

# **Estimating National HIV Prevalence in Malawi from Sentinel Surveillance Data**

The National AIDS Control Programme  
The POLICY Project  
Lilongwe, Malawi

May 2001

## **Introduction**

Sentinel surveillance systems for HIV are designed to provide information on trends to policy makers and program planners. The data are useful for understanding the magnitude of the HIV/AIDS problem in certain geographic areas and among special populations and for monitoring the impact of interventions. These data also can be used to prepare estimates of national HIV prevalence suitable for advocacy purposes and district planning. This paper describes the approach used in Malawi to develop an estimate of adult HIV prevalence. The methodology and assumptions reported here were developed during a workshop organized by the National AIDS Control Programme (NACP) in Lilongwe in September 1999 and updated for 2001 during a workshop in Lilongwe in May 2001. Participants represented the NACP, National Statistical Office, MACRO, College of Medicine, Ministry of Health and Population, University of Malawi, Department of Human Resources Management and Development, CDC and the POLICY Project.

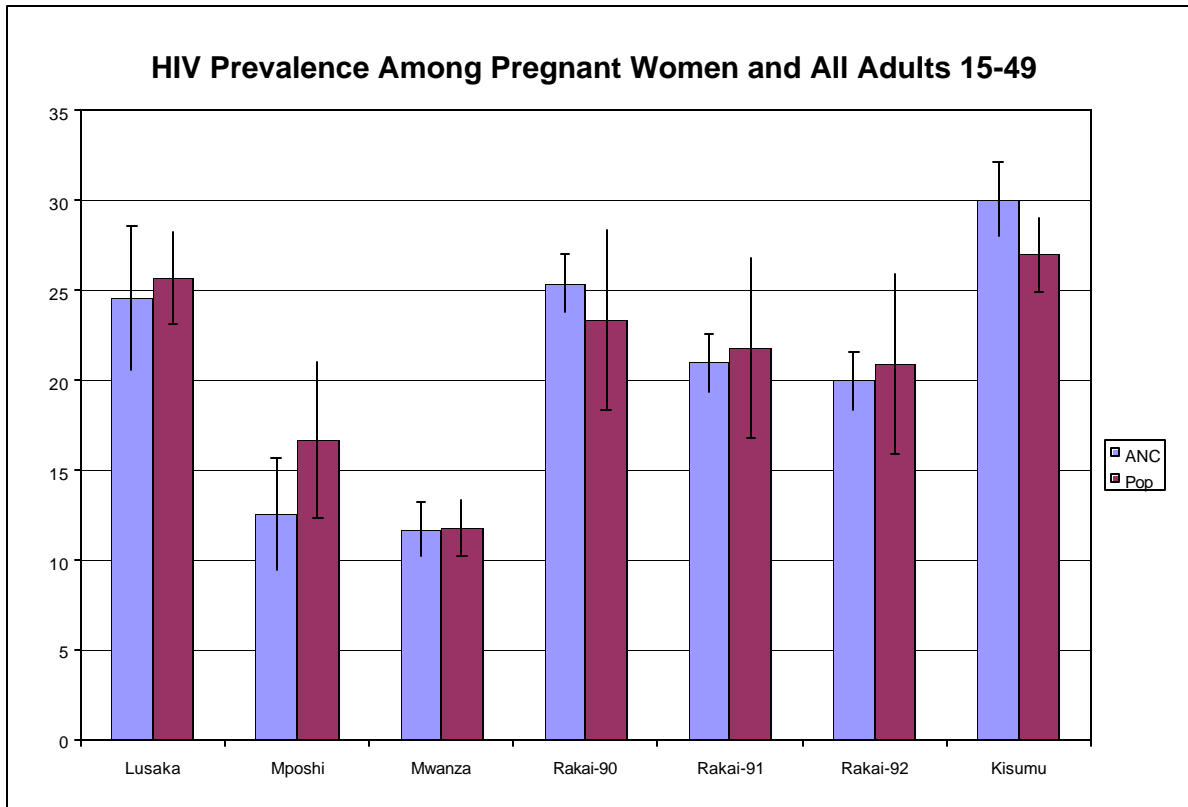
The HIV sentinel surveillance system in Malawi is implemented by the NACP. Data are analyzed for syphilis and HIV infection among ante-natal clinic (ANC) clients. HIV surveillance has been conducted at Queen Elizabeth Central Hospital in Blantyre since 1985. In 1994 a system of 19 sentinel sites was established. Sites were selected to represent the urban, semi-urban and rural areas as well as the northern, central and southern regions.

## **Representativeness of Data from Ante-natal Clinics**

Although ANC attendees are generally representative of the adult population 15-49, there are some differences between the two groups. Studies from several African sites have shown that women with HIV have lower fertility than those without infection. As a result, ANC data tend to under-estimate prevalence among women. These data also show, however, that male prevalence is lower than female prevalence. For the 15-49 age group, these differences tend to cancel each other. As a result, prevalence among pregnant women is a good indicator of prevalence among all adults 15-49, without adjustment. Figure 1 shows this comparison for several sites with data on both populations. (This conclusion is only valid for the population 15-49. For some sub-populations, such as 15-

19, there are significant differences in prevalence between pregnant women and all adults.)

**Figure 1. Comparison of HIV prevalence among pregnant women and all adults 15-49**



Sources:

**Lusaka, Mposhi:** Fylkenses, K., Mubanga-Musonda, M., Kasumba, K., Ndhlova, Z., Mluanda, F., Kaetano, L., Chipialia, C. “The HIV epidemic in Zambia: socio-demographic prevalence patterns and indications of trends among childbearing women” *AIDS* 1997 **11**:339-345.

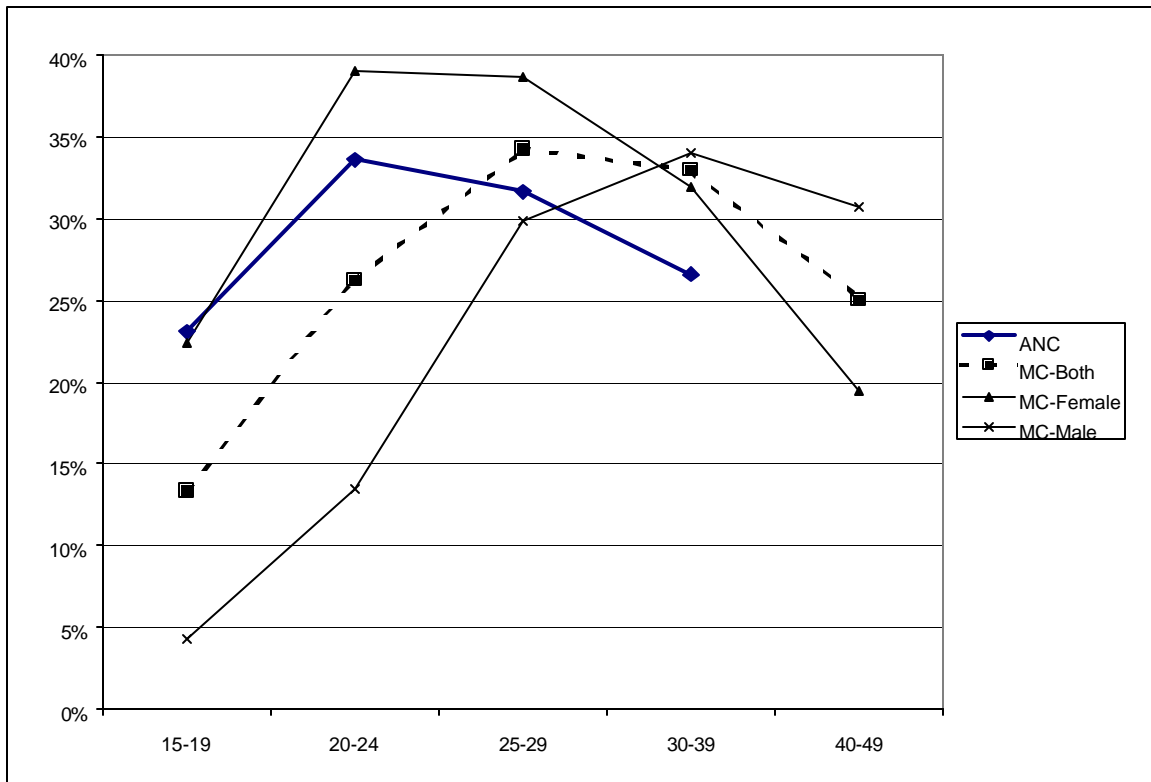
**Mwanza:** Kigadye, RM., Klokke, A, Nicoll, A., Nyamuryekunh'e, KM., Borgdorff, M., Barongo, L., Laukamm-Josten, U., Lisekie, F. Grosskurth H, and Kigadye F. “Sentinel surveillance for HIV-1 among pregnant women in a developing country: 3 years' experience and comparison with a population serosurvey”. *AIDS* 1993 **7**:849-855.

