have a high risk of HIV infection, making them a key group in AIDS prevention and control. PrEP and PEP as new biotechnological means of AIDS prevention, have great significance in controlling the spread of AIDS in MSM.

The three-year survey found that the proportion of MSM who had heard of PrEP was high, all exceeding 70%. Over 60% of MSM had correct knowledge of the role of PrEP in preventing HIV, that PrEP is applicable to high-risk populations such as MSM, female sex workers (FSW), and intravenous drug users (IDU), and that condoms should be used simultaneously while taking PrEP.

The overall level of basic knowledge of PrEP among respondents was relatively low, with 10.2% (340/3,337), 17.8% (948/5,313), and 26.5% (4,179/15,758) in 3 years, respectively.

Results from the PrEP survey were similar to those of the three-year survey of MSM regarding knowledge of PEP. Over 70% of respondents correctly answered 3 questions related to PEP: its role in preventing HIV, its

TABLE 1. Behavioral characteristics among MSM in 2019, 2021, and 2022 in selected cities in China.

Variable	2019 (*N*=3,337)	2021 (*N*=5,313)	2022 (*N*=15,758)
	N (%)	*N* (%)	*N* (%)
Had homosexual sex with men in the past 6 months			
Yes	2,652 (79.5)	3,405 (64.1)	9,859 (62.6)
No	685 (20.5)	1,908 (35.9)	5,899 (37.4)
Used condoms in sexual behaviors in the past 6 months			
Yes	3,137 (94.0)	5,057 (95.2)	14,834 (94.1)
No	200 (6.0)	256 (4.8)	924 (5.9)
Had group sex in the past 6 months			
Yes	372 (11.1)	521 (9.8)	1,692 (10.7)
No	2,965（88.9）	4,792 (90.2)	14,066 (89.3)
HIV infection status of sexual partners in the past 6 months			
negative or unclear	2,959 (88.7)	4,889 (92.0)	14,905 (94.6)
Positive	378 (11.3)	424 (8.0)	853 (5.4)
Rush use during sexual behaviors in the past 6 months			
Yes	1,148 (34.4)	1,555 (29.3)	2,568 (16.3)
No	2,189 (65.6)	3,758 (70.7)	13,190 (83.7)
Had infected with STD in the past 6 months			
Yes	484 (14.5)	267 (5.0)	1,348 (8.6)
No	2,853 (85.5)	5,046 (95.0)	14,410 (91.4)
Tested for HIV in the past 6 months			
Yes	2,680 (80.4)	4,664 (87.7)	10,748 (68.2)
No	657 (19.6)	649 (12.3)	5,010 (31.8)

Abbreviation: HIV=human immunodeficiency virus; MSM=men who have sex with men; STD=sexually transmitted disease.

applicability to those who have engaged in high-risk sexual behaviors within 72 hours, and the need to use condoms while taking PEP. The overall level of knowledge of PEP was 35.7% (1,190/3,337), 34.0% (1,807/5,313), and 42.2% (6,657/15,758) in the three-year period, respectively.

In the 3 cross-sectional surveys, the proportion of MSM using PrEP was 6.0%, 14.4%, and 27.2%, respectively. The proportion of MSM using PEP was 11.2%, 14.4%, and 24.6%, respectively (Table 2).

According to the correlation analysis, there was a positive correlation between PrEP use and PrEP awareness, as well as between PEP use and PrEP knowledge awareness, and between PEP use and PrEP use (Table 3).

DISCUSSION

A three-year cross-sectional study found that the proportion of MSM who had heard of PrEP and PEP was relatively high, but the proportion of MSM who could correctly identify the specific knowledge of PrEP and PEP was relatively low. This suggests that simply having heard of PrEP and PEP is not equivalent to understanding them, so multiple methods should be used to promote and educate MSM on relevant knowledge of PrEP and PEP in order to improve their cognition and understanding of these topics.

The study found that MSM had active sexual behavior over the three-year survey period, and that they had sexual partners who used drugs, had multiple partners, and were HIV positive, which greatly increased the risk of HIV infection in MSM, consistent with the findings of Beyrer et al. (*6*). To reduce the prevalence of AIDS in MSM, comprehensive interventions such as health education, active testing, partner promotion, and peer education should be strengthened.

