

**SCHOOL EDUCATION AND HIV CONTROL
IN SUB-SAHARAN AFRICA:
FROM DISCORD TO HARMONY?**

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Abstract: HIV is widely regarded as a disease of poverty and ignorance. However, within sub-Saharan Africa, more developed countries and sub-populations appear to have higher levels of HIV prevalence. This paper considers the evidence and possible reasons for this, by focussing on the relationships between education and the spread of HIV at the macro and micro levels. It is concluded that more educated populations are initially particularly vulnerable to HIV but are also better equipped to mount effective responses. Expanding provision of and access to secondary education could facilitate HIV control but is severely hampered by the morbidity and mortality effects of HIV epidemics. Efforts to sustain and increase education levels and to reduce HIV infections should therefore be mutually re-enforcing but will require extensive resources.

1 INTRODUCTION

HIV is frequently described as an epidemic of poverty. Among developing countries, lower *per capita* income has been shown to be associated with higher HIV prevalence in urban centres (World Bank, 1997). Worldwide, countries with lower adult literacy tend to have larger HIV epidemics (UNAIDS, 1998). On the basis of these and other findings, socio-economic development is often advocated as the most realistic means of controlling HIV epidemics.

There are, however, at least two important caveats. First, developing countries with large disparities in education and income levels between males and females also tend to have bigger HIV epidemics (World Bank, 1997). Thus, development that serves to magnify such imbalances may tend to increase susceptibility to major HIV epidemics at the population level. Second, processes associated with development such as urbanisation and more intensive migration can facilitate rapid and extensive transmission of HIV infection (Caldwell and Caldwell, 1993). Thus, there is the perverse possibility that some HIV epidemics might be better described as epidemics of development than of poverty. Indeed, there is some evidence for this within sub-Saharan Africa. For example, in the mid-1990s, those countries that had achieved the highest levels of adult literacy were typically the same countries that were suffering the most severe HIV epidemics (UNAIDS, 1998).

Similarly, within any given population, it might have been expected that individuals with greater socio-economic status would have greater access to information and greater

personal autonomy and would therefore be better placed to avoid HIV infection. Thus, increasing individual education and income levels would be one means of slowing rates of HIV transmission. In practice, most community surveys have found the very opposite: typically, there are strong *positive* associations between risk of HIV infection and indicators of socio-economic status such as level of education (Hargreaves *et al.*, 2000), formal sector employment (Barongo *et al.*, 1992; Serwadda *et al.*, 1992), and urban residence (Barongo *et al.*, 1992; Serwadda *et al.*, 1992; Fylkesnes *et al.*, 1997; Boerma *et al.*, 1999). Generally, these associations hold true for both men and women.

However, the greater vulnerability of more developed populations and sub-populations could be a transient feature of the early stages of epidemics (Over and Piot, 1993). Whilst initially more exposed to rapid infections, more developed populations should *ceteris paribus* also be in a better position to establish effective responses. Even in First World countries, HIV prevention efforts have typically been less successful in poorer, less well-educated communities (UNAIDS, 1998).

In this article, we begin to investigate the temporal dynamics of the influence of socio-economic development on rates of HIV transmission by comparing levels of HIV infection in countries with more and less educated populations at differing stages of HIV epidemics. We go on to examine the small number of micro-level studies that provide longitudinal data on the association between HIV and educational attainment.

The results indicate recent reductions in the excess infection levels initially seen among more educated groups, especially at young ages (Hargreaves *et al.*, 2000), a trend that

could reflect faster adoption of less risky lifestyles among the more educated members of cohorts now growing up in AIDS-afflicted populations. If this is the case, it could represent the beginnings of a process that would echo those seen previously in developing countries (for example, in regard to the use of modern medical services and methods of family planning), wherein the more educated adopt innovative behaviours most rapidly and are subsequently copied by their less educated contemporaries (Rogers, 1983). To investigate this possibility, we contrast current patterns of risk behaviour in more and less educated young people using data from a population-based survey in rural Zimbabwe. Finally, we briefly discuss the possible implications of implied changes in behaviour for reducing lifetime risks of acquiring HIV infection.

2 EDUCATION AND HIV RISK AT THE POPULATION LEVEL

Development Facilitates More Extensive Early Spread?

The association between levels of adult literacy and adult HIV prevalence for countries in sub-Saharan Africa at the end of the 1990s is shown in Figure 1. In contrast to the situation in urban areas for developing countries as a whole (World Bank, 1997), the association is strongly positive, HIV prevalence rising by 2.5 per cent for every 10 per cent increase in adult literacy.

At the macro level, associations between education and HIV prevalence reflect the close inter-relationships between education and other aspects of development. For example,

countries with more resources are better placed to invest in education systems whilst greater investment in such systems can result in accelerated socio-economic development. A number of factors contribute to the higher HIV prevalence seen in more developed countries. Bigger formal sectors give rise to larger and more extensive income differentials, especially between men and women. Better transport infrastructure facilitates more intensive, short-term, circular migration both between urban and rural areas and within rural areas.

Other things being equal, in the poorest African countries, the relatively more developed, urban populations usually have the highest levels of HIV prevalence but constitute only a small fraction of the total population in each case. In medium income countries, urban populations are larger (UNDP, 2000) but urban-rural HIV differentials may be smaller. HIV prevalence in antenatal clinic attendees in Harare is currently thought to be around 30 per cent, a level similar to that seen in the late 1980s in Kampala when the epidemic in Uganda was probably at a comparable stage. In the districts of Mutasa and Makoni in Zimbabwe, 22 per cent of women in agrarian villages are currently HIV-positive compared to 46 per cent of those in major roadside, trading centres (Gregson *et al.*, 2000). In the Rakai District of Uganda, in 1989, the level of infection in major roadside trading centres was almost identical (47 per cent), but HIV prevalence in the surrounding agrarian villages was only 9 per cent (Serwadda *et al.*, 1992). The HIV epidemic in Mutasa and Makoni is believed to be reasonably typical of that in Zimbabwe's predominantly rural districts (UNAIDS, 2000). Rakai, on the other hand, is probably one of the worst affected rural districts in Uganda.

