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Aids and Society Research Unit

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The Cost of HIV Prevention and Treatment Interventions in South Africa

This paper estimates the costs of introducing several AIDS-related prevention and treatment programmes in South Africa.[1] Our approach combines detailed information about the costs of implementing these interventions with demographic projections of their impact. Information about prices, wages and other cost components is drawn from a range of primary and secondary sources.

Johnson and Dorrington's (2002) modelling of the demographic impact of four AIDS-related health interventions is a central input into our costing exercise. We begin the paper with an overview of the key characteristics and results of their ASSA2000 'Interventions Model'.[2] The paper then discusses the cost components of each of these interventions. We draw attention to the additional costs not considered in our primary analysis, and to the effect of antiretroviral medicine prices on the total cost of providing highly active antiretroviral therapy (HAART) to those who need it.

HAART is expensive, but the *net* costs to government are significantly lower than the direct costs of providing HAART. This is because people on HAART experience fewer opportunistic infections (OIs) – thereby saving the government the costs of treating those OIs. We estimate these 'hospital costs averted', provide a brief discussion of the savings associated with fewer orphans, and then conclude with a calculation of the cost of prevention and treatment programmes as a percentage of GNP.

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[1] The spreadsheets used for the cost calculations are available upon request from Nathan Geffen at nathan@tac.org.za. Numerous people provided essential information for this research. Thank you to Leigh Johnson, Rob Dorrington, Zackie Achmat, Neva Makgetla, Mark Heywood, Cecille Dehoper, Marta Darder, Toby Kasper, Eric Goemaere, Catherine Orrell, Robin Wood, Dikeledi Tshukudu, Fareed Abdullah, Marc Cotton, Linda-Gail Bekker, Jonathan Berger, David Coetzee, Barbara Kaparkis, Glenda Gray, Karen Kallmann, Stephen Gelb, staff at LifeLine and staff at Aid for AIDS. Leigh Johnson's contribution to this work has been especially critical.

[2] The ASSA2000 model is South Africa's premiere demographic model. It, and the Interventions Model developed by Johnson and Dorrington, can be downloaded (free of charge) from the Actuarial Society of South Africa website: www.assa.org.za/aidsmodel.asp.

The Demographic Modelling

Johnson and Dorrington (2002) analyse the demographic impact of the following four health interventions: voluntary counselling and testing (VCT); mother-to-child transmission prevention (MTCTP) of HIV; better management of sexually transmitted infections (STIs) and highly active anti-retroviral therapy (HAART). The key aspects of these interventions are highlighted in Table 1.

Table 1: Interventions Modelled in the ASSA2000 Interventions Model

Prevention Interventions	• VCT is offered before and after HIV testing. Counselling on safer sex is included. • MTCTP is implemented using the HIVNET 012 protocol (Guay *et al.*, 1999). Fifty percent of women on this programme use formula milk. • Syndromic management guidelines become the norm in the private sector. Acyclovir is used to treat patients with Herpes blisters. Medicine shortages at public STI clinics are eliminated. Private practitioners can purchase medicines for treating STIs at state tender prices, therefore these medicines become more widely available in the private sector.
Treatment interventions (HAART)	Antiretroviral therapy using three or more medicines is made available to adults with AIDS defining symptoms or whose CD4 counts are below $200/\mu l$. For children, therapy is initiated if the child is experiencing AIDS-defining symptoms, according to the CDC Clinical Staging System for Children, or if their CD4 percentage is below 15 percent.

Source: Johnson and Dorrington (2002)

We refer to VCT, MTCTP and managing STIs as ‘prevention’ interventions because their primary function is to reduce transmission of HIV. HAART is referred to as a ‘treatment’ measure because its primary function is to improve the health of people with HIV/AIDS. This distinction is, of course, somewhat arbitrary because prevention interventions can improve health (e.g. through counselling), and treatment interventions can reduce HIV transmission by lowering viral loads and encouraging people to be tested and counselled about safer sexual practices.

Johnson and Dorrington (2002) model three different intervention scenarios. Scenario One assumes that none of the interventions are implemented and thus no direct additional costs are incurred. Scenario One broadly resembles the current situation in the public sector. The only AIDS-related cost is the treatment of OIs of people living with AIDS. Hospitalisation costs rise over time under Scenario One as HIV morbidity (i.e. ill-health) in the general population increases. Scenario Two assumes that the government introduces various prevention measures, and Scenario Three also includes a treatment intervention (HAART). Table 2 summarises the components of the different scenarios.

Table 2: Interventions modelled under each scenario

	VCT	MTCTP	STI	HAART
Scenario One (treatment of opportunistic infections only)	No	No	No	No
Scenario Two (prevention interventions and treatment of opportunistic infections)	Yes	Yes	Yes	No
Scenario Three (Treatment with antiretroviral therapy, prevention and treatment of opportunistic infections)	Yes	Yes	Yes	Yes

Source: Johnson and Dorrington (2002)

The ASSA2000 Interventions Model assumes that the various interventions are phased in over time. Table 3 displays the percentage of the population assumed to have access to the interventions over time. We refer to these as the phase-in rates. The phase-in rates are not increased beyond 90 percent since few public health interventions are rolled out to more than 90 percent of the population using the public health system.

Table 3: Percentage of population for which the interventions are available over time

	2001	*2002*	*2003*	*2004*	*2005*	*2006*
MTCTP	10%	30%	50%	70%	85%	90%
All other interventions	0%	20%	40%	60%	80%	90%

Source: Johnson and Dorrington (2002)

According to the ASSA2000 Interventions Model, life expectancy will improve significantly if prevention interventions are introduced (Scenario Two), and dramatically if treatment and prevention interventions (Scenario Three) are introduced. According to Scenario One, life expectancy is likely to be just over 40 years in 2008, whereas under Scenario Three, people can expect to live 8-10 years longer (see Figure 1). This improvement in life expectancy is a function of the life-prolonging impact of HAART and lower rates of HIV transmission (arising from MTCTP, lower rates of STIs and safer sexual practices following VCT).

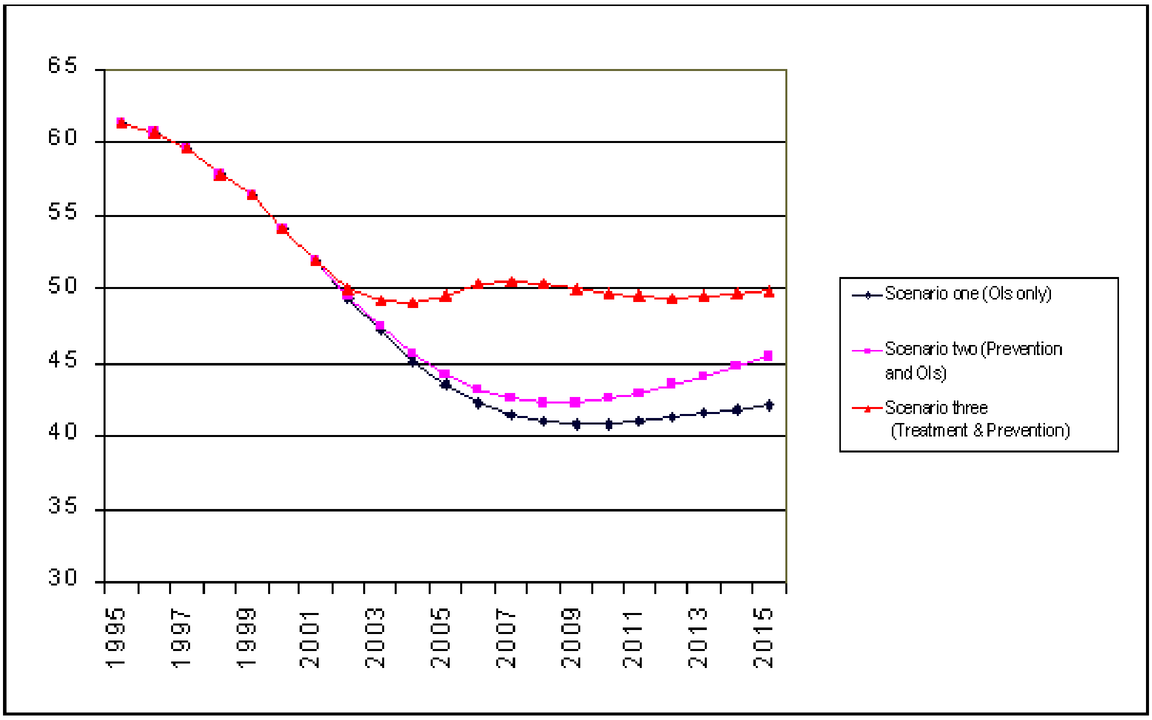

Figure 1: Life-expectancy under the three scenarios (from Johnson and Dorrington, 2002)

Over 2.5 million new HIV infections and slightly fewer than three million AIDS deaths are avoided under Scenario Three compared with Scenario One. In Scenario Two, over 1.5 million new HIV infections are avoided, but fewer than 500 000 AIDS deaths are prevented (see Figure 2).

