

# Education and vulnerability: the role of schools in protecting young women and girls from HIV in southern Africa

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Education has a potentially important role to play in tackling the spread of HIV, but is there evidence that this potential is realized? This analysis combines the results of previous literature reviews and updates them with the findings of recent randomized controlled trials and a discussion of possible mechanisms for the effect of schooling on vulnerability to HIV infection. There is a growing body of evidence that keeping girls in school reduces their risk of contracting HIV. The relationship between educational attainment and HIV has changed over time, with educational attainment now more likely to be associated with a lower risk of HIV infection than earlier in the epidemic. Educational attainment cannot, however, be isolated from other socioeconomic factors as the cause of HIV risk reduction. The findings of this analysis suggest that the equitable expansion of primary and secondary schooling for girls in southern Africa will help reduce their vulnerability to HIV. Evidence of ineffective HIV prevention education in schools underlines the need for careful evidence-based programme design. Despite the challenges, recent provisional evidence suggests that highly targeted programmes promoting realistic options for young adults may lead to safer sexual behaviour. Targeted education programmes have also been successful in changing students' attitudes to people living with HIV and AIDS, which is associated with testing and treatment decisions. This reduction in stigma may be crucial in encouraging the uptake of voluntary counselling and testing, a central strategy in the control of the epidemic. Expansions of carefully designed and evaluated school-based HIV prevention programmes can help to reduce stigma and have the potential to promote safe sexual behaviour.

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## Introduction

Education has been suggested as a 'social vaccine' to prevent the spread of HIV. In sub-Saharan Africa, infection rates are lowest among children in primary school. These children represent a 'window of hope' for the future [1]. If they can gain the skills and knowledge necessary to make healthy choices about their sexual behaviour, the potentially devastating effects of the pandemic on the next generation could be attenuated.

## A focus on girls

There is a strong rationale for making girls a particular focus of such HIV prevention efforts. Biologically, socially, and culturally, girls are particularly vulnerable to HIV infection. For physiological reasons women are more likely to be infected with HIV from an infected male partner than are men who have sex with an infected female partner [2]. In many of the hyperendemic countries social and cultural influences on girls' behaviour prevent them from making choices that could be protective: staying in school, buying condoms, or

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discussing safer sex measures with parents, teachers, or partners, for example. Girls are also more likely than boys to be sexually abused, and their first sexual encounters are often forced or violent [3]. Even in schools, girls are targets of sexual harassment and abuse [4]. Given the social and economic insecurity that many adolescent girls face, risky behaviour such as sex with an older partner may be a rational decision. In one study, girls who became pregnant by a man more than 10 years older were more likely to marry than if the father was less than 5 years older (79% versus 42%) [5]. HIV cannot be tackled effectively unless boys' and men's behaviour changes along with girls'. Girls' vulnerabilities to infection, however, make it critical to focus on general or HIV/AIDS-specific educational programmes that may reduce their risk.

We examine the evidence on this issue in two sections. First, we look at the impact of increased schooling on HIV infection. Does reaching a higher level of education lead to a reduced risk of infection? Does attending school lead to a reduced risk of infection? We review studies addressing these two questions including a recent systematic review of evidence for a relationship between educational attainment and HIV [6]. Second, we report findings from our own systematic review of studies of the effectiveness of school-based HIV prevention programmes. Third, we make a series of educational policy recommendations as well as suggestions for HIV/AIDS-specific curriculum development. This analysis furthers the discussion of HIV and education by combining the results of previous literature reviews and updating them with the results of recent randomized controlled trials and a discussion of possible mechanisms for the impact of schooling on vulnerability to HIV infection.

## **Section 1: the relationship between educational attainment and HIV infection**

In this first section we examine the relationship between schooling and HIV infection. Here we are concerned with two distinct effects of formal schooling. The first involves the consequences of merely attending school, regardless of what is learned there. The second involves the consequences of higher levels of educational attainment. This latter effect concerns the general education resulting from formal schooling rather than specific HIV-prevention education programmes. Throughout the following discussion we aim to keep these two pathways, of school attendance and educational attainment, distinct because they are supported by different bodies of evidence and involve different causal mechanisms. A number of limitations are faced when investigating the connection between general education levels in a population and HIV infection. Studies that aim to answer this question are generally associational rather than causal as a result of the logistical and ethical concerns

that would accompany a randomized controlled trial of education provision. We believe, however, that sufficient evidence exists to suggest patterns. We examine the evidence in three sections, moving up the chain of causality from education to HIV infection. First we look at education's influence on the determinants of sexual behaviour, then on sexual behaviour itself, and finally we assess whether education influences the risk of HIV infection.

### **Schooling and the determinants of sexual behaviour: a theoretical framework**

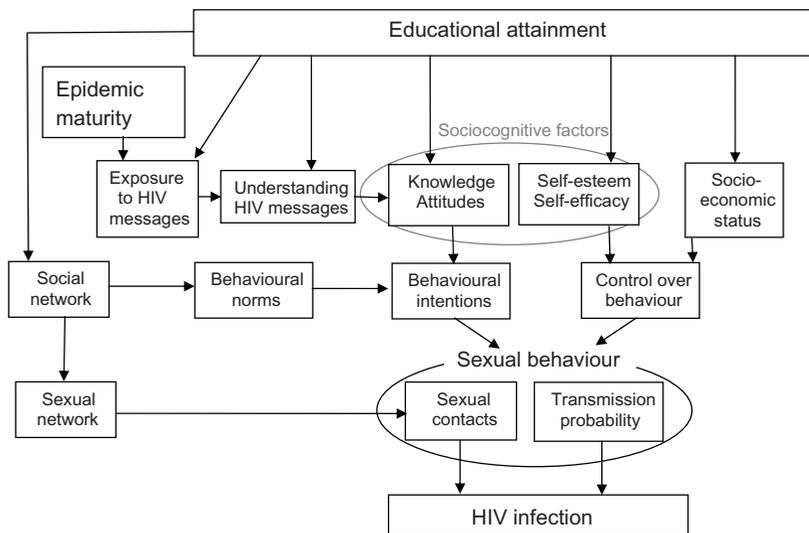
Attending formal schools can lead to behaviour change in many ways. Here we identify three routes by which increased educational attainment may affect sexual behaviour: by changing the sociocognitive determinants of behaviour (knowledge, attitudes and perceived control), by influencing social networks, and by leading to a change in socioeconomic status. These mechanisms are illustrated in Fig. 1. We later discuss separately the ways in which school attendance alone can affect sexual behaviour.

