

The Demographic Impact of HIV/AIDS in South Africa



National Indicators for 2004

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Disease
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The Actuarial
Society of
South Africa

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This report can be downloaded from the following websites:

www.commerce.uct.ac.za/care

www.mrc.ac.za/bod

www.assa.org.za

Executive Summary

Just over 5 million people out of a total 46 million South Africans were HIV positive in 2004, giving a total population prevalence rate of 11%. This is estimated from the ASSA2002 demographic and AIDS model which is based on a thorough analysis of a range of epidemiological and demographic data including the antenatal surveys up to the year 2002. Compared with previous models, the impact of HIV/AIDS has been revised downwards as better epidemiological data has emerged. The new model also allows for several behaviour and treatment interventions and a plausible pace of implementation is used as the default scenario for future projections.

These projections suggest that ART could, even at this late stage, reduce the number of AIDS deaths per year. Without ART we would have expected some 495 000 deaths due to AIDS in 2010, with ART this will be reduced to approximately 380 000 – a difference of about 100 000 deaths in a year. There is uncertainty about the coverage of the ART roll-out and the number of deaths in 2010 could be anything between 290 000 and 450 000. With the default scenario of the interventions, life expectancy is projected to fall to just under 50 years compared with the previous estimate of 43 years.

The life expectancy in 2004 is estimated to be 48.5 years for males and 52.7 years for females and the Infant Mortality Rate is estimated to be 56 per 1000 live births. There are a total of 1.1 million orphans (maternal orphans under the age of 18 years) of which just over 250 000 were newly orphaned in 2004. On the assumptions in the model it is estimated that about 500 000 people were in need of treatment. By October 2004, 19 500 people were receiving ART in the public sector.

The distribution of male condoms has increased and reached 302 million by 2003 and in addition 0.19 million female condoms were distributed in that year. Other indicators of prevention are sadly lacking. The proportion of facilities providing PMTCT increased from 20% in 2002 to 52% in 2003 but no information could be obtained on the number of mothers who have received this intervention or the impact that it is having. The Department of Health has reported increases in the number of people being counselled for testing from 412 696 in 2002/3 to 690 537 in 2003/4.

The population growth rate has been affected by HIV/AIDS and although falling is not expected to become negative. It is estimated to be about 0.8% in 2004 and is projected to fall still further to around 0.4% in the years beyond 2011.

Further developments of the ASSA model are underway to provide provincial estimates and to estimate bounds of uncertainty around key indicators. In the meanwhile, these indicators for 2004 and the projections from 1990 – 2015 highlight the urgent need to strengthen our efforts to respond to the epidemic and should be used to guide planning the response.

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Glossary

AIDS	Acquired Immune Deficiency Syndrome
ART	Antiretroviral therapy
ARV	Antiretroviral
ASSA	Actuarial Society of South Africa
BMR	Bureau of Market Research
DBSA	Development Bank of South Africa
CARE	Centre for Actuarial Research, University of Cape Town
DoH	Department of Health
HIV	Human immuno-deficiency virus
HIV+	Positive for Human immuno-deficiency antibodies
HSRC	Human Sciences Research Council
IEC	Information, education and communication
IFR	Institute for Futures Research
IMR	Infant mortality rate, the probability that a newborn dies before reaching age 1, q_0 (usually expressed as number dying out of 1 000 newborns)
PMTCT	Prevention of mother to child transmission
MRC	Medical Research Council
Stats SA	Statistics South Africa
STD	Sexually transmitted disease
STI	Sexually transmitted infection
UNAIDS	The Joint United Nations Programme on HIV/AIDS
UNICEF	United Nations Children's Fund
U5MR	Under five mortality rate, the probability that a newborn dies before reaching age 5, ${}_5q_0$ (usually expressed as number dying out of 1 000 newborns)
VCT	Voluntary counselling and testing
WHO	World Health Organisation
45Q15	The probability of a 15-year old dying before reaching age 60, ${}_{45}q_{15}$ (usually expressed in this report as a percentage)

Introduction

As we enter the third decade of the global HIV epidemic and the second decade of the major heterosexual epidemic affecting the Southern African region, government and other role-players need reliable estimates of the impact of the epidemic and the possible course that it could take in South Africa in order to respond more effectively.

The demographic model of the Actuarial Society of South Africa (ASSA) uses a wide range of empirical evidence from different sources to provide estimates of the progression of the epidemic and the numbers of South Africans directly affected. The latest version of the model, ASSA2002, became available in 2004 and is calibrated to data including the antenatal clinic survey results¹ and deaths from the population register². The most recent year for which these were available at the time of release was 2002, hence the date in the name.

The ASSA2002 model predicts that some five million South Africans were infected with HIV in mid-2004. This is about a third lower than estimates produced using the earlier version of the model. The drop in the estimates is due mainly to improvements to the model to incorporate more up-to-date evidence about the relationship between antenatal prevalence and general population prevalence in South Africa. This relationship is different from that observed in other African countries, where fertility levels, particularly at the younger ages, are higher than in South Africa. However, it is also due in part to the fact that the new model allows for interventions that have been in place for some years (such as increasing use of condoms and improved treatment of sexually transmitted diseases (STDs)) as well as newer interventions such as programmes to prevent mother-to-child-transmission. The ASSA2002 model also differs from the earlier version in that it allows for the introduction of antiretroviral treatment programmes, which will improve survival of those infected.

These downward revisions are not unique to ASSA. Estimates by UNAIDS also overstated the extent of the epidemic. The UNAIDS estimates for 2003 and 2004, not only for South Africa, have been revised down as more empirical data have become available. However, even these revised numbers indicate that the epidemic is the largest that we have ever experienced and that responding to the epidemic poses major challenges to governments and societies. By the start of 2004, the UNAIDS model predicts 5.6 million³ infected people in South Africa, as against the 4.9 million estimated by ASSA2002 at that point.

¹ Department of Health. 2003. National HIV and Syphilis antenatal sero-prevalence survey in South Africa - 2002.

² Provided by the Department of Home Affairs as part of the Rapid Mortality Surveillance project run by the Burden of Disease Unit, MRC in collaboration with the Centre for Actuarial Research, UCT.

³ UNAIDS. 2004. 2004 Report on the Global AIDS Epidemic. (The number they publish for "adults and children" is 5.3 million and excludes adults over 49, who are estimated to number another 300 000.)

Uncertainty about the true number is inevitable. However, this does not mean we can ignore all estimates. Planning in all sectors, and not only the health sector, must take the impact of HIV/AIDS into account. In this report, the ASSA2002 model is used to estimate the impact of HIV/AIDS epidemic on key indicators for mid-2004 in South Africa and give guidance on the numbers of people affected. These model based indicators are complemented with data for selected prevention and treatment activities in the health sector at a national level. The model is used to assess the potential impact of the ART roll-out and the age groups in which new infections will occur.