**Rakai:** Wawer, J.M., Serwadda, D., Gray, R.H., Swankambo, N., Chuanjun, L., Nalugoda F., Lutalo T., Konde-Lule J.K. “Trends in HIV-1 prevalence may not reflect trends in incidence in mature epidemics: data from the Rakai population-based cohort, Uganda” *AIDS* 1997, **11**:1023-1030.

**Kisumu:** Kahindo, M., Nyang, J., Chege, J. “Multicentre study On factors determining the differential spread of HIV in Africa - Preliminary results of the Kisumu study site” 2nd National Conference on HIV/AIDS in Kenya, 28-30 October 1998, Nairobi, Kenya and sentinel data from the National AIDS and STDs Control Programme, Nairobi.

Figure 2 shows age-specific levels for Kisumu, Kenya. It compares age-specific prevalence from the ANC in 1998 with data from the Multi-Centre study of Kisumu. It shows that ANC data tend to under-estimate female prevalence, except at the youngest ages. The under-estimate is due to the suppressing effect of HIV infection on fertility. At the youngest ages, the fact that all ANC attendees are sexually active raises ANC prevalence relative to all females at that age. The ANC data over-estimate male prevalence, except in the over 30 age groups. For the total population, ANC data over-estimate prevalence below age 25 and under-estimate over age 25. For the entire 15-49 age group these differences cancel out. As a result, ANC prevalence is a reasonable estimate of total prevalence among males and females aged 15-49.

**Figure 2. Comparison of ANC prevalence with general population prevalence for Kisumu, 1998**



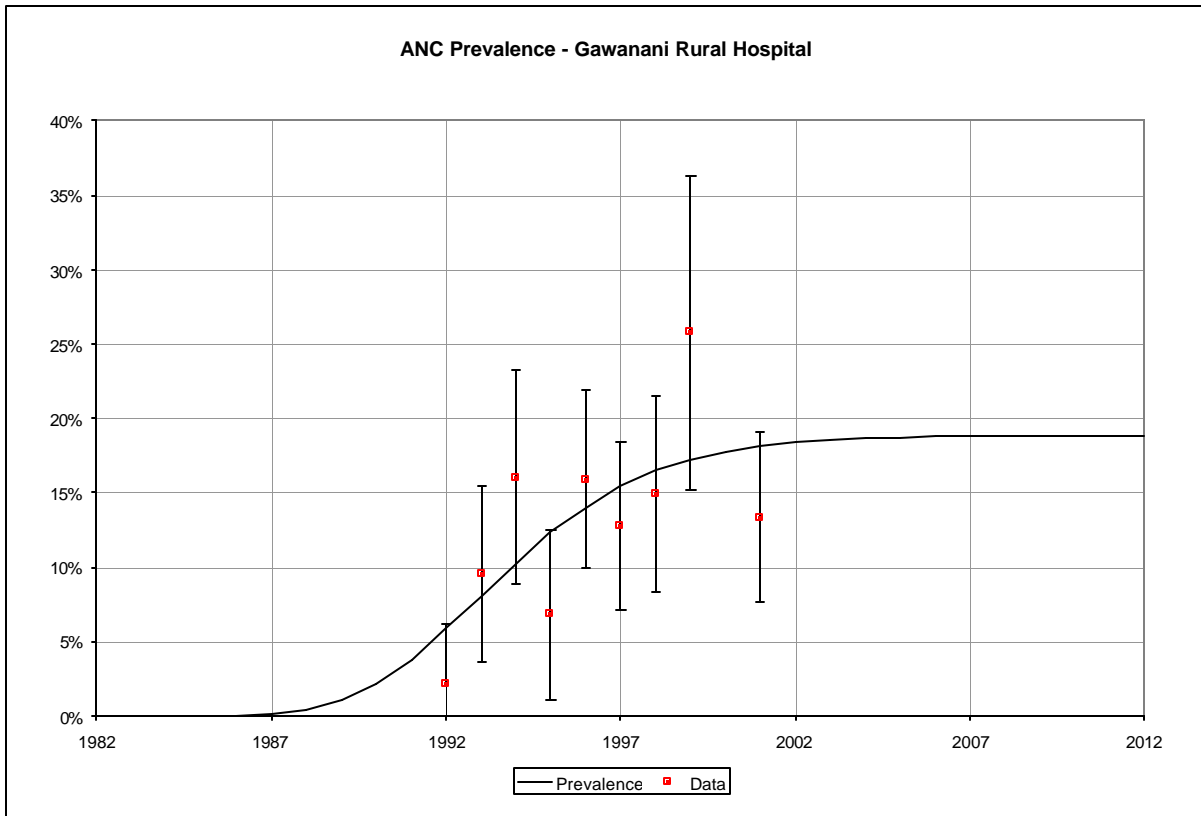
There are no studies in Malawi of HIV prevalence in the general population that can be used to confirm that ANC prevalence is similar to prevalence in the entire 15-49 population. However, the evidence from other sites with mature epidemic is clear. Therefore, in this analysis HIV prevalence among all ANC patients is assumed to be the same as prevalence among all adults 15-49.

## Methodology

There are five major steps in the preparation of the national estimate.

- 1. Curve fitting.** For most sites, surveillance data are available annually from 1994. For some sites data are available for years prior to 1994. The average sample size is about 500-600 for the urban and semi-urban sites and about 150-200 for rural sites. To smooth the fluctuations resulting from small sample sizes, a gamma curve is fit to the sentinel data. The curve indicates the trend through the available data points. Values from these curves (rather than the actual sentinel site point estimates) are used to estimate national prevalence. An example of these curves is shown in Figure 2 for Gawanani Rural Hospital in Machinga District. The projection of these curves to 2012 is meant to indicate the future situation if past trends continue. These projections are not a prediction of what we expect to happen, since we expect that prevention programs will eventually lead to a reduction in HIV prevalence.

**Figure 3. Curve fit to surveillance data for Gawanani Rural Hospital**



These curves have been fit to the data in all 19 sites. The shape of the curve (corresponding to the speed and timing of the epidemic) is determined by the alpha and beta parameters. Small values of alpha represent early and slow epidemics and high values represent later and faster epidemic. Table 1 shows the values for alpha and beta for each site.

