Estimating the Effects and Costs of Changing Guidelines for ART Eligibility

John Stover[1], Lori Bollinger[1], Carlos Avila[2]

[1]Futures Institute, Glastonbury, CT USA; [2]UNAIDS, Geneva, Switzerland

September 25, 2009

Introduction

WHO is considering changes to its guidelines for ART in low-income settings concerning when to start treatment, what regimens to recommend for first and second line therapies as well as other issues. As part of the preparations for these deliberations a working group is considering the impact and cost of potential changes. This paper describes initial work to prepare a model to examine these issues.

Methods

We have constructed a model to calculate the number of people that would be in need of ART with different eligibility criteria. The model tracks the HIV+ population by CD4 count using an approach similar to one used in South Africa recently to estimate the need for treatment[1]. Figure 1 shows the outline of the model. We assume that all newly infected people start with CD4 counts above 500. Their CD4 counts decline over time. The transition probabilities λ1, λ2, λ3 and λ4 represent the probability of progressing from one CD4 category to the next.

In each category there is some probability of death from HIV-related causes, designated as μ1, μ2, μ3, μ4 and μ5 as well as a chance of death from non-AIDS causes, μ0 (not shown in the figure). The probability of HIV-related death increases as CD4 counts decrease.

The number of people in the different CD4 count categories represents the HIV-infected population that is not on ART. The number of people eligible for treatment is the number in each CD4 count category that is below the recommended level for initiating ART.

Depending on the eligibility criteria and the level of first line ART coverage a percentage of those eligible for treatment will start first line ART (c1, c2, c3, c4, c5). Those on ART are categorized by their CD4 count at the initiation of treatment. The model does not track the

[1] Adam MA, Johnson LF. Estimation of adult antiretroviral treatment coverage in South Africa. *SAMJ* September 2009: 99;9: 661-667.

temporal decline of CD4 counts of those on treatment. Those on first line ART have a probability of failure depending on their CD4 count at initiation, $\alpha 1$, $\alpha 2$, $\alpha 3$, $\alpha 4$ and $\alpha 5$.

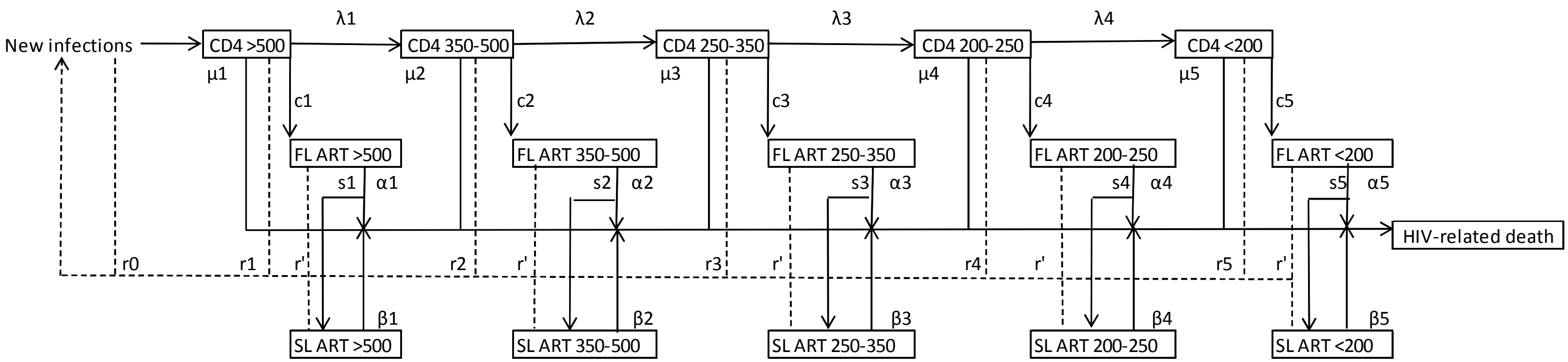
The number starting ART each year is determined by the assumed coverage and the number of people in the eligible for treatment. We assume that those starting on ART will be distributed among the eligible CD4 categories such that an equal percentage of people in each eligible CD4 category initiate treatment.

Those failing on first line ART will either start on second line ART (according to second line coverage s1, s2, s3, s4 and s5) or die from HIV-related causes. Those on second line have some probability of dying from HIV-related causes each year ($\beta 1$, $\beta 2$, $\beta 3$, $\beta 4$, $\beta 5$).

The number of HIV-related deaths each year is the sum of deaths from those not on ART and those on ART.

The historical annual number of new infections is exogenous to the model and is based on a Spectrum projection using historical surveillance and survey data to determine HIV prevalence and incidence trends. The future number of new infections is also based on the Spectrum projection but can be modified by expanding treatment. For those not on ART infectiousness varies by CD4 count (as a result of variations in viral load) as indicated by r1, r2, r3, r4 and r5. Infectiousness is high during primary infection, r0, low during the asymptomatic period (r1, r2, r3 and r4) and high during the symptomatic period, r5. Those on ART have reduced infectiousness, r'. As a result the future number of new infections can be influenced by the dynamics of CD4 decline and the coverage of ART.

