

## HIV/AIDS - facts, figures and the future

*Using data obtained from annual surveys of pregnant women attending public sector antenatal clinics, this chapter attempts to estimate the current and future size and impact of the HIV/AIDS epidemic by means of projection models. The chapter looks at the possible impact of HIV/AIDS on the economy of the country as well as the economies of households, the capacity of traditional coping mechanisms to deal with ill and dying people and orphans, future health care costs in both the public and the private sectors, and the possible impacts of various interventions on the growth of the epidemic.*

*This paper is adapted from a report published by loveLife with support from the Henry J. Kaiser Family Foundation. Demographic projections were undertaken by Metropolitan Life AIDS Research and Consulting.*

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## Introduction

Despite the scale of the HIV/AIDS epidemic, there is relatively little data on impacts at personal community, firm or national levels. One reason for this is undoubtedly the enormous stigma that is still attached to HIV infection. Routine anonymous surveys of public sector, antenatal clinic attendees remain the only national source of information on the scale of the epidemic. Thus assumptions regarding impact have to be based on mathematical simulation models which are calibrated to antenatal data. This methodological approach underlies much of the work contained in this chapter.

Most data on the South African HIV/AIDS epidemic is obtained from the anonymous, annual survey of pregnant women attending public sector antenatal clinics. HIV infection levels in the general community in South Africa are thought to be lower than in the public sector antenatal clinic attendee population. Children and the elderly, who are at substantially lower risk of HIV, are not captured by antenatal surveys. Even among adults in sexually active age groups, the antenatal survey prevalence figures do not reflect the lower overall risk of men, people who are less sexually active, and communities using the private sector. On the other hand, recent studies indicate that fertility among HIV positive women is substantially lower than among uninfected women, and this suggests that antenatal data may in fact underestimate HIV prevalence in women of reproductive age in many communities.

Although imperfect, these data are sufficient to estimate the current and future size and impact of the epidemic by using projection models, particularly the Doyle simulation model (see appendix 1), to extrapolate from antenatal clinic attendees to the rest of the population.

It is important to emphasise that these data only provide a picture of the epidemic for the general population by provincial area, gender and age. While these data give some sense of the different risk profiles in the population, additional surveys serve to remind us that the majority of the population is at risk of HIV infection and that certain sectors of the population are at much higher risk of infection than the general population. Provincial estimates from these data mask large differences between regions and HIV impacts on specific communities within any region may differ markedly.

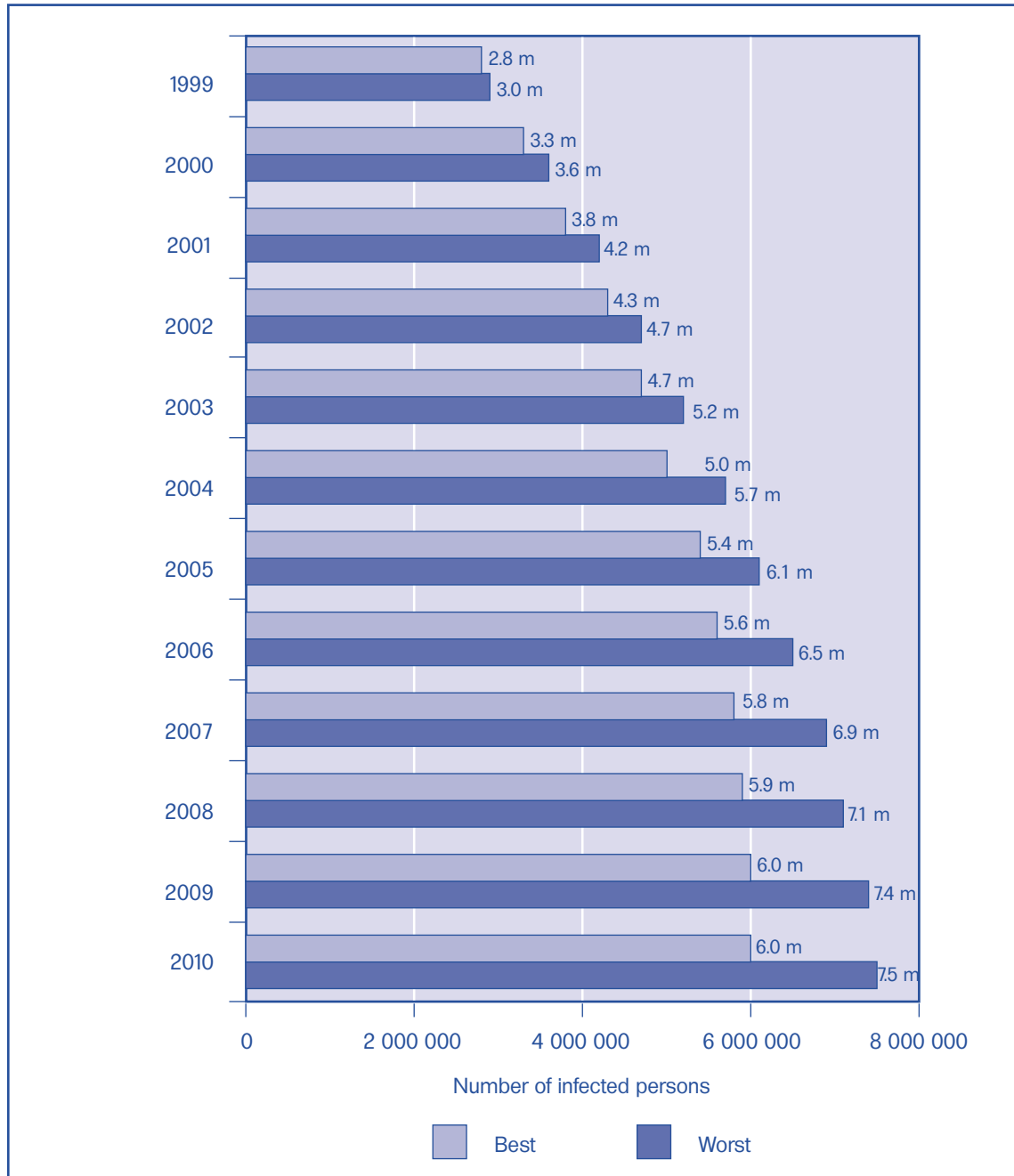
For example, in a survey that explored HIV infection rates among people aged 20-50, in a sub-provincial area, estimates ranged from 21% among people living in private houses to 36% among those living in informal settlements.<sup>1</sup>

## Projections for the future impact of the epidemic

### HIV prevalence

It is estimated that around 3.5 million South Africans are currently HIV infected. This number is projected to more than double over the next 10 years (in the absence of any major behaviour changes that could significantly alter the course of the epidemic) and there could be around 5.3-6.1 million infected individuals by 2005, and 6-7.5 million by 2010. Figure 1 shows projected numbers of HIV infected individuals - best and worst case scenarios.

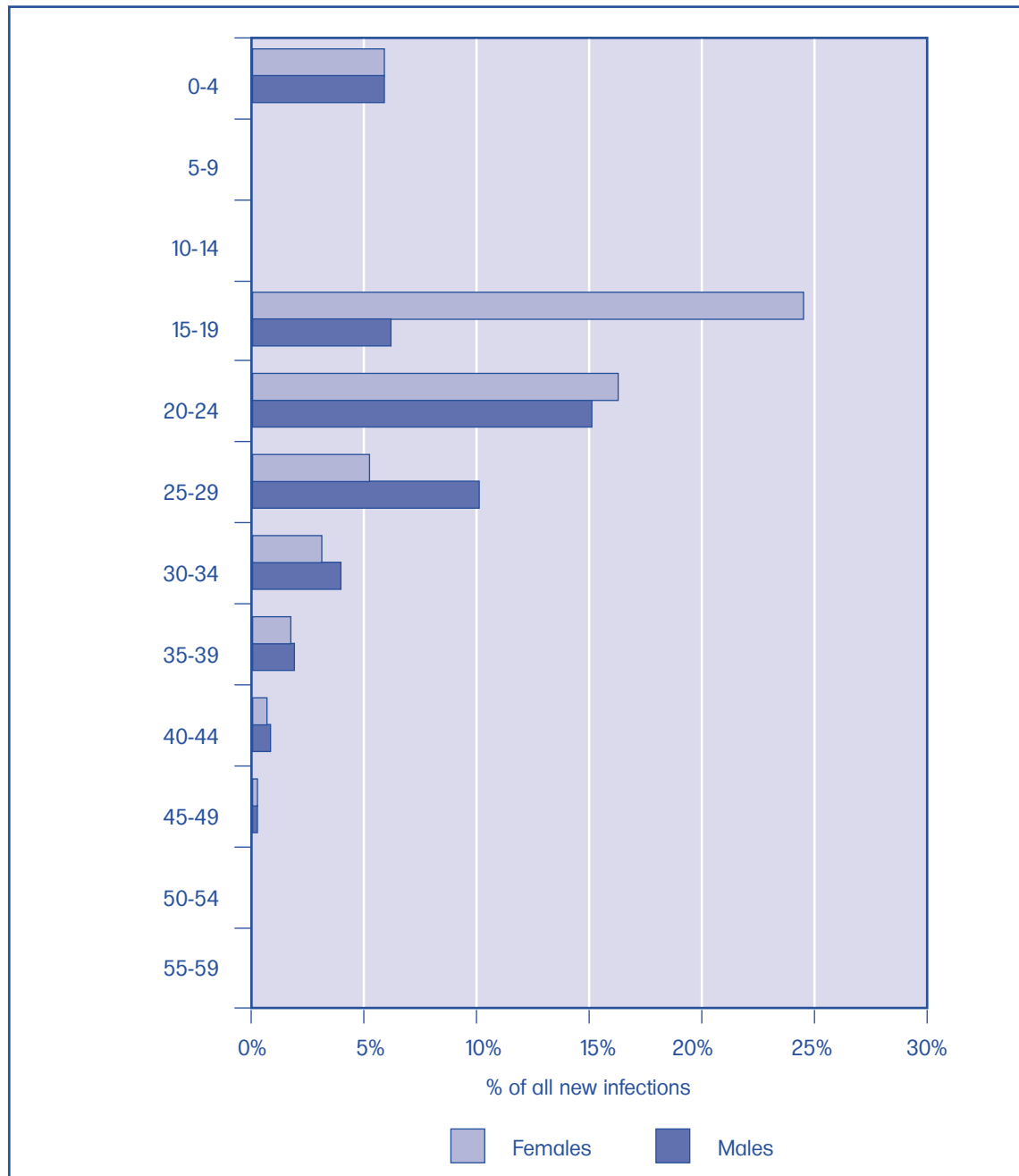
Figure 1: Projected numbers of HIV infected individuals - best and worst case scenarios



While there are large provincial variations in HIV infection levels, the antenatal survey has thus far shown similar epidemic patterns for all provinces except the Western and Northern Cape, indicating that current differences can be attributed more to time lags than intrinsically lower risk of infection. This suggests that in most provinces the epidemics in populations served by public sector health services could well be of similar severity to the provinces worst affected at present.