**Table 1 Curve Fit Parameters by Sentinel Site**

<i>Site</i>	<i>Region</i>	<i>Type</i>	<i>Years</i>	<i>Alpha</i>	<i>Beta</i>
St. John's	North	Urban	1987-2001	37.8	0.16
Rumphi	North	Semi-urban	1994-2001	8.1	1.00
Nkhata Bay	North	Semi-urban	1994-2001	6.2	1.00
Mbalanchanda	North	Rural	1992-2001	6.5	1.00
Kaporo/Kasoba	North	Rural	1992-2001	11.4	1.00
Lilongwe	Centre	Urban	1987-2001	3.4	2.00
Mchinji	Centre	Semi-urban	1992-2001	9.7	1.00
St. Anne's	Centre	Semi-urban	1994-2001	10.4	1.00
Ntcheu	Centre	Semi-urban	1994-2001	10.5	1.00
Thonje	Centre	Rural	1992-2001	25.9	0.46
Kamboni	Centre	Rural	1992-2001	76.6	0.14
Kasina	Centre	Rural	1994-2001	6.5	1.00
Blantyre (QECH)	South	Urban	1985-2001	7.9	0.84
Mulanje	South	Semi-urban	1992-2001	8.9	1.00
Mangochi	South	Semi-urban	1994-2001	9.8	1.00
Nsanje	South	Semi-urban	1994-2001	14.0	1.00
Milepa	South	Rural	1992-2001	8.2	1.00
Gawanani	South	Rural	1992-2001	11.9	1.00
Mianga	South	Rural	1992-2001	10.0	1.00

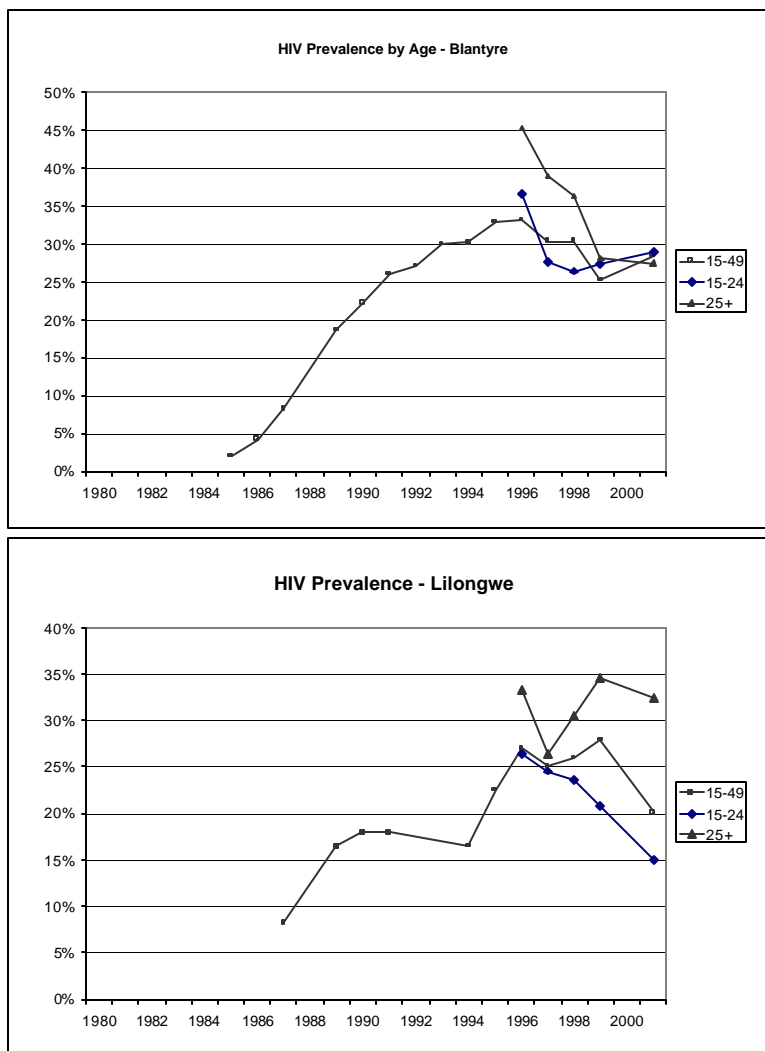
The gamma curve fits well to the data from most sites in Malawi. However, it is not appropriate in situations where prevalence may be declining. There is some evidence that prevalence may be declining slightly in Blantyre and Lilongwe. Therefore, a different model was used to fit the data for these sites. This is a simple epidemiological model recently developed for this purpose by the UNAIDS Reference Group on Estimates and Projections. This model uses four parameters to fit the epidemic: the start year of the epidemic, the force of infection (which governs the speed of the increase in prevalence), the initial fraction of the population at risk (which determines the peak prevalence) and the high-risk replacement factor (which determines the amount of decline in prevalence after the peak).

It is not clear that prevalence is, in fact, declining in Blantyre or Lilongwe. Prevalence in Blantyre was about 33 percent in 1995 and 1996 and has averaged about 29 percent from 1997 to 2001. This apparent decline could be due to random fluctuations in the sample tested or to the effects of migration. If prevalence is declining it could be due behavior change or to an increased number of AIDS deaths among those with the highest risk. Prevalence among 15-24 year old women has not shown a declining trend, so it is

unlikely that prevalence has declined due to behavior change. Prevalence among those 25 years and older has declined from 45 percent in 1996 to about 27 percent in 1999-2001. This could be due to deaths among those with the highest risk.

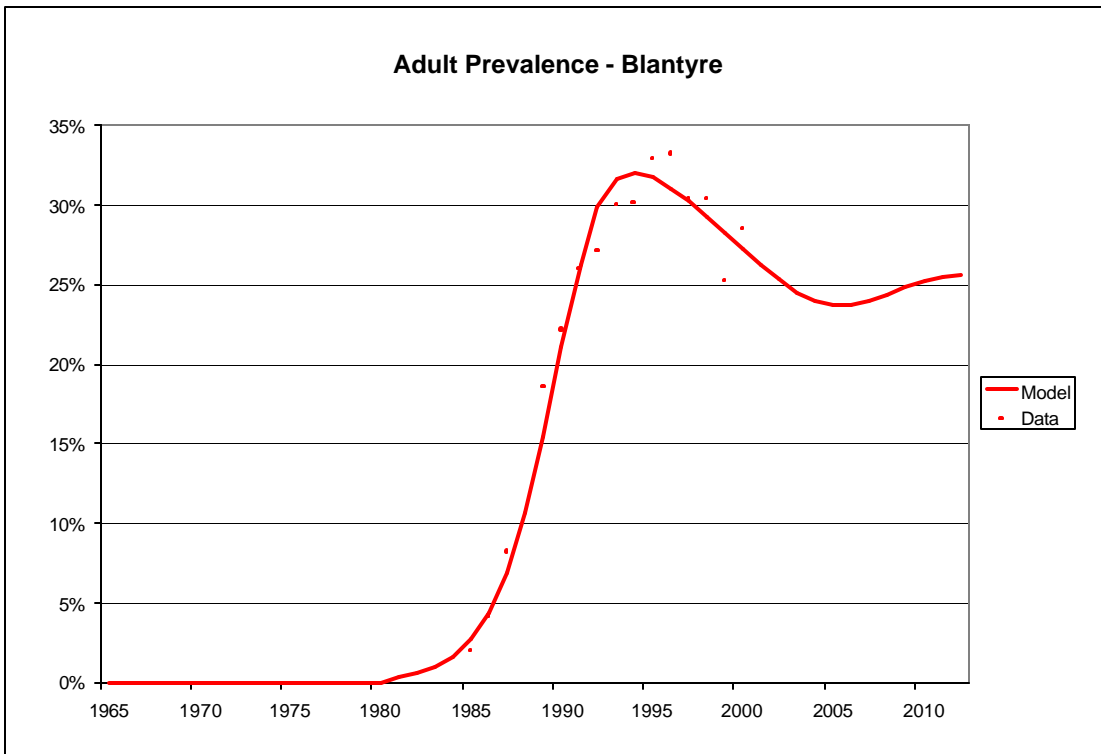
In Lilongwe the 2001 estimate of 20 percent is significantly below the average of 26.5 percent prevalence for 1996 to 1999. This point, by itself, is not enough to conclude that prevalence is declining. However, prevalence among women 15-24 has declined steadily from 22 percent in 1997 to 13 percent in 2001. This could be an indication of safer sexual behavior among youth in Lilongwe. Unlike Blantyre, prevalence among those 25 years and older shows no trend in the past few years.

