

WORLD HEALTH ORGANIZATION

REGIONAL OFFICE FOR THE WESTERN PACIFIC

**FEASIBILITY ASSESSMENT OF USING ANTIRETROVIRAL
THERAPY TO PREVENT VERTICAL TRANSMISSION OF HIV
FROM MOTHER TO CHILD
IN CAMBODIA**

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SUMMARY

A sensitivity analysis encompassing four alternatives was carried out assuming levels of HIV seroprevalence of 5% and 2%, and within these choices, a level of attendance to antenatal clinics of 33% or 50%. Within each of these alternatives, costs were estimated under two different hypotheses for testing for HIV: an Elisa test followed by a rapid test, or two rapid tests followed by an Elisa test. A Nevirapine treatment was assumed to be provided and it is recognized that this approach is still under research as only one study has provided information on its effectiveness. Findings are as follows:

- (1) If the seroprevalence of women 15-49 years of 5%, the estimated ex ante recurrent cost of Nevirapine treatment per DALY (including also recurrent cost of HIV testing) would vary between \$11 to \$17, and if we include the investment costs of testing for HIV in the cost of ARV treatment, the ARV treatment costs from \$37 to \$53 per DALY;
- (2) If the seroprevalence of women 15-49 years is of 2%, the estimated ex ante recurrent cost of Nevirapine treatment per DALY (including also recurrent cost of HIV testing) would vary between \$29 to \$43, and if we include the investment costs of testing for HIV in the cost of ARV treatment, the ARV treatment costs from \$93 to \$132 per DALY;
- (3) In the least expensive alternative, the recurrent and the total (including investment) cost per case would be respectively \$573 and \$1 866.

Given that all investment costs have already been incurred in the National MCH Center where the Pilot Project may be run, and that its personnel is already functional and may be trained to provide the Nevirapine, this Pilot Project is feasible and may be implemented successfully. The contribution of the MOH will be mainly in terms of personnel costs.

However, expanding the ARV treatment programme to additional locations where the investment in testing for HIV+ has not yet been done would be very costly and not be effective given the few persons benefiting from the project. It would also not be operationally feasible given the lack of qualified personnel to carry out the VCT in other locations.

Recommendations:

- (1) It is not recommended to enlarge the ARV treatment programme to areas where the initial investment in training and equipment of testing for HIV+ has not yet taken place as it would divert useful MOH resources to less effective uses.
- (2) Running the pilot projects in selected locations of urban areas is feasible and has benefits for the Ministry of Health as long as donors continue financing most of the cost and that the Ministry of Health bears only a small portion of the total cost, i.e. the recurrent cost or a portion thereof. However, the high cost of testing has to be borne in mind and other more productive use of funds, for example allocating funds to health districts operations, may need to be examined.
- (3) When the pilot projects are run, it would be useful to collect the same data as those mentioned in the report in order to be able to assess real costs and benefits ex post, rather than estimated ex ante costs shown above.

INTRODUCTION

The Consultant went to Cambodia from Nov. 29th to Dec. 13th 1999 in the framework of a WHO Mission in order:

To undertake a feasibility assessment of the possibility of using antiretroviral therapy (ARV) to prevent vertical transmission (from mother to child) of HIV in Cambodia on a limited scale (e.g. some hospitals or MCH centers) or larger scale (Provincial or National). This study will include assessments of the:

- operational and resource requirements of such an intervention;
- operational feasibility;
- cost-effectiveness;
- potential impact of such programs on reducing financial, human and other resources available for primary prevention;
- the likely sustainability requirements for this intervention.

The Consultancy was aimed at providing preliminary guidance to the Technical Working Group on MTCT in order to allow the Ministry of Health to gather the information needed to make a more informed decision.

The Technical Working Group recommended that the Consultant concentrate first on the National MCH Center, and based on his assessment there, provide guidelines for data collection in other locations.

1. BACKGROUND

1.1 Important Factors Influencing Mother to Child Transmission¹

Overall, 90 % Cambodian births occur at home or in other non-medical facilities. Seventy percent of births to mothers living in the capital city occurred in a medical facility, versus about 25 % for mothers living elsewhere.

The majority of births are attended by Traditional Birth Attendants (TBAs), again with the sole exception of the capital city where the percentage of medical assistance during pregnancy is 83 %. The remaining 17 % rely on a TBA. In all other parts of the Country, the average is about 25 % medical assistance versus about 75 % provided by TBAs. On the whole, a medical person attended only a third of the births in the last five years; while traditional birth attendants attended the overwhelming majority.

For the majority (54.5 %) of live births in the last 5 years, the mother did not receive any antenatal care at all. There are however wide differences depending on the location: In the capital city, 81.3 % of the births in the last 5 years had received antenatal care while in the remote and isolated locations, less than 40 % of births were preceded by any antenatal care. And there is even a greater gap when focusing on antenatal care provided by medically trained personnel (doctor, nurse or trained midwife): 76.7 % of births in the

¹ This paragraph borrows information from National Institute of Public Health, Ministry of Health, National Health Survey 1998, printed in Phnom Penh, Cambodia, 1999, p. iii-x.

capital city received antenatal care from a medically trained person compared to only 25 % and 22 % in the remote and isolated province groups respectively.

Seventy two percent of births to mothers in the highest socioeconomic group received antenatal care from a medically trained person while only 19 % in the lower socioeconomic groups obtained antenatal care from a trained provider.

Under five mortality for the period 0-4 years is estimated at 115 deaths per 1,000 live births. Most of the mortality occurs during the first year of life and is due to a variety of causes:

- Lack of exclusive breast feeding, even in very young infants: Among children 0-3 months, 99 % were breastfed with 70 % given other liquid and 13 % given semi solid foods;
- High levels of infant diarrheas, dysentery, and respiratory infection related to the early giving of supplemental food and fluid to very young infants deprives many Cambodian children of the protective effects of exclusive breast feeding and exposes them to pathogens;
- A relatively low rate of appropriate treatment for common child illnesses as defined by a consultation with a trained health professional and a tendency to treat illnesses of young infants with medicines bought directly from a shop, without previous advice from a trained health worker. This is more common for infant illnesses than for older children.
- Low level of immunization against childhood diseases and low coverage with Vitamin A prophylaxis.

The percentage of population having access to safe water supply is estimated at 35 % with a rate of 26 % for rural areas and 65 % for urban areas. Thus serious concerns exist on the potential risk of artificial feeding for the infants.

1.2 HIV Situation Now and in the Future

Cambodia has the most serious HIV epidemic in the Region: In 1998, almost 4 % of the population 15-45 years was already infected with HIV and this included 54,041 women.

It is estimated that in the year 2000, there will be about 77,330 HIV infected women from the age of 15 to 49, and 8,000 HIV infected children in Cambodia.² The ARV Therapy Program would be directed to the infected mothers and to their future children.

1.3 Recent Developments in PMTCT

As mothers are likely to transfer the HIV to their children, it is necessary to prevent vertical transmission from mother to child, which is the largest source of HIV infection in children below the age of 15 years. The virus may be transmitted during pregnancy, mainly late, childbirth, or breast feeding:

"Considering 100 children born to mothers who are HIV+, the number of children infected by HIV will be about 30, 5 in pregnancy, 15 during labor and 10 during breastfeeding in a context of two years of breastfeeding."³

² WHO, Consensus Report on STI, HIV and AIDS Epidemiology, Cambodia, 1999, p. 12-13.

