Changes in sexual risk behavior among MSM participating in a research cohort in coastal Kenya

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Objective: To describe changes in sexual risk behavior among Kenyan MSM who received regular risk reduction counseling (RRC).

Design: Data were derived from two cohorts of HIV-1-negative and HIV-1-positive MSM in Kenya. Behavioral data were collected at enrollment and at monthly or quarterly scheduled follow-up visits. At each visit, RRC was provided to all men and HIV-1 testing to seronegative men.

Methods: Random effects logistic and Poisson regression models with time since study entry as main variable of interest were used to evaluate changes in number of sex partners and unprotected sex in the past week, and insertive, receptive, and unprotected anal intercourse in the past 3 months. Analyses were adjusted for HIV-1-status, calendar year of follow-up, and several baseline characteristics. Trends over follow-up time were allowed to differ by HIV-1-status. Men were censored when they seroconverted for HIV.

Results: Number of regular and casual sex partners and unprotected anal intercourse decreased in both HIV-1-negative and HIV-1-positive men. Unprotected sex with both regular and casual sex partners decreased more strongly early in follow-up in HIV-1-positive men than in HIV-1-negative men. Decreases in insertive anal intercourse were found for HIV-1-positive men only, whereas decreases in receptive anal intercourse were found for HIV-1-negative men only.

Conclusion: MSM who were regularly exposed to RRC showed some reductions in sexual risk behavior, but it is uncertain if these reductions are sustained over time. As HIV-1 incidences in Kenyan MSM are very high, RRC should be supported by comprehensive biomedical interventions.

Keywords: HIV-1, Kenya, MSM, risk reduction counseling, sexual behavior
Introduction

Male same-sex behavior and HIV-1/sexually transmitted infections (STI) transmission among men who have sex with men (MSM) in sub-Saharan Africa (sSA) have been described recently [1–7], despite years of neglect of this population due to stigma and criminalization [1,8,9]. As a result of the belated recognition of African MSM as a key group for interventions, front-line health workers lack training that would enable them to communicate with MSM and provide education about HIV-1 transmission risk [10]. An important public health question concerns how best to promote HIV and STI screening and prevention services for MSM within diverse healthcare settings in sSA [8].

Behavior change interventions conducted in North-America or Western Europe have been efficacious in reducing the frequency of unprotected anal intercourse among MSM in the early years of the epidemic, but have not been sufficient to stop the HIV-epidemic in the era of combination antiretroviral therapy [10]. Typically, behavioral interventions focused on reducing unprotected anal intercourse, or numbers of sexual partners. The vast majority of these studies have taken place in settings with good access to tailored information. Given the difficulties African MSM face in accessing prevention interventions, an important question remains whether regular risk reduction counseling (RRC) with tailored health information can influence men's sexual risk behavior in sSA.

Since 2005 in Mtwapa, Kenya, we have followed HIV-1-negative MSM in an HIV-1 vaccine preparedness cohort study, and HIV-1-positive men who enrolled in a parallel cohort for care. Our objective was to evaluate whether participation in a study with regular RRC led to changes in partner numbers, unprotected sex, and insertive (IAI), receptive (RAI), or unprotected anal intercourse (UAI) reported by either HIV-1-negative or HIV-1-positive MSM.

Methods

Study population

In July 2005, a prospective cohort study of adult men and women at high risk for HIV-1 acquisition was initiated by the Key Populations Studies cluster of the Kenya Medical Research Institute-Wellcome Trust Research Programme (KEMRI-WTRP) in Kilifi, Kenya [11]. Participants were identified and recruited by a team of trained peer mobilizers who approached individuals via personal networks and at venues where they met with their partners and clients. HIV-1-negative adults aged 18 to 49 years were eligible for enrollment if they met any of the following criteria: any report of transactional sex, recent STI, multiple sexual partners, anal sex, or regular sex with an HIV-1-infected partner in the previous 3 months. Individuals who had prevalent HIV-1 at screening could enroll in a parallel cohort for HIV-1-infected participants. The present study focuses on MSM only, and includes all eligible men who enrolled in either cohort between July 2005 and December 2011 and who reported having had anal sex with another man at any point during follow-up. Only men with at least one follow-up visit were included in the analyses. Men who reported no sex during the past week (n = 61) on all of their study visits were excluded.