**Figure 4. Prevalence by age in Blantyre and Lilongwe**

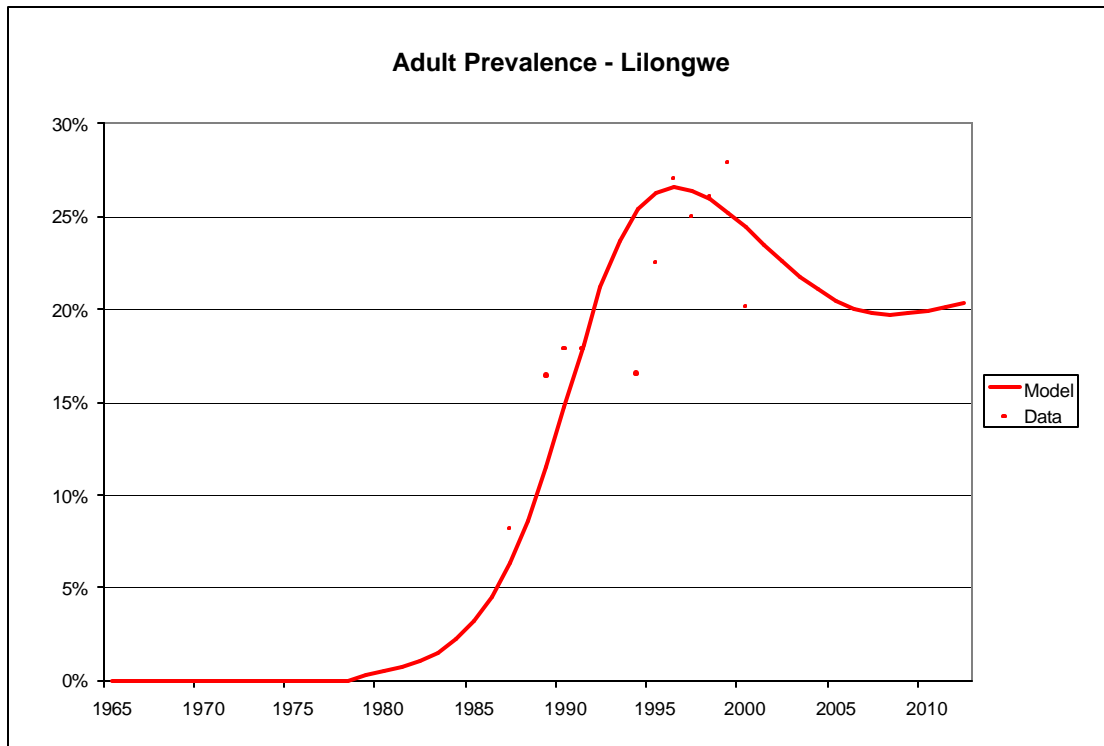


It is not clear why the situation in Blantyre and Lilongwe should be so different. Additional research will be needed to understand whether these trends are real and, if so, why the patterns are so different. Figures 5 and 6 show the application of this model to Blantyre and Lilongwe.

**Figure 5. Model fit to HIV prevalence in Blantyre**



**Figure 6. Model fit to HIV prevalence in Lilongwe**



**2. Adjusting for geographic distribution.** Malawi has 28 districts. It would be impossible to establish an urban and rural sentinel site in each district. Therefore, the prevalence in the urban and rural population in each district is represented by one of the 19 sentinel sites. For each district a sentinel site was chosen to represent the urban population and a site to represent the rural population. This selection was done on the basis of geography and similarity of key characteristics. The characteristics considered are shown in Table 2. Table 3 shows the districts and the sentinel sites that were chosen to represent them. Table 4 provides some of the reasons for the specific assignments.

**Table 2. Characteristics used in assigning sentinel sites to represent districts**

Geographic proximity
Socio-cultural factors (practices, rites)
Development levels (infrastructure, schools, shops, etc.)
Access to major transportation routes (main highways, lake, railroad)
Economic aspects (agriculture, estates, commercial centers, cross-border trade)
Migration (migrant farmers/laborers, cross-border migration, economic opportunity)
Sexual networks
History



**Table 3. Districts and sentinel sites used to represent them**

<i>Region</i>	<i>District</i>	<i>Urban site</i>	<i>Rural site</i>
North	Chitipa	Kasoba/Kaporo	Mbalachanda-Kaporo
	Karonga	Nkhata Bay	Kasoba/Kaporo
	Rumphi	Rumphi	Mbalachanda
	Nkhata Bay	Nkhata Bay	Mbalachanda-Kaporo
	Mzimba	Rumphi	Mbalachanda
	Mzuzu City	St. John's	St. John's
	Likoma	Nkhata Bay-Kaporo	Nkhata Bay-Kaporo
	Central	Kasungu	Mchinji
Nkhotakota		Nkhotakota	Kamboni
Ntchisi		Thonje-Mchinji	Thonje
Dowa		Mchinji	Thonje
Salima		Mchinji-Nkhotakota	Nkhata Bay-Kaporo
Lilongwe		Lilongwe	Kasina
Mchinji		Mchinji	Kamboni
Dedza		Ntcheu	Kasina
Ntcheu		Ntcheu	Kasina
South		Mangochi	Mangochi
	Machinga	Mangochi	Gawanani
	Balaka	Mangochi-Ntcheu	Gawanani
	Zomba	Blantyre	Gawanani-Milepa
	Chiradzulu	Mulanje	Milepa
	Blantyre	Blantyre	Milepa-Mianga
	Mwanza	Mchinji	Gawanani
	Thyolo	Mulanje	Mianga
	Mulanje	Mulanje	Mianga
	Phalombe	Milepa	Milepa
	Chikwawa	Nsanje	Milepa-Mianga
	Nsanje	Nsanje	Milepa-Mianga

**Note:** Where two sites are listed, such as Milepa/Mianga, the average prevalence in the two sites is used.

**Table 4. Reasons for assigning sites to districts**

<b>District</b>	<b>Urban Site</b>	<b>Rural Site</b>
<b>North</b>		
Chitipa	Kaporo Geographic proximity; similar in size, culture & development level	Mbalachandra-Kaporo Mbalachandra: Similar proximity to & cross-border activity with Zambia Kaporo: Similar in culture & proximity to & cross-border activity with Tanzania
Karonga	Nkhata Bay Similar in culture, social-economic activities; cross-border trade	Kaporo*
Rumphi	Rumphi*	Mbalachanda Similar in culture, agricultural activities & level of development
Nkhata Bay	Nkhata Bay*	Mbalachandra-Kaporo Mbalachandra: Geographic proximity; similar in culture, agricultural practices & economic activity Kaporo: Similar lake-related economic activities
Mzimba	Rumphi Similar in size, population & level of economic & social activity	Mbalachanda*
Mzuzu City	St. John's Hospital*	
Likoma	Nkhata Bay-Kaporo Similar to both sites in culture, population size & lake-related economic activities; frequent contact with Nkhata Bay	Nkhata Bay-Kaporo Similar to both sites in culture, population size & lake-related economic activities; frequent contact with Nkhata Bay
<b>Central</b>		
Kasungu	Mchinji Similar in culture/language, agricultural practices, commerce & road networks	Kamboni*
Nkhotakota	St. Anne's Hospital*	Kamboni Similar culture & agricultural