In some senses, urban and rural populations in more developed countries may also be less socio-economically distinct. Many of the same individuals are found in urban and rural areas during different periods of their lives or at different times of year. Also, large areas of the countryside are relatively developed, particularly where there are large-scale commercial farming estates or trading centres supported by basic infrastructure such as tarred roads, electricity and telephone connections. To the extent that differences persist, intensive interactions between the two tend to facilitate the spread of HIV infections from urban to rural populations. For example, labour migrants can maintain families in rural areas by making regular return visits at weekends and during holiday periods. Whilst in town, these migrants can form extra-marital relationships with high-risk partners that lead to exposure to infection among their rural-based spouses and children. Other relatively well-off, urban-based men with high levels of prior exposure to HIV infection can pay frequent visits to rural areas where they can use their greater resources to tempt poorer women into unprotected sexual relationships. Equally, rural residents can make more regular visits to towns where they may become involved in casual relationships. For example, in Zimbabwe, it has been observed that young single women from rural areas sometimes spend a period of time in towns engaging in commercial sex work before returning to their rural homes to get married (Charlotte Watts and Geoff Foster, personal communication).

Development Facilitates More Rapid Control?

These differences tend to make the populations of more developed countries in sub-Saharan Africa more vulnerable to rapid dissemination of HIV infection once an

epidemic takes hold. However, other aspects of development give grounds for hope that these countries could be in a stronger position to establish effective responses to HIV epidemics - particularly, once the effects of escalating sickness and mortality begin to counter the initial tendency towards denial. More highly educated populations, more extensive and better quality primary healthcare services, more developed national infrastructure, and greater resources that could, potentially, be deployed on HIV-control might all be expected to give more developed countries a head-start in mounting effective responses.

The ages of national HIV epidemics differ between the regions of the sub-continent. The early spread of HIV-2 in some West African countries apart, the pandemic affected countries in central and eastern Africa initially before spreading west and south. Thus, if it is true that more developed countries are able to mount more rapid and effective prevention programmes, it might be expected that the positive association seen between education and HIV prevalence within the region as a whole would be strongest in southern Africa and weakest in central and eastern Africa. This possibility is explored in Figure 2.

There are substantial differences in the current scale of the HIV epidemics in the different regions. Overall, HIV prevalence is greatest in southern Africa, where literacy levels are also highest (range: 42%-87%). Within this region, there is a strong positive association between levels of adult literacy and HIV prevalence. However, a degree of caution is warranted because the epidemics in the two least developed countries in the region (Mozambique and Angola) may be at an earlier stage due to their relative

isolation from countries affected initially. HIV prevalence data are especially limited for these two countries but there appears to have been a steady rise in infection rates in Mozambique over the past 4-5 years. It must also be recognised that the southern African countries with the highest HIV prevalence levels are characterised by extreme internal socio-economic inequalities. Much of this inequality stems from the particularly uneven form of development undertaken during the relatively recent colonial period.

Literacy levels in central and eastern Africa countries are somewhat lower, being clustered in an intermediate range (36%-80%). The association between literacy and HIV prevalence remains positive but is much weaker - the gradient of the linear regression line is almost flat and its explanatory power is poor. HIV prevalence is known to have declined significantly in one of the more developed countries of the region (Uganda), at least in part, due to behaviour change (Asiimwe-Okiror *et al.*, 1997). The wider picture is encouraging but, at the same time, potentially deceptive, as many of the countries in the region have been plagued by wars in recent years. Military activity has probably both disrupted education services and contributed to the spread of HIV infection (Smallman-Raynor and Cliff, 1991). In such circumstances, data quality is also liable to have suffered.

The situation in West Africa is also difficult to read. There is great heterogeneity in levels of adult literacy within the region, some countries having extremely low levels (range: 15%-81%). Again, there is a weak positive association between literacy and HIV prevalence. The strength of any genuine association between the two is obscured by variation in the stage of epidemics and the extent of religious and cultural practices,

including male circumcision, that are thought to restrict HIV transmission (Moses *et al.*, 1990; Caldwell and Caldwell, 1993; Weiss *et al.*, 2000).

3 EDUCATION AND HIV AT THE INDIVIDUAL LEVEL

Secondary Education: Risk Factor for HIV Infection in Young Epidemics?

A recent extensive review of the literature conducted under the auspices of UNAIDS (Hargreaves *et al.*, 2000) established that most of the studies undertaken in sub-Saharan Africa (and, indeed, in other developing countries) to date have reported increased risk of HIV infection amongst the more educated. This finding held true in studies where adjustments had been made for the effects of age and other potentially confounding socio-demographic factors.

In the absence of HIV epidemics, more educated people generally have higher rates of sexual partner change, primarily because they have greater personal autonomy and spatial mobility (Blanc, 2000). More educated women start to have sex later but typically experience longer periods between starting sex and getting married, so are liable to accumulate larger numbers of partners during this period than their less educated peers (Blanc and Way, 1998). Educated people make greater use of modern methods of family planning but the contraceptive pill is most commonly employed and condom use is low. Taken in the round, this pattern of behaviour makes more educated people especially vulnerable to HIV infection in the early stages of an HIV epidemic.

The effect is compounded by the prevailing patterns of sexual mixing (Anderson *et al.*, 1991): educated men form partnerships with equally and less educated women while educated women tend to mix more assortatively - i.e.: with men of equal or higher education.

Secondary Education: Facilitates HIV Risk Reduction in Mature Epidemics?

As HIV epidemics progress and their effects on morbidity and mortality become more clearly apparent, adding greater credibility to information disseminated through AIDS awareness campaigns, it might be expected that more educated people would be better placed to adopt safer lifestyles quickly. Formal instruction in school and easier access to information made available through the media should provide greater exposure to the facts about HIV and AIDS (Gregson *et al.* 1998), enhanced sense of self-efficacy and negotiating skills should reduce fatalism and inadvertent involvement in high-risk relationships (Bandura, 1977; Lindan *et al.*, 1991), and greater readiness to use modern health services should increase access to prompt treatment for sexually transmitted diseases and to condoms (Blanc, 2000).

As the macro level enhanced socio-economic status can be both a determinant and a consequence of greater education. The same is the case at the micro level. Better-off families are more able to afford to keep children in school for longer periods. Thus, women of secondary school age who remain in school may have less reason to resort to commercial sex or to seek early marriage. Equally, women from poorer households who do commence sexual activity at young ages are more likely to become pregnant and be

forced to drop out of school. However, once men and women attain secondary school qualifications, they are in a stronger position to build upon their socio-economic status and to be more careful and selective in conducting sexual relationships.

