

# COST UTILITY ANALYSIS OF HIV/AIDS TREATMENT:

*A CASE STUDY OF ANTIRETROVIRAL TREATMENT AND  
HERBAL TREATMENT IN GHANA*

Francis E. Klutse Dagbah



Master thesis at the Faculty of Medicine

Institute for Health Management and Health Economics

UNIVERSITY OF OSLO

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## ABSTRACT

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The thesis is about the cost utility analysis (CUA) of the treatment of HIV/AIDS in Ghana. One hundred and six participants took part in the study. Participants of this study were People Living with HIV/AIDS. These are clients in two different clinics in Ghana-the Fevers' Unit of the Korle Bu Teaching Hospital and the Health for All Herbal Clinic. Two treatment strategies were considered. The treatment strategy at Fevers' Unit is the ARV drugs, while the treatment strategy at the Health for All Herbal Clinic is the herbal treatment, DnT Veramin 1&2. Questionnaires were administered to the participants to elicit information about their demographic characteristics, their annual cost of HIV/AIDS treatment and their effect measures. The effect measures are QALY taken from EQ5D5. These outcome measures were calculated from the societal perspective and the individual payer perspective. The incremental cost effectiveness ratio (ICER) was calculated. Results show that ARV treatment is cost effective. From the societal perspective, The ICER is GHC3,493 per QALY when the productivity cost is included and GHC3,193 per QALY (when productivity cost is excluded). From the individual health care payer perspective, the ICER is GHC860 per QALY when productivity cost is included and GHC560 per QALY when productivity cost is excluded. The willingness to pay (WTP) is set at the GDP per capita of Ghana, which is GHC5,022. When the computed ICERs are compared with the per capita GDP of GHC5,022 per QALY, the ICER values are less. This shows that the ARV treatment is cost effective, and policy makers and all stakeholders should (all things being equal) implement programmes to scale up ARV treatment for PLWHAs.



# DEDICATION

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This work is dedicated to my dear wife, Edith. Sweetie, your words of encouragement have been phenomenal. I love you.

.....and to my sweet daughter, Senam, your birth has inspired me to raise my targets a bit higher. I love you.

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To my dear wife, Edith and to my sweet daughter Senam, thank you so much, for your support.

Any omission and commission in this thesis are certainly my liability alone.

Thank you.

Francis Klutse Dagbah -2012



# TABLE OF CONTENTS

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CHAPTER 1: INTRODUCTION.....	1
1.1 Background .....	1
1.2 Rationale of the study.....	3
1.3 The research areas .....	4
1.3.1 Fevers' Unit of Korle Bu Teaching Hospital .....	4
1.3.2 Health for All Herbal Clinic .....	4
1.3.3 Geographical Location of the Research Areas .....	5
1.4 Economic evaluation of health care programmes .....	8
1.4.1 Cost effectiveness analysis .....	8
1.4.2 Cost Utility Analysis .....	9
1.4.3 Cost benefit analysis.....	9
1.4.4 Cost Minimization Analysis .....	10
1.4.5 Measure of Health-Related Quality of Life (HRQoL).....	11
CHAPTER 2: THEORETICAL FRAMEWORK AND LITERATURE REVIEW .....	14
2.1 Theories and Perspectives .....	14
2.2 Literature review .....	21
2.3 ARV Treatment in Ghana .....	27
CHAPTER 3: METHODOLOGY.....	28
3.1 Introduction .....	28
3.2 Sample.....	29
3.3 Ethical Considerations.....	29
3.3.1 Informed consent.....	30
3.3.2 Confidentiality.....	30
3.3.3 Deception .....	30
3.3.4 Debriefing.....	30
3.4 Data Collection.....	31
3.5 Statistical analysis .....	32
CHAPTER 4: DATA ANALYSIS .....	34
4.2 Analyzing the differences between the two centers with respect to demographic variables .....	35
4.3 Analysing the differences between the two centers with respect to costs and QALY ...	37

4.3.1 cost .....	37
4.3.2 QALY.....	37
4.3.3 Regression .....	38
5.0 Discussions and conclusions .....	46
6.0 References .....	50
Appendix A .....	55
Appendix B .....	60

## Figures

Figure 1: The map showing an Africa map with Ghana and the research locations within Ghana. ....	6
Figure 2: Comparison of the ICER and WTP (which is per capita GDP of Ghana).....	45

## Tables

Table 1: Demographic characteristics of participants .....	34
Table 2: Demographic of the participants by the groups.....	36
Table 3: Test results with the p-values of the costs and QALY.....	37
Table 4: Regression results for the effects of drugs on QALY .....	38
Table 5: Mean annual HIV related cost per patient from the societal perspective .....	40
Table 6: sensitivity analysis of cost of HIV/AIDS treatment in Ghana.....	45





# CHAPTER 1: INTRODUCTION

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## 1.1 Background

Ghana's Human Immunodeficiency Virus/Acquired Immune Deficiency Syndrome (HIV/AIDS) epidemic status has been categorised as "generalised." This means that the country has not been hard hit by the HIV/AIDS epidemic like other countries in sub-Saharan Africa (Rosen and Asante, 2010). The estimate of (median) prevalence for HIV/AIDS in Ghana was about 2 per cent of the population. However there are variations between urban areas and rural areas. The urban areas have the higher prevalence rate, with Agormanya recording prevalence of 7.8 per cent (Rosen and Asante, 2010).

The HIV/AIDS epidemic has been a source of great drain to the economy. Much resource is committed to financing many diverse aspects of the sickness. For instance in 2007 alone, an amount of USD52,445,091 was allocated for HIV/AIDS related programmes. About 42 per cent of this money was committed to HIV/AIDS treatment and care (Asante and Fenny, 2008).

The introduction of antiretroviral (ARV) therapy was a great watershed in the history of HIV/AIDS. This has had a great improvement on the health of people living with HIV/AIDS (PLWHA), enabling them to live longer (Doran, 1997). According to the joint United AIDS document, there is an increase in access of ARV to PLWHAs in sub-Saharan Africa, resulting in some level of decline in HIV/AIDS related morbidity and mortality. There has also been significant increase in access to ARV for pregnant women resulting in reduction in mother to child transmission (MCT). For instance, in 2009, 37 per cent of PLHWA had access to ARV in sub - Saharan Africa. Also, about 54 per cent of pregnant women received treatment to prevent MCT. There was 20 per cent decrease in HIV/AIDS related deaths in the region, and a significant decrease in HIV/AIDS among children (UNAIDS, 2010). However, there are still problems with access. A cursory look at the statistics above showed that, since total coverage of ARV treatment was estimated to be 37 per cent, then about 63 per cent of the total population of PLHWAs do not have access to ART. There is therefore a need to scale up efforts to increase the access to treatment. There is also the need to undertake thorough studies, to establish whether the ARV treatment and scaling-up the treatment programmes

will significantly reduce, if not totally eliminate the HIV/AIDS epidemic in sub-Saharan Africa.

Since the emergence of the HIV/AIDS, there have been efforts from various stakeholders to explore ways of finding local (traditional) medicine for the treatment of the disease. There has been evidence that people living with HIV/AIDS use traditional medicine (Babb, et al, 2004). In an effort to manage the disease in South Africa, some people living with HIV/AIDS use hypoxis and sutherlandia (Mills, Cooper, Dugald and Kanfer, 2005), although the effectiveness of these treatment options have not been established.

The World Health Organisation (WHO) defines traditional medicine as:

“ health practices, approaches, knowledge and beliefs incorporating plant, animal and mineral based medicines, spiritual therapies, manual techniques and exercises, applied singularly or in combination to treat, diagnose and prevent illnesses or maintain well-being.” (WHO, 2003).

From the above definition, it could be deduced that traditional medicine is based on both spirit and the material. The material part of healing enables the traditional medical practitioners to use herbs which include plants to prevent or cure diseases.

The traditional medical practitioners seem to be the first point of call, especially in Africa where they are used for treatment for ailments including HIV/AIDS. This is because they are readily available and their cost of treatment is affordable (Langlois-Klassen, Kipp, Jhangri, Rubaale, 2007). A common knowledge about some shortcomings of the traditional medical practice especially in Africa is that the traditional medical practitioners do not have any effective ways of diagnosing HIV/AIDS. They also do not observe basic hygienic practices thus exposing their clients to other infections. Finally, there has not been any systematically conducted study to establish the effectiveness of any of the traditional medical preparations.

In Ghana, a herbal practitioner, called Dr. Normeshie, owner of Health for All Herbal Clinic has developed the DNT veramin 1 and 2, which seem to have anti-retroviral agents. Some people living with HIV/AIDS have been using this therapy and seem to be doing well. Plans to conduct scientifically proven clinical efficacy of the treatment is underway, however, Dr Normeshie has organised some of the HIV/AIDS clients in his clinic into providence groups, who meet periodically for seminars on how to combat the challenges of living with HIV/AIDS ([ankwa-roots.org](http://ankwa-roots.org)). A word of caution here is that though DNT Veramin 1&2

herbal treatment appears to improve the quality of life of the people using it, no empirical study has been done to establish its efficacy or effectiveness. It has been established that ARV treatment is cost effective. No direct evidence show cost effectiveness of herbal drugs in treating HIV/AIDS. Evidence shows that the mere fact that PLWHA receive care from others improves their health (Gatsi, 2008). Due to the fact that herbal treatment may increase QALYs and is much cheaper than ARV, one cannot rule out totally herbal drugs being cost effective. This may influence the health gains from the clients receiving DNT veramin 1 and 2 treatment. This study therefore uses the veramin 1 and 2 treatment as control, rather than effective treatment.

## **1.2 Rationale of the study**

The search for a cure for HIV/AIDS has for some time now eluded the research community. HIV/AIDS is not affecting only the health of the people. It affects the economic activities of the people, as victims who are sick may not be able to engage in productive activities. They may not be able to earn decent incomes. Their loss of income may not affect them alone, but also their dependants. Anti-retroviral therapy has been seen as the stop gap solution for HIV/AIDS treatment as it helps increase the life span of the PLWHAs and also helps them to take part in productive economic life. As discussed above, the challenge of using anti-retroviral therapy in HIV/AIDS in many sub-Saharan Africa countries is the cost. Many people cannot afford the treatment and thus making coverage as low as just above 30 per cent. Some traditional herbal practitioners have developed herbal treatment options for treating the disease. However, the efficacy of such traditional treatment alternatives has not been adequately proven. ARV treatment is thus the only viable option. There is therefore the need to find affordable ways of treating people living with HIV/AIDS. Treatment cost is not the only challenge for people living with HIV/AIDS, other costs included transportation and time among others.

The discussion above throws a challenge for the research community, and therefore this study intends to:

1. compare the costs and effects of the scientifically proven Antiretroviral drugs to the DNT veramin 1&2 in the treatment of HIV/AIDS .

2. calculate the Incremental cost effectiveness analysis (ICER) for the alternative programmes.

This study is conducted as a trial base study. The study also covered only a year. This is consistent with a trial based study done by Torrance, Raynauld, Walker *et al.* (2002), where they compared two treatment strategies for osteoarthritis. Since this study is also trial based, and covers only one year, modeling will not be done for the cost utility analysis.

### **1.3 The research areas**

The two research areas, the Fevers' Unit of the Korle Bu Teaching Hospital and the Health for All Herbal Clinic are described below.

#### **1.3.1 Fevers' Unit of Korle Bu Teaching Hospital**

The Fevers' Unit at Korle Bu Teaching Hospital handles treatment for HIV/AIDS related conditions. The unit has been operational since 2003. Some physicians and other support staff render services for the HIV/AIDS clients. Services carried out include voluntary counseling and testing (VCT) whereby clients are screened for HIV/AIDS infection, administration of ARV treatment, prevention of mother to child transmission (PMTCT) and other related services. The various assessments show that the minimum of five Ghana Cedi (GHC5.00 ) payment for ARV drugs is affordable for some fractions of patients visiting the unit, even though some could still not afford it (uneca.org).