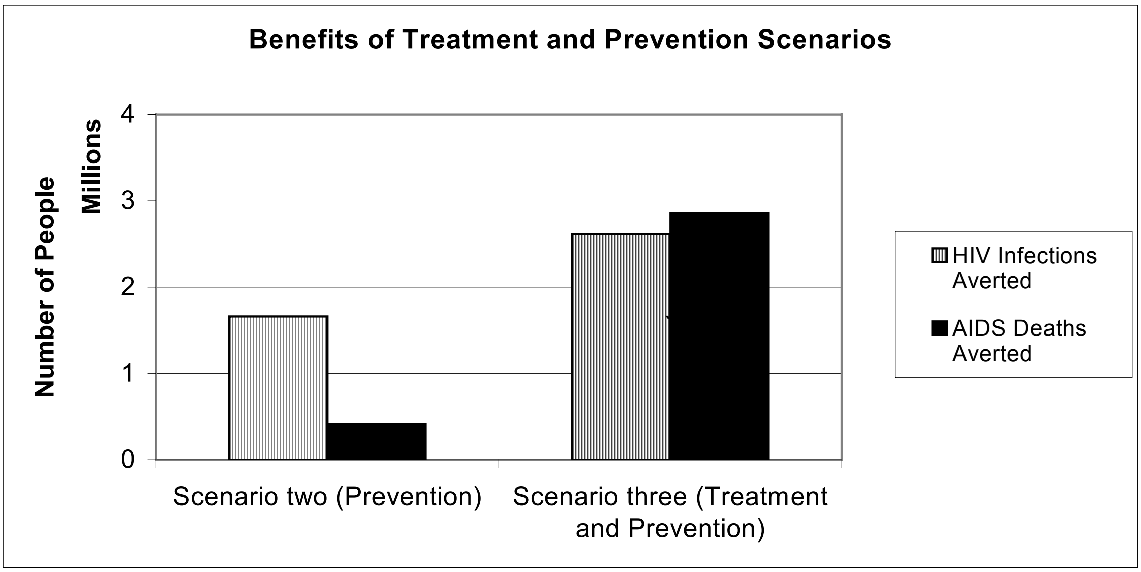

Figure 2: HIV infections and AIDS deaths averted, July 2002 to June 2015 (from Johnson and Dorrington, 2002)

Under Scenario One, about three million maternal orphans (those who lose their mother) under the age of 18 are produced by the year 2015. Under Scenario Three, this number is reduced by approximately 700 000. Double-orphans (i.e. those who have lost their father and mother) are reduced from approximately two million in Scenario One to approximately one million in Scenario Three.

Table 4: Number of People Accessing Interventions in Scenario Three

	2007	*2010*	*2015*
MTCTP	935 000	903 000	883 000
VCT (HIV-)[3]	283 000	273 000	277 000
VCT (HIV+)	139 000	94 000	59 000
Adult HAART	1 147 000	1 941 000	2 317 000
Paediatric HAART	110 000	157 000	166 000
STI Treatments	10 505 000	8 264 000	6 612 000
Public Sector STI Treatments	4 202 000	3 306 000	2 645 000

Source: Projections from the ASSA2000 model provided by Leigh Johnson

Table 4 reports the projected number of people using the various interventions modelled in Scenario Three (treatment and prevention). We use these estimates in our calculation of the total cost to the government of providing the interventions in Scenario Three.

The Cost of Interventions

Information about the costs of the interventions was obtained from various primary and secondary sources. Interviews were conducted with doctors and budget administrators at the following institutions: Somerset Hospital, Chris Hani Baragwanath Hospital, Tygerberg Hospital, Groote Schuur Hospital, the Medecins Sans Frontieres pilot antiretroviral project in Khayelitsha, the Western Cape Department of Health, Black Sash, Pinetown Child Welfare and personnel in the Government administrative offices in Pretoria. Nearly all price data (including anti-retroviral medication) was collected between September 2001 and October 2002. Data from earlier periods was adjusted upwards to account for inflation. All monetary amounts projected into the future are given in 2002 prices.

[3] This is the number of HIV-negative people who receive VCT. The next row gives the number who are HIV-positive. More personnel time is spent with HIV-positive patients.

The largest factor in the cost of Scenario Three is the price of anti-retroviral medication which varies according to exchange rate fluctuations and conditions in pharmaceutical markets. Greater stability of prices could be achieved through local production of generic anti-retrovirals, and importation of medicines from countries with currencies that move in sync with the Rand.

Common Cost Factors

A number of cost factors, such as personnel and HIV testing, are common to all interventions. These are presented in Tables 5 and 6. LifeLine (a non-governmental organisation providing counselling services) reports that counsellors spend one day a week with their supervisors, therefore, on average, only 14 days per month are spent counselling.[4] We make this assumption in our costing model and assume further that each working day entails five hours of counselling time. This is consistent with information provided by the Western Cape Department of Health, but should probably be regarded as a pessimistic estimate of potential counsellor productivity.

Table 5: Salaries of staff working in different health interventions

Salaries (includes benefits and the cost of ongoing training)		
Employee	Monthly	*Source*
Counsellor supervisor	R7,500	Galbraith and Bennish, 2001
Doctor	R18,000	Medecins Sans Frontieres estimate
Manager / Project supervisor	R12,000	Johnson *et al.*, Jan 2001, p.53
Nurse	R10,000	Johnson *et al.*, Jan 2001, p.53
Counsellor	R2,500	Galbraith and Bennish, 2001

Table 6: Productivity of key health staff

Staff Productivity		
Employee	Hours Productive per Day	Workdays per Month*
Counsellors	5	14
Nurses	8	18
Doctors	8	18

* Includes only active workdays – i.e. leave is deducted

We obtained estimates for nursing and counselling costs from a number of sources, but decided to err on the side of caution by using those on the higher

[4] Personal communication with LifeLine.

end of the scale. Counselling costs in some provinces are substantially lower than the ones used here. As such, the above figures should probably be viewed as estimates of counselling costs in properly functioning facilities. Table 7 documents the additional parameters we used in the costing of VCT and MTCT programmes.

Table 7: Additional Parameters Used in Costing Counsellors

Counsellor Specific Values		
Factor	**Value**	**Source**
Average Time Period Counsellors Work in an Intervention Before Leaving	12 months	Simplifying assumption for calculation purposes, but probably pessimistic
Recruitment/Counsellor	R1,029	Galbraith and Bennish, 2001
Training per Counsellor	R3,286	Galbraith and Bennish, 2001

The MTCTP and VCT interventions include HIV tests. The VCT and HAART interventions include CD4 tests. The cost factors of these tests are presented in Table 8. We assume that patients undergoing HIV tests are given a rapid *Determine* test. Those patients who are found to be HIV-positive then undergo a *Smartcheck* test. All patients whose initial results are indeterminate (assumed to be 5 percent of those tested) then undergo an Elisa test. Note that some provinces receive donated test kits (e.g. Western Cape), so there is reason to believe our estimated costs are probably on the high side.

Table 8: Costs of HIV antibody and CD4 tests

Cost of Tests		
Factors	Value	Source
Cost of Rapid Test	R10.70	Personal communication with Western Cape Department of Health (2001)
Cost of Smartcheck	R6.25	
Cost of Elisa	R29.10	
Indeterminacy Rate	5%	
CD4 Test	R82.40	D. Glencross (NHLS)

The total cost of the VCT programme includes personnel costs and HIV testing costs. Total costs per patient for personnel and testing depend on HIV status. The costing exercise assumes that those who test HIV-positive will then undergo regular CD4 tests. An adjustment is included to allow for patients who drop out of the programme (see Table 9). Patients spend time with nurses and counsellors on an individual basis and also participate in group counselling sessions consisting of about 20 patients (see Table 10).

