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THE ECONOMIC FEASIBILITY AND POTENTIAL RESOURCE REQUIREMENTS OF SCALING UP PREVENTION OF MOTHER TO CHILD TRANSMISSION OF HIV SERVICES IN ZAMBIA FROM A PROVIDER'S PERSPECTIVE

By

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

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EXECUTIVE SUMMARY

Zambia's antenatal HIV prevalence of 19% is among the highest in the world. As part of the response to this epidemic the Zambian government has committed itself to scaling up Prevention of Mother to Child Transmission (PMTCT) services to the following targets: 90 per cent utilization of antenatal care, 70 per cent uptake of voluntary counseling and testing services (VCT), 75 per cent adherence to nevirapine antiretroviral therapy and 85 per cent adherence to follow up testing of HIV exposed babies by 2008. Even though the cost-effectiveness of nevirapine antiretroviral therapy to reduce mother-to-child transmission (MTCT) of HIV is well established, there has been no examination of the resources required to scale up PMTCT to the proposed Zambian national targets. The purpose of this study was to estimate the costs and human resource requirements of scaling up PMTCT to the proposed targets. Estimates are compared with the proposed 2006-2008 medium term expenditure estimates and projected staffing levels to ascertain the feasibility of reaching the proposed targets.

Data on the demographics, antenatal HIV prevalence, human resources, envisaged nature of PMTCT service delivery and proposed utilization targets of the scale up program were obtained by conducting semi-structured interviews with key informants and reviewing key policy documents. This was undertaken at the central level which includes the Ministry of Health and its implementation body known as the Central Board of Health (CBoH). A full cost analysis, from the public health system perspective, was undertaken at 2 selected pilot site facilities to calculate the unit costs associated with PMTCT. One rural and one urban health facility was selected using stratified random sampling to take into account possible variations due to geographical positioning. By combining these unit costs with the proposed utilization targets, the costs of scaling up were estimated. Human resource requirements for scaling up PMTCT were estimated based on the observed time to complete each program element (pre-test counseling, testing, post-test counseling, delivery and follow up) in the selected facilities. All quantitative data were analyzed using Microsoft Excel® while qualitative data were analyzed in Microsoft Word®.

Some of the major findings from the analysis were;

- In both facilities, VCT costs (i.e. pre-test counseling, testing, post-test counseling) were the largest component accounting for 84% of the total direct costs. This was mainly related to the high acceptance of VCT services (>90%) and high cost of the HIV screening (US$1.38) and confirmatory test (US$3.69) in the facilities.

- The unit costs of providing PMTCT were higher in the rural facility than in the urban facility. This gives some indication of the diseconomies of scale associated with scaling up to rural areas and potential economies of scale associated with the extra one year maturation period in the urban facility.

- Difficulties associated with reaching PMTCT targets were highlighted as a non-negligible proportion of women were lost to follow-up at each phase, mainly at the delivery and follow up stage of the PMTCT program. The drop out rates indicated that follow up testing for infants has been the most challenging element with 59% and 88% failing to adhere to follow up testing in the urban and rural facilities respectively.

- It was estimated that the total direct costs of scaling up over a three year period (2006-2008) would be US$24.3 million with VCT costs accounting for more than 70% of the total costs in each year. However, the results of this study have highlighted a possible budgetary deficit of at least US$5.06 million when these costs are compared to the 2006-2008 MTEF estimates.

- The analysis suggests that there would be significant cost reductions in scaling up PMTCT if HIV prevalence were to decline. This reinforces the approach of prevention of primary HIV infection as outlined in the internationally accepted four prong approach to implementing PMTCT.

- The study found that 476 full time equivalent (FTE) midwives would need to be recruited to deliver the proposed scaled up PMTCT services in 2008. However, the analysis estimates that when the staffing levels, attrition rates and annual graduates in the public sector are taken into account, the projected number of midwives available in Zambia in total would only be able to handle 5% of the

2008 PMTCT workload. In addition to these shortages, imbalances in staffing which favour urban sites, threaten the scale up program to rural areas.

In conclusion, some of the policy recommendations that have been drawn from the study findings include;

- In the advent of cheap ARV drugs, the next challenge lies in reducing costs of HIV testing. Using cheaper but effective testing methods such as finger prick method as opposed to drawing blood with syringes should be considered.

- In light of the possible budgetary constraints in the scale up program, Government is urged to mobilize and allocate adequate resources to the program. Government must take advantage of unprecedented international commitment and funding sources such as the Global fund to fight HIV/AIDS, Tuberculosis and Malaria (GFATM) to mobilize more resources for scaling up PMTCT.

- In order to improve uptake rates in the facilities the following are recommended; 1) encouraging male involvement in VCT to help reduce stigma and increase the number of women who enroll into the PMTCT program; 2) assigning new roles to traditional birth attendants such as VCT, following-up antenatal and postnatal women in communities and assisting in monitoring adherence to nevirapine for the large proportion of women who deliver at home.

A multifaceted approach to dealing with the human resource shortages is recommended. It includes;

- Introducing financial and non-financial incentives to motivate and retain a greater number of staff.
- Improving recruitment and deployment practices, by basing them on existing staff imbalances, would help scale up services to rural areas.
- Making greater investments in pre-service training in order to produce the requisite quantity and quality of staff for PMTCT services.
- Recruiting cheaper cadres like traditional birth attendants to provide services like VCT in order to help reduce the total cost of scaling up.

ACRONYMS

AIDS	Acquired Immunodeficiency Syndrome
ANC	Antenatal Care
ART	Antiretroviral Therapy
ARV	Antiretroviral
AZT	Zidovudine
BHCP	Basic Health Care Package
CBoH	Central Board of Health
CDC	Centre for Disease Control
CHAZ	Churches Health Association of Zambia
CIDA	Canadian International Development Agency
CIDRZ	Centre for Infectious Disease Research in Zambia
CPs	Cooperating Partners
CSO	Central Statistics Office
DANIDA	Danish International Development Agency
DFID	Department for International Development
DHMT	District Health Management Team
ELISA	Enzyme-Linked Immunosorbent Assay
FAMS	Financial Administration Management System
FHI	Family Health International
GDP	Gross Domestic Product
GFATM	Global Fund for the fight against AIDS, Tuberculosis and Malaria
GRZ	Government of the Republic of Zambia
HAART	Highly Active Antiretroviral Therapy
HIV/AIDS	Human Immunodeficiency Virus/Acquired Immunodeficiency Syndrome
HMIS	Health Management Information System
HR	Human Resources
JICA	Japan International Cooperation Agency
MMD	Movement for Multi-Party Democracy
MoFnP	Ministry of Finance and National Planning
MoH	Ministry of Health

MTCT	Mother to Child Transmission of HIV
MTEF	Medium Term Expenditure Framework
NAC	National HIV/AIDS/STD/TB Council
NGOs	Non-Governmental Organizations
NVP	Nevirapine
PCP	*Pneumocystis Carinii* pneumonia
PEPFAR	President's Emergency Plan for AIDS relief
PMTCT	Prevention of Mother to Child Transmission of HIV
SFHI	Society for Family Health International
SWAp	Sector Wide Approach
TB	Tuberculosis
tTBA	Traditional Birth Attendant
UNAIDS	Joint United Nations Program on HIV/AIDS
UNFPA	United Nations Population Fund
UNGASS	United Nations General Assembly Special Session on HIV/AIDS
UNICEF	United nations Children's Fund
USAID	United Stated Agency for International Development
UTH	University Teaching Hospital
VCT	Voluntary Counseling and Testing
WFP	World Food Programme
WHO	World Health Organisation
ZMK	Zambian Kwacha

transmission rate without intervention, 5 to 10 per cent will be as a result of transmission through pregnancy, 10 to 20 per cent during labour and 5 to 10 per cent through breastfeeding (Hira 1989). Given the high HIV prevalence and this transmission risk, of the 550,000 babies born annually in Zambia, 103,000 could be born to an HIV-positive mother, which would imply approximately 40,000 acquiring HIV infection without intervention. This translates to about 110 new infections in babies per day (Central Board of Health (CBOH) 2003). The majority of those infected will die before their second birthday (UNICEF 2003).

The implementation of Prevention of Mother to Child Transmission (PMTCT) of HIV programmes has yielded positive results in developed countries and in Thailand, a middle-income country, where the mother to child transmission (MTCT) rates have been reduced to less than 2 per cent and 10 per cent respectively (Central Board of Health (CBOH) 2003; UNAIDS 2003b; Family Health International 2004; World Health Organisation (WHO) 2004a). If the Zambian program is to have significant impact on childhood HIV infection and increasing mortality trends, PMTCT services need to be scaled up to all Maternal Child Health (MCH) services in the country. Scaling up includes four key strategies: prevention of primary infection, prevention of pregnancy in HIV infected women, prevention of mother to child transmission using ARVs and care and support of infected families (Luo 2000; Ministry of Health 2003; Ministry of Health 2006).

At health facility level, strategies planned include improving antenatal and postnatal utilization to 90 per cent, acceptance of VCT to 70 per cent, acceptance and adherence to ARV therapy by HIV positive women to 75 per cent and ensuring clean and safe deliveries in the health facility and the home (Central Board of Health (CBOH) 2003; Ministry of Health 2006). This package includes voluntary counselling and testing (VCT) for HIV and the provision of Nevirapine (NVP) according to the HIVNET 012 regimen to all pregnant women who test positive for HIV (Guay, Musoke et al. 1999; Central Board of Health (CBOH) 2003). The phase-in plan includes the successive addition of new districts to the PMTCT program, and then devolution of program activities from central facilities to more accessible district health facilities (Ministry of Health 2006).

In order for the country to put in place an effective scale up program there is a need to understand costs, systems and process implications. This will help to allocate scarce resources to the most cost-effective methods (Wilkinson, Floyd et al. 1999; Scotland, Terjlingen et al. 2003). In addressing this issue, the study will be looking at available pilot on-site information to describe some of these implications.

1.1 Problem Statement

Similar to many of the sub–Saharan African countries, Zambia is experiencing an HIV/AIDS epidemic that has affected every aspect of the population's socio-economic wellbeing. In 2001, Zambia was part of the 189 countries at the United Nations General Assembly Special Session (UNGASS) on HIV/AIDS that committed themselves to a comprehensive program of international and national action to fight HIV/AIDS by adopting the Declaration of Commitment on HIV/AIDS (UNAIDS 2003b). The Declaration established specific goals, which included reducing the proportion of infants with HIV by 20% by 2005 and 50% by 2010 (UNAIDS 2003b). For this to become reality there is a need to increase access for pregnant mothers to information, counseling services and other HIV prevention services. In addition, there is a need to increase availability and access to effective ARV prophylaxis to infected women in order to reduce the MTCT of HIV while ensuring that the quality of these services are not undermined (AIDS Campaign Team for Africa (ACTafrica) 2001; Stover, Walker et al. 2002; Central Board of Health (CBOH) 2003; Family Health International 2004).

However due to the limited amount of resources available to the government there is a need to understand the implications for costs, infrastructure and delivery of such a service. Therefore, in order to make policy recommendations, there is further need to understand the most efficient way of scaling up and using such limited resources. A costing of existing pilot facilities would provide assistance to policy makers on real life situations.

1.3 Justification/Rationale for the Study

Since 1991, Zambia has embarked on an ambitious health reforms program, whose vision has been " to provide Zambians with equity of access to cost-effective, quality health care as close to the family as possible" (Central Board of Health (CBOH) 2003). The effort to improve access to PMTCT services clearly falls within the country's health vision. However like most developing countries, there are tremendous challenges to achieving these objectives. The reoccurring theme of limited and inadequate resources has hampered the speed of implementing such reforms (Central Board of Health (CBOH) 2004). In anticipation of increased resources from debt relief and global funds, Zambia plans to use this additional funding to scale up PMTCT services to a greater number. However, at the same time, the health system faces many other challenges such as the inability to maintain adequate health professionals to provide basic health care to its citizens (Central Board of Health (CBOH) 2003; Ministry of Health 2005b). In February 2004, the Mid Term Review of the Zambian NHS Strategic Plan noted that:-

> *'Health care is a labour intensive industry and cannot be delivered only through action plans, physical facilities or supplies. Without addressing this issue, we fear that most if not all of the essential indicators can be expected to deteriorate, to a point where the public health sector would be in danger of collapse.' (Central Board of Health (CBOH) 2004)*

This observation captures the essence of the current crisis facing the health service. Essentially, too few staff are struggling to provide care to a population of 10.9 million that faces massive deficiencies in maternal and child health and rampant epidemics of HIV/AIDS and malaria (Ministry of Finance and National Planning 2002; Central Board of Health (CBOH) 2003; Central Statistics Office (CSO) 2003). This has been exacerbated by the poor infrastructure, lack of adequate equipment, the limited capacity to train replacements, and poor incentives for the already over-stretched workforce. These challenges have hampered the smooth operations of many health facilities.

- Chapter five presents the findings of the study. The direct costs of scaling up to the proposed national targets are presented in 2005 prices which are converted to US dollars. The costs are compared to proposed allocations in the 2006-2008 MTEF budgets to establish feasibility of scaling up. The human resource requirements to scale up PMTCT are presented based on the staff time dedicated to PMTCT in the selected pilot sites.

- Chapter six discusses the findings. The discussion provides further insight into the costs of scaling up, human resource requirements, and the assumptions used in this study. The chapter ends by discussing the limitations of the study.

- Finally, chapter seven gives a summary of the key findings with reference to the feasibility of scaling up PMTCT in Zambia. The chapter also gives recommendations and provides suggestions for further research.

any intervention, it is estimated that 40 per cent of babies born to HIV positive mothers are infected with the virus (Central Board of Health (CBOH) 2003). It is also estimated that HIV/AIDS morbidity and mortality results in about 50% of general hospital admissions (Ministry of Health 2005b).

2.4 Political, Economic and Social Background

2.4.1 Political Background

After nearly a century under British colonial rule, Zambia gained independence on the 24th October, 1964. The United National Independence party (UNIP) lead by President Kenneth Kaunda assumed power in that year. The period between 1964 and 1972 which is known as the first republic, consisted of multi-party politics until 1972 when the constitution was changed to establish a one party rule system (World Health Organisation (WHO) 2002). In 1991, Zambia reverted back to multiparty politics and embarked on liberalization of the trade and exchange rate, parastatal reform, privatization of the mining sector, removal of state subsides and health reforms including the introduction of user fees (Lake 2000).

2.4.2 Socio-Economic Background

Zambia is a riches to rags story. After inheriting one of the strongest African economies in 1964 from the British, today it is ranked as one of the Least Developed Countries (LDCs) in the world (Ministry of Finance and National Planning 2002). Zambia's economic decline can be traced to the sharp decline in prices and consequently production of copper, which accounts for 90% of the country's export earnings, support of numerous regional liberation movements and high oil prices in the 1970's (Central Statistics Office(CSO) 1999; Lake 2004). This reduction in foreign exchange earnings meant that the government had less to spend on social sectors such as health and education (Ministry of Health(MoH) 2005). According to the living conditions monitoring survey of 1998, the level of overall poverty rose (that is those classified as moderately or extremely poor) from 24% in the 1980's to 73% in 1998 (Central Statistics Office(CSO) 1999). Gross Domestic Product (GDP) per Capita fell from US$ 451 in the 1980's to US$ 359 in 2002, much lower than the average of US$480 for Sub-Saharan countries (Lake 2000).

implementing body, it has within it a number of Technical Working Groups that play an advisory role to all sectors in response to the HIV/AIDS epidemic (National HIV/AIDS/STD/TB Council 2002). An increasing number of partners have been crucial in supporting the expansion of PMTCT services in 2004 and 2005 (Central Board of Health (CBOH) 2003). Among these are (a) the UN partners which include UNICEF, WHO, WFP and UNFPA, (b) the PEPFAR-funded partners such as CDC, JHPIEGO, MSH, CIDRZ, LINKAGES Project, SFHI, (c) bilateral agencies such as DANIDA, JICA, DFID and World Bank , (d) Non-governmental organizations such as MSF Holland, MSF Greece, PCI, DAPP, World Vision and (e) faith-based organizations and mission hospitals most of whom fall under Churches Health Association of Zambia supported by the Catholic Medical Missions Board. The partners are members of the PMTCT implementation team that is coordinated by the reproductive health unit of CBoH (Ministry of Health 2005b). Some of these partners provide direct financial assistance to the PMTCT program through basket funding while others (e.g. PEPFAR-funded partners) have vertical assistance programs that directly support implementing facilities with donations of drugs, testing kits, training of staff, equipment and infrastructure renovations. Through CBoH leadership, partner's activities are coordinated with an aim of streamlining delivery of PMTCT services in Zambia.

2.6 Human Resources

Human resources form the backbone of any strong health system. They are a key factor in enabling a health system to deliver quality health services to meet the health needs of any population (World Bank 2004). However, the figures in table 4 indicate a human resource crisis in Zambia (Kombe, Galaty et al. 2004).

Table 4: Current Staff Number by Cadre in the Public Sector and Staff to Population Ratio

Staff type	Annual graduates	Attrition rates	Staff currently available (2005)	Current (2005) staff: population ratio
Doctors	49	9.8%	646	16,873
Nurses(registered and enrolled)	540	5.3%	6,096	1,788
Midwives	150	4.0%	2,273	4,795
Pharmacists(incl. technicians)	20	4.2%	108	1,009
Lab technicians	38	3.5%	292	37,329
Total	**647**		**9,415**	**61,794**

Source: Ministry of Health Strategic Plan 2006-2011

The low numbers of annual graduates indicate the current lack of capacity of our training institutions to produce the numbers required to address the shortage of skills in the health sector. The shortages have been compounded by high attrition rates that have been partly as a result of the brain drain and losses of staff to HIV/AIDS (Huddart, Furth et al. 2004). There are now growing concerns to address these problems, as the health system struggles to meet the demands imposed on it by the HIV/AIDS epidemic (World Bank 2004). Programs such as PMTCT require added competencies in counseling, testing, delivery and follow up that will undoubtedly add to the workload of an already overstretched workforce (Huddart, Furth et al. 2004). This study provides a concise examination of the human resource requirements to meet the proposed PMTCT scale up targets. By comparing these requirements with the projected staff levels, conclusions and recommendations will be drawn about the feasibility of scaling up PMTCT.

2.7 Description of the Zambian PMTCT Service

2.7.1 Background

Recognising the need to address the HIV/AIDS epidemic, the Central Board of Health began the national expansion process of PMTCT services to all provinces in December 2002 (Ministry of Health 2003). As of January 2006, there were 265 PMTCT sites (i.e. located in district health centres) in the country across the 72 districts and 9 provinces in Zambia out of a total of 1,327 health facilities. This represents 20% of all health facilities (Ministry of Health 2006). With an estimated 550,000 deliveries every year and an estimated 19% prevalence among pregnant women, it is estimated that about 103,000 HIV infected women give birth every year (Central Board of Health (CBOH) 2003). In 2005, 176,184 pregnant women were tested and 87% of the women testing positive received nevirapine (Ministry of Health 2005a). Using this utilization data and the estimated 19% national antenatal HIV prevalence, approximately 33,500 of the 176,184 pregnant women were found to be HIV positive. Therefore 87% of those found to be HIV positive would translate to approximately 29,145 HIV positive women receiving nevirapine. From these calculations, it is estimated that only 29% of the estimated 103,000 HIV infected pregnant women in Zambia are currently benefiting from the PMTCT program as of December 2005.

The proposed scale-up benchmarks are outlined in the table below:

Table 5: Indicators for the National PMTCT Scale up Plan

Indicators	2005 (Baseline)[a]	2006	2007	2008
Antenatal utilization[3]	97%	97%	97%	97%
Improving VCT uptake	32%	40%	60%	70%
Acceptance and adherence to ARV therapy	29%	35%	50%	75%
Follow up testing of HIV exposed babies	-------	55%	70%	85%

[a] Sourced form 2005 HMIS Data

2.7.4 Main Activities

The Zambia National PMTCT programme uses the globally agreed upon four-prong approach to PMTCT adopted from WHO recommendations which includes, 1) primary prevention of HIV among young people, women and men; 2) prevention of unwanted pregnancies among HIV positive women; 3) prevention of HIV transmission from infected mothers to their babies; 4) care and support to HIV infected families (Central Board of Health (CBOH) 2003; Family Health International 2004). Although the four pronged approach has been advocated, it is the third component that involves the use of antiretroviral treatment to reduce the risk of transmission of HIV from mother to child that has been the main focus of research (Sweat, O'Reilly et al. 2004). The handling of potential clients in the pilot sites follows the standard national protocol (Ministry of Health 2006). The patients go through the following sequential steps (see Appendix I);

2.7.4.1 Pre-test counseling

The first step is for all pregnant women to know their serostatus using an opt-out approach to counseling[4] . Women typically present to the antenatal clinic early in the morning and an initial group counseling session is given to all the pregnant women present. The talk is usually given by a trained midwife and includes information on HIV infection, HIV transmission, the benefits of knowing one's serostatus, importance of partner involvement, confidentiality of the test results, the implications

[3] Current utilization of ANC already exceeds the targeted 90%, therefore the current utilization rates of 97% have been used in this study instead.

[4] The opt-out model is a model where all antenatal care attendees receive counseling for HIV testing but where the counseled pregnant woman has the option to refuse the HIV testing.

of a positive or negative test and information on Nevirapine (NVP) and PMTCT. The group session is then followed by individual pre-test counseling, where each woman is further counseled individually in private rooms by midwives. At this point women may either opt-out or provide consent for testing. Their antenatal books are coded to indicate whether they refused or accepted testing.

2.7.4.2 HIV testing

HIV testing involves the use of a screening and confirmatory test. The testing is conducted by trained midwives. The screening test uses a rapid test called the Determine test HIV-1/2 from Abbot Laboratories, USA which is highly sensitive. If the test result is negative, then the client is determined to be HIV negative, however if the result is positive then a second confirmatory test is conducted (see Appendix I). The Genie II HIV-1/2 is a more specific rapid test that is used as the confirmatory test in Zambia. If both tests are positive then the client is confirmed to be HIV positive, however if the first test is positive and the second test is negative the result is called indeterminate. A tie breaker test (which occurs in less than 1% of all cases) is conducted in a reference lab using an ELISA test kit (see Appendix I). The use of rapid test kits allows the results to be handed back to the women within one hour.

2.7.4.3 Post- test counseling

The post-test counseling is conducted by a trained midwife in private rooms in the antenatal clinic. If the client is deemed HIV negative, the session reinforces how to maintain the HIV negative status and the need to retest after 3 months as there is a chance that the woman could have presented in the 'window' period[5] in which the rapid tests are unable to detect HIV antibodies. Those that test positive and agree to receive the results are offered the opportunity to join the PMTCT programme and are provided with more information on the disease and antiretroviral drugs offered.

There are several different regimens for PMTCT that have been shown to be effective. The design and efficacy of some of the various drug regimens evaluated to date are presented in Appendix II. Due to the low cost, ease of administration and the

[5] After a person is infected with HIV, there is a period of time when s/he will not test positive for HIV but can infect other people. This is called the window period, and it can last from several weeks to three months. This is because the tests are based on the presence of antibodies to HIV, which can take time to develop in detectable quantities.

months using the ELISA test. Retesting at 18 months is conducted due to the fact that at 9 months a false positive result may result from a slow clearing of maternal antibodies to HIV in the infants. In all HIV exposed infants, cotrimoxazole to prevent *Pneumocistis Carinii* Pneumonia (PCP) is administered daily starting at 6 weeks until the baby tests negative and is not breastfeeding in follow up visits to the health centre.

