Change in sexual behaviour and decline in HIV infection among young pregnant women in urban Uganda

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Objective: To describe sexual behaviour that may partly explain a decline in HIV seroprevalence in pregnant women in urban settings in Uganda, East Africa.

Settings: Two major urban districts in Uganda.

Methods: Repeated population-based behavioural surveys in 1989 and 1995, and repeated HIV serological surveys in consecutive pregnant women attending antenatal clinics from 1989 to 1995.

Results: During the study period, a 2-year delay in the onset of sexual intercourse among youths aged 15–24 years and a 9% decrease in casual sex in the past year in male youths aged 15–24 years were reported. Men and women reported a 40% and 30% increase in experience of condom use, respectively. In the same study area, over the same period, there was an overall 40% decline in the rates of HIV seroprevalence among pregnant women attending antenatal clinics. It can be hypothesized that the observed declining trends in HIV correspond to a change in sexual behaviour and condom use, especially among youths.

Conclusions: This is the first report of a change over a period of 6 years in male and female sexual behaviour, assessed at the population level, that may partly explain the observed decline in HIV seroprevalence in young pregnant women in urban Uganda. This result should encourage AIDS control programmes to pursue their prevention activities.

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Keywords: HIV-1 prevalence, sexual behaviour change, pregnant women, Uganda

Introduction

Thirteen years into the pandemic, AIDS has continued to spread relentlessly in most areas of the world. However, in a few settings in the developing world where HIV has been present for 10 years or more, and is now a 'mature' epidemic, stable or even declining HIV prevalence rates have been reported [1–3]. The reasons for the decrease in HIV prevalence, usually assessed with sentinel surveillance data among pregnant women attending antenatal clinics, may be due to a variety of factors including the adoption of safer sexual behaviour.

Uganda is among the African countries where the HIV epidemic was first recognized and among the locations where it is the most severe [4,5]. In 1986, HIV seroprevalence among antenatal clinic attendees in Kampala, the capital city, was found to be already about 15%. The official figures by end of 1994 stated that there were an estimated 1.3 million adults infected with HIV of a total population of 19.5 million adults

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and children. As is the case in a number of countries, the main focus of HIV infection is among urban dwellers, with an estimated prevalence of 25% in January 1995 [5]. The transmission of HIV among adults in the Uganda population is believed to be almost exclusively through heterosexual contact. A male-to-female sex ratio of HIV of 1 : 1.4 was reported from Uganda in 1990 [6,7].

In this article, we first present evidence that there has been a change in sexual behaviour in urban Uganda between 1989 and 1995. We will then present HIV serological results from pregnant women in the same urban areas showing declining HIV prevalence over a 6-year period; a trend strongly suggestive of a decrease in HIV incidence. Finally, we will discuss the possibility that this decrease may be partly caused by behavioural change.

Methods

Population surveys

In October–November 1995, population-based surveys on HIV/AIDS and sexual behaviour with a sample size of about 1500–1600 adults were conducted in five urban and rural districts of Uganda, using a multistage sampling technique [8]. The main objective was to measure prevention indicators for the evaluation of AIDS control programme activities [9]. All these surveys used clustered probability sample designs and face-to-face interviewing with all individuals aged 15–49 who spent the night in selected households. Local interviewers were specially recruited and trained for 7 days. In Kampala and Jinja, data from HIV sentinel surveillance sites were also available. The comparison between the behavioural data and the data on HIV prevalence is thus restricted to Kampala and Jinja, the two most populated urban districts in Uganda.

A representative sample of the population aged 15–49 years was interviewed on demographic characteristics, regular and non-regular sexual relations, condom use and symptoms of sexually transmitted diseases (STD). Marriage also included informal union, cohabitation and any sexual relationship that had lasted for 1 year or more. All relationships lasting less than 12 months were classified as 'non-regular' relationships. The non-response rate was 7.8% in Kampala and 9.6% in Jinja mainly due to the absence of eligible respondents. The individual refusal rate was 3% and 0.5%, respectively. Overall 1438 respondents were interviewed in Kampala and 1545 in Jinja.

