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# High HIV seroprevalence, rectal STIs and risky sexual behaviour in men who have sex with men in Dar es Salaam and Tanga, Tanzania

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## ABSTRACT

**Objectives:** To assess HIV and sexually transmitted infection (STI) prevalence and associated risk factors in men who have sex with men (MSM) in two cities in mainland Tanzania.

**Methods:** We conducted respondent-driven sampling of 300 MSM in Dar es Salaam and Tanga.

**Results:** In Dar es Salaam, 172 (86%) men (median age 23, IQR 21–28) consented to HIV/STI testing, and 30.2% were HIV seropositive. Only five reported a previous positive HIV test: >90% were new HIV detections. 2.5% were syphilis-exposed and none hepatitis B positive, but 21.4% had a curable STI. Over 90% of the gonorrhoea and chlamydia was rectal. In Tanga, 11.1% of MSM were HIV seropositive, 8% hepatitis B positive and 0% were syphilis-exposed, with 4.4% having a curable STI. Predictors of HIV infection were number of MSM known, city, identifying as gay and having first sex with a man. Predictors for STIs were recent unprotected receptive anal intercourse, and number of MSM seen in the last month. 30% of the sample reported that they sold sex. There was no significant association between HIV and STI infection.

**Conclusions:** HIV and STI rates were substantially lower in MSM in a provincial city than in a large metropolis and rates appear to depend on larger numbers of MSM known. Most HIV detected were new cases, and there was a high burden of asymptomatic curable rectal STIs (>1 in 5 MSM). Owing to stigma, MSM may not report homosexuality and thus not have rectal STIs treated. High need for tailored HIV testing and STI screening and treatment of MSM in Tanzania is apparent.

## Strengths and limitations of this study

- It is the first study of mainland Tanzanian men who have sex with men (MSM) with behavioural and HIV and sexually transmitted infection prevalence data.
- The study samples MSM from a large metropolitan area and a smaller provincial city.
- The study provides prevalence data for gonorrhoea and chlamydia from urethral and rectal samples, HIV, hepatitis B infection and past or present syphilis infection.
- The data are cross-sectional.
- The data may not be generalisable outside East Africa or to non-urban settings.

## INTRODUCTION

There are significant populations of men who have sex with men (MSM) in East Africa. In Mombasa, Kenya, a port city about 200 miles north of Dar es Salaam, Geibel *et al*[1] identified 77 potential MSM contact locations and calculated that 739 men sell sex to other men in and around Mombasa (population about 900 000). Sanders *et al*[2] recruited 285 MSM in Mombasa. There was a high level of HIV-1 infection in the exclusive MSM (43%) compared with the MSM who also had sex with women (12%) (Kenyan general population, 6.1%). Significant adjusted predictors for HIV infection were (reference group insertive anal intercourse only): receptive anal intercourse (RAI) only (OR=3.9) and both insertive and RAI (OR=8.0); being exclusively MSM (OR=6.3); having peri-anal condylomata on examination (OR=5.1); and, in the 18–24 age group, an OR equivalent to 1.10/year of age.

A study of MSM in Malawi, Namibia and Botswana[3] in 2008 indicated that HIV seroprevalence increased with age, with an overall prevalence of 17.4%, with 5.1% denied healthcare based on their sexuality and 18.5% afraid to seek health services for the same reason. While HIV seroprevalence was 8.3% in those aged under 24, it was 35.7% for those aged over 30. Price *et al*[4] reviewed MSM studies in Nairobi and Cape Town and found that predictors of HIV acquisition included report of genital ulcer

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(HR=4.5), not completing secondary education (HR=3.4), RAI (HR=8.2) and paying for sex (HR=0.2).

In a cohort in coastal Kenya, Sanders *et al*[5] reported that 75% of symptomatic and 12% of asymptomatic MSM had rectal chlamydia or gonorrhoea (18% of those with any history of receptive anal intercourse). In their sample, HIV incidence was 8.6/100 person-years, with one-third of exclusively MSM acquiring HIV within a year of study enrolment.