A 2000 UNAIDS report on costing guidelines for HIV prevention strategies explains:

"Cost-effectiveness analyses served to provide basic evidence for on-going policy questions and debates. Cost analyses have always been identified with issues of efficiency, cost recovery and sustainability of programmes. However, cost analysis can also play an important role in examining issues of equity and targeting which have recently come to the forefront of the policy debate. With the ongoing research and development of new HIV prevention strategies, the question of feasibility is integrally connected with issues of cost, efficiency and priorities for resource allocation. Cost and cost-effectiveness analyses are even more germane in this context" (UNAIDS 2000 pg 7)

The costing of HIV programs has come to the fore more recently following the establishment of the Global fund to fight AIDS, TB, and Malaria (GFATM), "3 by 5" World Health Organisation initiative, the President's Emergency Plan for AIDS Relief (PEPFAR), and the Bill and Melinda Gates Foundation (Lake 2004). These initiatives are committed to scaling up health interventions and to meeting the Millennium Development Goals (MDGs). All these partners and key stakeholders need information on costs of scaling up these interventions in order to buy-in to this plan, avoid duplication of resources, and to maximize the scale up efforts (Johns and Tan-Torres 2005). As most of these initiatives prefer programmes that reflect national ownership and respect country led formulation and implementation processes, the availability of funding relies heavily on the preparedness and willingness of the government's health sector (Connelly 2002). It is therefore imperative that Zambia not only plans but also costs the planned scale up program in order to fully take advantage of these initiatives. Indeed, to a large extent the success of these programs depends on identifying and adequately funding costs associated with increasing access to HIV testing, counselling, strengthening prevention activities, increasing access to PMTCT and increasing community participation (Söderlund, Broomberg et al. 1993; UNAIDS 2000; World Bank 2005).

study. This approach makes it easier for policy makers to understand the implications of scaling up a program on a limited budget (Creese and Parker 1994; UNAIDS 2000; Mogyorosy and Smith 2005).

3.5 Outcome Measures

Cost data is usually presented combined with some measure of health outcome to capture the expected health effects of a program (Drummond, Stoddart et al. 1987; Gold, Siegel et al. 1996; UNAIDS 2000). Although the costing procedures are fairly standard, the choice of outcome measure can differ considerably. The measures of health outcome can be classified into two main categories namely intermediate and final (UNAIDS 2000). An Intermediate outcome reflects an intermediate change in the intervention occurring before the final outcome. The final outcome measures the final impact on a health intervention (UNAIDS 2000; Dolan 2001). An example of the former would be the number of HIV positive women accepting treatment in a PMTCT program and an example of the latter would be the number of infant HIV infections averted. Evans and Hurley (1995) advocate for the use of final outcomes with the following argument:

"Cost effectiveness (CE) based on intermediate outcome indicators can only be used to compare programmes with the goal of producing that outcome. Those studies based on final outcomes indicator can compare the efficiency of a broader range of programmes if they are aimed at the same outcome, such as saving lives"
(Evans and Hurley 1995) Pg 505

However in this study, intermediate outcomes such as antenatal mothers accepting VCT and number of pregnant HIV positive women accepting treatment have been used instead of infant HIV infections averted. There are several practical problems in determining the final outcomes of programs such as PMTCT, especially if the program has only recently been introduced. Although the efficacy of NVP in reducing vertical transmission of HIV from mother to child has been established in several studies, the effectiveness of the intervention in the Zambian context has yet to be evaluated. As a result, credible epidemiological information of the actual numbers of HIV infections averted in the PMTCT program are currently absent.

many analyses the assumption made was that the higher cost of transportation, supervision, and training in remote areas when compared to urban areas caused such diseconomies of scale (AIDS Campaign Team for Africa (ACTafrica) 2001; Kumaranayake, Kurowski et al. 2001; Edejer 2004; Johns and Tan-Torres 2005; Mogyorosy and Smith 2005). In other studies there was evidence that economies of scale occurred when the fixed costs such as infrastructure were spread over more people accessing the service in urban areas (Johns and Tan-Torres 2005). Therefore the ideal situation would be to make adjustments to average costs based on the expected changes as coverage increases (Kumaranayake and Watts 2000; AIDS Campaign Team for Africa (ACTafrica) 2001). However this would require one to re-estimate average costs as the scale of PMTCT activities increased in different settings, which has meant that most studies have not made adjustments to average costs but have simply multiplied the average cost of providing PMTCT services such as VCT, by the expected utilization of the service at the desired scale. This approach introduces some uncertainty around the cost estimates calculated as it is possible to either overestimate or underestimate the true costs of scaling up (Kumaranayake and Watts 2000; Johns, Baltussen et al. 2003; Evans, Edejer et al. 2005). Therefore to address uncertainty around the cost data a sensitivity analysis is conducted to test the robustness of the results within a plausible range of epidemiological and cost estimates (Johns, Baltussen et al. 2003; Evans, Edejer et al. 2005).

Economies of scope occur when the cost of joint production is less than the cost of producing two or more related outputs separately (Clewer and Perkins 1998). The PMTCT program in Zambia is provided as part of an integrated reproductive health package which includes antenatal care, family planning, tetanus toxoid immunization, and anemia prophylaxis (Ministry of Health 2003). Scaling up PMTCT in an integrated approach may release economies of scope by using any under-utilized capacity in the health facilities. On the other hand, if the facilities are working at or near capacity, diseconomies of scope (i.e. increase in costs of joint production) may be observed as facilities are overloaded and the intervention is delivered less efficiently (Johns and Tan-Torres 2005).

costed was not described in detail, making it difficult to assess whether the costs could be extrapolated to other settings in the country. In addition there was lack of detail regarding the identification, measurement and valuation of resources used in the study. There were no details given on the quantities of resources used, discount rate, and handling of overhead costs. The model was dependent on effectiveness data from other studies and made assumptions on its applicability to the South African context when clearly this was not the case. Furthermore the assumptions made in the study were not subjected to a sensitivity analysis making it difficult to assess robustness of the results to changes in the assumptions used. The results were prone to selection bias as only one rural district was sampled and extrapolated to the whole country. This may have overestimated the costs of the program in urban areas where there may be little need to improve infrastructure.

Another study was conducted by Marseille et al (2003) to estimate the cost and public health impact of scaling up prevention of mother to child transmission of HIV in Uganda. The aim of the study was to examine the resources needed to implement this intervention on a national scale. The study was based on a standard micro-costing method at the project level and adopted a health system perspective. The model was based on the use of UNICEF PMTCT planning estimates of the use of nevirapine in Ugandan District hospitals. The model is said to cost PMTCT activities in two facilities, and national HIV prevalence was used to calculate the expected utilization for the entire country. The costing model used variable costs (e.g. test kits, drugs) and fixed costs (e.g. equipment, and facility improvement). The cost of providing VCT was calculated as US$8.28 per woman completing the counseling and testing sequence. The major cost driver in the VCT program was the test kit accounting for 80% of the variable costs. The unit cost for the PMTCT program was US$289 per case averted or US$16 per DALY saved. The annual cost of the program was calculated by multiplying the unit costs by the projected numbers requiring nevirapine therapy nationwide. The major cost driver was the VCT program that constituted 75% of all the costs of the program. A multivariate sensitivity analysis was conducted on all variables using crystal ball software package, which indicated a 90% probability that the program costs would be between US$2.6 million and US$6.2 million. Despite a well thought out model, the limitations in the validity are similar to

3.7 Empirical Literature

There have been several economic evaluation studies that have been conducted to ascertain whether PMTCT is a technically and allocatively efficient intervention (Geffen 2001; Creese, Floyd et al. 2002; Scotland, Terjlingen et al. 2003; Desmond, Franklin et al. 2004). What is now needed is a better understanding of the costs of scaling up PMCT. From the literature reviewed there are a number of variations in the methodological approach and outcome measures used in costing and evaluating the scaling up of PMTCT in various contexts. These will be discussed and evaluated with reference to Drummond's (1996) ten point check list namely: 1) is the perspective explicitly stated?; 2) are appropriate costs included?; 3) are sources of cost data included?; 4) are quantities of resources included?; 5) are sources of outcome data included?; 6) is discounting used when appropriate?; 7) is marginal or incremental analysis used when appropriate?; 8) is sensitivity analysis used?; 9) is affordability of the intervention discussed?; 10) is the generalisability of the results discussed?

Wilkinson et al (1999) conducted a study to estimate the cost and cost effectiveness nationally and for each province of a programme to reduce MTCT of HIV in South Africa. A model developed to estimate cost and cost effectiveness of interventions in Hlabisa, KwaZulu-Natal, was modified and applied to each province. This model assumed a 37% reduction in pediatric HIV infections if short-course oral zidovudine (ZDV) plus infant formula feed for 4 months were provided within a strengthened health system. The estimates of the number of pregnancies and HIV prevalence among pregnant women per province in 1997 were combined with an estimated 30% MTCT rate. Costs were calculated from a health system perspective, and effectiveness was estimated as cost per infection averted and cost per disability-adjusted life year (DALY) gained. The cost of a national programme was estimated at R155.9 million (1997 Rands, 0.94% of the annual national health budget). Major cost drivers were drugs (R46.4 m, 30%), staff salaries (R45.8 m, 29%), and formula feed (R37.1 m, 24%). The estimated national cost per infection averted was R6,724, and R213 per DALY gained. Provincial cost per DALY ranged from R176 to R369. Although the study showed that PMTCT was potentially cost-effective and affordable, the methodology used had several limitations. The intervention and protocol that was

for exchange rates and inflation rates. Uncertainty in the results was not subjected to any sensitivity analysis. On the other hand, one of the strengths of the study was that it provided an analysis of the human resource requirements to scale up the interventions. Health workers are central to the success of any health system (World Bank 1997; World Health Organisation (WHO) 2004b). The study found that the greatest constraint to the scale-up of HIV/AIDS services was the shortage of qualified, trained doctors, followed by laboratory technicians and pharmacists. The inadequacy of health workers in sub-Saharan Africa has been identified as a major obstacle to increasing access to life saving interventions to millions of people in dire need (World Health Organisation (WHO) 2004b; World Health Organisation (WHO) 2006).

Desmond et al (2004) conducted a costing study of prevention of mother to child transmission in four sites in South Africa. The specific aims of the study included providing a range of cost data for informing the funding requirements of a national roll out of the PMTCT program and cost data that could be used for policy, planning and management. Two rural and two urban sites were purposively selected in order to capture a range of costs associated with differences in resources and HIV prevalence at the sites. The costing approach used was designed to capture economic costs of providing the intervention, defined as the financial cost of the resources that were paid for directly out of the PMTCT budget as well as the value of existing resources (e.g. existing staff). The perspective used was the provider's perspective and patient costs (e.g. cost and time borne by patients to access VCT and free formula) were excluded from the analysis. The input categories that were captured were facilities (infrastructure), staff, drugs (nevirapine, cotrimoxazole etc), infant formula feed and others (e.g. test kits, training). To enable comparison between the different sites, the PMTCT program was broken down into five components namely pre-test counseling, testing, post-test counseling, delivery, and follow up care. The inputs were costed in each category. The training costs and capital infrastructure were annualized over 5 and 15 years respectively. Compared to the other components, in one of the sites, the total costs of the pre-test and post-test counseling components included a high proportion of direct financial costs (71% and 76% respectively). This occurred primarily as a result of the appointment of lay counselors. Staffing was found to the biggest input accounting for approximately 48% of the total costs while formula feed

accounted for 17% of the total costs. There was great variation in administration and startup costs in the various sites due to different staffing levels. The areas with higher prevalence were found to have higher total costs, but lower unit costs. The results have to be interpreted with caution due to a number of limitations. Although infrastructure and other capital investments were annualized, there is no mention of the discount rate used and no sensitivity analysis was conducted. The presentation of results lacked transparency on the handling and allocation of overhead costs. These limitations make it difficult to asses the relevance and generalisability of the results.

There is very limited cost data on PMTCT in Zambia. Mwikisa (2002) conducted a study to determine the financial implications of HIV/AIDS interventions in Zambia. The costing approach varied for the different components of the HIV/AIDS interventions. International standard cost estimates from neighboring counties, cost estimates from other studies, and expert opinion was used for PMTCT. The model uses assumed coverage targets of 10,000 pregnant women screened in 2001; 100,000 in 2002; and 250,000 in 2003. It was assumed that 30% of women would be expected to test positive of which 70% would go ahead with treatment. Of these it was further assumed that 50% would be treated with short course AZT and the 50% with Nevirapine. Using a UNAIDS costs estimate it was assumed that the cost for one woman managed under short course AZT is US$130 and Nevirapine is US$84. In addition the model assumes an expansion cost of US$500,000 for each 10,000 new clients plus 10% of running costs to cover strengthening of antenatal clinic. Using these assumptions it was estimated that a total cost for 2001-2003 of US$27.3 million would be used for PMTCT of which US$18.8 million would be attributed to expansion costs and US$8.5 million would be for running costs. It was noted the entire cost was to be borne by donor partners as nothing had been committed by the Zambian Government. Similar to a number of other studies, this study relied on assumptions and hypothetical costs from unknown sources, international organizations, and other developing countries to estimate the costs of a national PMTCT program. These assumptions may not be generalisable as health system practices vary greatly from country to country. Furthermore the assumptions were not subjected to any sensitivity analysis. Precision and accuracy should have been of greater concern in a context where donors would foot the entire bill of

implementation! The perspective used in this study was not stated making it difficult to identify which costs were included in the study. There was also very little transparency in identifying health resources used, handling of capital costs, allocation of overheads, adjusting for inflation and differential timing of costs. This greatly compromised the validity of the results.

Stringer et al (2003) used a crude measure of Zambia's PMTCT program costs that did not take into consideration Drummond's recommended guidelines in conducting a cost analysis. Even more disconcerting is a lack of any detail on the methodology used to come up with the final estimates. The calculated unit costs were US$9.34 per patient counseled, US$12.96 per patient tested, and US$55.12 per seropositive woman identified or US$848.26 per infection averted. The study concluded that prevention of mother-to-child HIV transmission was feasible and cost-effective in resource-limited settings. However, the perspective of the study was not revealed, a description of the alternative interventions was not given, costs and health benefits were not identified and valued credibly and the study did not take into consideration any discount rate or sensitivity analysis. An intervention is only said to be more cost-effective if it is less costly and more effective than its comparator. In a situation where an intervention is more costly and more effective, an incremental cost-effectiveness ratio gives a clearer indication of the additional costs required for the additional benefit and is therefore a better policy guide. However in this study the total costs, effectiveness of the alternative interventions, and an incremental analysis were all omitted. Furthermore there was no examination of the budgetary implications of such findings. Such discrepancies were unlikely to positively affect an astute policymaker. The lack of a full costing exercise on the PMTCT program in Zambia has left a lot of gaps in information for planners and policy makers.

A study by Galbraith and Bennish (2001) aimed to estimate the incremental costs of a program to reduce MTCT of HIV in Hlabisa, a rural district of South Africa The major components of the program consisted of management, community mobilization, VCT, Nevirapine intervention, and follow up. A costing model that only included incremental costs was developed. It excluded preexisting district resources (e.g. staff and clinic space) contributed to the program. A provider's perspective was used to

national PMTCT program. The model uses an assumed lifespan of 32 to 60 months and monthly grants of 100 Rands to calculate the welfare costs for a HIV positive child. In the interventions assessed, it was assumed that 90% to 93% of pregnant women would consent to an HIV test and that 92.5% of these would accept treatment with ARVs. By reviewing several studies, the perinatal transmission rate among HIV positive mothers who breastfeed and accept AZT was assumed to be 16.5% to 18%, while among those accepting NVP the transmission rate of 13.1% was used. The transmission rate among those HIV positive mothers not using any ARVs was assumed to be 25% to 31.6%. The results were presented with the best case and worse case scenarios. The total direct costs of an AZT intervention were between US$12.6 and US$22 million. VCT (pretest counseling, testing, post-test counseling) accounted for 35% to 58.7% of these costs while providing AZT and PCP prophylaxis accounted for 41.2% to 65% of these costs. Nevirapine with a direct cost-effectiveness ratio of US$195 to US$410 per child saved was found to save more lives and was more cost-effective than using AZT that had a cost-effectiveness ratio of US$688 to US$916 per child saved. The authors show that the costs to government of health and welfare expenses for HIV positive children are greater than the costs to government of implementing a PMTCT program. The authors consequently argued that the PMTCT programs were clearly affordable. This study was not without limitations. In this study the perspective was not explicitly stated making it difficult to ascertain whether the full range of relevant costs were included. The inclusion of welfare grants for HIV positive children was highly controversial as these transfer costs simply represent transfer of resources from one party to another and do not strictly represent a real economic cost in resource use. Despite the inclusion of these future welfare costs, no discounting was conducted which biased the results towards greater savings resulting from implementation of a PMTCT program. Another interesting finding of the study was that the total health and welfare costs of the AZT and NVP interventions were significantly more than the costs that would be saved if a program was implemented compared to doing nothing. The high costs of both interventions negated any potential saving arising from their implementation. In conclusion the authors advocate for the implementation of the more effective PMTCT interventions on the argument that government would save money when compared to doing nothing.

3.7.1 Implications for This Study

Many of the studies reviewed revealed great variation in methodological approach, sources of cost data, outcome measures used and some lacked sufficient details about the services being costed, inclusion and exclusion of costs, discount rate, the handling of overheads and sensitivity analysis. Clearly, no one study can answer all the cost-related questions in a PMTCT or HIV/AIDS program. There will always be limitations based on the context of the study, assumptions used, availability of cost and outcome data, and the methodological approach used. In addition, there are several disagreements in literature on the recommended perspective of study, costs to exclude or include, approach to valuing opportunity costs, handling of overhead costs, measurement and valuation of indirect costs, choice of outcome measures and choice of discount rate, which all lead to great variation in the costing methods used. Therefore it becomes more important that one is as transparent as possible on the decision problem, the methodological approach used and model assumptions to allow the reader to assess for themselves the relevance of the results to their own settings. This study uses the consensus in literature on defining a decision problem, describing the service, followed by identifying, measuring and valuing resources and conducting a sensitivity analysis to establish costs associated with scaling up PMTCT in Zambia

This study provides real costs from two existing pilot sites that will aid decision makers to make real trade offs between costs of scaling up and the practical constraints of scaling up. The provider's perspective was used in order to establish the direct costs that will be borne by government and donor agencies in implementing a scale up program. Although some advocate for a societal perspective, a provider's perspective will aid policy makers to better understand the budgetary and financial implications of the program. Intermediate outcomes as opposed to final outcomes are used as credible epidemiological data on the number of HIV infections prevented by PMTCT is at present lacking. The use of intermediate outcomes will also allow a comparison of the costs of the different components of the PMTCT program with other studies that have presented the results in the same way. In addition, showing the costs of a combination of activities would help planners to strategize on what combination and volume of each activity they would want to scale up to best meet agreed targets. A full costing approach was used in this study as opposed to

incremental approach. This method allows all the economic costs, both existing and new, to be taken into account including infrastructure and overheads, thus avoiding underestimating costs of displaced resources, required extra space, and administration. Average or unit costs that include both fixed and variable costs are used instead of marginal costs, which exclude fixed costs. The use of unit costs allows generalisability to national levels, when changes to infrastructure are expected as is the case in a PMTCT program. In contrast to some studies that use cost estimates from international organizations, other studies and other developing countries, this study makes use of actual data from interviews with local experts and facility staff, the central statistical office, local routine facility based information together with expenditure data from the financial administration system to increase relevance to the Zambian context.

3.7.2 Conceptual Framework

Based on literature (Wilkinson, Floyd et al. 1999; Kumaranayake, Kurowski et al. 2001; Scotland, Terjlingen et al. 2003; Kombe, Galaty et al. 2005) there are several factors that one must consider before scaling up a program. Figure 2 below depicts a framework for analyzing these factors.

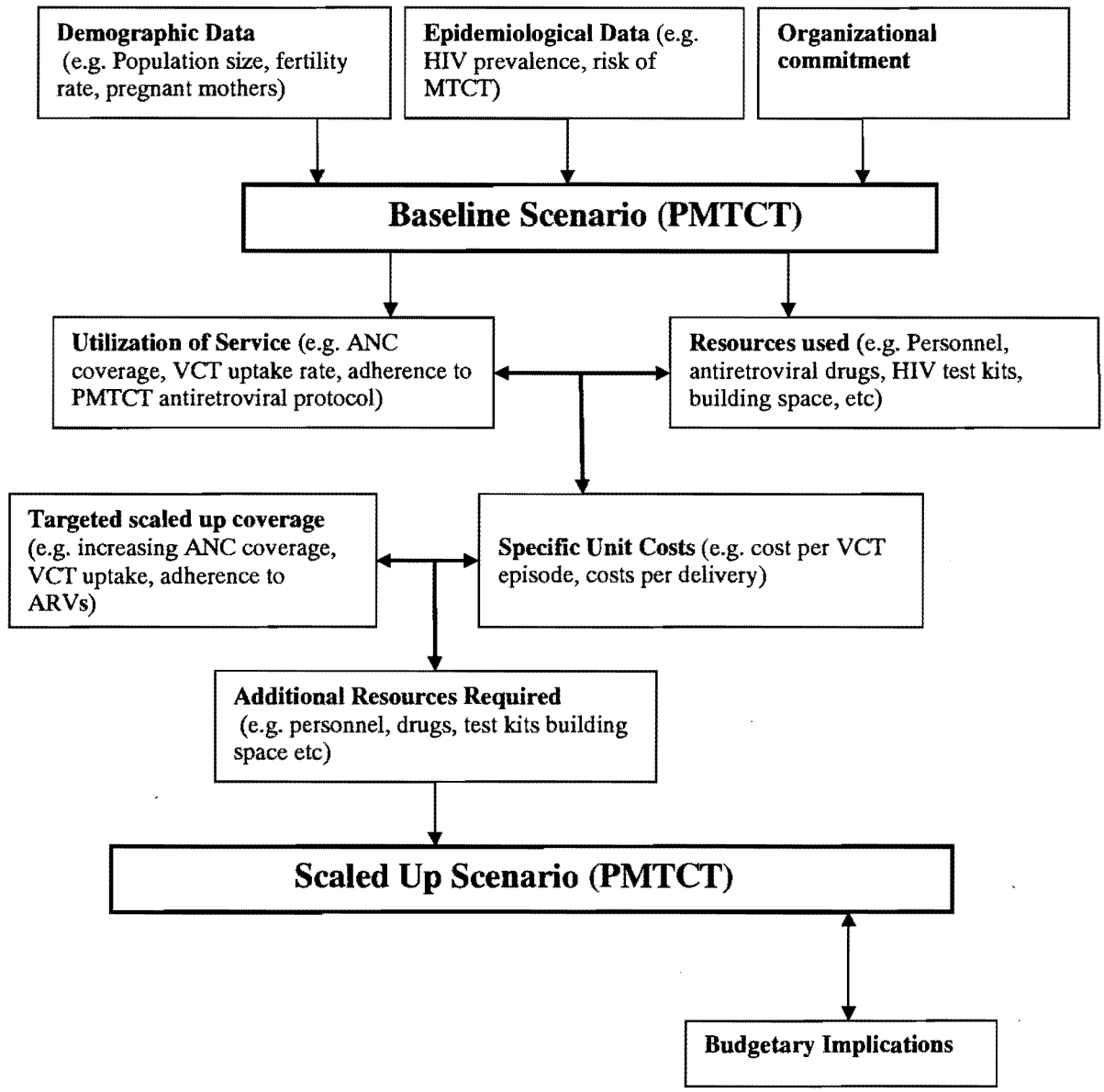


Figure 2: Conceptual framework

The conceptual framework, as illustrated in Figure 3, looks at two main scenarios; the current or baseline and the desired or scaled-up one. In the baseline scenario, the epidemiological and demographic data (see appendix III) describe the current users of the service. Current use of services and the cost of the PMTCT program will be

greatly dependent on the number of pregnant women, the overall HIV prevalence rate and the scale at which the service is offered. The resources used in the facilities essentially define the total cost on items such as staff salaries, training, drugs, test kits, infrastructure and equipment costs. By combining the utilization data for services used (pre-test counseling, delivery, testing and post-test counseling) and the total cost, the unit cost per service can be estimated. The functional scale up must go hand in hand with organizational scale up. Functional scale up implies an increase in both the number and type of activities to be performed. For example there will be an increase in the number of pregnant women accessing VCT in addition to the introduction of new antiretroviral treatment regimens for consenting HIV positive mothers. Organizational scale up implies an increase in capacity at international, national, provincial, district and community to support district expansion, interaction linkages, monitoring and evaluation, and co-ordination (Ministry of Health 2005b). In light of this, the level of commitment from the national level and health facilities must be well coordinated and focused. A focused analysis of the allocations to the health budget may provide clues to this commitment.