<b>District</b>	<b>Urban Site</b>	<b>Rural Site</b>
		practices
Ntchisi	Thonje-Mchinji Thonje: Similar in development level, schools & recreational activities Mchinji: Similar in culture, agricultural practices & commerce	Thonje Similar in development level, schools & recreational activities
Dowa	Mchinji Similar urban area, commerce & along busy transportation route,	Thonje*
Salima	Nkhotakota-Mchinji Nkhotakota: Similar in culture, religion & lake-related activities Mchinji: Similar transportation route, commerce activities & culture for western half of district	Kamboni- Thonje Kamboni: Similar in culture & agricultural activities Thonje: Similar in development level & recreational activities
Lilongwe	Lilongwe Central Hospital*	Kasina Similarly very rural; similar in culture, social & agricultural activities
Dedza	Ntcheu Similarly located on border along same highway, similar in agricultural & trade activities & economic migration	Kasina Similarly rural; similar in culture & agricultural activities
Ntcheu	Ntcheu*	Kasina Similarly rural; similar in culture & agricultural activities
Mchinji	Mchinji*	Kamboni Similar in culture, level of development, agricultural activities
<b>South</b>		
Mangochi	Mangochi*	Gawanani
Machinga	Mangochi	Gawanani
Balaka	Mangochi-Ntcheu	Gawanani
Zomba	Blantyre	Gawanani-Milepa
Chiradzulu	Mulanje	Milepa

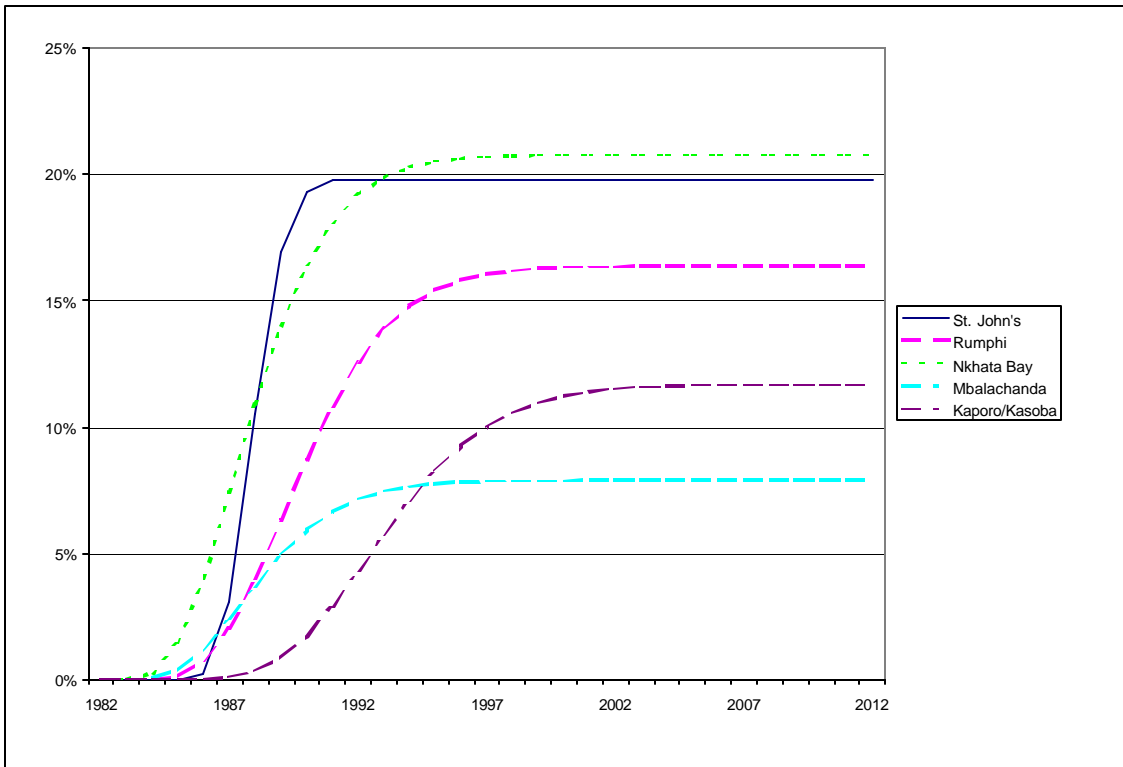
District	Urban Site	Rural Site
Blantyre	QECH	Milepa-Mianga
Mwanza	Mchinji Similar in cross-border trade & proximity to urban center	Gawanani
Thyolo	Mulanje Similar agri-estates	Mianga
Mulanje	Mulanje*	Mianga
Chikwawa	Nsanje Geographical proximity; similar in culture	Milepa-Milanga
Nsanje	Nsanje*	Milepa-Milanga
Phalombe	Milepa	Milepa

3. **Estimating the size of the adult population.** The report of the 1998 census (*1998 Population and Housing Census, Report of Final Census Results*, National Statistical Office, Zomba, December 2000) provides the total urban and rural population in each district in 1998 and 1987 and the population growth rates between the censuses in 1977, 1987 and 1998. These data are used to estimate the size of the urban and rural population in each district by year from 1982 to 2012. The growth rate is assumed to remain constant, at the 1987-1998 value, after 1998 in all but seven districts. In Dedza, Ntcheu, Mangochi, Thyolo, Mulanje, Chikwawa and Nsanje the regional average growth rate is used for 1998-2012 because the 1978-1988 growth rates were judged to be abnormally low due to migration. The population 15-49 by district is calculated from the proportion of the total population that is 15-49 in the 1998 census.
4. **Estimating the number of adults infected.** The number of people infected with HIV in each district is estimated separately for the urban and rural populations and then summed. For both the urban and rural populations the number of people infected is calculated by multiplying the number of people between the ages of 15 and 49 by the estimated and projected HIV prevalence for the chosen surveillance site.
5. **Estimating HIV prevalence.** HIV prevalence among adults is calculated by dividing the number of people infected with HIV by the size of the population between the ages of 15 and 49.

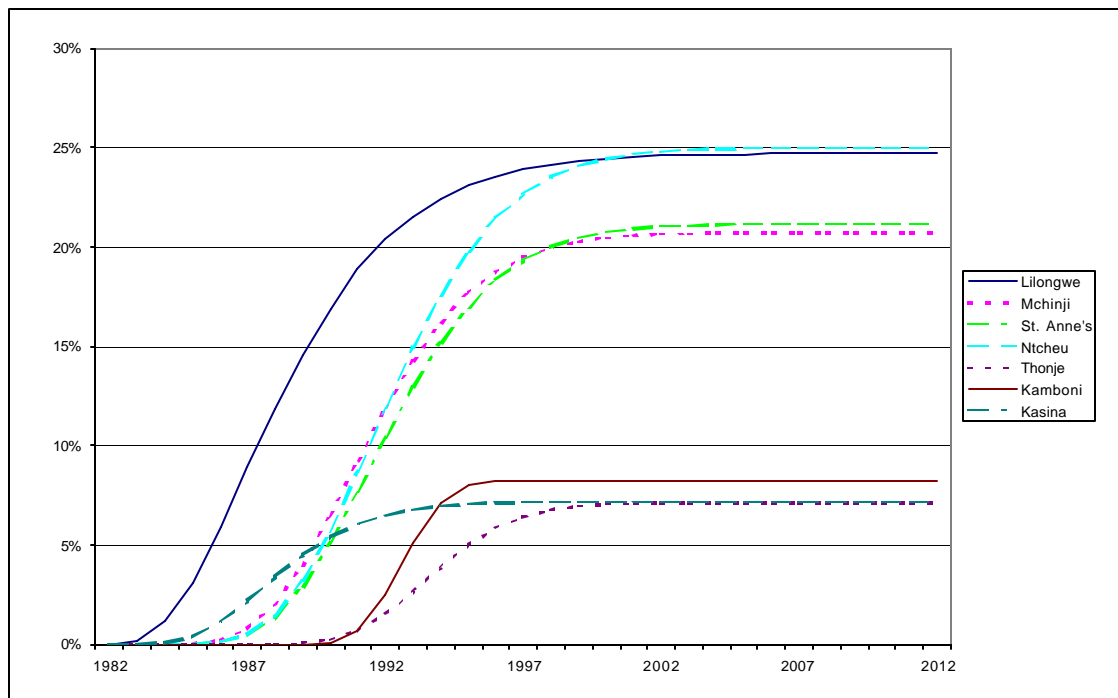
## Results

The results of applying this methodology to the sentinel surveillance data are shown in Figures 4 to 8. Figures 4, 5 and 6 show the estimated and projected prevalence by site for the North, Centre and South. Figure 7 shows adult prevalence for the total, urban and rural populations. Prevalence for the entire adult population is estimated to be about 14 percent in 1998 and to increase slowly to about 16 percent by 2012. In 1998, prevalence is considerably higher in urban areas (26 percent) than in rural areas (12 percent). Figure 8 shows prevalence by region. It is highest in the South (18 percent), about 11 percent in the Centre and lowest in the North (9 percent).

