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Supporting Online Material for

HIV Decline Associated with Behavior Change in Eastern Zimbabwe

Simon Gregson,* Geoffrey P. Garnett, Constance A. Nyamukapa, Timothy B. Hallett, James J. C. Lewis, Peter R. Mason, Stephen K. Chandiwana, Roy M. Anderson

*To whom correspondence should be addressed. E-mail: Sajgregson@aol.com

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MATERIALS AND METHODS:

Study populations

We conducted a longitudinal open cohort survey of men aged 17-54 years and women aged 15-44 years in 12 communities representing 4 socio-economic population strata – small towns (2), large-scale tea, coffee and forestry estates (4), roadside trading settlements (2) and subsistence farming areas (4) – in Manicaland, Zimbabwe's eastern province. Individuals eligible for the study were identified in preliminary censuses of all households conducted in each site at each survey round.

The baseline survey was conducted in a phased manner (one site at a time) between July 1998 and February 2000. Regular household members who had slept in the household at least four nights in the last month and had been resident in the household at the same time one year earlier were eligible for enrolment in the study. To increase the statistical power of a randomised controlled trial of HIV prevention interventions (see below), a maximum of one member per marital union was selected at random for enrolment into the study. Local village community workers were employed as guides to identify and assist in locating households and individuals eligible for enrolment. Where eligible individuals were not available for interview at the first household visit, appointments were arranged and up to two further visits were made.

The follow-up survey was conducted three years later in each site. All baseline respondents, individuals who had previously been too young to participate but who now came within the eligible age-range, and individuals who were present but failed to meet the residence tests at both survey dates (e.g. visitors and persons who had stayed for less than four nights in the previous month at the time of each survey date) were eligible in the follow-up round. The restriction to one member per marital union applied at baseline was also applied at follow-up. Due to funding constraints, persons who had migrated into the study areas in the three-year inter-survey period were only eligible for interview at follow-up from site 5 onwards.

HIV surveillance among pregnant women attending for check-ups at antenatal clinics in the 12 study communities was carried out concurrently during each round of the survey. These surveys were conducted using standard antenatal clinic surveillance procedures(*1*) but were organised as part of the current investigation and were separate from Zimbabwe's national programme of routine antenatal surveillance of the HIV epidemic.

Written informed consent was sought as a condition of enrolment and continuation in the study. Prior ethical approval for the study was obtained from the Research Council of Zimbabwe - Number 02187 - and the Applied and Qualitative Research Ethics Committee in Oxford, United Kingdom - N97.039.

Specimen collection and laboratory diagnostics

Dried blood spot specimens were collected onto Whatman No. 3 filter paper and air-dried prior to storage at 4°C before being transported to the Biomedical Research and Training Institute laboratory in Harare. For long-term storage (>1 month), blood spots were stored at -20°C. For baseline studies, blood was eluted into phosphate-buffered saline (PBS) and antibodies to HIV were detected using a dipstick dot EIA (ICL-HIV 1 & 2 Dipstick,

Thailand) and a standard protocol (*2*). The ICL Dipstick has been evaluated in Zimbabwe, and was shown to have a high sensitivity and specificity (99.6% in each case) (*3*). All positives and a 10% sample of negatives were confirmed using a plate EIA (Abbott 3rd Generation HIV 1 & 2 EIA, USA or Genelavia MIXT HIV1&2, Sanofi Diagnostics Pasteur S.A., France). There were no discrepancies between results using the dot EIA and the plate EIA. For follow-up studies, a similar protocol was followed. Only the samples from those participants recorded as being HIV seronegative at baseline were tested. At the time of follow-up, the Thai dot-EIA was no longer available, and an alternative commercially available test using similar technology (Combaids-HIV-1 & 2 Dipstick, India) was used. This test has also been evaluated to have a high sensitivity (>99.9%) by the World Health Organisation, and in a small in-house evaluation, there was 100% concordance between the results from 160 positive and negative samples tested by both the Thai and the Indian dot-EIAs. Where seroconversion was indicated, the frozen stored baseline sample was retested to confirm the original negative result using the same (Indian) dot EIA test. Where the baseline result remained negative, the Abbott EIA test was used to confirm both baseline and follow-up results. The Biomedical Research and Training Institute laboratory test results are routinely evaluated in the Zimbabwe National Quality Assurance Programme (ZINQAP). Apart from the principal investigators (based in Harare and Oxford) and research nurses given permission by participants requesting voluntary counselling and testing, all research personnel remained blind to the HIV status of individual participants.

Sexual behaviour data

Participants were interviewed using a structured questionnaire on socio-demographic characteristics and sexual relationships. Questions on sexual relationships asked at both survey visits covered age at first sex, number of lifetime partners (sub-divided into two questions on numbers of regular and casual partners in the follow-up survey round),

number of new partners in the previous year, number of partners in the previous month, number of current partners (defined as persons with whom the respondent had had sex and considered him- or herself to be still in an ongoing sexual relationship), and detailed information on up to two most recent sexual partners in the previous month. The latter information included whether the partner had been a regular or casual partner and number of sex acts and condom use in the previous two weeks. Partnerships were taken to be regular if they had lasted for 12 months or more; otherwise, they were treated as being casual. Estimates of consistent condom use were obtained by combining data from the two separate questions on number of sex acts in the past two weeks and number of times condoms were used during these sex acts. In addition, in the follow-up survey, respondents were asked to report numbers of regular and casual sexual partners in the past three years - i.e. since the previous interview date.

