

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

Summary:

This impact analysis revealed that the number of HIV positive teachers is likely to increase, as could AIDS mortality and absenteeism. ART, particularly second-line ART could reduce these problems and save money. HIV prevalence in Rwandan teachers could reach 12% by 2015. Considerable effort is required to reduce pupil-teacher ratios and increase orphan school attendance. Rwanda can celebrate its successes in increasing net enrolment.

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. Details of the methods and inputs are described in appendix.

The scenarios explored to generate the results are described below:

VCT/ART scenarios Between now 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.

Achievement of EFA Two scenarios are contrasted: that where Net Enrolment and Teacher recruitment levels are maintained at current levels between 2008-2015, and that where they are increased to achieve 100% net enrolment and a pupil-teacher ratio of 40.

Teacher relative risk Two scenarios are contrasted: that where teachers have the same risk as the general population of being infected, and that where teachers have twice the risk.

Impacts of HIV on children in Rwanda

HIV positive children.

It is estimated that there were 27,000 HIV positive children in Rwanda in 2005¹. The coverage of PMTCT Was 36% of HIV positive pregnant women in 2005², a comparatively high rate of coverage. By contrast, the roll-out of ART to infected children is low, at 8% of children needing it in 2006³. The low rate at which infected children are protected by ARV treatment means that many will continue to die before reaching school-age, but the high rate of PMTCT means that many fewer children will be infected around birth. Rwanda is therefore expected to have a declining number of HIV positive children in coming years (Cooper et al. 2008).

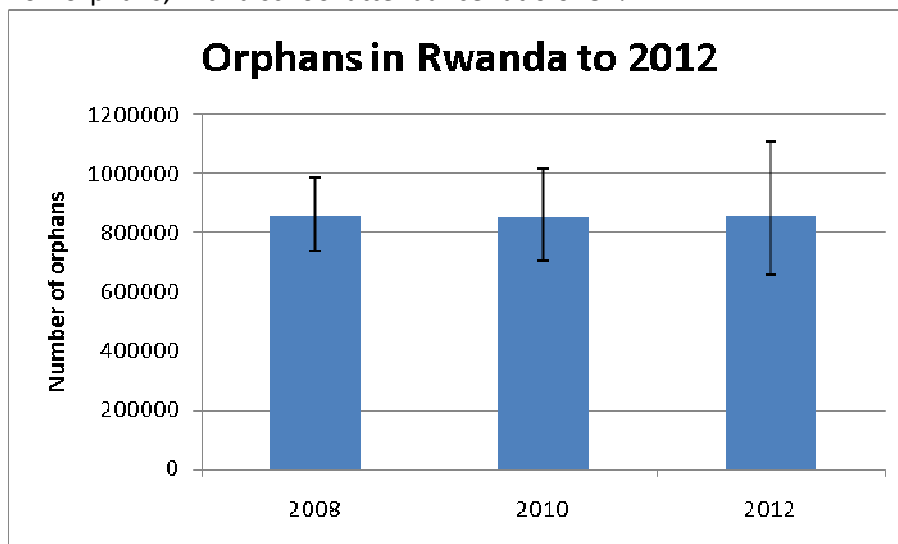
¹ http://www.unicef.org/infobycountry/Rwanda_statistics.html

² <http://www.who.int/globalatlas/docs/hiv/annex3web.xls>

³ <http://www.who.int/globalatlas/docs/hiv/annex2web.xls>

Orphans

Despite the predicted decline in the number of HIV positive children, the total number of orphans in Rwanda is projected to remain approximately constant to 2012 at around 850,000 (See figure A1). The difference in trajectories of HIV positive children and orphans, despite that many HIV positive children are orphans, is largely due to the fact that HIV prevalence is relatively low in Rwanda for the region, and the parents of the majority of orphans did not die from AIDS-related causes. Orphans in Rwanda were found to be attending school at a markedly lower rate than non-orphans, with a school attendance ratio of 82%.⁴



FigureA1. Estimates of orphans of all causes found in Rwanda aged 0-17. Error bars represent high and low estimates.

The situation in Rwanda

The situation regarding HIV, and regarding education in Rwanda has certain characteristics which differ from other countries in the region, making it s case somewhat special. Teachers in Rwanda appear to be younger than in other countries, which affects their susceptibility to HIV (See figure A2).

⁴ http://www.unicef.org/infobycountry/Rwanda_statistics.html, Orphan data from MICS and DHS, 1997-2002.

