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Bisexual men are at less risk of HIV infection than exclusive gay men in sub-Saharan Africa

Les hommes bisexuels sont moins exposés au virus de l'immunodéficience humaine que les homosexuels exclusifs en Afrique subsaharienne

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➔ Abstract

Introduction: In sub-Saharan Africa, as in the rest of the world, men who have sex with men (MSM) are at greater risk of HIV infection than the general population. Bisexuals are often perceived to be more at risk than exclusive gay men.

Purpose of research: We propose a review of epidemiological surveys conducted in sub-Saharan Africa since 2005 to provide an overview of knowledge on HIV exposure among gay/bisexual men.

Results: We reviewed 355 publications and identified 62 measures of the association between bisexuality and HIV prevalence and 8 measures of the association between bisexuality and incidence. Except for 4 of 62 measures, the HIV prevalence observed among bisexuals was equal to or lower than that observed among exclusive gay men. In terms of incidence, all but one of the identified studies observed lower or equal HIV incidence among bisexuals. From a behavioural perspective, most studies found no difference in condom use. Bisexuals may have less frequent sex and consistently less receptive anal sex. They mainly started their sexual lives with men later, had fewer partners, and were less likely to know their HIV status.

Conclusions: Bisexuals are less likely to be at risk of HIV than exclusive gay men, partly because of behavioural differences. Prevention and treatment programs for MSM must take the specificities of bisexuals into account and design differentiated services.

Keywords: HIV Seroprevalence, Incidence, Sexual Orientation, Sub-Saharan Africa, Health Risk Behaviors

➔ Résumé

Introduction : En Afrique subsaharienne, comme dans le reste du monde, les hommes ayant des rapports sexuels avec des hommes (HSH) sont plus exposés à l'infection par le virus de l'immunodéficience humaine (VIH) que la population générale. Les bisexuels sont souvent perçus comme plus à risque que les homosexuels exclusifs.

But de l'étude : Nous proposons une synthèse des connaissances sur l'exposition au VIH des homo-bisexuels à partir d'une revue des enquêtes épidémiologiques réalisées en Afrique subsaharienne depuis 2005.

Résultats : Nous avons étudié 355 publications et avons identifié 62 mesures de l'association entre bisexualité et prévalence du VIH et 8 mesures de l'association entre bisexualité et incidence. À l'exception de 4 mesures sur 62, la prévalence du VIH observée parmi les bisexuels était inférieure ou égale à celle des homosexuels exclusifs. En matière d'incidence, toutes les études identifiées sauf une observent une incidence du VIH plus faible ou égale parmi les bisexuels. Du point de vue comportemental, la majorité des études n'ont pas relevé de différence d'utilisation du préservatif. Les bisexuels ont parfois une fréquence de rapports sexuels moindre et systématiquement moins de rapports anaux réceptifs. Ils ont commencé leur vie homosexuelle plus tardivement, ont eu moins de partenaires et sont moins nombreux à connaître leur statut VIH.

Conclusions : Les bisexuels sont moins exposés au VIH que les homosexuels exclusifs, notamment en raison de différences comportementales. Il importe que les programmes de prévention et de traitement à destination des HSH prennent en compte les spécificités des bisexuels et conçoivent des offres différenciées.

Mots-clés : Séroprévalence VIH ; Incidence ; Orientation sexuelle ; Afrique subsaharienne ; Comportements à risque pour la santé.

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Introduction

Sero-epidemiological surveys of HIV exposure among men who have sex with men (MSM) in sub-Saharan Africa only emerged in the mid-2000s, having been non-existent for over two decades of the AIDS epidemic. The first study to measure HIV prevalence among MSM on the continent was conducted in Senegal in 2004 and published in 2005 (1). With an HIV prevalence of 22% among MSM, compared to the low prevalence observed in the general population (less than 1%), this study highlighted the high exposure of MSM to HIV, which was confirmed by the numerous surveys developed since in sub-Saharan Africa, in parallel with the growing international attention given to MSM in resource-limited countries (2): the Global Forum pre-conference on MSM and HIV alongside the larger 2006 World AIDS Conference; the creation of the Africagay network in French-speaking Africa in 2007; and thematic sessions dedicated explicitly to MSM for the first time at the 2008 African AIDS Conference (ICASA), etc.

The MSM acronym (*men who have sex with men*) emerged at the beginning of the 1990s (3) in works on HIV. It conveys the idea that it is behaviours, not identities, which put individuals at risk of HIV exposure, an essential distinction since some scientists and medical experts had initially presented gay identity as a risk factor, which was a source of stigma (4). The MSM category has gradually become more prevalent in epidemiological surveys, enabling greater inclusiveness by including men who do not necessarily consider themselves “gay” but have sex with men. It includes both men who have sex with men exclusively (MSME) and men who have sex with both men and women (MSMW).

The 2004 Senegalese survey also provided important information about bisexual behaviour: 94% of respondents reported having had sex with a woman at least once in their lifetime (1). In the article, the authors highlighted this information as being a risk factor for the epidemic to spread to the general population. In 2005, the Senegalese authorities used this argument to advocate for the implementation of a prevention program for MSM (5): targeting MSM would protect the general population, as bisexuals could constitute a “bridge” between groups.

This large proportion of men with bisexual practices has become a recurring feature of surveys on MSM in Africa and one of the most debated aspects, in a context where the idea that MSMW are more susceptible to HIV acquisition than MSME was prevalent.