HIV studies of MSM in mainland Tanzania have not been published, although Dahoma *et al*[6] and Johnston *et al*[7] have found that for MSM on Zanzibar island there is high overlap between MSM risk behaviour and injecting drug use (IDU) (14%), with IDU-MSM more likely to have paying partners and MSM having generally high levels of paying partners and risk behaviour despite high awareness of HIV. Dahoma *et al*[6] report HIV prevalence of 12.3% in MSM (compared with about 0.5% of adult men in the general Zanzibar population) associated with hepatitis C infection and paying partners. Our earlier studies of MSM in Dar es Salaam indicated nearly 100 MSM-related meeting places widely distributed across the city.[8] As there are few data on prevalence of HIV in the context of sexually transmitted infection (STI) co-infection in African MSM, we examined HIV risk behaviours, seroprevalence of syphilis and urethral and rectal chlamydia and gonorrhoea prevalence in MSM in a major and a provincial city in north-east Tanzania.

## METHODS

### Study design, sampling and recruitment

Data were collected in 2012 (Dar es Salaam) and 2013 (Tanga) from a cross-sectional survey of 200 MSM in Dar es Salaam and 100 in Tanga, Tanzania. Dar es Salaam is the major city in Tanzania, with a metropolitan area population of about 3 million, while Tanga is a provincial city in the northeast, midway between Dar es Salaam and Mombasa, with a metropolitan population of about 280 000. Data were collected from 300 MSM using RDS (Respondent Driven Sampling). RDS is a research method that involves snowball sampling where a researcher can use 'seed' individuals to refer those they know and in turn these individuals refer those they know, using a predetermined number of coupons, throughout a network.[9] RDS was used during data collection for two main reasons: first, we were dealing with a closed community which cannot be reached easily and this method helped us to reach them since they recruited themselves. Second, homosexual behaviour is illegal and highly stigmatised in Tanzania and it was not easy for us to reach MSM openly so we need a reference from other members from the target population to gather information. We identified five seeds in each city, who were different ages and from different areas of each city for better representativeness, to recruit the first wave of participants. Each seed or referrer was given three coupons to recruit three members who they knew were MSM. Coupons had unique identification numbers linking coupons to the referring seed. Characteristics of those recruited as part of the waves were continually compared to the characteristics of seeds to determine when the sample reached equilibrium for age and education. As we were about to close any seed we reduced the number of coupons to two and the last respondents in each seed were not given any coupon. Our desired sample size of 200 in Dar es Salaam and 100 in Tanga was reached after an average of seven waves. Equilibrium for education and age was also reached after seven waves.

Based on HIV rates reported in MSM in Mombasa of 40% in exclusively gay men and 10% in bisexuals,[2] with 40% in one group and 20% in the other and a power of 80%, we would need a minimum of 80 in each group. We anticipated that the differences between groups may be smaller (in the order of 25% in one group to 13% in the other) than in Mombasa and probably vary by city, so in order to obtain 80% power in each city, we calculated a total sample of 310.

### Procedure

Eligible participants underwent a self-administered interview using a structured questionnaire on laptop with some open-ended questions, assisted by a research assistant. Prior to interview, participants were fully informed regarding the purpose of the interview, the study's rationale and the benefits/risks of participation. To protect participants' identity and confidentiality, oral informed consents were obtained in Swahili or English (the two official languages of Tanzania), as the participant preferred. The interview took about 30–40 min to administer. If participants had difficulty in understanding item(s), research assistants who were graduates and trained in research interviewing read or explained the item(s) in a manner consistent with the item's meaning. For participants who could not read, a research assistant read all questions to the participants. The interviews took place in private at a house rented for the project or in a prearranged alternative safe location. Participants could choose to take the interview in Swahili or English. For the Swahili version of the questionnaire, the accuracy of the translations and its content validity was assessed by a panel of native Swahili-speaking experts. After translation into Swahili and back-translation into English, the questionnaire was pilot-tested with five MSM for comprehension, clarity and response range and modified as appropriate. Each participant and the referrer received an equivalent of US$2.75 in compensation for transportation.