Until recently, developing countries had only two main strategies for limiting the numbers of HIV infected infants:

- primary prevention of MTCT by protecting women of child bearing age from becoming infected with HIV;
- the provision of family planning services and pregnancy termination services, to avoid unwanted births.

However, it was not possible to envisage using antiretroviral therapy to prevent MTCT because of the high cost of the drugs involved. For example, an ARV Zidovudine treatment is estimated to cost \$ 20⁴ per mother.

But now, it is also possible for HIV positive women who want to give birth to take a course of Nevirapine and to also provide it to the children at a cost of only \$ 2 to \$ 6. This may or may not be followed by replacement feeding.

1.4 Current Issues on PMTCT Facing Cambodia

Drug is not the only cost as voluntary counseling and testing, need also to be provided to the mother and be integrated into the overall provision of primary health care:

*"Introducing a strategy of antiretroviral drugs use and replacement feeding is however a complex process. To take advantage of the intervention, mothers need to know that they are HIV-positive, and they must therefore have access to voluntary counseling and testing. Costs and benefits need to be carefully assessed. Policy makers need to decide what kind of program is feasible and most appropriate for their countries and whether or not to test models of the strategy in pilot projects before introducing it more widely. Such a program requires a commitment to ensuring there is an efficiently functioning primary health care system with certain key services as a basis for introducing the strategy. Where these conditions do not already exist, decisions need to be made about how to strengthen the health infrastructure, what time frame would be realistic, and what else is needed to create the conditions for sage and successful introduction of antiretroviral drugs and replacement feeding."*⁵

Given the level of resources to be committed to the provision of such complex services, one may wonder if saving the lives of the few children that may be saved through this process is worth the time and money, given that there is so much else to be done that would require also the little time and money available. On the other hand, it is necessary for the Ministry of Health to investigate this aspect in order to produce guidelines that are acceptable and quality oriented. Otherwise, there is a risk to see the private sector taking over and providing poor quality or unnecessary antiretroviral treatment.

³ SOUCAT Agnes, KNIPPENBERG Rudolf, Large Scale Implementation of Prevention of Mother to Child Transmission of HIV. Should we go for it? How?, UNAIDS Asia Pacific Inter-country Team, Bangkok, 1999, p. 3.

⁴ Gordon MANSERGH, Cost-effectiveness of Short-Course Zidovudine to Prevent Perinatal HIV Type 1 Infection in a Sub-Saharan African Developing Country Setting. JAMA, July 10, 1996, Vol. 276, No 2, p. 139.

⁵ UNAIDS, Prevention of HIV transmission from mother to child, Strategic Options, 1999, p. 6-7.

The Technical Working Group on MTCT Prevention, coordinated by the National Center for HIV/AIDS, Dermatology, and STD Control (NCHADS) will investigate this aspect in the framework of pilot projects run in selected locations. This will assist in defining what the policy of the Ministry of Health should be, including towards the private sector. At present, this group has already produced a useful document summarizing the existing situation regarding MTCT⁶.

It is possible that the numbers of lives saved might be quite small: In the year 2000, there will be about 77,330 HIV+ women in Cambodia. With a crude birth rate of 36 per 1000 live births, they will give birth to 2,800 children out of which a full scale MTCT Prevention Program providing the Nevirapine, VCT, and breast milk substitutes, could decrease transmission from about 30 % to about 10 %, thus saving perhaps 20 % or about 560 children.

Is this feasible and does it justify taking away resources from other valuable programs, for example aimed at malaria control or at taking care of many more children who are HIV negative but were born from HIV+ mothers who have died? And if the Program was implemented, how many children would be reached?

1.5 Aims and Limitations of this Feasibility Assessment

This Paper aims at providing preliminary guidance to the Technical Working Group on MTCT in order to allow the Ministry of Health to gather the information needed to make a more informed decision.

To assist the Ministry of Health (MOH) in clarifying its policy, the Technical Working Group has decided to run pilot projects in several locations. They include the National MCH Center, Calmette Hospital, Battambang operational district including the Provincial Hospital, as well as in an antenatal clinic and a health center located close to the Battambang Provincial Hospital. It is expected that these pilot projects will be financed by donors.

The Technical Working Group recommended that the Consultant concentrate first on the National MCH Center, and based on his assessment there, that he provides guidelines for data collection in other locations. This choice was guided by the following constraints:

- This Consultancy was to be carried out by two persons but only one was able to come;
- As the Consultant had only 10 working days to spend in Cambodia, time available did not allow analyzing economic aspects in all these locations.

The objective of this paper is thus to provide preliminary information on the economic aspects related to the MTCT Prevention Program at the National MCH Center and to provide guidelines relating to future data collection for economic purposes. It does not mean that UNICEF, UNAIDS or WHO endorse treating

⁶ Technical Working Group on MTCT Prevention, Rapid Assessment on Mother to Child Transmission of HIV in Cambodia, 1999, p. 11-27.

seropositive patients with Nevirapine only, following the protocol presented in this paper.

2. FINDINGS

- It is necessary to define the contents of the Prevention Program;
- And to present a methodology to appraise the costs.
- Based on it, data on costs and benefits may be gathered to the extent possible in order to draw conclusions.

2.1 Contents of the Prevention Program

A Technical Working Group on MTCT Prevention has already been created to assist the Ministry of Health in analyzing this issue and has already concluded that:

- Using a new regimen of ZDV and Nevirapine is not a feasible choice in Cambodia at present given the high cost of such a protocol;
- It is not appropriate to provide testing and counseling to the pregnant mother when she has not previously received antenatal care and arrives just for the delivery because any explanation given during labor cannot lead to an informed consent of the mother;

The contents of the ARV therapy to be used in the framework of the Program envisaged were defined in agreement with the Technical Working Group on MTCT Prevention and are based on the following premises:⁷

Operational Approach: Four different groups of health facilities providing antenatal and obstetric services were identified in which activities to prevent Mother To Child Transmission of HIV could be implemented. **A specific package of activities was developed for each of these groups, to be run in selected locations as shown in tables 1 and 2 below.** The locations were the following:

- National Hospitals which are to represent quality standards for public services, namely the National MCH center and the Calmette hospital;
- Hospitals to represent standards of care in the private sector (not for profit and for profit);
- A pilot district (including a hospital and satellite health centers) in which the full package of improved reproductive health and enhanced response to HIV (including prevention in high risk groups and care) is to be offered and a model tested for future extension on a national scale;
- All the other health centers/antenatal clinics throughout the countries in which a minimum package to respond to HIV among the population of reproductive age is to be offered.

In the first three groups, Voluntary Counseling and Testing for HIV will be integrated into an improved approach of counseling for reproductive health. ARV treatment will be provided to mothers who test HIV+. This is summarized in tables 1 and 2 below.

⁷ The following is extracted from a Mission Report provided by Dr. Agnes Soucat, including the tables 1 and 2 attached. The tables were prepared in cooperation with the members of the National Working Group on Prevention of MTCT.

This operational approach follows the Guidelines for the Implementation of the Prevention of MTCT of HIV integrated in MCH and Primary Health Care Services,

which provide information on the five phases of the intervention.⁸

The Group also decided that the analysis to be done by the Consultant should be started at the National MCH Center.