#### *Educational attainment and sociocognitive determinants of behaviour*

In a direct way education may affect the thought processes of individuals, which subsequently affect their behaviour. Social cognition models point to several such key determinants of sexual behaviour. In most theories, knowledge and understanding of a behaviour and its consequences is a necessary but not sufficient condition for performing the behaviour and underpins the perception of [7] and attitudes towards [8] that behaviour. In the context of HIV, understanding transmission routes and methods of blocking them are essential for the adoption of safer sexual behaviour.

More educated people are more likely to be exposed to prevention information as part of formal schooling and also through the media [9]. Greater levels of education may also provide a framework of biological knowledge and an understanding of causality into which HIV prevention messages can be assimilated. Education thus helps individuals understand the connection between a behaviour (e.g. unprotected sex) and its outcome (HIV infection). Social cognition models [10] also suggest that the evaluation of this outcome is important. Individuals must be sufficiently motivated to avoid HIV infection and pregnancy in order to avoid unprotected sex. Evidence suggests that attending school influences the evaluation of this outcome [11] (discussed below).

Another key theoretical determinant of behaviour is the perceived control one has over the behaviour. This includes self-efficacy, one's belief in one's capabilities to perform a specific action required to attain a desired outcome [12], the perceived personal power one has over the behaviour [8] and the actual personal power one has



**Fig. 1. Pathways for the effect of educational attainment on HIV infection and how these mechanisms are influenced by epidemic maturity.** In the absence of HIV prevention messages, greater control over behaviour puts educated individuals at greater risk. When HIV prevention messages become more common, educated individuals are better placed to act on them. (See text for full explanation.)

over a behaviour [13]. Evidence suggests that education is associated with increased self-efficacy in general [12] and in the context of the HIV epidemic in sub-Saharan Africa in particular [14]. In addition, more educated people are more likely to believe they have control over their own behaviour, rather than another individual or fate, and they are more likely to have actual control over their own behaviour. For example, educated women are more able and likely to negotiate safer sex [15–17], discuss family planning with their partner [18], and feel a sense of control in their sexual relationships [19].

#### *Educational attainment and social/sexual networks*

Increased education levels can also influence the kind of people one meets and the way they behave. The enhanced social status or wealth associated with increased education may lead to someone having different sexual networks. It may also influence the behaviour of other individuals in this network, perhaps increasing their willingness to become sexual partners or influencing their effectiveness in negotiation about sexual behaviour. The suggestion that more educated individuals have different sexual networks than poorly educated individuals has an implied impact on an individual's risk, which depends on the particular epidemiology of HIV in the individual's country and region. Assortative sexual mixing by education level is likely to reinforce the relationship between education and HIV, increasing the risk or bolstering the protection. It is difficult to discern whether education influences HIV risk in this way. The nature of this impact is likely to be long term and linked to social mobility. To our knowledge, little research has been done linking educational levels to sexual networks in sub-

Saharan Africa; the hypothesis that education may act as an HIV prevention mechanism by sorting educated people into safer sexual networks deserves further enquiry.

Social networks are also important because of the power of the normative beliefs that are held by groups of people. These norms influence individuals' behaviour, especially for young people [20]. In South Africa, social norms surrounding men's dominance over women in sexual relationships are prevalent, and these norms are problematic in terms of HIV prevention efforts [21]. Social norms can influence protective behaviours as well as risk-taking behaviours. According to a study in Kenya 'the probability that women will favor sexual faithfulness depends significantly on the number of network partners who also favor this method of protective behaviour' [22]. Social norms were a strong predictor of intention to use a condom in a South African study [23].

Social norms and education are interrelated in several ways. First, people of different educational levels may have different sets of social norms. Case studies in South Africa found separate social group identities for adolescents who had different types and levels of education, those who went to school outside of the community, those who went to local schools, and those who had dropped out of school [24]. Second, in a reversal of the relationship, social norms may determine how interested an individual is in HIV/AIDS education. For university students in Ethiopia, the perception of social norms regarding HIV/AIDS was a significant predictor of the desire to learn about HIV/AIDS [25]. Admittedly,

social norms are difficult to alter through interventions; however, 'once altered the new norms tend to be perpetuated' [26].

In addition to the above mechanisms, education may also enhance the effectiveness of social support networks. One study in Manicaland, Zimbabwe, showed that more educated women are able to benefit more from other protective measures. This study looked at membership in social groups related to churches or political parties, among other organizations. Women who were members of a well-functioning social group were 1.3 times more likely to avoid HIV infection than those who were not in such groups or who were in groups with which they were dissatisfied. Women with secondary education were more likely to belong to such groups and among women with secondary education, those who were members of well-functioning groups were 1.5 times less likely to be infected with HIV, whereas women with no education received no such benefits from group membership [27]. Membership of a social group may provide support to individuals in making protective decisions that are contrary to local social norms [26]. Social networks may also be informal conduits of protective resources. For example, almost 50% of individuals obtaining condoms at 12 health clinics in South Africa had given condoms to or received them from others in the previous month. This percentage rose with education level [28].

#### *Educational attainment and socioeconomic factors*

Sexual behaviour is influenced directly by the higher socioeconomic status that can result from increased educational attainment. There are a number of mediating pathways involved in this relationship. We discussed two of these above: the increased psychological sense of control over sexual behaviour and the different sexual networks associated with people of higher socioeconomic status. In addition, sexual behaviour, particularly of men, is influenced by higher levels of disposable income, increased leisure time, and increased ability to travel and to use commercial sex partners [29–31]. Psychological factors, mobility and income all contribute to individuals having more choice and greater control over their sexual behaviour [32].

For women, one consequence of higher levels of education is that they start having sex later but delay marriage to an even greater extent. This leads to them being single and sexually active for a longer period of time and thus to having a greater number of sexual partners [33].

#### *School attendance*

In this section we discuss mechanisms for changes in sexual behaviour that result merely from attending school. These mechanisms are distinct from the consequences of increased educational attainment discussed above. Here, we are interested in how school enrollment

can affect behaviour, regardless of what is learnt in the classroom. There are a number of ways in which this can happen. One mechanism that increases the risk of HIV infection are the widely reported [4,34] but rarely documented cases of male teachers using their position of power to engage in sex with female pupils. In one qualitative study conducted in Tanzania, sexual relationships between female students and male teachers were reported in eight of nine villages in which interviews were conducted [35].

Many other mechanisms lead to safer sexual behaviour among school pupils. Hargreaves and colleagues [36] suggested that school pupils have smaller sexual networks than their out-of-school peers. This suggestion was based on the finding that students have less risky sexual behaviour and fewer sexual partners than non-students, even though there was no difference in HIV knowledge or access to HIV prevention materials between the two groups because school-based HIV prevention programmes were poorly developed in the study area at the time.

