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PAYING TO WASTE LIVES: THE AFFORDABILITY OF REDUCING MOTHER-TO-CHILD TRANSMISSION OF HIV IN SOUTH AFRICA

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Paying to Waste Lives: The Affordability of Reducing Mother-to-Child Transmission of HIV in South Africa

Abstract

It is estimated that each HIV-positive child in South Africa costs the government more in terms of health and welfare expenses than it does to reduce mother-to-child transmission (MTCT) of HIV through the use of anti-retroviral regimens (where the mother continues to breast-feed). Programmes to reduce MTCT of HIV/AIDS are thus clearly affordable. Using Nevirapine (according to the HIVNET 012 Protocol) saves fewer lives, but is more cost-effective than using Zidovudine (CDC two-week regime).

Introduction

South Africa has the fastest-growing AIDS epidemic in the world, and more HIV-positive people than any other country. Commenting on the five-fold increase between 1990 and 1999 in the number of people dying at the age of 30, Dr. Makgoba (the head of South Africa's Medical Research Council) observed that only a war would give comparable deaths amongst young people (cited in Van der Vliet, 2000a).

South Africa is clearly facing a crisis of disturbing proportions. To make matters worse, the government's response has been slow, stumbling and at times counter-productive (see Marais, 2000; Van der Vliet, 2001). This is particularly evident with regard to mother-to-child transmission (MTCT) of HIV. As the *Mail and Guardian* argued in an editorial on 21 July 2000:

> 'If our government any longer hesitates and prevaricates on the issue of providing anti-retrovirals to HIV-positive pregnant women, it should not be surprised to hear charges of genocide directed against it. For to fail to act right

> now against the HIV/AIDS pandemic on the basis of best-available science and with all the resources we can muster will have genocidal results. Whether the outcome is the result of malevolence, of incompetence, of panic-induced denial, or of pig-headed obduracy among senior members of the government will scarcely matter. For they will have been warned often enough.'

This paper discusses the economics of preventing MTCT of HIV in South Africa. We do not speculate about whether the government's failure to act appropriately was the result of 'malevolence, incompetence, panic-induced denial or pig-headed obduracy', but rather explore the economic concerns about affordability and effectiveness that may have been relevant to government's decision-making on this issue.

We begin by reviewing the different approaches taken by various studies to the cost-effectiveness of preventing MTCT of HIV in South Africa – all of which conclude that the government should have been allocating resources to prevent such transmission. The question thus raised is why, in the face of such evidence, the Ministry of Health continues to maintain that a MTCT prevention programme is 'unaffordable'. While this may be a convenient excuse for inaction, it is possible that this policy position has arisen because existing studies of cost-effectiveness do not frame the argument in a way that addresses the full impact on the government's budget.

We then present an alternative way of approaching the issue of affordability – i.e. by comparing the costs to the health sector of two short-course drug regimens that reduce MTCT with the costs of *not* intervening. We show that unless the government is planning to deny hospital care to children with HIV/AIDS (which would be unconstitutional in South Africa), it costs the government more to let the children contract HIV from their mothers, get sick and die, than it does to save them. There is, in other words, no basis for the argument that the government 'cannot afford' a programme to prevent MTCT.

There are of course various alternative treatment regimes to reduce MTCT that involve different drugs, in different combinations and with different infant-feeding regimes (see e.g. Marseilles and Kahn, 1999, Farley et al, 2000). This paper considers two easy-to-administer regimes (i.e. a short course of AZT from the 36^{th} week of pregnancy and three-hourly during labour; and a single dose of Nevirapine for the mother and child),

and assumes the mother continues to breast-feed.[1] These regimens were chosen because they are easy to administer, and hence have distinct advantages in a resource-constrained environment.

Government Policy Towards Preventing MTCT in South Africa

The history of the AIDS pandemic, and the failure of the apartheid and post-apartheid South African governments to respond adequately, have been well documented (see, for example, Crewe, 1992; Marais, 2000; Whiteside and Sunter, 2000; van der Vliet, 2001). This literature tells a demoralising story about how AIDS policy was overshadowed by competing political priorities, undermined by institutional inadequacies and insufficient funding, and plagued by high-level scandals. Once President Mbeki raised concerns about the causal relationship between HIV and AIDS, South Africa's AIDS policies were undermined still further. His subsequent inclusion of 'AIDS dissidents' like Peter Duesberg and David Rasnick (who questioned the efficacy of anti-retroviral treatments and the validity of AIDS tests) on his 'Presidential International Panel of Scientists on HIV/AIDS in Africa' – almost certainly slowed down the development of a coherent policy response to the AIDS crisis.