2.2 Methodology to Appraise Costs⁹

The HIV prevention strategies that are used in this Program include Voluntary Counseling and Testing (VCT), and Antiretroviral therapy. We will examine the contents of these strategies in order to better understand the issues related to the costing of these aspects:

2.2.1 Voluntary Counseling and Testing

Its contents

This service involves pre-test counseling, post test counseling and the test itself, which implies support activities such as training of staff and development of IEC materials.

The objectives of VCT include:

- to strengthen motivation to change sexual behavior so that seronegative people protect themselves from infection, and to prevent transmission from seropositive people;
- to encourage those likely to be high risk to come forward for testing;
- to enable people to cope with stress about HIV related problems and relieve anxiety associated with uncertainty about HIV status;
- to provide a service including counseling to those who seek knowledge of their serostatus so that they can protect themselves and others from infection and plan for the future.¹⁰

It is important to note that the acceptability of antenatal care is low at present as only about 30 % of the deliveries are preceded by antenatal care. This needs to be increased to make the Program more effective.

The main activities of VCT include:

- i. A pretest counseling session, between a trained counselor and one client, a couple or a group;
- ii. Laboratory tests for those clients who decide to accept the test;

⁸ UNICEF, UNAIDS, WHO, Guidelines for the Implementation of the Prevention of Mother to Child Transmission of HIV integrated in MCH and Primary Health Care Services, p. 27-29.

⁹ This paragraph borrows from KUMARANA YAKE Lilani, et al., Costing Guidelines for HIV/AIDS Prevention Strategies, London School of Hygiene and Tropical Medicine, 1998, p. 21-25.

¹⁰ For more details on the contents of the staffing and of the counseling itself, see an excellent brochure from UNAIDS, Counseling and voluntary testing for pregnant women in high HIV prevalence countries, Elements and issues, Geneva, 1999, p. 1-18.

- iii. A post test counseling session on an individual basis for those who have been tested and shown positive. The partner should also be encouraged to be tested.

“There is a controversy over the effectiveness of VCT at both the individual and population levels: evidence has recently been reviewed by De Zoysa et al.¹¹ An additional review of 50 studies (only 3 of them in developing countries) showed mixed results for the impact of counseling and testing on risk behaviors. ... It has been concluded that although a number of studies suggest that VCT may be effective, at least in the short term, in modifying sexual behavior amongst heterosexuals and especially when couples are counseled together, there are very few controlled trials which have been rigorously done. In particular, studies have not disentangled secular change in behavior from the influence of the intervention itself. There has been some concern that VCT, because of its emphasis on personal counseling, is a very expensive strategy. It has been suggested that those who come forward for VCT may be a special group, who maybe could be reached by other less costly means. Other non-HIV benefits of VCT, which should be reported in the analysis, include the diagnosis of STDs, and prevention of STD infection which may occur because of changing sexual behavior. There are concerns about adverse effects, which have been highlighted by the reluctance to receive test results of many enrolled in research studies.”¹²

Description of the Project at the National MCH Center

The National MCH Center is a hospital with 144 beds. It has been built by JICA on a site of more than 11,700 m², and has a total floor area of 9,407 m². It has all the equipment needed for examination of the expecting mother, as well as for deliveries and operations. It also has a neonatal care unit.

It has been built and equipped for an amount of \$ 21,000,000 out of which \$ 16,000,000 were for the construction alone. The Voluntary Counseling is provided in a 48 m² training room for groups, and in a 12.4 m² for individual counseling.

The Voluntary Counseling Unit has provided 19,000 antenatal consultations in 1998 out of which 7000 were first antenatal visits, and is estimated to carry out about 7900 first antenatal visits in 1999. It carried out 6089 deliveries in 1998 and is estimated to carry out about 6864 deliveries in 1999.¹³ It also already provides individual counseling for syphilis.

The pre and post test counseling will be provided by two people who at present are occupied only about 50 % of their time and are paid \$ 15 a month by the Government and \$ 45 a month by the hospital.

¹¹ DE ZOYSA I. et al., Role of HIV counseling and testing in changing risk behaviour in developing countries, AIDS 9 (Supp. A), 1996: S95-101.

¹² KUMARANAYAKE Lilani, et al., Costing Guidelines for HIV/AIDS Prevention Strategies, London School of Hygiene and Tropical Medicine, 1998, p. 21-22.

¹³ Data from the National MCH Center for 1998 and based on an extrapolation using the first 10 months of 1999.

Table 1: Proposal of an Operational approach to reducing Mother To Child Transmission in Cambodia through a Pilot Project run in selected locations

	All health centers	One pilot district including hospital and satellites health centers	Public Hospital		Private Hospital
Site chosen		Battambang	National MCH,	Calmette	
Phase Alpha: reducing HIV+ pregnancies	100% condom policy in commercial sex places Life Skills STIs treatment Family Planning	100% condom policy in commercial sex places Life Skills STIs treatment Family Planning	Counseling in Treatment of STIs Information	Family Planning	
Phase 1: Inform in ANC	Anemia prophylaxis Treatment of STIs in pregnant women	Treatment of STIs in pregnant women Counseling in Treatment of STIs Information VCCT Improved ANC Syphilis Partner's information Partner's testing	VCCT Improved ANC STIs Syphilis Partner's information Partner's testing		Idem
Phase 2: Prophylactic treatment	UP SOP BCC		<i>HIV+ mothers:</i> ARV UP SOP BCC	<i>HIV – and unknown status</i> UP SOP BCC	Idem public
Phase 3: Care of children and mothers	Exclusive Breastfeeding up to 6 months Complementary feeding as of 6 months IMCI	Infant feeding counseling IMCI	<i>HIV+ mothers:</i> Infant feeding counseling for HIV+ mothers: BMS or EBF, early cessation and complementary food IMCI	<i>HIV – and unknown status mothers</i> Infant feeding counseling for EBF 6 months and complementary food IMCI	Idem public
Phase w		Communication for Acceptance raising Home based Care PCP	Home based Care PCPP TB		

Table 2: Cambodia strategy within the regional strategy for Prevention of Mother To Child Transmission

	Group A (Thailand, Malaysia)	Group B: Myanmar, Cambodia/ PNG	Group C: Vietnam, China, Philippines/ Indonesia
High prevalence areas	Full package PMTCT: VCT-ARV-IFC + PREVENT and SUPPORT	Improve access MCH +trigger response to HIV + test full package PMTCT	Test full package PMTCT+ Improve quality MCH
Low prevalence/ high incidence areas	VCT-ARV-IFC + PREVENT	Improve access MCH PREVENT package Exclusive BF	Improve quality MCH PREVENT package Exclusive BF
Low prevalence/low incidence areas	VCT-ARV-IFC	Exclusive BF	Exclusive BF

ARV: anti-retrovirals

IMCI: Integrated Management of Childhood Illnesses

IFC: Infant Feeding Counseling

EBF: Exclusive breastfeeding

BMS; Breast-milk substitutes

SOP: Safe Obstetric Practices

UP: Universal Precautions

BCC: Birth Canal cleansing

STIs: Sexually transmitted infections

VCCT: Voluntary Counseling and testing.

