



HIV and AIDS in Rwanda



2010 Epidemiologic Update

Members of 2010 Technical Working Group (TWG) on HIV Estimates and Modeling:

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HIV and AIDS Estimates and Projections

Methodology

Each year the Government of Rwanda develops estimates of the burden of HIV infection in order to inform national strategic and operational planning and to address national and international reporting commitments. The Rwanda Technical Working Group (TWG) on HIV Estimations and Models developed this 2010 HIV and AIDS Epidemiologic Update from January to April 2010 using the updated 2010 Estimation and Projection Package (EPP) (Version Beta U) and the most recent version of the Spectrum software package (Version 3.46). EPP generates an epidemic curve of the HIV epidemic based on sentinel HIV sero-surveillance data and national-level surveys that included HIV biological markers. Spectrum uses the epidemic (incidence) curve of EPP and other programmatic data as inputs to generate estimates of prevalence, new HIV infections, AIDS-related mortality, and orphans due to HIV and AIDS. Information on the models can be found on the UNAIDS and the USAID | Health Policy Initiative websites.

Demographic data inputs:

The demographic data used in the models were population estimates developed by the Rwanda National Institute of Statistics (NISR), based on 1978 and 2002 census data and other known demographic indicators including fertility rates and life expectancy.

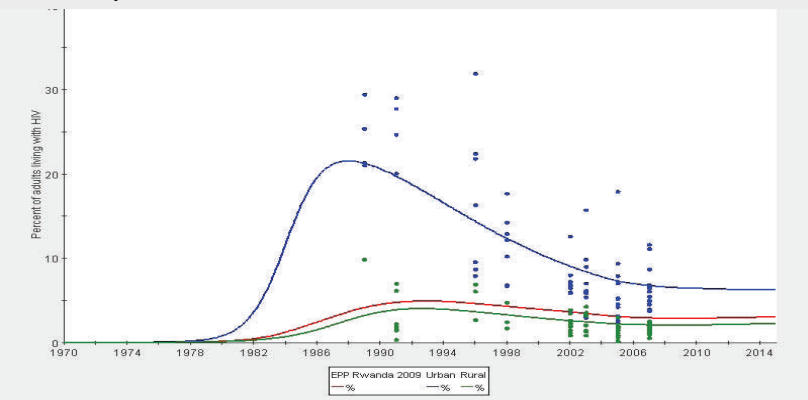
Epidemiological data inputs:

HIV prevalence data principally came from sentinel surveillance studies conducted among pregnant women attending ante-natal clinics throughout the country. The first three rounds of sentinel surveillance were conducted in 1988, 1991, and 1996. In 2002, the sentinel surveillance system was expanded to 24 ANC sites, and then further reinforced in 2005 to 30 ANC sites, encompassing both urban and rural areas throughout the country. The median prevalence curves at urban and rural sites were then adjusted using

data from a nationally representative population-based survey from 1986, in order to better fit the epidemic curves to available data from the early years of the epidemic before sentinel surveillance data was routinely collected; then subsequently calibrated with the DHS prevalence data points for the general population in 2005 (Figure 1). In addition, uncertainty analyses on urban and rural prevalence data were modeled to provide a range of results.

Other programmatic inputs used in Spectrum include the numbers of adults and children receiving antiretroviral treatment (ART), the number of HIV+ pregnant women receiving PMTCT antiretroviral prophylaxis, the number of children born to HIV+ mothers receiving prophylaxis, and infant feeding patterns within the general population. The model also takes into account the change in national guidelines regarding CD4 eligibility criteria in 2007-2008. A more detailed methodology including all programmatic data inputs and assumptions used in the model are attached as Annex A. The following estimates were presented to national HIV experts in March 2010 during the National Validation Workshop for the Rwanda UNGASS 2010 in order to gain consensus around the estimates.

Figure 1: National (red), urban (blue), and rural (green) HIV prevalence curves, modeled by EPP



HIV Estimates

According to the model, the total population in Rwanda is expected to increase from an estimated 9.8 million in 2010 to 11.1 million in 2015. Through 2015, the model predicts that HIV prevalence will remain stable at approximately 3%, from 2.93% [2.5%-3.3%] in 2010 to 3.02% [2.5%-3.6%] in 2015 (Figure 1 and Table 1). The number of adults (15+ years) living with HIV will increase from 151,850 [131,030–171,840] in 2010 to 187,190 [155,360–220,640] in 2015 (Table 1). The number of new HIV infections among adults 15+ will increase from

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9,040 [4,680 –15,220] in 2010 to 10,640 [5,790–18,230] in 2015. As shown in Table 2, the number of children (0-14) living with HIV will increase from 22,240 [11,230– 33,860] in 2010 to 24,550 [12,870–37,540] in 2015. The model predicts that the number of new infections among children (0-14) will remain constant at 2,740 [1,390–4,130 in 2010; 1,340-4,300 in 2015].

