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Hidden and Mobile: A Web-based Study of Migration Patterns of Men Who Have Sex With Men in China

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Abstract

Background—Men who have sex with men (MSM) are highly vulnerable to human immunodeficiency virus (HIV) infection and more likely to migrate due to widespread stigma and discrimination in China. Their mobility complicates estimation of local MSM population sizes and the provision of HIV services, and may also contribute to the spread of HIV.

Methods—Between 1 January 2008 and 31 December 2012, the visits of all individuals to the largest Chinese MSM dating website were recorded. After a predesigned de-identification procedure by the website, we analyzed Internet Protocol addresses for migration patterns. Migrants were defined as individuals who were away from their registered residence for >6 months in the last 12 months.

Results—The website contained data on 794 912 MSM eligible for the study, of which 34.5% were migrants. The median age was 26 years (range, 18–61 years), and 85.5% were unmarried. Compared with nonmigrant MSM, migrants were less likely to be married to a woman (8.6% vs 13.5%; $P < .001$). The 5 provinces with the highest migrant inflow ratios were Guangdong, Shanghai, Beijing, Tianjin, and Zhejiang. Eastern coastal cities were the primary destination of MSM from southwestern China.

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Conclusions—Preferential MSM migration may influence MSM population sizes in both originating and destination provinces, particularly for provinces with uneven inflow and outflow. MSM migration from southwestern China, which has the highest HIV prevalence in this population, to coastal cities with lower prevalence may have implications for the spread of the HIV epidemic as well as HIV care services.

Keywords

men who have sex with men; migration; HIV/AIDS; China

China decriminalized homosexuality in 1997 and removed it from the list of mental disorders in 2001. However, significant social stigma against same-gender sexual activity persists. In this family- oriented society [1], men who have sex with men (MSM) are often pressured to get married to a woman and father at least 1 child. Same-sex marriage is not legal within China. To avoid these pressures, many MSM migrate away from their homes to secure employment elsewhere, only returning for the annual traditional festivals [2]. Although the development of the human immunodeficiency virus (HIV)/AIDS epidemic among MSM has been examined in many studies [3–6], the influence of MSM migration patterns on population size estimation and HIV prevalence are still poorly understood in China.

MSM population size estimation remains challenging worldwide, and there is no widely accepted size estimate of the MSM population in China. In 2007, the Chinese government estimated there were 3.1–6.3 million MSM [7], but other sources report much higher numbers [8], up to 18–20 million [1]. Due to widespread stigma, discrimination, and prevailing social norms, MSM are more likely to migrate to large metropolitan and developed areas [2]. This migration may complicate MSM population size estimation at the provincial, city, and county levels. The geographical distribution of the HIV epidemic among urban Chinese MSM is varied, with the highest HIV prevalence found in southwestern China (17%–20%) and the lowest in northern China (2%–3%) [3]. The mobility of MSM may also compromise the coverage and uptake of HIV services and affect the spread of HIV.

We analyzed domestic migration patterns of Chinese MSM to explore the potential influence of differential migration patterns on reliable population size estimates and the spread of HIV to low-burden areas. In addition, we produced adjustment factors to improve MSM population size estimates and to better support program planning and evaluation.

METHODS

This study used data from the gay male dating website BF99 (www.bf99.com), believed to be the largest dating website for MSM in mainland China. By the end of 2012, BF99 had >3 million registered members across the nation. The website was established in 2000 by an MSM community-based organization in Beijing to specifically target MSM and to set up an online social network covering all provinces and regions of China for MSM >18 years of age.

Data Collection

When individuals register for BF99, the site collects basic sociodemographic and residential information on each user. Registration includes consenting to a privacy policy stating that members' personally identifiable information will not be shared, but de-identified data might be used in research studies. Information on self-described sexual orientation, date of birth, current city, hometown, marital status, and occupation was collected at the time of registration. At registration and all subsequent visits, the site automatically records the date, time, length of the visit, and Internet Protocol (IP) address. The BF99 administrators eliminated duplicate records by checking the IP address, username, and email address. For all active site users (at least 1 visit in the last year), the stated residence at enrollment was compared with the IP address at first visit. If the 2 were concordant and the individual visited the website at least twice in 1 year, the individual's site visit data were used in the study analysis. If residential information at enrollment and the IP address at first visit were discordant, the individual was excluded from the analysis. All data were abstracted from the BF99 website and de-identified prior to analysis, and there was no study-specific data collection instrument.