The preliminary finding (discussed below) that interventions to keep girls in school lead to a reduction in pregnancy rates [37] suggests other mechanisms for the effect of school attendance on sexual behaviour. School policies insisting that pregnancy should result in exclusion may act as an incentive for girls to avoid unprotected sex. Alternatively, girls may be more optimistic about their future as a result of their continuing education and thus see greater opportunity costs in getting pregnant. This interpretation is supported by a number of findings. As discussed above, school girls are more likely to evaluate negatively the consequences of unprotected sex [11]. In addition, a study in Kenya [38] found that girls' dropout from school was more sensitive to the quality of schooling than boys' dropout. In schools in which academic achievement was lowest, girls were more likely to drop out from school than in higher-quality schools and were more likely to be married or pregnant. This suggests that education competes with another life course for girls, and when education is of poor quality girls choose to marry and start families. Other aspects of school quality are also important. Studies in Kenya and Egypt found that 'gender neutral' schools are more likely to encourage girls to persist with their education [39–41].

To conclude, we have identified four classes of mechanisms by which schooling may affect sexual behaviour. Three of these mechanisms relate to educational attainment: sociocognitive determinants, social networks and socioeconomic/demographic factors. One final mechanism relates to changes in sexual behaviour resulting from school attendance. We now turn to the evidence of whether sexual behaviour is indeed influenced by educational attainment and school attendance.

## Schooling and sexual behaviour

### *Educational attainment and sexual behaviour*

To our knowledge, no evidence exists identifying increased educational attainment as the causal factor in an individual's sexual behaviour. Much evidence, however, suggests that sexual behaviour is associated with education level. For some behaviours, education is a risk factor for HIV infection. For other behaviours education is protective. We deal first with the risk factors. There are a number of aspects of the sexual behaviour of more educated individuals that initially puts them at greater risk of infection, largely related to the socio-economic and demographic mechanisms discussed above. More educated individuals change partners more rapidly [32] and have a greater number of sexual partners [33]. A study in South Africa found that more educated individuals were more likely to have multiple concurrent sexual partners (Cockroft, personal communication). Educated women who delay marriage also have more sexual partners [33]. The choice of contraceptives also differs by level of education. Although educated people may be more likely to use contraception overall, they are also more likely to choose methods, such as the contraceptive pill, which do not protect against sexually transmitted infections such as HIV. Taken together, and in the absence of any educational response to an epidemic, these factors increase the vulnerability of more educated individuals to HIV infection in the early stages of an epidemic.

There are also ways in which education leads to a greater adoption of safer sexual behaviour in response to the HIV epidemic. Data from demographic and health surveys in 11 countries [16] showed that women with primary school education were more likely than those with no education to report using a condom at last sex. In nine of these countries, secondary education was associated with a further increase in the likelihood of using a condom at last sex. Another study in Zimbabwe [42] found that women with secondary education were less likely to report having had unprotected casual sex and were more likely to delay sexual debut. Of these factors, the delay of sexual debut was a better predictor of HIV status. A study in the four African cities of Cotonou in Benin, Ndola in Zambia, Yaoundé in Cameroon, and Kisumu in Kenya found that education was associated with less risky sexual behaviour. Condom use was more common among more educated individuals in all four cities [43]. The exchange of money for sex was less likely among educated women in all four cities and among more educated men in Yaoundé. Non-marital sex without a condom was less prevalent among more educated women in all four cities and among more educated men in Cotonou and Kisumu. In Yaoundé, more educated men and women were less likely to have sex with a casual partner on the day of meeting, and in Ndola, for both men and women, not knowing a partner's age was much more common among those with little schooling [44]. Among Zambians aged

15–24 years, increases in condom usage between 1995 and 2003 were greatest for those with higher educational levels. In addition, they were less likely to have had more than one sexual partner in the previous year than those with lower educational levels [45].

Other behaviours that reduce HIV infection are also more common among the educated. For example, more educated people are more likely to seek treatment for other sexually transmitted diseases, which would decrease their vulnerability to becoming infected with HIV [32].

### *School attendance and sexual behaviour*

Evidence for a causal relationship between general education and sexual behaviour comes from a recent study in Kenya [37], which aimed to lower the cost of education by providing school uniforms and thus reduce school dropout. Girls in schools in which uniforms were distributed were 2.5 percentage points less likely to drop out, a 15% reduction in the dropout rate. The dropout rate for boys also decreased by approximately 15%. Girls in schools in which uniforms were distributed were 1.5 percentage points less likely to have had a child, which amounts to nearly a 10% decrease in the childbearing rate for teenagers. Self-efficacy may also have been improved; girls in the uniform schools were significantly more likely to be confident that they could say no to a partner who wanted to have sex. The authors suggest that the reason for the change in behaviour is not related to what pupils learn at school but that girls typically plan to delay childbearing and marriage until after they complete schooling. This may reduce the likelihood of their engaging in unprotected sex while they are at school, and indicates that they believe that they have a future through education. This study is currently under peer review but if the results are confirmed they will provide the first experimental evidence to our knowledge demonstrating that attending school for a longer period of time leads to safer sexual behaviour.

One study in South Africa [36] compared the sexual behaviour of students with those out of school. They found that the lifetime number of partners was lower for students of both sexes. Among young women, fewer students reported having partners more than 3 years older than themselves, having sex more than five times with a partner, and having had unprotected sex during the past year.

### *Schooling and sexual behaviour: conclusions*

To summarize the preceding sections, there is much evidence showing an association between sexual behaviour and both attendance and attainment. Experimental evidence that school attendance leads to safer sexual behaviour is currently under review. Studies suggest several pathways through which sexual behaviour, and the risk of HIV infection, may be influenced by schooling. Students attending school have a smaller sexual network

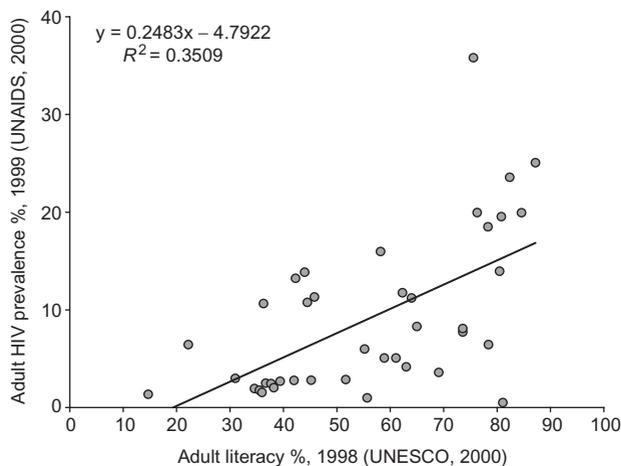
and a stronger motivation to avoid the consequences of unprotected sex (both pregnancy and HIV infection) than their out-of-school peers.

