Bisexual Behavior and Infection with HIV and Syphilis Among Men Who Have Sex with Men Along the East Coast of China

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Abstract

This study examined the correlates of bisexual behavior and infection with HIV/syphilis among men who have sex with men only (MSM-only) and those who have sex with both men and women (MSMW) in Shandong, China. Cross-sectional surveys probed sociodemographic information, sexual and drug use behaviors, knowledge, and use of prevention services; blood samples were tested for HIV/syphilis status. Of 2996 participants, 39.5% acknowledged being MSMW; 60.5% being MSM-only; 2.5% were HIV-infected with similar rates for MSMW (2.5%) and MSM-only (2.6%); 5.5% syphilis-infected with comparable rates for MSMW (5.6%) and MSM-only (5.5%). In multivariable models, MSMW were more likely than MSM-only to be older, local residents, recruited from outdoor cruising area, drug users, and less likely to have used a condom during last anal sex with a male partner. HIV-infected MSMW were more likely to have syphilis and other sexually transmitted diseases (STDs) and less likely to have received peer education. HIV-infected MSM-only were more likely to be older, nonlocal residents, and have syphilis and other STDs. MSMW with syphilis were more likely to be recruited from Jinan, Qingdao, and Zibo (versus Yantai), infected with HIV, and less likely to have received lubricant promotion. MSM-only with syphilis were more likely to be recruited from Jinan and Qingdao (versus Yantai), drug users, infected with HIV, and have had sex with male partners in the past 6 months. High prevalence of bisexual behavior and HIV/other STDs with common unprotected sex and multiple sexual partners among Shandong's gay community revealed in this study highlighted the importance of bisexuals as a potential epidemiologic bridge. Further research is needed to investigate the impact of bisexual behaviors on population transmission.

Introduction

THAT MEN WHO HAVE SEX WITH MEN (MSM) are disproportionately affected by HIV in the West is well documented.¹ Historically, the HIV/AIDS epidemic in China has been largely confined to certain high-risk populations such as injection drug users (IDUs) and former blood and plasma donors in geographically disparate rural areas.^{2–6} The rapid rise in HIV prevalence among MSM and female sex workers (FSWs) suggests that China is beginning to resemble other Asian countries where HIV infection is not confined to traditional high-risk populations.^{2,7–11} Of the estimated 700,000 infections in 2007, nearly half of the estimated new cases were

transmitted sexually, with 11% resulting from unprotected sex between men. However, the alarming and rapid rise in both HIV and syphilis prevalence among MSM in recent years in China has primarily been reported in some urban areas.^{8–10,12,13}

The prevalence of bisexual behaviors among MSM varies according to a country's culture and its social acceptance of homosexuality.¹⁴ In many countries, MSM behaviors are highly unacceptable and MSM face strong social pressure. Such social environments may lead MSM to hide their sexual orientation by unwillingly engaging in heterosexual relationships.¹⁵ These bisexual and marital relationships could have a strong impact on the HIV epidemic, as across different

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countries the rate of unprotected sexual behaviors between spouses and/or regular heterosexual partners tends to be very high.^{13,16,17} This potential route of HIV transmission may explain the HIV epidemic in certain settings.¹⁷ The traditional Chinese culture does not openly endorse MSM behaviors.¹² Under social pressure, many MSM conceal their sexual orientation and do not inform their female sex partners about their homosexual behaviors; nearly one third of MSM are married in China, and an even higher proportion reported having had sex with women.^{13,18} Therefore, bisexually active men in China could play a critical bridging role in spreading HIV and other sexually transmitted diseases (STDs) from their high-risk male-to-male sexual partners to low-risk female partners, e.g., their wives.^{19,20} The prevalent bisexual behaviors among Chinese MSM has not been fully investigated.²⁰ Little is known about the infections of HIV and syphilis among bisexually active men in China. No evidence-based intervention program has ever specifically targeted bisexually active men as well. To facilitate better targeted HIV prevention effort, this study investigated the correlates of bisexual behaviors and infections with HIV/syphilis among MSM-only and men have sex with both men and women (MSMW) along the east coast of China, Shandong Province.