The scaled-up scenario embodies choices that were made by policy makers. In Zambia, the targets that were set following the UNGASS meeting of 2001 included increasing utilization of ANC services to 90% of all pregnant mothers, 70% VCT uptake by expectant mothers and 75% adherence to treatment of those found to be HIV positive by 2007 (UNAIDS 2003b). These assumptions have direct implications for the number of clients to be seen, and the resources needed to provide the service. Once the baseline information is entered the total estimates for costs and resource requirements in the scaled-up scenario can be calculated. The total costs for the scaled-up service is equal to the baseline unit cost multiplied by the number of people who are targeted to receive it in the scaled up scenario. The human resource requirements per annum can be calculated from the full time equivalent (FTE), which is derived by dividing the actual total hours that staff devote to the PMTCT service by the average number of working hours per annum for clinical staff in the public sector. Therefore, by calculating the expected gap in utilization for these services between baseline and scaled up scenarios the costs and resources needed for the scaled-up scenario can be calculated. Hence by looking at the planned allocated budget from

the Ministry of Health in 2006 and 2007, the number of mothers that can be treated each year can also be calculated. Using different assumptions for the growth of the PMTCT budget, this study illustrates the different consequences of increased population coverage. This framework helps in thinking through and conceptualizing requirements for scale up such as human resources, infrastructure, test kits, and drugs. However, the framework is not intended to measure the cost-effectiveness of alternative regimes, nor is it meant to project the AIDS epidemic. This is best done with other models.

CHAPTER 4: METHODOLOGY

4.0 Introduction

This chapter outlines the field work methodology that was used in this study. The sources and types of data collected are discussed and examined. A detailed discussion of the costing methodology is presented. The chapter also discusses the data collection and sampling techniques employed as well as the method of data analysis used. The chapter ends with a brief description of the ethical issues involved in the study.

4.1 Study Design

This was a descriptive study that used a retrospective ingredients approach in identifying, measuring, and valuing resource use in the selected pilot sites. The study focuses on resources used in the Zambian public sector in scaling up PMTCT from a provider's perspective. In order to increase relevance of the study findings a full cost analysis as opposed to an incremental approach was used to calculate the average cost per service provided (e.g. cost per mother tested) in the selected pilot sites. Full costing as opposed to an incremental approach involves calculating all relevant costs of producing a PMTCT service and therefore includes the opportunity costs of existing resources (e.g. infrastructure, staff time) that may be displaced as a result of the program. In order to gain a clear and detailed description of the PMTCT scale up process and targets, the study incorporated the use of qualitative and quantitative data from key informants in the Ministry of Health, PMTCT implementation team, site staff and the Central Board of Health. Apart from the total costs, the feasibility of scaling up is explored by examining issues such as human resource requirements and affordability within the proposed 2006-2008 MTEF expenditure estimates.

4.2 Study Sites

The study was conducted mainly in two parts as data were collected at two levels, namely at central level and at pilot site level in Zambia. The process of data collection used a combination of key informant interviews and in-depth reviews of records, documents, national statistics and unpublished literature. Data collection at central level involved baseline information on the PMTCT process including epidemiological and demographic data (see Appendix III), strategic framework and

targets for scaling up PMTCT, the 2006-2008 MTEF expenditure estimates, the number of facilities offering PMTCT, and national human resource data. This data was extracted from Ministry of Health (MoH) and Central Board of Health data bases such as Health Management Information Systems (HMIS), Financial and Administrative Management System (FAMS), and document reviews of the Health Sector Committee basket reports, Annual Health Statistical bulletin, Demographic and Health Survey reports, Local Conditions Monitoring Survey reports, Human Resources Strategic Plan, and the PMTCT strategic plan. Data collection was conducted in a collaborative fashion in which key informants assisted in collecting relevant information. The use of such a method was aimed at increasing the relevance of the results to key stakeholders.

In order to gain a deeper insight into the objectives, goals, coordination, policy, resource mobilization, and current constraints in the scale up process key informants were purposively selected for a semi-structured interview (see Appendix IV) from the Ministry of Health, PMTCT implementation team, and Central board of Health. Key informants were selected for the semi-structured interviews based on their expertise on PMTCT and availability during the data collection period. After an appointment was made with the informant, the interviews were conducted on the agreed date in an isolated environment to enable the respondent to express themselves freely without any interference. In addition this enabled the respondents to explain in detail their understanding of scaling up, objectives, goals, coordination, policy, resource mobilization, and current constraints in the scale up process. The selected key informants included seven members of the PMTCT implementation team, four from collaborating donor partners, and two from the CBoH and MoH. This was done in Lusaka, which is the capital city of Zambia where both Central Board of Health (CBoH) and Ministry of Health (MoH) are located. Hence, there was no sampling required at this stage. The second part of the study involved the costing of the PMTCT program in selected pilot sites. Unfortunately due to limited resources and time, the study could not cover a large number of facilities. Two pilot sites were selected by random stratified sampling from the sampling frame that contained the 262 available pilot sites. The sites were stratified by geographical setting i.e. rural and urban. Each site was numerated and listed according to stratum. By using a

random numbers table, one site was randomly selected from each stratum i.e. one site from a rural setting while the other was from an urban setting. This was done in order to capture possible variation in costs due to differences in geographic setting, HIV prevalence, equipment use, infrastructure, and drop out rates. There was a difference in the maturation of the PMTCT program with the urban and rural site program having been in operation since 2002 and 2003 respectively.

4.3 Costing Approach

The approach to costing the scaled up PMTCT activities is based on a standard micro-costing method at the health centre and client level, adopting a health care system (provider's) perspective. The costs borne by patients and households such as time lost from work, travel time, waiting time, user fees and transport fares are therefore not included in this analysis. The use of micro-costing assumes that the mix of inputs can be generalized to the next application in a new setting (Johns, Baltussen et al. 2003; Evans, Edejer et al. 2005). This assumption is critical in costing a scale up program, as the feasibility of the scale up program will depend on the ability to replicate the pilot program in other areas (Evans, Edejer et al. 2005). In each of the selected facilities the site manager (a doctor), the PMTCT coordinator (usually a midwife), and 3 other midwives involved in PMTCT were interviewed. The interviews with the mentioned staff provided information on the description of the PMTCT program, resources used and current constraints in running the program. Using this bottom up approach, the quantities for each item used are established, multiplied by the cost of each item, summed and then divided by the unit of outcome to calculate unit costs (e.g. cost per mother counseled, cost per mother tested, cost per mother and child pair adhering to treatment). The model used in this study assumes the scale up of PMTCT according to the HIVNET 012 protocol being implemented in the selected pilot sites. Information on the composition, activities, inputs, process and outputs of the PMTCT program was obtained through a series of staff semi-structured interviews (see Appendix IV and V) as well as in-depth reviews of facility HMIS, FAMS reports, asset registers, laboratory and pharmacy records, staff establishments, and annual district plans. The use of the semi-structured interviews held with key informants in the selected facilities was used to obtain a detailed description of the service provided, staff involved, facilities used, drug regimen and test kits used. This process helped to identify the resources that were included in the costing analysis. In addition the

description included an identification of the resources used at each stage (and comment if they were any different from what should have been used based on the national protocol), time spent on providing each service, space allocated and comments on the current constraints in providing PMTCT services.

4.4 Categorization and Allocation of Costs

Over a period spanning from December 2005 to February 2006, all the relevant recurrent and capital costs associated with the PMTCT program from January to December 2005 were collected (see Appendix VIII and IX). These costs were further classified according to those associated with pre-test counseling, testing, post-test counseling, delivery and follow up. This allows one to identify which of the processes are the essential cost drivers and allows us to compare the results with other studies that have used similar methods. The recurrent costs, which are resources that are consumed within a year of purchase, included: salaries of staff, drugs (NVP pills and suspension, cotrimoxazole syrup), HIV test kits (Determine Abbot and Genie II), transportation (travel allowances for staff, fuel costs, oil charges), maintenance costs (building, vehicles, equipment), stationary, utilities (telephone, electricity, water), and other supplies (test tubes, 5mls syringes, examination latex gloves, 21g needles, 750 ml bleach solution, methylated spirit, waste containers, biohazard bags). The capital costs, which are resources that have a useful life span of greater than one year, included: vehicles (motor bikes, 4 x 4 automobile), equipment (electric or manual centrifuge, rotator, timers, thermometers, automatic pipette, electric or kerosene refrigerator, sphygmomanometers, weighing scales, delivery kits (including draw sheets and aprons), furniture (counseling room tables, chairs, and cupboards; delivery and examination beds), non-recurrent training, and other capital costs (e.g. computers, radio, televisions and printers). In valuing resource use both available financial and economic costs were estimated in this study. The financial costs refer to the actual expenditure on goods and services used in the study while the economic costs are the opportunity costs associated with items in the program. This takes into account the costs of existing facilities and the productivity costs to staff due to displacements from previous roles to current roles in PMTCT.

Salary costs were calculated as gross (i.e. pre-tax) salary and contribution to pensions plus other benefits were taken into account. These costs were estimated from salary records kept by the hospital administrator and by interviewing relevant staff. They were confirmed by comparing these figures with official pay scales at the Ministry of Health. The productivity time of staff was calculated as the proportion of their salaries that could be accounted for by the proportion of total working hours spent providing the service. Interviews can be subjective depending on who is being interviewed and what opinion they may have. Therefore in order to verify the time spent on providing different activities, time and motion studies were conducted to directly assess time spent on pre-test counseling, testing, post-test counseling, delivery and follow up. This is a more accurate method as personnel may either underestimate or overestimate the time spent on various activities. A total of a least five observations of each service was conducted in each facility and an average time required for each service was then calculated in each of the selected facilities.

Most of the drugs, HIV testing kits and supplies that were found at the sites were either donated by partner organizations or centrally procured by the Ministry of Health. The quantity of drugs, HIV testing kits and medical supplies used was extracted retrospectively by examining pharmacy and laboratory records which were coded for the PMTCT service. The value of drugs, HIV testing kits and the other medical supplies was obtained from the Ministry of Health procurement unit using existing market prices of procured supplies. These prices included a 25% markup which was added for the costs of insurance, freight, import duties, storage and distribution. The total costs of drugs, HIV test kits and supplies were estimated by multiplying the quantity used between January and December 2005 by the relevant price for each. These costs were all (100%) allocated to the PMTCT program (see Appendix VIII and IX).

Maintenance, transport, stationary and utilities costs were obtained by retrospectively reviewing facility FAMS data for the period spanning from January to December 2005. These overhead costs were directly allocated to the PMTCT program based on an allocation factor that was worked out as a proportion of the total annual visits that were accounted for by the PMTCT program. A physical inspection of the

infrastructure used in PMTCT activity including drug storage was conducted and dimensions of the facilities were collected from building records kept by the hospital administrator. Vehicle costs were directly allocated to the PMTCT program according to the percentage of total mileage which involved PMTCT activity. Information on the actual mileage associated with PMTCT was obtained from FAMS records and the transport register of each vehicle which contains detailed information on the dates, destination, distance and a brief explanation on the reason for the trip.

Capital costs which included buildings, vehicles, equipment, furniture, non-recurrent training, computers and printers were valued based on current replacement value, and then annualized using an assumed discount rate of 3% and assumed useful life to obtain an equivalent annual cost (see Appendix VIII and IX). This method automatically incorporates both the depreciation aspect and the opportunity cost aspect of the capital costs (Brouwer, Rutten et al. 2001). The replacement values of building spaces allocated to PMTCT was estimated using the 2005 market prices of building per meter squared of space as information on the full building costs was absent. The replacement values and useful lifespan for buildings, vehicles, equipment, training, furniture and other capital costs was obtained by consulting the appropriate experts at the Central Board of Health and Ministry of Health. The equivalent annual costs were calculated assuming a useful lifespan of 20 years for buildings, 10 years for equipment, furniture and vehicles and 5 years for training, computers, televisions and radios. The costs associated with training were regarded as a capital cost as the skills accrued from training are beneficial over many years and hence cannot be burdened on the current financial year. The total training costs included the 1 week orientation costs of the district health management team (DHMT), community mobilization costs, and the in-service training costs for clinical staff and site manager. In-service training consisted of a 4 week training program that was divided into a 2 week theory session followed by a 2 week practicum on PMTCT service delivery.

All values are shown in the 2005 US Dollars using an exchange rate of ZMK[6] 3, 600 = 1 US$, which was sourced online from http://www.xe.com/ucc (xe.com, the universal currency converter) in November, 2005. The effect of a fluctuating exchange rate was examined in the sensitivity analysis. The values used in the sensitivity analysis were based on actual exchange rates from January 2004 to December, 2005 and were obtained from the central statistical office. The most recent cost data for each health facility were for the 2004/2005 financial year. As some of the cost data were for 2004 the only way of comparing the cost data for the same period was to adjust the prices to 2005 prices by using the consumer price index. In this study 2004 ZMK prices were adjusted to 2005 ZMK prices by using an inflation rate of 18.2% which was extracted online from http://www.zamstats.gov.zm ,which is the official Zambian Central Statistical office web site (Central Statistics Office 2005).

The total costs for each element of the service were calculated by first allocating each resource to each element and then summing up all the recurrent and capital costs.

Output measures were extracted from reviewing client utilization data in each facility over the same corresponding period i.e. January to December 2005. From this data, the number of pregnant women using ANC, the number of pregnant women offered VCT, number of pregnant women undergoing testing, the number of pregnant women found positive, number of HIV positive women who accept ARV treatment according to the HIVNET 012 protocol, the number of HIV positive women who adhere to the treatment and the number of mother and baby sets that adhere to follow up testing was collected.

The unit costs were then calculated by dividing the total costs of a particular element of the service with the corresponding output units. Hence the cost per mother pre-test counseled, cost per mother tested, cost per mother post-test counseled, cost per delivery (i.e. mother and baby adhering to ARV protocol) and the cost per mother and baby set that adhere to follow up testing can be calculated.

[6] Zambian Kwacha

resource use, epidemiology of the disease and need to invest in infrastructure improvements. The use of analytical methods in the measuring and valuing of resources such as the choice of discount rate and choice of exchange rate introduce a degree of uncertainty in the results. The standard practice is to handle uncertainty by conducting some form of sensitivity analysis. To test the robustness of the results a simple sensitivity analysis (one-way and multi-way) was conducted in this study. A simple sensitivity analysis is used to test the generalisability of the results and to analyze uncertainty related to analytical methods (Briggs 1995). A number of key variables such as the cost of drugs and HIV test kits, discount rate, exchange rate, antenatal population, HIV prevalence, staff time, and uptake rates were varied in plausible ranges in order to test how sensitive the model design was to these variables. The effect of distributing the input values between a low and high case country level scenario on the calculated baseline total costs of the scaled up PMTCT program was examined in the one way analysis. The effect of combining all the input values in the low and high case scenarios on the calculated baseline total costs of PMTCT was examined in the multi-way analysis. The range of plausible drug and HIV test kit costs were obtained from the Ministry of Health and were based on the 2005 quoted market prices of various suppliers of originator and generic supplies. The low case scenario was associated with cheaper generic supplies while the more expensive originator supplies were used in the high case scenario. The range of values used for examining the uncertainty around the antenatal population, HIV prevalence, exchange rate and VCT uptake rates were obtained from the central statistical office in Lusaka.

4.5.2 Human Resource Requirements

In order to calculate the human resource requirements, methods used by Kombe (2005) were adopted in this study. The human resources requirements are calculated from the full time equivalent (FTE), which is derived by dividing the total annual workforce hours required for PMTCT services by the total annual number of hours that staff devotes to providing client services. Therefore based on the expected annual utilization of services (pre-test counseling, testing, post-test counseling, delivery and follow up) and associated required time per service, the total time required annually can be calculated. Based on information obtained from the facilities, health workers have an average of 36 days annual vacation, 20 days sickness leave, 12 public holidays and 12 days for monthly mother's day. Based on 260 weekdays per year, the

average number of working days is 180. Staff work for 8 hours per day of which 6 hours are devoted to providing all client services including PMTCT while the other 2 hours are spent in meetings, workshops, recording information, and waiting time. Therefore the total annual number of hours that staff devotes to client services is assumed to be 1,080 hours. By calculating the total number of personnel required the associated training costs and required salaries were then calculated. The required staffing levels to scale up to the 2008 coverage targets are compared to the projected numbers that will be available at current attrition and entry rates in the health sector in 2008.

4.6 Data Sources and Collection Methods

The data collection period was 3 months from December 2005 to February 2006. In line with the objectives set out for this study, table 7 below outlines the specific data to be collected, method of collection and the source of the information.

Table 7: Objectives, specific data to be collected and methods used

Objective	Specific data to be collected	Method of collection and source of information
To estimate the average direct health care cost per mother attended to for VCT services, delivery, and follow up in the pilot study sites from a provider's perspective.	Number of pregnant women using ANC, VCT services, testing positive and adhering to treatment and follow up	Review of facility HMIS utilization data (January–December 2005)
	PMTCT service provided, resources used, number and type of cadre providing PMTCT service	Interview with site staff (see Appendix V), review of staff establishments
	Time dedicated to each service	Time and motion studies
	Staff salaries	Interview with site staff and review of official pay scales at the Ministry of Health
	Other service costs (recurrent and capital costs)	Interview with key staff, review of Financial Administration Management records (FAMS) (January–December 2005), expert opinion from CBoH
	Quantity of drugs , test kits and supplies used	Facility utilization data (January–December 2005), review of laboratory and pharmacy records
	Dimensions of space used for PMTCT in the facility	Physical inspection and measurements
	Training costs, duration, content, and source of funding	Interview with staff, review of FAMS records at central and facility level
To estimate the direct costs associated with scaling up PMTCT services to the required national targets from a provider's perspective.	Demographic and epidemiological data (see Appendix III)	Central statistical office website; review of Zambia Demographic Health Survey, 2001 – 2002; Health Management Information Systems (HMIS), sentinel surveillance reports, Central Board of Health and Ministry of Health data bases
	National PMTCT targets	Central Board of Health, 2003 Strategic framework for expansion of PMTCT

	Total number of facilities and the number offering VCT and PMTCT services	Central Board of Health, Health Management Information Systems (HMIS) and review of annual statistic bulletin
	Current number of counselors/midwifes	Ministry of Health, department of planning; review of the human resources strategic plan
To calculate the proportion of the national health budget that will be needed to scale up services to all 72 districts.	Projected 2006-2008 MTEF health sector budget	Ministry of Health and Central Board of Health Planning Units
To describe organizational and management of PMTCT in the study pilot sites	Qualitative data from site manager, key informants and National PMTCT coordinator on coordination of process and lessons learnt so far	Semi-structured key informant Interview (see Appendix IV and V)
To describe current human resources used and provide estimates for workforce required to scale up PMTCT services.	Time dedicated to each service	Time and motion studies
	PMTCT service provided, Number and type of cadre providing PMTCT service	Interview with site staff (see Appendix V)
	Current Number of Counselors/Midwives	Central Board of Health, Health Management Information Systems (HMIS), review of the Human Resource plan

In this study both qualitative and quantitative data were used. All quantitative data such as cost data were analyzed in Microsoft Excel® while qualitative data such as description of the PMTCT service were analyzed in Microsoft word®.

4.7 Quality Control

The methods used to increase reliability and validity (internal and external) in this study included:

- Semi-structured interview schedules were piloted on 15 people and redrafted twice before carrying out the study to ensure that the questions would be clear, simple and unambiguous to the respondents.
- During the interviews, the initial questions were followed up by probing questions to ensure that the initial information that was offered was correct.
- The interview schedules were designed deliberately to ask two or more similar questions that would yield similar answers. This was done to increase reliability of the response obtained.
- Where possible, an attempt was made to re-interview the key informants on a selected proportion of questions. Responses from the first interview and the second interview were checked for consistency to establish reliability in the responses.

- When differences or inconsistencies were found, the more accurate methods of reviewing records, documents, databases and observational techniques (time and motion studies) were used to verify the responses given in the interview.

4.8 Ethics

The collection of information relied on conducting interviews with key informants, reviewing documents, facility records, observation and did not review any patient's record nor did it involve interviewing any patients. Ethical clearance to conduct the study was granted by the Research Ethics Committee of the University of Cape Town (see Appendix VI). In addition authorization was also granted by the Zambian Ministry of Health to conduct the study. In each of the selected facilities, the purpose of the study was explained and participants were assured that any information that was offered during the study would remain anonymous and no record of the facilities or any information that would link them to the study would be made public. Therefore in this study the sites are simply referred to as urban site and rural site. Each of the key informants that was asked to participate was informed of their right to decline participation and to withdraw from the study at any given time. The proposed benefits of the study were explained to the participants and each of the participants and stakeholders was given the assurance that they would receive a copy of the final report. Informed consent was then sought from all participants by signing a consent form (see Appendix VII).

CHAPTER 5: RESULTS

5.0 Introduction

This chapter presents the findings of the study. Section 5.1 provides a brief description of the staffing levels and services provided in each of the study sites. Section 5.2 takes a detailed look at PMTCT utilization data from each of the facilities. The direct cost of providing PMTCT in each facility is presented in section 5.3. Section 5.4 shows the costs categorized by PMTCT component (i.e. pre-test counseling, testing, post-test counseling, delivery and follow up). The unit costs are estimated in section 5.5 and the costs of scaling up the PMTCT program to the proposed national targets are estimated in section 5.6. A sensitivity analysis is conducted to test the robustness costing model in section 5.6. The chapter ends by examining the human resource requirements in section 5.8.

5.1 Service Provision in the Study Sites

The urban health centre provides services to an estimated catchment population of 310,000 in a rapidly growing peri-urban area while the rural health centre provides services to a much smaller and less densely populated area with a catchment population of 121,000. PMTCT services in Zambia are provided through health centers and day hospitals as part of an Integrated Reproductive Health program which includes antenatal care, postnatal care, family planning, and training of traditional birth attendants. The centers also provide other basic curative, preventive, obstetric, nutrition and child health services. The selected health centers for this study operate for a total of 8 hours during the weekdays during which time antenatal bookings and follow up visits are made. Table 8 below provides a breakdown of staff working in the health centers. The midwives are responsible for the provision of PMTCT services in the health centers.

Table 8 : Type and number of staff working in the selected health centers

Staff Category	Urban Health Centre	Rural Health Centre
Registered Midwife	4	--
Enrolled Midwife	2	3
Registered Nurse	4	1
Enrolled Nurse	13	7
Nursing officer in charge	1	1
Medical Officer	2	1
Driver	1	2
Dental Technician	2	1
Radiographer	2	1
Clerk	5	2
Cleaner	14	8
Hospital administrator	1	1
Environmental technician	2	1

The urban facility has a total of 6 midwives of whom 4 are registered and 2 are enrolled. In comparison the rural facility has no registered midwives and 3 enrolled midwives. Registered midwives have more training and experience than enrolled midwives. Therefore, the urban facility has both a greater quantity and caliber of staff than the rural facility. An examination of the other staff groups reveals a similar staffing pattern which is skewed in favour of the urban centre.

5.2 Utilization Data for the Selected Health Facilities

Table 9 provides 2005 annual utilization data for the clinics.

Table 9: 2005 annual utilization data for the Health centers

Clinic	Total Visits	PMTCT Associated Visits* (%)
Urban	22,897	5,544 (24%)
Rural	10,821	1,599 (14%)

*Visits associated with ANC and VCT (pre-test counseling, testing, post-test counseling) were counted as one visit as they were offered as part of an integrated package, while visits associated with delivery and follow up were counted separately.

The number of visits in 2005 was 22,897 in the urban health centre and 10,821 in the rural health centre. The total number of PMTCT associated visits was 5,544, or 24% in the urban health centre and 1,599 or 14% in the rural health centre. Table 10 below shows the PMTCT associated visits in each of the health facilities over 12 months in 2005. The number of women attending the ANC in the urban facility was 3.4 times the numbers in the rural facility.

