National HIV Indicators for Kenya: 2011

National AIDS Control Council and the National AIDS and STD Control Programme
March 2012

Background

Kenya has a number of sources of information on HIV prevalence levels and trends. Three national surveys, the Kenya Demographic and Health Survey of 2003[1] (KDHS 2003), the Kenya AIDS Information Survey 2007[2] (KAIS 2007) and the Kenya Demographic and Health Survey of 2008/9[3] provide good estimates of national prevalence for those three years and the trend between those years. Antenatal clinic surveillance has been conducted since 1990 starting with 13 sites and expanding to 44 sites today. ANC surveillance provides information on trends at surveillance sites particularly in the period before the first survey in 2003. The new estimates for 2011 are based on the three national surveys and surveillance data through 2011.

Prevalence among pregnant women tested at PMTCT sites may be useful for tracking national trends in the future once most pregnant women are covered but has not yet been verified for this use. Information on behaviors from national surveys and behavioral surveillance may be useful to explain changes in prevalence and incidence.

Kenya produces annual estimates of HIV prevalence and key indicators. The last estimate was prepared in 2011[4]. This paper describes the process to use the new information to prepare national estimates for 2011 and describes the results for key indicators.

Methods

The methods used to estimate national HIV prevalence in Kenya have changed over time in response to the data available. Before the first national survey, smooth prevalence curves were fit to individual surveillance sites to determine trends at those sites and then these trends were aggregated by weighting them by the population represented by each site. When the first national survey became available the national trend was adjusted to match the survey findings in 2003[5].

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[1] Central Bureau of Statistics (CBS) [Kenya], Ministry of Health (MOH) {Kenya], and ORC Macro. 2004. *Kenya Demographic and Health Survey 2003*. Calverton, Maryland" CBS, MOH and ORC Macro.
[2] National AIDS and STD Control Programme, Ministry of Health, Kenya. July 2008. *Kenya AIDS Indicator Survey 2007: Preliminary Report*. Nairobi, Kenya.
[3] KNBS [Kenya] 2009. *Kenya Demographic and Health Survey 2008-09 Preliminary Report*. Calverton, Maryland. KNBS, NACC, NASCOP, NPHLS, KMRI, NCAPD, ICF Macro, September 2009.
[4] NACC and NASCOP. National HIV Indicators for Kenya: 2010. Nairobi, NACC and NASCOP, July 2011.
[5] National AIDS Control Council (NACC) and National AIDS and STD Control Programme (NASCOP) 2007. National HIV Prevalence in Kenya. Nairobi: NACC and NASCOP.

Now that three surveys are available they can be used to adjust not only the level but also the trend in prevalence from 2003 to 2009.

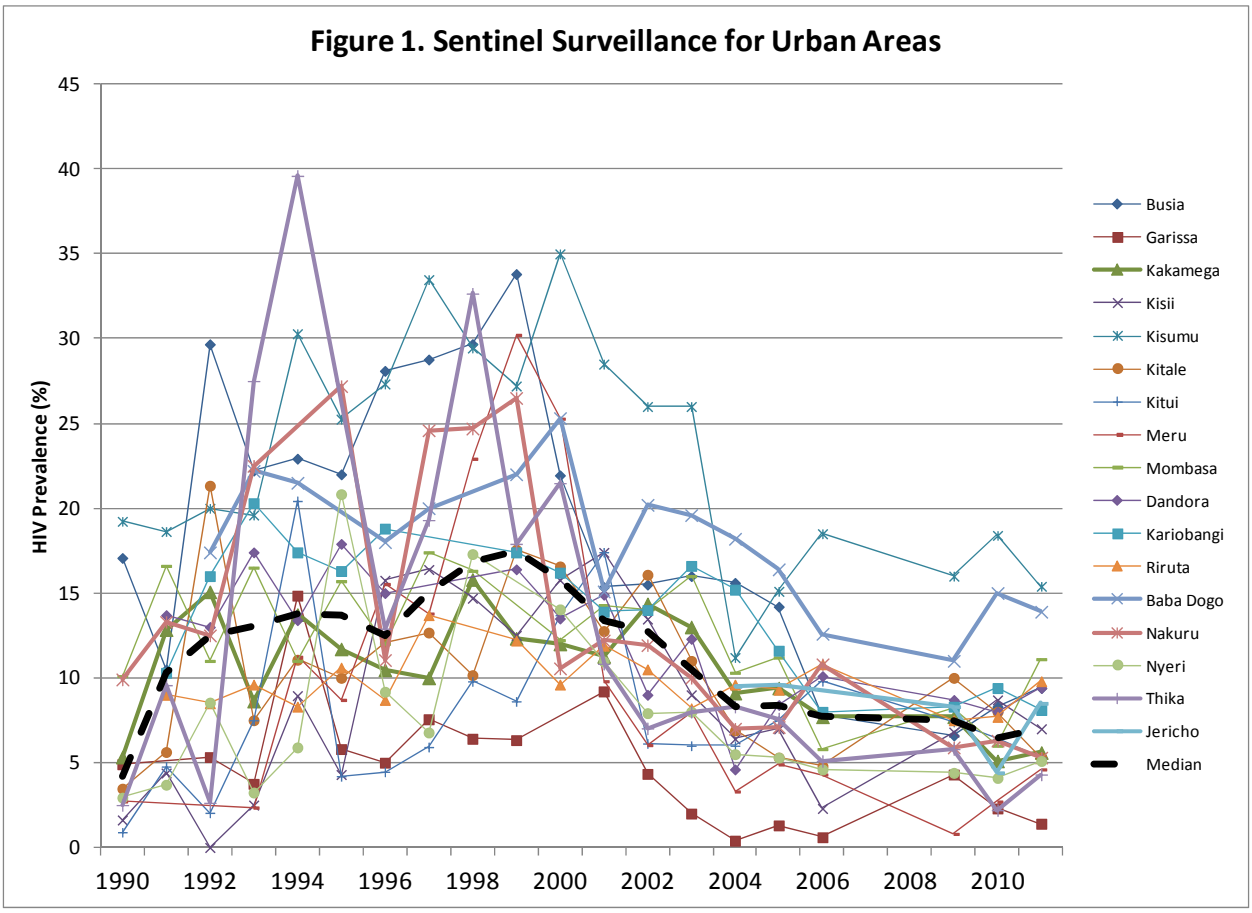
UNAIDS has supported the development of a number of tools to make national estimates. For Kenya the relevant tools are the Estimation and Projection Package[6] (EPP) and Spectrum[7]. EPP is used to fit smooth prevalence curves to surveillance and survey data separately for urban and rural areas. These curves are combined into a single national curve. The incidence implied by the national prevalence curve is then transferred to Spectrum where it is combined with additional information on the age structure of incidence and program coverage (ART, PMTCT, cotrimoxazole for children) to estimate indicators of interest such as the number of people infected with HIV, the number of new infections, AIDS deaths and the need for ART, PMTCT and cotrimoxazole.

