

# High HIV Prevalence Among Men Who Have Sex With Men in Nigeria: Implications for Combination Prevention

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**Background:** This study provides population-based estimates of HIV prevalence and factors associated with HIV infection among men who have sex with men (MSM) in 3 large cities in Nigeria. We aimed to increase the knowledge base of the evolving HIV epidemic among MSM, highlight risk factors that may fuel the epidemic, and inform future HIV prevention packages.

**Methods:** A total of 712 MSM, aged 18 years and older, living in Abuja, Ibadan, and Lagos were recruited using respondent-driven sampling. Participants completed a behavioral questionnaire and tested for HIV. Population-based estimates were obtained using RDSAT software. Factors associated with HIV infection were ascertained using multiple logistic regression adjusting for RDSAT individualized weights.

**Results:** A high proportion of MSM reported high-risk behaviors, including unprotected anal sex with men (30–50%), unprotected vaginal sex with women (40%), bisexual behavior (30–45%), and never been tested for HIV (40–55%). The population-based estimates of HIV among MSM in the 3 cities were 34.9%, 11.3%, and 15.2%, respectively. In Abuja, HIV was significantly associated with unprotected sex and transactional sex. In Ibadan, HIV was significantly associated with unprotected sex and self-identified bisexual. In Lagos, HIV was significantly associated with the older age.

**Conclusions:** HIV prevalence among MSM in the 3 cities was 4–10 times higher than the general population prevalence and was behaviorally linked. In response to a complex set of risks and disadvantages that put African MSM at a greater risk of HIV infection, future interventions targeting MSM should focus on a comprehensive approach that combines behavioral, biomedical, and structural interventions.

**Key Words:** HIV, men who have sex with men, respondent-driven sampling, combination prevention, Nigeria, Africa

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L. V., S. A., W. T., M. S., and A. K. conceived and designed the study. L. V., S. A., and J. N. coordinated the field data collection. L. V. conducted statistical analysis and drafted the paper. All authors interpreted the findings, provided critical review, and approved the final manuscript.

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## INTRODUCTION

Men who have sex with men (MSM) remain the most HIV-infected and affected subpopulation in Western Europe, North America, and Australia.<sup>1</sup> In contrast, the epidemic in Africa is primarily driven by heterosexual and vertical transmission of HIV,<sup>2</sup> although same-sex activities also account for an unknown proportion of new infections. Recently, a growing number of studies highlighted the high burden of HIV among MSM in low- and middle-income countries<sup>1–10</sup> where MSM are 19 times more likely to be infected with HIV than the general population.<sup>2</sup> In Africa, MSM are 4 times more likely to be infected with HIV<sup>2</sup> with an estimated prevalence of 17%.<sup>1</sup> In addition, because of stigma, discrimination, homophobia, and criminalization that MSM face in the course of their lives in many African countries, many are reluctant to access health care services and participate in research thus heightening their vulnerability to HIV infection.<sup>11–15</sup>

The situation is not much different in Nigeria where homosexuality is viewed as originating from the West<sup>3</sup> and MSM are highly stigmatized and they live in a hostile and homophobic environment.<sup>3,5</sup> Additionally, homosexuality is criminalized.<sup>3,4</sup> Consequently, Nigerian MSM often live double lives of publicly engaging in heterosexual relationships and same-sex relationships secretly.<sup>3</sup> MSM also experience conflicts between their cultural, religious, family values, and expectations and their sexual identities.<sup>3</sup> According to the first national integrated behavioral and biological surveillance survey (2007), the HIV prevalence among MSM in Nigeria was 3 times higher than the general population and about half had sex with both men and women.<sup>5</sup> Despite this, Nigerian MSM do not consider themselves as having a higher risk of HIV infection compared with the general population.<sup>5</sup>

Recent scientific reviews of HIV among MSM in Africa have called for improvements in HIV surveillance systems and the reporting of key HIV indicators.<sup>1,6,7</sup> Quantifying the problem is the first step for government to tailor policy toward universal access of HIV prevention, care, and treatment services. This study is part of a larger initiative to inform HIV programming for key populations in Nigeria through the Enhancing Nigeria's Response to HIV/AIDS. Through this study, we aim to provide population-based estimates of HIV prevalence, to increase the knowledge base of the evolving HIV epidemic among MSM, and to highlight risk factors and unmet needs that may fuel the epidemic within the MSM communities and their linkages to the general population. It is possible that HIV infection among MSM can be mitigated by understanding the risk-related behaviors and unmet needs and allocating appropriate resources for a comprehensive intervention package.