Approximately 13% of all South African adults aged 20-64 are currently infected and these levels could rise to 20-23% by 2005 and 22-27% by 2010. HIV is a disease that mostly affects younger people with around half of all adults who acquire HIV becoming infected before they turn 25. These young people typically die of AIDS before their 35th birthday. Figure 2 shows the proportion of all new infections projected between 1995 and 2010 by gender and age categories.

Figure 2: Proportion of all new infections projected between 1995 and 2010 by gender and age



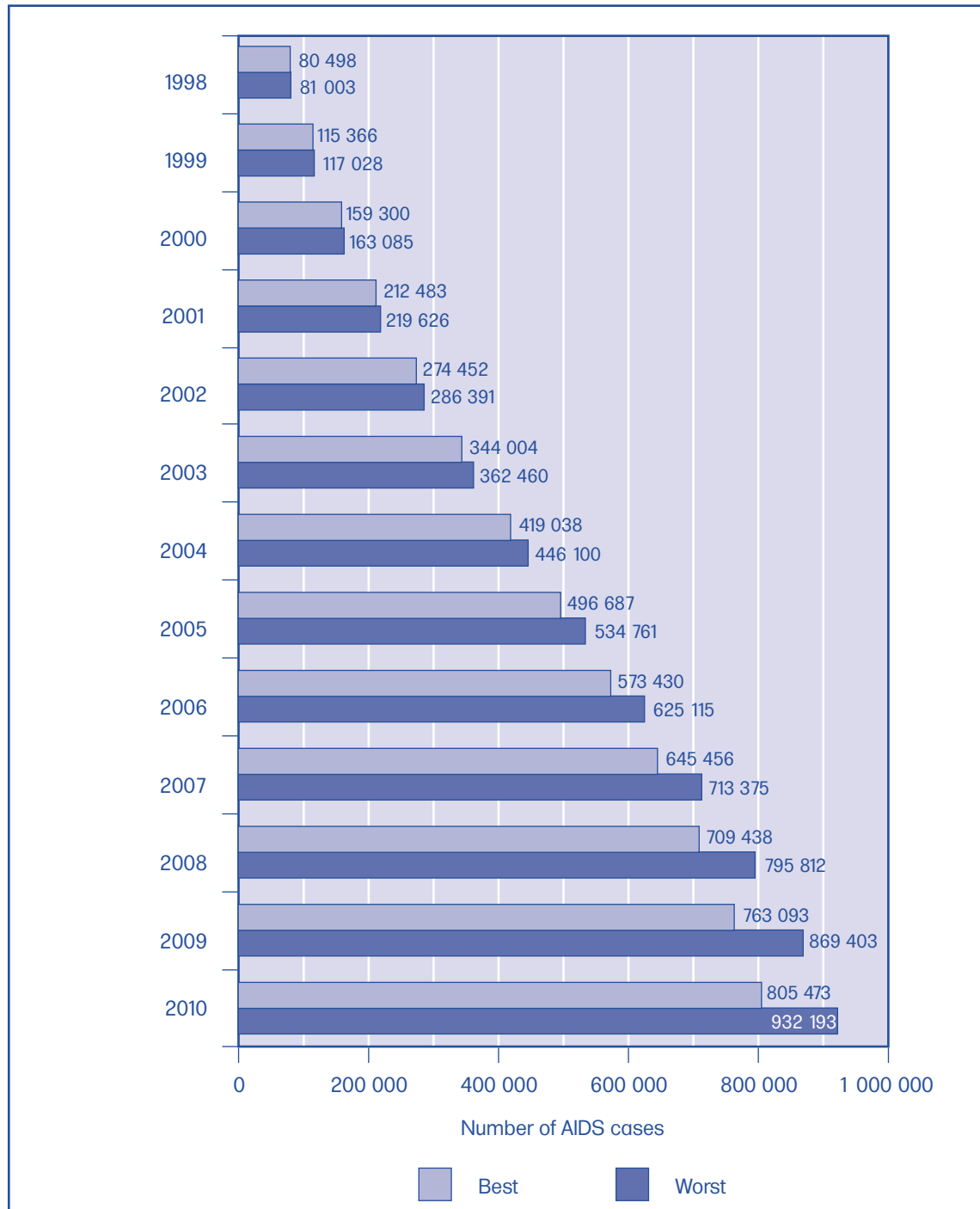
Gender differences are also quite pronounced, with women at highest risk between the ages of 15 and 20, whereas men probably achieve their highest incidence at older ages. Infection levels among teenagers, which tend to be the first to reflect reduction in risk behaviour, are still increasing at alarming rates. Fifty three percent of South Africa's population is under the age of 25 years, emphasising the enormous impact that infection on young people will have on the population as a whole.

#### AIDS cases

There are currently between 159 000 and 163 000 people estimated to be living with AIDS in the country. This will rise rapidly over the next decade to almost a million by the year 2010, when it will not yet have reached its peak. Half a percent of all adults are expected to

have AIDS in the year 2000 and this will rise to between 2.8 and 3.2% by 2010. Figure 3 shows the projected numbers of AIDS cases under best and worst infection scenarios.

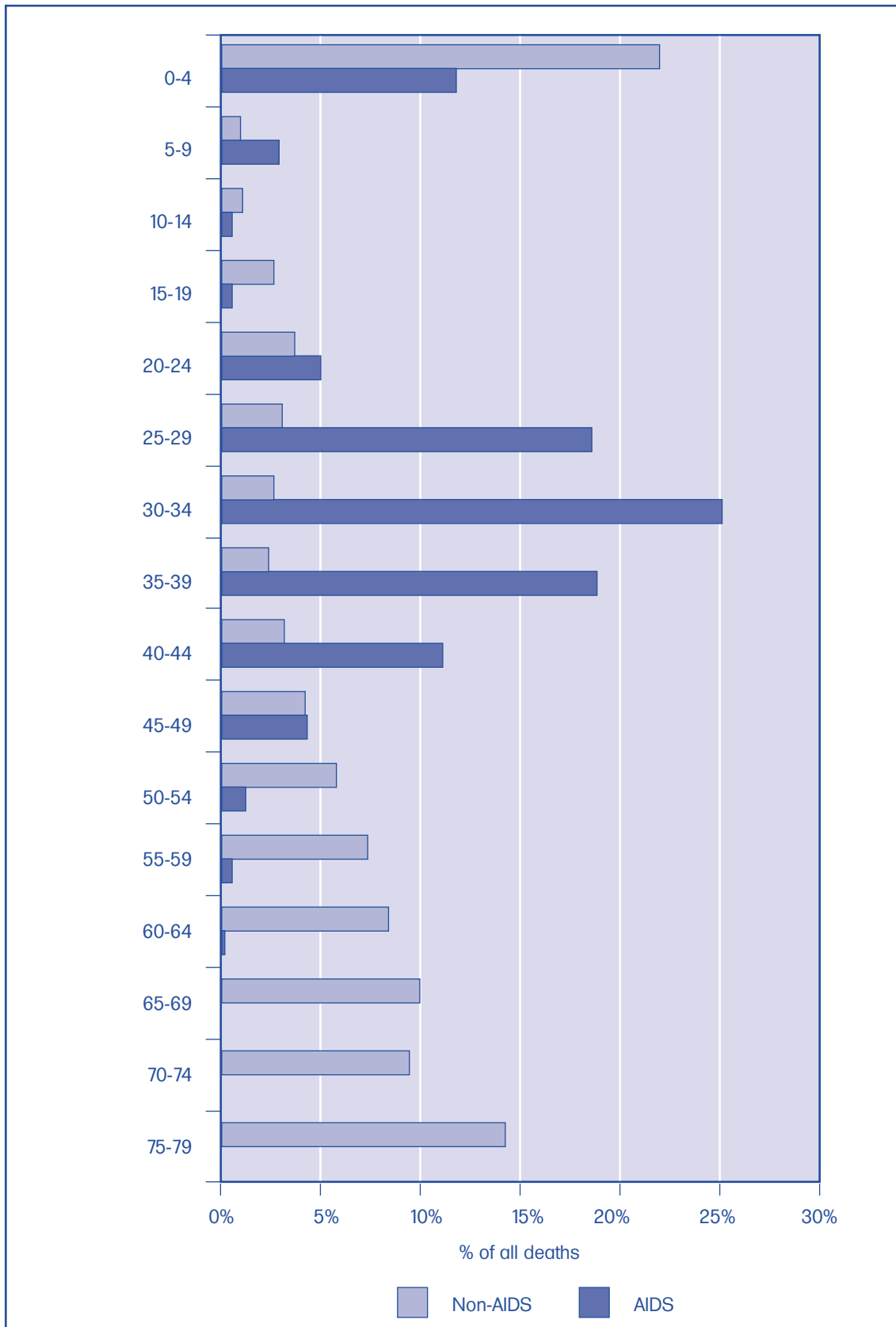
**Figure 3: Projected numbers of AIDS cases under best and worst infection scenarios**



### AIDS deaths

The number of deaths each year due to AIDS is expected to rise rapidly in South Africa from around 90 000 in 2000, to between 354 000-383 000 in 2005, and up to 545 000-635 000 for the year 2010. Figure 4 shows the estimated AIDS and non-AIDS deaths in 2010 by age. AIDS deaths will soon outstrip non-AIDS deaths in adults in the economically active age groups. In the most severely affected provinces, the proportion of the adult population dying from AIDS will reach 2.2-2.6% by 2010.

Figure 4: Age distribution of AIDS and non-AIDS deaths in 2010



## Impact of HIV/AIDS on population size and structure

HIV/AIDS will impact on population directly through deaths of infected people. In addition, birth rates are expected to decline due to deaths among people in relatively high fertility age groups, and reduced fertility of HIV-infected women. In the absence of HIV/AIDS, the South African population would have been expected to grow from 43.7 million in 1999 to 51.3 million in 2010, with a growth rate of around 1.7% in 1999, falling to around 1.5% by 2010. As a result of HIV and AIDS, the population is now expected to reach only 47 million in 2010 under a best-case scenario. Under the worst scenario, the population will peak at 46.7 million in 2008, and have slightly negative growth thereafter.