Figure 1. Model of HIV-Infected Population, Eligibility for ART and HIV-related Mortality



Notes:

1. FL ART = First line ART, SL ART = Second line ART
2. The population receiving ART is categorized according to CD4 count at the initiation of ART.
3. The population in each box is also subject to non-AIDS mortality.
4. Solid lines indicate flows of people, dashed lines indicate flows of information.

Parameter Values

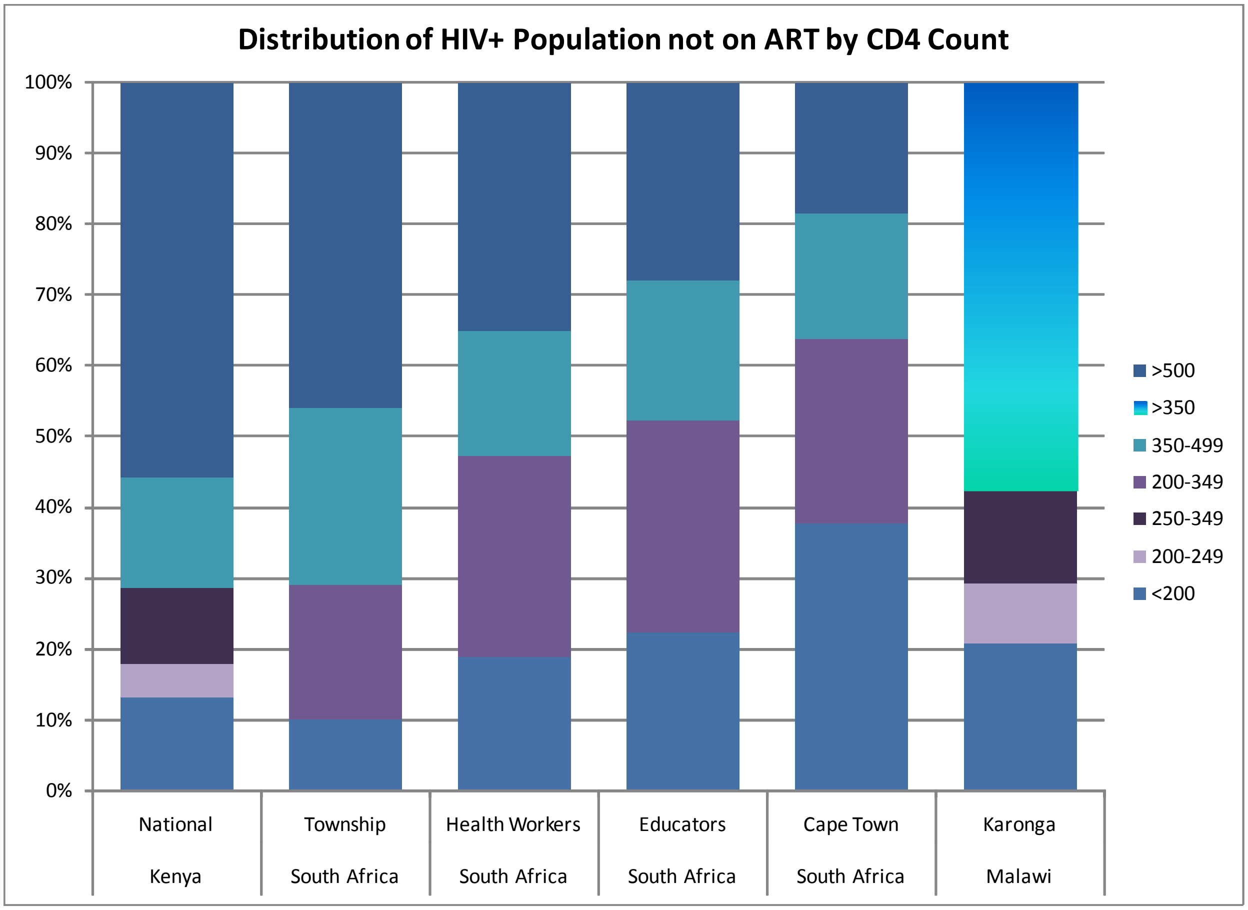
Transition Probabilities

We have estimated the transition probabilities by fitting the model to data on the distribution of the HIV-infected population by CD4 count and the pattern of progression from HIV infection to AIDS death. Data on the distribution of the HIV-infected populations by CD4 count are available from studies in South Africa (township near Johannesburg[2], health care workers[3], educators[4], Cape Town[5]), Malawi (Karonga[6]) and Kenya (national[7]). The distribution of these populations by CD4 count category is shown in Figure 1. Only the Kenya data set is a nationally representative sample and it is the only one that provides information on all CD4 categories of interest. Thus we have estimated the parameter values using only the Kenya data set, but checked the results against the other data sets.