This paper presents an overview of epidemiological knowledge about HIV acquisition among different categories of homo-bisexuals in epidemiological surveys conducted in sub-Saharan Africa since 2005, including a comparison of available data on HIV prevalence and incidence along different dimensions of measuring sexual orientation.

Materials and methods

Scientific monitoring

Since 2005, we have maintained an ongoing scientific monitoring on publications concerning sexual and gender minorities in sub-Saharan Africa, based on searches of major bibliographic portals, references identified through reading or at international conferences, and reports or even unpublished analyses of which we have become aware through our research networks. This is not a systematic review, as the identification and collection of articles have been carried out continuously over a period of 15 years. The methodology used is similar to that of “narrative reviews” or “critical reviews” (6)

From this review of the scientific literature, which includes publications issued up to the end of 2020, we selected those presenting a quantified comparison of HIV prevalence or incidence among MSM, based on biological measurements (seroprevalence surveys, incidence cohorts, etc.). A review of the literature based on the same corpus and focusing on the construction of sexual orientation and gender categories in quantitative surveys conducted in sub-Saharan Africa has also been published (7) (see also <https://doi.org/10.5281/zenodo.4569342> for a summary table of the results).

Measuring sexual orientation

In light of published data, we distinguished three dimensions of individuals’ sexual orientation: (i) sexual activity category, (ii) self-reported sexual orientation, and (iii) sexual attraction. The sexual activity category measures bisexuality in terms of the sex of sexual partners over a given period of time. A distinction is therefore made between men who have sex with men exclusively (MSME) and men who have sex with both men and women (MSMW), with the reference period indicated in brackets if relevant.

Self-reported sexual orientation is captured in most surveys as a “How would you define yourself?” question with pre-coded response modalities, most often “homosexual” and/or “gay,” “bisexual,” “heterosexual”. Sexual attraction to one or the other sex is usually measured with a question such as “Are you attracted only to men; rather to men but also to women; to both men and women; rather to women but also to men; only to women?”.

Indicators obtained

For each publication selected, and following the dimensions of sexual orientation used by the authors, we obtained the reported HIV prevalence and incidence as well as the comparative ratio between bisexuals and exclusive gay men: odds ratio (OR) or prevalence ratio (PR) for prevalence and hazard ratio (HR) or incidence risk ratio (IRR) for incidences. Depending on the publication, the comparative ratios could be unadjusted, weighted according to RDS (respondent driven sampling, a sampling technique used by the majority of surveys) (8), or adjusted (multivariate analysis, the cofactors considered varying from one study to another). Some articles report comparative ratios without indicating the observed prevalence. For those studies which did not publish a comparative ratio, we calculated an unadjusted OR from the data in the article. Ratios were standardized to systematically compare bisexuals (including or not including heterosexuals) with exclusive gay men, depending on the dimension considered. Some studies compared bisexuals and exclusive gay men on several dimensions.

Given the significant heterogeneity in terms of methods and indicators, it seemed preferable not to perform a statistical meta-analysis.

Results

We pre-identified and retrieved between 400 and 500 publications, then reviewed the full texts of 355 of these and identified 62 measures of association between bisexuality and HIV prevalence (corresponding to 41 publications – a single publication may present several different indicators of bisexuality – covering 38 different surveys) and 8 measures of association between bisexuality and HIV incidence (corresponding to 6 publications covering 5 different surveys).

Bisexuality and prevalence of HIV

The measures of association collected between bisexuality and HIV prevalence are detailed in Table S1 (<https://doi.org/10.5281/zenodo.6470463>).

HIV prevalence among bisexuals and exclusive gay men was documented for 48 (77%) of the 62 identified measures of association (Figure S2). In the majority of cases (43/48), the prevalence measured among bisexuals was lower than those measured among exclusive gay men (points positioned above the diagonal line). In 4 cases, the prevalence was higher; in one case, the same value was observed among bisexuals and exclusive gay men.

A similar result can be seen in Figure 1, which reports 62 measures of comparison between bisexuals and exclusive gay men, mainly odds ratios (for 58 of 62 measures) but also prevalence ratios (4/52). The ratio is greater than 1 (indicating that bisexuals are more infected than exclusive gay men) for only 9 (14.5%) measures, equal to a 1 for 1 (1.6%) measure and less than 1 for 52 (83.9%) measures. In half of the cases (32/62), the 95% confidence interval included the value 1, indicating no significant difference. Of the 30 measures with a significant effect, 26 had a ratio of less than 1.

Only 4 measures had a ratio significantly greater than 1. Two had a low confidence interval close to 1: in Ghana in 2017 (9) with an unadjusted odds ratio of 1.18 [95% Confidence Interval: 1.00-1.38] and in Benin in 2016 (10) with a weighted odds ratio of 1.14 [1.01-1.29]. Note that, in the absence of RDS weighting, the odds ratio falls below unity (OR: 0.77 [0.42-1.39]), and the prevalence observed in bisexuals was lower than that observed in exclusive gay men (11.7% vs 14.6%). The only study to report odds ratios greater than 2 was conducted in Tanzania in 2014 in two towns/cities (11,12) and reported adjusted odds ratios of 5.6 [3.9-12.8] in Dodoma and 8.0 [4.1-15.6] in Dar es Salaam.

Bisexuality and incidence of HIV

Five studies measured and compared HIV incidence between bisexuals and exclusive gay men (Table 1). Only one study (13), conducted in Benin between 2016 and 2018, reported higher incidence among bisexuals (7.7 per 100 person-years [5.1-11.7]) compared to exclusive gay men (4.9 [3.3-7.2]), a non-significant difference (unadjusted HR: 1.5 [0.9-2.7]).