## METHODS

### Data Collection

This study was conducted to determine the prevalence of HIV, sexually transmitted infections (STIs), the behavioral risk factors associated with HIV, and differences in reporting pattern of sensitive behaviors between 2 interview modes (audio computer-assisted self-interview and face-to-face interview) among MSM in 3 major cities in Nigeria: Abuja, Lagos, and Ibadan. Abuja is the capital of Nigeria located in the North Central with an estimated population of 2 million and Lagos and Ibadan are both in the South West with estimated population of 16 million and 2 million, respectively.

MSM were recruited through respondent-driven sampling (RDS), an adaption of snowball or chain-referral sampling where peers recruit their peers into the study.<sup>8,9</sup> This sampling strategy is typically used to recruit hard-to-reach populations. To initiate the recruitment of participants, “seed” participants were purposively selected based on a diverse set of characteristics (age, socioeconomic status, and linkages to other MSM). Seeds recruited 3 of their peer MSM who met the recruitment criteria and each successive peer recruited 3 peers until the desired sample size was reached. Recruiters and their recruits were linked by unique identification numbers on the recruitment coupons, and participant’s network sizes were recorded. These 2 pieces of information are crucial for data analysis.

MSM were defined as men aged 18 years and older who had reported oral or anal sex with another man in the past 12 months. A total of 712 MSM living in Abuja ( $n = 194$ ), Lagos ( $n = 308$ ), and Ibadan ( $n = 210$ ) were recruited between August and September 2010. Participants were randomly assigned to either face-to-face interview or audio computer-assisted self-interview lasting about 30 minutes. The survey elicited information about HIV risks (sexual history, sexual orientation, drug use, condom use, number of sex partners, and selling sex).

### Laboratory Procedures

Blood samples were tested with HIV rapid tests using the serial algorithm for the detection of HIV antibodies in accordance with Nigeria’s HIV Counseling and Testing national guidelines. Participants received test result and posttest counseling within 30 minutes. Participants who tested positive were referred to HIV clinics for confirmation and further management.

### Data Analysis

Descriptive analyses were conducted using RDSAT software to adjust for recruitment patterns and the relative sizes of participant’s peer networks.<sup>16</sup> RDS recruitment coupled with RDSAT data analysis produced population-based estimates. We report estimated point prevalence and corresponding 95% confidence intervals (CIs).

Individualized weights based on the outcome variable (HIV status) were generated in RDSAT and exported to STATA software (version 12.0; STATA Corp, College Station, TX) for logistic and multiple logistic regression analyses. Logistic regression analyses with HIV status as the outcome were conducted separately for each of the 3 cities given the

distinct networks within cities. Selection of independent variables into the regression model was determined through literature and theoretical concepts, including socioeconomic characteristics, sexual identity, and HIV risks. Selection of HIV risk factors into the model was determined if its relationship with HIV status in bivariate analysis was significant at  $P$  values of less than 0.2. Unadjusted and adjusted odds ratios (AORs) and 95% CIs were reported.

### Ethical Considerations

Ethical approvals were obtained from both the Institutional Review Boards of the Population Council and the Nigerian Institute of Medical Research. Special precautions were taken in conducting this study to maximize the safety and confidentiality of participants. Participants were offered free STI treatment, condoms and lubricants, and HIV/AIDS brochures. No adverse events were observed during the entire study.