Surveys conducted in 2022 revealed that the level of PrEP knowledge ranged from 10.2% to 26.5%, and the percentage of PrEP use was 6.0% to 27.2%, which was lower than the results of a study conducted in Shanghai (*7*). The level of PEP knowledge ranged from 57.8% to 66.0%, and the percentage of use was 11.2% to 24.6%, which was slightly higher than the results of a study on PEP among MSM in 2019 (*8*). Overall, the level of knowledge and utilization percentage of PrEP were at a low level. The survey results in 2022 showed that the percentage of PrEP use was slightly higher than the level of knowledge, suggesting that MSM took drugs without fully understanding PrEP. If the use methods and conditions of PrEP, and matters needing attention were not correctly understood, it could affect the prevention effect of drugs and the compliance of taking drugs, resulting in adverse consequences, such as failure to effectively prevent HIV infection and resistance to antiviral drugs.

It is essential to promote and publicize PrEP and PEP in multiple forms. To do this, clinical and public health experts should first unify the most important information about PrEP and PEP to create a clear core message, and then leverage community involvement and peer education. Additionally, the role of networks, media, and other publicity channels should be utilized to educate the public about PrEP and PEP. With friends providing education about PrEP and PEP, MSM will be more likely to trust the content and understand the effects and methods of use of the drugs. Utilizing networks, media, and other convenient information dissemination channels will improve the dissemination and coverage of PrEP and PEP, thus increasing the likelihood of MSM's acceptance of PrEP and PEP.

This survey indicates that knowledge of PrEP and use of PEP are positively correlated with the use of PrEP, suggesting that knowledge of PrEP and the use of PEP are promoting factors of PrEP use, consistent with relevant research results (*9*). Increasing PrEP knowledge publicity may be an effective way to promote PrEP use among MSM populations. PEP is recognized and accepted by MSM as a 'regret drug' after high-risk sexual behaviors, due to awareness of the high risk of HIV infection. Thus, MSM are also a potential target population for PrEP services. After evaluating risk, MSM who have taken PEP should be referred in a timely manner to receive PrEP services, which is important to prevent HIV transmission among key populations from a public health perspective.

doi: 10.46234/ccdcw2023.053

[#] Corresponding author: Guang Zhang, zhangguang2000@chinaaids.cn.

[1] National Center for AIDS/STD Control and Prevention, Chinese Center for Disease Control and Prevention, Beijing, China; [2] Chinese Association of STD & AIDS Prevention and Control, Beijing, China; [3] Chinese Center for Health Education, Beijing, China.

Submitted: November 21, 2022; Accepted: March 22, 2023

TABLE 2. Knowledge and use of PrEP and PEP among MSM in parts of the city of China in 2019, 2021, and 2022.

