

**COST-BENEFIT ANALYSIS OF A  
PROGRAMME TO PREVENT MOTHER-TO-  
CHILD HIV TRANSMISSION IN  
MOZAMBIQUE**

**FINAL REPORT**

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## **GLOSSARY OF ACRONYMS**

ARV	Anti-retroviral
VCT	Counselling and Voluntary Tests
CET	Cost-Effectiveness Tool
CPN	Ante-natal consultation
DALY	Disability Adjusted Life Year
OBD	Occupied Bed Day
PHD	Provincial Health Directorate
CHD	City Health Directorate
MCHN	Mother and Child care nurse
HCM	Maputo Central Hospital
HP	Provincial hospital
DHS	Demographic and Health Survey
IUD	Intra-uterine device
MISAU	Ministry of Health
MTs	Meticaïs
NVP	Nevirapine
GSB	General State Budget
PMTCT	Prevention of Mother-to-Child Transmission
PNC DTS/SIDA	National Programme against Sexually Transmitted Diseases/AIDS
SIS	Health Information system
MCH	Mother and Child Care
UA	Care Unit

## EXECUTIVE SUMMARY

The objective of the current study is to assess the costs and benefits of supplying pregnant women with a complete package for preventing mother-to-child HIV transmission (PMTCT). This package includes: 1. Improved quality of health care before, during and after the birth; 2. Counselling and voluntary tests; 3. Anti-retroviral treatment with nevirapine; and 4. Nutritional counselling. The net benefit (cost) of the PMTCT programme corresponds to the difference between the costs of the programme (costs of improving the current level of mother and child care services + costs linking to implementing VCT and NVP activities) and the costs of treating children infected with HIV (monetary benefits).

**The economic model** used was based on the "Cost-Effectiveness Tool for Evaluating Anti-retroviral Drug and Substitute Feeding Intervention to Prevent Mother-to-Child Transmission of HIV" (UNAIDS). We calculated cost-effectiveness and cost-benefit for a hypothetical programme comparable to the urban population of Chimoio with 217,156 people and 9,283 pregnant women going to their first ante-natal consultation. Four versions of this programme were evaluated: with and without an increase in the number of MCH staff, and both possibilities with and without supplies of artificial milk.

**The general demographic and health** data used in the model were taken from IDS 97.

**The size of the population that could possibly be covered by the programme** was assessed thanks to observations and discussions with the staff of Gaza and Manica health units. We calculate that, of the 9,283 pregnant women who go to the first ante-natal consultation, 7,129 (775) could attend all the counselling sessions and would agree to be tested. Of this number, 1,929 (27%) would be HIV-positive, and the 1,369 (71%) who give birth in a public health unit could receive the treatment with nevirapine.

As for **the rate of HIV transmission without treatment**, we took the figures of 25% perinatal transmission and 14% during breast-feeding, in accordance with the data published in the literature.

**The total cost of treating an HIV-positive child** (from birth until death) was assessed at US\$ 517, with the data available in the clinical files of the HIV-positive children who attend the AIDS consultation in the paediatric department and/or who are interned in the HCM paediatric department. The cost was broken down into direct costs or costs that can be directly attributed to the treated child (medicines, for example), and indirect costs of which only a part can be attributed to a specific child (hospital electricity expenditure, for example).

As regards **improving the MCH services**, we considered two scenarios in cost evaluation, taking into account the great difficulty of increasing the number of MCH staff. First, an ideal situation in which the MCHN (MCH nurses) and midwives would increase in number so that each consultation lasted for 15 minutes, and it would thus be possible to undertake all the activities envisaged for an adequate consultation. For Chimoio city, this would mean an

additional 18 MCHN (including midwives for the maternity wards). The additional cost would be US\$ 1,857 a month for Chimoio City.

Second scenario: without any increase in staff, with the existing number of MCHN, and with the activities it is possible to undertake, the costs for staff training, and improvements in equipment and consumables were evaluated. The additional cost would be US\$ 570 a month for Chimoio City.

We assessed the cost of Counselling and Voluntary Testing at US\$ 7.56 per client counselled.

**Treatment with nevirapine** costs US\$ 5.6 per mother/child pair and we took an effectiveness of 47% for nevirapine, in accordance with the published literature.

For every 100 HIV-positive women, **the programme of substitute milk** costs US\$ 8,063 a year (for the supply of milk, counselling and follow-up). This programme would make it possible to save US\$ 2,621 due to HIV infections that were avoided, but would lead to additional health expenses of US\$ 2,954 due to other causes provoked by the use of artificial milk.

For a city the size of Chimoio, this programme could have the following results: each year 132 deaths could be avoided thanks to nevirapine, and 8 thanks to the milk substitution programme.

The annual cost of the programme would be US\$ 62,864 without any increase in staff. To this should be added US\$ 15,444 if the number of staff is increased, and US\$ 110,417 for a milk substitution programme.

The costs of treating HIV-positive children could be reduced by US\$ 68,106 a year because of the reduction in the number of children infected thanks to nevirapine, and by US\$ 4,363 thanks to the substitute milk programme. However this latter programme could also lead to an increase of US\$ 40,456 in the costs of treating children for causes other than HIV.

The net cost would be negative if there were no additional staff and no substitute milk programme: in other words, the costs are lower than the benefits, which means a net saving of US\$ 5,242. The other scenarios have net costs varying between US\$ 10,202 (with an increase in staff, but without substitute milk) and US\$ 156,712 (with both increased staff and substitute milk).

In economic terms, it is possible to implement a programme of this kind, under our conditions, without increasing staff and without milk substitutes, in a city such as Chimoio, saving money and saving lives. But the most relevant matter is not simply saving money, but also avoiding a great deal of suffering for children, for families and for communities.

With VCT, couples will adopt measures that may also lead to a reduction in horizontal transmission of HIV. Apart from all these benefits, one also notes that better care for mothers would lead to lower maternal mortality, and eventually to an increased rate of family planning.

## 1. INTRODUCTION

The HIV/AIDS epidemic is now under control in several parts of the world, but continues to evolve in a catastrophic fashion in Africa, particularly in the sub-Saharan region, where Mozambique is located.

In Mozambique, the HIV prevalence among the general public is about 16-17%, according to data published by the PNC DTS/SIDA. The data concerning the situation of children have been obtained by extrapolation, and it is thus estimated that, out of the total number of infected people, 25% are children aged 0-4 years (INE. 2000).<sup>1</sup>

In sub-Saharan Africa, 90% of children with HIV/AIDS acquired the infection from their mother, that is by vertical transmission. This transmission may occur during pregnancy (10-15%), at birth (70-80%), or through breast milk (10-15%) (Working Group on MTCT of HIV, 1995).<sup>2</sup>

Consequently, programmes to prevent vertical transmission envisage measures that seek to reduce the transmission of the virus at these three moments. It is thus important to keep pregnant women in good nutritional shape, without anemia, with screening and adequate treatment for sexually transmitted diseases (use of condoms) and other infectious diseases that might act as co-factors in HIV transmission.