There have been disappointingly few longitudinal studies that have reported data on the association between level of education and HIV infection. Results from those that have been published (Bulterys *et al.*, 1994; Chao *et al.*, 1994; Kapiga *et al.*, 1994; Malamba *et al.*, 1994; Nunn *et al.*, 1994; Kapiga *et al.*, 1998; Kilian *et al.*, 1999; Fylkesnes *et al.*, 2000) are summarized in Figure 3, in the form of odds ratios that contrast the risk of HIV infection in individuals with secondary or higher education with that for individuals with primary or no education. The odds ratios are for women unless stated to the contrary.

In most cases, the associations reported are between education level and HIV prevalence. The latter will be slow to reflect any changes in the association with new 'incident' cases of HIV infection. Thus, where changes in the association with incidence have occurred, the sample sizes obtained will generally be too small for these to be detected with confidence. Furthermore, odds ratios based on HIV prevalence reflect risk factors for survival as well as those for incidence. Differentials in duration of survival by education level are likely to be small given the inaccessibility of anti-retroviral therapy in most African populations. Nevertheless, more educated sub-groups may have better general health care and nutrition which could extend their survival periods slightly and obscure any shift towards a negative association between higher education and HIV incidence as epidemics age.

Some studies have reported data on baseline prevalent HIV cases, followed by results for subsequent incident cases. These studies have the advantage that they compare older and more recent infections but are still problematic due to small numbers of incident cases. There are also differences between the studies in the levels of education compared and the form of analysis undertaken.

Despite these difficulties, two points do seem to emerge from the data. First, they illustrate the almost universal early excess of HIV infection among the more educated (Hargreaves *et al.*, 2000). Most of the data shown in Figure 3 are from women attending family planning or antenatal clinics. In the one instance where it is possible to compare data for antenatal attendees with data for women in the general population at the same time point, it is interesting to note that the odds ratio is lower in the general population. This may be because those educated women who become pregnant and attend local antenatal clinics more often are also more likely to engage in unprotected sexually activity than their peers who have not yet become pregnant or who do so less frequently. This is an important finding in regard to interpretation of antenatal HIV surveillance data. However, the timing of the survey and the relatively small quantum of the difference are such that it does not appear to contradict the overall conclusion that more-educated women are generally at greater risk in the initial stages of HIV epidemics.

The second point is that the data indicate that the excess HIV infection in more educated adults does indeed seem to reduce as epidemics progress. With the exception of the small population-based study in an area of Tanzania subject to intensive HIV prevention

activities (Kwesigabo *et al.*, 1998), this is a consistent finding across all the studies. However, perhaps for the reasons outlined above, the effect is only statistically significant in one case.

The studies from Fort Portal, Uganda and urban and rural Zambia provide data on the association between education level and HIV by age. In Fort Portal, in 1991-94, HIV prevalence was highest in women with secondary education in both the 15-24 year and 25-49 year age groups (Kilian *et al.*, 1999). However, in 1995-97, infection levels were lower in all age and education categories except the older illiterate group. The largest declines were seen amongst younger women and women with secondary education.

In Zambia, HIV prevalence also fell between 1994 and 1998 in both urban and rural areas, with the strongest declines again being seen in younger more educated women (Fylkesnes *et al.*, 2000). The changes in age-specific prevalence odds ratios are shown in Figure 4. In accordance with earlier observations (Hargreaves *et al.*, 2000), the excess in infection rates among the more educated is greatest in the rural areas. Sample sizes for individual age groups are small but there appears to be a shift from a convex pattern of excess risk by age among those with secondary education to a more concave pattern, particularly in the urban areas. Given the long incubation period for AIDS, the former would reflect a gradual accumulation of excess infection with increasing age, tapering off at older ages due to mortality and declining sexual activity. The latter suggests a recent reduction in excess risk among the more educated which is consistent with the available data on local sexual behaviour patterns (Fylkesnes *et al.*, 2000). Again, given the long post-infection survival periods associated with HIV, more rapid behaviour

change amongst the more educated would be expected to show an effect most quickly at the youngest ages. These women have been sexually active for short periods so most infections are recent. The pattern would be expected to be especially pronounced were younger educated women to adopt safer behaviour more quickly than their older counterparts.

4 EDUCATION AND HIV IN RURAL ZIMBABWE

To confirm that reductions in excess risk among more educated young men and women result from faster adoption of safer practices in response to HIV epidemics and to understand the nature of any such changes in behaviour, linked sex-, age- and education-specific data on HIV prevalence and behavioural risk factors for HIV infection are required. Detailed data of this kind were collected in a population-based survey of 9,826 adults, conducted in rural areas of Manicaland Province in eastern Zimbabwe between July 1998 and January 2000 (Gregson *et al.*, 2001).

Overall, HIV prevalence was extremely high: 19 per cent for men and 28 per cent for women. Zimbabwe has a well-developed education system and the highest level of adult literacy in sub-Saharan Africa (UNDP, 2000). In the study population, 81 per cent of men and 74 per cent of women had completed at least one year of secondary education. The observed prevalence odds ratios for HIV infection among individuals with experience of secondary education are shown by age and sex in Figure 5. From these results, it seems that more educated people are actually at equal or even lesser risk of

HIV infection than their less educated contemporaries. As we noted earlier, the fact that this picture differs from that seen in most other studies can be ascribed, in part, to use of population-based rather than antenatal clinic data. However, even at antenatal clinics, the current excess risk of HIV infection among more educated women is low for a predominantly rural population (Figure 3).

HIV prevalence is lower at young ages - especially among men - and the proportions of men and women with no secondary education are relatively small. Thus, confidence intervals are wide in the youngest age groups. Nonetheless, the patterns of HIV prevalence odds ratios by age for both men and women appear to be broadly convex with just a suggestion of a possible straightening out at the youngest ages. Among 17-18 year-old men, HIV prevalence was low in both students (0.4%) and school leavers (0.8%). Among women of this age, students (1.4%) were significantly less likely to be infected than those no longer in school (8.4% - age-adjusted odds ratio: 0.15; $P=0.009$). This may be due in part to girls being expelled from school if they become pregnant or are known to be sexually active.

In a previous analysis, we found that the principal risk factors for early-age infection in this population include early sexual activity, larger numbers of lifetime partners and age-difference with sexual partners. Large age-differences between partners are common even at young ages, with men typically being several years older than their female partners. Women with older partners and men with partners close to their own age were found to be at greater risk of being HIV-positive (Gregson *et al.*, 2001). A history of

unprotected sex with casual partners is also a likely risk factor but it was not possible to confirm this with the current data set.