[6] Estimating National Adult Prevalence of HIV-1 in Generalized Epidemics, UNAIDS/WHO, 2009.
[7] Stover, John. 2009.. AIM: A Computer Program for Making HIV/AIDS Projections and Examining the Demographic and Social Impacts of AIDS. Washington, DC: Futures Group International, Health Policy Initiative, Task Order 1.

Results

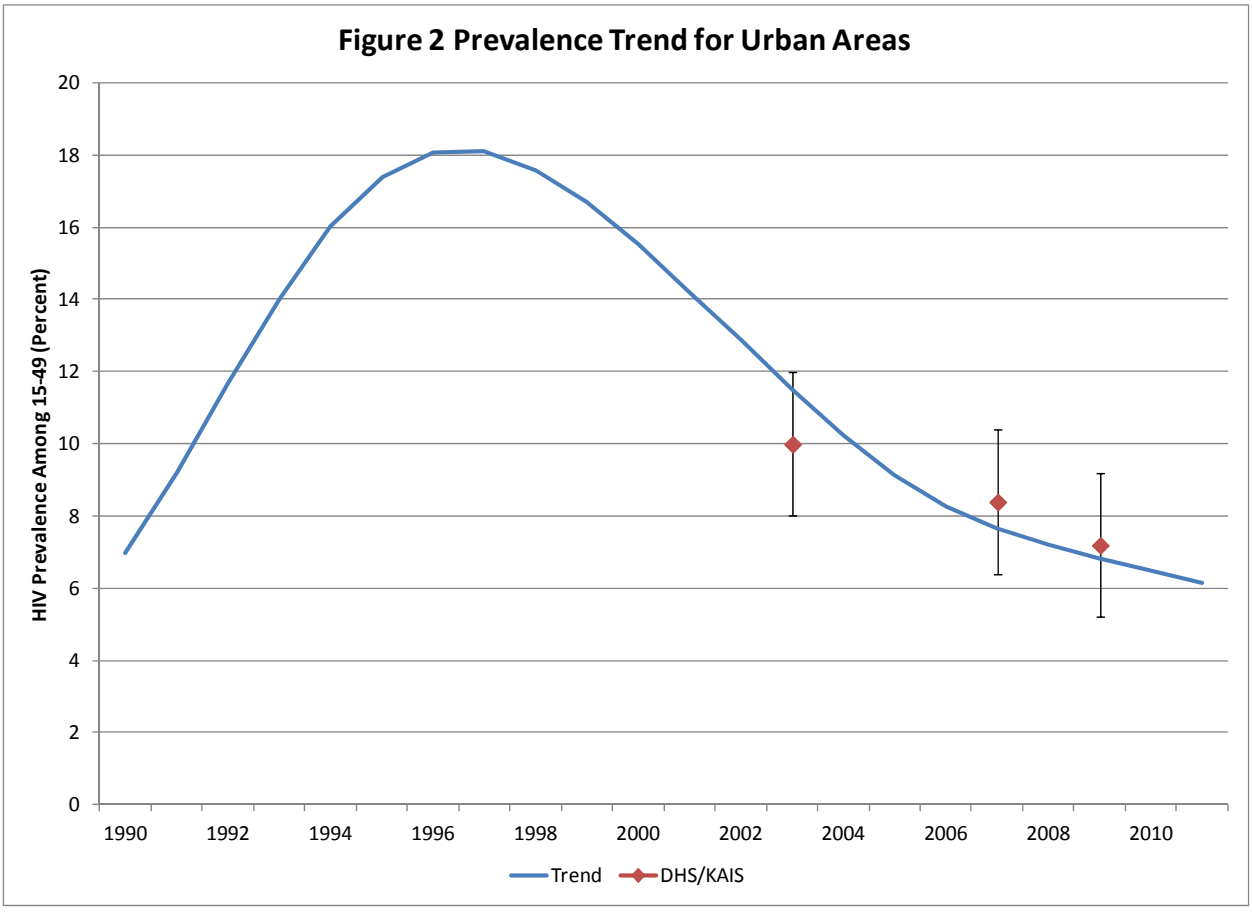
Adult HIV Prevalence

Adult HIV prevalence is the percentage of adults 15-49 infected with HIV. For urban areas the sentinel surveillance data indicate that prevalence rose sharply during the late 1980s and early 1990s reaching a peak in the mid-1990s. Since then prevalence has declined in most sites and, in some sites, the decline has been quite steep (Figure 1)