The levels of behavioural variables in 1995 were then compared with the results of a population survey carried out in 1989 that also used a Global Programme on AIDS of the World Health Organization (GPA/WHO) protocol [10] and that were based on a subsample of 1186 individuals selected in the same urban areas. The sampling method used in the 1989 survey was rigorously the same as the one used in 1995. Comparisons were carried out between the answers to identical questions in 1989 and 1995 according to sex, age and urban residence of the respondents. The analysis of the behavioural data is restricted to urban residential areas for a better match with HIV prevalence data from the urban sentinel sites.

A validation study of the protocol and the questionnaire developed by GPA/WHO was conducted in Kampala in 1993 using both quantitative and qualitative methods [11]. The proportions of people reporting sex with a non-regular partner during the last 12 months were always higher when using in-depth interviews than the survey-type questionnaire. For condom use, the differences were not significant. In addition to the validation study, a comprehensive review of qualitative and anthropological studies over the last 5 years was conducted to assess changes in attitudes and sexual behaviour [12].

HIV serosurveillance

Sentinel surveillance in Uganda was first established in 1987 in women attending antenatal clinics and STD patients seen at STD clinics. The procedures were revised in 1989, following the GPA/WHO guidelines [13]. At their first visit to an antenatal clinic, all pregnant women for a period of 6–8 weeks had their blood tested for HIV infection to achieve a sample size of 250–300 women at each of the six selected sites. The inclusion criteria are solely based on the first visit of women during a current pregnancy. In 1993, seven additional sites were included in the sentinel surveillance to achieve better geographical coverage for the estimation of HIV prevalence. Anonymous and unlinked testing of samples are drawn for syphilis testing. Blood samples are unlinked and used for HIV surveillance during the first months of each year. Rapid plasma reagin (RPR) and *Treponema pallidum* haemagglutination assay (TPHA) testing are performed and women who are found to be HIV-positive are treated. Data on syphilis prevalence are not available. Since 1990, the blood specimens have been transported to the Uganda Virus research Institute in Entebbe, where they are tested for antibodies to HIV-1 following a rigorous quality control procedure. All serum samples are tested by using enzyme-linked immunosorbent assay (ELISA) tests manufactured by Genetic Systems (Seattle, Washington, USA), Cambridge Systems (Cambridge Biotech, Galway, Ireland) or Wellcozyme (Murex, Dartford, Kent, UK). No confirmatory tests are performed as recommended by WHO protocol for HIV testing. Six antenatal clinics out of 13 of the

sentinel surveillance system, including Kampala and Jinja, have been positively evaluated in 1994 and 1995 with regard to procedures used for the recruitment of mothers, blood collection, serum separation, storage and sera testing. As a result of the evaluation, the sampling period was extended to 10 weeks to achieve larger sample sizes in order to facilitate age-stratified analyses over time.

EPI Info (WHO, Geneva, Switzerland) was used for data entry and all data were analysed using the Statistical Package for the Social Sciences (SPSS, Chicago, Illinois, USA) and Statview (Abacus Concepts, Inc., Berkeley, California, USA) software. Simple χ^2 tests were used to test for a difference between the 1989 and 1995 data for each domain/site. Trend analysis were calculated following the method of Fleiss [14].

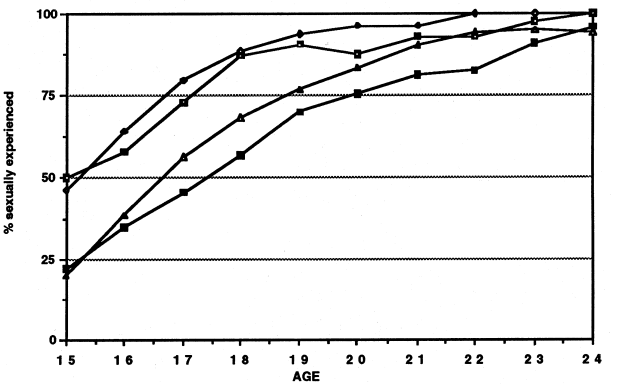

Fig. 1. Percentage of sexually experienced youth at current age (15–24 years) in 1989 and 1995. (■), Men 1995; (▲), women 1995; (□), men 1989; (△), women 1989.