Table 9: Patient monitoring factors in VCT intervention

Patient Monitoring	Value
Follow-up Rate First Visit	75%
Subsequent Follow-up Rate	95%
Number of CD4 Tests per Patient per Year	1

Source: Medecins Sans Frontieres in Khayelitsha, Groote Schuur Hospital

Whereas the ASSA2000 Interventions Model assumes individual counselling (Johnson and Dorrington, 2002), we assume an initial group counselling session followed by an individual counselling session. We further assume that the demographic impact of the VCT intervention is the same as that projected by the ASSA2000 Interventions Model.

Table 10: Time spent with patients in VCT intervention

Personnel Time	Value
Nursing Time per Patient 1st Visit	3 minutes
Nursing Time per Patient 2nd Visit	3 minutes
Counselling Session Lengths	45 minutes
Length of Group Sessions	2 hrs
Patients per Group	20
1st Visit (Group)	
2nd Visit (Individual)	45 minutes
3rd Visit (Group)	
4th Visit (Group)	
Wastage Factor	5%

Source: Medecins Sans Frontieres Programme in Khayelitsha

The Cost of an STI Intervention

Table 11 describes the symptoms and associated prescribed medicines associated with a syndromic management STI programme.[5] We obtained the numbers of patients suffering from each type of symptom (as well as the percentage of cases that are expected to be treated correctly) from the ASSA2000 Interventions Model. Of those cases of ulcers that are actually caused by herpes simplex virus-2 (HSV-2), 20 percent are expected to be misdiagnosed. These patients will receive the medicines prescribed for patients suffering from ulcers not caused by HSV-2.

[5] In practice, different medicines would be prescribed to pregnant women, but we do not take this into account here.

Table 11: Medicines prescribed for the syndromic management of sexually transmitted infections

Syndromic Management: Medicines Prescribed						
Symptom	Cipro-floxacin	Doxy-cycline	Metro-nidazole	Benzathine penicillin	Erythro-mycin	Acy-clovir
Male						
Discharge	Yes	Yes				
Ulcers (not HSV-2)				Yes	Yes	
Ulcers due to HSV-2						Yes
Female						
Discharge	Yes	Yes	Yes			
Ulcers (not HSV-2)				Yes	Yes	
Ulcers due to HSV-2						Yes

Table 12 presents the medical prescriptions and prices used in the costing exercise. The cost per patient is a function of the unit price per pill (implicit in the 'Medicine Costs' column) multiplied by the number of pills specified in the 'Prescription' column.

Table 12: Medicine costs and dosages for STI intervention

Syndromic Management: Medicine Costs				
Medicine	**Prescription**	**Medicine Costs**	**Cost per Patient**	**Source**
Acyclovir	400mg 3 times a day for 5 days	Price of pack of 25, 200mg pills is R15.63	R18.76	Prices are state tender ones as of the first quarter of 2002. Dr. D. Coetzee of UCT School of Public Health provided dosage information.
Erythromycin Stearate	500mg 3 times a day for 5 days	Price of pack of 100, 250mg pills is R34.05	R10.22	
Ciprofloxacin	500mg once	Price of pack of 10, 500mg pills is R57.32	R5.73	
Doxycycline	100mg twice daily for 7 days	Price of pack of 100, 100mg pills is R10.90	R1.53	
Metronidazole	400mg twice daily for 5 days	Price of pack of 500, 400mg pills is R39.51	R0.79	
Benzathine Penicillin	2.4mu intravenously once	2.4mu solution is R2.86	R2.86	

Table 13: Time spent on patient consultations in STI intervention

Personnel Consultation	Doctor	Nurse	Counsellor	*Source*
Time to Diagnose and Treat Male Patient	10 minutes	15 minutes		Personal communication with B. Kaparkis and D. Coetzee
Time for Counselling			10 minutes	
Ratio of Patients Seen by Doctors to Nurses	1 : 5			Assumption
Extra Diagnosis and Treatment Time for Females	20%			Assumption

Research suggests that diagnosis and treatment of females takes longer than that of males. In order to compensate for this, all times spent by medical personnel with female patients were inflated by 20 percent. Diagnosis and treatment time is assumed to be shorter for doctors than for nurses, and we assume that one in six patients is treated by a doctor rather than a nurse.

The Costs of Preventing Mother-to-Child Transmission of HIV

Table 14: Various factors affecting the cost of MTCTP

Medicines, Nutrition, Uptake		
Factors	Values	Source
Percentage of HIV+ uptake ARV	100%	Communication with WC DOH
Cost of NVP/mother-child	R6.00[6]	Galbraith and Bennish, 2001
Cost of formula milk per month	R83.20	WC DOH Budget for an MTCTP Site
No. of months of formula milk	6	WC DOH Budget for an MTCTP Site
Uptake % of formula milk	50%	This has been obtained by multiplying the percentage of households with access to running water by the uptake rate of formula milk in the Paarl Maternity Obstetrics Unit.[7]
Transmission rate at birth (no ARV)	25%	ASSA2000 (based on synthesis of a number of studies)
Transmission rate due to breastfeeding	10%	ASSA2000 (based on synthesis of a number of studies)
Nevirapine intrapartum reduction rate	47%	Guay et al., 1999

[6] We obtained varying estimates of this cost ranging from R6 to as high as R21. However, given that a number of provinces now receive this medicine as part of a donation, we opted for the lower end of the range of estimates.

[7] We assume that the uptake rate in the Paarl Maternity Obstetrics Unit is typical of a fully implemented MTCTP programme in an area where most people have access to running water.

Our costing of the MTCTP intervention is the most detailed of the costing exercises presented in this paper. The number of pregnant women attending maternity obstetrics units, the seroprevalence rate expected amongst these women and a phase-in rate for the programme are given by the ASSA2000 Interventions Model. Table 14 lists the uptake rates, drug costs and formula milk costs. Table 15 details time spent by personnel with patients. We assumed that children born to HIV-positive women are given cotrimoxazole for the eighteen-month period after birth. The costs involved are listed in Table 16.

Table 15: Time spent by personnel with patients for MTCTP intervention

Personnel Time With Patients		
Factors	Values	Source
Pre-test Counselling/woman	30 minutes	Communication with Western Cape Department of Health
Post-test Counselling/HIV+ woman	45 minutes	
Post-test Counselling/HIV- woman	20 minutes	
Pre-test Counselling for child test	30 minutes	Communication with Western Cape Department of Health and others
Post-test Counselling child test (-)	30 minutes	
Post-test Counselling child test (+)	45 minutes	
Nurse time per woman	15 minutes	Communication with Medecins Sans Frontieres and others
Additional Nurse time per HIV+ woman	10 minutes	Communication with Medecins Sans Fronteires and others
Nurse time per child born to HIV+ woman	25 minutes	Assumption

Table 16: Cotrimoxazole cost factors for MTCTP intervention

Cotrimoxazole		
Factors	Values	Source
Follow-up Rate of Babies at 18 Months	100%	Assumption
Cost of Cotrimoxazole per Month	R2.28	Communication with Western Cape Department of Health
Months of Cotrimoxazole per Child	18	Assumption
Cotrimoxazole Uptake Rate	100%	Assumption

The costs of hiring counsellors, coordinators[8] and counsellor-supervisors are also included in the calculation, as are the costs of technical assistance and the renovations of counselling rooms. All such costs are apportioned on a per

[8] We assume that one counsellor co-ordinator manages two MTCTP sites.

site basis. A site typically consists of more than one clinic and is assumed to cater for 5 000 pregnancies per year. Certain cost categories are included on both a start-up and annualised basis. However, start-up costs are not all incurred in the first year. These are also phased in, but differ from annualised costs in that they are incurred only once.

