The global strategy to eliminate HIV infection in infants and young children: a seven-country assessment of costs and feasibility

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Objective: Model the feasibility and affordability of the 2001 UN General Assembly Special Session on AIDS goals to reduce mother-to-child transmission of HIV (MTCT) by 50% by 2010 and achieve 80% coverage of interventions to reduce it among women presenting for antenatal care.

Methods: The cost and human resource needs of prevention of MTCT (PMTCT) and paediatric treatment were modelled for 2007–2015 and compared with the AIDS budgets and available health workforce in Burkina Faso, Cameroon, Cote d'Ivoire, Malawi, Rwanda, United Republic of Tanzania, and Zambia. Interventions used were promotion of family planning to people living with HIV, HIV testing and counselling, antiretroviral treatment to prevent MTCT and for HIV-infected children, and cotrimoxazole prophylaxis for mothers with advanced HIV infection and HIV-exposed children.

Results: The cumulative cost from 2007 to 2015 of the intervention in the seven countries combined amounted to US$587 688 291, 86% for PMTCT and 14% for paediatric treatment. Three out of the seven countries – Rwanda, Zambia, and Burkina Faso (almost) – were predicted to have sufficient AIDS funding, but only one – Zambia – was predicted to have also sufficient human resources to scale up the interventions by 2010 and sustain them up to 2015. The cost-effectiveness would be less than US$1150 per infection prevented in fully scaled-up programmes.

Conclusion: Scaling up PMTCT will require more funds than currently available in many countries, but human resources appear to be a greater bottleneck than funding. We suggest that human resource capacity be assessed when increased funds for PMTCT are requested.

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Introduction

Although the effectiveness of antiretroviral drugs in preventing mother-to-child transmission of HIV (PMTCT) has been documented for 15 years now [1], their uptake was a mere 34% at the end of 2007 [2]. Moreover, in sub-Saharan Africa, most women used a single-drug regimen with nevirapine (NVP) in spite of WHO 2006 recommendations to use more effective approaches [3]. Faced with this state of affairs, vigorous action has been argued for to meet the targets set by the 2001 UN General Assembly Special Session on AIDS (UNGASS) – namely, reach 80% coverage of mothers attending antenatal care (ANC) with PMTCT interventions and reduce MTCT of HIV by 50% by 2010 [4,5].

The present article aims to explore whether it is feasible and affordable to scale up PMTCT, using the more effective combination antiretroviral prophylaxis regimens recommended by WHO to the desired coverage, within

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the current fiscal and human resource constraints in seven countries. The countries were chosen because UNITAID – an international drug purchase facility, established to provide access to drugs and diagnostics for HIV/AIDS, malaria, and tuberculosis in developing countries – agreed to fund their drugs and diagnostics for PMTCT, thus challenging them to rapidly scale up their interventions [6].

Methods

A spreadsheet model was constructed to forecast cost and human resource requirements of interventions to reduce MTCT and paediatric treatment in Burkina Faso, Cameroon, Cote d'Ivoire, Malawi, Rwanda, United Republic of Tanzania (hereafter abbreviated to 'Tanzania'), and Zambia. Key demographic, HIV service coverage, health worker force, and AIDS funding data from UNAIDS [7], Levine *et al.* [8], and WHO [9,10] are included in Table 1.

The interventions were costed from provider's perspective using a methodology described by Kumaranayake and Watts [11]. Cost categories included commodity cost (medicines and diagnostics for HIV serology, CD4 cell count determination, HIV polymerase chain reaction, PCR, haematology and chemistry), human resource cost, capital cost, and cost of family planning. Opportunity costs, the cost of goods/services not fully paid for by the PMTCT programme, and costs of donated goods were not included. Future costs were discounted at an annual rate of 3% and all costs are in 2007 US dollars.

The intervention package for PMTCT consisted of promotion of family planning to people living with HIV (PLWH), HIV testing and counselling of pregnant women in ANC, provision of antiretroviral and cotrimoxazole prophylaxis to HIV-infected women and cotrimoxazole prophylaxis to HIV-exposed infants.