Variable	2019 (*N*=3,337)	2021 (*N*=5,313)	2022 (*N*=15,758)
	N (%)	*N* (%)	*N* (%)
Ever heard of PrEP of HIV			
Yes	2,401 (72.0)	4,223 (79.5)	12,028 (76.3)
No	936 (28.0)	1,090 (20.5)	3,730 (23.7)
PrEP can be taken daily			
Yes	1,158 (34.8)	2,114 (39.8)	7,520 (47.7)
No	2,179 (65.2)	3,199 (60.2)	8,238 (52.3)
PrEP can be taken as needed			
Yes	1,484 (44.5)	3,022 (56.9)	8,971 (56.9)
No	1,853 (55.5)	2,291 (43.1)	6,787 (43.1)
Do not know how to take PrEP			
Yes	1,091 (32.6)	1,414 (26.6)	4,662 (29.6)
No	2,246 (67.3)	3,899 (73.4)	11,096 (70.4)
The role of PrEP to prevent HIV			
Yes	2,247 (67.3)	3,924 (73.9)	10,083 (63.9)
No	1,090 (32.7)	1,389 (26.1)	5,675 (36.1)
PrEP is applicable to people with high risk of HIV infection			
Yes	2,228 (66.8)	3,725 (70.1)	9,786 (62.1)
No	1,109 (33.2)	1,588 (29.9)	5,972 (37.9)
Condoms are required during the use of PrEP			
Yes	2,316 (69.5)	3,951 (74.4)	11,223 (71.2)
No	1,021 (30.5)	1,362 (25.6)	4,535 (28.8)
Ever consulted for PrEP?			
Yes	654 (19.6)	1,951 (36.7)	7,004 (44.4)
No	2,683 (80.4)	3,362 (63.3)	8,754 (55.6)
Ever used PrEP?			
Yes	199 (6.0)	767 (14.4)	4,291 (27.2)
No	3,138 (94.0)	4,546 (85.6)	11,467 (72.8)
Ever heard about PEP of HIV			
Yes	2,616 (78.4)	4,069 (76.6)	12,068 (76.6)
No	721 (21.6)	1,244 (23.4)	3,690 (23.4)
Role of PEP in preventing HIV			
Yes	2,254 (67.5)	3,424 (64.5)	9,816 (62.2)
No	1,083 (32.5)	1,889 (35.5)	5,942 (37.8)
PEP is applicable to those who had high-risk sexual behaviors within 72 hours			
Yes	2,445 (73.3)	3,662 (68.9)	10,985 (69.7)
No	892 (26.7)	1,651 (31.1)	4,773 (30.3)
Condoms are required during the use of PEP			
Yes	2,566 (76.9)	3,890 (73.2)	11,470 (72.8)
No	771 (23.1)	1,423 (26.8)	4,288 (27.2)
Ever consulted for PEP?			
Yes	820 (24.6)	1,951 (36.7)	7,294 (46.3)
No	2,517 (75.4)	3,362 (63.3)	8,464 (53.7)
Ever used PEP?			
Yes	377 (11.2)	767 (14.4)	3,884 (24.6)
No	2,960 (88.8)	4,546 (85.6)	11,874 (75.4)

Abbreviation: PrEP=pre-exposure prophylaxis; PEP=post-exposure prophylaxis; HIV=human immunodeficiency virus; MSM=men who have sex with men.

TABLE 3. Correlation analysis between knowledge and use of PrEP and PEP among MSM in parts of the city of China.

Variable	Level of PrEP knowledge	Rate of using PrEP	Level of PEP knowledge	Rate of using PEP
Level of PrEP knowledge	–	–	–	–
Rate of using PrEP	R=1.000*	–	–	–
Level of PEP knowledge	R=-0.500	R=-0.500	–	–
Rate of using PEP	R=1.000*	R=1.000*	R=-0.500	–

Note: "–" means that the correlation between the corresponding two variables has been analyzed and will not be repeated here.
Abbreviations: PrEP=pre-exposure prophylaxis; PEP=post-exposure prophylaxis; MSM=men who have sex with men.
**P* value of less than 0.05.