The other studies observed a significantly lower incidence of HIV among bisexuals, regardless of the sexual orientation dimension considered. A South African

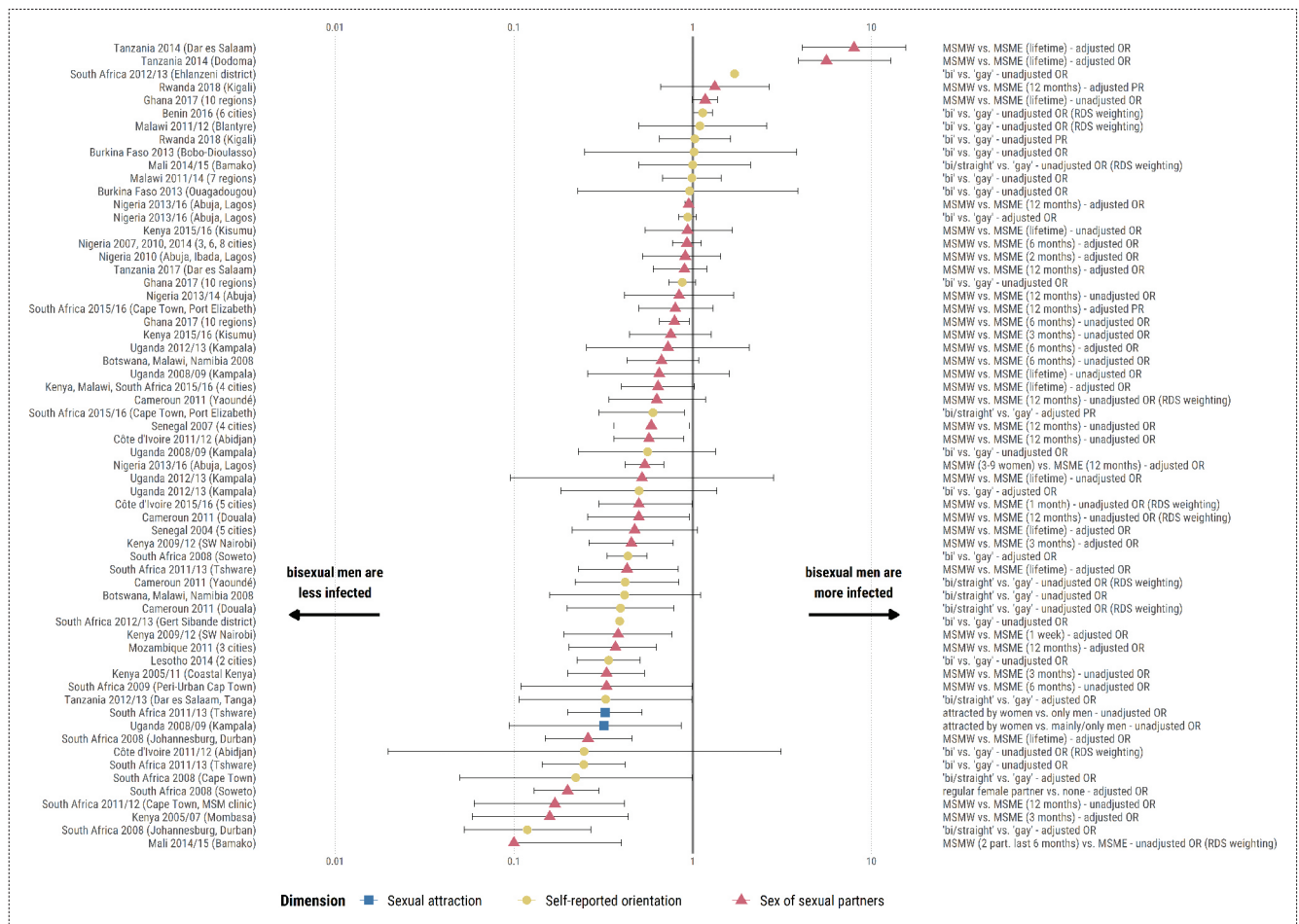


Figure 1: Odds Ratio (OR) or Prevalence Ratio (PR) of the probability of being infected with HIV for a bisexual compared to an exclusive homosexual, in sub-Saharan Africa (2004-2018), according to different dimensions of sexual orientation (sexual activity, declared sexual orientation, sexual attraction)

MSMW men who have sex with men and women, according to the time period considered; MSME: men who have sex with men exclusively; RDS: respondent driven sampling. Horizontal bars indicate 95% confidence intervals.

study (14) conducted between 2015 and 2017 compared those identifying as bisexual, heterosexual, or other with those identifying as gay (adjusted HR: 0.09 [0.01-1.0]). In Kenya, a 2005 to 2011 study (15) compared MSMW (past 3 months) with MSME (adjusted HR: 0.27 [0.2-0.5], $p < 0.001$). One article (16) reported follow-up data from this same cohort over 2005 to 2016 and found similar results (adjusted IRR: 0.50 [0.3-0.9], $p = 0.016$).

A Nigerian study (17) conducted between 2013 and 2018 reported a lower incidence by both sexual activity categories measured over the past 12 months (10.1 per 100 person-years vs 22.9) and by self-reported sexual orientation (bisexual vs gay, 12.5 vs 23.1). In this article, the unadjusted (unweighted) HRs are significantly ($p < 0.05$) lower than unity (0.46 and 0.56, respectively). When RDS

weighting is applied, the HRs remain below unity (0.82 and 0.83) but are no longer significant ($p > 0.05$).