Key Results and Targets

Care and Treatment

In estimating the need for treatment among adults (15+), the median values produced by the model seemed relatively low compared to historical national program data on numbers of adults (15+) on ART. In order to provide figures more in line with national quantification efforts based on historical program data, the upper limit (97.5% CI) estimates are presented in this update and recommended for use by national institutions for planning purposes.

In 2008 the national immunologic eligibility criteria for the initiation of ART was changed from a CD4 count less than 200 cells/mm³ to a CD4 count less than 350 cells/mm³. The updated Spectrum model takes this shift into account, though it should be noted that the resulting expansion in the number of HIV-infected persons who are eligible for ART affects ART coverage. Through 2009, the total estimated need for ART among adults (15+) was 79,550 [65,460-91,400], based on the new eligibility criteria of CD4 less than 350 cells/mm³, while 70,047 were known to have been receiving treatment as of December 31, 2009 (77%) (Figure 2). The target for national ART coverage is 93% in 2012, with an estimated

101,500 individuals receiving treatment.

According to the model, out of a total estimated need for ART in children (0-14) of 13,500 [7,320-20,450] in 2009, 6,679 were currently receiving treatment as of December 31, 2009 (Figure 3). Based on target national pediatric ART coverage of 85% in 2012, this number would increase to 13,600 children on treatment.

Mother to Child Transmission (MTCT)

According to the model, the number of HIV+ pregnant women eligible for PMTCT services in 2009 was 10,310 [5,230-15,580]. According to TRAC Plus national PMTCT program reports, 68% (7,030) of HIV+ pregnant women received a prophylactic antiretroviral (ARV) regimen in 2009. Based on target coverage of 90% in 2012, approximately 9,500 HIV+ pregnant women will receive a prophylaxis regimen. It is important to note that these estimates are also based on expert consensus regarding future national scale-up of PMTCT treatment regimens according to new national guidelines which indicate a transition towards triple ARV prophylaxis and HAART; and the use of DHS 2005 data on infant feeding practices. According to expert consensus, the majority (40%) of HIV+ pregnant women is expected to receive triple ARV prophylaxis, 15% dual ARV prophylaxis, and 34% triple ARV treatment (covering the breastfeeding period) in 2015. It is important to note that the figures presented in this update only reflect the num-

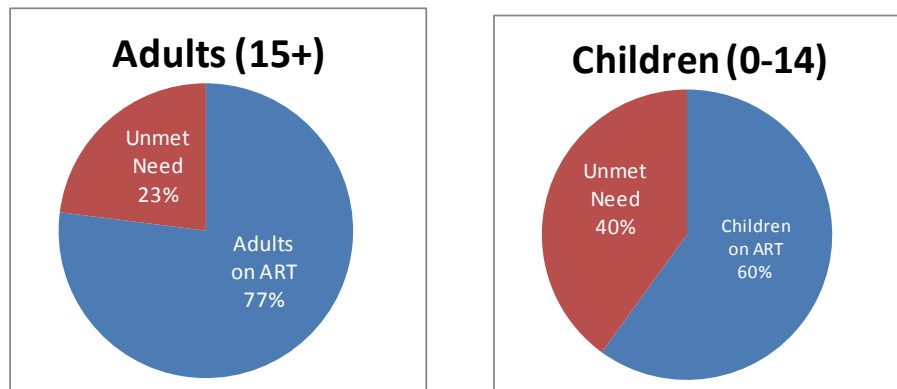
ber of HIV+ women receiving a prophylactic ARV regimen, and does not report the number of HIV- women in HIV-discordant couples receiving a prophylactic ARV regimen, as indicated according to the national program for sero-discordant couples. For this reason, coverage values reported here may not be identical to MOH reports on the number of overall pregnant women receiving a prophylactic ARV regimen which include both HIV+ and HIV- women.