Age at first sex was later in men (median age: 18.8 *versus* 18.2 years) and women (19.5 *versus* 17.5 years) with secondary education. Further survey results on current sexual activity and marital status by sex, age and education status are shown in Figure 6 and Table 1. In accordance with the typical pattern (Blanc, 2000), more educated young people spend longer periods between starting sex and getting married, the proportionate difference being small for men but substantial for women. Largely because of the delay in marriage, fewer of the more educated people have experienced divorce or widowhood.

The results shown in Table 1 indicate minimal differences in numbers of lifetime partners and partners in the last year by level education. Less educated women have slightly larger age-gaps with their partners and a few more of the less educated men have partners who are older than themselves. Young men with and without secondary education are equally likely to report casual partners; those that do, are equally likely to have had unprotected sex. Young married women are less likely to report recent casual relationships than those who are single, divorced and widowed. It is interesting, therefore, that fewer women with secondary education report casual relationships. This seems to be because more educated women are systematically less likely to report casual relationships across all marriage classes, an effect that outweighs the increased risk that results from fewer being married. There was no difference in condom use among women

by level of education, so the differential in involvement in casual relationships translates into a similar differential in unprotected sex with casual partners.

In summary, it appears that secondary educated young women currently acquire HIV infection at a slower rate due to later onset of sexual relations and less unprotected casual sex. The picture is less clear for men but delayed sexual activity may also be reducing the risk of HIV infection among the more educated. In other respects, the sexual experiences currently reported by young men with and without secondary education are very similar.

5 DISCUSSION

Major HIV epidemics are liable to hamper socio-economic development but it is less clear whether greater development facilitates or obstructs HIV control. To a degree, the latter almost certainly depends on the precise pattern of development. In this article, we have examined the relationship between greater education and the spread of HIV infection within the context of early and maturing HIV epidemics in sub-Saharan Africa. Education itself may influence HIV transmission but it also serves as a useful proxy for the wider effects of socio-economic development.

We have shown that *ceteris paribus*, higher levels of education are currently associated with larger HIV epidemics in sub-Saharan African countries and have argued that this is primarily because more educated populations typically have pre-existing patterns of

sexual behaviour that provide greater vulnerability to rapid HIV transmission. Similarly, at the individual level: the prior behaviour patterns of the more educated make them more vulnerable to HIV infection for the initial period of ten or more years when the effects of the epidemic remain silent (Garnett *et al.*, 2001).

However, we suggest that once these effects of HIV on morbidity and mortality become recognised, more educated populations and sub-populations might be expected to respond more speedily. Previous population programmes, such as those introduced to improve primary healthcare and to promote the use of modern methods of family planning, have often been most successful in more developed countries. Within countries, they have generally been taken up initially by more educated individuals, after which, others have begun to follow suit. Thus, trends in the behaviour of the more educated segments of populations are of particular interest (Melbye *et al.*, 1986).

At the macro level, evidence for faster declines in HIV prevalence in more educated populations is limited due to shortcomings in national HIV surveillance estimates for many countries, problems in reliance on HIV prevalence as an indicator of contemporary infection rates, regional differences and temporal changes in levels of development, and the influence of other factors such as local culture, religion, military disruption and the predominance of different HIV subtypes (Anderson *et al.*, 1996). Comparison of trends at the national level is made particularly problematic by the paucity of satisfactory longitudinal data.

However, there are a number of signs at the micro level that the relative risk for HIV infection among more educated individuals could be reducing. In particular, we have been able to identify the following trends:

- (1) An almost universal shift towards reduced relative risk of HIV infection in those with secondary education in the populations for which longitudinal data are available;
- (2) A shift from a convex shape to a more concave shape in the age-pattern of relative risk in populations for which age-specific data are available. This is the trend that would be expected where more educated people are the first to modify their behaviour; and
- (3) Safer sexual behaviour practices among young people with secondary education in contemporary rural Zimbabwe. In pre-AIDS populations, the opposite is generally the case.

There is an important caveat to point (3). The differential in age at first sex by educational attainment for females, large as it is, pre-dates the AIDS epidemic in Zimbabwe (Parirenyatwa, 1995) and is a familiar feature in the early stages of fertility transition. Thus, it cannot be ascribed to a behaviour change adopted in response to AIDS. This conclusion is given further credence by the similar proportions of the educated and less educated young women (13 per cent *versus* 12 per cent) yet to commence sexual activity who cited concerns about HIV/AIDS as being the paramount

reason. Later onset of sexual relations in young men is more unusual but, again, a degree of caution is in order, as similar proportions of those who have not started sex gave HIV/AIDS as the reason (20 per cent *versus* 21 per cent). Nevertheless, the absence of a surfeit of risky behaviour amongst young men with secondary schooling and the less risky behaviour of the more educated young women do provide some grounds for optimism.

What would be the longer-term implications of reduced risk at young ages? At current levels of HIV prevalence, the adult lifetime risks of HIV infection are similarly high (approximately 2-in-3) for men and for women in rural Zimbabwe, despite the fact that young men are much less likely to be infected than young women (Gregson and Garnett, 2000). Here, differences in early-age behaviour serve to postpone rather than to prevent male infections. Could the same be true for differentials by level of education? The answer is currently unclear. Delayed onset of sexual activity has been found to be associated with a lesser propensity towards subsequent extra-marital intercourse (White *et al.*, 2000). However, in populations where marriage is an almost universal experience, the behaviour of the marital partner is as important as that of the individual. For women, in particular, the benefits of reduced risk at young ages are liable to be offset later unless older men also cut down on unprotected extra-marital relationships.

More definitive conclusions on whether behaviour change is occurring more rapidly among individuals with greater education, the extent to which this is followed by behaviour change among those with less education, and the longer-term prospects for avoiding HIV infection will require further longitudinal studies. Longitudinal data are

probably most readily available from antenatal clinic surveillance but are limited to women and in the scope of the behaviour data that can be collected. As the Zimbabwe results illustrate, patterns of HIV prevalence recorded at antenatal clinics require caution in interpretation (Zaba and Gregson, 1998). Selective inclusion of the minority of more educated women, who are sexually active at young ages and therefore become pregnant earlier or more often, can give the false impression that women with higher levels of education also have higher HIV prevalence in circumstances where the reverse is true. Lower participation among more educated women as a whole can give a biased picture of levels and trends in HIV infection (Fylkesnes *et al.*, 1997). Thus, wherever possible, population-based studies are needed to complement routine antenatal surveillance.