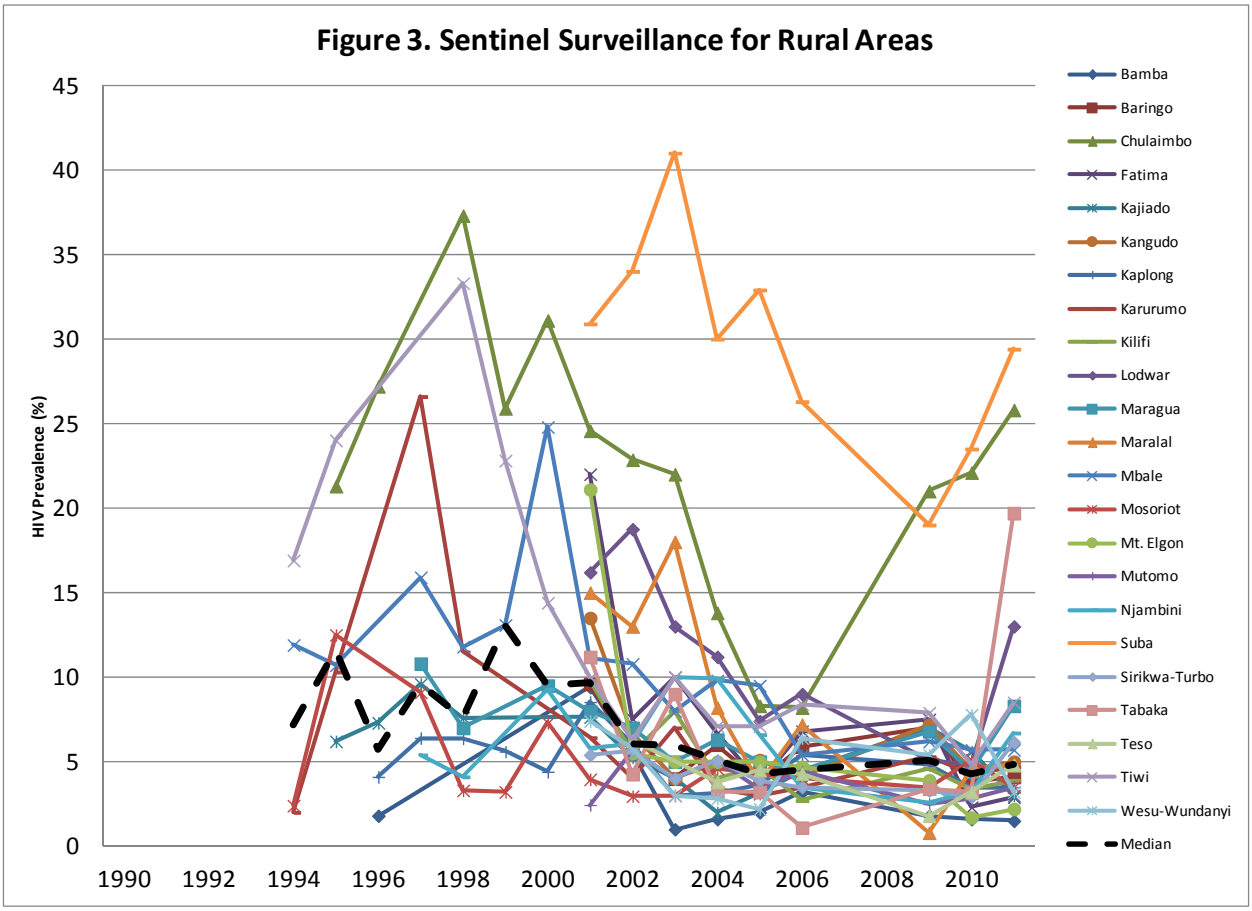


According to the national surveys HIV prevalence among urban adults declined from 10.0% (6.9%-13.1%) in 2003 to 8.0% (6.6%-10.2%) in 2007 and to 7.2% (4.6%-9.8%) in 2008/9. Together this information indicates that urban prevalence peaked around 1997 and has declined steadily since then. This trend is shown in Figure 2 below.

Due to anomalies in the data surveillance results for 1995 and 1996 were excluded from the fit. All other surveillance data and all three surveys were included. The urban prevalence trend was fit to the data using the EPP Classic model fit. No prevalence restrictions were applied and the default prior assumptions for the model parameters were used (force of infection: 0.5<r<150; percent at risk at beginning of the epidemic: 0<fo<1; start year of the epidemic: 1970<to<1990; behavior change: phi median = 100, scale = 50).



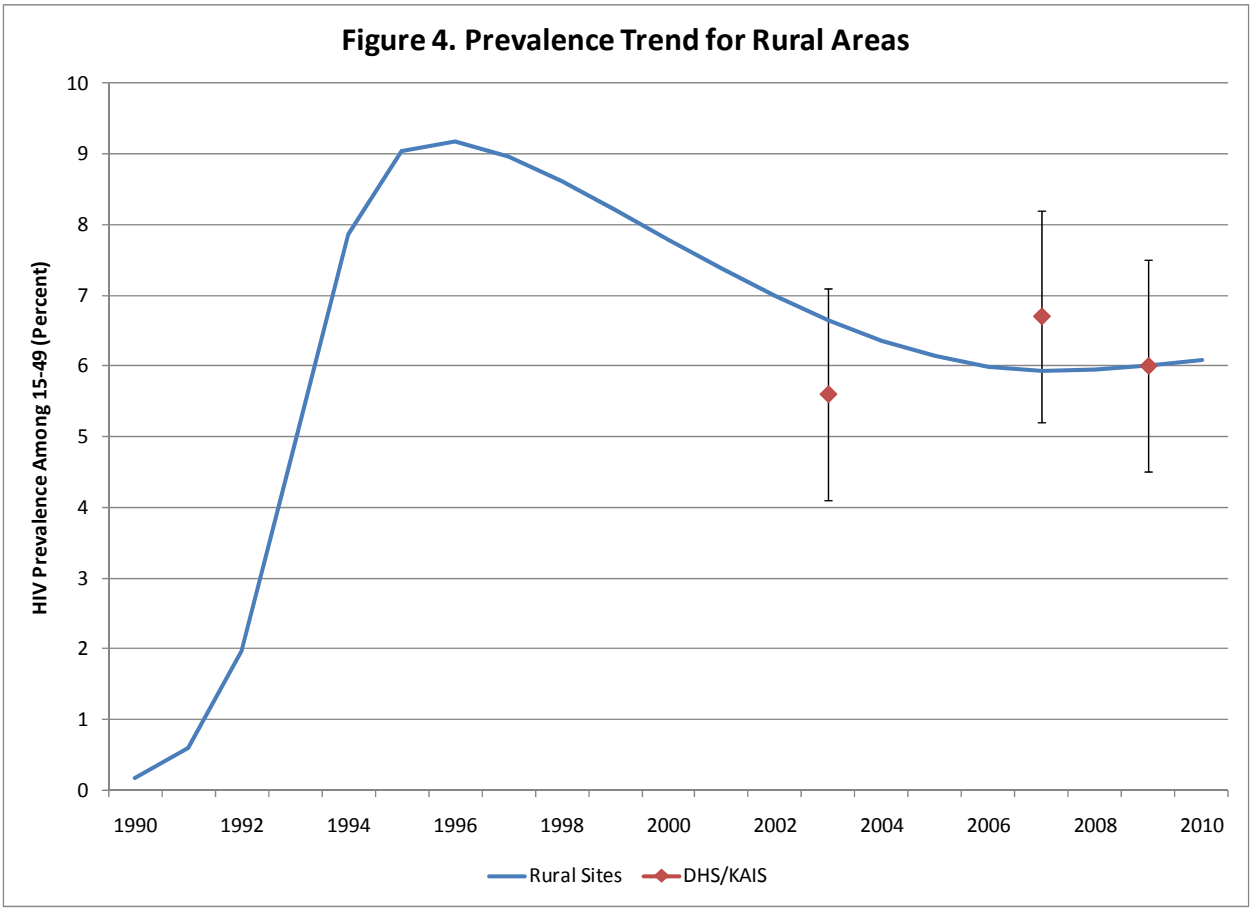
For rural epidemics the antenatal surveillance data also indicate that prevalence rose during middle 1990s and then declined starting around 2000 and then leveled off in the last few years (Figure 3).