The estimates provided in this report are for the calendar year 2004. In respect of 'stock' variables, which reflect the number at a particular time, the estimates are the same as those provided by the ASSA2002 model, as the latter provides estimates for the middle of the year. So, for example, the estimate of the number of people who are sick with AIDS in 2004 is the same in this report as in the ASSA2002 model. In respect of 'flow' variables, such as births, deaths and new infections, which reflect the number occurring over a period, the estimates from the ASSA2002 model cover the period from the middle of one calendar year to the middle of the next, while the estimates in this report are for the calendar year 2004. There will thus be a difference between the estimates of 'flow variables' produced when one runs the ASSA2002 model and those reported in this report.

ASSA2002 AIDS and Demographic Model

The ASSA2002 model extends the 'behavioural cohort component projection' ASSA2000 model⁴, by calibrating to fit additional data and allowing for the impact of interventions. In particular, in terms of additional data, the results of two more annual antenatal clinic surveys were available, as well as more recent death data from the Department of Home Affairs and data from the Human Sciences Research Council survey on HIV prevalence in households⁵.

In respect of interventions, five interventions are modelled in ASSA2002, namely:

- information and education campaigns,
- improved treatment of sexually transmitted diseases,
- voluntary counselling and testing,
- mother-to-child transmission prevention, and
- antiretroviral treatment.

This makes the model more relevant, since both the public and private sectors are implementing various interventions.

The model of the heterosexual epidemic has also been refined to take into account additional behavioural and epidemiological processes. Assumptions about the impact of HIV on fertility and the relative levels of HIV prevalence in

⁴ Dorrington et al, 2002. HIV/AIDS profile of province of South Africa: Indicators for 2002.

⁵ Shisana O, Simbaya L. 2002. South African National HIV Prevalence, Behavioural risks and Mass Media Household Survey of 2002.

women using private and public antenatal services have been improved, to allow for smaller differences in HIV prevalence between the public and private sector, and bigger differences between antenatal prevalence and the prevalence of the overall population than previously assumed. The transmission from an infected mother to her newborn child and the survival assumptions have also been adjusted to accord with new empirical data. Entry into the sexually experienced population is phased in up to the age of 25, an improvement on the previous simpler assumption that everybody becomes sexually active at the age of 15, but with a low average level of sex activity. Individuals over the age of 14 who are not yet sexually active are assumed not to be exposed to the risk of HIV infection. The probability of HIV infection in young women, per act of intercourse with an infected partner, is assumed to be highest for sexual activity at the lowest ages, then to decrease with age up to 25, and remain constant at ages above 25, in line with empirical evidence

The model now produces estimates of the number of HIV-infected people in the different stages of disease. In the absence of antiretroviral treatment, adults are assumed to progress through four stages of disease before dying from AIDS. These four stages correspond to those defined in the WHO Clinical Staging System⁶. The effects of antiretroviral treatment (ART) are modelled by introducing a further two stages, which represent people receiving treatment and people who have started treatment but subsequently discontinued treatment. Descriptions of these six disease states are given in Table 1. The first two stages are largely asymptomatic. Symptoms occur more frequently in stage 3, and include weight loss and oral infections. People in stage 4 experience a range of more severe conditions, such as pneumonia, extrapulmonary TB and wasting syndrome. These conditions are referred to collectively as AIDS. The model estimates that currently roughly 11% of people with HIV (i.e. over half a million South Africans) are sick with AIDS.

Table 1. Stages of HIV/AIDS used in ASSA2002

Stage	Description
1	WHO stage 1: Acute HIV infection
2	WHO stage 2: Early disease
3	WHO stage 3: Late disease
4	WHO stage 4: AIDS
5	Receiving antiretroviral treatment
6	Discontinued antiretroviral treatment

Most of the estimates provided in this report are derived from the default scenario. In the default scenario it is assumed that all five interventions described above are introduced, but at different times and at different rates of phase-in. The effects of each intervention in terms of the key epidemiological parameters in the model are shown in Table 2, as well as the default assumptions about rates of phase-in. It is assumed that all individuals

⁶ WHO International Collaborating Group for the study of the WHO Staging System (1993) Proposed 'World Health Organization staging system for HIV infection and disease': preliminary testing by an international collaborative cross-sectional study. *AIDS*. 7: 711-718

participating in a prevention of mother-to-child transmission (PMTCT) or ART programme would receive counselling and testing prior to joining the programme. The behavioural changes that occur under VCT are therefore assumed also to occur under PMTCT and ART scenarios. Improved STD treatment lowers the probability of HIV transmission, because other STDs enhance the risk of HIV transmission when present in either the HIV-negative or HIV-positive partner. Antiretroviral treatment also lowers the probability of HIV transmission, because this treatment lowers the concentration of HIV in the body, and hence renders recipients less infectious. However, those on treatment survive longer and hence could infect more people in future unless efforts are undertaken to ensure less risky behaviour once on treatment.

Table 2. Summary of the interventions in ASSA2002 and the default scenario assumptions

Intervention	Condom usage	Frequency of sex	Probability of sexual transmission	Probability of mother-to-child transmission	Survival with HIV	Assumption for default scenario
IEC and social marketing	✓					From 3% in 1994 to 95% coverage over 10 years
Improved STD treatment			✓			From 10% in 1994 to 95% over 10 years
VCT	✓	✓				From 5% in 1995 to 50% over 9 years
PMTCT	✓	✓		✓		From 10% in 2001 to 90% over 5 years
Antiretroviral treatment	✓	✓	✓		✓	From 2% in 2000 to 50% over 10 years

The model has been developed for each of the nine provinces but the projections are still to be finalized. This report therefore provides only national estimates derived from the lite version of the model.

Website

The tables on the following pages provide a summary of indicators which show where South Africa stands in 2004. The ASSA2002 model is publicly available on ASSA's website (<http://www.assa.org.za/default.asp?id=100000050>) and could be useful for a wide variety of users, including demographers, government, those who make decisions on health policy, economists, actuaries, health care professionals, academics researching HIV/AIDS, underwriters and journalists. Further charts and tables are available on the website.

Potential Impact of Antiretroviral Treatment (ART)

The projections show that interventions have had and are having a significant impact on the course of the epidemic. The PMTCT programme has reduced the number of babies infected and behaviour change, in particular, has seen an increase in condom use and has reduced the number of adults infected. The national ART programme can be expected to play a particularly important role in the future outcome of the epidemic. For example, as shown in Figure 1, the model projects that by 2010, there are likely to be roughly 381 000 AIDS deaths per annum rather than the 495 000 that would have been expected if no ART programmes were introduced. In the default scenario, it is assumed that ultimately only about half of South Africans who need ART will be able to access it. If we assume that only 20% manage to access ART then the estimated number of AIDS deaths in 2010 increases to 450 000, but if the proportion is as high as 90% the number of AIDS deaths would be reduced to 290 000.