## RESULTS

### Sociodemographic Background and Sexual Identity

Characteristics of the study population are presented in Table 1. The majority of the participants were younger than 30 years. The median age for MSM in Abuja, Ibadan, and Lagos was 25 (range: 18–52), 23 (18–43), and 21 (18–45), respectively (data not shown). In Abuja, over half of the MSM had completed secondary education (56.8%) and about one-third had no income (35.4%). In Ibadan, 67.3% had completed secondary education and over one-third had no income (43.2%). In Lagos, 83.5% of MSM had completed secondary education and approximately one-third had no income (34%). Abuja had the highest proportion of MSM who had tertiary education (34.3%) compared with Ibadan (23.7%) and Lagos (11.8%). Over one-half of MSM in Abuja and Ibadan were living in rented dwellings (51.5% and 55.0%, respectively), and an equally high proportion were also living with their parents (33.1%, 35.9%, respectively). In contrast, 28.9% of MSM in Lagos were living in rented dwellings and 61.9% were living with their parents. In Ibadan, 18.9% of MSM were married compared with just more than 2% in Abuja and Lagos. Roughly, three-quarter of MSM in all 3 cities were Christian and the remaining were Muslim.

Half of the respondents from Abuja self-identified as gay or homosexual (52.3%), and 44.0% self-identified as bisexual. In Ibadan, a higher proportion (58%) self-identified as bisexual. In contrast, in Lagos, only 35.1% identified as gay/homosexual and a higher proportion identified as bisexual (63.5%). Few MSM across all cities identified themselves as straight (3.7% in Abuja, 2.3% in Ibadan, and 1.5% in Lagos).

### HIV Risk Behaviors

HIV risk behaviors are presented in Table 2. Although 28% of respondents in Abuja reported having sex with both