---

[2] Auvert B, Males S, Puren A, Taljaard D, Carael M, Williams B. 2004. Can Highly Active Antiretroviral Therapy Reduce the Spread of HIV? A Study in a Township of South Africa *J Acquir Immune Defic Syndr* 36:1;613-621.
[3] Connelly D, Veriava Y, Roberts, Tsotetsi J, Jordan A, DeSliva E, Rosen S, Backman DeSilva M. 2007. *SAMJ* 97:2;115-123.
[4] Rehle T, Shisana O. 2005. Estimates of eligibility for antiretroviral treatment (ART) and projected ART impact on AIDS mortality among South African educators *Journal of Social Aspects of HIV/AIDS* 3:3;304-310.
[5] Holmes CB, Wood R, Badri M, Zilber S, Wang Bingxia, Maartens G *et al.* CD4 Decline and Incidence of Opportunistics Infections in Cape Town, South Africa: Implications for Prophylaxis and Treatment 2006. *J Acquir Immune Defic Syndr* 42:4;464-469.
[6] McGrath N, Kranzer K, Saul J, Crampin A, Malema S, Kachiwanda L, Zaba B, Jahn A, Fine P, Glynn J. 2007. Estimating the need for antiretroviral treatment and as assessment of a simplified HIV/AIDS case definition in rural Malawi *AIDS* 21(suppl 6):S105-S113.
[7] National AIDS and STI Control Programme, Ministry of Health, Kenya. July 2008. *Kenya AIDS Indicator Survey 2007: Preliminary Report.* Nairobi, Kenya.

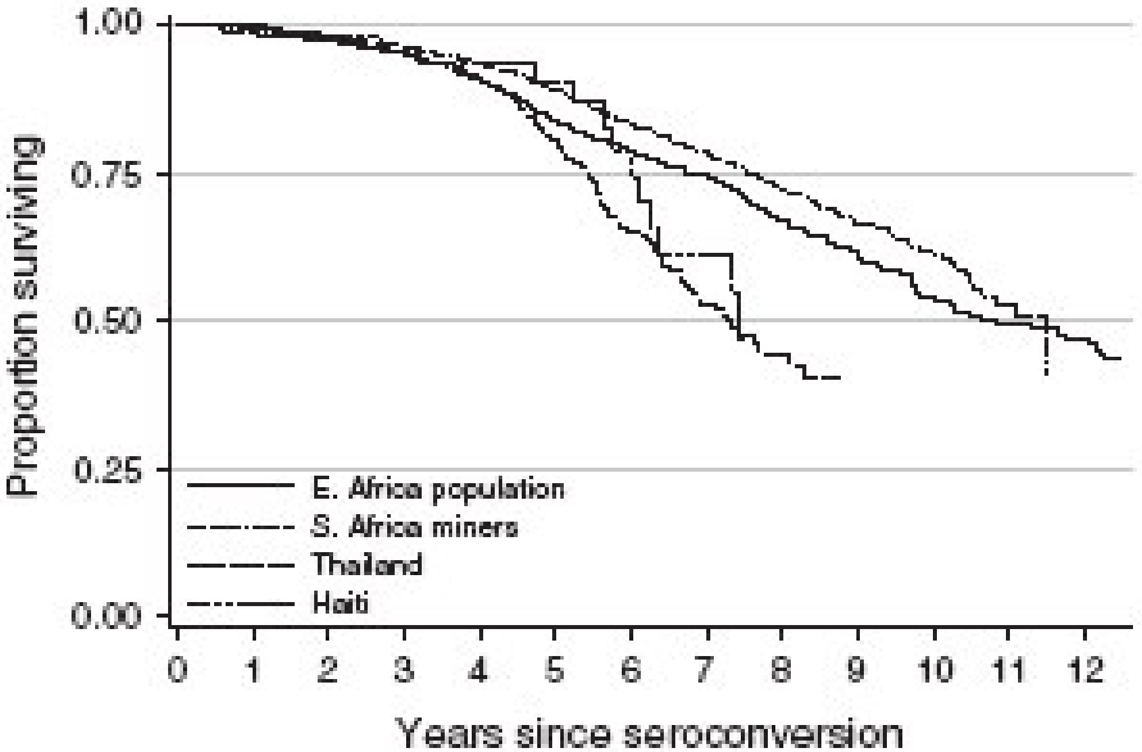
Figure 1. Distribution of HIV-infected population by CD4 count



Data are also available from several cohort studies on the overall progression from HIV infection to HIV-related death. The APLHA Network has conducted a pooled analysis using data from several cohorts to estimate the proportion surviving by the number of years since infection[8] (Figure 2). We have used the age-adjusted, net survival curve based on the East and Southern Africa cohorts.

[8] Todd J, Glynn JR, Marston M, Lutalo T, Biraro S, Mwita W *et al.* Time from HIV seroconversion to death: a collaborative analysis of eight studies in low and middle-income countries before highly active antiretroviral therapy *AIDS* 2007, 21(suppl 6):S55-S63.