Educational attainment and HIV risk have a complex relationship (see Fig. 1). As educated individuals tend to have more control over their sexual behaviour, the association between education and HIV depends crucially on behavioural intentions. In the absence of information about HIV transmission, many individuals may intend to have several sexual partners. It is the greater control over the behaviour of more educated individuals that allows them to act on these intentions and puts them at greater risk of HIV infection. Educated individuals are, however, more likely to be exposed to HIV prevention messages, more likely to understand them and consequently have more knowledge about prevention methods. This may lead educated individuals to have different behavioural intentions and different behaviours. Given that HIV prevention messages become more prevalent with epidemic maturity, this leads to a hypothesis about the changing relationship between HIV and education. In the early stages of an epidemic, education is a risk factor for HIV infection. As an epidemic matures and prevention messages become more common, education is a protective factor against HIV infection. This hypothesis is examined in the next section.

## Schooling and HIV prevalence

### National level associations

At the national level in sub-Saharan Africa there is a positive relationship between literacy rates and HIV infection rates (Fig. 2): more literate countries have higher rates of HIV infection. More literate African countries tend to be the most developed on the continent, and they share a number of features that make them vulnerable to high rates of HIV infection. First, the most developed countries often have the largest



**Fig. 2.** HIV prevalence in adults aged 15–49 years by level of adult literacy for 40 countries in sub-Saharan Africa. Reproduced from Gregson *et al.* [52], with permission.

income disparities between men and women, a factor associated with higher HIV infection rates [46]. Similarly, employment in the formal sector is associated with higher HIV infection [47,48]. Increased migration and improved transport infrastructure can facilitate the spread of HIV [49]. Urban residence is also associated with higher levels of HIV infection [47,48,50,51]. Finally, as discussed below, higher levels of education *per se* are associated with higher infection rates. According to this analysis the educational advantage of the southern African countries became their disadvantage at the beginning of the HIV epidemic. The high levels of education in the region may help explain initial high levels of vulnerability to HIV infection.

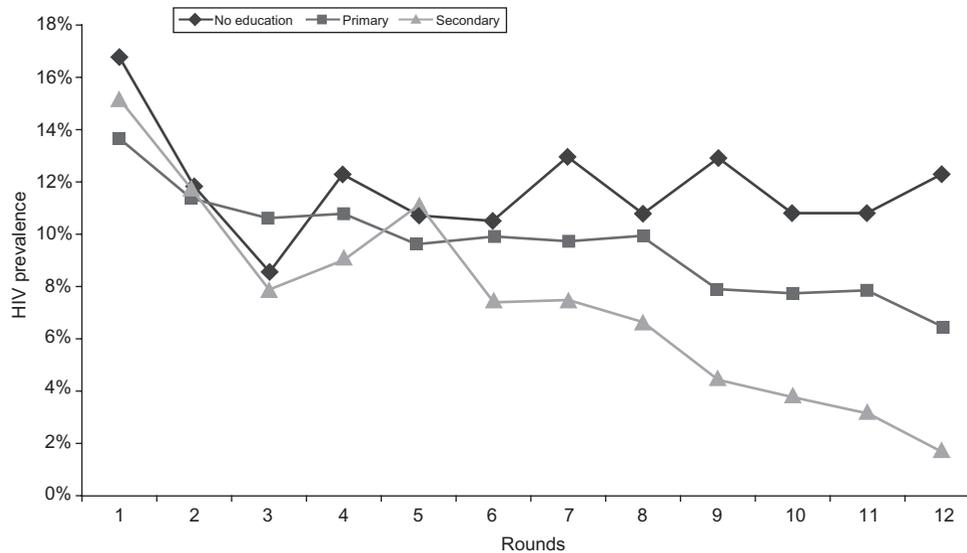
Although various demographic and socioeconomic conditions put the educated at greater risk of HIV infection, it has been hypothesized above that they will be more likely to change their behaviour in response to information about the epidemic [52,53]. One way in which this trend may manifest itself at the national level is in the weakening of the relationship between literacy and HIV infection rates as the epidemic matures. We would expect the positive relationship between HIV infection and literacy to be weaker (or even to become negative) in the later stages of the epidemic. This hypothesis has been tested [52] by comparing the relationship between adult HIV prevalence in 1999 and adult literacy in 1998 in three different regions of sub-Saharan Africa. In two regions (west/central Africa and east Africa) the epidemic is more mature and the relationship between HIV prevalence and literacy is relatively weak compared with the region with the most recent epidemic (southern Africa). A similar inversion may be occurring in the relationship between income and HIV status [54].

This analysis is consistent with the hypothesis that education better prepares individuals to mount a response to the HIV/AIDS epidemic. There are, however, difficulties in using population-level data to draw inferences about individuals. For example, in countries with high HIV prevalence and high literacy rates it is not clear whether literate individuals are the ones with HIV infection without conducting an individual-level analysis. It is to this that we now turn in the following section.

### Individual level associations

The majority of studies investigating this issue have found a positive relationship between educational level and HIV infection. That is, HIV prevalence is higher among educated individuals [31,55–63]. Five population-based studies have, however, found the opposite trend [42,44,64–66], whereas several other studies found no significant relationship between education and HIV [42,44,67].

The overall pattern of these results is complex. This is to be expected if the pattern represents the combination of



**Fig. 3.** HIV prevalence by education category for individuals aged 18–29 years, rural Uganda, 1990–2001. Reproduced from de Walque and colleagues [64,69], with permission.

two opposing trends: the initial increased vulnerability of educated individuals to HIV infection followed by their more rapid behavioural change once informed about the epidemic. The studies reported do allow us several opportunities to try to untangle these two trends by analysing their evolution alongside epidemic maturity.

#### *Changing relationship between HIV and education with epidemic maturity*

A recent systematic review [6] uses three strands of evidence to conclude that the association between educational attainment and HIV infection is weakening over time. First, studies conducted from 1996 onwards were more likely to find a lower risk of HIV infection among the most educated. A study conducted among urban and rural men and women in Zambia found that the risk of HIV infection among 15–49-year-olds with 10 or more years of education fell from 1995 to 2003 [68]. The situation in Africa contrasts with that in other areas of the world. For example, in Thailand the HIV epidemic was monitored by existing mechanisms and was initially confined to high-risk groups. This allowed the spread of information about the epidemic before the spread of the infection to the general population. This is perhaps why the most educated individuals were protected from HIV from the early 1990s.