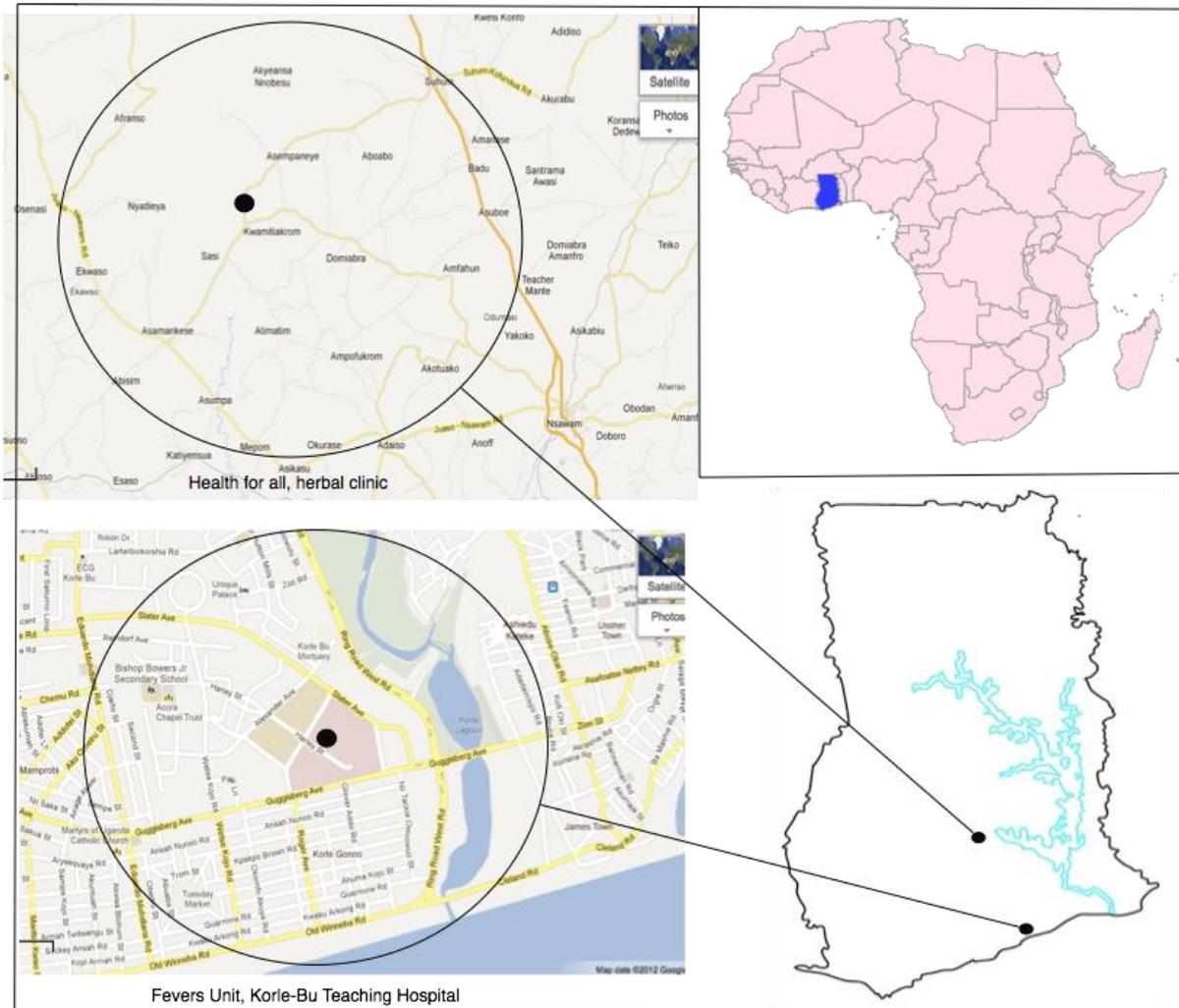
#### **1.3.2 Health for All Herbal Clinic**

The Health for All Herbal Clinic started work in 1984, in Owuram a village located along the Asamankese – Suhum road. This herbal centre provides treatment for many ailments using herbal medicine. The clinic also serves as research centre for herbal medical research. The Health for All Herbal Clinic has in co-operation with the Ananse Village Programme started a providence group for clients of the clinic who report to have HIV/AIDS related ailments. Apart from giving herbal treatment for the clients in the clinic, the clients are also given counselling services. The herbal centre has teamed up with a non-Governmental organisation (NGO) to provide some small credit to boost the economic activities of members of the group (<http://www.ananseghana.org/healthforall>). The DNT veramin 1 and 2 is supposed to be given

to the clients free but practically some small amount of money is taken from clients and some extra herbal drugs are also supplied for which they pay for. It is clear that the treatment is not wholly free. The services of the Health for All Herbal clinic is patronised largely by people in its catchment areas. The HIV/AIDS services are relevant alternatives to people who could not afford the cost of ARV drugs and transport costs to Accra and other places where HIV/AIDS services provided by public sector health care facilities are located. Proximity is an important factor in healthcare assessment therefore location of this clinic is relevant in this study.

### **1.3.3 Geographical Location of the Research Areas**

The geographical locations of the research areas are presented in figure 1 below. The map shows the research sites.



**Figure 1: The map showing an Africa map with Ghana and the research locations within Ghana.**

Footnote: the maps were taken from google.com/maps. I organized them myself.

The research area of the ARV intervention, the Fever's unit is located in the Accra metropolis, Ghana's Capital. The Accra area has a very diverse status as people from all over the country and beyond live in the metropolis. The city population is estimated to be about two million people. It is estimated that migration contributes to the population increase.

There are the very wealthy people living in upscale communities and the very poor people as well. The city has major health care facilities including the Korle Bu Teaching Hospital which houses the Fevers' Unit ([www.ama.ghanadistricts.gov.gh/](http://www.ama.ghanadistricts.gov.gh/))

The research area for the herbal intervention, Health for All Herbal Clinic is located at Owuram village in the West Akim Municipality in the Eastern Region of Ghana. The Village is located about 13 kilometers from Asamankese, the municipal capital. The West Akim Municipality covers an area of about 1 018 square kilometers. Asamankese, the municipal capital is about 75 kilometers from Accra. The Municipal Assembly is bounded in the North by the Kwaebibrem District, the Birim South Municipal assembly to the West. The Agona, Awutu and Ga East Municipal to the South, and Suhum-Kraboa-Coalter and the Akwapim South Municipal Assemblies in the East.

The main economic activities that form basis for household income in the area are crop agriculture, business/ trading, family workers' salaries, manufacturing, food processing and remittances. Agriculture forms 40 per cent of the income of the people in the area. The incidence of poverty is quite high in the area. The landscape of West Akim Municipality is very rich and support both cash crop and food crop cultivation. There are also deposits of minerals like gold and diamond in commercial quantity in the Municipality. The population of the municipality is estimated at about 166 000.

The health infrastructure in the municipality includes one municipal hospital, three clinics and six health posts. The Health for All Herbal Clinic also provides significant health services to the people. There are only two medical doctors in the municipality with the nurse to patient ratio at one nurse to about 3000 patients

Malaria and infectious diseases are among the most common causes of consultations in the health centers and remain the most common causes of death in the area.

The VCT service in the municipality has not been encouraging. It must be noted however that, people who patronise health care facilities come from different places, and thus there are people resident outside the municipality who assess health care in the health centers located in the municipality. HIV/AIDS has been identified as a major concern in the health system in the Municipality (<http://westakim.ghanadistricts.gov.gh/>).

From the above it is very clear that there are still serious challenges in the health delivery system in the two research sites and the Ghana as a whole. It is also very prudent that the scarce resources for the interventions are evaluated to ensure that they are being put into judicious use. Finally an evaluation also ensures that decision makers are guided by empirical evidence in their quest to implement their policies.

The two research areas are very diverse. The Fevers' Unit is urbanized while the Health for All Herbal Clinic is located in the rural area. This disparity plays much role in access and delivery of health care. Major health care programmes and facilities are in the urban areas. There are also higher economic activities in the urban area resulting in higher income and higher socioeconomic status in the urban areas. The effects outplay in access to HIV/AIDS treatment and care cannot be overemphasized.

## **1.4 Economic evaluation of health care programmes**

The major issue in Economics is the scarcity of resources. This entails that individuals and society give up some resources in order to get some other (Folland, Goodman and Stano, 2010). According to Drummond *et al.* (2005), when we say economic evaluation, we are talking about the cost and consequences of a programme that allow us to make a decision on how scarce economic resources are to be used. To undertake an economic evaluation, the various cost elements of the activities being conducted must be identified, measured, valued, and compared with the effect of each of the activities or programmes. These enable choices to be made for the best alternative programme. There are various types of economic evaluation. These include cost effectiveness analysis (CEA), cost utility analysis (CUA), and cost benefit analysis (CBA). The three techniques are similar in the identification and valuation of costs. The only differences are how the effects are measured in the various techniques. Due to scarcity of resources, conducting economic evaluation helps determine efficient allocation of health care resources. Further it ensures that the various interventions are compared to determine which ensures better health, and also helps decision makers, operating within a given budget, choose between alternative programmes (Gold et al 1996).

### **1.4.1 Cost effectiveness analysis**

Cost-effectiveness analysis (CEA) is the type of economic evaluation in which the various cost elements of the programme are related to a single common effect, and this effect may

differ in magnitude between the alternative programmes. The cost effectiveness analysis can only be conducted on programmes that have a common effect, which are stated in natural units (Drummond et al, 2005). In CEA the estimate is comparing a nonmonetary objective, for example lives saved. In CEA the net or incremental cost of an intervention is estimated. The estimate involves the cost of the health outcomes of the programme. The main objective of conducting a CEA is to compare the relative value of different interventions in creating better health, longer life or both.

### **1.4.2 Cost Utility Analysis**

According to Drummond et al (2005), in cost utility analysis (CUA), the measure under consideration is the Quality Adjusted Life Years (QALY) or some variants health outcome derived by the society or individuals. Utility of various health outcomes differ from one individual to the other and from society to society. This must be taken into consideration to determine the economic evaluation of a programme. The CUA is thus a variation of cost effectiveness analysis where the measures of benefits reflect the individuals' or society's preferences over the health effects of alternative programmes. An advantage of using utility analysis is that the health related quality of life adjustment to treatment outcome and generic comparisons of the outcomes can be simultaneously calculated for the given costs and outcomes of different programmes under consideration. The main generic outcomes include quality adjusted life years (QALY), healthy years equivalent (HYE), and Disability Adjusted Life Years (DALY).

The CUA results are usually presented as incremental cost per healthy year gained or cost per quality adjusted life year gained for undertaking one programme rather than another programme.

### **1.4.3 Cost benefit analysis**

The third form of economic evaluation worth discussing is the cost benefit analysis (CBA). The cost benefit thus combines both the cost and consequences of alternatives under consideration in monetary terms. The CBA requires that we place monetary values on improvements in life and well-being from a project. The results of CBA are presented as ratio of cost to benefit. In CBA, when the monetary benefits of a project exceed the costs, then the project is worth undertaking (Drummond et al, 2005). However, since it is difficult to value

the benefits of health gains to society in monetary terms, CBA is not much used in health economics.

#### **1.4.4 Cost Minimization Analysis**

Sometimes, economic evaluations are referred to as Cost Minimisation Analysis (CMA). Cost minimisation analysis describes a situation where the effects of the treatment options being considered are broadly equivalent. The cost of the treatment options determines which of them to choose (Drummond et al, 2005)

According to Drummond et al (2005), the methods of economic evaluation identified above have similarities and differences. They may have similar cost elements. However, they differ at the effects side. For instance measures of effect in CEA are single, programme specific and unvalued. However, effect measures in CUA may be single or multiple. They are not programme specific but generic. They are also preference based. The CUA also have broad applicability. It is therefore more useful by decision-makers than CEA. It is also more useful than CBA because of the difficulty in placing monetary value on health outcomes, which the later measures.

It must be noted that classifying study types or techniques are just a way of identifying that completed studies have different analytic characteristics. It does not prescribe a particular study because in the beginning of every study, it is difficult to identify a study type in advance, as data may not be available. Also different approaches could be combined to conduct an analysis, since each could explore various dimensions of the study. The objective of the study spelt out by the decision-maker drives the choice of the form of study. However, Gold et al, (1996), stated that the three various techniques (especially CEA and CUA) are not very different and can be used interchangeably. My study uses CUA. Also, expected quality of life is an important aspect of herbal treatment from the herbal clinic, and this can be assessed using CUA. In standard economics, we usually read utilities as ordinal, but in health economic evaluations the preferences are cardinal therefore calibrating them as utilities is ideal.

#### **1.4.5 Measure of Health-Related Quality of Life (HRQoL)**

There are various gains in health measures associated with programmes during economic evaluations. Some of these are explained below.

In most health care programmes, one significant economic benefit of an intervention is the improvement in quality of life (Drummond et al, 2005). The Health-Related Quality of Life (HRQoL) is the effect of a disease on the way a person enjoys life, which includes the way illness affects a person's ability to live free of pain, to work productively, and to interact with other people. The HRQoL score thus translates a perception of quality into a number (Muening, 2002).

There are various tools, developed to measure Health Related Quality of Life (HRQoL). These include Life Years gained (LY), Disability Adjusted Life Year (DALY) and Quality Adjusted Life Years (QALY), among others.

The Disability Adjusted Life Years (DALY) was used in the World Health Report in 1993 conducted by the World Bank. DALY is a measure of disease burden. It measures the number of years lost to a disability, illness, or death. The DALY assigns disease weights to health outcomes, where the value 0 equals full health and 1 equals death. DALYs may also be adjusted for age and sex.

Some criticisms have been leveled against the DALY. This measure is biased towards the poor and the elderly in society. In order to use DALYs, one needs to discount for age and sex, however, it has been argued that these two variables are not the only sources of disparities among populations. Socioeconomic factors are also a source of disparities and thus DALYs discriminate against people from low socio-economic backgrounds (Robberstad , 2005).

DALY is not used in this study because an analysis using DALYs would have a bias against relatively poor and elderly people compared to relatively rich and middle age people in the study in Ghana.

