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Descriptive Epidemiology of Factors Associated with HIV Infections Among Men and Transgender Women Who Have Sex with Men in South India

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Abstract

Purpose: Men and transgender women who have sex with men (MTWSM) continue to be an at-risk population for human immunodeficiency virus (HIV) infection in India. Identification of risk factors and determinants of HIV infection is urgently needed to inform prevention and intervention programming.
Methods: Data were collected from cross-sectional biological and behavioral surveys from four districts in Karnataka, India. Multivariable logistic regression models were constructed to examine factors related to HIV infection. Sociodemographic, sexual history, sex work history, condom practices, and substance use covariates were included in regression models.
Results: A total of 456 participants were included; HIV prevalence was 12.4%, with the highest prevalence (26%) among MTWSM from Bellary District. In bivariate analyses, district ($P = 0.002$), lack of a current regular female partner ($P = 0.022$), and reported consumption of an alcoholic drink in the last month ($P = 0.004$) were associated with HIV infection. In multivariable models, only alcohol use remained statistically significant (adjusted odds ratios: 2.6, 95% confidence intervals: 1.2–5.8; $P = 0.02$).
Conclusion: The prevalence of HIV continues to be high among MTWSM, with the highest prevalence found in Bellary district.

Key words: alcohol use, HIV risk, India, men who have sex with men.

Introduction

The human immunodeficiency virus (HIV) epidemic in India continues to be a global concern, with the heterosexual spread of HIV through female sex work, an important factor in earlier phases of the HIV epidemic in southern India.[1] With a prevalence of 1.3% in prenatal clinics, Karnataka state in southern India was found to be one of six states with a high HIV prevalence,[1] triggering a considerable amount of investment in resources for prevention and intervention work.[2]

A challenge for prevention and intervention efforts is the tremendous amount of heterogeneity that exists in India.[3] For example, within northern Karnataka, the presence of the *Devadasi* tradition (a form of sex work where young women are dedicated through marriage to gods or goddesses),[4] geographic proximity to large urban centers in

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Maharashtra state, and a largely rural population have conspired to produce substantially different drivers of the HIV epidemic compared to southern Karnataka.[5–8] In fact, a gradient in HIV prevalence from north to south, with a higher prevalence in the northern parts of Karnataka, is known to exist.[6]

Increasing emphasis has been placed on characterizing and responding to heterogeneity in the Indian HIV epidemic, and the different risk populations currently affected by HIV,[9–11] such as among men and transgender women who have sex with men (MTWSM).[10,12–15] MTWSM are recognized as a core group and are thus a priority for targeted interventions by the National AIDS Control Organization of India.[16] Although recent studies have increased our understanding of MTWSM,[9,11,17,18] there is still a paucity of data on the correlates of HIV infection among MTWSM in India. It is known that MTWSM in southern India have high rates of infection with HIV,[10,13] as well as other sexually transmitted infections (STIs),[11,13] relative to the general Indian population. For example, two studies of MTWSM in Karnataka state have reported HIV prevalence to be between 13% and 17% among MTWSM in their samples.[10,11] In comparison, the HIV prevalence in the general male population in Karnataka state has been estimated at less than 1%.[12,19] One survey of men living in Chennai slums found that the HIV prevalence was ninefold higher among MTWSM, compared to non-MTWSM individuals.[20]

Among MTWSM, HIV prevalence is known to vary by age,[21,22] sexual identity,[11,17,21,23] and location of residence,[11] while the cruising location and level of literacy have been associated with HIV risk behaviors.[22,24,25] A large body of literature exists on the relationship between sex work and HIV among MTWSM in India.[23,26,27] Research has demonstrated that a substantial proportion of MTWSM are married, or have female sex partners[11,17,21,22,25]; at the same time, condom use has been demonstrated to be low among MTWSM.[21,28] Age at first sex and composition of current sexual partners have been shown to be associated with HIV risk.[11,22,29] Contributing to their risk for HIV, MTWSM in India remain highly stigmatized and marginalized in the Indian society[26,30] and experience high rates of sexual violence.[10,26,31,32] Finally, substance use, including alcohol use, has been shown to be elevated among MTWSM[33] and has also been demonstrated to be associated with HIV.[20,22]

