

**Estimates of the Impact of HIV and teacher ART take-up on the
Education Sector and the achievement of EFA in Kenya**

by

P. O. Box

Telephone +Website:

Submitted To:

Teachers' Service Commission

Private Bag, Nairobi, Kenya

Telephone : +254-20-2892000 ; Fax +254-20-

Website: <http://www.TSC.org/>

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Abstract

An analysis was carried out to indirectly estimate the impact of HIV on the education sector in Kenyan provinces using the Ed-SIDA model which uses teacher demographic information and combines this with epidemiological projections to determine the number of teachers who are living with HIV, their AIDS absenteeism and associated mortality. Unit costs were applied to these processes to determine the economic impact of HIV on education. The main results were that HIV prevalence among Kenyan teachers can be expected to be high, 15%, due to teachers belonging to vulnerable age groups. AIDS mortality is currently estimated to equal around 2% of all teachers, and at any one time, 1.5% of teachers are estimated to be off sick due to AIDS illnesses. The numbers of orphans are expected to increase in Kenya. Economically, investing in VCT and ART provision in Kenya is cost-saving. It would provide a return of 2.14 on the Shilling due to teacher deaths and the amount of absenteeism which is averted. Policymakers may consider funding ART and VCT for teachers and encouraging membership of support organisations for all teachers living with HIV, especially KENEPOTE.

Acronyms and abbreviations

AIDS	Acquired Immuno-Deficiency Syndrome
ART	Anti Retroviral Therapy
CBO	Community Based Opportunity
CRC	Convention on the Rights of the Child
DHS	Demographic and Health Survey
FLART	First-Line ART
HIV	Human Immuno-Deficiency Syndrome
KDHS	Kenya Demographic and Health Survey
KESSP	Kenya Education Sector Support Programme
KNBS	Kenya National Bureau of Statistics
MoH	Ministry of Health
OVC	Orphans and Vulnerable Children
pART	Paediatric ART
PMTCT	Prevention of Mother-to-Child Transmission
SLART	Second-Line ART
TLWH	Teachers Living With HIV
TSC	Teachers' Service Commission
UIS	UNESCO Institute for Statistics
UN	United Nations
UNAIDS	Joint United Nations Programme on HIV/AIDS
UNESCO	United Nations Educational, Scientific and Cultural Organization
VCT	Voluntary Counseling and Testing
WHO	World Health Organization

Introduction

An analysis was performed using the Ed-SIDA model to estimate the current and future impacts of HIV and the care and support of teachers living with HIV (TLWH), on teachers, pupils and the achievement of Education For All.. Analyses were carried out for each province, and where results from Kenya are presented, these are the sum of the individual analyses. The scenarios explored to generate the results are described below:

VCT/ART scenarios Between 2008 and 2015, VCT and ART can be provided to teachers at different levels. Here, the VCT and ART scenarios explored were (1) VCT and ART kept at current levels of provision; (2) VCT and first-line ART (FLART) provided to 80% of those in need; and (3) VCT and ART provided to 80% of those in need, including both first- (FLART) and second- (SLART) line therapy.

HIV epidemic scenarios UNAIDS model produce high, low and medium scenarios of HIV prevalence in the population. The error bars above and below the estimates present the high and low scenarios.

EFA achievement The model was set to increase teacher recruitment such that, in each province, the NER = 100 and the PTR = 40; contrasted with the scenario where teacher recruitment was maintained at a stable level.

Impacts of HIV on children in Kenya:

Children living with HIV

UNAIDS estimate that there were between 130,000 – 180,000 children living with HIV in 2001, and between 110,000 – 160,000 in 2007 (UNAIDS and WHO 2008). Models predict a subsequent continuing decline, despite a projected increase in the child population. The decrease in the number of children living with HIV is due to the disparity between the provision of ART to children requiring it, and provision of PMTCT services. In 2006, paediatric ART (pART) levels were at just 8% of children

who needed therapy (WHO 2007 a). This low level of pART provision allows the majority of children perinatally infected with HIV to die before they reach school age. Concurrently, PMTCT roll-out is succeeding to a greater extent, with an estimated 20% of children born to HIV positive mothers protected with PMTCT in 2005 (WHO 2007b). This results in a decrease in infection of babies, which also reduces numbers of children living with HIV. The future number of depends on the relative levels of PMTCT and pART, and in particular, the school-age population of children living with HIV depends on sustained pART uptake and the extent to which pART provision is sustained throughout the school-going age (Cooper et al. 2008).