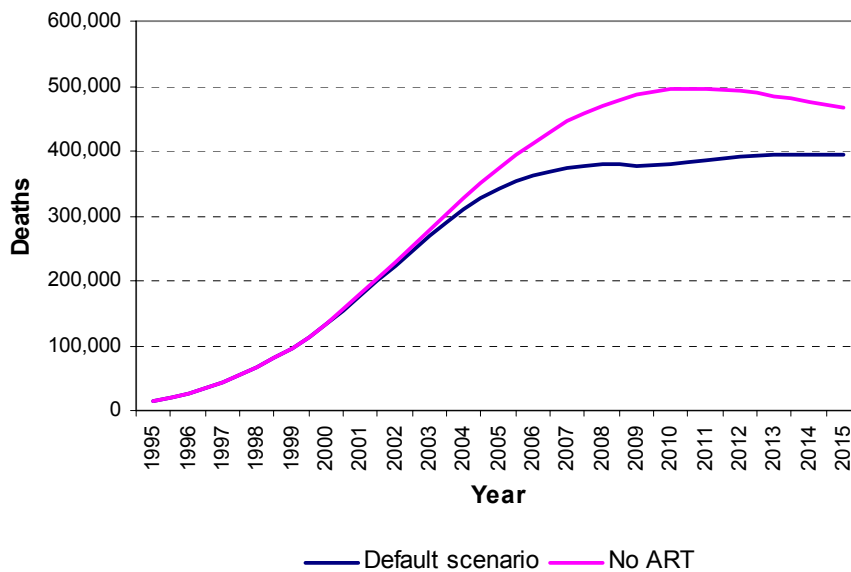


Figure 1. Projected number of AIDS deaths with and without national ART programme, ASSA2002

Figure 2 shows the difference that the ART programme is expected to play in prolonging life expectancy. Already in 2004, the HIV/AIDS pandemic has taken about 13 years off life expectancy. Life expectancy is thus 51.0 years, rather than the 63.9 years it would have been without HIV/AIDS. Without the ART programme, the decrease in life expectancy would be 18 years by 2015, with an average life expectancy of just under 48 years. With the ART programme, the difference is expected to reduce to 15 years, giving a life expectancy of 50 years.

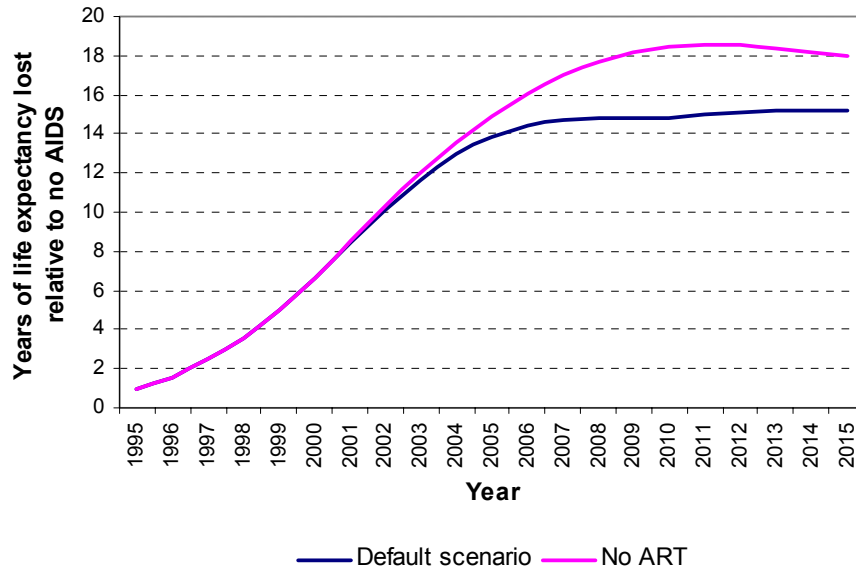


Figure 2. Projected impact on life expectancy (e₀) with and without national ART programme, ASSA2002

Based on a scenario of ART being made available so that half those that need treatment would be receiving treatment by 2010, life expectancy at birth is now expected to fall to a little below 50 years by 2005 (48 years for men and 52 for women) and then plateau around this level. Previous estimates, which did not allow for interventions (some of which have been in place for a number of years) suggested that life expectancy would fall to around 43 years before climbing back up to level off at around 50 years.

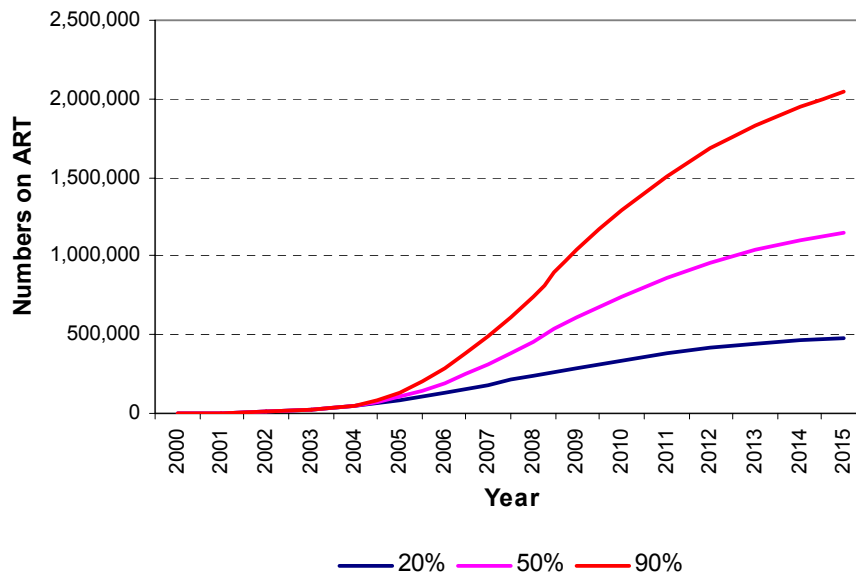


Figure 3. Projected numbers receiving treatment according to various coverage scenarios, ASSA2002

The model suggests that in 2004 around 500 000 people are in need of ART (in terms of the definition used in terms of the role out plan). The number of people that would be receiving treatment will be a function of the how successful the role out is, and of how successful ARVs are in extending life. Figure 3 shows the expected numbers on treatment under three different scenarios of ultimate coverage of the treatment programme; 20%, 50% (the current default) and 90%.

Incidence of HIV by demographic groups

The incidence of infections is one of the most important indicators of the progression of the epidemic that needs to be monitored, particularly in the more mature stage of the epidemic. Figure 4 shows the projected number of people who will be expected to be newly infected with HIV each year, using the default scenario. From this figure it is clear that it is the 15-24 year age group, and particularly young women, that contributes high numbers of new infections. Empowerment of young women is clearly an important strategy if the spread of the epidemic is to be slowed down.