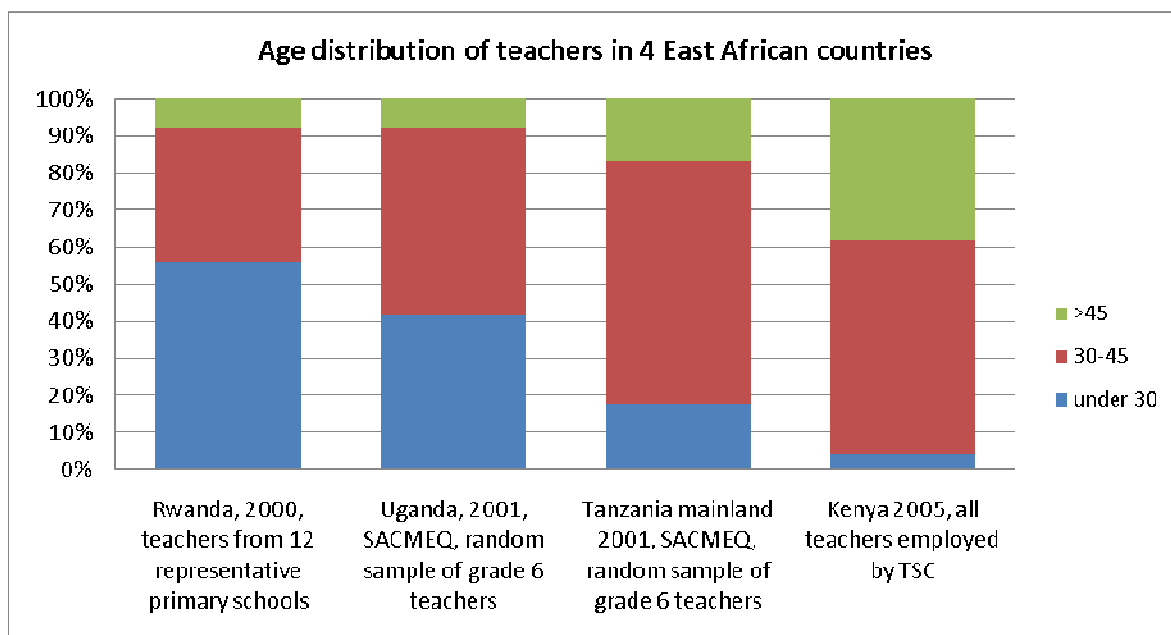


Figure A2: Proportion of teachers in three age groups in EAC countries.⁵

Rwanda also differs in that, in addition to the altered risk imposed by their age distribution, teachers are more susceptible to HIV than people from the general population of the same age and gender. An analysis of DHS data (<http://www.measuredhs.com/>) indicated that teachers have twice the risk of the general population of being infected with HIV, which was statistically significant (see table A1). Other countries tested did not show a significant difference between the HIV prevalence among teachers and the general population.

| | Kenya | Rwanda | Tanzania |
|--|-------|--------------|----------|
| Year | 2003 | 2005 | 2004 |
| Prevalence in DHS sample | 6.60% | 3.20% | 6.47% |
| Prevalence in teachers DHS sample | 9.20% | 6.40% | 4.46% |
| P value (adjusted for age and gender) | 0.135 | 0.048 | 0.586 |
| Relative risk of teachers for infection | 1.39 | 1.98 | 0.69 |

Table A1. Risk of teachers of being infected with HIV, compared to the general population. Data are from Demographic and Health DHS) surveys . Statistical significance was determined taking into account the risk imposed by teachers' age and gender.

This increase in risk was accounted for by running the model with an extra scenario; the relative risk of teachers was set at 100% then 200% of the general population. It would be interesting to get more data to address this problem. In this report, the

⁵ Data on Rwanda are from Earnest and Treagust (2001, <http://www.aare.edu.au/01pap/ear01163.htm>); data on Uganda and Tanzania are from the SACMEC surveys (<http://www.sacmeq.org/>); and data from Kenya were supplied by the TSC.

main results presented are those from model runs where teachers have the same risk of infection as the general population. The scenario where teachers have a relative risk of 200% is shown as error bars or as a separate series where appropriate.

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 Rwanda. 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.