Subjects, Materials, and Methods

Participants

Two consecutive cross-sectional surveys were conducted in four cities, Yantai, Qingdao, Zibo, and Jinan in Shandong, from April to July in 2008 and 2009, respectively. Shandong is one of the largest and most populous provinces in China. These four cities host about a quarter (25.8%) of Shandong's 94 million residents. After sociodemographic mapping, participants were recruited and interviewed by trained health professionals through multiple methods: venue-based recruitment, Internet advertisement, community outreach, and peer referrals. Participants were recruited from gay-oriented venues such as bars, night clubs, tea houses, bathhouses, saunas, public parks and bathrooms, outdoor cruising areas, non-venue-based grassroots communities, HIV testing sites, and Internet advertisement as well. All potential participants were invited for eligibility assessments and interviews in community-based voluntary counseling and testing (VCT) centers and/or STD clinics. Survey information were collected anonymously and remained confidential. The enrolment criteria were male, 18 years of age or older, self-reported ever had sex with another male in the past 12 months, willing to complete the study and provide written informed consent. The study was approved by the Institutional Review Board of Shandong Center for Disease Control and Prevention.

Measures

Face-to-face interviews provided demographics, sexual and drug use behaviors, HIV knowledge, and HIV-related prevention services. Demographic characteristics included age, marital status, ethnicity, residency, education, and recruitment venues. Respondents were asked how they perceived sexual identity. An eight-question test was used to assess HIV knowledge by asking participants to identify HIV transmission modes and prevention as well as misperceptions. All questions were weighted equally. Responses to

these questions were combined into an overall score for each correct and incorrect answer. The participants were then stratified into two groups, according to whether six or more appropriate responses were given to the eight questions. The participants were asked whether they received counseling before HIV testing and other HIV-related services (free condoms, lubricants, peer education, STD examination and/or treatment, and HIV-related educational materials) in the last year. Participants were also asked whether they had any STD-related symptoms in the past year. The survey took approximately 15 minutes to complete.

Blood samples were collected for HIV and syphilis tests. Two screening tests were used to diagnose HIV: an enzyme-linked immunosorbent assay and a confirmatory test using the HIV-1/2 Western blot immune assay (HIV Blot 2.2 WB; Genelabs Diagnostics, Singapore). Syphilis was determined using rapid plasma reagin (RPRTM) and a Passive Particle Agglutination Test for Detection of Antibodies to *Treponema pallidum* (TPPATM, Rong Sheng Biostix Inc, Shanghai, China).

Statistical analysis

Survey data and testing results were recorded and assessed for congruency using the EpiData software (EpiData 6.4 for WindowsTM, the EpiData Association Odense, Denmark). The Statistical Program for Social Sciences software (SPSS® software, version 15.0; SPSS Inc., Chicago, IL) was utilized for all analyses. MSMW was defined as the participants who were married or cohabiting with a woman or reported ever had sex with a woman in the past 6 months. Univariate analyses were conducted for demographic, sexual and drug use variables, HIV knowledge, and related prevention services. Multivariable logistic regression analyses were conducted using a stepwise backward sequence. Potential collinearity between variables was examined. We included "condom use with the last sex with clients" and removed "condom use in the past 6 months with clients" in the final model. Variables with $p < 0.05$ in multivariable analysis were determined as statistically significant.

Results

Characteristics of participants

A total of 3012 participants were contacted in this study, 16 were excluded due to repeated participation in two surveys. Of the 2996 participants included in the analyses, 39.5% acknowledged being MSMW; 78.0% were single, 19.2% currently married or cohabiting with a woman and 2.8% divorced, separated, or widowed; the median age was 25 years (range, 8–59 years); 21.8% were nonlocal residents with more for MSM-only (23.5% versus 19% for MSMW); 79.9% received high school or higher education; only 0.7% belonged to a non-Han ethnic group; about three quarters (77.3%) correctly answered at least 6 of 8 questions on HIV transmission, prevention as well as misperceptions (Table 1).