Orphans and Vulnerable Children (OVCs)

It is estimated that 1.8 million children have been orphaned by HIV and AIDS (Republic of Kenya, 2008a). In 2003, orphans were approximately 11% of all children under 15years (KDHS, 2003). The number is expected to rise to 2 million by before 2010 (Republic of Kenya, 2005d) and UNAIDS models predict a subsequent slight decline. As orphans often live with HIV, this decline can be attributed to the same causes as discussed for children living with HIV, as these groups have many of the same children in common. In 2004, NGOs provided services to 973, 372 OVCs, faith based organizations to 498,716 and CBOs to 58,734 (Republic of Kenya, 2005d). In 2005, the Ministry of Home Affairs developed the National Policy on Orphans and Vulnerable Children which is aimed at ensuring that all Kenyan children who are orphaned or vulnerable are able to achieve their full potential. Of the 7.6 million children enrolled in primary schools in 2005, 8.1% were orphaned. The 2003 data for secondary schools enrollment indicate that 13.2% are orphans (see Tables 9 and 10 below). According to international estimates,

(http://www.unicef.org/infobycountry/kenya_statistics.html), there were 2.3M orphans in Kenya aged between 0-17 in 2005. The relative attendance of orphans and non-orphans found through DHS surveys was 95%; and the attendance and enrolment ratios of all children were both ~ 79%. Taken with the EMIS statistics provided in the table below, this implies there are 817,000 orphans of school going age in Kenya, 204,000 of whom are not in school. Orphaned children are defined as having special needs, and as such, schools receive an extra Ksh2000 per OVC to support them. (<http://www.commonwealtheducationfund.org/downloads/Kenya%20OVC%20WER%20Research%20report%20second%20dft%202%20November.pdf>) To provide this support to enable educational access for the orphans who were out of school in 2005 would cost Ksh 408 M, (US\$ 16 M).

Methodology and Data inputted into the Ed-Sida Model

Overall Approach

The Ed-SIDA model combines an epidemiological model, using UNAIDS processes to project the course of the HIV epidemic, and an education planning model, using standard education planning tools to project teacher supply needs for a given set of education parameters.

Model description

The model used has been developed from that described in Grassly (2003). It enumerates the processes which affect the number of primary school teachers in each country. Costs are then applied to these processes and scenarios examined to generate

cost estimates in various circumstances. This model allows for the exploration of the addition of care and support for teachers, and the probability of death is based on age, gender and expected time since infection.

The epidemiological model provides province-specific epidemiological projections of HIV prevalence, incidence and AIDS deaths. Projections were made using UNAIDS software, which output these values for each gender and 5-year age group, and give high, low and medium estimates. The education model is a national planning tool, where education data were taken from the UIS online database where available, and sourced from Ministries of Education otherwise.

Incorporating teacher risk differences due to age and gender patterns

Age- and gender- specific HIV prevalence and AIDS death rates were obtained using UNAIDS methods. The age and gender profile of teachers in each province was then used to predict the HIV prevalence and AIDS death rates among teachers. Figure A shows the data for Kenya. It is apparent that there are marked differences between the age distributions of male, female and newly recruited teachers. It is also apparent that there are marked differences between the age distributions of HIV infection by gender. These patterns are captured by the model.

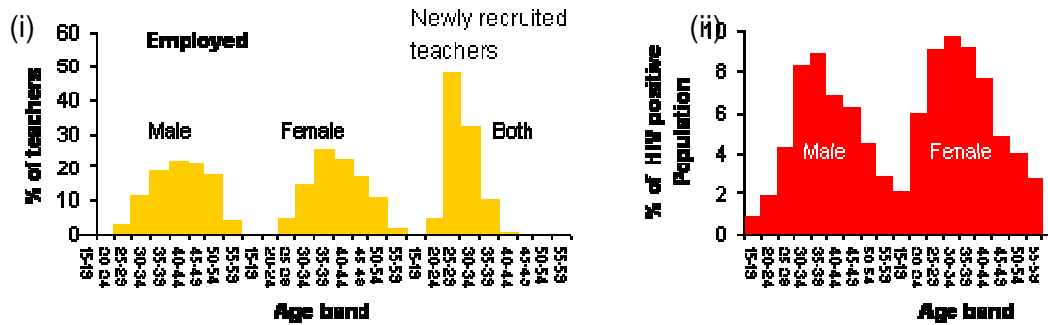


Figure 1 (i) Age distribution of teachers employed in Kenya, 2005, by gender, and those recruited in that year input into the model for each country in the East Africa sub-region. (ii) Age distribution HIV infection in sub-Saharan Africa, 2005, by gender. The age-gender distribution of teachers parallels the age-gender distribution of those most at risk of being HIV positive.

The available data on HIV age-distribution are for the population as a whole, and not for teachers specifically.

The relative risk of teacher infection is a topic currently under debate. In this study, teachers in Kenya were presumed to have the same risk as people of the same age and gender in the same province, i.e. relative risk = 100%.