Table 10 : 2005 PMTCT Utilization Data per Health Facility

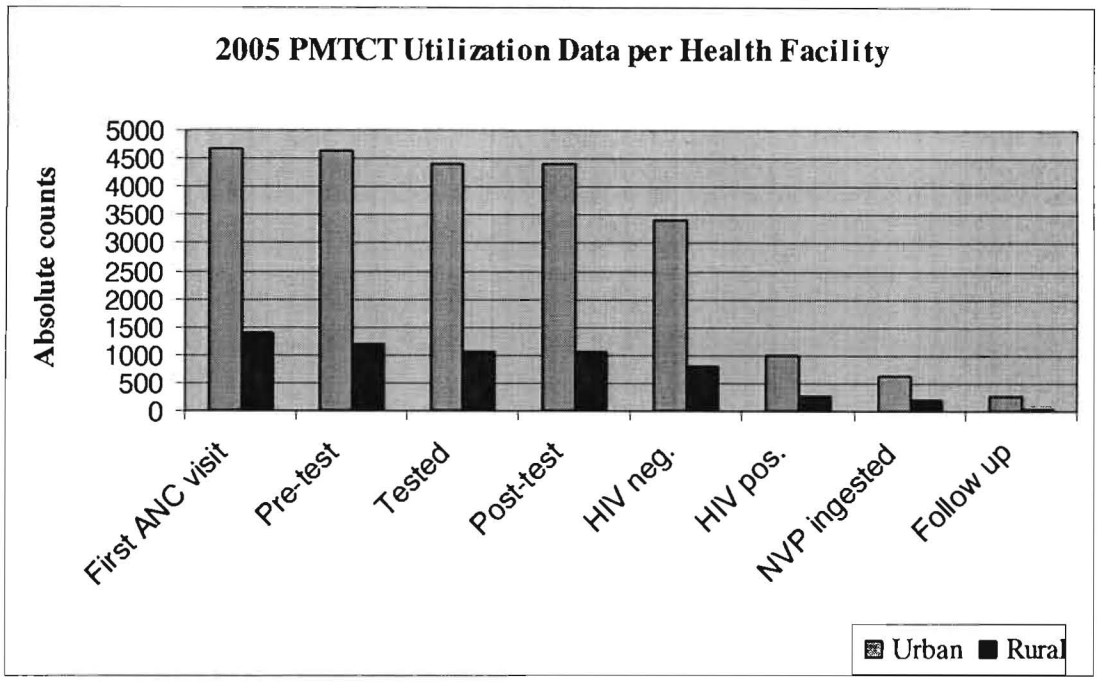
Variable	Urban Health Facility	Rural Health Facility
First Visit (ANC)	4654	1377
Pre-test Counseled	4648	1194
Tested	4417	1075
Post-test Counseled	4407	1065
HIV neg.	3412	796
HIV pos.	995	269
Women NVP (Delivery)[7]	631	199
Follow up	259	23

In the urban center the total number (i.e. 5,544) of PMTCT associated visits includes the 4,654 first ANC attendees that were also offered VCT services, 631 HIV positive women that ingested NVP under supervision during delivery and the 259 exposed babies that adhered to follow up testing. In the rural facility, the total number (i.e. 1,599) of PMTCT associated visits includes the 1,377 first ANC that were also offered VCT services during that single visit, 199 HIV positive women that ingested NVP under supervision during delivery and the 23 exposed babies that adhered to follow up testing. The average monthly first visits to the ANC worked out to approximately 388 and 115 in the urban and rural facility respectively. This difference was mainly attributed to a much larger catchment population of 310,000 for the urban facility compared to 121,000 for the rural facility. In addition the lack of a reliable transport system and more sparsely populated settlements pose extra challenges for the rural community in accessing the health facility.

Table 10 above and Figure 3 below reveals a decrease from the number of women counseled, tested, and then adhering to NVP treatment for those who tested HIV positive.

[7] Number of women that adhere to ingestion of NVP at delivery as outlined in the national protocol.

Figure 3 : 2005 PMTCT Utilization Data per Health Facility



In the urban facility, 4654 women were attended to during their first visit to the ANC and 99.9% (4648) of them were pre-test counseled. Of those that underwent pre-test counseling 95% (4417) went on to be tested. Of the 4417 women that were tested, 4407 (99.8%) agreed to receive their results in a post-test counseling session. The results also revealed that 995 of the 4417 women that were tested were found to be HIV positive, representing a prevalence of 22.5%. There is a further reduction of those that enter the PMTCT program as 15.5% (154) of the 995 women that tested positive refused to accept receiving NVP tablet. A total of 841 HIV positive women went on to enter the PMTCT program. However, 631 of the 841 HIV positive women that agreed to enter the PMTCT program went on to adhere to treatment[8] during delivery. This represents a drop out rate of 25% at this stage. The largest drop out rate was during the follow up stage where approximately 59% (372) of the 631 HIV positive women that adhered to treatment, failed to adhere to follow up testing for the baby. These results were compared with the utilization and uptake rates in the rural facility and a statistical analysis was conducted to determine if there was any significant difference between the calculated proportions at the 5% level of significance (i.e. 95% confidence interval). The results are presented in table 11 below.

[8] Adherence to treatment implies actual ingestion of the NVP tablet, as observed under the supervision of a midwife

Table 11: Uptake Rates for PMTCT in Health Facilities

Uptake Indicator	Urban Health facility	Rural Health facility	Test Statistic (Z) and P-value
Women Counseled as % of new ANC Attendees	99.87%	86.71%	Z= 24.62, P< 0.0001
Women Tested as % of those Counseled	95.03%	90.03%	Z= 6.49, P<0.0001
Women tested as % of New ANC attendees	99.77%	78.07%	Z=31.90, P<0.0001
Received Results as % of those Tested	99.77%	99.07%	Z= 3.40, P<0.001
HIV Prevalence	22.53%	25.02%	Z= -1.74, P=0.082
% of HIV pos. Mothers accepting NVP	84.52%	85.13%	Z= -0.246, P=0.81
% of those accepting NVP, adhering to treatment during delivery	75.04	86.90%	Z= -3.816, P<0.0001
% of those adhering to treatment, who adhere to follow up testing	41.05%	11.56%	Z=7.658, P<0.0001

Although the rural facility had less than a third of the urban facility ANC visits, the proportion of new ANC attendees that were pre-test counseled (86.71%), the proportion of those pre-test counseled that went on to be tested (90.03%), the proportion of new ANC attendees that were tested (78.07%), and the proportion of those tested that agreed to receive their results (99.07%) were all significantly less than the corresponding proportions in the urban facility (P<0.001). These differences in the two facilities relate to greater capacity to deliver counseling services, a higher acceptability of VCT services by ANC attendees, and an extra one year maturation period of the PMTCT program in the urban facility relative to the rural facility. There was no significant difference in the HIV prevalence of 22.5% and 25.02% among women tested in the urban and rural facilities respectively (P>0.05), although in the rural facility, it is possible that those who were worried about their HIV-status might have been more likely to be tested. Furthermore, there was no significant difference in the proportion of HIV positive mothers that accepted to enter the PMTCT program in the two facilities (p>0.05), however there was a significantly greater proportion of women in the program that dropped out in the urban facility (25%) when compared to the rural facility (13.1%). The majority of these women are provided the NVP tablet before giving birth and are then instructed to return to the facility for delivery. However women who may have been recruited in the PMTCT program in one facility may deliver either at home or in another facility and are consequently recorded as drop outs should they fail to return to the recruiting facility. The difference in drop out between rural and urban facilities may be attributed to the fact that clients in urban areas have access to a number of facilities for delivery and are not as restricted in the

choice of facility as compared to clients in rural areas. Nonetheless, the exact causes of drop-outs among such women merit further research. In the rural facility, 88% of those that adhered to treatment during delivery, failed to comply with follow up testing. Even though this was significantly greater than the corresponding 59% ($p<0.0001$) drop out recorded in the urban facility, the challenges faced in following up clients are similar in the two facilities. Some of these challenges include:

- The facilities are woefully understaffed such that at any one time, there are no more than two PMTCT competent nurses on duty.
- Follow up is conducted as an outreach activity by the PMTCT nursing staff in the catchment population. The nurses usually have no transport and they have to walk limiting the distance they are able to cover. This problem is even more acute in the rural area owing to more sparsely populated settlements when compared to the urban setting. To try and avoid this, they try to combine PMTCT follow up activities with outreach activities such as immunization. However, such trips are limited, infrequent, and haphazard making it hard for the PMTCT staff to synchronize their clinical schedules with outreach activities.
- Some patients deliberately give wrong address to avoid being followed up, thus reducing the number who can be followed.
- Other patients change residence and are untraceable thereafter.
- Even after being identified positively, some patients deny ever having been tested for HIV. Often these are patients who had not informed their partners or members of the family.
- The program continues to rely on ELISA test kits that require at least 18 months before a HIV-exposed baby's serosatus can be conclusively determined. Such a long lag time between birth and definitive testing increases the chances of clients being lost to follow up.

It is primarily for these reasons that credible evidence on the actual numbers of averted infections is currently missing in Zambia.

5.3 Costing of PMTCT services in the Health Facilities

Table 12 below presents the direct costs and cost profile of providing PMTCT services in each of selected study sites over 12 months in 2005. All costs are presented in 2005 US$ and are further categorized by input type.

5.3.1 Costs of PMTCT Services in the Rural Facility

The total direct cost in the rural facility amounted to US$28,797.95 of which recurrent and capital costs account for 80.14% and 19.86% respectively. As illustrated in figure 4 below the major cost drivers were personnel costs followed by medical supplies. Approximately 23% of the total costs were attributed to personnel costs while medical supplies accounted for 22 % of the total costs. Personnel and medical supplies costs accounted for 29% and 28% of the variable costs. Medical supplies costs were further sub-divided into costs associated with testing supplies, follow up supplies and delivery supplies.

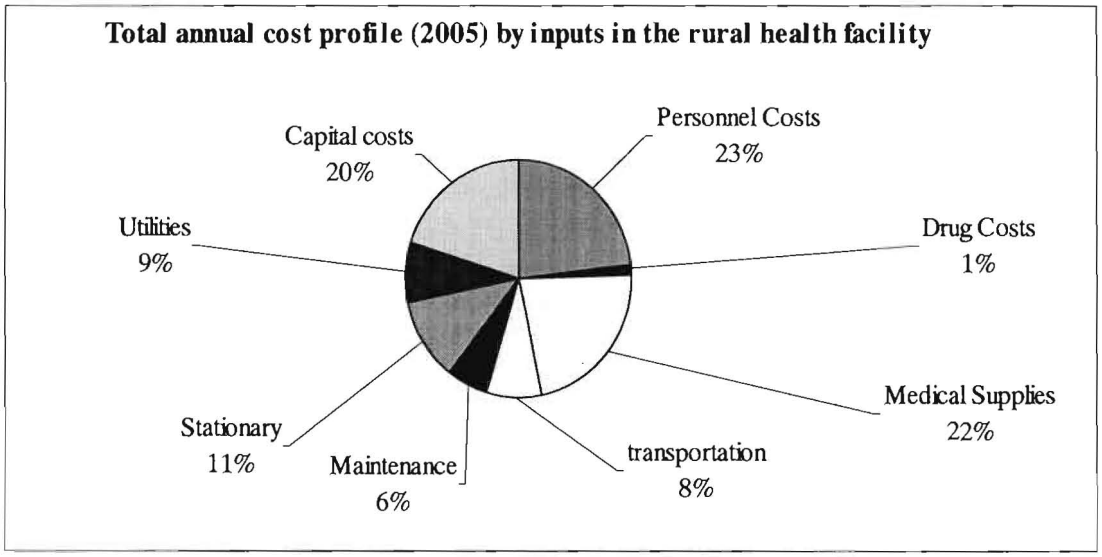
Table 12: Direct costs of PMTCT services categorized by Input Type

Input Type		Rural Health facility		Urban Health Facility	
		Total Costs US$ (2005)	Cost Profile %	Total Costs US$ (2005)	Cost Profile %
Recurrent costs					
Personnel costs		6,640.45	23.06%	19,619.63	31.84%
Drug Costs		395.97	1.38%	4,004.87	6.50%
Medical supplies	Testing Supplies	5,591.44	19.42%	17,887.63	29.03%
	Delivery Supplies	791.01	2.75%	1,947.09	3.16%
	Follow up Supplies	54.02	0.19%	305.07	0.50%
Transportation		2,275.11	7.90%	1,821.44	2.96%
Maintenance		1,688.04	5.86%	1,517.86	2.46%
Stationary		3,185.16	11.06%	3,278.59	5.32%
Utilities		2,457.12	8.53%	3,849.30	6.25%
Total Recurrent Costs		*23,078.32*	*80.14%*	*54,231.50*	*88.01%*
Capital Costs					
Building Costs		998.76	3.47%	1,144.25	1.86%
Vehicle costs		944.36	3.28%	976.92	1.59%
Equipment		795.69	2.76%	772.89	1.25%
Furniture costs		990.27	3.44%	871.25	1.41%
Training Costs		1,650.88	5.73%	2,694.80	4.37%
Other Capital costs		339.66	1.18%	928.01	1.51%
Total Capital Costs		*5,719.62*	*19.86%*	*7,388.12*	*11.99%*
Grand Total		***28,797.95***	***100.00%***	***61,619.61***	***100.00%***

Testing supply costs, which include the costs of HIV testing kits, examination gloves, syringes, needles and test tubes, accounted for 87% of medical supply costs and 19%

of the total costs. Medical supplies used during delivery and follow up account for the remaining 13% of medical costs and 3% of the total costs. Drug costs accounted for less than 2% of the total costs. The largest proportion of capital costs, i.e. 29% and 17%, were attributed to training and building costs respectively.

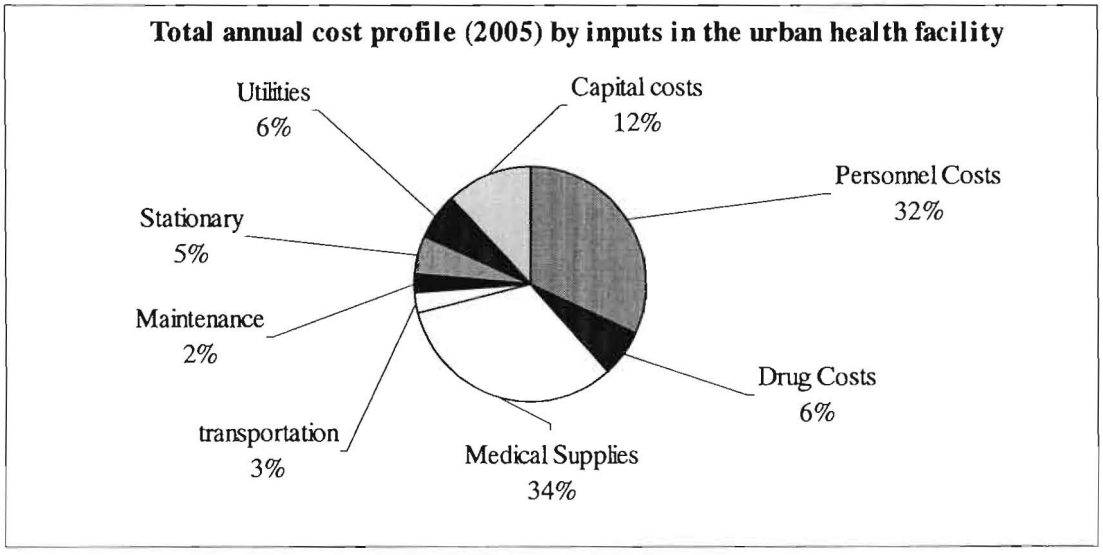
Figure 4: Cost profile in the Rural Health Facility



5.3.2 Costs of PMTCT Services in the Urban Facility

In the urban facility, the PMTCT program cost a total of US$ 61,619.61 of which recurrent and capital costs account for approximately 88% and 12% of the total direct costs respectively. Similar to the cost profile in the rural facility, the major cost drivers were costs associated with personnel and medical supplies which accounted for approximately 32% and 34% of the total costs respectively. Personnel and medical supplies contributed 37% and 36% of the recurrent costs.

Figure 5 : Cost profile in the Urban Facility



The majority of the medical supply costs were due to testing supplies that accounted for 89% of the total medical supplies and 29% of the total costs. Drug costs accounted for 6.5% of the total costs.

In both facilities the high personnel costs are as a result of the staff time used to provide VCT services while the high testing costs relate to the high costs of the HIV screening (US$1.38 per test) and confirmation (US$ 3.69 per test) test kits as well as the high proportion of pre-test counseled women that went on to be tested (> 90% in both facilities). The low drug costs are mainly related to the low cost of the nevirapine tablet (US$ 0.24) and suspension (0.03 per ml) as well as the small number of eligible women that made it through all the steps and received NVP treatment.

The differences in the costing results in the two facilities relate to the differences in utilization patterns of the two facilities. The costs associated with personnel, medical supplies, and drugs are all much higher in the urban facility because there were a greater number of women that underwent VCT, delivery and follow up in the urban facility. Hence the quantity of staff time spent on PMTCT, and the amount of medical supplies and drugs used in the urban facility was greater than that of the rural facility.

5.4 Costs Categorized By PMTCT Component in the Health Facilities

Table 13 below presents the costs of the PMTCT program after they were allocated to the PMTCT program components (i.e. pre-test counseling, testing, post-test counseling, delivery and follow up).

Table 13: PMTCT element costs

PMTCT Element	Urban Facility	% of Total Costs	Rural facility	% of Total Costs
Pre-test Counseling	12,239.26	19.86%	6,593.82	22.90%
Testing	28,961.74	47.00%	11,853.17	41.16%
Post-test counseling	10,520.96	17.07%	5,738.98	19.93%
Delivery	5,282.24	8.57%	4,092.79	14.21%
Follow up	4,615.42	7.49%	519.18	1.80%
Grand Total(US$)	***61,619.62***	*100.00%*	***28,797.94***	*100.00%*

VCT costs (i.e. pre-test counseling, testing, and post-test counseling) constitute approximately 84% of the total costs in both facilities. In both facilities the costs associated with testing were the major cost driver accounting for 47% and 41% of the PMTCT costs in the urban and rural facility respectively. The costs associated with follow up were the least in both facilities accounting for 7% and 2 % in the urban and

rural health facility respectively. When the PMTCT element costs were broken down to the input costs, varying cost profiles emerged.

Table 14: PMTCT element costs by input type in the Rural Health facility

Input type	Pre-test Counseling costs (US$2005)	%	Testing costs (US$2005)	%	Post-test Counseling costs (US$2005)	%	Delivery Costs (US$2005)	%	Follow up Costs (US$2005)	%
Recurrent cost										
Personnel cost	**2,206.35**	**33.46**	1,614.34	13.62	**1,825.54**	**31.81**	**949.96**	**23.21**	44.27	8.53
Drug costs	N/A	N/A	N/A	N/A	N/A	N/A	59.60	1.46	**336.38**	**64.79**
Medical Supplies	N/A	N/A	**5,591.44**	**47.17**	N/A	N/A	791.01	19.33	54.02	10.40
Transportation	687.02	10.42	618.55	5.22	612.80	10.68	343.51	8.39	13.23	2.55
Maintenance	509.74	7.73	458.94	3.87	454.67	4.07	254.87	6.23	9.82	1.89
Stationary	961.83	14.59	865.97	7.31	857.91	14.95	480.92	11.75	18.53	3.57
Utilities	741.98	11.25	668.03	5.64	661.82	11.53	370.99	9.06	14.29	2.75
Sub-Total	*5,106.93*	*77.45*	*9,817.28*	*82.82*	*4,412.74*	*76.89*	*3,250.85*	*79.43*	*490.54*	*94.48*
Capital Costs										
Building costs	301.60	4.57	271.54	2.29	269.01	4.69	150.80	3.68	5.81	1.12
Vehicle costs	285.17	4.32	256.75	2.17	254.36	4.43	142.58	3.48	5.49	1.06
Equipment	N/A	N/A	697.20	2.33	N/A	N/A	98.49	2.41	N/A	N/A
Furniture	299.04	4.54	269.23	2.27	266.73	4.65	149.52	3.65	5.76	1.11
Training	498.52	7.56	448.84	3.79	444.66	7.75	249.26	6.09	9.60	1.85
Other capital	102.57	1.56	92.35	0.78	91.49	1.59	51.28	1.25	1.98	0.38
Sub-total	*1,486.89*	*22.55*	*2,035.89*	*17.18*	*1,326.24*	*23.11*	*841.94*	*20.57*	*28.64*	*5.52*
Grand Total	***6,593.82***	***100***	***11,853.17***	***100***	***5,738.98***	***100***	***4,092.79***	***100***	***519.18***	***100***

In the rural facility as shown above in table 14, personnel costs were the major input costs in the pre-test and post-test counseling and delivery components accounting for 33%, 32% and 23% of the costs respectively. The largest input cost in the testing component was the testing supplies accounting for 47% of the testing costs. Drug costs (i.e. cotrimoxazole), which were the major cost driver in the follow up element, constituted 65% of the follow up costs. In all the PMTCT elements recurrent costs constituted more than 76% of the costs. Amongst the capital costs, training and building costs form the major input costs in all the PMTCT components.

In the urban facility as shown in table 15 below, personnel costs were the major cost driver in the pre-test and post-test counseling components accounting for 58% and 54% of the costs. Medical supplies (i.e. testing and delivery) formed the largest input costs in the testing and delivery elements. Medical supplies accounted for 62% of the testing component and 37% of the delivery component costs. Drug costs (i.e.

cotrimoxazole) constitute the largest component, approximately 82% of the follow up element costs in the urban facility.

Table 15: PMTCT element costs by input type in the Urban Health facility

Input type	Pre-test Counseling costs (US$2005)	%	Testing costs (US$2005)	%	Post-test Counseling costs (US$2005)	%	Delivery Costs (US$2005)	%	Follow up Costs (US$2005)	%
Recurrent cost										
Personnel cost	**7,157.39**	**58.48**	5,570.40	19.23	**5,702.59**	**54.20**	949.96	17.98	239.30	5.18
Drug costs	N/A	N/A	N/A	N/A	N/A	N/A	216.99	4.11	**3,787.88**	**82.07**
Medical Supplies	N/A	N/A	**17,887.63**	**61.76**	N/A	N/A	**1,947.09**	**36.86**	305.07	6.61
Transportation	541.86	4.43	514.93	1.78	513.77	10.68	220.68	4.18	30.19	0.65
Maintenance	451.55	3.69	429.11	1.48	428.14	4.07	183.90	3.48	25.16	0.55
Stationary	975.35	7.97	926.88	3.20	924.78	8.79	397.23	7.52	54.35	1.18
Utilities	1,145.13	9.36	1,088.22	3.76	1,085.76	10.32	466.38	8.83	63.81	1.38
Sub-Total	*10,271.29*	*83.92*	*26,417.17*	*91.21*	*8,655.03*	*82.26*	*4,382.25*	*82.96*	*4,505.76*	*97.62*
Capital Costs										
Building cost	340.40	2.78	323.49	1.12	322.75	3.07	138.64	2.62	18.97	0.41
Vehicle costs	290.63	2.37	276.18	0.95	275.56	2.62	118.36	2.24	16.19	0.35
Equipment	N/A	N/A	674.40	2.33	N/A	N/A	98.49	1.86	N/A	N/A
Furniture	259.19	2.12	246.31	0.85	245.75	2.34	105.56	2.00	14.44	0.31
Training	801.68	6.55	761.84	2.63	760.11	7.22	326.50	6.18	44.67	0.97
Other capital	276.07	2.26	262.35	0.91	261.76	2.49	112.44	2.13	15.38	0.33
Sub-total	*1,967.97*	*16.08*	*2,544.57*	*8.79*	*1,865.93*	*17.74*	*899.99*	*17.04*	*109.66*	*2.38*
Grand Total	***12,239.26***	***100***	***28,961.74***	***100***	***10,520.96***	***100***	***5,282.24***	***100***	***4,615.42***	***100***

5.5 Unit costs of PMTCT service components

The unit costs associated with the different PMTCT service elements are presented below in table 16.

Table 16: PMTCT service Unit costs

		Pre-Test Counseling	Testing	Post-Test Counseling	Delivery	Follow Up
Urban Health Facility	Total Costs (2005 US$)	12,239.26	28,961.74	10,520.96	5,282.24	4,615.42
	Outcome	4648	4417	4407	631	259
	Unit costs	***2.63***	***6.56***	***2.39***	***8.37***	***17.82***
Rural Health Facility	Total Costs (2005 US$)	6,593.82	11,853.17	5,738.98	4,092.79	519.18
	Outcome	1194	1075	1065	199	23
	Unit costs	***5.52***	***11.03***	***5.39***	***20.57***	***22.57***

The calculated unit costs were; US$2.63 per mother pre-test counseled, US$ 6.56 per mother tested, US$2.39 per mother post-test counseled, US$ 8.37 per mother and

baby set adhering to NVP treatment during delivery, and US$ 17.82 per mother and baby set adhering to follow up testing in the urban facility. In the rural facility the calculated unit costs were; US$5.52 per mother pre-test counseled, US$11.03 per mother tested, US$5.39 per mother post-test counseled, US$ 20.57 per mother and baby set adhering to NVP treatment during delivery, and US$ 22.57 per mother and baby set adhering to follow up testing. The calculated cost per mother attended to for VCT (i.e. pre-test counseling, testing and post-test counseling) was US$11.58 and US$21.94 in the urban and rural facility respectively. Table 17 below shows the unit costs of each of the activities broken down into input type (personnel, supplies, drugs etc) to get an idea of what exactly drove the differences in unit costs between the two facilities. The major cost drivers under each activity are in bold type.