As regards the birth, there are various measures to be taken, and these seek to avoid the early rupture of membranes, episiotomy and caesarian births in certain cases. After the birth, and in accordance with the country's infant mortality rate, breast milk can be replaced by artificial milk (UNICEF, 1998).<sup>3</sup> One of the most effective measures, proven to be so at various levels, in differing socio-economic contexts, and different levels of HIV-prevalence, is the administration of anti-retroviral drugs to the pregnant woman and to the newly born child. These drugs can be given in different schemes, with one or several drugs together, in regimes that vary in duration, and with costs varying between 4 and 1,000 US dollars (Dabis et al, 1998)<sup>4</sup> The cheapest is the scheme for administering Nevirapine in a single dose to the mother and the newborn child (US\$ 4.00), which was initially experimented in Uganda and later in several other countries in the region with a reduction of vertical transmission of about 47% in a population with breast feeding (Marseille et al, 1999).<sup>5</sup>

Given the fact that the reduction in vertical transmission is more than proved, and that there is still no policy in this regard in Mozambique, it was necessary to assess whether the measures to be taken for a programme of intervention would be as cost-effective and cost-beneficial as has been shown in other countries.

Thus UNICEF, in coordination with the Ministry of Health, decided to sponsor a study entitled "Cost-Benefit Analysis of a Programme to Prevent Mother-to-Child HIV Transmission". The study was undertaken by a team consisting of a health economist, a paediatrician and a gynaecologist-obstetrician.

The current report describes the objectives, the methodology used, including the UNAIDS model and how it was adapted to our context, the areas of study, the meetings held with various officials, the data obtained, and the methodology of the calculations and tables that have allowed us to draw the conclusions that are stated at the end of the report.

## **Acknowledgements**

A large number of people contributed, in a kind and generous manner, to the success of this study, which had the merit of gathering important and detailed information in just six weeks.

Without Dr. Martinho Dgedge, Director of the Department of Reproductive Health in the Ministry of Health, nothing would have been done. With his scientific spirit and his initiative, he gave the necessary drive so that the study could be undertaken.

The management of Maputo Central Hospital, in the person of Dr Rogerio Prista, was promptly willing to collaborate, providing staff and various information of an administrative and clinical nature, understanding the importance of undertaking studies that will in future allow a better tasking of decisions and a more rational use of existing resources. At the HCM, the Administrative Director, Dr Chichava, the Finance Officer, Mr Balane, and other workers provided invaluable assistance in gathering statistical and economic data.

In the Manica and Gaza provincial directorates, Drs Dezi Mahotas, Veronica, Alicia, Celso Varinde, Gisela, Brigida, and those responsible for the mother and child health sectors, nurses Julieta and Joana, contributed on the organisation of the health services in the cities of Chimoio and Xai-Xai, with an enthusiasm and anxiety which just demonstrates that there is no time to lose, for concrete action is expected as regards the vertical transmission of HIV.

Ms Isabelle Yersin of MSF-Switzerland generously provided a great deal of information on VCT and vertical transmission.

Dr Fernando Munoz of the Medicines and Medical Material Centre courteously provided the list of prices of drugs in the national formulary.

The Health Ministry's group on counselling and voluntary tests provided valuable collaboration with material so that a correct assessment of the introduction of VCT at provincial level could be made.

Finally, it was UNICEF which, through Carolina Siu, Vivianne, Martine, Alex, Dina and the other collaborators, made the greatest contribution in encouraging, sponsoring and supporting the team that undertook the study with their ideas, sometimes in agreement, and sometimes in disagreement, but always constructive.

We would like to thank them all very much.

## 2. OBJECTIVES

The **general objective** of the study is to compare the costs and the benefits of providing pregnant women with a complete package for the prevention of mother-to-child transmission of HIV (PMTCT). This package consists of:

- improved quality of health care before, during and after the birth;
- counselling and voluntary tests;
- anti-retroviral treatment with Nevirapine (NVP);
- nutritional counselling.

The comparison is undertaken through a cost-benefit study (the costs and the benefits are expressed in monetary units, which makes it possible to deduct the costs from the benefits to reach the net cost of the programme). Cost-effectiveness study (the costs are expressed in monetary units, and the benefits in other units, such as fatalities or DALYs<sup>1</sup>; which makes it possible to obtain cost-effectiveness ratios by dividing the benefits by the costs).

The **specific objectives** are:

- Evaluating the costs of hospitalising and following up children with HIV/AIDS;
- Evaluating the costs of improving care before, during and after the birth;
- Evaluating the costs of introducing counselling and voluntary tests in ante-natal consultations;
- Evaluating the costs of administering Nevirapine to the mother and child;
- Evaluating the cost of introducing substitutes for breast milk.

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<sup>1</sup> Disability Adjusted Life Years = number of years of life saved by an intervention weighted by the quality of life perceived by the person and by the social value attributed to each year of life in function of age.

### 3. METHODOLOGY

#### 3.1 Economic model

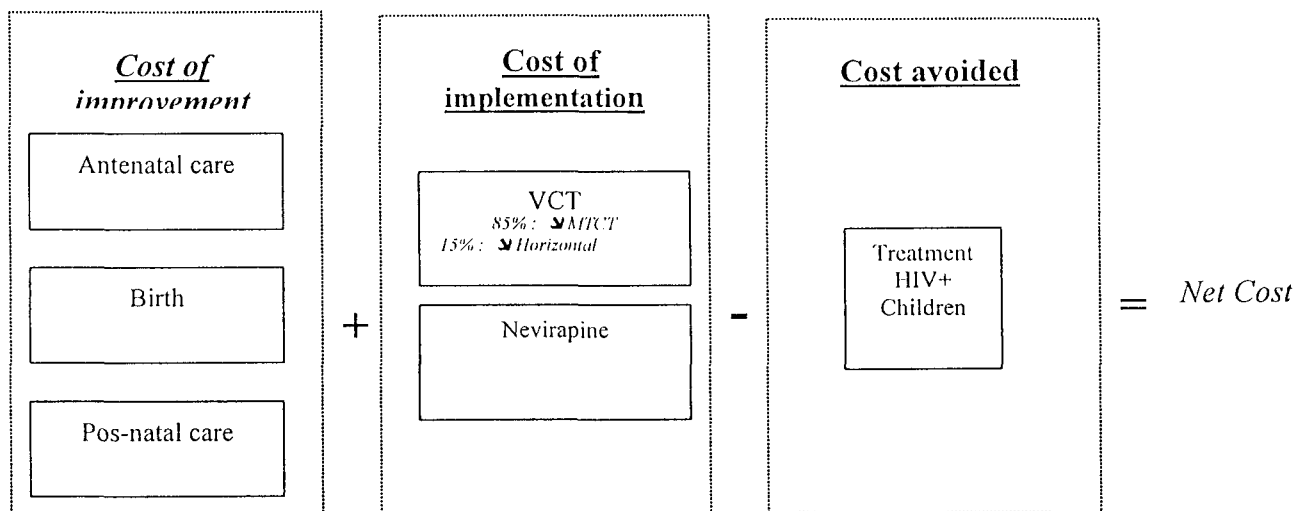
The economic model used in carrying out this study was largely derived from the model developed by Health Strategies International for UNAIDS for the economic evaluation of programmes to prevent vertical transmission of HIV (Marseille and Khan, 1999). This model, called "Cost-Effectiveness Tool for Evaluating ARV Drug and Substitute Feeding Intervention to Prevent MTCT of HIV" allows comparison of costs, results, cost-effectiveness and cost-benefits of 4 versions of a PMTCT programme.

The programme studied includes improving the Mother and Child Health (MCH) services, Counselling and Voluntary Tests (VCT), the administration of a short regime of Nevirapine (NVP) to mother and child, and the provision of substitute milk to HIV-positive mothers. Four versions of the programme were evaluated: with and without an increase in the number of MCH staff, and both possibilities with and without the provision of artificial milk.