Previous research in Manicaland revealed a reluctance to disclose accurate personal information (*4*). To promote more complete disclosure, in the baseline survey, an informal confidential voting interview (ICVI) method was used for questions on sexual relationships in three-quarters of the interviews with literate respondents (selected at random). This method provides the confidentiality associated with fuller disclosure in postal self-completion questionnaires or computer-assisted interviews (*5*), in a way that is practicable in less developed settings (*6*). Illiterate respondents (8%) were all interviewed in standard face-to-face interviews. In the follow-up survey, behaviour data were collected from re-interviewees using the same method as had been employed at baseline. All new literate respondents were interviewed using the ICVI method. These arrangements led to an increase in the overall proportion of respondents interviewed using the ICVI method from 73% at baseline to 79% at follow-up. Respondents typically report greater risk behaviour when interviewed by ICVI (*6, 7*). Therefore, unadjusted reductions in risk behaviour observed in the study will be conservative.

Enumerators (social work and sociology graduates) were trained to introduce themselves and the project thoroughly, to spend time building a good rapport with respondents, to adopt an informal, flexible and non-prejudicial approach, and to explain the confidentiality procedures carefully.

Data analysis

Data entry and validation were conducted using custom-made forms created in SPSS-PC. Data analysis used the *STATA* 7.0 statistical package (*8*).

Participation rates

The household participation rate at each survey round was calculated as the percentage of households identified in the census that were enumerated. Households in each study site were identified initially by local village community health workers. Individual participation rates were calculated at baseline by using enumerators' assessments of whether members of households enumerated in the census met the criteria for selection for individual interview. In the follow-up survey, for the purposes of making a valid comparison with the baseline data, a modified procedure was used whereby only individuals who met the baseline criteria – in terms of age and household residence - at the date of the follow-up visit were treated as meeting the selection criteria. Five hundred and thirty-seven individuals recorded as no longer being members of households enumerated at baseline were interviewed in the household census conducted at follow-up. To increase statistical power to correctly detect differences between sub-groups, these individuals were included in the analyses presented in this paper on the grounds that, if they were present to be interviewed at follow-up, they were most likely still resident in the study areas. This interpretation is supported by data from the individual interviews in which only 3% (17/537) of these respondents reported that they were visitors to the

village where the interview was conducted. The principal substantive findings of statistically significant declines in HIV prevalence, overall, and in men and women, separately, still hold if these cases are removed from the analysis.

In the computations given in Table S4, follow-up rates in the closed cohort were calculated as the percentages of baseline respondents known to be still alive at follow-up who were re-interviewed.

On this basis, 98% (8,211/8,376) and 94% (7,102/7,543) of the households identified in the survey areas at baseline and at follow-up, respectively, were enumerated. Male and female participation rates were 78% (4,320/5,561) and 80% (5,134/6,419) at baseline and 77% (3,047/3,958) and 80% (3,972/4,936) at follow-up, respectively. Fifty-four per cent (2,242/4,142) of the males and 66% (3,265/4,922) of the females interviewed at baseline - and not known to have died subsequently - were re-interviewed at follow-up. Out-migration was the principal reason for loss-to-follow-up – this reason was given directly by village guides in 56% of cases and the individuals or their households could not be located in a further 42% of cases. Only 1% of baseline respondents declined to participate in the follow-up interviews. The participation and follow-up rates obtained in the study compared well with those achieved in previous similar investigations (Table S1).

The overall size of the population enumerated was reduced from 9,454 to 7,019 during the inter-survey period. This resulted from out-migration, the exclusion from the study of individuals migrating into the first four communities, and changes in employment and migration patterns caused by Zimbabwe's land resettlement programme and substantial shrinkage in the formal sector economy. However, as is noted in the article, subsequent out-migrants did not have a higher HIV prevalence at baseline than non-migrants. At follow-up, HIV prevalence in recent migrants was lower than in long-term residents - 18.6% versus 22.6% in the eight sites where migrants and residents were both

enumerated. Thus, the unadjusted comparison of HIV prevalence provides a conservative estimate of the decline that occurred between the two survey rounds.

The numbers of pregnant women aged 15-44 years who were interviewed in the antenatal surveys were 1,215 in 1998-2000 and 1,232 in 2001-2003.

Tests for change in HIV prevalence

Evidence for declines in HIV prevalence between the two survey rounds in the general population (Tables S2-S3) and the antenatal clinic samples was assessed using logistic regression to calculate odds ratios adjusted for the changes in the age-group-, socio-economic location- and duration of residence-composition of the population. Three-year age-groups were used to distinguish changes occurring within successive age-cohorts to match the three-year interval between survey rounds.

For the comparisons of HIV prevalence between survey rounds by age and sex (Fig. 1) and within the closed cohort (Table S4), exact confidence intervals were calculated based on a Binomial distribution.

For the analysis of the contributions of mortality and HIV incidence to changes in HIV prevalence within the closed cohort, HIV incidence was calculated per 100 years of estimated exposure to risk amongst individuals uninfected at baseline. Each individual who sero-converted in the inter-survey period was taken to have become infected at the mid-point between the date of baseline interview and the date of follow-up interview. Mortality estimates for HIV-infected individuals and for HIV-uninfected individuals were based on HIV infection status at baseline. Periods of exposure to the risk of dying for individuals who died during the inter-survey period were calculated using dates of death recorded at follow-up. For individuals who were interviewed, refused, resident but

not available for interview, or known to be sick or in hospital at the date of follow-up, the period of exposure was taken to be the inter-survey period. For individuals who were said to have out-migrated or whose households could not be located, the exposure period was taken to be one and a half years. The mortality rates calculated in this way are probably conservative since some individuals – particularly those from the town and estate communities – almost certainly out-migrated for reasons associated with illness.

The statistical significance of the number of sites within which declines in HIV prevalence were observed between the two survey rounds was tested under the null hypothesis of a Binomial distribution of 12 sites with 6 declining and 6 increasing (exact, two-tailed tests).