Study procedures

Eligible individuals were offered confidential HIV-1 counseling and testing at baseline. HIV-1-negative participants underwent HIV-1 testing at each study visit. Participants were followed monthly or quarterly, depending on their reported risk behavior and HIV-1 status (i.e., monthly for most HIV-1-negative men who reported RAI and otherwise quarterly). At enrollment and follow-up visits, participants completed face-to-face interviews with counselors to collect information on their sexual behavior, with data recorded on paper questionnaires (prior to 2009) or directly captured into a computer database (2009 onwards). A physical examination was performed at each visit. Participants who acquired HIV-1 during follow-up (n = 69) were excluded from this study from their first HIV-1-positive visit onwards, as they were enrolled into a separate protocol without detailed risk behavior assessments.

At each scheduled follow-up visit, brief RRC was conducted for all participants. These sessions lasted 20 minutes on average and included assessment of HIV-1 knowledge, risk behavior, and substance use; identification of what supports and hinders use of condoms and other STIs. All clinic counselors attended regular supervisory meetings that discussed challenges of RRC in the context of research, and attending to MSM in a society that largely rejects same-sex practices [12]. At each scheduled visit, condoms and water-based lubricants were provided. The studies were approved by the ethical review boards at KEMRI and, for the HIV-1-positive cohort, at the University of Washington. All participants provided written informed consent.

Variables

Seven primary sexual risk behavior outcomes were investigated. First, number of sexual partners in the past week was studied separately for regular partners (defined as 'boyfriend', 'girlfriend', or a spouse) and casual partners (defined as an occasional or new sex partner). Second, we studied unprotected sex in the past week during any type of sex separately for regular and casual partners. Sex was considered to be protected when the number of sexual...
acts where a condom was used was equal to the number of reported sexual acts, or when no sex in the past week was reported. Third, UAI (both insertive or receptive), any RAI (both protected and unprotected), and any IAI (both protected and unprotected) in the past 3 months were studied. UAI was dichotomized; men reporting ‘never’, ‘sometimes’ or ‘frequently’ using condoms during anal sex were considered as having UAI, and were compared to men reporting ‘always’ using condoms or not having had anal sex, as a marker of behavior that reduces the risk of HIV transmission.

At enrollment, we collected information on socio-demographic factors. Educational level was divided into two categories: primary school or lower vs. secondary school or higher. Married monogamous, polygamous, separated/divorced and widowed men were categorized as ever married, and other men as never married. Religion was categorized into Christian (Catholic, Protestant, other Christian), Muslim, and none/other. Employment was categorized into none, self, and formal employment. Men were asked at enrollment whether they had been previously tested for HIV-1. At every visit, questions on sex with women, group sex, receiving payment for sex, and paying for sex in the past 3 months were asked, and these variables were dichotomized. Information on alcohol use in the past month was also collected at every visit, and dichotomized as no vs. any use.

Statistical analyses
Participants were censored at the last study visit before December 2011 (end of study date), date of last study visit if lost to follow-up, or date of last HIV-1-negative study visit if they seroconverted during follow-up. Changes in sexual risk behavior over follow-up years after cohort enrollment were evaluated using multivariable random effects logistic regression for the five binary outcomes and multivariable random effects Poisson regression for the two count outcomes, allowing for smoothly varying trends via restricted cubic splines. The intercept and linear time trend were allowed to differ per individual via random effects. Time since study entry was the principal covariable. To allow for differential trends in sexual risk behavior on the first visit was discounted in the analyses. Additionally, odds ratios for the effect of follow-up time were calculated for dichotomous outcomes, comparing baseline (0 years of follow-up) and 4 years of follow-up to 1 year of follow-up, to consider possible rebounding of reported sexual behaviors. All statistical analyses were performed using Stata version 11.2 (StataCorp, College Station, Texas, USA), and the R statistical computing environment version 3.1.1 [14].

Results
Study population
Of the 776 MSM enrolled in either of the two cohorts, 215 (27.7%) did not return for any follow-up visits. Baseline characteristics from men with and without follow-up visits are presented in Supplementary Table 1, http://links.lww.com/QAD/A779. Men without follow-up tended to be younger than men with follow-up, had more casual sex partners in the past week, and more often had unprotected sex with casual partners.

