Decreased incidence of sexually transmitted diseases among trucking company workers in Kenya: results of a behavioural risk-reduction programme

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Objective: To establish a cohort of high-risk individuals suitable for HIV-prevention trials, and to measure changes in sexual behaviour and sexually transmitted disease (STD) incidence after a behavioural intervention.

Design: Prospective cohort study in trucking company depots in Mombasa, Kenya.

Participants: A total of 556 male HIV-seronegative employees of trucking companies.

Interventions: HIV serological testing, individual counselling, condom promotion, STD diagnosis and management.

Main outcome measures: Sexual risk behaviour and symptomatic STD incidence.

Results: Using time-trend modelling, significant declines in self-reported high-risk sexual behaviour were demonstrated during a 1-year follow-up. The percentage of men reporting any extramarital sex during the 3-month period prior to a follow-up visit decreased from 49% during the first quarter of follow-up to 36% during the last quarter ($P < 0.001$). The decline in reported female sex worker contact was from 12% to 6% ($P = 0.001$). Approximately 30% of men reported consistent condom use during extramarital sex and this percentage remained unchanged during the study period. The incidence of STD declined from 34 per 100 person years (PY) during the first quarter to 10 per 100 PY during the last quarter ($P = 0.001$). Significant reductions in gonorrhoea (15 to five cases per 100 PY, $P = 0.04$), non-gonococcal urethritis (10 to two cases per 100 PY, $P = 0.05$), and genital ulcer disease (nine to two cases per 100 PY, $P = 0.02$) were observed.

Conclusions: Among truck company workers who participated in a cohort study in Mombasa, Kenya, there was a significant decrease in sex with high-risk partners, but no change in condom use. The change in heterosexual risk behaviour was accompanied by a significant decrease in incidence of gonorrhoea, non-gonococcal urethritis, and genital ulcer disease.

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Introduction

It is estimated that over 30 million HIV infections will have occurred world-wide by the year 2000, within 20 years of the first case reports of AIDS in the USA [1]. AIDS is already the leading cause of adult death in some urban and rural areas of sub-Saharan Africa [2,3], and models of the course of the epidemic predict that this will soon be the case for many other parts of this region [4]. The importance of cofactors, such as ulcerative and non-ulcerative sexually transmitted diseases (STD) and uncircumcised status in men, in the rapid spread of the HIV epidemic among heterosexuals in east and central Africa is well documented [5,6]. Interventions to decrease the prevalence and incidence of STD in the general community have been targeted at STD high-frequency transmitter core groups, such as female commercial sex workers (CSW) and their clients [7]. Truck drivers have been identified as a male occupational group at high risk of STD and HIV acquisition, who may play an important role in dissemination of these infections because of their geographical mobility [8].

In the absence of an efficacious vaccine, there is a clear need to identify other practical interventions which will reduce HIV transmission. Behaviour change programmes, incorporating health education, risk-reduction counselling and condom promotion have been successful in decreasing HIV incidence in CSW in Africa and homosexual men in North America [9,10]. Little is known, however, about the ability of educational interventions to effect changes in sexual behaviour and incidence of HIV or STD in heterosexual male cohorts.

In 1993, a cohort of HIV-seronegative men who were at high risk of HIV infection and who would be suitable for future HIV-preventive vaccine trials was established in Mombasa, Kenya. A behavioural intervention programme was instituted which included risk-reduction counselling and condom promotion, at enrolment and at each follow-up visit. In this paper, changes in reported sexual risk behaviour and STD incidence during follow up are evaluated.

Materials and methods

Study population and procedures

Mombasa is a city of approximately half a million people and a major east-African sea port. Trucking companies which service trade routes throughout east–central Africa have terminals in Mombasa where trucks are maintained and loads assigned to drivers. Recruitment of a prospective cohort of male trucking company employees started in March 1993 as part of the Preparation for AIDS Vaccine Evaluation (PAVE) initiative of the US National Institutes of Health.