Lastly, a final study (18) conducted in Malindi, Kenya in 2016/17 reported similar incidences (no significant difference) comparing MSMW (3 months) and MSME (adjusted IRR: 1.25 [0.3-5.0], $p = 0.798$). Unlike previous studies which did not distinguish gender, this one categorized participants defining themselves as female separately, given their significant number.

It is noteworthy that a Kenyan study of only MSM sex workers in Nairobi between 2009 and 2012 (19) also reported a lower incidence of HIV among those who reported having had at least one vaginal intercourse in the past three months (unadjusted HR: 0.76 [0.4-1.6], $p = 0.489$).

Table I: Incidence of HIV by self-reported sexual orientation, gender identity and sexual attraction in quantitative surveys of MSM in sub-Saharan Africa (2005-2018)

Country	Year	Region	Sample, Recruitment, Eligibility Criteria	Dimension compared	Incidence of HIV (per 100 people per year)	Ratio [CI 95%] (p-value)	Source
South Africa	2015/17	Cape Town, Port Elizabeth	N=167 community-based recruitment, prospective follow-up 18 years or over; assigned male at birth; anal sex with male (past 12 months)	reported orientation 'bisexual, straight, other' vs 'homosexual'	bisexuals: 1.5 [0.0-8.4] homosexuals: 10.6 [4.6-20.9]	unadjusted HR: 0.14 [0.02-1.1] adjusted HR: 0.09 [0.01-1.0]	(14)
Benin	2016/18	6 towns/cities	N=358 RDS recruitment, prospective follow-up biological male; 18 years or over; oral or anal sex with a man (12 months)	reported orientation 'bisexual' vs 'homosexual'	bisexuals: 7.7 [5.1-11.7] homosexuals: 4.9 [3.3-7.2]	unadjusted HR: 1.5 [0.9-2.7]	(13)
Kenya	2005/11	coastal Kenya	N=449 community-based recruitment, prospective follow-up men 18-49 years old; anal sex with a man (last 3 months)	sexual activity MSMW vs MSME (3 months)	MSMW: 5.8 [4.2-7.9] MSME: 35.4 [23.9-52.3]	unadjusted IRR: 0.16 [0.1-0.3] (p<0.001) adjusted IRR: 0.27 [0.2-0.5] (p<0.001)	(15)
Kenya	2005/16	coastal Kenya	N=753 community-based recruitment, prospective follow-up men 18-49 years old; anal sex with a man (last 3 months)	sexual activity MSMW vs MSME (3 months)	MSMW: 3.4 [2.4-4.9] MSME: 14.6 [11.4-18.6]	unadjusted IRR: 0.23 [0.2-0.4] (p<0.001) adjusted IRR: 0.50 [0.3-0.9] (p=0.016)	(16)
Kenya	2016/17	Malindi	N=168 among the 219 participants tested HIV negative in first study; 18 years or over; assigned male at birth; male sexual partner (last 6 months)	sexual activity category MSMW vs MSME (6 months)	MSMW: 3.4 [1.3-9.1] MSME: 4.5 [1.1-17.8]	unadjusted IRR: 0.77 [0.1-3.3] (p=0.735) adjusted IRR: 1.25 [0.3-5.0] (p=0.798)	(18)
			<i>individuals who self-identified as «female» were categorized into a separate group and excluded from the MSMW vs MSME comparison</i>	<i>MSMW vs Transgender</i>	<i>MSMW: 3.4 [1.3-9.1] Transgender: 20.6 [6.6-63.9]</i>	<i>unadjusted IRR: 0.17 [0.04-0.67] (p=0.012) adjusted IRR: 0.67 [0.09-5.0] (p=0.663)</i>	(18)
Nigeria	2013/18	Abuja, Lagos	N=441 RDS recruitment, prospective follow-up born male; 16 yrs or older (Abuja); 18 yrs or older (Lagos); anal sex with a man (12 previous months)	sexual activity category MSMW vs MSME (12 months)	MSMW: 10.1 MSME: 22.9	unadjusted HR: 0.46 [0.3-0.7] (p<0.05) HR (RDS weighting): 0.82 [0.4-1.5] (p>0.05)	(17)

Country	Year	Region	Sample, Recruitment, Eligibility Criteria	Dimension compared	Incidence of HIV (per 100 people per year)	Ratio [CI 95%] (p-value)	Source
				reported sexual orientation 'bisexual' vs 'homosexual'	bisexual: 12.5 homosexual: 23.1	unadjusted HR: 0.56 [0.4-0.9] (p<0.05) HR (RDS weighting): 0.83 [0.6-1.2] (p>0.05)	(17)

For multi-site surveys, results are presented in multiple lines. Self-reported gender identity and sexual orientation are reported using the terms used in the original publication (which may differ from the terms and/or language of the questionnaire). RDS: Respondent Driven Sampling. MSMW: men who have sex with men and women. MSME: men who have sex with men exclusively. For sexual activity, the duration cited in brackets indicates the time period considered. HR: hazard ratio. IRR: incidence risk ratio. For ease of reading, eligibility criteria related to being HIV-negative upon inclusion, consent, geographic residence and/or not participating in another study are not presented. Brackets indicate 95% confidence intervals.

