

**HIV and Sexually Transmitted Infections among Men Who Have Sex with Men in Dodoma
Municipality, Tanzania: A cross sectional Study**

Elia John Mmbaga^{1,2}, Kåre Moen², Neema Makyao³, Rose Mpembeni¹, Melkizedeck T.
Leshabari⁴

¹Department of Epidemiology and Biostatistics, Muhimbili University of Health and Allied
Sciences, Dar es Salaam, Tanzania. P.O.BOX 65015, Dar es Salaam, Tanzania, email:
elijelia@yahoo.co.uk, Telephone: +255785900101

²Department of Community Medicine and Global Health, Institute of Health and Society,
University of Oslo, Norway

³National AIDS Control Programme, Ministry of Health and Social Welfare, Dar es Salaam,
Tanzania

⁴Department of Behavioural Sciences, Muhimbili University of Health and Allied Sciences, Dar
es Salaam, Tanzania

Keywords: HIV; Homosexuality; Sexual behaviours; Africa

ABSTRACT

Objectives: To determine the seroprevalence of HIV, STI and related risks among MSM in Dodoma municipality, Tanzania.

Methods: A cross sectional study utilizing a respondent driven sampling (RDS) was employed to recruit study participants aged 18 and above. Data on socio-demographics, HIV/STI knowledge and sexual practices were collected. Blood samples were tested for HIV and selected STIs.

Results: A total of 409 participants aged from 18 to 60 years took part in this study. The median age at first anal intercourse was 15 years. At last anal intercourse, 37.5% practiced receptive, 47.5% insertive, and 15.0% both an insertive and receptive anal intercourse. The seroprevalence of HIV, HSV-2, syphilis, HBV and HCV were 17.4%, 38.5%, 0.2%, 5.4% and 3.4%, respectively. A third of MSM perceived their risk for HIV to be low and this was associated with unprotected sex (adjusted odds ratio (AOR), 4.8, 95%CI: 1.8,10.2). HIV seropositivity was also associated with HSV-2 (AOR, 5.0, 95% CI: 3.01, 11.21); having lived outside Dodoma (AOR 1.7, 95% CI: 1.1, 6.7); age above 25 years; AOR 2.1, 95% CI: 1.7, 3.7); sexual relationship with a woman (AOR 5.6, 95% CI: 3.9, 12.8); assuming a receptive (AOR 7.1, 95% CI: 4.8, 17.4); or receptive and insertive (AOR 4.5, 95% CI: 1.9, 11.4) anal intercourse during last anal intercourse; engaging in group sex (AOR 3.1, 95% CI: 1.2,6.1); and the use of alcohol (AOR 3.9, 95% CI: 1.1, 9.2).

Conclusions: HIV prevalence among MSM is five times higher compared to men in the general population in Dodoma. Perceived risk for HIV infection was generally low and low risk perception was associated with unprotected sex. STI, bisexuality and other behavioural risk

factors played an important part in HIV transmission. The findings underscore the need for intensified HIV prevention programming addressing and involving key populations in Tanzania.

Key messages

- MSM in Central Tanzania carries a high burden of HIV and HSV2
- MSM have a low perceived risk of HIV infection and commonly practice HIV risk behaviours.
- HIV prevention and treatment tailored for MSM are needed in Tanzania to achieve the three zeros

INTRODUCTION

The Tanzania HIV and Malaria Indicator Survey reveals that the seroprevalence of HIV has decreased in Tanzania in recent years, from 7% in 2003 to 5.1% in 2012 [1,2]. Despite this overall decrease, accumulating evidence indicate that HIV infection rates are still high among what is now often referred to as “key populations” in the HIV epidemic (men who have sex with men, persons who inject drugs, and persons who sell sex).

This same pattern is found across much of the African continent. Among men who have sex with men (MSM), HIV seroprevalence rates in Africa have been reported to be between 2 and 20 times higher than that in the overall population in various countries, and estimated to contribute up to 30% of new HIV infections [3-6]. These high prevalence rates may be attributed to a combination of biological, social, cultural and legal circumstances, as well as to deficiencies in HIV prevention programming [7-10]. Significantly, moreover, HIV-related research and programming in Africa has often failed to include persons who engage in anal intercourse in general, and same-sex practicing men in particular.