Thus, the higher prevalence of HIV and social and structural vulnerabilities (such as stigma, marginalization, and oppression) contribute to the creation of conditions that mirror the early spread of HIV among Indian female sex workers (FSWs).[13,34] For example, MTWSM often live in poverty, are often involved in sex work, and are harassed by state institutions such as the police in India.[26,35] At the same time, collectivization, community mobilization, and empowerment of FSWs are all thought to have played a vital role in curtailing the HIV epidemic among FSWs in Karnataka state.[36,37] Although broadly less successful in MTWSM communities, due to the high stigmatization and illegality (in India) of same-sex relationships among men, Jha et al. note that peer-led education, community-led program planning and implementation, condom distribution and promotion, and integrated testing and treatment services were hallmarks of successful interventions among MTWSM communities.[38] In terms of program planning, there are substantial gaps in knowledge regarding the correlates of HIV infection, and how, in turn, these correlates may affect prevention, screening, and treatment.[38,39] For example, Thomas et al. note that the effect of alcohol and other substance use on risk for HIV has not been well studied in the Indian context.[39] Therefore, studies describing the distribution of HIV among MTWSM and that examine the correlates of HIV infection are a priority for program planning. Using the most recent data available from a series of cross-sectional surveys of four districts in Karnataka State, southern India, this study sought to describe the prevalence of HIV among MTWSM and to examine factors related to HIV prevalence. The cross-sectional surveys were used to help evaluate the impact of the Bill & Melinda Gates Foundation's *Avahan* program in India, which sought to curtail the spread of HIV in India.[40,41]

Methods

Study design and sampling

Institutional Review Boards at the University of Manitoba in Winnipeg, Canada, and St. John's Medical College and Hospital in Bangalore, India, approved the study and the verbal consent process. Interviews were conducted anonymously; because of the high level of stigmatization of MTWSM populations in India, verbal consent was obtained for all respondents in lieu of written consent, as MTWSM are reluctant to sign their names to documents. An independent witness signed each consent form, affirming that consent was correctly obtained.

Data were collected from the second round of a cross-sectional survey (i.e., the Integrated Biological and Behavioural Assessment [IBBA]) of MTWSM populations in four districts in Karnataka State, southern India: Belgaum, Bellary, Mysore, and Shimoga. As part of a comprehensive monitoring and evaluation strategy, results from the IBBA were used to evaluate the impact of the *Avahan* program, which aimed to slow HIV transmission in India by bringing prevention efforts to scale among populations thought most at risk for HIV, including MTWSM.[40,41] MTWSM in Belgaum ($n=198$), Bellary ($n=71$), Mysore ($n=100$), and Shimoga ($n=87$) were recruited in 2011 through multistage cluster sampling.[17,42] Briefly, multistage cluster sampling is a sampling technique that takes advantage of natural, relatively homogenous clusters in a population and is thought to be highly efficient in the sampling of hard-to-reach populations.[43] A sample size of 400 at the district level was thought adequate to detect an absolute difference of 15% or more from an assumed value of 50% in key behavioral characteristics between survey administrations, with 95% confidence and 90% power.[41] The four districts in this analysis were treated as a single study. Program and mapping activities were directed at the most at-risk MTWSM and focused on those practicing receptive anal intercourse. These two concepts were operationalized by concentrating on MTWSM who gathered at cruising sites and other public spaces.[17,42] Selection of solicitation sites occurred in the first stage of sampling, and selection of MTWSM in the second. Time–location cluster sampling was used to select specific clusters. Informed by previous mapping exercises, a total of 110 clusters with a minimum of five interviews in each cluster were targeted across the four districts. Within each cluster, MTWSM were randomly approached by field staff and asked to participate. Free transportation was then arranged to a private venue for MTWSM agreeing to participate. At the venue, MTWSM were explained IBBA procedures in detail and given the opportunity to ask questions; the

voluntary nature of the survey was emphasized, especially the ability of the participant to withdraw participation at any point in the survey. Before field work and recruitment, a specific effort was made to inform community members of the scope, purpose, and the risks and benefits of the IBBA by field workers through community-based organizations. Participants were included in the study if they were 18 years or older and reported having had sex with a man at least once in their lifetime. Participants who were intoxicated or were otherwise unable to provide consent were excluded.