Rotating on-site clinics were held one morning each week in the depots of each of six of the largest trucking companies in Mombasa. The mobile health team consisted of physician, nurses, health educator, clerical assistant and driver. Informal group discussions were held by the health educator at each company visit for men interested in joining the project or requesting information on health-related issues. All of the health educators, nurses, and physicians received training in an HIV/STD counselling course by specialists from the University of Nairobi Department of Community Health, encompassing pre- and post-test HIV counselling, condom negotiation, demonstration, and promotion, and HIV/STD-risk reduction. The course was spread over a period of 3 months, with course work interspersed with in-service training provided by a professional counsellor employed by the project.

Risk-reduction health education materials, produced by the Kenyan Ministry of Health and local non-governmental organizations, were distributed. These materials contained information on HIV and STD transmission, actively promoted condom use, advocated a reduction in the number of sexual partners, and sought to heighten the perception of personal risk. A supply of free condoms was offered to each man, after demonstrations of condom use using penile models. Informed consent was obtained after individual pretest counselling and a 10-ml blood sample was drawn for HIV and syphilis serology. Each individual was given a return appointment a week later, at which time the physician provided results and post-test counselling. HIV-seronegative men were invited to enrol in the prospective cohort study. An enrolment questionnaire regarding demographic and occupational variables, medical history and sexual behaviour was completed and a physical examination, including genital examination, was performed. Subjects were informed that they would have open access to free primary healthcare, including STD diagnosis and management, at each mobile team visit.

Men returned for follow up at 3-month intervals, or as their work schedule allowed. At each follow-up visit, a questionnaire on interim sexual behaviour and medical history was completed, physical examination was performed, and a 10-ml blood sample was drawn for HIV serology. Further risk-reduction counselling and condom promotion was carried out at these follow-up visits, and 1 week later when they returned for results. Men with symptoms or signs of STD, at either scheduled or interim visits, underwent additional evaluation. Urethral discharges were investigated by Gram stain, culture for *Neisseria gonorrhoeae*, and antigen detection of *Chlamydia trachomatis*. Genital ulcers were evaluated

for the presence of *Haemophilus ducreyi* by culture. Syphilis serological testing was repeated on all subjects after 12 months of follow up.

Laboratory methods

Specimens were transported to the research laboratory at Coast Provincial General Hospital, Mombasa, Kenya for processing. Sera were tested by synthetic peptide enzyme-linked immunosorbent assay (ELISA) for HIV-1 and HIV-2 antibodies (Behring Werke, Marburg, Germany). Positive samples were confirmed for HIV-1 using a recombinant ELISA system (Recombigen, Cambridge Biotech Corporation, Worcester, Massachusetts, USA). Western blot assays (Cambridge Biotech Corporation, Worcester, Massachusetts, USA) were performed if the two ELISA produced discordant results, and to confirm all HIV seroconversions. Serological testing for syphilis with rapid plasma reagin card test (RPR; Becton-Dickinson, Cockeysville, Maryland, USA) and *Treponema pallidum* haemagglutination assay (TPHA; Becton-Dickinson, Cockeysville, Maryland, USA) was carried out on all subjects at enrolment. Active syphilis infection was defined by a positive RPR and TPHA. A negative RPR and positive TPHA provided evidence of past syphilis infection. RPR testing was performed at the 12-month follow-up visit, with TPHA confirmation if positive. Gonorrhoea was diagnosed by positive culture of urethral swab on modified Thayer–Martin media. Non-gonococcal urethritis was defined by detection of *C. trachomatis* antigen (Syva Microtrak Chlamydia enzyme immunoassay, San Jose, Calfornia, USA) or the presence of five or more polymorphonuclear cells per high-power field on a Gram-stained slide of urethral secretions, in the absence of *N. gonorrhoeae* infection. Genital ulcer disease was a clinical diagnosis, and *H. ducreyi* was cultured on activated charcoal media.

