Sexual and Social Network Correlates of Willingness to Self-Test for HIV Among Ever-Tested and Never-Tested Men: Implications for the Tanzania STEP Project

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Abstract

We examined factors associated with HIV self-testing (HIVST) willingness among male ever-testers and never-testers who participated in a midpoint survey of a cluster randomized controlled HIV prevention trial in Dar es Salaam. Linear mixed binary logistic regression models were constructed to examine factors (demographic, HIV risk behavior, and sexual/social network) associated with willingness to self-test. Sixty-seven percent of 301 never-testers were willing to self-test for HIV compared to 72% 577 of ever-testers. Among never-testers, having discussed testing for HIV with a sexual partner was the only factor associated with HIVST willingness (2.36, 95% CI: 1.35–4.15). For ever-testers, younger men were less willing to self-test than older men while men with higher education were more willing to self-test than less educated men. Having a moderate/great HIV risk perception decreased the odds of HIVST willingness relative to no risk perception (0.40, 95% CI 0.23–0.70) for ever-testers. Discussing HIV testing with a sexual partner and having been encouraged to test for HIV by a friend were associated with higher odds of being willing to self-test (2.22, 2.23; 95% CI 1.34–3.67, 1.14–4.39, respectively) among ever-testers. These findings suggest that HIVST willingness is highly acceptable among both male ever-testers and never-testers.

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Keywords

HIV self-testing; men; never-testers; social network; Tanzania

Introduction

Despite progress made in the past decades in the fight against HIV, the epidemic remains a pressing public health issue, especially in Sub-Saharan Africa (UNAIDS, 2014a). There are a combination of individual, interpersonal, and structural factors that contribute to the spread of HIV in the region, including the lack of HIV testing (Ghebremichael & Paintsil, 2011; Shand, Thomson-de Boor, van den Berg, Peacock, & Pascoe, 2014). For example, it is estimated that 1.4 million people are living with HIV (PLWH) in Tanzania but only 960,000 of them are aware of their HIV status (UNAIDS, 2016). In order to reach the first 90 objectives of the UNAIDS 90-90-90 targets (UNAIDS, 2014b), more efforts are needed to increase HIV testing among men in Tanzania. Increasing men's HIV testing rate is important because HIV testing is associated with consistent condom use and knowledge of partner's HIV status among men in Tanzania (Conserve, Sevilla, Mbwambo, & King, 2013). However, HIV-related stigma, low perceived risk of HIV infection, time conflicts, reputational masculinity norms, and lack of privacy and confidentiality have deterred men from testing for HIV (Conserve, Alemu, Yamanis, Maman, & Kajula, 2018; Musheke et al., 2013).

In 2016, the World Health Organization recommended HIV self-testing (HIVST) as a complementary HIV testing strategy to reach men who do not test at healthcare facilities (WHO, 2016). HIVST provides users the ability to learn their HIV status in the privacy of their home and can help address some of the aforementioned barriers to testing for men (WHO, 2013). A recent literature review focusing on factors needed to scale up HIVST in sub-Saharan Africa suggested that HIVST acceptability and uptake is high among multiple groups but found no published HIVST studies from Tanzania (Indravudh, Choko, & Corbett, 2018). At the time of the review, only Kenya had published guidelines on HIVST delivery (NASCOP, 2017). As the Tanzania Ministry of Health considers implementing HIVST in their national HIV prevention guidelines (Buguzi, 2018), more research is needed to inform the development of policies and strategies to reach groups such as heterosexual men since the primary mode of HIV transmission in Tanzania is by heterosexual contact (TACAIDS & NBS OCGS, 2013). In addition, the Tanzania Commission for AIDS (TACAIDS) is developing the 2018–2020 Male Catch Up Plan in order to reach more men and adolescent boys with HIV testing services, including HIVST, once the law to implement HIVST is approved (TACAIDS, 2018).

A growing body of evidence from sub-Saharan Africa suggests that men's social networks influence their HIV testing behavior and perceived HIV testing norms, including their willingness to self-test for HIV (Conserve et al., 2018; Yamanis et al., 2016). In Uganda, it was found that men who did not perceive HIV testing as normative in their village were less likely to have been tested (Perkins et al., 2018). In Tanzania, men's perception of HIV testing norms for their close friends was associated with personal HIV testing uptake, with

higher testing reported among men who perceived their close friends had tested (Mulawa et al., 2016). A number of studies have also shown that leveraging men's sexual networks to encourage them to test for HIV is an effective strategy (Rosenberg et al., 2015), with recent evidence showing that distributing HIVST kits to men via their female partners is acceptable and feasible (Choko et al., 2017; Thirumurthy et al., 2016). To contribute to this growing literature, we examined: (1) HIVST willingness among male ever-testers and never-testers and; (2) sexual and social network factors associated with willingness to self-test for HIV among men to inform the development of the Tanzania STEP (HIV *S*elf-*T*esting *E*ducation and *P*romotion) Project for men (Conserve et al., 2018, Conserve, Muessig et al. 2018).