Variables which affect costs

- The geographical and social accessibility of the population, which will influence the workload of the service;
- Whether or not pregnant mothers are encouraged to come and to have testing done, the extent to which they modify their habits to attend ANC clinics on a more regular basis and the extent to which they accept HIV testing, including when coming only at delivery time;
- Advertising will increase the cost of service but will also increase the effectiveness;
- The level of training of counselors: The more trained they are, the better the service but also the more costly
- The degree of emphasis placed on careful and intensive counseling: As VCT services are labor intensive, a high proportion of the costs are associated with the time required to ensure that informed consent is given;
- The number of attendants as compared to the capacity of the service;
- The type and number of test provided;
- The relative importance of the use of volunteers;
- The degree of sophistication of the educational materials used and their cost of development and production;
- Whether or not free supplies are distributed, for example condoms.

2.2.2 Prevention strategy used to prevent mother to child transmission

Prevention method used

Within a low income country context, a possible regimen consists of an oral Zidovudine short course regimen for HIV infected pregnant women administered 4 weeks before the delivery and subsequently at regular intervals, and at delivery.

Another treatment that has been used is the provision of Nevirapine:

There are only few studies that examine costs and cost-effectiveness of antiretroviral drugs provided to pregnant mothers to prevent transmission from mother to child:

- It is estimated that the risk of a baby acquiring the virus from an infected mother ranges from 25 % to 35 % in developing countries¹⁴.
- A recent trial in Thailand using a short course of Zidovudine shows that this strategy reduces the risk of MTCT to below 10 % when breast feeding is strictly avoided.¹⁵
- A study estimated that a Zidovudine short course program would reduce perinatal HIV transmission from 25 % to 16.5 %.¹⁶

¹⁴ UNAIDS, Prevention of HIV transmission from mother to child, Strategic Options, Geneva, 1999, p. 6.

¹⁵ Vallop THAINEUA et al., From research to practice: Use of a short course Zidovudine to prevent mother to child transmission in the context of routine health care in Northern Thailand, South East Asian Journal of Tropical Medicine and Public Health, Vol. 29, No. 3, Sept. 1998, p. 429.

¹⁶ JAMA, Cost-effectiveness of Short Course Zidovudine to Prevent Perinatal HIV Type 1 Infection in a Sub-Saharan African Developing Country Setting, July 10, 1996, p. 139.

- A study estimated that without treatment, 25.5 % of HIV positive mothers transmitted HIV to their infants during pregnancy, delivery and 1 week postpartum while with Zidovudine monotherapy, it reduced the transmission rate by about two thirds to 8.3 %.¹⁷
- **Finally a recent study (and the only one available to the author on the use of Nevirapine), shows that a short course regimen of a single 200 mg oral dose given to women at onset of labor and a 2 mg/kg dose given to neonates within 72 hrs of birth, reduced the transmission rate by at least 47 % from 28 % to 13.1 % (or 15 % reduction) at age 14-16 weeks.¹⁸ In this study, no replacement feeding was provided. In this presentation, we have assumed that the same treatment protocol would be used leading to similar results, i.e. having a 15 % reduction.**

Key issues affecting costs are:

- Price of drugs;
- HIV prevalence as this has a high impact on unit cost thus on cost effectiveness;
- Capacity to administer: This requires well trained staff;
- Acceptability of treatment, which requires compliance with taking the complete course of drugs. This is not so important with Nevirapine but is essential if a Zidovudine treatment is being provided.
- Secondary effects of Nevirapine, if any.

As for replacement feeding after the treatment has been provided, there does not seem to be a consensus on its effectiveness. For example, KUMARAYANAKE et al mention:

*"It is yet unclear to what extent breastfeeding post natally will lower cost-effectiveness of the treatment regimen."*¹⁹

And the UNAIDS Program mentions:

"The issue of replacement feeding is a complex one: Promotion of breastfeeding as the best possible nutrition for infants has been the cornerstone of child health and survival strategies for the past two decades, and has played a major part in lowering infant mortality in many parts of the world. It remains the best option for the great majority of infants, and in providing for replacement feeding as part of the strategy to reduce MTCT of HIV, policy makers need to take into account the risks of undermining breastfeeding generally and of relaxing vital controls on the promotion of infant formula by the industry. They also need a sound assessment of how safe it is to recommend replacement feeding in their local setting. For example, is infant formula readily available; is the

¹⁷ Elliot MARSEILLE et al, Cost effectiveness of antiviral drug therapy to reduce mother to child HIV transmission in sub-Saharan Africa, AIDS 1988, Vol. 12, No 8, p. 939-941.

¹⁸ Elliot MARSEILLE et al., Cost effectiveness of a single dose Nevirapine regimen for mothers and babies to decrease vertical HIV-1 transmission in sub-Saharan Africa, Lancet, Vol. 354, No 9181, 4 Sept. 1999, p. 803-809.

¹⁹ KUMARANAYAKE Lilani, et al., Costing Guidelines for HIV/AIDS Prevention Strategies, London School of Hygiene and Tropical Medicine, 1998, p. 24.

supply of formula assured over the long term; do people have access to clean water and fuel for boiling it; and are they sufficiently educated and informed to make up replacement feeds correctly? If used incorrectly – mixed with dirty, unboiled, water, for example or over diluted breastmilk substitutes – they may cause infection, malnutrition and death."²⁰

The National Policy asks for breastfeeding for a variety of reasons:

Given the low income of the general population, the high cost of replacement feeding would be an impediment to continuous breast-feeding in Cambodia.

In addition, if the water is not properly boiled, it may cause diarrheas. As the percentage of population having access to safe water supply is estimated at 35 % with a rate of 26 % for rural areas and 65 % for urban areas, serious concerns exist on the risk of artificial feeding for the infant.

Finally, there might be a stigma attached to the provision of continuous supplementary feeding.

As a result, it appears necessary not to promote supplementary feeding in the framework of a National ARV therapy program **at this stage** in Cambodia.

However, in the framework of the pilot projects in Phnom Penh, it may be desirable to let mothers chose the feeding method and encourage only those with a high economic status to provide replacement feeding. Research on this topic would show whether, in that socioeconomic advantaged group, the provision of supplementary feeding was a factor in limiting transmission from MTC.

This is the more so that we do not have information on the socio economic status of mothers coming to the NMCH Center. Women with high income may prefer to go to the Calmette Hospital or to the private sector.

It will also be desirable to put in place structures to take care of the children born from seropositive mothers who have died. Otherwise, they may become street children after the death of both parents, or they may be deprived of a normal lifestyle.

2.3 Costs of the Program

Costs considered here are estimated from the viewpoint of the MOH as it is trying to assess the feasibility of starting an ARV Program. Thus costs to society have not been estimated although they are real.

Calculations should in theory only take into account marginal costs, i.e. those that the MOH will have to absorb if it were to run the Program. Thus a first series of calculations concern only marginal costs, while a second set of calculations includes investment costs that have been previously paid for by donors but that would have to be incurred if the Program had to start in some new location. These calculations have been made assuming a 5 % seroprevalence (which is close to that estimated for the

²⁰ UNAIDS, Prevention of HIV transmission from mother to child, Strategic Options, Geneva, 1999, p. 10.

general population 15-45, and which is much larger than that estimated for women alone) and 2 %, which is the lower estimated prevalence rate.²¹

Costs will be incurred in the National MCH Center for activities related to Voluntary Counseling and may include:

- Development and production of IEC materials. Clients may be shown a video or handed education material at pre test and post test counseling sessions;
- Training of counselors in the appropriate techniques and supervision of the staff;
- Pretest counseling done with individuals, couples or groups and post test counseling made individually with those found positive;
- Management and administration.