Few available studies mostly from Dar es Salaam in Tanzania have provided data on MSM identities, risk perception, risk behaviours and HIV/STI prevalence [11-18]. However, most of these studies were conducted a decade ago and concentrated in the major metropolitan city of Dar es Salaam. We conducted a cross sectional study in Dodoma, the capital city of Tanzania located inland part of Tanzania about 500 kilometres from Dar es Salaam. The study aimed at estimating the prevalence of HIV, STIs, and associated risk practices among MSM.

METHODS

Study participants and design

This was a cross-sectional study where MSM aged 18 years and above residing in Dodoma municipality were eligible to participate. Residence was defined as having lived in the city for the last 6 months. The study was conducted between June and October, 2014.

Study Setting

This study was conducted in Dodoma region the capital city of Tanzania. The region of Dodoma has a population of about 2 million people, 0.41 million of which live in the city of Dodoma [19]. Life in the capital is associated with a high degree of mobility, and Dodoma is among the regions where the prevalence of HIV is higher among men (3.7%) than among women (2.1%) [2]. In recent years, there has been a relative increase in the population of young people in Dodoma, partially explainable by the establishment of the country's largest public university in the municipality of Dodoma.

Sample size and sampling technique

Sample size estimation

The sample size was calculated on the assumption that HIV prevalence among MSM in Dodoma would be at least 15% (i.e., roughly 20% higher than that found among MSM in Zanzibar in 2007 [6]). Taking into account a design effect of 1.8 (based on respondent driven sampling (RDS) experience in Tanzania, we required a sample size of 407 [5].

Sampling technique

RDS, a chain referral method developed for the sampling of populations for which there is no available sampling frame, was used to recruit participants. With RDS, members of the target population are asked to refer other members of the same population to participate, and an underlying mathematical model provides a theoretical basis for the estimation of population proportions and their variances through statistical adjustment. When certain assumptions are met, RDS will approach unbiased estimates of characteristics in the population under study. First-order Markov modelling allows calculation of sample weights and standard errors that adjust for the otherwise biased recruitment pattern [20,21].

Recruitment process

Five ‘seeds’ (first generation study participants) were identified and chosen so that they represented different strata of the MSM population with respect to socio-economic status, age, residence, and civil status. At the end of their visit to the study centre, these men were given three recruitment coupons each and asked to pass them on to other MSM. Those who accepted the invitation were in turn enrolled into the study, and also given three recruitment coupons to pass on to their acquaintances. This process was repeated until the desired number of participants had been reached. After the interview and blood specimen collection, each participant was invited to a discussion about HIV/STI, provided with sexual practice-relevant health education, and given condoms and lubricants. Participants were also offered appointments to come for post-test counselling, during which they were informed about their blood test results.

Interviews

Trained interviewers conducted face-to-face interviews using a structured questionnaire. Issues covered included socio-demographic characteristics, sexual practices, HIV risk perception, and alcohol and substance use. The questionnaire was developed based on the results of our previous qualitative studies in Tanzania [12-15, 17]. To further ensure that it used terms that would be understood by the study population, we pretested it among 10 MSM. All interviews were conducted in Swahili, the language spoken by practically all Tanzanians. Participants were reimbursed for transport costs.

Biological specimen testing

HIV status was determined using Allere Determine™ HIV-1/2 assay (Allere Medical Co., Ltd, Japan). Reactive samples were confirmed on a second rapid assay; Uni-Gold™ HIV-1/2 (Trinity Biotech Plc, Ireland). Discrepancies between the first and second test were resolved by Enzygnost HIV Integral II Antibody/Antigen ELISA (Siemens, Germany). Screening for the presence of Hepatitis B surface antigen (HBsAg) and Hepatitis C antibody test (Anti-HCV test) were done using the SD Bioline rapid test (Standard Diagnostics, Inc., Korea) and reactive samples were confirmed on a micro particle enzyme immune-assay (MEIA) (Abbott AxSYM, Germany). Syphilis screening was performed using the Venereal Disease Research Laboratory assay (VDRL; Omega Diagnostic, UK) and reactive samples were confirmed by Treponemal Particle Hemagglutination Assay (TPHA; Omega Diagnostic, UK). Herpes simplex virus 2 (HSV-2) serostatus was determined using HSV-2 IgG ELISA (Abbott Murex, UK) and reactive specimens were tested further on HSV-2 IgM ELISA to identify active infection.