The study was reviewed and approved by the Institutional Review Board of the National Center for AIDS/STD Control and Prevention of the Chinese Center for Disease Control and Prevention and reviewed by the Center for Global Health, Office of the Associate Director for Science, at the United States Centers for Disease Control and Prevention.

Measures

In accordance with the definition used by the Chinese State Bureau of Statistics, we defined a "migrant" as someone who had been away from his registered residence for >6 months in the last 12 months [9]. The migration statuses of BF99 users were determined on an annual basis, starting in January. The IP address and time of each visit of all users are automatically recorded by the website. We compared the IP address at the time of BF99 registration with the IP addresses recorded at subsequent visits. A participant was defined as a migrant if his subsequent visits to the website suggested a location different from his original IP address for >6 months. Otherwise, website visitors were defined as nonmigrant. Furthermore, for each province, we defined an inflow ratio as the size of the in-migration population divided by the size of the out-migration population to predict the impact of mobility on the local MSM population sizes. A province with a floating ratio >1.0 therefore sees more MSM migrating into the province than emigrating from it, and a province with a floating ratio of <1.0 suggests a decrease in the MSM population size due to migration.

Data Analysis

This study analyzed data collected by the BF99 website starting from 1 January 2008 to 31 December 2012. Data elements that were analyzed included self-identified sexual orientation, date of birth, current city, hometown, marital status, and occupation. By checking IP addresses, usernames, and email addresses, the website's administrator staff cleaned duplicate records, substituted provincial and city names for IP addresses, and removed any potentially identifying information. Descriptive statistics, including frequencies and cross-tabulations, were calculated for all characteristics by migration status, sexual

orientation, date of birth, current city, hometown, marital status, and occupation. Based on the results of the National Pilot Project on MSM and HIV/AIDS conducted in 2008 and 2009 [3], we classified Mainland China into different regions by the level of HIV prevalence and assessed migration patterns for MSM from each region. Inflow and outflow proportions were compared across regions from 2008 to 2012 by calendar year using χ^2 tests.

RESULTS

We analyzed data from 815 754 individuals who used the website during the study period. After removing 7952 (1.0%) duplicate cases and 12 890 (1.6%) cases with discordancy between the stated home residence and the IP address, 794 912 (97.4%) users met the eligibility criteria and were included in further data analysis. The median age of participants was 26.0 (SD, 6.2) years (range, 18–61 years), nearly 85% were unmarried, and 34% were migrants. Migrant MSM, compared with nonmigrant MSM, were younger (median age, 25.3 vs 26.6 years; $P < .001$) and less likely to be married to a woman (8.6% vs 13.5%; $P < .001$) (Table 1). The proportion of MSM classified as migrants remained largely stable throughout the study period, ranging from a low of 32.7% in 2010 to a high of 35.5% in 2008.

East China, north China, and south China were the primary destinations of migrants (Table 2). Each year, approximately half of MSM migrants moved from southwest to east and south China (Figure 1), where HIV prevalence is much lower than the prevalence in the southwest [3] region.

To explore the impact of migration on regional MSM population size estimation, inflow and outflow of MSM were compared by year and province. The top 8 provinces with high inflow and low outflow are presented in Table 3. For example, in 2008, approximately 7 MSM moved into Guangdong province for every 1 MSM who moved out.