Drummond et al (2005) explained that when using the Quality Adjusted Life Years (QALYs), premature death and morbidity are combined, while weights are assigned to health states. The QALY attempts to estimate the number of years that could be added by an intervention. Each year lived is given a value. The value 0 is equal to death, while the value, 1 equals perfect health. The QALY of an individual is a product of the health related quality of life of the

health state and the duration of the health state. This study uses QALYs because unlike DALYs, results of QALYs are not biased against people of lower socioeconomic status.

The weight values of QALY are determined by the methods listed below:

**Standard Gamble:** This is a preference based measurement based on von Neuman Morgenstern utility theory. A core issue of measurement using the standard gamble is the preferences between two prospects. For the first prospect, you live with your current chronic disease while for prospect 2 you either die immediately or you regain full health. The patient is given a choice of a treatment that has two options, either the patient is restored to perfect health and lives for some additional years or the patient dies immediately. Alternatively, the patient remains with the chronic state for life. The options are varied until the patient becomes indifferent to the two prospects. Standard gambles can be obtained from patients by face to face interviews, paper based approaches, group interviews among others.

**Time Trade Off:** Here the respondents are asked to make a choice between staying in an ill health conditions for a period of time and undergoing a medical intervention that has a potential of restoring them to perfect health but with a shorter life. The individual is to decide what length of time he or she is to live in full health which would make him indifferent between that and the current. In effect, the individual is answering the question “how much time are you willing to forgo in order to live the rest of your life in full health?”

**Visual Analogue Scale:** Respondents are asked to rate their state of ill health condition on scale from 0 to 100. The score of zero represents death, while 100 represents perfect health

Apart from the above methods, EuroQol Group has developed a questionnaire based measure called EQ5D5. The EQ5D5 has two parts of measurement. The first part is a descriptive system which categorizes health states according to the following dimensions: mobility, self-care, usual activities (e.g. work, study, homework or leisure activities), pain/discomfort and anxiety/depression. However, each dimension has 5 levels: no problems, slight problems, moderate problems, severe problems, and extreme problems. The interviewee ticks the level that corresponds to the dimension of his or her health. The part two of the questionnaire includes an EQ Visual Analogue Scale, which is a 20 cm vertical visual analogue scale with endpoints labeled as “the best health you can imagine” at the upper end point and “the worst health you can imagine”. The scale is calibrated from 0 to 100. There is a box below the

VAS scale. The respondents are instructed to mark an X on the scale to indicate their health on the day of filling the questionnaire. The score marked on the VAS scale is then recorded on the box below the VAS scale (EuroQol Group, 2011).

The health dimension scores from the health state scores computed to develop the QALY. This study will use the EQ5D5L to collect the QALY data. Through periodic researches and reviews using different population groups and cultures, the EQ5D5 scale has been adapted and various scores computed for different cultures. In sub-Saharan Africa, the questionnaire has been adapted for use in South Africa, based on the UK value sets. The EQ5D5 value sets are developed into QALYs. The QALY scores have also been adapted for Zimbabwe. This study will use the conversion scale for Zimbabwe to measure the QALY measures for the participants (EuroQol, 2011). Zimbabwe is in Sub-Saharan Africa, and shares some development trends with Ghana. This country thus serves as an ideal proximate measure of the QALYs for Ghanaian participants in this study.

## **CHAPTER 2: THEORETICAL FRAMEWORK AND LITERATURE REVIEW**

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### **2.1 Theories and Perspectives**

This chapter deals with the relevant theories and perspectives upon which this study rests. The theories and perspectives are relevant to throw more light on the research topic and findings. These include von Neumann- Morgenstern utility theory, welfarist theory, societal perspective and individual patient perspective. In conducting economic evaluation of various health care programmes, it is expedient to identify the various cost elements that the programme entails and also the consequences. The perspective taken determines which cost to include and which to exclude.

#### **2.1.1 Expected Utility theory**

The expected utility theory which is also called the Neumann-Morgenstern utility theory, is a theory developed to describe how rational individuals ought to make decisions in terms of uncertainties. According to this theory, alternative actions have possible outcomes. Each outcome has set of corresponding probabilities. The preferences of these outcomes are given quantitative values, which have cardinal or ordinal characteristics. (von Neumann and Morgenstern, 1944). In health, the outcomes are seen as cardinal. The utilities of each outcome are multiplied with its probability. The products are summed for each outcome and to determine the expected utility (Drummond et al, 2005).

#### **2.1.2 The Welfarist Perspective**

The welfarist perspective considers the value the individuals place on outcomes, because they assumed the individuals to be the best judges of their welfare. The welfarist thus determines the amount the individual is willing to pay for the programme, in evaluating the cost-effectiveness of the programme (Drummond et al, 2005). Garber, Weinstein, Torrence (1996) explained that overall welfare of society is derived from the individual preferences. According to the welfarist perspective, the utility of individuals depends on their consumption, and this utility and preferences function follow certain conditions of rationality and logical consistency. Also, they posit that aggregation of individual preferences makes up welfare of

society. This means that in designing programmes, decision makers need to among other things consider how the combination of resources affects the welfare of the society.

### 2.1.3 Societal perspective

According to Muenning (2002) a study is said to be conducted from a perspective when a group or organisation's need influences the costs and outcomes that are selected into the cost utility analysis. The societal perspective involves taking into consideration all costs relevant to the analysis into the study. A nice way to standardize cost effectiveness analysis is to require that all cost-effectiveness analysis assume the same perspective. The reference case scenario of the Panel on cost effectiveness in Health and Medicine requires that the societal perspective be adopted (Gold, et al, 1996). Also, according to Hunink, Glasziou et al (2001), a prime benefit of CEA (in this case CUA) is to allow decision makers to compare and make choices among programmes, therefore it is imperative that there be a bank of comparable CEA. Societal perspective ensures this comparison. This study will also assume the societal perspective.

It is very important to calculate the cost and effects of an intervention relative to other interventions. In cost effectiveness analysis the cost of an intervention, the quality of life and the number of years of life gained are combined into a ratio called the cost effectiveness ratio. The formulae for calculating the cost effectiveness ratio is presented below:

$$\frac{\text{cost of an intervention} - \text{cost averted by the intervention}}{\text{QALYs gained by the intervention}} \quad (1)$$

The cost – effectiveness ratio shows how much an intervention costs relative to the number of QALYs gained in the cohort. A disadvantage of the cost effectiveness ratio however, is that it does not provide information on how the intervention compares to other strategies for treating the disease under consideration.

When a study intends to do comparison between interventions the appropriate formula to use is the incremental cost – effectiveness ratio.

In an incremental cost effectiveness ratio, two or more active options for interventions and their effects are compared. The incremental cost effectiveness ratio (ICER) is thus the added cost per unit of added benefit of an option, relative to the next less expensive choice (Hunink, 2001).

The formula according to Muening, (2002) is given below

$$ICER = \frac{\text{Total cost of intervention 1} - \text{Total cost of intervention 2}}{QALYs \text{ of intervention 1} - QALYs \text{ of intervention 2}} \quad (2)$$

In my study where the interventions included ARV treatment and the DNT Veramin 1 & 2 herbal treatment, the ICER will be given as:

$$\frac{\text{Total Cost ARV} - \text{Total Cost Vermin 1\&2}}{QALY \text{ ARV} - QALY \text{ DNT Veramin 1\&2}} \quad (3)$$

The measure of a cost is the value forgone when resources are used for one purpose rather than the next best alternative. According to Drummond et al (2005), the cost of a programme is made up by the resources consumed by the programme. To determine the cost of the programme, quantities of the programme are calculated and then multiplied by the appropriate prices. The resources consumed in the health care programme may include costs in the health sector, and societal costs incurred by patient or family and then productivity losses.

Health care sector costs may arise from items such as drugs, lab tests, physician visits etc. Health care costs may also include follow up visits. Resources from other sectors may include voluntary work. The resource use by patient and family may include cost of travelling to the hospital, and various out of pocket payments for the medicines.

According to Drummond et al, (2005) an important decision in cost effectiveness study is to determine which costs to be considered in a specific study. The types of costs involve in a study is influenced by some factors explained below:

**1. The view point of the analysis:** the view point of a study determines the type of costs to be included in the study. This is because an item which may be a cost at one point of view may not be a cost at another point of view. For instance when a patient spent extra money on a special diet recommended by the physician, as part of his treatment, it may be a cost from the patient's perspective and the societal perspective, but that may not be a cost from the insurer's perspective. Also, even though transfer payments, like worker compensation payments are cost to the paying agencies, gain to the worker, they are neither gain nor cost to society.

**2. Scope of comparison:** costs that are common in studies with scope narrowed down to programmes immediately under study can be eliminated. This could reduce the work load involved in the studies, without affecting the choice between the programmes under study. However, if a broader comparison and other alternatives will be included at a later time, then all the other costs should be included in the analysis.

**3. Ranges of cost:** an economic analysis may turn out only to confirm results that will be obtained by considering a narrower range of costs. In this case, these costs can be eliminated without influencing the choice of programme. Eliminating such costs can simplify the analysis. In this case reasons for excluding such costs should be stated.

**4. Order of magnitude:** the order of magnitude of the costs should also be considered. Cost effectiveness analysis requires a great deal of resources, therefore costs that are so infinitesimal and thus could not affect the outcome in any meaningful way could be eliminated. Reasons for eliminating such costs, for instance based on empirical studies can be given as basis to eliminate such cost items.

A very important aspect of analysis after identifying costs is assigning values and measuring each individual cost item. This means that costing involves measuring quantities of resource use and assigning unit cost (i.e. price). Measuring quantity of resource use can be done in different ways. It can be collected on case report form when economic analysis is done alongside clinical trial. Some resource quantity data can be collected by review of patient charts or hospital records, or by asking patients. In theory, resource cost is its opportunity cost. However, in practice (health care) resources are valued at their market price. Sometimes the market price may differ from the actual price of resource consumed. For instance when the health care resource is subsidized in a specific hospital, the price will be different from the market price. This transfer cost representing the difference is not the major factor directing this study. There are uncertainties whether the opportunity costs represent the market price in this situation. However, since most of the cost items are paid out of pocket from the patients, we based it on opportunity costs as these represent values that may have alternative use.

**Values of non-market items:** when people are sick, they spend their own time seeking health care. Also family and friends also give their time to support the recovery process of the patient. These are non-market resources and needed to be given a price tag for good evaluation. These times are sometimes evaluated using market wage rate. However some

studies exclude volunteer hours from friends and family. But in using societal perspective, patients' time spent on accessing health care form a core part of resource cost.

***Adjustment of market prices:*** mostly, due to the imperfection of the health care market, the market prices differ greatly from opportunity cost. Hospital charges by hospitals operating as a monopoly may not reflect the market price of the health care charges. There may be the need to adjust for some of these charges in order to reflect the market price. However some studies use health care cost unadjusted. Health care cost may be adjusted if there is a clear and objective way of making the adjustment. They may also be adjusted if leaving them unadjusted could result in serious biases in the study outcome.

***Unrelated health care costs:*** there are health care costs that may be due to a certain health care intervention. For instance, children kept alive after a vaccination programme against whooping cough and measles will grow old. They may be sick of something else and still enjoy health care. The question arises whether the health care costs unrelated to the main intervention should be included in the analysis. Some pundits argue that health care costs in later years results from keeping the individual alive. This point of view agrees with the view that health care costs in later years should be included in the analysis. Others see this as unfair to assign other unrelated health care costs to a previous intervention. A suggestion to guide in making a stand in this debate is to determine whether there are enough data and also the extent to which a relationship could be established between the health care intervention under evaluation and the additional care of added years

***Capital outlay and overhead costs:*** health care programmes or interventions are not delivered in a vacuum. Structures are involved in implementing the programmes. For instance HIV/AIDS treatment programmes that we are working on are done in a hospital setting. Some of these structures include buildings, equipment, fixtures and fittings among others. These are examples of fixed assets. A characteristic of fixed assets is that they are used for many different programmes or interventions. Also, their uses extend into the future and do not end even after a single intervention, but are used over time. Finally a huge amount of money is invested in providing these assets. The cost involved in providing for these are called capital costs, since they include the injection of major capital. In economic evaluation, the depreciation of the capital cost can be calculated and used in the study. Also, they annuitize the initial capital over the useful life of the asset. An illustration where all costs are expressed

on annual basis by obtaining an equivalent annual cost could be important to explain the capital cost. The formulae from Drummond et al (2005) is expressed below

$$K = \frac{E}{(1+r)} + \frac{E}{(1+r)^2} + \dots + \frac{E}{(1+r)^n}$$

Where K= capital,  $n$  period,  $r$  interest

The E, which is the annuity factor is always taken from a table provided.

Let us say that a hospital have an investment of GHC 60 000 on a CT scan machine that is assumed to last for ten years and where 1/5 of the services it provides goes to your programme. Assuming an interest rate e.g. 3,5%, the equivalent annual cost (E) can be calculated using the formulae

$$E = K/A$$

A=annuity factor and is calculated by the formulae

$$\text{Annuity factor} = \frac{1-(1+r)^{-n}}{r}$$

What you get is  $A=0,291081/0,035=8,316605$ .  $E = K/8,316605=7214,482$ .

Of this 1/5 goes to your project, i.e. 1442,89 each year.