Methods

Study setting and recruitment

This study was conducted with young and adult men who participated in the midpoint assessment of a microfinance and health leadership randomized controlled trial designed to prevent HIV and gender-based violence among male "camp" members in four wards (Mabibo, Manzese, Tandale, Mwanyanamala) of the Kinondoni Municipality in Dar es Salaam, Tanzania (Kajula et al., 2016). Camps are social groups of mostly young men and have been in existence for close to a decade (Yamanis, Maman, Mbwambo, Earp, & Kajula, 2010). More details are provided elsewhere (Kajula et al., 2016) about the camp identification and selection process for the RCT. In order for camp members to participate in the trial, they had to be 15 years of age, had been a camp member for 3 months, visit the camp at least once a week, and plan to reside in Dar es Salaam for the next 30 months (Kajula et al., 2016). A total of 978 participants provided consent and completed the midpoint assessment; 100 of them were excluded because they had incomplete data for the outcome variable (HIVST willingness), or the prior HIV testing variable, were not sexually active, or reported to be HIV-positive.

Outcome measure

Willingness to self-test for HIV was derived from a yes/no question asking participants if they would be willing to test themselves for HIV using an oral fluid HIVST kit.

Demographic measures

All demographic, risk behavior, and social sexual/network variables used in analyses originated from the 12-month follow-up questionnaire. Age was categorized into four groups (15–19, 20–24, 25–29, and 30+ years). Education was classified as standard 7 or less, form 1–3, or form 4 or higher. Religion was reported as either Muslim or Christian by participants and marital status was categorized as dichotomous (Married vs. single, divorced, separated, or widowed). Whether or not a participant was in a camp that participated in the health education component of the intervention was also included.

HIV risk behavior measures

Participants were asked how many people they engaged in sex with during the past 12 months; this variable was categorized as none, one, or two or more. Participants were also asked about their perceived risk of acquiring HIV/AIDS (no risk, small, moderate, and

great); for analyses, the moderate and great response categories were combined. A variable was also created to describe condom use in the past month with partners (up to two) listed by participants; the categories were: 0% of the time, between 1% and 99% of the time, 100% of the time, and no partner or sexual activity in the past month (Hill et al., 2018; Hill, Maman, Kilonzo, & Kajula, 2017). Additionally, a measure of sexual concurrency within the past 12 months was created with three categories: engaged in sex with others than current partner, did not engage in sex with others than current partner, or no partner.

Sexual and social network measures

All relevant social and sexual network questions were asked with regard to each participant's friends (a maximum of two) or sexual partners (a maximum of two). Given the design of the questionnaire, participants were asked information about two best friends or only one friend if they did not want to or did not have a second friend. Similarly, participants were asked about up to two sexual partners. For sexual network variables, participants were asked if they have ever discussed HIV testing with their partners, and if they had HIV tested together with their partners in the past 12 months (not relevant to the subset of individuals who did not test in the past 12 months). For the social network variables, participants were asked if they think their friends have ever tested for HIV, and if their friends have ever encouraged them to test for HIV. The response to each of these four questions were categorized as "No" or "Yes, at least one partner/friend."

Statistical analyses

Descriptive statistics were calculated for the demographic, HIV risk behavior, and social/sexual network variables of interest for all study participants included in the final analyses, stratified by ever or never testing for HIV. Pearson chi-squared tests were used to compare strata. Among those who had ever tested for HIV up to midpoint, two separate explanatory generalized linear mixed models (one containing only demographic and HIV risk behavior covariates; the other containing only demographic and sexual/social network covariates) with willingness to self-test for HIV as a Bernoulli response and a logit link were fit using Gauss–Hermite quadrature. The decision to use separate models for these two sets of covariates (HIV risk behavior and sexual/social network) was made in order to prevent model over-parameterization due to the risk of not having enough events or non-events in the response data. The same fitting process described above was repeated among individuals who had never tested for HIV up to midpoint. A random intercept for camp was included in all models to account for clustering within camps and was assumed to be normally distributed. All covariates were chosen a priori and no model covariate selection was performed. The presence of influential camps and influential individuals was assessed using deletion diagnostics such as Cook's distance. All testing was two-tailed, p-values less than 0.05 were considered statistically significant, and analysis was performed using SAS version 9.4 (Cary, NC).