Scientific trials of specific strategies to provide better education on sexual and reproductive health within schools are currently in progress (Grosskurth *et al.*, 2000). These trials will provide valuable data on the role that education systems can play in providing well-focussed (i.e.: targeted at the age groups at greatest risk of imminent infection) opportunities for mounting HIV prevention initiatives. However, further research is needed on the wider potential advantages that more educated populations could offer in the implementation of effective AIDS control programmes.

Widespread formal education is a key plank in development and can provide a strong platform from which to combat HIV epidemics (Vandemoortele and Delamonica, 2000), both through the skills and life-chances it imparts and the opportunities it provides for schools-based interventions. At the same time, AIDS epidemics pose intense challenges to the education system itself (Shamu *et al.*, 1997; Cohen, 1999). On the demand side,

there are pressures to remove children from school prematurely, both due to shortage of cash for fees, uniforms and so on, and because children are needed at home to care for sick relatives or to fulfil the roles of those who have died (Foster *et al.*, 1995; World Bank, 1997). The latter is liable to be a particular problem for young girls. On the supply side, education services are becoming increasingly disrupted by staff sickness and death. In the Zimbabwe study, male and female teachers had similarly high levels of HIV infection to other adults in the general population (19.2% and 28.8% *versus* 19.2% and 27.6%, respectively). In this context, sustaining and building upon existing education services will be extremely difficult and will require extensive resources. Nevertheless, the attempt has to be made and will pay dividends in reducing HIV transmission, morbidity and mortality, as well as in underpinning more positive development strategies.

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FIGURE LEGENDS

Figure 1: HIV prevalence in adults aged 15-49 years by level of adult literacy for 40 countries in sub-Saharan Africa.

Figure 2: HIV prevalence in adults aged 15-49 years by level of adult literacy and sub-region within sub-Saharan Africa. Countries allocated to sub-regions in accordance with the World Bank classification (World Bank, 1996). Graph (a): southern Africa; (b) central and east Africa; and (c) west Africa.

Figure 3: Odds ratios (with 95 per cent confidence intervals) for HIV infection in adults with secondary or higher education compared to those with primary or no education for eight African populations with data for more than one time point. *Note:* odds ratios are not available for the 1991-1993 study in Rwanda but it was reported that there was no significant difference in incidence rates between more and less educated women in this period (Bulterys *et al.*, 1994). ‡ secondary *versus* no education; † primary *versus* no education; and †† secondary *versus* primary or no education. ** multivariate analysis; * age-adjusted analysis.

Figure 4: Log-transformed HIV prevalence odds ratios by age group, for women with secondary education among antenatal clinic attendees in selected urban and rural areas of Zambia in 1994 and 1998. Adapted from Fylkesnes *et al.*, 2000.

Figure 5: Log-transformed age-adjusted HIV prevalence odds ratios (and 95 per cent confidence intervals), by age group for 3,959 men and 4,663 women, aged 17-44 years, with secondary education in rural areas of Zimbabwe, 1998-2000.

Figure 6: Sexual activity and marital status of 2,142 men and 2,274 women aged 15-24 years in rural areas of Zimbabwe, 1998-2000.