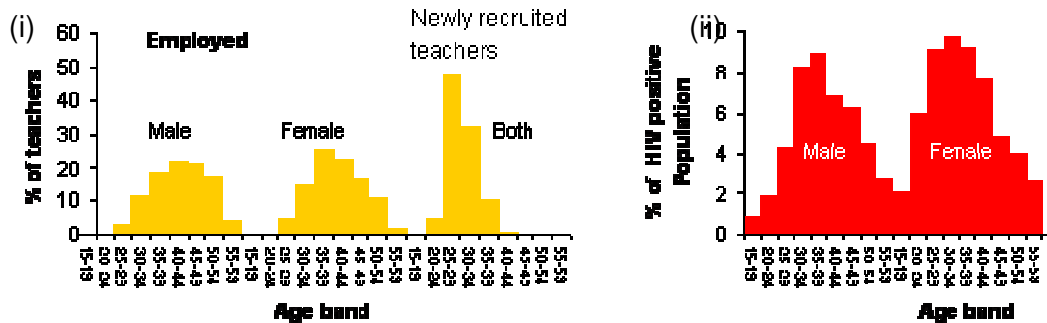


Figure A2 (i) Age distribution of teachers employed in Kenya, 2005, by gender, and those recruited in that year input into the model for each country in the East Africa sub-region. (ii) Age distribution HIV infection in sub-Saharan Africa, 2005, by gender. The age-gender distribution of teachers parallels 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 Rwanda were presumed to have the same risk as people in the general population of the same age and gender.

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.

For the present estimations it was assumed that where the PTR exceeded 40:1 the rate of recruitment of teachers would result in the reduction of the ratio to 40:1 by 2015. Where the PTR was already below 40, we assumed that the recruitment would aim to maintain this low ratio, and did not allow reducing teacher numbers to be compensated by rising PTRs.

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 resulting from teacher absences due to sickness or deaths of family members,

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 two policy scenarios, one where 80% of teachers undergo VCT and those found to require ART are provided with it and the other where ART use, and second line therapy if required, is provided to 80% of teachers. The % of those who require ART who are provided with it in the general population was sourced from UNAIDS. 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 is given in the table below.

| | | |
|--------------------------------|---------------------------------------|--------|
| Primary school teachers | Numbers, 2007, '000s | 28 |
| | % F in 2007 | 53% |
| | Average age in 2000 | 32.6 |
| Primary school pupils | Net enrolment in 2007 | 94% |
| | Pupil-teacher ratio 2007 | 69.286 |
| HIV | Population HIV prevalence in 2007 | 2.79% |
| | Proportion in need of ART in 2007 | 51% |
| | % of those in need taking ART in 2007 | 58.35% |

Table A2. Inputs into the Ed-SIDA model

Results

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

Estimated HIV positive primary teachers and their ART needs in Rwanda

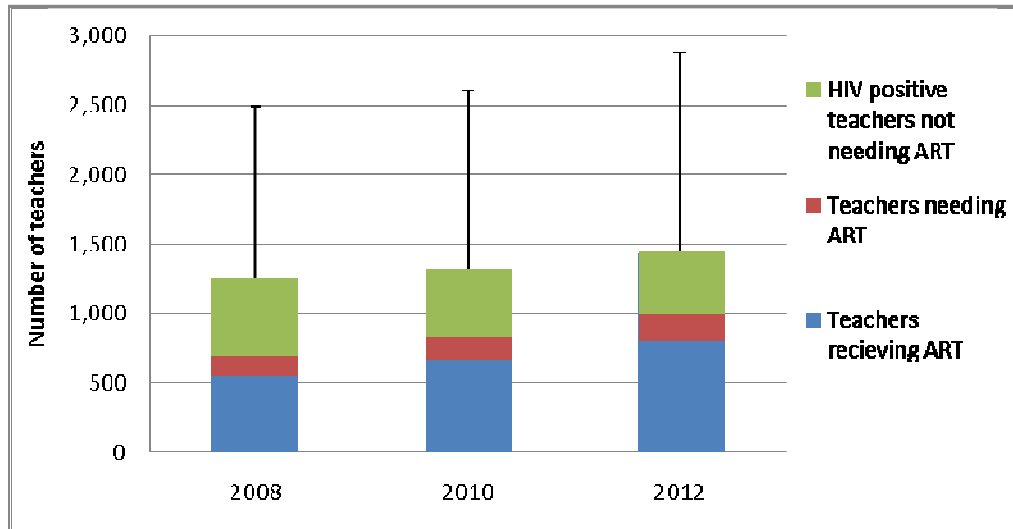


Figure A3. HIV positive teachers in Rwanda, split according to their needs for ART. The scenario shown is where ART is maintained at current level, and EFA is achieved. Top error bar shows the number of HIV positive teachers where the relative risk is 200%.