Apart from capital costs, other resources serve different programmes and departments. For instance in a hospital, radiography department and hostel also use same lighting, heating among others. Also laboratory equipment can be used for various tests. Light, computers, and other equipment in the lab can be used for different departments like HIV/AIDS, maternity and gynecology. These are known as overhead costs. Since these costs are shared by different departments, assigning the whole cost to one programme will inappropriately inflate the cost of the programme. The overhead cost per programme is computed based on method called allocation basis. By this some methods are used to apportion overhead costs to programmes or interventions that incurred them. The overhead costs can be allocated using direct allocation, where the overhead cost of a programme is allocated directly to the programme using allocation bases. For instance, let us assume a hospital has HIV/AIDS treatment programme that runs ten hours per month. Another programme also runs for fifty hours. The total lighting

cost of GHC 6000 will be  $(10 \times 6000)/60$  to the HIV/AIDS department. Other issues to consider are whether future costs should be considered and the rate of discounting these future costs.

Other concerns on costing include adjusting for differential timing of costs. Individuals turn to have preference for benefit earlier than later, and to incur cost later than earlier. Also the value for cost items today may be higher than in the future. These should be taken into consideration in calculation cost of treatment or interventions.

Rosen and Asante (2010) used the systems approach which ensures that all inputs involved in an HIV/AIDS treatment are accounted for. They identified the major type of costs for HIV/AIDS treatment in Ghana as costs for labour, capital, supplies. They itemized the supplies include ARV drugs, laboratory services, prophylaxis. Labour inputs include nurses, physicians and other health care workers.

It is clear from the above discussions that different cost elements make up the HIV/AIDS treatment interventions. These costs elements must be identified and valued to determine the actual programme costs for the interventions.

The clients attend treatment at the two clinics on average once every month. These clients have been on treatment and thus their treatment history is known. Any additional days required for them are communicated to them, so the treatment process is quite uniform and the items identified are relevant. However in cases that the items are not relevant to the treatment of a client, he or she skips it when filling the questionnaire.

The other cost items including capital costs, overhead costs, and labour costs of the two clinics were estimated. These costs were taken from the grants expenditure manual computed by Health for All Health clinic. For the Fevers' unit, I computed these costs from the cost items survey by Rosen and Asante (2010). This information is presented in table (5) below

The process of collecting the cost for this study and the intervention will fully be described under the methodology. An important issue in health care is the effects of externalities, which are defined as costs incurred or benefits received by third parties who are not directly involved in a transaction (Folland, Stano and Goodman). HIV/AIDS treatment of a pregnant woman on ARV provides a benefit of reducing the infection of foetus in her womb. This child

may not be part of transaction but may benefit from the reduction in the mother's ability to infect others.

## **2.2 Literature review**

The infection with HIV/AIDS has been associated with increased in mortality rate. Colebunders, Ryder, Francis et al (1991), found out that disease progression is higher in Africa, compared to developed countries. In Uganda for instance, Morgan, Mahe, Mayanja, Okongo, Lubega and Whitworth (2002) found out that the median progression rate of HIV/AIDS to death to be 9.8 years. HIV/AIDS disease has thus been a source of increase in mortality in Africa. After the introduction of ARV therapy, Bakari, Urasa, Pallangyo, Swai, Mhalu, Biberfeld and Sandstrom (2004) also found out that death rate among Tanzanians infected with HIV/AIDS is higher than among people from the developed world. However, there are similarities between disease progression rate among Tanzanians and people from the developed world. The introduction of antiretroviral therapy was to minimize the progression of the disease and also prolong the life of those infected with HIV virus.

There have been various researches conducted on the ARV treatment and various health outcomes. This has established that the application of ARV has been effective in reducing morbidity and mortality due to HIV/AIDS.

In a study, Beck and his colleagues (1999), took up the challenge and conducted a study with objective of investigating the association between usage of ARV drugs, hospital usage and change in morbidity among HIV/AIDS patients. This study was a prospective cross-sectional design, and collected data through the National Prospective Monitoring System (NPMS), a system designed to examine use, cost and outcome of HIV/AIDS services provided in Hospitals in England. Data was collected on patients' average hospital usage, average HIV related opportunistic infections and the percentage usage of ARV drugs by patient. Results showed a reduction in inpatient hospital usage among patients. The average inpatient days was reduced. Treatment of related opportunistic infections was also reduced drastically. The percentage of ARV drugs usage also increased.

Evidence emerged that a combination drugs for treatment of HIV/AIDS is more efficacious in minimising disease progression (Gulick, Mellors, Havlir *et al* (1997) and mortality (Palella, Delaney, Moorman , *et al.* (1998) among PLWHA. This findings developed interests among

researchers. Much of the researches tried to find out the cost effectiveness of some of the use of combinations ARVs for the treatment of HIV/AIDS.

Also, research in France found a reduction in hospital cost among PLWHA after being enrolled on highly active antiretroviral therapy (HAART). The study was designed to assess the impact of HAART on the health status and hospital costs in severe HIV-infected patients followed in a hospital in France. The study considered the first 500 patients who received the HAART treatment, and had CD4+ cell count below 250/mm<sup>3</sup>. Markov modelling was used to determine the description of patients among varying health states (including) death. The financial charges and HAART treatment costs in the hospitals were also computed. Health states of patients, determined by both CD4 counts and viral loads, over the 14 month period were used to show clinical changes in the patients. A simplified model based on CD4 counts, over two 14 month periods were used to assess the economic impact of HAART initiation. This was done to assess effect before initiation and also after initiation of the HAART. Results from the study showed that from day 0 – 14 months, the proportions of patients in the least severe state defined as CD4+ > 100/mm<sup>3</sup> and viral load < 500 copies/mL increased from 1 % to 50%. The proportion with more than 100 CD4+ cells/mm<sup>3</sup> increased from 17% to 80%. On the other hand, hospital charges fell from five thousand one hundred and thirty eight French francs ( Fr 5,138) per patient month to three thousand one hundred and thirty six( Fr 3,136), representing about 39 per cent reduction in hospital costs. There were minimal increases in ARV treatment cost but the drastic reduction in hospital cost has compensated for the increase ARV treatment (Le Pen, et al, 2001).

Researches were conducted in England to find out whether the use of highly active antiretroviral therapy will be cost effective compared to new approaches to using antiretroviral therapy for the management of HIV infection among English HIV infected individuals. The researchers designed a study that used a Markov modelling to simulate the progression of HIV infection and to estimate the cost, effects and the cost effectiveness of the treatment options under investigation. The health states were based on CD4 counts of the participants. This provided the basis upon which cost effectiveness of HIV treatment was modelled. The cost effectiveness was assessed by dividing the differences in costs by the differences in health outcomes, i.e. the life years or quality adjusted life years (QALYs) saved, between the treatments under consideration. This was used to determine the incremental cost effectiveness ratio (ICER). The interventions were HAART, which was dual

NRTI therapy plus a protease inhibitor or a non-nucleoside reverse transcriptase inhibitor compared to dual NRTI therapy. The health outcome measures included projected life expectancy, cost-effectiveness in GBP per life year saved and QALYs saved. Results showed treatment effect of therapy with HAART produced incremental cost effectiveness ratios of £14 602 per life-year saved and £17 698 per QALY saved, which suggested that the use of HAART in England is at least moderately cost-effective compared with treatment to two NRTIs alone (Miners, Sabin, Trueman et al 1999). Another simulation study was conducted in the US to find out the effect of combinatorial ART treatment for HIV/AIDS. The drugs included zidovudine, lamivudine, and indinavir. The study was designed using a computer-based simulation model of HIV disease to compare alternative ART treatments. The main data for the study was obtained from major clinical trials (e.g. AIDS Clinical Trial Group 320 Study, John Hopkins HIV Clinic Cohort study, the Italy, Netherlands Canada and Australia - INCAS trial. Cost data was based on national AIDS Cost and Services Utilization Survey. The researchers used indicators including changes in both CD4 cell count and the HIV RNA level, the development of opportunistic infections, adverse reactions to medications, and death to simulate course of disease in a hypothetical cohort of HIV infected persons. Health outcome measures included primary and recurrent opportunistic infections, life expectancy, life expectancy adjusted for quality of life, and lifetime direct medical costs, and cost effectiveness in dollars per quality – adjusted year of life gained. The efficacy of ART treatment was measured by a reduction in the HIV RNA level, resulting in the CD4 cell count and reduction in the probability of opportunistic infections and AIDS related death. Results from this study showed that, in comparison with no therapy, life expectancy adjusted for quality of life for three drug therapy increased from 1.53 to 2.91 years, and per- person life time costs increased from USD 45,460 to USD 77, 300. The incremental cost per quality adjusted life year of life gained, as compared with no therapy, was USD 23,000. This means that treatment of HIV infection with a combination of three antiretroviral drugs is cost-effective use of resource. This meant that treatment of HIV infection with a combination of three antiretroviral drugs is cost-effective use of resources (Freedberg, Losina, Weinstein, *et al.* 2001).

The above studies gave vivid illustration to the efficacy of antiretroviral therapy. However, these studies were conducted in developed countries, and there are grounds to question whether this can be directly applied in (sub-Saharan) African countries. For instance it has been established that there are greater disparities in health care spending between the

developed countries and the developing (African) countries. The health care per capita costs in the United States of America (USA), Norway and United Kingdom (UK) are USD 6,350, USD 4,307 and USD 2,597 respectively. In a sharp contrast, the health care per capita in Nigeria for instance is USD 45. Also, developed countries have higher access to health as most of their health care expenditure is publicly financed. Public health care expenditure in the UK for instance is 87 per cent. In Norway it is 84 per cent, and in the US it is 45 per cent. Out of pocket payments are 12 per cent, 15 per cent and 13 per cent respectively in these countries. In sharp contrast, in developing countries a very high percentage of health care expenditure is financed through out of pocket payments. (Olsen, 2009). These disparities by extension come into play in the treatment of HIV/AIDS. Due to these factors, it should be argued that a further investigation of the effects of cost-effectiveness of ARV medication be done in the developing countries.

Will the findings in the above studies apply to least developed countries as well? Some few studies conducted in some developing countries concerning ARV treatment are worth evaluating.

Efforts to fight the HIV/AIDS pandemic in sub-Saharan Africa have been limited by lack of access to the counselling and testing services. Sweat et al (2000) conducted a study in Kenya and Tanzania to test the impact, cost and cost-effectiveness analysis for voluntary counselling and testing (VCT) of HIV-1. In this study cost effectiveness was a hypothetical cohort of 10 000 people seeking VCT in some cities in East Africa. The main outcome measures estimated for this study were programme cost, number of HIV-1 infections averted, cost per HIV-1 infection averted and cost per Disability Adjusted Life Years (DALY) saved. Modelling was done on the impact of targetting VCT by HIV-1 prevalence of the client population. The research also modelled the impact on couples who receive VCT compared to individuals. Sensitivity analysis was also done on all model parameters. Results from the study show that, during the subsequent years HIV -1 VCT was estimated to avert 1104 HIV -1 infections in Kenya and 895 HIV-1 infections in Tanzania. The cost per HIV-1 infection averted was USD 249 in Kenya and USD 346 in Tanzania. The cost per DALY saved was USD 12.77 and USD 17.78 representatively. The intervention was also very cost-effective for HIV-1 infected people and those who received VCT as a couple. The cost-effectiveness of VCT also improved significantly when targetting VCT to population with HIV-1 prevalence and couples.

The effect of the HIV/AIDS pandemic is not limited to adults only. Even children are affected. Children born to mothers who have HIV/AIDS are at risk of getting infected with HIV/AIDS. According to the UNAIDS report (1998), about 90 per cent of the children who got infected with HIV/AIDS through mother to child transmission were in sub-Saharan Africa. Marseille and his colleagues decided to conduct a study into cost effectiveness of HIVNET 012 nevirapine regimen in reducing mother to child transmission. The researchers assessed the cost-effectiveness in hypothetical cohort of 20 000 pregnant women in sub-Saharan Africa. The main outcome measures included programme cost, paediatric HIV-1 cases averted, cost per case averted, and cost per disability adjusted life. The study model compared the costs, outcomes, and cost-effectiveness of five short-course antiretroviral-based strategies aimed at decreasing mother to child transmission of HIV-1 with no intervention. The regimens included HIVNet 012 (targeted), HIVNet 012 (universal), PETRA-A, PETRA-B, and Thai (targeted). Results show that HIVNet 102 regimen would avert 603 cases of HIV-1 in babies, cost USD83,333 and generate 15862 DALYs, for universal treatment with 30 per cent HIV seropositive prevalence. The associated cost – effectiveness ratios were USD 138 per case averted or USD 5.25 per DALY. At 15 per cent seropositive prevalence, the universal treatment option would cost USD 83,333 and avert 302 cases at USD 276 per case averted or USD 10.51 per DALY. HIVNet 012 would cost 141 922 USD and avert 476 cases at USD 298 per cases averted or USD11.29 per DALY, for targetted treatment at 30 per cent HIV-1 seropositive prevalence. With seropositive prevalence higher than 3.0 per cent for universal and 4.5 per cent for targetted treatment, the HIVNet 012 regimen was likely to be as cost effective as other public health interventions. The sensitivity analyses show that the cost-effectiveness analysis was robust under a wide range of parameters. The result shows that in high seropositive prevalence settings, HIV 012 regimen can be highly cost-effective. It also shows that nevirapine therapy could have a major public health impact at a reasonable cost in areas with lower seropositive prevalence when multi dose regimens are not cost effective (Marseille, 1999).