DISCUSSION

In China, many HIV testing and care programs are targeted toward MSM, but very little is currently known about patterns in the mobility of MSM. To our knowledge, this study is the first in China to explore such migration trends. Migration is difficult to examine with quantitative approaches [10], especially for hard-to-reach populations. Current laws and regulations, as well as stigma and discrimination, force many MSM to hide their sexual orientation and behaviors in both their originating and destination residences. Furthermore, migrants are frequently undocumented in administrative records, so a significant proportion of migrant MSM face a double burden in hiding their identities. To address these challenges, we used a large de-identified database from a popular MSM dating website to analyze migration routes. Our study demonstrated that analysis of Web-based data may be a feasible and practical way to facilitate such research. Our quantitative analysis contributes to the understanding of migration patterns among this highly stigmatized and hidden population, which will support the development of future HIV prevention programs targeting migrant MSM.

MSM migrants are unable to access many healthcare services and are not covered by many HIV/AIDS programs in China due to their unregistered residential status [11, 12]. Few

studies have explored the association between HIV and migration, making it more challenging to address these “invisible residents” in surveillance and prevention programs. Our study is the first to investigate migration routes of MSM within China. We found that the primary destinations of MSM migrants from southwest China, the region with the highest HIV prevalence, were southern and eastern China, which are considered low-prevalence areas; this finding highlights the potential spread of HIV from high- to low-HIV-prevalence regions. Nevertheless, it remains difficult to characterize the relationship between migration and HIV infection risk, and we are cautious in drawing definite conclusions based on these findings.

In reviewing HIV prevention and treatment strategies in China, Russia, and India [13], Todrys and Amon noted that internal rural-to-urban migrants faced barriers in accessing HIV prevention and treatment services. Other studies report that negative stereotypes toward migrants present barriers for receiving essential health services [10, 14, 15]. China’s health system has yet to achieve a high coverage of providing accessible and affordable services to rural-to-urban migrants, and Chinese migrants typically have poorer utilization of health services [16] compared to the nonmigrant population.

While they are part of the larger and well-documented rural-to-urban migrant population, MSM migrants may have additional motivations for leaving their home province, such as unfriendly social environments and high family pressure to conform to norms. Rural-to-urban migrants are overrepresented among high-risk populations and among people with HIV and other sexually transmitted infections in many cities [16, 17]. Some large cities in China have reported that >0% of newly diagnosed HIV cases are among MSM migrants [3, 17]. Therefore, increased efforts are needed to facilitate HIV/AIDS-related medical services targeting this key subpopulation, including prevention, testing, and treatment interventions.

An additional component in our study is the use of inflow ratios to indicate the 8 most frequent destination provinces for migrant MSM. China’s Guideline of Population Size Estimation recommends the “capture/recapture” method for MSM populations; this relies on several assumptions, including that the population under examination is “closed” (ie, without any in- or out-migration during the study period) [8]. As has been demonstrated by the inflow ratios in this study, the presence of many migrant MSM potentially compromises the results of “capture/recapture” MSM population size estimates.

There were several limitations to this study. We used existing data recorded on a website that was not designed for a study, and we were unable to contact users to collect additional data on behavior or HIV serostatus. Data were analyzed at the population level on an annual basis, rather than at an individual level in a longitudinal manner. Our dataset may not be representative of the larger MSM migrant community because it originated from 1 specific website; thus, our analysis excluded MSM who do not have access to the Internet or elect not to use dating websites. However, a national survey indicated that more than half of all MSM use the Internet as their primary way of meeting partners, and we note the large number of MSM migrants who were registered at BF99 and included in our study. We therefore believe that our study’s key findings will be informative to policymakers and HIV program stakeholders in China.

CONCLUSIONS

MSM migration in China appears substantive and may alter local MSM population sizes over time. We note that migration routes typically begin in provinces with higher HIV-prevalence estimates among MSM and end in provinces with lower HIV-prevalence estimates. This could influence HIV incidence in destination provinces, particularly in provinces and large urban cities with high inflow but low outflow among migrants. We propose that tracking MSM migration by using de-identified internet usage data is an imperfect yet useful method to estimate the size of local MSM populations and to better understand mobility among this vulnerable and stigmatized population.