Results

Summary statistics for the outcome (willingness to self-test for HIV), demographic variables, HIV-related risk behavior variables, and sexual/social network variables are

presented in Table 1, stratified by previous testing status. Five-hundred and seventy-seven men composed the ever-testers stratum and 301 composed the never-testers stratum. There was a statistically significant difference in age and marital status between testers and never-testers, with never-testers more likely to be younger and not married compared to testers. There were no statistically significant differences between testers and never-testers for HIV-related risk behaviors and HIV risk perception. However, never-testers compared to ever-testers were less likely to report (1) discussing HIV testing with at least one of their sexual partners, (2) thinking at least one of their two close friends had tested, and (3) having been encouraged to test by at least one of their two close friends. Although 72% of ever-testers compared to 67% of never-testers were willing to self-test, the difference was not statistically significant.

Among both ever-testers and never-testers, condom use and sexual concurrency variables were to be included in the full models, but due to model non-convergence, they were only included in the unadjusted analyses. Table 2 lists unadjusted and adjusted odds ratios [aOR] for willingness to self-test for HIV among ever-testers. In the unadjusted analyses, age, education, HIV risk perception, condom use, sexual concurrency, and the sexual/social network variables were statistically significantly associated with willingness to self-test. In the adjusted model for the demographic and HIV-related risk variables, age, education, and HIV risk perception remained statistically significantly associated with willingness to self-test. Ever-testers aged 15–19 years and 20–24 years had 0.36 (95% CI 0.17–0.78) and 0.25 (95% CI 0.14–0.45) less the odds of being willing to self-test for HIV as compared to those aged 30 years and older. In contrast, ever-testers in the form 1–3 and form 4 or higher education categories had 2.32 (95% CI 1.08–4.95) and 2.15 (95% CI 1.36–3.40) times the odds of being willing to self-test for HIV than those in the standard 7 or less group. Surprisingly, having a moderate/great HIV risk perception decreased the odds of being willing to take an HIV self-test relative to no risk perception (aOR 0.40, 95% CI 0.23–0.70). Age and education were also statistically significantly associated in the same direction with willingness to self-test for HIV in the demographic and sexual/social network variables model. Additionally, discussing HIV testing with at least one partner and having at least one friend who encouraged HIV testing were associated with higher odds of being willing to self-test for HIV (aOR 2.22, 2.23; 95% CI 1.34–3.67, 1.14–4.39, respectively).

Table 3 provides unadjusted and adjusted odds ratios for willingness to self-test for HIV among never-testers. In the unadjusted model, the sexual and social network variables were statistically significantly associated with willingness to self-test for HIV. Never-testers who had discussed HIV testing with at least one sexual partner had higher odds of being willing to self-test for HIV (OR 2.52, 95% CI 1.52–4.18) than those who had not discussed HIV testing. Similarly, never-testers who had at least one friend who encouraged HIV testing had higher odds of being willing to self-test (OR 1.77, 95% CI 1.02–3.05) than their counterparts who were not encouraged. In the adjusted models, only the sexual network variable remained a significant factor. Never-testers who had discussed HIV testing with at least one sexual partner had higher odds of being willing to self-test for HIV (aOR 2.36, 95% CI 1.35–4.15) than those who had not discussed HIV testing with a sexual partner.

Discussion

To our knowledge, this is the first quantitative assessment of HIVST willingness focusing on heterosexual men in Tanzania. HIVST willingness was found to be high among both men who have tested and those who have never tested for HIV. More importantly, sixty-seven percent of men who had never tested for HIV reported a willingness to self-test for HIV, indicating the potential of HIVST to increase the number of men who learn their HIV status and possibly an earlier start into treatment for those who are found to be infected and link to care. These findings support an earlier study in Malawi that included men who had not previously tested and were accepting of self-testing (Choko et al., 2011). In Tanzania, qualitative research from the STEP Project revealed that the reasons male never-testers are willing to self-test are similar to those for men who have tested and include, but are not limited, to the privacy and confidentiality that self-testing allows (Conserve, Muessig et al. 2018). However, men also reported reasons for not willing to self-test related to low self-efficacy to perform the test properly and the potential lack of post-test counseling and linkage to care support in case of a positive self-test result (Conserve, Muessig et al. 2018). To address these barriers of HIVST, men recommended that future HIVST interventions include HIVST education and counseling as well as using mobile health (mHealth) strategies for participants to reach a healthcare professional for further assistance during the self-testing process (Conserve, Muessig et al. 2018).