We calculated the costs, results, cost-effectiveness and cost-benefits for a hypothetical programme which could potentially cover a population comparable to the urban population of Chimoio - that is, 217,156 people, or 9,283 pregnant women going for their first antenatal consultation.

The cost-benefit analysis compares monetary costs with monetary benefits. The net benefit (cost) of the PMTCT programme corresponds to the difference between the costs of the programme (costs in improving the current levels of mother and child care + costs linked to implementing the VCT and NVP programmes) and the costs of treating children infected with HIV (monetary benefits).

- Figura 1 : Cost-benefit analysis





The cost-effectiveness analysis compares monetary costs with benefits expressed in result units, such as deaths avoided or DALYs.

The perspective considered was that of the Health Ministry. This body is responsible for the budget for the programme of preventing HIV transmission, and also for the budget of units such as hospitals and health centres where the infections associated with HIV in children are treated. This perspective does not consider the costs and savings for households and for society in general.

The outcomes are the net cost for the Health Ministry, the number of deaths avoided, the cost per death avoided, and the cost per DALY.

Future costs and benefits were discounted at 3% per year and the exchange rate used was that in effect at the start of this study: 1 US\$ = 17,100 meticais in December 2000.

## **3.2 Data used in the model**

### **3.2.1 General demographic and health data**

**Total Population**: 217,156 inhabitants of Chimoio city (PHD Manica, 2000)

**Life expectancy at birth for men**: 40.7 years for Manica province (INE, Census 1997)

**Life expectancy at birth for women**: 44.9 years for Manica province (INE, Census 1997)

**Neonatal mortality (1 month)**: 34/1,000 for Manica province (INE-MISAU, IDS 1997)

**Infant mortality (1 year)**: 91/1,000 for Manica province (INE-MISAU, IDS 1997).

### **3.2.2 Population covered by the programme**

**Pregnant women whose child is born alive**: 4.5% of the population (percentage used by MISAU).

**Women going to their first ante-natal consultation**: the data gathered by the Manica PHD indicate that 102% of the pregnant women attended their first ante-natal consultation in 2000. There is clearly a problem in the SIS, since a figure higher than 100% is impossible. However, discussions with nurses and PHD officials led us to conclude that almost all women attend their first ante-natal consultation. For the study we took a percentage of 95%.

**Women who went to the first ante-natal consultation and who go to the group counselling session**: according to the nurses at the Chimoio and Xai-Xai health centres, almost all the women attended the group sessions. We took 90% for the study.

**Women who went to the group counselling session and who go to the individual counselling session:** according to the nurses at the Chimoio and Xai-Xai health centres, almost all the women attended the individual sessions. We took 90% for the study.

**Women who went to the individual counselling session, and who agree to be tested.** according to the nurses at the Chimoio and Xai-Xai health centres, almost all the women would agree to be tested. There is a highly successful syphilis screening programme in Chimoio. The women are very interested, and have frequently expressed a wish to be tested for HIV. We took 95% for the study.

**Prevalence of HIV among pregnant women:** 27%. Latest results from an epidemiological surveillance survey in Chimoio (10/2000).

**HIV-positive women who enter into the NVP programme:** according to information gathered on the ground, it would be very unlikely that a women could take NVP at the start of labour if she was giving birth at home. But on the other hand, it would be possible to administer NVP to all the women (and their children) who give birth in a public health institution. In Chimoio city, 71% of births are institutional (PHD, 2000), and so that is the percentage we used for the proportion of tested women who would enter the NVP programme.

**Table 1. Population covered**

Population	217	156
Pregnant women	4.5%	9,772
First ante-natal consultation	95%	9,283
Group session	90%	8,355
Individual session	90%	7,520
Test	95%	7,144
HIV+	27%	1,929
NVP	71%	1,369

### **3.2.3 Perinatal transmission of HIV without treatment**

No studies have been undertaken in Mozambique on this subject. Studies published found rates of 25.5% in the industrialised world (Corner et al, 1994)<sup>6</sup>, 24% in Thailand (Walker, 1997)<sup>7</sup>, and 25.1% in Uganda (HIVNET 012, 1999)<sup>8</sup>. Other studies found either lower rates - 17.2% on average in Tanzania, Uganda and South Africa (Saba, 1999)<sup>9</sup> - or higher ones: 30% in South Africa (Wilkinson, 1998).<sup>10</sup>

For the present study, we took a rate of perinatal transmission of 25%.

### **3.2.4 Cost of treating HIV-positive children**

We assessed the total cost (from birth until death) of treating HIV-positive children who attend the AIDS consultation in the paediatric ward and/or are hospitalised in the HCM paediatric department. The total cost can be broken down into direct costs, or costs directly attributable to the child under treatment (medicines, for instance), and indirect costs of which only a part can be attributed to a specific child (hospital electricity expenditure, for example).

#### **Direct Costs:**

Between 1993 and 1999, the clinical files on HIV-positive children hospitalised in the HCM paediatric wards were systematically archived by a nurse of this department: of these, about 74 concern children currently being followed, 98 refer to children with whom contact has been lost, and 52 to children who have died. Treatment of the children currently being followed and of some of the children now lost, which appears in the files, is incomplete, and we therefore chose to base ourselves on the files of the dead children. The time available for the study allowed analysis of 48 of the 52 dossiers on dead children.

The medicines and analyses provided during hospitalisation and receipted in out-patient consultations were valued for each child. The drug prices considered were those supplied by the Health Ministry's Medicine and Medical Articles Centre, to which we added 40.4% applied by Medimoc for taxes, storage and distribution (GCI, 1995).<sup>11</sup>

For the analyses, it was difficult to obtain the real cost including expenditure on products, staff and equipment. We obtained price lists from some private laboratories in Maputo. These prices are higher than the costs of the analyses since the private laboratories apply a profit margin. We also obtained the list of prices for sales of analyses to patients by the HCM laboratory. The HCM prices are lower than the real ones since, as the director of the HCM laboratory, Dr. Elisabeth Coelho, confirmed, the sale prices are subsidised. In order not to exaggerate the potential benefits of the programme studied, we opted to use the sale prices of the HCM laboratory.

The average direct costs we found are shown in Table 2, More details can be found in summary table 1.

**Table 2. Treatment of HIV-positive children: direct costs**

	<b><u>Consultation</u></b>	<b><u>Hospitalisation</u></b>	<b><u>Total</u></b>
Medicines	29	124	153
Analyses	7	71	78
Total	36	195	231

### **Indirect Costs:**

The indirect costs consist mainly of recurrent expenditure on staff, goods and services, and capital costs.

The data available did not allow us to calculate capital costs. In theory, a list was needed of all investments (buildings, medical equipment and material, office material, vehicles etc), their value, their purchase date, and the amortization period. The HCM administrative management cannot provide us with this data since investment is financed from several sources (mainly the General State Budget and donors), and the HCM does not record investment in an overall fashion. Taking a prudent attitude, we opted not to include these costs, thus leading to a minimisation of the benefits of the programme under study.

To evaluate the other indirect costs, we based ourselves on data provided by the HCM administrative management. As can be seen from the table below, total recurrent expenditure for the year 2000 was 97 billion meticaïs. This expenditure was financed by the GSB, and by the HCM's own normal and special income.