In total, 561 MSM returned for at least one follow-up visit and were included in this study, of which 92 (16%) were HIV-1-positive and 469 (84%) were HIV-1-negative. The median number of follow-up visits per participant was 9 [interquartile range (IQR) 4–16] for HIV-1-negative and 8 (IQR 4–14) for HIV-1-positive men. The median follow-up time was 1.2 years (IQR 0.5–2.3), with a median of 1.1 years for HIV-1-negative and 1.8 years for HIV-1-positive men. Baseline demographic and sexual behavior characteristics of the 561 study participants are presented in Table 1, overall and by HIV-1-status. HIV-1-positive men were generally older than HIV-1-negative men, and less often had HIV-1 testing prior to study enrollment. Compared with HIV-1-negative men, HIV-1-positive men were less likely to
have had IAI, more likely to have had RAI, less likely to have had sex with women, and less likely to have paid for sex.

**Changes in sexual risk behavior**

**Number of sex partners in the past week**

HIV-1-negative and HIV-1-positive men showed a similar decrease in number of regular sex partners ($P$ interaction = 0.72), but the time trend itself was only significant for HIV-negative men, most likely due to the differences in sample size ($P < 0.001$ for HIV-1-negative men and $P = 0.14$ for HIV-1-positive men; Fig. 1a). There was a borderline significant difference in trend between HIV-1-negative and HIV-1-positive men for number of casual sex partners ($P = 0.09$). The number of casual partners seemed to decrease earlier in follow-up for
HIV-1-positive men, but the trend itself was not significant ($P = 0.36$), whereas it was significant for HIV-1-negative men ($P < 0.001$; Fig. 1b).

Unprotected sex in the past week
Patterns in unprotected sex with regular partners seemed to differ between HIV-1-negative and HIV-1-positive men ($P_{interaction} = 0.07$), with a decrease early in follow-up for HIV-1-positive men ($P = 0.005$; Fig. 2a). For HIV-1-negative men, there was a more smoothly decreasing trend, but this was overall not statistically significant ($P = 0.13$). Similar trends were seen for unprotected sex with casual partners ($P = 0.03$ for HIV-1-positive men and $P = 0.18$ for HIV-1-negative men, $P_{interaction} = 0.04$; Fig. 2b). Using 1 year of follow-up as reference time point, the odds of engaging in unprotected sex with regular partners were higher at entry for HIV-1-positive men [adjusted odds ratio (aOR) 2.84, 95% confidence interval (CI) 1.37–5.96]. A similar, but slightly weaker effect was seen for unprotected sex with casual partners at baseline (aOR 2.12, 95% CI 0.97–4.64). There was no further decrease observed in unprotected sex with regular or casual partners between 1 and 4 years of follow-up for HIV-1-positive men. For HIV-1-negative men, no significant decrease between baseline and 1 year of follow-up was seen for unprotected sex with regular or casual partners. We did see a decrease between 1 and 4 years of follow-up; HIV-1-negative men at 4 years of follow-up were less likely to have unprotected sex with regular partners than at 1 year of follow-up (aOR 0.52, 95% CI 0.28–0.94), and a similar trend was shown for unprotected sex with casual partners (aOR 0.53, 95% CI 0.28–1.01 for HIV-1-negative men at 4 years of follow-up).

Unprotected anal intercourse in the past 3 months
There was no significant interaction between HIV-1-status and follow-up years for UAI in the past 3 months ($P = 0.10$). Both HIV-1-negative and HIV-1-positive men showed a significant decrease in UAI over follow-up years ($P = 0.05$ for HIV-1-negative men and $P = 0.01$ for HIV-1-positive men; Fig. 3), with the largest change observed in the first 12 months. In accordance, the odds of engaging in UAI were higher at baseline compared to 1 year of follow-up for both HIV-1-negative and HIV-1-positive men (aOR 2.07, 95% CI 1.19–3.61 and aOR 2.63, 95% CI 1.12–6.20, respectively), but there was no significant further decline at 4 years of follow-up compared to 1 year of follow-up for either group (aOR 0.56, 95% CI 0.22–1.41 and aOR 0.61, 95% CI 0.20–1.93, respectively).