### Effect on households

Although the HIV/AIDS epidemic affects all sectors of society, poor households in South Africa carry the greatest burden of disease, experience the greatest negative impacts and have the least reserves available to cope with the disease. Many households in South Africa have to provide care in cramped housing with limited or no access to basic amenities such as water and sanitation. Household impacts of HIV have received minimal research attention in South Africa,<sup>2</sup> and it is critical that government and international funders commit resources to this task as soon as possible. The discussion which follows draws from anecdotal evidence and research from other countries.<sup>3</sup>

The most severe impact of HIV/AIDS occurs at household level. The impact of HIV/AIDS is greater than for other diseases for several reasons.

- ◆ AIDS mainly strikes adults aged between 25 and 45, so people are ill and die in the years in which they tend to have the greatest role as providers, carers and nurturers. Financial impacts of AIDS on households have been shown to be as much as 30% more than deaths from other causes.<sup>4</sup>
- ◆ Enormous costs can be incurred for anti-retroviral drugs and other drugs, sometimes for long periods of time, and these are not paid for by the State or by most health insurers, thus depleting household savings.
- ◆ The disease is stigmatised, and this prevents affected people from accessing some of the few means of social support that they might be eligible for.
- ◆ AIDS typically strikes more than one household member.

### Impact on household economies

Initial household impacts due to HIV status and societal discrimination can include loss of insurance and medical benefits, as well as costs of pre-AIDS treatments or attempts to find a cure. Once a household member develops AIDS, increased medical and other costs, such as transport to health services, occur simultaneously with reduced capacity to work, creating a double economic burden. Members who would otherwise be able to earn income or perform household and family maintenance activities may now spend their time caring for the person with AIDS.<sup>5</sup>

Many families may become entirely dependent on an elderly member's old age pension, other social support grants, or sale of assets.<sup>2</sup> Expenses will often reduce ability to pay for children's education, food, housing, basic utilities and home maintenance, causing economic losses that will extend well beyond the affected person's death. Many families will use a

large proportion or all of their remaining resources to cover burial costs. Burial conventions, including large outlays and attendance requirements, resulting in travel expenses to relatives and community members, who often live far apart, may change as the epidemic progresses. Surviving members, including children, may be forced into very low paid work, crime or sex work, which would in turn perpetuate the epidemic.

### Impact on women

Women are particularly heavily affected by the epidemic. They are at greater risk of infection due to biological, social and economic factors, and are also more vulnerable to impacts for several reasons. Women headed households in South Africa tend to be poorer than those headed by men, and therefore have less reserves.

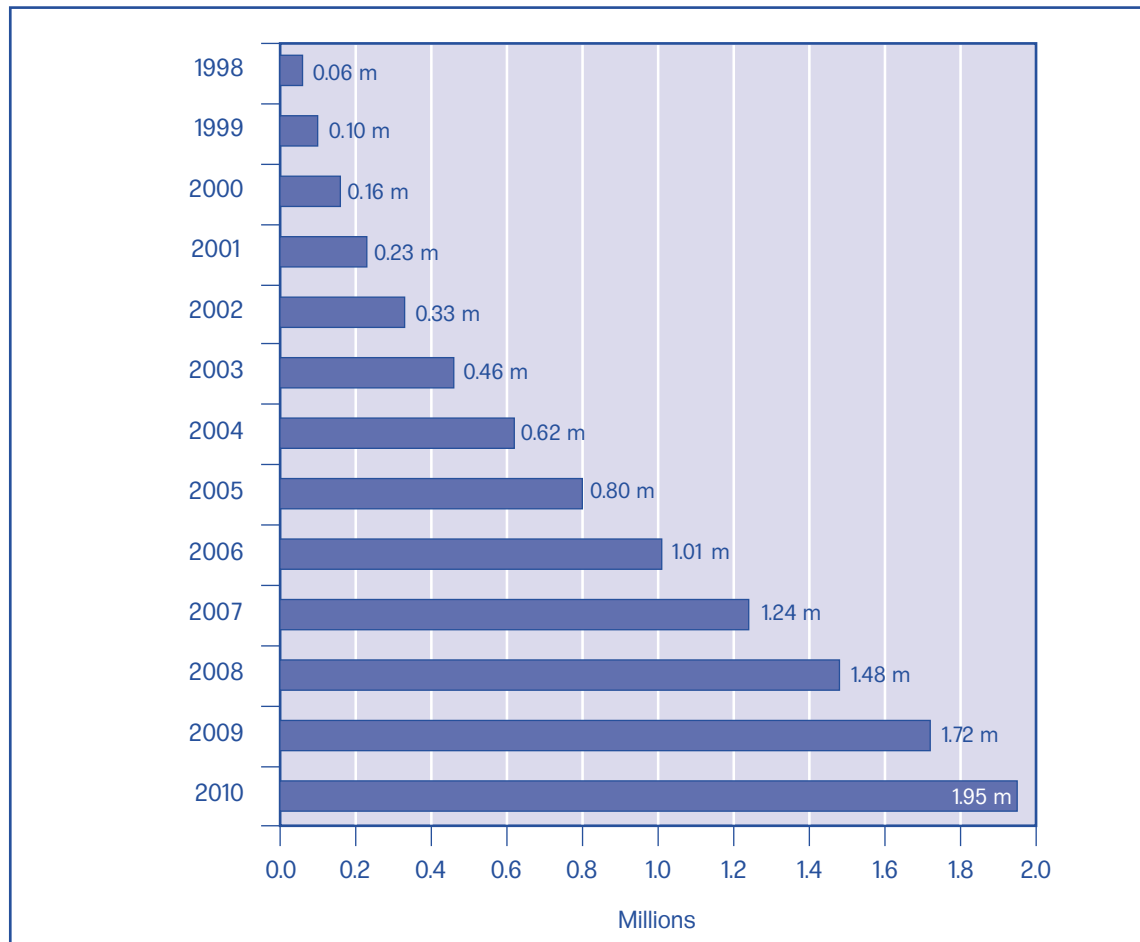
Unemployment is far higher amongst women than men. Even amongst married women, there is a high level of economic maltreatment; a recent survey indicated that partners of one in five married women regularly withheld money for essential living expenses, such as food, rent or bills, whilst having money for other things. Violence against women is high, with 13% of women reporting being beaten by a partner. Many women face risk of abandonment and abuse, following disclosure of HIV positive status. Women traditionally provide care to the terminally ill, and girl children in particular may be required to provide care especially in single-parent households or when one parent has already died of AIDS.<sup>6</sup> Widows may become dependent on a husband's male heir for support under some customary legal arrangement, which may make them more vulnerable.<sup>2</sup>

### Orphans

Orphans are perhaps the most tragic and enduring legacy of the HIV/AIDS epidemic. Caring for them is one of the greatest challenges facing South Africa. By 2005 there are expected to be around 800 000 orphans under the age of 15, rising to 1.95 million in 2010.<sup>a</sup> This is shown in Figure 5.

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a Orphans are defined as children under age 15 who have lost their mother to AIDS.

**Figure 5: Estimated number of orphans by year**

Many orphans will grow up as street children or will form child-headed households to avoid being separated from siblings.<sup>7</sup> Others will be brought up by grandparents with limited capacity to take on parenting responsibilities. All will have been traumatised by the illness and death of parents, and often by separation from siblings.<sup>8</sup> Trauma will be exacerbated by stigma and secrecy around HIV/AIDS that hampers the bereavement process and exposes children to discrimination in their community and even extended family. Orphans will probably be more susceptible to becoming HIV-infected through abuse, sex work or emotional instability leading to high-risk relationships.

As children grow up in these pressurised circumstances, without adequate parenting, support and opportunities, they are at high risk of developing antisocial behaviour and of becoming less productive members of society. The consequences for affected children and society as a whole will be profound.

### **Capacity of traditional coping mechanisms**

Throughout Africa, households and communities have shown remarkable capacity to cope with HIV/AIDS impacts, including orphan care. However, even strong coping mechanisms have often broken down under the huge burden imposed by HIV/AIDS. Certain households (e.g. poor, single parent or breadwinner, multiple infected members) are more vulnerable. In addition, short-term coping may hide long-term impacts on individuals and society through factors such as reduced childcare and education.

In South Africa, traditional extended family and community coping mechanisms are likely to be weak in comparison to many other African countries because apartheid has left a legacy of disrupted family and communal life. Rapid urbanisation and expectations that the State will provide health care and other support have weakened mechanisms further. A 1992 survey indicated that 62% of Sowetans felt that care for AIDS orphans was government's responsibility. Only 28% felt that relatives should take care of them.<sup>9</sup>

South Africa, unlike many affected countries, does have a formal welfare system, including institutional care of orphan or foster care support. However uptake of foster care grants is low, and even at current uptake rates, large cost implications of HIV/AIDS have been projected. Costs of institutional care are prohibitively high. Alternate models of providing support for vulnerable children and communities need to be explored urgently.

## **Economic impact**

### **Background: The South African Economy**

The HIV/AIDS epidemic confronts South Africa at a time its economy has shown growth averaging 2% p.a. between 1995 and 1999, and inflation averaging around 7% p.a. Although its GDP per capita positions South Africa as a middle income country, this masks large differences between rich and poor. South Africa's Gini coefficient of 0.61 is among the highest in the world, and is large relative to other African countries such as Kenya (0.57) Nigeria (0.59) and Zambia (0.44).<sup>10</sup>

Manufacturing is the largest contributor to GDP in South Africa, followed by community, social and personal services. The greatest percentage of workers is employed in these sectors. Some industries, notably mining, are undergoing a rapid shift from labour-intensive to mechanised production methods. The government's current strategy is to spur economic growth via restraint in public spending and encouraging international investment. It has done little to directly stimulate employment.

Current unemployment in South Africa is estimated to be about 30%, and despite modest economic growth, there has been a steady shedding of formal sector jobs throughout the 1990's. Unemployment amongst women is far higher than that of men, with approximately 38% of women and 22% of men unemployed. There are large provincial differences in unemployment rates, ranging from a low of 19% the Western Cape to a high of 41% in the Northern Province and Eastern Cape.

### **Effect of HIV/AIDS on businesses**

The HIV/AIDS epidemic primarily affects working age adults and far outweighs any other threat to the health and well being of South African employees. AIDS deaths will soon exceed all other causes of death put together amongst employees in South African workforces. Over the next 10 years, the number of employees lost to AIDS is expected to be the equivalent of 40-50% of the current workforce in many South African firms.