DHS data shed some light on the relative risk on teachers, as information on occupation is given. The table below shows the analysis of DHS data for several countries, which indicates that there is no evidence that teachers in Kenya, Tanzania and Ethiopia are at greater or reduced risk of HIV infection than the general population. Teachers in Rwanda are at a significantly increased risk of infection compared to the Rwandan population of the same age and gender.

	Kenya	Rwanda	Tanzania	Ethiopia
Year	2003	2005	2004	1997/2005
Population sampled	6188	10391	10544	11049
Number of teachers	174	109	112	53
Prevalence in the entire sample	6.60%	3.20%	6.47%	1.92%
Prevalence in teachers	9.20%	6.40%	4.46%	1.89%
Significance level (adjusted for age and gender susceptibilities)	0.135	0.048	0.586	0.821
Relative risk	1.39	1.98	0.69	0.79

Table 1. Relative risk of teacher infection, adjusted for age and gender, in 4 East African countries.

Costs

If costs were taken from another country, then costs were scaled on the relative GDP.

To calculate the cost in current prices, costs were inflated at 3% per annum.

Calculation of outputs

Output	Description of calculation method
Teachers living with HIV	HIV prevalence in general population for each age and gender x teacher relative risk (=1) x number of teachers in that age and gender group
AIDS absenteeism	TLWH x AIDS absenteeism rate
Teacher AIDS deaths	TLWH x Probability of death in HIV positives in that year in that age in that gender.
Cost of absenteeism	AIDS absenteeism x cost of a replacement teacher. Estimated as P1 teacher salary without allowances; Ksh 141,000 (\$1786 USD) in 2008.
Costs of AIDS deaths	(1) Benefits to the family of the deceased and (2) costs of training a new teacher. Unit costs were taken from the following sources: (1) Death benefits were taken from "teacher codes and regulations",

	calculated to be Ksh 306,000 (\$3,873) in 2003; (2) The costs of training a teacher were not known for Kenya, so the unit cost for Tanzania was used, at Ksh 28,000 (\$355).
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Table 2. Calculation of the major model outputs

Projection benchmarks, from 2008-2015

The Ed-SIDA model can be set to examine the impact HIV on the difficulty of achieving EFA goals.

Enrolment: The enrolment benchmark is associated with goal 2 of both EFA and the MDG: to achieve universal primary education by 2015. In this analysis, this is interpreted as a net enrolment target of 100% by 2015. The model projects a linear increase in enrolment between 2008 and 2015, the rate of which can be adjusted by the user.

Pupil-teacher ratio: The PTR benchmark for primary schools, based on Education For All (EFA) goal 6, is a ratio of 40 students per teacher by 2015. As with the enrolment rate, this is achieved in the model by a linear increase in the number of teachers from 2008-2015.

Estimating costs

Costs incorporated in the model are: Absenteeism (represented by teacher salary). Death benefits payable to the family of the deceased from the Ministry of Education (excluding pension); the cost of training a teacher to fill the vacancy caused by the death; FLART and SLART; VCT. Some costs of HIV not incorporated are: Treatment

of opportunistic infections; transport to and from clinics; nutrition of HIV positive teachers.

Costs were converted to 2008 equivalent using a rate of inflation of 3%. For future and past years, they were then discounted at a rate of 3%.

Treatment scenarios

We chose to examine three policy scenarios, one where treatment is maintained at the current, 2008 level, a second where 80% of teachers undergo VCT and those found to require ART are provided with it and the other where ART use, and a third where in addition to 80% first-line therapy provision, second line therapy is also provided if required, to 80% of teachers. The % of those who require ART who are provided with it in the general population was given by the MoH. This rate of ART uptake was assumed to apply to teachers. This is in turn assumed to be equal to the % of the population undergoing annual VCT. Where second-line therapy is not introduced, resistance to therapy increases annually, modelled as a linear increase in mortality and absenteeism in HIV positive people. Thus, those people undergoing VCT are assumed to take a test annually, collect their results, and all of those requiring ART of these are assumed to be able to access it and take it up. The people undergoing VCT are assumed to be a representative sample of the population with regard to infection status, ART requirement, gender and age.

Data input into the model

The key education and health data input into the model by province is given in the table below.