REFERENCES

1. Chen J, Huang YL, Chen HL, Xia J. Nitrite inhalants use, sexual behaviors and HIV/syphilis infection among men who have sex with men in Chongqing, China. Infect Dis Poverty 2020;9(1):127. http://dx.doi.org/10.1186/s40249-020-00748-6.
2. He N. Research progress in the epidemiology of HIV/AIDS in China. China CDC Wkly 2021;3(48):1022 – 30. http://dx.doi.org/10.46234/ccdcw2021.249.
3. Grant RM, Lama JR, Anderson PL, McMahan V, Liu AY, Vargas L, et al. Preexposure chemoprophylaxis for HIV prevention in men who have sex with men. N Engl J Med 2010;363(27):2587 – 99. http://dx.doi.org/10.1056/NEJMoa1011205.
4. Przybyla S, Fillo J, Kamper-DeMarco K, Bleasdale J, Parks K, Klasko-Foster L, et al. HIV pre-exposure prophylaxis (PrEP) knowledge, familiarity, and attitudes among United States healthcare professional students: a cross-sectional study. Prev Med Rep 2021;22:101334. http://dx.doi.org/10.1016/j.pmedr.2021.101334.
5. Shao Y, Li J, Liu A, Yu YP, Chen ZL, Jiang TJ, et al. Analysis of knowledge awareness and service acceptance of HIV non-occupational post-exposure prophylaxis (nPEP) among students in three cities of China. Chin J AIDS STD 2020;26(3):259 – 63,272. http://dx.doi.org/10.13419/j.cnki.aids.2020.03.09. (In Chinese).
6. Beyrer C, Sullivan P, Sanchez J, Baral SD, Collins C, Wirtz AL, et al. The increase in global HIV epidemics in MSM. AIDS 2013;27(17):2665 – 78. http://dx.doi.org/10.1097/01.aids.0000432449.30239.fe.
7. Zheng YH, Xie Y, Wei W. Awareness, willingness to use and influencing factors of HIV pre-exposure prophylaxis amongst men who have sex with men in Shanghai. Prac Prev Med 2021;28(7):802 – 6. http://dx.doi.org/10.3969/j.issn.1006-3110.2021.07.008. (In Chinese).
8. Han J, Li J, Wang KR, Jiang TJ, Song B, Wang H, et al. Status and influencing factors of knowledge awareness and service acceptance of HIV non-occupational post-exposure prophylaxis of men who have sex with men among college students among three cities of China, 2019. Chin J Prev Med 2020;54(11):1220 – 6. http://dx.doi.org/10.3760/cma.j.cn112150-20200310-00302. (In Chinese).
9. Siemieniuk RAC, Sivachandran N, Murphy P, Sharp A, Walach C, Placido T, et al. Transitioning to HIV pre-exposure prophylaxis (PrEP) from non-occupational post-exposure prophylaxis (nPEP) in a comprehensive HIV prevention clinic: a prospective cohort study. AIDS Patient Care STDs 2015;29(8):431 – 6. http://dx.doi.org/10.1089/apc.2015.0014.

Policy Notes

The Standards for Drinking Water Quality of China (2022 Edition) Will Take Effect

Jiayi Han[1]; Lan Zhang[1]; Bixiong Ye[1]; Shenghua Gao[1]; Xiaoyuan Yao[1]; Xiaoming Shi[1,#]

Safe drinking water is a valuable public health resource that affects people's livelihood and is essential for human health, making it an international concern for drinking water quality improvement. The *Standards for Drinking Water Quality of China* (China SDWQ) is a legal document approved and issued by the Standardization Administration of the People's Republic of China that serves as a starting point for protecting public health and ensuring the quality of human life. There are three versions of China SDWQ, including the 1985 edition, 2006 edition, and 2022 edition. China SDWQ (2022 edition) sets a wide variety of indices covering biological, chemical, physical, and other risk factors in drinking water. Additionally, it establishes management requirements for the entire water supply process, providing a technical basis and criteria for ensuring drinking water safety and a scientific basis for developing drinking water safety policies and proposing targeted public health protection measures.

BACKGROUND

In 1985, the Ministry of Health of the People's Republic of China issued China's first national drinking water standard, which included 35 water quality indices, such as sensory and general chemical indices, toxicological, microbiological, and radioactive indices (*1*). This standard, known as China SDWQ (1985 edition), was established as a mandatory national standard and its status and role in the health regulatory system were clarified and consolidated. As China's economic construction developed, some of the technical requirements in China SDWQ (1985 edition) became outdated, so the Ministry of Health revised the standard in 2005 and officially issued it as China SDWQ (2006 edition) in December 2006 (*2*). This new edition contains 106 water quality indices, more than drinking water standards of developed countries or regions have at the same time. This is the first time that a developing country has established such higher regulations on water quality, and it is the first time by merging both rural and urban standards into a single unified standard text.

The promulgation and implementation of China's SDWQ (2006 edition) has played an important role in improving the quality of drinking water and protecting public health. However, rapid economic and social development has caused major changes in the water environment, resulting in difficulties in maintaining drinking water quality. Water purification and treatment techniques, contaminant risk assessments, and water quality testing have seen great progress and improvement in China. In March 2018, a new round of revisions to the SDWQ was officially launched in response to the current situation.