At the level of individual businesses, HIV/AIDS among managers, employees and their families will impose significant direct and indirect costs. Direct costs to companies include costs of health care and other employee benefits. However, as lower income earners who are disproportionately affected typically have few benefits, HIV/AIDS impacts on these direct costs will not be as much as may have been expected. Nonetheless, HIV/AIDS is already resulting in rising costs of employee benefits in South Africa. The cost of an average set of risk benefits is expected to double over the next 5-10 years, unless they are restructured.

Projected cost increases, for specific benefits, as a percentage of salary in South Africa, are illustrated in Table 1.

**Table 1: Projected costs of risk benefits as a percentage of salary in South Africa**

	1997	2002	2007
Lump sum death or disability benefit	1.5	2.9	4.5
Spouse's pension	4.0	5.9	7.5
Disability pension	1.5	2.1	2.6

Source: Metropolitan Life Ltd

The most significant costs for most companies are likely to be indirect. These costs include costs of absenteeism due to illness or funeral attendance, lost skills, training and recruitment costs, and reduced work performance and lower productivity. Obviously, these costs are most striking for skilled workers, where instant substitution is more difficult. By 2010 it is estimated that approximately 15% of highly skilled employees will have contracted HIV.

The vulnerability of businesses to HIV/AIDS impacts will vary, depending on factors such as the type of business and production processes. Labour intensive firms may appear to be at higher risk of lost production. The impact will depend on the ease with which employees can be substituted, however. For a high skill, labour intensive industry, such as education, it will be very costly to retrain replacement staff, whereas low-skill industries such as commercial cleaning will be easily able to find replacement employees even at the height of the epidemic.

Some capital intensive industries can be more vulnerable to HIV/AIDS than labour intensive ones, where employees specialise in operating particular machinery. Within the mining industry, for example, gold mine employees have borne the brunt of the HIV epidemic, but because there is relatively little task specialisation, production has not been seriously affected. Coal mining, on the other hand, employs small numbers of machine operators each performing specialised tasks, and loss of a few operators can lead to substantial production losses.

Other factors influencing costs include the risk profile of employees, risk modification attempts by firms, and the degree to which work processes have been planned to take HIV infection into account.

For most businesses, costs of HIV/AIDS among employees are unlikely to be devastating in any one year but, over time, costs will be substantial, and will affect international competitiveness in particular. In some firms, illness and death of owners or key managers may be disastrous. Small and medium size businesses reliant on local skilled people are probably particularly susceptible.

Businesses may also be susceptible to inadequate responses to HIV/AIDS among key suppliers. Particularly important are likely to be water and electricity, telecommunications and basic government service suppliers, where breakdowns due to HIV/AIDS impacts could have a downstream effect on many other firms. Impact assessment and forward response planning by all sectors of government will be critical to minimising these impacts.

## Impact on markets

HIV/AIDS will also impact on the growth of many markets for goods and services. Vulnerability of particular markets will be influenced both by the nature of the good or service produced, and the demographic and risk profile of consumers. Certain markets will even expand, most notably for health care services.

Probably the most profound impact on consumption will be in distributional terms. Affected households are likely to divert expenditure to HIV/AIDS-related needs such as health care and funeral expenses. “Luxury”, non-essential goods with high income elasticities of demand are likely to be more susceptible to household expenditure shifts to HIV/AIDS-related expenses. HIV/AIDS is also expected to increase polarisation of incomes and expenditure. Poor households, which will bear the main burden of illness and deaths, will be pushed further into poverty. Many middle income households will fall back into poverty. Market growth for goods and services targeted at upwardly mobile households may be more severely affected.

The risk of default on credit payments will also increase significantly in response to the epidemic. Pre-loan testing will offset some of this, but for long term loans, such as mortgages, this will be of limited value as borrowers will have a high probability of becoming infected after approval of the loan. Long term lenders and insurers have already begun adapting products to reduce their exposure. Furthermore, affected households will need to draw on savings for more immediate needs, thus reducing savings levels and credit supply.

## Macroeconomic impact of HIV/AIDS

Any estimates of the macroeconomic impacts of HIV should be treated with circumspection. Economists have great difficulty predicting the effect of factors that have been studied for the last 100 years on economic growth. It should thus come as no surprise that predicting the likely effect of a new phenomenon like AIDS is a far from exact science. Having said that, the impact of HIV/AIDS on economic growth is anticipated to be relatively small compared to other shocks like war, significant natural disasters, and cyclical and global economic events. Nonetheless, the epidemic has the potential to reduce growth through:

- ◆ Reducing the numbers of workers available in the economy (human capital) and increased production costs; these may reduce international competitiveness
- ◆ Decreased public sector, corporate and personal savings due to health care and other HIV/AIDS related expenses, which in turn may reduce investment, and drive up the costs of capital
- ◆ Reduction in direct government investment in areas such as infrastructure and education due to diversion of expenditure to HIV/AIDS needs.

Impacts on human and social development are expected to be much more profound than reflected in very limited indicators such as GDP or per capita GDP. Increased illness and deaths, and reduced life expectancy, will clearly compromise development objectives. Affected people, particularly orphans, will also have greatly reduced chances of fulfilling their human potential. Apart from disadvantages of reduced nurturing, many affected children will have less educational and other opportunities. HIV/AIDS is also likely to increase socio-economic disparities. HIV/AIDS can be expected to exacerbate poverty and inequality.

## Health care cost projections

One of the most immediately evident economic impacts of the HIV/AIDS epidemic is the increasing need for resources for caring for people ill with AIDS. Although these are not routinely measured, they can be estimated using demographic projection models and currently observed HIV-associated health care costs.

South African health care is characterised by two largely distinct funding and provision environments. The private health sector is funded mainly via employment-related health insurance schemes, covering around 20% of the population. The balance of the population makes use of a publicly funded hospital and primary care clinic system funded out of general tax revenue. Although public hospitals are required to charge means tested user fees, services are essentially free of charge.

A mathematical simulation model was used to project likely health care expenditure increases due to AIDS in both public and private sectors. This approach assumes that levels of care offered early on in the epidemic (1992-1996), and associated expenditure per affected person, will be maintained despite increasing levels of illness. It thus gives an estimate of likely costs should all needs continue to be met at mid-1990s levels. The data sources and methods underlying these projections of health care costs are described in appendix 2.

### Public and private sector impact

Both public and private sectors are likely to be seriously affected by the AIDS epidemic, with whole population seroprevalence levels reaching 13% and 9% respectively by 2010 under the best projection scenario. Impacts on the private sector are likely to be delayed compared to those on the public sector. While public sector data can easily be confirmed by comparison with antenatal sero-survey data, there is little by way of confirmatory prevalence data for the private sector. We are also likely to see a change in the relative mix of different stages of disease across the study period. As the epidemic progresses, a greater proportion of people will be in the later stages of disease, as the pool of newly infected people declines and the bulk of infected people enter the late stages of disease.

Health care costs differ significantly at different stages of disease. Table 2 shows estimated in-patient and outpatient average costs of care per year for public and private sectors by stage of disease.

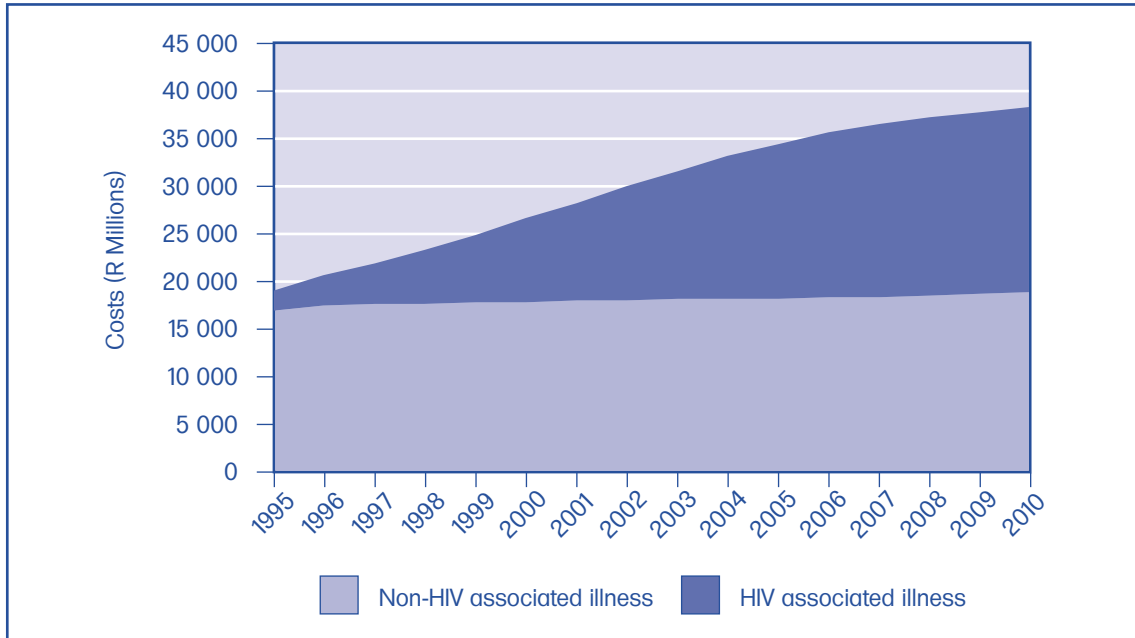
**Table 2: Average cost of care per infected person per year by stage and sector**

	Public sector			Private sector		
	Total	inpatient	outpatient	Total	inpatient	outpatient
Stage 4	R 17 000	R 15 500	R 1 400	R 38 300	R 35 100	R 3 200
Stage 3	R 6 200	R 5 200	R 1 000	R 14 200	R 11 800	R 2 400
Stages 1 and 2	R 1 300	R 700	R 600	R 3 000	R 1 600	R 1 400

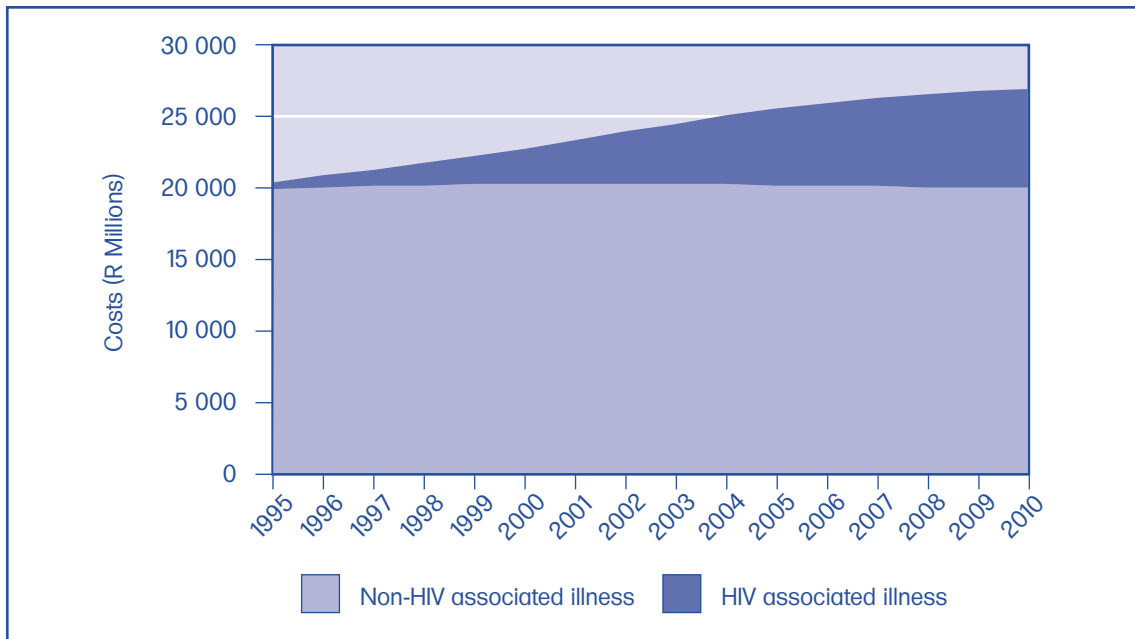
Importantly, neither include the costs of anti-retroviral therapy. Triple anti-retroviral therapy costs around R44 000 per year according to a recent study from Costa Rica,<sup>11</sup> with another approximately R7 000 per year required for monitoring.