The study used an 8-item short version of the Internalised Homonegativity (IH) 'Reactions to Homosexuality Scale'.[10] This IH scale has been validated among MSM in Sub-Saharan Africa (SSA) and comprises factors including personal comfort with homosexuality, social comfort with gay men and public identification as gay[11 12] with a 6-point Likert-type response from



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1=strongly disagree to 6=strongly agree. We used the Patient Health Questionnaire-9 (PHQ-9), a validated instrument measuring the nine diagnostic criteria for DSM-IV depressive disorders.[13] This 9-item scale measures depression diagnosis and severity. It has been extensively used in SSA and validated in Swahili.[14]

HIV-1 was tested by two rapid tests, Determine, Abbott Laboratories, Chicago, Illinois, USA; and Unigold (Trinity Biotech, Bray, Ireland) to confirm a positive test. Syphilis antibody was tested using DetermineTP Rapid Syphilis Assay and hepatitis B was tested for hepatitis B surface antigen (HBsAg) using Determine HBsAg assay (both Inverness Medical Innovations, Waltham, Massachusetts, USA). Chlamydia and gonorrhoea were tested at the University of Washington/University of Nairobi Mombasa STI Laboratory with a first-pass urine sample and an anal swab using APTIMA Combo2 (Hologic Gen-Probe, San Diego, California, USA). Pretest and post-test HIV counselling was provided according to Tanzanian national guidelines and all HIV seropositive men were referred on to the Muhimbili Hospital HIV Centre in Dar es Salaam or the Bombo Regional Hospital in Tanga. Syndromic STI examination and treatment was provided at the time of data collection.

## ANALYSES

Data were analysed using SPSS V.21. Categorical data were analysed using $\chi^2$ analyses with Yates correction for discontinuity where appropriate and interval or ratio data using t test with pooled variance estimates unless Levene's F was significant, when separate variance estimates were used. Logistic regressions utilised Hosmer and Lemeshow's criterion for inclusion of independent variables. All tests were 2-tailed with significance set at the 5% level. For logistic regression, continuous variables were split at the median and analysed as binary categories. As Heckathorn[15] advises, unadjusted data were used for analyses of associations. As RDS obtains a random sample of networks,[16–18] we used a combination of parametric and non-parametric tests as appropriate.

## RESULTS

The sample comprised Tanzanian nationals, disproportionately well educated, median age 23 (IQR 21–28) for Dar es Salaam and Tanga. The majority was never married and nearly a third reported selling sex as their major source of income (table 1). Of the 200 respondents in Dar es Salaam, 172 (86%) consented to an HIV test. Of those, 52 (30.2%) were HIV seropositive. Only 5 of the total 62 positives in both cities reported a previous positive HIV test: thus, 91.9% of those who tested positive were *new detections*. Only 5 (1.9%) of those who tested had evidence of past or present syphilis infection (all in Dar es Salaam) and 8 (3.1%) hepatitis B positive (all in Tanga) (table 2). The burden of HIV/STIs was markedly higher in Dar es Salaam than Tanga. Of those with a rectal STI, only 12.5% reported ever having an anal discharge (compared with 9% of those without a rectal STI, Yates $\chi^2$=0.44, df=1, p=0.83). There was no significant relationship between HIV status and STI status ($\chi^2$=0.53, df=1, p=0.47). The great majority of respondents (87%) reported they were circumcised and there were no differences in HIV infection by circumcision status. HIV infection differed significantly between the exclusive MSM (sex only with men in the past 5 years, 38.5%) and men who had sex with men and women (MSMW) in that time (10.7%, $\chi^2$ =27.9, df=1, p=0.001), but there were no significant differences in urethral and anal STI rates between these 2 groups. RAI without a condom with one of the last three partners was associated with both HIV infection (tables 3 and 4) and a rectal STI (29.2% vs 11.2%, $\chi^2$ = 10.5, df=1, p=0.001).

Sexual positioning preference taken over the last three partners was no anal sex, 24.5%; receptive anal only, 33%; insertive anal only, 32.5%; and versatile (insertive and receptive), 10%. There was no significant relationship between those who considered themselves exclusively gay (n=175) and bisexual (n=125) on partner numbers in the past 6 months (8.1±13.2 vs 7.6±6.9, t=0.37, p=0.71). Almost all the respondents knew that receptive (94.3%) and insertive (92.9%) anal sex without a condom could spread HIV.

Tables 5 and 6 illustrates predictors of HIV and STI infection. Size of city, number of gay men known, self-identifying as gay (as opposed to bisexual) and having a man as the first sexual partner all significantly predicted HIV infection. For STI infection, receptive anal sex without condoms with 1 of the last 3 sexual partners, size of city, number of gay men known and number of those gay men seen over the last month were all significant predictors.