Table 17 : Unit costs disaggregated by Input type for each health facility

Input type	**Pre-Test Counseling unit cost (US$)**		**Testing unit cost (US$)**		**Post-Test Counseling unit cost (US$)**		**Delivery unit cost (US$)**		**Follow Up unit cost (US$)**	
	urban	rural	urban	rural	urban	rural	urban	rural	urban	rural
Recurrent cost										
Personnel cost	***1.54***	***1.85***	1.26	1.50	***1.29***	***1.71***	***1.51***	***4.77***	0.92	1.92
Drug costs	--	--	---	---	--	--	0.34	0.30	***14.63***	***14.63***
Medical Supplies	---	---	***4.05***	***5.20***	--	--	***3.09***	***3.97***	1.18	2.35
Transportation	0.12	0.58	0.12	0.58	0.12	0.58	0.35	1.73	0.12	0.58
Maintenance	0.10	0.43	0.10	0.43	0.10	0.43	0.29	1.28	0.10	0.43
Stationary	0.21	0.81	0.21	0.81	0.21	0.81	0.63	2.42	0.21	0.81
Utilities	0.25	0.62	0.25	0.62	0.25	0.62	0.74	1.86	0.25	0.62
Sub-Total	*2.21*	*4.28*	*5.98*	*9.13*	*1.96*	*4.14*	*6.94*	*16.34*	*17.40*	*21.33*
Capital Costs										
Building cost	0.07	0.25	0.07	0.25	0.07	0.25	0.22	0.76	0.07	0.25
Vehicle costs	0.06	0.24	0.06	0.24	0.06	0.24	0.19	0.72	0.06	0.24
Equipment	--		0.15	0.65	--		0.16	0.49	---	--
Furniture	0.06	0.25	0.06	0.25	0.06	0.25	0.17	0.75	0.06	0.25
Training	0.17	0.42	0.17	0.42	0.17	0.42	0.52	1.25	0.17	0.42
Other capital	0.06	0.09	0.06	0.09	0.06	0.09	0.18	0.26	0.06	0.09
Sub-total	*0.42*	*1.25*	*0.58*	*1.89*	*0.42*	*1.25*	*1.43*	*4.23*	*0.42*	*1.25*
Grand Total	**2.63**	**5.52**	**6.56**	**11.03**	**2.39**	**5.39**	**8.37**	**20.57**	**17.82**	**22.57**

The calculated unit costs in the rural facility are higher than those in the urban facility as the PMTCT service in the rural area proportionately covers fewer women. The higher unit costs in the rural area also give some indication of the diseconomies of scale as the program is scaled up to rural areas. Therefore in order to lessen a possible

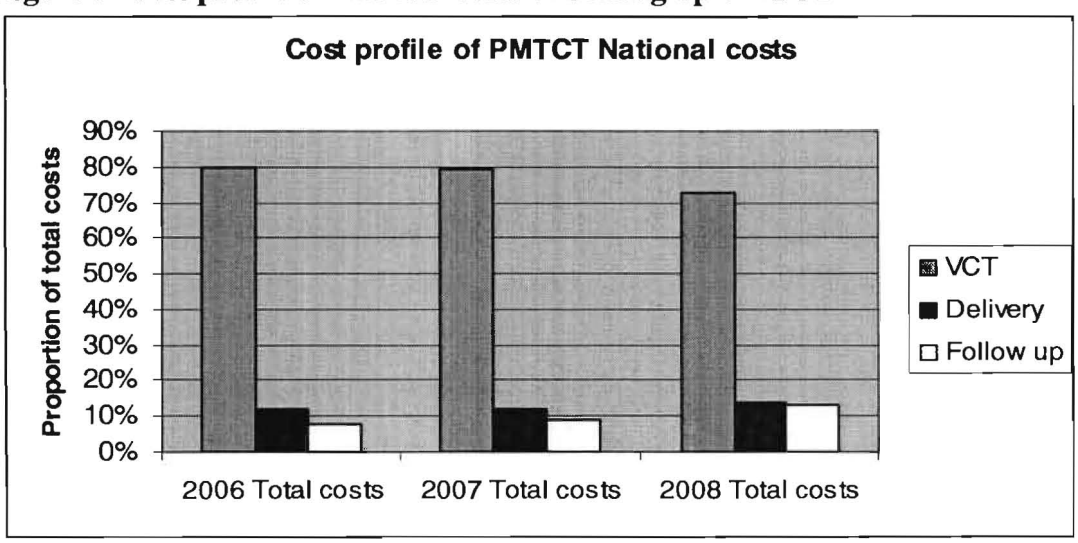
constant unit cost in calculating the costs of scaling up, the higher rural unit costs have been used in this study. The total direct cost of scaling up the program in 2006, 2007 and 2008 are presented in table 19 below. The total direct costs of the PMTCT program in each year are also discounted and presented in US$ 2005 net present value (NPV)

Table 19 : Costs of Scaling up to the proposed national targets

	Unit costs (US$)	2006 total costs (US$)	% of total costs	2007 total costs(US$)	% of total costs	2008 total costs(US$)	% of total costs
VCT	21.94	4,681,438.78	**80%**	7,022,158.17	**79%**	8,192,517.87	**73%**
Delivery	20.57	729,663.67	**12%**	1,042,376.67	**12%**	1,563,565.01	**14%**
Follow up	22.57	440,462.38	**8%**	800,840.69	**9%**	1,458,674.11	**13%**
Grand total		*5,851,564.83*		*8,865,375.53*		*11,214,756.99*	
NPV(2005)		***5,681,130.90***		***8,356,466.71***		***10,263,091.32***	

The average direct national program costs in 2005 US$ for the PMTCT intervention are US$ 5.68 million in 2006, US$ 8.36 million in 2007, and US$ 10.26 million in 2008. The total costs of scaling up over the three year period (2006-2008) are US$ 24.3 million. The average direct costs of the program increase as the program is scaled up to the 2008 scenario. The major cost driver of the PMTCT program is the VCT component that constitutes over 70% of the program costs in each year (figure 6).

Figure 6: Cost profile of National costs of Scaling up PMTCT



As the numbers of HIV positive women and baby sets that enter the program and adhere to follow up reach the proposed 2008 targets, the proportion of the total costs accounted for by the delivery and follow up components increases from 12% and 8%

to 14% and 13% respectively. While the proportion of the national costs accounted for by the VCT component decreases from 80% in 2006 to 73% in 2008.

In order to assess the feasibility of reaching the proposed national targets, the projected PMTCT costs were compared with the projected 2006-2008 MTEF health budgets and the estimated allocations for the national reproductive health program. Table 20 below outlines the findings of this comparison. The scaling up of PMCT was budgeted for as part of an integrated reproductive health program budget that also includes the costs of program management, integrated management of childhood illness (IMCI), vaccinations and drugs, the safe motherhood program and community mobilization. The results show that there would be budgetary constraints if the scale up program met the proposed national targets.

Table 20: Comparison with projected 2006-2008 MTEF and Reproductive Health Budget

	Estimated PMTCT Costs(US$) [1]	Total Health Budget(US$) [2]	% of Total Health Budget [1]/[2]	Budget for Reproductive Health(US$) [4]	Variance [4]-[1]
2006 estimates	5,851,564.83	139,833,650.51	4.18%	4,414,682.68	-1,436,882.15
2007 estimates	8,356,466.71	174,445,687.18	4.79%	6,705,216.44	-1,651,250.27
2008 estimates	10,263,091.32	204,765,920.33	5.01%	8,297,047.78	-1,966,043.54

As a proportion of the projected total health budget, the estimated national PMTCT program cost would require approximately 4.18 % in 2006, 4.79% in 2007 and 5.01% in 2008 to meet the proposed scaling up targets. However, the results also show that even if the entire allocation for the reproductive health program was used for the PMTCT program there would be still be a deficit of US$1.44 million in 2006, US$1.65 million in 2007 and US$1.97 million in 2008 in the required PMTCT costs to meet the proposed targets. The total deficit would amount to approximately US$5.06 million over the three year period (2006-2008). The actual deficits in the PMTCT program are likely to be much larger as a proportion of the reproductive health budget is used for other programs like immunization, IMCI, and the safe motherhood program. The discrepancy points to the need to revise the proposed patient targets or revise the allocated reproductive health budget if it becomes evident that the targets are being meet. Clearly there is an urgent need for government to

identify and allocate additional resources to the PMTCT program. It is also evident that at least an additional US$5.06 million would need to be allocated to the reproductive health budget to meet the 2006-2008 proposed PMTCT package.

5.7 Sensitivity Analysis

In order to test the robustness of the costing results of the scaled up PMTCT program, a one-way and multi-way sensitivity analysis was conducted. The variables used in the sensitivity analysis were based on identified cost drivers, uncertainty around key input variables and assumptions used in the costing model. In the simple one-way sensitivity analysis the selected variables are varied one by one between a low case and high case scenario to determine the impact on the projected average national PMTCT costs of the 2008 scaled up scenario. In the multi-way sensitivity analysis, the effect of combining all the selected variables in the low case and high case scenario on the projected average 2008 national PMTCT costs was examined. Although it may seem unrealistic to combine the variables in this way, it provides an indication of the plausible range of program costs that would be incurred by the government in the scaled up scenario. The base-case value of each selected variable, the range of values examined and the impact on the projected average 2008 PMTCT national costs in the one-way sensitivity analysis are displayed in table 21 below. The low and high case scenario values used in the staff time variables were obtained directly from actual observation of activities in the pilot facilities. The proportion of time spent on PMTCT was established by timing a total of 50 clinical consultations. The low and high case values used in the uptake rates and other key variables are based on actual country level parameters obtained from the Central Board of Health (CBoH) and the Central Statistical Office (CSO). The last major column is the most informative as it shows the percentage change from the 2008 PMTCT costs in the low and high case scenario of each variable.

Table 21 : Sensitivity Analysis (one-way)

Scenario	Baseline case	% Change from Baseline for Low case	% Change from Baseline for High case	% Change from 2008 Total projected Costs For PMTCT (US$10,263,091.32)	
				Low Case	High Case
A) Staff time					
Pre-test Counseling time (mins)	24	-17% (20)	67% (40)	**-1.03%**	**4.10%**
Post-test Counseling time HIV +ve (mins)	26	-23% (20)	131% (60)	-0.39%	2.20%
Post-test Counseling time HIV -ve (mins)	21	-5% (20)	90% (40)	**-0.19%**	**7.47%**
Delivery time (mins)	62	-52% (30)	29% (80)	-1.67%	0.94%
Follow up time (mins)	25	-60% (10)	60% (40)	-0.67%	0.67%
B) Other Key Variables					
Antenatal HIV Prevalence	19%	-13% (6%)	13% (32%)	**-18.44%**	**18.86%**
Exchange Rate To US$	3600	39% (5000)	-19% (2900)	**-28.00%**	**24.14%**
Discount Rate	3%	7% (10%)	-3 (0%)	**-12.10%**	**9.27%**
Antenatal population	550,000	-18% (450,000)	5% (580,000)	**-18.18%**	**5.45%**
Costs of Determine Test Kit (ZMK)	4,200	-6% (3960)	63% (6840)	-0.26%	2.89%
Costs of Genie II Test Kit (ZMK)	11,250	-23% (8640)	28% (14400)	-0.71%	0.86%
Costs of ELISA Test (ZMK)	1,620	-30% (1,134)	60% (2592)	-0.18%	0.37%
Nevirapine cost per 200mg tablet (Mother)(US$)	0.244	-49% (0.125)	207% (0.75)	-0.09%	0.39%
Nevirapine Syrup(Baby) cost per ml (US$)	0.031	-40% (0.0188)	202% (0.094)	-0.01%	0.03%
Cotrimoxazole Syrup cost per ml (US$)	0.006	-38%(0.0038)	120%(0.0132)	**-3.37%**	**9.37%**
Building costs per M^2 (ZMK)	2106000	-36%(1350000)	23%(2,600,00)	-1.14%	0.75%
Training costs per person (ZMK)	3,121,500	-7% (2,900,000)	15%(3600000)	-0.17	0.37%

The results of the sensitivity analysis show that the costing model is moderately robust with changes in many of the variables causing small percentage changes in the projected 2008 baseline PMTCT costs of US$10,263,091.32. The PMCT costs were fairly robust to variations in the costs of HIV testing kits, building space used, and training costs. The model was also insensitive to using either the more expensive originator drugs or cheaper generic versions. For instance increasing the cost per 200mg nevirapine tablet by 207% would only increase the direct program costs by 0.39% and increasing the cost of the nevirapine syrup by 202% would only result in a 0.03% increase in the program costs. However the model seemed moderately sensitive to the cost of cotrimoxazole, which relates mostly to the quantity that is taken by all HIV-exposed babies in the 18 month follow up period while waiting to determine their serostatus.

Among the other key variables the model was most sensitive to variations in the antenatal HIV prevalence, exchange rate, choice of discount rate and the national antenatal population. The impact of the variation in the antenatal HIV prevalence is associated with the numbers of HIV positive women that proceed to further confirmatory testing, NVP therapy and follow up testing for their babies. Scaling up the program in a scenario where the HIV prevalence increases by 13% results in a 19% increase in total costs while a reduction of 13% in HIV prevalence leads to a corresponding 18% reduction in the total costs. This finding augments the need to intensify primary prevention programs of HIV as outlined in the internationally accepted four pronged approach to PMTCT.

Holding all other things constant, a 19% appreciation in the Zambian Kwacha against the US Dollar would lead to a 24% increase in the amount of US dollars needed to locally fund the PMTCT program, while 39% depreciation would lead to a 28% reduction in the US dollar amounts required. Given that the health budget receives a substantial amount of donor funding in US dollars, volatility in the exchange rate would make long term planning and budgeting for PMTCT scale up more difficult and less predictable.

The use of a higher discount rate (i.e. 10%) places a lower value on future costs than using 3% and therefore, when the costs are discounted to net present value (NPV), a higher discount rate leads to a lower net present value. Using a lower discount rate (e.g. 0%) leads to a higher net present value. A 3% discount rate has been used in this study to ensure that the results are comparable with studies conducted in other developing countries.

The model was moderately sensitive to variations in use of staff time used for pre-test counseling and post-test counseling given for a HIV negative result and less sensitive for a HIV positive result. Using this staff time less efficiently (i.e. high case) leads to increase in the total costs of the program. This underscores the necessity to include time management techniques in the VCT training curriculum to ensure that staff understand the implications of using staff time inefficiently. Time management also

poses an important managerial challenge for supervisors of the program in the clinical settings.

Due to the paucity of data on adjusted unit costs for different levels of program coverage, a multi-way analysis has been conducted to determine the plausible range of costs for the 2008 scaled up scenario. The results of the multi-way sensitivity analysis are shown in table 22 below.

Table 22 : Sensitivity Analysis (Multi-way)

Scenario	2008 Total Baseline Costs(US$)	Total Costs Under Scenario(US$)	% Change from Baseline Scenario
Combination of All Low case Scenarios (3% discount Rate)	10,263,091.32	8,326,099.77	**-18.87%**
Combination of All High case Scenarios (3% discount rate)	10,263,091.32	12,370,068.34	**20.53%**

The average national PMTCT costs are estimated to be US$8.33 million when all inputs are combined in the low case scenario and US$12.37 million when all inputs are combined in the high case scenario.

5.8 Human Resource Requirements

Many studies have identified PMTCT as a cost-effective intervention, but few have estimated the human resources required to provide the services to reach scale up targets. Human resources, in adequate numbers and skills, have now been identified as one of the prerequisites for a well functioning health system that is capable of responding to the challenges imposed on it by a growing HIV crisis. Hence an estimation of human resource requirements for the scale up of the Zambian PMTCT program was calculated in this study. The number of full time equivalent (FTE) staff required to provide the PMTCT services is based on the observed time required to complete each program element and the projected utilization of services in the 2008 scaled up scenario. Based on activity in the selected facilities, it was noted that midwives were the ones tasked with providing PMTCT services (i.e. VCT, delivery and follow up). Therefore FTE personnel in this case refer to FTE midwives. Table 23 presents the estimated number of FTE required for each service element and total number of FTE required for the PMTCT program.

Table 23 : Projected Number of FTE Staff needed for PMTCT

Service	Time per activity (mins)	Target Number of Clients	Total time required annually (hours)	Total FTE* Personnel Required
Pre-test counseling	24	373,450	149,380.00	138
Post-test for HIV pos.	26	76,024	32,943.63	31
Post-test for HIV neg.	21	297,426	104,099.19	96
Total FTE required for counseling				**265**
HIV testing (screening)	16	373,450	99,586.67	92
HIV testing (confirmation)	18	76,024	22,807.13	21
Total FTE required for testing				**113**
Delivery	62	76,024	78,557.88	**73**
Follow up	25	64,620	26,925.08	**25**
Grand Total of FTE Personnel Required for PMTCT				***476***

* FTE calculated by dividing total annual time required by the total time devoted to providing client services (i.e. 1,080 hours).

Based on the targeted scenario, a total of 476 FTE midwives would be required to provide PMTCT services. The distribution of staff follows the cascade pattern of utilization of services in the facilities. Out of 474 FTE midwives, 265 (56%) would be required for counseling services, 113 (24%) for testing services, 73 (15%) for delivery services and 25 (5%) for follow up services. The bulk of counseling time (i.e. 52%) would be spent on providing pre-test counseling services. 81%(92) of the 113 FTE midwives required for testing services are as a result of the projected HIV screening workload.

To put this requirement into some perspective it is compared with the projected number of midwives that would be available in the Zambian public health system during the scale up process. Table 24 presents the projected numbers of midwives in 2006, 2007 and 2008. These projections, ceteris paribus, are based on the 2005 actual number of midwives available, annual number of graduates from local training institutions and the estimated attrition rate.

Table 24: Projected Staff Stocks 2006-2008

Staff	Annual graduates	Attrition rates	2005 Actual	2006 projected	2007 projected	2008 Projected
Midwives	150	4%	2,273	2,332	2,389	**2,443**

It is projected that the number of available midwives would be 2,332 in 2006; 2,389 in 2007 and 2,443 in 2008. At face value it would appear that the 2,443 midwives that would be available in 2008 could easily accommodate the 476 FTE midwives required for PMTCT. However, keep in mind that the current levels of staff are already struggling to provide basic health services, like immunization, to a growing population with estimated 2005 staff (midwife) to population ratio of 1:4,795. Therefore one needs to consider the number of staff required to maintain the provision of basic health services at current staff to population ratios *in addition* to the number of midwives required to provide PMTCT services in the 2008 scaled up scenario. By comparing these calculated numbers with the projected staff levels that will be available in 2008, we bring into focus the feasibility of scaling up PMTCT at current staff to population ratios. By combining an estimated 2.1% annual population growth with an estimated 2005 national population of 10.9 million and staff to population ratio of 1:4,795 the number of staff required to provide basic services in 2008 is calculated. As shown in table 25 below, 2,421 midwives will be required to provide basic health services in 2008. An additional 476 FTE midwives would be required to scale up PMTCT resulting in a projected total of 2,897 midwives required.

Table 25 : Human Resource Gap

Staff	Staff Needed for PMTCT (2008) [1]	Required to maintain 2005 staff: Population Ratio [2]	Total projected Staff needed [3]= [1] + [2]	Total Available (2008 projected) [4]	HR Gap [5]=[4]-[3]	HR Gap as % of Staff needed for PMTCT [5]/[1]
Midwife	476	2,421	2,897	2,443	**- 454**	**95%**

When the total projected number of midwives required is compared to the numbers that are projected to be available in 2008, there is a shortfall of 454 midwives. Assuming that staff continue to provide basic services at the current staff to

population ratio, the projected number of midwives in 2008 would only be able to meet 5% of the PMTCT staff requirement. Clearly the shortages of adequately skilled staff threaten to derail the PMTCT scale up process unless steps are taken to address what is already a serious human resource crisis. It is also predictable, that unless greater efforts are made in increasing the annual number of skilled graduates, retention of staff and addressing the root causes of attrition, Zambia will not achieve the set out coverage targets within the given time frame.

Based on the findings from the selected facilities, one of the major capital costs would be training costs. According to the PMTCT scale up plan, selected midwives would receive a 4 week training package that would comprise of 2 weeks of theoretical training followed by a 2 week practicum in a pilot site. The inputs used in the training include training materials (e.g. reference booklets, flipcharts, chalk, and pens), transportation, accommodation costs and meal allowances for each participant and trainer. Table 26 shows that the estimated training costs for the estimated 476 FTE midwives would amount to approximately US$413,000. This equates to an annualized cost of US$90,121.85 over a useful life of 5 years. Possible savings on this figure could result from integrating PMTCT training into pre-service training.

Table 26 : Additional in-service training and salary costs

Staff	Staff Needed for PMTCT (2008) [1]	Training cost per person (4 weeks) US$ [2]	Total in-service training Costs (US$) [3]=[1] x [2]	Gross Annual Salary (US$) [4]	Total salary costs(US$) [5]=[1] x [4]
Midwife	476	867.08	**412,907.94**	4989.23	**2,375,889.35**

The total annual salary costs would amount to approximately US$ 2.38 million. These salaries would be required to maintain the required staff in the public service. Therefore given that the government intends to spend US$ 90 million annually (2006 to 2008) on salaries for health workers, the cost required to employ the extra midwives would represent an increase of approximately 2.6% in health worker personnel emolument expenditure.

CHAPTER 6: DISCUSSION

6.1 Introduction

This chapter provides further insight into the results of the cost analysis conducted in this study. The discussion focuses on the calculated cost estimates, utilization patterns in the health facility, the estimated total costs of scaling up, human resource requirements and their implications for the scale up program in Zambia. The chapter ends by examining the limitations of the study.

6.2 Costing in the Health facilities

The study results showed that the PMTCT program cost almost twice as much in the urban facility than it did in the rural health facility. However this can not be interpreted to mean that the rural health facility was more efficient than the urban health facility. The cost difference could be explained by differences in staffing, input mix, and utilization patterns in the two facilities. For instance, the urban facility covers a much larger catchment population and is therefore allocated a larger proportion of available government resources as compared to the rural facility. In addition, the higher utilization patterns in the urban facility meant that in comparison to the program in the rural facility, a higher amount of staff time, medical supplies, drugs, and other consumables were used. An examination of the total cost profiles showed an 80/20% and 88/12% division between recurrent and capital costs in the rural and urban health facility respectively. The results reveal a similar weighting of capital and recurrent costs from similar studies (Bertozzi, Zurita et al. 2001; Desmond and Boyce 2004). In both cases the most costly item was personnel costs, followed by medical supplies and overhead costs associated with stationary, utilities, maintenance, and transport. Akin to several studies conducted on primary health care services, personnel costs were found to be largest expense in both facilities (Scotland, Terjlingen et al. 2003). These costs relate mainly to the proportion of staff time dedicated to PMTCT, which underlines the importance of stressing the need for efficient management of this resource for program success. Transport costs were higher in the rural facility giving some indication of the higher costs of providing outreach services in a sparsely populated rural area. Drug costs accounted for less than 2% of the total costs in the rural facility and 6.5% in the urban facility. Although

earlier studies on scaling up PMTCT such as the one conducted by Wilkinson, Floyd et al. (1999) had focused on drugs as the major cost driver, it is now evident that following the availability of cheaper ARV drugs, the main cost drivers would be the costs associated with enhancing the health system to deliver such services (Galbraith and Bennish 2001; Marseille, Onyango et al. 2003; Desmond and Boyce 2004). Making such additional investments in personnel, medical supplies and administration would go a long way to alleviating a number of bottlenecks in the scale up program. Even though such investments would have to be budgeted for realistically, there would likely be positive spin-offs in terms of improvements in other reproductive health services such as antenatal clinic services. Capital costs form a smaller but significant portion of the total cost with training and building costs being the main cost drivers. These costs have been appropriately annuatized over a number of years but are likely to account for significant financial start up investments for the PMTCT services to be provided in the appropriate quantity and quality. The current dilapidated state of most of the health infrastructure and the understaffing that is currently prevalent in the health system make such investment crucial for program success. Since such capital costs form a significantly large part of the total costs, program planners should explore more strategies to share such costs by reinforcing integration of PMTCT with other reproductive health programs.