Discussion

Bisexual practices and risky behaviours

The high proportion of heterosexual practices among MSM in Africa is often thought to result from a fear of stigmatization and thus a need to camouflage themselves under the guise of a heterosexual lifestyle. Some consider that this increases the risk of spreading HIV to the rest of the population (implied to be “heterosexual”) through the intermediary of the MSM’s female partners, but also among the MSM themselves. Furthermore, there is sometimes a psychologizing view that bisexuals are less able to accept themselves as gay and, therefore, less able to take care of themselves and protect themselves against HIV. The results of the surveys available provide insight into the factors of exposure to risks from another angle.

Whether considering HIV prevalence or incidence, sub-Saharan bisexuals are generally less infected with HIV than exclusive gay men, regardless of the dimension considered to define bisexuality: sexual activity, reported sexual orientation, or sexual attraction, and although they do not overlap precisely, these three dimensions are highly correlated (7,20,21). These differences in prevalence and incidence do not necessarily imply an intrinsic susceptibility to HIV risk related to having bisexual or exclusive same-sex practices but may result from behavioural differences that impact the risk of HIV exposure.

From a prevention perspective, most studies found no significant difference in the frequency of condom use

between bisexuals and exclusive gay men (5,22-25), and a few measured a higher likelihood of condom use among MSMW (26,27). In contrast, bisexuals appear to have sex with men less frequently and have fewer sexual partners (28,29). Therefore, the likelihood of having unprotected anal intercourse would be lower (30,31) or equal (28,32,33) among bisexuals compared with exclusive gay men. Bisexuals generally reported having had their first sexual intercourse with a man later in life (20,28,29) and had a lower total number of male sexual partners in their lifetime (28,34)

Most importantly, it appears that bisexuals consistently engage in less receptive anal sex and more insertive sex (19,20,23,28,29,33,35,36). This finding is consistent with a study (37) conducted in South Africa between 2015 and 2016 highlighting how bisexuals (whether self-defined as “bisexual”, “heterosexual” or “other”, or those who reported having had at least one female sexual partner in the past 12 months) had lower prevalence of anal chlamydia and gonorrhoea but higher prevalence of urethral chlamydia and gonorrhoea. Bisexuals are therefore less exposed to HIV as it has been shown that the likelihood of acquiring HIV during receptive anal sex is 15 to 20 times greater than during insertive anal sex (38).

Bisexuality and perception of risk

Bisexuals are often perceived, especially by MSM themselves, whether exclusive or not, as being at greater risk than exclusive gay men, based on the assumption that bisexuals are less likely to comply with preventive

guidelines. This is reinforced by the idea reported in several surveys that sex with a woman is more (or as much) at risk of transmission as sex with a man.

In surveys that have measured this representation, most participants do not perceive sex between men as being “riskier” than sex with a woman. In Abidjan, Côte d’Ivoire, in 2011/12, 13% of participants identified men as being the riskier partners, 23% identified women, and 66% considered both men and women to be equally risky (39). In Kampala, Uganda, in 2012/13, these proportions were respectively 15.6%, 34.8% and 49.5% (40). In Lesotho in 2014, only 28.4% of respondents in the town of Maseru and 22.9% in Maputsoe knew that anal sex was riskier (41). In Burkina Faso in 2013, these proportions were 8% in Ouagadougou and 25% in Bobo-Dioulasso (42).

Similarly, several studies have shown that most respondents did not perceive receptive anal sex as being riskier than insertive anal sex in terms of HIV infection. In Nigeria in 2013/16, only 42.7% of respondents knew this (43). This compares to 46.3% in Mesuru and 59.7% in Maputsoe, Lesotho in 2014 (41); 15% in Ouagadougou and 16% in Bobo-Dioulasso, Burkina Faso, in 2013 (42).

Access to care and prevention services

Although bisexuals appear to be less exposed to HIV than exclusive gay men, they have less overall access to prevention and care services. Thus, concerning access to HIV testing, the reviewed articles show similar (31,44-47) or lower (20,26,48) testing rates. A Nigerian study documented a lower, but not significant, probability of early initiation of antiretroviral therapy among HIV-infected participants who identified themselves as bisexual (OR: 5,67 [0,30-1,42], $p=0,148$) (49).

These differences in access to services may reflect differential degrees of insertion in MSM sexual and social networks. Stahlman et al. combined data from three RDS surveys conducted in Lesotho, Swaziland, and Malawi and analyzed the results according to waves of RDS recruitment (50). Differences emerged between early recruitment waves (waves 0-3, indicative of the core of the recruitment network) and later recruitment waves (8-14, on the fringe of the network): more peripheral participants defined themselves as bisexual or heterosexual (73% vs 51%), less HIV-infected (15% vs 48% prevalence), but also less aware of their HIV status (33% vs 53%).

Conclusion

On all dimensions, bisexuals are less exposed to HIV than exclusive gay men, in part due to behavioural differences. Thus, it is not exclusively same-sex practices or identities that in themselves expose people to HIV, but rather they are associated with greater insertion in the network of sexual exchanges between men and with a higher cumulative exposure factor.

However, it is problematic to think in terms of these two categories alone. Bisexuality is multifaceted in sub-Saharan Africa: bisexuals are not a homogeneous group, and sexual identities are so diverse that simply contrasting exclusive gay men with bisexuals is reductive (7,28). The standardization of questionnaires and the lack of attention to the social environment of practices tend to decontextualize the reported data.

From a health perspective, it is crucial that prevention and treatment programs for MSM take their diversity into account and thus design differentiated services. Although responses specifically targeting this population, particularly those provided by community NGOs, have been – and remain – essential to improving access to health services, they are not necessarily welcomed by all MSM: some say that they benefit from a more attentive ear and feel more confident, while others prefer to use services intended for the general public and to avoid those dedicated to MSM, for reasons of discretion, fear of the gaze of others and fear of being recognized (51). Although those who do not identify themselves as gay or who are less involved in MSM socialization networks are more frequently found in the second group, the gay/bisexual distinction does not overlap exactly with preferences for health services. This suggests the need, beyond this one dimension, to adapt health services to the diversity of situations, expectations and health needs of MSM and their female partners in sub-Saharan Africa.