Data analysis

RDSAT, a special software package for analysis of RDS data [22] was used for analysis, together with STATA version 12 for Windows. Because selection probability is not the same for each participant when RDS is used (larger networks are more likely to be represented than small), data were weighted according to network size by calculating weights as the inverse of the participants' network size [20,21]. To reduce clustering and ensure that the whole sample was reflected in the analysis, we multiplied the weight by the sample size and divided it by the sum of the weights. All statistical tests were weighted to control for clustering. Frequencies of categorical variables were calculated to show their proportional distribution. Mean and standard deviations were used to summarize continuous variables. Logistic regression models were built to identify independent associations between risk perception and practices potentially associated with HIV risk. Variables with $p < 0.2$ in the bivariate analysis were included in the multivariable logistic regression model. All analyses were two-tailed and the significance level was set at 5%.

Ethical considerations

The study received ethical clearance from the Muhimbili University of Health and Allied Sciences ethical committee (MU/DRP/AEC/Vol. XVIII/110). Participants provided written informed consent before taking part. To maintain confidentiality and to enable effective collection of biological samples, interviews were conducted within the premises of the Dodoma Regional Hospital. Participants who had a positive HIV test result received post-test counselling, during which the choice of a care and treatment centre was discussed. The aim was to assist HIV positive participants to access health care services from a convenient and friendly health facility.

RESULTS

A total of 409 MSM aged from 18 to 60 years, and with a median age of 27 years, participated in the study. Around a third (36.4%) were younger than 24 years, while men aged between 25 and 34 years constituted about half (48.2%) of the sample. A large majority (80.4%) were unmarried, but 8.1% were married to or living with a woman. More than a third (35.2%) of the respondents had children, a majority (69%) of whom had only one child. Almost all (99%) had formal education, with 38.6% having completed primary education, 24.9% having completed secondary education, and 3.4% having completed higher education. A large majority (71.1%) of the respondent reported to have been born in Dodoma municipality, as shown in Table 1.

Table 1: Socio-demographic characteristics of men who have sex with men who participated in this study (N=409)

Variable	Category	n (%)
Age groups	18-24	149 (36.4)
	25-34	197 (48.2)
	35 and above	63 (15.4)
Marital status	Single	329 (80.4)
	Married/cohabiting	33 (8.1)
	Divorced/separated/widowed	47 (11.5)
Occupation	Employed by govt/parastatal	6 (1.4)
	Employed by private company	22 (5.4)
	Self employed	199 (48.8)
	Student	32 (7.8)
	Petty trader	97 (23.7)
Education level	Other	53 (12.9)
	No formal education	72 (17.6)
	Primary completed	219 (53.5)
	Secondary	102(24.9)
Do you have children	Above secondary	16 (3.9)
	Yes	144 (35.2)
Born in Dodoma	No	165 (64.8)
	Yes	291 (71.1)
	No	118 (28.9)

HIV and STI sero-prevalence

Of the 409 participants interviewed, 94.5% gave blood for HIV, HSV-2, HBV, HCV and syphilis testing. The prevalence of HIV was 17.4% (95% confidence interval (CI): 12.6-25.4) and the HSV-2 prevalence stood at 38.5% (95% CI: 31.3-42.9). The syphilis prevalence was 0.2 % (95% CI: 0.01-0.60), the prevalence of HBV was 5.4% (95% CI: 2.0- 16.0), and that of HCV was 3.4% (95% CI: 1.7-5.0).

Among the study participants, 37.5% reported to practice receptive anal intercourse, 47.5% said they practiced insertive anal intercourse, and 15.0% reported to engage in both insertive and receptive anal intercourse(versatile). during their last anal intercourse

Men who were practicing receptive anal intercourse (31.7%) during the last penile-anal intercourse had the highest prevalence of HIV and HSV-2, followed by versatile (16.5%).