Sexual and drug use behaviors

Of the 2996 participants, 90.7% had sex with men in the past 6 months; 62.2% had 2 or more male anal sex partners in the past 6 months with similar numbers of male sexual partners for both MSM-only and MSMW; 58.9% used a condom with a male partner at last anal sex (62.1% for

TABLE 1. DEMOGRAPHICS, RISK BEHAVIORS, HIV-RELATED KNOWLEDGE, AND THE USE OF HIV-RELATED PREVENTION SERVICES AMONG MEN WHO HAVE SEX WITH MEN ONLY (MSM-ONLY) OR WITH MEN AND WOMEN (MSMW) IN SHANDONG PROVINCE, CHINA (N=2996)

Factors	MSM-only		MSMW			OR (95% CI)	AOR (95% CI)
	Total (n) ^a	% ^b	Total (n) ^a	% ^b	% ^c		
<u>Demographics</u>							
<u>Study sites</u>							
Yantai	348	19.2	249	21.1	41.7	1.0	
Jinan	560	30.9	392	33.2	41.2	1.0 (0.8–1.2)	
Qingdao	460	25.4	300	25.4	39.5	0.9 (0.7–1.1)	
Zibo	446	24.6	241	20.4	35.1	0.8 (0.6–1.0)	
<u>Age (years)</u>							
<25	1087	59.9	348	29.4	24.3	1.0	1.0
25–34	648	35.7	479	40.5	42.5	2.3 (2.0–2.7) ^a	2.4 (2.0–2.9) ^d
≥35	79	4.4	355	30.0	81.8	14.0 (10.7–18.4) ^d	14.2 (10.3–19.4) ^d
<u>Marital status</u>							
Single/separated	1814	100	607	51.4	25.1		
Married or cohabitating	0	0	575	48.6	100		
<u>Residency</u>							
Other city	425	23.5	228	19.3	34.9	1.0	1.0
Local	1387	76.5	954	80.7	40.8	1.3 (1.1–1.5) ^e	1.5 (1.2–1.8) ^d
<u>Ethnicity</u>							
Han	1800	99.3	1173	99.3	39.5	1.0	
Other	13	0.7	8	0.7	38.1	1.0 (0.4–2.5)	
<u>Education</u>							
Middle school or lower	347	19.2	254	21.5	38.7	1.0	
High school or higher	1465	80.8	925	78.5	42.3	0.9 (0.7–1.0)	
<u>Venues of recruitment</u>							
Internet, HIV testing sites, or grassroots	504	28.1	270	22.9	34.9	1.0	1.0
Bars, night clubs, or tea houses	921	51.3	552	46.9	37.5	1.1 (0.9–1.3)	1.1 (0.9–1.4)
Bathhouses or sauna	271	15.1	193	16.4	41.6	1.3 (1.0–1.7) ^f	1.3 (0.9–1.6)
Outdoor cruising area	99	5.5	162	13.8	62.1	3.0 (2.3–4.1) ^d	2.4 (1.8–3.3) ^d
<u>Study year</u>							
2008	862	47.5	690	58.4	44.5	1.0	
2009	952	52.5	492	41.6	34.1	0.6 (0.5–0.7) ^d	
<u>HIV-related knowledge</u>							
Score ≥6	1441	79.4	874	73.9	37.8	1.0	
Score <6	373	20.6	308	26.1	45.2	1.4 (1.1–1.6) ^d	
<u>Sexual and drug use behaviors</u>							
<u>Anal sex with man in P6M</u>							
No	168	9.4	103	9.0	9.0	1.0	
Yes	1611	90.6	1040	91.0	91.0	1.0 (0.6–1.3)	
<u>No. of male anal sex partners in P6M</u>							
<2	918	61.1	610	64.1	36.9	1.0	
≥2	585	38.9	342	35.9	39.9	0.9 (0.7–1.1)	
<u>Condom use during anal sex with man in the last sex</u>							
Yes	990	62.1	540	53.0	35.3	1.0	1.0
No	603	37.9	479	47.0	44.3	1.5 (1.2–1.7) ^d	1.4 (1.1–1.7) ^e
<u>Condom use during male anal sex in P6M</u>							
Always	460	29.6	245	24.6	34.8	1.0	
Sometimes or never	1094	70.4	749	75.4	40.6	1.3 (1.1–1.5) ^e	
<u>Ever having commercial sex with man in P6M</u>							
Yes	331	20.1	208	19.3	38.6	1.0	
No	1314	79.9	867	80.7	39.8	1.0 (0.8–1.2)	
<u>Condom use with paid male sex partner the last time</u>							
No	80	24.3	60	29.3	42.9	1.0	
Yes	249	75.7	145	70.7	36.8	0.8 (0.5–1.2)	
<u>Condom use with paid male sex partners in P6M</u>							
Always	115	35.2	73	35.4	38.8	1.0	
Sometimes or never	212	64.8	133	64.6	38.6	1.0 (0.7–1.1)	