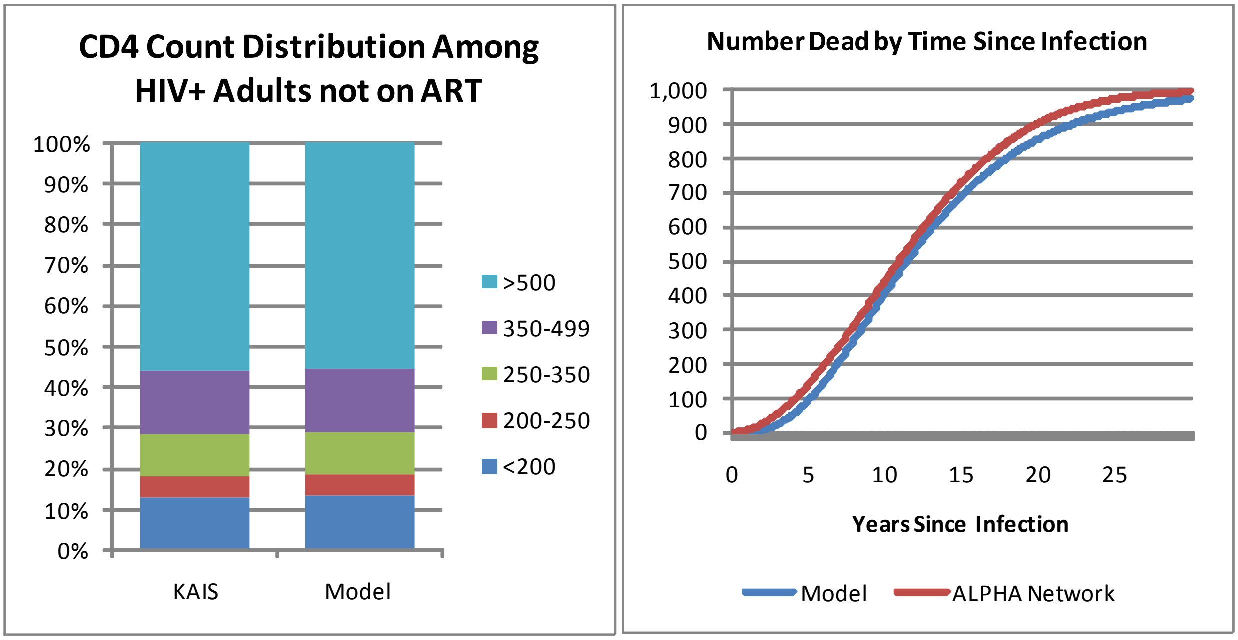
Figure 2. Kaplan-Meier survival curves for adjusted to age 25-29 years at infection



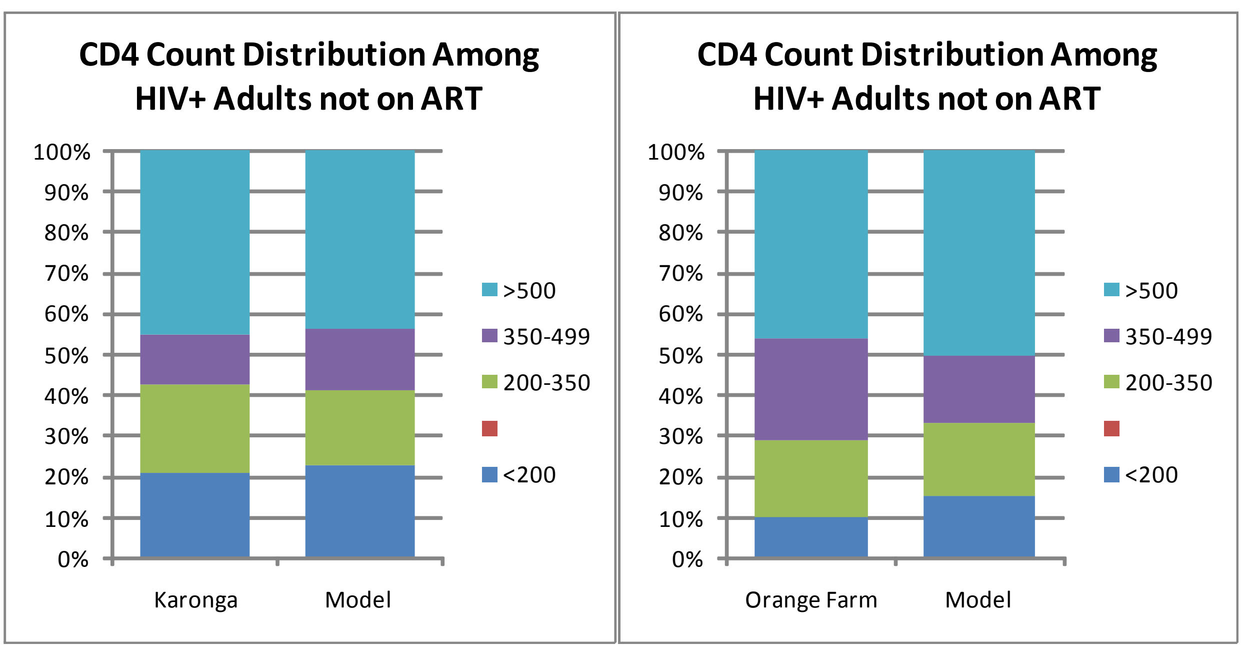
Source: Todd J, Glynn JR, Marston M, Lutalo T, Biraro S, Mwita W *et al.* Time from HIV seroconversion to death: a collaborative analysis of eight studies in low and middle-income countries before highly active antiretroviral therapy *AIDS* 2007, 21(suppl 6):S55-S63.