When the costs were broken down into PMTCT elements (i.e. pre-test counseling, testing, post-test counseling, delivery and follow up), the analysis from both the urban and rural health facilities showed that the largest costs are associated with voluntary counseling and testing. In both facilities VCT costs (i.e. pre-test counseling, testing, and post-test counseling) accounted for 84% of the total direct costs. Within these costs, the costs associated with testing were the major cost drivers accounting for 47% and 41% of the total direct costs in the rural and urban facilities respectively. The differences in the costs in the two facilities related mainly to the differences in the number of women that used VCT and advanced to the confirmatory testing stage in the health facilities. The urban facility recorded three times the number that was tested in the rural facility. This analysis shows that ultimately the costs of VCT will depend on the numbers that will eventually use VCT services in the heath facilities.

When the testing component was broken down into input costs it emerged that the largest input was the testing supplies which include the test kits. Testing supplies constituted 47% and 62% of the testing component costs in the rural and urban facilities respectively. These results are similar to the findings of Marseille et al (2003) and Kombe et al (2005) that found that VCT was the main cost driver of the PMTCT program due to the high cost of the Abbot test used for screening and the Capillus test used for confirmation. The testing algorithm in this study shows that each woman that accepts to be tested is subjected to an Abbott screening test (US$1.38 per test) and if the test is positive, then a second confirmatory test (US$ 3.69 per test) is conducted. The high costs associated with testing are largely due to the fact that VCT services serve as a gateway to accessing PMTCT services (Marseille, Onyango et al. 2003). For any of the women to access PMTCT services they must first determine their HIV status. This underscores the need to recognize VCT services as an important component that needs to be scaled up if the PMTCT program is to succeed. In addition, VCT also provides an opportunity to strengthen preventive measures by allowing identified HIV positive mothers to join the PMTCT program and by reinforcing knowledge about HIV among those found to be uninfected (Ministry of Health(MoH) 1999). As drug (nevirapine) costs are no longer the main cost driver, the next challenge in reducing PMTCT costs lies mainly in reducing costs associated with testing. This would include reducing costs associated with testing kits, testing methods, and procurement. Cheaper alternative testing methods such as the use of finger prick testing and saliva based testing as opposed to the use of syringes and test tubes would also need less expertise (Marseille, Onyango et al. 2003; Stringer, Sinkala et al. 2003). In view of the critical staff shortages, this would allow program managers greater flexibility to take advantage of less skilled and cheaper workers such as traditional birth attendants and community health workers to perform the testing and counseling. Shifting of tasks such as testing and counseling would also free up midwives to conduct other activities such as deliveries and follow up. With this extra capacity, economies of scope would lead to lower costs of providing PMTCT in the facilities. Further cost reductions could be accomplished by procuring the testing supplies in bulk as opposed to the erratic and inefficient procurement arrangements that characterize the current logistics management system in Zambia (Ministry of Health 2005b).

6.3Utilization of services in the Health Centers

In terms of the utilization patterns in both facilities, it is evident that a cascade decline pattern is noticed from the number of women who attended their first antenatal visit at the facilities, get tested, and eventually enter the PMTCT program. As already noted testing is the key entry point for PMTCT services and therefore must be widely available for the program to succeed. Testing and counseling pregnant women who are HIV-negative about HIV infection helps them remain uninfected. For pregnant women who are HIV-positive and know their status, counseling may help them: 1) make informed decisions about their pregnancy, 2) receive appropriate and timely interventions to reduce MTCT, 3) secure early access to HIV treatment, care and support services, 4) disclose their results to partners and family members and 4) receive follow up and ongoing health care for themselves and their HIV-exposed infants (Dabis, Newell et al. 2000; World Health Organisation (WHO) 2004b). In both facilities more than 90% of those that were counseled accepted to be tested. This high acceptability may be attributed to the use of private one-on-one counseling and the opt-out counseling strategy in each of the facilities. The use of the opt-out strategy has improved VCT uptake as written consent is no longer required for HIV testing (Ministry of Health 2006). The opt-out strategy entails that all women attending antenatal clinics go through HIV counseling during which they may opt not to take the HIV test. This counseling is conducted in a private office that allows the woman to make a decision without any group pressure. The high acceptability of going through to get tested provides a window of opportunity to strengthen HIV programs aimed at increasing treatment, support and prevention, including PMTCT. The downside is that women may not inform their partners of the counseling and HIV test results. Male involvement is still a challenge which may negate the efforts to strengthen the program and sensitize partners to the benefits of knowing one's status. There are current plans to invite men to come to the facilities over the weekend for counseling and testing. However the lack of staffing and enthusiasm from the male partners has posed to be the greatest problem in implementing such a good idea. It is envisaged that with greater male involvement, even a greater proportion of women would be tested for HIV. These efforts need to be supported and continued.

The proportion of ANC attendees that were counseled and consequently tested was significantly larger in the urban facility than in the rural facility. In the urban facility 99.9% and 99.8% of the new antenatal care attendees were counseled and tested, while in the rural health facility 86.7% and 78.1% of the new antenatal care attendees were counseled and tested respectively. This indicates some of the challenges involved in scaling up PMTCT services in rural areas. The challenges are associated with lower acceptability of the counseling process among antenatal attendees, capacity to deliver antenatal care and higher levels of stigma when compared to urban facilities. A major difference that impacted on this result is the fact that the urban facility has registered midwives who have greater expertise and experience in administering a PMTCT program than their enrolled colleagues in the rural facility. Furthermore, the urban facility had an extra one year maturation period during which the extra experience in administering such a program has resulted in higher output than in the rural facility.

In both facilities more that 99% of those that were tested returned to receive the results. This collection of results is relatively high considering that the program is relatively new in both of the study sites. This has been mainly attributed to the use of rapid HIV test kits that are able to provide conclusive results within an hour. This finding is also consistent with findings of similar evaluations of PMTCT conducted in a number of African countries (Scotland, Terjlingen et al. 2003; Sweat, O'Reilly et al. 2004).

The results also highlighted that 22.5% and 25.02% of those tested in the urban and rural facilities respectively were found to be HIV-seropositive. This is significantly higher than the national antenatal seroprevalance of 19%. It might be argued that this might be related to self-selection bias. It is plausible that those who think they have been exposed to the virus or are more worried about their HIV status are more likely to seek VCT services and then go on to get tested (Kombe and Smith 2003). As a result, the seroprevalance among those who seek to be tested would be higher than the reported prevalence in surveillance studies that employ random testing. However, given the high uptake of testing in each facility, this explanation seems implausible,

and instead it is more likely that these clinics serve catchment areas with higher than average seroprevalence.

The drop out rates among HIV positive women at the stage of joining the PMTCT program, delivery and follow up threaten the success of the scale up program. The results showed that 15% of the women that tested positive in both facilities refused to actually join the PMTCT program. Of those that entered the program, 25% in the urban facility and 13% in the rural facility failed to ingest nevirapine under supervision in the facilities. This is closely related to the fact that only 61% of total deliveries are supervised by a trained health professional in Zambia (Ministry of Health 2005a). The remaining 39% are conducted at home, mostly with the aid of a traditional birth attendant (Ministry of Health 2005a). Seropositive mothers who accept to enter the program are given NVP in the ANC with instructions on when to ingest it. Because no follow-up was undertaken by hospital and project staff, it cannot be conclusively established whether the women who gave birth at home ingested nevirapine or not. The effectiveness of the programme could be potentially improved by using traditional birth attendants to follow-up mothers in communities, improve adherence to treatment during home deliveries and to refer antenatal and postnatal mothers to antenatal clinics.

As a proportion of those who ingested nevirapine during delivery in the facilities, 59% in the urban facility and 88% in the rural facility failed to adhere to follow up testing. The drop out rates indicate that mother–child follow-up has been one of the most challenging activities of the Zambian PMTCT programme. Currently, the National PMTCT program indicates that an ELISA test for children at 18 months should be conducted (Ministry of Health 2006). Early testing of the babies is hampered by lack of necessary laboratory tests such as PCR while HIV testing of the babies at 18 months is minimal because the children are not brought back for testing. The result is that while the programme might be effective in preventing MTCT, very little data is currently available on the number of infections averted. When staff undertake active tracing, they are unable to find the children or do it infrequently due to staff shortage. This lack of PCR testing for babies also impacts negatively on the costs of PMTCT. This is because cotrimoxazole forms the largest cost driver in the

follow up component. Cotrimoxazole prophylaxis can only be stopped once the exposed babies are tested as negative. The use of ELISA testing at 18 months means that each exposed baby is prescribed cotrimoxazole for a minimum of 18 months regardless of actual serostatus. The cost of an 18 month cotrimoxazole prophylaxis regimen was estimated at US$ 14.63 per baby. PCR could be potentially cost saving if it would cost less than 14.63 per baby. The use of PCR may help to bring the cost associated with cotrimoxazole prophylaxis down as it is able to determine the serostatus within 48 hours of birth. Hence only those that test positive would need to take cotrimoxazole prophylaxis.

It is also evident from the facilities that HIV stigma is still a significant problem affecting the PMTCT program. It was noted that some of the major failures associated with follow up are associated with stigma. These include the fact that:

- Some patients deliberately give the wrong address to avoid being followed up
- Other patients change addresses and are untraceable afterwards
- Even after being identified, some patients deny ever having been tested for HIV. Often these are clients who had not disclosed their status to their friends and family.

The refusal by HIV positive women to join the PMTCT program, the effect of stigma and the causes of drop outs from the program merit further research. Other challenges in the follow up component include poor access to health facilities for the women as a result of the long distances they need to cover and the lack of reliable and affordable transport. It is primarily due to such reasons that the actual numbers of averted infections and hence the impact of the program in the Zambian context is currently absent.

6.4 Unit costs

The results of the unit cost calculation are summarized in Table 16. The most costly state-sector PMTCT provider is the urban facility. However, on average the rural facility has higher costs per PMTCT component (pre-test counseling, testing, post-test counseling, delivery, and follow up) than the urban facility. The unit cost estimates in the urban facility were US$11.58 per mother attended to for VCT services (pre-test counseling, testing, post-test counseling), US$ 8.37 per mother and baby set adhering

to treatment during delivery and US$ 17.82 per mother and baby set adhering to follow up testing in the urban facility. While in the rural area the unit costs were US$21.94 per mother attended to for VCT, US$ 20.57 per mother and baby set adhering to treatment during delivery and US$ 22.57 per mother and baby ser adhering to follow up testing. The unit costs in the rural facility are higher than the unit costs in the urban facility as the total costs in the rural area proportionally cover fewer women than in the urban area. The higher unit costs in the rural facility provide some indication of the diseconomies of scale as the program is scaled up to the rural area. Scaling up PMTCT may be cost-effective but is likely to be less efficient than running pilot projects. With expanded coverage and scale, the unit costs are likely to increase and the effectiveness may not be as large due to the additional difficulties of home deliveries and tracing exposed babies.

The calculated unit costs in this study are consistent with some of the findings of earlier published studies on PMTCT in other Sub- Saharan African counties. Walker (2003) found that the cost of VCT ranged from US$ 4.15 to US$ 28.93 per mother attended. There was a greater than fourfold variation in costs of HIV counseling per woman screened, ranging from US$4 to US$18.50 based on evidence from Zambia and Uganda respectively (Scotland, Terjlingen et al. 2003). The wide variations are probably a reflection of differences in costing methodology used and price structures within sub-Saharan Africa (Walker 2003). In areas where labour is more expensive, the cost of providing counseling will be higher. Therefore one of the major strengths of this study is that it is based on the use of actual pilot site cost data. The VCT unit costs of this study significantly exceed the US$ 4.31 VCT cost calculated by Kombe and Smith (2003) in Zambia. Kombe and Smith (2003) conducted an incremental costing of the PMTCT service and hence underestimated the economic cost of displaced resources like infrastructure and staff which have been found to be significant cost drivers in this study.

Unfortunately these unit costs provide us with no indication of the "quality of care" provided in the facilities. The quality of care was not evaluated in this study and remains an area for future research. The importance of the pilot site unit cost findings

depends on the extent to which they can be generalized. It is therefore important to note some of the characteristics of the selected sites.

1) Sites used integrated approach: the PMTCT program is integrated into the reproductive and childhood programs such as the antenatal care and safe motherhood delivery program. This entails that the mothers receive a holistic package of services once they start to attend ANC.
2) Strong management support: in each of the sites, it was found that supportive supervision from both the provincial health office and the district management teams had helped to establish leadership in scaling up the program. The mentioned offices provided opportunities to find quick solutions to any operational problems that could not be handled by the clinical staff. It is through such mechanisms that strong ties were forged between the clinical staff and district health management teams.
3) Steady supply of consumables: an examination of the laboratory and pharmacy records showed that there was a good supply of crucial items such as testing kits and drugs.
4) Strong political support: in both sites, it was also reported that the community and local politicians such as the councilors had greatly supported the establishment of PMTCT in each of the districts by actively sensitizing and mobilizing community members about the program.

These efforts need to be replicated elsewhere in Zambia, for the results to remain relevant to the scale up program

6.5 National costs of scaling up PMTCT

The 2006-2008 projected national costs of the PMTCT program are based on the projected national utilization targets, the projected antenatal population, antenatal HIV prevalence, and calculated rural unit costs. Ideally these costs should have been based on unit costs that were adjusted for different levels of coverage, however this data is absent. The rural unit costs were used to minimize a possible underestimation bias in the total costs. In reality it is likely that as the program reaches a higher coverage, the average costs would be higher than those found in the urban area. The extent to which average unit costs will rise largely depends on whether diseconomies of scale are encountered as the service is expanded to rural and remote areas. By using a unit

cost that includes both fixed and variable components, this study assumes that in the long run fixed costs will be variable (i.e. additional infrastructure will be available) and that this will not be via excess capacity in the facilities.

The direct costs of scaling up to the national targets are considerable. It was estimated that the total costs of scaling up the program over a three year period (2006 to 2008) would be US$ 24.3 million. The estimated costs of the 2008 scaled up scenario alone were US$ 10.3 million. The study was conducted from the provider's perspective and therefore the results give an estimate of the requirements for scaling up PMTCT services in the public sector. On the government side, these cost are related to providing reliable and confidential voluntary testing and counseling; the antiretroviral drugs and their administration; basic equipment for safe deliveries; counseling and support for infant monitoring, and follow up for the first 18 months. The cost borne by clients, their relatives and friends, such as transport costs, time lost form work, and other out-of pocket expenses were excluded. Therefore by only considering the costs borne by the Ministry of Health, the actual total costs have been underestimated as societal costs were not included. Nonetheless, it provides a guide to policy makers on the budgetary requirements needed to meet the proposed targets.

Similar to the cost profile of the selected pilot facilities, VCT forms the main cost driver in the national PMTCT program exceeding 70% of overall program costs in each year. This again emphasizes the fact that the next frontier in reducing PMTCT costs lies in reducing VCT costs which are mainly a result of the high costs of testing. The cost associated with delivery and follow up constitute the remaining smaller but significant proportion of costs. The lower direct costs associated with delivery and follow up are as a result of the fewer numbers of HIV positive women that actually enter the program, adhere to NVP treatment and follow up testing.

In order to assess the feasibility of scaling up, it is important to link the projected estimates to the Medium-Term Expenditure Framework (MTEF). In addition, the sources of funds for the prepared budget should be known as well as the available amount, including any gaps, in order to facilitate the mobilization of resources. Although the estimated cost of scaling up a programme to provide the HIVNET 012

regimen to HIV infected women in Zambia would account for no more than 5% of the annual health budgets, there would be serious budgetary constraints should the program meet its proposed targets. Based on the allocations for the integrated reproductive health budget of which PMTCT is a part, there would be a total projected deficit of at least US$5.06 million over the three year period (2006-2008). This implies that either the proposed national targets for the scale up program will need to be revised or a greater amount of resources will need to be allocated should it become evident that the proposed targets are being met. The obvious question is, where would such additional resources come from?

6.5.1 Availability of Additional Funding

Over the years the availability of global pooled funds for the health sector has continued to increase. Currently a number of targeted funds have been made available to the Zambian Government including: Global Fund for HIV/AIDS, TB and Malaria; Presidential Emergency Fund (PEPFAR) for HIV/AIDS; Global Alliance on Vaccines and Immunizations (GAVI); and Zambia National Response to HIV/AIDS (ZANARA) (Ministry of Health 2005b). A total of US$5 million was expected in 2005 for various HIV/AIDS programmes through these funds (Ministry of Health 2005b). As these funds come in the form of vertical programs, they have not been accounted for in the Ministry of Health's medium term expenditure framework budget for 2006-2008. The Ministry should take advantage of these funds and mainstream them into the well-established basket funding mechanisms to complement its scale up efforts to address the targeted health challenges for PMTCT. GFATM funding is intended to be additional to existing funds for target diseases, whether channeled through the health sector basket funding or separately through direct funding of health facilities. Although this is a somewhat unrealistic expectation, given the fungibility of the different financing sources available to government, and is also contradictory to the recent emphasis given to strengthening recipient government leadership in prioritization and resource allocation. Such funding should be tracked if possible, through analysis of the shares of total and discretionary government spending allocated to the health sector (and to HIV/AIDS where treated separately) (Lake 2004). This may be achieved by implementing some form of public expenditure tracking system for HIV/AIDS expenditure which is currently non-existent.

In addition to these external funds, government should increase the proportion of the discretionary government spending on health to the agreed Abuja target of 15%. This is currently set at between 10% and 11% (World Health Organisation (WHO) 2002). Given the importance of health in economic development, greater prioritization should be given to funding the health sector (World Bank 1997). The lack of adequate funding for the health sector threatens to derail scale up efforts for PMTCT. Increased allocations coupled with the substantial debt relief from the Highly Indebted Poor Countries (HIPC) initiative would provide policy makers with more resources for critical sectors such as health (Ministry of Health 2005b).

6.6 Sensitivity Analysis

A simple one-way and multi-way sensitivity analysis was conducted to test the robustness of the costing estimates to several assumptions that were used in this study. The simple one-way analysis analyzed the uncertainty in key variables associated with staff time, drug and medical supply costs, HIV prevalence, antenatal population, and exchange rate. Imprecision in the cost data used in such a costing model is not uncommon (Briggs 2001). The costs of Nevirapine and other medical supplies such as HIV test kits were valued at average market costs from the current suppliers to the Ministry of Health. However, the results were not sensitive to the possible imprecision and variation in the estimated costs of drugs and HIV test kits.

Using reasonable assumptions on the use of staff time in providing PMTCT services revealed that the model was moderately sensitive to inefficient use of staff time. Given that personnel costs form a significant proportion of the program costs, management must ensure this resource is used efficiently. The results are comparable to those found by Galbraith and Bennish (2001). They argued that the greatest managerial challenge from a program perspective would be the efficient use of staff time. The study findings corroborate this by showing that using staff time less efficiently lead to a significant increase in the total program costs.

The model was also sensitive to variations in antenatal population and HIV prevalence. The analysis showed that the program costs increase significantly when implemented in a setting where the antenatal population and the HIV prevalence are increasing. Increases in these variables are directly related to increases in the

numbers of HIV-positive women using VCT services which was found to be the largest driver of PMTCT program costs. This is mainly because of the resources used to conduct both screening and confirmatory tests on those found to be HIV-positive. On the other hand, cost reductions increase as HIV prevalence declines. This reinforces arguments that prevention of primary infection remains one of the most cost-effective methods of combating HIV as outlined in the four pronged approach to PMTCT (Family Health International 2004).

The multi-way analysis shows the imprecision in the estimated total costs of the 2008 scaled up scenario. Combining low case and high case scenarios show that the 2008 program cost could possibly range from approximately US$ 8.3 million to US$ 12.4 million. Such imprecision in the estimates used in this study stems from using field data from only two pilot sites due to limited time and resources. Therefore, to increase precision, these estimates should be adjusted using more sites as the scale of the program increases.

6.7 Human Resources

6.7.1 Human resource gap

Apart from the financial requirements, effective implementation of the scale up depends largely on the quantity and quality of staff deployed in the health system. Most nations in the developing world, including Zambia, have lacked appropriate personnel, training, and infrastructure to deliver such services (World Health Organisation (WHO) 2006). The study findings confirm such statements. Based on efficiency levels in the selected sites, it is estimated that an additional 476 full time equivalent (FTE) midwives would be needed to reach the proposed targets in 2008. When these numbers are analyzed in view of the 2005 midwife to population ratios and the levels of production from training schools, it is estimated that the numbers of midwives would only be able to handle 5% of the 2008 PMTCT staff requirements. In absolute terms this translates into a shortfall of 454 midwives by the end of 2008. The low numbers of annual graduates (150) and high attrition rates (4%) shows that the production of midwives has not kept pace with need, especially with the ever-increasing burden of disease brought about by HIV/AIDS and resurgent epidemics. Anecdotal evidence suggests that the attrition rates within the nursing profession in the public sector are largely as a result of losses of staff to overseas institutions, the

private sector, and donor funded programs as they are tempted by greater access to in-service training and the associated allowances, transport and housing allowances (Ministry of Health 2005b). These continued shortages of critical staff in the public sector will undoubtedly hamper efforts to effectively scale up PMTCT services. The effect of such shortages fall heavily at the point of service delivery which is the health facility. When staff are not on duty, the clients do not get the services. Equally in very busy facilities, there are many missed opportunities for PMTCT. VCT services are most likely to be affected, given that 80% (378) of the 476 FTE midwives would be required for these services. A study by Stringer et al (2003) in Lusaka attributed 18% of the failure rate at the stage of offering HIV testing/counseling to lack of adequate staffing in the health facility. These missed opportunities negatively impact on the effectiveness of the program.

6.7.2 Cost of required Personnel

The staffing increases proposed for the scale up of PMTCT entails increases in cost of employing such cadres. The cost of the new establishment would increase the proposed annual salary budget of US$90 million to US$92.4 million (Ministry of Health 2005b). Any increase in staffing levels must be feasible and affordable and aligned with national policies and reforms. One way to increase current staffing levels and remain within the MTEF ceilings would be to increase the staffing levels of non-formal health workers and non-health professionals (e.g. traditional birth attendants, community health nurses). This is an area that should be explored to extend coverage and address distributional imbalances. There is evidence to suggest that the performance standards achieved by non-health professionals, particularly in the delivery of HIV/AIDS services, is as high as health professionals and that loss rates among these cadres is substantially lower than that of professional staff (Huddart, Furth et al. 2004). However, while affordability is a key criterion in increasing staffing levels, other factors must also inform decisions on staffing levels. Factors such as the availability and quality of training capacity and facilities to produce the increased numbers, the functioning of human resource planning, management capacity, systems to recruit, deploy and retain them should also inform decision making or should be developed (World Health Organisation (WHO) 2006).

6.7.3 Cost of training

With an estimated deficit of 454 FTE midwives in 2008 for the PMTCT program and high staff to population ratios, greater investments in increasing the number of annual graduates should be made. Training institutions need to be strengthened to produce the required quantity and quality of staff required in the public sector. It was also estimated that approximately US$ 413,000 would be required to provide in-service training for the 476 FTE midwives. However, given the attrition rate and expected need for training replacements in the facilities, this figure is likely to be much higher. A study by Huddart (2004) estimated that if this training was provided to five health care workers in all hospitals and urban health centers, and two health care workers in all rural health centers , then the total cost would be nearly US$3.9 million. Possible savings on such a substantial cost could arise by incorporating PMTCT training into the pre-service training curriculum of all health workers. Currently in-service training is not properly integrated and coordinated, leading to significant numbers of front line staff spending at least 4 weeks in-service training programmes at the expense of providing PMTCT services. Pre-service training in PMTCT would equip health workers with the necessary skills, knowledge and competencies to undertake expanded responsibilities and new forms of service provision. Training other health cadres like nurses would help to increase capacity to deliver services such as VCT which does not necessarily need to be conducted by midwives. In addition, midwife training can only be taken after a basic nursing qualification has been obtained. However, while the option of direct entry into midwife training may produce greater numbers in a shorter time, it should be noted that such specialised cadres will have limited career development and advancement opportunities, which may make the recruitment and retention for this particular cadre challenging.