## DISCUSSION

This sample is the first collected for MSM in mainland Tanzania which includes HIV, hepatitis B, syphilis serostatus, and urethral and rectal chlamydia and gonorrhoea. The HIV rate of over 30% for those tested in Dar es Salaam is very high, comparable to the 35% HIV rate of IDUs tested in Dar es Salaam.[19] Syphilis infection rates, which could include evidence of previous or present infection, were low at 2.5% (consistent with Zanzibar MSM data, which also utilised an antibody detection test), and no hepatitis B infection was detected. In Tanga, in contrast, HIV and STI rates were lower, a third that of Dar es Salaam, suggesting that a much smaller provincial city may have significantly lower (but still unacceptably high) rates in MSM compared with the major metropolis. This is probably due to smaller networks of MSM, and low levels of travel of MSM between provincial cities and the major metropolis. High HIV rates are likely an indication of the lack until very recently of HIV interventions carried out in



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**Table 1** Demographic variables

| | DES | | | Tanga | | |
|---|---|---|---|---|---|---|
| | N | Mean | SD | N | Mean | SD |
| Age | 200 | 24.61 | 5.27 | 100 | 24.91 | 5.12 |
| Education | 200 | N | % | 100 | N | % |
| Some primary school and under | | 10 | 5.0 | | 5 | 5.0 |
| Completed primary school, some secondary school or complete secondary school | | 179 | 89.5 | | 91 | 91.0 |
| Some or completed tertiary education | | 11 | 5.5 | | 4 | 4.0 |
| Marital status | 199 | N | % | 100 | N | % |
| Never married | | 183 | 92.0 | | 88 | 88.0 |
| Married | | 5 | 2.5 | | 6 | 6.0 |
| Separated/divorced/widowed | | 7 | 3.5 | | 5 | 5.0 |
| Living with partner | | 4 | 2.0 | | 1 | 1.0 |
| Ever married/lived with a female partner* | 158 | N | % | 96 | N | % |
| No | | 124 | 78.5 | | 83 | 86.5 |
| Yes | | 34 | 27.4 | | 13 | 13.5 |
| Currently employed† | 199 | N | % | 100 | N | % |
| Yes | | 162 | 81.4 | | 81 | 81.0 |
| No | | 37 | 18.6 | | 19 | 19.0 |
| Self-identified sexual orientation | 200 | N | % | 100 | N | % |
| Gay/homosexual | | 126 | 63.0 | | 49 | 49.0 |
| Straight/heterosexual | | 3 | 1.5 | | 2 | 2.0 |
| Bisexual | | 64 | 32.0 | | 44 | 44.0 |
| Undecided | | 7 | 3.5 | | 5 | 5.0 |
| Sexual activity over the past 5 years | 200 | N | % | 100 | N | % |
| Only men/mostly men | | 161 | 80.5 | | 82 | 82.0 |
| Equal men/women | | 5 | 2.5 | | 7 | 7.0 |
| Mostly women | | 34 | 17.0 | | 11 | 11.0 |
| Paid sex, last month | 200 | N | % | 100 | N | % |
| Been paid for sex | | 161 | 80.5 | | 84 | 84 |
| Paid another man for sex | | 36 | 18.5 | | 10 | 10 |
| If any paid sex, both paid and paying | | 30 | 15 | | 8 | 8 |

*Twenty-four people did not respond in DES.
†Does not include transactional sex.
DES, Dar es Salaam.

MSM in mainland Tanzania and probably represent the approximate rate in an un-accessed MSM population.

That >90% of the HIV seropositives were *newly detected cases* underscores the fact that this is a largely untested population, or at least not tested for some time. Only 14% of respondents did not want to wait for results and this suggests that most MSM do want to know their test results and, by implication, prevent HIV spread and access treatment. This is an accessible and undertested population who responded positively to community outreach. However, it is likely that they will require some help to access and trust treatment services for HIV and STIs given the stigma associated with homosexuality.