A study was conducted in the Republic of South Africa, to compare cost effectiveness of some patients on the highly active antiretroviral treatment for HIV / AIDS and a comparison not receiving the ARV. The study involved all HIV infected people who were assessing HAART at the health care facilities affiliated to the University of Cape Town, in South Africa. These patients were included in the large scale Cape Town AIDS Cohort study. These were included in the treatment group, while patients who have never accessed ARV treatment

were included in a match comparison (control) group. The study ensured that the two groups were matched on immunological, clinical, social and economic variables. Results from this study also showed that HAART is a cost-effective intervention in South Africa. HAART treatment is also seen as cost saving when treatment cost is reduced further (Badri, Maartens, Mandalia et al, 2006).

In a related study in Burundi, some researchers found that the use of ARV treatment is cost – effective. The study was conducted to assess the cost effectiveness of the HIV care provided by a non-Governmental Organisation (NGO), called Society of Women Against AIDS (SWAA). The NGO set up a clinic that gave primary care treatment including ARV to PLWHAs. They also gave social and psychological support including, home visits food support, counselling among others ( Renaud, Basenya Borman, 2009).

The items included in the measure of cost effectiveness were different in the various settings. For instance in the study in Burundi, the treatment centre was a private NGO, and the items included in the treatment was home visit and food. There is not much evidence that these costs are replicated elsewhere in ARV services for PLHWAs. Also, evidence showed that transportation cost is a big burden for patients in accessing health care, and has been an important reason depriving patients from accessing health care (Løchting, 2008). However this very important aspect of health care cost has not been considered in both the study done in South Africa and Burundi. The estimation of the cost items were also not without questions. In the Burundian study, the cost of the various drugs were estimated from three different sources (and then averaged, due to unavailability of accurate data. The Burundian study also used Disability Adjusted Life Years to measure cost-effectiveness. However as noted above, DALYs are known to be bias towards the poor and the elderly.

Finally, none of the studies conducted involved traditional medicine as comparator. This study however uses a traditional medicine as comparator since traditional medicine has been an important part of African health delivery system.

### **2.3 ARV Treatment in Ghana**

Ghana has adopted some pragmatic measures towards HIV/AIDS prevention and treatment. Ghana established the National AIDS/STI control Programme in 1987. The provision of ARV drugs was integrated into the public health care system from 2003 (NACP, 2005). The main types of ARV drugs use in Ghana are combination of nevirapine, zidovuvine, stavudine, lamivudine drugs. Also patients use firstline and second line drugs (Rosen and Asante, 2010).

## CHAPTER 3: METHODOLOGY

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### 3.0 Introduction

This chapter describes the research techniques employed in collecting the data for the study. The concepts tackled in this chapter include research methods, ethics of research, population and sample size and access to the research area. The sites for the study are the Fevers' Unit of the Korle-Bu Teaching Hospital and Health for All Herbal Centre at Owuram (near Asamankese), in the West Akyem Municipality in Ghana.

They both provide counseling and support for the PLWHA, but the Fevers' Unit at Korle Bu provides ARV treatment, whereas the Health for All Herbal Centre provided only herbal treatments (thus no ARV treatment for the patients). The treatments in these two centers ensure that the study obtained two different groups. Those on Antiretroviral treatment, ARV KBTH and those on herbal treatment HERB HFHC.

Identification, measurement and valuation of cost are important elements in cost utility analysis (Drummond et al, 2005). Prior to conducting the study, I held a meeting with some officials in the two centers and requested permission from them to enable me carry out the study in their centers. The counselors at both the Fevers' Unit at Korle Bu and the Health for All Herbal Centre explained to me they have been helping other researchers in collecting data from their clients. I was briefed on the routines in accessing ARV treatment at Fevers' Unit and the DnT veramin 1 & 2 Herbal treatment at the Health for All Herbal Centre. The medical treatment history of the clients in both centres is known. The study used out-patient clients. After diagnoses, these clients are put on the drugs as medically feasible. They come for reviews monthly, unless it becomes necessary to request them to schedule another review within the month. On average, they are given care ones every month. The meeting I had earlier with the two clinics enabled me to be acquainted with the processes involved in the treatment and aslo to identify the necessary cost elements. The costs identified at the monthly medical visits include laboratory analysis, consultation, purchases of the appropriate drugs from the pharmacy (at either of the health centers) etc (refer to the appendix I and II). The patients pay for the services rendered at the two clinics. The costs are valued in Ghana Cedis (GHC). The cost data is directly taken from the patients using the questionnaire so the valuation and the measurement are done concurrently.

I wrote a follow up letter and attached my proposal to the two centres, and was given a green light. After developing the questionnaires and seeking clearance from my supervisor, I sent the questionnaires through the internet to the research assistants for the data collection at the two centers. I was also in touch with them by mobile phone and on the internet throughout the period of the data collection. When they were not clear with anything concerning the data collection, they sought clarification from me before going on to ensure that the study went on successfully.

### **3.1 Sample**

The study used a cross-sectional study design and a systematic sampling strategy, which ensures that every *n*th element is selected for the study. In my study, *n*th is equal to every 2<sup>nd</sup> client. The inclusion criteria were being an adult (man or woman) between the ages of 20 and 55 and being on treatment at either the Fevers' Unit at Korle Bu or Health for All Herbal Clinic. People who are HIV/AIDS seronegative, those not attending treatment at the two centers even though they may be seropositive, and those who are HIV-positive but either below twenty or above 55, and also those who in any other way did not meet the inclusion criteria were excluded from the study. At each centre during the clinical days, the staff who attended to the HIV/AIDS clients asked second male or female who attended either of the clinics and met the inclusion criteria if they would be willing to take part in the study. None of the clients turned down the request. However, at Fevers' Unit, one lady who was HIV positive but was 19 years old was not given the chance to take part since she did not meet the age criteria. Each participant was referred to the research assistant who guided him or her through answering the questionnaire, after asking for his or her informed consent.

A total of 51 HERB HFHC participants and 55 ARV KBTH participants participated in the study.

### **3.2 Ethical Considerations**

Ethical considerations are a well-known guideline in conducting social research. Cavan (1977) defined ethics as 'a matter of principled sensibility to the rights of others.' There are a lot of ethical considerations in conducting a research especially in a sensitive area as HIV/AIDS, which I set out to do. Some ethical considerations applied in the research as enumerated by Santrock (2003), includes:

### **3.2.1 Informed consent**

This states that what the study was about and any (potential) risk the participant may be exposed to must be explained to the participant ahead of starting the study. This enables the participant to decide whether to partake in the study or not. Additionally, the participant has the right to withdraw from the study at any time even if he or she agreed to take part in the study.

### **3.2.2 Confidentiality**

This gives the responsibility to researchers to ensure that data collected from research participants be kept from other third parties. The data should be kept anonymous (if possible), in other not to give away the identity of the participants.

### **3.2.3 Deception**

This gives the researcher discretion to withhold some sensitive information, which may affect the outcome of the study from the participant, until after the study. This also entreats the researcher to ensure that diligent care is taken that this does not harm the participants. Finally, the participant must be debriefed after the study.

### **3.2.4 Debriefing**

This entreats researchers to inform the participants about the purpose of the study, after ending the study. This also entreats the researchers to explain to the participants any information withheld from them (in the beginning of the study), and the reason these pieces of information were withheld from them.

In my research, I tried as much as possible to follow the ethical guidelines spelt above, even though I used research assistants in collecting the data. I trained the research assistants well whilst in Ghana during the summer holidays (in 2011). I was also in touch with them through the telephone, during the entire period of data collection. In the first place, some of the research assistants I used were the trained counsellors in both centers, who have been working with the participants, so the issue of confidentiality has been taken care of. Also, the questionnaire did not require participants to disclose their names, so none of them could be traced to the questionnaires and get the answers they gave. Again, we sought explicit consent from the participants before including them in the study. We explained reasons for conducting the study and when some information concerning the effect of the study was withheld from them at the beginning of the study, they were debriefed.

I believe by following these guidelines, the rights of the participants were respected.

### **3.3 Data Collection**

I designed a questionnaire that asks the participants to identify and estimate the cost of the various items involve in their treatment, from either the herbal treatment or the ARV treatment. They also rate their health effects on the EQ5D5 scales. The Questionnaires can be found in the appendix I and II.

Cost elements were identified based on the information from the two clinics on the routine and treatment procedures of the clients. The participants are patrons of either of the two clinics. The clinical history of each client on treatment is established, so routine reviews like lab test (for CD4 counts improvement), consultation, going to the pharmacy for the drugs for the recommended drugs, etc were identified as the main cost items. The patients visit the clinic monthly, or as recommended based on their health state.

In the study, the cost elements considered include the following:

***Health care resources:*** These include out of pocket payment for the ARV drugs, the additional drugs purchased from the pharmacy, consultation fees and Lab tests/VCT.

The prophylaxis includes septrine for PLWHA with CD4 count of 350 and above.

The ***non-health care resources:*** these include the transportation cost of patients from and to the hospital. Finally, productivity of patients was ascertained. The productivity loss of patient is the (value of) money lost due to absence from work when sick or attending clinic.

An important issue is the time cost. The clients spent their time to come for treatment in the two centres. Most of them travel from far away and spend the whole day on receiving treatment. Different ways were suggested on including time costs into the study. Luce, Manning, Siegel and Lipscomb (1996) stated that time costs could be evaluated by using suitable measure of opportunity cost, to convert the time cost as dollar (monetary) cost and include this in the numerator. In my study, self employed people are also part of the study. Most of these people worked in the informal sector as farmers, market women, artisans, and others who work in the formal sector. Incomes are expected to vary. The study requested that the clients estimate the income they lose through the time of the treatment in the year.

The cost items in the questionnaire were estimated by asking the patients to identify the appropriate cost items from the questionnaire that applied to them. I used this as a solution because, most of the people who are self employed (in the informal sector) will be highly undervalued when minimum wage is used to estimate productivity cost. The costs taken directly from the hospital, which includes the capital costs, HIV/AIDS subsidy for ARV can be found in table 5.

### **3.5 Quality Adjusted Life Years (QALYs)**

In CUA, the health benefit as stated earlier is described using non-monetary measures. The effectiveness measure in this study is QALY. The QALY is determined by the EQ5D5 scale. The participants are asked to value effects after the treatment on their health state (as at the time they are taking part in the study) by marking their health state on the EQ5 D5 VAS scale. They also answered questions concerning their health on five health dimensions, based on a five scale (refer to appendix i).

Data were collected using the EQ5D5, a structured questionnaire with closed ended questions. The questionnaires were pretested using 6 clients at Fevers' Unit and 2 clients at Health for All Herbal Centre. These clients were not involved in the study. The questionnaire was divided into three sections- A, B and C. Section A captures the demographic characteristics of the participants. Section B assesses the Cost items and Section C assesses the effect of the treatment. The questionnaire is in English. The research Assistants and the counseling staff of both clinics, who assisted in the administration of the questionnaires, could speak the three main local languages, Ga, Twi and Ewe, so we decided that should any participant have difficulty in reading in English language, the questionnaire will be translated for him or her. However most of the participants have good knowledge of the English language so there was less difficulty in the data collection. When a participant had difficulty in understanding any concept, the research assistants came in to explain. This ensured that the study went on successfully.

### **3.4 Statistical analysis**

The EQ5D5 Questionnaire was used to measure the QALYs of the participants. The QALY participants were calculated based on the health profile in the questionnaire. The crosswalk

from Zimbabwe was used to compute the QALY. The costs and the QALYs calculations are based on one year (2011). The participants' medical histories are known since they have been patrons in the two clinics. The statistical analysis done on the data include regression analysis used to assess the effects of treatment on the QALYs of the participants. The chi-square test was used to compare the effects of age, civil status employment on accessing health at the two clinics. The independent sample t-test was used to assess the QALY and the Mann-Whitney U-test was used to assess cost differences in the two treatment centers. The Mann-Whitney U test was used because of somewhat skewed cost data. I used SPSS version 19 and Excel version 2010 to analyse the data. In order to calculate the average costs the midpoint in each cost in the questionnaire is used. The cost categories above GHC80 are pegged at GHC100. Information gathered from the field shows that maximum average cost of the cost items will be GHC 100, for most clients. In addition, I will present the ICERs from both the societal and the individual health care payer perspective, with and without the productivity cost.

## CHAPTER 4: DATA ANALYSIS

### 4.1 Demographics

	frequency	percentage
<b>GENDER</b>		
Male	53	50
Female	53	50
<b>AGE</b>		
20-29	21	20
30-39	35	33.
40-49	32	30
50-55	18	17
<b>MARITAL STATUS</b>		
Single	27	25
Married	55	52
Divorced, Separated,Widowed	23	22
<b>EDUCATION</b>		
None	3	3
Primary	29	27
Secondary	64	60
Tertiary	10	9
<b>EMPLOYMENT</b>		
Employed	31	29
Self employed	60	57
Unemployed	14	13

Table 1: Demographic characteristics of the participants

For demographic characteristics of the sample, see table 1, above. The sample consists of 53 males and 53 females each, and majority of the patients have finished secondary education and are self employed.