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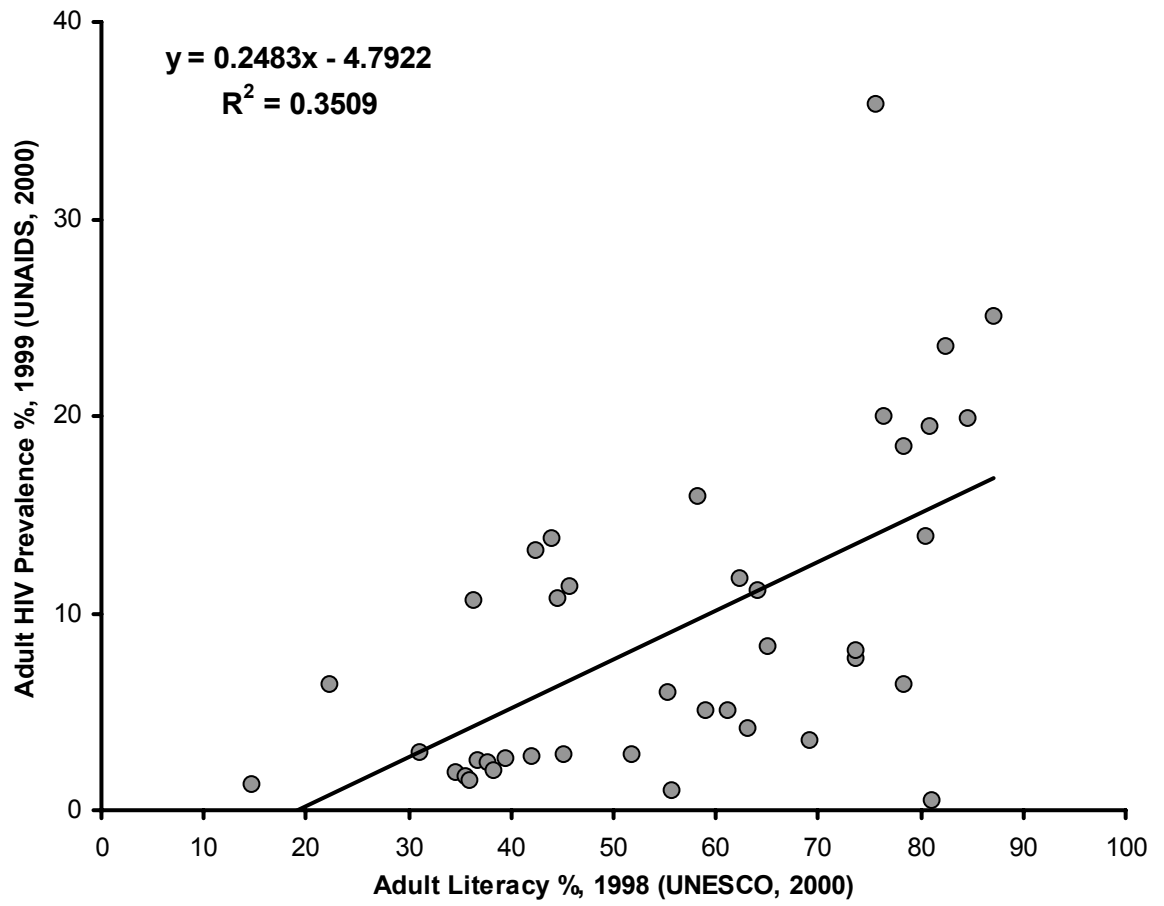
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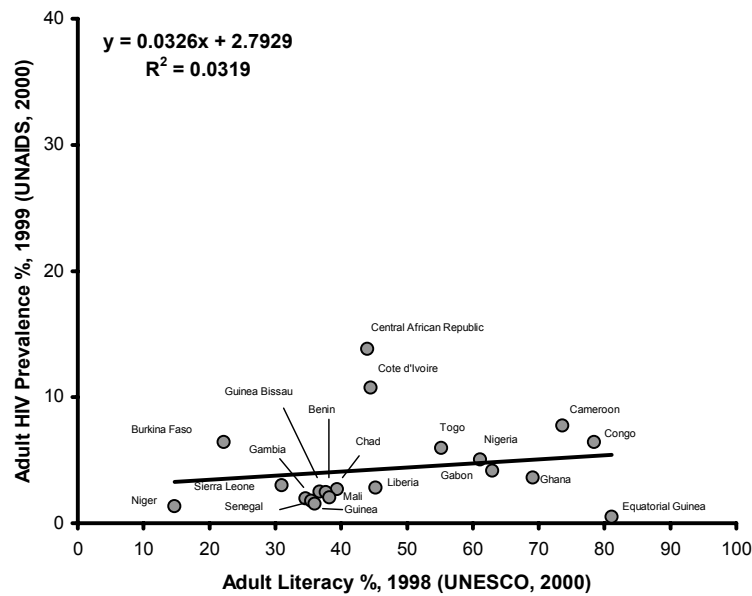
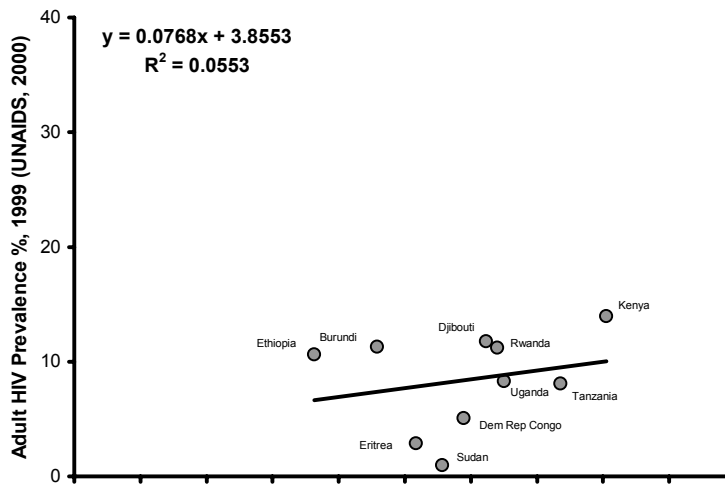
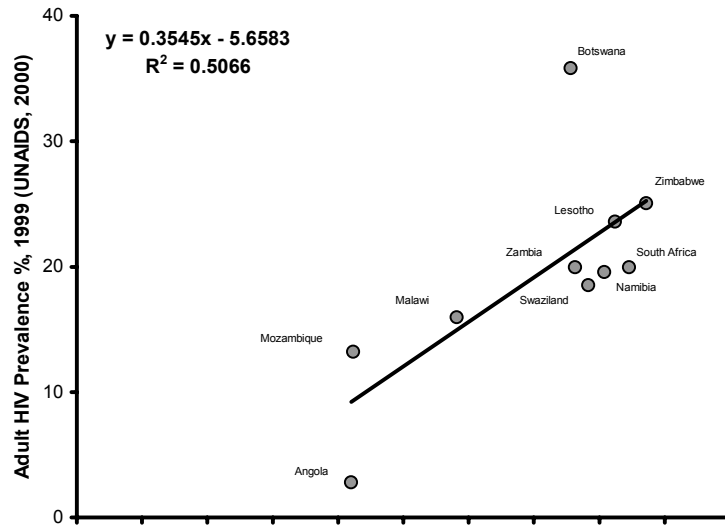
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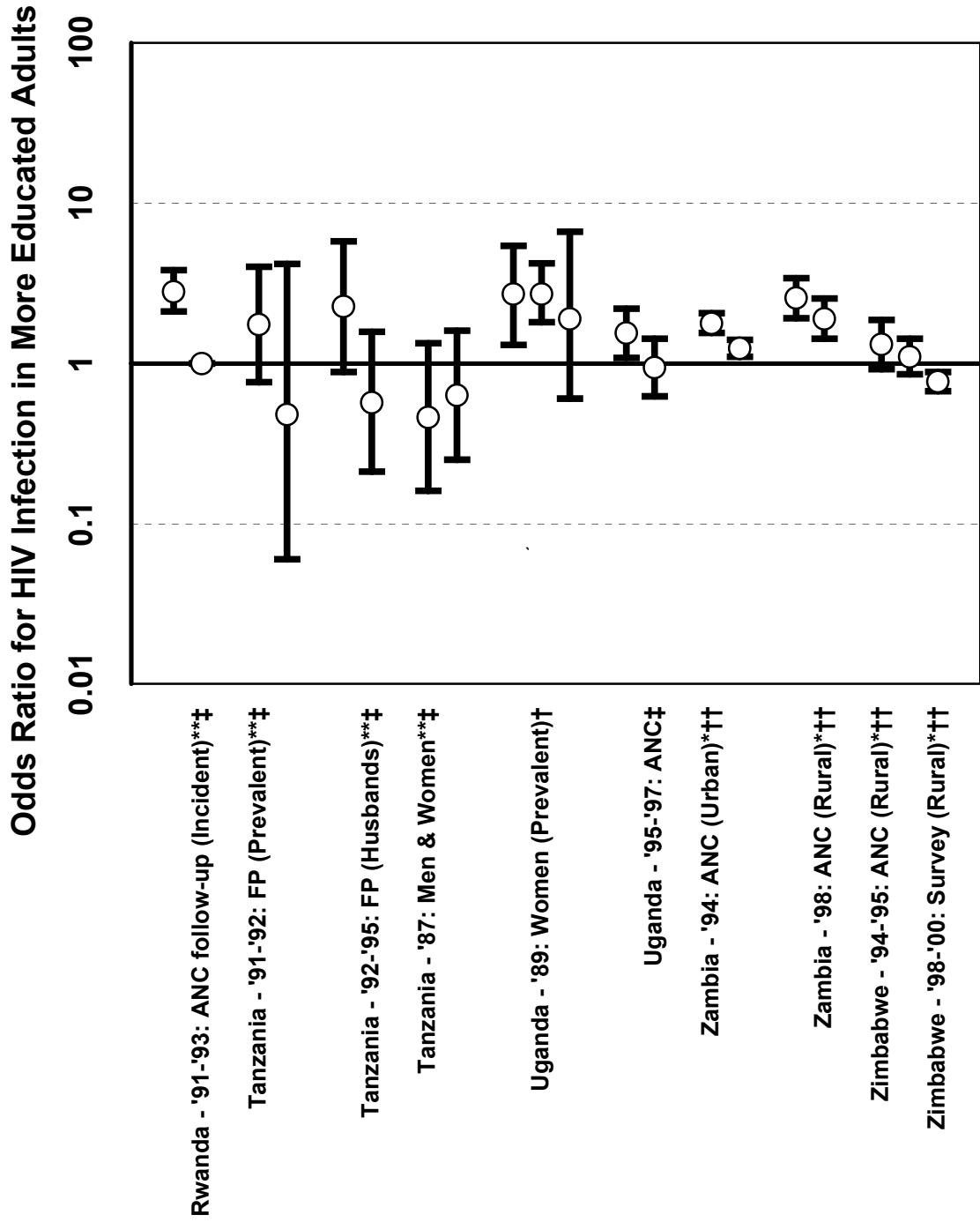
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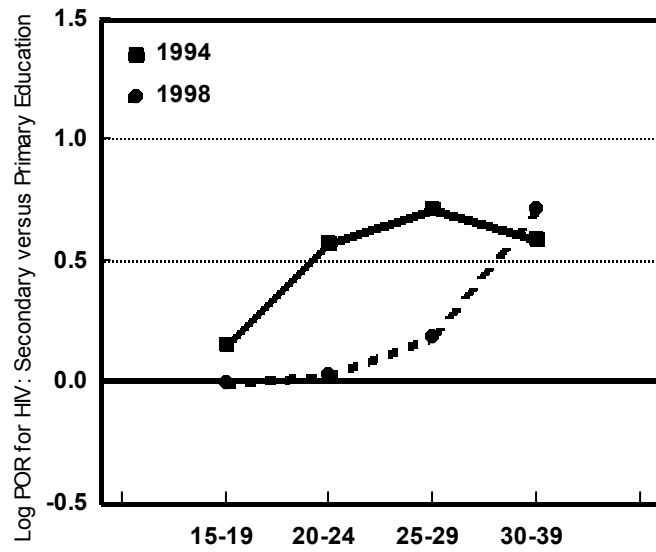
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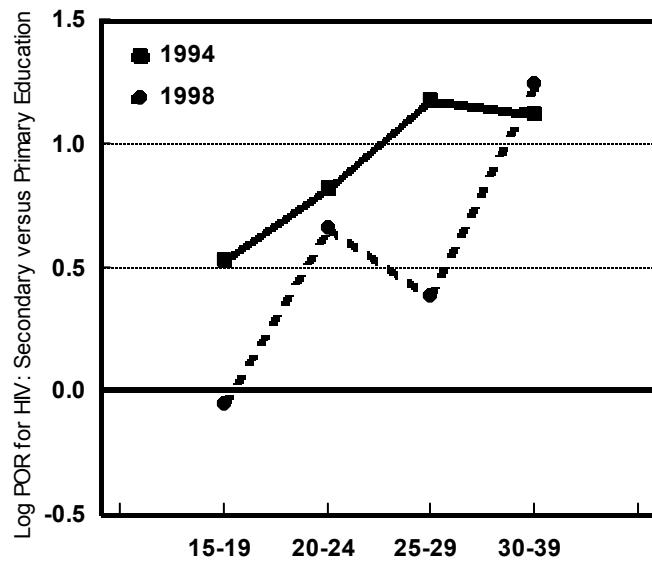