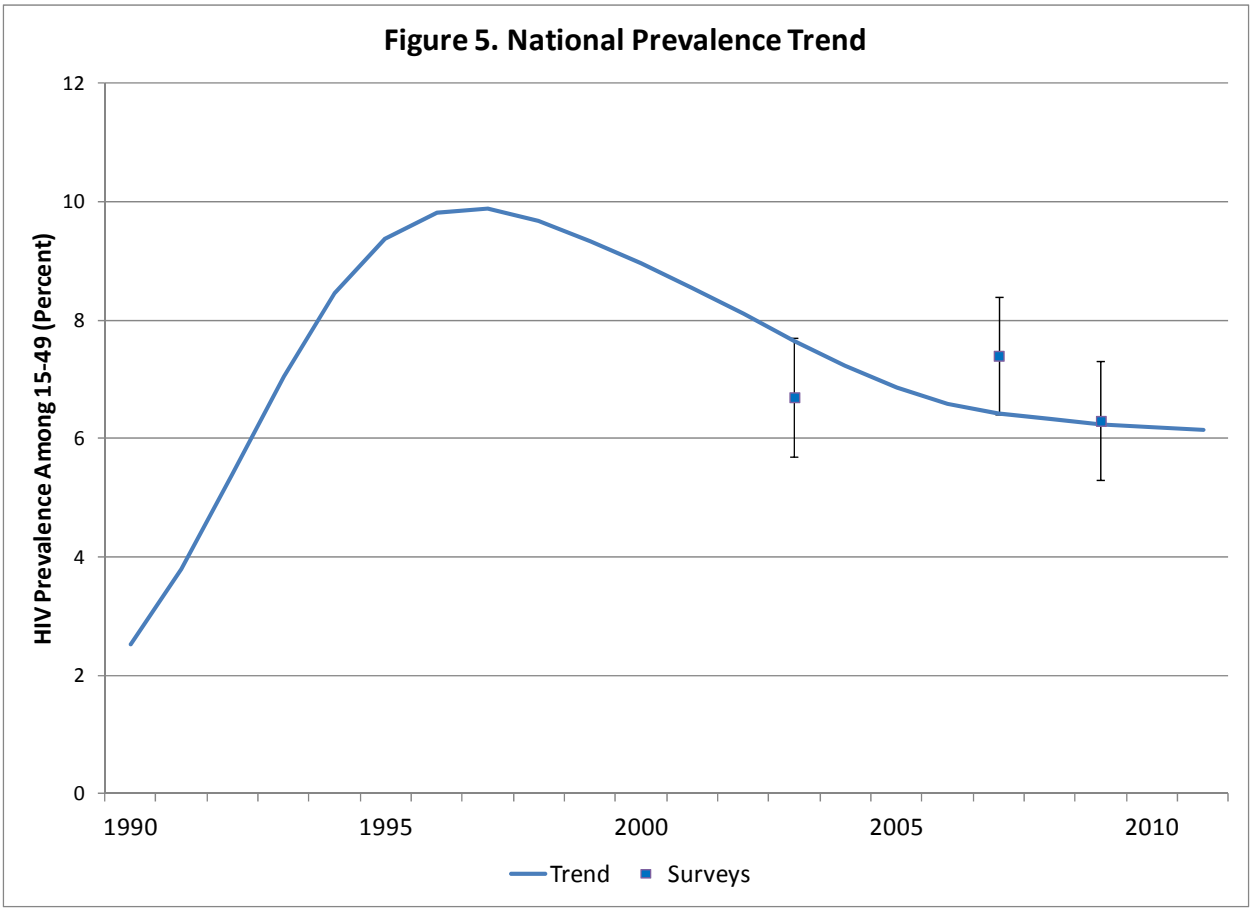
The surveys show that rural prevalence has been more or less constant since 2003 with estimates of 5.6% (4.2%-7.0%) in 2003, 6.7% (5.7%-7.7%) in 2007 and 6.0% (4.6%-7.4%) in 2008/9.

For this estimate we have fit a prevalence curve with roughly stable prevalence over the past few years, as indicated by the surveys and surveillance data. The result is shown in Figure 4.

All surveillance data and surveys were used to fit the rural prevalence curve using the EPP Classic model. Some default parameter values were used (force of infection: 0.5<r<150; behavior change: phi median = 100, scale = 50) but the range for the fraction at risk at the beginning of the epidemic, fo, was changed to 0.0 – 0.1 and the range for the start year of the epidemic, to, was changed to 1970-1980. Two conditions on prevalence were used: in 1982 prevalence must be greater than 0 (to set an early start to the epidemic since no surveillance data are available before 1994) and prevalence in 2011 must be greater than 6.0 (to exclude curves that show declining prevalence). Curves showing a declining prevalence after 2007 were excluded to be consistent with the survey and surveillance data and to exclude estimates of need for PMTCT services that are nearly equal to current service provision.

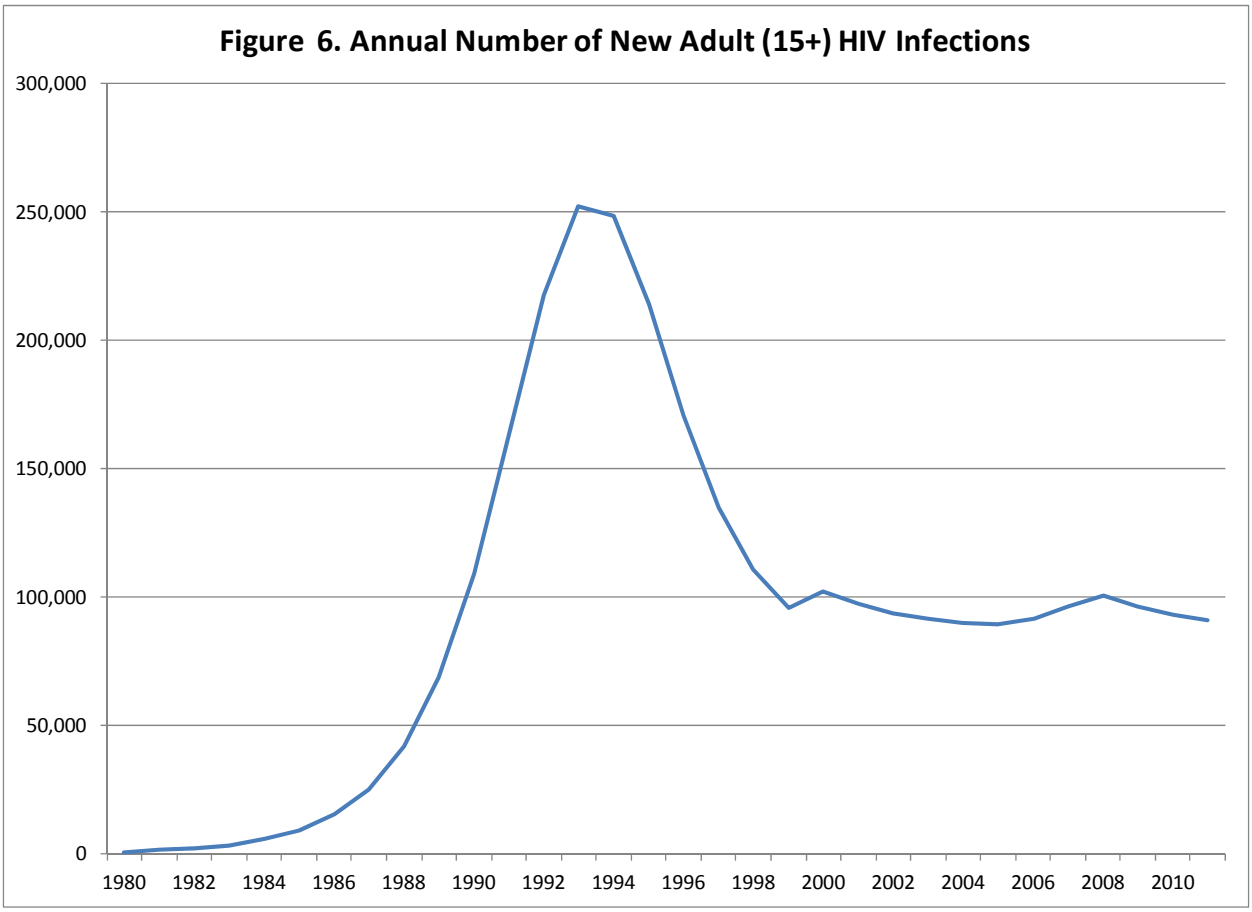


When these two trends are combined they indicate that national prevalence peaked at 10-11% in the mid-1990s, declined to about 6.3% by 2006 and has been relatively stable at that level for the past several years (Figure 5).