References

1. Wade AS, Kane CT, Diallo PAN, Diop AK, Gueye K, Mboup S, et al. HIV infection and sexually transmitted infections among men who have sex with men in Senegal. *AIDS Lond Engl*. 2 Dec 2005;19(18):2133-40.
2. Larmarange J. Homo-bisexuals masculins au Sud: il est temps d'agir! *Transcriptases*. 22 Nov 2010;(144):68-70.

3. Dowsett GW. Reaching Men who have Sex with Men in Australia. An Overview of AIDS Education: Community Intervention and Community Attachment Strategies. *Aust J Soc Issues*. 1990;25(3):186-98.
4. Young RM, Meyer IH. The Trouble With "MSM" and "WSW": Erasure of the Sexual-Minority Person in Public Health Discourse. *Am J Public Health*. July 2005;95(7):1144-9.
5. Larmarange J, Wade AS, Diop AK, Diop O, Gueye K, Marra A, et al. Men Who Have Sex with Men (MSM) and Factors Associated with Not Using a Condom at Last Sexual Intercourse with a Man and with a Woman in Senegal. Jones JH, editor. *PLoS ONE*. Oct 2010;5(10):e13189.
6. Sutton A, Clowes M, Preston L, Booth A. Meeting the review family: exploring review types and associated information retrieval requirements. *Health Inf Libr J*. 2019;36(3):202-22.
7. Larmarange J, Broqua C. Orientation sexuelle et identité de genre chez les "hommes ayant des rapports sexuels avec des hommes": quelles catégories d'enquête en Afrique subsaharienne? In: Rault W, Trachman M, editors. *Minorités de genre et de sexualité: objectivation, catégorisations et pratiques d'enquête*. Ined. Paris; to be published. (Méthodes et savoirs).
8. Heckathorn DD. Respondent-Driven Sampling: A New Approach to the Study of Hidden Populations. *Soc Probl*. 1 May 1997;44(2):174-99.
9. Ghana AIDS Commission. Ghana Men's Study (2017). Mapping and population size estimation (MPSE) and integrated bio-behavioral surveillance survey (IBBSS) amongst men who have sex with men (MSM) in Ghana (Round II) [Internet]. Accra: Ghana AIDS Commission; 2017 p. 92. Available at: [https://www.ghanais.com.gh/mcadmin/Uploads/Ghana%20Men's%20Study%20Report\(2\).pdf](https://www.ghanais.com.gh/mcadmin/Uploads/Ghana%20Men's%20Study%20Report(2).pdf)
10. Hessou SHP, Glele-Ahanhanzo Y, Ahoussinou C, Sylvie Azandjeme C, Djignefa Dadje C, Bonou W, et al. Seroprevalence, Knowledge and Behavioral Factors Associated with HIV Infection Among Men Who have Sex with Men (MSM) in Benin. *Cent Afr J Public Health*. 2020;6(2):95.
11. Mmbaga EJ, Moen K, Leyna GH, Mpembeni R, Leshabari MT. HIV Prevalence and Associated Risk Factors Among Men Who Have Sex With Men in Dar es Salaam, Tanzania. *J Acquir Immune Defic Syndr* 1999. 1 March 2018;77(3):243-9.
12. Mmbaga EJ, Moen K, Makyao N, Mpembeni R, Leshabari MT. HIV and STI s among men who have sex with men in Dodoma municipality, Tanzania: a cross-sectional study. *Sex Transm Infect*. Aug 2017;93(5):314-9.
13. Hessou SPH, Glele-Ahanhanzo Y, Adekpedjou R, Ahoussinou C, Djade CD, Biaou A, et al. HIV incidence and risk contributing factors among men who have sex with men in Benin: A prospective cohort study. Zhang C, editor. *PLOS ONE*. 9 June 2020;15(6):e0233624.
14. Sullivan PS, Phaswana-Mafuya N, Baral SD, Valencia R, Zahn R, Dominguez K, et al. HIV prevalence and incidence in a cohort of South African men and transgender women who have sex with men: the Sibanye Methods for Prevention Packages Programme (MP3) project. *J Int AIDS Soc* [Internet]. Oct 2020 [cited 1 Oct 2021];23(S6). Available at: <https://onlinelibrary.wiley.com/doi/10.1002/jia2.25591>