Use of HIV Estimates

The 2010 HIV Estimates were adopted by a group of national HIV experts in March 2010 in a meeting chaired by the National AIDS Control Commission, including representatives from MOH, TRAC Plus, Global Fund CCM, and the USG/PEPFAR Program, where it was agreed that these projections should be used as **the official data source for all national strategic planning processes**. Notably, these estimates were used as the official estimates for the 2010 UNGASS Report submitted by Rwanda in March 2010.

The TWG on HIV Estimations and Models would like to emphasize that the models and software used to produce these national estimates are constantly being updated, and that new inputs are continually being added, based on the best available national and international data. For this reason, the TWG recommends that all institutions include the confidence bounds when citing these estimates and projections. Estimates were rounded to the nearest tenth in this update. The process of developing these estimates is intended to be iterative, largely coinciding with the release of results from future sentinel surveillance studies and RDHS.

Figure 2: Care and treatment among adults and children in 2009



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Table 1. Key HIV and AIDS Indicators for Adult (15+) HIV Population

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
HIV+ Population (Adults and Children)												
Lower (2.5%)	148,190	144,430	143,500	143,290	144,290	146,000	149,490	154,860	160,370	164,830	169,890	175,010
Median (50%)	166,580	163,410	162,690	163,400	165,470	169,110	174,090	180,910	188,200	195,890	203,720	211,730
Upper (97.5%)	195,290	190,340	188,110	187,900	189,510	193,380	198,620	208,320	218,250	229,030	238,930	250,330
HIV+ Adults (15+)												
Lower (2.5%)	128,420	124,890	123,990	124,840	125,150	127,340	131,030	136,140	141,200	146,090	150,860	155,360
Median (50%)	143,490	140,590	140,120	141,170	143,260	146,930	151,850	158,440	165,460	172,710	179,930	187,190
Upper (97.5%)	164,370	160,280	159,690	160,570	162,680	166,570	171,840	179,960	189,280	198,970	209,780	220,640
Adult HIV Prevalence (15-49)												
Lower (2.5%)	2.91	2.73	2.64	2.58	2.53	2.52	2.5	2.5	2.5	2.47	2.47	2.45
Median (50%)	3.22	3.07	2.99	2.94	2.91	2.92	2.93	2.96	2.98	3.00	3.02	3.02
Upper (97.5%)	3.64	3.45	3.34	3.27	3.23	3.24	3.28	3.36	3.42	3.49	3.55	3.6
New Adult HIV infections												
Lower (2.5%)	6,070	3,490	1,660	1,520	3,770	4,620	4,680	4,850	5,100	5,340	5,590	5,790
Median (50%)	8,960	6,880	5,770	5,710	7,510	8,990	9,040	9,300	9,600	9,960	10,280	10,640
Upper (97.5%)	11,380	9,680	9,410	10,370	12,270	15,270	15,220	15,750	16,250	16,900	17,530	18,230
Annual Adult AIDS deaths in Adults												
Lower (2.5%)	10,120	7,350	2,680	270	1,620	940	1,300	1,600	1,260	1,120	1,080	1,090
Median (50%)	12,280	9,570	6,080	4,510	5,290	5,230	4,020	2,580	2,400	2,460	2,700	2,910
Upper (97.5%)	15,630	12,920	10,620	10,360	10,790	12,240	9,310	4,170	5,620	6,550	7,540	8,230
Adults (15+) Eligible for ART												
Lower (2.5%)	25,740	28,650	34,490	38,490	63,590	65,460	69,360	75,340	80,120	84,030	86,650	90,030
Median (50%)	31,070	33,370	38,850	45,480	75,680	79,550	84,350	90,460	96,670	102,780	108,610	114,260
Upper (97.5%)	39,160	40,210	44,830	51,440	87,410	91,400	96,040	102,380	109,370	117,520	125,020	132,500
Adults (15+) Receiving ART												
Actual	8,815	17,646	31,379	43,719	57,514	70,047						
<i>Target</i>							81,500	92,500	101,500	110,500	119,500	128,500
ART Coverage												
Upper (97.5%)		44%	70%	85%	70%*	77%						
<i>Upper Target (97.5%)</i>							85%	90%	93%	94%	96%	97%

*Change in national immunologic eligibility criteria for the initiation of ART from a CD4 count less than 200 cells/mm³ to a CD4 count less than 350 cells/mm³.