Costs will also be incurred for activities related to testing and will include:

- Testing including the first and any subsequent confirmatory test;
- Storage of blood, medical supplies, materials and equipment;
- Training of personnel in blood testing;
- Planning and supervision of the activity.

All these costs may be summarized in a table of the type shown below including the inputs, i.e. capital and recurrent costs:

Capital costs include:

- Buildings:
- Equipment:
- Vehicles:
- Investment for Training:

In theory, capital costs have to be amortized over a period of several years, about 20 years for buildings and 5 for equipment and vehicles, so that the yearly cost allocation is obtained by dividing the total initial cost by the duration of the amortization period.

Recurrent costs include:

- Personnel
- Supplies
- Operation and maintenance of buildings and equipment
- Other

²¹ WHO, Consensus Report on STI, HIV and AIDS Epidemiology, Cambodia, 1999, p. 12-13: shows a seroprevalence of 5.11 % for the general population. 2 % may be the lower estimate as mentioned on p. 8 of the same publication.

2.4 Benefits of the ARV Treatment Program

Benefits of the Program include the MTCT avoided thanks to the Program. For each child, they are estimated to represent the number of years added to the life of the child, i.e. assuming that these children would have lived to the age of 51²², which is the average life expectancy, and that without the Program, they would have died 1 year old, this adds 50 years to the life of the child. It is customary to discount these years in order to obtain their present value. A usual social discount rate used for such programmes is 4 %, leading to an estimate of the years saved of 21.6 instead of 51. In this presentation, we have tried to estimate the maximum savings that MOH may obtain thanks to the MTCT Program and we have not discounted, thus assuming that a year saved in 51 years is worth as much as a year saved today.

Other benefits from the Program include savings in cost of treatment and in out patient visits avoided within the health care system. The Consultant has attempted to estimate that saving but, in the absence of information on costs of treatment for children, he has used information on adults, **which may be useful only in giving some general order of magnitude:**

- It has been estimated that in Cambodia, 30 % of people living with AIDS (PLWA) will be hospitalized an average of 3 times, 10 days per episode, at an average cost per inpatient day of \$ 20 and with an average drug cost of \$ 40 per episode; this represents a total of \$ 720 per hospitalized patient.²³
- It has also been estimated that PLWA in Cambodia will have 5 outpatient episodes at an average cost per episode of \$ 15, thus totaling \$ 75 per person.²⁴

Thus, if costs per children were the same as those for adults, out of the 18 children not infected by HIV, 30 % of the children would have incurred hospital in patient costs of \$ 720 each, and 18 would have incurred \$ 75 each in outpatient costs. The Program would thus be said to have saved respectively \$ 3,937 and \$ 1,367 totaling \$ 5,304. This is the total amount in treatment costs saved thanks to the Program (if we assume that children would incur similar costs to adults). It is recognized that statistics applying to adults are not valid for children and that the costs mentioned above may be underestimates as the number of hospitalizations are likely to be greater for children.

2.5 Results

Costs and benefits have been estimated ex ante from the viewpoint of the MOH, in order to measure the additional costs and the maximum benefits it would incur if it carried out the Program.

²² World Bank, World Development Report, 1999, p.

²³ Sok BUNNA and Charles MYERS, First Draft, Estimated Economic Impacts of AIDS in Cambodia, p. 10.

²⁴ Sok BUNNA and Charles MYERS, First Draft, Estimated Economic Impacts of AIDS in Cambodia, p. 12.

In order to test sensitivity, these costs and benefits are shown in table 3, under 4 different hypotheses:

- if 2 % or 5 % of the mothers are seropositive²⁵;
- It is estimated that only 33 % of the mothers that come for antenatal care at the MCH Center return there for delivery²⁶. However, if a deliberate effort is made to encourage the mothers to accept the test at the first antenatal visit or in subsequent ones, we may assume that perhaps 50 % to 80 % of the mothers that have attended the first antenatal visit will come back for delivering at the MCH Center, and these should include all the seropositive ones as they will want their child not to be transmitted the HIV+ virus. Thus we have selected hypotheses favorable to the Programme, and assumed that with seropositivity of 2 % or 5 %, 50 % or 80 % of the women having come for the first antenatal visit would return for delivering in the institution where they received antenatal care;

In table 3, p. 18 below, recurrent costs have been estimated under two different protocols:

- Option CDAG (Center de Depistage Automatique et Gratuit) is the system presently in use including first an Elisa test provided to all followed by a Rapid Test Multispot if the result of the first test is positive. The reactives for this test cost on average \$ 1.375 per person;
- The other protocol encompasses 2 rapid tests followed by an Elisa confirmation test for those who were positive on one of the first two tests, and its cost is of \$ 3.42 per person.

Detailed explanations of the calculations are presented in Annex I attached.

Table 3 shows that:

Recurrent/marginal costs (including those of the reactives) vary with the number of tests done. They are to be compared with the benefits represented by the avoidance of transmission of virus, which would generate the number of DALYs shown on line 10 and 11 of table 3 below.

These costs are those that the MOH might incur if it decided to run an ARV Treatment Program.

Recurrent/marginal costs per DALY vary from \$ 10.68 to \$ 16.81 (see lines 10 and 11,

²⁵ WHO, Consensus Report on STI, HIV and AIDS Epidemiology, Cambodia, 1999, shows p. 11, that in year 2000, the prevalence of HIV for adults men and women is estimated at 5.11 %. As the estimated number of HIV cases is of 257,490 cases out of which 77,332 are women, it implies that the prevalence rate among women is of $(77,332/257,490) \times 5.11 \% = 1.53 \%$. Taking as a basis for the calculations 2 % may be the lower limit, while 5 % provides a maximum number of beneficiaries.

²⁶ See National Technical Working Group on MTCT Prevention, Rapid Assessment on Mother to Child Transmission of HIV in Cambodia, 1999, p.18 showing that out of 7900 ANC first visits, only 2607 came back for delivering at the MCH Center.