**TABLE 1.** Background Characteristics of MSM in Abuja, Ibadan, and Lagos

Characteristics	Abuja (n = 194)		Ibadan (n = 210)		Lagos (n = 308)	
	Unadjusted, % (n)	Adjusted, % (95% CI)	Unadjusted, % (n)	Adjusted, % (95% CI)	Unadjusted, % (n)	Adjusted, % (95% CI)
Age (yrs)						
18–20	13.0 (24)	19.1 (10.1–27.7)	22.9 (48)	29.8 (20.8–39.1)	43.9 (133)	49.5 (41.2–56.5)
21–25	48.1 (89)	48.5 (35.4–59.2)	43.3 (91)	43.7 (35.1–52.8)	40.3 (122)	39.7 (32.7–47.4)
26–30	25.4 (47)	22.3 (14.7–34.1)	19.5 (41)	15.3 (9.2–21.5)	12.2 (37)	9.5 (6.2–14.6)
≥31	13.5 (25)	10.2 (5.1–16.5)	14.3 (30)	11.2 (0.6–17.4)	11.0 (3.6)	1.3 (0.4–2.4)
Education						
Primary	9.3 (18)	8.9 (4.5–14.0)	6.2 (13)	9.0 (4.1–14.4)	4.9 (15)	4.7 (1.7–7.9)
Secondary	47.9 (93)	56.8 (47.2–66.1)	61.0 (128)	67.3 (58.5–75.0)	78.2 (241)	83.5 (77.9–88.4)
Tertiary	42.8 (83)	34.3 (24.7–44.1)	32.8 (69)	23.7 (16.7–32.4)	16.9 (52)	11.8 (8.0–16.5)
Job						
Not earning	30.9 (60)	35.4 (25.6–44.0)	39.5 (83)	43.2 (34.0–50.8)	30.8 (95)	34.0 (27.3–41.5)
Part time	20.6 (32)	19.8 (12.4–28.0)	24.8 (52)	24.2 (18.3–31.6)	37.7 (116)	38.2 (30.6–45.5)
Self-employed	18.6 (36)	20.2 (11.6–28.2)	24.3 (51)	21.5 (14.8–29.1)	15.9 (49)	12.4 (8.2–17.2)
Full time	29.9 (58)	24.6 (18.7–33.9)	11.4 (24)	11.2 (6.9–16.3)	15.6 (48)	15.4 (9.8–22.1)
Type of dwelling						
Own	8.8 (17)	8.7 (3.7–14.6)	6.7 (14)	3.8 (2.3–9.3)	7.8 (24)	5.8 (3.0–8.6)
Rent	57.2 (111)	51.5 (41.5–61.8)	53.3 (112)	55.0 (44.0–64.4)	30.5 (94)	28.9 (22.4–35.3)
Parents' house	25.8 (50)	33.1 (23.3–42.9)	36.7 (77)	35.9 (27.3–45.3)	57.1 (176)	61.9 (55.7–68.9)
Others	8.3 (16)	6.7 (3.2–11.0)	3.3 (7)	5.3 (1.0–7.7)	4.6 (14)	34.0 (14.0–59.0)
Marital status						
Single	80.0 (152)	79.1 (70.9–88.5)	69.5 (146)	65.8 (56.8–74.5)	56.5 (174)	57.0 (48.2–63.7)
Living with female partner	5.6 (11)	8.7 (3.5–18.6)	2.4 (5)	2.1 (0.3–4.6)	10.1 (31)	11.0 (7.1–15.8)
Living with male partner	10.5 (20)	10.2 (4.3–12.3)	14.8 (31)	13.2 (7.8–19.1)	30.2 (93)	28.7 (22.3–36.0)
Married to a woman	3.7 (7)	2.0 (0.2–2.7)	13.3 (28)	18.9 (10.4–28.5)	3.3 (10)	3.2 (1.1–6.2)
Religion						
Christian	75.9 (145)	76.8 (66.9–86.3)	70.3 (147)	59.6 (52.3–71.5)	73.7 (227)	72.6 (63.3–81.2)
Muslim	24.0 (46)	22.8 (13.3–32.8)	29.6 (62)	38.0 (27.3–46.7)	25.7 (79)	27.2 (18.6–36.5)
Sexual identity						
Straight	5.1 (9)	3.7 (0.4–7.8)	2.6 (5)	2.3 (0.3–4.9)	3.2 (9)	1.5 (0.4–3.0)
Bisexual	46.0 (81)	44.0 (33.8–55.1)	56.7 (110)	58.0 (48.7–68.0)	60.4 (172)	63.5 (55.2–70.7)
Gay (homosexual)	48.9 (86)	52.3 (41.5–62.6)	40.7 (79)	39.7 (29.5–49.3)	36.5 (104)	35.1 (27.6–43.5)

Unadjusted analyses were conducted using STATA, and adjusted analyses were conducted using RDSAT software.

men and women in the past 2 months, a higher proportion of MSM in Ibadan (39%) and Lagos (46%) had sex with both men and women. About 20–30% of MSM had multiple female partners and over half had multiple male sex partners in the past 2 months across the 3 cities. MSM reported high levels of unprotected anal intercourse at last sex with their male partners in Abuja (31%), Ibadan (50%), and Lagos (44%). Of those who had vaginal intercourse with women, about half of their last vaginal intercourse was unprotected. In Lagos, one-third reported that their last male sex partner was a commercial sex partner. Overall, half of the respondents reported being paid money or goods in exchange for sex in the last 6 months, and 20–30% reported sexually transmitted infections symptoms in the previous year. Appropriately, 7% of MSM reported using drugs in the past year. A high proportion of MSM had never been tested for HIV (44% in Abuja, 68% in Ibadan, and 62% in Lagos).

### Population-Based Estimates of HIV Prevalence and Factors Associated With HIV Infection

The population-based estimate of HIV among MSM in Abuja was 35% and was significantly associated with unprotected sex (AOR = 2.9, 95% CI: 1.1 to 8.3), selling sex (AOR = 4.9, 95% CI: 1.8 to 13.6), and ever tested for HIV (AOR = 5.6, 95% CI: 1.9 to 16.6). The population-based estimate of HIV among Ibadan MSM was 11.3% and was significantly associated with having unprotected sex (AOR = 5.1, 95% CI: 1.5 to 17.8) and self-identifying as bisexual (AOR = 9.1, 95% CI: 1.2 to 70.6). The population-based estimate of HIV among Lagos MSM was 15.2% and was significantly associated with older age (AOR = 3.8, 95% CI: 1.5 to 9.7) and Christian religion (AOR = 3.9, 95% CI: 1.4 to 10.9) (Table 3).