Results

Demographic data

The age distribution of respondents in the 1989 and 1995 population surveys did not differ significantly. In 1995, a slightly higher proportion of respondents belonged to the youngest age group, as compared with 1989 but the difference was not significant. No differences were found with respect to educational level and type of residence: the proportion of urban residents in the 1989 and 1995 samples were 38.8 and 36.2%, respectively. The proportion of women who had never married, which was 17.8% in the 1989 sample, rose to 23.1% in 1995.

The onset of sexual intercourse

Proportions of male and female youths aged 15–19 years reporting that they have never had sex increased from 31% and 26% in 1989, to 56% and 46% in 1995, respectively ($P = 0.005$ and $P = 0.001$); this suggests a significant increase in the age of first sexual intercourse. In 1989, typically about 50% of males and females had experienced intercourse by the age of 15 years, but in 1995, only about 20% of this age group reported sexual experience. The median age at first sexual intercourse increased to 17.4 and 16.6 years respectively. The proportion of youths reporting that they had ever experienced sexual intercourse by year of age in 1989 and 1995 are shown in Fig. 1. To smooth erratic fluctuations arising from the small number of respondents in each single-year age group, a three-year moving average was taken. Similarly, in the 15–19 year age group the proportion never married increased from 75% in 1989 to 84% in 1995 in men (not significant) and from 46% to 62% in women ($P = 0.001$).

Sexual relations with non-regular partners

The prevalence of reported sex outside partnerships that had lasted more than a year in the last 12 months among men were 22.6% in 1989 and 18.1% in 1995 ($P = 0.05$) with a mean number of 2.3 and 2.0 for those who reported sex with a non-regular partner (Table 1). The trend towards fewer non-regular partners in 1995 was not, however, statistically significant among young men aged 15–24 years. Among women, the corresponding values were 6.0% in 1989 and 8.0%

Table 1. Percentage distribution of male and female respondents according to the number of non-regular sexual partners (among all persons who have been sexually active in past 12 months).

	No. of partners											
	0		1		2–4		≥ 5		Totals			
	1989	1995	1989	1995	1989	1995	1989	1995	%	n, 1989	n, 1995	*P* value*
Men												
15-19 (years)	70.1	81.2	8.3	5.8	14.9	8.7	6.7	4.3	100	60	69	0.14
20-24 (years)	67.4	75.2	13.2	10.9	14.8	11.7	4.7	2.3	100	129	130	0.17
15-49 (years)	77.4	81.9	8.7	8.6	10.5	7.8	3.4	1.8	100	527	725	0.07
Women												
15-19 (years)	88.3	87.7	5.2	7.5	6.5	4.1	0.0	0.7	100	94	147	0.78
20-24 (years)	94.9	88.8	4.3	4.7	0.0	6.1	0.8	1.4	100	118	232	0.06
15-49 (years)	94.0	92.0	3.6	4.3	1.8	3.3	0.6	0.4	100	532	967	0.15

**P* values for the comparison of the proportions in age group reporting none and one or more non-regular sexual partners in 1989 and 1995.
n, Number of respondents.

in 1995 showing a slight but non-significant increase. The mean number of sexual partners in the last 12 months was 1.8 in both 1989 and 1995. Among those who reported at least one non-regular sexual partner in 1989, 76% of men and 84% of women reported exchange of money in such circumstances. Forty-three per cent of men and 44% of women reported sex in exchange for money in 1995.

Among the respondents who reported a current spouse or regular partner, there were no significant changes in the proportions reporting more than one regular partner in 1989 and 1995; the figures were 16% in 1989 and 15% in 1995 for men and 4% and 6% for women.