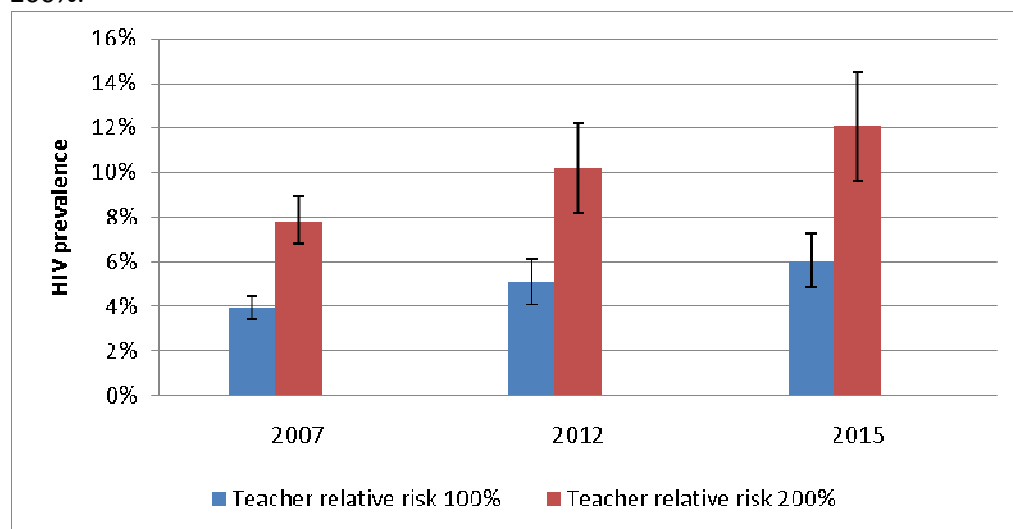
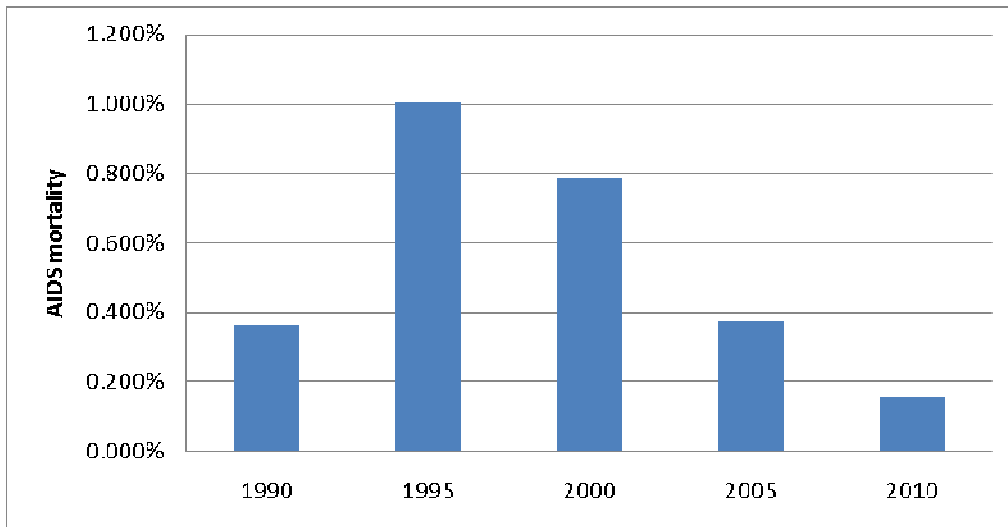