HIV risk perception

Perceived susceptibility to HIV infection is key in shaping risk behaviours. Perceived risk for HIV infection was assessed for all participants who did not know their HIV status at the time of the survey (89.7%). When asked what was the probability that they may be infected with HIV given that they do not know their statuses, 45.0% reported their self-perceived risk as “high”, 21.0% judged it as moderate, while 34.0% were of the opinion that such a chance was small or did not exist.

Practice of HIV risk behaviours

The reported age at first sex varied from 10 to 29 years, the median being 15 years. More than half of the study participants (57.2%) had had anal penetrative sex during their first sexual experience, whereas 43.5% had had vaginal sex. Only 3.9% had initially engaged in oral sex.

Use of condom during first anal intercourse was reported by 29 men (7.1%), and was less likely the younger the person was. A few had used Vaseline and/or cooking oil as a lubricant at first anal intercourse and no one reported using water-based lubricants. When asked if anything worried them during the first sexual experience, approximately half (52.4%) said they had not had any worries.

We asked participants what they would say was the motive behind their initial first anal intercourse experience. Half (50.9%) said they were seeking pleasure, 21.8% that they wanted money, 8.3% engaged in sex in exchange for a gift, and 7.8% said they had anal intercourse out of curiosity.

About one out of every ten participants (11.2%) answered that they had been raped at their first anal intercourse experience. Those who had had their first anal intercourse experience before the age of 15 years were significantly more likely to report rape (23.6%) than those who had debuted later ($P=0.006$).

Almost three quarters (73.1%) said they had had sex with female partners in addition to sexual relations with men. In the three months preceding the study, 38.1% had had three or more female sexual partners, and only 23.2% had had none.

Group sexual practices were common place, with 43.5% of study participants having ever participated in a sexual constellation involving more than two partners, and 21.0% having done

so in the last three months. In over half of the cases, the group had consisted of more than three persons. The most common form of group sex involved only men, but some involved both men and women.

Condom use with both male and female partners was not reported to be a common practice.

Only 13.9% reported that they used condoms during their last sex with a male partner. Condom use with a female partner during the last encounter was reported by only 12.4% of the respondents.

About a third of the respondent reported use of alcohol once per week, 31.2% twice per week and 20.1% three times per week. About one in every five (17.8%) said they were drinking alcohol every day. Alcohol and drug was commonly used during sex. In this study, 61.4% and 47.0% of the participants reported using alcohol and drugs during last anal intercourse, respectively.

Factors associated with HIV infection

We examined for independent determinants of HIV infection using multivariate logistic regression (Table 2). Men who were infected with HSV-2 were five times more likely to be HIV seropositive than others (adjusted odds ratio (AOR), 5.0, 95% CI: 3.0, 11.2). Participants born outside of Dodoma municipality were almost twice as likely to be HIV positive as were those born within it (AOR, 1.7, 95% CI: 1.1, 6.7). Age 25 years and older was associated with almost two times increased likelihood of HIV infection as compared to those young age (18-24) (AOR, 2.1, 95% CI: 1.7, 3.7).

Table 2: Bivariate and Multivariate analysis of risk factors for HIV infection among MSM in Dodoma (N=409)