Condom use

The proportion of sexually active respondents who reported having ever used condoms increased for men from 15.4% in 1989 to 55.2% in 1995, and from 5.8% to 38.7% for women ($P < 0.001$) (Fig. 2). In 1995, the rates among those reporting that they had ever used condoms were the highest among men and women aged 20–24 years, followed by the 15–19 years olds. In 1995, among those who reported sexual relations with a non-regular partner in the last 12 months, 66% of men and 49% of women in urban areas reported the use of a condom during the last sexual intercourse of risk; among 20–24 years old, this rate increased to 60% of women. No data were available for a comparison with the year 1989, but the proportions were likely to be very low given the low prevalence of those reporting that they had ever used condoms. Finally, in 1995, 11% of men and the same percentage of women reported condom use during the last sexual intercourse with their current spouse or regular partner.

Reported symptoms of STDs

In 1989, men were asked to report any episodes of symptoms of urethritis (pain during urination or discharge from the penis) in the last 12 months and 8% reported at least one episode. In 1995, to a similar question, 9% reported such episodes, a non-significant difference.

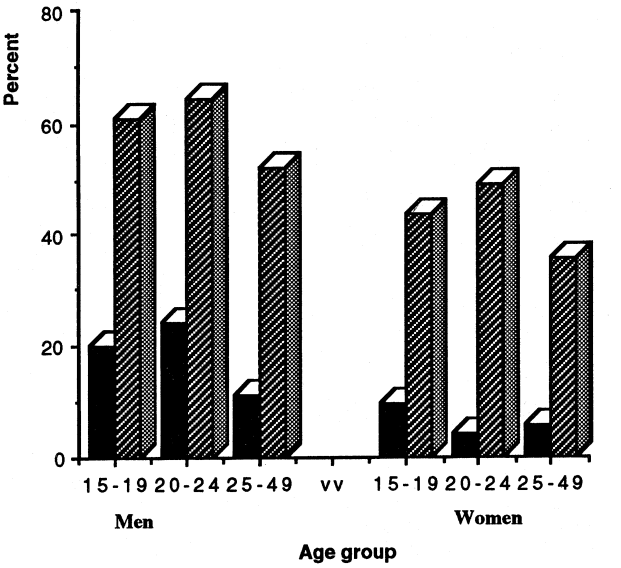

Fig. 2. Percentage of respondents who had ever used condoms by age group. (■), 1989; (▨), 1995.

Prevalence of HIV among pregnant women

After a peak in 1990–1991 in Nsambya, Kampala, a peak in 1992 in Rubaga, Kampala, and in 1991–1992 in Jinja, HIV seroprevalence rates declined significantly over time, resulting in an overall HIV reduction of 27% to 47% (Table 2). In Table 3, the prevalence rates by age group were compared over time in the three urban sites. The reference year was different in each site because HIV serological results by age were not always available. In Nsambya, Kampala, significant declines were observed over time in 15–19 and 20–24 year-olds but not in older age groups. In Jinja, a significant decline was seen only among those aged 15–19 years.

In Nsambya, when comparing the total proportion of pregnant women aged 15–19 years that tested for HIV relative to older age groups, there is a significant decline over time, from 38.3% in 1990 to 25.5% in 1996, reflecting probably a delay in the onset of sexual activity and/or a change in fertility patterns. Such a

Table 2. HIV infection rates among antenatal clinic attenders in urban Uganda, 1989-1996.

Sites	1989	1990	1991	1992	1993	1994	1995	1996	*P* value*†
Kampala, Nsambya									
n	NA	64	262	152	456	396	432	1294	(1990–96)
% HIV-positive	24.5	28.1	27.9	26.3	26.6	21.2	16.7	15.3	$P < 0.001$
95% CI		17.1–39.1	22.5–33.3	19.3–33.3	22.5–30.7	17.2–25.2	13.2–20.2	13.3–17.3	
Kampala, Rubaga									
n	‡	‡	305	269	302	401	392	390	(1991–96)
% HIV-positive			27.5	29.4	23.5	16.5	20.2	20.3	$P < 0.001$
95% CI			22.5–32.5	23.6–35.2	18.7–28.3	12.9–20.1	16.2–24.2	16.4–24.2	
Jinja									
n	NA	356	300	296	287	446	400	210	(1990–96)
% HIV-positive	20.8	15.7	22.0	19.9	16.7	16.4	13.3	16.8	$P = 0.038$
95% CI		11.9–19.5	17.3–26.7	15.4–24.4	13.4–21.0	13.3–20.1	10.0–16.6	11.5–22.2	

*χ^2 test for linear trend. †Year ranges in parentheses. ‡Site had not been opened at the maternity hospital. CI, Confidence interval. NA, not available.