	Public primary school teachers				Public school pupils		HIV	
	Numbers, 2008, '000s	% F in 2008	F Average age in 2008	M Average age in 2008	Net enrolment in 2006	Pupil-teacher ratio 2004	Population HIV prevalence in 2007	% of those in need taking ART in 2005
Kenya	141	46%	44	41	75%	40	7.8%	17%
Central	18	55%	47	44	83%	41	3.8%	13%
Coast	10	45%	43	40	72%	56	7.9%	8%
Eastern	31	46%	45	41	95%	39	4.7%	12%
Nairobi	4	82%	47	42	33%	57	9.0%	26%
NorthEastern	1	25%	38	34	21%	62	1.0%	1%
Nyanza	25	40%	43	40	98%	47	15.3%	18%
RiftValley	32	47%	43	40	91%	42	7.0%	19%
Western	21	47%	45	42	97%	52	5.1%	15%

Table 3. Summary of the major data input into the Ed-SIDA model

Results

The number of HIV positive teachers by province and the HIV prevalence over time is plotted below.

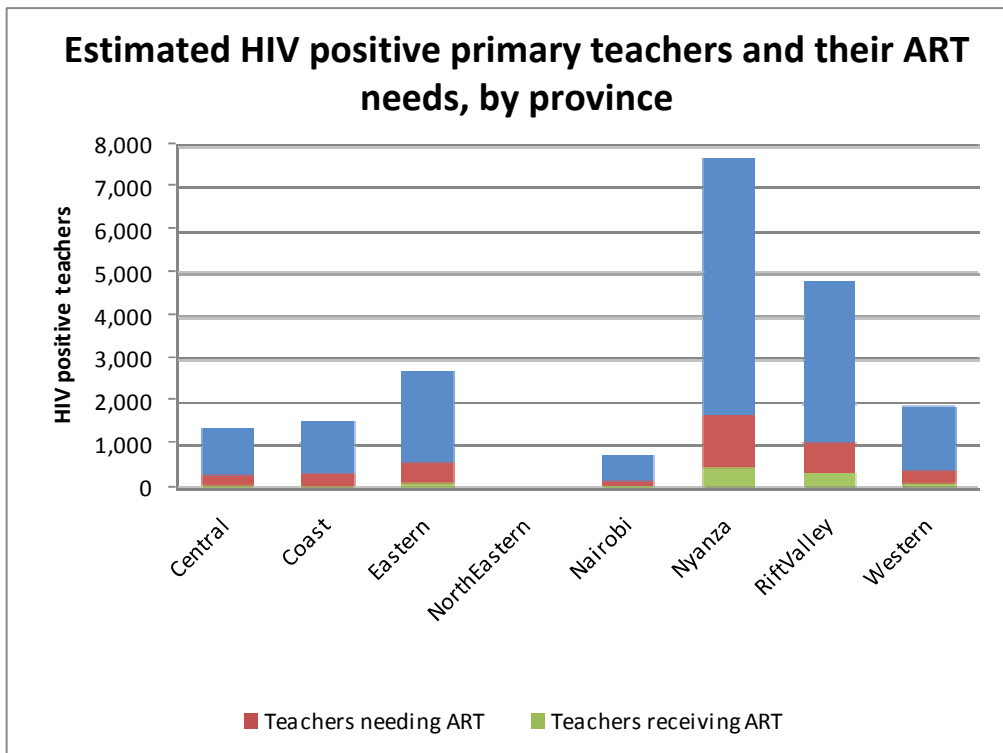


Figure 2. HIV positive teachers by province in Kenya, split according to their needs for ART.

Nyanza province, although third in overall number of teachers, has the greatest number of HIV positive teachers with close to 8000 teachers living with HIV. Just over 1,500 require ART, of whom about 500 are receiving it.

