

A Cost-effectiveness analysis of managing chronic diarrhoea diseases in human immunodeficiency virus and acquired immune deficiency syndrome adult patients in an academic hospital in Lusaka, Zambia

A mini-dissertation submitted to the Department of Public Health and Primary Health Care, University of Cape Town, in partial fulfilment of requirements for the award of the degree of Master of Philosophy in Public Health (MPhil).

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DECLARATION

This research is my original work and has not been submitted for any academic and/ or examination purposes at any other university.

Signed by candidate

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This research paper has been submitted for examination with my approval as the University supervisor.

EDINA SINANOVIC

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List of acronyms

AIDS	Acquired Immune Deficiency Syndrome
CD4+	T cell lymphocyte
CDD	Chronic diarrhoea diseases
CEA	Cost-effectiveness analysis
CMV	Cytomegalovirus
CSO	Central statistics office
ECA	Economic Commission for Africa
GIT	Gastrointestinal tract
GNP	Gross National Products
HAART	Highly active antiretroviral therapy
HIV	Human immunodeficiency virus
NRTI	Nucleoside reverse transcriptase inhibitor
PCP	Pneumocystis carinii pneumonia
rIL2	Recombinant Interleukin-2
SIV	Simian immunodeficiency virus
SIVcpz	Simian immunodeficiency virus Chimpanzees
UTH	University Teaching Hospital
UNAIDS	Joint United Nations Programme on HIV/AIDS
WHO	World Health Organisation

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Abstract

The high burden of human immunodeficiency virus (HIV) and acquired immunodeficiency syndrome (AIDS) related chronic diarrhoea diseases (CDD) has strained the meager resources of the health sector and yet the effectiveness of management strategies leaves much to be desired. A study was done at a university teaching hospital (UTH) in Lusaka to evaluate two management strategies for these patients. The first strategy involved managing patients without investigations, while the other included investigations in the management strategy. Relevant costs were estimated. The effectiveness measure was based on medical records. Systematic random sampling was done in order to avoid bias. A cost-effectiveness analysis (CEA) was performed in terms of the total cost per patient treated divided by the cure rate. The total cost per patient treated was obtained by dividing the total costs by the number of patients treated for each strategy. The cure rate was achieved by dividing the number of patients cured by the total number of patients managed in that strategy multiplied by 100 to obtain the percentage rate. The cost-effectiveness ratio for strategy 1 was 260.12 and that for strategy 2 was 254.56. Based on these results, strategy 2 is most preferred because it has a lower cost-effectiveness ratio.

Chapter One

Background

1.1 Introduction

Most developing countries experience a dual infection epidemic of both new viral and old bacterial infection. Towards the end of the 20th century, the bacterial infections like diarrhoea and tuberculosis were on the decline (Haslett et al, 1999). Unfortunately with the emergence of human immunodeficiency virus (HIV) and acquired immune deficiency syndrome (AIDS), the past efforts to reduce the dual were overcome and they eventually topped the list of opportunistic infections.

Human immunodeficiency virus and acquired immune deficiency syndrome has been the biggest and longest epidemic that has ever hit Zambia, leaving 99,000 people dead in 1999 alone (UNAIDS/WHO, 2000). Being a developing country, Zambia has not yet managed to fight the epidemic effectively due to vast public demands in the midst of limited resources. There is a need to effectively utilise the resources allocated towards the health sector, particularly those allocated towards management of chronic diarrhoea disease (CDD) in HIV/AIDS patients. This will increase the cure rate and consequently reduce the costs that the hospital would incur for readmission of these patients. This is particularly important as it is proven that the cost of a new admission is far more than keeping the patients a few more days in the wards (Green, 1992).

1.2 Research problem

In Zambia, planning and allocation of resources in the health sector does not follow the zero-based or at least modified zero based budgeting, which allows planners to review what has been and replace it, based on evidence, with what is appropriate. They merely follow the

historical way of incrementalism with a few percentages up or down. This does not allow for appropriate allocation of the resources including those that are necessary for management of HIV/AIDS. Being a developing country, Zambia has limited public resources. Therefore, a cost-effectiveness analysis is required in order to identify the best alternative method. In this study, a cost-effectiveness analysis (CEA) is performed to measure the cost-effectiveness of managing CDD in HIV and AIDS adult patients in an academic hospital in Lusaka. Using this method, the limited health resources will be allocated effectively in order to achieve the desired goals. This leads to efficiency and makes the saved resources available for other service within the health sector or within the public services.