In this study, we found that only discussing HIV testing with a sexual partner was associated with a higher willingness to self-test among never-testers. Based on the potential of women to deliver HIVST kits to men (secondary distribution) during HV testing discussion with male partners and the effectiveness of women-delivered HIVST kits on increasing male partners' HIV testing (Masters et al., 2016), a woman-delivered HIVST kits to male partners project is being piloted in Tanzania. The project is part being implemented by the National AIDS Control Program and Jhpiego Tanzania in 7 out 14 regions of the Sauti program, a PEPFAR-funded program (Han, 2017). Secondary distribution of HIVST from women to men can also increase couple's HIV testing since 75% of women who received HIVST kits to distribute to their partners in a randomized controlled trial reported to have tested as a couple compared to 33% in the control group (Masters et al., 2016). Another approach for reaching male never-testers, especially those who may not have a steady sexual partner, is leveraging the existing cadre of community health workers (CHWs) supported by the Tanzanian Government (Geldsetzer et al., 2017). CHWs have been trained to assist in the distribution of HIVST kits as part of the targeted HIVST implementation science project. CHWs can be engaged to identify male-never testers and provide them with HIVST information and kits. In addition, CHWs can also be available to help address barriers that men reported that may prevent them from self-testing (Conserve, Muessig et al. 2018). This approach has been employed in one of the largest community HIVST distribution trial, where community counselors provided HIVST to community residents and assisted them with the instructions, interpretation, and offered counseling to those who reported positive self-test results (Choko et al., 2015).

Our findings also showed that younger ever-testers were less likely to be willing to self-test than older ever-testers. With the proper information and support, younger ever-testers may

become interested in self-testing as demonstrated in the two years community HIVST distribution trial in 14 neighborhoods in Malawi and 90% of men aged 16–19-years-old reported to have self-tested (Choko et al., 2015). Interestingly, we also found that ever-testers with higher HIV risk perception were less likely to be willing to self-test which differs from the finding of another study in Zambia where 90% of individuals, including men, who perceived themselves to be at higher HIV risk would self-test compared to 88% of those who perceived low HIV risk (Zanolini et al., 2018). The fear of a positive result and the burden of knowing one's HIV status (Izugbara, Undie, Mudege, & Ezeh, 2009; Jürgensen, Tuba, Fylkesnes, & Blystad, 2012; Leblanc, Flores, & Barroso, 2016) are possible reasons men who perceive themselves at high risk may be unwilling to self-test. Previous studies conducted in Tanzania and Uganda have found that men who perceive themselves to be at risk for HIV prefer to seek advice about HIV testing from peers who have engaged in similar risky sexual behaviors (Conserve et al., 2018; Siu, Wight, & Seeley, 2014). In addition, men have reported that one of the reasons they encouraged their male peers to test for HIV was the awareness of their peers' risky sexual behavior, with some men accompanying their friends who were reluctant to attend the HIV test clinic alone (Conserve et al., 2018). Based on these findings and our previous male peer-led HIV prevention in Tanzania (Kajula et al., 2015), the STEP Project will leverage men's social networks to promote HIVST among men by recruiting and training men on HIVST and instructing them to engage in conversations about HIVST with their male network members (Conserve, Muessig et al., 2018).

Limitations

Several limitations are associated with this study including the fact that data originated from a cross-sectional survey and were not collected to assess the causal relationship between variables of interest and the willingness to self-test for HIV. Therefore, measures of the relationships described in this paper should be viewed as associations captured at a moment in time and not causal in nature. Given the self-reported nature of the variables examined, the accuracy of responses may vary from participant to participant, and some participants may have responded systematically inaccurately (e.g., consistently answering questions in such a way as to suggest no sexual activity). Also, information regarding the timing of HIV testing among those who had tested for HIV at some point was not available. Therefore, it is possible that omission of this information may have confounded the relationship between willingness to self-test for HIV and such covariates as discussing testing with friends (e.g., those having recently tested may be more likely to discuss testing with friends). As discussed, the condom use and sexual currency variables were not included in the full models as they contributed to model non-convergence. As a sensitivity analysis, the models with convergence issues were fit again, this time including condom use and sexual currency, but without any random effects. The inclusion of these variables had negligible effects on the regression coefficients of the other explanatory covariates, suggesting that the bias originating from excluding them in the final models was minor.

Conclusion

Overall, this is one of the first quantitative studies to focus on the factors associated with HIVST willingness among male ever-testers and never-testers. These findings suggest that HIVST willingness is highly acceptable among both groups of men. However, HIVST willingness is lower among men who may be at high risk for HIV. One strategy that is being piloted in Tanzania to reach men who are at high risk for HIV is a secondary distribution of HIVST kits through female sex partners and male peers. This approach has been demonstrated to be effective in increasing male partner HIV testing (Masters et al., 2016). Future research should examine HIVST uptake among male ever-testers and never-testers and associated factors that influence HIVST uptake for different groups of men.

Acknowledgements

References

Buguzi S (2018). Tanzania to roll out HIV self-testing, deputy ministry of health reveals. The Citizen.