Promotion of family planning was costed on the assumption that each year the unmet family planning need among HIV-infected women will decrease by 6% and that the incremental cost of its uptake by HIV-infected women from baseline levels will be borne by the PMTCT programme.

HIV testing was costed on the assumption that initial testing is done with Determine and confirmation tests with Unigold or Capillus rapid tests, both for mothers during ANC and for HIV-exposed children, at 15 and 18 months. If their mother accessed PMTCT in centres that offer CD4 cell counts during pregnancy, infants were assumed to be assessed in addition with PCR twice to establish infant HIV infection.

As regards antiretroviral drugs for PMTCT, it was assumed that at baseline in 2007, 9% of women used HAART during pregnancy because they needed it to treat advanced HIV infection, in keeping with WHO's progress report on Universal Access in 2008 [2]. It was thus assumed that at baseline in 2007, three times as many women, or 27%, would have access to CD4 cell counts during ANC, because, when tested with CD4 cell counts, only one-third would have CD4 cell count less than 350/μl and be eligible for HAART [12,13]. Two-thirds of women, whose CD4 cell counts were assessed, but whose CD4 cell counts were higher than 350/μl (14% of those accessing antiretroviral drugs for PMTCT), were assumed to use the combined prophylaxis regimen with zidovudine (ZDV) and NVP recommended by WHO [3]. The remaining 73% of HIV-infected women in ANC were assumed not to have access to CD4 cell counts; of whom, three-quarters were assumed to use the single-drug regimen with NVP (SD-NVP) used in the HIVNET 012 trial [14] and one-quarter the WHO-recommended combined prophylaxis regimen. In keeping with findings by Leroy *et al.* [13], who described that only 3% of HIV-infected women attending ANC have clinically detectable advanced HIV infection, women without access to CD4 cell counts were assumed to access HAART in only 3% of cases.

It was assumed that, with the scale-up of MTCT intervention, the proportion of known HIV-infected women with access to CD4 cell counts during ANC will increase rapidly, from 27% in 2007 to 100% in 2010, and that the uptake of HAART and the WHO-recommended combined prophylaxis regimen will increase concomitantly.

The cost of providing mothers with HAART, clinical and laboratory monitoring was charged to the PMTCT programme from 2 months prior to and 9 months after birth, a time at which all infants are assumed weaned, based on reports from the DREAM cohort [15]. All women starting HAART were assumed to start cotrimoxazole prophylaxis and to continue it for 9 months at the expense of PMTCT programme. All HIV-exposed children were assumed to start cotrimoxazole prophylaxis, and, if followed after delivery, to continue it at the expense of PMTCT programme for 2 years.

Provision of formula to replace breastfeeding was not included in the intervention package, as WHO recommends exclusive breastfeeding [16] and as recent data suggest that breastfeeding-related transmission can be controlled with HAART [15,17,18]. Primary prevention of HIV infection in women was not included.

Paediatric treatment consisted of HAART, clinical and laboratory monitoring. Of the infected children, 8% were assumed to have access to paediatric treatment, as this is the proportion of HIV-exposed infants currently accessing HAART in developing world [2]. However,

Table 1. Baseline country data.