We fit the model to both sets of data simultaneously. One version of the model was set up for Kenya and used the Spectrum estimates of the number of new infections from 1980 to 2007 and the reported number of people on ART from 2000 to 2007. We compared the data on distribution by CD4 count from the Kenya AIDS Indicator Survey (KAIS) with the model projection for 2007. Another version of the model followed a cohort of 1000 new HIV infections as they progress through the various CD4 categories and to death. The resulting proportions surviving were compared with the ALPHA network survival curve for East and Southern Africa. We searched for the single set of transition probabilities that provided the best fit in both cases. The model used a time step of one-tenth of a year in order to accommodate the short duration in the 200-250 category that could be less than one year. The fits are shown in Figure 3. The results are shown in Table 2.

Figure 3. Model results compared to CD4 count distributions in Kenya in 2007 and progression from infection to death compared to ALPHA network analysis



The fit of the model to Karonga (Malawi) and Orange Farm (South Africa) data sets using the parameter values derived from the fit to the Kenya data and the annual number of new infections in Malawi and South Africa is shown in Figure 4.



Values of the other parameters are derived from various sources as shown in Table 2.

Table 2. Parameter values

Parameter	Symbol	Value	Source
Transition rates (annual rate of transition)			
>500 to 350-500	TransProb500	0.18	Model fit
350-500 to 250-350	TransProb350	0.55	Model fit
250-350 to 200-250	TransProb250	0.60	Model fit
200-250 to <200	TransProb200	1.10	Model fit. This is above 1 because the duration in the category is less than one year.
Mortality rate (annual rate of AIDS death)			
Non-AIDS mortality	NonAIDSmort	0.007	Typical value low income country
Annual rate of AIDS death			
CD4 >500	AIDSmort1000	0.010	CASCADE Collaboration
CD4 350-500	AIDSmort500	0.020	CASCADE Collaboration
CD4 250-350	AIDSmort350	0.070	1/3 of value for <200 based on Badri *et al.* 2006
CD4 200-250	AIDSmort250	0.070	1/3 of value for <200 based on Badri *et al.* 2006
CD <200	AIDSmort200	0.250	Model fit
First line ART failure by CD4 count at initiation (annual)			
>500	Fail1000	0.015	RR of 1.94 compared to < 500, Kitahata *et al.*
350-500	Fail500	0.030	RR of 1.69 compared to < 350, Kitahata *et al.*
250-350	Fail350	0.050	2/3 Calmy to 1/2 Etard of <200
200-250	Fail250	0.050	2/3 Calmy to 1/2 Etard of <200
<200	Fail200	0.100	UNAIDS, 2009
Second line ART failure by CD4 count at initiation (annual)			
>500	FailSL1000	0.015	Same as first line
350-500	FailSL500	0.030	Same as first line
250-350	FailSL350	0.050	Same as first line
200-250	FailSL250	0.050	Same as first line
<200	FailSL200	0.100	Same as first line
Infectivity ratios (compared to infectivity in asymptomatic stage)			
Primary stage	Primary	8	Pilcher et al., Powers et al.
Asymptomatic stage	Asymptomatic	1	
<200	Symptomatic	4	Pilcher et al., Powers et al.
On ART	OnART	0.5	Kayitenkore et al., Bunnell et al.
Duration of primary stage (years)	Duration	0.25	

Badri M., Lawn S. D. and Wood R. (2006) Short-term risk of AIDS or death in people infected with HIV-1 before antiretroviral therapy in South Africa: a longitudinal study. Lancet. 368(9543): 1254-9

Bunnell R, Ekwaru J, King R, et al. 3-year follow-up of sexual behavior and HIV transmission risk of persons taking ART in rural Uganda. Program and abstracts of the 15th Conference on Retroviruses and Opportunistic Infections; February 3-6, 2008; Boston, Mass. Abstract 29.

CASCADE Collaboration. Short-term risk of AIDS according to CD4 cell count and viral load in antiretroviral drug-naïve individuals and those treated in the monotherapy era AIDS 2004, 18:51-58.

Kayitenkore K, Bekan B, Rufagari J, Marion-Landais S, Karita E, Allen S. The impact of ART on HIV tranmission among HIV serodiscordant couples Poster discussion: AIDS 2006 - XVI International AIDS Conference. Abstract no. MOKC101.

Pilcher et al. "Brief but Efficient: Acute HIV Infection and the Sexual Transmission of HIV"

JID 2004:189 (15 May) pps. 1785-1792.
Powers KA, Poole C, Pettifor AE, Cohen MS Rethinking the heterosexual infectivity of HIV-1: a systematic review and meta-analysis The Lancet Published on line August 5, 2008 DOI:10.1016/S1273-3099(08)70156-7.
UNAIDS 2009. Notes on Assumptions for Spectrum 2009 on Adult Survival Estimates among Individuals Starting ART.
Kitahata MM, Gange SJ, Abraham AG, Merriman B, Saag MS, Justice AC et al. Effect of Early versus Deferred Antiretroviral Therapy for HIV Survival New England Journal of Medicine 360:18:1815-1826, April 30, 2009
Calmy A, Pinoges L, Szumilin E, Zachariah R, Ford N, Ferradini L. Generic fixed-dose combination antiretroviral treatment in resource-poor settings: multicentric observational cohort. AIDS 2006;20:1163-9.
Etard JF, Ndiaye I, Thierry-Mieg M, Gueye NF, Gueye PM, Laniece I, Dieng AB, Diouf A, Laurent C, Mboup S, Sow PS, Delaporte E. Mortality and causes of death in adults receiving highly active antiretroviral therapy in Senegal: a 7-year cohort study. AIDS 2006;20:1181-9.