Statistical methods

Statistical Package for the Social Sciences for Windows, version 6.0 (SPSS, Chicago, Illinois, USA) was used to perform descriptive and comparative analyses, and S-PLUS (StatSci, Mathsoft, Seattle, Washington, USA) used for time-trend modelling techniques. For cross-sectional comparisons, the Wilcoxon rank-sum test was used to test differences for continuous variables and Pearson's χ^2 test and Fisher's exact test were used for categorical variables. Generalized estimating equations with a binomial link and exchangeable correlation structure were employed for examination of changes in the sexual behaviour variables over time, and generalized estimating equations with a Poisson link and exchangeable correlation structure were used to model changes in STD incidence [11]. Use of the exchangeable correlation structure was based on the assumption that there should be no difference over time in the correlation between observations made on the same man.

Results

Study population and enrolment characteristics

A total of 1195 men were screened for antibodies to HIV-1 between 1 March 1993 and 14 October 1994, of whom 206 (17%) were seropositive. A total of 856 HIV-seronegative men were enrolled in the prospective cohort study. Of the 133 seronegative men who were screened but not enrolled, 126 did not return for results. The remaining seven men declined to participate. No demographic or risk-profile characteristics are available from these 133 men.

Of those enrolled, 556 men returned for at least one follow-up visit. This represented 72% of 771 who were scheduled for follow-up on or before 14 October 1994. A total of 494 person–years (PY) of follow–up were accrued, and 1620 follow-up visits recorded. Mean follow-up was 326 days (range 21–588 days). The mean number of follow-up visits was 2.9 (range 1–8), and the mean interval between follow-up visits was 101 days (range 3–431 days).

There were no significant differences between men who did or who did not return for follow-up with regard to median age (29 versus 29), unmarried status (35% versus 37%), median age at first sex (both 15 years), lifetime history of sex with a female CSW (57% versus 57%), median number of sex partners in the previous year (two versus two), or history of condom use (52% versus 55%). There was a significant difference in occupational travel, with 37% of those men who travelled more than 2 weeks each month failing to return for follow up, compared with 25% of men who travelled two weeks or less each month ($P = 0.001$).

The enrolment demographic, occupational, behavioural and medical characteristics of the 556 participating men are detailed in Table 1. The median age was 29 years and 63% were married. The majority of men had completed primary education. Almost half of the cohort travelled in the course of their work, often for extended periods of time. Over 50% reported a history of sex with a female CSW and only 51% had ever used condoms. Fifty-nine per cent reported more than one sex partner in the previous year, and 20% reported unprotected sex with a CSW.

At first presentation, 20 men had a urethral discharge, including 14 (2.5%) with gonococcal infection and six (1.1%) with non-gonococcal urethritis. Eight (1.4%) men had genital ulcer disease, including three who were *H. ducreyi* culture positive. Nineteen (3.4%) men had serological evidence of active syphilis infection (RPR and TPHA positive).

Sexual behaviour and STD incidence during follow up

During follow-up, 53% (184) of married men reported

Table 1. Demographic, occupational, behavioural and medical characteristics at enrolment.

Characteristics at enrolment	n (%)*
Demographic	
Age, median (years)	29 (range 16–62)
Marital status	
Married	348 (63)
Never married	199 (36)
Widowed/divorced	9 (2)
Education, mean (years)	9.1 (range 0–16)
Religion	
Protestant	223 (40)
Catholic	190 (34)
Moslem	121 (22)
Other	22 (4)
Occupation	
Driver	62 (11)
Assistant driver	102 (18)
Mechanic	172 (31)
Ancillary worker	220 (40)
Travel	
No travel	299 (54)
< 15 days/month	142 (26)
≥ 15 days/month	115 (21)
Sexual behaviour	
Lifetime	
Age at first sex, median (years)	16
History of sex with CSW	314 (57)
History of condom use	286 (51)
Past 1 year	
Sex partners 0	19 (3)
1	213 (38)
2–5	270 (49)
> 5	54 (10)
Sex with CSW	168 (30)
Unprotected CSW sex	109 (20)
Sex with girlfriend or casual partner	311 (56)
Any unprotected extramarital sex	309 (56)
Other behaviour	
In past year used:	
Alcohol	262 (47)
Tobacco	215 (39)
Miraa†	84 (15)
Medical	
Uncircumcised	72 (13)