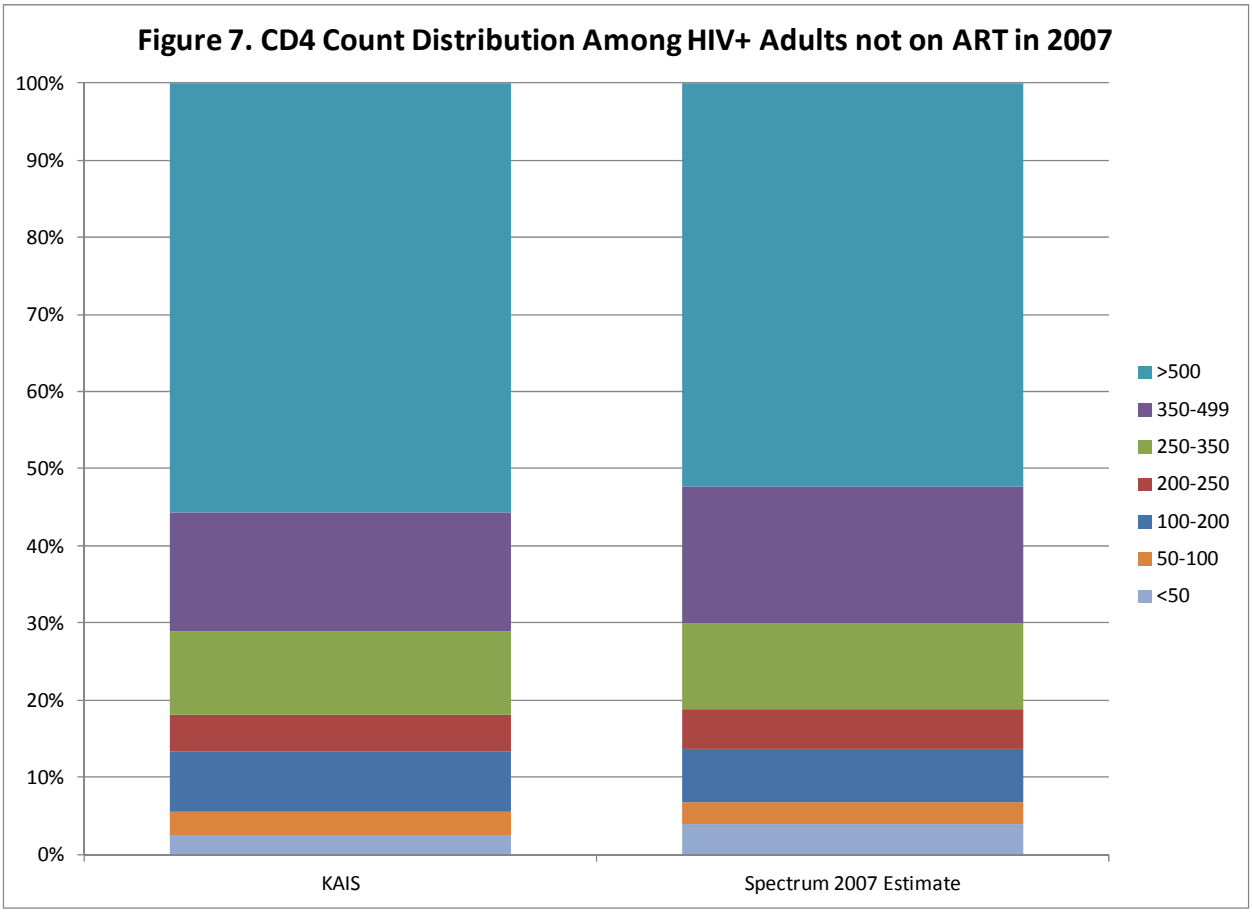
New Adult HIV Infections

These prevalence trends are used to estimate national adult incidence over time by incorporating the effects of AIDS mortality, non-AIDS mortality and population aging. Those calculations indicate that the annual number of new HIV infections among adults 15 years of age and older increased steadily to a peak in the mid-1990s before declining to about 100,000 today (Figure 6).



Need for Treatment

The estimated number of new adult infections is combined with information about progression in CD4 counts, the mother-to-child transmission rate and service statistics to estimate the need for services. For adult ART, eligibility for treatment was a CD4 count of less than 200 cells/µl through 2006, less than 250 cells/µl from 2007-2009 and a CD4 count of less than 350 cells/µl in 2010 and later. Spectrum tracks HIV+ adults by CD4 count based on assumed rates of progression to lower CD4 counts, AIDS mortality by CD4 count and initiation of ART[8].The parameters of the model were set to reproduce the CD4 count distribution of the HIV+ population not on ART reported by the 2007 KAIS (Figure 7).



[8] Stover, John. CD4 Model of HIV and ART in Spectrum, March 10, 2011. Futures Institute.

For children, eligibility for treatment is based on Kenyan guidelines as updated in 2008 which include all HIV-infected children under the age of 18 months, children 19-59 months with CD4 percents under 25 and children older than 5 years with CD4 counts under 350. The child model has been updated in Spectrum to take into account new information showing that children infected through breastfeeding survive longer than those infected peripartum[9].

WHO released new guidelines for the prevention of mother-to-child transmission of HIV which incorporate new prophylaxis options. Spectrum has been updated to include these new options and to use the latest estimates of the probability of transmission for each option[10].

There are uncertainties inherent in these estimates based on the error of measuring HIV prevalence through population surveys and the uncertainty in the assumptions used for time of progression, the distribution of new infections by age and sex, mother-to-child transmission rates, and the effectiveness of treatment. In order to quantify this uncertainty we performed 1000 Monte Carlo projections using randomly selected values for these assumptions with ranges indicated by the sources. The results provide plausibility bounds around each estimate.

Table 1 shows the results for key indicators for 2011. These estimates are similar to those produced previously.