TABLE 3: ESTIMATED COSTS AND EFFECTIVENESS OF THE PROJECT AT THE NATIONAL MCH CENTER

Costs and Beneficiaries	2 % seroprev.	2 % seroprev.	5 % sero +	5 % sero +
	50 % return for delivery	80 % return for delivery	50 % return for delivery	80 % return for delivery
1	2	3	4	5
Recurrrent/Marginal costs				
1. CDAG Protocol: 1st test Elisa, if + 2nd Rapid test	15722	23731	16198	24491
2. 2 Rapid tests: if one +, Confirmation with Elisa	23622	36371	24098	37131
3. Investment Cost	32390	32390	32390	32390
Beneficiaries				
4. Estimated number of first antenatal visits in 1999	7900	7900	7900	7900
5. Number of women accepting the test and returning for delivery (50 % or 80 %)	3950	6320	3950	6320
6. Number of seropositive women (2 % or 5 %)	79	126	198	316
7. Number of live births (96.78%)	76	122	191	306
8. Number of beneficiaries of the ARV treatment = line 8 * 15 %	11	18	29	46
9. Number of DALYs gained	573	917	1434	2294
Recurrent /Marginal cost per DALY				
10. Based on CDAG Protocol: 1st test Elisa, if + 2nd Rapid test Obtained by dividing the contents of line 1 by those of line 9	27.42	25.87	11.30	10.68
11. Based on 2 Rapid tests: if one +, Confirmation with Elisa Obtained by dividing the contents of line 2 by those of line 9	41.19	39.64	16.81	16.19
Total cost per DALY (including investment cost)				
12. Based on CDAG Protocol: 1st test Elisa, if + 2nd Rapid test Obtained by dividing the contents of line 1+3 by those of line 9	84	61	34	25
13. Based on 2 Rapid tests: if one +, Confirmation with Elisa Obtained by dividing the contents of line 2+3 by those of line 9	98	75	39	30
Recurrent /Marginal cost per case				
14. Based on CDAG Protocol: 1st test Elisa, if + 2nd Rapid test Obtained by dividing the contents of line 1 by those of line 8	1,371	1,293	565	534
15. Based on 2 Rapid tests: if one +, Confirmation with Elisa Obtained by dividing the contents of line 2 by those of line 8	2,060	1,982	840	809
Total cost per case (including investment cost)				
16. Based on CDAG Protocol: 1st test Elisa, if + 2nd Rapid test Obtained by dividing the contents of line 1+3 by those of line 8	4,195	3,058	1,695	1,240
17. Based on 2 Rapid tests: if one +, Confirmation with Elisa Obtained by dividing the contents of line 2+3 by those of line 8	4,884	3,747	1,970	1,515
Savings generated in the health care system				
18. Savings inn patient costs = 30 % * No of cases of HIV transmission avoided (contents of line 9) * \$ 720	2,477	3,963	6,193	9,909
19. Savings in out patient cost = \$ 75 per case of HIV transmi-ssion avoided * No of cases as provided on line 9	860	1,376	2,150	3,441
20. Total savings generated into the system	3,337	5,340	8,343	13,349

columns 4 and 5 of table 3) if the seroprevalence is of 5 % but they would be much higher (\$ 25.87 to \$ 41.19) if the seroprevalence was of 2 % (see same lines, columns 2 and 3).

If we include investment costs, the cost per DALY varies from \$ 25 to \$ 98 depending on the protocol and hypotheses adopted, and the cost per case prevented varies from \$ 534 to \$ 2,060, costs which are higher than the cost of many interventions.

These costs per DALY may be compared to the:

- cost of polio + DPT immunization (\$ 20 - \$ 40);
- measles immunisation (\$ 2 - \$ 15);
- food supplementation for pregnant women (\$ 25);
- improved STI treatment (\$ 10);
- \$ 35 to \$ 350 for diarrhea treatment with oral rehydration therapy;
- \$ 30 to \$ 250 for maternal and perinatal health treatment;
- \$ 2,600 to \$ 12,000 for cancers²⁷.

Thus the costs of an ARV treatment pilot project appear to be in line with other effective interventions when the best possible hypotheses are selected. And as the investment cost has already been made by donors, the implementation of such a Program does not generate financial constraints for Cambodia, which will be assuming only a minimal portion of the recurrent cost.

3. CONCLUSIONS

Annex I, p. 23 of this report provides detailed explanations on the calculations mentioned above. These have led to the following conclusions on an ARV pilot Treatment Pilot Project and are presented first for the NMCH Center, second for the ARV Treatment Pilot Project as defined in table 1, p. 10, and finally for a national program.

3.1 Regarding the NMCH Center

3.1.1 Operational and Resource Requirements

At present, the French Cooperation has already carried out the investment needed for HIV testing and JICA has already built a functional and well designed NMCH Center where facilities for VCT are already available. As for the personnel, it is already in place and to some extent under utilized so that no new personnel will be needed to carry out the ARV Treatment Pilot Project in the NMCH Center.

As for the personnel needed for training and supervising those implementing the Pilot Project at the NMCH Center, they are available or may be provided by donors interested in financing the pilot project.

²⁷ See WHO/UNAIDS, Guidance Modules on Antiretrovirals Treatments, Module 2, Introducing Antiretroviral Treatments into Health Systems: Economic Considerations, 1998, p. 10.

Thus there are no problems for obtaining the operational and resource requirements in the framework of a pilot project.

3.1.2 Operational feasibility

Given that all investment costs have already been incurred, and that the personnel of the NMCH Center is already functional and can be trained to do the work, this Pilot Project is feasible and may be implemented successfully.

3.1.3 Cost effectiveness and potential impact

The higher the seroprevalence rate of HIV+, the higher the cost effectiveness of a Pilot Project: If the seroprevalence is of about 5 % and that 80 % of women having attended the first ANC visit return for delivery, then the recurrent cost per DALY and per case are respectively of \$ 10.68 and \$ 534 (see lines 10 and 14 under column 5 of table 3). From the viewpoint of the MOH, given that the French Cooperation will continue financing the investment cost for testing of HIV +, as well as a substantial portion of the associated recurrent cost, the MOH will incur minimal costs, mainly those relating to the value of the time of their personnel in the locations considered. **Thus from its viewpoint, this is cost-effective.**

Would this pilot project (Program) reduce the resources available for primary health care?

Yes, but it is not very significant since financial resources will be provided in the framework of pilot projects and that the staff of the NMCH Center is not yet fully utilized. The same reasoning applies to the other locations where the pilot project would be run.

3.1.4 Sustainability Requirements

As long as the investment is provided by a donor, the MOH may envisage to continue contributing with its personnel and bear some of the recurrent costs of the Program but if investment costs were to be borne by the Government, it would certainly not be cost effective, nor sustainable.

3.2 Regarding the other locations where the pilot project may be implemented

The same conclusions as above may be drawn for the other health facilities where the pilot project may be implemented, these locations including the Calmette Hospital, the Battambang Provincial Hospital and one ANC clinic and one health center in the vicinity of the Battambang provincial hospital. This is because in these facilities, the investment cost has already been borne by a donor. As for the personnel, it has been already involved in VCT (except in one ANC clinic and one health center) so that the time required for training purposes will not be very high.

3.3 Regarding the Feasibility of a National Program

Expanding the ARV treatment Program to additional locations where the investment in testing for HIV + has not yet been done would be very costly since the investment would have to be made. The costs per case would then go from \$ 1,240 in the best hypothesis to \$ \$ 4,884 in the least favorable hypothesis (see table, p. 18, lines 16 and 17). And it would not be effective, given the few persons benefiting from the Project;

It would also not be operationally feasible given the lack of qualified personnel to carry out the VCT in locations where the large investment done by the French Cooperation has not been done;

It would not be sustainable unless donors continue providing extensive financing. This is because the Government, with a per capita expense of \$ 1 per year²⁸, cannot possibly be expected to divert funds, for example from a district where the MOH's budget for the year 2000 will be of \$ 1.50 per capita including the cost of drugs.²⁹ As for most households with an average monthly household expenditure of \$ 80 in the rural areas and of \$ 120 in the urban areas³⁰, they would be incapable of paying \$ 1,240 (investment cost per case in the best scenario as shown on column 4, p.18, line 16) to save one child from HIV+, thus families would not be able to pay for such a Program and would not even be able to pay for the recurrent cost of \$ 534 per case.

Thus promoting a National ARV treatment Program appears not possible nor desirable at this moment.