Effective Reproduction Number, R_t

The effective Reproductive Number, R_t, measures the number of secondary infections arising from each primary infection at time t in an HIV epidemic (*9*). A value of R_t less than 1 indicates that an HIV epidemic has been in a period of decline. An approximation for the effective Reproduction Number R_t can be obtained using the formula:

$$R_t \approx \{ G(t,t+n) / n \} D / F(t)$$

where $G(t,t+n)$ is the number of new HIV infections occurring between time t and time $t+n$, D is the duration of infectiousness in an infected person, and $F(t)$ is the number of infected people in the population at time t. This formula was applied to the data from Zimbabwe by setting the number of years of observation, n, equal to three years and by assuming an estimated duration of infectiousness in an infected person, D, of ten years. Movement out of and into the study communities will cause incident infections beyond these communities; but this mobility could also mean that some of the incident infections

we observed were acquired elsewhere and brought back into the study communities. In our calculations of R_t, we assumed that the baseline prevalence and consequent incidence is representative of what is occurring in the study communities. Data for the sites (1-4) for which in-migrants were not enrolled into the study in the follow-up survey were excluded from the calculations of R_t.

HIV incidence and number of sexual partners in the inter-survey period

Evidence for association between number of sexual partnerships and risk of HIV infection during the inter-survey period was assessed separately for males and females using Cox proportional-hazard models with controls for the stratification of the population by socio-economic location. All sexually active men (n=1,455) and women (n=1,967) uninfected with HIV at baseline, for whom data on HIV infection status at follow-up and number of sexual partners during the inter-survey period were available, were included in this analysis. Separate tests were conducted for: (i) increased risk of HIV infection associated with multiple sexual partners during the inter-survey period compared with having had a single partner, and (ii) for a linear increase in risk of HIV infection associated with increasing number of sexual partners during the inter-survey period. Consistent condom use in casual partnerships lessened the risk of HIV infection in men with such partners (AOR, 0.38; 95% CI, 0.15-0.99) and was therefore controlled for in the analyses for males.

Tests for change in sexual behaviour

Data on age at first sex were treated as time-to-event data with individuals 'surviving' as they age until their first sexual experience. For respondents who reported never having had sex, survival times until first sex were treated as censored. To provide a valid comparison over the three year inter-survey time interval, analysis was restricted to the

experience of males aged 17-19 years and females aged 15-17 years at baseline and the mutually exclusive groups of males and females in the same age-groups at follow-up. In addition, at each round of the survey, we excluded those who had first had sex more than three years previously, since the experience of individuals who fell into this category at follow-up could not have been influenced by conditions pertaining during the three-year inter-survey period. Despite these exclusions, the data utilised provide good statistical power since the median age at first sex is 17 years for both sexes and hence many individuals will be becoming sexually active at the ages examined. Cox proportional-hazard models were used to compare the hazard of first sex at baseline and follow-up, separately for males and females, with adjustment made for whether or not individuals had migrated into the study areas in the last three years and the type of study site.

Tests for difference in numbers of sexual partners over varying time periods reported at and between baseline and follow-up interviews were conducted using negative binomial regression models adjusting for three-year age-group, socio-economic location, marital status, three-year duration of residence, literacy and mode of interview. Logistic regression models with adjustments for the same variables were used in tests for difference in the last or previous sexual partner in the past month having been a casual partner and (separately) for unprotected sex with recent casual and regular partners. In the latter tests, a measure of consistent condom use was calculated from the data on the number of sex acts in the previous two weeks and the number of times condoms were used throughout in these sex acts. Where an individual reported having not used condoms in all sex acts with casual partners or with regular partners in the past two weeks, this individual was taken to have had unprotected sex with a recent partner of that type.

The estimates for the contribution of AIDS-associated mortality to observed reductions in sexual partner change were calculated by comparing reports of numbers of new sexual partners in the 12 months prior to interview in each survey round. In this comparison, it

was assumed that individuals who died between survey rounds would have had the same numbers of new sexual partners in the 12 months prior to follow-up as they had reported for the same period prior to baseline.

SUPPORTING TEXT:

Comparison of the decline in HIV prevalence observed in the general population with that seen in local antenatal clinic attendees

The pattern of change in HIV prevalence by age observed in women attending antenatal clinics in the study communities is illustrated in Fig. S1. The declines in HIV prevalence in young women attending antenatal clinics were more modest than those seen in the general population, from 18.4% to 13.1% (29%) in women aged 15-24 years (Fig. S1); almost certainly because pregnancy is highly selective for more extensive early sexual activity (*10*).

National decline in HIV prevalence in women attending antenatal clinics

The declines in HIV prevalence in the general population and in women attending antenatal clinics observed in the study sites in Manicaland are consistent with declines seen in national antenatal clinic surveillance data. HIV prevalence in women attending for routine antenatal check-ups at the 19 clinics followed in the national HIV surveillance system fell from 32.1% [95% CI, 31.5%-32.7%] in 2000 to 29.8% [29.2%-30.4%] in 2002 and 23.8% [23.3%-24.3%] in 2004 (*11, 12*). In the capital city of Harare, HIV prevalence in pregnant women peaked at 35% towards the end of 1998, decreasing to 25% by 2002 (*11*).

In Zimbabwe, as a whole, the estimated annual number of condoms distributed increased from 21.5 million in 1990 to 49.5 million in 2000 and 81.1 million in 2004 (*11*). Numbers

of clients taking up voluntary counselling and testing services increased from 2,217 in 1999 to 448,598 in 2004. In 2000, a National AIDS Council was established to coordinate a multi-sectoral response to the HIV epidemic with finance from an "AIDS Levy", effectively an extra 3% on income tax. Funds are channelled through District AIDS Action Committees for disbursement at Ward and Village level and support grassroots initiatives on HIV prevention, home-based care, orphan care and impact mitigation.