Costs

Four categories of cost are considered: ARV drugs, laboratory costs, service delivery costs and identification (outreach and testing). The cost of drugs is determined from the number of people on first and second line, the distribution of patients by regimen and the costs of each regimen.

Drug costs may be different for patients in low and middle income countries. Current costs are based on WHO and Clinton Foundation reports (Table 3).

Table 3. ARV Costs per patient per year

Regimen	Low Income Countries	Middle Income Countries
d4T+3TC+NVP	$89	$88
AZT+3TC+NVP	$149	$226
AZT+EFV+3TC	$220	$281
TDF+3TC+EFV	$210	$268
TDF+FTC+EFV	$255	$325
TDF=FTC+NVP	$190	$243
TDF+3TC+LPV/r	$590	$1070
AZT+3TC+LPV/r	$585	$1150

Laboratory costs are calculated separately for new and continuing patients and can vary by regimen. Currently, laboratory costs are calculated as the annual median cost for lab tests across recent literature. Recent studies in various countries (Cote d'Ivoire, Ethiopia, Mexico, Nigeria, South Africa, Thailand, Uganda, Zambia) are used as the basis.[9] The median cost is $190 per patient per year for continuing patients and $250 per year for new patients.

Service delivery costs are based on a standard number of in-patient days and out-patient visits per patient per year and country specific costs for in-patient days and out-patient visits. For this analysis we used the same studies referenced above for laboratory costs (with the exception of

[9] Goldie SJ, Yazdanpanah Y, Losina E, et al., "Cost-Effectiveness of HIV Treatment in Resource-Poor Settings - The Case of Cote d'Ivoire." NEJM 355;11(1141-1153); G Kombe, D Galaty, R Gadhia, C Decker. The Human and Financial Resource Requiremens for Scaling Up HIV/AID Services in Ethiopia. PHRPlus, Feb 2005 ; Bautista SA, Dmytraczenko T, Kombe G, Bertozzi SM. "Costing of HIV/AIDS Treatment in Mexico." PHRPlus report, June 2003; PHRPlus. Nigeria: Rapid Assessment of HIV/AIDS Care in the Public and Private Sectors. August 2004; Cleary SM, McIntyre D, Boulle AM. "The cost-effectiveness of Antiretroviral Treatment in Khayelitsha, South Africa - a primary data analysis." Cost Eff Resource Alloc 2006, 4:20; Katajima T, Kobayashi, Y, Chaipah W, Sato H, Chadbunchachai W, Thuennadee R. "Costs of medical services for patients with HIV/AIDS in Khon Kaen, Thailand." AIDS 2003 Nov 7;17(16):2375-81; Chandler R, Musau R. "Estimating Resource Requirements for Scaling up Antiretroviral Therapy in Uganda." PHRPlus paper October 2005; Kombe G, Smith O. "The Costs of Anti-Retroviral Treatment in Zambia." PHRPlus October 2003. Huddart J, Furth R, Lyons JV. "The Zambia Workforce Study: Preparing for Scale-up." April 2004; available at www.qaproject.org.

Cote d'Ivoire and the addition of another South Africa study[10]) to calculate the median number of out-patient visits per year as 9.5. Only three of these studies also had data on the number of in-patient days for ART patients[11]; we used these to calculate the median number of in-patient days for ART patients per year as 1.56. The country-specific costs per in-patient day are the costs of one bed day at a primary-level hospital as reported in the WHO-CHOICE database of service delivery costs.[12] The cost of an out-patient visit is for a 20-minute outpatient visit at a health centre, from the same WHO database. Representative regional costs are shown in Table 4.

Table 4. Representative service delivery costs

Regional Service Delivery Costs for ART patients	Annual cost of Inpatient Days (ART patient)	Annual cost of Outpatient visits (ART patient)	Total annual service delivery cost (ART patient)
Sub-Saharan Africa	$18.43	$53.62	$72.05
East Asia	$36.48	$64.36	$100.84
Oceania	$56.33	$77.62	$133.94
South and South-East Asia	$29.20	$64.77	$93.98
Eastern Europe and Central Asia	$52.07	$71.82	$123.89
Western and Central Europe	$106.23	$239.38	$345.61
North Africa and Middle East	$63.44	$73.68	$137.12
Caribbean	$58.92	$70.52	$129.45
Latin America	$59.34	$72.91	$132.25

Outreach and testing costs vary primarily by the type of population reached. The model considers 10 population categories for testing:

1. Patients with symptoms of HIV
2. STI patients
3. TB patients
4. Pregnant women
5. Other health system contacts
6. Sex workers

[10] Badri M, Maartens G, Mandalia S, Bekker LG, Penrod JR, et al. (2006) Cost-Effectiveness of Highly Active Antiretroviral Therapy in South Africa. PLoS Med 3(1): e4 doi:10.1371/journal.pmed.0030004.