The second line of evidence is that, when data were available over time, HIV prevalence fell more consistently among highly educated groups than among less educated groups, in which HIV prevalence sometimes rose while the overall population prevalence was falling. The clearest evidence comes from a longitudinal survey in rural areas of Masaka district, Uganda [69]. The national prevalence of HIV in the adult population declined from its peak of 14% in the early 1990s to approximately 5%, largely as a

result of a strong prevention campaign [70]. As illustrated in Fig. 3, the rate of decline in prevalence is greater for those with secondary education than for those with lower levels of education, and those with primary education show a faster decline in prevalence than those with no education. The chances of contracting HIV during this period was reduced by 6.7% for each year spent in school [69], and those with no education were 2.2 times more likely to become infected than those who had completed primary education.

The third line of evidence is that, in several populations, associations suggesting greater HIV risk in the more educated groups at earlier time points were replaced by weaker associations later. The data from Masaka district, Uganda, demonstrate the evolving nature of the relationship between HIV and education. In 1990, there was no relationship between HIV prevalence and education. In 2000, having completed primary education was associated with a 5.1% reduction in the risk of HIV infection, and secondary education was associated with an 8.8% reduction in risk. This relationship between HIV and educational attainment was found for women but not men. Similarly, in Rakai, Uganda, HIV infection was associated with increased levels of education in 1990 and 1992 but not by 1994 [56,71]. Similar patterns are found in other countries. In a population-based study in Zimbabwe, men and women aged 17–19 years were at a lower risk of HIV infection if they had secondary education. The benefit of education was lower for those aged 20–24 years, and there was little or no protective benefit for those aged 25 years and over [42]. In Fort Portal, HIV prevalence among women aged 15–49 years attending an antenatal clinic was highest for those with secondary education in 1991–1994, but by 1995–1997 older illiterate women had the highest prevalence [59].

Prevalence reduced to the greatest extent among women with secondary education and among young women. Similarly, there was a positive association between education level and HIV infection among women attending an antenatal clinic in 1994 but not by 1998 [60,61]. Again, the largest reductions were seen among younger, more educated women. Similar patterns were seen in northern Malawi [72], but there was no evidence of a changing association between HIV and education in Blantyre, Malawi [73] or in Kagera, Tanzania [74].

Overall, causal evidence is lacking, but these observational findings suggest that education has moved from being a risk factor for HIV to being a protective factor. The analysis is consistent with the thesis that educated individuals are at a higher risk of HIV infection initially but are better able to mount a response to the HIV epidemic.

#### *School attendance and HIV infection*

We are aware of only one study that examined the relationship between school attendance and HIV infection. This study in South Africa found that male students were less likely to be infected with HIV than male non-students [36]. No such relationship was found for young women. The results for women were, however, complicated because sexual activity can influence school attendance, when pregnant girls drop out, as well as school attendance influencing sexual activity.

#### *Evidence of a causal relationship between educational attainment and HIV infection*

To our knowledge, only one randomized controlled trial has been conducted to link schooling with HIV-related behaviour [37]. The study is under review, but if findings prove valid they will provide causal evidence that keeping girls in school reduces the incidence of unprotected sex. In our dichotomous classification of schooling this supports arguments for increased school attendance of girls but does not address the argument for increased educational attainment of girls. Causal evidence of this latter relationship is harder to find. Longitudinal studies are helpful in our understanding of the relationship between educational attainment and HIV infection. Cross-sectional studies are unable to establish whether HIV infection leads to poor educational attainment or vice versa. Also, cross-sectional studies examining HIV prevalence do not take into account the influence educational level may have on the length of survival of HIV-infected individuals. Longitudinal studies can help resolve these issues. One study in a poor rural community in KwaZulu-Natal, South Africa [75] followed individuals initially uninfected with HIV for just over one year. They found that participants were 7% less likely to become infected with HIV for each year of education they had completed.

A similar study in Tanzania looked at the same longitudinal relationship using aggregated data from 20

regions over 8 years [76]. The study estimated that each increase of 1% in female primary school enrollment was responsible for a 0.15% reduction in HIV prevalence in this group, corresponding to 1408 infections in the period 1994–2001. A further analysis of these data suggests that the investment in increased school enrollment is justified by the averted cases of HIV and the earning potential of these individuals, with a cost–benefit ratio of between 1.3 and 2.9.

Even with such longitudinal data, however, we cannot rule out the possibility that educational attainment is a proxy for some other characteristic, such as socio-economic status. We have noted that changes in the relationship between socioeconomic status and HIV infection over time are similar to changes in the relationship between education and HIV – socioeconomic status is increasingly found to be protective against HIV in associational studies [52]. Analyses from Uganda [69] and elsewhere [77] suggest that parental and individual income are not explanatory factors in the relationship between HIV and educational attainment. Several studies have attempted to determine whether economic status, mobility or education is most important in determining HIV vulnerability. A review of these studies finds mixed results [34].

The ecological nature of the evidence presented implies other limitations. It may be that participants in studies were not representative of the overall population. Although studies based in antenatal clinics report close to a 100% response rate, such studies do not include men, sexually inactive women or those who do not use clinics. This latter group in particular may exhibit a different relationship between education and HIV, particularly as clinic use may be associated with education level.

Given the need for policy decisions to be based on clear evidence, it is of concern that all evidence addressing the relationship between HIV and educational attainment is observational in nature. Further evidence is required before it can be concluded that educational attainment is a causal factor in the reduction of HIV vulnerability. The long-term follow-up of randomized controlled trials to improve educational access, for example through conditional cash transfers, and analyses of the long-term consequences of recent educational expansion policies in Africa offer the potential to examine the causal relationship between educational attainment and HIV. In the final section of this paper we make suggestions about how policy can be formulated on the basis of current evidence.

#### **Expanding educational access in hyperendemic countries**

The foregoing discussion of the effect of education on HIV prevalence and risk must be placed in the context of educational access in southern Africa. The first panel of

**Table 1. Net enrollment ratios in nine southern African countries, 2005.**

Country	Net enrollment ratio	Male net enrollment ratio	Female net enrollment ratio
<b>Primary</b>			
Botswana	85	85	84
Lesotho	87	84	89
Malawi	95	92	97
Mozambique	77	81	74
Namibia	72	69	74
South Africa (2004)	87	87	87
Swaziland (2004)	80	79	80
Zambia	89	89	89
Zimbabwe (2003)	82	81	82
<b>Secondary</b>			
Botswana	60	57	62
Lesotho	25	19	30
Malawi	24	25	22
Mozambique	7	8	6
Namibia	39	33	34
South Africa (2002/3)	66	63	68
Swaziland (2004)	33	31	35
Zambia	26	29	23
Zimbabwe (2003)	34	35	33

Source: UNESCO [78]. Note: Net enrollment is defined as 'enrolment of the official age group for a given level of education, expressed as a percentage of the population in that age group' (p. 393).