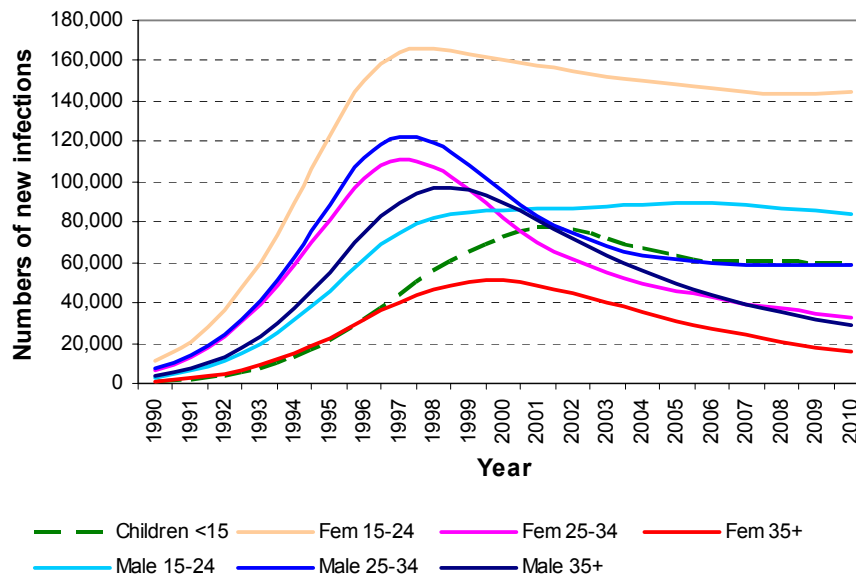


Figure 4. Projected number of newly infected people by sex and age group, ASSA2002

HIV and AIDS Indicators at mid-2004

Births	
Uninfected births (over calendar year)	1 010 000
HIV+ births (over calendar year)	37 000
Infected through breastfeeding	26 000
People living with HIV/AIDS	
Total HIV infected	5 024 000
Adults (18-64)	4 728 000
Adult men (18-64)	2 180 000
Adult women (18-64)	2 548 000
Adults (15-49)	4 510 000
Adult men (15-49)	1 959 000
Adult women (15-49)	2 550 000
Youth (15-24)	961 000
Male youth (15-24)	225 000
Female youth (15-24)	736 000
Children (0-14)	245 000
New infections	512 000
Prevalence	
Total HIV infected	11.0%
Adults (18-64)	18.1%
Adult men (18-64)	17.6%
Adult women (18-64)	18.6%
Adults (15-49)	18.5%
Adult men (15-49)	16.6%
Adult women (15-49)	20.2%
Youth (15-24)	10.8%
Male youth (15-24)	5.1%
Female youth (15-24)	16.4%
Children (0-14)	1.7%
Incidence	
Total population	1.3%
Adults (18-64)	1.9%
Adult men (18-64)	2.0%
Adult women (18-64)	1.7%
Perinatal (of births)	3.6%
Breastfeeding (no. infected through breastfeeding in year/uninfected births in that year)	2.6%
Number adults (14+) infected by stage	
Stage 1	1 476 000
Stage 2	1 098 000
Stage 3	1 671 000
Stage 4 (incl. those on treatment and those who have discontinued treatment)	534 000
Number children (<14) infected by stage	
Pre-AIDS	211 000
Stage 4 (incl. those on treatment and those who have discontinued treatment)	33 000
AIDS sick	
New AIDS sick during 2004	419 000
Total AIDS sick mid-year	525 000

Note: Numbers rounded to nearest thousand to avoid spurious accuracy

HIV prevalence by sex and age, 2004

Figure 5 shows HIV prevalence levels by sex and age group in 2004. Prevalence is higher for women than men for the 15 to 34 age group, while it is higher for men in the older ages. Among women, the rate is highest (at 30%) – for the age group 25-29 years. Among men, the rate peaks at slightly older ages, with 26% of those aged 30-34 years being estimated to be infected.

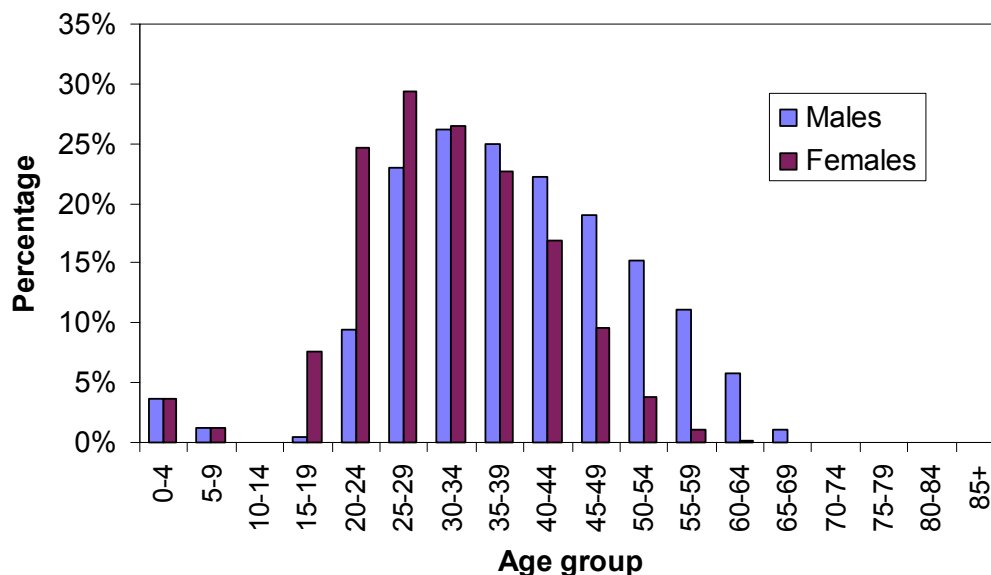


Figure 5. Estimated prevalence of HIV by sex and age, 2004

Age Group	Males	Females
0-4	3.6%	3.6%
5-9	1.2%	1.2%
10-14	0.0%	0.0%
15-19	0.5%	7.6%
20-24	9.5%	24.7%
25-29	23.3%	29.7%
30-34	26.4%	26.8%
35-39	24.9%	22.7%
40-44	22.2%	16.8%
45-49	19.0%	9.6%
50-54	15.3%	3.8%
55-59	11.1%	1.0%
60-64	5.8%	0.2%
65-69	1.0%	0.0%
70-74	0.0%	0.0%
75-79	0.0%	0.0%
80-84	0.0%	0.0%
85+	0.0%	0.0%

Mortality Indicators, 2004

Deaths	
Total deaths during 2004	701 000
Non-AIDS deaths during 2004	389 000
AIDS deaths during 2004	311 000
Accumulated AIDS deaths mid-year	1 212 000
Percentage of deaths due to HIV/AIDS	
Adults (15-49)	70%
Adults (15+)	45%
Children (<15)	42%
Total deaths	44%
Mortality statistics	
Infant mortality rate (per 1000)	56
Child mortality rate (${}_5q_0$) (per 1000)	87
Adult mortality (${}_{45}q_{15}$)	54%
Adult male mortality (${}_{45}q_{15}$)	60%
Adult female mortality (${}_{45}q_{15}$)	48%
Life expectancy	
Life expectancy (e_0) (years)	51.0
Male life expectancy (e_0) (years)	48.9
Female life expectancy (e_0) (years)	53.1
Maternal orphans (under 18)	
Total orphans	1 126 000
Total AIDS orphans	626 000
New orphans	252 000

Population pyramid, 2004

Figure 6 shows the population pyramid for 2004 followed by a table of the underlying numbers. As expected, in the age groups up to 14 years the number of boys slightly exceeds the number of girls. However, from age 20 upwards women exceed men in every age group, with the disproportion greatest in the oldest age groups due to the longer female life expectancy. The impact of AIDS is seen most clearly in the middle age groups, where the cohorts are smaller than they would otherwise have been. This has implications in terms of dependency rates, as these age groups are the ones which traditionally are expected to support older and younger people. The lower than expected number in this age group is also the cause of the high number of child orphans shown later. The relationship between the old cohorts and the young cohorts are also shifting as the population ages.