	Burkina	Cameroon	Cote d'Ivoire	Malawi	Rwanda	United Republic of Tanzania	Zambia
Demography							
Total population [7]	14 784 000	18 549 000	19 262 000	13 925 000	9 725 000	40 454 000	11 922 000
Crude birth rate [7]	44.2	35.0	35.5	41.0	44.2	39.5	39.6
People living with HIV [7]	130 000	540 000	480 000	930 000	150 000	1,400 000	1,100 000
Children living with HIV [7]	10 000	45 000	52 000	65 000	19 000	140 000	95 000
Population growth rate [7]	1.029	1.016	1.017	1.022	1.023	1.018	1.017
Women 15–49 in union [8]	2 461 000	3 082 000	2 813 000	2 173 000	1 199 000	6 053 000	1 692 000
HIV prevalence among mothers [7]	1.6	5.1	3.9	11.9	2.8	6.2	15.2
Service coverage (source)							
Antenatal care (%) [9]	73	82	88	92	94	78	93
HTC coverage in ANC (%) [10]	85.9	43.7	20.5	65.6	70.7	52.5	52.9
PMTCT intervention uptake in ANC (%) [10]	18.0	22.0	12.0	32.0	60.0	32.0	47.0
Contraceptive use (any method) (%) [8]	13.8	26.0	15.0	41.7	17.4	26.4	34.2
Family planning unmet need (%) [8]	28.8	20.2	27.7	27.6	37.9	21.4	27.4
Health workforce available [10]							
Doctors	708	3124	2106	973	507	30 395	3386
Nurses	6557	26 042	10 180	7264	3647	13 292	22 010
Counsellors	1201	5902	2107	26	12 557	689	10 853
Laboratory technicians	336	1793	460	16	26	1327	1163
Funding							
AIDS funding [7]	47 298 132	37 825 960	14 016 100	54 602 956	87 129 456	96 511 420	189 929 904
Year for which data were used [7]	2006	2007	2006	2005	2006	2005	2006
Funding that could reasonably be allocated to PMTCT intervention and paediatric treatment.	3 638 318	3 152 163	1 518 411	3 816 336	11 036 398	9 651 142	16 403 037

2007 data, unless otherwise stated. ANC, antenatal care; HTC, HIV testing and counselling; PMTCT, prevention of mother-to-child transmission.

HIV-infected children whose mothers had access to CD4 cell counts during pregnancy were assumed to start HAART in a much higher proportion of cases (69%), in keeping with data from the UK and Ireland [19], as it was assumed that they have access to PCR for early diagnosis of HIV infection.

The cost of providing treatment to women and children was adjusted for the average ability of African cohorts to retain HIV-infected people on treatment, from Rosen *et al.* [20]

Unit cost assumptions

Medicines

Costs of paediatric antiretroviral formulations were taken from the Clinton Foundation [21], and that of adult formulations and paediatric formulations for which the Clinton Foundation did not provide a cost we used the average price between April 2006 and April 2007 from the WHO Global Price Reporting Mechanism [22]. The cost of cotrimoxazole was assumed to be the average 2007 price reported by the Management Sciences for Health (MSH) [23].

Diagnostics

The frequency of laboratory testing is shown in Table 2 [24]; the cost of CD4 cell counts was obtained from International Dispensary Association (IDA) [25], that of PCR from Rouet *et al.* [26], and that of haematology and chemistry from a case study from Ethiopia by Abt Associates Inc [27].

Family planning

We used the high estimate (18.21 US$) for the cost per couple year of protection (against pregnancy), from Levine *et al.* [8], which includes the full programme cost of promoting family planning, as, to achieve increased family planning coverage, increased investment in health promotion is necessary.

Human resource costs

The total amount of person time needed to deliver all parts (e.g. HIV testing) of the intervention was calculated from observations of the time to deliver them from a study in Zambia [24], expressed in full-time equivalents, and compared to the total number of full-time workers available in the health sector in each country. In keeping with prior studies [24,28,29], we assumed that healthcare workers would do clinical work 6.5 h per day and that there are 220 working days per year – hence, a full-time equivalent was 1430 h clinical service per year. The human resource costs were calculated by multiplying the average time needed to deliver the interventions with the salary cost of doctors, nurses, counsellors, and laboratory technicians. The salary costs of different professionals for Cote d'Ivoire and Malawi were obtained from WHO's Global Atlas [10] and for Zambia from the Quality Assurance project [24]. For other countries, data on labour costs were not available. We extrapolated their labour costs from the average salary, weighted for gross domestic product (GDP), from the countries for which data were available. In keeping with studies from Haiti and Rwanda [30,31], South Africa [32], Cambodia [33], and Zimbabwe [34], we further assumed that all tasks that could reasonably be shifted from doctors to nurses or mid-wives, and from them to counsellors, would be, as shown in Table 2.

Capital costs

US$0.396 for infrastructure enhancement and maintenance and health worker competence was attributed to each mother presenting for ANC, taken from Sweat *et al.* [35] and annualized over the period of the intervention.