15. Sanders EJ, Okuku HS, Smith AD, Mwangome M, Wahome E, Fegan G, et al. High HIV-1 incidence, correlates of HIV-1 acquisition, and high viral loads following seroconversion among MSM: *AIDS*. Jan 2013;27(3):437-46.
16. Wahome E, Thiong'o AN, Mwashigadi G, Chirro O, Mohamed K, Gichuru E, et al. An Empiric Risk Score to Guide PrEP Targeting Among MSM in Coastal Kenya. *AIDS Behav*. July 2018;22(S1):35-44.
17. Nowak RG, Mitchell A, Crowell TA, Liu H, Ketende S, Ramadhani HO, et al. Individual and Sexual Network Predictors of HIV Incidence Among Men Who Have Sex With Men in Nigeria: *JAIDS J Acquir Immune Defic Syndr*. April 2019;80(4):444-53.
18. Kimani M, van der Elst EM, Chiro O, Oduor C, Wahome E, Kazungu W, et al. PrEP interest and HIV-1 incidence among MSM and transgender women in coastal Kenya. *J Int AIDS Soc*. 2019;22(6):e25323.
19. McKinnon LR, Gakii G, Juno JA, Izulla P, Munyao J, Ireri N, et al. High HIV risk in a cohort of male sex workers from Nairobi, Kenya. *Sex Transm Infect*. May 2014;90(3):237-42.
20. Kajubi P, Kanya MR, Raymond HF, Chen S, Rutherford GW, Mandel JS, et al. Gay and bisexual men in Kampala, Uganda. *AIDS Behav*. May 2008;12(3):492-504.
21. Dah Ter Tiero E, Orne-Gliemann J, Guiard Schmid JB, Becquet R, Larmarange J. Les hommes qui ont des rapports sexuels avec d'autres hommes (HSH) et l'infection à VIH à Ouagadougou, Burkina Faso: connaissances, attitudes, pratiques et enquête de séroprévalence. *Rev D'Épidémiologie Santé Publique*. Sep 2016;64(4):295-300.
22. Aho J, Hakim A, Vuylsteke B, Semde G, Gbais HG, Diarrassouba M, et al. Exploring Risk Behaviors and Vulnerability for HIV among Men Who Have Sex with Men in Abidjan, Cote d'Ivoire: Poor Knowledge, Homophobia and Sexual Violence. Stephenson R, editor. *PLoS ONE*. 24 June 2014;9(6):e99591.
23. Sanders EJ, Graham SM, Okuku HS, van der Elst EM, Muhaari A, Davies A, et al. HIV-1 infection in high-risk men who have sex with men in Mombasa, Kenya. *AIDS Lond Engl*. 30 Nov 2007;21(18):2513-20.
24. Kassegne S, Moukam LV, Babila Macauley I, Domkam Kammogne I, Billong SC, Tchwenko RF. Étude intégrée de surveillance comportementale et biologique chez les hommes ayant des rapports sexuels avec les hommes au Cameroun: premier passage. Yaoundé: CARE International Cameroun; 2012 May p. 50.
25. Strömdahl S, Onigbanjo Williams A, Eziefule B, Emmanuel G, Iwuagwu S, Anene O, et al. Associations of Consistent Condom Use Among Men Who Have Sex with Men in Abuja, Nigeria. *AIDS Res Hum Retroviruses*. Dec 2012;28(12):1756-62.
26. Beyrer C, Trapence G, Motimedi F, Umar E, Ipinge S, Dausab F, et al. Bisexual concurrency, bisexual partnerships, and HIV among Southern African men who have sex with men. *Sex Transm Infect*. Aug 2010;86(4):323-7.
27. Onyango-Ouma W, Birungi H, Geibel S. Understanding the HIV/STI risks and prevention needs of men who have sex with men in Nairobi, Kenya [Internet]. Washington, DC: Population Council; 2005 Sep p. 48. Available at: <http://www.popcouncil.org/pdfs/horizons/msmkenya.pdf>
28. Larmarange J, Desgrées du Lou A, Enel C, Wade AS, Groupe ELIHoS. Homosexualité et bisexualité au Sénégal: une réalité multifforme. *Population*. 2009;64(4):723-56.
29. Twahirwa Rwema JO, Lyons CE, Herbst S, Liestman B, Nyombayire J, Ketende S, et al. HIV infection and engagement in HIV care cascade among men who have sex with men and transgender women in Kigali, Rwanda: a cross-sectional study. *J Int AIDS Soc* [Internet]. Oct 2020 [cited 1 Oct 2021];23(S6). Available at: <https://onlinelibrary.wiley.com/doi/10.1002/jia2.25604>