METHODS

In March 2018, the National Health Commission, in collaboration with the Ministry of Ecology and Environment, the Ministry of Housing and Urban-Rural Development, the Ministry of Water Resources, and the Ministry of Natural Resources, initiated a revision of China's SDWQ. The National Institute of Environmental Health, China CDC was responsible for organizing the drafting and revision process.

Since 2012, continuous monitoring of drinking water quality has been conducted in urban and rural areas in China to understand changes in drinking water quality. The data from this long-term monitoring have provided support for index screening and risk assessment of standard revision. Significant scientific and technological achievements related to safety and health of drinking water, made under the national major scientific and technological projects for water pollution control and treatment during the 11th, 12th, and 13th Five-Year Plans, as well as research results from domestic departments, scientific research institutions, and universities, have contributed to the definition of the index standard limit. This revision adopts the universally accepted health risk assessment

technology as the technical principle, based on a large number of monitoring data and scientific research results. Relevant standard literature at home and abroad, thematic research, and sufficient demonstration have been conducted to ensure the scientificity, rationality, and standardization of the index revision.

RATIONALE AND EVIDENCE

The key aspect of the standard is the screening of water quality indices and the setting of their standard limits. The basic process mainly includes the following steps. First, a list of potential contaminants is developed based on the latest drinking water standards at home and abroad, the latest research results and survey data in the field of drinking water and health, and tracking evaluation information on the China SDWQ (2006 edition). Second, a water quality index is identified from the list if its exposure level in drinking water causes health risks or affects sensory acceptability. Monitoring, testing, investigation, and other technical methods are used to determine the presence and exposure level of the candidate indicators in drinking water. Third, the benchmark value of the water quality index is established based on the results of the health risk assessment for the contaminant. Finally, based on the baseline value of the water quality index, a comprehensive assessment is conducted to determine the standard limit value of the water quality index in SDWQ, taking into account the contaminants detection technology, the treatment process, risk management measures, and other factors. The technical route of standard limits setting is illustrated in Figure 1.

In accordance with the above principles, the 2022 edition of the China SDWQ reduced the number of mandatory indices from 106 to 97 (*3*). Four indices were added, including perchlorate, acetochlor, geosmin, and 2-methylisoborneol. A total of 13 indices were removed, including heat-resistant coliforms, trichloroacetaldehyde, hydrogen sulfide, cyanogen chloride (measured as CN^-), hexachlorocyclohexane (total), parathion, methyl parathion, lindane, dichlorodiphenyltrichloroethane, formaldehyde, 1,1,1-trichloroethane, 1,2-dichlorobenzene, and ethylbenzene. The standard limits for 8 indices were adjusted, including nitrate (N), turbidity, permanganate index (measured as O_2), free chlorine, boron, vinyl chloride, trichloroethylene, and dimethoate. The number of non-mandatory indices increased from 28 to 55, including pollutants such as nitrosodimethylamine, perfluoro caprylic acid, perfluorooctane sulfonate, and iodide. The 2022 edition of the China SDWQ has unified the assessment requirements of urban and rural water supply quality, strengthened the scientific and safety of disinfection, and improved the management requirements of sensory properties of drinking water, which is more in line with the current requirements of drinking water quality in China.

PRESENTATION

After four years of research and demonstration, the China SDWQ (2022 edition) was issued on March 15, 2022 and will take effect on April 1, 2023 (*3*). The standard specifies the quality requirements for drinking water and drinking water sources, sanitation requirements for centralized water supply units, secondary water supplies, products involving drinking water sanitation safety products, and water quality standard examination methods. This standard can be applied to all types of drinking water.

China is a rapidly developing country with a variety of geographical and geomorphological conditions and varying economic levels, as well as differences in drinking water quality. The Standard and its Appendix, combined with China's current water quality problems and management, specify water quality standard limits for 152 indices. These indices are classified as regular, expanded, and reference indices. The regular indices refer to water quality indices that reflect the basic characteristics of water quality, including 43 indices. The expanded indices refer to water quality indices that reflect the characteristics of regional drinking water quality in a specific period or under specific conditions, consisting of 54 indices. It is important to note that both the expanded and regular indices are mandatory requirements with the same legal status, and they are not permitted to exceed the standard limit. The reference indices refer to water quality indices that have reference significance for China's current testing, monitoring, management, and evaluation of drinking water quality, but the technical basis for their inclusion in the standard body is not sufficient. There are 55 reference indices in this edition.