In contrast with MSM in Zanzibar (45 miles offshore from Dar es Salaam: Zanzibar City population about 220 000) who reported 12.3% HIV prevalence and predictors of injecting drugs in the past 3 months, hepatitis C infection and being paid for sex in the past year,[6 7] the Dar es Salaam sample had 2.5 times the HIV prevalence in Zanzibar and quite different predictors. These predictors were receptive anal sex and lifetime numbers of sex partners. There are clearly different dynamics in geographically close MSM communities associated with HIV infection in East Africa, and a need to tailor prevention programmes to local contexts. In Dar es Salaam, MSM also had an HIV rate some 2.5 times that of the *general population*. Nearly a third reported selling sex as their major source of income, and this figure was very similar to our study of MSM 5 years previously in Dar es Salaam[20] and our later data.[21] These data are consistent with those of Sanders *et al*[5 22] a few hundred miles north in coastal Kenya, with significant levels of rectal gonorrhoea and chlamydia in MSM and similar rates of selling and buying sex, although we did not replicate an association between STIs and HIV infection. We also found, like Sanders *et al*, significantly higher differences in HIV infection rates in exclusive MSM compared with MSM who also had sex with women and in those MSM who reported they had unprotected RAI with one of their last 3 sexual partners. Despite lower prevalence in MSMW and in a provincial city, these rates in a smaller city and in MSMW are still substantial: as MSMW are a



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**Table 2** STI and HIV prevalence among MSM in DES and Tanga

| Variable | DES | | | Tanga | | |
|---|---|---|---|---|---|---|
| | N* | n | % | N* | n | % |
| HIV status | 172 | | | 90 | | |
| Positive | | 52 | 30.2 | | 10 | 11.1 |
| Negative | | 120 | 69.8 | | 80 | 88.9 |
| Hepatitis B status | 172 | | | 90 | | |
| Positive | | 172 | 100.0 | | 8 | 8.9 |
| Negative | | 0 | 0.0 | | 82 | 91.1 |
| Syphilis | 172 | | | 90 | | |
| Exposed | | 5 | 2.9 | | 0 | 0.0 |
| Negative | | 167 | 97.1 | | 90 | 100.0 |
| Urine chlamydia† | 179 | | | 40 | | |
| Positive | | 4 | 2.2 | | 3 | 7.5 |
| Negative | | 175 | 97.8 | | 37 | 92.5 |
| Urine gonococcus† | 179 | | | 40 | | |
| Positive | | 1 | 0.6 | | 1 | 2.5 |
| Negative | | 178 | 99.4 | | 39 | 97.5 |
| Anal chlamydia† | 180 | | | 40 | | |
| Positive | | 23 | 12.8 | | 1 | 2.5 |
| Negative | | 157 | 87.2 | | 39 | 97.5 |
| Anal gonococcus† | | | | 40 | | |
| Positive | | 26 | 14.4 | | 1 | 2.5 |
| Negative | | 154 | 85.6 | | 39 | 97.5 |
| Any STI (excluding HBV and HIV) | 190 | | | 91 | | |
| Positive | | 45 | 23.7 | | 4 | 4.4 |
| Negative | | 145 | 76.3 | | 87 | 95.6 |

*The total sample sizes shown indicate the number of respondents that have data on the variables above. For example, if though there were 200 respondents from DES, only 172 of them had HIV data. Prevalence was computed based on respondents with available data.
†Urine and anal chlamydia and gonococcus data for Tanga is limited as only about 40% of the respondents in that city have data on these variables.
DES, Dar es Salaam; HBV, hepatitis B virus; MSM, men who have sex with men; STI, sexually transmitted infection.

bridge to the general population, treatment in these populations is also crucial.

Of particular interest and concern is the much higher rate of rectal chlamydia and gonorrhoea than urethral infection. We suspect that as a high proportion of rectal infection is likely to be asymptomatic (only 12% in this sample reported symptoms), men do not seek treatment. This hardly differed from those without a diagnosis of rectal infection. Symptoms will be neither sensitive nor specific for a rectal STI diagnosis. Of additional concern is that the syndromic guidelines do not generally provide approaches for rectal infections. However, the fact that more than 1 in 5 MSM in these samples had a treatable STI (and that in Dar es Salaam, more than 90% of the STIs were rectal) is a wake-up call that specific services for MSM are required in East Africa. Many of our respondents told us that if they do present for treatment, they admit only to heterosexual contact to avoid stigma, precluding any rectal investigation and diagnosis. These findings are consistent with reports of