Survey organization and methods

MTWSM were interviewed individually by trained peer workers using a structured questionnaire administered in the local language. Biological data were gathered using blood and urine samples as described in previous studies.[17,42] HIV serological testing was conducted using MicroELISA (J. Mitra and Company, India), and positive tests were confirmed using Genedia HIV 1/2 ELISA 3.0 (Green Cross Life Science Corporation, South Korea). When serum samples were not provided, dried blood spot testing was performed on finger prick blood using the same serological tests. When neither serum nor finger prick samples were provided, urine samples were tested for HIV by Calypte Biomedical Corporation (Berkeley, CA) and confirmed by Western blot. Because surveys and tests were conducted anonymously, results from HIV tests could not be linked back to individuals; however, syndromic treatment for bacterial sexually transmitted infections was provided on site, and vouchers were given to participants for free testing at community-based clinics.

Measures

In addition to the primary outcome (HIV status), respondents were compared on sociodemographic, sexual history, sex work-related, condom use, and substance use characteristics. Age group, literacy level (ability to read and write), marital status (ever married or never married), district of residence, and sexual identity were included as sociodemographic variables. Sexual identity among MTWSM is highly diverse; similar to other studies,[10,17] MTWSM could self-identify as *Kothis* (those who primarily practice receptive anal sex and are feminine-acting males); *Hijras* (transgender people who often self-identify as female; many are castrated); *Panthis* (those who primarily practice insertive anal sex and are often clients of Kothis or Hijras); *Double-deckers* (DD) (those who practice both insertive/receptive anal sex), and *others.* MTWSM were grouped into the following identities: *Kothis/Hijras*; DD; and all others.[10] Kothis and Hijras were grouped together for the purposes of statistical power. Finally, where respondent was recruited into the study (public garden/washroom, railway station/bus stop, or Hamam) was used as a proxy for where respondents cruised for sex with other MTWSM.

Sexual history included age at first sexual encounter with a man, whether first sex was forced (yes/no), and history of vaginal intercourse (yes/no). Binary variables for each of the following were created: whether the respondent currently had a regular female partner, a regular male partner, or no partner at all. Sex work-related questions included whether the respondent had ever engaged in sex work and binary variables created from questions asking whether respondents had ever paid for sex from FSWs and/or male sex workers. Condom use questions included asking whether respondents had ever used condoms, whether condoms were used at last anal sex with a male partner, whether respondents ever felt they could not use a condom in the past 6 months, and whether the decision to use condoms at last sex was entirely up to their partner. Finally, variables were created to capture the use of alcohol in the last month (ever vs. never), injection drug use, and use of other drugs. No respondent reported injection drug use, and only one reported use of other drugs; therefore, only alcohol use was included in further analyses.

Statistical analysis

Descriptive analyses included comparisons between HIV-positive and HIV-negative MTWSM based on sociodemographic, sexual history, sex work, condom use, and substance use characteristics.