When demographic projections are combined with cost data, expenditure projections are produced until 2010. Figures 6 and 7 show these for the public and private sectors respectively in constant 2000 terms. Costs include all acute in and outpatient care but exclude prevention activities, long-stay and rehabilitation activities, and administration and management costs in both private and public sectors.

**Figure 6: Cost of public sector health care by year - constant 2000 rands**



**Figure 7: Cost of private sector health care by year - constant 2000 rands**



Acute health care costs would be expected to more than double in real terms in the public sector if levels of care were to remain constant. The proportional impact on the private sector is significantly less than in the public sector. This is partly because of lower infection

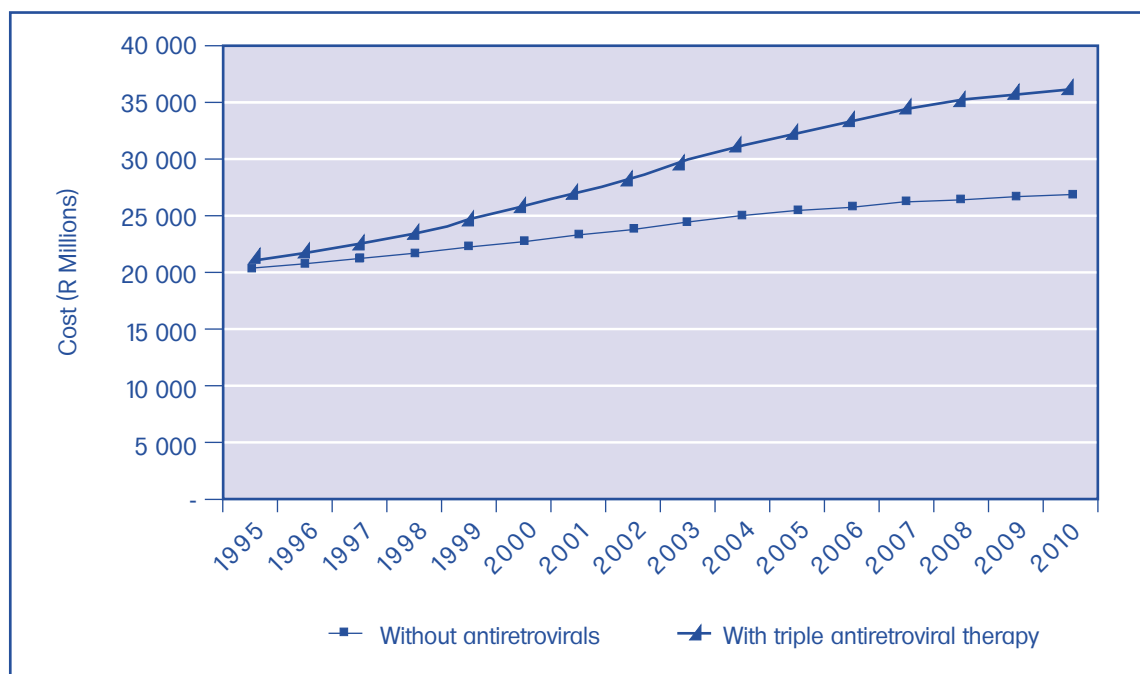
rates, and partly because of high levels of expenditure in the private sector on non-HIV related interventions, which are not commonly provided in the public sector. The main form of care that falls into this category is elective surgery for non-life-threatening conditions, for example, hip replacements, cataract surgery, and hernia repair.

Non-HIV associated spending is projected to decline, or experience a slower rate of growth in both public and private sectors because of demographic changes. Early on in the epidemic, a decrease in the number of women of childbearing age leads to a decrease in pregnancy and birth-related expenditures. Later in the epidemic - around 2025, the model suggests that non-HIV associated costs will decrease as a result of the relatively small proportion of people entering old age.

### Anti-retroviral use

It seems unlikely that anti-retroviral use will reduce overall costs of care. Figure 8 shows the likely costs of care in the private sector with and without provision of anti-retrovirals for stage 3 and 4 patients, taking into account likely savings in hospital and ambulatory care.

**Figure 8: Private sector costs in South Africa with and without provision of triple anti-retroviral therapy**



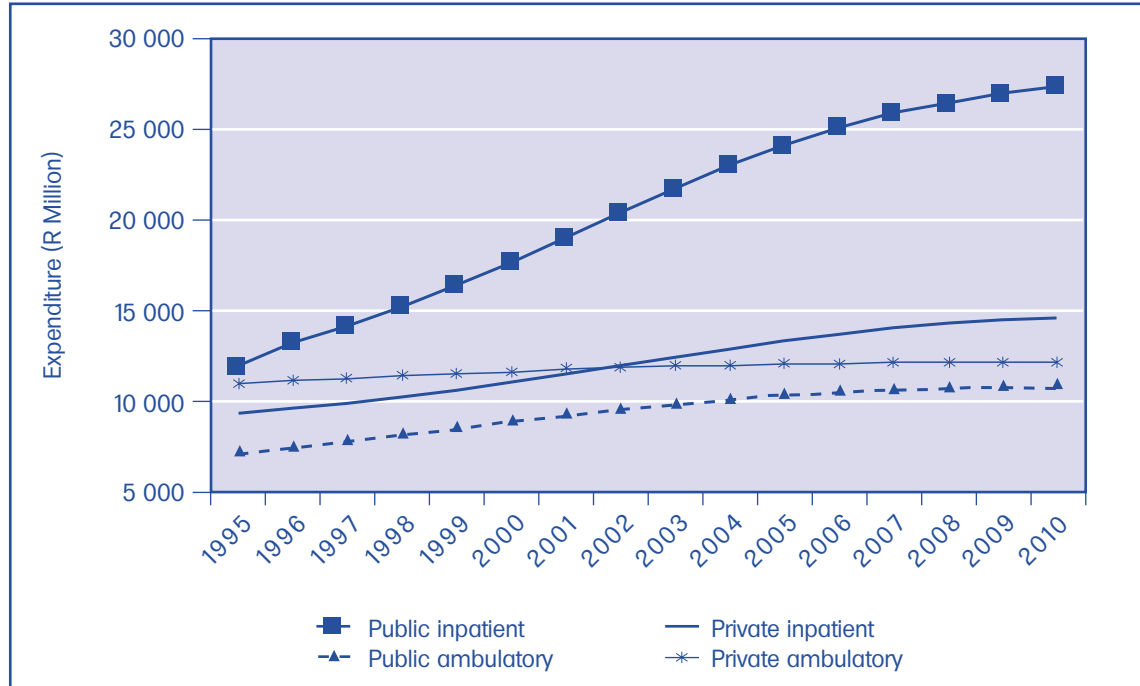
Costs of care would increase by R9 billion in 2010, and the costs of HIV-related care more than double. For triple anti-retroviral therapy to at least pay for itself through savings in other HIV-related costs, it would have to cost less than one tenth of current market prices in South Africa, assuming effectiveness equivalent to that used in the Costa Rican study.<sup>11</sup> Such drastic price reductions seem unlikely at the moment.

Provision of triple anti-retroviral therapy within the public sector would be proportionately far more expensive than the private sector because of lower levels of resources generally, and a higher burden of HIV disease. If triple therapy at current market prices were given to all public sector patients in stages 3 and 4 it would cost R70 billion per year by 2010, thus approximately tripling South Africa's public health care budget for that year.

## Rationing

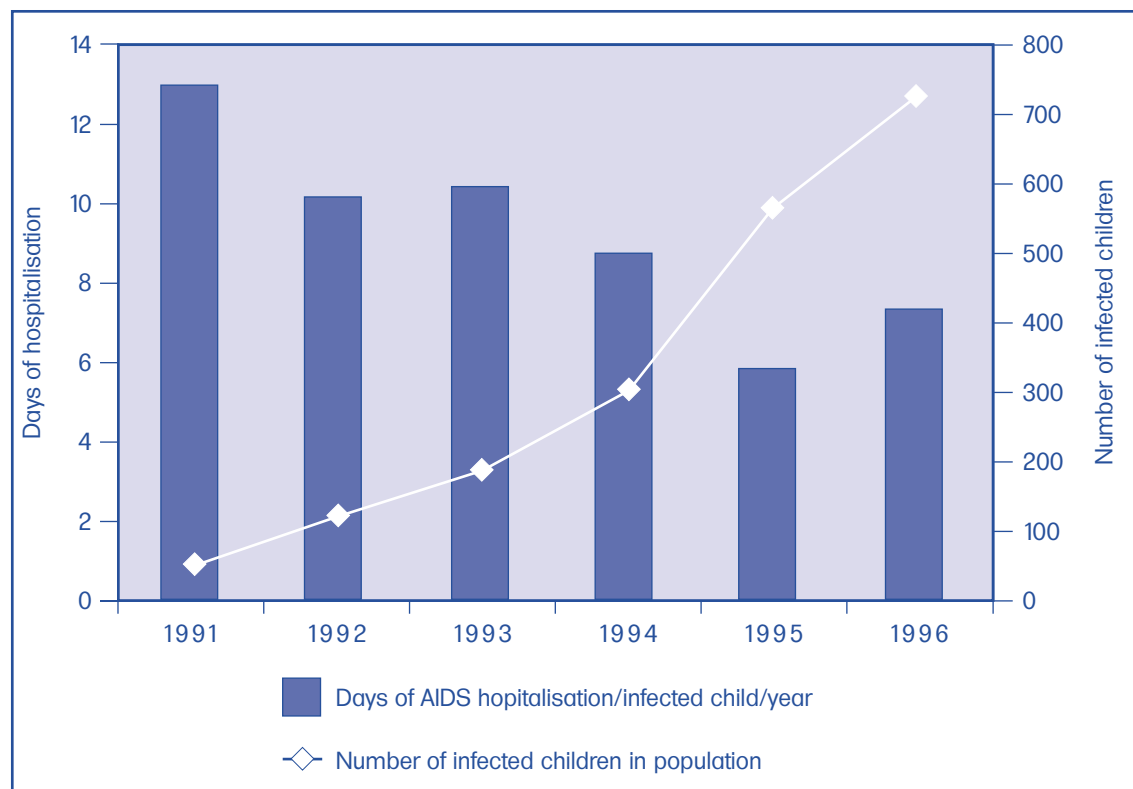
The increased health care burden imposed by the epidemic will fall mainly on the public hospital sector. Figure 9 shows projected increases in required expenditure in inpatient and ambulatory components of public and private sectors.