[11] Bautista SA, Dmytraczenko T, Kombe G, Bertozzi SM. "Costing of HIV/AIDS Treatment in Mexico." PHRPlus report, June 2003; Cleary SM, McIntyre D, Boulle AM. "The cost-effectiveness of Antiretroviral Treatment in Khayelitsha, South Africa - a primary data analysis." Cost Eff Resource Alloc 2006, 4:20; Badri M, Maartens G, Mandalia S, Bekker LG, Penrod JR, et al. (2006) Cost-Effectiveness of Highly Active Antiretroviral Therapy in South Africa. PLoS Med 3(1): e4 doi:10.1371/journal.pmed.0030004.

[12] Available at: http://www.who.int/choice/costs/en/ .

7. Men who have sex with men
8. Injecting drug users
9. VCT
10. General population

VCT services average about $16 per client. We have used this cost also for provider-initiated testing and counseling. No additional testing and counseling costs are included for pregnant women since the costs of testing are already covered in the PMTCT programs. Similarly we assume that outreach and counseling for sex workers, IDU and MSM are already covered in prevention programs for those populations. We add only $1 for the costs of the test itself. For general population testing we have doubled the personnel costs associated with VCT to allow for additional outreach programs. The resulting costs is $23 per person tested

The number of tests for each population group will depend on the eligibility criteria and the coverage. We assume that patients with symptoms who are found to be HIV+ will be in the lowest CD4 count category. We assume that those who are found to be HIV+ in the other population groups will be distributed by CD4 count according to the distribution of all HIV+ people excluding those <200.

Results

The model has been applied to the global situation and to five countries: Burkina Faso, Nigeria, Russia, Tanzania and Ukraine. The number of new infections each year and the number of people on ART through 2008 were taken from the Spectrum projections for each country. Estimates of the population sizes are based on national estimates prepared as part of the effort to estimate global resource needs[13].

The following tables show the additional cost and impact of scaling up ART coverage to reach 85% by 2015 assuming that the criterion for eligibility to treatment switches from a CD4 count 200 to either 250 or 350 in 2010. All cost and impact figures are discount to the beginning of 2010 at 3% per year.

Switching the eligibility criterion from CD4 count <200 to < 250 results in an 18% increase in the need for ART while a switch to < 350 results in a 53% increase in need globally. The country results vary from increases of 12%-22% for the switch to 250 and 33%-62% for the switch to 350.

The costs of ART programs to increase coverage to 85% by 2015 would be 18% (11%-22%) higher with a switch to 250 and 57% (29%-65%) higher with the switch to 350. The additional

[13] UNAIDS. Financial Resources Required to Achieve Universal Access to HIV Prevention, Treatment, Care and Support, September 2007.

resources required between 2010 and 2015 amount to $4 billion for the switch to 250 and $11.5 billion for the switch to 350.

Table 5. Switch eligibility from <200 to <250 in 2010, increase coverage to 85% by 2015

World	<250	<200	Difference	% Change
Person years of ART (2010-2015)	52,048,420	44,106,173	7,942,247	18%
AIDS Deaths (2010-2015)	6,840,200	7,679,073	-838,873	-11%
Life years of PLHIV	163,163,214	162,696,629	466,585	
New infections (2010-2015)	10,221,532	10,869,289	-647,756	
ART Costs (2010-2015) Millions of US$	$31,959	$27,887	$4,072	20%
Testing Costs (2010-2015) Millions of US$	$3,089	$1,282	$1,807	
$/HIVLY			$ 12,601	
$/Death averted			$ 7,009	

Burkina Faso	<250	<200	Difference	% Change
Person years of ART (2010-2015)	189,359	168,623	20,736	12%
AIDS Deaths (2010-2015)	22,093	24,270	-2,177	-9%
Life years of PLHIV	463,058	461,110	1,948	
New infections (2010-2015)	25,658	27,213	-1,555	
ART Costs (2010-2015) Millions of US$	$109	$99	$10	11%
Testing Costs (2010-2015) Millions of US$	$5	$3	$1	
$/HIVLY			$ 5,933	
$/Death averted			$ 5,309	

Nigeria	<250	<200	Difference	% Change
Person years of ART (2010-2015)	4,784,394	3,997,191	787,203	20%
AIDS Deaths (2010-2015)	705,676	789,188	-83,512	-11%
Life years of PLHIV	16,946,892	16,922,669	24,222	
New infections (2010-2015)	1,207,084	1,279,322	-72,238	
ART Costs (2010-2015) Millions of US$	$2,719	$2,319	$400	18%
Testing Costs (2010-2015) Millions of US$	$66	$48	$18	
$/HIVLY			$ 17,267	
$/Death averted			$ 5,008	