(continued)

TABLE 1. (CONTINUED)

Factors	MSM-only		MSMW			OR (95% CI)	AOR (95% CI)
	Total (n) ^a	% ^b	Total (n) ^a	% ^b	% ^c		
Ever having sex with woman in P6M							
Yes	0	0	714	61.7	100		
No	1814	100	444	38.3	19.7		
Condom use with female partners in the last sex act							
Yes	NA	NA	326	46.6			
No	NA	NA	374	53.4			
Condom use with female partners in P6M							
Always	NA	NA	184	26.3			
Sometimes or never	NA	NA	516	73.7			
Drug use							
No	1758	97.3	1109	94.9	38.7	1.0	1.0
Yes	49	2.7	59	5.1	54.6	1.9 (1.3–2.8) ^e	2.2 (1.5–3.3) ^d
Ever injecting drug							
No	45	93.8	54	98.2	54.5	1.0	
Yes	3	6.3	1	1.8	25.0	0.3 (0.1–2.8)	
<u>HIV-related prevention services in the past year</u>							
Condom promotion/VCT							
Yes	1017	56.1	672	56.9	39.8	1.0	
No	795	43.9	510	43.1	39.1	1.0 (0.9–1.2)	
Lubricant promotion							
No	1418	78.3	888	75.1	38.5	1.0	
Yes	392	21.7	294	24.9	42.9	1.2 (1.0–1.4) ^f	
Received peer education							
Yes	790	44.2	514	43.7	39.4	1.0	
No	999	55.8	663	56.3	39.9	1.0 (0.8–1.1)	
Had free HIV test in the past year							
No	983	54.3	668	56.5	40.5	1.0	
Yes	827	45.7	514	43.5	38.3	0.9 (0.8–1.1)	
Returned to seek the testing result							
No	34	4.0	30	5.7	46.9	1.0	
Yes	811	96.0	499	94.3	38.1	0.7 (0.4–1.2)	
<u>HIV/syphilis infection and self-reported STDs</u>							
HIV status							
Negative	1765	97.4	1154	97.6	39.5	1.0	
Positive	48	2.6	28	2.4	36.8	0.9 (0.6–1.4)	
Syphilis status							
Negative	1713	94.5	1115	94.4	39.4	1.0	
Positive	100	5.5	66	5.6	39.8	1.0 (0.7–1.4)	
Self-reported STDs in the past year							
No	1558	86.4	984	85.6	38.7	1.0	
Yes	245	13.6	165	14.4	40.2	1.1 (0.9–1.3)	

^aTotal *n* for each subgroup may not equal to the number of 2996, because of missing data.

^b%: Constituent ratio.

^c%: The prevalence of MSM who had sex with both man and women (or bisexuals);

^d*p* < 0.001.

^e*p* < 0.01.

^f*p* < 0.05.

OR, odds ratio; 95% CI, 95% confidence interval; AOR, adjusted odds ratio; P6M, the past 6 months; NA, not applicable; VCT, voluntary counseling and testing; STD, sexually transmitted disease.

MSM-only, 53.0% for MSMW, *p* < 0.001); 27.9% consistently used condoms in the past 6 months with male partners (29.6% for MSM-only, 24.6% for MSMW, *p* < 0.01); 19.8% had commercial sex with men (20.1% for MSM-only, 19.3% for MSMW); 35.3% consistently used condoms in the past 6 months with paid male sex partners, with similar proportion

for both MSM-only and MSMW. MSMW were less likely to use a condom during the last sex with a woman than during last anal sex with a man (46.6% versus 53.0%, *p* < 0.05). Additionally, 3.6% of all participants used drugs with higher rate among MSMW (5.1%) than that among MSM-only (2.7%; Table 1).