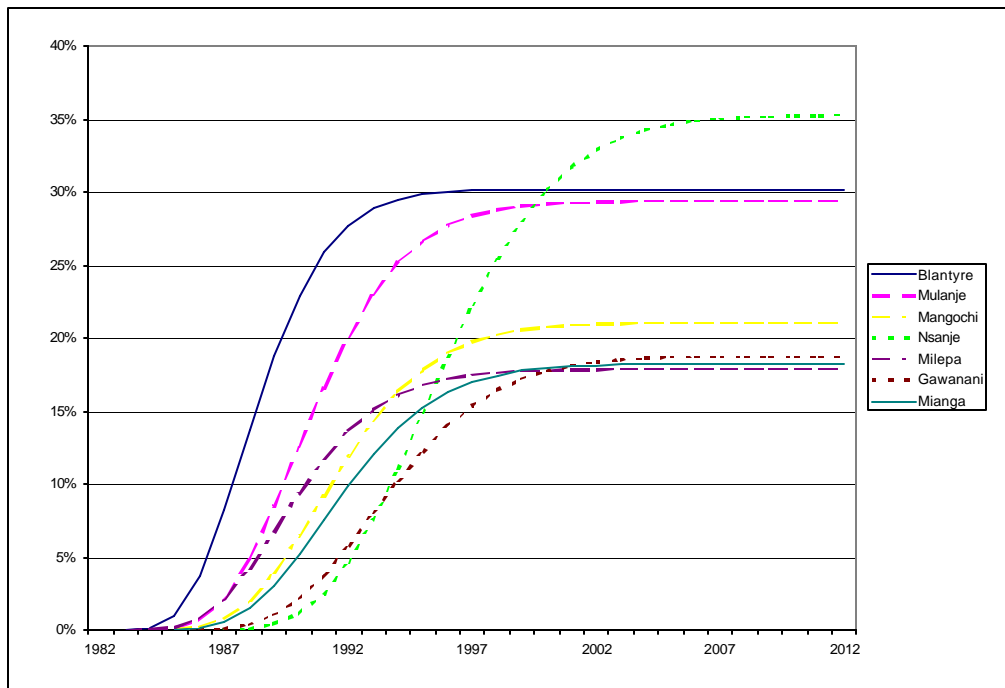
**Figure 7. Adult (15-49) HIV Prevalence at Surveillance Sites in the North**



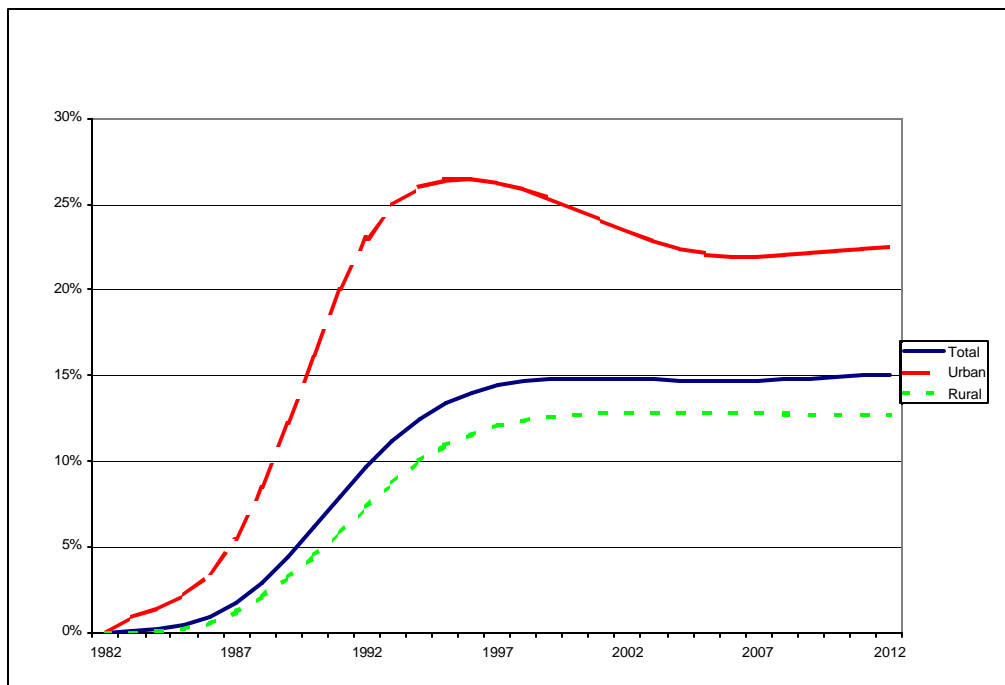
**Figure 8. Adult (15-49) HIV Prevalence at Surveillance Sites in the Centre**



**Figure 9. Adult (15-49) HIV Prevalence at Surveillance Sites in the South**



**Figure 10. Estimate of national adult prevalence by place of residence**



**Figure 11. Adult HIV Prevalence by Region**

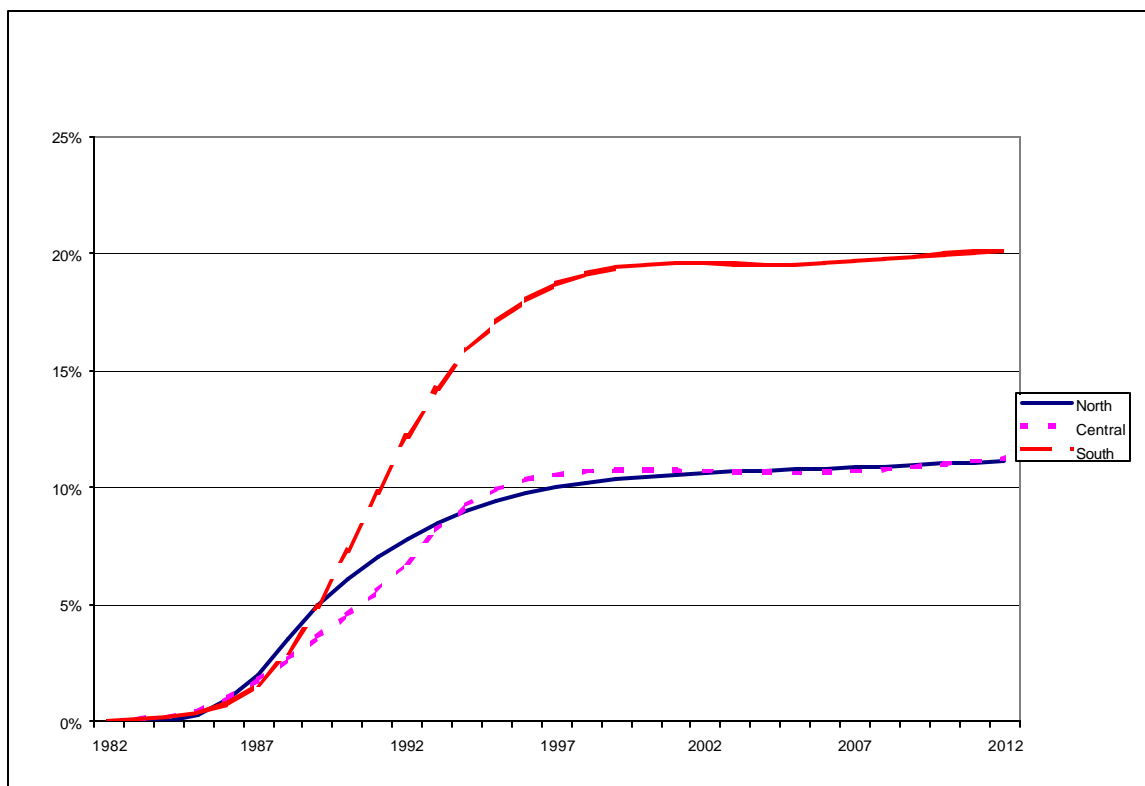


Table 4 shows the implications of these prevalence estimates for 2001. Adult HIV prevalence is estimated at about 15 percent for Malawi, 25 percent in urban areas and 13 percent in rural areas. The total number of adults infected with HIV is about 740,000. When infected children and adults over the age of 50 are included, the total number of people infected with HIV in Malawi is about 845,000.