Increase in HIV prevalence in the closed cohort

HIV prevalence in the closed cohort increased between the two rounds of the survey (Table S4) despite there being a greater number of deaths of HIV-positive individuals (i.e. 291) than new HIV infections (221). The principal reason for this is that deaths were measured in the entire cohort of individuals who were interviewed at baseline whereas HIV incidence (and prevalence) could only be measured in members of the cohort who were seen again at follow-up. If we assume that HIV incidence in individuals who were uninfected at baseline, but subsequently lost to follow-up, was the same as HIV incidence in those who were seen again and re-tested, we obtain a total of 303 new infections - which exceeds the 291 reported deaths.

HIV prevention activities in the study areas

A community-randomised controlled trial of peer education, condom distribution and enhanced syndromic management and systemic (holistic) counselling for sexually transmitted infection patients was conducted in the study areas over the period between the two survey rounds. HIV incidence in the intervention sites was not reduced compared to that in the control sites [AOR, 1.27, 95% CI, 0.92-1.75] and there was no evidence for more rapid sexual behaviour change in the intervention sites (*13*).

For reasons of research ethics, participants in both intervention and control communities received free information about HIV, AIDS and sexually transmitted infections, access to free treatment for sexually transmitted infections provided by a research nurse, and access to a free voluntary counselling and testing for HIV (VCT) service provided by the project. Take-up of the VCT service was low (under 2%) and the remaining services were also available locally from Ministry of Health and non-governmental organisations.

In other respects, both intervention and control communities received similar HIV control activities to those being implemented elsewhere in Zimbabwe and the decline in HIV prevalence was particularly strong in recent migrants into the study communities (Table S3).

Social desirability bias and reliability of estimates for sexual behaviour change

HIV prevalence among study participants who reported not yet having started sex – an indication of false reporting of behaviours - at baseline and follow-up interviews were 0.58% and 0.40%, for males aged 17-19 years, respectively, and 1.51% and 0.81%, for females aged 15-17 years. These levels are very low given the high HIV prevalence in the study populations as a whole and the fact that they decline rather than increase over time indicates that the delay in onset of sexual activity recorded in the study is unlikely to reflect an increase in social desirability bias.

The mean number of lifetime sexual partners reported by males aged 17-54 years in successive rounds of the survey fell from 8.42 at baseline to 6.92 at follow-up (Table S6). However, men in the closed cohort with sexual experience prior to baseline reported fewer lifetime sexual partners on average at follow-up (7.85) than they had done at baseline (8.47). This may reflect an increase in social desirability bias over time. If so,

the reductions in reports of recent high-risk sexual activity for HIV transmission observed in the study could overstate the genuine changes in behaviour that have occurred. However, we also found that inconsistent reports - defined as reporting fewer lifetime sexual partners at follow-up interview than at baseline interview – among members of the closed cohort were positively associated with number of lifetime partners reported at baseline [AOR, 1.10, 95% CI, 1.08-1.13] and with number of new partners in the past year reported at follow-up [AOR, 1.06, 95% CI, 1.01-1.12]. This suggests that at least some of the discrepancy can be accounted for by increasing recall bias with age amongst males with high levels of sexual partner change. Random mistakes associated with the use of the ICVI method (*7*) will also have contributed to the inconsistent reports of numbers of lifetime sexual partners. Finally, the question on number of lifetime sexual partners asked at baseline was separated into two separate questions on number of regular sexual partners and number of casual sexual partners in the questionnaire for the follow-up survey. The requirement to distinguish casual partners from regular partners could also have contributed to the reduction in total number of lifetime sexual partners recorded amongst men in the closed cohort.

The mean number of lifetime sexual partners reported by women aged 15-44 years in successive rounds of the survey increased from 2.11 at baseline to 2.61 at follow-up whilst women in the closed cohort recorded an increase from 2.09 to 2.64. These increases were also concentrated amongst the smaller fraction of women who report high numbers of lifetime sexual partners and could also be partly explained by changes in recall bias.

Fig. S1: Change in HIV prevalence in pregnant women by age-group, over a three-year inter-survey period, 1998-2000 to 2001-2003, Manicaland, Zimbabwe. Error bars represent 95% CI around the sample mean

Fig. S2: Hazards ratio (with 95% CI) for incident HIV infection by reported number of sexual partners, over a three-year inter-survey period, 1998-2000 to 2001-2003, Manicaland, Zimbabwe: (A) Men, aged 17-54 years;

(B) Women, aged 15-44 years. Histograms show distributions of men and women by reported number of sexual partners in the inter-survey period.

Fig. S3: Comparison of sexual behaviours reported in the baseline (1998-2000) and follow-up (2001-2003) rounds of an open cohort survey, Manicaland, Zimbabwe. Kaplan-Meier plots, adjusted for migrant status and site type, of the proportions of men, aged 17-19 years, and women, aged 15-17 years, who reported not having started sex at each exact age between 14 and 19 years (men) and 12 and 17 years (women).

Table S1: Participation (panel (a)) and follow-up (panel (b)) rates in selected large-scale population-based HIV sero-surveys

Table S2: Comparison of HIV prevalence in 1998-2000 versus 2001-2003 by sex and three-year age-group, Manicaland, Zimbabwe

Table S3: Comparison of HIV prevalence in 1998-2000 versus 2001-2003 by socio-demographic status, Manicaland, Zimbabwe

Table S4: Components of change in HIV prevalence in a closed cohort of adults followed for three years, Manicaland, Zimbabwe

Table S5: Comparison of sexual behaviour indicators, 1998-2000 versus 2001-2003, Manicaland, Zimbabwe

Table S6: Comparison of number of lifetime sexual partners reported by male and female members of the open and closed cohorts who reported sexual experience at baseline: 1998-2000 versus 2001-2003