**Figure 9: Projected required increases in expenditure by type of care and sector**



If 1995 levels of care were maintained, public spending on hospitals would have to increase 2.3 times. The impact on ambulatory care in both public and private sectors is likely to be significantly less. These estimates reflect the degree to which South Africa relies on acute hospitals for care, which may be more cost-effectively provided in other settings. There is thus a serious need for developing hospice-type institutions, which would provide some substitute for acute hospital care. So far, very little by way of public or private sector resources has been put into such initiatives.

Projected expenditure requirements will almost certainly not be sustainable given public and private sector affordability constraints. This implies that some rationing will have to occur to reconcile needs with available resources. There are indications that this is already happening within the public sector. Figure 10 shows decreased hospital utilisation per child ill with an AIDS-related disease at Baragwanath hospital over the period 1991-1996.

**Figure 10: Rationing of access to hospital care for children ill with AIDS with increasing levels of infection**

It is possible that HIV-related disease sufferers will experience a greater degree of rationing than other health service users. There are already anecdotal reports of public hospitals refusing to admit patients at all if they have a positive HIV test, or refusing them any form of surgery even for trauma. There will be increasing temptation to blame the victims of the epidemic for the strain caused to health services, and deny them access to basic care. Clearly, the challenge for both public and private sectors is to shift to fundamentally more cost-effective modes of therapy for people ill with HIV-related diseases, rather than resort to irrational or even discriminatory exclusion from services. This will need to include a fundamental re-orientation towards lower-cost hospice-type care instead of acute hospitalisation, and consistent and substantial support to community-based care initiatives. Economic evaluations of a number of these initiatives are currently being assessed.<sup>b</sup> These confirm findings from an earlier study that these community-based care initiatives may be more costly than previously expected and will require levels of efficiency and economies of scale to be more cost effective.<sup>12</sup>

Neither of the above interventions has yet received much attention from the public sector. At the primary care level, widespread roll-out of cost-effective secondary prevention programmes, such as TB and pneumonia prophylaxis should be urgently implemented.

It appears that widespread use of anti-retroviral therapy for people ill with AIDS does not offer a realistic solution to the health care impacts projected. Even in the relatively wealthy private sector, an order of magnitude price reduction would be required before net savings could be expected. AIDS activists and international agencies would better spend their time advocating delivery of basic programmes of care.

<sup>b</sup> Dr Saul Johnson, Abt Associates. Person communication.

## HIV prevention in South Africa

With no prospect of an AIDS vaccine in the foreseeable future, HIV prevention requires sustained efforts of social mobilisation toward healthier and safer sexual behaviour. Data presented above have shown high rates of HIV infection in the sexually active population. This indicates high risk behaviour, which has been confirmed by various behavioural surveys.

For example, data from the South African Demographic and Health Survey of 1998 indicate early onset of sexual activity and poor condom usage. The survey showed that approximately 35% of non-married women, aged 15 - 19, had at least one sexual partner in the last 12 months, and that only 16% of all women interviewed, who had sex in the last 12 months, had used a condom in their last sexual encounter with their non-spouse partner.

A further example demonstrates that people have a good knowledge of HIV/AIDS, its mode of transmission, and how it can be prevented but often fail to act on this. In a study conducted in the mining community of Carletonville, all questions asked regarding risk factors for HIV infection and modes of prevention were correctly answered by the majority of responders.<sup>1</sup> There was a relatively weak relationship between perceived risk of infection and actual infection, however. Twenty two percent of those who thought they were at low-risk were infected, compared to 29% of those who thought they were at high risk of infection. Of those who had no opinion as to their risk status, 36% were infected. Men surveyed reported using condoms in less than 25% of contacts with non-regular partners, however, and in less than 5% of contacts with their regular partner.

The greatest barriers to achieving HIV prevention are fear and ignorance. HIV prevention efforts have been plagued above all by silence brought on by the denial and stigmatisation that is associated with the disease. In one study of home-based care schemes in Southern Africa, fewer than 1 in 10 people who were caring for an HIV-infected patient at home acknowledged that their relative was suffering from AIDS. Patients themselves were only slightly more likely to acknowledge their status.

Achieving sexual behaviour change is a complex task, requiring integrated intersectoral approaches implemented at all levels of society. Prevention initiatives need to succeed in creating a social consciousness that leads to appropriate personal action.

Once effective interventions are adopted, their actual success will depend on how they are implemented and sustained. Implementing agencies (which may include the State; employers; schools; non-governmental and community-based organisations) require the organisational support, staffing and skills, sufficient resources and technical assistance in order to achieve the desired impact of the intervention. Decisions to commit increased resources to HIV prevention will be determined, to a large extent, on a perception of their cost effectiveness.

### Cost-effectiveness of prevention

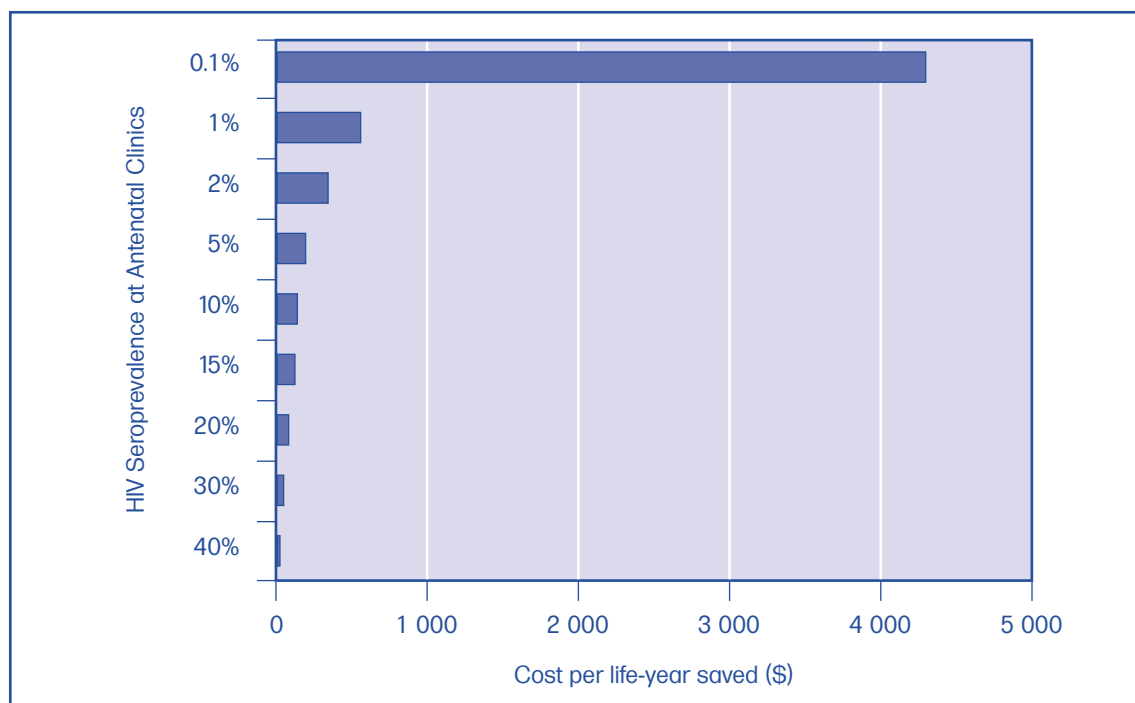
The costs of delivering prevention programmes can vary widely, depending on the strategy used and the nature of the implementing agency. However, most prevention programmes are far more cost-effective when they are introduced as early as possible in the course of the epidemic, as they prevent both primary cases of new HIV infections and their complications, as well as subsequent new HIV infections. Prevention interventions are likely to be much less costly than managing HIV complications at a later date. It has been estimated, for work place settings, that costs averted are estimated to be around 3.5-7.5 times the costs of prevention interventions.<sup>15</sup>

Despite almost universal acceptance that prevention strategies are far more cost effective than treatment of HIV, relatively little research has gone into rigorously evaluating the relative effectiveness of different approaches. Sufficient evidence exists, though, that prevention efforts can be successful.

◆ Blood screening and mother to child transmission prevention programmes

- There is good evidence locally and internationally that blood screening and mother to child transmission prevention programmes are both effective and cost-effective in medium and high prevalence contexts. While the former has been in place in South Africa since the late 1980's, the latter has yet to be implemented in the public sector.
- Mother to child transmission prevention programmes are more cost-effective within mature epidemics, where they are likely to pick up high numbers of infected people who have not yet manifested with secondary infections that would draw attention to their HIV status. Figure 11 shows the cost-effectiveness of an antenatal screening and maternal to child prevention programme at different levels of HIV prevalence.<sup>14</sup>

**Figure 11: Cost per life year saved of long-course anti-retroviral administration for preventing mother to child transmission (in \$)**



◆ Management of sexually transmitted diseases

- An important study in the Mwanza district of Tanzania showed that improving the quality of STD services could reduce new cases of HIV infection by as much as 40%.<sup>15</sup> A similar study conducted in the Rakai district of Uganda at a much later stage of the epidemic showed minimal effect of STD treatment on HIV incidence, however, suggesting that this intervention is effective mainly early on in the epidemic and should be especially targeted at the youth.
- Evidence for the cost-effectiveness of treating other sexually transmitted diseases during the rapid growth phase of the epidemic has been shown in a mining sector prevention programme in South Africa. This programme was estimated to have

avoided costs of HIV/AIDS over the next 8-10 years equivalent to 45 times the cost of the programme.