**Table 5. National HIV estimates for 2001**

Indicator	Value
National adult (15-49) prevalence	15%
Number of infected adults (15-49)	739,000
Urban adult prevalence	25%
Number of infected urban adults	224,000
Rural adult prevalence	13%
Number of infected rural adults	516,000
Number of infected children	65,000
Number infected over age 50	41,000
Total HIV+ population	845,000



District estimates of numbers of adults 15-49 infected are shown in Table 5.

**Table 6. Estimates of adults 15-49 infected with HIV by district, 2001**

<i>Region</i>	<i>District</i>	<i>HIV+ Adults</i>	
North	Chitipa	5,700	
	Karonga	12,200	
	Rumphi	5,900	
	Nkhata Bay	8,300	
	Mzimba	20,700	
	Mzuzu City	11,100	
	Likoma	600	
	Central	Kasungu	23,300
Central	Nkhotakota	11,100	
	Ntchisi	6,100	
	Dowa	15,300	
	Salima	20,100	
	Lilongwe	98,200	
	Mchinji	14,100	
	Dedza	17,600	
	Ntcheu	12,800	
	South	Mangochi	53,700
	South	Machinga	32,200
Balaka		22,100	
Zomba		53,200	
Chiradzulu		20,300	
Blantyre		115,000	
Mwanza		12,100	
Thyolo		40,800	
Mulanje		37,800	
Phalombe		19,500	
Chikwawa		32,000	
Nsanje	16,500		
North		64,700	
Central		218,700	
South		456,000	
Total		739,300	

## **Spectrum Projections**

The HIV prevalence estimates have been used with the Spectrum model to project the consequences of these figures. Two modules of Spectrum have been used, DemProj and AIM. DemProj projects the population by age and sex and displays a full range of demographic indicators while AIM calculates the number of people infected with HIV, AIDS cases, AIDS deaths, AIDS orphans and other consequences of AIDS.

The demographic projection is based on the census of 1977, 1987 and 1998. The population by age and sex in the base year (1982) is from the population projection reported in "Malawi Population Census, 1977, Analytical Volume, Vol. II." The basis for the other demographic inputs is as follows:

Total fertility rate and age distribution of fertility:

1982: Family Formation Survey, 1984

1984: Family Formation Survey, 1984;

1991: Demographic and Health Survey

1999: Demographic and Health Survey

2000-2012: Population and Housing Census 1987, Volume VII, Analytical Report

Life expectancy:

1982-2000: "Malawi Population Census, 1987, Analytical Report, Volume VII."

2000-2012: Life expectancy is assumed to increase at 1 year every five years.

Sex ratio at birth: Calculation based on 1998 census.

International migration: The effect of international migration is assumed to be zero. The projection begins in 1982, before the Mozambique refugee immigration/emigration of 1986 - 1995.

The HIV/AIDS assumptions were derived as follows:

Adult HIV prevalence: from this report

Start year of epidemic: assumed to be about 1982 since the first AIDS cases were identified in 1985.

Incubation period: Following UNAIDS recommendations the median time from infection to AIDS for adults is assumed to be about 8 years. This is consistent with the medium incubation period for adults. For children, the fast incubation period is used.

The age distribution of HIV prevalence: Calculated from surveillance data for females "Sentinel Surveillance Report 1998" Table 8. For males the ratios are calculated from the distribution of reported AIDS cases, "AIDS Cases Surveillance 1998 Report" adjusted five years younger to account for the lag from HIV to AIDS.

The results of the Spectrum projections are shown in Tables 5 and 6.

**Table 7 Key demographic indicators from the Spectrum projection, 1982-2012**

	<i>1982</i>	<i>1987</i>	<i>1992</i>	<i>1997</i>	<i>2002</i>	<i>2007</i>	<i>2012</i>
<b>Fertility</b>							
Input TFR	7.60	7.21	6.66	6.44	6.08	5.64	5.20
Calculated TFR	7.60	7.18	6.45	6.10	5.74	5.33	4.91
Child-woman ratio	0.88	0.87	0.82	0.77	0.75	0.73	0.70
<b>Mortality</b>							
Male LE	40.5	45.9	46.4	41.0	39.7	40.8	42.1
Female LE	43.6	48.1	48.3	41.6	38.9	40.2	41.5
Total LE	42.1	47.1	47.4	41.3	39.3	40.5	41.8
IMR	171.8	138.4	119.7	113.6	105.5	97.5	90.1
U5MR	257.8	206.6	178.9	177.5	168.3	156.1	145.1
<b>Vital Rates</b>							
CBR per 1000	54.0	49.9	44.7	43.0	41.7	39.9	37.7
CDR per 1000	24.0	18.7	16.3	18.7	19.7	18.7	17.7
RNI percent	3.00	3.12	2.83	2.43	2.19	2.12	2.00
<b>Annual births and deaths (Thousands)</b>							
Births	348.69	376.73	392.51	431.03	468.14	499.54	524.21
Deaths	155.10	141.28	143.62	187.31	221.64	234.27	245.87
<b>Population (Millions)</b>							
Total population	6.45	7.54	8.78	10.02	11.24	12.53	13.90
Male population	3.12	3.66	4.29	4.92	5.55	6.23	6.94
Female population	3.33	3.88	4.49	5.10	5.69	6.30	6.95
Percent 0-4	20.10	19.56	18.42	17.55	17.33	16.90	16.28
Percent 5-14	27.22	28.66	29.68	29.28	28.36	27.87	27.64
Percent 15-49	43.62	43.05	43.29	44.64	45.88	46.91	47.81
Percent 15-64	50.12	49.27	49.40	50.66	51.75	52.64	53.46
Percent 65 and over	2.56	2.51	2.49	2.51	2.56	2.59	2.62
Sex ratio	93.86	94.46	95.45	96.37	97.59	98.82	99.85
Median age	16	16	16	16	17	17	18

**Table 8. Key HIV/AIDS indicators from the Spectrum projection, 1982-2012**

	<i>1982</i>	<i>1987</i>	<i>1992</i>	<i>1997</i>	<i>2002</i>	<i>2007</i>	<i>2012</i>
HIV population (Millions)							
Total	0.00	0.06	0.41	0.74	0.89	1.00	1.15
Males	0.00	0.03	0.19	0.33	0.40	0.45	0.52
Females	0.00	0.02	0.21	0.41	0.49	0.55	0.62
Adult prevalence (%)	0.0	1.7	9.5	14.3	14.7	14.6	15.0
New AIDS cases (Thousands)							
Total	0.00	0.66	14.65	54.90	82.70	92.24	103.07
Males	0.00	0.41	7.69	25.78	37.03	41.90	47.24
Females	0.00	0.25	6.96	29.13	45.68	50.34	55.83
Annual HIV+ births (Thousands)							
Total	0.00	1.23	9.44	17.33	19.69	20.96	22.52
Percent	0.00	0.33	2.41	4.02	4.21	4.20	4.30
Annual AIDS deaths (Thousands)							
Total	0.00	0.45	12.04	50.58	81.05	91.34	101.82
Males	0.00	0.28	6.38	23.94	36.33	41.42	46.65
Females	0.00	0.17	5.66	26.64	44.72	49.92	55.18
Per thousand	0.00	0.06	1.37	5.05	7.21	7.29	7.33
Cumulative AIDS deaths (Millions)							
Total	0.00	0.00	0.03	0.20	0.55	0.99	1.48
Males	0.00	0.00	0.02	0.10	0.26	0.46	0.68
Females	0.00	0.00	0.01	0.10	0.29	0.53	0.80