TABLE 2. FACTORS ASSOCIATED WITH HIV INFECTION AMONG MEN WHO HAVE SEX WITH MEN ONLY (MSM-ONLY) OR WITH MEN AND WOMEN (MSMW) IN SHANDONG PROVINCE, CHINA (N=2996)^a

Factors	HIV+ (%)	MSMW OR (95% CI)	AOR (95% CI)	HIV+ (%)	MSM-only OR (95% CI)	AOR (95% CI)
Age (years of age)						
<25	1.4	1.0		1.6	1.0	1.0
25-	2.5	1.8 (0.6–5.1)		4.5	2.9 (1.6–5.4) ^b	3.5 (1.9–6.5) ^b
35-	3.1	2.2 (0.8–6.4)		2.5	1.6 (0.4–7.2)	1.8 (0.4–8.4)
Residency						
Local	2.1	1.0		2.2	1.0	1.0
Other city	3.5	1.7 (0.7–3.9)		4.0	1.8 (1.0–3.3) ^c	2.0 (1.1–3.8) ^c
Education						
Middle school or lower	0.8	1.0		2.0	1.0	
High school or higher	2.7	3.5 (1.0–14.8) ^c		2.8	1.4 (0.6–3.1)	
Drug use						
No	2.3	1.0		2.6	1.0	
Yes	3.4	1.5 (0.3–6.3)		4.1	1.5 (1.2–2.7) ^d	
Received peer education						
Yes	1.4	1.0	1.0	1.5	1.0	
No	3.2	2.4 (1.0–5.6) ^d	2.5 (1.1–5.0) ^d	3.0	1.5 (0.8–2.7)	
Syphilis status						
Negative	1.8	1.0	1.0	2.2	1.0	1.0
Positive	12.1	7.6 (3.2–17.8) ^b	7.6 (2.9–19.5) ^b	10.0	4.9 (2.4–10.1) ^b	5.0 (2.3–10.8) ^b
Self-reported STDs in the past year						
No	1.9	1.0	1.0	2.1	1.0	1.0
Yes	4.8	2.6 (1.1–6.0) ^c	2.2 (1.1–5.7) ^c	6.6	3.3 (1.8–6.2) ^c	3.0 (1.6–5.6) ^d
Venues of recruitment						
Internet, HIV testing sites, or grassroots	2.2	1.0		2.6	1.0	
Bars, night clubs, or tea houses	2.9	1.3 (0.5–3.4)		2.6	1.0 (0.5–2.0)	
Bathhouses or sauna	3.1	1.4 (0.5–4.4)		3.0	1.1 (0.5–2.8)	
Outdoor cruising area	0	NA		3.0	1.2 (0.3–4.2)	

^aTotal *n* for each subgroup may not equal to the number of 2996, because of missing data.^b*p* < 0.001.^c*p* < 0.05.^d*p* < 0.01.

OR, odds ratio; 95% CI, 95% confidence interval; AOR, adjusted odds ratio; NA, not applicable.

HIV/STD-related prevention services

Of the 2996 participants, 56.4% received condom promotion, 22.9% received lubricant promotion, 44.0% received peer education, and 44.8% received a test for HIV in the last year. These rates were similar among both MSMW and MSM-only, except for MSMW reported a higher proportion who received lubricant promotion (24.9% versus 21.7%, *p* < 0.05; Table 1).

Prevalence of HIV, syphilis, and self-reported STDs

Of the 2996 participants, 2.5% were HIV-infected with similar rates among MSMW (2.4%) and MSM-only (2.6%); 5.5% syphilis-infected with similar rates MSMW (5.6%) and MSM-only (5.5%); 13.9% had self-reported STDs with 14.4% for MSMW and 13.6% for MSM-only. HIV infection and syphilis predicted each other among both MSMW and MSM-only (Tables 1–3).

Correlates of bisexual behaviors

In the multivariable logistic regression analyses, MSMW were more likely than MSM-only to be older (adjusted odds ratio [AOR] = 14.2; 95% confidence interval [CI]: 10.3–19.4,

versus <25 years), local residents (AOR = 1.5; 95% CI: 1.2–1.8), recruited from outdoor cruising areas (AOR = 2.4; 95% CI: 1.8–3.3, versus bars/night clubs/tea houses), drug users (AOR = 2.2; 95% CI: 1.5–3.3), and have never used a condom during the last anal sex with male partners (AOR = 1.4; 95% CI: 1.1–1.7; Table 1).