Table 2. Human resource assumptions.

Task	Time needed in minutes [24]	Unit of assessment	Professional responsible
Pretest information prior to HIV testing in ANC	10	per client in ANC services in which HIV testing is offered	Nurse
Time for HIV testing during ANC	15	per ANC client accepting HTC	Nurse
Posttest counselling for HIV + clients	25	per HIV + woman tested	Nurse
Follow-up of HIV-exposed children after delivery	80	per exposed infant	Nurse
HIV serologic testing of HIV-exposed infants	14	per infant, done twice	Nurse
CD4 cells for mothers during ANC	10	per HIV + mother tested for HIV in ANC if CD4 cell counts available	Laboratory technician
Laboratory time for CD4 cell counts, haematology and chemistry	120	per patient-year of follow-up in HAART	Laboratory technician
PCR for infant diagnosis of HIV infection	25	per HIV-exposed infant if PCR available, done twice	Laboratory technician
Follow-up of patients (children and women) while receiving HAART	189	per patient-year of follow-up in HAART	Nurse
	67		Doctor
	96		Counsellor

ANC, antenatal care; HTC, HIV testing and counselling; PMTCT, prevention of mother-to-child transmission.

Model operation

The number of live births, HIV-exposed pregnancies in ANC, and HIV-infected women accessing PMTCT services anticipated each year in each country was calculated from the total population expected each year from 2007 to 2015. The number of women tested and completing antiretroviral drugs intervention was calculated using the ANC coverage and HIV testing and counselling, HTC coverage. Both ANC and HTC coverage were assumed to remain constant if at baseline, that is 2007, the coverage was already 80% or above; if coverage was below 80%, it was expected to increase from baseline levels to 80% by 2010 and remain constant after 2010. Coverage of PMTCT was assumed to increase from the baseline levels of 2007 to 80% by 2010 and remain constant after 2010.

The number of infant HIV infections occurring and averted with single-dose NVP was calculated using transmission rates of 12% with formula-fed and 21% with breast-fed infants (average early transmission rate in the HIVNET 012 and SAINT studies) [13]; we assumed breastfeeding would add 9% to the transmission rate at 18 months [36]. The transmission rates used for the WHO 2006 recommended strategy were 5.1 and 9.4% among infants receiving formula and breastfeeding, respectively [37], if mother had access to CD4 cell counts, and 7.1 and 11.4%, respectively, if mother did not have access to CD4 cell count, as in the absence of CD4 cell testing, 30% fewer women will access HAART and have postnatal HIV transmission rates of up to 15% [36] compared with – between 2.3 and 2.7% [15,38] – when using HAART.

To calculate the cost of paediatric treatment, it was assumed that all HIV-exposed children will start cotrimoxazole prophylaxis (using one patient-year of liquid formulation and one patient-year of solid formulation) and that all HIV-infected infants will start HAART immediately after birth. From the number effectively starting HAART, we calculated the number of children under treatment at mid-year of each year of their survival and calculated the cost of providing antiretroviral drugs to children for each 1-year cohort of patients, using the dosage and formulation of antiretroviral drugs recommended by WHO for their weight [39] and using the mean weight for age from the WHO standard growth curves for girls and boys [40] to determine the formulation and dose of antiretroviral drugs that each 1-year age group should take.

Cost of drugs for HAART and cotrimoxazole prophylaxis for women with advanced HIV infection was calculated assuming that all start ZDV, lamivudine (3TC), and NVP, with a 5% annual switching rate to second-line treatment with abacavir, didanosine, and lopinavir/ritonavir.

The cost of decreasing family planning unmet need by 6% per year and number of HIV-exposed pregnancies prevented of women living with HIV was calculated from the number of HIV-infected women of reproductive age living in union.

Affordability and feasibility benchmarks

We used proportion of PLWH, who are children, multiplied by the AIDS funding in the country to get the proportion of funds that can be allocated to PMTCT and the same multiplied by HIV seroprevalence in the country to define the proportion of health workforce that could reasonably be used to prevent and treat HIV infections in children in each country. The latest available annual funding for AIDS was obtained from country reports to UNGASS 2008 [37] or the epidemiological fact sheets [9]. Data on health workforce were obtained from WHO Global Atlas [10].