Multivariable analyses

A hierarchical, stepwise approach was taken for parsimonious model building in multivariable logistic regression analyses. Factors of interest were grouped into five blocks: sociodemographic, sexual history, sex work, condom use, and substance use. *A priori*, age group, district of residence, and sexual identity were forced into models. As a consequence, the null model (Model 1) used for each comparison included age group, district, and sexual identity as covariates. In the first step, each block was entered separately into multivariable regression models in the following sequence: substance use, condom use, sex work, sexual history, and sociodemographic blocks. All blocks not associated with HIV status (adjusted for age group, sexual identity, and district) at $P < 0.10$ were excluded from further analysis. In the second step, for each block remaining, covariates comprising the included block were entered into regression models individually. Covariates were kept if they were associated with the outcome at $P < 0.10$ (Model 2). In the third step, all covariates that were excluded in the first and second steps of the model building process were entered individually into Model 2; any covariates significant at the $P < 0.05$ level were then retained. This final step was repeated until no other covariates were associated with HIV status at $P < 0.05$. Wald tests were used to assess statistical significance, and sampling weights were utilized in regression models to account for the complex sampling design, using survey methods in Stata 12 (College Station, TX). Multicollinearity was assessed using the variance inflation factor and tolerance statistics, corrected for the survey methods used.[44]

Results

A total of 456 respondents were included from an original study sample of 459. Two respondents were eliminated because they did not consent to HIV testing, and one other respondent was excluded due to missing responses for several variables. Table 1 includes a description of the sample, both for the total study group and by HIV status. The mean age of the sample was 32.1 years, with MTWSM identifying as DD composing 50% of the sample. At the bivariate level, HIV-positive respondents were more likely to be from Bellary ($P = 0.002$), less likely to report having a current regular female partner ($P = 0.022$), and more likely to report having at least one alcoholic drink in the last month ($P = 0.004$). HIV prevalence in the total sample was 12.4% (Table 2), with prevalence lowest

Table 1. Sample Characteristics by HIV Status, MTWSM South India (Weighted %, $N=456$)

Variables	HIV −ve MTWSM (n=399)	HIV +ve MTWSM (n=57)	Total (n=456)	P
Sociodemographic				
Age group				
18–24	29.2%	25.6%	28.7%	0.888
25–29	17.0%	20.6%	17.5%	
30–39	28.8%	27.1%	28.6%	
40+	25.0%	26.7%	25.2%	
Sexual identity				
Panthi/bisexual/ other	11.8%	13.1%	11.9%	0.320
DD	50.9%	39.6%	49.5%	
Kothi/Hijra	37.3%	47.3%	38.6%	
District				
Belgaum	54.9%	33.1%	52.2%	0.002
Bellary	10.4%	26.1%	12.3%	
Shimoga	5.4%	5.3%	5.4%	
Mysore	29.3%	35.6%	30.1%	
Where recruited				
Public garden/ toilet	11.2%	20.6%	12.4%	0.209
Railway station/ bus-stop	22.8%	24.5%	23.0%	
Hamam	66.0%	54.9%	64.6%	
Can read and write				
No	34.6%	32.6%	34.3%	0.763
Yes	65.4%	67.4%	65.7%	
Ever married				
No	49.8%	63.6%	51.6%	0.058
Yes	50.2%	36.4%	48.4%	
Sexual history				
Age at first sex (with male)				
<15	17.0%	15.6%	16.9%	0.579
15–18	45.4%	54.2%	46.5%	
19–21	23.7%	15.6%	22.7%	
>21	13.8%	14.5%	13.9%	
First sex with male forced				
No	60.5%	59.9%	60.4%	0.938
Yes	39.5%	40.1%	39.6%	
Have regular male partner				
No	46.1%	50.5%	46.6%	0.602
Yes	53.9%	49.5%	53.4%	
Have regular female partner				
No	53.4%	69.7%	55.5%	0.022
Yes	46.6%	30.3%	44.5%	
Has no regular partner				
No	74.7%	64.3%	73.4%	0.160
Yes	25.3%	35.7%	26.6%	
Has had vaginal sex				
No	45.7%	43.3%	45.4%	0.742
Yes	54.3%	56.7%	54.6%	
Sex work				
Ever				
No	62.5%	52.6%	61.2%	0.186
Yes	37.5%	47.4%	38.8%	
Ever paid for sex (MSW)				
No	90.5%	88.7%	90.3%	0.702
Yes	9.5%	11.3%	9.7%	
Ever paid for sex (FSW)				
No	98.0%	98.8%	98.1%	0.620
Yes	2.0%	1.2%	1.9%	
Condom use				
Could not use condom (last 6 months)				
No	88.9%	83.8%	88.3%	0.396
Yes	11.1%	16.2%	11.7%	
Partner decides when to use condom				
No	92.9%	91.0%	92.6%	0.621
Yes	7.1%	9.0%	7.4%	
Ever used condom				
No	2.5%	0.0%	2.2%	0.263
Yes	97.5%	100.0%	97.8%	
Used condom at last sex				
No	1.0%	0.0%	0.8%	0.446
Yes	99.0%	100.0%	99.2%	
Substance use				
Alcohol frequency				
Never	38.7%	18.9%	36.3%	0.004
Ever	61.3%	81.1%	63.7%	