Correlates for HIV infection

In the multivariable logistic regression analyses, HIV-infected MSMW were more likely to have never received peer education (AOR = 2.5; 95% CI: 1.1–5.0), have syphilis (AOR = 7.6; 95% CI: 2.9–19.5), and self-reported STDs in the past year (AOR = 2.2; 95% CI: 1.1–5.7). HIV-infected MSM-only were more likely to be older (AOR = 3.5; 95% CI: 1.9–6.5, versus <25 years), nonlocal residents (AOR = 2.0; 95% CI: 1.1–3.8), and have syphilis (AOR = 5.0; 95% CI: 2.3–10.8), and self-reported STDs in the past year (AOR = 3.0; 95% CI: 1.6–5.6; Table 2).

Correlates for syphilis

In the multivariable logistic regression analysis, syphilis-infected MSMW were more likely to be recruited from Jinan,

TABLE 3. FACTORS ASSOCIATED WITH SYPHILIS AMONG MEN WHO HAVE SEX WITH MEN ONLY (MSM-ONLY) OR WITH MEN AND WOMEN (MSMW) IN SHANDONG PROVINCE, CHINA (N=2996)^a

Factors	Syphilis (%)	MSMW OR (95% CI)	AOR (95% CI)	Syphilis (%)	MSM-only OR (95% CI)	AOR (95% CI)
Study sites						
Yantai	0.8	1.0	1.0	2.9	1.0	1.0
Qingdao	6.7	8.8 (2.0–38.0) ^b	10.7 (2.5–46.0) ^b	6.3	2.2 (1.1–4.7) ^c	3.1 (1.1–8.5) ^c
Zibo	5.0	6.4 (1.4–29.1) ^c	6.7 (1.5–30.1) ^c	6.1	2.2 (1.0–4.6) ^c	2.3 (0.9–6.4)
Jinan	8.2	10.9 (2.6–46.0) ^b	12.7 (3.0–54.0) ^b	6.1	2.2 (1.1–4.5) ^c	3.8 (1.5–10.1) ^b
Venues of recruitment						
Internet, HIV testing sites, or grassroots	6.3	1.0		6.0	1.0	
Bars, night clubs, or tea houses	5.6	0.9 (0.5–1.6)		5.8	1.0 (0.6–1.5)	
Bathhouses or sauna	2.1	0.3 (0.1–1.0) ^c		4.1	0.7 (0.3–1.4)	
Outdoor cruising area	8.6	1.4 (0.7–2.9)		6.1	1.0 (0.4–2.5)	
Sex with men in the past 6 months						
No	5.4	1.0		4.9	1.0	1.0
Yes	7.2	1.4 (0.7–2.5)		9.1	1.9 (1.2–3.1) ^b	2.3 (1.3–3.9) ^b
Drug use						
No	5.3	1.0		5.1	1.0	1.0
Yes	10.2	2.0 (0.8–4.9)		16.3	3.6 (1.6–7.9) ^b	2.3 (1.0–5.7) ^c
Lubricant promotion						
Yes	4.6	1.0	1.0	5.4	1.0	
No	8.5	1.9 (1.2–3.2) ^c	2.4 (1.4–4.1) ^c	6.1	1.2 (0.7–1.8)	
Ever had HIV test in the past year						
No	4.6	1.0		4.5	1.0	
Yes	6.8	1.5 (0.9–2.5)		6.8	1.6 (1.0–2.3) ^c	
HIV status						
Negative	5.0	1.0	1.0	5.1	1.0	1.0
Positive	28.6	7.6 (3.2–17.9) ^d	9.6 (3.8–24.1) ^d	20.8	4.9 (2.4–10.1) ^d	5.0 (2.2–11.1) ^d
Self-reported STD in the past year						
Yes	5.3	1.0		4.9	1.0	
No	8.5	1.7 (0.9–3.1)		9.0	1.9 (1.2–3.1) ^c	

^aTotal N for each subgroup may not equal to the number of 2996, because of missing data.

^b $p < 0.01$.

^c $p < 0.05$.

^d $p < 0.001$.

OR, odds ratio; 95% CI, 95% confidence interval; STD, sexually transmitted disease.