Variable	Category	COR \neq	AOR*	P-value \S
Age groups	18-24	1	1	
	25-34	2.2(1.8,4.0)	2.1 (1.7, 3.7)	0.002
	35 and above	1.9(1.1,3.9)	1.5(0.8,4.5)	0.059
Marital status	Single	1	1	
	Married/cohabiting	1.2(0.4,2.1)	1.1(0.4,2.2)	0.164
	Divorced/separated	2.5(1.1,3.9)	1.7(0.9,6.5)	0.089
Occupation	Employed by govt/parastatal	1	1	
	Employed by private	1.3(0.7,2.9)	1.1(0.6,2.5)	0.634
	Self-employed/petty trader	0.8(0.5,5.1)	0.9(0.3,4.0)	0.286
	Student	1.1(0.7,3.2)	1.0(0.8,3.7)	0.313
Education	No formal education	1	1	
	Primary completed	1.2(0.9,2.8)		0.825
	Secondary	1.1(0.8,3.6)		0.649
	Above secondary	0.9(0.6,5.7)		0.522
Have children	Yes	1	1	
	No	0.9(0.2-3.1)	1.1(0.3-2.3)	0.287
Born in Dodoma	Yes	1	1	
	No	2.1(1.2,5.4)	1.7 (1.1, 6.7)	0.002
Sexual position	Insertive	1	1	
	Versatile/both	4.3(1.8,10.6)	4.5 (1.9, 11.4)	0.001
	Receptive	7.5(5.0,16.5)	7.1 (4.8,17.4)	<0.001
Perceived risk of HIV	High	1	1	
	Moderate	2.3(1.1,7.5)	2.1(0.9,11.3)	0.062
	No/low	5.1(2.0,9.7)	4.0 (1.5,9.9).	<0.001
Had sex with women	No	1	1	
	Yes	5.8(4.1,10.9)	5.6 (3.9, 12.8)	<0.001
Had group sex	No	1	1	

	Yes	3.2(1.4,6.7)	3.1(1.2,6.1)	0.003
Used drugs during last anal intercourse	No	1	1	
	Yes	2.9(1.1,14.0)	2.5(0.9,15.4)	0.058
Used alcohol during last anal intercourse	No	1	1	
	Yes	3.8(1.2,10.1)	3.9 (1.1, 9.2)	0.016
HBV serostatus	Negative	1	1	
	Positive	1.4(0.6,23.1)	1.2(0.6, 23.9)	0.427
HCV serostatus	Negative	1	1	
	Positive	1.1(0.2,17.3)		0.752
HSV-2 serostatus	Negative	1	1	
	Positive	5.3(2.9,10.4)	5.0 (3.0, 11.2)	<0.001
Syphilis serostatus	No	1	1	
	Yes	2.1(0.4,18.2)	1.5(0.3,21.7)	0.261
Used condom during last sex	Yes	1	1	
	No	3.4(1.5,6.6)	3.2 (1.4,5.6)	0.018
Treated for genital ulcers past 12 months	No	1	1	
	Yes	2.9 (1.1,6.5)	2.7(1.1,7,9)	0.007
Treated for genital discharge past 12 months	No	1	1	
	Yes	1.6(0.7,11.1)		0.634

COR; Crude Odds ratio; AOR; Adjusted odds ratio for all variables in the table; §p-value for AOR

Participants who were in a sexual relationship with a woman were six times more likely to be infected with HIV than others (AOR, 5.6, 95% CI: 3.9, 12.8). Likewise, participants who perceived their risk of HIV to be low had almost five times higher odds of being infected as compared to those who had high perceived HIV risk ((AOR), 4.8, 95%CI: 1.8,10.2).

Compared to those who assumed an insertive anal intercourse during last anal intercourse, men who had been receptive had considerably higher odds of being HIV positive (AOR, 7.1 95% CI: 4.9, 17.4). The same pertained to those who had taken both a receptive and insertive anal intercourse (AOR, 4.5, 95% CI: 1.9, 11.4). Participants having children were twice as likely to be infected with HIV as those who did not.

MSM who engaged in group sex were three times more likely to be HIV infected than other MSM (AOR, 3.1, 95% CI: 1.2,6.1), and used of alcohol during last anal intercourse was associated with four times higher odds for HIV (AOR, 3.9, 95% CI: 1.1, 9.2). Moreover, low perceived risk for HIV infection (AOR, 4.0, 95%CI:1.5,9.9) and not using a condom during last sex (AOR, 3.2, 95%CI: 1.4,5.6), history of treatment for genital ulcers during the past 12 months preceding the survey (AOR,2.7, 95%CI:1.1,7,9) was associated with high risk of HIV infection in this community. HIV infection was not associated with HBV, HCV, or syphilis in this MSM community.