Table 17: Staff, management and infrastructure costs for MTCTP intervention

Staffing and Management			
Factor	Start-up	Annualised	Source
Site Size		5,000	WC DOH MTCTP Site Budget & Galbraith and Bennish, 2001
Counsellor Supervisor per Site		0.5	Calculation based on number of supervisors in LifeLine Western Cape
Recruitment per Counsellor Supervisor	R4,455		Galbraith and Bennish, 2001

The Costs of HAART

In our costing of the HAART intervention, we distinguish between adult and paediatric programmes and consider three main cost components: drug costs, monitoring costs and personnel costs. We apply these to the number of people on HAART (as projected by the ASSA2000 Interventions Model).

The ASSA2000 Interventions Model projects the number of people in each stage of HIV (as defined by the World Health Organisation (WHO). Johnson and Dorrington (2002) made the following assumptions when modelling the demographic impact of providing HAART.

- Triple-drug antiretroviral therapy is made available to adults with AIDS defining illnesses or whose CD4 count is below 200/μl.
- In the first six months of treatment, there is an 8.2 percent chance of death due to AIDS and a 9.1 percent chance of ceasing treatment due to adverse side-effects.
- In each subsequent year there is a 5.8 percent chance of death due to AIDS and a 5.8 percent chance of ceasing treatment due to adverse side-effects.
- When patients cease treatment they are assumed to experience a level of mortality compared to antiretroviral naïve patients, i.e. they go back to the stage they were at the onset of HAART.

- The reduction in incidence of AIDS-related morbidity for patients on HAART is 75 percent.

For children, the above assumptions are the same, except:

- Triple-drug therapy is given to children who are experiencing AIDS defining illnesses according to the Centre for Disease Control Clinical Staging System for Children or if their CD4 percentage is below 15 percent.
- In the first six months on treatment children have a 9.6 percent chance of death due to AIDS and a 13.7 percent chance of ceasing treatment due to adverse side effects.
- In each subsequent year, children on antiretroviral treatment are assumed to experience an AIDS mortality rate of 11.4 percent, and a drop-out of 5.8 percent.

These assumptions are based on an extensive analysis of HAART-related studies and the interested reader is referred to Johnson and Dorrington (2002) for more details. To summarise, the outcome of these assumptions is that patients on HAART live longer and experience less morbidity (illness). Each year, some patients on HAART either die or leave the programme and go back to the stage they were at the onset of HAART.

Table 18: Prices of antiretroviral regimens

Drug Costs	Values	Source
Monthly Cost of First-line Treatment	R355	Price of AZT, Lamivudine, Nevirapine that MSF purchases from Brazil.
Monthly Cost of Second-line Treatment	R611	Price of Didanosine, Stavudine, Lopinavir, Ritonavir in South Africa October 2002 (This is the price quoted by pharmaceutical manufacturers to the HIV/AIDS Clinicians Society. It excludes VAT and prescription fees. – source: Aid for AIDS)[9]
Monthly Cost of Paediatric HAART	R583	Communication with Dr Mark Cotton at Tygerberg Hospital – Paediatric HAART costs are highly variable across individuals, so an average price of R7000 per year has been used.

Drug costs vary according to whether patients are on their first or second antiretroviral regimen (i.e. 'first line' or 'second line' treatment). The number of patients on first and second line treatment is supplied by the

[9] This is based on communication with R. Wood and C. Orrell of Somerset Hospital.

antiretroviral module of the ASSA2000 Interventions Model.[10] We assume that bioequivalent generic antiretrovirals at current best prices are available to the public sector. Alternatives to this assumption are considered later.

The distinction between first line and second line antiretroviral regiments has not been made in costing the treatment of children. Prescriptions for children vary according to body weight, tolerance and whether paediatric or standard pharmaceutical formulations are used. A single average cost of R7 000 (this rises to R7 350 once a 'wastage' factor is accounted for) per child per year for medicines has therefore been used.[11] Monitoring methods and unit costs are assumed to be the same as those for the adult HAART programme.

Monitoring costs per patient depend on the year of treatment of the patient. In our model the costs vary between the first and subsequent years because closer patient monitoring is necessary in the first year. The monitoring costs include the costs of Lactate Dehydrogenase (LDH), CD4, Full Blood Count (FBC), Differential (Diff) and Amylase tests (see Table 19).

Table 19: Frequency of monitoring tests for HAART and cost per monitoring test

Monitoring Costs		
Tests Conducted	Values	Source
No. of LDHs first year	7	Communication with R. Wood and C. Orrell
No. of CD4s first year	3	
No. of FBCs first year	7	
No. of Diffs first year	7	
No. of Amylase first year	7	
No. of LDHs subsequent years	4	
No. of CD4s subsequent years	2	
No. of FBCs subsequent years	4	
No. of Diffs subsequent years	4	
No. of Amylase subsequent years	4	
Cost of LDH	R26.00	Communication with NHLS/SAIMR
Cost of FBC	R57.00	
Cost of Diff	R34.00	
Cost of Amylase	R28.00	

[10] The median period spent on first line treatment is slightly more than three years.

[11] This estimate is based on communication with M. Cotton, a paediatrician running the HAART programme at Tygerberg Hospital).

Table 20 summarises the assumptions about time spent by personnel with patients on HAART. We relied heavily on information from Medecins Sans Frontieres (MSF) concerning their HAART programme in Khayelitsha.

Table 20: Time spent by personnel with patients on HAART

Personnel Time Spent With Patients			
Follow-up Rate After 1st visit	75%		
Subsequent Follow-up Rate	95%		
Session Length in First Year	**Nurses**	**Doctors**	**Counsellors**
1st Visit	30 minutes	1 hr	1 hr
2nd Visit	15 minutes	30 minutes	30 minutes
3rd Visit	15 minutes	15 minutes	45 minutes
4th visit	15 minutes	15 minutes	45 minutes
5th Visit	15 minutes	15 minutes	15 minutes
Session Length in Subsequent Years	15 minutes	15 minutes	45 minutes
Number of Sessions in First Year	5	4	5
Number of Sessions in Subsequent Years	4	4	2
Admin Time per Session (nurse)	3 minutes		
Time spent on Drug Distribution per Patient per Year	30 minutes		
Group Counselling			
Number Sessions First Year			8
Number Sessions Subsequent Years			12
Length of Session			2 hours
Patients per Group			20
Nurse Training			
Additional Training Factor (nurses)	10%	Based on Interview with MSF	

*Based on the experience of MSF in Khayelitsha.

We have assumed that patients in their first year of treatment are on a first-line regimen. There is a 20.6 percent chance of a patient moving to a second-line regimen in each subsequent year. For simplicity, once patients move to a second-line regimen, they are assumed to remain there until the ASSA2000 Interventions Model removes them from the HAART programme.

Table 21: Wastage and additional care assumptions in costing of HAART intervention

Other Assumptions		
Factor	**Value**	**Source**
Additional Care Factor	20%	Communication with Wood and Orrell
Wastage Factor	5%	Assumption

The information reported so far can be used to calculate the number of people in first and subsequent years of antiretroviral treatment. These figures can then be multiplied by the cost per patient in first and subsequent years of treatment and added to the drug and monitoring costs to calculate a total cost for the programme. Note that all calculations include a wastage factor. A factor is also included to cater for patients who require additional care (e.g. due to serious side-effects, inadequate recovery, psychological factors, special medicine needs etc). Table 22 provides details on the cost factors for paediatric HAART which differ from those in the adult programme.

Table 22: Paediatric cost factors for HAART intervention

Paediatric HAART Staffing	
Time spent per session (minutes)	Values
Doctor	45
Nurse	30
Admin (Nurse)	15
Blood Test (Nurse)	20
Number of Sessions (per year)	
Sick 1st Year	7
Sick 2nd Year	3

Source: M. Cotton (Tygerberg Hospital)

Costing the Intervention Scenarios

The cost over time of the interventions under Scenarios Two (prevention interventions) and Three (prevention and treatment interventions) are presented in the tables below. These costs exclude public education and certain infrastructure costs.[12]

HAART is the intervention most beneficial to adults, but it is also the most expensive. The cost of adult HAART dwarfs the other interventions. It increases until 2015 when it peaks at R18.2 billion. At this point 2.3 million adults receive HAART in the public sector (about 220 000 adults receive HAART through medical schemes). The cost of HAART declines after 2015 as the number of HIV-positive people falls (from about 6 million in 2015 to about 5 million in 2025).