Insertive and receptive intercourse in the past 3 months
There was a significant difference in time trend between HIV-1-positive and HIV-1-negative men in IAI ($P < 0.001$). For both HIV-1-negative and HIV-1-positive men, there was no significant difference in time trend in IAI between men who paid for sex and men who did not (aOR 0.76 for HIV-1-negative and $P = 0.67$ for HIV-1-positive; Figs. 4a and b). As can be seen in Fig. 4b, there was a strong decline in IAI early in follow-up for HIV-1-positive men, but this decline was not statistically significant (aOR at baseline compared with 1 year of follow-up $2.27$, 95% CI $0.83–6.18$ for men who did not
pay for sex and aOR 3.89, 95% CI 0.37–41.07 for men who paid for sex). Between 1 and 4 years of follow-up, a further decline was seen for both groups, but only statistically significant for men who did not pay for sex (aOR at 4 years compared with 1 year of follow-up 0.23, 95% CI 0.06–0.86 for men who did not pay for sex and aOR 0.02, 95% CI 0.00–2.73 for men who paid for sex).

For HIV-1-negative men, no clear decline in IAI was seen (Fig. 4a).

For RAI, there was also a significant difference in time trend between HIV-1-positive and HIV-1-negative men (P = 0.01). For both HIV-1-negative and HIV-1-positive men, there was no statistically significant difference in time trend for RAI between men who received payment for sex and men who did not (P = 0.22 for HIV-1-negative and P = 0.11 for HIV-1-positive; Figs. 4c and d). RAI was very common among HIV-1-positive men; in those who were paid for sex it was close to 100%, and it did not significantly decline over time for either men who did or did not pay for sex. For HIV-1-negative men, there was an initial decline in RAI, both for men who did not receive payment for sex (aOR at baseline compared with 1 year of follow-up 9.24, 95% CI 3.06–27.92), and for men who did receive payment (aOR 2.98, 95% CI 1.02–8.70). For both groups, this decline continued between 1 and 4 years of follow-up (aOR at 4 years compared with 1 year of follow-up 0.04, 95% CI 0.00–0.30 for men who did not receive payment for sex and aOR 0.03, 95% CI 0.00–0.25 for men who did receive payment).

**Discussion**

This unique, longitudinal study on trends in sexual risk behavior among African MSM shows that it is possible to engage, enroll, and follow-up a relatively large number of MSM in a setting unsupportive of same-sex practices.
MSM enrolled in this study received regular RRC and, for seronegative men, HIV-1 testing, and reductions in sexual risk behavior were observed. Reductions were found in number of partners and any type of unprotected sex in the past week, and UAI in the past 3 months. In addition, HIV-1-positive men showed decreases in IAI, and HIV-1-negative men in RAI.

We found reductions in number of regular and casual sex partners and UAI for both HIV-1-positive and HIV-1-negative men. Reductions in number of partners were only statistically significant for HIV-1-negative men, but as trends in number of regular and casual sex partners were similar for HIV-1-negative and HIV-1-positive men, the lack of significance for HIV-1-positive men may be due to limited power for analyses in this smaller group. These decreases in partner numbers and UAI may be the effect of regular exposure to counseling. Elsewhere, studies have shown that behavioral interventions can result in reducing the number of partners and UAI [15–17], although most

Fig. 4. Trends in insertive and receptive anal intercourse in the past 3 months over follow-up time among men who have sex with men, Kilifi, Kenya, 2006–2011. (a, b) Insertive anal intercourse in the past 3 months among MSM who paid (dashed line) or not paid (solid line) for sex. (c, d) Receptive anal intercourse in the past 3 months among MSM who received payment (dashed line) or not received payment (solid line) for sex.
behavioral interventions have only had modest effects on self-reported behaviors and little or no impact on HIV-1 incidence [10]. However, as this is an observational study in which all men were counseled, we were not able to assess the effect of RRC on its own.

HIV-1-positive men showed stronger decreases in unprotected sex with both regular and casual sex partners in the past week early in follow-up than HIV-1-negative men. This may be due to the fact that 85% of HIV-1-positive men enrolled were not previously aware of their HIV-1-status. Several studies have shown that MSM decrease their sexual risk behavior immediately after becoming aware of their HIV-positive status [18–21].