Table 3. HIV infection rates among antenatal clinic attenders in three clinical settings, Nsambya, Rubaga and Jinja, by age group, urban Uganda.

	HIV-positive (%) (number HIV-positive/total)				
Age group	15–19 years	20–24 years	25–29 years	30–34 years	≥ 35 years
Nsambya					
1990	21.7 (5/23)	33.3 (9/27)	60.0 (3/5)	0.0 (0/5)	25.0 (1/4)
1991	28.0 (23/82)	35.9 (33/92)	19.6 (11/56)	27.3 (6/22)	10.0(1/10)
1992	23.3 (10/43)	31.9 (15/47)	34.2 (13/38)	5.9 (1/17)	16.7 (1/6)
1994	16.5 (15/91)	25.0 (43/172)	15.5 (13/84)	25.0 (9/36)	33.3 (4/12)
1995	9.3 (11/118)	18.9 (36/190)	22.5 (16/71)	16.7 (6/36)	12.5 (2/16)
1996	10.0 (33/330)	17.5 (88/502)	17.4 (55/316)	15.5 (17/110)	14.7 (5/34)
P value	$P < 0.001$	$P < 0.001$	$P = 0.29$	$P = 0.34$	$P = 0.72$
Rubaga					
1993	18.2 (16/88)	23.1 (27/117)	32.8 (20/61)	25.0 (7/28)	14.3 (1/7)
1994	10.5 (13/124)	16.0 (24/150)	26.0 (19/73)	23.7 (9/38)	7.1 (1/14)
1995	18.8 (24/128)	20.7 (35/169)	21.0 (13/62)	17.4 (4/23)	37.5 (3/8)
1996	6.7 (6/90)	18.3 (23/126)	22.0 (11/50)	7.7 (2/26)	14.3 (1/7)
P value	$P = 0.17$	$P = 0.62$	$P = 0.14$	$P = 0.08$	$P = 0.51$
Jinja					
1990	21.0 (22/105)	16.2 (18/111)	10.1 (8/79)	7.3 (3/41)	26.3 (5/19)
1994	10.7 (12/112)	17.7 (28/158)	22.3 (21/94)	12.3 (8/65)	20.0 (3/15)
1995	8.5 (18/118)	15.2 (20/132)	16.7 (14/84)	16.7 (8/48)	5.9 (1/17)
1996	4.5 (3/66)	19.7 (13/66)	16.7 (7/42)	20.8 (5/24)	25.0 (3/12)
P value	$P < 0.001$	$P = 0.74$	$P = 0.44$	$P = 0.06$	$P = 0.52$

Years with missing data on HIV prevalence by age group: Nsambya, 1993; Rubaga, 1990–1992; Jinja, 1991–1993. **P* value for χ^2 for linear trend in age groups.

decrease in the relative number of pregnancies among the 15–19 years age group was not observed in the two other sites.

Discussion

In two major cities of Uganda, the prevalence of HIV among pregnant women attending antenatal clinics included in the national sentinel surveillance programme has significantly declined since 1991–1992. It is unlikely that differences in rates of non-compliance, or error in the ascertainment of HIV serostatus account for such a consistent decline for the following reasons. Firstly, childbearing women are a well identified group. It has recently been estimated that, in Ugandan urban areas, between 90 and 92% of pregnant women attend an antenatal clinic at some time during their pregnancy [15]. Secondly, since 1990, HIV serological tests have been performed in the same central laboratory where supervisory field visits in 1994 and 1995 failed to discover any systematic mistakes that would suggest a bias in HIV serological diagnosis or, after a on-site visit, in enrolment procedures. In addition, no major changes in the health care system occurred during this period.