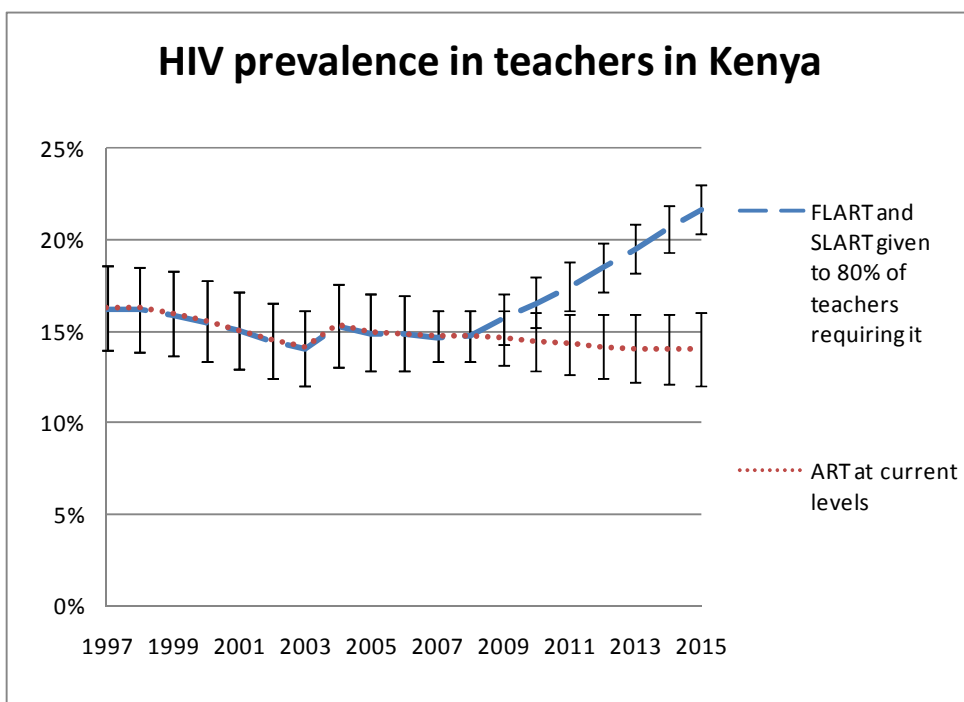


Figure 3. HIV prevalence in the whole of Kenya, 1997-2015, where ART is given to all teachers requiring it, and where ART is maintained at current levels. The error bars represent the high, medium and low estimates of population prevalence.

HIV prevalence in teachers is very high, and if ART is provided to all teachers, it is set to rise. This is because of better survival of teachers living with ART. The importance of ART is that it reduces absenteeism and attrition of the education work force (see Figure 6 below).

The HIV prevalence estimated in teachers is compared with the results of the KAIS population HIV prevalence in each province in the table below:

Province	Population Prevalence, KAIS	Projected teacher prevalence
Kenya	7.8%	14.72%
Central	3.8%	7.32%
Coast	7.9%	15.51%
Eastern	4.7%	9.39%
Nairobi	9%	20.12%
NorthEastern	1%	1.56%
Nyanza	15.3%	30.49%
RiftValley	7%	14.12%
Western	5.1%	10.26%

Table 4. HIV prevalence in teachers and in the general population in 2008.

HIV prevalence among teachers is approximately twice that in the general population, due largely to the age profile of teachers (see figure 1 above).

Where ART is given to those teachers requiring it, the number of HIV positive teachers is set to increase, but so do the total number of teachers, and the cumulative number of teacher AIDS deaths between now to 2015 is also less where ART treatment is provided at elevated levels compared to the

scenario where the roll-out of treatment is maintained at current levels. This beneficial impact of providing ART to the teacher workforce can be seen in figure 6 below.

ART at current levels ART provided to 80% of those teachers requiring it

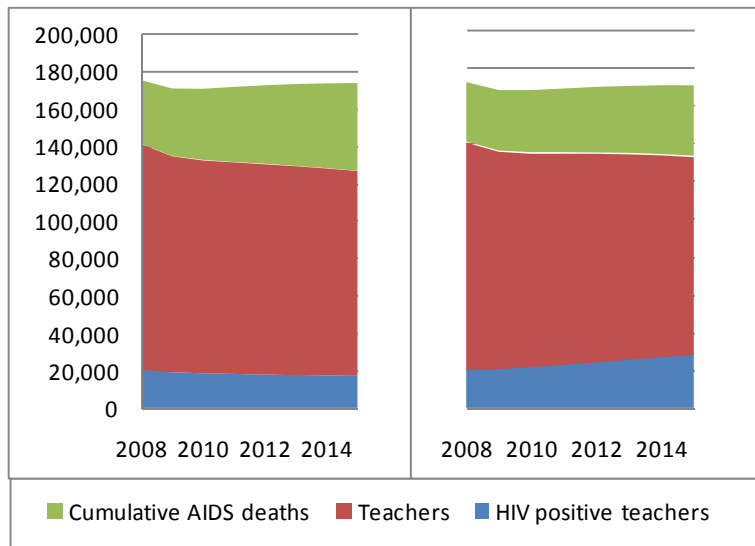


Figure 4. Teachers by infection status, and cumulative number of teachers who have died from AIDS¹

The impact of HIV on the achievement of the EFA goals can be seen more directly by examining the pupil-teacher ratio (PTR). Figure 7 below estimates the pupil-teacher ratio over time in the presence and absence of HIV, under two scenarios- 1) recruitment of teachers is increased to achieve the EFA goal of 40:1 PTR and 100% NER, and 2) the status quo is maintained. To provide a provincial perspective, the example of Nyanza is taken, where the desired PTR has not been achieved and HIV prevalence is high.

Recruitment increased to achieve EFA by 2015 (PTR of 40 and 100% NER)	Status quo is maintained (stable recruitment and enrolment)
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¹ The recruitment scenario here is status quo; recruitment and enrolment are stable meaning that EFA is not achieved.