Results

Cost and affordability

The model predicts that, to meet the UNGASS targets for PMTCT by 2010 and maintain coverage after, the seven countries combined will need a cumulative total of US$587 688 291 between 2007 and 2015. PMTCT would absorb 86% of the funds and would prevent 486 625 cases of HIV infection, 46% of the cases expected without intervention. With improved programme efficiency after full scale-up, the percentage of cases prevented increased to 51%. Commodities accounted for 81% (39% antiretroviral drugs, 22% CD4 cell count, PCR, and other laboratory commodities, 5% for HIV tests, 3% cotrimoxazole, and 11% on commodity management costs); human resources for 14%, capital costs for 3%, and family planning for 2% of the cost of PMTCT. Paediatric treatment would absorb 14% of the total cost, of which 93% would be for commodities (including 55% antiretroviral drugs, 25% laboratory reagents, and 12% commodity management cost) and 7% for human resources.

Figure 1 shows the combined costs of PMTCT and paediatric treatment, divided by our affordability benchmark. When this ratio rises above one, the programme is deemed unaffordable. If AIDS funding continues as in the recent past, three countries – Burkina Faso, Rwanda, and Zambia – would have sufficient funding to attain the proposed coverage targets and be able to scale up paediatric treatment to levels that can be considered to represent Universal Access. By our affordability benchmark, Cote d'Ivoire and Malawi would be unable to afford the PMTCT interventions and paediatric treatment in 2007, whereas Cameroon and Tanzania are seen to need more funds than our affordability benchmark from 2008.

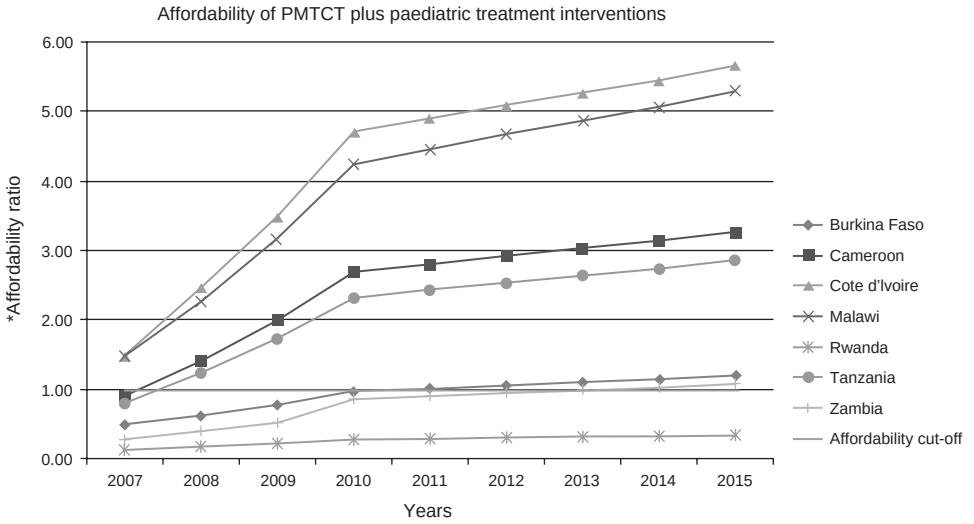

Fig. 1. Affordability of prevention of mother-to-child transmission and paediatric treatment interventions. '*' Indicates prevention of mother-to-child transmission (PMTCT) and paediatric treatment cost divided by available funding [available funding = AIDS funding multiplied by proportion of people living with HIV (PLWH) who are children]. If this ratio is greater than one, interventions are deemed unaffordable.

The shape of the curves in Fig. 1 is determined by the hypothesis of rapid scale-up between 2007 and 2010. After 2010, the cost increase is explained by increasing paediatric treatment costs and by population growth.