**TABLE 2.** HIV Risk Behaviors Among MSM in Abuja, Ibadan, and Lagos

Characteristics	Abuja (n = 194)		Ibadan (n = 210)		Lagos (n = 308)	
	Unadjusted, % (n)	Adjusted, % (95% CI)	Unadjusted, % (n)	Adjusted, % (95% CI)	Unadjusted, % (n)	Adjusted, % (95% CI)
HIV prevalence	42.0 (73)	34.9 (25.5–45.9)	8.8 (17)	11.3 (5.1–16.8)	20.2 (60)	15.2 (9.7–21.2)
Had sex with both men and women						
Yes	27.8 (54)	27.7 (18.3–37.0)	37.1 (78)	39.0 (30.7–47.2)	44.2 (136)	45.8 (38.2–53.3)
No	72.2 (140)	72.3 (63.0–81.7)	62.9 (132)	61.0 (52.8–69.3)	55.8 (172)	54.2 (46.7–61.8)
Number of female sex partners						
0	64.4 (125)	63.8 (53.6–73.6)	50.0 (105)	46.3 (37.7–54.7)	48.7 (150)	47.0 (39.6–54.9)
1	13.9 (27)	13.7 (7.3–21.0)	22.4 (47)	23.8 (16.8–31.6)	14.9 (46)	18.0 (11.4–25.6)
2	21.7 (42)	22.4 (14.1–31.3)	27.6 (58)	29.9 (22.2–37.7)	36.4 (112)	35.0 (27.9–42.1)
Had unprotected vaginal sex						
Yes	40.9 (27)	41.6 (19.4–73.7)	41.4 (46)	41.1 (28.0–52.7)	34.0 (63)	35.5 (24.1–50.6)
No	59.1 (39)	58.4 (26.3–80.6)	58.6 (65)	58.9 (46.5–71.1)	66.0 (122)	64.5 (49.4–75.9)
Number of male sex partners						
0	10.3 (23)	7.1 (3.9–11.7)	25.7 (54)	16.5 (10.4–23.6)	12.7 (39)	14.5 (9.6–19.2)
1	31.4 (61)	39.7 (29.8–50.3)	28.6 (60)	31.0 (23.2–39.2)	18.5 (57)	24.5 (17.4–32.4)
2	58.3 (113)	53.2 (42.1–63.6)	45.7 (96)	52.5 (43.4–61.3)	68.8 (212)	61.0 (52.9–69.0)
Had unprotected anal sex with men						
Yes	28.3 (49)	31.1 (21.2–41.0)	42.8 (80)	49.8 (39.1–59.7)	40.5 (117)	43.5 (35.5–53.5)
No	71.7 (124)	68.9 (59.0–78.8)	57.2 (107)	50.2 (40.3–60.9)	59.5 (172)	56.5 (46.5–64.5)
Being paid for sex						
Yes	43.3 (84)	38.0 (29.3–48.0)	48.1 (101)	51.0 (42.6–59.8)	55.5 (171)	54.5 (46.3–62.9)
No	56.7 (110)	62.0 (52.0–70.7)	51.9 (109)	49.0 (40.2–57.4)	44.5 (137)	45.5 (37.1–53.7)
Type of male sex partner						
Steady	43.8 (85)	44.0 (34.3–51.9)	53.3 (112)	53.5 (45.1–61.6)	36.3 (112)	30.5 (24.0–37.9)
Casual	43.3 (84)	44.1 (36.1–53.9)	31.4 (66)	30.6 (23.2–38.5)	31.8 (98)	33.9 (26.4–42.2)
Commercial sex	12.9 (25)	11.9 (6.5–18.4)	15.2 (32)	16.0 (10.2–22.0)	31.8 (98)	35.6 (28.1–43.2)
Used drugs past year						
Yes	6.7 (13)	8.3 (3.4–14.8)	6.7 (14)	5.3 (2.3–9.4)	9.1 (28)	7.5 (4.7–12.0)
No	93.1 (176)	91.7 (85.2–96.6)	93.3 (195)	94.7 (90.6–97.7)	90.9 (280)	92.5 (88.0–95.3)
Ever tested for HIV						
Yes	68.4 (130)	55.8 (44.1–67.4)	46.7 (98)	31.8 (24.0–41.3)	52.3 (161)	38.3 (31.6–47.2)
No	31.6 (60)	44.2 (32.6–55.9)	53.3 (112)	68.2 (58.7–76.0)	47.7 (147)	61.7 (52.8–68.4)
STI symptoms past year						
Yes	29.4 (57)	27.5 (18.1–37.5)	25.2 (53)	23.6 (17.5–30.0)	36.4 (112)	37.1 (28.5–45.1)
No	70.6 (137)	72.5 (62.5–81.9)	74.8 (157)	76.4 (70.0–82.5)	63.6 (196)	62.9 (54.9–71.5)