The pyramid for 2015 has been included in Figure 6 for comparative purposes (as clear bars superimposed on the solid bars representing the population in 2004). This shows that while the teenage and young, and old adult populations continue to grow the middle aged population hardly grows at all. In addition, together with declining trend in fertility HIV/AIDS is expected to lead to a significant decline in the number of children over the next 10 years.

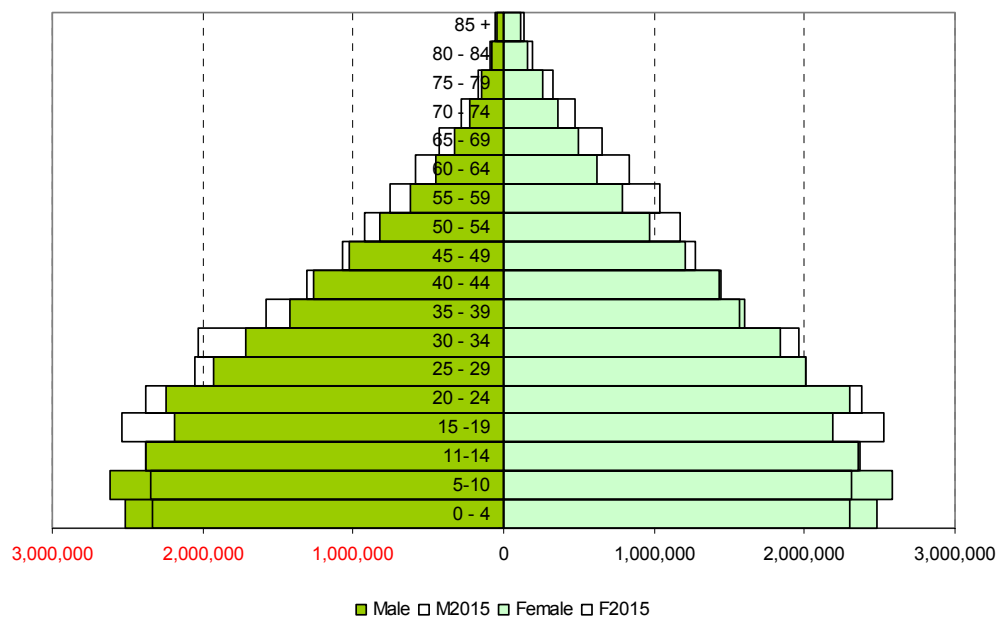


Figure 6. Estimated population pyramid, 2004

Age	Male	Female
0-4	2 511 339	2 477 928
5-9	2 611 379	2 584 841
10-14	2 381 627	2 364 159
15-19	2 188 920	2 190 422
20-24	2 249 752	2 303 214
25-29	1 933 680	2 005 949
30-34	1 715 138	1 843 299
35-39	1 424 714	1 600 347
40-44	1 264 405	1 448 927
45-49	1 031 642	1 205 309
50-54	818 920	970 198
55-59	625 833	786 487
60-64	454 030	625 186
65-69	324 353	494 562
70-74	222 065	364 607
75-79	143 988	255 525
80-84	81 374	161 355
>=85	47 113	117 413
Total	22 030 273	22 799 730

Prevention and Treatment Indicators

	1998	2000	2002	2003/4
Condom use				
Number of male condoms distributed by DoH (millions) ⁷	150	250	294	302
Number of female condoms distributed by DoH (millions) ⁸				0.19
% men 15-49 used condom with non-regular sex partner	-	-	-	-
% women 15-49 used condom with non-regular sex partner	16.4% ⁹	-	-	-
% men 15-24 who used condom at last sex	-	-	57.1% ¹⁰	57%(49-64) ¹¹
% women 15-24 who used condom at last sex	16.6% ⁹	-	46.1% ¹⁰	48%(45-51) ¹¹
Sexually transmitted diseases				
% men 15-49 with STD symptoms in last 3 months	12.7% ⁹	-	-	-
% men 15-24 with STD symptoms in last 12 months	-	-	-	8.1 ¹¹
% women 15-24 with STD symptoms in last 12 months	-	-	-	14.1 ¹¹
Prevention of Mother to Child Transmission (PMTCT)				
% of public facilities that provide PMTCT	-	-	20%(16-25) ¹²	52% ⁸
% of pregnant women booked at facilities offering PMTCT who tested for HIV	-	-	66%(53-78) ¹²	-
% of pregnant women tested who are positive	-	-	20%(14-26) ¹²	-
% of pregnant women tested positive who were treated	-	-	70%(55-85) ¹²	-
Access to PMTCT as % of pregnant women	-	-	9% ¹³	-
Number of pregnant women with access to nevirapine	-	-	7 853 ¹³	-
Voluntary Counselling and Testing				
Number of public facilities offering VCT	-	-	427 ¹⁴	2 582 ⁸
VCT clinics per 100 000 population	-	-	0.9	5.6
Number of people pre-counselled	-	-	412 696 ¹⁵	690 537 ¹⁵
VCT per 10 000 people aged 15-59	-	-	152	+251
Tested for HIV after counselling	-	-	89% ¹⁰	70% ⁷
Tested positive of HIV	-	-	31% ¹⁰	-
Antiretroviral treatment				
Number of health facilities accredited	-	-	-	+103 ¹⁵
% of public primary care facilities that provide ART	-	-	-	+2%
Number of people on ARV provided by public sector	-	-	-	19 500 ¹⁵

Indicators in this table are taken from different sources; they may not match indicator definition or calendar year precisely – see footnotes

⁷ National Department of Health. 2004. Provided by STD and HIV Prevention Unit.

⁸ National Department of Health. 2004. Annual Report 2003/04. (Figures refer to financial year 2003/04).

⁹ National Department of Health. 2000. South African Demographic and Health Survey 1998.

¹⁰ HSRC. 2002. Nelson Mandela/HSRC Study of HIV/AIDS South African National HIV Prevalence Behavioural Risks and Mass Media Household Survey 2002.

¹¹ Reproductive Health Research Unit. 2004. HIV and Sexual Behaviour among young South Africans 2003. (95% confidence interval in brackets)

¹² Health System Trust. 2004. The National Primary Health Care Facilities Survey 2003. (95% confidence interval in brackets).

¹³ Doherty T, Besser M, Donohue S. 2003. An evaluation of the PMTCT initiative in South Africa. Lessons and key recommendations. Health Systems Trust. 2003.

¹⁴ Department of Health. 2002. List of voluntary counselling and testing sites.