30. Arnold MP, Struthers H, McIntyre J, Lane T. Contextual Correlates of Per Partner Unprotected Anal Intercourse Rates Among MSM in Soweto, South Africa. *AIDS Behav.* 1 May 2013;17(1):4-11.
31. Vu L, Andrinopoulos K, Tun W, Adebajo S. High levels of unprotected anal intercourse and never testing for HIV among men who have sex with men in Nigeria: evidence from a cross-sectional survey for the need for innovative approaches to HIV prevention. *Sex Transm Infect.* Dec 2013;89(8):659-65.
32. Tun W, Kellerman S, Maimane S, Fipaza Z, Sheehy M, Vu L, et al. HIV-related conspiracy beliefs and its relationships with HIV testing and unprotected sex among men who have sex with men in Tshwane (Pretoria), South Africa. *AIDS Care.* 2012;24(4):459-67.
33. Smith AD, Muhaari AD, Agwanda C, Kowuor D, van der Elst E, Davies A, et al. Heterosexual behaviours among men who sell sex to men in coastal Kenya: *AIDS.* Dec 2015;29:S201-10.
34. Sekoni AO, Ayoola OO, Somefun EO. Experiences of social oppression among men who have sex with men in a cosmopolitan city in Nigeria. *HIVAIDS Auckl NZ.* 2015;7:21-7.
35. Sheehy M, Tun W, Vu L, Adebajo S, Obianwu O, Karlyn A. High levels of bisexual behavior and factors associated with bisexual behavior among men having sex with men (MSM) in Nigeria. *AIDS Care.* 2 Jan 2014;26(1):116-22.
36. Raymond HF, Kajubi P, Kanya MR, Rutherford GW, Mandel JS, McFarland W. Correlates of Unprotected Receptive Anal Intercourse Among Gay and Bisexual Men: Kampala, Uganda. *AIDS Behav.* 1 Aug 2009;13(4):677-81.
37. Jones J, Sanchez TH, Dominguez K, Bekker L, Phaswana-Mafuya N, Baral SD, et al. Sexually transmitted infection screening, prevalence and incidence among South African men and transgender women who have sex with men enrolled in a combination HIV prevention cohort study: the Sibanye Methods for Prevention Packages Programme (MP3) project. *J Int AIDS Soc [Internet].* oct 2020 [cited 1 Oct 2021];23(S6). Available at: <https://onlinelibrary.wiley.com/doi/10.1002/jia2.25594>
38. Patel P, Borkowf CB, Brooks JT, Lasry A, Lansky A, Mermin J. Estimating per-act HIV transmission risk: a systematic review. *AIDS.* 19 June 2014;28(10):1509-19.
39. Hakim AJ, Aho J, Semde G, Diarrassouba M, Ehoussou K, Vuylsteke B, et al. The Epidemiology of HIV and Prevention Needs of Men Who Have Sex with Men in Abidjan, Cote d'Ivoire. *PLOS ONE.* 24 April 2015;10(4):e0125218.
40. Hladik W, Sande E, Berry M, Ganafa S, Kiyingi H, Kusiima J, et al. Men Who Have Sex with Men in Kampala, Uganda: Results from a Bio-Behavioral Respondent Driven Sampling Survey. *AIDS Behav.* May 2017;21(5):1478-90.
41. Sweitzer S, Rolfe J, Ketende S, Grosso A, Baral S. Examining Factors Associated with HIV-Related Risk Behaviors, HIV Prevalence, and Population Size Estimates of Two Key Populations—Men who have Sex with Men (MSM) and Female Sex Workers (FSW)—in Lesotho. Baltimore: USAID; 2015 Jan p. 75.
42. Ouedraogo HG, Ky-Zerbo O, Grosso A, Goodman S, Samadoulougou BC, Tarnagda G, et al. Human immunodeficiency virus (HIV) among men who have sex with men: results of the first integrated biological and behavioral survey in Burkina Faso, West Africa. *BMC Public Health.* Dec 2019;19(1):5.
43. Rodriguez-Hart C, Bradley C, German D, Musci R, Orazulike I, Baral S, et al. The Synergistic Impact of Sexual Stigma and Psychosocial Well-Being on HIV Testing: A Mixed-Methods Study Among Nigerian Men who have Sex with Men. *AIDS Behav.* Dec 2018;22(12):3905-15.
44. Park JN, Papworth E, Billong SC, Elat JB, Kassegne S, Grosso A, et al. Correlates of prior HIV testing among men who have sex with men in Cameroon: a cross-sectional analysis. *BMC Public Health.* 25 Nov 2014;14(1):1220.
45. Goodman SH, Grosso AL, Ketende SC, Ouedraogo GH, Kouanda S, Ky-Zerbo O, et al. Examining the Correlates of Sexually Transmitted Infection Testing Among Men Who Have Sex With Men in Ouagadougou and Bobo-Dioulasso, Burkina Faso. *Sex Transm Dis.* May 2016;43(5):302-9.
46. Ramadhani HO, Ndembi N, Nowak RG, Ononaku U, Gwamna J, Orazulike I, et al. Individual and Network Factors Associated With HIV Care Continuum Outcomes Among Nigerian MSM Accessing Health Care Services: *JAIDS J Acquir Immune Defic Syndr.* Sep 2018;79(1):e7-16.
47. Shangani S, Naanyu V, Mwangi A, Vermandere H, Mereish E, Obala A, et al. Factors associated with HIV testing among men who have sex with men in Western Kenya: a cross-sectional study. *Int J STD AIDS.* Feb 2017;28(2):179-87.
48. Sandfort T, Nel J, Rich E, Reddy V, Yi H. HIV testing and self-reported HIV status in South African men who have sex with men: results from a community-based survey. *Sex Transm Infect.* 11 Jan 2008;84(6):425-9.
49. Charurat ME, Emmanuel B, Akolo C, Keshinro B, Nowak RG, Kennedy S, et al. Uptake of treatment as prevention for HIV and continuum of care among HIV-positive men who have sex with men in Nigeria. *J Acquir Immune Defic Syndr.* 1 March 2015;68 Suppl 2:S114-123.
50. Stahlman S, Johnston LG, Yah C, Ketende S, Maziya S, Trapence G, et al. Respondent-driven sampling as a recruitment method for men who have sex with men in southern sub-Saharan Africa: a cross-sectional analysis by wave. *Sex Transm Infect.* 2016;92(4):292-8.
51. Inghels M, Kouassi AK, Niangoran S, Bekelyncck A, Carillon S, Sika L, et al. Perceptions, préférences et recours aux offres communautaires de dépistage du VIH chez les hommes ayant des relations sexuelles avec d'autres hommes (HSH) en Côte d'Ivoire. In Dakar: communication orale (SPD1 session); 2020. Available at: <http://www.afrahiv2020.org/>

Annexes

Table S1. HIV prevalence by self-reported sexual orientation, gender identity and sexual attraction in quantitative surveys of MSM in sub-Saharan Africa (2004-2018).

Figure S2. HIV prevalence measured among bisexual and exclusively gay MSM in sub-Saharan Africa (2004-2018), by self-reported sexual orientation, gender identity and sexual attraction

NB: we have deposited this appendix on Zenodo to make it accessible via a dedicated DOI, which is cited in the body of the manuscript.