By the late 1990s, there was a wealth of evidence from developed and developing countries that treating pregnant women with a short course of anti-retrovirals could reduce MTCT dramatically. South African medical research subsequently came to similar findings (see, for example, Söderland et al, 1999; McIntyre and Gray, 1999; Wilkinson et al, 2000). However, all the recommended treatment regimes entailed the use of HIV

[1] Where substitute feeding is used rather than breast-feeding, MTCT can be reduced by about 50% (see Farley *et al*, 2000; Wood, 2001: 11). However the relative advantages of substitute feeding over breast-feeding for reducing MTCT in developing countries have yet to be established conclusively. Indications are that an exclusive breast-feeding regime followed by abrupt weaning may be more effective than the mixed-feeding regimes typically followed in breast-feeding populations (Wood, 2001: 11-12). And, given that substitute feeding is associated with higher infant mortality, the life-saving properties of formula-feeding will be reduced accordingly. After reviewing the available evidence, the WHO Technical Consultation team (2000) recommended that where substitute feeding is feasible, affordable, sustainable and safe, then breast-feeding should be avoided altogether. Otherwise, exclusive breast-feeding is recommended, followed by abrupt weaning. The decision should be based on counseling the woman so that she can make an informed choice.

tests and anti-retrovirals – i.e. the very things the AIDS dissidents were opposed to (and which the Presidential AIDS Panel was discussing).

This posed a problem for the Health Ministry, because to implement appropriate treatment regimes whilst the Presidential AIDS panel was sitting, could have been construed as a slap in the face for the President. But there was another argument against introducing a programme to reduce MTCT – and that was that South Africa could not afford it.

This argument first reared its head when the Health Minister (then Nkosazana Zuma) announced in 1998 that anti-retrovirals (especially AZT) were too expensive. Arguments to the effect that the paediatric costs of HIV-positive children far exceeded the costs of the intervention (see Nattrass, 1998; and McIntyre and Gray, 1999) appeared to have had no impact. Once the price of AZT was slashed by Glaxo-Wellcome, and Nevirapine offered free of charge to South Africa for five years, the Health Ministry's argument lost further credibility. Nevertheless, government officials continued to maintain that the programme was unaffordable. They argued that the costs associated with testing all pregnant women for the virus, as well as those of the necessary counselling and provision of infant formula (to prevent transmission of HIV through breast-milk), were too high (Van der Vliet, 2001: 166-7). The Health Ministry persisted with this line of argument, despite work by economists showing that even after making adjustments for these further costs, it was still cost-effective to prevent MTCT (see Skordis, 2000).

The Health Ministry's intransigence unleashed a storm of protest from researchers, AIDS activists and church leaders. The Western Cape provincial government decided to ignore government policy and went ahead with pilot projects to provide AZT and free infant formula at two clinics in Cape Town. The Treatment Action Campaign (an NGO dedicated to providing affordable treatment for those with HIV/AIDS) reviewed the available evidence (summarised in Geffen, 2000) and threatened to instigate legal proceedings against the national government.

In early 2001, the government changed its policy stance and announced that selected hospitals would provide free HIV tests to pregnant women. Those who tested positive would be offered a short course of Nevirapine and six months' supply of infant formula in order to reduce the chances of MTCT. This apparent concession, however, was not put into practice at the national level, and the decision was referred back to cabinet. In July 2001, the Treatment Action Campaign instigated legal proceedings against the government to force them to implement a national MTCT reduction programme.

The government is still clearly worried about the costs of a national programme to prevent MTCT. Nono Simelela, Chief Director

(HIV/AIDS and STDs) in the Department of Health, argued in the *Mail and Guardian* on 28 July 2000 that those advocating such programmes were 'cherry-picking'. She argued that this was a 'luxury' that the Health Ministry could not afford as it had to respond to the health needs of all South Africans. In other words, the concern was that money spent on preventing MTCT was money lost to other parts of the health sector

The problem with this argument is that it does not take into account that the additional children born HIV-positive as a result of government inaction also cost the government money. Such costs have to be taken into account explicitly when evaluating whether the programme is 'affordable' or not.

Methodological Considerations

The emerging literature on the cost-effectiveness of reducing MTCT in South Africa tends to be framed in terms of disability-adjusted-life-years, i.e. DALYs (see, for example, Söderland et al, 1999; Geffen, 2000; Wilkinson et al, 2000). DALYs combine 'time lived with a disability and the time lost due to premature mortality' (Murray, 1994: 441). DALYs are age-weighted and include a discount factor.[2]

The DALY is designed to help policy-makers rank interventions in terms of cost-per-DALYs saved. But how useful is it when it comes to practical budgetary allocations? In the Wilkinson *et al* (2000) study, the cost-per-DALY associated with a programme (using AZT) to prevent MTCT was estimated as ranging from $17 (R134) in KwaZulu Natal to $46 (R369) in the Western Cape, averaging $27 (R213) nationally. Geffen (2000) estimated (using different assumptions about formula-feeding, seroprevalence and other variables) that the national cost-per-DALY of an AZT regime to reduce MTCT was almost three times higher, at $76 (R606) per DALY.

Whilst such calculations are an interesting first step, they are only really meaningful from a policy perspective when placed in the context of a range of costs per DALY for different interventions. These must include not only interventions in the health sector, but all other government programmes and projects that improve health indicators (e.g. the provision of clean water, the removal of environmental hazards, income-generating programmes, etc.). As Anand and Hanson point out,

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[2] Anand and Hanson (1997) argue that this is one of the least attractive features of the DALY and that there are no ethical grounds for the application of such discounting factors. See Murray and Acharya (1997) for a defence of the DALY.