*Total n = 556. †Plant containing amphetamine-based substance. CSW, Female commercial sex worker.

extramarital sex, 42% (145) unprotected (without condom use) extramarital sex, 20% (71) CSW sex, and 16% (54) unprotected CSW sex. Forty-four per cent (152) of married men reported at least one 3-month period when they did not have sex with their wife, and they were significantly more likely to report sex with another partner during these periods [odds ratio (OR), 2.5; 95% confidence interval (CI), 1.8–3.4; $P < 0.001$)] or acquire an STD (OR, 4.9; 95% CI, 2.7–8.7; $P < 0.001$). Eighty-six percent (178) of unmarried men reported sex with any partner, 73% (152) unprotected sex, 27% (55) sex with a female CSW, and 15% (32) unprotected sex with a CSW. No sex with a male partner was reported.

Of the 126 men who reported sex with a CSW, 46 (36%) never used condoms, 40 (32%) sometimes used condoms, and 40 (32%) consistently used condoms. Of 323 men who reported sex with a girlfriend, 159 (49%) never used condoms, 116 (36%) sometimes used condoms, and 57 (18%) consistently used condoms. Significantly more men reported consistent condom use with CSW than with girlfriends ($P = 0.002$). Overall, condoms were used for 27% of sex acts with girlfriends and 50% of sex acts with a CSW.

In the course of follow-up, there were 20 seroconversions to HIV-1 (4.0 per 100 PY), 62 cases of gonorrhoea (12.6 per 100 PY), 37 cases of non-gonococcal urethritis (7.5 per 100 PY), and 35 cases of genital ulcer disease (7.1 per 100 PY), including seven that were *H. ducreyi* culture-positive. One incident syphilis infection was seen (0.3 out of 100 PY). Histories of an additional 117 episodes of urethral discharge and an additional 38 cases of genital ulcer disease which occurred between clinic visits were recorded. Men who travelled more than 2 weeks each month had significantly more STD than those with less occupational travel (risk ratio, 1.9; 95% CI, 1.5–2.6; $P < 0.001$).

Changes in risk behaviour and STD incidence during follow up

There were significant declines in the percentage of men reporting extramarital sex or sex with a female CSW during the prior 3-month period, as shown in Table 2 and Fig. 1. Statistical modelling indicates that the percentage reporting extramarital sex decreased from 49% during the first quarter to 36% during the last quarter of follow up ($P < 0.001$). The analogous decline for sex with a CSW was from 12% to 6% ($P = 0.001$). To determine if loss to follow-up was causing biased results (e.g., differential loss to follow-up of men with higher levels of risk behaviour would produce an artefactual decline), we modelled separately the

Table 2. Proportion of men with selected sexual behavioural variables by quarter of follow-up.

	n (%)						
Sexual behaviour	0–3 months	4–6 months	7–9 months	10–12 months	13–15 months	16+ months	*P* value of change
Any CSW sex	22/210 (10)	59/375 (16)	23/278 (8)	21/227 (9)	14/181 (8)	12/145 (8)	0.001
Any extramarital sex	105/210 (50)	189/375 (50)	126/278 (45)	104/227 (46)	71/181 (39)	58/145 (40)	< 0.001
Consistent condom use during extramarital sex	36/105 (34)	51/189 (27)	38/126 (30)	39/104 (38)	13/71 (18)	17/58 (29)	0.5

CSW, Female commercial sex worker.