4. RECOMMENDATIONS

It is not recommended to carry out a country wide ARV Treatment Program given that its cost would be high for relatively small benefits. It would not be operational nor feasible either, and would divert useful MOH's resources to less effective uses.

However, given that the initial investment for VCT has already been made in a number of locations, running pilot projects in these selected locations of urban areas is feasible and has benefits for the MOH as long as donors continue financing most of the cost and that the Ministry of Health bears only a small portion of the total cost, i.e. the recurrent cost or a portion thereof.

²⁸ WHO, Office of the WHO Representative in Cambodia, Analysis of the Health Sector in Cambodia, 1999, p. 1.

²⁹ Health Sector Reform Project, Briefing Note, Boosting the Operational District & Coverage Plan, 1999, p. 4.

³⁰ WHO, Office of the WHO Representative in Cambodia, Analysis of the Health Sector in Cambodia, 1999, p. 1.

That is, from the viewpoint of the MOH, the Project brings benefits but it is costly, and if the Ministry had to pay all recurrent costs in the selected locations, it is recommended that it considers other alternative uses of funds in light of the fact that the seroprevalence for adult women is likely to be closer to 2 % than to 5 %, with as a result, a small number of beneficiaries from the pilot projects.

When the pilot projects are run, it would be useful to collect the same data as those mentioned in the report to be able to assess real costs and benefits ex post, rather than estimated ex ante costs shown above.

And given the strong sensibility of results to the hypotheses selected, i.e. to rates of seropositivity and number of mothers coming for delivery to the NMCH Center as a percentage of the total number of mothers having had the first antenatal visit, it is strongly recommended to test these two hypotheses during the year 2000. This should be easy since all data would have to be collected anyways by the Program. And then, at the end of the year 2000, calculations may be redone with correct hypotheses and a forecast for the next year may be made.

ANNEX I: BASIS FOR COST and BENEFIT ESTIMATES

1. Estimation of costs

Costs of carrying out the Program at the National MCH Center include capital and recurrent costs:

Capital:

- The cost of the building of the National MCH Center is of \$ 16,000,000 out of which the group training room has costed about \$ 81,640 and the individual counseling room costed about \$ 21,100. Given an amortization over 20 years, these amounts represent a yearly expense of respectively \$ 4,000 and of \$ 1,000. Assuming that each of rooms is used 20 % of the time for activities related to the Program, these represent an estimated yearly usage of respectively \$ 800 and of \$ 200, totaling \$ 1,000;
- Equipment and initial training costs for testing purposes are included in the cost of testing and are estimated at \$ 31,390 for the PTME: **This is obtained using table 4** where we find that total investment costs have been of \$ 199,848 over the first 4 years. Out of that $6000/(12200+10000+6000+10000)$ or 15.70 % = \$ 31,390 have been allocated to the Program;
- It is assumed that there is no other equipment for the ARV treatment alone;

Thus the total capital cost for the Program is estimated at \$ 32,390 and is shown in table 3, p. 18, line 3.

Recurrent:

Recurrent costs include cost of testing, cost of treatment by Nevirapine and other costs:

Cost of testing varies depending on the method adopted:

At present, there is a program financed by the French Cooperation Fund carrying out tests in several facilities and its cost is shown in the tables 4, 5, and 6 attached provided by Dr. B. Fabre-Teste, member of the National Working Group.

Table 4 is divided into 3 tables that show:

- Investment for HIV testing purposes;
- recurrent cost for HIV testing purposes;
- the number of people tested in 1997-1999, a forecast of their number for the year 2000, and the number of mothers who may be tested if an ARV Program was implemented.

Table 5 shows the cost of reactives under two options:

- Option CDAG (Center de Dépistage Automatique et Gratuit) is the system presently in use including first an Elisa test provided to all followed by a Rapid Test Multispot if the result of the first test is positive. The reactivities for this test cost on average \$ 137.50 for 100 persons or **\$ 1.375 per person**;
- The other protocol is based on 2 rapid tests followed by an Elisa confirmation test for those who were positive on one of the first two tests, and its cost is of **\$ 3.42 per person**.

But we have to add other costs for quality control, regular training, medical and other supplies, maintenance, supervision to the the cost of the reactivities, leading to an average cost (including all recurrent costs only) per test of \$ 3.30 under the first protocol and of \$ 5.30 under the second. For details, see tables 5 and 6.

Thus for the 3,950 women who might undertake the tests at the National MCH Center, the recurrent cost of testing would be respectively of \$ 3,950* \$3.30 = \$ 13,035 under the CDAG Protocol and of \$ 20,935 under the other protocol.

Cost of treatment with Nevirapine

The Nevirapine treatment consists of a short course regimen of a single 200 mg oral dose given to women at onset of labour and a 2 mg/kg dose given to neonates within 72 hrs of birth. Its cost is estimated at \$ 4 per woman³¹ thus totaling **4 * 79 = \$ 316**.

The provision of the ARV treatment itself is not very time consuming: Perhaps about 10 minutes for each of the 79 women receiving the treatment will be sufficient. This represents 790 minutes or 13 hours of personnel time **or about \$ 8**.

Other costs:

Personnel of the hospital should provide pretest **counseling** to about 3,950³² women who will undertake the HIV test and this may require, say a 30 minutes session given twice a week, for groups of 20 - 25 mothers. This pretest counseling would incorporate information on the risks of HIV/AIDS, the risk of transmission and the potential impact of ARV treatment.

In addition post test counseling of 20 minutes may be provided individually to about 79³³ mothers.

The total represents about 125 hours of pretest and post test counseling or a maximum of **\$ 42 of staff time**.

³¹ See Elliot MARSEILLE et al., Cost effectiveness of a single dose Nevirapine regimen for mothers and babies to decrease vertical HIV-1 transmission in sub-Saharan Africa, Lancet, Vol. 354, No 9181, 4 Sept. 1999, p. 804.

³² See paragraph below on benefits where the number of women receiving the test is calculated.

³³ Idem.

Training in counseling will also be provided to the educators carrying out pretest and post test counseling. The materials have already been developed and are used by the CDAGs so that the cost to be included here is only that of training the counselors. There are already two STD counselors at the NMCH Center who are used only part time so that no new counselors will need to be hired. Training them might require 2 weeks of their time or **about \$ 60**. The cost of the trainers is included in the recurrent cost of testing (see below).

In addition, training will have to be provided to the personnel of the NMCH Center in order for it to carry out the rapid tests. This training will require time from the staff, say one week for 10 people at \$ 60 a month totaling **\$ 240**.

Training will also be provided to the nurses who will procure ARV treatment, say 20 minutes a month for one year, given by one person to the 10 nurses providing the medication or 44 hours of training time, at \$ 60 a month, or **about \$ 15**. The cost of the trainers is included in the recurrent cost of testing (see below).

In addition, **transportation** costs will be incurred to take blood samples from the NMCH center to the Institut Pasteur, at a cost of, **say \$ 2,000 a year**.

Maintenance cost includes the maintenance of the building. The total yearly maintenance cost is estimated at \$ 4,000. The maintenance of the facilities used for counseling and for the provision of the treatment might cost about \$ 30 a year out of which 20 % or (\$ 6) were for counseling related to ARV and HIV.

Thus the total of other costs is estimated at \$ 2,363.