Unadjusted analyses were conducted using STATA, and adjusted analyses were conducted using RDSAT software. Biological STIs were low (around 2%, except for Chlamydia for Ibadan MSM).

## DISCUSSION

The findings of this study suggest a high burden of HIV among MSM in these 3 cities in Nigeria with HIV prevalence of approximately 4–10 times higher than in the general population (3.6%).<sup>10</sup> The relatively lower HIV prevalence of 11.3% reported among MSM in the semiurban city of Ibadan compared with the other 2 cities could indicate a more recent epidemic or migratory patterns of MSM to urban cities like Abuja and Lagos where there are better prospects of meeting other MSM. Ibadan is an older traditional indigenous city, in contrast to Lagos, a cosmopolitan commercial hub of Nigeria, and Abuja, a modern city of mainly recent migrants.

We found that MSM in the 3 cities reported high-risk sexual behaviors. About one-third had sex with both men and

women (bisexual behavior), 50% had multiple male sex partners, more than 20% had multiple female sex partners, 30–40% of the last anal intercourse with men were unprotected, and about 60% of vaginal intercourse were unprotected. These findings are consistent with the 2007 integrated behavioral and biological surveillance survey where half of MSM had sex with both men and women in the past year.<sup>5</sup> Bisexual behavior is also found in many other countries in Asia, Latin America, and Eastern Europe.<sup>11,12,17,18</sup> Findings suggest important bridging links between MSM and the general population through their female partners. Studies suggest that bisexual men are often uncomfortable with their homosexual identity or suffer from varying degrees of internalized homophobia.<sup>3,12,13</sup> As a result, these men are less likely to access HIV prevention services and