We used the "Step Down" methodology (Shepard et al, 2000)<sup>12</sup> in order to assess what part of the HCM indirect expenditure concerns the paediatric department. The hospital departments were divided into various support levels. Each level supports the departments on the following level. On level 1 is the Central Administration, on level 2 Maintenance, on level 3 the auxiliary services (blood bank, stores, general pharmacy, and laboratory tests), and on level 4 the direct services (paediatrics, surgery, medicine etc). The expenditure of each level is divided among the lower levels, In the HCM, 18.7 billion meticaïs (19% of the recurrent indirect expenditure) were thus attributed to the Paediatric Department. The detailed calculations are found in appendix II.

The division of indirect expenditure between consultation and hospitalisation was based on the division of paediatric staff. From Appendix III it can be seen that 97% of the staff costs refer to hospitalisations, and 3% to consultations - that is, 18.2 billion meticaïs for hospitalisation and 488 million meticaïs for consultations.

To obtain the indirect cost per OBD and per consultation, we divided the figures mentioned above by the total number of OBD and consultations in the paediatric department in 2000. We thus reached an indirect cost of US\$ 9.09 per OBD and 2.22 per consultations, as can be seen in table 3.

**Table 3. Treatment of HIV-positive children**

In mts	Funding			Income	Income	Total
	OG	GSB				
Staff	189,394	48,315,254		484,464	10,738,007	59,727,121,040
Goods	27,986,035	0		0	0	27,986,035
Services	8,831,671	0		0	0	8,831,671
Others	474,967	0		0	0	474,967
<b>Total</b>	<b>37,482,068</b>	<b>48,315,254</b>		<b>484,464</b>	<b>10,738,007</b>	<b>97,019,795</b>

In mts	Total	%	Total	Paed. Hospital	Consult. Ext.
Staff	59,727,121	19	11,529,629	11,229,093	300,535
Goods	27,986,035	19	5,402,380	5,261,559	140,820
Services	8,831,671	19	1,704,851	1,660,412	44,439
Others	474,967	19	91,686	89,297	2,3890
<b>Total</b>	<b>97,019,795</b>		<b>18,728,548</b>	<b>18,240,363</b>	<b>488,184</b>

**Total Occupied Bed Days Paediatric Department** 117

**Indirect costs/OBD** 155,000 MT

**Indirect costs /OBD** 9.0 \$

**Total Paediatric External Consultations** 12

**Indirect costs/consultation** 37,000 MT

**Indirect costs/consultation** 2.2 \$

**Total costs:**

The average total cost of treating an HIV-positive child in the HCM is US\$ 517 (IC 95%: [376;658])

**Table 4. Treatment of HIV-positive children: costs**

<b>Consultations</b>		
Medicines	29 \$	6%
Analyses	7 \$	1%
<b>Total direct costs</b>	<b>6 \$</b>	<b>7%</b>
Average no. of consultations	5	
Indirect costs per consultations	2 \$	
Total Indirect costs	10\$	2%
<b>TOTAL CONSULTATIONS</b>	<b>46 \$</b>	<b>9%</b>

<b><u>Hospitalisations</u></b>		
Medicines	124 \$	24%
Analyses	71 \$	14%
<b><u>Total direct costs</u></b>	<b><u>95 \$</u></b>	<b><u>38%</u></b>
Average number of OBDs	30	
Indirect cost per OBD	9 \$	
Total indirect costs	276 \$	53%
<b><u>TOTAL HOSPITALISATIONS</u></b>	<b><u>471 \$</u></b>	<b><u>91%</u></b>
<b><u>TOTAL TREATMENT</u></b>	<b><u>517 \$</u></b>	<b><u>100%</u></b>

### **3.2.5 Cost of improving the MCH services**

Taking into account the great difficulty in increasing the number of MCH staff, two possible scenarios were considered in evaluating the costs involved in improving MCH services

1. An ideal situation in which the number of MCH nurses and midwives would increase so that each consultation would last for 15 minutes. It would thus be possible to undertake all the activities envisaged for an adequate consultation. For Chimoio city this would mean an increase of 18 MCH nurses (including midwives for the maternity wards).
2. With the current number of MCH nurses and with the activities it is possible to undertake, the costs were assessed for staff training, improvements in equipment in consumables, but without any increase in staff.

#### **3.2.5.1 Without increasing staff**

##### **Additional staff**

In this scenario there would be no costs, since there would be no additional staff.

##### **Training**

An initial course was considered for 4 trainers lasting for 4 days and to be held in the provincial capital every 3 years (Appendix IV). The cost of wages, per diems, renting rooms, editorial material, and snacks comes to a total of US\$ 1,425. Divided by the total number of MCH nurses and midwives who will be trained by these trainers, the sum works out to US\$ 40 per midwife/MCH nurse. Divided by 36 months, the sum amounts to US\$ 1.10 per MCH nurse or midwife per month.

The second course would also be organised in the provincial capital, in which the 4 trainers would train the 36 existing MCH nurses and midwives (Appendix V). In the same way, the total costs were calculated, and they amount to US\$ 10,387: divided by 36 MCH nurses and midwives, the sum is US\$ 289 per midwife or nurses, and the monthly cost is US\$ 8.01 per midwife/MCH nurse.

Thus the total monthly cost per MCH nurse or midwife for training corresponds to US\$ 317 for the health units of Chimoio city.

### **Consumables and medicines**

We did not note any significant ruptures in stocks of MCH medicines.

Since there is a shortage of syringes and gloves in all the health units, the costs for all MCH and birthing activities were considered in the following way: the amount of disposable syringes and needles amounts to 10% of the first ante-natal consultations and 100% of the births for the administration of Metilergometrine and a further 25% of the births for local anaesthetic, when there are lacerations or episiotomies.

The gloves needed amount to 10% of the family planning consultations for insertions of IUDs, and 100% of the births, using three pairs per birth. This amount was divided by 4, since each pair of gloves can be sterilised 3 times after its first use.

The amount of chromium catgut thread to stitch up lacerations or episiotomies was calculated for 25% of the births using 1.25 packets per birth.

### **Equipment**

In the MCH consultations, the costs of speculums and lights sources for gynaecological examinations were not considered, because gynaecological examinations are not carried out routinely for lack of time.

In the births, the costs of glasses, bathtubs and towels for the new born child, soap dishes and three sheets per birth for two days, so that they can be washed, dried and sterilised the day following use, were considered. The total monthly cost is US\$ 91.21.

Adding the partial costs together, one reaches a total monthly cost of US\$ 570.82 for improving the MCH services in the Chimoio city health units.

**Table 5. Cost of improving MCH without increasing staff**

	E. Mondlane	1 <sup>a</sup> May	Nhamaonha	Chissui	Hospital	Total
<b>Additional staff</b>						
No. additional MCH Nurses/midwives	0	0	0	0	0	0
Monthly wage	65	65	65	65	65	
<b>Total</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>
<b>TRAINING (cost perMCH nurse/midwife per month)</b>						
No. MCH nurses	4	3	2	1	18	28
No. midwives	0	4	4	0		8
Course for trainers	1,10	1,10	1,10	1,10	1,10	0,71
Course nurses/midwives	8,01	8,01	8,01	8,01	8,01	8,01
<b>Total</b>	<b>36</b>	<b>64</b>	<b>55</b>	<b>13</b>	<b>164</b>	<b>317</b>
<b>CONSUMABLES</b>						
MCH activities	2,39	1,60	1,97	0,32	0,00	6,28
Births	0,00	24,64	25,44	0,00	105,92	156,00
<b>Total</b>	<b>2,39</b>	<b>26,24</b>	<b>27,41</b>	<b>0,32</b>	<b>105,92</b>	<b>162,28</b>
<b>EQUIPMENT</b>						
MCH activities	0,00	0,00	0,00	0,00	0,00	0,00
Births	0,00	14,53	14,99	0,00	61,69	91,21
<b>Total</b>	<b>0,00</b>	<b>14,53</b>	<b>14,99</b>	<b>0,00</b>	<b>61,69</b>	<b>91,21</b>
<b>Total Improvement</b>	<b>38,85</b>	<b>104,57</b>	<b>97,09</b>	<b>12,93</b>	<b>331,66</b>	<b>570,82</b>

### **3.2.5.2 With an increase in MCH staff and midwives**

#### **Additional staff**

In this scenario, there would be an increase of 18 MCH nurses or midwives, which implies additional costs in wages of US\$ 1,178 per month.