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Table 2. Key HIV and AIDS Indicators for HIV+ Children (0-14) and PMTCT

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
HIV+ Children (0-14)												
Lower (2.5%)	11,230	11,110	11,110	10,980	11,070	11,120	11,230	11,410	11,660	12,000	12,370	12,870
Median (50%)	23,100	22,820	22,570	22,230	22,210	22,180	22,240	22,470	22,740	23,180	23,790	24,550
Upper (97.5%)	35,850	35,230	34,690	34,450	34,210	34,160	33,860	33,750	34,420	35,380	36,120	37,540
New HIV infections in Children												
Lower (2.5%)	1,800	1,660	1,620	1,430	1,290	1,300	1,390	1,370	1,350	1,360	1,360	1,340
Median (50%)	3,940	3,670	3,440	3,070	3,000	2,890	2,740	2,680	2,640	2,680	2,710	2,740
Upper (97.5%)	6,130	5,720	5,440	5,080	4,960	4,860	4,130	4,110	4,030	4,130	4,220	4,300
Annual Adult AIDS deaths in Children												
Lower (2.5%)	1,350	1,130	970	810	600	500	540	540	450	400	360	320
Median (50%)	2,870	2,610	2,380	2,130	1,730	1,580	1,320	1,070	960	850	750	670
Upper (97.5%)	4,510	4,200	3,900	3,630	3,040	2,830	2,200	1,710	1,560	1,390	1,220	1,110
Children (0-14) Eligible for ART												
Lower (2.5%)	4,640	4,560	4,640	4,610	5,920	7,320	8,420	8,780	9,000	9,460	10,010	10,620
Median (50%)	9,600	9,430	9,370	8,890	10,580	13,500	13,990	14,730	15,960	17,150	18,510	20,100
Upper (97.5%)	14,900	14,500	14,430	13,600	15,910	20,450	20,270	21,300	23,390	25,580	27,920	30,610
Children (0-14) Receiving ART												
Actual	468	1,443	2,757	4,350	5,635	6,679						
<i>Target</i>							8,390	11,050	13,600	15,500	17,600	19,100
Coverage												
Upper 97.5%	5%	15%	29%	49%	53%	49%						
<i>Target</i>							60%	75%	85%	90%	95%	95%
HIV+ Pregnant Women Eligible for PMTCT Services												
Lower (2.5%)	5,820	5,640	5,480	5,330	5,250	5,210	5,230	5,300	5,370	5,390	5,410	5,310
Median (50%)	11,710	11,240	10,850	10,580	10,410	10,310	10,310	10,380	10,500	10,650	10,760	10,840
Upper (97.5%)	17,730	16,870	16,320	16,000	15,710	15,560	15,580	15,990	16,090	16,490	16,790	17,020
HIV+ Pregnant Women Receiving PMTCT Services												
Actual	4,144	5,762	7,082	7,241	6,387	7,030						
<i>Target</i>							8,250	8,800	9,500	9,600	9,700	9,800
Coverage												
Median (50%)	35%	50%	65%	68%	61%	68%						
<i>Target</i>							80%	85%	90%	90%	90%	90%

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Annex A

The process for developing the 2010 HIV estimations began in January 2010 using the most recent versions of EPP (Beta U) and Spectrum (Version 3.46).

Inputs and Assumptions

The TWG used all available data in Rwanda to model the HIV epidemiologic incidence curve projected through 2015, fitted to historical data. The inputs and data sources used to inform the models are displayed in Table 3 below.

As with any model, some assumptions were made for certain parameters and values. These assumptions can largely be classified into two general categories a) standard parameters that are built into the model structure and cannot be changed; and b) parameters for which local data were not available and therefore modified assumptions

needed to be made. For the latter category, the same assumptions used in the 2009 Epidemiological Update were used. Table 4 provides detailed information on these assumptions.

Model Fitting and Estimate Production

Incidence curves were first developed for both urban and rural populations by fitting general epidemic curves to local data from sentinel surveillance and other population-based surveys. Uncertainty estimates were then generated around each curve. Once the uncertainty estimates were completed, the curves were calibrated for the best fit with the available survey data, particularly the 2005 DHS, and adjusted for urban/rural population changes over time. The final adjusted and calibrated curves were used to generate results for the national epidemic. These curves were then input to the Spectrum software to develop national

HIV estimates, including estimates of the total HIV population, HIV prevalence and incidence, AIDS deaths, need for ART, and the need for PMTCT for each year, projected through 2015. Based on the incidence curves from EPP, and the programmatic data entered into Spectrum, the Spectrum software generated 95% confidence intervals for all estimates.