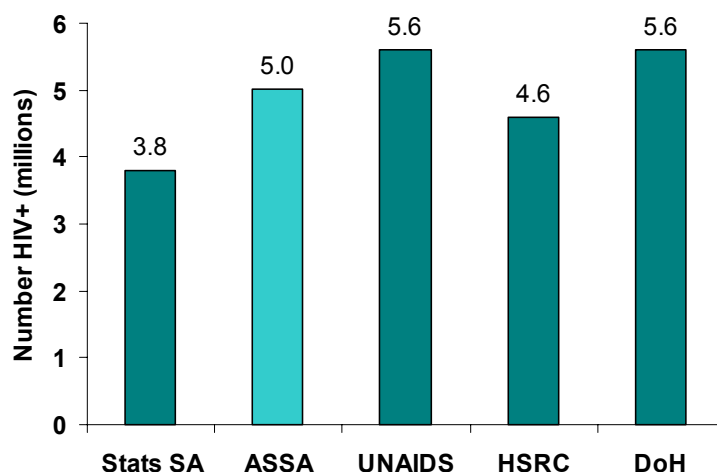
<http://www.doh.gov.za/aids/index.html>

¹⁵ Dr Tshabala-Msimang in a written reply to questions in the National Assembly, 25 November, 2004. (Numbers of patients by October 2004).

Comparison with other estimates

One of the problems that policy and decisions makers are faced with is the wide range of estimates of the size and impact of the epidemic. However, not all the uncertainty is in the estimates of the numbers infected, some of it is about the size of the population as a whole. Figure 7 and Figure 8 show a range of estimates of the total number infected, and the accumulated AIDS deaths by 2004, while Figure 9 shows the range of estimates of the total population. The implied prevalence rates for the population as a whole are shown in Figure 10. It is important to note that the level of uncertainty about the estimate from the ASSA model is not as great as that presented to the public by the wide range of estimates. It can be demonstrated that some of these estimates are faulty. We consider the ASSA estimates to be based on the most thorough research but it is nonetheless useful to contrast them with other estimates that have been produced recently.

It is not the purpose of this booklet to analyse the strengths and weaknesses of each of these estimates. However, users would be well advised to be careful about using outlier estimates unless these have been backed up by sound empirical data and reasoning.



Notes: The Stats SA published this number as the total number infected it is actually their estimate of the number infected aged 15-49. The DoH estimate is for 2003.
Sources: StatsSA¹⁶, UNAIDS¹⁷, HSRC¹⁸, DoH¹⁹

Figure 7. Number of people infected with HIV in 2004

¹⁶ Statistics South Africa. 2004. *Mid-year population estimates, South Africa 2004*. P0302. Pretoria: Statistics South Africa.

¹⁷ UNAIDS/WHO. 2004. *2004 Report on the Global HIV/AIDS Epidemic*. Geneva: Joint United Nations Programme on HIV/AIDS/World Health Organization.

¹⁸ Rehle, Thomas and Olive Shisana. 2003. "Epidemiological and demographic HIV/AIDS projections: South Africa", *African Journal of AIDS Research* 2(1):1-8.

¹⁹ Department of Health. 2004. *Summary Report: National HIV and Syphilis Antenatal Sero-Prevalence Survey in South Africa 2003*. Pretoria, South Africa: Directorate: Health Systems Research, Research Coordination and Epidemiology, Department of Health.

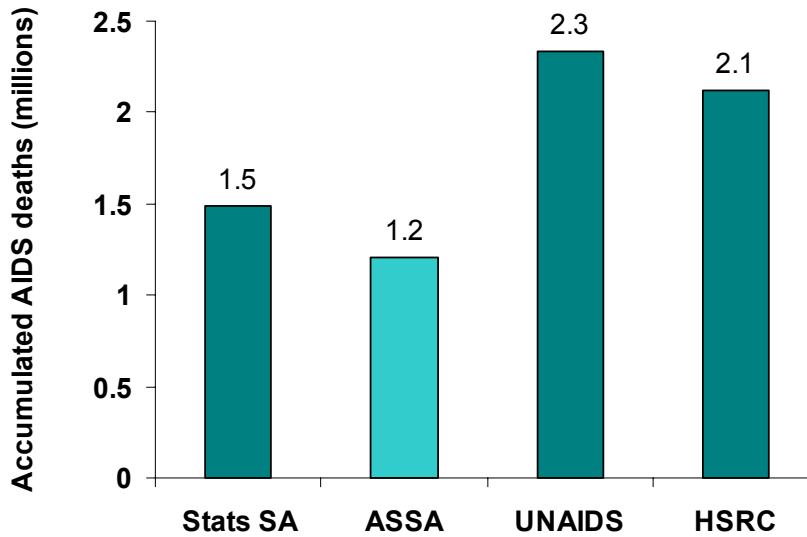
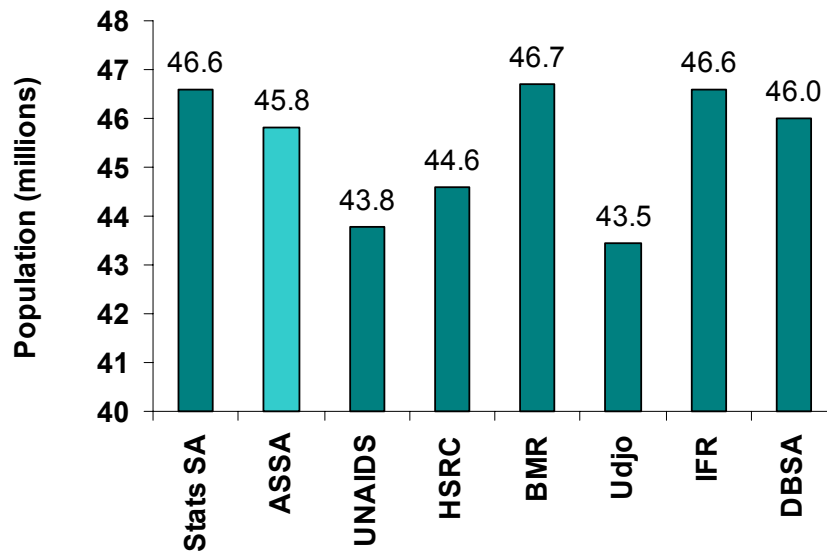


Figure 8. Accumulated number of AIDS deaths to middle 2004



Notes: Udjo's estimate is for 2001
 Source: BMR²⁰, Udjo²¹, IFR²² and DBSA²³

Figure 9. Total population mid-2004

²⁰ van Aardt, Carl J. 2004. *A projection of the South African population, 2001 to 2021*. Research Report No. 330 (07). Pretoria: Bureau of Market Research, University of South Africa.

²¹ Udjo, Eric O. 2003. *Modelling the population of South Africa within the context of HIV/AIDS as a means of evaluating the 2001 census*. Monograph of Epidemiology and Demographic Unit, HSRC.

²² Haldenwang, Barbel.B. 1999. *High, Medium and Low Projections of the South African Population, 1996-2031*. Belville: Institute of Futures Research, University of Stellenbosch.

²³ Development Bank of South Africa. 2000. *Provincial Population Projections, 1996-2021 High and low HIV/AIDS Impact (2 reports)*. Midrand: Development Bank of South Africa.