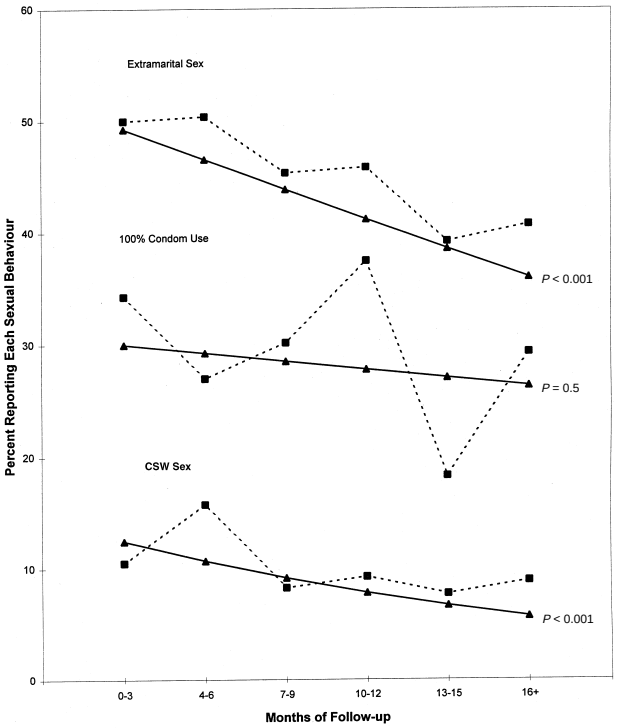

Fig. 1. Percentage of men who reported extramarital sex, sex with a female commercial sex worker and consistent (100%) condom use in the previous 3 months by quarter of follow up: statistical modelling of time trends. (■), Actual data; (▲), modelled data.

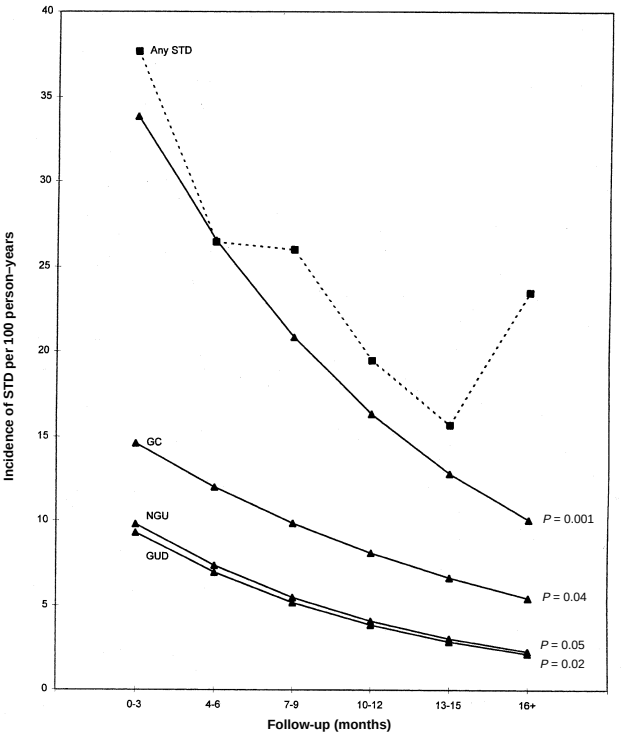

Fig. 2. Incidence of sexually transmitted diseases (STD) (GC, gonorrhoea; NGU, non-gonococcal urethritis; GUD, genital ulcer disease) diagnosed over follow-up time. (■), Actual data; (▲), modelled data.

trends in sexual behaviour of men who attended < 75% and ≥75% of their scheduled follow-up visits. In both subgroups, there were significant reductions in the percentage of men reporting extramarital sex ($P = 0.02$ and $P = 0.006$, respectively) and CSW sex ($P = 0.02$ for both).

These declines in high-risk sexual exposure were not accompanied by changes in condom use. As shown in Fig. 1, the percentage of men who reported consistent condom use during extramarital sex remained fairly constant at approximately 30% ($P = 0.5$). Men with < 75% and ≥ 75% follow-up compliance had similar rates of consistent extramarital condom use, and no significant changes were observed over time ($P = 0.2$ and $P = 0.9$ respectively). Average frequency of condom use and the percentage of men who reported ever using condoms with any partner type also remained fairly stable over time (data not shown).