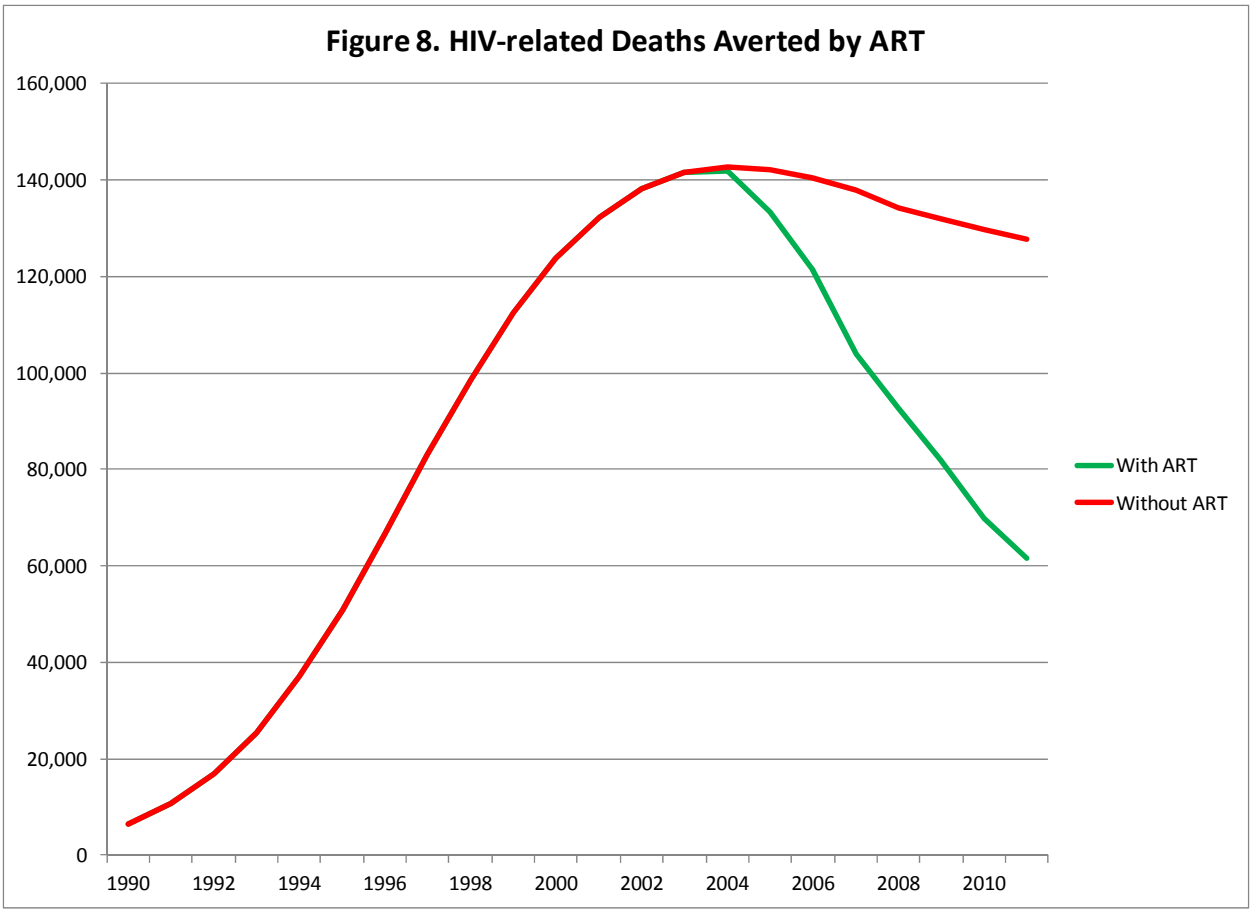
Table 1. National HIV estimates for 2011

Indicator	Value	Range
Number living with HIV	1.6 million	1.5 – 1.7 million
Prevalence (15-49)	6.2%	5.9 – 6.3%
New adult infections	91,000	86,000 – 102,000
New child infections	13,000	10,000 – 17,000
Annual AIDS deaths	62,000	55,000 – 69,000
Need for ART: adults	590,000	570,000 – 620,000
Need for ART: children	155,000	135,000 – 180,000
Mothers needing PMTCT	87,000	77,000 – 98,000

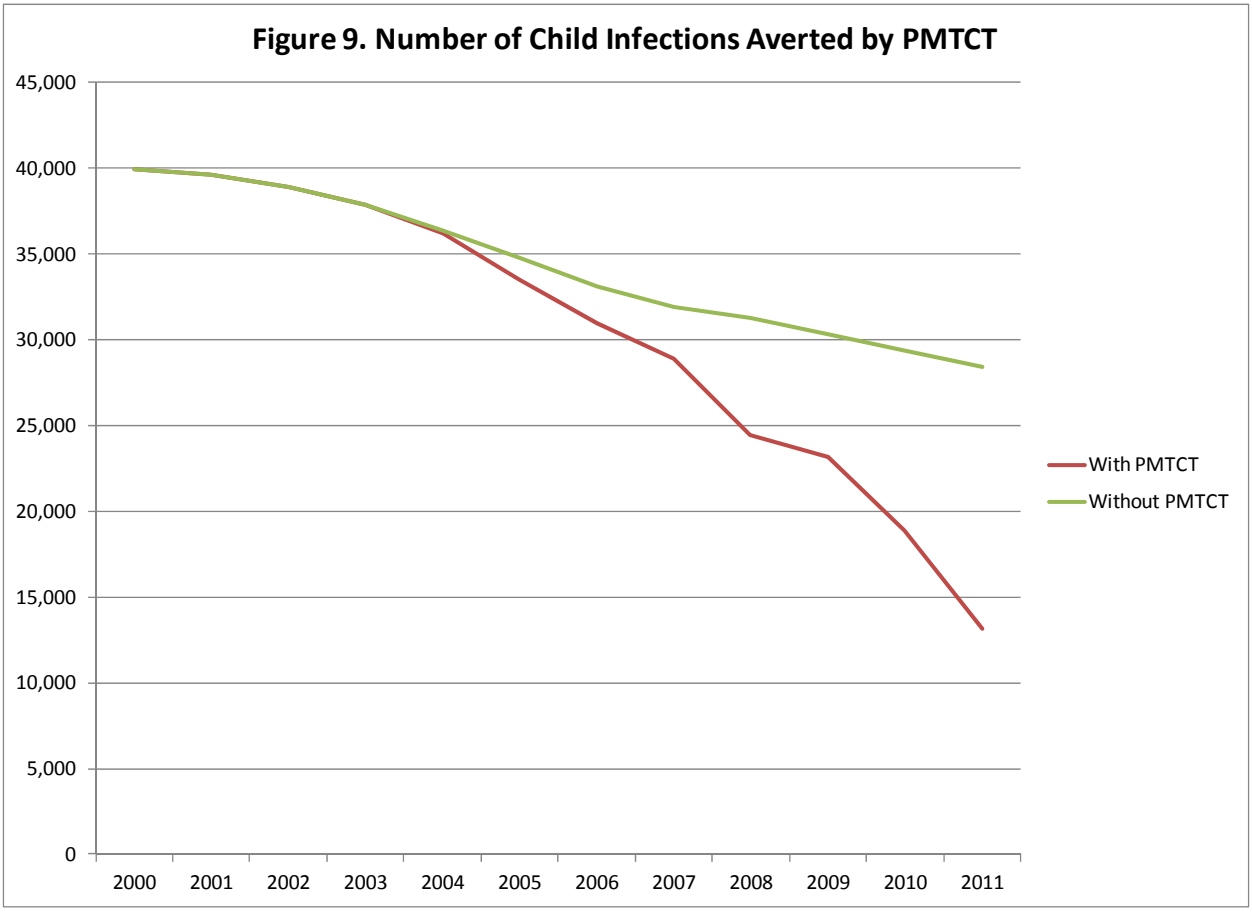
[9] Stover, John. Spectrum: Methods for Estimating HIV among Children, December 29, 2010. Futures Institute.
[10] Stover, John. Spectrum: Methods for Estimating Mother-to-Child Transmission of HIV, May 6, 2011. Futures Institute.