#### **4.2 Analyzing the differences between the two centers with respect to demographic variables**

The Chi-square analysis of the data is presented below. The hypothesis based for example on gender is then

H0: There is no difference in the proportion accessing the two health facilities based on gender.

H1: There is a difference in the proportion accessing the two health facilities based on gender.

As can be seen from the results from the table 2, below, the variables gender and marital status, show a small and non-significant difference between the health centres. Although there are some indications that patients on ARV (from the Teaching Hospital) are older, less self-employed and have higher education than patients at the herbal clinic, there are no significant differences for these variables either. This could be due to small sample size

Variable	GROUPS				p-value for difference
	HFAHC (herbal)		KBTH (ARV)		
	Observed n	percentage	Observed n	percentage	
Gender:					0.85
Male	25	49	28	51	
Female	26	51	27	49	
AGE					0.194
20-29	14	27	7	12	
30-39	17	33	18	33	
40-49	14	27	18	33	
50-55	6	13	12	22	
MARITALSTATUS					0.539
Single	14	27	13	24	
Married	24	47	31	56	
Divorced, separated,	13	26	11	20	
EMPLOYMENT					0.282
Employed	11	22	20	37	
Self Employed	31	61	28	52	
Unemployed	9	18	6	11	

**Table 2: Demographic of the participants by groups**

## 4.3 Analysing the differences between the two centers with respect to costs and QALY

### 4.3.1 cost

An independent t-test was conducted to compare the health care payers' costs of KBTH Fevers' Unit and the Herbal Clinic. The cost differences are skewed, therefore we use the bootstrapping percentile method of 10 000 samples. There is significant difference between the health cost of KBTH (mean=338, SD=158) and the herbal clinic (mean=195, SD=101). The p-value 0.00 is less than the 0.05 significant level, hence there is a difference in costs. The patients at the Fevers' Unit (at the Teaching Hospital) have the higher cost. This may be because of higher cost of medication at the teaching hospital.

### 4.3.2 QALY

The independent t-test for the two groups shows that there is a significant difference between the quality adjusted life years gained by the two groups. The average score for KBTH is 0.84, (SD=0.08) and Herbal Clinic 0.69, (SD=0.10) showing that a higher QALY for patients from the Fevers' Unit (Teaching hospital). This means that the QALY level attained by using ARV drugs from the Fevers' Unit is higher than the QALY level attained from the herbal treatment.

Variable	Mean difference HFAHC-KBTH	95% confidence Interval		p-value
		lower	upper	
Cost	-142.15	-195	-94	0.01*
QALY	-0.15	-0.19	-0.12	0.01+

**Table 3: Test results with the p-values of the costs and QALY**

Footnote: 1.\*Bootstrap confidence interval and Mann-Whitney U-test

2. + Independent sample t-test

### 4.3.3 Regression

Multiple regressions showing the combined effects of the drugs on QALY is shown in the table.

<b>Variables</b>	<b>B</b>	<b>P-Value</b>	<b>Lower bound</b>	<b>Upper bound</b>
Dependent (QALY)				
(Constant)	0.71	0.01	0.68	0.74
ARV	0.12	0.01	0.08	0.16
Other drugs	-0.04	0.01	-0.08	-0.09
Prophylaxis	0.06	0.01	0.02	0.10

**Table 4: Regression results for the effects of drugs on QALY**

Looking at the combined effect of the drugs (prophylaxis, ARV and other drugs), all the three drugs have a p-values less than 0.05, showing a significant effect on QALY.

The estimated regression model is:  $QALY = 0.71 + 0.12 * ARV + 0.06 * prophylaxis - 0.04 * other\ drugs$

The R square value is 0.44. This shows that 44 per cent of the variation in QALY in the two groups is explained by the prophylaxis, ARV and the other drugs.

ARV, which is only given to patients at the teaching hospital, has the greatest effect on QALYs. Prophylaxis and other drugs, which are given to patients in both health centres have smaller effects.

However, from the regression results, other drugs do not add to the QALY of the patients. This is probably mainly due to herbal treatment (DnT Veramin 1 & 2) being included in the “other drugs” category, and these patients have a lower level of QALY than patients at the Teaching Hospital. However, it may be explained with the fact that other drugs are given to treat opportunistic infections only, resulting in the negative relationship between this and the ARV, prophylaxis and QALY.

#### **4.4 COST EFFECTIVENESS**

To calculate the incremental cost effectiveness ratio, we need to identify all the components of the two treatment strategies. In order to assess the additional cost per QALY gained in treating HIV/AIDS, we need to calculate the incremental cost effectiveness ratio (ICER). The cost components from the hospitals are expected to differ much more between the health centres than the health care payers' costs. The data taken from the costs and proposal data of Health for All Herbal Clinic and some secondary sources for Fevers' Unit of the Korle Bu Teaching Hospital are presented in table 5, below.

<b>Identification of cost</b>	<b>KBTH (ARV) n=55</b>	<b>HFAFC (DnT VERAMIN) n=51</b>
Labour cost (staff) *	53	3
Physical structure*	27	3
Admin support:		
NACP&GHS	164	0.00
DnT veramin		20
Support from 4H (NGO)*		25
ARV drug (subsidy)*	202	0.00
<b>Total cost from clinic</b>	<b>446<sup>1</sup></b>	<b>51<sup>1</sup></b>
Patient cost:	53	0
ARV	29	23
Other drugs	29	12
Prophylaxis	10	10
Consultation	14	16
Lab	31	21
Outpatient		
<b>Patient cost without productivity (total)</b>	<b>166</b>	<b>82</b>
Patient time (productivity cost)	144 <sup>2</sup>	99 <sup>2</sup>
<b>Patient cost with productivity (total)</b>	<b>310<sup>3</sup></b>	<b>181<sup>3</sup></b>
<b>Total cost per client (from societal persp) <sup>1+3</sup></b>	<b>756</b>	<b>232</b>
<b>Total client cost <sup>3</sup> - <sup>2</sup> (without prod cost)</b>	<b>612</b>	<b>133</b>
Mean QALY	0.84	0.69

**Table 5: Mean annual HIV related cost per patient from the societal perspective**

Footnote: All costs are in Ghana cedis (GHC). \*The cost items are taken from Rosen & Asante 2010 (for ARV treatment) and from cost data from Herbal clinic.

<sup>1</sup> total costs from each of the two clinics.

<sup>2</sup> productivity costs.

<sup>3</sup> total patients cost with productivity cost.

An issue in cost utility analysis is how to deal with productivity cost. Some experts suggest they should be eliminated totally. Others said that they should be included in either the denominator or the numerator. There is no conclusive agreement between the various views. However, a suggestion is that we do the analysis with the productivity cost and then also present the analysis without the productivity cost (Drummond et al, 2005).

This study adopted the latest view. The ICER with the productivity cost and the ICER without the productivity cost are presented below. The societal perspective as stated earlier considers all costs including subsidies, the individual patients' cost and other related costs.

### **Societal perspective**

The ICER is  $\frac{KBTH\ arv - HFAHC\ herbal}{QALY\ arv - QALY\ herbal}$

The ICER (from the societal perspective) with the productivity cost is presented below.

$$ICER = \frac{756 - 232}{0.84 - 0.69} = \frac{524}{0.15} = 3,493$$

From societal perspective with productivity cost, the ICER is GHC 3,493/QALY.

From the societal perspective, the average cost for treating HIV using ARV is GHC 756. The average cost of treating HIV using the herbal drug, DnT veramin, is GHC232. The productivity costs are 144 and 99 the ARV and HERBAL respectively. The productivity costs are deducted and the ICER is presented. The average QALY of patients on ARV is 0.84. The average QALY of patient on herbal treatment is 0.69.

The Incremental cost effectiveness ratio:

$$= \frac{612 - 133}{0.84 - 0.69} = \frac{479}{0.15} = 3,193$$

From the societal perspective (without productivity cost), the The ICER is GHC3,193 per QALY.

### **The individual patient's perspective**

The individual payer perspective, takes into account only the costs incurred by the individuals in treating HIV/AIDS. The cost elements are taken from the questionnaire. Therefore other costs (for instance, capital costs) are not included.

From the individual patient perspective with the productivity cost, the ICER is

$$\frac{310-181}{0.15} = \frac{129}{0.15} = 860$$

Health care perspective ICER = GHC 860/QALY

From the individual health care payer perspective with productivity cost the cost per QALY for a using ARV is GHC 860/QALY.

ICER from individual perspective without the productivity cost is calculated by deducting the productivity costs from the patient's cost before calculating the ICER. The total patient costs from Fevers' Unit and the Health for All Herbal Clinic are GHC310 and GHC181, with GHC144 and GHC99 as respectively as productivity costs. From the Fevers' Unit, GHC 310 minus GHC144 is GHC166. From the Herbal clinic, GHC181 minus GHC99 is GHC82.

The ICER without productivity costs is:

$$\frac{166-82}{0.84-0.69} = \frac{84}{0.15} = 560$$

From the individual health care payer (patient's) perspective without the productivity cost, the ICER is GHC560 per QALY.

Drummond et al. (2005) stated that in order to make decisions and draw valid conclusions, the ICER is compared with other measures for instance from published thresholds. Babinguda et al (2009), for example, used a threshold of per capita GDP of 1-3 suggested by WHO, in their CUA study in Uganda. I will also use this threshold.

According to the CIA world fact book, Ghana's GDP per capita is USD3,100 (www.cia.gov). In December 2011, USD 1 equals GHC1.62 (oanda.com). When we use the December 2011 exchange rate for the US Dollar, then USD3,100 translates to GHC5,022. All the ICER values calculated from both societal and individual payer perspectives (which included or excluded productivity cost) are lower than the threshold value. The ICER from societal perspective which included the productivity cost and the ICER without the productivity cost are GHC 3,493/QALY and GHC 3,193/QALY respectively. These are lower than the threshold of GDP per capita, i.e. GHC5,022. Also, the ICER from the individual payer perspective with the productivity cost and the ICER without the productivity cost are GHC860/QALY and GHC 560/QALY respectively. These are also lower than the threshold value of the per capita income of GHC 5,022. This means that ARV treatment is cost effective compared to treatment given at the herbal clinic. The results are summarized in figure 2.

### Sensitivity analysis

I conducted sensitivity analysis based on varying the cost data for the patients on ARV. Their choice is arbitrarily done only on the view that these costs are higher. The sensitivity analysis is done to check, the effect of changes in their cost. The costs are changed by ten percent lower or higher, twenty percent lower or higher, and thirty percent lower or higher respectively. The results are presented in table 6 below.

	ARV	Herbal	ICER (GHC/QALY)
Total from table 5	756	232	3,439
10% down	680	232	2,987
10% up	832	232	4,000
20% down	605	232	2,487
20% up	907	232	4,500
30% down	529	232	1,980
30% up	983	232	5,007

**Table 6: sensitivity analysis of cost of HIV/AIDS treatment in Ghana**

The range between the cost of HIV treatment in the two clinics is wide. By varying the cost, I tried to estimate how changes in the various costs up and down will affect the ICER. In effect as could be seen from the table 6 above, the effect of changes between ten percent and thirty percent higher or lower of the ARV treatment cost will still be cost effective. This is because the ICERs for the sensitivity analysis are still less than society's WTP, i.e. GHC5022. The cost utility analysis is thus robust.