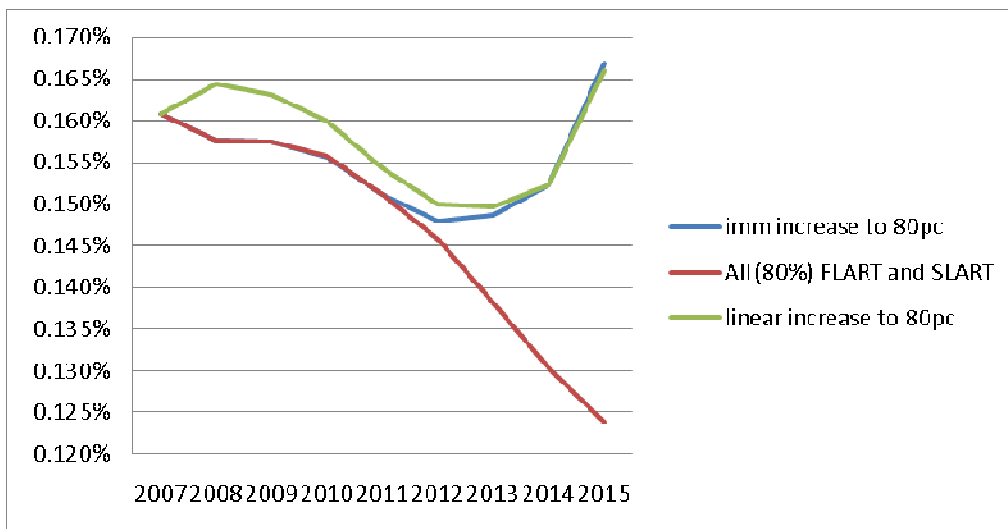
Figure A4. HIV prevalence in Rwanda, 2007-2015, at two different relative risks of teachers being infected, where ART is given to all teachers requiring it that's feasible. Error bars represent high and low population prevalence estimates.

HIV prevalence in teachers is quite high, especially so if the results of the DHS are representative of all teachers and their relative risk is twice that of the general population (red bars). This high prevalence is in part due to the success of Rwanda's

ART roll-out; in countries where teachers are not provided with ART, HIV positive teachers die and causing a lowered prevalence in the remaining workforce. The importance of ART is that it reduces absenteeism and attrition of the education work force.



AIDS mortality in teachers



Future AIDS mortality in teachers by ART scenario

EFA goals.

Rwanda has made great strides in improving access to education for all of its school-age population in the last few years, as the figure below illustrates. It is faring less well in reducing its pupil-teacher ratio, however, which is much higher than the recommended target PTR of 40:1.

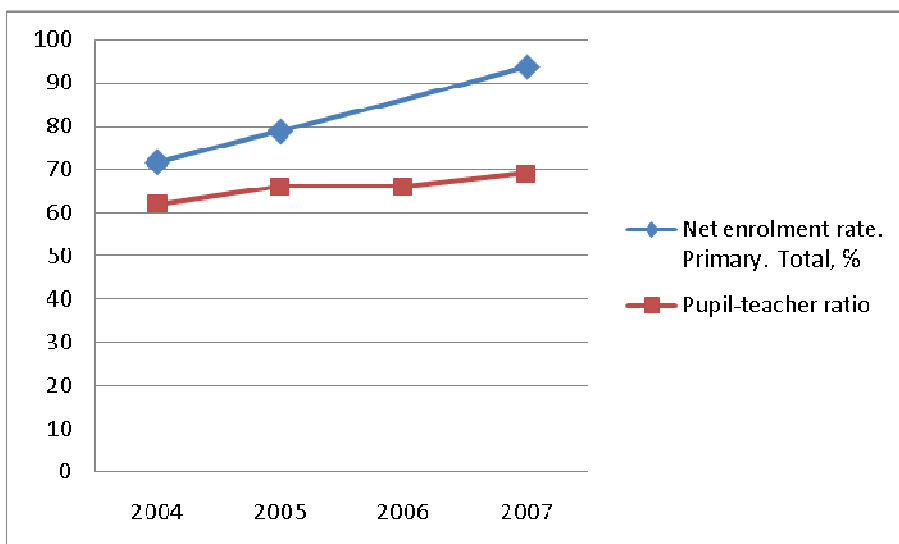


Figure A5 NER and PTR in Rwanda for all primary schools, 2004-2007. Data source: UIS

The impact of HIV on the achievement of the EFA goals can be seen 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.