Impact

The Spectrum model can be used to estimate the impact of treatment in terms of the number of lives saved. To do this we make a second projection in which no one is placed on ART. The difference in the number of AIDS deaths between the two projections is the estimated impact of treatment. As Figure 8 shows an estimated 270,000 AIDS deaths have been avoided through 2011 due to the scale-up of ART.



The program to prevent mother-to-child transmission of HIV has been scaling up rapidly in the past several years. In 2011 over 60,000 HIV+ women received ARV prophylaxis to prevent transmission to their new born children. This represents about 69% of need. As a result of the scale up of this program since 2004, about 46,000 child infections have been averted.



Projections

Projections into the future can be made based on the prevalence trends. These projections, especially those regarding the need for treatment and PMTCT services, can be useful for planning purposes. Since the need for treatment includes those on treatment any projection of need is dependent on assumptions about the number who will get on treatment in the future. The projection shown here is based on targets for adult treatment and PMTCT included in the Kenya National AIDS Strategic Plan (KNASP). The number of people newly needing treatment is not subject to assumptions about the number getting treatment, so it may be a more reliable basis for planning. Tables 2 and 3 below show the full set of indicators.

Table 2. Indicators for Adults 15+

	2000	2001	2002	2003	2004	2005	2006	2007
HIV population								
Total	1,486,913	1,440,245	1,387,254	1,333,406	1,283,507	1,247,046	1,227,141	1,231,924
Male	621,471	597,993	572,416	547,154	524,242	507,664	498,604	500,323
Female	865,443	842,252	814,838	786,252	759,265	739,382	728,537	731,601
Adult prevalence (15+)	8.5	8.0	7.4	6.9	6.5	6.1	5.8	5.7
New HIV infections								
Total	77,219	72,329	71,875	74,074	77,729	81,523	85,201	91,082
Male	33,150	31,067	30,886	31,845	33,431	35,079	36,677	39,224
Female	44,069	41,262	40,990	42,229	44,297	46,444	48,524	51,858
Incidence	0.50	0.45	0.43	0.43	0.43	0.44	0.44	0.46
Annual AIDS deaths								
Total	102,794	112,448	118,629	121,661	121,172	111,622	99,117	81,048
Male	47,384	51,156	53,251	53,912	53,083	48,463	42,745	34,889
Female	55,410	61,292	65,378	67,749	68,089	63,158	56,372	46,159
Annual AIDS deaths among those on ART								
Total	0	0	0	0	374	2,124	3,484	5,736
Male	0	0	0	0	194	1,092	1,778	2,906
Female	0	0	0	0	180	1,032	1,706	2,831
Annual AIDS deaths among those not on ART								
Total	102,794	112,448	118,629	121,661	120,798	109,498	95,632	75,311
Male	47,384	51,156	53,251	53,912	52,889	47,371	40,966	31,983
Female	55,410	61,292	65,378	67,749	67,910	62,127	54,666	43,328
Total need for ART								
Total	206,074	229,387	244,226	251,456	252,442	249,713	252,036	327,585
Male	94,093	103,008	107,949	109,535	108,545	106,182	106,245	135,816
Female	111,981	126,379	136,277	141,921	143,898	143,531	145,791	191,769
Total receiving ART (Dec 31)								
Number	0	0	0	6,240	24,960	54,093	120,389	168,234
Percent	0	0	0	3	10	25	39	51
Number newly needing treatment								
Total	113,146	114,885	114,100	111,506	107,735	103,443	99,208	94,690
Male	51,090	51,157	50,191	48,547	46,521	44,389	42,374	40,311
Female	62,056	63,728	63,909	62,959	61,215	59,053	56,834	54,379
Unmet need for treatment								
Total	206,074	229,387	244,226	251,456	239,962	210,187	164,795	183,274
Male	94,093	103,008	107,949	109,535	103,167	89,375	69,462	75,631
Female	111,981	126,379	136,277	141,921	136,795	120,812	95,333	107,643
Population								
Total	17,528,707	18,099,127	18,680,173	19,269,158	19,858,191	20,452,410	21,053,294	21,663,077
Male	8,665,816	8,952,631	9,245,754	9,543,369	9,840,893	10,140,074	10,441,278	10,744,905
Female	8,862,891	9,146,496	9,434,418	9,725,789	10,017,298	10,312,336	10,612,015	10,918,172

Table 2. Indicators for Adults 15+ (continued)