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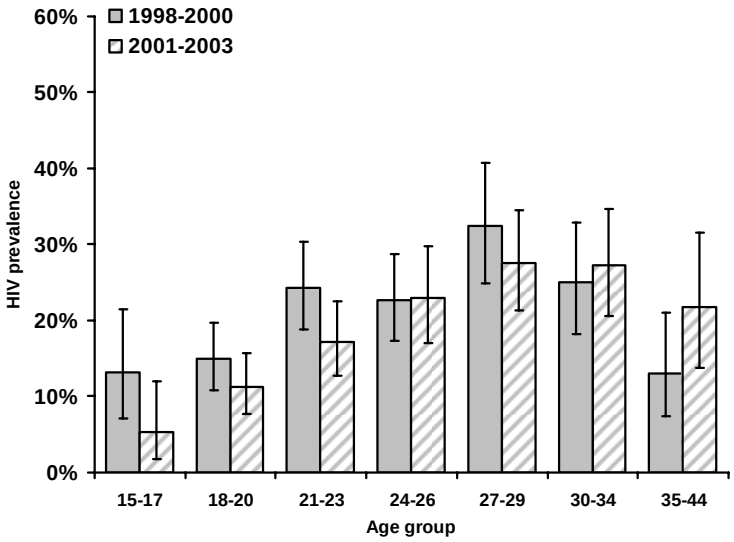
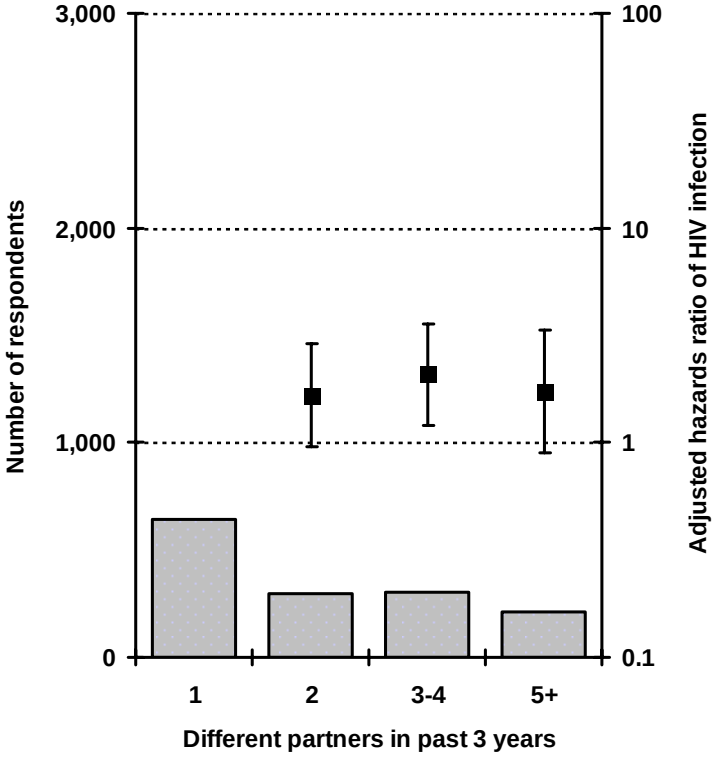
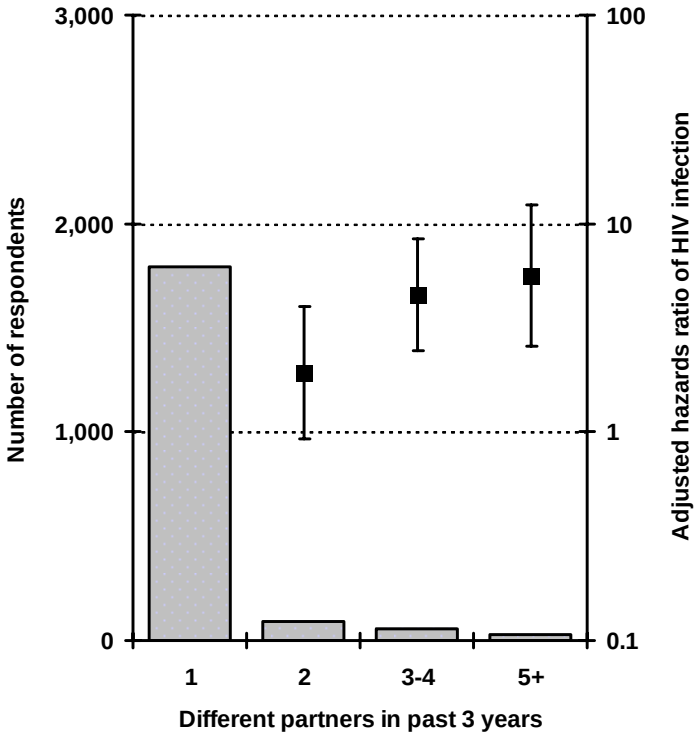
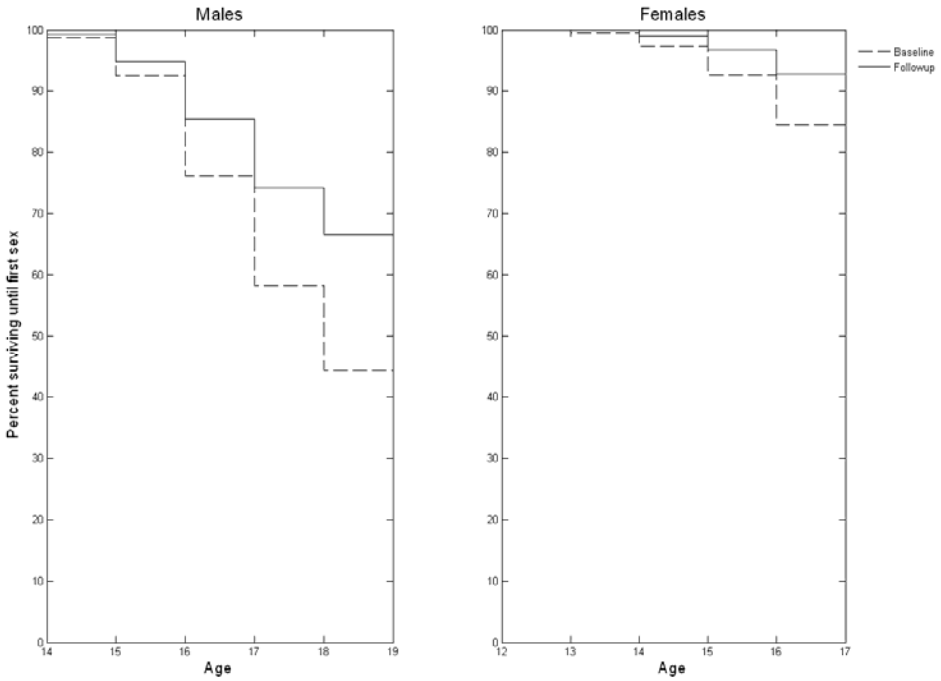