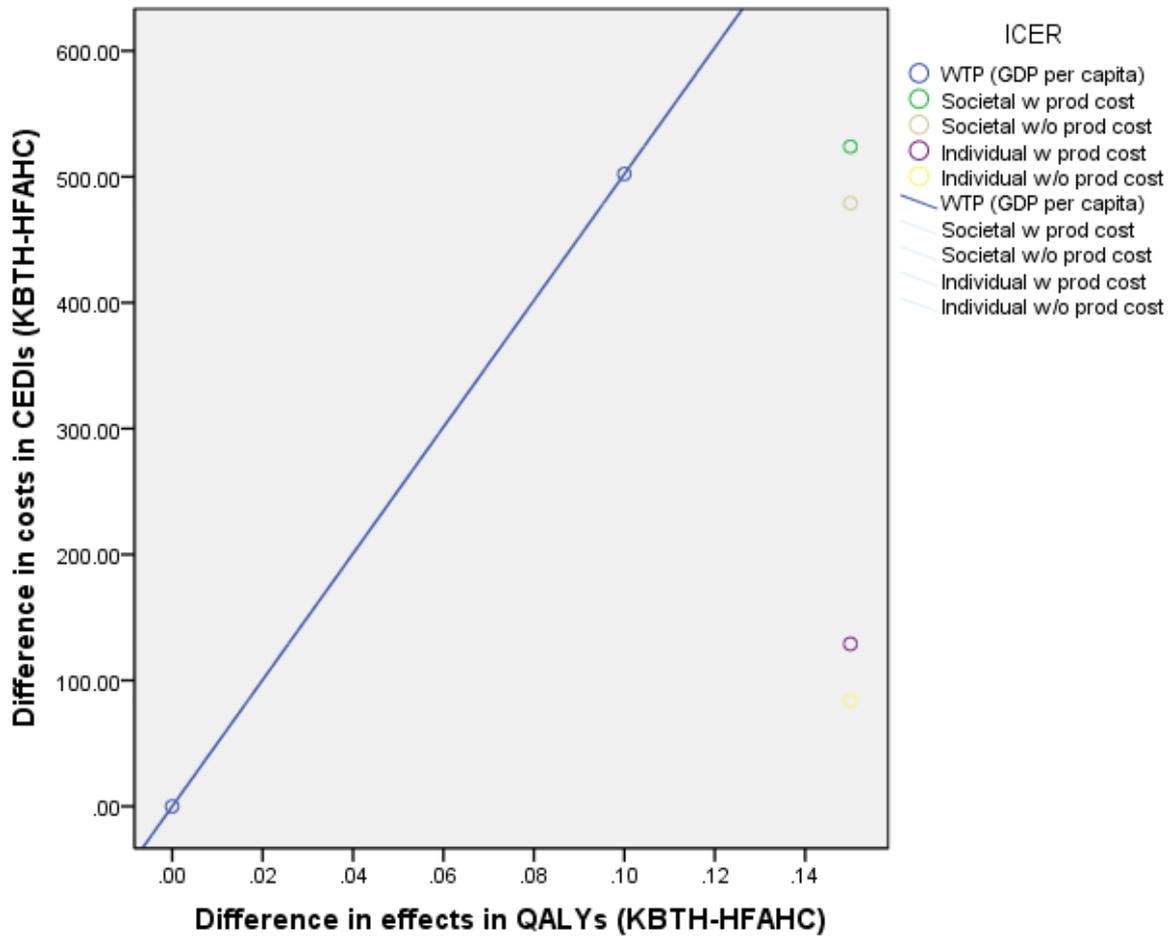


Figure 2: Comparison of the ICER and WTP (which is per capita GDP of Ghana)

## 5.0 Discussions and conclusions

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Ghana has been among the countries in sub-Saharan Africa that have scaled up the treatment of HIV/AIDS using antiretroviral treatment. The usage of some herbal drugs for the management of the disease has moderate patronage among some people. This study intends to find out cost and the utility of the HIV/AIDS treatment in Ghana. The study compares the herbal treatment to ARV treatment.

Even though the groups differ on wealth and age, the demographic characteristics of participants in the group that uses ARV and the group that use the Veramin DnT 1&2 herbal drugs are quite similar. This allows for meaningful and valid comparisons.

A point to note here is that, there are higher percentages of older people in the group accessing ARV as compared to people accessing herbal drugs. These elderly people may have higher income than the younger people in the herbal clinic.

Also, the settings of the two clinics are different. The herbal clinic is located in the rural district in the country side. The facilities and staff cannot match that of the Fevers' Unit. The Fevers' Unit is located in the main city of Accra. It is housed in the same premises and shares some of the resources of the University of Ghana Medical School, and the Korle Bu Teaching Hospital. Staff strength is stronger and recruitment of skilled staff is better as compared to the herbal clinic. The provision of better counseling services and medical attention is better at the Fevers' Unit than the herbal clinic. This could also account for the better health outcome for the participants on ARV. The clients that the two centres attract may vary economically. Since the Fevers Unit is in the city, it may attract people with better socioeconomic status (in terms of education, wealth, social amenities) than those who attend the herbal clinic. These disparities may also account for the differences in the cost and health outcomes of the two groups.

The independent sample t-test shows that there are differences in the QALYs of the PLWHAs receiving ARV treatment as compared to those receiving the herbal treatment. Specifically, the mean QALY is higher in the ARV group than in the herbal treatment group.

Also, the regressions analysis shows that that the ARV drugs and prophylaxis adds to QALY, while the other drugs did not add to the QALYs. This means that we can increase the QALYs of the patients by putting them on ARV and prophylaxis as appropriate. The other drugs including DnTveramin 1 & 2 herbal drugs do not add to QALY. This is because veramin may not have antiretroviral effects and also because other drugs are given to the patient mostly to treat opportunistic infections.

A very important analysis in conducting cost utility analysis is the ICER. The ICER result from the societal perspective shows that cost per QALY gained is GHC 3,493 (with productivity cost) and GHC3,193 per QALY (when productivity cost is excluded). Also, the ICER was GHC 860 per QALY when productivity cost is included, and GHC 560 per QALY when productivity cost is excluded, when considered from the individual care perspective.

In comparison to the GDP per capita, the ICER from the societal perspective is lower than the GDP per capita. Also, from the individual payer perspective, the ICER is lower than the GDP per capita. From both perspectives the ICER is lower than the threshold of GHC 5,022, showing that the treatment of HIV/AIDS using ARV drugs is cost effective.

Sensitivity analysis is conducted by varying the cost of the ARV treatment up and down between ten to thirty percent. The ICERs conducted after varying the costs are compared and with the WTP. The results presented in table 6, shows that these ICERs are also less than society's WTP in Ghana. The results are very robust.

The finding from the study is consistent with other findings reviewed in the literature review that shows cost effectiveness of treatment of HIV/AIDS using ARVs. For instance it is consistent with studies conducted by Badri Maartens, Mandalia et al (2006) in South Africa and Renaud, Basenya and Borman (2009) in Burundi. However, this is the first study to compare ARV to traditional herbal medication.

The study has policy implication. Based on the analysis, society should fund ARV drug for treatments of HIV/AIDS in Ghana, since ARV treatments appeared cost effective from both societal and health care perspective.

## **5.1 Limitation of the study and recommendations**

Every human endeavor has limitations and this study is not exempted. In my study, even though I tried my best, some of these phenomena, I think are considered limitations in my study. I included only point estimates for the societal perspective ICERs. This is because I did not have enough information about estimates on uncertainty in cost in other areas than included in the questionnaire. If I were to get enough information, I could have done modeling in TreeAge (e.g. a cohort simulation).

I set cost categories above GH80 in the questionnaire to be GH100, based on the experience on the field that an average of 100 on most of the cost items in the questionnaire could take care of annual expenses. I used cost categories to facilitate remembrance from participants. However this implementation may have some biases.

Firstly, the study is constrained by time. The whole research is conducted within a semester. Going through the rudiments of research within this short period will not allow for me to consider some other aspects of the research. Collecting data and writing this report within the short period did not allow me to gather enough information, especially secondary data.

Financial resource constraint is also a limitation to my study. Research work needs a lot of money. One needs to travel to and from the research site, pay research assistants among others. Lack of money prevented me from going to the field physically. However, the research assistants I used and the counsellors did a good job.

Again, there is no clear cut consensus among experts in the field concerning the types of cost that could be excluded and the one that should be included in the economic evaluations. This affects the study too. I used my discretions only on costs included and those who were not included.

There may be recall biases as participants were asked to recall in eliciting responses from the participants. They only call those they could remember and may also make intelligent guesses.

I will recommend that financial support be provided to especially the international students for data collection, especially to research sites outside Norway. Also, the programme can be restructured so that all taught course are taken in the first year. This will enable the students focus only on the thesis.

## 5.2 Conclusion

This research did a cost utility analysis of the treatment of HIV/AIDS in Ghana. Participants in the research were taken from a population of PLWHAs accessing ARV treatment at Korle Bu Teaching Hospital and DnT Veramin 1&2 treatment at Health for All Herbal Clinic at Owuram. The two treatment strategies compared were ARV and Veramin DnT 1&2 herbal drug. The results show that ARV drug treatment is cost effective from societal perspective. The incremental cost effectiveness ratios were GHC3,493, GHC3,193, GHC 860, GHC560. Ghana's GDP per capita which is used as the threshold is GHC 5,022. The ICER from societal perspective and the individual health payer perspective are lower than the GDP per capita threshold, hence the conclusion that ARV treatment is cost effective in Ghana. This represents the short term only. The result shows that even though HIV/AIDS has not known cure fore now, some gains can be made using ARV. Therefore in maximizing the societal welfare, ARV use among the PLWHA will be cost effect (in the short term) in Ghana. Individuals with HIV/AIDS should be supported to enroll on the ARV treatment programme.

This result is for short term only. Further research needs to be done to confirm the long term effects. The result has implications for policy making. Based on the results, investing in the use of ARV drugs for treatment of HIV/AIDS is a in the right direction. More clinics need to be equipped, by recruitment, training and retention of staff, to administer the ARV drugs. The subsidy on ARV drugs should be increased and also education on access and the importance of enrolment on the ARV treatment programmes needed be intensified.

It must be noted that Ghana government like every other economic entity is constrained by scarce resources. The ARV treatment may not be the only economic activity that may be cost effective when implemented, other economic activities, like road, education among others also may be cost effective. Looking at the budget constraints not all projects that are cost effective could be implemented.

## 6.0 References

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**Asante FA and Fenny AP (2008).** Ghana National AIDS Spending Assessment 2007 Level and Flow of Resources and Expenditures to Confront HIV and AIDS. A Report Prepared by the Institute of Statistical, Social and Economic Research (ISSER), University of Ghana for the Ghana AIDS Commission (GAC) and the Joint United Nations Programme on HIV and AIDS (UNAIDS)

**Babb DA, Pemba L, Seatlanyane P, Charalambous S, Churchyard G, Grant AD (2004):** Use of traditional medicine in the era of antiretroviral therapy: experience from South Africa *ejournal of the international AIDS society* (accessed on 02.02.2012).

**Badri M, Maartens G, Mandalia S, et al (2006):** Cost effectiveness of highly active antiretroviral therapy in South Africa. *Plos Medicine*, 3, 0048-0056.

**Bakari M, Urassa W, Pallangyo K, Swai A, Mhalu F, Biberfeld G, and Sandström E (2004):** The Natural Course of Disease Following HIV-1 Infection in Dar es Salaam, Tanzania: A Study among Hotel Workers Relating Clinical Events to CD4+ T-lymphocyte Counts *Scandinavian Journal of Infectious Diseases*,36, 6-7, 466-473.

**Bambigura JB, Sethi AK, Smyth KA, Singer ME (2009):** Cost effectiveness of facility based, home based care and mobile clinic for provision of Antiretroviral therapy in Uganda. *Pharmacoeconomics*,27(11), 963-973.

**Beck, E J, Mandalia S, Williams I, Power A, Newson R, et al(1999):** Decreased morbidity and use of hospital services in English HIV infected Individuals with increased uptake of anti-retroviral therapy 1996-1997. *AIDS*,13, 2157-2164

**Cavan, S (1977):** Review of JD Douglas's (1976) 'Investigative Social Review: Individual and Team Field Research.' *The American Journal of Sociology*).

**Colebunders R, Ryder R, Francis H et al (1991):** Seroconversion rate, mortality and clinical manifestations associated with the receipt of a human immunodeficiency virus-infected blood transfusion in Kinshasa, Zaire. *J Infect Dis*, 164:450-456.

**Doran CM (1997):** New Approaches to using antiretroviral therapy for the management of HIV infection. *Ann Pharmacother*, 31, 228-236

**Drummond M, et al (2005):** *Methods of Economic Evaluation of Health Care Programmes*. Oxford University Press. New York.

**EuroQol Group(2011):** EQ-5D-5L User Guide: Basic information on how to use the EQ-5D-5L.

**Folland, Goodman and Stano (2010):** *The Economics of Health and Health Care* Prentice Hall. New Jersey.

**Freedberg KA, Losina E, Weinstein MC, et al (2001):** The Cost effectiveness of combination Antiretroviral therapy for HIV Disease. *New England Journal of Medicine*, 344 (11), 824-831.

**Gatsi E (2008):** The Effects of stress and coping strategies on the health of HIV/AIDS patients. A dissertation submitted to the Department of Psychology, University of Ghana, in partial fulfillment of the requirements for the award of the B.A (Hons) Degree in Psychology.

**Garber AM, Weinstern MC, Torrance GW and Kamelt MS (1996):** Theoretical foundations of cost effectiveness analysis. In: Gold MR, Siegel JE, Russel LB, Weinstein MC (Ed). *Cost effectiveness in Health and Medicine* (pp 25-53).

**Gold et al (1996):** *Cost-effectiveness in Health and Medicine*. Oxford University Press. New York.

**Gulick RM, Mellors JW, Havlir D et al (1997):** Treatment with indinar, zidovudine, and lamivudine in adults with human immunodeficiency virus infection and prior antiretroviral therapy. *New England Journal of Medicine* , 337, 734-739.

**Hunink M, Glasziou P, Siegel J, Weeks J, Pliskin J, Elstein A and Weinstein M (2001):** *Decision Making in Health and Medicine: integrating evidence and values* Cambridge University Press. Cambridge.

**Langlois-Klassen D, Kipp W, Jhangri GS, and Rubaale T (2007):** Use of Traditional Herbal Medicine by AIDS Patients in Kabarole District, Western Uganda. *American Journal of Tropical Medicine and Hygiene*, 77(4), 2007, pp. 757–763.

**Le Pen C, Rozenbaum W, Downs A, Maurel F, Lilliu H, et al (2001):** Effect of HAART on health status and hospital costs of severe HIV-infected patients: a modelling approach. *HIV Clinical Trials* 2: 136-145

**Løchting L I (2008):** The price to pay for maternal health care in rural Gambia.

Thesis submitted as a part of the Master of Philosophy Degree in International Community Health in the University of Oslo.