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Figure 1. Primary migration routes of men who have sex with men (MSM) from regions with higher human immunodeficiency virus (HIV) prevalence to regions with lower HIV prevalence, 2008–2012, China. The southwest comprises Sichuan, Chongqing, Yunnan, Guizhou, and Tibet. Percentages represent the estimated HIV prevalence among MSM published in 2013 by Wu et al [3].

Table 1

Sociodemographic Characteristics of Migrant and Nonmigrant Men Who Have Sex With Men Visiting the Largest Gay Male Dating Website in China, 2008–2012

Characteristics	Total, % (N = 794 912)	Migrant MSM, % (n = 269 993)	Nonmigrant MSM, % (n = 524 919)	P Value
Age, y, median (SD)	26.0 (6.2)	25.3 (6.1)	26.6 (6.3)	<.001
Occupation				
Service industry	22.3	25.1	20.9	<.001
Agriculture-related	0.6	0.6	0.6	
Technology-related	28.5	29.2	28.1	
Student	21.8	17.6	23.9	
Self-employed	10.6	11.1	10.3	
Other	12.8	13.2	12.6	
Unemployed	3.5	3.2	3.6	
Marital status				
Single	85.5	88.7	83.8	<.001
Married to heterosexual woman	7.6	5.4	8.7	
Married to lesbian	4.3	3.2	4.8	
Divorced	2.7	2.7	2.7	

Abbreviations: MSM, men who have sex with men; SD, standard deviation.

Table 2
Migration Patterns of Men Who Have Sex With Men by Region and Year, 2008–2012, China

Destination of Out-migration	Region of Residence, No. (%)														
	Northeast China	North China	East China	South China	Central China	Northwest China	Southwest China	Total							
Northeast China	8323	20.2	15 328	37.3	8782	21.4	3691	9.0	2024	4.9	1252	3.0	1708	4.2	41 108
North China	4356	10.9	16 494	41.3	8207	20.5	3404	8.5	3195	8.0	2194	5.5	2131	5.3	39 981
East China	4131	6.2	12 632	19.1	29 835	45.1	7541	11.4	5528	8.4	3084	4.7	3387	5.1	66 138
South China	569	3.7	1701	11.0	3370	21.8	6258	40.5	1771	11.5	462	3.0	1317	8.5	15 448
Central China	1358	2.6	6922	13.5	14 541	28.4	20 206	39.4	3713	7.2	1747	3.4	2801	5.5	51 288
Northwest China	674	3.9	3565	20.4	3993	22.8	2777	15.9	1453	8.3	3047	17.4	1980	11.3	17 489
Southwest China	1208	3.1	5252	13.6	10 065	26.1	9159	23.8	2456	6.4	2332	6.1	8069	20.9	38 541

Northeast China comprises Liaoning, Jilin, and Heilongjiang; north China comprises Beijing, Tianjin, Hebei, Shanxi, and Inner Mongolia; east China comprises Shandong, Jiangsu, Zhejiang, Anhui, Fujian, and Shanghai; south China comprises Guangdong, Guangxi, and Hainan; central China comprises Hubei, Hunan, Henan, and Jiangxi; northwest comprises Shan' anxi, Gansu, Qinghai, Ningxia, and Xinjiang; southwest China comprises Yunnan, Guizhou, Sichuan, Chongqing, and Tibet.

Provinces With an Inflow Ratio^a 1.0 of Migrant Men Who Have Sex With Men in China, 2008–2012

Table 3

Province	2008	2009	2010	2011	2012
Guangdong	6.7	6.7	7.3	6.9	7.1
Shanghai	4.3	4.0	4.3	4.5	4.1
Beijing	4.4	3.8	3.8	4.3	4.7
Tianjin	2.3	2.4	2.1	2.4	2.4
Zhejiang	2.0	1.8	1.9	2.1	1.9
Jiangsu	1.7	1.8	1.7	1.9	1.7
Fujian	1.4	1.3	1.3	1.3	1.1
Hainan	1.1	1.0	1.1	1.1	1.0

^aInflow ratio: the size of the in-migration population divided by the size of the out-migration population.