> 'If mother's education, or improving water supply and sanitation conditions generate bigger 'bang-for-a-buck' than health interventions, then the health budget should be redirected to the ministry of education, or of public utilities. A committed DALY maximiser should in principle be willing to give over the entire health budget to other ministries! Otherwise, this restricted cost-effectiveness exercise can lead to a seriously sub-optimal allocation of resources in the improvement of health outcomes' (1997: 699).

In South Africa's case, very few DALY calculations have been made with regard to government programmes. Wilkinson et al report two other estimates for comparative purposes: an immunisation programme ranging from $25-30 per DALY, and a family planning programme at $100-150 per DALY (both in 1990 prices). But what does this mean in policy terms? Does it mean that we should be putting more money into reducing MTCT than into family planning? And, given that immunisation appears to be more cost effective than reducing MTCT in the Western Cape, should we put money into the former rather than the latter programme? Of course Wilkinson et al would argue vigorously against any such interpretation, as there are no doubt many other programmes (such as kidney dialysis and heart transplants) which are undoubtedly much less cost-effective in terms of cost-per-DALY. However, until such time as a significant number of comparable DALY studies (using similar assumptions) have been done, an isolated cost-effectiveness measure (or even a small collection of such measures) is of limited policy significance.

Some South African authors have attempted to get around this problem by comparing cost-per-DALY with some kind of objective standard of cost-effectiveness. For example, Söderlund et al (1999) cite the 1993 World Development Report as suggesting that interventions costing less than $100 per life year saved are cost-effective for developing countries. Geffen (2000) uses the same figure as a benchmark to argue that reducing MTCT is cost-effective, and hence worth doing. However, this kind of analysis runs counter to the original purpose of the DALY as a tool for allocating health resources between competing claims. It begs the question of how many *other* interventions cost less than $100 per DALY and fails to interrogate the problem of using a rough international indicator as a benchmark against which to evaluate policies at country-level.

At most, presenting such cost-effectiveness calculations alongside a rough international benchmark provides some kind of indication that the cost per (adjusted) life year is in some sense low. However, in that case, one could well ask why not simply calculate the cost per life saved? In the Wilkinson et al study, the cost per life saved was $841, and in the Geffen

study it was $1,378. Such low costs per life saved are perhaps more compelling from a policy point of view than the cost-per-DALY calculations.

In the absence of any means of ranking the cost-per-DALY in terms of the cost-effectiveness of alternative interventions, the existing South African studies express total costs of the programme as a percentage of the health budget in order to show the relatively limited resource implications of the intervention. Wilkinson et al (2000) report that a national programme to reduce MTCT would amount to less than 1% of the national health budget – or $0.49 per person living in South Africa. In his review of the available studies, Geffen observes that there is consensus in the South African literature that such a programme will not cost more than 3% of the national government health budget (2000: 5).

But while this is more helpful to the process of budgetary allocation than a raw cost-per-DALY, it is not sufficient. In our subsequent net-cost calculations, we also show what percentage of the health budget would be absorbed by an intervention to reduce MTCT – but we take the calculation one step further and compare this with the costs to the health budget of *not* making the intervention.[3]

We present a series of best and worst-case calculations of the cost of MTCT, and of trying to reduce MTCT by using a short course of AZT versus Nevirapine. Estimates have been taken from primary and secondary studies conducted worldwide – with particular emphasis on those studies conducted either in South Africa or in a developing world context.

For each variable used in the model (such as HIV prevalence, the estimated number of women who would accept anti-retroviral therapy, etc. a range of observed mean values can be found in the literature. However, for the purposes of this paper, only the highest and lowest available figures were used to derive the upper- and lower-bound estimates respectively. This has the advantage of making explicit the possible range within which our estimates could fall. Mid-point estimates of the key findings are provided in the conclusion.

As regards screening, the tests used to establish the HIV status of mothers are assumed to be Rapid tests rather than ELISAs (hence the high uptake figures). As the name suggests, Rapid tests provide the expectant mother with a result shortly after the test. There is no need for her to return to the hospital at a future date to obtain her results.

Unlike other studies, we move beyond the bounds of the health budget by including the costs of the child-support grant (allocated through

[3] This approach was pioneered in a polemical piece by Nattrass (1998) and refined and improved by Skordis (2000) and Skordis and Nattrass (2001).

the Department of Welfare) for HIV-positive children. Although many HIV-negative children also benefit from the grant, we have not included these costs in the calculation on the grounds that the state can 'recover' this investment in human capital when the child grows up to be a productive, tax-paying adult. By contrast, the welfare resources devoted to HIV-positive children over the course of their short lives are what we term 'unrecoverable' – and should be viewed as a form of consumption spending. For this reason, we have included the welfare costs of HIV-positive children, but not HIV-negative children.

The Baseline Calculation: How Much Does it Cost to do Nothing?