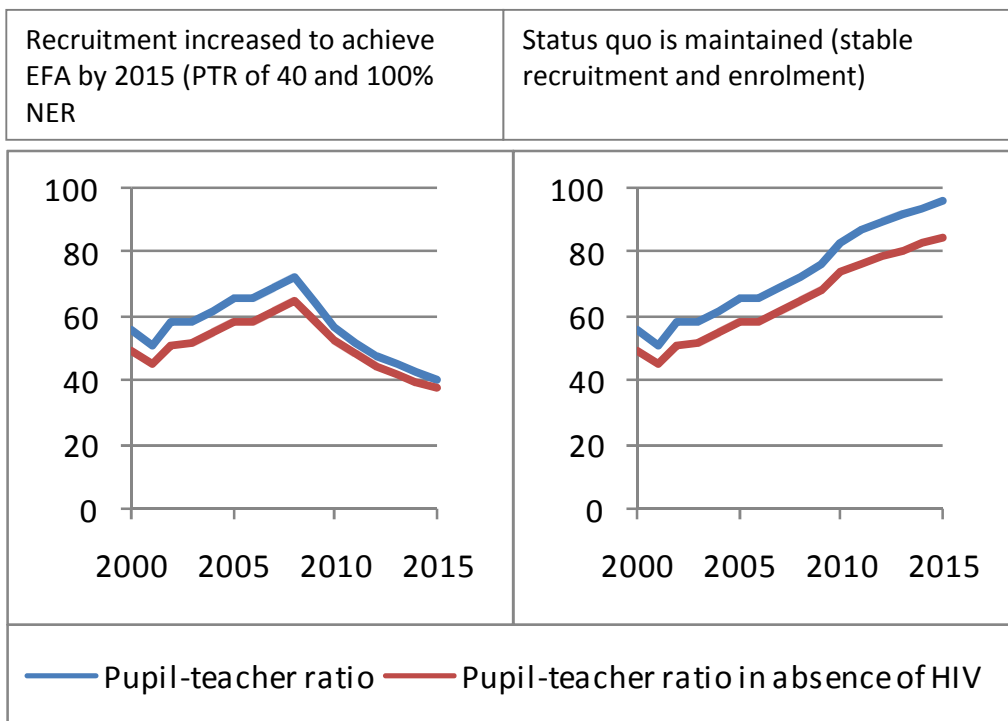


Figure A6. Pupil-teacher ratios in the presence and absence of HIV, where recruitment and enrolment are increased so that the EFA goals are achieved, and where the status quo is maintained. Teacher relative risk = 200%.

If the status quo of teacher recruitment is maintained in Rwanda, 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 be slightly easier to achieve. A large increase in the recruitment of teachers is required to reach the EFA goals.

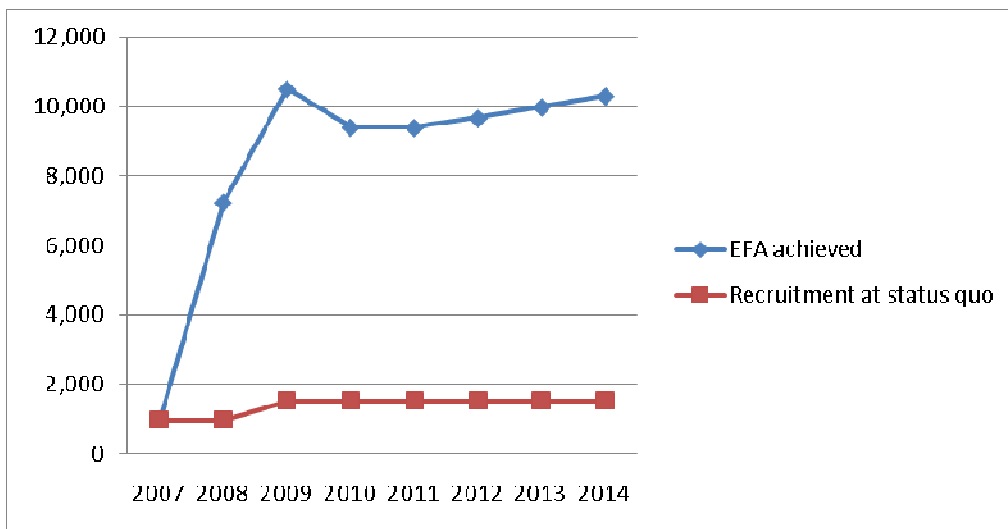


Figure A8. Teacher recruitment

Figure shows that many more teachers need to be recruited if the PTR in Rwanda is to be reduced below 40 to achieve a better quality education for Rwandan children.