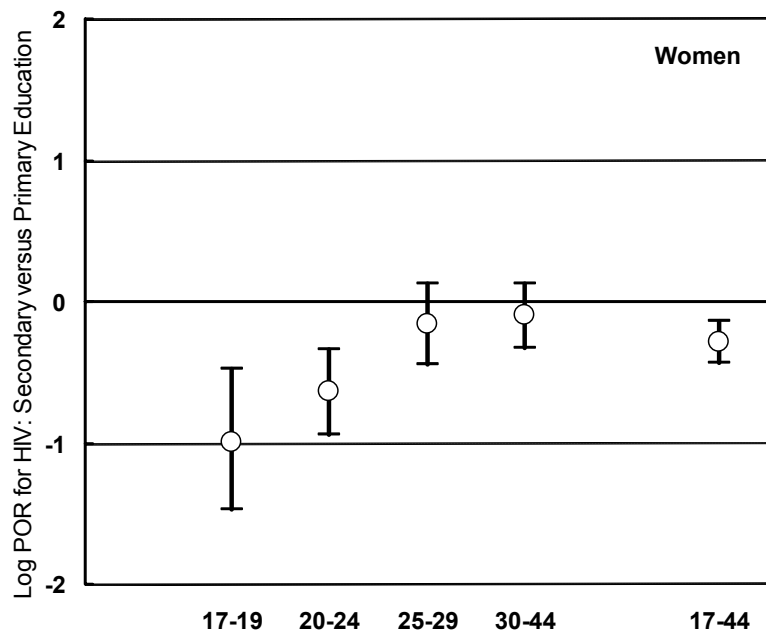
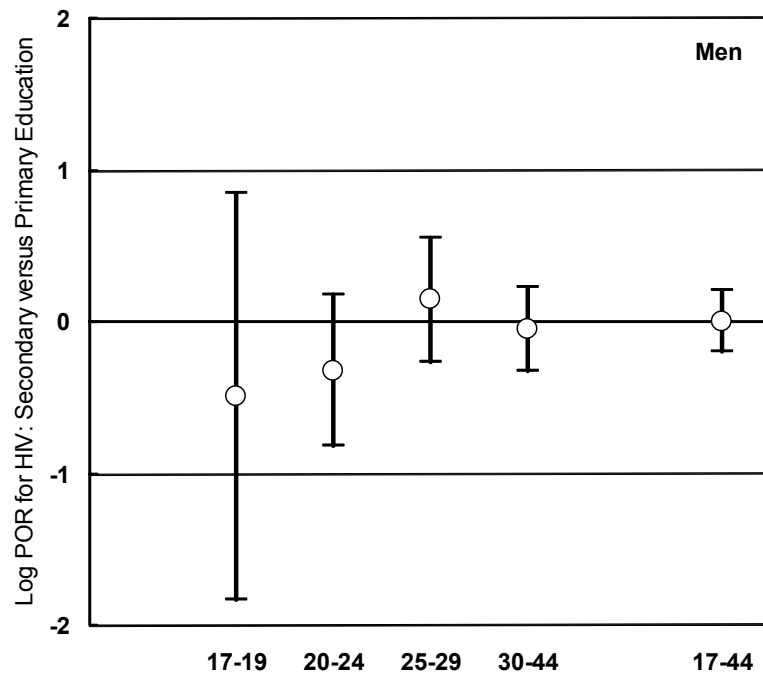