We start off by outlining a baseline cost to the South African government of an HIV-positive child. This is summarized in Table 1. We assume that the average HIV-positive child spends between 11.9 and 12.7 days in hospital care during the course of its life (Cotton et al, 1998) and that the cost of a high-care hospital bed is $128 per day (WCDH, 1999). We opted to use the cost of a high-care bed in our calculations for two reasons. Firstly, HIV-positive children are likely to be placed in high-care beds when they are hospitalised due to the nature of the common opportunistic infections with which they present. Secondly, we did not include in our calculations the cost of medication to treat these opportunistic infections. HIV-positive children commonly present with serious illnesses such as pneumonia, tuberculosis, encephalitis, gastroenteritis, diarrhoea, acute respiratory tract infections, marasmia and a host of others. These diseases usually require more care than a low cost, general hospital ward can offer. Also, they often require relatively expensive testing to confirm the diagnosis, and costly medication for treatment. Unfortunately, reliable estimates of these costs are not readily available, and given the wide range of common infections, it is impossible to estimate a credible set of 'typical' medication costs. By assuming the costs of a high-care bed, we are compensating partially for the absence of medication and diagnostic costs in our calculations.[4] Note that this is the average cost of a bed. Given that South Africa's hospitals are operating at, or close to, full capacity in all urban centres, this is a reasonable costing assumption.

[4] Interestingly, this proxy for pediatric costs of AIDS is very close to (i.e.15% below) the average cost (adjusted to 1999 prices) reported by studies in Tanzania, Zaire and Thailand (reported in Marseille and Kahn (1999: 60)).

Note also that this baseline costing exercise excludes the private costs borne by parents/care-givers in getting the children to hospital and the costs associated with staying home from work to care for the child within the home environment. It is thus a severe under-estimate of the broader economic costs of the HIV-positive child.

TABLE 1: THE COST OF A SINGLE CHILD LIVING WITH HIV

	Upper Bound	**Lower Bound**
1.1. Average life span for an HIV-positive child in months (WCDH,1999), (Hussey et al,1998)	60	32
1.2. Mean duration of hospital stay for an HIV-positive child - in days (Cotton, 1998)	12.7	11.9
1.3. Daily cost of a high-care hospital bed (WCDH, 1999)	$128	
1.4. Inpatient costs per child (excluding symptomatic treatment) – This is calculated as the mean duration of the hospital stay multiplied by the daily cost of a high-care hospital bed (1.2. x 1.3.)	*$1,621*	*$1, 519*
1.5. Welfare cost for a single child over duration of life span – calculated at R100 per month over the life of the HIV-positive child	*$750*	*$400*
1.6. Total cost (health and welfare) per HIV-positive child with no intervention (1.4. + 1.5)	***$2,371***	***$1,919***

The welfare contribution listed in Table 1 is the value of the means-tested child-support grant available in South Africa. The model assumes that all mothers with HIV-positive children will receive the child-support grant. While this may at first appear to be an over-estimate because the grant is means tested and not all HIV-positive mothers will qualify for it, it is important to note that the women attending antenatal clinics in South Africa are skewed towards the lower-income groups. It is thus likely that the vast majority of HIV-positive children will end up receiving a state contribution to their welfare. Furthermore, the model presented here does not take into account the administrative costs to the state of means-testing

and of distributing the grant to eligible mothers. These costs are substantial, and their exclusion from the welfare cost estimate more than compensates for any over-estimation introduced by the assumption that all HIV-positive children receive the grant. The welfare cost estimate is thus likely to be an under-estimate.

The potential costs to the state of caring for an HIV-negative child (such as foster-care costs for orphaned children) have not been included for two reasons. Firstly, although the child's mother is more likely to die shortly after its birth than one born of an HIV-negative mother, we assume that an alternative member of the child's extended family will take responsibility for his or her upbringing (as is largely the case at present). In the event that the child does end up in state care, we deem that cost to be 'recoverable' over the course of his or her adult life, and hence do not include it as a cost.

To summarise then, in the case of an HIV-negative child, the welfare payment is considered a transfer payment and as such is not included in the calculation as a cost. In the case of an HIV-positive child however, it is considered a cost because the child will not live to repay the State for the investment in its well-being.

Table 1 shows that the cost to the state of a single HIV-positive child is between $1,919 and $2,371. The lower-probability estimate assumes that a child lives for 32 months, spends an average of 11.9 days in a high-care hospital ward and receives a child-support grant each month for the duration of his or her life. The upper-probability estimate assumes that the child will live for 60 months, spends an average of 12.7 days in a high-care hospital ward and receives a child-support grant each month for the duration of his or her life.

The cost of caring for a single HIV-positive child (as outlined in Table 1) is the cost of caring for a child over the duration of his or her life. Given that South Africa is in the grip of a growing AIDS pandemic, the number of HIV-positive children born each year will be at least the same as – and probably more than – the previous year. One can thus regard the numbers in Table 1 as a conservative estimate of the annual cost per child from the state's perspective.

The estimated number of HIV-positive children

Projections of the number of pregnant women used in this paper were produced using the Metropolitan Life/Doyle 'Scenario 99' Model for projections of demographic impacts of HIV/AIDS in South Africa (HIV Management Services, 1998). The number of pregnancies quoted is the number of live births anticipated for 1998 and is in line with the estimated

number of live births published with the antenatal results for 1996, when adjusted for the findings of the 1996 census.

The number of HIV-positive births used in this study is based on the findings of the 1998 Antenatal Clinic Study (HIV Management Services, 1998). The study estimated that approximately 27% of the pregnant women presenting at antenatal clinics were HIV-positive. The findings of the 1999 Antenatal clinic study were released recently and have raised many questions as to the validity of the data, due to reported changes in the methodology. As such, a lower probability of infection (of 19.2%) (UNAIDS/WHO, 2000) amongst pregnant women attending antenatal clinics has been included as the lower probability observation, while the 1998 projected infection rate has been retained as an upper-probability estimate in Table 2.