#### **Training**

The training would be as described for the case of no increase in staff, but the cost per MCH nurse or midwife would be lower, both for the trainers' course (Appendix VI) and for the course of MCH nurses and midwives (Appendix VII) since there would be a larger number of MCH nurses and midwives.

However the total monthly costs of training are larger, amounting to US\$ 373 for the Chimoio city health units.

#### **Consumables**

The number of disposable syringes and needles amounts to 10% of the first ante-natal consultations for the treatment of syphilis and 100% of the births for the administration of Metilergometrine and a further 25% of the births for local anaesthetic, when there are lacerations or episiotomies.

The gloves needed amount to 100% of the first ante-natal and post-natal consultations for gynaecological examinations, 10% of the family planning consultations for insertions of IUDs, and 100% of the births, using three pairs per birth. This amount was divided by 4, since each pair of gloves can be sterilised 3 times after its first use.

The amount of chromium catgut thread to stitch up lacerations or episiotomies was calculated for 25% of the births using 1.25 packets per birth.

The total monthly cost of consumables is US\$ 171.47 for the Chimoio city health units.

### Equipment

In this scenario the costs of speculums and light sources for gynaecological examinations were considered for the MCH consultations, since with the increased numbers of staff it would be possible to undertake these examinations.

In the births, the same costs as defined in the first scenario were considered: glasses, bathtubs and towels for the new born child, soap dishes and three sheets per birth for two days. The cost of the consumables and equipment for births is the same in the two scenarios, US\$ 156 and US\$ 91.21 respectively.

The total cost for improving the quality of MCH consultations in this scenario is US\$ 1,857.81 per month for the Chimoio city health units.

**Table 6. Cost of improving MCH with an increase in staff**

	E. Mondlane	1st May	Nhamaonha	Chissui	Hospital	Total
<b>Additional staff</b>						
No. additional MCH nurses/midwives	5	3	4	0	6	18
Monthly wage	65	65	65	65	65	
<b>Total</b>	<b>327</b>	<b>196</b>	<b>262</b>	<b>0</b>	<b>393</b>	<b>1178</b>
<b>TRAINING</b> (cost per MCH nurse/midwife per month) No. MCH nurses/ midwives	9	6	6	1	24	46
Course for trainers	0,71	0,71	0,71	0,71	0,71	0,71
Course nurses/midwives	7,34	7,34	7,34	7,34	7,34	7,34
<b>Total</b>	<b>36</b>	<b>48</b>	<b>50</b>	<b>11</b>	<b>193</b>	<b>373</b>
<b>CONSUMABLES</b>						
MCH activities	6,00	4,02	4,67	0,79	0,00	15,47
Births	0,00	24,64	25,44	0,00	105,92	156,00
<b>Total</b>	<b>6,00</b>	<b>28,66</b>	<b>30,11</b>	<b>0,79</b>	<b>105,92</b>	<b>171,47</b>
<b>EQUIPMENT</b>						
MCH activities	16,40	11,58	11,91	3,99	0,00	43,88
Births	0,00	14,53	14,99	0,00	61,69	91,21
<b>Total</b>	<b>16,40</b>	<b>26,11</b>	<b>26,90</b>	<b>3,99</b>	<b>61,69</b>	<b>135,08</b>
<b>Total Improvement</b>	<b>421,02</b>	<b>299,11</b>	<b>368,41</b>	<b>15,91</b>	<b>753,35</b>	<b>1857,81</b>

### **3.2.6 Cost of Voluntary Counselling and Testing**

The monthly budget for the VCT component of the PMTCT programme is detailed below. Apart from reducing vertical transmission, the VCT programme could also lead to a reduction in horizontal transmission. Thus some of the costs of the programme could be deducted since the present study only concerns the prevention of vertical transmission. The authors of the CET model advise a deduction of up to 30% of the costs. In the present study we have deducted 15% of the costs.

#### **Staff**

To calculate VCT costs, it was assumed that a counsellor can attend to about seven pregnant women a day. Thus a health centre with an average of 500 ante-natal consultations per month would have 3 counsellors. The counsellors would be women, preferably retired nurses.

#### **Training**

The training would start with two counsellors for the provincial level attending a 2 week course (Appendix VIII); they would then be the trainers who would train 15 counsellors in a 4 week course (Appendix IX). Training would take place every three years.

The counsellors would be paid wages equivalent to those of Health Ministry basic technical staff, since the great majority of MCH nurses are basic level.

The counsellors would attend day-long monthly seminars with the provincial supervisor to exchange experiences, and on that day they would receive a monetary remuneration (per diem) (Appendix X).

#### **Material**

##### **HIV/AIDS tests**

Rapid HIV tests were considered: Capillus and HIV SPOT in accordance with the guidelines of the Health Ministry's national programme on sexually transmitted diseases and AIDS. First the Capillus test is given. If it is negative, the result is regarded as negative. If it is positive, it is followed by the HIV SPOT test. If that is positive, the result is regarded as positive, and if it is negative, the result is undetermined.

In addition to the tests, the costs of gloves, cotton wool and disinfectant were taken into account, as well as tea, sugar and milk to offer to the pregnant women and create a more welcoming environment.

## Equipment

The costs of a refrigerator to keep the boxes of tests already opened were considered, plus a table and three chairs for each counsellor, and the rehabilitation of the counselling room.

## Radio announcements

The radio announcements will be 60 seconds long, and will be broadcast twice a day for 30 days every three months. The prices quoted include the 50% discount that Radio Mozambique offers to the Health Ministry

After obtaining the results of the monthly cost of each activity, and adding all the activities together, this sum was divided by 500 clients to obtain the cost per client seen, which amounts to US\$ 7.56.

**Table 7 Monthly cost of VCT**

Counsellors (basic technician level)	3	85				255
Auxiliary staff	1	52				52
<b>Total staff costs STAFF</b>						<b>307</b>
<b>TRAINING</b>	Total cost	No.counsellors	Regularity (months)	Monthly cost counsellor	No.counsellor %	Monthly cost %
Preparing manual	7 500	180	36	1	3	3
Trainers' course	21 961	180	36	3	3	10
Counsellors' course	23 777	15	36	44	3	132
Refreshers for Counsellors	770	15	1	51	3	154
<b>Total training</b>						<b>300</b>
<b>MATERIAL</b>	Amount	Unit price				Cost
Tests	500	5,57				2 787
Disposable gloves (pairs)	500	0,01				5
Cotton wool (1 roll)	1	1,50				2
Cetremide,Chlorexidine100 ml	1	2,54				3
Notebooks	3	1,46				4
Pens	6	0,29				2
Tea (kilo)	1	2,05				2
Sugar (kilo)	6	0,76				5
Powdered milk (400 gm tins)	8	2,05				16
<b>Total materials</b>						<b>2825</b>
<b>EQUIPMENT</b>	Amount	Unit price	Duration Monthly			(months) cost
Refrigerator	1	1185	60			20
Tables	3	58	120			1
Chairs	9	18	60			3
Rehabilitation	1	2000	60			33
<b>Total equipment cost</b>						<b>57</b>
<b>PUBLICITY</b>	Price per month	No. of months transmission	Annual cost			Monthly Cost
Radio spots	879	4	3515			293
<b>GENERAL MONTHLY TOTAL</b>						<b>3782</b>

Cost per client who finishes the process 7.56

### 3.2.7 Cost and effectiveness of ARV treatment with NVP

**Cost:** John Hopkins University Hospital Pharmacy (1999) indicates the following costs for nevirapine:

- mother: 200 mg NVP = US\$ 3.87
- child: 4 mg/kg NVP = US\$ 0.13.