◆ Programmes aimed at changing sexual behaviour

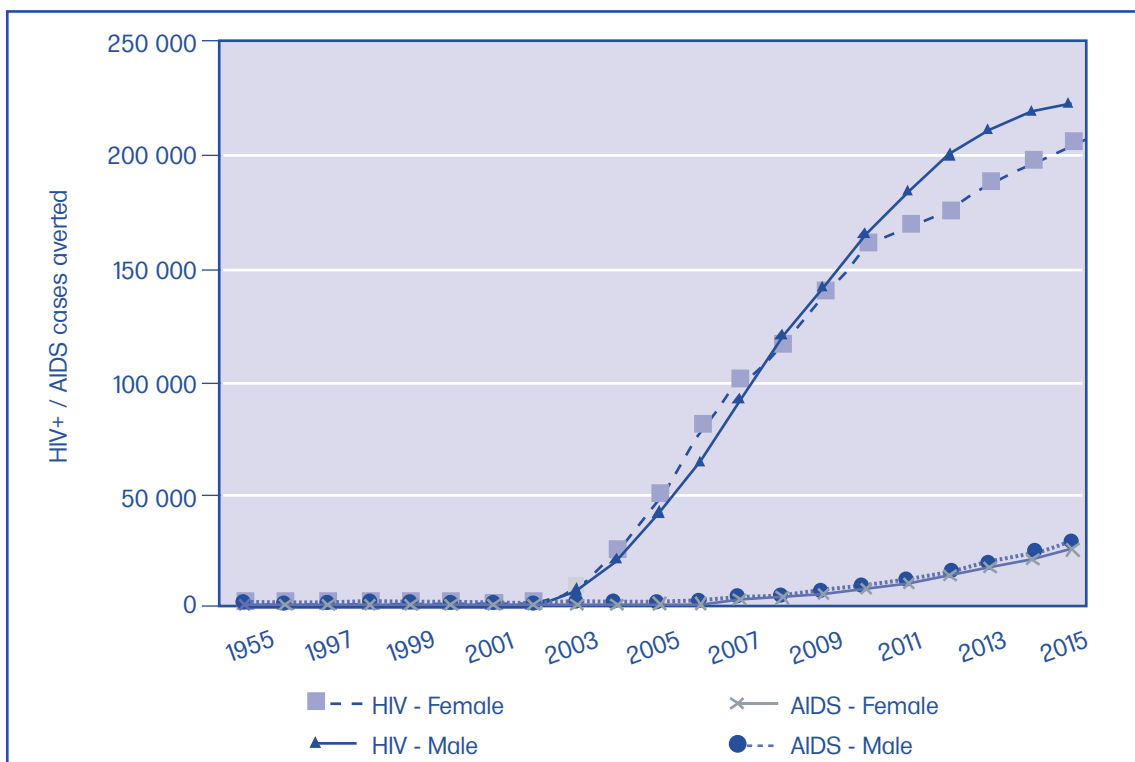
- Interventions that rely on behaviour change have not often been shown to be successful. One encouraging report from Uganda, however, indicated that HIV incidence is declining, particularly in the 15 to 19 year age group.<sup>16</sup> This was linked to changes in sexual behaviours: younger people are waiting longer before they become sexually active, have fewer sexual partners and are using condoms more regularly.

**Modelling the impact of targeted prevention programmes**

In most cases, targeting limited resources towards specific high-risk or high prevention opportunity groups represents the best value for money. The nature of these groups changes with the maturity of the epidemic. Early on, emphasis is appropriately placed on educating specific high-risk groups, such as commercial sex-workers. Later in the epidemic, it is harder to identify risk groups so narrowly, and whole sexually active sectors of society need to be targeted. For this reason, early HIV diagnosis through voluntary counselling and testing and subsequent partner notification, with intensive education and support, makes sense.

Projections can be used to estimate what effect interventions might have on the epidemic in South Africa. Using a standard epidemiological projection model, with the assumption that an intervention is introduced that increases condom use by 15% for all sexually active people starting in the year 2000, the profound impact of this relatively modest intervention on population HIV prevalence rates and AIDS cases can be shown. This is illustrated in figure 12.

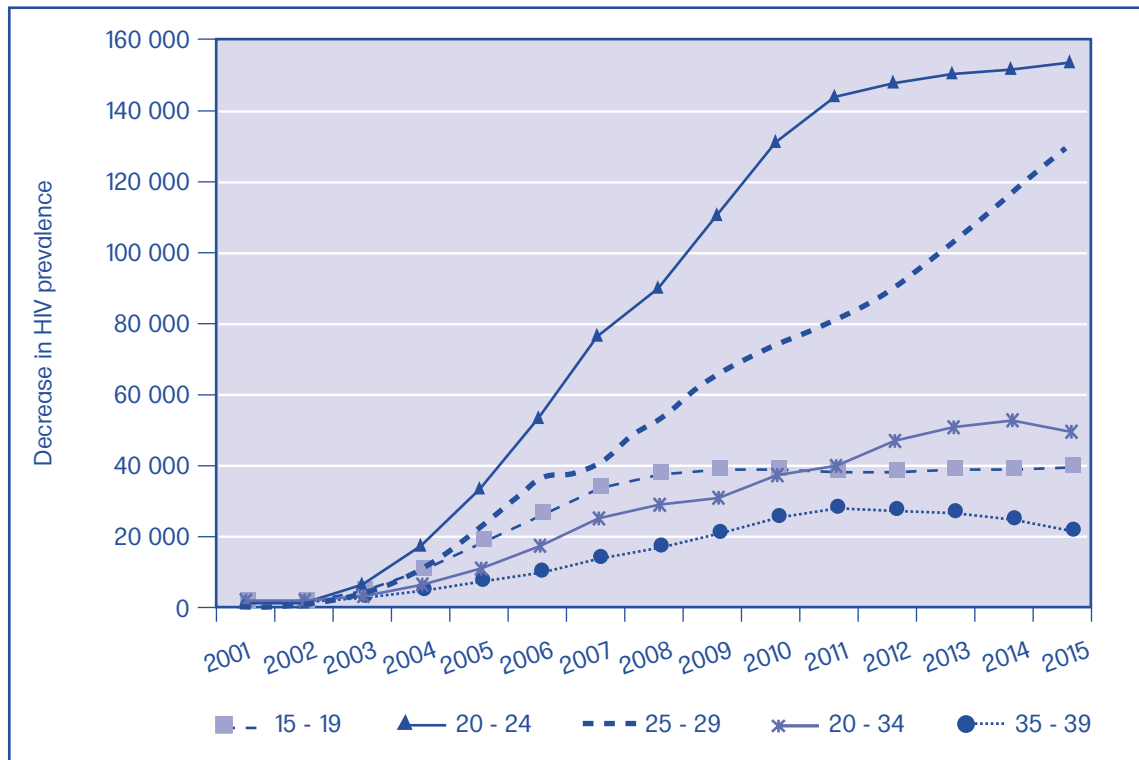
**Figure 12: Decreases in HIV infection and AIDS cases in men and women as a result of a sustained 15% increase in condom use**



HIV prevalence amongst women declines before it does in men because of their higher susceptibility to infection, but the time-lag between the sexes is minimal. The effect on AIDS cases is significantly delayed, however, and suggests that even very effective preventive strategies will take a long time to reduce the burden on treatment institutions.

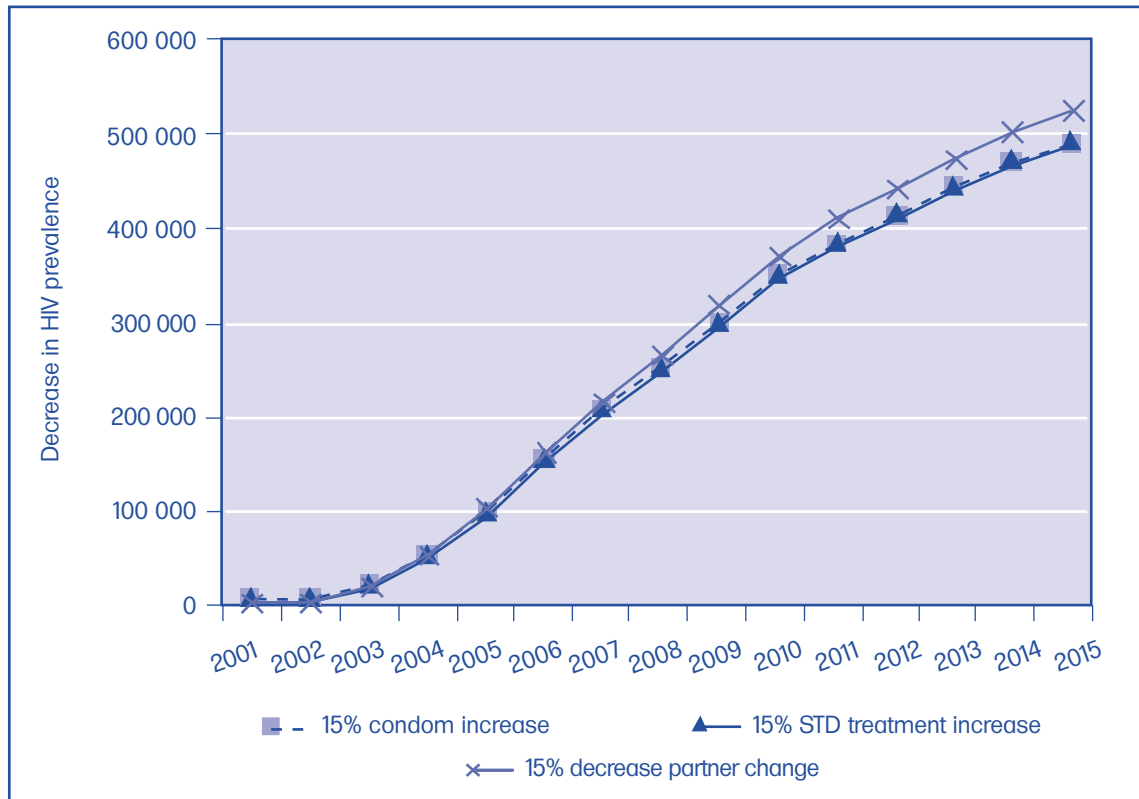
Age effects are of interest. The 20-24 year age group shows the greatest benefit from the intervention, as shown in Figure 13. It is this group that would have been exposed to youth education programmes in the preceding 5 years. The impact is modest in the 15 to 20 year age group because this group is being regularly refilled with 'at-risk' people. This emphasises the need for repeated intervention in the 10-15 year age group, who will go on to constitute this group of susceptibles. Because of greater susceptibility to infection, girls in particular need to be targeted before the age of 15. If we assume a five year lag between effective, sustained interventions and HIV seroprevalence changes, then it would appear that educating those over 25 yields proportionately little by way of epidemic reduction.