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 in the face of increased illness due to HIV. Figure 9 below shows absenteeism by future ART scenario and recruitment of teachers to achieve EFA in 2015

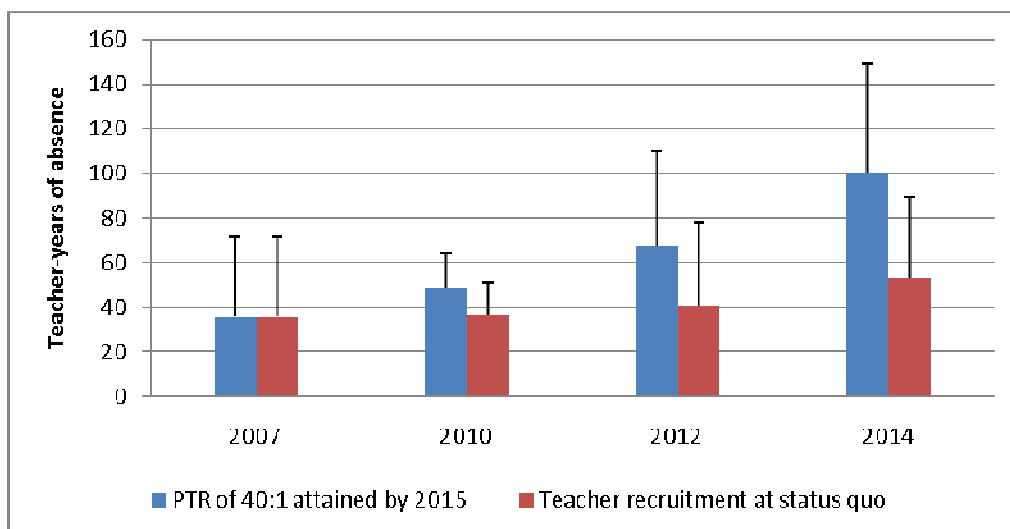


Figure A10: the absenteeism of teachers estimated from 2007 on, where the number of teachers is increasing in order to lower the PTR, and where they are maintained at current levels. The main data are for teacher relative risk of 100%, and the error bars show the extent of the absenteeism where teacher relative risk is 200%.

Currently a cumulative total of 35-70 teacher-years of absence is estimated, which implies that at least this number of replacement teachers would be required to cover these absences. This is set to increase in 2015. The exceptionally low rates of teacher absences due to HIV in Rwanda is due to the very high-rates of ART provision to those requiring it.

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 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 SLART per teacher on that.

| | 2008 | 2015 | 2015 |
|---|-----------|-----------|-----------|
| Costs to the MoE of: | | | |
| Teacher training to replace AIDS deaths | \$26,000 | \$122,000 | \$91,000 |
| Funeral costs | \$154,000 | \$727,000 | \$540,000 |
| Covering AIDS absences | \$39,000 | \$275,000 | \$204,000 |

FLART maintained at 80% but SLART not provided

SLART given to as many patients needing therapy as possible

| Costs to the MoH of: | | | |
|----------------------|-----------|-------------|-------------|
| FLART | \$97,000 | \$221,000 | \$221,000 |
| SLART | \$0 | \$0 | \$85,000 |
| VCT | \$943,000 | \$1,516,000 | \$1,516,000 |

Table A2: Costs associated with the impacts of HIV on education, US\$. Future recruitment and enrolment are at the levels required to meet EFA.

| Costs | Cost of Second-line drugs (US\$) | \$ 143,000 |
|-----------------|--|------------|
| Benefits | Teachers' deaths averted | 100 |
| | Teacher-years of absenteeism saved | 110 |
| | Total saving 2007-2015 to MoE of providing SLART(US\$) | \$ 500,000 |

Table A2: Cost and benefits of provision of second-line therapy to teachers in Rwanda needing it. Future recruitment and enrolment are at the levels required to meet EFA.

It can be seen that the provision of SLART would be beneficial for Rwanda; universal access to second-line therapy would save an extra ~100 teachers and \$500,000. This saving to the MoE is due to reducing the requirement for replacement teachers and the need to pay death benefits.⁶

⁶ The returns to education of providing universal access are < 1 in Rwanda, whereas in other East African countries, these returns are >>1. This is due to the relative costs of VCT and death benefits. The cost of VCT in Kenya and Rwanda was found from a 1997 study (Sweat M, Sangiwa G, Balmer D, 1998, study of cost-effectiveness of VCT in Tz and Kenya (\$27)), which becomes much larger than other estimates when expressed in today's prices. By contrast, the amount paid by the MoE on death benefits is taken from Uganda and scaled on their relative GDP, and is consequently quite small (\$327 in 2008, about 10-fold less than the Kenyan estimate provided by the MoE).