DD, double-deckers; FSW; female sex worker; HIV, human immunodeficiency virus; MSW, male sex worker; MTWSM, men and transgender women who have sex with men.

among 18–24-year olds (11.1%) and highest among 25–29-year olds (14.7%). HIV prevalence was highest in Bellary (26.3%) and lowest in Belgaum (7.9%). HIV prevalence among Kothis/Hijras, Panthis/Bisexuals/others, and DDs was 15.3%, 13.7%, and 9.9%, respectively.

Multivariable analysis

Table 2 presents the results from multivariable analyses, with Models 1 and 2 showing the results from the hierarchical stepwise procedure. Model 2 was the final model chosen. In Table 2, Model 1 represents the base model used in the stepwise procedure. After the first step in the procedure through which all five blocks were entered independently (from 5 to 1), only Block 5 (alcohol use, $P=0.046$) remained significantly associated with HIV status at the $P<0.10$ level. In the next step, alcohol use within the last month ($P=0.046$) was retained (Model 2). In this final model, after adjusting for all other variables in the model, only recruitment from Bellary (adjusted odds ratios [AOR]: 4.5; 95% confidence intervals [CI]: 2.2–9.4; $P<0.001$) and reporting having at least one alcoholic drink (AOR: 2.6; 95% CI: 1.2–5.8; $P=0.02$), relative to reporting never having an alcoholic drink in the last month, were significantly associated with HIV infection.

Discussion

Our results demonstrate that HIV infection continues to be a major issue among MTWSM in southern India, with an overall HIV prevalence of 12% in our sample. HIV prevalence reported in this study is slightly lower than the prevalence of 14% reported using data from Round 1 of the IBBA.[10] HIV

TABLE 2. HIV PREVALENCE AND AOR AND 95% CI FROM LOGISTIC REGRESSION MODELS EXAMINING CHARACTERISTICS ASSOCIATED WITH HIV STATUS, MTWSM SOUTH INDIA ($N=456$)