Thus total recurrent costs are of \$ 13,035 + \$ 324 + \$ 2,363 = \$ 15,722 or \$ 23,622 depending on the protocol used. These are the amounts shown in table 3, p. 18, line 1 and 2 of column 2. Similar calculations were undertaken for all other columns giving the results shown in the table under the other columns.

2. Estimation of Benefits

The benefits estimated below are those of a single dose of Nevirapine. Perhaps, benefits would have been greater if the mothers had provided replacement feeding but this aspect is not considered in the calculations presented below, as discussed in p. 4-5 of this paper.

Benefits of the program will include diminished MTCT for the mothers that followed the treatment. There were about 7900³⁴ first ANC first visits in 1999;

- Out of them, 50 %³⁵ or 3,950 came back for delivering at the NMCH Center;

³⁴ National Working Group on MTCT Prevention, Rapid Assessment on MTCT of HIV in Cambodia in 1999, p.19, showing top of the page 7000 first visits in 1998: If we assume that the No of first antenatal visits will increase in the same proportion as the estimated number of deliveries between 1998 and 1999, we obtain 6864 deliveries in 1999 divided by 6089 deliveries in 1998, multiplied by 7000 = 7890.

³⁵ National Working Group on MTCT Prevention, Rapid Assessment on MTCT of HIV in Cambodia in 1999, p.18 shows that about 33 % of those having come for a first visit return for delivery. We have

- All of them are assumed to have taken the HIV test³⁶;
- Out of them 2 %³⁷ or 79 are assumed to be HIV positive;
- Out of them, an estimated 96.78 %³⁸ gave birth to a live infant thus the number of mothers and infants at which the program is aimed is of 76. Assuming that all of them accept to follow the ARV treatment, this represents 76 women;
- Based on the only study assessing the impact of Nevirapine³⁹, we will assume that the transmission rate decreased from 28 % to 13 %, that is a 15 % reduction or $0.15 \times 76 = 11.4$ lives, will have benefited from an increased time span thanks to the Program. This impact is obtained without the provision of replacement feeding. Assuming that these 11 children would have lived to the age of 51⁴⁰, which is the average life expectancy, and that without the Program, they would have died 1 year old, this adds 11.4×50 years or 573 DALYs⁴³. This figure is found p. 18, table 3, column 2, line 9.

The ARV Treatment Program is aimed at these 76 women and their children who will be the real beneficiaries of the Program. Other beneficiaries will be the few seropositive women who will not follow the ARV treatment but may still draw some benefit from VCT, and the seronegative women who will benefit from VCT and may change to some extent their sexual habits because of this.

These 573 years gained are to be compared with the recurrent/marginal cost of the Program of \$ 15,722 or \$ 23,622 providing an average recurrent/marginal cost per DALY of \$ 27.42 or \$ 41.19 per DALY depending on the protocol used.

These costs are substantially higher than the \$ 10.51 or the \$ 11.29 referenced by Marseille⁴⁴ for another Nevirapine Program.

selected more optimistic assumptions as more mothers may come back for delivery if they are provided a Nevirapine treatment for free.

³⁶ This assumption is optimistic as Gordon MANSERGH, Cost-effectiveness of Short-Course Zidovudine to Prevent Perinatal HIV Type 1 Infection in a Sub-Saharan African Developing Country Setting, JAMA, July 10, 1996, Vol. 276, No 2, p. 141, shows that among the women receiving the counseling on HIV transmission, only 83 % volunteered to take the HIV test.

³⁷ WHO, Consensus Report on STI, HIV and AIDS Epidemiology, Cambodia, 1999, shows p. 11, that in year 2000, the prevalence of HIV for adults men and women is estimated at 5.11 %. As the estimated number of HIV cases is of 257,490 cases out of which 77,332 are women, it implies that the prevalence rate among women is of $(77,332/257,490) \times 5.11 \% = 1.53 \%$. Taking 5 % as a basis for the calculations provides a maximum number of beneficiaries.

³⁸ The Center National de Protection Maternelle et Infantile shows that in 1998, there were 5985 live births for 6,184 total number of births.

³⁹ Elliot MARSEILLE et al., Cost effectiveness of a single dose Nevirapine regimen for mothers and babies to decrease vertical HIV-1 transmission in sub-Saharan Africa, Lancet, Vol. 354, No 9181, 4 Sept. 1999, p. 803-809.

⁴⁰ World Bank, World Development Report, p.

⁴³ DALYs may be discounted using a rate for example of 3% but this has not been done in this document thus assuming that each year of life has the same value.

⁴⁴ Elliot MARSEILLE et al., Cost effectiveness of a single dose Nevirapine regimen for mothers and babies to decrease vertical HIV-1 transmission in sub-Saharan Africa, Lancet, Vol. 354, No 9181, 4 Sept. 1999, p. 803.

These costs per DALY may be compared to the cost of polio + DPT immunization (\$ 20 - \$ 40), Measles immunisation (\$ 2 - \$ 15), food supplementation for pregnant women (\$ 25), and improved STI treatment (\$ 10)⁴⁵ to note that they are rather on the higher side as compared to these essential interventions.

Calculations similar to those mentioned above have been carried out under different hypotheses:

- Under two different protocols,
- Excluding and including capital costs,
- Assuming a seroprevalence among women 15-49 of 2 % and of 5 %,
- Assuming that 50 % or 80 % of the women attending to a first ANC visit at the NMCH Centre would return for delivery.

All these hypotheses are summarized in the table 3, p. where we find on line:

1. The recurrent or marginal cost of carrying out the tests = the number of women accepting to be tested (see line 5) * the average cost of the test as shown on table 5, top table (\$ 3.3) + the ARV treatment cost = \$ 4 * number treated as shown on line 8 + the remainder of the recurrent costs including mainly training;
2. The recurrent or marginal cost of carrying out the tests = the number of women accepting to be tested (see line 6) * the average cost of the test as shown on table 5, bottom table (\$ 5.3) + the ARV treatment cost = \$ 4 * number treated as shown on line 8 + the remainder of the recurrent costs including mainly training;
3. The investment cost is as estimated on p. 23 under the par. "Capital".
4. The number of first antenatal visits as mentioned has been estimated in 1999 at 7900 based on the increase from 1998 when the number was of 7000.⁴⁶
5. Among the 7900, how many accepted to be tested and returned for delivering in the NMCH Center;
6. 2 % or 5 % of the above;
7. Percentage of live births as provided by the NMCH center;

⁴⁵ See WHO/UNAIDS, Guidance Modules on Antiretroviral Treatments, Module 2, Introducing Antiretroviral Treatments into Health Systems: Economic Considerations, Geneva, 1998, p. 10.

⁴⁶ Technical Working Group on MTCT Prevention, Rapid Assessment on Mother to Child Transmission of HIV in Cambodia, 1999, p. 17.

8. Number of children who will not be HIV +, thanks to the treatment;

9. DALYs gained are obtained by multiplying the number on line 8 by 50 years;

Subsequent lines are obtained by dividing the results obtained above by the number of DALYs or of children saved.

3. Discussion:

The Program described above is not very costly, because the investment in testing has already been paid for by the French Cooperation and that the cost estimates only include the marginal costs added by the Program.

Although the first system appears to be less expensive, it may be more advantageous to the NMCH Center to use the second protocol because it allows to give the results of the test to the mother much more quickly.

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