[12] We include these costs later in the costing exercise.

Table 23: Direct cost to the Department of Health of treatment and prevention strategies for 2010 and 2015 for the non-medical scheme population (prices in Rands)

	2010		2015 (most expensive year)	
	Scenario Two (Prevention)	Scenario Three (Treatment and Prevention)	Scenario Two (Prevention)	Scenario Three (Treatment and Prevention)
VCT	R21 million	R17 million	R16 million	R13 million
MTCTP	R121 million	R121 million	R111 million	R108 million
STI	R78 million	R90 million	R53 million	R69 million
Adult HAART	Zero	R15 billion	Zero	R18.2 billion
Child HAART	Zero	R1.5 billion	Zero	R1.5 billion

There is no sudden impact on the health budget because the implementation of the interventions is phased in (up to 90 percent). Table 24 indicates that the cost implications of the implementation of HAART are gradual enough to prepare the necessary budget increases. Table 25 presents the phased in costs for Scenario Two.

Table 24: Cost of interventions under Scenario Three (treatment and prevention) from 2002 to 2007 in millions of Rands

	2002	*2003*	*2004*	*2005*	*2006*	*2007*
MTCTP	R 50	R 82	R 112	R 133	R 137	R 133
VCT	R 9	R 14	R 20	R 25	R 25	R 23
Adult HAART	R 226	R 966	R 2,325	R 4,348	R 6,816	R 9,289
Paediatric HAART	R 53	R 198	R 409	R 663	R 921	R 1,134
STI	R 166	R 165	R 158	R 147	R 133	R 120

Table 25: Cost of interventions under Scenario Two (prevention) from 2002 to 2007 in millions of Rands

	2002	*2003*	*2004*	*2005*	*2006*	*2007*
MTCTP	R 50	R 82	R 112	R 132	R 136	R 131
VCT	R 9	R 14	R 20	R 26	R 27	R 26
STI	R 166	R 165	R 158	R 146	R 130	R 114

Including Viral Load Tests

The above costing of adult and paediatric HAART interventions omits viral load tests. According to the WHO guidelines (World Health Organisation, 2002a), viral load tests are optional because of resource constraints. However, given the benefits of using viral load tests to monitor patients, we have extended the cost calculation to include them (see Table 26). Currently, MSF pays R625 per viral load test. This means that the combined price of CD4 and viral loads tests is R707.40. Recently, at least two laboratories have begun offering CD4 and viral load tests for R500 – so these costs can be expected to fall.

Table 26: Cost of HAART when viral load tests are included

		2007	*2010*	*2015*
R500 for CD4 and Viral Load	Paediatric HAART	R1.3 billion	R1.7 billion	R1.7 billion
	Adult HAART	R10.9 billion	R17.4 billion	R20.8 billion
R707.40 for CD4 and Viral Load	Paediatric HAART	R1.4 billion	R1.8 billion	R1.8 billion
	Adult HAART	R11.7 billion	R18.5 billion	R22 billion

Cost of Infrastructure and Public Education

Our costing of the HAART intervention has yet to include health-care infrastructure costs (such as building counselling rooms for the VCT intervention, technical assistance and office expenses for site co-ordinators). It also excludes public education and outreach programmes designed to popularise the interventions and increase their uptake.

This section provides an estimate of such costs for all the interventions. We base these primarily on information available from various MTCTP pilot projects (as this is the best data available on intervention-related infrastructural and other costs). Note that our analysis here does not take into account that many of these costs could be shared by the different interventions and therefore our calculated costs in this section are probably on the high side.

Table 27: Components of additional infrastructure and public education costs

Infrastructure and Public Education	Start-up	Annualised	Source
Counselling Room per Site	R50,000	R10,000	Communication with Western Cape Department of Health
Community Meetings per Site	R9,500		Galbraith and Bennish, 2001
Recruitment of Educators per Site		R5,000	
Training Educators per Site		R15,000	
Educator Salaries per Site	R11,538	R180,000	
Materials per Site		R5,000	
Office Expenses of the Coordinator	R6,200	R24,000	
Technical Assistance per Site	R30,769	R9,231	
Recruitment of Coordinator	R25,700		
Coordinator Salary	R67,500	R135,000	
Coordinators per Site		1	

The additional intervention infrastructure cost is composed as follows: a co-ordinator per site, office expenses for the co-ordinator, technical assistance costs and counselling rooms for the intervention sites.[13] The public education cost is composed of the costs of community meetings, the employment of educators and the purchase of materials. These are all based on information from MTCTP intervention sites. Table 27 summarises this information, and Table 28 provides a total cost estimate (phased in) based on these additional costs.

We have assumed that the additional infrastructure and public education costs per patient for MTCTP can be projected as the cost per patient for other interventions (except the STI intervention because the recommended changes do not require extensive additional expenditure on infrastructure and public education). Our public education costs are probably too high because civil society organisations that specialise in outreach – and which are not predominantly state funded – can be expected to absorb a substantial part of this cost.

[13] We did not include these co-ordinator related costs in the earlier costing for the MTCTP programme (so there is no double-counting).

Table 28: Additional cost to MTCTP intervention in millions of Rands when education and additional infrastructure specific to the programme are included for Scenario Three

	2002	*2003*	*2004*	*2005*	*2006*	*2007*
Education	R 13	R 21	R 29	R 34	R 35	R 35
Infrastructure	R 18	R 25	R 32	R 35	R 33	R 32
Total	*R 31*	*R 46*	*R 61*	*R 69*	*R 69*	*R 66*

The combined infrastructure and educational cost per individual benefiting from an intervention in Scenario Three peaks at approximately R85 per year. These costs are phased in according to the phase-in rates discussed previously.

Table 29: Cost in millions of Rands of education and infrastructure for Scenario Three

	2002	*2003*	*2004*	*2005*	*2006*	*2007*	*2010*	*2015*
Education	R 105	R 164	R 216	R 248	R 252	R 246	R 243	R 232
Infrastructure	R 21	R 34	R 51	R 69	R 81	R 89	R 119	R 133
Total	*R 126*	*R 198*	*R 268*	*R 317*	*R 332*	*R 336*	*R 362*	*R 365*

Cost of Condom Distribution

VCT programmes will be more successful if they include a safer-sex component which emphasises condom use (Voluntary HIV-1 Counselling and Testing Efficacy Study Group, 2000). Using the Voluntary HIV-1 Counselling and Testing Efficacy Study Group results, Johnson and Dorrington (2002) assume 25 condoms are distributed to patients receiving VCT. We assume that the VCT and MTCTP programmes distribute condoms out of the existing government stock, and therefore no additional costs relating to condom distribution are included. It is possible, however, that this more targeted condom distribution will result in greater demand for condoms by the public sector. The state tender price for condoms is R0.25 per male condom and R1.17 per female condom (personal communication, Department of Health). If we make the (implausible) assumption that the condoms distributed in the VCT and MTCTP interventions are over and above the stock that the government usually distributes, then the additional cost would be negligible; less than R8 million at the peak of the epidemic.

Cost of Medicines

As stressed earlier, the cost of antiretroviral medicines is the largest component of adult HAART. The following analysis demonstrates the effect on the costing of adult HAART of different medicine prices. In the analysis presented earlier, we considered both patented brand-name antiretroviral medicines and bioequivalent generics. In this section, we present three other options: 1) only patented medicines are used at the best prices that have been offered around the world; 2) transposing the first- and second-line medication regimens (which results in a cheaper first-line regimen and a more expensive second-line regimen) and; 3) the prices of generic or brand-name medicines drops to R300 for a first-line regimen and R450 for a second-line regimen.

This assumed decrease in price of medications is realistic when one considers: a) that there are already first-line generic regimens below R300 including one that has been approved by the World Health Organisation; and b) that there will be economies of scale generated by the South African epidemic. In particular, the Department of Health would have considerable negotiating power for lower medicine prices if it opted to provide antiretrovirals on a large scale.