6.7.4 Health Facility Staffing Levels

The World Health Organization (WHO) has recommended the following Staff/Population ratios for Africa, 1:5,000 for doctors and 1:700 for nurses (Ministry of Health 2005b; World Health Organisation (WHO) 2006). Based on this analysis, it could be observed that the aggregate nurse to population ratio for Zambia is approximately three times lower than the recommended WHO staff population ratios for nurses. Owing to such high staff to population ratios, staff workloads have increased tremendously over the years. Such increased workloads are likely to

compromise staff morale, productivity and the quality of health services. In such conditions, motivation of staff is likely to be a significant challenge as staff view addition of new activities such as PMTCT as an extra-burden. Due to these shortages some of the staff have even been forced to take up additional roles such as PMTCT data collection, hospital administration and logistics management, which have distracted them from the core business of providing clinical services. With a workforce already struggling to provide basic services, the quantity and quality of PMTCT services will suffer. Indeed, all interviewed staff were in agreement that there are too many registers which increase work load as well as increased work from counseling, testing and follow up of clients. As PMTCT is implemented as part of an integrated reproductive package, the PMTCT staff are not paid any extra allowances by the government. However most of the staff interviewed were aware that some partners/donors are compensating the PMTCT/HIV counselors in other facilities. This was considered demotivating since the other staff that are not getting compensated felt they were doing the same work if not more than those being compensated.

These challenges are further compounded by disparities in staffing skewed in favour of urban areas. Analysis of the urban and rural health facility staffing levels in this study shows significant disparities. The urban facility had 4 registered midwives, 2 enrolled midwives, 4 registered nurses, 13 enrolled nurses and 2 doctors, while the rural facility had no registered midwives, 3 enrolled midwives, 1 registered nurse, 7 enrolled nurses and 1 medical doctor. These imbalances are a result of a number of factors which include uncoordinated recruitment methods, weak posting procedures, personal preferences, poor rural incentives and socio-economic considerations (Kombe, Galaty et al. 2004). Such inequities have proved to be basic obstacles to scaling up and providing health services to rural populations where the shortages are even more severe than in the urban areas. In Zambia, there are also disincentives to work in rural areas, which encourage staff to defect. Poor transport, inadequate educational facilities for children and an absence of professional and social stimulation are some of the reasons why rural practice is unattractive. Health professionals are well educated and find rural living lacks the social stimulation that they have been accustomed to in medical or nurse training schools. There may be no

schools for their children, no social amenities, no electricity to read or even stimulating conversation to be had. Transport away from these areas is likely to be non-existent or extremely unreliable (Huddart, Furth et al. 2004). There are now growing concerns to address these problems, as the health system struggles to meet the demands imposed on it by the HIV/AIDS epidemic (World Bank 2004).

In summary, the human resource shortages are caused by a number of factors. These include:

- Inadequate conditions of service (pay, allowances and incentives)
- Poor working conditions (facilities, supplies and equipment)
- Weak human resource management systems
- Inadequate education and training systems

It is predictable that unless staffing shortages are addressed alongside other constraints on the delivery of PMTCT, care will not become available on an accessible and equitable basis for many Zambians for the foreseeable future. The issues raised above suggest that any programme to strengthen the staffing levels in both remote and urban locations requires a broad based yet integrated approach. Several initiatives can be applied at various levels within the health sector, aimed at addressing the human resource crisis. In the long run, these initiatives will have to include (Ministry of Health 2005b; World Health Organisation (WHO) 2006):

1. Making jobs more attractive through improving conditions of service (pay, allowances, loans and incentives) and workplace environments.
2. Taking cognisance of any disparities in conditions of service and introducing conditions that attract critically needed staff to areas of greater need such as rural areas.
3. Using staff more effectively and efficiently through improved HR management and practices. These include improving the overall rigour and transparency of recruitment, selection, and deployment procedures.
4. Strengthening training institutions to produce the requisite quantity and quality of staff required to scale up PMTCT.

Further investigation will be needed throughout the implementation period of the PMTCT scale up in order to track and analyse attrition rates and trends and to use this

information to develop the most appropriate strategies to retain essential health worker cadres. As these initiatives will lead to increases of costs to the government, they will need to be costed and budgeted for accordingly.

6.8 Limitations

There are 5 main limitations that have been identified in this study. The limitations are discussed briefly below and where possible, the steps taken to limit possible bias are explained.

1. The model used in this study uses a number of assumptions in reaching various conclusions which include the costs of scaling up. These assumptions include a useful lifespan of 20 years for buildings, 10 years for equipment and vehicles, 5 years for training and computers, the exchange rate, choice of discount rate (3%), 550,000 annual antenatal populations and 19% antenatal HIV prevalence. In addition the model assumes that the intervention can be standardized and delivered at the same level of efficiency as encountered in the rural facility, supplies are dependable, and the current mode of delivery requires that the service be replicated, including infrastructure and staff requirements. Although these assumptions will vary with geographic regions and time, the assumptions used in this study have been based on available data and are explicitly stated to allow the reader to assess for themselves whether any modifications are needed for the results to have greater relevance to other settings.

2. Due to limited resources and time, only two sites were randomly selected to assess the costs associated with the PMTCT program. Although there are no clear guidelines or agreement in the literature on the number of facilities that should be examined, the limited number of sites may not have captured the full variations of costs associated with geographic settings, HIV prevalence, and efficiency in delivering the service. In reality such an exercise would be very costly and time consuming. Therefore this study uses sensitivity analysis to assess some of the uncertainties around the cost data to examine the robustness of the results.

3. The costs associated with the private sector, activities at the central level (e.g. administration costs) and provincial level (e.g. monitoring and evaluation costs) have been excluded from the study. The costs associated with establishing a PMTCT program in a private health facility are likely to be higher than that of a public facility owing to the higher costs of labour, use of more costly medical supplies, drugs, and equipment. Even though the costs of the private sector are important to examine, they are unlikely to affect the government costs in scaling up the public sector program that caters for the majority of the Zambian population. The initial stages of the scale up program included the establishment of capacity at central and provincial levels to provide leadership in the scale up program to the district levels. Currently these structures are in place and fully operational. The greater need lies in scaling up the actual delivery of PMTCT program in health facilities to the proposed coverage and uptake targets. Therefore this study focuses on the costs required to deliver the PMTCT program at public health facility level and the costs associated with provincial and central management have been excluded.

4. There is a possible bias in the use of constant unit costs to estimate the costs of scaling up PMTCT in Zambia. This method is at odds with basic economic theory as it ignores the possible diseconomies of scale that are associated with scaling up service delivery to the proposed national targets (AIDS Campaign Team for Africa (ACTafrica) 2001; Kumaranayake, Kurowski et al. 2001). In reality, starting from a point of low coverage, scaling up is likely to be accompanied by decreasing unit costs. These economies of scale relate to changes in resource use as the program becomes more familiar to staff over time, which could partially explain why the older urban service had lower unit costs. Once a certain level is reached, additional investments in infrastructure and higher costs of service delivery in rural areas will result in rising unit costs (AIDS Campaign Team for Africa (ACTafrica) 2001). Ideally the total costs of scaling up should be based on existing unit costs that have been adjusted for different levels of coverage, HIV prevalence, and infrastructure requirements. This unit cost data is currently absent (Kumaranayake and Watts 2000;

Kumaranayake, Kurowski et al. 2001). Therefore the use of unit costs from the urban facility could underestimate the true costs of scaling up at higher levels of coverage (AIDS Campaign Team for Africa (ACTafrica) 2001). In order to lessen this possible bias, this study uses the higher calculated unit costs to estimate the total costs of scaling up to the projected higher levels of service coverage.

CHAPTER 7: SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

7.1 Introduction

This is the final chapter of the study that gives a summary of the major research findings. These findings are summarized with regards to the objectives of the study given in the first chapter in order to evaluate whether the study has achieved what it set out to do. Section 7.2 therefore gives a summary of the key findings in relation to the research objectives. In section 7.3, the recommendations of the study are discussed while section 7.4 gives suggestions for further research related to this study.

7.2 Summary of key Findings in relation to the research objectives

The key findings of the study are summarized in the context of the following research objectives:

Primary costing objectives:

- To estimate the average direct health care cost per mother attended to for VCT services, delivery and follow up in the pilot sites from a provider's perspective.
- To determine the current human resources used to provide PMTCT services in the pilot study sites
- To describe the organization and management of PMTCT in the study pilot sites

Modeled costs of scaling up and related issues:

- To estimate the direct health care costs associated with scaling up PMTCT services to the national targets.
- To calculate the proportion of the national health budget that will be used to scale up PMTCT to all 72 districts.
- To estimate the workforce required to scale up PMTCT services.
- To develop appropriate policy recommendations based on the study findings.

7.2.1 Primary costing in the health facilities.

The total direct costs of providing PMTCT services were estimated to be US$29,000 and US$62,000 in the rural and urban facilities respectively. The differences in the two facilities were not related to efficiency per se but rather to differences in input mix, staffing levels, and utilization patterns. The urban facility had approximately 3 times the utilization rates of the rural facility which in turn lead to a higher use of

resources in that facility. However, the average costs were lower in the urban facility as it had a proportionately higher output for the inputs used. This could also point to potential economies of scale as the costs were spread over more people in the urban facility.

Analysis of the cost profiles in the facilities shows that the majority of total costs are recurrent costs. Recurrent costs accounted for 80% and 88% of the total costs in the rural and urban facilities respectively. In both facilities personnel costs were the largest expense followed by costs associated with testing supplies. The findings suggest that nevirapine costs are no longer the major cost driver as found in earlier published studies. The advent of cheaper, easy to administer and cost-effective Nevirapine tablet (US$0.24) and suspension (US$0.03 per ml) provides a unique opportunity to avail this treatment to greater numbers of eligible women in resource constrained settings. When the total costs were allocated to the PMTCT program components it was found that VCT (pre-test counseling, testing, post-test counseling) costs were the largest expense accounting for 84% of the total costs in both facilities. This was because of the large number of women that underwent VCT and the high costs of the HIV testing Kits. Given that VCT services form the entry point for PMTCT and generally have such important benefits in terms of enhancing HIV-prevention messages and timeously identifying HIV-positive people who might be in need of care, support and treatment, lowering the costs associated with testing is a key challenge.

The average direct health care cost per mother attended to for VCT services was US$11.58 in the urban facility and US$ 21.94 in the rural facility. The average cost per mother and baby set adhering to treatment during delivery was US$ 8.37 in the urban facility and US$ 20.57 in the rural facility. The average cost per mother and baby set adhering to follow up testing was US$ 17.82 in the urban facility and US$ 22.57 in the rural facility. The higher rural unit costs give some indication of the diseconomies of scale that are expected as the program expands to these areas. Although efficiency was not assessed in this study, it also indicates that equity rather than efficiency may be the driving force in scaling up services to rural areas.

7.2.2 Organisation and Management of PMTCT services in the Health facilities

The importance of the pilot site unit cost findings depends on the extent to which they can be generalized. Therefore an understanding of the model of service delivery is key to understanding the uptake of the service and some of problems in service delivery that may hamper the scale up program. In each of the facilities PMTCT is being offered as part of a holistic and integrated reproductive health care package in the antenatal clinics. PMTCT has been linked to other ANC services such as provision of tetanus toxoid, malaria and anemia prophylaxis, promotion of postnatal care and provision of family planning counseling, making ANC a one-stop shop for reproductive health services. Other factors contributing to continuum of care include strong management from the district health management teams, good and steady supply of consumables and strong political support from local politicians and community members.

In each of the facilities the program was managed and provided by trained midwives. The utilization patterns in both facilities revealed a cascade decline from those offered counseling and testing to those who eventually went on to enter the program and adhere to the national guidelines as outlined in Appendix 1. There was a high acceptability of VCT services as over 90% of the clients who were pre-test counseled opted to go on to testing. Of those that went on to be tested 22.53% and 25.02% were found to HIV seropositive in the urban and rural facilities respectively. The HIV prevalence significantly exceeded the estimated national antenatal HIV prevalence of 19% potentially owing to self-selection among the antenatal attendees. Although with more than 90% acceptance of testing, it could also be that the facilities were based in areas with higher HIV prevalence. The research findings show that there were significant drop outs at the point of entering the PMTCT program, delivery and follow up. The drops out rates during delivery are closely related to the fact that only 61% of the deliveries nationwide are supervised in institutions and the remaining 39% deliver at home. Follow up is the most difficult PMTCT component due to stigma, lack of PCR testing for HIV exposed babies, staff shortages and lack of transport. The wide spread provision of PCR testing would not only help to quickly determine the serosatutus of the infant but could also potentially save money associated with the

lengthy 18 month cotrimoxazole prophylaxis regimen for all HIV exposed babies while awaiting an ELISA test.

7.2.3 Cost of scaling up PMTCT

Zambia's HIV prevalence rates are among the highest in the world. As part of the response to this epidemic Zambia initiated pilot PMTCT programs in 1999 and is now in the process of scaling up the service to desired levels. The estimated direct national costs of scaling up PMTCT were based on the expected utilization under the national targets of 97% antenatal clinic utilization, 70% utilization, 75% adherence to ARVs during delivery, 85% adherence to follow up testing and the calculated unit costs form the pilot sites. The HIVNET012 PMTCT regimen may be relatively cost-effective but the study findings suggest that the national costs of scaling up would be substantial. In 2005 discounted US dollars, the program would cost US$ 5.7 million in 2006, US$ 8.4 in 2007, and US$ 10.3 in 2008. This would amount to a total of US$24.3 million over the three year period (2006-2008). As a proportion of the total health MTEF budgets, it was found that the PMTCT program would account for 4.2% in 2006, 4.8% in 2007 and 5% in 2008. As a result of the expected pattern of utilization, VCT was found to account for at least 70% of the total annual PMTCT costs. Comparing the estimated costs of the scale up program to the proposed reproductive health allocations show that there would be budgetary constraints if the program where to meet its targets. The analysis shows that there would be a total deficit of approximately US$5.06 million over the three year period (2006-2008). Such a deficit would hamper efforts to allocate adequate resources that would ensure that the desired utilization levels where achieved. The efforts by policy makers to overcome such deficits must be analyzed in context of underlying macroeconomic constraints that have beset our nation.

The level of funding which the Government of the Republic of Zambia (GRZ) can allocate to health is constrained by the overall status of the economy which limits the total revenue available to allocate to health. Currently between 10% and 11% of the total government budget is allocated to the health sector, but there is room for improvement given the Abuja target of 15%.

The Ministry receives a lot financial and technical support from cooperating partners, which has resulted in high dependence on donor support. The international community and the donor community are important partners in the fight against HIV/AIDS. Donors need to partner with governments in order to not impose conflicting demands and multiple frameworks on countries. However, it was found that donor funds such as PEPFAR and GFATM have been directly supporting implementation at the facility level instead of directing the funds into the health sector's basket funding. Such fragmentation imposes heavy transaction costs on scarce government capacity, taking time and resources away from core government tasks. In addition it has made it difficult to track the actual amounts that are being spent on scaling up HIV interventions including PMTCT. Finally, the vertical segregation of such donor funding flows has seriously hampered government's efforts at medium- and long-term planning.

The results of the sensitivity analysis reinforce other published studies that indicate that the management of staff time could be the biggest challenge of the scale up Program. The inefficient use of time could potentially lead to significant increases in the total cost of the 2008 scaled up scenario. Significant cost reductions were found to be associated with declining HIV prevalence, supporting the use of primary prevention as outlined in the international four pronged approach to PMTCT.

7.2.4 Human Resources

The success of the scale up program heavily depends on having the requisite quantity and quality of human resources to deliver the services. The analysis of the human resource requirements to meet the proposed 2008 scaled up utilization targets shows that the levels of production and retention of midwives would be too low to meet the required numbers in the public sector. Some of the key highlights of the analysis are;

- ***Need outpaces production of health workers:*** based on the efficiency levels in the pilot sites it was estimated that 476 FTE midwives would be required to meet the proposed 2008 scaled up targets. However when the attrition rate (4%), annual graduates (150) and the current public sector levels are factored in, a considerable human resource gap appears. The analysis shows that there would be a shortfall of 454 midwives in 2008, which would translate into a 95% shortfall in required human resource capacity. It is therefore predictable that unless greater efforts are

made to address these shortfalls, Zambia would have serious constraints in meeting the proposed coverage targets

- ***Cost of new personnel:*** The cost of employing the additional 476 FTE midwives would entail an increase in the total annual health sector salary budget from the allocated US$ 90 million to US$ 92.4 million. However given the constraints that the health budget would be under, this may not be affordable in the MTEF ceilings. Therefore further exploration must be made to increase the staffing levels of more multi-skilled non-formal health workers and non health professionals (e.g. traditional birth attendants, community health nurse). The use of trained traditional birth attendants (TBAs) would allow them to assist in deliveries and contribute to PMTCT services. With training they would be able to perform HIV testing using the finger prick method. This strategy is likely to increase the number of women being tested and offered PMTCT services
- ***Training:*** The production and training of midwives has not kept pace with health sector needs, both quantitative and qualitative, especially to address the increasing burden of disease as a result of HIV/AIDS and to cater for evolving and expanding health worker roles and new forms of service provision. The low numbers of annual graduates reflects the lack of capacity of the training institution to response to the challenges posed by HIV. The training of midwives for the scale up of PMTCT is currently conducted as in-service training usually at the expense of providing clinical services for up to 4 weeks. This is counter intuitive, given that the costs of the PMTCT program have been shown to be sensitive to the inefficient use of staff time. Incorporating PMTCT training into pre-service training may yield greater benefits.
- ***Staffing levels in the pilot facilities:*** The staffing levels show that there are geographical disparities in staffing skewed in favour of the urban facilities. The urban facility had 6 midwives of whom 2 were registered midwives, while the rural facility had only 3 enrolled midwives with no registered midwives. Such imbalances pose extra challenges to scaling up services in rural areas. These imbalances are as a result of a number of factors which include uncoordinated recruitment methods, weak posting procedures, personal preferences, lack of financial incentives (e.g. top-up salaries for staff in remote areas, group performance incentive schemes) and non-financial incentives (provision of

transport, renovation of houses, electrification using solar in remote areas, faster career progression) (Kombe, Galaty et al. 2004).

The feasibility of scaling up PMTCT to the proposed levels will largely depend on the success of the efforts to address the financial and human resource constraints that have been highlighted in this study. The unprecedented commitment by international organizations and governments, and the availability of cheap and effective antiretroviral regimens make the feasibility of scaling up PMTCT a real possibility even in a resource poor setting like Zambia.

7.3 Recommendations

The following recommendations are given based on the research findings of the study:

- The study recommends that since the largest expense in the PMTCT national program is the costs associated with VCT, efforts should be made to scale up testing with cheaper but effective testing methods. These methods include the use of finger prick and saliva based HIV testing instead of drawing blood with syringes. This would also allow trained non-formal health personnel (e.g. tTBA) to assist in conducting VCT services.

- The study reveals that there would be significant financial constraints on government resources should the PMTCT scale up program reach its proposed targets. A recommendation is made that government make greater efforts to identify, mobilize and allocate adequate financial resources to the scale up program for it to succeed. Government should take advantage of additional resources from funding sources such as PEPFAR, GFATM and HIPC savings to allocate greater amount of resources to the scale up program.

- There are currently no accurate data on the funds that are being spent on HIV/AIDS interventions. This is partly as a result of the international partners and donors vertically allocating their funding directly to implementing facilities and the lack of a public expenditure tracking system. The Ministry of Health is recommended to take the lead in streamlining funding into established funding mechanisms such as the basket funding and introducing a public expenditure

tracking system to link expenditure to the proposed outputs of the PMTCT scale up program.

The drop out rates at the point of entering the PMTCT program, delivery and follow up are likely to reduce the return on investments in the PMTCT scale up program. The following measures are recommended to increase uptake rates in health facilities:

- Increase community participation by encouraging male involvement in the VCT component of the PMTCT program. This is also likely to help reduce stigma and increase the numbers of HIV positive women that eventually enroll into the PMTCT program.

- It is also recommended that in view of the non-negligible proportion of women that deliver at home, the role of tTBA should be expanded to help provide VCT services, supervise NVP ingestion, follow up mothers in the community and refer mothers and babies for postnatal checkups.

- The study provides evidence that primary prevention of HIV would be effective in reducing the overall costs of the scale up program. It is therefore recommended that the current selective emphasis on the NVP intervention should revert to the international agreed 4 prong approach which includes emphasis on primary prevention of HIV infection.

The study shows that the current shortages and disparities in the level of staffing in the health facilities are a limiting factor in the scale up progress. Any intervention to address such a human resource crisis would have to be multifaceted. Based on the study findings the following recommendations have been made;

- ***Introduce financial and non-financial incentives:*** The introduction of financial incentives (e.g. top-up salaries for staff in remote areas, group performance incentive schemes) and non-financial incentives (provision of transport, renovation of houses, electrification using solar energy in remote areas, faster career progression) would lead to greater motivation and retention of staff.

- ***Improve HR management and develop systems and practices:*** Transparent recruitment with deployments based on existing imbalances in staffing levels would help to expand PMTCT services to the rural areas.
- ***Greater investments in pre-service training:*** it is recommended that more resources should be used to strengthen pre-service training for midwives to produce a higher number of annual graduates with the required skills to keep pace with the levels required to scale up PMTCT.
- ***Reconfigure staffing pattern:*** As staff costs are a significant cost driver, using non-formal health care workers (e.g. Community health workers, traditional birth attendants) in new roles such as lay counselors would help reduce costs of scaling up. Although these cadres would help to meet the requirements of scaling up, there is no evidence available locally that quality of care would not be compromised. It is therefore recommended that the new cadres adhere to strong quality assurance measures and should be supervised by a trained health professional.

7.4 Further Research

The following are suggestions for further research:

1. There is need to conduct a costing study from the societal perspective to determine the costs that are borne by the clients and families.

2. The costing model in this study looked at one PMTCT service delivery model. Economic evaluations should be conducted on possible alternative scale up strategies which would also evaluate different models of offering VCT. Given the cost implications of prescribing cotrimoxazole for all exposed infants and the loss to follow-up that was associated with testing babies at 18 months under this protocol, an evaluation of PCR versus ELISA testing should be conducted to determine whether the savings in cotrimoxazole costs would offset the higher costs of the PCR tests.

3. This study used intermediate outcomes due to the lack of information on the final outcome (infections averted) of the PMTCT program. Therefore future

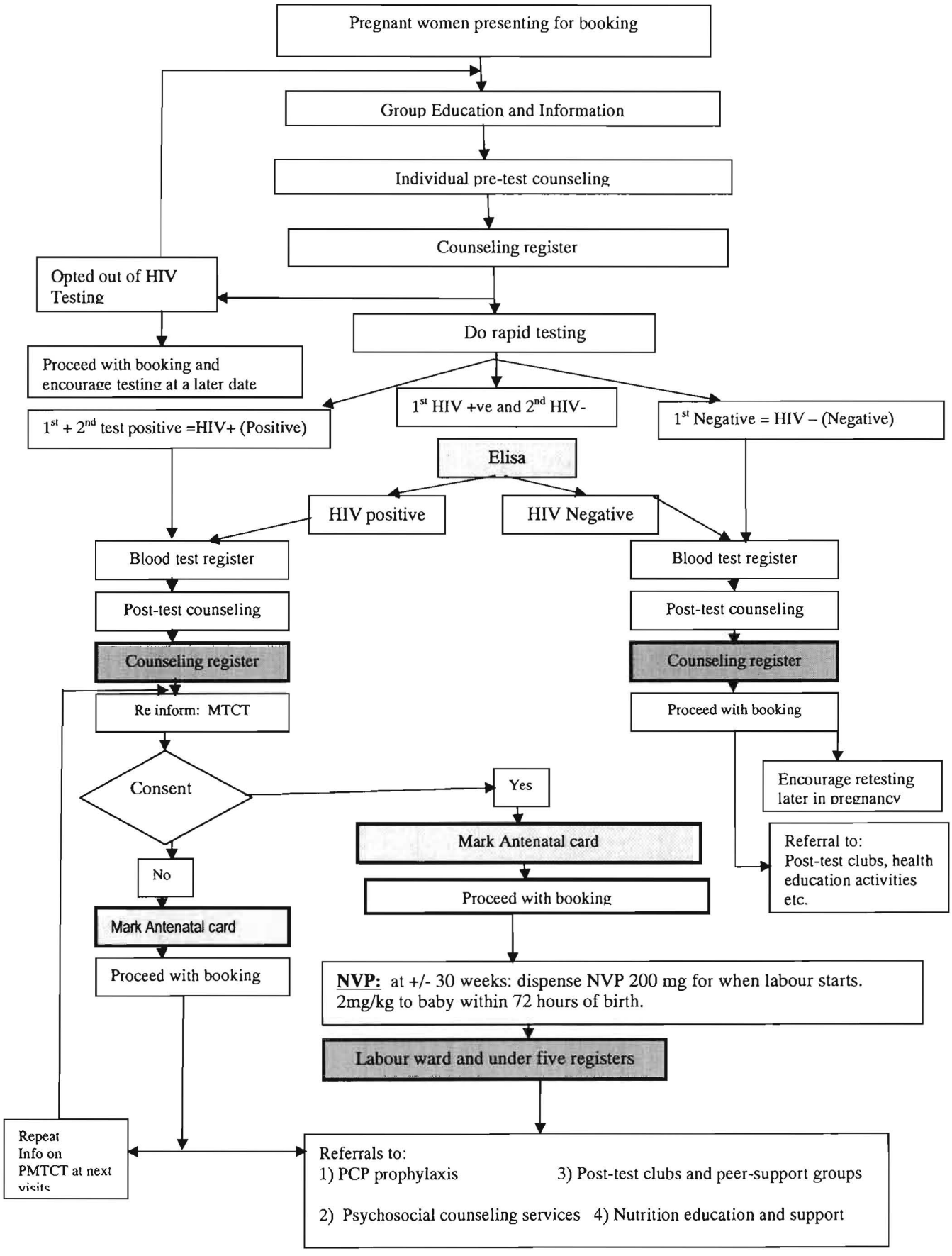
studies should evaluate the actual effectiveness of the PMTCT program in the Zambian context.