Cost-effectiveness of prevention of mother-to-child transmission intervention

Table 3 shows the cost-effectiveness of the PMTCT intervention. The average cost of preventing a case of MTCT over the duration of the model is US$1285 but after scale-up is complete in 2010, it drops to under 1150 US$/case prevented.

Human resource needs

Table 4 shows the ratio of full-time equivalents of health workers available in countries multiplied by HIV prevalence in country and the proportion of children among PLWH in the country, divided by the number of full-time equivalents needed to implement PMTCT and paediatric treatment. A ratio less than one indicates insufficient number of health workers to implement the interventions. Only Zambia is seen to have enough healthcare workers to implement both interventions. Cameroon and Cote d'Ivoire have sufficient healthcare workers at 2007 baseline coverage levels, but both are predicted to have shortages within 1 or 2 years. The rest of the countries have healthcare worker shortages starting at baseline.

Sensitivity analysis

Cost items contributing 10% or more to total programme cost and HIV prevalence in ANC were univariately varied; Table 5 shows the results. Total programme cost is very sensitive to HIV prevalence among women in ANC, cost of antiretroviral treatment, and cost of laboratory monitoring of treatment, less to human resource costs, and not very sensitive to changes in the intensity of family planning promotion. However, less family planning promotion results in overall cost increase and higher cost per HIV infection prevented; when family planning is not promoted, the cost per HIV infection prevented increases to US$1392 from US$1285 when it is promoted, and the cumulative number of HIV infections prevented in all seven countries combined between 2007 and 2015 decreases from 486 625 to 454 519. Decreasing HIV prevalence by 50% results in a 32.5% increase in cost per case prevented.

Table 3. Cost (US$) of mother-to-child transmission intervention/HIV infection prevented.

	2007	2008	2009	2010	2011	2012	2013	2014	2015
Burkina Faso	6817	2790	1930	1582	1552	1524	1499	1476	1455
Cameroon	2258	1482	1306	1247	1229	1213	1198	1185	1172
Cote d'Ivoire	3037	1436	1237	1186	1163	1142	1123	1105	1089
Malawi	1170	989	963	973	953	934	917	901	886
Rwanda	1142	1112	1123	1136	1104	1075	1049	1025	1003
Tanzania	1377	1119	1059	1047	1031	1015	1001	988	976
Zambia	737	782	841	892	873	856	840	825	811
Average	2362	1387	1208	1152	1129	1108	1089	1072	1056

Table 4. Human resource needs.

MTCT intervention and paediatric treatment	2007	2008	2009	2010	2011	2012	2013	2014	2015
Burkina Faso	0.06	0.06	0.06	0.05	0.05	0.05	0.05	0.05	0.05
Cameroon	1.35	0.98	0.75	0.60	0.59	0.59	0.59	0.58	0.58
Côte d'Ivoire	1.02	0.50	0.33	0.25	0.25	0.24	0.24	0.24	0.24
Malawi	0.33	0.28	0.24	0.21	0.20	0.20	0.20	0.20	0.20
Tanzania, United Republic	0.82	0.63	0.51	0.41	0.41	0.40	0.40	0.40	0.40
Rwanda	0.44	0.43	0.42	0.41	0.41	0.41	0.40	0.40	0.40
Zambia	2.78	2.22	1.85	1.58	1.56	1.54	1.52	1.51	1.51

Ratio of human resources (full-time equivalents) available/needed. MTCT, mother-to-child transmission.

Discussion

When we set out looking at PMTCT, we were primarily trying to answer the question whether reaching the UNGASS 2001 goal – a 50% reduction in the incidence of HIV infection in infants –could be feasible. Our model suggests that these goals could be theoretically reached. However, using publicly available data on AIDS funding and human resources, we found that the ability of countries to achieve these goals is severely constrained.

Human resource limitations would appear to be the most important constraint, as only one country – Zambia – was predicted to have sufficient human resources to fully scale up PMTCT and paediatric treatment up to 2015. Four countries were found to be investing already more human resources in PMTCT now than the relative importance of PMTCT in their HIV epidemic would justify. Unless there was a significant increase in the number of healthcare workers in those countries between 2004, the last year for which we could locate data, and 2007 (as was the case in Malawi, [41]), those healthcare workers were likely obtained from other health programmes, unless health sector staff were underutilized before.