Choko AT, Desmond N, Webb EL, Chavula K, Napierala-Mavedzenge S, Gaydos CA, … French N (2011). The uptake and accuracy of oral kits for HIV self-testing in high HIV prevalence setting: A cross-sectional feasibility study in Blantyre, Malawi. PLoS Medicine, 8(10), e1001102. [PubMed: 21990966]

Choko AT, Kumwenda MK, Johnson CC, Sakala DW, Chikalipo MC, Fielding K, … Corbett EL (2017). Acceptability of woman-delivered HIV self-testing to the male partner, and additional interventions: A qualitative study of antenatal care participants in Malawi. Journal of the International AIDS Society, 20(1), 21610. [PubMed: 28691442]

Choko AT, MacPherson P, Webb EL, Willey BA, Feasy H, Sambakunsi R, … Hayes R (2015). Uptake, accuracy, safety, and linkage into care over two years of promoting annual self-testing for HIV in Blantyre, Malawi: A community-based prospective study. PLoS Medicine, 12(9), e1001873. [PubMed: 26348035]

Conserve DF, Alemu D, Yamanis T, Maman S, & Kajula L (2018). "He told me to check my health": A qualitative exploration of social network influence on men's HIV testing behavior and HIV self-testing willingness in Tanzania. American Journal of Men's Health, 1557988318777674.

Conserve DF, Muessig KE, Maboko LL, Shirima S, Kilonzo MN, Maman S, & Kajula L (2018). Mate Yako Afya Yako: Formative research to develop the Tanzania HIV self-testing education and promotion (Tanzania STEP) project for men. PloS one, 13(8), e0202521. doi:10.1371/journal.pone.0202521 [PubMed: 30148846]

Conserve D, Sevilla L, Mbwambo J, & King G (2013). Determinants of previous HIV testing and knowledge of partner's HIV status among men attending a voluntary counseling and testing clinic in Dar es Salaam, Tanzania. American Journal of Men's Health, 7(6), 450–460. doi:10.1177/1557988312468146

Geldsetzer P, Francis JM, Ulenga N, Sando D, Lema IA, Mboggo E, … Hu J (2017). The impact of community health worker-led home delivery of antiretroviral therapy on virological suppression: A non-inferiority cluster-randomized health systems trial in Dar es Salaam, Tanzania. BMC Health Services Research, 17(1), 160. [PubMed: 28228134]

Ghebremichael M, & Paintsil E (2011). High risk behaviors and sexually transmitted infections among men in Tanzania. AIDS and Behavior, 15(5), 1026–1032. [PubMed: 19636698]

Han HH (2017). Characterizing the Sauti Vagyw HIV risk assessment tool to measure vulnerability of adolescent girls and young women in Tanzania. Maryland: Johns Hopkins University.

Hill LM, Gottfredson NC, Kajula LJ, Pence BW, Go VF, Moody J, & Maman S (2018). Changes in anxiety and depression symptoms predict sexual risk behaviors among young men living in Dar es Salaam, Tanzania. AIDS and Behavior, 22(5), 1435–1445. [PubMed: 29168066]

Hill LM, Maman S, Kilonzo MN, & Kajula LJ (2017). Anxiety and depression strongly associated with sexual risk behaviors among networks of young men in Dar es Salaam, Tanzania. AIDS Care, 29(2), 252–258. [PubMed: 27469516]

Indravudh PP, Choko AT, & Corbett EL (2018). Scaling up HIV self-testing in sub-Saharan Africa: A review of technology, policy and evidence. Current Opinion in Infectious Diseases, 31(1), 14–24. [PubMed: 29232277]

Izugbara CO, Undie C-C, Mudege NN, & Ezeh AC (2009). Male youth and voluntary counseling and HIV-testing: The case of Malawi and Uganda. Sex Education, 9(3), 243–259.

Jürgensen M, Tuba M, Fylkesnes K, & Blystad A (2012). The burden of knowing: Balancing benefits and barriers in HIV testing decisions. A qualitative study from Zambia. BMC Health Services Research, 12(1), 2. [PubMed: 22222028]

Kajula L, Balvanz P, Kilonzo MN, Mwikoko G, Yamanis T, Mulawa M, … Reyes HLM (2015). Vijana Vijiweni II: A cluster-randomized trial to evaluate the efficacy of a microfinance and peer health leadership intervention for HIV and intimate partner violence prevention among social networks of young men in Dar es Salaam. BMC Public Health, 16(1), 113.