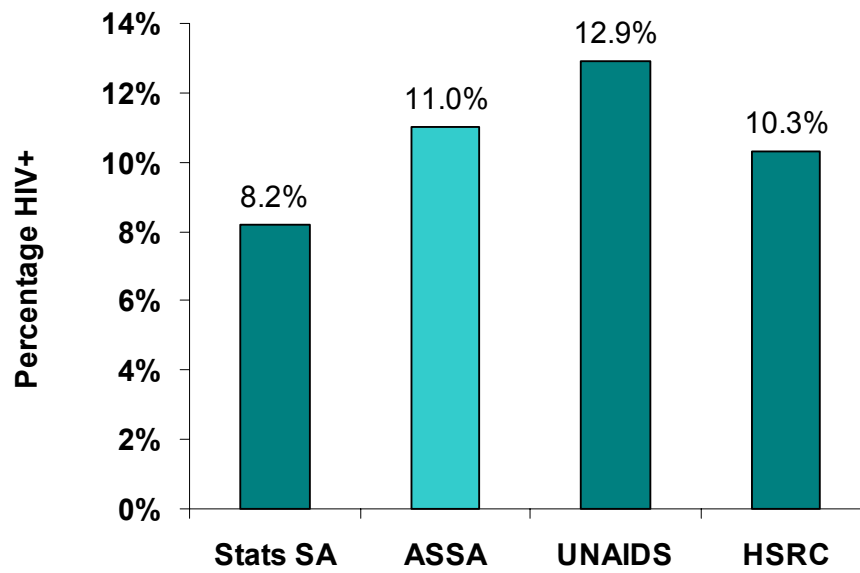


Figure 10. HIV prevalence rate in total population in 2004

Projections 1990 – 2015

Total population, number of HIV+ and AIDS sick people and cumulative AIDS deaths

The overall expected trends for population size, the number of people infected with HIV, the number AIDS sick, and the number of accumulated AIDS deaths for each year are shown in Figure 11. The total population continues to increase over the period, although at a decreasing rate. From 2011, the expected annual rate of increase is 0.4%. The number of people infected with HIV peaks in 2013, at just over 5.4 million, after which it starts to decrease slowly. In contrast, the number of people sick with AIDS in the middle of each year continues to rise over the period, reaching nearly 743 000 in 2015. Accumulated AIDS deaths are close to 5.4 million by the same year. By 2004, it is estimated that over 1,2 million people have already died as a result of AIDS, just over 5 million are infected with HIV, and over 500 000 are AIDS sick.

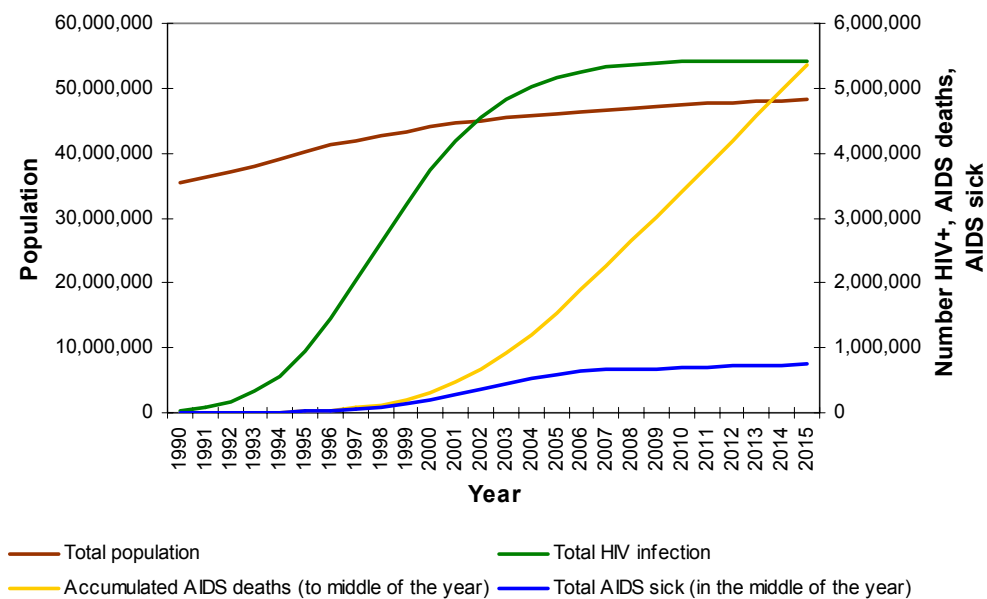


Figure 11. Projected population, number of HIV positive, AIDS sick and cumulative AIDS deaths for 1990-2015, ASSA2002 (default scenario)

Year	Total Population	Annual growth rate	Total HIV+	Cumulative AIDS deaths	Total AIDS sick
1990	35 538 787	1.8%	38 597	326	293
1991	36 240 467	2.0%	83 498	851	741
1992	37 114 697	2.4%	170 469	2 061	1 750
1993	38 074 173	2.6%	323 473	4 704	3 892
1994	39 092 136	2.7%	571 958	10 140	8 158
1995	40 153 091	2.7%	943 590	20 662	16 135
1996	41 229 197	2.7%	1 447 952	39 855	30 123
1997	41 978 303	1.8%	2 028 544	72 804	52 305
1998	42 690 294	1.7%	2 632 714	125 488	85 620
1999	43 352 481	1.6%	3 212 716	204 933	132 518
2000	43 966 756	1.4%	3 731 645	318 697	194 424
2001	44 524 453	1.3%	4 176 138	473 326	268 545
2002	45 016 927	1.1%	4 539 754	673 232	351 878
2003	45 452 388	1.0%	4 820 223	919 883	439 086
2004	45 830 002	0.8%	5 024 237	1 212 117	525 461
2005	46 156 343	0.7%	5 165 797	1 542 169	589 454
2006	46 443 101	0.6%	5 259 148	1 897 965	636 131
2007	46 700 411	0.6%	5 319 835	2 269 574	663 547
2008	46 938 003	0.5%	5 359 890	2 648 012	677 102
2009	47 164 179	0.5%	5 388 805	3 026 181	678 695
2010	47 380 126	0.5%	5 408 621	3 404 415	692 511
2011	47 582 605	0.4%	5 418 096	3 787 573	708 472
2012	47 772 800	0.4%	5 419 579	4 175 979	722 262
2013	47 953 297	0.4%	5 416 539	4 568 340	732 402
2014	48 126 588	0.4%	5 411 964	4 962 998	738 865
2015	48 294 565	0.3%	5 407 945	5 358 501	742 261

Mortality rates for children and adults

The mortality rates for infants and young children, as well as for adults are shown in Figure 12. The infant and under-5 mortality (the number of newborns expected to die before age 1 and 5 respectively) curves have a similar shape, with both peaking around 2001. However, the infant rate peaks at 63 per 1 000, while that for children under five years peaks at 92 per 1 000. After this they both fall mainly as a result of the impact of PMTCT programme assumed in the model.

The figures and graphs for adults represent the probability that people aged 15 years will die before they reach the age of 60 years (45q15). The rate for women is lower than that for men throughout the period, due to lower non-AIDS mortality, but the relative difference between the two rates narrows from the mid-1990s onwards as a result of the more immediate and severe impact of HIV/AIDS on women. The male rate peaks in 2006/7 at around 64%. The female rate levels off from around 2007 at 54%. In 2004, less than two-fifths of 15-year old young men and half of 15-year old young women are expected to die before reaching their 60th birthday.