Luce BR, Manning WG, Siegel JE and Lipscomb J (1996): Estimating Costs in Cost-Effectiveness Analysis. In: Gold MR, Siegel JE, Russel LB, Weinstein MC (Ed). *Cost effectiveness in Health and Medicine* (pp176-213

**Marseille E, Kahn JG, Mmiro F, Guay L, Musoke P, Fowler MG, Jackson JB (1999):** Cost effectiveness of single-dose nevirapine regimen for mothers and babies to decrease vertical HIV-1 transmission in sub-Saharan Africa. *Lancet*,354, 803-809.

**Mills E, Cooper C, Seely D and Kanfer I (2005):** African herbal medicines in the treatment of HIV: Hypoxis and Sutherlandia. An overview of evidence and pharmacology. *Nutritional Journal*.

**Miners AH, Sabin CA, Trueman P, et al (1999):** Assessing the costeffectiveness of highly active antiretroviral therapy for adults with HIV in England. *HIV Medicine* (2001) 2, 52-58

**Morgan D; Mahe C, Mayanja B; Okongo JM ; Lubega R; Whitworth J AG (2002):** HIV-1 infection in rural Africa: is there a difference in median time to AIDS and survival compared with that in industrialized countries? *AIDS* ,4, 597-603.

**Muening P(2002):** Designing and Conducting Cost-Effectiveness Analysis in Medicina and Health Care. John Wiley and Sons Inc. New York.

**National HIV/AIDS/STI Control Programe (NACP) 2005:** Guidelines for Anteretroviral Therapy in Ghana. 2nd Edition. Accra, Ghana

**Olsen JA (2009):** Principles in Health Economics and Policy. Oxford University Press Inc. New York.

**Palella FJJ, Delaney KM, Moorman AC et, al (1998):** Declining morbidity and mortality among patients with advanced human immunodeficiency virus infection. HIV Outpatient Study Investigators. New England Journal of Medicine, 338, 853-860.

**Renaud A, Basenya O, Borman N (2009):** The cost effectiveness of integrated care for people living with HIV including antiretroviral treatment in a primary health care centre in Bujumbura. AIDS Care, 21(11), 1388-1394.

Robberstad B (2005): QALYs vs DALYs vs LYs gained: What are the differences, and what differences do they make for health care priority setting? Norsk Epidemiologi, (15) 2, 183-191

**Rosen J and Asante F (2010):** Cost of HIV & AIDS Adult and Pediatric Clinical Care and Treatment in Ghana. Washington, DC: Futures Group, Health Policy Initiative.

**Santrock JW(2003):** Psychology. Boston. McGrawHill.

**Sweat M, Gregorich S, Sangiwa G, Furlonge C, Balmer D, Kamenga C, Grinstead O, Coates T (2000):** Cost-Effectiveness of Voluntary HIV-1 Counselling and testing in reducing sexual transmission of HIV-1 in Kenya and Tanzania,356, 113-121.

**Torrance G W,Raynauld JP,Walker V, Goldsmith CH, Bellamys N, Band PA Schultz M, Tugwell (2002):** A Prospective, randomized, pragmatic, health outcomes trial evaluating the incorporation of hylan G-F 20 into the treatment paradigm for patients with knee osteoarthritis (part 2 of 2): economic results.

Von Neumann J and Morgenstern O (1944): Theory of games and economic behavior. Princeton University Press, Princeton, New Jersey.

**World Health Organization (WHO) 2003:** Traditional Medicine.Geneva: WHO. Fact Sheet 134. Available at: <http://www.who.int/mediacentre/factsheets/2003/fs134/en/> [Accessed 20.01. 2012].

**UNAIDS (1998):** Mother-to child transmission of HIV: UNAIDS technical update. Geneva.

**websites**

<http://ama.ghanadistricts.gov.gh/> [Accessed 10.03.2012]

[www.ananseghana.org/healthforall](http://www.ananseghana.org/healthforall) [Accessed 10.12.2011]

<http://www.ankwa-roots.org/ghana/?cat=12&lang=en> [Accessed10.01.2012].

<https://www.cia.gov/library/publications/the-world-factbook/geos/gh.html>[Accessed10.05.2012].

[www.oanda.com/currency/historical-rates](http://www.oanda.com/currency/historical-rates) [Accessed10.05.2012].

www.unaids [http://www.unaids.org/documents/20101123\\_FS\\_SSA\\_em\\_en.pdf](http://www.unaids.org/documents/20101123_FS_SSA_em_en.pdf)

UNAIDS, 2010 Global Reports. FACT SHEETS. Sub-Saharan Africa [Accessed10.01.2012].

<http://www.uneca.org/tap/joint-mission/Report-Accra-joint-field-visit.pdf> [accessed 10.03.3012].

<http://westakim.ghanadistricts.gov.gh/> [accessed 10.03.3012].

# Appendix A

HFHC

## Questionnaire

I am an MPhil student in University of Oslo. I am conducting a research as part of my studies, on the cost of HIV/AIDS treatment in Ghana. The questions below are designed to seek the costs on your treatment. Kindly answer the following questions as best as you can.

### Part I :DEMOGRAPHY

- Gender
- Male
- Female
- Age (in years)
- 20-29
- 30-39
- 40-49
- 50-55
- Marital status
- single
- Married
- divorced/seperated/widowed
- Highest education
- none
- primary
- secondary
- tertiary



Care giver time      100 or less [ ]    200 [ ]    300 [ ]    400 or more [ ]

Kindly identify and give the cost of any other money spent that was not mentioned above

Item ..... cost.....

Item ..... cost.....

Figure 1: EQ-5D-5L (UK English sample version)

Under each heading, please tick the **ONE** box that best describes your health **TODAY**

**MOBILITY**

- I have no problems in walking about
- I have slight problems in walking about
- I have moderate problems in walking about
- I have severe problems in walking about
- I am unable to walk about

**SELF-CARE**

- I have no problems washing or dressing myself
- I have slight problems washing or dressing myself
- I have moderate problems washing or dressing myself
- I have severe problems washing or dressing myself
- I am unable to wash or dress myself

**USUAL ACTIVITIES** (e.g. work, study, housework, family or leisure activities)

- I have no problems doing my usual activities
- I have slight problems doing my usual activities
- I have moderate problems doing my usual activities
- I have severe problems doing my usual activities
- I am unable to do my usual activities

**PAIN / DISCOMFORT**

- I have no pain or discomfort
- I have slight pain or discomfort
- I have moderate pain or discomfort
- I have severe pain or discomfort
- I have extreme pain or discomfort

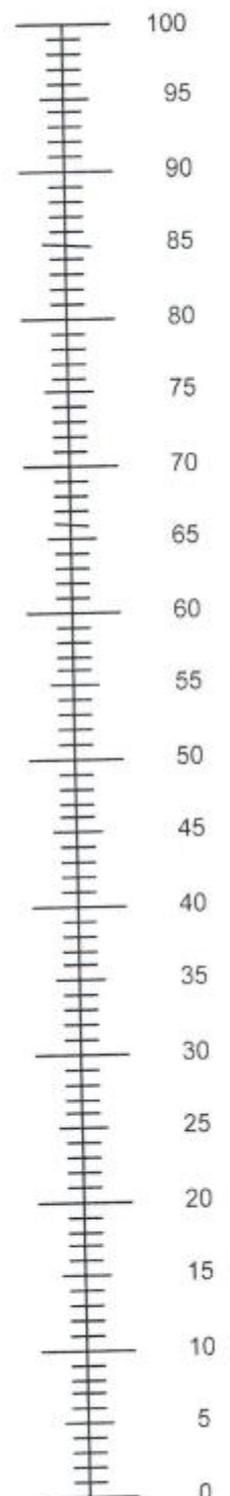
**ANXIETY / DEPRESSION**

- I am not anxious or depressed
- I am slightly anxious or depressed
- I am moderately anxious or depressed
- I am severely anxious or depressed
- I am extremely anxious or depressed

- We would like to know how good or bad your health is **TODAY**.
- This scale is numbered from **0** to **100**.
- **100** means the best health you can imagine.  
**0** means the worst health you can imagine.
- Mark an **X** on the scale to indicate how your health is **TODAY**.
- Now, please write the number you marked on the scale in the box below.

YOUR HEALTH TODAY=

The best health  
you can imagine



The worst health  
you can imagine

# Appendix B

KBTH

Questionnaire

I am an MPhil student in University of Oslo. I am conducting a research as part of my studies, on the cost of HIV/AIDS treatment in Ghana. The questions below are designed to seek the costs on your treatment. Kindly answer the following questions as best as you can.

## Part I :DEMOGRAPHY

Gender Male

Female

Age (in years) 20-29

30-39

40-49

50-55

Marital status single

Married

divorced/seperated/widowed

Highest education none

primary

secondary

tertiary [ ]

Employment                      employed [ ]

self employed [ ]

unemployed [ ]

## Part II health care and other costs

Kindly mark the space showing the costs items and the costs that you spent intreatment annually. Each cost item is in New Ghana Cedis

### a. Health care cost

Anteretroviral      20 or less [ ]   21-40[ ]   41-60[ ]   61-80 [ ]   81 or more[ ]

#### Drugs (ARV drugs)

Other drugs      20 or less [ ]   21-40[ ]   41-60 [ ]   61-80 [ ]   81 or more [ ]

    Prophylaxis      10 or less [ ]   11-20[ ]   21-30[ ]   61-80 [ ]   81 or more [ ]

    Consultation      10 or less [ ]   11-20 [ ]   21-30 [ ]   61-80 [ ]   81 or more [ ]

Lab tests/VCT      10 or less [ ]   11-20 [ ]   21-30 [ ]   61-80 [ ]   81 or more [ ]

Out patient visits   20 or less [ ]   21-40 [ ]   41-60 [ ]   61-80 [ ]   81 or more [ ]

Other sectors

Transport to hospital    20 or less [ ]    21-40 [ ]    41-60 [ ]    61-80 [ ]    81 or more [ ]

Productivity cost

    Patient time            100 or less [ ]    200 [ ]    300 [ ]    400 or more [ ]

Care giver time    100 or less [ ]    200 [ ]    300 [ ]    400 or more [ ]

Kindly identify and give the cost of any other money spent that was not mentioned above

Item ..... cost.....

Item ..... cost.....

Figure 1: EQ-5D-5L (UK English sample version)

Under each heading, please tick the **ONE** box that best describes your health **TODAY**

**MOBILITY**

- I have no problems in walking about
- I have slight problems in walking about
- I have moderate problems in walking about
- I have severe problems in walking about
- I am unable to walk about

**SELF-CARE**

- I have no problems washing or dressing myself
- I have slight problems washing or dressing myself
- I have moderate problems washing or dressing myself
- I have severe problems washing or dressing myself
- I am unable to wash or dress myself

**USUAL ACTIVITIES** (e.g. work, study, housework, family or leisure activities)

- I have no problems doing my usual activities
- I have slight problems doing my usual activities
- I have moderate problems doing my usual activities
- I have severe problems doing my usual activities
- I am unable to do my usual activities

**PAIN / DISCOMFORT**

- I have no pain or discomfort
- I have slight pain or discomfort
- I have moderate pain or discomfort
- I have severe pain or discomfort
- I have extreme pain or discomfort

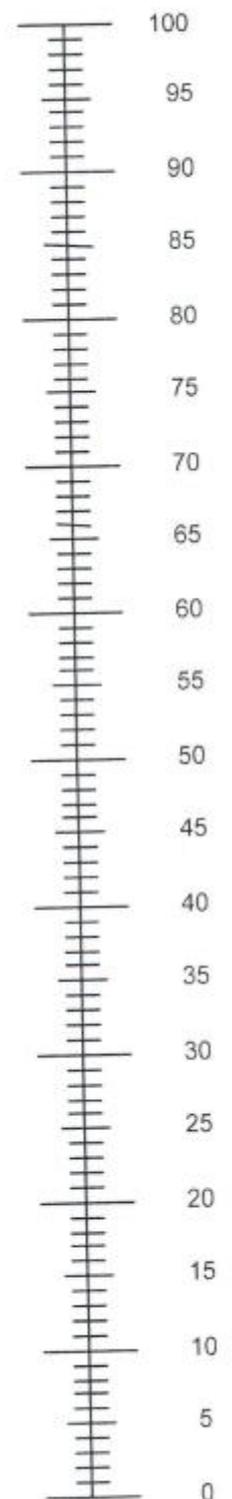
**ANXIETY / DEPRESSION**

- I am not anxious or depressed
- I am slightly anxious or depressed
- I am moderately anxious or depressed
- I am severely anxious or depressed
- I am extremely anxious or depressed

- We would like to know how good or bad your health is **TODAY**.
- This scale is numbered from **0** to **100**.
- **100** means the best health you can imagine.  
**0** means the worst health you can imagine.
- Mark an **X** on the scale to indicate how your health is **TODAY**.
- Now, please write the number you marked on the scale in the box below.

YOUR HEALTH TODAY=

The best health  
you can imagine



The worst health  
you can imagine