Kajula L, Balvanz P, Kilonzo MN, Mwikoko G, Yamanis T, Mulawa M, … Reyes HLM (2016). Vijana Vijiweni II: A cluster-randomized trial to evaluate the efficacy of a microfinance and peer health leadership intervention for HIV and intimate partner violence prevention among social networks of young men in Dar es Salaam. BMC Public Health, 16(1), 1. [PubMed: 26728978]

Leblanc NM, Flores DD, & Barroso J (2016). Facilitators and barriers to HIV screening: A qualitative meta-synthesis. Qualitative Health Research, 26(3), 294–306. [PubMed: 26631679]

Masters SH, Agot K, Obonyo B, Mavedzenge SN, Maman S, & Thirumurthy H (2016). Promoting partner testing and couples testing through secondary distribution of HIV self-tests: A randomized clinical trial. PLoS Medicine, 13(11), e1002166. [PubMed: 27824882]

Mulawa M, Yamanis TJ, Hill LM, Balvanz P, Kajula LJ, & Maman S (2016). Evidence of social network influence on multiple HIV risk behaviors and normative beliefs among young Tanzanian men. Social Science & Medicine, 153, 35–43. [PubMed: 26874081]

Musheke M, Ntalasha H, Gari S, Mckenzie O, Bond V, Martin-Hilber A, & Merten S (2013). A systematic review of qualitative findings on factors enabling and deterring uptake of HIV testing in Sub-Saharan Africa. BMC Public Health, 13(1), 220. [PubMed: 23497196]

NASCOP. (2017). HIV self-testing: An operational manual for the delivery of HIV self-testing services in Kenya. Nairobi: National AIDS and STI Control Programme (NASCOP), Kenya Ministry of Health.

Organization WH (2016). Guidelines on HIV self-testing and partner notification: Supplement to consolidated guidelines on HIV testing services In Guidelines on HIV self-testing and partner notification: Supplement to consolidated guidelines on HIV testing services.

Perkins JM, Nyakato VN, Kakuhikire B, Mbabazi PK, Perkins HW, Tsai AC, … Bangsberg DR (2018). Actual versus perceived HIV testing norms, and personal HIV testing uptake: A cross-sectional, population-based study in rural Uganda. AIDS and Behavior, 2, 616–628.

Rosenberg NE, Mtande TK, Saidi F, Stanley C, Jere E, Paile L, … Miller WC (2015). Recruiting male partners for couple HIV testing and counselling in Malawi's option B+ programme: An unblinded randomised controlled trial. The Lancet HIV, 2(11), e483–e491. [PubMed: 26520928]

Shand T, Thomson-de Boor H, van den Berg W, Peacock D, & Pascoe L (2014). The HIV blind spot: Men and HIV testing, treatment and care in Sub-Saharan Africa. IDS Bulletin, 45(1), 53–60.

Siu GE, Wight D, & Seeley JA (2014). Masculinity, social context and HIV testing: An ethnographic study of men in Busia district, rural eastern Uganda. BMC Public Health, 14(1), 33. [PubMed: 24417763]

TACAIDS. (2018). Bottlenecks and catch-up plan for engagement of adult men and adolescent boys in HIV counselling and testing in tanzania. Tanzania Commission For AIDS (TACAIDS).

TACAIDS, Z., & NBS OCGS, I. (2013). Tanzania HIV/AIDS and Malaria Indicator Survey 2011–12. Dar es Salaam, Tanzania. Dar es Salaam, Tanzania: Tanzania Commission for AIDS (TACAIDS), Zanzibar AIDS Commission (ZAC), National Bureau of Statistics (NBS), Office of the Chief Government Statistician (OCGS), and ICF International.

Thirumurthy H, Masters SH, Mavedzenge SN, Maman S, Omanga E, & Agot K (2016). Promoting male partner HIV testing and safer sexual decision making through secondary distribution of self-tests by HIV-negative female sex workers and women receiving antenatal and post-partum care in Kenya: A cohort study. The Lancet HIV, 3(6), e266–e274. [PubMed: 27240789]

UNAIDS. (2014a). The gap report. Geneva: UNAIDS, 3.

UNAIDS. (2014b). 90-90-90: an ambitious treatment target to help end the AIDS epidemic. Geneva: UNAIDS.

UNAIDS. (2016). Country factsheets United Republic of Tanzania HIV and AIDS Estimates.

WHO. (2013). Report on the first international symposium on self-testing for HIV: the legal, ethical, gender, human rights and public health implications of HIV self-testing scale-up. Geneva, Switzerland, 8–9 4 2013.