Change in incidence of STD during follow-up quarter are shown in Fig. 2 and Table 3. There was a decrease in the modelled incidence of observed STD from 34 cases per 100 PY during the first quarter to 10 cases per 100 PY during the last quarter of follow-up ($P = 0.001$). Similar declines were seen when each of the STD of interest (gonorrhoea, non-gonococcal urethritis, and genital ulcer disease) were modelled sepa-

Table 3. Incidence of STD by quarter of follow up.

	No. of episodes of STD (incidence rate per 100 PY)						
STD	0–3 months PY = 135.3	4–6 months PY = 113.4	7–9 months PY = 92.3	10–12 months PY = 72.0	13–15 months PY = 51.0	16+ months PY = 29.8	*P* value of change
GC	24 (17.7)	10 (8.8)	13 (14.1)	7 (9.7)	3 (5.9)	5 (16.8)	0.04
NGU	14 (10.3)	10 (8.8)	6 (6.5)	3 (4.2)	3 (5.9)	1 (3.4)	0.05
GUD	13 (9.6)	10 (8.8)	5 (5.4)	4 (5.6)	2 (3.9)	1 (3.4)	0.02
Any observed STD	51 (37.7)	30 (26.5)	24 (26.0)	14 (19.4)	8 (15.7)	7 (23.5)	0.001
Any reported STD (between visits)	64 (47.3)	54 (47.6)	26 (28.2)	9 (12.5)	2 (3.9)	0 (0.0)	< 0.001
Any observed or reported STD	115 (85.0)	84 (74.1)	50 (54.2)	23 (31.9)	10 (19.6)	7 (23.5)	< 0.001

STD, Sexually transmitted disease; GC, gonorrhoea; NGU, non-gonococcal urethritis; GUD, genital ulcer disease; PY, person–years of follow up in a quarter.

rately or when self-reported STD symptoms (urethral discharge or genital ulcers) occurring between clinic visits were added to the model ($P < 0.001$). The incidence of observed STD underwent significant reductions in men with $< 75\%$ follow-up compliance (from 20% to 4%, $P = 0.05$) and $\geq 75\%$ follow-up compliance (from 47% to 11%, $P = 0.001$). No significant time trends were discernible with respect to HIV seroincidence, but the power of this study was insufficient to definitively address this issue.

Discussion

The baseline HIV seroprevalence of 17%, seroincidence of 4.0% per annum, and high incidence of other STD confirmed the high-risk nature of this occupational cohort. During the course of follow-up, significant changes in high-risk sexual behaviour were documented. In addition, significant decreases in incidence of both ulcerative and non-ulcerative STD provided objective evidence of behaviour change. The power of the study was insufficient to detect significant changes in HIV incidence. A prospective, randomized controlled trial in Tanzania, however, documented a reduction in HIV incidence with provision of STD diagnostic and treatment facilities at a community level [12]. Thus, it is plausible that decreased risk behaviour and STD incidence would lead to a discernible decrease in HIV acquisition in this occupational cohort over time.

Several limitations of this study should be noted. First, this study included STD evaluation only for symptomatic men, and hence provided an underestimate of STD incidence. Asymptomatic urethral infection is common in sub-Saharan Africa. In a cross-sectional survey of these trucking company employees, the prevalence of urethral infection with *N. gonorrhoeae*, *C. trachomatis*, or *Trichomonas vaginalis* was 8.3% in asymptomatic men [13]. The extent to which these asymptomatic infections increase susceptibility to HIV infection, or transmission of HIV to sex partners is unclear but in future studies it would be interesting to monitor changes in both symptomatic and asymptomatic STD. Secondly, this study included only HIV-seronegative men because the objective of establishing the cohort was to evaluate preventive interventions. The evaluation of behavioural interventions among HIV-seropositive men would be of great public health importance. Thirdly, the reported changes apply to a selected group of HIV-seronegative men, as there were 133 men who were screened but not enrolled, and a further 215 men who did not contribute to follow-up. Although men who did and who did not return for follow-up were similar for baseline characteristics except for occupational travel, it is possible that our results were biased. The high rate of loss to follow-up was due in part to loss of jobs within the truck companies. There were large fluctuations in the Kenyan currency in 1993, which temporarily decreased the volume of international trade, and adversely affected the transport industry.