However, a routine surveillance system such as that in Uganda often show weaknesses such as missing data, inconsistencies in the samples and lack of precision of estimates of HIV seroprevalence. One cannot exclude differences in the characteristics of women over time, as shown with the age distribution in the Kampala data which may be due to a delay in the onset of first sexual intercourse. The changes in specificity of ELISA tests used over time may also have affected the precision of the estimated HIV prevalences. It is also worrying that data on positive cases of syphilis were not recorded. In addition, at the social level during this period, the army was demobilized, there was more geographical movement than before and Rwandan immigrants departed. The influence of these factors on the stability of the female urban population is not known.

Data from three other semi-urban HIV sentinel surveillance sites among antenatal clinic attenders, Mbarara,Tororo and Mbale, where no behavioural data are available, disclose divergent HIV trends. In Mbarara, after peaking at 30.2% (62 of 205) in 1991, HIV prevalence declined to a level of 15.0% (35 of 233) in 1996; a trend similar to the one described in Kampala and Jinja. The prevalences in Tororo and Mbale have remained relatively stable in the range of 9–13%. In seven rural sentinel sites where HIV testing in pregnant women started in 1993 and where prevalence rates are much lower, in the range of 2–9%, no clear HIV trend was observed, illustrating that the decline in HIV prevalence is mostly a feature of large urban centres where prevalence is still high. The findings cannot be generalized throughout the country [16].

Three other studies, from Kampala, Maraka and Rakai, using different methods, also showed declining HIV trends. Data from the Mulago Hospital prenatal clinic in Kampala showed an even earlier decline in HIV prevalence among pregnant women from 28.1% in

1989 to 16.2% in 1993 [17]. Decreased HIV prevalence rates were also significant among 15–19 and 20–24 year olds. Turning to the population level, a cohort study conducted in the rural district of Masaka (1989–1994) has also shown a significant decline in the prevalence of HIV infection among young men aged 13–24 years which fell from 3.5% in 1990 to 1.0% in 1994 [18]. Another cohort study, in the rural district of Rakai, HIV prevalence in males and females aged 13–24 years declined from 17.3 to 12.6% between 1990 and 1992 [19].

It is well recognized that selection bias in HIV prevalence surveillance data may distort estimates. As data come from antenatal clinics, infertile women or women using modern contraception are obviously not represented. As infertility stems for the most part from STDs including HIV, this would tend to result in underestimates of HIV prevalence especially at older ages where infertility is most common [20].

Stable or declining HIV prevalence in antenatal clinic attendees may mask a high incidence often concentrated in young age groups, combined with increased mortality and fertility effect associated with HIV [21,22]. The decreasing HIV seroprevalence hence may be the result of a number of behavioural and biological factors such as increasing HIV-related death, or other causes of death; out-migration of HIV-infected persons to rural areas where sentinel surveillance is performed less and/or immigration of HIV-negative persons; ageing; saturation of the susceptible population; decline in the infectiousness of HIV-infected persons and altered transmissibility of HIV. Finally, HIV incidence may have fallen due to behavioural change or improvement in STD case management. However, the sharp decline in HIV prevalence observed over time in two out of three urban sites among the youngest age groups is likely to be due to a true decline in HIV incidence and less likely to be due to ageing and/or a change in mortality or fertility. The immigration and emigration pattern in this age group is difficult to assess but there were no indications of a massive change within the last 6 years.

The comparison of the results of two population surveys conducted in 1989 and 1995 and an in-depth review of the current qualitative studies on sexual behaviour [12] highlighted impressive reported behavioural changes in urban settings: delay in sexual debut for both sexes; a slight decrease in non-marital sex among men aged 15–24 years; and sharp increase in condom use in relationships of risk and in the rates of those reporting that they had ever used condoms for both sexes. The proportion of men and women engaging in sex in exchange for money dropped by nearly 50%. These behavioural changes were reported more by younger than by older respondents and may in themselves be sufficient to explain the decline in HIV prevalence over time. By contrast, in rural areas, surveys showed that reported condom use during last sexual intercourse of risk is still below 17% [23].