Another widely accepted model for measuring the impact of HIV/AIDS in South Africa is the ASSA600 model (Dorrington, 2000; ASSA600, 2000). The projection calculated by this model starts with an estimate of the population as at 1/11/1985 and projects forward annually from that date. The number of HIV-positive children projected for the year 2000 by the ASSA600 model is 67,912 (ASSA600, 2000).

This figure is very close to the average of the upper- and lower-probability findings for Scenario 99. Using the Scenario 99 measure of the population as a base, we arrive at an estimated range of between 48,616 and 86,415 HIV-positive children born each year. This is an average of 67,516 HIV-positive children per year, a slightly lower estimate than that yielded by the ASSA600 model.

Impact on the Budget

If the higher estimate of the number of HIV-positive children born each year (see Table 1) is multiplied by the upper-bound inpatient costs of caring for HIV-positive children, then this amounts to $140.1 million – i.e. 3,5% of the Health Budget (see Table 2). If the lower-bound estimates are used, then the cost of caring for HIV-positive children amounts to 1,8% of the Health Budget. Adding the ('unrecoverable') welfare costs of these children inflates the cost to the state to $205 million and $93.4 million for the upper- and lower-bound estimates respectively. This amounts to 0,% and 0,% respectively of the total government budget.

As argued above, one can make an unanswerable case for the affordability of an intervention if the costs of *not* intervening are greater than the costs of intervening. The rest of the paper shows how a short-course AZT treatment regime (with breast-feeding) and a single-dose Nevirapine regime (with breastfeeding) involve less cost to the state than would be the case if nothing were done to reduce MTCT.

TABLE 2: THE COST OF HIV-POSITIVE CHILDREN		
	Upper Bound	**Lower Bound**
2.1 Number of pregnancies which will potentially present at antenatal services (1998) (HIV Management Services, 1998)	1,012,831	
2.2. HIV prevalence among pregnant women (HIV Management Services, 1998, UNAIDS/WHO, 2000)	27.0%	19.2%
2.3. The number of HIV-positive pregnant women (2.2 x 2.1)	273,464	194,464
2.4. Perinatal transmission rate: breastfeeding, vaginal delivery and no intervention (Ratcliffe et al, 1998 (Cotton,1998)	31.6%	25.0%
2.5. Number of HIV-positive babies perinatally infected (2.4. x 2.5)	86,415	48,616
2.6. Inpatient costs per HIV-positive child (from Table 1)	$1,621	$1,519
2.7. Total inpatient costs for all HIV-positive children (2.5. x 2.6.)	*$140.1 million*	*$73.9 million*
2.8. Total inpatient costs of all HIV-positive children as % of the government's Health Budget	3,5%	1,8%
2.9. Total welfare costs for all HIV-positive children	*$64.9 million*	*$19.5 million*
2.10. Total costs (health and welfare) of all HIV-positive children (2.7 + 2.9)	*$205 million*	*$93.4 million*
2.11. Total (health and welfare) costs as percentage of total government budget	0,7%	0,3%

AZT Intervention

Before introducing any form of intervention, the HIV status of the potential patient needs to be ascertained. Studies have shown that between 90 and

93% of women are likely to consent to an HIV test at an antenatal clinic (HIV Management Services, 1998). As can be seen in Table 3, the cost of pre-test counselling and (Rapid) testing all pregnant women who present at antenatal clinics, as well as post-test counselling for HIV-positive women, will range from $6.9 million to $7 million.[5] Of those screened and found to be positive, approximately 92.5% are likely to accept anti-retroviral (ARV) treatment to prevent MTCT if they are offered it. This results in between 235,248 and 161,891 women being enrolled into the ARV programme.

TABLE 3: OUTCOME USING AZT INTERVENTION (WITH BREAST-FEEDING)

	Upper Bound	**Lower Bound**
3.1. Number of pregnancies which will potentially present at antenatal services (from Table 2)	1,012,831	
3.2. Counselling costs (rule of thumb is 40 minutes per patient and 5000 counselling hours needs 3 full-time counsellors at $6,875 per annum each. Each counsellor sees 2500 people, i.e. $2.8 per person) per person	$2.8	
3.3. Cost of pre-test counselling (3.1 x. 3.2)	$2.8 million	
3.4. Percentage of these women who are likely to accept an HIV test (HIV Management Services,1998)	93%	90%
3.5. Total number of women likely to be tested for HIV (3.1 x 3.4)	941,933	911,548
3.6. Direct cost of the test per person (WCDH, 1999)	$4.5	
3.7. Total cost of the HIV test (3.5 x 3.6)	$4.2 million	$4.1 million
3.8. Total cost of pre-test voluntary counselling and testing (3.3 + 3.7)	$7 million	$6.9 million
3.9. HIV prevalence among pregnant woman (from Table 2)	27%	19.20%

[5] The information used to estimate these costs came from the Western Cape HIV/AIDS Directorate.