**Table 3** t Test of difference in means for continuous variables

| Variable name | N | HIV− Mean±SD | HIV+ Mean±SD | p Value |
|---|---|---|---|---|
| Number of gay men over 15 known | 252 | 11.6±12.5 | 25.1±23.3 | 0.0001 |
| Number of these men seen in the last month* | 260 | 5 | 10 | 0.0001 |
| Age | 262 | 25.5±5.2 | 24.9±5.6 | 0.5821 |
| Age had sex for the first time | 262 | 15.8±2.9 | 14.3±3.6 | 0.0035 |
| Lifetime number of men subject had sex with* | 258 | 6 | 15 | 0.0001 |
| Age of first sex with man | 258 | 17.4±3.6 | 14.7±4.1 | 0.0001 |
| PHQ9 depression score | 176 | 3 | 7 | 0.0001 |
| Internalized Homonegativity Score | 259 | 23.7±7.9 | 20.1±8.3 | 0.0013 |

*These variables were not normally distributed so Wilcoxon non-parametric tests were used to compare HIV+ and HIV− participants. Values shown were median values instead.



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Table 4 $\chi^2$ Test of association for categorical variables

| Variable name | N | HIV− % (n/N) | HIV+ % (n/N) | p Value |
|---|---|---|---|---|
| Ever married/lived with female partner(Yes) | 220 | 21.3 (36/169) | 11.8 (6/51) | 0.1288 |
| Sexual activity past 5 years (only/mostly men) | 262 | 77.0 (154/200) | 95.2 (59/62) | 0.0056 |
| First sexual partner was a man | 262 | 41.5 (83/200) | 75.8 (47/62) | 0.0001 |
| Been forced to have sex with someone(yes) | 260 | 33.8(67/198) | 41.9 (26/62) | 0.2457 |
| Paid another man for sex in the last month | 214 | 16.7 (28/168) | 28.3 (13/46) | 0.0767 |
| Been paid to have sex in the last month | 249 | 87.2 (164/188) | 88.5 (54/61) | 0.7908 |
| Earned income by selling sex | 262 | 28.5 (57/200) | 41.9 (26/62) | 0.0469 |
| Currently employed (yes) | 261 | 80.4 (160/199) | 83.9 (52/62) | 0.5414 |
| Self-identified as gay/homosexual | 252 | 49.7 (95/191) | 88.5 (54/61) | 0.0001 |
| Used water-based lubricants | 260 | 30.7 (61/199) | 63.9 (39/61) | 0.0001 |
| Used condom anal with recent commercial partner | 239 | 31.7 (57/180) | 49.2 (29/59) | 0.0152 |
| Ever been tested for HIV (yes) | 259 | 77.2 (153/198) | 80.3 (49/61) | 0.6146 |
| Depression (depressed)* | 176 | 37.1 (49/132) | 68.2 (30/44) | 0.0003 |

*Depression was dichotomised at the cut-off point of 4. Depressed participants had depression score of 5 or less while non-depressed participants had depression score of 4 or less (Monahan *et al*, 2009[13]).

high levels of stigma towards MSM from healthcare workers in southern Africa[23] and anecdotal data from our Tanzanian sample. Although there was no question about anal transmission of STIs, nearly 95% of men knew that HIV could be transmitted by unprotected anal sex. Age at first sex was significantly higher in HIV seropositive MSM and this reinforces the need for comprehensive sexual health education during adolescence.

Significant predictors of HIV and STI infection were the size of the city and size of the gay network, both related to sexual mixing. For HIV, gay identification (with exclusively gay men more likely to be infected) was associated with infection. For STI, having unprotected RAI with one of the last 3 sexual partners was a predictor. This is not surprising given that the bulk of STI infection detected was rectal.

The relationship of STIs to HIV is not significant. This is consistent with the suggestion of Grosskurth *et al*,[24] based on the Rakai and Mwanza studies, that despite it being known that STI treatment reduces HIV shedding in the genital tract, at a population level, the contribution of STIs to HIV transmission decreases as HIV epidemics mature. They suggest that where HIV infection becomes much more prevalent relative to other STIs, the proportion of HIV transmission attributable to co-infection with other STIs may be limited. This suggestion is consistent with the HIV epidemic in MSM in Dar es Salaam and Tanga being at a mature stage. Nevertheless, the high rates of STIs (compared with those reported in the Rakai and Mwanza studies) and the contention by Orroth *et al*[25] that STIs were underestimated in the Mwanza study (which did demonstrate a reduction in HIV infection associated with STI treatment) suggest that treatment of curable STIs in MSM in cities in East Africa may still have an appreciable impact on HIV infection in this population. Study design may also have influenced our ability to show an association. If HIV infection was more distant, current STIs would