DISCUSSION

This is the first HIV-related study of same-sex practicing men in the inland region of Tanzania. The HIV prevalence in this population was high (17.4 %); five times higher compared to men in the general population in Dodoma (3.7%). HSV-2 infections were prevalent, and were likely to play a major role in driving HIV transmission and acquisition. MSM who engaged in receptive anal intercourse, were bisexual, had children, came from outside of Dodoma, engaged in group sex, and used alcohol or drugs, practiced unprotected sex and had low perceived risk were at higher risk of HIV infection.

The high prevalence of HIV infections among men who have sex with men in Dodoma is similar to what has been reported in other studies in Tanzania and in neighbouring countries [5, 6, 9, 16-18]. While HIV infection rates appear to be on the decrease in the overall population in Tanzania [1,2], it is now clear that men who have sex with men carry a very considerable burden of HIV, indeed. This calls for urgent efforts to strengthen HIV prevention and care activities with and among members of this population. Population specific, culturally sensitive and effective interventions among men who have sex with men are crucial if the government's efforts to achieve the intended 'three zeros' are to succeed [16, 22,24].

While many studies from within and outside of Tanzania indicate that bacterial STIs, such as gonorrhoea and syphilis, are on the decrease, viral infections such as HSV-2 were highly prevalent in this MSM community [25, 26] and significantly associated with HIV. History of genital ulcers treatment during the past 12 months preceding the survey presumably resulting from HSV-2 infection was also associated with HIV infection. These results suggest that HIV prevention care and treatment among MSM should involve screening for HSV-2 and provision of suppressive therapy. Moreover, the planned revision of the comprehensive HIV intervention package among key population in Tanzania should include the above measures and incorporate health education components that relates to HSV-2 such as abstinence during symptoms.

Practice of high risk behaviours including sexual and/or alcohol related behaviour was common among MSM in this community. Practice of these behaviours goes hand in hand with low perceived risk for HIV infection. Similar findings of high practice of risk sexual behaviours including unprotected sex among MSM has been reported elsewhere in Africa [5,6,16,18,27]. It is therefore crucial to engage with MSM in discussions about ways in which men's sexual practices can be rendered safer. Such discussions should address the specific risks that may be

associated with the range of practices that MSM engage in, including anal intercourse in dyads or groups, multiple sexual partnerships, and the use of alcohol and recreational drugs.

One strength of this study is the fact that it was conducted in a non-metropolitan municipality in the inland of Tanzania where same-sex relations have at times been believed to be uncommon.

This study provides evidence that anal sex is a common practice among men in Dodoma similar to what has been reported in coastal municipalities such as Dar es Salaam, Tanga and Zanzibar [5, 6]. Moreover, testing for HIV and STI used robust nationally recommended algorithm as opposed to other previous studies which utilized, for example, only rapid test to diagnose HIV infection [5].

However, these results should be interpreted in light of a number of limitations; Firstly, we recognize that collection of information on behaviour perceived to be sensitive can potentially lead to desirability bias, and this could have influenced the findings of this study. Secondly, the cross sectional nature of the survey does not allow conclusions to be made about causality of risk factors. However, the causal role of most risk factors identified in this study have already been proved in robust, longitudinal studies elsewhere. RDS was used in the recruitment of participants and this non-probabilistic recruitment method may have influenced the results presented.

However, analysis for this study included robust adjustment to control for network size. Finally, we do acknowledge that assessment of perceived risk for HIV infection included participants who were HIV positive although they did not know their status. These individual may perceive themselves to be at lower risk hence underestimating the HIV risk perception in this community.

CONCLUSIONS

MSM in Dodoma have five times higher HIV prevalence than other men. The perceived risk for HIV infections was generally low, and low risk perception was associated with low use of

condoms. About 40% of MSM were infected with Herpes Simplex virus type -2. HSV2, bisexuality, and unprotected anal intercourse in dyads and/or groups played a role in HIV transmission. The findings indicate that in order to be able to achieve the three zeros in Tanzania, tailored interventions targeting MSM should be given priority and these should address behavioural change communication, HSV-2 prevention and management, screening for other anorectal as well as HIV care and treatment.