**TABLE 3.** Factors Associated With HIV Infection Among MSM in Abuja, Ibadan, and Lagos

Variables	Abuja		Ibadan		Lagos	
	OR (95% CI)	AOR (95% CI)	OR (95% CI)	AOR (95% CI)	OR (95% CI)	AOR (95% CI)
Age (yrs)						
18–25	1.0	1.0	1.0	1.0	1.0	<b>1.0</b>
26–40	1.7 (0.7–3.8)	2.5 (0.9–7.8)	0.9 (0.3–2.9)	0.6 (0.1–3.4)	4.5(1.9–11.1)***	<b>3.8 (1.5–9.7)**</b>
Education						
Secondary and less	1.0	1.0	1.0	1.0	1.0	1.0
Tertiary	1.2 (0.5–2.8)	0.8 (0.3–2.1)	0.8 (0.3–2.8)	3.4 (0.8–14.1)	2.9 (1.1–7.4)*	1.9 (0.7–5.2)
Religion						
Muslim	1.0	n/a	1.0	n/a	1.0	<b>1.0</b>
Christian	0.4 (0.2–11)		0.8 (0.3–2.3)		3.9 (1.4–11.1)**	<b>3.9 (1.4–10.9)**</b>
Sexual identity						
Straight/bisexual	1.0	1.0	5.3 (1.1–25.4)*	<b>9.1 (1.2–70.6)*</b>	1.0	n/a
Homosexual	1.1 (0.5–2.7)	2.1 (0.8–5.4)	1.0	<b>1.0</b>	0.9 (0.4–2.2)	
Had multiple sex partners						
No	1.0	1.0	1.0	1.0	1.0	1.0
Yes	1.1 (0.5–2.6)	0.7 (0.3–1.6)	1.2 (0.4–3.4)	2.6 (0.8–8.6)	1.2 (0.5–2.8)	1.2 (0.5–2.9)
Had unprotected anal sex						
No	1.0	<b>1.0</b>	1.0	<b>1.0</b>	1.0	1.0
Yes	1.2 (0.5–2.9)	<b>2.9 (1.1–8.3)*</b>	3.8 (1.0–14.4)*	<b>5.1 (1.5–17.8)**</b>	0.8 (0.3–1.8)	1.0 (0.4–2.5)
Being paid for sex						
No	1.0	<b>1.0</b>	1.0	n/a	1.0	1.0
Yes	2.7 (1.2–6.1)**	<b>4.9 (1.8–13.6)**</b>	1.0 (0.3–2.7)		1.9 (0.8–4.7)	1.9 (0.7–5.2)
Ever tested for HIV						
No	1.0	<b>1.0</b>	1.0	n/a	1.0	n/a
Yes	3.8 (1.5–9.5)**	<b>5.6 (1.9–16.6)**</b>	0.7 (0.2–2.1)		1.6 (0.7–3.7)	
Had any STI symptoms						
No	1.0	1.0	1.0	n/a	1.0	n/a
Yes	1.8 (0.7–4.3)	3.4 (1.0–11.9)	2.0 (0.4–9.4)		1.1 (0.4–2.5)	

RDSAT individualized weights were included in all analyses. Biological STIs were too low to include in the regression analysis for Abuja and Lagos. STI was not associated with HIV among Ibadan MSM. n/a indicates not applicable.

\**P* < 0.05; \*\**P* < 0.01; \*\*\**P* < 0.001.

often have lower self-efficacy for condom use, placing them at higher risk of HIV infection, compared with MSM.<sup>14,15,18-20</sup> The high-risk sexual behaviors reported by MSM in this study with both men and women underscore a potential high rate of HIV transmission between MSM and their male and female partners. Qualitative studies have documented that MSM in Nigeria maintain relationships with women to secure their safety and to gain family and societal acceptance.<sup>3</sup> Structural interventions are urgently needed in Nigeria to create an enabling and less homophobic environment.

In Lagos, older age was significantly associated with being HIV infected. In general, age has been associated with an increase in number of sexual partners and increased exposure to HIV.<sup>12,21</sup> Thus, over time, many more MSM in Nigeria are likely to become infected if appropriate targeted interventions are not made available and acceptable to MSM. Given that older MSM are more likely to be less comfortable and open about their sexual identity, it is pertinent that more focused attention should also be given to older MSM, particularly programs for people living with HIV. HIV testing and linkages to care and treatment services will reduce viral loads and ultimately reduce the probability of HIV transmission. With the advent of antiretroviral-

based interventions including oral preexposure prophylaxis (PrEP) and treatment as prevention, combination prevention approach comprising of behavioral, biomedical, and structural interventions is a key to averting new HIV infections among MSM.<sup>22,23</sup>

Self-reported bisexual identity was associated with HIV seropositivity in Ibadan. Over half (54%) of MSM in Ibadan who self-identified as bisexual or straight tested HIV positive. Studies have found that married men are less likely to disclose their sexual identity to sex partners or health care provider and are less likely to test for HIV compared with MSM who disclose their sexual identity.<sup>16,24</sup> Studies have reported associations between discomfort with sexual identity and poor access to health care services,<sup>13,14</sup> low self-efficacy for condom use, and increased risk of HIV infection.<sup>20,25,26</sup> This underscores the importance of creating tailored interventions for hidden and married MSM because of their high HIV burden, high risks, and the likelihood of bridging the epidemic to the general population.