3.10. Number of HIV-positive pregnant woman who are likely to be identified through screening (3.4 x 3.9)	254,322	175,017
3.11. Cost of post-test counselling for HIV+ women (3.2 x 3.10)	$0.7 million	$0.5 million
3.12. Percentage of above HIV-positive women who are likely to accept anti-retroviral treatment (HIV Management Services, 1998)	92.5%	
3.13. Number of HIV-positive women accepting the anti-retroviral (3.10 x 3.12)	235,248	161,891
3.14. Cost of Zidovudine (AZT) to mother (given from 36 weeks and 3 hourly during labour) per patient (WCDH, 1999)	$57.4	$28.7
3.15. The cost per child of PCP Prophylaxis (i.e. Bactrim syrup at R1.15 per 50 ml from 2 months to 15 months) (WCDH,1999)	$3.3	
3.16. Cost of administering AZT to all of these HIV-positive women and providing PCP prophylaxis to the child (WCDH,1999) ((3.14 + 3.15) x 3.13)	$14.3 million	$5.2 million
3.17. *Total direct costs of the intervention to prevent MTCT (3.8 + 3.11 + 3.16)*	*$22 million*	*$12.6 million*
3.18. Perinatal transmission rate amongst HIV-positive women who accept AZT (and breastfeed) (Dabis et al, 1999, Mansergh et al, 1996)	18%	16.5%
3.19. Perinatal transmission rate amongst those women who did not accept the AZT (and who breastfeed) (Cotton, 1998, Ratcliffe *et al*, 1998)	31.6%	25%
3.20. Number of HIV-positive children perinatally infected by those who accepted ARV (3.18 x 3.13)	42,345	26,712
3.21. Number of HIV-positive children perinatally infected by those mothers who refused to be tested, and those who tested positive but refused the anti-retroviral {[(3.1 – 3.5) x 3.9] + (3.10 – 3.13)} x (3.19)	12,077	8,143
3.22. Total number of HIV-positive children born during a programme of AZT intervention (3.20 + 3.21)	54,422	34,855
3.23. Calculated cost of inpatient care per HIV-positive child excluding symptomatic treatment (from Table 1).	$1,621	$1,519
3.24. *Calculated cost of inpatient care for projected number of HIV-positive children (excluding symptomatic treatment) (3.22 x 3.23)*	*$88.2 million*	*$52.9 million*

3.25. *Total direct costs for the intervention plus the inpatient costs of the projected number of HIV-positive children (3.17 + 3.24)*	*$110.2 million*	*$65.5 million*
3.26. Number of children saved as a result of the intervention (2.5 – 3.22)	31,993	13,761
3.27. Direct Intervention costs (i.e. screening, counselling, cost of AZT and providing PCP prophylaxis to the child) per child saved 3.17/3.26	$687.7	$915.6
3.28. Total health costs of doing nothing to prevent MTCT of HIV minus total health costs under the AZT treatment regime (2.7 – 3.25)	*$29.9 million*	*$8.4 million*
3.29 Welfare cost for projected number of HIV-positive children over duration of life span (3.22 x 1.5)	*$40.8 million*	*$13.9 million*
3.30. Total cost (health and welfare) for the projected number of HIV-positive children under an AZT treatment regime (3.25 + 3.29)	*$151 million*	*$79.4 million*
3.31. Total costs (health and welfare) of doing nothing to prevent MTCT of HIV minus total costs (health and welfare) of the intervention (2.10 – 3.30)	*$54 million*	*$14 million*

It costs between $29 and $57 to administer Zidovudine (AZT) to each mother enrolled in the programme from the 36th week of her pregnancy, followed by three-hourly doses during her labour (WCDH, 1999). It costs a further $4 to provide PCP Prophylaxis to each infant (WCDH,1999). This results in a total cost of between $5.2 million and $14.3 million to treat all the women enrolled in the programme and each of their infants. This naturally assumes that these women will attend the clinics prior to the birth and will not present for the first time in advanced labour, as this would make screening and administration of the drug prohibitive. Amongst these women in the programme (i.e. those who present at the clinic before the onset of labour, accept testing, and if positive, accept ARV therapy), the perinatal transmission rate is likely to drop from between 25% (Cotton et al, 1998) and 31.6% (Ratcliffe et al, 1998) to between 18% (Dabis et al, 1999) and 16.5% (Mansergh et al, 1996).

The total number of HIV-positive children born during a programme of AZT intervention includes not only the HIV-positive children of the women within the programme, but also the children born to those women who either did not accept the ARV or were not tested at the outset. With AZT intervention, the total number of HIV-positive children born is likely to be between 34,855 and 54,422, which is 13,761 and 31,993 fewer than would have been the case in the absence of the programme to

reduce MTCT. If we consider the direct costs of the intervention (i.e. testing, counselling and the cost of the ARV regime) this amounts to between $688 and $916 per child saved.

In order to examine the issue of affordability, we first examine it from the point of view of the Health Budget. Table 3 shows that it costs the Health Ministry between $8 million and $30 million more to treat the HIV-positive children born in the absence of a programme to reduce MTCT than it would to fund such a programme (and treat those children born HIV-positive despite the programme). When the welfare cost of HIV-positive children is included in the calculation, the difference becomes even greater. This indicates that it is costing the government between $14 million and $54 million not to introduce a programme to reduce MTCT.