Acknowledgments

We want to thank all the participants for agreeing to take part in this study. We also thank the staff of the Muhimbili University Referral Laboratory for conducting the laboratory test for this study.

Competing interests

None of the authors reported any competing interests.

Authors contributions

EJM, Conceived and designed the study, supervised data collection, analyzed the data, interpreted the results, wrote the first draft of the manuscript and revised the final version of the manuscript. KM, Conceived and designed the study, interpreted the results and revised the final version of the manuscript. NK, Supervised data collection, interpreted the results, and revised the final version of the manuscript. RM, participated in the analysis of the data, interpreted the results and revised the final version of the manuscript, ML, Conceived and designed the study, supervised data collection, interpreted the results, and revised the final version of the manuscript.

Funding

This study was funded through a grant from Global Funds to Fight HIV, Tuberculosis and Malaria through the Tanzania National AIDS Control Programme.

The corresponding Author has the right to grant on behalf of all the authors and does grant on behalf of all the authors, an exclusive licence (or non-exclusive for government employees) on a worldwide basis to the BMJ Publishing Group Ltd to permit this article (if accepted) to be published in STI and any other BMJPGGL products and sub-licences such use and exploit all subsidiary rights, as set out in our licence <http://group.bmj.com/products/journals/instructions-forauthors/licence-forms>

REFERENCES

1. Tanzania Commission for AIDS (TACAIDS), Zanzibar AIDS Commission (ZAC), national Bureau of Statistics (NBS), Office of the Chief Government Statistician (OCGS), ICF International *Tanzania HIV/AIDS and Malaria Indicator Survey 2007/8. Dar es salaam, Tanzania: (2008)*. TACAIDS, ZAC, NBS, OCGS, ICF International
2. Tanzania Commission for AIDS (TACAIDS), Zanzibar AIDS Commission (ZAC), national Bureau of Statistics (NBS), Office of the Chief Government Statistician (OCGS), ICF International *Tanzania HIV/AIDS and Malaria Indicator Survey 2011-2012. Dar es salaam, Tanzania: (2013)*. TACAIDS, ZAC, NBS, OCGS, ICF International
3. Djomand G, Quaye S, Sullivan PS. HIV epidemic among key populations in west Africa. *Curr Op HIV AIDS*,2014, 9(5):506-13.
4. Wirtz AL, Jumbe V, Trapence G, Kamba D, Umar E, Ketende S, Berry M, Strömdahl S, Beyrer C, Baral SD. HIV among men who have sex with men in Malawi: elucidating HIV prevalence and correlates of infection to inform HIV prevention. *JIADS*, 2003;16 Suppl 3:18742.
5. Ross MW, Nyoni J, Ahaneku HO, Mbwambo J, McClelland RS, McCurdy SA. High HIV seroprevalence, rectal STIs and risky sexual behavior in men who have sex with men in Dar es Salaam and Tanga, Tanzania. *BMJ Open*, 2014, 4(8): e006175
6. Dahoma M, Johnson L, Holman A, Millar LA, Mussa M, Othman A, Khatib A, Issa R, Kendall C, Kim AA (2011). HIV and related risk behaviour among men who have sex with men in Zanzibar, Tanzania: results of a behavioural surveillance survey. *AIDS & Behav*, 2011,15:186-92.