Table 30: Different drug prices used to cost adult HAART

Medicine Price Option	*First-line*	*Second-line*	*Monthly price of first-line per patient*	*Monthly price of second-line per patient*
Best current prices	AZT, Lamivudine, Nevirapine	Didanosine, Stavudine, Lopinavir, Ritonavir	R355	R611
Alternative regimen at best current prices	Lamivudine, D4T, Nevirapine	AZT, DDI, Lopinavir, Ritonavir	R290	R743
Possible future price	Not applicable	Not applicable	R300	R450
Patented prices only (optimal patented regimen, sub-optimal price)	AZT, Lamivudine, Nevirapine	Didanosine, Stavudine, Lopinavir, Ritonavir	R908	R611
Patented prices only (optimal price, sub-optimal regimen)	Didanosine, Stavudine, Nevirapine	AZT, Lamivudine, Lopinavir, Ritonavir	R557	R961

When examining medicine prices, we used regimens recommended by the WHO (World Health Organisation 2002a). This resulted in the second-line regimen being cheaper than the first-line regimen because the patented versions of Didanosine and Stavudine (recommended for second-line use) are much cheaper than the patented versions of AZT and Lamivudine (recommended for first-line use). In this section, we consider the cost of adult HAART for patented medicines only where AZT and Lamivudine is used as the first-line regimen in one costing exercise, and as the second-line regimen in another.

Table 31: Cost of adult HAART in 2015 under different pricing options

Option	*Medicine Price Option*	*Medicine cost per patient*	*Staff and monitoring costs*	*Total cost in 2015*
1	Best current prices (generics and patented medicines)	R6,413	R1,464	R18.2 billion
2	Alternative regimen at best current prices (generics and patented medicines)	R7,088	R1,464	R19.8 billion
3	R300 for first-line and R450 for second-line	R4,917	R1,464	R14.7 billion
4	Best patented prices (AZT/Lamivudine in first-line)	R9,190	R1,464	R24.6 billion
5	Best patented prices (Didanosine. Stavudine in first-line)	R10,703	R1,464	R26.7 billion

Although using patented AZT and Lamivudine as a second-line (option 4 in Table 31) is cheaper than using it as a first-line (option 5) in 2015, this is only because by 2015 more patients will be on the second-line regimen. Spread over time, the medically optimal regimen is much more expensive. For example, in 2007 the sub-optimal patented regimen is R13.4 billion versus R15.6 billion for the optimal regimen.

For the same reason, the alternative regimen (option 2 in Table 31) at best current prices is also more expensive than the WHO recommended regimen (option 1) in 2015, but is marginally cheaper in the phasing-in stage of the programme up to 2007. Option 2 starts off with an average drug cost per patient per year of R4 243, but escalates to R7 088 per patient per year in 2015, because of the increasing numbers of patients on second-line regimens.

Sometimes the regimens considered here are inappropriate for a patient. For example, patients using Nevirapine might experience hepatoxicity and have to switch to Efavirenz, which at this time is slightly more expensive than Nevirapine. However, the 20 percent additional patient care factor discussed previously has been included to cover this.

Savings Incurred in Scenario Three (Prevention and Treatment)

Scenario Three has the greatest benefits in terms of reduced mortality, reduced morbidity and reduction of new infections. It also has a wide range of socio-economic benefits which include: reduced sick-leave; higher productivity, fewer days taken off for employees to attend funerals; lower employee replacement costs; preservation of human capital (such as nurses, teachers and educated high school students) and fewer orphans (Nattrass, 2002). We have not attempted here to estimate these wider benefits.

But from the narrow perspective of the Department of Health's budget, the costs of introducing the full range of treatment and prevention programmes appears substantial (even prohibitive) at the peak of the epidemic. However, as argued below, prevention and treatment programmes entail both costs *and* savings for the public health sector. These savings need to be considered in order to obtain an understanding of the *net* costs of prevention and treatment programmes. In this section, we point to the financial savings (mainly due to lower hospitalisation requirements) implied by Scenario Three. We also point to potential savings for the state due to lower orphans.

Savings on Hospitalisation Costs

When HAART is commenced under the conditions modelled here, there is a significant reduction in morbidity resulting in lower hospitalisation costs. The in- and out-patient hospitalisation costs of people in each clinical stage of HIV has been estimated by Kinghorn *et al.* (1996) for Baragwanath Hospital. We rely on these estimates (suitably adjusted for inflation). Since they were made six years ago and for one health institution only, the results in this section must be treated with caution.

The ASSA2000 Interventions Model estimates the number of people in each stage of the disease. This information is then used to calculate the hospitalisation costs for each scenario. The model also provides information on the number of people on antiretrovirals who are still in Stage Four (AIDS-sick), and the number of people on antiretrovirals who have become healthy. The assumption is made that people whose immune systems have been reconstituted (through HAART) have the same hospitalisation costs as those in Stage One (other than the costs of the HAART programme). Given the absence of better data, we use the Kinghorn *et al.* (1996) estimates for children as well. Table 32 lists the hospitalisation costs per HIV-positive patient in a given WHO stage per year.

Table 32: Hospitalisation costs for patients with HIV

Stage	*Cost per patient per year*
Adult Stage One	*R1,378*
Adult Stage Two	R1,378
Adult Stage Three	R6,572
Adult with AIDS	R18,020
Adult on HAART who has become healthy again	R1,378
Child pre-AIDS	R1,378
Child with AIDS	R18,020

Table 33 shows the hospitalisation costs of people with HIV assuming that everyone who requires treatment for an opportunistic infection receives it.

Table 33: Costs in billions of Rands of public hospitalisation for people with HIV under the three scenarios

	2002	*2003*	*2004*	*2005*	*2006*	*2007*	*2010*	*2015*
Scenario One	24	28	31	34	36	37	36	32
Scenario Two	24	27	31	34	35	36	35	27
Scenario Three	24	27	29	30	30	30	29	26

The 2002/03 health budget is R33.981 billion (National Treasury, 2002). The AIDS-related hospitalisation costs we project for 2002 are approximately 71 percent of the budget. Assuming the health budget remains the same in real terms[14] hospitalisation costs for HIV patients in Scenario One eventually exceed the health budget.

[14] There has been a *per capita* decrease in health expenditure over the last eight years.

A Department of Health report states:

> "The largest single impact of HIV/AIDS on the public health sector lies in the hospital sector. Research commissioned by the Department of Health indicates that, in the year 2000 an estimated 628,000 admissions to public hospitals were for AIDS-related illnesses, which amount to 24 percent of all public hospital admissions. Modelling indicates very clearly that, as more people who are already HIV-positive become sick each year, this demand for hospitalisation will increase steadily every year in the absence of significant alternative interventions. In financial terms, the cost of hospitalising AIDS patients in public facilities is already likely to be at least R3.6 billion in the current financial year, or 12.5 percent of the total public health budget" (Department of Health, 2001, p. 3).

The Department of Health only spent R3.6 billion on in-patient AIDS hospitalisations in 2000. Our estimate of the actual in- and out-patient hospitalisation needs for 2000 is R13.6 billion. Yet according to the Department of Health, only R3.6 billion was spent on in- and out-patient hospitalisations in 2000. How do we reconcile this information? If we assume that patient-cost estimates *and* the Department of Health's facts are accurate, then either a substantial number of AIDS-related illnesses are not being presented at hospitals (people are not attempting to get treated) or a high level of patient rationing is taking place in the public health sector.

According to the numbers estimated by Kinghorn et al. (1996), the cost of out-patient care range from less than 10 percent of hospitalisation costs for patients in Stage Four to approximately 47 percent of costs for patients in Stage One and Two. Assuming the higher range for out-patient costs (i.e. 47 percent), the upper limit on the cost of in- and out- hospitalisation costs on people with HIV in 2000 is R6.7 billion, or 24 percent of the health budget for 2000. The implication is that the health budget was at least R6.9 billion, but probably much closer to R10 billion, short of the amount necessary to provide treatment to all who need it and to avoid rationing of HIV patients.

It must be emphasised that the above estimates are rough approximations, because of the large number of assumptions that underpin them. However, the margin of error would have to be enormous to render inaccurate the conclusion that South Africa is failing to provide adequate health care to the HIV-positive people who need it.