DISCUSSION

China's mandatory national standard, Standards for

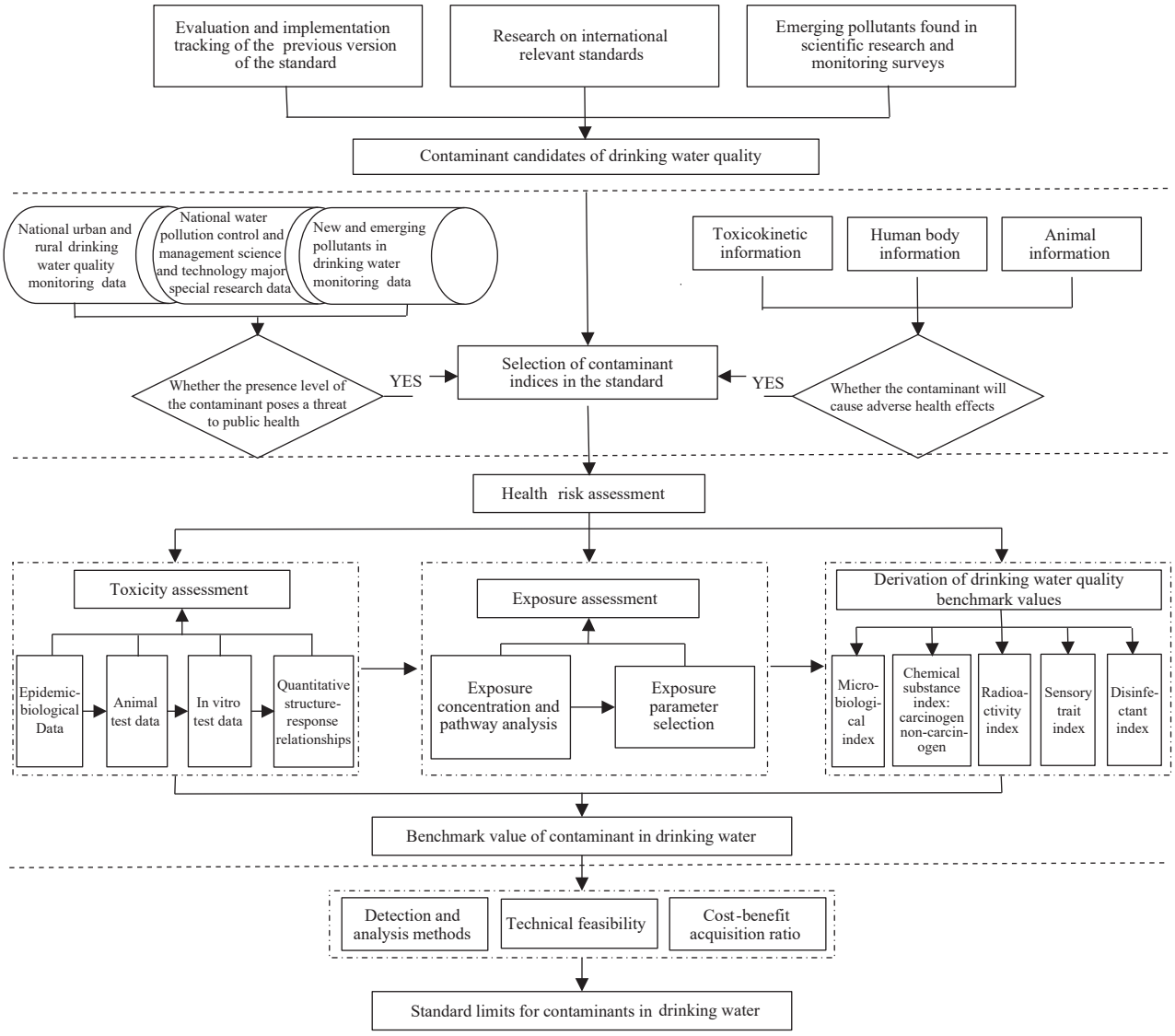

FIGURE 1. Technical process of establishing standard limits.