After applying Medimoc's margin of 40.4% for taxes, storage and distribution, we reach a cost of US\$ 5.6 per mother and child.

**Effectiveness:** The HIV NET 012 study in Uganda found a difference of 47% ([25.1-13.1]/25.1) between transmission of HIV-1 at 14-16 weeks in the group with Zidovudine (transmission = 25.1%), and in the group with nevirapine (transmission = 13.1%). If zidovudine is effective, nevirapine would be even more so, compared with a placebo or in the absence of intervention. The figure of 47% could even underestimate the real effectiveness of nevirapine.

### 3.2.8 Cost and effectiveness of a programme of breast milk substitute

**Breast feeding habits:** the data on breast feeding were taken from IDS 97 and refer to Mozambique in general.

The percentage of women who feed their babies exclusively on breast milk at 1, 3 and 7 months are 52%, 29% and 4% respectively. 99% of women breast fed their babies at least once. The percentage of women who give their babies breast milk exclusively, or in combination with other foods, at 6 and 24 months are 97% and 40% respectively.

**Supply period and cost of breast milk substitute:** artificial milk would be supplied to HIV-positive women for 6 months starting from the day of the child's birth. We used the prices mentioned by the authors of the CET economic model: average price, including distribution, of US\$ 4.00 per kilo and consumption of 3.3 kilos/month/child. Women would be counselled once about feeding before birth, and there would be 3 follow-up sessions.

**Table 8: Cost of breast milk substitute**

Wages	0.5
Counselling session	15
Number of sessions before birth	1
<b><u>Cost of</u></b>	<b><u>0.13</u></b>
Supervisory session	20
Number of sessions	3

<u>Cost of</u>	<u>0.50</u>
Cost of milk per kilo (including distribution)	4
Months of consumption	6
Amount per month (kilos)	3.3
<u>Cost of milk</u>	<u>80</u>
 <u>Total cost per mother</u>	 <u>80.63</u>
 Number of mothers entering the substitute of breast milk programme	 <u>1,369</u>
 <u>COST</u>	 <u>110,417</u>

**Risks of transmission of HIV through breast feeding**: this risk is not constant and is at its greatest at the start of breast feeding. However, for this study, we used the figure for average risk associated with any type of breast feeding including for short periods, assessed by Dunn (1992)<sup>13</sup> at 14%.

**Relative risk of mortality from causes other than HIV in children who are not breastfed, compared with children who are**: we used the relative risk proposed by the authors of the CET economic model : 3 for urban contexts (for rural contexts it is advisable to use an RR = 4). This Relative Risk is based on several published studies (Hobcraft et al, 1985).<sup>14</sup>

**Compliance with breast feeding recommendations**: there are no published studies in this regard, neither for the Mozambican context, nor for anywhere else. The authors of the CET model proposed the use of compliance percentages of 75% both for exclusive breast feeding and for breast milk substitutes. We preferred to be more prudent and use a percentage of 75% for compliance with exclusive breast feeding, but only 50% for breast milk substitute.

Costs of treatment linked to HIV and to other causes: substitute milk influences the costs of treatment in two ways. First, the expected reduction in transmission produces savings in the costs of treating illnesses linked to HIV. But on the other hand, children fed on substitute milk are less protected than are children who are breast fed, which means an increase in treatment costs.

The ratio (1.479 = 13.7/9.3) of medical costs due to other causes with the substitute milk programme, compared with the medical costs due to other causes with the existing breast feeding scheme, was evaluated by using the ratio of fatal events due to other causes with the milk substitution programme (13.7) compared with the fatal events from other causes with the existing breast feeding scheme (9.3) (see "Effectiveness" below).

The cost of treating HIV-negative patients was assessed at 29% of the cost of treating HIV-positive patients, based on a percentage calculated for South Africa (Marseille, 1999)<sup>15</sup>. The

cost of contraceptives was assessed at US\$ 9 per year based on the prices applied in Mozambique.

To summarise, the milk substitution programme could avoid treatment costs linked to HIV to a sum of US\$ 2,621/year/100 HIV-positive women and would cause additional treatment costs for other causes of US\$ 2,954/year/100 HIV-positive women. This is a net cost of US\$ 333/year/100 HIV-positive women.

**Effectiveness:** the health outcome of the present model consists of the fatal events, which correspond to the total number of deaths due to causes other than HIV, such as diarrhoeas and pneumonias, plus the new HIV infections through breast feeding. The fatal events were calculated by dividing the annual rates of mortality and of HIV transmission month by month up to the 24th month. The difference, for every 100 HIV-positive women, between the number of fatal events with the existing scheme of breast feeding (9.3 due to other causes and 14 due to HIV, or a total of 23.3), and with the milk substitution programme (13.7 due to other causes and 8.9 due to HIV, or a total of 22.7), is 0.6. In other words. the milk substitution programme could avoid 0.6 fatal events for every 100 HIV-positive women.

In summary fashion, the costs and benefits of a milk substitution programme would be as follows (see the detailed table in Appendix X):

**Table 9: Net cost of breast milk substitution**

**Cost per 100 HIV-positive women per year**

Cost of supplying milk, counselling and follow-up	8,063
Costs of treatment due to HIV avoided	(2,621)
Additional costs of treatment due to other causes	2,954
<b><u>Net cost of the programme</u></b>	<b><u>8,396</u></b>

## 4. STUDY AREAS

### 4.1 Maputo Central Hospital

Maputo Central Hospital is the largest hospital in the country. In the Mozambican health care reference system, it is a quaternary level unit.

In this hospital there is a Paediatric Department that has 380 beds. Since 1984 there has been a service of special care for children with HIV/AIDS in this department. Because the hospital has this organised service, it was chosen as a study area, for collecting data concerning the treatment and follow-up of children with HIV/AIDS. Data was gathered here that allowed us to assess the direct and indirect costs of treating these children.

For the direct costs, data was taken from the files on deaths from AIDS. For each file, a form was completed with data on the number of consultations, hospitalisation, analyses made and medication given.

The directors of the laboratory and the pharmacy were also interviewed, in order to obtain the costs of the analyses and some drugs used.

For the indirect costs the Administrative Director of the hospital, the finance officer and the officer in charge of the paediatric department administration were interviewed. Data was gathered on the number of staff and their distribution in the paediatric department, on the portion of the general state budget allocated to the hospital, recurrent expenditure, wages and cost recovery through the activities of the special clinics, The results obtained can be found in the form of tables under point 6.

### 4.2 Xai-Xai

To determine the cost of counselling, a visit was made to the Xai-Xai city health services, with the purpose of evaluating the feasibility and the needs in terms of resources to provide an operational counselling service in ante-natal consultations.