4. Further investigation will be needed throughout the implementation period of the PMTCT scale up in order to track and analyse expenditure, staff attrition rates and trends and to use this information to develop the most appropriate strategies to retain essential health worker cadres.

5. There is also need to carry out a comprehensive study looking at the underlying causes of drop outs in the PMTCT program.

8.0 APPENDICES

Appendix I: Antenatal Care Follow Chart



Appendix II: Antiretroviral Prophylaxis Regimens for MTCT prevention (Summary of evidence)

Course	Antenatal	Intrapartum	Postnatal	Vertical transmission Rate (VTR)and efficacy
Zidovudine (ZDV) and Nevirapine (NVP) (DITRAME plus/ ANRS 1201.0 trial Abidjan, Ivory Coast)	**Mother: ZDV 300mg** twice a day starting at 36 weeks or as soon as possible thereafter	**Mother: ZDV 600mg** at onset of labour and every 6 hours until delivery **NVP 200mg** single-dose at onset of labour	**Infant: NVP 2mg/kg** oral suspension immediately after birth, **AND ZDV 4mg/kg** twice a day for 7 days starting immediately after birth	VTR at 6 weeks 6.4% (331 infants)
		OR ZDV 600 mg at onset of labour **and** single dose NVP 200 mg at onset of labour	OR NVP 2 mg/kg oral suspension immediately after birth	
ZDV (Ivory coast CDC short-course ZDV trail)	**Mother:** ZDV 300 mg twice a day starting at 32 weeks or as soon as possible thereafter	**Mother:** ZDV 600 mg at onset of labour **OR** ZDV 300 mg at onset of labour and every 3 hours until delivery	None	VTR 15.7% in intervention arm versus 24.9% in placebo at 3 months(37% efficacy)(230 infants)
ZDV and NVP for infant (when mother has received no ARV prophylaxis) (NVAZ trial Malawi)	None	None	**Infant: NVP 2 mg/kg** oral suspension immediately after birth and **ZDV 4 mg/kg** twice a day for 7 days. When ZDV oral suspension not available, **NVP 2 mg/kg** as soon as possible after delivery and a repeat dose of **NVP** 72 hours after birth.	Overall VTR at 6-8 weeks 15.3% in NVP+ZDV arm and 20.9% with ZDV only. VTR at 6-8 weeks in infants who were negative at birth 7.7% and 12.1%, respectively(36% efficacy)(952 infants)
NVP (HIVNET 012 trail of NVP vs. ZDV)	None	**Mother:** Single-dose NVP 200 mg at onset of labour	**Infant: NVP 2mg/kg** oral suspension immediately after birth.	VTR 15.7% in NVP arm vs. 25.8% in ZDV arm (41% efficacy) at 18months(451 infants)

Widely used in Zambia

Source: Recommendations on ARVs and MTCT Prevention in Resource- Constrained settings, WHO, 2004

Appendix III: Sources of National Demographic and Epidemiological Data Collected

Data Item	Sources
Total Population (10.9 million)	2005 Central Statistical Office website (http://www.zamstats.gov.zm)
Annual Antenatal Population (550,000)	Central Statistical Office website (http://www.zamstats.gov.zm); 1994-2004 Zambia Antenatal Clinic Sentinel Surveillance Report 2004
HIV Prevalence (19%)	Zambia Demographic Health Survey, 2001 – 2002; 1994-2004 Zambia Antenatal Clinic Sentinel Surveillance Report
No. of pregnant women receiving ANC, testing, and PMTCT intervention	2005 Health Management Information Systems, Central Board of Health
No. of pregnant women receiving supervised delivery	2005 Health Management Information Systems, Central Board of Health

Appendix IV: Interview Schedule Used at Central level

Date____/____/__

Name of person being Interviewed_____

Title_____

Site:_____

Duration in Current position_____

(i) When did the Scale up of PMTCT begin in Zambia? What are the objectives of Scaling up PMTCT services in Zambia? What is the Rationale behind Scaling up PMTCT services?

(ii) Was a situational analysis performed before the scale-up? What criterion was used to select the pilot and scale up sites?

(iii) To What level has PMTCT been scaled up In Zambia? List the Major Stakeholders (Who is responsible for advocacy and resources mobilization, Policy development, and Coordination)?

(iv) How many full time and part-time staff are assigned to PMTCT level? Is this sufficient? What additional capacity is required? (collect salaries)

(v) How would you describe the PMTCT program, a Vertical or Integrated program? Why?

(vi) What linkages does the PMTCT program have? (ART, Reproductive Health, IMCI, Adolescent health, Family planning, Safe motherhood, Neonatal and child programs etc) Have they worked?

(vii) What percentage of the National health Budget does PMTCT/ HIV receive? Is there a Budget line for PMTCT in the National Budget?

(viii) What percentage of the PMTCT program is donor funded?

(ix) How has the Process been managed? How is this process organized?

(x) What structures are in Place at National, provincial and National level to coordinate the PMTCT activities? What is the relationship with the various stakeholders?

(xi) Is there any specific Community based strategies for the community(PMTCT, Male involvement, etc)

(xii) How has the scale up engaged the private sector/industry in Scaling up?

(xiii) How are districts and provinces beginning strengthen for PMTCT planning and implementation?

(xiv) What have been the constraints to Scaling up services to the national targets? What lessons have been learnt so far?

(xv) What have been the successful areas during this process? What have been the failures?

(xvi) How will the program be funded? What kind of assistance are you receiving?

(xvii) Would you describe the scale up as affordable and sustainable?

(xviii) What are the policies that exist to guide program implementation?

(xix) Scaling up requires a systematic planning approach to meet training needs, developing national standards, management protocols and establishing monitoring systems. What structures are in place and how will this be achieved?

(xx) A cornerstone of the expansion program will be capacity development. How do you hope to reconcile the need for greater capacity with the current Human Resource shortages?

(xxi) What modalities are in place to ensure that duplication of efforts in training is avoided? Are there any specific challenges in capacity development and how will these be addressed (Training Materials, Budgets, Quality assurances, numbers of trainers, skills mix, retention, HR plan)

(xxii) Is PMTCT training integrated with other types of training?(e.g. Pre service) Any Follow up Assessments?

(xxiii) Describe the Information systems for capturing PMTCT Data? (e.g. Indicators, Linkages, Consolidated Private and Public, time lag,) What improvements need to be made to reporting tools and formats?

(xxiv) Are there any quality assurance measures that have been put into place and if so how are they operating?

(xxv) How would you describe the political commitment to the Scale up program? How has the MOH expressed its commitment?

(xxvi) What is the current policy on infant feeding for babies born to HIV positive mothers in The PMTCT program?

(xxvii) How effective has the Program been in preventing infant HIV infection?

(xxviii)Could you highlight any other recent policy developments in the Scale up program?

(xxix) If we could start over what would you do differently?

Thank you for your time.

Appendix V: Interview Schedule for Site staff
Date____/____/__
Name of person being Interviewed_____
Title_____
Site:_____
Duration in Current position_____

(i) When was the PMTCT program started in this facility?

(ii) Please describe the mode of service delivery for PMTCT that has implemented in this facility. Please include the Resources that are used at every stage. How long does it take to complete each task?

(iii) Please describe the number and type of cadres who are involved in the program. Are there any incentives paid to the workers?

(iv) How is the program being managed? How would you describe your relationship with the District Health Management Team?

(v) What goals have been set out for the program? Do you have specific targets to be met?

(vi) How has the program been received by the community and Staff?

(vii) What have been the constraints you have been facing in implementing the PMTCT program?

(viii) What are the success and failures you have encountered in implementing the program?

(ix) Is there anything else you would like to highlight with regard to this program?

Appendix VI: Ethical clearance granted by the Research Ethics Committee of the University of Cape Town

UNIVERSITY OF CAPE TOWN

Health Sciences Faculty
Research Ethics Committee
Room E53-24 Groote Schuur Hospital Old Main Building
Observatory 7925
Telephone [021] 406 6338 • Facsimile [021] 406 6411
e-mail: prsward@curie.uct.ac.za

10 November 2005

REC REF: 377/2005

Dr M Kamanga
Health Economics Unit
Public Health & Family Medicine

Dear Dr Kamanga

THE ECONOMIC FEASIBILTIY AND POTENTIAL IMPACT OF SCALING UP PREVENTION OF MOTHER TO CHILD TRANSMISSION OF HIV SERVICES IN ZAMBIA FROM A PROVIDER'S PERSPECTIVE

Thank you submitting your study to the Research Ethics Committee for review.

Decision:

- Study has been approved

Please note that the following must be addressed:

- PI to complete both section dealing with UCT's Intellectual Property Rights and not mark N/A, as well as the section dealing with the independence of researchers.
- Please note that permission from local authority will be required

Please quote the REC. REF in all your correspondence.

Yours sincerely

PROF T. ZABOW
CHAIRPERSON

bngidi

Appendix VII: Consent Form for Participation in the Study

STUDY TITLE: The Economic Feasibility and Potential Impact of Scaling Up PMTCT in Zambia

Principal Investigator:

Mpuma Kamanga, MPH Student, University of Cape Town

The University of Cape Town and the Central Board of Health are conducting a study on the economic feasibility and the potential impact of scaling up prevention of Mother to Child Transmission of HIV services in Zambia. The study will involve the collection of PMTCT facility based utilization and cost data, and interviews with key personnel involved in the provision of PMTCT services. The findings of the study will assist policy makers to understand the cost and resource implications of the scale up of PMTCT services. It will also contribute to the limited knowledge about resource requirements for scale up and will form a base for further cost-effectiveness studies in this field. The study poses no risk or physical hazards, pain or discomfort to any of the participants.

In connection with this, I would like to ask you some questions regarding the PMTCT services in this facility. Your participation is entirely voluntary and you have the Right to withdraw from the interview whenever you desire. All the information you will provide will be kept confidential, and I wish to assure you of complete anonymity with regards the information that will be provided. If I have your permission to proceed with the interview, please, sign the declaration below.

The Research has been explained to me and I understand what will be required of me if I take part in the study. The research team led by Dr. Mpuma Kamanga has answered my questions concerning the study. I understand that, at any time my organization and I may withdraw from this study without giving notice.

Participant_____ **Signature**_____

Principal Investigator_____ **Signature**_____

Appendix VIII: Costing Model Results for The Rural Health Facility

Costing in Rural Facility (2005 US$ prices)				
Rural Facility Variable costs				
A) Personnel	Number	(US$)	Allocation Basis	Total Costs (US$)
Midwives	3	4,746	% time spent	6,640.45
Sub Total				**6,640.45**
B) Drugs	Unit costs (US$)	Dosage per client	Number of clients	Total Costs (US$)
Nevirapine 200mg tablet	0.224/tablet	1 ml	229	55.85
Nevirapine Suspension	0.031/ml	0.6 ml	199	3.75
cotrimoxazole	0.006/ml	130 mls/month	23	336.38
Sub Total				**395.97**
C) Medical Supplies	Unit costs (US$)	Quantity	Allocation Basis	Total Costs (US$)
I) Testing				
Determine Abbot Test Kits	1.38	1075	Direct (100%)	1,482.43
Genie II Test kit	3.69	269	Direct (100%)	993.62
EDTA Test tubes	0.72	1075	Direct (100%)	776.51
Red Top Test tube	0.72	1075	Direct (100%)	776.51
5ml Syringes	0.05	1075	Direct (100%)	52.94
examination gloves	0.06	2150	Direct (100%)	134.12
21g needles	0.03	1598	Direct (100%)	47.21
Cotton Wool	6.24	148	Direct (100%)	923.27
Methylated spirit	5.58	24	Direct (100%)	133.96
Sodium Chloride (bleach)	2.46	70	Direct (100%)	172.38
Medicated hand soap	0.49	40	Direct (100%)	19.70
Needle Waste containers	0.82	96	Direct (100%)	78.80
Sub Total				**5,591.44**
ii) Delivery Supplies	Unit costs (US$)	Quantity	Allocation Basis	Total Costs (US$)
examination gloves	0.06	398	Direct (100%)	24.83
Methylated spirit	5.58	12	Direct (100%)	66.98
Sodium Chloride (bleach)	2.46	50	Direct (100%)	123.13
Medicated hand soap	0.49	55	Direct (100%)	27.09
Needle Waste containers	0.82	36	Direct (100%)	29.55
Maternity pads	0.25	796	Direct (100%)	196.02
Cord Clamps	0.49	199	Direct (100%)	98.01
IV Cannula(18g)	0.76	299	Direct (100%)	225.42
Sub Total				**791.01**
iii) Follow up Supplies	Unit costs (US$)	Quantity	Allocation Basis	Total Costs (US$)
ELISA test Kits	0.53	46	Direct (100%)	24.47
Yellow Tips	0.03	100	Direct (100%)	3.28
1cc Syringe	0.26	100	Direct (100%)	26.27
Sub Total				**54.02**
D) Non-Medical costs	Total facility costs (US$)	Allocation basis	Allocation factor	Total Costs (US$)
Transportation	16,250.80	% of visits	0.14	2,275.11
Maintenance	12,057.45	% of visits	0.14	1,688.04
Stationary	22,751.13	% of visits	0.14	3,185.16
Sub Total				**7,148.31**
E) Utilities	Total facility costs (US$)	Allocation basis	Allocation factor	Total Costs (US$)
Telephone	5,460.27	% of visits	0.14	764.44
Electricity	10,530.52	% of visits	0.14	1,474.27
Water	1,560.08	% of visits	0.14	218.41
Sub Total				**2,457.12**
Total Variable costs				**23,078.33**

Rural facility Capital costs (Discount rate 3%)				
	Quantity	Replacement costs	Allocation basis	Annualized costs
A) Building	25.4 m2	14859	Direct (100%)	998.76
Sub Total				**998.76**
B) Vehicles	Quantity	Replacement costs	Allocation basis	Annualized costs
Motorcycles	2	13,888.89	% of total mileage(10%)	162.82
4x4 Vehicle	1	55,555.56	% of total mileage(12%)	781.54
Sub Total				**944.36**
C) Equipment	Quantity	Replacement costs	Allocation basis	Annualized costs
Manual Centrifuge	1	694.44	Direct (100%)	81.41
Rotator	1	2,222.22	Direct (100%)	260.51
Timer	1	33.33	Direct (100%)	3.91
Thermometer	1	11.11	Direct (100%)	1.30
Automatic Pipette	1	833.33	Direct (100%)	97.69
Kerosene refrigerator	1	2,083.33	Direct (100%)	244.23
Pastuer pipettes	1	69.44	Direct (100%)	8.14
Sphygmomanometer	1	63.71	Direct (100%)	7.47
weighing Scales (children)	1	45.00	Direct (100%)	5.28
Weighing Scales (adult)	1	60.00	Direct (100%)	7.03
Delivery kit	1	332.00	Direct (100%)	38.92
Baby resuscitator (Ambu)	1	320.00	Direct (100%)	37.51
Fetoscope	1	12.50	Direct (100%)	1.47
Stethoscope	1	6.94	Direct (100%)	0.81
Sub Total				**795.69**
D) Furniture	Quantity	Replacement costs	Allocation basis	Annualized costs
Lockable Cupboard	2	444.44	Direct (100%)	52.10
Bookshelf	1	125.00	Direct (100%)	14.65
Table	1	416.67	Direct (100%)	48.85
chair	3	666.67	Direct (100%)	78.15
Sofa Set	1	2,222.22	Direct (100%)	260.51
Curtains	4	100.00	Direct (100%)	11.72
Filling Cabinet	1	277.78	Direct (100%)	32.56
Wooden benches	4	105.56	Direct (100%)	12.37
Washing basin	1	41.67	Direct (100%)	4.88
Examination bed	2	1,000.00	Direct (100%)	117.23
Delivery bed	2	2,777.78	Direct (100%)	325.64
Drip Stand	1	36.11	Direct (100%)	4.23
Screen	1	97.22	Direct (100%)	11.40
Buckets	8	88.89	Direct (100%)	10.42
Medicine trolley	1	47.22	Direct (100%)	5.54
Sub Total				**990.27**
E) Training	1	7,560.56	Direct (100%)	1,650.88
Sub Total				**1,650.88**
F) Other capital costs	Quantity	Replacement costs	Allocation basis	Annualized costs
Desktop Computer	0	0	Direct (100%)	
Printer	0	0	Direct (100%)	
Radio	4	500.00	Direct (100%)	109.18
Television sets	2	833.33	Direct (100%)	181.96
Video cassette player	1	222.22	Direct (100%)	48.52
Sub Total				**339.66**
Total Capital costs				**5,719.62**

Appendix IX: Costing Model Results for the Urban Health Facility

Costing in Urban Facility (2005 US$ prices)				
Urban Facility Variable costs				
A) Personnel	Number	Gross Annual Salary (US$)	Allocation Basis	Total Costs (US$)
Midwives	6	4,989	% time spent	19,619.63
Sub Total				**19,619.63**
B) Drugs	Unit costs (US$)	Dosage per client	Number of clients	Total Costs (US$)
Nevirapine 200mg tablet	0.224/tablet	1 ml	841	205.11
Nevirapine Suspension	0.031/ml	0.6 ml	631	11.88
cotrimoxazole	0.006/ml	130 mls/month	259	3,787.88
Sub Total				**4,004.87**
C) Medical Supplies	Unit costs (US$)	Quantity	Allocation Basis	Total Costs (US$)
I) Testing				
Determine Abbot Test Kits	1.38	4,417	Direct (100%)	6,091.04
Genie II Test kit	3.69	995	Direct (100%)	3,675.28
EDTA Test tubes	0.72	4,417	Direct (100%)	3,190.55
Red Top Test tube	0.72	4,417	Direct (100%)	3,190.55
5ml Syringes	0.05	1,075	Direct (100%)	52.94
examination gloves	0.06	8,834	Direct (100%)	551.09
21g needles	0.03	6,611	Direct (100%)	195.34
Cotton Wool	6.24	98	Direct (100%)	611.36
Methylated spirit	5.58	30	Direct (100%)	167.45
Sodium Chloride(bleach)	2.46	49	Direct (100%)	120.66
Medicated hand soap	0.49	24	Direct (100%)	11.82
Needle Waste containers	0.82	36	Direct (100%)	29.55
Sub Total				**17,887.63**
ii) Delivery Supplies	Unit costs (US$)	Quantity	Allocation Basis	Total Costs (US$)
examination gloves	0.06	1,262	Direct (100%)	78.73
Methylated spirit	5.58	10	Direct (100%)	55.82
Sodium Chloride(bleach)	2.46	52	Direct (100%)	128.05
Medicated hand soap	0.49	36	Direct (100%)	17.73
Needle Waste containers	0.82	24	Direct (100%)	19.70
Maternity pads	0.25	2,524	Direct (100%)	621.54
Cord Clamps	0.49	631	Direct (100%)	310.77
IV Cannula(18g)	0.76	947	Direct (100%)	714.77
Sub Total				**1,947.09**
iii) Follow up Supplies	Unit costs (US$)	Quantity	Allocation Basis	Total Costs (US$)
ELISA test Kits	0.53	518	Direct (100%)	275.52
Yellow Tips	0.03	100	Direct (100%)	3.28
1cc Syringe	0.26	100	Direct (100%)	26.27
Sub Total				**305.07**
D) Non-Medical costs	Total facility costs (US$)	Allocation basis	Allocation factor	Total Costs (US$)
Transportation	7,589.32	% of visits	0.24	1,821.44
Maintenance	6,324.44	% of visits	0.24	1,517.86
Stationary	13,660.78	% of visits	0.24	3,278.59
Sub Total				**6,617.89**
E) Utilities	Total facility costs (US$)	Allocation basis	Allocation factor	Total Costs (US$)
Telephone	4,857.17	% of visits	0.24	1,165.72
Electricity	9,360.17	% of visits	0.24	2,246.44
Water	1,821.44	% of visits	0.24	437.15
Sub Total				**3,849.30**
Total Variable costs				**54,231.50**

Urban facility Capital costs (Discount rate 3%)				
	Quantity (surface area)	Replacement costs (US$)	Allocation basis	Annualized costs
A) Building	29.1 m2	17,024	Direct (100%)	1,144.25
Sub Total				**1,144.25**
B) Vehicles	Quantity	Replacement costs (US$)	Allocation basis	Annualized costs
Motorcycles	0	0	% of total mileage	0.00
4x4 Vehicle	1	55,555.56	% of total mileage(15%)	976.92
Sub Total				**976.92**
C) Equipment	Quantity	Replacement costs (US$)	Allocation basis	Annualized costs
Electric Centrifuge	1	1,805.56	Direct (100%)	211.67
Rotator	1	2,222.22	Direct (100%)	260.51
Timer	1	33.33	Direct (100%)	3.91
Thermometer	1	11.11	Direct (100%)	1.30
Automatic Pipette	1	833.33	Direct (100%)	97.69
Electric refrigerator	1	777.78	Direct (100%)	91.18
Pastuer pipettes	1	69.44	Direct (100%)	8.14
Sphygmomanometer	1	63.71	Direct (100%)	7.47
weighing Scales (childern)	1	45.00	Direct (100%)	5.28
Weighing Scales (adult)	1	60.00	Direct (100%)	7.03
Delivery kit	1	332.00	Direct (100%)	38.92
Baby resuscitator (Ambu)	1	320.00	Direct (100%)	37.51
Fetoscope	1	12.50	Direct (100%)	1.47
Stethoscope	1	6.94	Direct (100%)	0.81
Sub Total				**772.89**
D) Furniture	Quantity	Replacement costs (US$)	Allocation basis	Annualized costs
Lockable Cupboard	1	222.22	Direct (100%)	26.05
Bookshelf	1	125.00	Direct (100%)	14.65
Table	1	416.67	Direct (100%)	48.85
chair	2	444.44	Direct (100%)	52.10
Sofa Set	1	2,222.22	Direct (100%)	260.51
Curtains	4	100.00	Direct (100%)	11.72
Filling Cabinet	1	277.78	Direct (100%)	32.56
Wooden benches	3	79.17	Direct (100%)	9.28
Washing basin	1	41.67	Direct (100%)	4.88
Examination bed	1	500.00	Direct (100%)	58.62
Delivery bed	2	2,777.78	Direct (100%)	325.64
Drip Stand	1	36.11	Direct (100%)	4.23
Screen	1	97.22	Direct (100%)	11.40
Buckets	4	44.44	Direct (100%)	5.21
Medicine trolley	1	47.22	Direct (100%)	5.54
Sub Total				**871.25**
E) Training	1	12,341.39	Direct (100%)	2,694.80
Sub Total				**2,694.80**
F) Other capital costs	Quantity	Replacement costs (US$)	Allocation basis	Annualized costs
Desktop Computer	2	3,555.56	Direct (100%)	776.37
Printer	1	694.44	Direct (100%)	151.64
Radio	0	0	0	
Television sets	0	0	0	
Video cassette player	0	0	0	
Sub Total				**928.01**
Total Capital costs				**7,388.12**

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