7. Baggaley RF, White RG, Boily MC. HIV transmission risk through anal intercourse: systematic review, meta-analysis and implications for HIV prevention *Int J Epidemiol*. 2010 Aug;39(4):1048-63.
8. Fay H BS, Trapence G, Motimedi F, Umar E, Iipinge S, Dausab F, Wirtz A, Beyrer C. Stigma, health care access, and HIV knowledge among men who have sex with men in Malawi, Namibia, and Botswana. *AIDS & Behav* 2011; 15:1088-97.
9. MCKirnan DJ. On the Margins- Men who have sex with men and HIV in the developing world. *Int J Public Health* 1998; 9:494-9.
10. Niang C TP, Weisse E. Its running stones Stigma violence and HIV vulnerability among men who have sex with men in Dakar Senegal. *Cult Health Sex* 2003; 5:499-512.
11. Lockhart C. Kunyenga, "real sex," and survival: assessing the risk of HIV infection among urban street boys in Tanzania. *Med Anthropol* , 2002 :16(3):294-311.
12. Moen, K., Aggleton, P., Leshabari, M. T., &Middelthon, A. L. Same-sex practicing men in Tanzania from 1860 to 2010. *Arch Sexl Behav*,2014: 43(6), 1065-1082.
13. Moen K, Aggleton P, Leshabari MT, &Middelthon A-L (2012). *Not at all so hard-to-reach: Same-sex attracted men in Dar es Salaam*. *Cult, Health & Sexuality*, 2003, 14(2): 195-208.
14. Moen, K., Aggleton, P., Leshabari, M. T., &Middelthon, A. L. Gays, guys, and mchichamwiba: same-sex relations and subjectivities in Dar es Salaam. *J Homosex* 2014: 61(4), 511-539.
15. Moen, K., Aggleton, P., Leshabari, M. T., &Middelthon, A. L. Situating Condoms in Sexual Lives: Experiences of Same-sex-Attracted men in Tanzania. *Int J Sex Health*, 2013, 25(3), 185-197.

16. Anderson, A. M., Ross, M. W., Nyoni, J. E., & McCurdy, S. A. (2015). High prevalence of stigma-related abuse among a sample of men who have sex with men in Tanzania: implications for HIV prevention. *AIDS Care*, 27(1), 63-70.
17. Mmbaga E.J, Dodo M, Leyna G.H, Moen K, Leshabari M.T. Sexual Practices and Perceived Susceptibility to HIV Infection among Men Who have Sex with Men in Dar Es Salaam, Mainland Tanzania. *JAIDS*, 2012, S1:012.
18. Ross, M. W., Nyoni, J., Ahaneku, H. O., Mbwambo, J., McClelland, R. S., & McCurdy, S. A. High HIV seroprevalence, rectal STIs and risky sexual behaviour in men who have sex with men in Dar es Salaam and Tanga, Tanzania. *BMJ open*, 2014: 4(8), e006175.
19. National Bureau of Statistics (NBS) and ICF Macro. Tanzania Demographic and Health Survey 2010. Dar es Salaam, Tanzania: 2011, NBS and ICF Macro.
20. Heckthorn DD. Respondents driven sampling. A new approach to the study of Hidden populations. *Soc Problems* 2008; 44:174-99.
21. Wejnert C. An empirical test of respondent-driven sampling: Point estimates, variance, degree measures, and out of equilibrium data. *Sociol methodol* ,2009;39:73-116.
22. Volz, E.; Wejnert, C.; Cameron, C.; Spiller, M.; Barash, V.; Degani, I.; and Heckathorn, D.D. 2012. Respondent-Driven Sampling Analysis Tool (RDSAT) Version 7.1. Ithaca, NY: Cornell University
23. Bui TC, Nyoni JE, Ross MW, Mbwambo J, Markham CM, McCurdy SA. Sexual motivation, sexual transactions and sexual risk behaviors in men who have sex with men in Dar es Salaam, Tanzania. *AIDS& Behav.* 2014 ;18(12):2432-41.

24. Beyrer C, Trapence G, Motimedi F, Umar E, Ipinge S, Dausab F, Baral S. Bisexual concurrency, bisexual partnerships, and HIV among Southern African men who have sex with men. *Sex Transm Infect.* 2010 ;86(4):323-7.
25. Sanders E GS, Okuku H. HIV-I Infection in high risk men who have sex with men in Mombasa Kenya. *AIDS* 2007; 21:2513-252.
26. Baral S. A systematic review of HIV epidemiology and risk factor among men who have sex with men in Sub Saharan –Africa 2000-2008. Presented at xvii international AIDS Conference, Mexico City2008.
27. Bakai TA, Ekouevi DK, Tchounga BK et, Balestre E, Afanvi KA, Goilibe KB, Kassankogno Y, Pitche VP. Condom use and associated factors among men who have sex with men in Togo, West Africa. *Pan Afr Med J.* 2016, 24; 23:118.

Word count (excluding title page, abstract, references, and tables): 3000 words