Nevirapine Intervention

While the bulk of available research pertains to AZT, recent findings regarding Nevirapine suggest that it holds even greater promise for South Africa's fight against HIV/AIDS. Trials of Nevirapine indicate that the drug may be both more effective and cheaper than AZT (McDougal, 1999; Marseille and Kahn, 1999; Farley et al, 2000). The manufacturer has offered Nevirapine to the South African government free of charge for five years– and this is the assumption used in Table 4, where the calculations in Table 4 follow much the same lines as those in the previous table.

At a programme cost of as little as between $195 and $410 per child saved, Nevirapine can save between 19,265 and 43,520 children every year. As the drug comes in tablet form, an important benefit is that the mother can administer the first dose of the drug to herself when she goes into labour, hence reducing the strain on clinics and hospitals to a small degree.

Anecdotal evidence has revealed some concerns about women who present to clinics only once they are in labour, i.e. too late for the full HIV testing process. Under these circumstances one might consider administering Nevirapine in clinics to 'late presenters,' without first establishing HIV status. This could possibly be justified if the mother came from a higher-risk sector of the population, and was agreeable to taking the drug after the ramifications were fully and clearly explained to her. This possibility has not been included in the costing; however, its inclusion would not change the outcome significantly.

TABLE 4: OUTCOME USING NEVIRAPINE INTERVENTION (WITH BREAST-FEEDING)		
	Upper Bound	**Lower Bound**
4.1. Direct cost of testing and counselling pregnant women (from Table 3 – (3.8 + 3.11))	$7.7 million	$7.4 million
4.2. Cost of NVP for all these HIV-positive women (according to recent media reports)	R 0.00	R 0.00
4.3. Cost of the PCP prophylaxis to the child (WCDH,1999) (3.13 x 3.15)	$0.8 million	$0.5 million
4.4. Perinatal transmission rate amongst those women who accepted NVP (with breastfeeding and vaginal delivery) (MacDougall, 1999)	13.1%	13.1%
4.5. Perinatal transmission rate amongst those women who do not receive the antiretroviral (with breastfeeding, vaginal delivery and no intervention (from Table 3*)*	31.6%	25%
4.6. Number of HIV-positive children perinatally infected by those who did accept the antiretroviral (4.4 x 3.13)	30,818	21,208
4.7. Number of HIV-positive children perinatally infected by those mothers who did not accept the antiretroviral or who were not tested at the outset (and did not formula feed their babies) (from Table 3)	12,077	8,143
4.8. Total number of HIV-positive children born during a programme of NVP intervention (4.6 + 4.7)	42,895	29,351
4.9. Calculated cost of inpatient care per child (not including symptomatic treatment) (from Table 1)	$1,621	$1,519
4.10. Calculated cost of inpatient care for projected number of HIV-positive children (not including symptomatic treatment) (4.9 x 4.8)	$69.5 million	$44.6 million
4.11. *Total direct costs to the health budget of the intervention to prevent MTCT of HIV* (4.1 + 4.2 + 4.3)	*$8.5 million*	*$7.9 million*
4.12. *Total health costs of the intervention to prevent MTCT of HIV plus the inpatient costs of those children born HIV-positive despite the programme* (4.10 + 4.11)	*$78 million*	*$52.5 million*
4.13. Number of children saved (2.5 – 4.8)	43,520	19,265

4.14. Direct intervention costs (i.e. screening, counselling, cost of PCP prophylaxis) per child saved (4.11/4.13)	$195.3	$410.1
4.15. *Total health costs of doing nothing to prevent MTCT of HIV minus total health costs of using NVP* (2.7 – 4.12)	*$62.1 million*	*$21.4 million*
4.16. Welfare cost for projected number of HIV-positive children over duration of life span – calculated at R100 per month (1.5 x 4.8)	$32.2 million	$11.7 million
4.17. *Total cost (health and welfare) per annum for the projected number of HIV-positive children under an NVP treatment regime* (4.12 + 4.16)	*$110.2 million*	*$64.2 million*
4.18. *Total costs (health and welfare) of doing nothing to prevent MTCT of HIV minus total costs (health and welfare) under an NVP treatment regime* (2.10 – 4.17)	*$94.8 million*	*$29.2 million*

There are concerns about women developing resistance to Nevirapine as a result of taking the drug during labour. However, after reviewing the available evidence, Farley et al conclude that the efficacy of Nevirapine in subsequent pregnancies is unlikely to be affected, that the transmission of the resistant virus to sexual partners is unlikely, and that the course of the mother's HIV infection would probably not be affected (2000: 4-5). Drug resistance is a chronic problem for all HIV/AIDS interventions. Those women who develop a long-standing resistance to Nevirapine, and who are subsequently are able to access chronic treatment programmes to manage their own HIV infection, will have to use a different drug regimen. However, as generalized access to ARV medication for adults is not yet on the government's agenda, the point is academic.

Conclusion

We have argued that South Africa cannot afford to do nothing to combat MTCT of HIV. Short of denying HIV-positive children any access to healthcare (which would be unconstitutional), the cost of one HIV-positive child in terms of basic hospital costs and 'unrecoverable' welfare spending is substantially greater than the interventions discussed above. In addition, one should remember that this cost per HIV-positive child is a gross under-estimate as it includes no medicines for treating opportunistic infections, none of the economic costs of a parent or guardian staying home from work to care for a sick child, and none of the transport costs of getting the sick child to medical care.