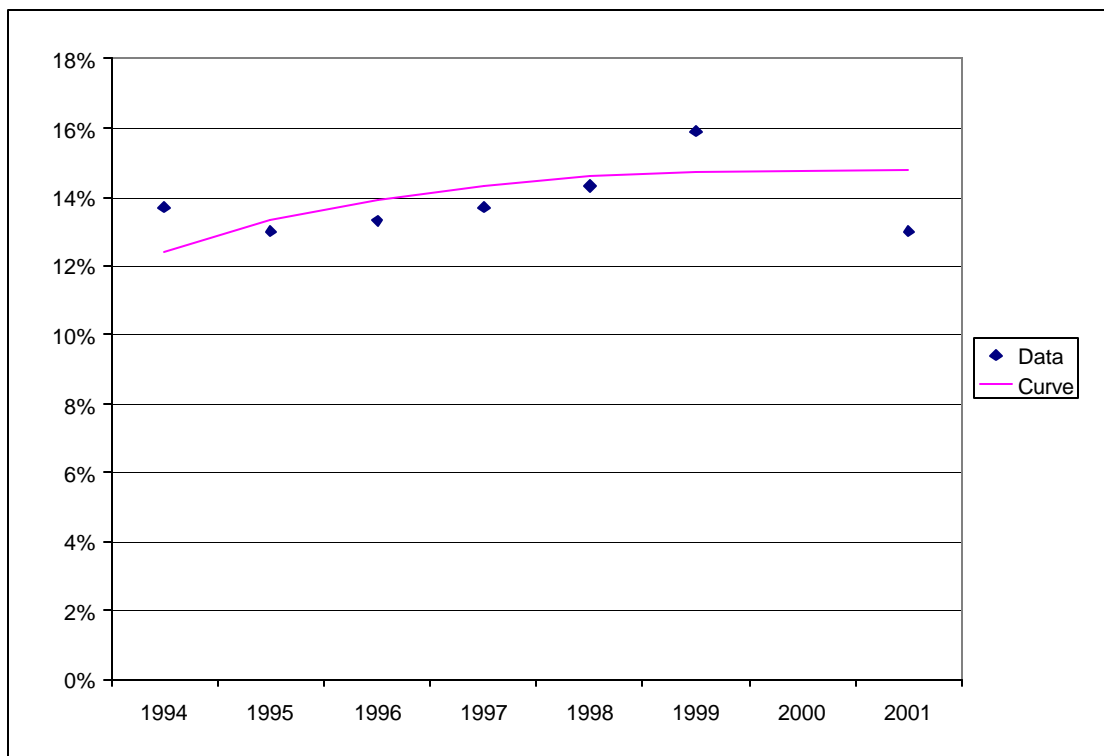
## Is there any evidence that HIV prevalence has started to decline in Malawi?

The methodology described here involved fitting curves to the actual surveillance points in order to smooth out random fluctuations. This approach could mask a decline in prevalence since the gamma curves would not reflect this decline. Figure 11 compares the smooth prevalence curve generated by this approach with the prevalence that would be calculated by using the exact prevalence estimates for each site and weighting them according to this methodology. The data point for 2001 is clearly below the trend. This could be because prevalence is starting to decline or it could be due to random fluctuations from year to year.

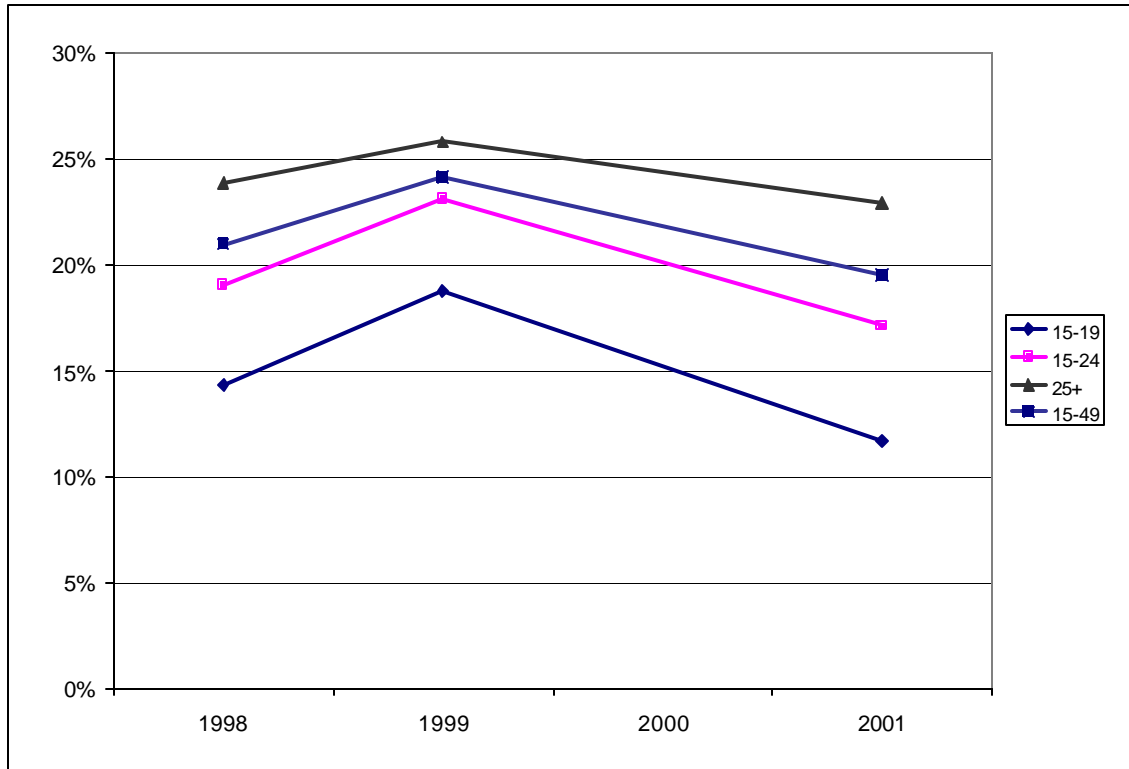
Prevalence could decline for several reasons including a high death rate among older adults and behavior change among young adults. An early indicator of behavior change is

prevalence in the youngest age groups. As noted earlier, prevalence is declining among 15-19 and 20-24 year olds in Lilongwe. However, there is no similar decline in Blantyre. Figure 12 shows the trend in prevalence by broad age groups for the entire sample. There is no special decline in the youngest age groups. Examination of similar trends for specific sites reveals no clear trend in declining prevalence in the younger age groups except for Lilongwe. Thus, there is some evidence of behavior change in Lilongwe but not elsewhere. This result needs to be confirmed by examining other evidence of behavior change (increase in condom use, reduction in the number of partners, later age at first sexual activity) before firm conclusions can be drawn.

**Figure 12. National prevalence calculated according to exact estimates by site and curve fits**



**Figure 13. Trends in prevalence by age for the entire surveillance sample**



## Appendix. List of Participants

### EXPERT GROUP ON HIV/AIDS PROJECTIONS (AIM WORKSHOP)

*CAPITAL HOTEL, 2-3 MAY 2001*

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