Qingdao, and Zibo (AOR=12.7, 95% CI: 3.0–54.0, Jinan versus Yantai; AOR=10.7, 95% CI: 2.5–46.0, Qingdao versus Yantai; AOR=6.7, 95% CI: 1.5–30.1, Zibo versus Yantai), infected with HIV (AOR=9.6, 95% CI: 3.8–24.1), and have never received lubricant promotion (AOR=2.4, 95% CI: 1.4–4.1). Syphilis-infected MSM-only were more likely to be recruited from Jinan and Qingdao (AOR=3.8, 95% CI: 1.5–10.1, Jinan versus Yantai; AOR=3.1, 95% CI: 1.1–8.5, Qingdao versus Yantai), drug users (AOR=2.3, 95% CI: 1.0–5.7), infected with HIV (AOR=5.0, 95% CI: 2.2–11.1), and have ever had sex with male partners in the past 6 months (AOR=2.3, 95% CI: 1.3–3.9; Table 3).

Discussion

This study demonstrated high prevalence of HIV/syphilis and common unprotected sexual behaviors among both MSM-only and MSMW in the four cities of Shandong Province. This study revealed the common bisexual practice among gay men and identified the substantial differences in correlates for infection of HIV/syphilis between MSM-only

and MSMW. Only a few studies have briefly mentioned bisexual behaviors in China,^{8,9,20–23} none of these studies examined the biological markers among bisexuals.^{8,9,13,19} The present study is the first in China to assess the correlates for biological makers, HIV, and syphilis, among MSMW and MSM-only. Our data contribute to understanding the potential role of bisexual behaviors in epidemiologic bridging of HIV transmission.

High prevalence of HIV infection among MSM has been reported in some, but not all metropolitan areas in China,^{9,20,23–28} however, high prevalence of syphilis has been consistently reported in different cities across the nation (from 7% in Jiangsu to 27% in Beijing).^{10,20,21,25,26} The HIV epidemic took place in Shandong relatively late compared to other parts of China.²⁹ Although HIV prevalence of 2.5% found in the present study was relatively lower than the national overall rate of HIV infection (4.9%) among MSM,³⁰ the rates of HIV, syphilis, self-reported STDs revealed in the present study significantly higher than the rates reported previously among MSM in these four cities, which have historically low prevalence rates of HIV, syphilis, and other

STDs as well.²⁹ The higher prevalence of syphilis was independently associated with HIV infection among both MSM-only and MSMW. High prevalence of syphilis and self-reported STDs among MSM demonstrated that a large number of MSM engaged in unprotected sex behaviors that place them at high risk for HIV.^{31,32} The epidemiologic synergy between HIV and other STDs^{7,24,33-41} and rapid spread of HIV/syphilis among Shandong's gay men and bisexuals highlighted the significance of the potential epidemiologic bridge in spreading HIV.

The high prevalence of unprotected sex among both MSM-only and MSMW is most worrisome, importantly, with respect to potential HIV transmission risk to women, MSMW are less likely to use a condom during the last sex with a male sex partner (53%) than MSM-only (62.1%), MSMW have even a lower rate of condom use during last sex with a female partner (46.6%), which may support the intensity bridging effect.

National estimates and local projections indicate that 2%–5% of Chinese males are primarily homosexual in their sexual behaviors, varying by urban and rural areas and by economic conditions.^{7,22,42} MSM include a wide range of sexual preferences, sexual identities, and sub-cultures. One can find in China gay men similar in education and attitude to their counterparts in the West. The common bisexual practice revealed in this study is consistent with other reports in China,^{13,19,25,27,32} it is far more common than a corresponding figure reported in the West.⁴³ Under societal and family pressure, most MSM fear revealing their true sexual orientation.^{12,19,44} Family pressure impels MSM to marry and have a child. Many Chinese MSM continue sexual relationships with their wives while maintaining concurrent secret homosexual relationships. In the past, such phenomena may not have drawn much attention to public health or academia. However, in the era of HIV/AIDS, there is increasing need for more information on homosexual and bisexual behaviors in China. Another group of MSM includes quasi- (or not so quasi-) sex workers known as “money boys.”⁴⁵ The present study found that one fifth reported ever having had commercial sex with male partners in the past 6 months with similar rates among both MSM-only and MSMW.