	2008	2009	2010	2011	2012	2013	2014	2015
HIV population								
Total	1,262,331	1,307,208	1,359,899	1,412,625	1,468,120	1,526,136	1,588,795	1,654,889
Male	513,204	532,251	554,542	576,776	600,060	624,336	650,640	678,419
Female	749,127	774,957	805,356	835,849	868,060	901,800	938,155	976,469
Adult prevalence (15+)	5.7	5.7	5.8	5.8	5.9	5.9	6.0	6.1
New HIV infections								
Total	105,292	108,764	105,072	98,263	91,949	85,569	86,593	90,986
Male	45,360	46,877	45,309	42,392	39,683	36,940	37,390	39,291
Female	59,933	61,887	59,763	55,871	52,266	48,629	49,204	51,695
Incidence	0.52	0.52	0.49	0.44	0.40	0.36	0.36	0.36
Annual AIDS deaths								
Total	70,706	60,552	49,653	43,530	35,106	26,720	23,624	25,066
Male	30,397	26,159	21,636	19,124	15,680	12,190	10,859	11,512
Female	40,308	34,393	28,016	24,407	19,426	14,530	12,765	13,554
Annual AIDS deaths among those on ART								
Total	5,631	6,952	8,528	9,236	10,887	11,617	10,616	9,920
Male	2,848	3,519	4,305	4,665	5,505	5,880	5,408	5,091
Female	2,783	3,432	4,224	4,571	5,382	5,738	5,208	4,829
Annual AIDS deaths among those not on ART								
Total	65,075	53,600	41,125	34,294	24,219	15,103	13,008	15,146
Male	27,549	22,639	17,332	14,458	10,175	6,310	5,451	6,421
Female	37,525	30,961	23,793	19,836	14,043	8,793	7,557	8,725
Total need for ART								
Total	350,135	380,617	535,028	584,365	640,572	705,283	777,919	852,543
Male	144,848	157,312	219,039	239,554	262,940	289,828	320,035	351,121
Female	205,287	223,305	315,989	344,811	377,632	415,455	457,884	501,422
Total receiving ART (Dec 31)								
Number	230,059	315,558	396,525	500,000	620,000	702,838	760,316	792,896
Percent	64	69	72	82	91	94	93	91
Number newly needing treatment								
Total	91,948	90,207	90,294	90,577	90,302	89,457	88,034	86,722
Male	39,071	38,307	38,511	38,644	38,528	38,165	37,554	37,009
Female	52,877	51,900	51,783	51,933	51,774	51,292	50,480	49,713
Unmet need for treatment								
Total	150,988	107,808	178,987	136,102	80,572	43,864	46,342	75,937
Male	62,227	44,485	72,424	55,310	32,920	18,159	19,405	31,956
Female	88,761	63,323	106,563	80,792	47,651	25,705	26,937	43,981
Population								
Total	22,280,656	22,919,713	23,590,366	24,287,077	25,010,921	25,757,833	26,526,394	27,322,243
Male	11,051,506	11,368,362	11,700,491	12,045,473	12,403,598	12,772,632	13,152,060	13,544,999
Female	11,229,150	11,551,351	11,889,874	12,241,604	12,607,323	12,985,201	13,374,335	13,777,244

Table 3. Indicators for Children 0-14

	2000	2001	2002	2003	2004	2005	2006	2007
HIV population								
Total	185,242	202,337	217,122	229,386	238,801	244,767	247,857	248,253
Male	93,424	102,027	109,465	115,629	120,357	123,344	124,884	125,070
Female	91,819	100,309	107,657	113,756	118,444	121,423	122,973	123,183
New HIV infections								
Total	42,883	41,729	40,134	38,257	35,943	32,683	29,806	27,598
Male	21,732	21,147	20,339	19,387	18,214	16,560	15,101	13,981
Female	21,151	20,582	19,796	18,870	17,729	16,122	14,705	13,617
Annual AIDS deaths								
Total	21,070	21,838	22,389	22,774	22,939	22,576	21,539	20,209
Male	10,632	11,019	11,295	11,487	11,568	11,383	10,859	10,187
Female	10,437	10,819	11,094	11,287	11,370	11,192	10,680	10,022
Children needing cotrimoxazole								
Total	326,133	331,465	333,427	332,560	329,558	325,089	320,135	315,243
Male	165,017	167,674	168,627	168,152	166,600	164,312	161,785	159,297
Female	161,116	163,791	164,799	164,408	162,958	160,778	158,351	155,946
Children receiving cotrimoxazole								
Total	0	0	0	0	0	0	0	0
Male	0	0	0	0	0	0	0	0
Female	0	0	0	0	0	0	0	0
Total need for ART								
Total	72,864	78,820	84,202	89,025	93,108	95,963	97,710	98,800
Male	36,725	39,719	42,422	44,843	46,889	48,315	49,183	49,722
Female	36,139	39,101	41,780	44,182	46,218	47,648	48,527	49,078
Total number receiving ART								
Total	0	0	0	0	0	0	4,727	13,576
Male	0	0	0	0	0	0	2,382	6,839
Female	0	0	0	0	0	0	2,345	6,737
PMTCT								
Number of HIV+ pregnant women	145,462	139,392	132,389	124,990	117,768	111,345	106,259	102,937
Mothers needing PMTCT	123,643	118,483	112,531	106,242	100,103	94,643	90,320	87,496
Mothers receiving PMTCT	0	0	0	0	2,450	19,439	34,795	50,659
MTCT rate at 6 weeks	20	20	21	21	20	19	17	15
MTCT rate including breastfeeding	35	35	36	36	36	35	33	32

Table 3. Indicators for Children 0-14 (continued)

	2008	2009	2010	2011	2012	2013	2014	2015
HIV population								
Total	244,114	238,543	229,953	216,854	202,664	188,947	175,810	163,248
Male	122,971	120,155	115,815	109,199	102,038	95,119	88,496	82,165
Female	121,143	118,388	114,138	107,655	100,626	93,828	87,314	81,083
New HIV infections								
Total	23,351	22,564	18,595	12,894	10,313	9,307	8,566	7,902
Male	11,827	11,428	9,417	6,531	5,223	4,713	4,338	4,001
Female	11,524	11,136	9,177	6,364	5,090	4,594	4,228	3,901
Annual AIDS deaths								
Total	18,121	16,798	14,951	13,118	11,144	9,410	7,929	6,582
Male	9,133	8,465	7,533	6,608	5,612	4,738	3,992	3,314
Female	8,988	8,333	7,418	6,510	5,532	4,671	3,936	3,268
Children needing cotrimoxazole								
Total	310,704	306,328	302,283	297,289	289,859	281,805	273,452	265,501
Male	156,999	154,788	152,742	150,217	146,462	142,389	138,167	134,151
Female	153,705	151,540	149,541	147,072	143,397	139,416	135,284	131,350
Children receiving cotrimoxazole								
Total	36,000	47,354	98,337	101,313	116,788	130,016	142,116	145,726
Male	18,191	23,928	49,689	51,193	59,011	65,694	71,807	73,632
Female	17,809	23,426	48,648	50,120	57,777	64,322	70,309	72,094
Total need for ART								
Total	98,482	154,549	168,345	157,913	149,026	140,072	131,981	125,054
Male	49,549	77,748	84,675	79,412	74,930	70,419	66,346	62,861
Female	48,933	76,801	83,670	78,501	74,097	69,653	65,635	62,193
Total number receiving ART								
Total	19,408	25,336	33,417	40,300	49,090	60,297	70,537	79,548
Male	9,775	12,759	16,826	20,289	24,711	30,349	35,499	40,031
Female	9,634	12,577	16,591	20,011	24,379	29,948	35,038	39,518
PMTCT								
Number of HIV+ pregnant women	101,897	102,086	101,977	102,105	101,964	101,396	100,832	100,242
Mothers needing PMTCT	86,613	86,773	86,681	86,789	86,669	86,187	85,707	85,206
Mothers receiving PMTCT	59,601	58,591	61,758	64,049	66,584	68,931	71,303	73,628
MTCT rate at 6 weeks	11	11	9	7	5	5	4	4
MTCT rate including breastfeeding	27	26	21	15	12	11	10	9