We found reductions in IAI among HIV-1-positive men only, and significant reductions in RAI among HIV-1-negative men only. Because counseling conveys the message that risk of transmission is greatest with the HIV-positive ‘top’ (i.e., insertive) partner and risk of acquisition greatest for the HIV-negative ‘bottom’ (i.e., receptive) partner, these findings could suggest that counseling messages have been heeded, and men may be translating this knowledge into behavior to avoid transmission or acquisition of HIV. It is possible that ‘strategic positioning’, a risk reduction strategy in which men exclusively have unprotected RAI if they are HIV-positive and unprotected IAI if they are HIV-negative [22], is being employed by the men in this study. Qualitative data on the use of strategic positioning and other harm reduction strategies among Kenyan MSM are currently lacking.

There are several limitations to these findings. First, data on sexual behavior are self-reported, and may therefore be subject to social desirability bias. Decreases in self-reported risk behavior do not necessarily equal decreases in actual behavior, nor directly translate into a reduction in HIV or STI acquisition risk. The use of direct biomarkers (e.g., prostate-specific antigen) of sexual activity among MSM could be explored in future studies. HIV-1 or STI acquisition outcomes would also help assess the impact of behavior changes objectively. Second, only data from men with at least two study visits were included in this study, and over a quarter of our volunteers did not return for follow-up. Men with only one study visit reported more casual sex partners and more unprotected sex with casual sex partners at their enrollment visit when compared with men who had follow-up visits. This suggests that our study population may represent a somewhat less risky group. However, HIV-1 incidences reported in this study population have been very high [5], especially in the first 3 months following cohort enrolment compared to the remainder of cohort follow-up (16.0 per 100 person-years in the first 3 months vs. 5.2 per 100 person-years in the remainder of follow-up), suggesting that risk of HIV-1 acquisition was very high in this group of MSM, and dropped along with reports of higher risk behaviors [23]. Third, some HIV-1-positive men were treated with antiretroviral therapy (ART) during the study, which may have influenced sexual risk behavior. To exclude a possible influence of treatment on sexual behavior, we conducted sensitivity analyses excluding visits by HIV-1-positive individuals on ART (results not shown), and found comparable trends to those reported here. Fourth, HIV-seroconverters were censored at their last HIV-negative visit. This may have had a downward impact on the reported trends for HIV-negative men, as we miss information about the time period immediately leading up to seroconversion, generally a time period with higher rates of risk behavior. However, as men visited the study clinic at least every 3 months, the largest part of the time period before seroconversion is included in analyses, and we expect the downward effect to be limited. Last, the median follow-up time in this study was only 1.2 years. This may be too short to be able to show long-term effects of counseling, as we only have long-term follow-up data for a small group of men.

Participation in this study with regular exposure to RRC seems to have had some effects on reducing sexual risk behavior in both HIV-1 negative and positive MSM in coastal Kenya, but its lasting effect on sexual behavior, or its impact on HIV-1 and STI transmission remains unclear. Future research may consider evaluating comprehensive HIV interventions, including peer support, structural changes, and improved access to care for MSM. Given that HIV-1 incidences remain very high in MSM populations in Africa, biomedical interventions including both early ART and PrEP are urgently needed to mitigate the effect of ongoing HIV-1 transmission.

In conclusion, we were able to study longitudinal changes in sexual risk behavior among African MSM. These unique data indicated that participation in a study with regular exposure to counseling may have led to some reductions in self-reported sexual risk behavior. Importantly, this study shows that MSM can be engaged to participate in longitudinal research in Africa.

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Author contributions: L.M.M. and I.G.S. performed data analyses, interpreted the data, and wrote the draft article.
R.B.G. performed data analyses and contributed to the interpretation of the data. H.S.O. ensured data quality and performed initial data analysis. E.W. performed data acquisition and quality assurance. M.A.P., S.M.G., and E.S. designed the cohort studies and contributed to interpretation of the data. All authors have contributed to and approved the final version of the manuscript.

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Conflicts of interest

There are no conflicts of interest.

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