		Model 1			*Model 2*		
	HIV prevalence	*AOR*	*95% CI*	P	*AOR*	*95% CI*	P
Age group							
18–24	11.1	Ref	—	—	Ref	—	—
25–29	14.7	1.57	0.57–4.35	0.38	1.41	0.52–3.83	0.50
30–39	11.8	1.45	0.60–3.47	0.40	1.32	0.57–3.07	0.51
40+	13.2	2.01	0.60–6.73	0.25	2.02	0.61–6.67	0.24
Sexual identity							
Panthi/bisexual/other	13.7	Ref	—	—	Ref	—	—
DD	9.9	0.60	0.16–2.23	0.43	0.64	0.16–2.51	0.51
Kothi/Hijra	15.3	0.87	0.23–3.32	0.83	0.93	0.22–3.85	0.92
District**							
Belgaum	7.9	Ref	—	—	Ref	—	—
Bellary	26.3	5.15	2.37–11.21	0.00	4.52	2.17–9.42	<0.001
Shimoga	12.2	1.75	0.74–4.12	0.20	1.78	0.74–4.30	0.13
Mysore	14.7	1.98	0.76–5.16	0.16	1.32	0.48–3.62	0.58
Where recruited							
Public garden/toilet	20.7	/	/	/	/	/	/
Railway station/bus-stop	13.2	/	/	/	/	/	/
Hamam	10.6	/	/	/	/	/	/
Can read and write							
No	11.8	/	/	/	/	/	/
Yes	12.8	/	/	/	/	/	/
Ever married							
No	15.4	/	/	/	/	/	/
Yes	9.3	/	/	/	/	/	/
Age at first MSM sex							
<15	11.5	/	/	/	/	/	/
15–18	14.5	/	/	/	/	/	/
19–21	8.6	/	/	/	/	/	/
>21	13.0	/	/	/	/	/	/
First MSM sex forced							
No	12.2	/	/	/	/	/	/
Yes	12.5	/	/	/	/	/	/
Have regular male partner							
No	13.5	/	/	/	/	/	/
Yes	11.5	/	/	/	/	/	/
Have regular female partner							
No	15.6	/	/	/	/	/	/
Yes	8.5	/	/	/	/	/	/
Has no regular partner							
No	10.9	/	/	/	/	/	/
Yes	16.7	/	/	/	/	/	/
Has had vaginal sex							
No	11.9	/	/	/	/	/	/
Yes	12.9	/	/	/	/	/	/
Sex work–ever							
No	10.7	/	/	/	/	/	/
Yes	15.2	/	/	/	/	/	/
Ever paid for sex (MSW)							
No	12.2	/	/	/	/	/	/
Yes	14.5	/	/	/	/	/	/
Ever paid for sex (FSW)							
No	12.5	/	/	/	/	/	/
Yes	7.8	/	/	/	/	/	/
Could not use condom (6 months)							
No	12.1	/	/	/	/	/	/
Yes	17.6	/	/	/	/	/	/
Partner decides on condom use							
No	12.5	/	/	/	/	/	/
Yes	15.6	/	/	/	/	/	/
Ever used condom							
No	0.0	/	/	/	/	/	/
Yes	12.7	/	/	/	/	/	/
Used condom at last sex							
No	0.0	/	/	/	/	/	/
Yes	12.8	/	/	/	/	/	/
Alcohol frequency (last 1 month)*							
Never	6.5	/	/	/	Ref	—	—
Ever	15.8	/	/	/	2.61	1.19–5.76	0.02

*Statistical significance at $P<0.05$ in Model 2.
**Statistical significance at $P<0.01$ in Model 2.
"/" are placeholders to signify exclusion from Models 1 and 2.
AOR, adjusted odds ratios; CI, confidence intervals.

prevalence in our study is similar to those found among MTWSM in North America (15.4%), Central/South America (14.9%), and other parts of South and Southeast Asia (14.7%), but lower than those reported from the Caribbean (25.4%) and sub-Saharan Africa (17.7%).[45] Among MTWSM in India, HIV prevalence in our sample is higher than prevalence reported in the states of Maharashtra (11%) and Tamil Nadu (8%),[11,20] but lower than prevalence reported in Andhra Pradesh state (21%).[11] Compared to a recent study of MTWSM in 12 cities in India, the prevalence reported in our study was higher than the prevalence in 10 of 12 cities; only Hyderabad (12.7%) and Madurai (13.1%) reported higher HIV prevalence. In comparison to other priority populations in Karnataka state, studies have found HIV prevalences of ~15% among FSWs, 5% among clients of FSWs,[46] and 0.8% in the general population.[47] Consistent with other studies from India, our study found that HIV prevalence was highest among MTWSM who self-identified as *Kothi* or *Hijra*.[11] Unlike other published studies,[11] those who identified as DD had the lowest HIV prevalence, at 10%. This may have been related to our inclusion of *Panthis* with the ''Others'' group, as *Panthis* were shown to have the lowest HIV prevalence in the study by Brahmam et al.[11] In addition, the fact that more than 50% of our sample was composed of DD may have contributed to lowering HIV prevalence in this group through regression to the mean.