60%
50%
40%
30%
20%
10%
0%
HIV prevalence
1998-2000
2001-2003
15-17
18-20
21-23
24-26
27-29
30-34
35-44
Age group


3,000
2,000
1,000
0
100
10
1
0.1
Number of respondents
Adjusted hazards ratio of HIV infection
1
2
3-4
5+
Different partners in past 3 years


3,000
2,000
1,000
0
100
10
1
0.1
Number of respondents
Adjusted hazards ratio of HIV infection
1
2
3-4
5+
Different partners in past 3 years


Males
Females
Percent surviving until first sex
Age
Age
Baseline
Followup

Study	Publication reference	Survey round(s)	Types of data collected	Participation rate†
Current study	-	1-2	HIV & sexual behaviour	76%
British National Survey of Sexual Attitudes & Lifestyles	Johnson et al., Nature, 1992	Single round	Sexual behaviour	63%
Mwanza Study, Tanzania	Grosskurth et al., Lancet, 1995	Baseline	HIV & sexual behaviour	80%
Rakai Study, Uganda	Wawer et al., Lancet, 1999	1-2	HIV & sexual behaviour	78%
Masaka Study, Uganda	Kamali et al., Lancet, 2003	1-2	HIV & sexual behaviour	72%
Kisesa Study, Tanzania	Mwaluko et al., AIDS, 2003	1-2	HIV & sexual behaviour	76%
Mali Demographic & Health Survey 2001	MEASURE Evaluation	Single round	HIV & sexual behaviour	81%
Zambia Demographic & Health Survey 2002	MEASURE Evaluation	Single round	HIV & sexual behaviour	77%
Kenya Demographic & Health Survey 2003	MEASURE Evaluation	Single round	HIV & sexual behaviour	73%

† In each case, these take into account estimates of missed households as well as eligible individuals within enumerated households who were not interviewed. Average participation rates are given for multi-round surveys.

Table S1(a): **Participation rates in single round and serial cross-sectional surveys for levels and trends of HIV infection and associated behaviours**

Study	Publication reference	Survey round(s)	Duration of follow-up	Overall follow-up rate	Loss to follow-up per annum
Current study	-	1-2	3 years	61%	(15%)
Mwanza Study, Tanzania	Grosskurth et al., Lancet, 1995	1-2	2 years	71%	(16%)
Rakai Study, Uganda	Wawer et al., Lancet, 1999	1-2	10 months	74%	(30%)
Masaka Study, Uganda	Kamali et al., Lancet, 2003	1-2	2 1/4 years	61%	(20%)
Kisesa Study, Tanzania	Mwaluko et al., AIDS, 2003	1-2	2 years	69%	(17%)
Kisesa Study, Tanzania	Mwaluko et al., AIDS, 2003	2-3	3 years	52%	(20%)

Table S1(b): **Follow-up rates in closed cohort studies for measurement of HIV incidence and mortality**

Population sub-group	1998-2000		2001-2003		Test for difference		
	%	n	%	n	OR*	(95% CI)	p
Overall	23.0	9454	20.5	7019	0.87	(0.80-0.95)	0.001
Males	19.5	4320	18.2	3047	0.84	(0.74-0.96)	0.010
Females	25.9	5134	22.3	3972	0.88	(0.79-0.98)	0.015
Males							
17	0.5	376	0.5	200	1.02	(0.09-12.02)	0.990
18-20	2.3	907	0.8	644	0.38	(0.14-1.04)	0.059
21-23	7.2	640	4.7	424	0.66	(0.38-1.14)	0.136
24-26	22.0	610	13.8	347	0.58	(0.40-0.84)	0.004
27-29	28.2	365	25.5	330	0.87	(0.61-1.23)	0.420
30-32	45.9	283	32.2	227	0.54	(0.37-0.78)	0.001
33-35	47.9	240	47.5	158	1.07	(0.70-1.64)	0.745
36-38	38.6	215	45.6	158	1.33	(0.83-2.03)	0.183
39-41	39.7	184	35.0	140	0.82	(0.51-1.32)	0.414
42-44	28.1	135	37.3	126	1.58	(0.93-2.71)	0.094
45-47	33.6	122	21.5	93	0.53	(0.28-0.99)	0.047
48-50	28.8	104	34.9	106	1.31	(0.72-2.38)	0.373
51-54	18.7	139	25.5	94	1.74	(0.89-3.38)	0.104
Females							
15-17	4.0	755	1.4	801	0.39	(0.19-0.79)	0.010
18-20	12.6	716	6.7	536	0.53	(0.35-0.80)	0.002
21-23	27.9	613	19.9	396	0.61	(0.45-0.84)	0.002
24-26	39.1	555	30.9	349	0.69	(0.51-0.92)	0.012
27-29	41.4	473	35.3	346	0.77	(0.57-1.03)	0.081
30-32	41.6	401	43.8	347	1.19	(0.88-1.61)	0.261
33-35	36.6	402	36.2	282	0.96	(0.69-1.33)	0.805
36-38	32.2	404	32.4	296	1.04	(0.75-1.45)	0.801
39-41	29.2	366	28.9	325	0.99	(0.71-1.39)	0.958
42-44	16.5	449	29.3	294	2.09	(1.46-3.00)	<0.001