A limitation of our assessment of the feasibility of the interventions from a human resource perspective is that we made no attempt to disaggregate the limitations in availability of different types of healthcare workers. Therefore, we could not provide insight into the question whether shortages of specialized healthcare workers, such as physicians or laboratory staff, might constrain the implementation of the interventions, even when there is no shortage in unspecialized healthcare workers. In spite of our bleak conclusions, the effect of these limitations would be that we might be too optimistic about the ability of countries to implement the interventions.

Against a background of severe human resource shortages in the health sector in much of sub-Saharan Africa [42] and as major donors have announced their intent to increasingly remedy the health system constraints that limit the potential of their programmes [43,44], we feel that at least some characterization of human absorptive capacity should be pursued in future decisions on funding for AIDS. This would improve the efficiency with which funds are used and stimulate investment in human resource development when shortages become apparent.

We also found that in four out of the seven countries, implementation of PMTCT and paediatric treatment would require more funding than one could reasonably allocate to deal with HIV infection in children at the current level of AIDS funding.

Our costing has several limitations, a first set of which likely led to an underestimation of the costs. Other than a fixed mark-up for commodity management, we did not include administrative and management or human development costs; we used 2004 data on wages for three countries and estimated the wages for the rest of the countries; and we opted for a conservative hypothesis for the time PLWH are retained in follow-up. A second

Table 5. Sensitivity analysis.

	Cost of PMTCT intervention	Cost of paediatric treatment	Cost of PMTCT intervention and paediatric treatment combined	Number of HIV infections prevented	Cost of PMTCT intervention/case of HIV prevented
Human resource cost 50% less	−6.96%	−3.77%	−6.47%		−10.67%
Family planning promotion 50% less intensive	1.36%	2.17%	1.48%	−3.07%	3.73%
Cost of HIV serology 50% less	−3.39%		−2.88%		−5.24%
Cost of antiretroviral 50% less	−14.31%	−31.62%	−16.95%		−13.35%
Cost of laboratory reagents 50% less	−12.58%	−14.62%	−12.89%		−9.37%
HIV prevalence 50% less	−40.81%	−50.00%	−42.21%	−50.00%	32.55%

PMTCT, prevention of mother-to-child transmission.

limitation, which might have led to underestimation of amount of funding available, is that data on funding levels for AIDS might be incomplete. In two cases, we had only 2005, in four cases 2006 data, while AIDS funding has been increasing in recent years [45].

With an average cost of US$1150 per HIV infection prevented when the interventions are fully scaled up in 2010, cost-effectiveness of the more effective combination antiretroviral prevention approach to PMTCT in our model – which includes HAART for mothers with advanced HIV infection – appears better than in earlier work by Sweat *et al.* [35] (2517 US$/case averted), Marseille *et al.* [46] (5134 US$/case prevented), and similar to Mansergh *et al.* [47] (1115 US$/case prevented). This is in keeping with the acknowledged sensitivity of their (and our) models to the cost of antiretroviral treatment and the fact that unit costs for antiretroviral treatment and HIV testing in our model are much lower now than when they published their estimates..

In line with earlier modelling [35,48], we also found that adding family planning to PMTCT intervention decreases its cost and increases the number of HIV infections prevented. However, we found family planning to have a modest effect on HIV transmission, as the PMTCT interventions in our model are much more effective than the single-dose NVP regimen considered in their analyses, and as we used relatively conservative assumptions for the scale-up of family planning in our model.

In summary, we found that with the present technical recommendations on prevention of MTCT by WHO, it should be possible to reach the UNGASS goal of a 50% reduction in the number of children infected with HIV if the coverage of the interventions increases to 80%. However, our model predicts that only one out of the seven countries assessed would have both human resources and enough funding to scale up the intervention to reach Universal Access. As human resources were predicted to be a serious constraint in the majority of countries assessed, some characterization of human absorptive capacity should be pursued in future AIDS funding decisions.

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