Table 1 shows the primary school net enrollment ratios for the eight hyperendemic countries and Malawi. Some countries are far closer to achieving universal primary education than others. National-level statistics can, however, be misleading. Within countries there is often large regional variation. In a number of countries, including Zambia and Zimbabwe, internal geographical variation in net enrollment ratios has increased since the Dakar World Education Forum meeting in 2000 [78]. Achieving universal access is not just about meeting national goals, but about focusing on regions within countries that are falling behind. In addition, completion rates for the primary cycle of education lag far behind enrollment rates (Table 2).

Poor rates of primary completion and of secondary access are a concern because evidence presented above suggests that the protective benefits of education against HIV infection continue through all levels of education. Post-basic education has the strongest protective effect, as

discussed above for Zimbabwe and Uganda. Countries with high HIV prevalence rates are, however, still far from universal secondary net enrollment, as shown in the second panel of Table 1. Another possible implication of the proportionate relationship between sexual behaviour and education is that the least educated individuals in a society are vulnerable to HIV regardless of the overall level of education in that society. This interpretation of findings argues for the equitable expansion of schooling at all levels. Although this is an ambitious goal, it is not an all-or-nothing proposition; keeping girls in school a year longer is beneficial for HIV prevention even if they do not complete secondary school. Girls are less likely to engage in unprotected sex while they are attending school. Furthermore, evidence suggests that each additional year of schooling increases one's ability to avoid HIV infection. Whereas national governments should maintain high goals for the education of their girls, it is important to recognize that even moderate steps towards these goals help reduce vulnerability to HIV.

**Table 2. Survival rates to last grade of primary education and primary repetition rates in nine southern African countries.**

Country	Survival rate to last grade, 2004	Primary repetition rate, 2005
Botswana	85 (2003)	4.8
Lesotho	61	19
Malawi	34	20
Mozambique	46	10
Namibia	76	15
South Africa	77	8 (2004)
Swaziland	61	16
Zambia	–	6
Zimbabwe	62 (2002)	–

Source: UNESCO [78].

If these countries are to expand educational opportunities for children, a healthy teacher corps is vital. In South Africa, Shisana and colleagues [79] found an overall HIV prevalence rate among teachers of 12.7%. Among teachers aged 21–34 years, the rate was 21.4%. Many of these teachers will see their teaching careers shortened due to illness if they do not have access to treatment. Antiretroviral treatment may reduce teacher absences and mortality in sub-Saharan Africa by 90%, making it cost-effective as a national policy option for hyperendemic countries [80]. Considering solely education sector benefits, Risley and Bundy [80] calculated a return of US\$2.24 per dollar invested in treatment for teachers. Despite these benefits, many teachers do not have access

to antiretroviral treatment in the countries of southern Africa. One exception is Zambia, where an estimated 800 teachers die from AIDS-related causes each year and teachers now have access to free voluntary counselling and testing and antiretroviral drugs [81]. Hyperendemic countries must actively promote the health of their teachers in order to staff the additional schools and classrooms needed.

### **Conclusions: what does the evidence show?**

#### *Educational attainment*

Cross-sectional evidence shows that educational attainment is associated with a higher risk of HIV infection in the early stages of an epidemic and with a lower risk of HIV infection as the epidemic matures. Longitudinal studies show that educated individuals are less likely to acquire HIV infections over time. The causal role of education in these relationships cannot, however, be identified.

In some studies evidence suggests that educational attainment is associated with an increased number of sexual contacts. Others find that educational attainment leads to a reduction in sexual contacts and reduced transmission rates, as a result of increased condom use. These findings are consistent with evidence that when given accurate information about HIV, educated individuals are more likely to engage in safer sexual behaviour. This relationship is present at all levels of education.

#### *School attendance*

Evidence of a relationship between school attendance and sexual behaviour comes from one experimental study, currently under review, which demonstrates that keeping girls in school leads to a reduction in unprotected sex.

Evidence also suggests that school attendance is associated with a reduction in the number of partners for men and women and a reduction in HIV vulnerability for men.

We have discussed the effects of school attendance and increased educational attainment separately throughout this paper to highlight the different bodies of evidence underpinning these two effects. The implications of these two effects are, however, the same: efforts should be made to keep girls in school at all levels. This argument is supported by preliminary causal evidence on the impact of school attendance on sexual behaviour and associational evidence on the effect of educational attainment on sexual behaviour and HIV vulnerability.

## **Section 2: the impact of school-based HIV prevention education**

This section focuses on education programmes conducted in schools in sub-Saharan Africa that aimed to

have an impact on the sexual behaviour of participants and to reduce the prevalence of HIV. In this category we include both traditional knowledge-building sex education and skills-building programmes specifically focused on HIV prevention. Such programmes can be challenging to design and evaluate. A long chain of events must occur for these programmes to be successful, from appropriate design to staff training to the precise measurement of outcomes. Strong evidence of the effectiveness of such programmes can only be garnered from randomized controlled trials with biological outcomes. Such studies are, however, rare because of their expense and the difficulty of obtaining biomarker data from young people. Our review of the evidence falls into two sections. First, we look at studies that did not meet these stringent criteria and that constitute the vast majority of work in this area. Second, we look at more recent trials that met the criteria required to infer causality. To our knowledge, we have included all randomized controlled trials with biological outcomes that have been conducted in southern Africa. We reviewed all programmes included in other systematic reviews [82], evaluations found through searches conducted in Web of Science, and through contacts with key researchers in the field.

### **HIV prevention programmes evaluated without biological outcomes**

Several reviews have been conducted over the past several years that condense the current knowledge on HIV and sexual health prevention programmes. Gallant and Maticka-Tyndale [82] focus specifically on HIV/AIDS interventions for African youth that were conducted in schools. They include 11 peer-reviewed studies with quantitative evaluation data that were published between 1990 and 2002. Looking separately at knowledge, attitudes, and behaviours, the review by Gallant and Maticka-Tyndale [82] makes clear that a change in knowledge or attitude does not necessarily result in the desired change in behaviour.

All 11 programmes attempted to increase knowledge, and 10 were successful. In the remaining study, a school-based programme in Uganda focused on HIV/AIDS and sexually transmitted diseases, the authors found that the programme was not fully implemented as designed [83]. The reviewed programmes were also successful in changing student attitudes. All seven programmes that attempted to do so were able to produce change in students' attitudes towards people living with HIV and AIDS. This reduction in stigma has important implications that are discussed below.