Table 3: EPP and SPECTRUM Inputs and Data Sources, 2009

Inputs	Data Sources	Comments
Total 15+ Population in 2010	2002 National Census Report, NISR	Obtained from NISR staff
Urban and rural percentages of the population in 2010	2002 National Census Report, NISR	Obtained from NISR staff
HIV sentinel surveillance data from ANC clinics (among pregnant women)	TRAC Plus ANC Sentinel Surveillance Reports: 1989, 1991, 1996, 1998, 2002, 2003, 2005, 2007	Obtained from current and former TRAC Plus staff
First year survival on ART	Report, National ART Outcomes during 2004-2005; TRAC Plus, 2008	Obtained from TRAC Plus
Number of adults (15+) receiving antiretroviral therapy (ART)	TRACnet Data; TRACPlus Annual Reports 2005-2009	Please see section below for explanation of Future ART Projections
National HIV Sero-prevalence, general population	Survey 1: Bizimungu C, Ntilivamunda A, Tahimana M, et al. Nationwide community-based serological survey of HIV-1 and other human retrovirus infections in a central African country. <i>Lancet</i> 1989; 333:941-43 Survey 2 : R-DHS 2005 Final Report; Table 15.4, pg 232	
Total Fertility Rate	Interim DHS 2007/8; Table 4.1, pg 28	
Number of mothers in the PMTCT program	TRAC Plus Annual Reports 2005-2009	Obtained from TRACplus
Number of pregnant women receiving drug regimens for PMTCT	TRAC Plus Annual Reports 2005-2009	Obtained from TRACplus
Number of children receiving co-trimoxazole prophylaxis	TRAC Plus Annual Reports 2005-2009	Obtained from TRACplus
Number of infants for which an early diagnostic test was done	TRAC Plus Annual Reports 2005-2009	Obtained from TRACplus
Number of children receiving antiretroviral therapy (ART)	TRAC Plus Annual Reports 2005-2009	Obtained from TRACplus

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ART and PMTCT Projections

The national projections for ART coverage, i.e. the number of adults and children anticipated to initiate ART, and the projections for PMTCT coverage for the period 2009-15 were provided by TRAC Plus after a thorough review of historical program data and consultations with HIV experts and stakeholders. First, TRAC Plus program staff analyzed historical program data on monthly ART enrollment rates at different types of health facilities from 2005 through 2009 to gain an initial estimate on the in-

creased number of new patients on treatment each year. These historical trends were then projected through 2015 taking into account the number of new ART sites planned through 2015, and conservative estimates of the number of new enrollments. Finally these estimates were compared to available resources and previously committed funds for ART scale up through 2015 to produce estimates that reflect the historical trends in ART scale up and meet all ART coverage commitments and resources available. These projections will constantly be updated by TRAC Plus as new and more accurate data become available over time.

Table 4: EPP and SPECTRUM Assumptions, 2010

Inputs	Data Sources	Comments
Urban rural proportions and rates for: male proportion of the population, birth rate in 15+, survival to age 15, mortality in 15+, and 15+ growth rate	EPP Default estimates	Please see EPP Manual
Percentage of national population in each sub-population: urban and rural	EPP Default estimates	Please see EPP Manual
Total Net Migrants per year	Modified assumption based on expert consensus	Due to the 1994 genocide, reliable estimates of migration were not available from 1988-1998. The overall migration trend was thus adjusted to fit the overall population trends. For example, reliable population estimates were available for 1978 and 2002. Migration estimates were adjusted to fit a natural migration trend that would cross both of these known data sources.
Average duration of breastfeeding in the population	Spectrum Default, calculated from R-DHS 2005 Final Report; Table 10.3, pg 136	Though R-DHS data were not specific to the HIV population, data on infant feeding scenarios based on other available, non-representative data of the HIV population produced similar results in the model. Given this, expert consensus was to use Spectrum defaults from DHS.
ART coverage projections: 2010-15	TRAC Plus expert consensus	Please see section above for explanation of future ART Projections
Effectiveness of cotrimoxazole	Spectrum Default	Please see Spectrum Manual
Median duration from time of HIV sero-conversion to eligibility for ART at CD4 <350 cells/mm ³ (adults and children)	Spectrum Default; assumption cannot be changed	Please see Spectrum Manual



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