On 04/01/01, there was a meeting at the Gaza Provincial Health Directorate with the participation of the outgoing provincial chief doctor (Dr Celso), the new chief doctor (Dr Gizela), the UNICEF technical assistant in the PHD (Dr Martine), the provincial HIV/AIDS programme officer (Dr Brigida), the provincial MCH officer (nurse Joana), the Xai-Xai provincial hospital blood bank officer and the study team (Drs Nafissa and Dimitri). The objective of the meeting was to present the protocol of the study, the work plan during the team's stay, and a team interview to understand opinions regarding the implementation of VCT in ante-natal consultations, and to gather data on services and human resources in the Xai-Xai city health units.

Xai-Xai city has a health centre that provides mother and child care services, a health post with MCH activities and a maternity ward, and two health posts that only offer MCH. Xai-Xai provincial hospital contains the city's reference maternity ward. All these places were visited and a hypothetical exercise was made on the possibility of introducing an VCT service into the ante-natal consultations.

The document produced by the Health Ministry's VCT working group was used as the basis for evaluating the costs of VCT. A meeting was held with Dr Dimitri to assess in detail the costs of each component of VCT. This was revised and improved with the opinions of the people contacted in Xai-Xai.

In general, the provincial team, both in the directorate and in the health centres and posts, agreed with the possibility of implementing VCT in ante-natal consultations, and were positive towards the possibility of carrying out a programme to reduce vertical transmission of HIV. It is thought that there would be greater acceptability of HIV testing in the peri-urban and rural area rather than in the urban area, where about 30% might refuse to be tested.

The Xai-Xai health centre is operating provisionally in a former school, because the original health centre was destroyed by the floods. Here we met the city health director and the MCH nurses. The centre does not possess the conditions to install a counselling office. However, there is plenty of space in the yard that would allow provisional rooms to be set up.

The Marien Ngouabi health post has a maternity ward and infrastructures that would allow an VCT office to operate in ante-natal consultations.

The Praia health post has few patients and has no lack of space. At the Mocita health post, the MCH nurses think it would be very easy to set up installations for VCT, since there is a good relationship with the manager of the Mocita factory.

We visited the Xai-Xai provincial hospital maternity ward, where 90% of the women who give birth are from the city and 10% from the neighbouring districts. The midwives thought it would be easy to identify the HIV-positive women as long as there was a code in the ante-natal file.

### **4.3 Chimoio**

To determine the cost of improving mother and child health care, a visit was made to the Chimoio city health services on 9-12 January 2001, with the purpose of assessing the additional resources needed in each health centre and maternity ward to improve the quality of care before, during and after birth.

On 09/01/01 the study team (Dr Nafissa and Dr Dimitri) held a meeting in the Chimoio PHD with the interim head doctor (Dr Veronica) and with the interim provincial MCH officer (nurse Julieta). The purpose of the meeting was to present the protocol of the study,

the work plan for the team's stay, and the methodology for gathering statistical data from the PHD, the Chimoio CHD and from each health centre and maternity ward.

Chimoio city has 2 health centres with maternity facilities (Primeiro de Maio and Nhamaonha), two health centres without maternity facilities (Eduardo Mondlane and Chissui), and the maternity ward of the Chimoio Provincial Hospital. The study team visited each of these health units, accompanied by nurse Julieta and by Dr Alicia, who is the provincial MCH advisor and a collaborator of HAI (an American NGO). An evaluation was made of the existing services, and of the human and material resources that would be needed to improve the quality of the services provided.

Discussions were also held with the MCH staff in the health units about whether pregnant women would accept counselling and voluntary testing, and also their attitudes towards exclusive breast feeding or substitutes for breast milk. In the pharmacies and health centres, medicines and material supplied to the MCH services in 2000 were assessed, and whether there had been any rupture of stocks during the year.

#### **Rates of coverage by the MCH services in Chimoio city in 2000:**

- To determine rates of coverage of the first ante-natal consultation, the denominator assumed was 5% of the population.
- For the post-natal consultation, 4.5% of the population was considered in the denominator.
- For the first 0-4 years consultation, 4.5% of the population was considered in the denominator.
- The available data correspond to the first 11 months of 2000. Hence the formula used to obtain an annual estimate was: the data for 11 months multiplied by 12/11.

Many coverage rates in excess of 100% were found, which may be due to mistakes in gathering the statistical information, or to an under-estimate in the total calculation of the population and its distribution by health areas.

The first 0-4 years consultations include the 0-11 months consultations, and it was noted that for January all the consultations were regarded as the first of the year, although they were not in fact the first consultation in the life of the child. This may go at least some way towards explaining coverage rates way above 100%, up to 1009% in the Chissui health centre.

The births in the Manica Provincial Hospital correspond only to births to women from Chimoio city and outskirts. 5.7% of the births, to women from other districts, were excluded.

#### **Work load of the Chimoio city MCH staff in 2000**

The available data corresponded to the first 11 months of 2000. Hence to obtain an annual estimate of consultations (first and second), the formula used was: data from 11 months multiplied by 12/11. Adding together all the ante-natal, post-natal, 0-4 years and family

planning consultations, the figure for the total care units per year was obtained. The figure was divided by 12 to obtain the monthly care units, and this was then divided by 23 clear days to obtain the daily average.

The Eduardo Mondlane health centre has 5 MCH nurses, but since 1 is full-time in screening children, only 4 MCH nurses were taken into account. For each nurse, a month's holiday per year was deducted. The number of nurses in each centre multiplied by 11 months and divided by 12, and the daily care units divided by this figure made it possible to calculate the MCH care units per day per nurse. Taking a seven hour working day, it was possible to determine the duration of each care unit in each health centre. Taking into account that a consultation should last for 15 minutes, the number of additional nurses needed in each health centre was determined.

In general, a shortage of MCH nurses was noted in almost all the health units. The average length of time a woman was seen was observed at between 5 and 8 minutes, which does not allow for good quality in the provision of services. For example, gynaecological examinations which, in accordance with Health Ministry guidelines, should be undertaken in the first ante-natal and post-natal consultation, were not carried out in any of the health centres, even when the pregnant woman complained of leucorrhoea (she was just given a prescription for Eritromycine).

Screening for syphilis, using the RPR test, is undertaken in a well organised fashion in all the health centres. Acceptance by the users is very good. The service also attends to the women's partners who are very interested and participate actively. The nurses mentioned that many women think this test is for HIV, and most ask why they are not receiving an HIV test.

## 5. RESULTS

In order to differentiate the costs and benefits of the various programme components, 4 scenarios were calculated. The first two concern a programme that would not need to hire additional staff for the component of improving MCH services. Taking into consideration the difficulties linked to staff shortages facing the Ministry of Health, these two scenarios are probably the most realistic ones. While the first scenario is for an intervention without a milk substitution programme, the second scenario includes a milk substitution programme. Scenarios 3 (without milk substitution) and 4 (with milk substitution) are for a programme in which additional staff would be hired to improve the MCH services.

The summary table below shows, for each scenario, the health outcome, the monetary costs and benefits, as well as the cost-benefit (net cost) and cost-effectiveness (cost per fatal event avoided and cost per DALY) indicators.