1.3 Motivation of the study

Zambia has a high prevalence rate of HIV/AIDS, which was 19.7% as at April 2001 (HIV/AIDS, 2001). Of the opportunistic infections associated with HIV/AIDS, CDD is one of top five infections. It is therefore, important that cost-effective methods of treating HIV/AIDS adult patients with CDD are applied. Based on this motivation, this study seeks to evaluate the most cost-effective alternative for treating these patients. This will facilitate the most cost-effective use of the limited resources allocated to health facilities.

1.4 Aim

- To determine the most cost-effective strategy for managing CDD in HIV/AIDS adult patients at university teaching hospital (UTH) in Lusaka, Zambia.

1.5 Specific objectives

- To estimate costs that are relevant to the alternative management strategies employed in managing adult HIV/AIDS patients with CDD.

- To estimate the effectiveness of the two management strategies that are used in the management of CDD in adult HIV/AIDS patients.
- To estimate cost-effectiveness in terms of cost per number of HIV patients cured from one episode of CDD for each alternative management strategy being evaluated.
- To perform a sensitivity analysis of the results which are uncertain.

1.6 Dissertation roadmap

Chapter two comprises the literature review on HIV/AIDS. It describes the opportunistic infections of which chronic diarrhoea diseases are a major problem in Zambia. In this chapter, literature on costing is also presented. Finally, literature on cost-effectiveness analysis is presented as a tool on which this study relies and limitations of the study.

Chapter three discusses Zambia as the case study area. It describes the country settings, HIV epidemiology, the impact of the epidemic and finally, its HIV/AIDS policy.

Chapter four presents the methodology used in this study. Firstly, present the specific study area, the perspective of the study and the description of alternatives. Thereafter, conceptual framework, cost estimations as capital costs and annualization, recurrent costs, overheads and sensitivity analysis are presented. Finally, the effectiveness estimations and sampling, effectiveness measure and criterion for cost-effectiveness are also enumerated.

Chapter five presents the results of the study. This includes results of the cost analysis, effectiveness assessment and cost-effectiveness analysis. Lastly, it provides results of a sensitivity analysis.

Chapter six discusses the analysis of the results. In this chapter, the trade-offs between the competing alternatives are discussed. Using the cost-effectiveness ratios, the desired alternative is presented.

Chapter seven presents the conclusions and recommendations.

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Chapter Two

Literature review

There has been little work to date that has been performed in relationship to cost-effectiveness per say of CDD in HIV/AIDS patients. Therefore the literature review is done in segments of effectiveness, costs and finally cost-effectiveness as well. The aim of this literature review is to bridge the gap that exist in effectiveness alone, and costs alone in this aspect of managing these patients.

2.1 HIV/AIDS Opportunistic infections

HIV leads to progressive debilitation of the immune system. This renders the individual susceptible to opportunistic infections. Opportunistic infections are so called because they would normally not cause infection in an individual with intact immune system. There are a lot of opportunistic infections in these patients affecting virtually every system in the body; examples are oesophageal candidiasis, pneumocystis carinii pneumonia, herpes zoster (shingles) and ulcers. Cytomegalovirus for longer than one month, disseminated coccidiomycosis, disseminated histoplasmosis, kaposi sarcoma, encephalopathy and CDD also add to the list. These diseases rarely afflict patients with intact immune systems. Tuberculosis (*Mycobacterium avium*, *M. kansasii* and disseminated *Mycobacterium*) is also an important group of opportunistic infections. An HIV infected patient with one of the several opportunistic infections mentioned above results in an AIDS diagnosis.

The diagnosis of AIDS can also be made in the absence of laboratory evidence of infection if the patient has no other cause of immunosuppression and has the definitive diagnosis of one of a number of indicators of this viral disease. Evidence of immune dysfunction may be followed by clinical conditions ranging from fever, weight loss greater than 10% over a

period longer than 30 days (Fountas, 1998). These patients often show symptoms of malaise, lymphadenopathy (swellings of the human body for example around the neck and arm pits), and central nervous system dysfunction. The central nervous system is part of the human body that coordinates most functions using a network of connectors called nerves. They may also present with infections such as herpes simplex virus or oral candidiasis. These non-specific conditions are usually progressive and are a prelude to opportunistic infections that are diagnostic of AIDS. Weight loss greater than 10% baseline, fever lasting at least one month and diarrhoea lasting at least one month are collectively known as constitutional symptoms. Weight loss is the most prominent clinical symptom in most patients. Up to 35% of these HIV positive patients may progress to AIDS in five years (Minkoff, 1998). But once AIDS is diagnosed, better prognosis can be given to these patients by treating them adequately.