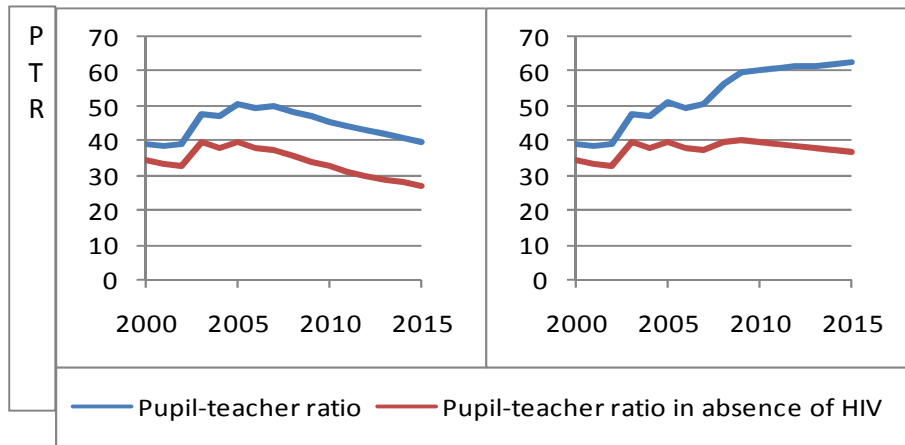


Figure 5. Pupil-teacher ratios in the presence and absence of HIV, where recruitment and enrolment are increased so that the EFA goals are achieved, and where the status quo is maintained.

If the status quo is maintained in Nyanza, it will result in missing the EFA goal by a wide margin. In the absence of an HIV epidemic, the desired PTR reduction to below 40 would have already been achieved. However given the HIV epidemic, an increase in the recruitment of teachers is required to reach the EFA goals.

To look more directly at the question of recruitment, the annual recruitment under three scenarios is presented in figure 8, below.

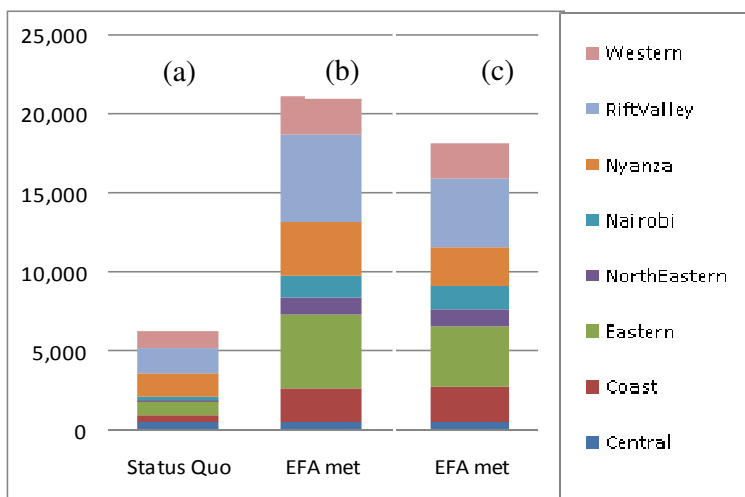


Figure 6. Number of teachers recruited annually, and the provinces to which they must be deployed, between now and 2015. (a) the current recruitment rate (“Status Quo”), (b) where recruitment is altered so that Education For All goals are met and the testing and treatment of teachers is at current levels;

and (c) where recruitment is altered so that EFA goals are met and all feasible (80%) testing and treatment is provided.

Figure shows that the greatest recruitment is required if EFA goals are to be achieved and when ART take-up has not increased. It also indicates the differences between provinces; the impact of ART is minimal in Western province (difference between the pink sections of the right-hand bars), as prevalence is not high there yet ART roll-out is proceeding well already (table, appendix). Although all provinces require increases in recruitment if EFA is to be met, the relative effort required varies by province. For example, Central province requires much less increase in recruitment than Eastern, where enrolment is low and PTR is high (table).

Ed-SIDA also evaluates the impact of HIV on the absenteeism of teachers. This indicates the minimum number of replacement teachers that would be required to sustain education provision. Figure 9 below shows absenteeism in 2008 (a), and by future ART scenario in 2015 (b and c)