It is recognized that men who migrate from their homes to find work participate in unsafe sexual practices [14]. In this study, men who reported sex with their wives in the previous 3 months were less likely to seek other partners, and less likely to become infected with an STD. Adult male rural-to-urban migration has become a feature of life in many developing countries. Although the economic root causes of this migration cannot be addressed by health or education sectors alone, the structure of adult male interventions should incorporate specific strategies to access migrant labourers, as they are often clients of CSW, an important urban male STD core group, and a source of spread of STD and HIV to rural areas [15].

No information was available on personal assessment of risk of HIV infection before enrolment and counselling, but during follow-up a subset of the cohort participated in a vaccine acceptability survey, and 86% stated that they felt at some degree of personal risk of AIDS [16]. This compares with only 8% of men with genital ulcer disease who were surveyed at an STD clinic in Nairobi in 1991 [17]. In that study, the factor most significantly associated with perception of personal risk was acquaintance with a person with AIDS. It is probable that the high perception of personal risk of HIV infection in our cohort played a significant role in decreasing risk behaviour [18]. As the effects of the epidemic become more widespread, the proportion of the general population with personal knowledge of AIDS through illness in a family member or friend will increase. This is likely to increase the receptivity of men to education and risk-reduction counselling, leading to behaviour change.

The absence of reported increases in condom use in any group in the cohort, despite active condom promotion and open access to unlimited free supplies, is a cause for concern, and a subject requiring further examination. Condom use varied significantly with different categories of sex partner in this study. Our results are consistent with those of a study of truck drivers in Tanzania which found that men were less likely to use condoms with regular partners, whom they classified as 'safe' [19]. This sense of security in men decreases the power of women to negotiate condom use, as they may be economically dependent on regular partners. Another study of factory workers in Tanzania reported no increase in overall condom use, but increased use with casual partners [20]. Men in this study were more likely to use condoms with sex partners they classified

as CSW than with partners they classified as girlfriends, and although condom use did not rise over time, it started at a higher level. As the HIV seroprevalence rises in communities, this situation becomes increasingly risky. Reported condom use increased in studies of HIV-discordant couples in Rwanda and Zaire, after an intervention of HIV serotesting and counselling [21,22]. It is likely that the HIV screening itself played a role in behaviour change in our cohort but, as we did not follow the men before serotesting, it is not possible to quantify that role. Our results highlight the difficulty in changing sexual behaviour of individuals once patterns have been established. Providing adolescents with condom handling and negotiation skills could facilitate condom negotiation for both males and females at the commencement of sexual activity and, in the long term, a generation of peer health educators and positive role models might be created.

This study shows that a climate favourable to behaviour change currently exists in this cohort of East-African men. How this climate can best be exploited to full benefit on a larger scale could be evaluated by randomized, controlled trials of programmes that include counselling, condom promotion, and service delivery systems in different occupational and community groups. The extent of study effects, cohort attrition, and return to high-risk behaviour could also be fully addressed in that context. In addition to behavioural intervention efficacy trials, identification of the most effective points of access and examination of cost-effectiveness issues should be carried out in order to ensure replicability. Exploration of partnerships with industry and private-sector employers might be possible, with intervention programmes paid for by industry, if they could be persuaded that a programme would be economically advantageous in the long term.

Even if a safe and efficacious HIV-preventive vaccine were to be developed soon, it would be overly optimistic to expect that HIV and STD transmission will be controlled in the near future. The need to effectively address the issue of sexual safety in both adults and adolescents in both urban and rural areas is urgent, especially in developing countries, where decisions on sexual relationships are often dominated by economic imperatives.

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