Yamanis TJ, Dervisevic E, Mulawa M, Conserve DF, Barrington C, Kajula LJ, & Maman S (2016). Social network influence on HIV testing among urban Men in Tanzania. AIDS and Behavior, 1–12. doi:10.1007/s10461-016-1513-8 [PubMed: 26370101]

Yamanis TJ, Maman S, Mbwambo JK, Earp JAE, & Kajula LJ (2010). Social venues that protect against and promote HIV risk for young men in Dar es Salaam, Tanzania. Social Science & Medicine, 71(9), 1601–1609. [PubMed: 20846768]

Zanolini A, Chipungu J, Vinikoor MJ, Bosomprah S, Mafwenko M, Holmes CB, & Thirumurthy H (2018). HIV self-testing in Lusaka province, Zambia: Acceptability, comprehension of testing instructions, and individual preferences for self-test kit distribution in a population-based sample of adolescents and adults. AIDS Research and Human Retroviruses, 34(3), 254–260. [PubMed: 28969432]

Table 1.

Sociodemographic characteristics and model covariates for male ever-testers and never-testers.

	Men who have tested for HIV before n = 577	Men who have never tested for HIV n = 301	Pearson chi-squared p-value
Age			<.001
15–19	71 (12)	90 (30)	
20–24	174 (30)	97 (32)	
25–29	173 (30)	50 (17)	
30+	159 (28)	64 (21)	
Education			.1
Standard 7 or less	323 (56)	178 (59)	
Form 1–3	51 (9)	36 (12)	
Form 4 or higher	203 (35)	87 (29)	
Religion			.48
Muslim	457 (79)	233 (77)	
Christian	118 (20)	68 (23)	
Other/Missing	2 (0.4)	0 (0)	
Marital status			.008
Single/divorced/separated/widowed	421 (73)	244 (81)	
Married	156 (27)	57 (19)	
Intervention			.25
No	292 (51)	140 (47)	
Yes	285 (49)	161 (53)	
Willing to self-test			.12
No	159 (28)	98 (33)	
Yes	418 (72)	203 (67)	
HIV-related risk behaviors & risk perception			
Number of sex partners in the past 12 months			.41
None	30 (5)	11 (4)	
One	328 (57)	183 (61)	
Two or more	217 (38)	107 (36)	
HIV risk perception			.97
None	260 (45)	133 (44)	
Small	212 (37)	112 (37)	
Moderate/great	98 (17)	52 (17)	
Condom use			.25
None	261 (45)	146 (49)	
Sometimes	107 (18)	63 (21)	
Consistent	147 (25)	64 (21)	
No partner	35 (6)	12 (4)	
Sexual concurrency			.48
No	368 (64)	190 (63)	
Yes	164 (28)	95 (32)	

	Men who have tested for HIV before *n* = 577	Men who have never tested for HIV *n* = 301	Pearson chi-squared *p*-value
No partner	30 (5)	11 (4)	
Sexual & Social Network			
Discussed HIV test with at least one partner			<.001
No	111 (19)	113 (38)	
Yes	466 (81)	187 (62)	
HIV tested with at least one partner in the past 12 months		N/A	
No	406 (70)	N/A	
Yes	169 (29)	N/A	
Thinks at least one close friend HIV tested			<.001
No	105 (18)	103 (34)	
Yes	452 (78)	189 (63)	
At least one friend encouraged HIV testing			<.001
No	89 (15)	85 (28)	
Yes	486 (84)	214 (71)	

[*]Reported values are frequency (percentage).

Table 2.

Odds ratios from mixed effects logistic regression predicting willingness to self-test for HIV (yes/no) among ever-testers.

	Crude odds ratios	Demographic and HIV risk behavior	Demographic and social/sexual network
Demographic			
Age			
15–19	0.57 (0.29–1.14)	0.36 (0.17–0.78) **	0.38 (0.17–0.82) *
20–24	0.33 (0.19–0.56) ***	0.25 (0.14–0.45) ***	0.27 (0.15–0.50) ***
25–29	0.67 (0.39–1.17)	0.58 (0.33–1.04)	0.57 (0.32–1.04)
30+	1	1	1
Education			
Standard 7 or less	1	1	1
Form 1–3	1.54 (0.76–3.19)	2.32 (1.08–4.95) *	2.05 (0.96–4.35)
Form 4 or higher	1.56 (1.02–2.40) *	2.15 (1.36–3.40) **	2.16 (1.36–3.46) **
Religion			
Muslim	1	1	1
Christian	1.24 (0.76–2.03)	1.17 (0.71–1.94)	1.09 (0.65–1.81)
Marital status			
Single/divorced/separated/widowed	1	1	1
Married	1.28 (0.81–2.0)	0.86 (0.52–1.43)	0.81 (0.48–1.38)
Intervention			
No	1	1	1
Yes	0.77 (0.48–1.22)	0.80 (0.53–1.23)	0.79 (0.51–1.21)
HIV-related risk behavior and risk perception			
Number of sex partners in the past 12 months			
None	0.57 (0.25–1.29)	0.49 (0.21–1.14)	N/A
One	1.45 (0.98–2.17)	1.33 (0.87–2.03)	N/A
Two or more	1	1	N/A
HIV risk perception			
None	1	1	N/A
Small	0.74 (0.48–1.14)	0.68 (0.43–1.05)	N/A
Moderate/great	0.41 (0.25–0.69) **	0.40 (0.23–0.70) **	N/A