Thus, the data showed evidence of increased condom use and a shift in sexual partners without necessarily changing the rate of new sexual partners for those sexually active. Men also reported similar levels of symptoms of urethritis in 1989 and 1995. The data showed significant sexual behavioural changes amongst women such as a delay in the onset of sexual intercourse and an increase in condom use in relationships where there was a risk for HIV/STD, but did not show any reduction in the small percentage reporting non-marital sexual relationships. A validation study conducted in 1994 in Kampala [11,24] showed evidence of under-reporting by women of non-marital sexual relationships. Whether the under-reporting is consistent through time is unknown, and makes it difficult to interpret reported non-marital sex by women. In addition, in a cultural context in which men frequently still have multiple partners, an unknown percentage of women may feel that changing their own behaviour would result only in a partial removal of their risk of HIV infection [25]. It may also happen that women had already changed their sexual behaviour before the 1989 survey because of a fear of AIDS. Finally, some women may have non-regular partnerships for situations such as economic need and therefore cannot further reduce their sexual contacts without putting themselves in difficulty.

By implication, data obtained by way of questions represent reported rather than observed behaviour. Doubts have often been expressed as to whether reported behaviour reflects actual behaviour rather than intentions or desired answers. However, it is striking that in these two surveys, the proportions of people reporting symptoms of STD, condom use with spouse or sex outside of marriage were quite similar in 1989 and 1995. Such levels of consistency enhance confidence in the trustworthiness of the collected information without yielding solid proof of its validity.

For nearly 10 years, the National AIDS Control Programme has had the stated objectives of increasing HIV/AIDS knowledge, faithfulness and promotion of condom use although it has not focused on a delay in sexual intercourse. The effect of these efforts, together with the high morbidity and mortality due to AIDS, which has affected most of the households especially in urban areas may explain the most obvious changes in youth behaviour. By 1995, more than 70% of urban adults were exposed to the death of relatives and close friends and there are high levels of knowledge, fear and anxiety regarding HIV/AIDS [12]. The findings appear to demonstrate some behavioural change in urban

settings, and suggest that AIDS prevention and control measures can contribute to that change. A more vigorous pursuit of AIDS control measures in rural areas should be encouraged with the goal of duplicating the urban-led change in areas where there has as yet been no sign of a substantial modification of behaviour.

The understanding of HIV and its related behaviours is clearly far from complete, especially in the youngest age groups where there is most evidence of change. It is recommended that sentinel and behavioural surveillance be expanded to look at these younger groups by single year of age, enabling changes such as a rise in age at first experience of sex to be determined more clearly. Efforts to collect socio-demographic data on sentinel populations, in order to compare them to general populations, would also contribute to a clearer interpretation of changing trends in behaviour and infection [26]. Sentinel populations capturing young men should be identified to fill the gap in information on trends in HIV infection in men.