* Adjusted for three-year age-group, location and whether lived in current location for at least three years

Table S2: **Comparison of HIV prevalence in 1998-2000 versus 2001-2003 by sex and age-group**

Population sub-group	1998-2000		2001-2003		Test for difference		
	%	n	%	n	OR*	(95% CI)	p
Socio-economic location							
Small towns	35.1	1575	33.0	1060	0.87	(0.72-1.04)	0.124
Estates	22.4	3106	21.5	2348	0.87	(0.76-1,01)	0.060
Roadside settlements	21.0	1599	17.2	1230	0.90	(0.73-1.11)	0.324
Subsistence farming areas	18.5	3174	15.7	2381	0.86	(0.74-1.00)	0.044
Focussed intervention							
Yes	24.5	4792	21.9	3537	0.86	(0.77-0.97)	0.010
No	21.4	4662	19.2	3482	0.88	(0.78-0.99)	0.033
Time site done at baseline							
July to December 1998	19.7	2636	17.8	1952	0.92	(0.78-1.08)	0.304
January to June 1999	26.9	2680	24.2	1912	0.83	(0.72-0.96	0.013
July 1999 to January 2000	22.5	4138	20.0	3151	0.90	(0.79-1.01)	0.076
Education							
No secondary	28.1	3719	27.9	2291	0.99	(0.88-1.12)	0.907
Secondary	19.7	5735	17.0	4728	0.77	(0.69-0.87)	<0.001
Marital status							
Single	8.1	3580	5.0	2694	0.62	(0.49-0.79)	<0.001
Married	26.9	4663	25.4	3571	0.90	(0.81-1.00)	0.049
Divorced or separated	48.2	778	46.2	442	0.94	(0.73-1.21)	0.654
Widowed	58.2	433	62.9	315	1.22	(0.89-1.67)	0.225
Employment							
Skilled	26.4	837	26.4	799	0.94	(0.74-1.19)	0.620
Manual or unskilled	26.0	1960	26.7	1045	0.86	(0.71-1.04)	0.123
Informal sector or self-employed	25.8	2624	26.4	1680	0.92	(0.79-1.06)	0.258
Unemployed	24.0	3216	21.5	2297	0.85	(0.74-0.97)	0.017
Student	1.3	855	1.1	1191	1.05	(0.44-2.51)	0.920
Mobility							
Resident for 3 years or more	22.7	7218	20.8	6132	0.92	(0.84-1.00)	0.064
Resident for less than 3 years	23.7	2236	18.4	887	0.62	(0.50-0.77)	<0.001
Males							
17-29 - resident for 3 years or more	9.7	1978	8.2	1655	0.75	(0.59-0.96)	0.023
17-29 - resident for less than 3 years	12.4	920	7.6	290	0.47	(0.28-0.77)	0.003
30-54 - resident for 3 years or more	36.2	1192	36.1	1013	1.01	(0.84-1.20)	0.942
30-54 - resident for less than 3 years	45.2	230	34.8	89	0.64	(0.38-1.09)	0.099
Females							
15-24 - resident for 3 years or more	14.1	1550	7.5	1488	0.61	(0.39-0.96)	0.034
15-24 - resident for less than 3 years	19.9	715	10.5	352	0.40	(0.18-0.93)	0.033
25-44 - resident for 3 years or more	32.0	2498	33.7	1976	1.05	(0.92-1.19)	0.476
25-44 - resident for less than 3 years	45.8	371	46.8	156	1.02	(0.69-1.49)	0.935

* Adjusted for sex, three-year age-group, location and whether lived in current location for at least three years

Table S3: **Comparison of HIV prevalence in 1998-2000 versus 2001-2003 by socio-demographic status**