	Crude odds ratios	Demographic and HIV risk behavior	Demographic and social/sexual network
Condom use			
None	1	NA	NA
Sometimes	0.65 (0.39–1.08)	NA	NA
Consistent	1.18 (0.71–1.94)	NA	NA
No partner	0.44 (0.20–0.97) *	NA	NA
Sexual concurrency			
No	1	NA	NA
Yes	0.86 (0.56–1.31)	NA	NA
No partner	0.44 (0.21–0.94)	NA	NA
Sexual/Social Network			
Discussed HIV test with at least one partner			
No	1	N/A	1
Yes	2.43 (1.55–3.82) ***	N/A	2.22 (1.34–3.67) **
HIV tested with at least one partner in the past 12 months			
No	1	N/A	1
Yes	1.55 (1.00–2.42) *	N/A	1.26 (0.77–2.05)
Thinks at least one close friend HIV tested			
No	1	N/A	1
Yes	1.75 (1.09–2.82) *	N/A	1.04 (0.56–1.94)
At least one friend encouraged HIV testing			
No	1	N/A	1
Yes	2.15 (1.31 –3.53) **	N/A	2.23 (1.14–4.39) *

Values in parentheses are 95% confidence intervals for respective odds ratios.

*
$p < .05$,

**
$p < .01$,

***
$p < .001$.

Table 3.

Odds ratios from mixed effects logistic regression predicting willingness to self-test for HIV (yes/no) among never-testers.

	Crude odds ratios	Demographic and HIV risk behavior	Demographic and social/sexual network
Demographic			
Age			
15–19	0.90 (0.45–1.79)	0.99 (0.45–2.18)	1.17 (0.52–2.68)
20–24	1.36 (0.68–2.72)	1.56 (0.72–3.38)	1.75 (0.79–3.86)
25–29	1.11 (0.50–2.47)	1.05 (0.45–2.44)	1.09 (0.46–2.59)
30+	1	1	1
Education			
Standard 7 or less	1	1	
Form 1–3	1.74 (0.74–4.07)	1.92 (0.78–4.73)	1.49 (0.60–3.70)
Form 4 or higher	0.90 (0.52–1.54)	0.95 (0.53–1.70)	0.83 (0.45–1.52)
Religion			
Muslim	1	1	1
Christian	1.24 (0.67–2.31)	1.35 (0.71–2.58)	1.05 (0.54–2.07)
Marital status			
Single/divorced/separated/widowed	1	1	1
Married	1.18 (0.62–2.25)	1.33 (0.63–2.81)	1.07 (0.50–2.27)
Intervention			
No	1	1	1
Yes	0.85 (0.52–1.40)	0.81 (0.48–1.38)	0.74 (0.43–1.29)
HIV-related risk be haviors and risk perception			
Number of sex partners in the past 12 months			
None	1.18 (0.29–4.82)	1.48 (0.34–6.49)	N/A
One	0.87 (0.52–1.46)	0.85 (0.49–1.50)	N/A
Two or more	1	1	N/A
HIV risk perception			
None	1	1	N/A
Small	1.56 (0.90–2.73)	1.71 (0.95–3.08)	N/A
Moderate/great	0.74 (0.38–1.44)	0.78 (0.38–1.58)	N/A
Condom use			
None	1	NA	NA
Sometimes	1.88 (0.98–3.64)	NA	NA
Consistent	1.52 (0.80–2.86)	NA	NA
No partner	1.92 (0.50–7.45)	NA	NA
Sexual concurrency			
No	1	NA	NA
Yes	0.72 (0.43 1.21)	NA	NA
No partner	1.17 (0.30–4.62)	NA	NA

	Crude odds ratios	Demographic and HIV risk behavior	Demographic and social/sexual network
Sexual/Social Network			
Discussed HIV test with at least one partner			
No	1	N/A	1
Yes	2.52 (1.52–4.18) ***	N/A	2.36 (1.35–4.15) **
Thinks at least one close friend HIV tested			
No	1	N/A	1
Yes	1.20 (0.71 –2.04)	N/A	0.87 (0.45–1.70)
At least one friend encouraged HIV testing			
No	1	N/A	1
Yes	1.77 (1.02–3.05) *	N/A	1.55 (0.76–3.13)

Values in parentheses are 95% confidence intervals for respective odds ratios.

*
$p < .05$,

**
$p < .01$,

***
$p < .001$.