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References

1. Mason CJ, Markovitz LE, Kitsiripornchai S, *et al.*: **Declining prevalence of HIV-1 infection in young Thai men.** *AIDS* 1995, **9**:1061–1065.
2. Buvé A, Caraël M, Hayes R, Robinson NJ: **Variations in HIV prevalence between urban areas in sub-Saharan Africa: do we understand them?** *AIDS* 1995, **9** (suppl A):S103–S109.
3. Magazani K, Laleman G, Perriens JH, *et al.*: **Low and stable HIV seroprevalence in pregnant women in Shaba Province, Zaire.** *J Acquir Immune Defic Syndr* 1993, **6**:419–423.
4. Serwadda D, Mugerwa RD, Sewankambo NK, *et al.*: **Slim disease: a new disease in Uganda and its association with HTLVIII infection.** *Lancet* 1985, **ii**:849–852.
5. World Health Organization: **Provisional country-specific estimates of adult HIV infections as of the end of 1994.** *Wkly Epidemiol Rec* 1995, **70**:353–360.
6. Berkley SF, Widy-Wirski R, Okware SI, *et al.*: **Risk factors associated with HIV infection in Uganda.** *J Infect Dis* 1989, **160**:22–30.
7. Berkley S, Naamara W, Okware S, *et al.*: **AIDS and HIV infection in Uganda. Are more women infected than men?** *AIDS* 1990, **4**:1237–1242.
8. World Health Organization: *Evaluation of National AIDS Programme: A Methods Package. 1. Prevention of HIV Infection.* Geneva: WHO/GPA/TCO/SEF/94.1; 1994
9. Mertens T, Caraël M, Sato P, Cleland J, Ward H, Smith GD: **Prevention indicators for evaluating the progress of national AIDS intervention programmes.** *AIDS* 1994, **8**:1359–1369.
10. National Survey in Uganda: *Analysis of the Social Dimensions of the Epidemic. National Survey September–December 1989.* Kampala: Makarere University, 1993.
11. Konings E, Bantebya G, Caraël M, Bagenda D, Mertens T: **Validating population surveys for the measurement of HIV/STD prevention indicators.** *AIDS* 1995, **9**:375–382.
12. UNAIDS: *Epidemics and Behaviours: a Review of Changes in Sexual Behaviour in Uganda in the Early 1990s. UNAIDS Core Reference Collection.* Geneva: UNAIDS; 1997.
13. World Health Organization: *FIELD guidelines for HIV Sentinel Surveillance. A Manual for AIDS Control Programmes.* Geneva: WHO/GPA; 1989.
14. Fleiss JL: **The comparison of proportions for many samples.** In *Statistical Methods for Rates and Proportions.* New York: John Wiley; 1973:99–102.
15. Kaijuka EM, Kaija EZA, Cross AR, Loaiza E: *Uganda Demographic and Health Survey.* Entebbe: Uganda Ministry of Health; 1989.
16. STD/AIDS Control Programme: *HIV/AIDS Surveillance Report.* Entebbe: Uganda Ministry of Health; 1997.
17. Bagenda D, Mmiro F, Mirembe C, Nakabito, Mugenyi D, Musaka L: **HIV prevalence rates in women attending antenatal clinics in Kampala, Uganda.** *Ninth International Conference on AIDS and STD in Africa.* Kampala, December 1995 [abstract Mo C016].
18. Mulder DW, Nunn AJ, Kamali A, Kengeya-Kayondo JF: **Decreasing HIV-1 seroprevalence in young men in a rural Ugandan cohort.** *BMJ* 1995, **311**:833–836.
19. Serwadda D, Wawer MJ, Sewankambo NK, *et al.*: **Trends in HIV incidence and prevalence in Rakai district, Uganda.** *Ninth International Conference on AIDS and STD in Africa.* Kampala, December 1995 [abstract Mo C085].
20. Gregson S, Donnelly CA, Parker CG, Anderson RM: **Demographic approaches to the estimation of incidence of HIV-1 infection among adults from age-specific prevalence data in stable endemic conditions.** *AIDS* 1996, **10**:1689–1697.
21. Batter V, Matela B, Nsuami M, *et al.*: **High HIV-1 incidence in young women masked by stable overall seroprevalence among childbearing women in Kinshasa, Zaïre: estimating incidence from serial seroprevalence data.** *AIDS* 1994, **8**:811–817.
22. Nunn AJ, Kengeya-Kayondo JF, Malamba SS, Seeley JA, Mulder DW: **Risk factor for HIV-1 infection in adults in a rural Ugandan community: a population study.** *AIDS* 1994, **8**:81–86.
23. Opio AA, Asiimwe-Okiror G, Musinguzi J, Kaweesa-Kisitu D, Maraa E, Nsubuga P: **Condom use in two rural districts of Lira and Soroti in Uganda [letter].** *AIDS* 1997, **11**:546–548.
24. Caraël M, Cleland J, Deheneffe J-C, Ferry B, Ingham R: **Sexual behaviour in developing countries: implications for HIV control.** *AIDS* 1995, **9**:1171–1175.
25. McGrath JW, Rwabukwali CB, Schumann DA, *et al.*: **Anthropology and AIDS: the cultural context of sexual risk behavior among Urban Baganda women in Kampala, Uganda.** *Soc Sci Med* 1993, **36**:429–439.
26. UNAIDS Best Practice Collection: *Case study: Working Towards Improved Surveillance.* Geneva: UNAIDS; 1997.