Russia	<250	<200	Difference	% Change
Person years of ART (2010-2015)	1,508,631	1,251,386	257,245	21%
AIDS Deaths (2010-2015)	229,879	257,226	-27,348	-11%
Life years of PLHIV	5,059,747	5,036,245	23,502	
New infections (2010-2015)	268,729	286,895	-18,166	
ART Costs (2010-2015) Millions of US$	$1,125	$979	$146	16%
Testing Costs (2010-2015) Millions of US$	$17	$10	$7	
$/HIVLY			$ 6,526	
$/Death averted			$ 5,609	

Tanzania	<250	<200	Difference	% Change
Person years of ART (2010-2015)	1,997,796	1,681,018	316,778	19%
AIDS Deaths (2010-2015)	311,462	345,020	-33,558	-10%
Life years of PLHIV	6,868,930	6,845,879	23,050	
New infections (2010-2015)	397,641	420,383	-22,742	
ART Costs (2010-2015) Millions of US$	$1,126	$966	$161	17%
Testing Costs (2010-2015) Millions of US$	$11	$9	$2	
$/HIVLY			$ 7,071	
$/Death averted			$ 4,857	

Ukraine	<250	<200	Difference	% Change
Person years of ART (2010-2015)	580,136	474,352	105,784	22%
AIDS Deaths (2010-2015)	96,182	107,405	-11,223	-10%
Life years of PLHIV	2,257,427	2,250,996	6,431	
New infections (2010-2015)	136,520	144,470	-7,950	
ART Costs (2010-2015) Millions of US$	$429	$368	$61	22%
Testing Costs (2010-2015) Millions of US$	$32	$11	$21	
$/HIVLY			$ 12,881	
$/Death averted			$ 7,381	

Table 6. Switch eligibility from <200 to <350 in 2010, increase coverage to 85% by 2015

World	<350	<200	Difference	% Change
Person years of ART (2010-2015)	65,824,174	44,106,173	21,718,002	49%
AIDS Deaths (2010-2015)	5,958,528	7,679,073	-1,720,545	-22%
Life years of PLHIV	163,798,929	162,696,629	1,102,300	
New infections (2010-2015)	9,627,939	10,869,289	-1,241,350	
ART Costs (2010-2015) Millions of US$	$39,377	$27,887	$11,490	57%
Testing Costs (2010-2015) Millions of US$	$6,524	$1,282	$5,243	
$/HIVLY			$ 15,180	
$/Death averted			$ 9,725	

Burkina Faso	<350	<200	Difference	% Change
Person years of ART (2010-2015)	224,210	168,623	55,587	33%
AIDS Deaths (2010-2015)	19,889	24,270	-4,381	-18%
Life years of PLHIV	465,367	461,110	4,257	
New infections (2010-2015)	24,289	27,213	-2,924	
ART Costs (2010-2015) Millions of US$	$127	$99	$28	29%
Testing Costs (2010-2015) Millions of US$	$5	$3	$2	
$/HIVLY			$ 7,058	
$/Death averted			$ 6,858	

Nigeria	<350	<200	Difference	% Change
Person years of ART (2010-2015)	6,177,956	3,997,191	2,180,765	55%
AIDS Deaths (2010-2015)	615,608	789,188	-173,581	-22%
Life years of PLHIV	16,988,503	16,922,669	65,833	
New infections (2010-2015)	1,138,922	1,279,322	-140,399	
ART Costs (2010-2015) Millions of US$	$3,444	$2,319	$1,125	52%
Testing Costs (2010-2015) Millions of US$	$155	$48	$107	
$/HIVLY			$ 18,715	
$/Death averted			$ 7,098	

Russia	<350	<200	Difference	% Change
Person years of ART (2010-2015)	1,940,824	1,251,386	689,438	55%
AIDS Deaths (2010-2015)	201,836	257,226	-55,390	-22%
Life years of PLHIV	5,086,468	5,036,245	50,223	
New infections (2010-2015)	252,364	286,895	-34,531	

ART Costs (2010-2015) Millions of US$	$1,393	$979	$414	43%
Testing Costs (2010-2015) Millions of US$	$23	$10	$13	
$/HIVLY			$ 8,489	
$/Death averted			$ 7,697	

Tanzania	<350	<200	Difference	% Change
Person years of ART (2010-2015)	2,550,440	1,681,018	869,422	52%
AIDS Deaths (2010-2015)	275,691	345,020	-69,329	-20%
Life years of PLHIV	6,897,481	6,845,879	51,601	
New infections (2010-2015)	376,460	420,383	-43,923	
ART Costs (2010-2015) Millions of US$	$1,412	$966	$447	46%
Testing Costs (2010-2015) Millions of US$	$14	$9	$6	
$/HIVLY			$ 8,762	
$/Death averted			$ 6,522	

Ukraine	<350	<200	Difference	% Change
Person years of ART (2010-2015)	767,206	474,352	292,855	62%
AIDS Deaths (2010-2015)	84,025	107,405	-23,380	-22%
Life years of PLHIV	2,265,781	2,250,996	14,786	
New infections (2010-2015)	128,974	144,470	-15,496	
ART Costs (2010-2015) Millions of US$	$547	$368	$179	65%
Testing Costs (2010-2015) Millions of US$	$81	$11	$70	
$/HIVLY			$ 16,791	
$/Death averted			$ 10,619	