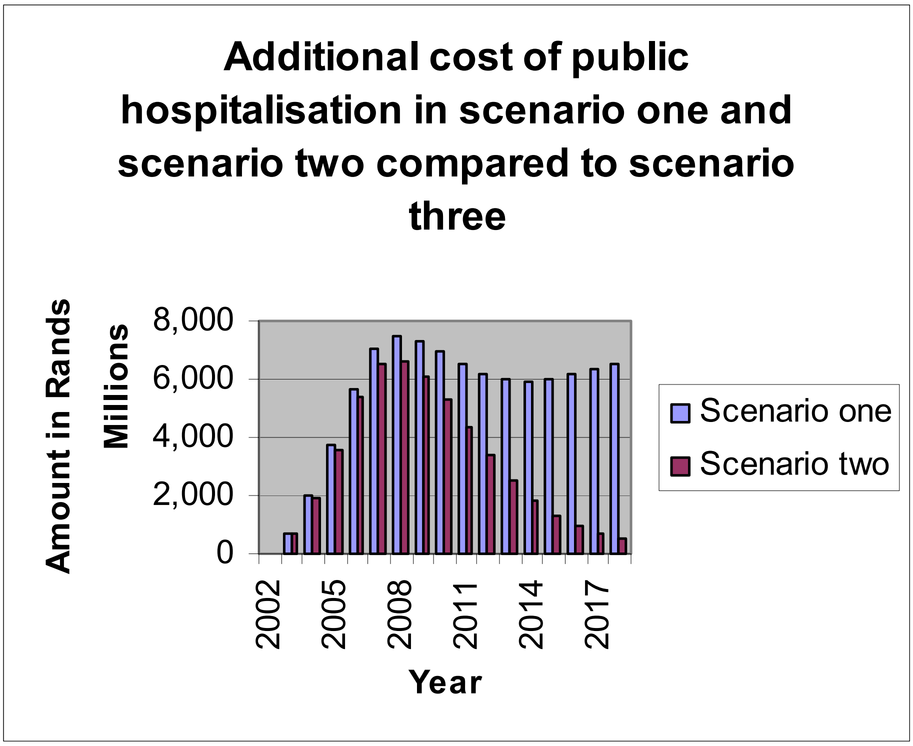

Figure 3: Additional expenditure in hospitalisation costs in Scenarios One and Two over Scenario Three

While some rationing is bound to occur, even in a very good health-care system,[15] the level of rationing that is probably occurring implies that current Government health-care policy objectives are not being realised. It is probable that many patients who use the public sector are getting sub-optimal treatment irrespective of their HIV-status. This correlates with descriptions of a public health-care infrastructure under enormous pressure (South African Health Review, 2002). High levels of rationing will probably continue in all three scenarios unless *per capita* health expenditure is increased to compensate for the shortfall.

Up until now, Scenario One has essentially been government policy, but even this limited policy objective (of treating OIs), is not being met. We have calculated the savings that Scenario Three generates in hospitalisation costs by assuming that the government meets its policy obligations and that no rationing takes place. This is depicted in Figure 3. Note that *per capita* savings would be even more significant, because of the additional population still alive in Scenario Three.[16]

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[15] Recall that the interventions all assume 10% rationing once fully implemented.

[16] ASSA2000 predicts a population of 46.8 million in Scenario One and 49.6 million people in Scenario Three in 2015. This amounts to approximate expenditures of R524 per person in Scenario Three versus R684 per person in Scenario One.

While these savings do not fully compensate for the additional direct financial cost to the Department of Health of Scenario Three, they demonstrate that the additional money spent in Scenario Three will reduce rationing and alleviate pressure on the public health system.

Savings on Orphan Costs

The ASSA2000 Interventions Model projects the number of double-orphans[17] in Scenario One and in a (simplified) version of Scenario Three where only VCT and HAART are implemented. Figure 4 shows that the difference between the scenarios becomes greater over time, culminating with Scenario Three having nearly one million fewer additional orphans in 2015.

Government expenditure on orphans is primarily on foster care grants and subsidies to children's homes. Fewer orphans implies greater savings on these grants and subsidies. However, due partially to administrative inefficiencies, many orphans living with guardians other than their parents do not receive a subsidy. Black Sash calculates the take-up rate of the foster-care grant as 36.7 percent (communication with Karen Kallmann of Black Sash, 2002). Further complexities that have to be considered when calculating implications of the different scenarios for such welfare spending include:

- Some children who become eligible for the foster care grant may have been previously receiving the child support grant (i.e. when their parents were alive).
- Some children who are eligible for the foster care grant receive a child support grant instead, because it is easier for the foster parents to apply for this.
- Some children whose mothers have died are effectively orphans because their fathers are absent. They might be eligible for foster care grants or a state subsidy if they are placed in children's homes.
- A small, possibly insignificant, percentage of orphans will not be eligible for a grant or subsidy because of independent incomes.
- Some children are eligible for placement in children's homes when their parents have not yet died because the parents' morbidity renders them unable to fulfil their parental obligations.
- The administrative costs of placing children in foster-care and children's homes might be large and therefore need to be considered.

[17] Double-orphans are defined here as children under 18 whose parents have both died.

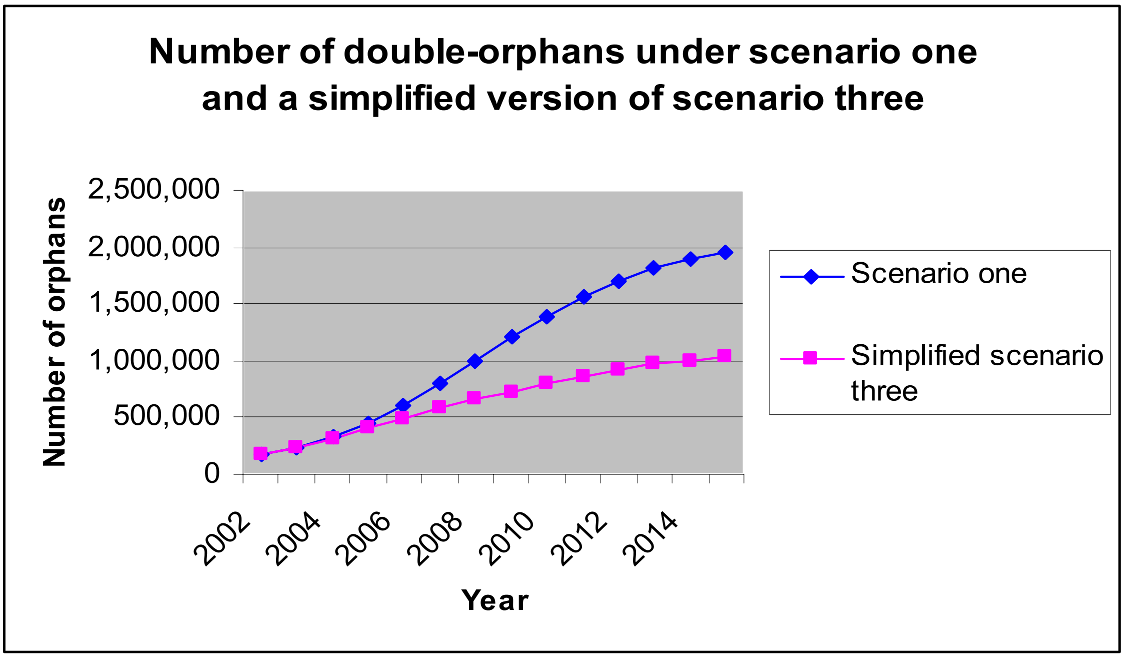

Figure 4: Number of double-orphans produced under Scenario One and simplified Scenario Three (only VCT and HAART implemented in simplified Scenario Three)

As of April 2002, the foster care grant was R450 per month and the child support grant, R130 per month. The government subsidy for children's homes in KwaZulu-Natal is R1 000 per child per month (personal communication with Pinetown Child Welfare).

Estimating the effect of additional orphans under Scenarios One and Two over Scenario Three would be a useful research project. The savings to the state under Scenario Three due to lower orphan costs are likely to be large. The following simple calculation gives a lower bound estimate of the cost of orphan grants in 2015, assuming that the current level of take up of foster care grants remains stable.

- In 2015, the ASSA2000 interventions model estimates that the simplified version of Scenario Three has 927 000 fewer orphans than Scenario One.
- Approximately 340 000 children take up a foster care grant (or live in government-funded children's homes, but since this is more expensive, we assume that all receive the foster care grant for the purposes of calculating a lower bound).
- We further assume that the 927 000 fewer orphans in Scenario Three are all eligible for child support grant, but that the uptake rate of this

grant is equivalent to the current uptake rate (52.8 percent according to Black Sash).