**Figure 13: HIV positive cases averted by a 15% increase in condom use by age group**



In addition to condom use, models have been used to estimate the effect of increased treatment of conventional sexually transmitted diseases (STDs) and decreased partner change. Figure 14 compares the effects of a 15% improvement in each of these in preventing HIV.

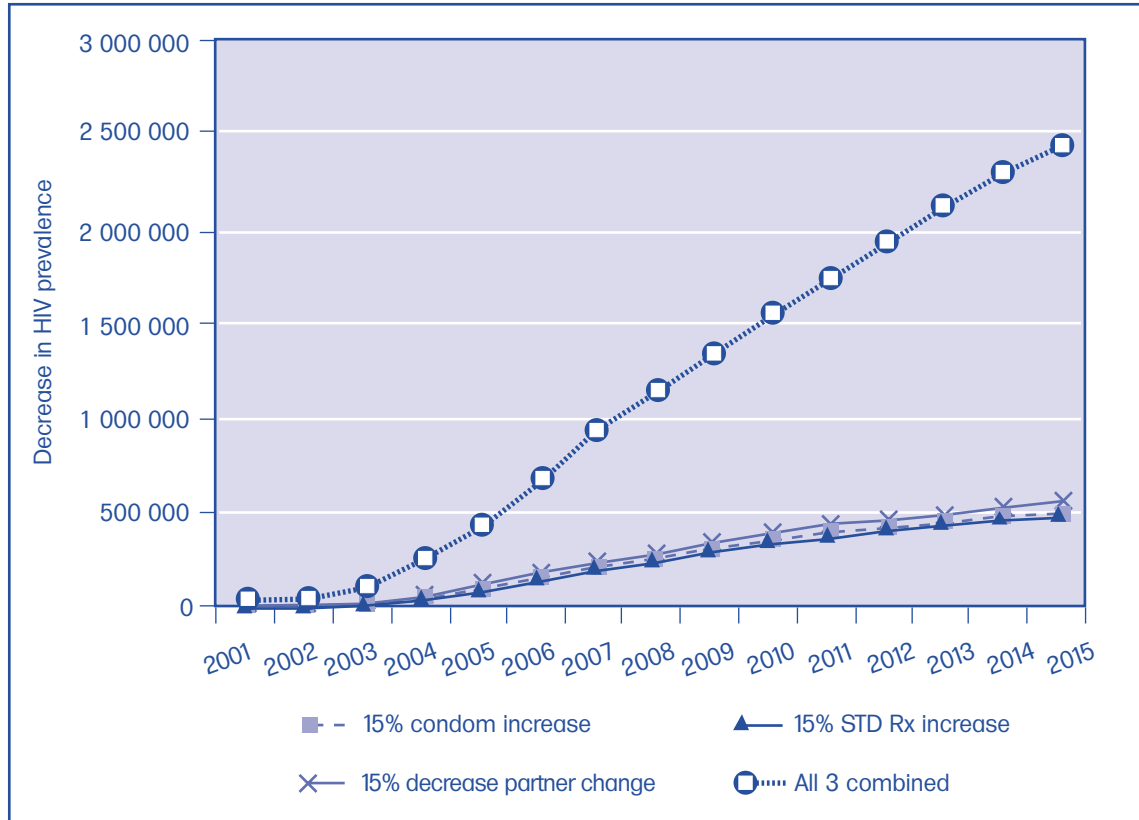
**Figure 14: Relative effect of condom use, STD treatment and decreased partner change**



Interventions are very similar in terms of their projected impact by 2010. Importantly, the impact of all sustained interventions is not only in saving those people directly affected by the intervention, but also in reducing the total number of people able to infect new cohorts entering sexual maturity. This suggests that combined interventions will be more effective than the sum of isolated single interventions.

Figure 15 shows projected seroprevalence decreases due to each of the interventions, and all three of them combined. By 2010 we would estimate that the decrease in HIV people in the population due to the combined intervention would be more than 50% greater than the sum of the effectiveness of each of the three individual interventions. Furthermore, while the effectiveness of individual interventions are showing signs of plateauing by 2010, the combined intervention is not.

Figure 15: The effect of combining intervention strategies



Although not shown in the graphs, the long term effect of all of these interventions is to reduce the level at which HIV seroprevalence plateaus, rather than eliminating infection altogether.

## Appendix 1: The Doyle Model

The model used to produce estimates of demographic impacts of HIV/AIDS for this report is the most up to date version of the Doyle model developed by Peter Doyle of Metropolitan Life Ltd. The model's calibration is continuously updated by the Metropolitan Life AIDS Unit to incorporate any significant new demographic and epidemiological data from South Africa and other African countries. The model has the longest track record of use in South Africa and is the most flexible model for projecting the HIV/AIDS epidemic in South Africa. A simplified, spreadsheet model developed by the Actuarial Society of Southern Africa is based on the approach used in the Doyle model.

The Doyle model combines features of a macro-simulation model and a micro-simulation programme. A macro-simulation model is calibrated in terms of inputs at a macro level, such as reported HIV prevalence levels at national or regional level. Pure macro-simulation models rely on inputs which can be very broad, and which are not directly defensible except through confirmation of the results they produce.

A micro-simulation model is built on comprehensive, scientifically defensible input parameters which consider the risk behaviour of individuals within a given population and aggregate their effects to produce projections of HIV/AIDS for whole groups or populations through complex iterative calculations. Pure micro-simulation models depend on a range of input parameters for which little reliable information can be found and also have difficulty in producing reliable projections.

Combination of features of a macro and micro model thus make the Doyle model robust and better able to produce reliable medium and longer term projections at a macro level without losing sensitivity to underlying micro parameters which may be relevant to particular sub-populations. The epidemic in a province, region or the whole country is assumed to be an aggregation of many sub-epidemics in particular population sub-groups. Each of these is defined by its unique demographics (eg race, gender, age profile), its geographic location and the timing of the epidemic in the area relative to other areas, and risk in terms of sexual behaviour patterns.

Of crucial importance to the projections is the notion that the epidemic moves through a population through interaction between various risk groups. Four behavioural risk groups are defined in the model: commercial sex workers and frequent clients; other people with high incidence of sexually transmitted diseases; people at risk of infection; and people not at risk of infection. Sub-epidemics are initially fed by infected people from outside a community and then multiply through contact between people in these risk groups.

## Appendix 2: Projection of health care costs: data sources and methods

As detailed in this chapter, the public and private health sectors differ fundamentally in the socio-economic profile of their users, their risk of HIV infection, and ability to pay for expensive AIDS care. HIV-associated expenditure requirements were thus calculated separately for public and private sectors. The detail of projections was constrained by the availability of reliable data, and a description of the data used is given below. Projections indicate likely health care costs due to HIV/AIDS, and all other health care costs. Obviously spending on AIDS and other medical conditions will always be limited by available resources. Likely costs can thus only be predicted with some knowledge of what resources will be

available, and in reality, we would expect a series of trade-offs between the quality and quantity of care offered, and constraints on both public and private sector affordability. All projections make use of the 'Best' projection scenario.

Assumptions regarding costs were based on studies of HIV/AIDS care at Chris Hani-Baragwanath Hospital<sup>17</sup> and three South African mine hospitals.<sup>18</sup> In both cases utilisation levels and costs were measured for different stages of the disease (using the four WHO clinical stages). Staging for the mine hospital data was done retrospectively from date of death assuming that all those who had had at least one HIV-related admission were in stage 3 or 4, and that the mean duration of stage 4 was 1.2 years. This produced a mean duration for stage 3 of 2 years. All care provided in acute or general hospitals likely to be due to underlying HIV disease, but excluding chronic TB care was included. This included admission for terminal or hospice type care to the extent that this occurred naturally in the settings studied. A simple average was taken between the mine hospital and Baragwanath costs and standardised to constant 2000 rands.

There are virtually no data on HIV seroprevalence and associated costs for the South African private sector. This is at least in part due to the fact that most private medical schemes excluded cover for HIV-associated disease prior to 2000, and it was thus in the interests of infected members to hide their status. We do have relatively good data on unit cost differences between public and private sectors, however, and these were used to construct notional private sector costs assuming HIV-related utilisation was the same as calculated from public sector sources.<sup>c</sup> Importantly, the costs of provision of anti-retroviral drugs such as AZT were excluded from expenditure projections as these are not normally covered even in the private sector.

The calculated annual inpatient and outpatient costs in each of the stages for both public and private sectors, were applied to the respective HIV positive population over the years 1995 to 2010 to project the expected utilisation of these services in future. Expenditure on non-HIV disease (i.e. utilisation for uninfected people and non-HIV associated utilisation for infected people) was calculated from total expenditure for the Gauteng public health sector in 1993 and 1996 data from a large health insurer for public and private sectors respectively. In both cases, relatively old data were used to minimise possible double counting of undetected HIV-associated disease. The model-projected HIV-related costs were stripped out of total public sector costs to yield the non-HIV associated proportion of total utilisation. All non-HIV associated costs were age sex standardised year by year across the study period. This is necessary because we would expect fewer adults reaching old age as a result of HIV/AIDS, and as a result, lower levels of old age-associated health service utilisation.

Projections should be interpreted with due consideration to the following issues in particular. Data on the natural history of HIV infection and health service utilisation in the South African context, particularly the private sector, are very limited. Both public and private sectors have little information on costs associated with the early stages of the disease, since contacts tend to be in outpatient or clinic settings, where minimal data are collected. This is further complicated in the private sector, where members of medical schemes may have risked restrictions on benefits, or even expulsion, if the HIV status was revealed.

Organisation of health services and approaches to managing people with HIV/AIDS will undoubtedly change with time and the introduction of new technologies. Some, such as an

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c Private sector costs per bed-day were approximately 2.5 times those of the public sector.

AIDS vaccine would fundamentally transform the course of the epidemic itself, whereas others, such as access to low-cost anti-retrovirals would change patterns of care only.

TB infection is the most common cause of hospitalisation for HIV-positive South Africans. Risk of TB infection in the non-HIV infected population is assumed to stay constant over time in this model. Given the rapid growth of TB in the HIV-infected population, and thus vastly increased levels of exposure to the whole population, this is unlikely. Most of the impact of this increase will probably be seen after 2010, as a result of growth in the pool of people susceptible to reactivation.