There was, however, less consistency in programme outcomes when condom usage and abstinence were outcomes. Two studies found a positive change in attitudes towards abstinence [83,84], whereas two others found no improvement [85–87]. According to the review

of Gallant and Maticka-Tyndale [82], student understandings of personal risk level may be the most difficult attitude for a school health programme to change. Despite this challenge, two programmes were able to improve reported self-efficacy [84,85,88].

Behaviour change proves more difficult than changing knowledge and attitudes. Only one of the three studies focusing on sexual behaviour found an impact on sexual debut and the number of partners [89]. Of four studies aimed at condom use, only one increased the reported rates of condom usage [84]. Although sexual behaviours may be difficult to impact directly, related behaviours seem to be more malleable. Several studies were able to increase communication between students and their parents, friends, and sexual partners about sexual issues and HIV [87–90]. Importantly, Gallant and Maticka-Tyndale [82] note that in no case did sexual activity rates increase as a result of the interventions. In all reviewed cases sexual activity decreased, although in many cases the changes were not statistically significant.

One key study using self-reported outcomes has been conducted since this review. A recent evaluation of the primary school action for better health programme in Kenya used matched pairs of 40 control schools and 40 intervention schools to identify programme effects [91]. The programme's effects differed by gender. Boys in programme schools who had been highly exposed to the programme were significantly more likely to report condom use at last sex [odds ratio (OR) 1.56 for pre-programme virgins and 1.47 for those who were not virgins at programme initiation], whereas there were no significant effects of the programme on girls' reported condom use even at a high exposure level. Both boys and girls in programme schools who were virgins at baseline were significantly less likely to begin sexual activity during the programme, but the effect was stronger for girls (OR 0.59) than for boys (OR 0.71). That study underlines the importance of tracking programme dose received by different groups of students, as many of the outcome measures differed between youth who had 'high' and 'low' programme exposure. Poor implementation fidelity and low programme dose threaten the results of even the best-designed programmes. This conclusion is supported by a randomized evaluation of KwaZulu-Natal's ninth grade life-skills-based programme. The study found that the programme did not change abstinence rates, condom use, measures of confidence, or communications regarding HIV/AIDS. The authors hypothesize that these poor outcomes are related to incomplete programme implementation in some schools [92].

A second useful review was conducted by Kirby and colleagues [93]. The review by Kirby *et al.* [93] covered 83 studies in 22 developed and developing countries. The programmes focused on sexually transmitted infections, HIV/AIDS, and pregnancy. Programme impacts varied

by sexual behaviour. Half of the programmes focusing on reducing sexual risk-taking were successful, compared with only 29% of programmes designed to reduce the frequency of sex. Overall, however, Kirby *et al.* [93] found that 65% of the studies reviewed had a positive and significant impact on at least one sexual behaviour, and only 7% had a significant negative impact on participants' behaviours. In addition to consolidating the findings of the 83 studies, Kirby *et al.* [93] identified 17 common traits of the successful programmes. The list of characteristics, covering curriculum, curriculum development, and implementation of the curriculum, can be used by designers of new school health programmes to maximize chances of success. Such a study is not unequivocal. Identifying the causal factors determining the success of interventions is not, however, possible with the data available and the analysis of Kirby *et al.* [93] is a valuable first step in building the evidence base for HIV prevention education.

### **Randomized trials of HIV prevention education interventions with biological outcome measures**

Three recent studies have assessed the impact of HIV prevention education using a randomized trial design with biological outcome measures, either using pregnancy as a proxy for sexual behaviour or directly assessing HIV infection. Duflo and colleagues [37] compared two HIV-related education interventions using a randomized controlled design in western Kenya. A condom essay and debate programme had a positive outcome on self-report measures; those who participated were more likely to report that they used condoms. A teacher training programme resulted in little change. Neither intervention had an impact on pregnancy rates.

Working in the same population in western Kenya, another recent study showed that risk-reduction education had a significant effect on risky HIV-related behaviour. Dupas [5] conducted a randomized controlled trial involving 328 primary schools in Kenya to evaluate an education campaign focusing on the risks of cross-generational sex. The campaign involved a 40-minute talk, a 10-minute video, and a survey. The programme was successful in reducing cross-generational sex: there was a 65% decrease in the number of pregnancies with adult fathers in the experimental group. Although sexual activity with same-age partners did increase, condom usage also rose and there was no increase in pregnancies by same-age partners. This study is currently undergoing peer review and its results should be interpreted with caution. If they are validated, the results would demonstrate that when a realistic goal is given for behaviour change, even a 50-minute information campaign may lead to changes in sexual behaviour. This potential for 'actionable knowledge' is worthy of further investigation.

Another large randomized trial has recently been conducted in neighboring Tanzania [94]. In that study

20 communities were randomly assigned to receive intervention or control activities. The Mema Kwa Vijana intervention included a teacher-led, peer-assisted sexual health education programme as well as community activities, training and supervision of health workers to provide 'youth-friendly' sexual health services, and peer condom social marketing. The intervention had a significant impact on knowledge and reported attitudes, reported sexually transmitted infection symptoms and several behavioural outcomes. There was, however, no evidence of a reduction in HIV incidence in the intervention group. This was possibly because HIV prevalence was still very low at the time of the evaluation.

### **HIV prevention programmes and stigma**

Stigma and discrimination are major barriers to testing and treatment in southern Africa [95]. Many individuals would rather not know their status, as the social consequences of a positive test result can be dire. School children are no exception, as children in families affected by HIV and AIDS face stigma and discrimination from community members [96,97]. The internal or felt stigma as well as the experienced stigma can make children feel different from their peers and isolated from their communities. Anecdotal evidence suggests that stigma and discrimination in schools may result in dropout among children affected by HIV and AIDS [98]. These children may be explicitly barred from schools or they may be treated so poorly by teachers, administrators, and other students that they drop out [99].

Evidence suggests that there is an association between stigma and the likelihood of having been tested for HIV. In South Africa, women who had less stigmatizing views towards people living with HIV and AIDS were more likely to have been tested [100]. Programmes that can reduce stigma, therefore, may increase the level of testing and consequently treatment. In the review by Gallant and Maticka-Tyndale [82] of school HIV prevention programmes in Africa discussed above, every programme that measured students' attitudes towards people living with HIV and AIDS was successful in changing these attitudes. A randomized study conducted in Tanzania measured student attitudes towards people living with HIV and AIDS before and after a 20-h prevention programme [87]. The authors found that changes in student attitudes remained significant at the 12-month follow-up, indicating that targeted in-school programmes can have a lasting effect on stigma.