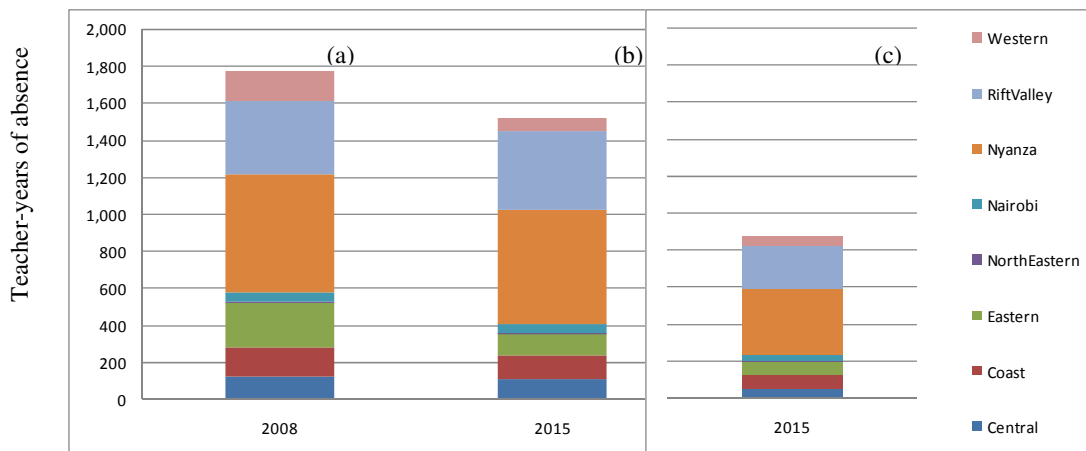


Figure 7: the absenteeism of teachers estimated in 2008 (a) and projected in 2015, where (b) ART is maintained at current levels, and (c), where Art is rolled-out to 80% of teachers who require it. Recruitment scenario = status quo; EFA not achieved.

Currently a cumulative total of about 2,000 teacher-years of absence is estimated, which implies that at least 2,000 replacement teachers would be required to cover these absences. This is set to decrease in 2015, and to a very significant extent where ART is taken by more teachers.

Costs of HIV to education estimated by Ed-SIDA

The costs applied to the Ed-SIDA outputs are as follows: 1 teacher-year of absence is evaluated as the cost of a replacement teacher salary, which is assumed to be equal to the lowest teacher pay grade. Deaths cost the amount paid to teachers' families by the Ministry of education, in addition to the cost of putting a teacher through training college to replace this teacher who has died. The unit cost of OVC is assumed to be equal to the bursary the government gives to schools taking in children with special needs. The annual health costs of HIV on education are (1) the cost of VCT per teacher (2) the annual cost of FLART per teacher taking it; and (3) the annual cost of START per teacher on that.

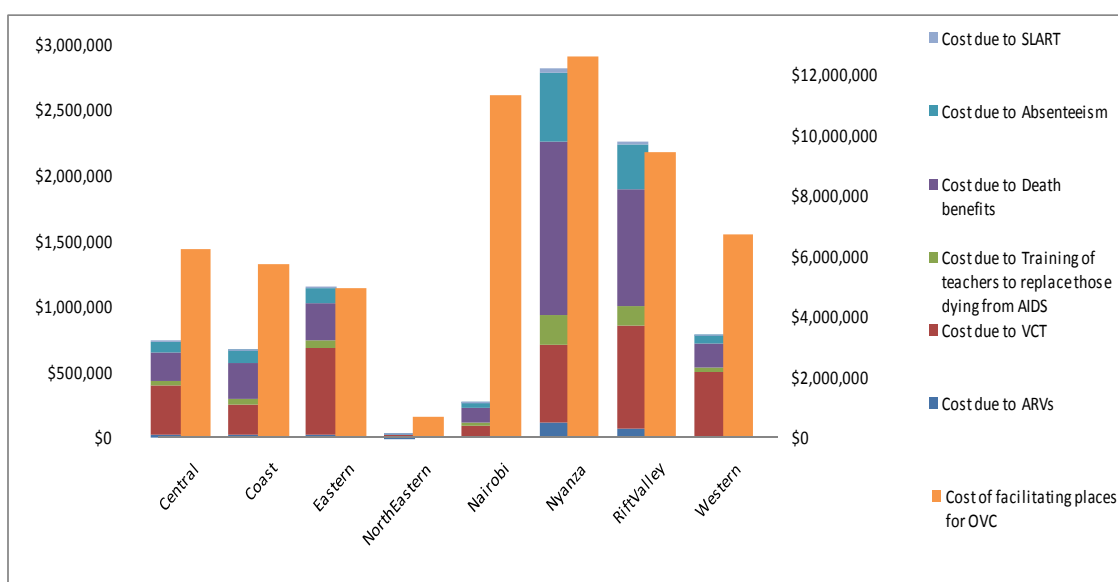


Figure 8. Costs of HIV to education by province in Kenya. The cost of OVC (orange bars) is plotted on the right-hand axis; other costs are plotted on the left-hand axis.