Urban

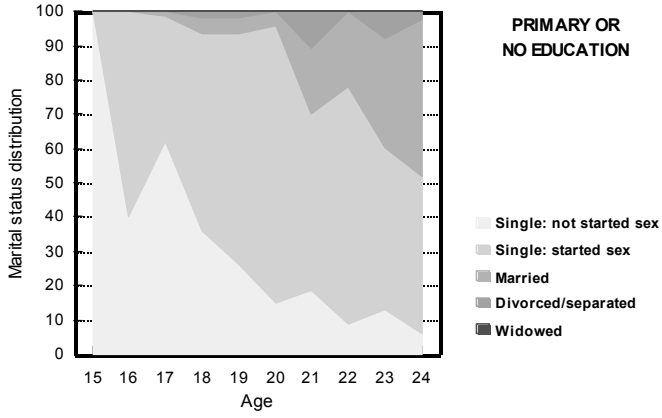


Rural





Males



Females

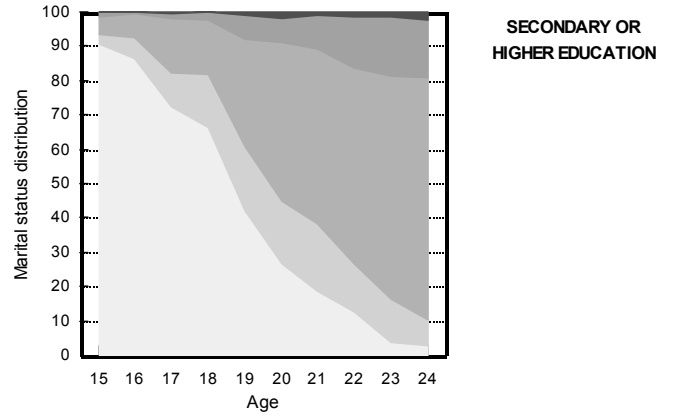
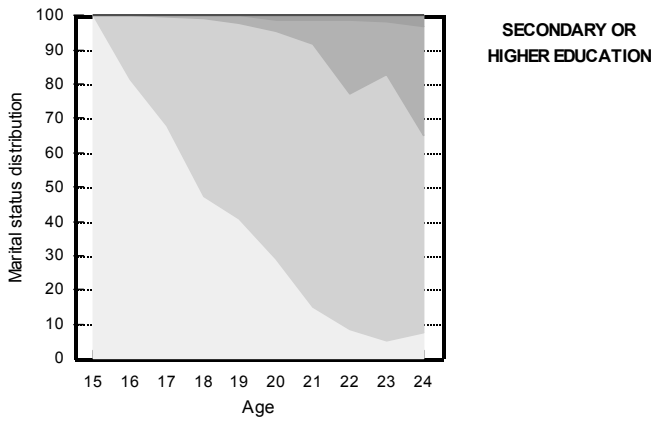
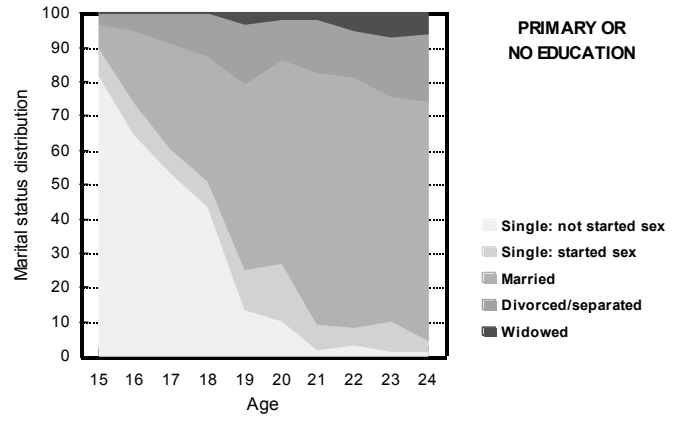


Table 1. Comparison of risk behaviours for early-age HIV infection in sexually-experienced young people with and without secondary schooling

Aspect of sexual behaviour	Males								Females														
	Secondary education				No secondary education				Secondary education				No secondary education										
	10%	Median	90%	(n)	10%	Median	90%	(n)	10%	Median	90%	(n)	10%	Median	90%	(n)							
A: Current age 17-19 years																							
Lifetime partners	7	3	1	(284)	7	3	1	(81)	3	1	1	(171)	3	1	1	(81)							
Partners in the last year	4	1	0	(286)	4	1	0	(82)	2	1	0	(172)	1	1	0	(82)							
Years younger than latest partner	0	-2	-3	(122)	1	-1	-3	(30)	11	6	2	(102)	17	7	3	(60)							
B: Current age 20-24 years																							
Lifetime partners	11	4	1	(743)	11	4	1	(185)	3	1	1	(606)	3	1	1	(272)							
Partners in the last year	5	1	0	(755)	4	1	0	(190)	1	1	0	(613)	1	1	0	(281)							
Years younger than latest partner	-1	-3	-6	(324)	1	-3	-6	(84)	12	5	1	(342)	20	6	2	(172)							
	%				%				%				%										
Casual partner in the last month*:																							
All (ages 17-24 years)				20.5				(1,148)	20.1				(299)	4.6				(841)	6.8				(385)
Single				20.2				(991)	20.1				(229)	9.2				(185)	13.2				(38)
Married				21.1				(142)	21.7				(60)	2.5				(527)	4.9				(266)
Divorced				33.3				(15)	10.0				(10)	6.9				(116)	9.1				(66)
Widowed				-				-	-				-	7.7				(13)	13.3				(15)
Unprotected sex with a casual partner in the last month*				9.8				(1,148)	9.8				(299)	2.7				(841)	3.8				(385)

* Includes those who have started sex but report no sexual partner in the last month.