Age at baseline	HIV prevalence % (95% CI)		Mortality/100 pyar* (number of events/pyar)		HIV incidence /100 pyar	Baseline subjects	Follow -up**
	1998-2000	2001-2003	HIV+	HIV-	(events/pyar)	N	%
Males							
17-54	19.5	23.9	6.87	0.61	1.87	4,320	54.1
	(18.3-20.7)	(22.1-25.7)	(130/1893.4)	(48/7839.7)	(99/5295.3)		
17	0.5	1.6	0.00	0.61	0.37	376	49.6
	(0.1-1.9)	(0.3-4.7)	(0/4.7)	(5/824.5)	(2/543.9)		
18-20	2,3	5,3	0.00	0.38	1.06	907	39.6
	(1.4-3.5)	(3.2-8.2)	(0/45.5)	(7/1826.1)	(11/1036.6)		
21-23	7.2	16.8	2.92	0.39	3.22	640	46.4
	(5.3-9.5)	(12.7-21.6)	(3/102.6)	(5/1281.2)	(25/777.1)		
24-26	22.0	27.9	4.36	0.83	2.89	610	53.9
	(18.7-25.5)	(23.1-33.2)	(13/298.4)	(9/1087.3)	(21/727.8)		
27-29	28.2	30.1	2.72	1.01	1.98	365	52.7
	(23.7-33.1)	(23.6-37.2)	(6/220.3)	(6/595.7)	(8/403.2)		
30-34	47.2	49.0	5.62	0.38	1.82	436	59.1
	(42.5-52.1)	(42.5-55.5)	(26/462.6)	(2/530.6)	(7/384.0)		
35-44	37.5	35.0	8.81	0.79	2.15	621	73.5
	(33.7-41.5)	(30.3-40.0)	(48/544.7)	(8/1006.6)	(18/836.1)		
45-54	26.6	22.9	15.84	0.87	1.19	365	76.9
	(22.1-31.4)	(17.8-28.6)	(34/214.7)	(6/687.7)	(7/586.7)		
Females							
15-44	25.9	27.6	5.16	0.54	1.67	5,134	66.3
	(24.7-27.1)	(26.1-29.2)	(161/3121.5)	(51/9443.0)	(122/7314.1)		
15-17	4,0	7,7	1.59	0.63	1.29	755	47.4
	(2.7-5.6)	(5.1-11.0)	(1/63.0)	(10/1590.3)	(13/1008.6)		
18-20	12,4	18.4	4.85	0.64	2.83	716	49.3
	(10.1-15.1)	(14.5-22.9)	(9/185.7)	(9/1406.5)	(25/884.6)		
21-23	27.9	33.0	4.32	0.20	2.67	613	53.4
	(24.4-31.6)	(27.9-38.5)	(16/370.1)	(2/1002.7)	(18/673.6)		
24-26	39.1	37.8	4.30	0.24	2.57	555	63.9
	(35.0-43.3)	(32.6-43.2)	(21/488.9)	(2/846.8)	(17/662.1)		
27-29	41.4	41.9	5.21	0.42	3.26	473	70.9
	(37.0-46.0)	(36.4-47.6)	(24/460.6)	(3/722.2)	(19/582.2)		
30-34	40.5	36.1	4.94	0.48	0.78	651	74.3
	(36.7-44.4)	(31.7-40.7)	(31/627.5)	(5/1034.7)	(7/894.8)		
35-44	26.4	24.6	6.37	0.70	0.88	1,371	88.0
	(24.1-28.8)	(22.1-27.2)	(59/925.7)	(20/2839.7)	(23/2608.2)		

pyar=person-years at risk.
* By HIV infection status at baseline interview.
** Amongst baseline respondents not known to have died.

Table S4: **Components of change in HIV prevalence in a closed cohort of 9,454 adults followed for 3 years**

Sexual behaviour	Males						Females					
	1998-2000		2001-2003		Test for difference*		1998-2000		2001-2003		Test for difference*	
	%	n	%	n	Co-eff*	p	%	n	%	n	Co-eff*	p
New sex partners in past year												
0	50.7	1799	66.3	1547			80.5	3279	86.5	2464		
1	27.7	981	22.1	515			16.3	665	11.3	321		
2	10.7	379	6.7	157			1.8	73	1.2	33		
3-4	6.7	238	3.6	84			1.0	39	0.5	14		
5 or more	4.2	150	1.2	29	-0.649	<0.001	0.4	17	0.6	17	-0.287	0.01
Sex partners in past month												
0	39.2	1391	36.6	854			36.6	1489	39.0	1110		
1	50.3	1785	54.7	1276			61.7	2514	60.0	1710		
2	7.6	268	6.8	158			1.0	41	0.5	15		
3-4	2.4	84	1.6	38			0.4	18	0.3	8		
5 or more	0.5	19	0.3	6	-0.127	<0.001	0.3	11	0.2	6	-0.06	0.044
Current sex partners												
0	21.6	766	22.6	528			19.5	796	22.7	647		
1	59.9	2123	66.4	1549			78.3	3188	76.0	2166		
2	12.2	431	8.4	196			1.4	57	0.7	21		
3-4	5.2	184	2.0	46			0.5	20	0.4	10		
5 or more	1.2	43	0.6	13	-0.196	<0.001	0.3	12	0.2	5	-0.073	<0.001
Last or previous partner a casual partner**	25.9	2070	13.2	1483	0.576	<0.001	7.5	2451	5.9	1885	0.87	0.292
Unprotected sex with recent casual partner**	57.8	360	58.4	154	1.02	0.94	73.8	141	63.5	85	0.32	0.003
Unprotected sex with recent regular partner**	88.6	1330	92.1	1158	1.01	0.961	93.9	1906	93.2	1488	0.75	0.056

Males aged 17-54 years and females aged 15-44 years in each round of the survey who report sexual experience in lifetime

* Negative binomial regression co-efficient adjusted for age-group, location, whether lived in current location for at least 3 years, literacy, marital status and mode of interview

** Odds ratio adjusted for age-group, location, whether lived in current location for at least 3 years, literacy, marital status and mode of interview

Table S5: **Comparison of sexual behaviour reported by men and women in 1998-2000 versus 2001-2003**

Sex partners in lifetime	Open cohort*				Closed cohort**			
	1998-2000		2001-2003		1998-2000		2001-2003	
	%	n	%	n	%	n	%	n
Males								
1	12.7	450	18.0	419	11.3	196	12.7	220
2	12.1	428	14.7	343	11.7	203	12.8	223
3-4	23.9	847	23.6	550	24.7	428	24.0	417
5-9	28.1	998	26.8	626	29.2	507	30.9	537
10 or more	23.2	824	16.9	394	23.2	402	19.5	339
Mean	8.4		6.9		8.5		7.9	
Females								
1	63.8	2598	63.0	1794	65.3	1532	61.9	1453
2	19.2	784	18.8	536	18.8	442	18.8	441
3-4	11.5	467	10.1	287	10.1	237	10.4	244
5-9	3.4	138	5.1	145	3.7	86	5.8	135
10 or more	2.1	86	3.1	87	2.1	49	3.1	73
Mean	2.11		2.61		2.09		2.64	

* Males aged 17-54 years and females aged 15-44 years in each survey round who report sexual experience
** Males aged 17-51 years at baseline and females aged 15-41 years at baseline interviewed again at follow-up

Table S6: **Comparison of change in number of lifetime sexual partners reported by male and female respondents in the open and closed cohorts, 1998-2000 to 2001-2003**