The observation that HIV prevalence was highest in Bellary, at 26.3%, is consistent with Round 1 data from Karnataka state, with prevalence reported to be as high as 30% among MTWSM.[48] Using the same data, Alary et al. reported HIV prevalence to be 16% among FSWs from Bellary, which was midway between the range of 10%–34% reported from five districts in Karnataka.[48] Conversely, HIV prevalence among clients of FSWs was 6%, which was one of the higher prevalences reported from Karnataka state.[48] Bellary was identified as one of the high priority districts in Karnataka state by the United Nations Development Programme,[48] given its high HIV prevalence in the general population, incidence of poverty, and more challenging socioeconomic conditions, including a high degree of wealth inequality.[1,48] Moreover, and contributing to its vulnerability to HIV,[49] Bellary district is home to a large and prosperous mining industry and thus hosts a highly mobile migrant worker population.[48]

The impact of alcohol use on decision-making and risky sexual practices has been acknowledged,[50] and further exploration of this issue among MTWSM in the Indian context has been argued for previously.[39] However, with few exceptions, the impact of alcohol use on HIV risk among Indian MTWSM has rarely been studied.[20,51] One Chennai-based study found that, at the univariate level, heavier alcohol use was associated with marriage to women and having unprotected anal and vaginal sex.[51] These results highlight the role that subgroups of MTWSM may have in furthering HIV transmission to both the MTWSM and general populations. Mimiaga et al. observed that 28% of MTWSM reported using alcohol to the point of being intoxicated or buzzed weekly, and they recommend the provision of alcohol counseling as part of comprehensive prevention and intervention strategies for MTWSM.[51] Although our study did not include a formal measure of alcohol use or abuse (such as the CAGE measure),[52] our results do confirm the need to include measures that enable a higher resolution of alcohol use in future studies. As others have suggested, discerning the extent to which alcohol is being used as a coping strategy to deal with issues of stigma and trauma would also be an important step to inform interventions focused on developing stronger adaptive coping strategies.[53] Furthermore, on the treatment side, alcohol use has been associated with nonadherence to HIV medication,[54,55] potentially affecting both the transmission of HIV and the health and well-being of MTWSM and other persons living with HIV/AIDS.

Our study had a number of strengths, including the integration of biological information with behavioral data. In addition, the focus of the IBBA was on MTWSM who were thought to be at highest risk of HIV infection/transmission. Finally, extensive premapping exercises and rigorous sampling methodology across several districts provided a robust and representative sample of MTWSM, to the greatest extent possible. Our study also had a number of limitations. First and foremost, alcohol use was measured broadly; future studies should incorporate more specific (and validated) measures of both frequency and abuse of alcohol. Second, although MTWSM were sampled from four different districts, substantial differences in sociocultural and political environments exist across different states in India; thus, inferences from our sample to other states and populations should only be undertaken with caution. Third, IBBA sampling methodology primarily relied on sampling from cruising sites and, therefore, our findings may not be generalizable to those MTWSM who do not frequent cruising sites. This sampling strategy was used, however, on the rationale that MTWSM who frequent cruising sites are at the highest risk of contracting HIV. It should also be noted that participants did receive a small gift as compensation for participating; this, as well as the fact that participants who were willing to participate in the survey may not be representative of MTWSM in Karnataka, further limits the generalizability of our findings. Fourth, the sexual identity categories for MTWSM were necessarily simplified and broad. Fifth, the possibility of recall bias exists as all behavioral questions were self-reported. Finally, data were of a cross-sectional nature and, thus, causality cannot be inferred from our study. The lack of statistical associations observed may indicate that a larger sample size may be needed in future studies. There was a large discrepancy in HIV prevalence, by district; however, samples were not sufficiently powered to perform district-level analyses.

Conclusion

In conclusion, using the latest available data on MTWSM from Karnataka state in India, we have found that HIV prevalence remains high and therefore remains a public health priority. Our results demonstrate an association between alcohol use and prevalent HIV infection, highlighting the need for further research to understand whether alcohol use may lead to further vulnerability.

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Disclaimer

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Author Disclosure Statement

The authors declare that no competing financial interests exist.

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