This calculation yields a saving of over R1 billion in 2015 in Scenario Three over Scenario One. It must be emphasised that this is a very conservative estimate of the lower bound of savings. When the other factors described above are taken into account and a more accurate analysis is done, the calculated savings will be considerably higher. Furthermore, the current uptake rate of the foster care grant is inadequate. If the state becomes more efficient at meeting its policy obligations towards orphans, the additional cost of orphan care would become extremely large under Scenario One.

The Direct Cost of Scenario Three as a Percentage of GNP

Table 34 presents the total direct cost of Scenario Three (i.e. excluding the savings discussed above) as a percent of the South African Gross National Product (GNP).[18]

Table 34: Total cost of Scenario Three (including infrastructure and education) in billions of Rands and as a percentage of GNP

Year	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2010*	*2015*
Scenario Three (R billion)	0.6	1.6	3.3	5.6	8.4	11.0	17.1	20.3
GNP (R billion)	1 012	1 033	1 053	1 074	1 096	1 118	1 140	1 163
Scenario Three as % of GNP	0.06%	0.16%	0.31%	0.52%	0.76%	0.99%	1.50%	1.74%

GNP Data from the South African Reserve Bank

The recently published report on the Commission on Macroeconomics and Health commissioned by the WHO states, "We believe that it is feasible, on average, for low- and middle-income countries to increase budgetary outlays for health by 1 percent of GNP by 2007 and 2 percent of GNP by 2015 compared with current levels, though this may be optimistic given intense competing demands for scarce public resources" (World Health Organisation, 2002b: 6).

[18] The GNP for the third quarter of 2001 through to the end of the second quarter of 2002 was R993 billion at current prices (South African Reserve Bank, 2002). The corresponding ASSA2000 time period is 2001 (ASSA2000 years run from July to June). We assume a modest real growth rate of 2 percent per annum for the GNP.

Scenario Three easily fits within the range of additional spending recommended by the Commission. If the cost of antiretroviral medicines can be brought down to R300 per first-line regimen and R450 per second-line regimen for adult HAART, the cost of Scenario Three drops to 1.44 percent of GNP in 2015. Even if a zero percent growth rate is assumed until 2015, the cost of Scenario Three escalates to 2.04 percent of GNP in 2015 assuming current generic medicine prices or 1.69 percent of GNP for the lower-price estimate.

There are, of course, health interventions other than those listed in Scenario Three which are also not yet provided by the Department of Health. But these are unlikely to be of the same order of magnitude as Scenario Three and therefore unlikely, when combined with Scenario Three, to push health expenditure beyond prudent levels.

The burden on the health-care budget of Scenario Three can be reduced in a number of ways. As has already been shown, bringing medicine prices down to R300 for a first-line regimen and to R450 for a second-line regimen would significantly alleviate the financial burden. The burden can be further alleviated by: 1) using funds from the recently established Global Fund to Fight AIDS, Tuberculosis and Malaria; 2) negotiating with pharmaceutical companies to lower antiretroviral prices in the private sector so that more people can purchase their medicines privately instead of using the public system; 3) encouraging the medical scheme industry to increase the size of their membership;[19] 4) encouraging more employers to offer antiretroviral therapy to their employees; and 5) charging a reasonable fee proportional to income for employed adults on public antiretroviral programmes.

Conclusions

The key conclusions of this analysis are:

- Of the three scenarios examined, Scenario Three (treatment and prevention) provides significant benefits for the population, but also requires the largest budget. However, if savings due to lower morbidity (reflected in fewer hospitalisations) and fewer orphans are offset against the extra direct expenditure required in Scenario Three, then the *net* cost to government is substantially lower.
- The combined direct cost of the interventions in Scenario Three at the peak of the epidemic (in 2015) is approximately R20 billion (including infrastructure and education costs). The savings in expenditure to which the

[19] Currently, about 16% of the South Africans are on medical schemes.

Government has legally committed itself (i.e. hospitalisation and orphan costs) would be a minimum of R7 billion.

- The price of antiretroviral medicines is the most significant factor in the cost of Adult HAART and consequently the most significant factor in the cost of Scenario Three. The price difference between best-priced patented medicines and generic versions is substantial. If the prices of antiretrovirals are brought down to R300 per patient per month for first line regimens and R450 per patient for second-line regimen, the cost of Adult HAART is estimated to come down by nearly R4 billion for 2015.
- Scenario One (i.e. no treatment and intervention programmes) is costly both in terms of human lives, and in terms of hospitalisation costs (associated with treating opportunistic infections). Scenario Two (prevention) is substantially better on both scores, but not as effective as Scenario Three.
- Our modelling of Scenario Three (treatment and prevention) does not entail a sudden massive increase in the health-budget. We show that it can be implemented gradually so that an unmanageable burden is not placed on the government budget. The cost of Scenario Three peaks in 2015 and gradually drops and levels off after that. The additional expenditure required by Scenario Three expressed as a percentage of GNP is within the recommended guidelines of the WHO.
- Irrespective of which scenario is implemented, the government has to increase substantially *per capita* spending on health and social welfare if it is to cater for the requirements of needy people. The health budget appears to be too small already to meet the health needs of the population – irrespective of HIV status.
- Further research is needed into hospitalisation and orphan costs. Home-based care and post-exposure prophylaxis have not been considered in this analysis – but are important interventions that need to be researched. New research on the effect of HAART on reducing the incidence of HIV-related Tuberculosis also needs to be considered (Wood *et al.*, 2002).
- The implementation of Scenario Two or Scenario Three, or even eliminating rationing in Scenario One, will require adequate planning, particularly with regard to staff allocation and timetables for rolling out interventions.

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25/02	*Comparing Alternative Measures of Household Income: Evidence from the Khayelitsha/Mitchell's Plain Survey*	By J. Skordis & M. Welch
26/02	*The Employment of Domestic Workers by Black Urban Households*	By M. Russell
27/02	*Poverty, Survival and Democracy in Southern Africa*	By R. Mattes, M. Bratton & Y.D Davids

The Centre for Social Science Research

The CSSR is an umbrella organisation comprising five units:

The Aids and Society Research Unit (ASRU) supports quantitative and qualitative research into the social and economic impact of the HIV pandemic in Southern Africa. Focus areas include: the economics of reducing mother to child transmission of HIV, the impact of HIV on firms and households; and psychological aspects of HIV infection and prevention. ASRU operates an outreach programme in Khayelitsha (the Memory Box Project) which provides training and counselling for HIV positive people

The Data First Resource Unit ('Data First') provides training and resources for research. Its main functions are: 1) to provide access to digital data resources and specialised published material; 2) to facilitate the collection, exchange and use of data sets on a collaborative basis; 3) to provide basic and advanced training in data analysis; 4) the ongoing development of a web site to disseminate data and research output.

The Democracy In Africa Research Unit (DARU) supports students and scholars who conduct systematic research in the following three areas: 1) public opinion and political culture in Africa and its role in democratisation and consolidation; 2) elections and voting in Africa; and 3) the impact of the HIV/AIDS pandemic on democratisation in Southern Africa. DARU has developed close working relationships with projects such as the Afrobarometer (a cross national survey of public opinion in fifteen African countries), the Comparative National Elections Project, and the Health Economics and AIDS Research Unit at the University of Natal.

The Social Surveys Unit (SSU) promotes critical analysis of the methodology, ethics and results of South African social science research. One core activity is the Cape Area Panel Study of young adults in Cape Town. This study follows 4800 young people as they move from school into the labour market and adulthood. The SSU is also planning a survey for 2004 on aspects of social capital, crime, and attitudes toward inequality.

The Southern Africa Labour and Development Research Unit (SALDRU) was established in 1975 as part of the School of Economics and joined the CSSR in 2002. SALDRU conducted the first national household survey in 1993 (the Project for Statistics on Living Standards and Development). More recently, SALDRU ran the Langeberg Integrated Family survey (1999) and the Khayelitsha/Mitchell's Plain Survey (2000). Current projects include research on public works programmes, poverty and inequality.