The social pressure may explain partially the observed common bisexual behaviors. This study found that MSMW are more likely to be older, have lower levels of HIV-related knowledge, and more frequent in outdoor cruising areas than MSM-only. An additional analysis also suggested that older age was independently associated with both being currently married/cohabiting and with current divorced/separation status (data not shown), which is consistent with other reports.¹⁹ Other studies suggested the social pressure for marriage increases with age, as there exists some normative age for getting married in China.¹⁹ Older single men may be seen as gay, which is not socially acceptable.¹⁹ A marriage brought about by social pressure may lead to spousal conflict over time,¹⁹ as also indicated by the high rate of divorce among older gay men in the present study. China is still a relatively conservative country; its culture does not consider homosexuality a subject open for discussion.¹² Stigmatization against MSM in Chinese societies may be still quite serious.⁴⁴ Relevant advocacy efforts in China are at most preliminary. Although the linkage between MSMW behavior and female partnership was very strong, the cultural context is likely play

an important role in the potential bridging effect of HIV transmission from MSMW to women.

Confronting rapid rise in HIV/syphilis prevalence among MSM, China recognized the urgent needs for the estimated 10–20 million gay men.⁴⁶ Without effective action in a timely fashion, this group could become the second most at-risk group for HIV infection in China following IDUs. Importantly, under stigmatizing and discriminating social pressure, MSMW with high rates of HIV/syphilis and common unprotected sex with multiple male and female partners, may play an important role in spreading HIV from MSM to female sex partners. The female sexual relationships were “not necessary” and/or “not desired,” having been formed under social pressure. The number of women exposed to HIV via their bisexual partners could have been decreased if social pressure was alleviated. Therefore, social pressure such as stigmatization against MSM partially accounts for the intensity of the aforementioned bridging effect.

This study did not find an association between drug use and HIV infection, although 3.6% of participants reported ever using illicit drugs, mainly methamphetamine, with significant higher rates among MSMW than that among MSM-only. The rate of drug use found in this study is consistent with the low rates of drug use among MSM from other reports.^{23,24,47} Conversely, drug abuse is common among the gay men in the West and often constitutes a major risk for HIV transmission in this population.^{16,48} The higher rate of drug use in MSMW was associated with HIV transmission.^{49,50} Drug use may relax safer sex norms and increase unprotected anal sex and the risk of acquiring HIV.^{16,48} This study found that drug use was independently associated with bisexual behaviors although drug use was not common. Our recent study revealed an alarmingly high prevalence of methamphetamine use among female sex workers in same cities of Shandong.^{29,51,52} The relationship between drug use and bisexual activities as well as syphilis displayed in the present study underscored that Shandong's gay men might also face potential risks of emerging drug use, which might play a potentially significant role of bisexual behaviors in epidemiologic bridging.

A high proportion of participants have HIV-related knowledge, which may indicate certain success of education intervention effort in the past years; however, the rates of condom use and the utilization of HIV-related prevention services were still at low level for both MSM-only and MSMW. More than half of participants reported never receiving a test for HIV in the past year. This showed that a large proportion of MSM who were infected with HIV do not know their status and could continue to spread the virus. China has scaled up HIV prevention effort, however, low uptake of HIV testing remain an impediment to prevention. Other data suggested social norms that foster stigma, discrimination associated with homosexuality and HIV/AIDS, being fearful of a positive result, a lack of coping skills, and knowledge of HIV risks are the other reasons for the low rate of HIV testing among MSM.

This study has several limitations. Data collection relying on retrospective self-reports was subject to recall bias. The sensitive nature of the questions (related to sexual and drug use behaviors) may have lead to information bias due to the social desirability of certain answers. Nonresponse information was not collected. The cross-sectional design precludes

identification of causal relationships. This makes it difficult to discern directly how potential risk factors may influence or be otherwise related to bisexual behaviors or HIV infection. Despite these limitations and possible biases, we feel the data highlight a prevention opportunity that cannot be ignored. This study highlighted an important area that warrants HIV prevention and research work.

High prevalence of HIV/syphilis/other STDs and common bisexual practice in Shandong's gay men and bisexuals with common unprotected sex and multiple sexual partners highlight the importance of bisexuals as a potential epidemiologic bridge. MSMW represent a unique risk group within the population among MSM that deserve further investigation to understand their sexual network in the context of China. Further investigation is also needed to assess whether MSMW have a central role in connecting multiple sexual networks, and whether MSMW have a substantial impact on population transmission. These findings underline the urgency of expanding more effective culture sensitive HIV prevention measures. So far, no effective intervention programs exist specifically targeting MSMW in China. In-depth, better targeted, culture-sensitive integrated HIV and other STD control is essential in bisexual men and MSM-only in many urban areas in China that data suggested a potential emerging public health emergency.

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