**Table 10: Results**

	Scenario 1	Scenario 2	Scenario 3	Scenario 4
	N/ Additional staff	N/Additional staff	Additional staff	Additional staff
	N/Supplying milk	Supplying milk	N/Supplying milk	Supplying milk
Fatal events avoided (NVP)	132	132	132	132
Fatal events avoided (milk)	0	8	0	8
<b>Total fatal events avoided</b>	<b>132</b>	<b>140</b>	<b>132</b>	<b>140</b>
Cost MCH and VCT	55 173	55 173	70 617	70 617
Cost NVP	7 691	7 691	7 691	7 691
Cost milk	0	110 417	0	110 417
<b>Total costs</b>	<b>62 864</b>	<b>173 281</b>	<b>78 308</b>	<b>188 725</b>
HIV benefits NVP	68 106	68 106	68 106	68 106
HIV benefits milk	0	4 363	0	4 363
HIV (-) cost milk	0	(40 456)	0	(40 456)
<b>Total benefits</b>	<b>68 106</b>	<b>32 013</b>	<b>68 106</b>	<b>32 013</b>
<b>Net cost of Programme</b>	<b>- 5 242</b>	<b>141 268</b>	<b>10 202</b>	<b>156 712</b>
<b>Cost per fatal event avoided</b>	<b>-40</b>	<b>1009</b>	<b>77</b>	<b>1119</b>
<b>Cost per DALY</b>	<b>- 1,53</b>	<b>38,69</b>	<b>2,97</b>	<b>42,92</b>

For a city the size of Chimoio, every year 132 fatal events would be avoided thanks to nevirapine, and 8 thanks to the milk substitution programme.

The annual cost of the programme would be US\$ 62,864 without an increase in staff. To this must be added US\$ 15,444 if there was an increase in staff, and US\$ 110,417 for a milk substitution programme.

The costs of treating HIV-positive children could be cut by US\$ 68,106 a year because of the reduction in the number of infected children thanks to nevirapine, and by US\$ 4,363

thanks to the milk substitution programme. However, this latter programme could cause an increase of US\$ 40,456 in the cost of treating children for causes other than HIV.

The milk substitution component would make it possible to avoid relatively few fatal events when compared to the nevirapine component, although the cost of the milk substitute is much higher than the cost of nevirapine.

The net result is the programme's cost-benefit indicator. The first scenario has a negative net cost: in other words the costs are lower than the benefits, which means a net gain of US\$ 5,242. The other scenarios have net costs ranging from US\$ 10,202 (with increase in staffing and without milk) and US\$ 156,712 (with an increase in staffing and with milk).

The cost per DALY and the cost per fatal event avoided represent the cost-effectiveness ratios, where the costs of the programme are the numerator, and the DALYs or fatal events avoided are the denominator. The lower the cost-effectiveness ratios, the better the results. These ratios can be negative, which means that the programme is not only cost-effective, but that it also makes it possible to save money.

The first scenario makes monetary savings possible so, the cost-effectiveness indicators are logically negative. The other scenarios have positive costs per DALY, but always lower than US\$ 50, which is generally considered as the limit up to which interventions are considered cost-effective in low income countries (World Bank, 1993).<sup>16</sup>

## **6. LIMITATIONS**

### **6.1 In general**

- The various parts of the study were undertaken in geographically different areas. Despite the similarity of the contexts (urban areas of Mozambican provincial capitals), comparison of data drawn from different contexts must be handled prudently.
- The data on Mozambique were taken from the Health Information System. During our visits we could observe some differences between the data in the health units, in the City Health Directorate, and in the Provincial Health Directorate. Whenever possible, we tried to use the most conservative data (minimising the benefits or maximising the costs of the programme).

### **6.2 Treatment of HIV-positive children**

- The size of the sample, 48 clinical files, is small, and a larger sample would have made it possible to reduce the confidence interval concerning the cost of treatment (US\$ 517). However, the confidence interval obtained [376;658] does not seem excessively large.
- The costs considered are solely those of consultations and hospitalisations at the HCM. Some of the children were probably treated in other health units, before and after treatment at the HCM. Inclusion of these costs would increase the average cost of treating an HIV-positive child.
- HCM capital expenditure was not taken into account. The inclusion of this expenditure would also increase the average costs of treating an HIV-positive child.

### **6.3 Improving the quality of MCH services**

- The concept of "quality" is difficult to measure objectively, and can differ, depending on whether the quantifier is a health professional or a patient. Our evaluation was based on the observations made by the health professionals we met on the ground.

### **6.4 Voluntary Counselling and Testing**

- There is a scarcity of data about this in Mozambique, since the only existing programme (in Alto Mae) ceased functioning in March 2000. The tests were not undertaken on the spot, but in the HCM laboratory, unlike the programme envisaged in the present study, where the rapid tests would be carried out on the spot.

## **6.5 Anti-retroviral treatment with nevirapine**

- As explained above, the percentage of 47% may underestimate the real effectiveness of nevirapine, since this percentage refers to the relative effectiveness of nevirapine compared with that of zidovudine.

- We considered that nevirapine could be administered only to women who give birth in a public health unit, which is 71% of pregnant women in Chimoio. If the programme is implemented, it is likely that more HIV-positive women would wish to give birth in a maternity ward, in order to limit the possibility of transmitting HIV to their child. In this case, the effectiveness of the programme would be greater.

## **8. DISCUSSION**

The results of this study show that there is no universal model to be applied homogeneously in all places. It is necessary to bear in mind the context of where one intends to carry out the intervention programme, and to adapt various factors, from ante-natal care, to the birth, to advice on breast feeding and artificial milk.

The programme certainly leads to a larger number of orphans, but they are healthy orphans and thus are less of a cost for those who have to look after them.

However, the most relevant and certainly the most interesting aspect of the study is that interventions with packages of this nature, make it possible not only to save money, but also to avoid a great deal of human suffering. This is suffering of the children, whose fundamental rights are violated when they are denied the right to life, and above all to a good quality life. It is the suffering of the family and of the community, who have to look after a sick child, with the consumption of financial, social and emotional resources implied in this situation.

We should also not forget that, with the population of reproductive age seriously affected, the labour force of tomorrow will be the children whom we manage to save today !

Logically, since the programme contains a component of counselling, and hence of educating the public, it will lead, through greater awareness of the problem, to people taking measures which can also lead to a reduction in horizontal transmission of HIV. This reduction of horizontal transmission will lead in future to a reduction in the number of orphans.

In addition to all the benefits, one also notes that better care for the mother leads to a fall in maternal mortality, and eventually to an increase in the rate of use of family planning.

Finally, it is important to state that partial results from the study are comparable to others drawn up in the region. For example, we estimate the cost of VCT at US\$ 7.56 per client counselled; this cost was estimated at US\$ 7.30 per mother in South Africa (Kinghorn, 1998)<sup>17</sup>. In the present study we assessed the indirect costs per occupied bed day at US\$ 9 in the HCM. For the Zimbabwean central hospital, these costs were assessed at US\$ 33, a higher figure, but comparable to the one we found (Hansen, 2000).<sup>18</sup>

The final result may be difficult to compare, since there is no record of publication of similar studies. In the published studies, there has been no concern, for instance, to consider improving ante-natal care, perhaps because this is a sector which elsewhere was of a quality to allow intervention, without needing to be changed. Likewise, to assess the cost of treating children with HIV/AIDS, hypothetical models have been used, rather than concrete data gathered from clinical files.

## **9. CONCLUSION**

In economic terms, it is possible to implement a programme of this kind, under our conditions, without increasing the number of staff, and without milk substitution, in a city such as Chimoio, saving money and also saving lives.

Evidence corroborated in other studies is proved once again in our context. It is imperative to act in order to reduce rapidly mother-to-child transmission.

## NOTE

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