	Facilitating OVC places	Replacing AIDS deaths	Death benefits	Absenteeism	VCT	First- line ARVs	Second- line ARVs
Central	\$6,249,000	\$37,000	\$218,000	\$84,000	\$377,000	\$18,000	\$5,000
Coast	\$5,745,000	\$46,000	\$268,000	\$104,000	\$231,000	\$22,000	\$4,000
Eastern	\$4,960,000	\$51,000	\$294,000	\$112,000	\$663,000	\$24,000	\$6,000
NorthEastern	\$704,000	-	\$3,000	\$1,000	\$33,000	-	-

Nairobi	\$11,312,000	\$20,000	\$114,000	\$44,000	\$86,000	\$10,000	\$5,000
Nyanza	\$12,616,000	\$229,000	\$1,328,000	\$517,000	\$596,000	\$111,000	\$40,000
RiftValley	\$9,447,000	\$153,000	\$887,000	\$343,000	\$776,000	\$74,000	\$27,000
Western	\$6,738,000	\$32,000	\$183,000	\$70,000	\$488,000	\$15,000	\$5,000
Kenya	\$57,772,000	\$567,000	\$3,295,000	\$1,275,000	\$3,249,000	\$274,000	\$91,000

Table 5: costs of HIV to the education sector, and costs to the health sector of teachers infected with HIV, by province in Kenya.

Costs throughout Kenya:

		ART at current levels	FLART immediately increased to 80%	FLART & SLART given to as many patients needing therapy as possible
	2008	2015	2015	2015
Ministry of Education:				
Teacher training to replace AIDS deaths	\$1,785,000	\$960,000	\$616,000	\$567,000
Funeral costs	\$10,369,000	\$5,577,000	\$3,579,000	\$3,295,000
Covering AIDS absences	\$3,172,000	\$2,206,000	\$1,385,000	\$1,275,000
Ministry of Health:				
FLART	\$79,000	\$52,000	\$273,000	\$274,000
SLART	-	-	-	\$91,000
VCT	\$1,177,000	\$864,000	\$3,247,000	\$3,249,000

		FLART only	FLART + SLART
Costs	Cost of increasing ART 2008-2015	\$1,674,000	\$1,862,000
	Cost of increasing VCT 2008-2015	\$21,422,000	
Benefits	Teachers' lives saved	7950	8110
	Teacher-years of absenteeism saved	6720	6880
	Total saving 2008-2015 to MoE of increasing	\$49,593,000	\$50,540,000

ART and VCT use		
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Table 6: Costs associated with the impacts of HIV on education, and cost-benefits of ART and VCT provision for Kenya

It can be seen that the provision of ART would have great benefit for Kenya; universal access to first-line therapy would save approximately 8,000 teachers' lives between 2008 and 2015, and additional universal access to second-line therapy would save an extra ~200 teachers. A substantial amount of money is also saved by the impact that ART has on reducing absenteeism caused by AIDS illnesses, and teacher deaths. This saving to the MoE is due to reducing the requirement for replacement teachers and the need to pay death benefits.

Key results

- i- Paediatric ART levels are low, so children perinatally infected with HIV will experience a high probability of dying before reaching school age

- ii- Numbers of orphans in Kenya are expected to increase

- iii- The greatest numbers of HIV positive teachers are found in Nyanza, followed by the Rift Valley

- iv - HIV prevalence among Kenyan teachers is currently estimated to be around 15%

- v- In Kenya, AIDS mortality is currently estimated to equal around 2% of all teachers, and at any one time, 1.5% of teachers are estimated to be off sick due to AIDS illnesses.

vi- HIV significantly impacts on Kenya's ability to achieve EFA. In Nyanza for example, in the absence of HIV, low pupil- teacher ratios of below 40 would have already been achieved; and without an increase in teacher deployment to Nyanza, PTRs are set to increase to above 60 by 2015.

vii- The current annual cost of HIV to education delivery in Kenya is estimated to exceed Ksh 1.1 Billion (\$15 M US).

viii- Increasing ART between now and 2015 would save the lives of around 8,000 teachers, and Ksh 4 Billion (\$50 M US).

ix- Investing in VCT and ART provision in Kenya is cost-saving. It would provide a return of \$2.14 on the dollar

Recommendations

Teachers are especially vulnerable to HIV infection simply due to their age and gender profile, and it is estimated that at least 2/3 of teachers living with HIV are currently not receiving the support provided by membership of KENEPOTE. More encouragement should be provided for these teachers to join up, to maximise their opportunities for care, support and treatment, to enable them to continue to contribute fully to education provision in Kenya.

Given the relatively low cost of VCT and ART provision compared with the costs of deaths and absenteeism, it is cost-effective for the MoE to fund VCT for all teachers in Kenya and treat those teachers requiring it. Investing in testing and treatment of teachers would provide a return of 2.15 on each Kenyan shilling invested

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