### **Integrating HIV/AIDS responses into broader school health programmes and the education sector**

Increasingly, HIV/AIDS responses are being scaffolded onto school health and nutrition programmes in Africa and in the rest of the world [101]. A few countries, including Kenya and the United Republic of Tanzania, have taken the further step of mainstreaming HIV/AIDS

throughout the education sector, from central offices to districts to local schools [81]. Combining anti-HIV efforts with other health campaigns should result in more consistency in focus and funding. Stand-alone HIV projects are more likely to be affected by political whim or trends in support than if they are enveloped in a wider curriculum of health promotion.

### **Conclusions: what does the evidence show?**

Overall, there is evidence that HIV prevention education can lead to a change in sexual behaviour. The pattern of results does not, however, strongly support the effectiveness of school-based prevention education programmes. This may be attributable to the difficulties in using schools and teachers to deliver sensitive messages about sexual behaviour [35] and the absence, until recently, of good evidence to guide the design of effective programmes [93]. It is intriguing that one behaviour change intervention claiming success [5] was not implemented by teachers. The possibility of external agencies implementing HIV prevention education in schools is worth further exploration. The provisional results of that trial in Kenya point to another aspect of the future potential of school-based interventions. When adolescents are given a realistic option for their sexual behaviour (i.e. choose sexual partners of your own age rather than older sexual partners) rather than unattainable ideals (i.e. abstinence) behaviour change may be more likely to occur.

## **Section 3: policy recommendations**

The policy recommendations below are divided into two sections: those directed at national-level educational policy, and those directed towards curriculum developers and programme planners designing HIV/AIDS interventions. Whereas making changes at either level would be beneficial, the evidence shows that both are necessary to exploit education fully as a means of combating HIV.

### **Policies on access to education**

We presented substantial evidence of a link between schooling and protection against HIV. The evidence is not, however, unequivocal. In the case of the relationship between educational attainment and HIV, no causal inferences can be drawn. For the relationship between school attendance and HIV, experimental studies have been conducted but results are not yet published. There is an urgent need to strengthen the evidence base. In the interim there are strong arguments for pursuing a policy of increased educational access to reduce the vulnerability of girls to HIV infection. Based on the studies relating to mechanisms, sexual behaviour and HIV infection the most likely interpretation of findings is that increased educational attainment leads to increased protection against HIV. Similarly, the best interpretation of findings

related to school attendance is that girls attending school are less vulnerable to HIV infection. Given the urgency of the situation, there is reason to act on the best available evidence.

On the basis of these arguments, achieving education for all (EFA) would be an important contribution to HIV prevention. Current global efforts as part of the EFA fast track initiative already recognize the importance of addressing HIV within the education sector and specifically encourage the inclusion of an HIV response with education sector plans [102]. Focusing EFA efforts on the poor, who are the least likely to attend school, may be disproportionately advantageous in fighting HIV. Poverty and HIV, the two most critical issues for the countries of southern Africa, are now firmly intertwined. When faced with financial constraints, it may be impossible for HIV and AIDS-affected families to pay school fees and the indirect costs of education such as uniforms and books. Programmes need to address this factor explicitly and make schooling affordable for the poorest segment of the population.

#### *Action points*

- (1) Strengthen country actions to achieve universal access to basic education, addressing equity and equality in gender and geography.
- (2) Develop a new focus on promoting participation in secondary education, especially for girls.

#### **Policies on curriculum responses to HIV/AIDS**

Whereas increasing levels of general education can be effective, a tailored HIV prevention curriculum also has a role to play. There are at least three successive levels at which a curriculum response can be effective. At the most basic level, even relatively simple interventions in resource-poor environments can usefully address stigma and discrimination, as discussed above. At a slightly higher level of complexity, provisional evidence suggests that strategic information or actionable knowledge can have an important impact while requiring relatively manageable interventions by the education sector. Provision of information that is useful, targeted, and relevant to students is one factor that influences parent and student perceptions of school quality. At the highest level of complexity, there is a clear and sound theoretical argument for providing an educational package that aims to develop knowledge, attitudes and skills specifically aimed at HIV prevention, promoting behaviours such as condom use and partner reduction [103]. It is not easy to implement these programmes well, especially at a large scale, and poorly implemented programmes are unlikely to show an effect. Guidance on how to develop skill-building programmes is vague and there is a great deal of confusion, resulting in enormous variation in programme content and quality. Although the recommendations by Kirby *et al.* [93] are an invaluable contribution towards consolidating knowledge about HIV prevention pro-

gramme design, they are not based exclusively on evidence from rigorous trials and further evidence is needed.

#### *Action points*

- (1) Ensure immediately that curricula at all levels address stigma and discrimination.
- (2) Explore the potential for approaches involving actionable knowledge, starting with implementing approaches of known effectiveness, while simultaneously identifying and testing new approaches.
- (3) Launch a systematic, subregional approach to implementing high-quality HIV prevention programmes, which incorporate impact evaluation as an intrinsic component of programme design.
- (4) Promote sustainability of the HIV response by packaging within existing frameworks, especially school health and nutrition programmes.

#### **Building a community of practice and sharing knowledge**

The challenges that HIV presents to the education sectors of southern Africa are unique to the region. In the education sector, however, there is a lack of a systematic mechanism for sharing knowledge and experiences of HIV, and in particular experiences that involve both the health and education sectors. Under guidance from UNAIDS the UN system has helped create mechanisms for information sharing among agencies, development partners and countries. The education sector has, however, not played a strong role in these mechanisms. It is apparent from the discussion above that there are actions that need to be taken, including developing new tools and approaches that are largely region-specific, but applicable to all the hyperendemic countries. Networks involving HIV focal points from Ministries of Education as well as representatives of national AIDS authorities have proved very effective mechanisms for facilitating the sharing of information in the western and eastern regions of Africa. Establishing such a mechanism among the countries of southern Africa might provide an important platform for sharing information and optimizing the investment in evaluations while avoiding duplication, and should be a specific area for donor focus.

#### *Action point*

- (1) Create an enabling network for the region, promoting information sharing and joint action by the education sector.

Many of these recommendations are not new but they are justified by emerging evidence that strengthening current efforts will have a big impact on the HIV epidemic. We have argued that keeping girls in school promotes safe sexual behaviour, that education can reduce HIV-related stigma, and that there is potential for girls to change their sexual behaviour when given effective HIV prevention

education, and that subregional information sharing and leadership is crucial in these efforts. In all these ways, education can help protect young women and girls in southern Africa from HIV.

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