TABLE 5: OVERVIEW OF ALL INTERVENTIONS WITH MID-POINT ESTIMATES

	AZT AND BREASTFEEDING			**NEVIRAPINE AND BREASTFEEDING**		
	Upper bound	Lower bound	Mid point	Upper bound	Lower bound	Mid point
5.1. Direct costs of the MTCT reduction programme	$22 million	$12.6 million	$17.3 million	$8.5 million	$7.9 million	$8.2 million
5.2. Lives saved	31,993	13,761	22,877	43,520	19,265	31,393
5.3. Cost of the MTCT reduction programme per saved child	$687.7	$915.6	$801.7	$195.3	$410.1	$302.7
5.4. Cost of the MTCT reduction programme per DALY (5.3/32)	$21.5	$28.6	$25.1	$6.1	$12.8	$9.5
5.5. Total amount saved by the Health Budget as a result of the programme to reduce MTCT of HIV	$29.9 million	$8.4 million	$19.2 million	$62.1 million	$21.4 mill-ion	$41.8 mill-on
5.6. Amount saved by the Health and Welfare Budgets as a result of the programme to reduce MTCT of HIV	$54 million	$14 million	$34 million	$94.8 million	$29.2 mill-on	$62 mill-on
5.7. Amount saved by the Health and Welfare Budgets as a result of the programme to reduce MTCT of HIV per DALY (5.6 / (5.2 x 32)	$52.8	$31.8	$46.4	$68.1	$47.4	$57.8

Table 5 summarizes some of the key results with regard to affordability. Although the AZT regimen saves the most lives, the Nevirapine regimen has the lowest cost per life saved and has the additional advantage of being simple to administer. In Table 5, we convert this into a rough cost-per-DALY measure by multiplying the number of lives saved by 32, i.e. the DALY estimate used by Wilkinson et al, 2000. However, this tells us nothing more, in terms of policy implications, than what we already knew from the simple cost-per-life-saved calculation.

As we argued in the introduction, the cost-per-DALY measure of cost-effectiveness is limited in that it requires a large range of other cost-per-DALY measures in order to be of policy relevance. Our approach to the issue of affordability does not suffer such drawbacks: if the costs of not intervening are higher than the costs of intervening, then the intervention is clearly affordable. We have argued that this is the case with regard to the two MTCT reduction programmes discussed in the paper.

Consider the estimates in Table 5. We show that it would *save* the Health Budget between $8 million and $29.9 million (in the case of the AZT regimen) and between $21.4 million and $62.1 million (in the case of the Nevirapine regimen) if the government intervened to reduce MTCT. This is because the costs of in-patient care associated with the higher number of HIV-positive children born in the absence of a programme to reduce MTCT more than compensates for the costs of the intervention, and costs of in-patient care, for those HIV-positive children born despite the programme. If we include the 'unrecoverable' welfare costs of those children who are born HIV-positive on both sides of the equation, then the Health and Welfare Departments together would save between $14 million and $54 million (AZT regimen) and between $29.2 million and $94.8 million (Nevirapine regimen) if a programme to reduce MTCT was introduced.

Note that if we were again to cast this particular cost-effectiveness calculation in a DALY framework, we would take the unusual step of dividing the amount the government saves through the intervention (rather than the cost of the intervention) by the number of DALYs saved by the intervention. Thus, as Table 5 shows, the government would be saving between $21.5 and $28.6 (AZT regimen) and between $6.1 and $12.8 (Nevirapine regimen) for every DALY saved by a programme to reduce MTCT if health costs alone are considered, and between $31.8 and $52.8 (AZT regimen) and $47.4 and $68.1 (Nevirapine regimen) if health and welfare costs are considered!

One could, of course, argue that we have over-estimated the costs of HIV-positive children to the state because we have not taken into account the fact that as the AIDS pandemic approaches its peak, over-

stretched hospitals will ration health care away from HIV-positive children and adults. Indeed, there is evidence that at least one hospital has already ruled that HIV-positive children are allowed only one hospital stay, and must otherwise be treated as out-patients (reported in Nattrass, 2001). However, even if we cut the health cost of an HIV-positive child to one hospital visit ($127) and add a rough (low) estimate for the cost of out-patient visits (say $50), and then assume further that the child dies earlier as a result (say at 24 months rather than the lower-bound 32 month estimate – thus costing the government only $300 in welfare grants), the total cost ($477) still exceeds the upper-bound cost-per-child saved of implementing a Nevirapine MTCT reduction programme (i.e. $410.1).

At this point the argument enters deep ethical territory. After all, if the government ruled that all babies born to HIV-positive mothers should be strangled at birth, they would end up costing the government nothing. Under such circumstances, our argument for the affordability of a MTCT reduction programme would clearly no longer hold. Fortunately no one is arguing this case in South Africa and it is illegal to discriminate against anyone on the grounds of his or her HIV status.

The power of the argument we make here is simply this: unless the government is planning to deny HIV-positive children access to basic health care and welfare payments, it will save money by implementing a MTCT reduction programme.

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