2.2 Chronic diarrhoea diseases

Chronic diarrhoea disease is defined as diarrhoea of duration greater than four weeks. This disease develops when the CD4⁺ (cells in the body that are part of the immune system) count drops to levels less than 300/mm³ in the blood. Chronic diarrhoea diseases are grouped into two categories, diarrhoea caused by an infection and not caused by an infection. Sometimes the causes of chronic diarrhoea remain unknown.

Chronic diarrhoea that is purely gastrointestinal (GIT) in origin, in HIV/AIDS patients, is usually multi-factorial in origin. HIV/AIDS patients lack the natural immunity to fight against any infection; this makes them susceptible to opportunistic infections including those of the GIT origin. The majority of these opportunistic infections that cause chronic diarrhoea disease in adults with HIV/AIDS are also the main causes of diarrhoea diseases in childhood.

Examples of these diarrhoeal diseases are fungal (candidiasis), viral (rotavirus), bacterial (*E. coli*) and indeed parasitic (*Cryptosporidium parvum*, *Isospora belli* and microsporidiosis) (Hope et al, 1989). These infections mainly cause a secretory type of diarrhoea. The burden of diseases due to CDD is quite high in terms of new medical admissions and readmission in these HIV/AIDS patients. This leads to increased bed occupancy by these patients since they are the majority for each admission in terms of the bed capacity that is available for all patients suffering from different types of diseases.

In order to achieve effective treatment of HIV/AIDS chronic diarrhoea patients, a lot of work has been going on to identify the pathogens (germs) common in these patients. Previous studies from African countries (Lebbad et al, 2001), where HIV-1 infection is prevalent, have shown that infections with *Cryptosporidium parvum*, *Isospora belli* and *Microsporidium* are frequently associated with chronic diarrhoea in AIDS patients.

According to Crotty & Smallwood (1996), opportunistic viral enteritis is an important gastrointestinal (gut) manifestation of HIV related diseases. Several viruses including cytomegalovirus (CMV), astrovirus, picobirnavirus, small round structured virus and rotavirus have been implicated in HIV-related diarrhoea. The major aetiological agent is CMV. Adenovirus too, have been linked to persistent diarrhoea in these patients.

A study carried out by Alonso et al (2001), on molecular analysis of relapse versus re-infection in HIV-positive patients suffering from recurrent *Clostridium difficile* (a bacteria germ) associated diarrhoea concluded that *Clostridium difficile* has a major tendency to recur especially in HIV positive patients.

Apart from opportunistic diarrhoea infections in HIV patients, dysentery can also infect these patients. A study carried out by Gwavava et al (2001) in Zimbabwe shows that the germs shigella, schistosoma mansoni and shiga-toxin-producing E.coli (0157) were major pathogens isolated in dysentery associated with HIV infected patients.

Prevention of HIV is preferred, but where it fails, prevention of opportunistic infections is the next best form of management. Most studies have been done in the areas of both its prevention and that of AIDS related opportunistic infections. The advent of antiretrotherapy started with monotherapy using nucleoside reverse transcriptase inhibitors (NRTI) called Zidovudine in 1986 in industrialised countries (Beck et al, 2001). There was continuous development in this area and by mid-90s, the protease inhibitors were also developed which led to the administration of combined therapy. This is known as highly active antiretroviral therapy (HAART). Under these circumstances HIV/AIDS is now considered to be a “chronic illness” (Beck et al, 2001).

HAART has significantly decreased the incidence of infectious diarrhoea affecting HIV infected patients. Some of the recent work in this regard includes a study, which found out that CD4+ count reduced to undetectable levels and the virus remained in the dormant state (Saag, 2001). However, HAART regime was found to be toxic to patients. According to Walker et al (2001), one of the side effects was fat malabsorption. The study reviewed that NRTI induces mitochondrial (a part of the human body cell) toxicity as a mechanism for HAART lipodystrophy. Another article by Poles et al (2001) argued that fat malabsorption represents a commonly undiagnosed entity in HIV patients with diarrhoea, whether or not they are on HAART regime. They further suggested that faecal fat determination should be

considered a routine part of the diagnostic workup of HIV infected patients experiencing diarrhoea.