Drinking Water Quality, is the basic requirement for drinking water quality, and its updating and revision is of great importance in ensuring drinking water safety. Over the past fifteen years, an extensive amount of drinking water monitoring, scientific research, and survey data have been collected in China to serve as the basis for the revision of the standard. The water quality problems and possible risks in China were taken into consideration as the primary factor in selecting indices, and the health risk assessment method was applied using the latest research results in the course of setting the standard limits. Additionally, the level of Chinese water treatment technology and testing technology was taken into account to ensure that the standard is scientifically rigorous and implementable.

The China SDWQ (2022 edition) is more comprehensive and stringent than ever before. Additionally, the standard has achieved international convergence in terms of the methodology for formulating baseline and standard values (*4*–*5*). In essence, China SDWQ (2022 edition) has fully presented the progress China has made in recent years in water pollution prevention, environment management, water treatment technology upgrading, and rural drinking water safety systems construction. With the implementation of the updated standard, drinking water quality and safety in China will be further improved and ensured.

Conflicts of interest: No conflicts of interest.

Funding: Health Standard Preparation and Revision Project, funded by the National Health Commission of China (20180901).

doi: 10.46234/ccdcw2023.054

[#] Corresponding author: Xiaoming Shi, shixm@chinacdc.cn.

[1] National Institute of Environmental Health, Chinese Center for Disease Control and Prevention, Beijing, China.

Submitted: March 07, 2023; Accepted: March 23, 2023

REFERENCES

1. General Administration of Quality Supervision, Inspection and Quarantine of the People's Republic of China. GB 5749-1985 Sanitary standard for drinking water. Beijing: Standards Press of China, 2005. https://std.samr.gov.cn/gb/search/gbDetailed?id=71F772D7B895D3A7E05397BE0A0AB82A. (In Chinese).
2. Ministry of Health of the People's Republic of China, Standardization Administration of the People's Republic of China. GB 5749-2006 Standards for drinking water quality. Beijing: Standards Press of China, 2007. https://std.samr.gov.cn/gb/search/gbDetailed?id=71F772D7FC82D3A7E05397BE0A0AB82A. (In Chinese).
3. State Administration for Market Regulation, Standardization Administration of the People's Republic of China. GB 5749-2022 Standards for drinking water quality. Beijing: Standards Press of China, 2022. https://std.samr.gov.cn/gb/search/gbDetailed?id=DAB6B92C0764FC96E05397BE0A0A5F84. (In Chinese).
4. World Health Organization. Guidelines for drinking-water quality: Fourth edition incorporating the first and second addenda. Geneva: World Health Organization; 2022. https://www.who.int/publications/i/item/9789240045064
5. United States Environmental Protection Agency. Methodology for deriving ambient water quality criteria for the protection of human health. US Environmental Protection Agency, Office of Water; 2000. Report No.: EPA-822-B-00-004. https://nepis.epa.gov/Exe/ZyPURL.cgi?Dockey=20003D2R.txt.

Indexed by Science Citation Index Expanded (SCIE), Social Sciences Citation Index (SSCI), PubMed Central (PMC), Scopus, Chinese Scientific and Technical Papers and Citations, and Chinese Science Citation Database (CSCD)

The inauguration of *China CDC Weekly* is in part supported by Project for Enhancing International Impact of China STM Journals Category D (PIIJ2-D-04-(2018)) of China Association for Science and Technology (CAST).

CCDC weekly

Vol. 5 No. 13 Mar. 31, 2023

Responsible Authority
National Health Commission of the People's Republic of China

Sponsor
Chinese Center for Disease Control and Prevention

Editing and Publishing
China CDC Weekly Editorial Office
No.155 Changbai Road, Changping District, Beijing, China
Tel: 86-10-63150501, 63150701
Email: weekly@chinacdc.cn

CSSN
ISSN 2096-7071
CN 10-1629/R1