Table 5 Predictors of HIV positivity

| | HIV as dependent variable | | | |
|---|---|---|---|---|
| Variable name | N | AOR | 95% CI | p Value |
| STI | 199* | 0.794 | 0.267 to 2.363 | 0.679 |
| Receptive anal sex without condoms | | 1.59 | 0.624 to 4.049 | 0.3311 |
| Insertive anal sex without condoms | | 0.84 | 0.282 to 2.499 | 0.7545 |
| Internalized Homonegativity Score | | 0.97 | 0.918 to 1.025 | 0.279 |
| City (Dar es Salaam vs Tanga) | | 3.47 | 1.255 to 9.596 | 0.0165 |
| Number of gay men over 15 known | | 1.03 | 1.002 to 1.055 | 0.0322 |
| Ever married or lived with a female partner | | 0.38 | 0.111 to 1.330 | 0.131 |
| First sexual partner was a man | | 0.4 | 0.168 to 0.971 | 0.0428 |
| Self-identified as gay/homosexual | | 3.06 | 1.007 to 9.308 | 0.0486 |

*Although 300 participants were entered into the regression model, only 199 participants were used in computing ORs for the variables above, because logistic regression models use list-wise deletions for in the regression process. Thus participants that have missing values for any of the variables above will be removed in the regression process and will not be used in computing ORs. That is, only 199 participants have non-missing values for all the variables above. AORs were adjusted for all the variables shown in the table.
AOR, adjusted OR.



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Table 6 Predictors of STI

| Variable name | STI as dependent variable N | AOR | 95% CI | p Value |
|---|---|---|---|---|
| HIV status | 198* | 0.951 | 0.375 to 2.407 | 0.915 |
| Receptive anal sex without condoms | | 3.69 | 1.471 to 9.254 | 0.0054 |
| Insertive anal sex without condoms | | 0.908 | 0.353 to 2.339 | 0.842 |
| City (Dar es Salaam vs Tanga) | | 8.217 | 2.519 to 26.809 | 0.0005 |
| Number of gay men over 15 known | | 1.03 | 0.996 to 1.064 | 0.0836 |
| Number of gay men seen in the last 1 month | | 0.96 | 0.916 to 0.998 | 0.038 |
| Ever been forced to have sex | | 0.54 | 0.236 to 1.228 | 0.1411 |
| Age at first sex with a man | | 0.97 | 0.869 to 1.090 | 0.6415 |
| Earned income selling sex | | 1.83 | 0.810 to 4.148 | 0.1457 |

*Although 300 participants were entered into the regression model, only 199 participants were used in computing ORs for the variables above, because logistic regression models use list-wise deletions for in the regression process. Thus participants that have missing values for any of the variables above will be removed in the regression process and will not be used in computing ORs. That is, only 199 participants have non-missing values for all the variables above. AORs were adjusted for all the variables shown in the table.
AOR, adjusted OR; STI, sexually transmitted infection.

not be expected to be causally associated with HIV in these men. Prospective studies are better suited to investigating these associations. However, it is important to note that such a high rate of rectal STI demands treatment in its own right.

Limitations of the study include a relatively small sample in two cities, limiting generalisation to larger urban areas, and the fact that some 12% did not agree to STI or HIV testing which provides an unknown bias. The fact that the sample was relatively young and connected to a gay subculture suggests that it may not include many MSM peripheral to the subculture.

These data suggest that HIV rates in MSM in smaller cities will be substantially lower than in a major metropolis, with MSM in Zanzibar and Tanga (both with populations in the 200–300 000 range) having about a third the MSM HIV seroprevalence of Dar es Salaam (which is about 10 times their population size). STI rates were correspondingly lower also, suggesting that the availability of larger networks of MSM is related to infection risk. For curable STIs (which have a much shorter symptomatic infection latency than HIV but may also be asymptomatic rectally), recent unprotected RAI is a significant predictor of infection. These high rates of HIV and STI, especially rectal STIs, in MSM in Dar es Salaam and the size, complexity and distribution of the MSM community there[8] underscore the urgency of developing HIV and STI risk reduction campaigns for this population in this and other large East African urban settings. Smaller provincial cities appear to have MSM communities with lower but significant HIV/STI prevalence and should also be included in HIV prevention efforts.

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