A high proportion of MSM in all 3 cities also engage in transactional sex. We found most of these men reported selling sex to more than 2 different partners, indicating that they

engaged in commercial sex work regularly. Transactional sex occurred most frequently in Abuja (62%) and was significantly associated with HIV infection. Studies suggest that condom negotiation is difficult during transactional sex.<sup>21,27</sup> MSM who sell sex may also be those who are in lower socioeconomic status or use drugs, putting them at higher risk of HIV infection. Besides the Men's Health Network, Nigeria program, which provides comprehensive MSM friendly HIV prevention intervention program targeting MSM subpopulations including MSM sex workers, and male sex work is rarely systematically addressed in Nigeria. Income-generating activities or other type economic improvement interventions as part of a structural component may be important to this MSM subgroup.

### LIMITATIONS

The study has a number of limitations. First, we tested for HIV using rapid HIV test with no confirmatory test performed. However, given the high sensitivity and specificity of the rapid HIV tests recommended by the national testing algorithm guideline, we believe that false test results were minimal. Second, the recruitment yielded a sample of primarily young MSM, though attempts were made to diversify the seeds. Currently, RDS is the best method for reaching MSM in poor settings.<sup>28</sup> However, RDS has been documented as limited in reaching older MSM in the higher socioeconomic bracket. Third, there are also limitations in self-reporting sensitive information regarding the individual's sexuality in a homophobic and hostile environment such as Nigeria. We found significantly higher reporting of sensitive information among MSM surveyed by audio computer-assisted self-interview compared with those interviewed by face-to-face interview. However, interview mode was not associated with HIV infection in this study.

### CONCLUSIONS

HIV prevalence among MSM in the 3 cities was 4–10 times higher than that in the general population and was behaviorally linked. MSM in Nigeria are at high risk of acquiring and transmitting HIV because of the high-risk behaviors they engage in with both men and women. In addition, there may be a high level of unmet need for HIV testing among MSM. About half of MSM had never been tested for HIV. Programs need to focus on increasing access to MSM friendly HIV prevention, care, and treatment services. Recognizing the heterogeneity of the MSM subpopulation, there is a need for targeted interventions for MSM who are bisexual, married, and male sex workers. In response to the multifaceted risks and vulnerabilities that put Nigerian MSM at a greater risk of HIV infection, future interventions targeting MSM should focus on a comprehensive intervention approach that includes behavioral, biomedical, and structural interventions (combination prevention approach).<sup>22,23</sup> More implementation science research is needed to evaluate the effectiveness and cost-effectiveness of different sets of combinations of behavioral, structural, and biomedical components in reducing HIV infection among MSM.

Given such high HIV prevalence, a reduction in risk behaviors may not be sufficient enough to reduce HIV

infection. MSM would still be highly vulnerable to HIV infection with occasional risks. This suggests that new and potential antiretroviral-based prevention technologies that reduce infectiousness such as oral PrEP, treatment as prevention, and rectal microbicides should be considered and/or further studied. Research has found great potential of treatment as prevention and PrEP toward an effective global response to HIV.<sup>29,30</sup> Modelers even suggested that the combination of earlier treatment and the use of PrEP in key populations, including MSM, could have a greater impact in halting the epidemic.<sup>31</sup> Demonstration projects with proper evaluation plans are needed to learn the best way of providing and when and how to provide these products to different key populations, including MSM. Last, the continued criminalization of same-sex behavior in Nigeria constitutes a major structural barrier to effective HIV interventions and therefore should be removed.<sup>32,33</sup>

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