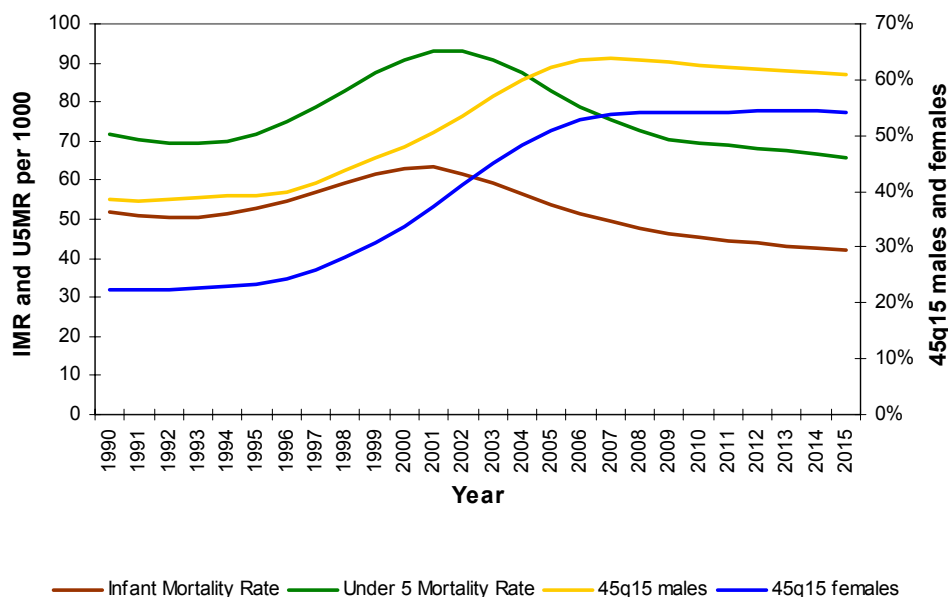


Figure 12. Projected rates of infant mortality (IMR), under five mortality (U5MR) and adult mortality (45Q15) for 1990-2015, ASSA2002

Year	Infant mortality rate q_0 (per 1000)	Child mortality rate ${}_5q_0$ (per 1000)	${}_{45}q_{15}$ males	${}_{45}q_{15}$ females
1990	52	72	38%	23%
1991	51	70	38%	22%
1992	51	70	39%	22%
1993	51	69	39%	23%
1994	51	70	39%	23%
1995	53	72	39%	23%
1996	55	75	40%	24%
1997	57	79	41%	26%
1998	59	83	44%	28%
1999	61	87	46%	31%
2000	63	91	48%	34%
2001	63	93	50%	37%
2002	62	93	54%	41%
2003	59	91	57%	45%
2004	56	87	60%	48%
2005	54	83	62%	51%
2006	51	79	63%	53%
2007	50	75	64%	54%
2008	48	73	64%	54%
2009	46	70	63%	54%
2010	45	69	63%	54%
2011	45	69	62%	54%
2012	44	68	62%	54%
2013	43	67	62%	54%
2014	43	67	61%	54%
2015	42	66	61%	54%

Maternal orphans under 18 years

Recognising the important role of mothers in ensuring the health and well-being of children, the number of maternal orphans is a key indicator. The most commonly used definition of orphan is children whose parents have died before the age of 15 years. However, orphans do not cease to have parenting needs on reaching 15. Figure 13 shows the trends in respect of maternal orphans under the age of 18 (children under the age of 18 who have lost a mother or both parents). At the start of the period there are fewer than 500 000 maternal orphans under the age of 18 years in the country, of whom very few lost their mothers as a result of AIDS. By 2004, the number of orphans has increased to over 1.2 million, and over 600 000 of the total have been orphaned as a result of AIDS. The number of non-AIDS orphans falls steadily from 2004, but the number of AIDS orphans is set to continue to increase throughout the period as a result of the ongoing increase in the number of deaths.

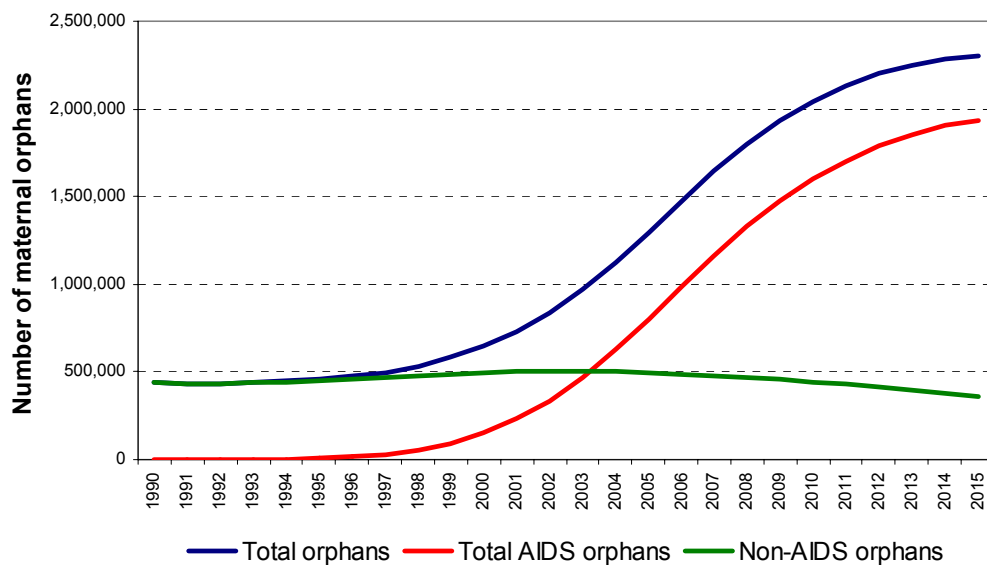


Figure 13. Projected number of maternal orphans under the age of 18 years due to AIDS and other causes of death for 1990-2015, ASSA2002

Year	Total orphans	AIDS orphans	Non-AIDS orphans
1990	436 352	86	436 266
1991	434 739	239	434 501
1992	435 778	615	435 163
1993	439 795	1 493	438 303
1994	447 085	3 421	443 664
1995	458 431	7 421	451 010
1996	473 835	15 185	458 650
1997	497 467	29 429	468 038
1998	531 333	53 581	477 752
1999	580 124	92 105	488 018
2000	644 753	149 456	495 297
2001	729 518	229 730	499 788
2002	837289	335 608	501 682
2003	970 339	468 619	501 720
2004	1 125 884	626 458	499 425
2005	1 297 197	802 334	494 864
2006	1 473 056	984 858	488 198
2007	1 642 464	1 163 002	479 462
2008	1 796 606	1 327 846	468 760
2009	1 929 332	1 473 037	456 295
2010	2 039 353	1 597 023	442 330
2011	2 129 021	1 701 854	427 168
2012	2 199 194	1 787 977	411 217
2013	2 250 416	1 855 478	394 938
2014	2 283 026	1 904 347	378 679
2015	2 301 177	1 937 696	363 481