Advances in treatment of HIV have continued. An article by Lafeuillad et al (2001) showed that treatment with HAART alone was not as adequate but a combination of HAART and an immune booster intervention like interleukin 2 or hydroxurea was much better. In view of the same argument, a similar clinical study by Saag (2001) demonstrated that recombinant interleukin-2 (rIL2) therapy produces substantial increases in CD4+ cell number and function in HIV-1 positive patients in both early and late stages of the disease. The study further indicated that low dose rIL2 could be used in a way that was safe and non-toxic, as well as prospects for immunological containment of latent or persistent HIV.

A study was carried out to establish whether HIV patients could benefit from administering ganciclovir therapy if dose adjustments were done according to their digestive and immunological status (Mouly et al, 2001). The results show that dose adjustments were necessary if these patients had to benefit from ganciclovir therapy.

Vitamins are important in all people including HIV infected patients. A recent study in Zambia reviewed that there is impaired bioavailability of vitamin A in both adults and children with persistent diarrhoea (Kelly et al, 2001). This puts these patients at risk of vitamin A deficiency and further lowers their immune system, mostly affected are HIV infected individuals.

2.3 Costing HIV/AIDS prevention or treatment interventions

Information on the cost of treatment and care of HIV infection enables assessment of the economic impact of the disease on the health care systems to be made and the affordability of new and existing interventions to be assessed. This information also provides a basis for health care resources planning and identifying resource requirements for HIV service provision. Beck et al (2001) revealed that costs for treatment and care are lower in absolute terms in Sub-Saharan Africa compared to industrialised countries, but as a percentage of resources spent on health delivery, these costs are likely to represent a greater burden for developing countries.

A study by Bozzette (2001) showed that estimates of costs can be constructed by using records of clinical events to model transitions to various clinical states and then applying cost per day estimates to those states.

According to the global review article by Beck et al (2001), knowledge of the costs of different types of interventions can help address whether service provision is affordable at an individual level. This information can be used to ascertain the cost-effectiveness of treatment and prevention.

2.4 Cost-effectiveness analysis

Cost-effectiveness analysis has been employed as a tool to aid program managers and planners in ministries of health and also dealing directly with HIV/AIDS to make informed decisions about resource allocations (UNAIDS, 1998). It can thus be used to measure efficiency (given output is achieved at least cost or that the output is maximized at a given cost) of service delivery. In CEA, the impact is measured using indicators related to change

in health status. In a CEA, various alternatives are considered. The results of the analysis are described in terms of the cost per unit of effectiveness for each alternative. The cost-effectiveness ratio is calculated for each alternative by dividing cost by the unit of effectiveness (for example, patient cured) (Drummond et al, 2000). Then a comparison of these ratios is made. The alternative with the lowest cost per unit of effectiveness is the most cost-effective and is generally preferred on grounds of economic efficiency.

CEA helps in the priority setting process of strategic planning. This is due to the fact that with high HIV/AIDS epidemic, the costs and initiatives proposed in an AIDS program must be known to decision-makers to make best use of the resources based on evidence. These economic measures are essential considering the fact that AIDS patients have doubled, if not tripled the health resources requirement, hence the need for a cost-effective intervention. CEA may be performed to identify efficient strategies and methods by comparing costs and consequences of alternative solutions.

Freedberg et al (1998) carried out a cost-effectiveness study of preventing AIDS-related opportunist infections. Their findings were that prophylaxis against HIV related opportunistic infections vary widely but prophylaxis against *pneumocystis carinii* (PCP), toxoplasmosis and *mycobacterium avium* complex is the most cost-effective alternative.

A study done by Miner et al (2001) assessed the cost-effectiveness of highly active antiretrotherapy for adults with HIV in England. They concluded that use of HAART is at least moderately cost-effective compared with treatment with nucleoside reverse transcriptase inhibitor.

HIV is now considered to be a “chronic disease” as discussed previously. An article by Simpson (1995) revealed that CEA when applied to drugs used in chronic diseases is skewed upwards. This is because of the high cost of routine medical care and concomitant medications that inflate costs, thus resulting in a high numerator for cost-effectiveness ratio. At the same time, the denominator, survival time, may be affected owing to the short life expectancy or quality of life adjustments required in studies involving chronic illness.

Bozzette (1995) illustrated that blind inclusion of all direct and indirect costs in empirical studies involving patients with HIV disease, total direct expenditure are driven by relating few cases involving very high costs. Such a problem could be mitigated by focusing on the positive and negative costs of specific infections, particularly for complications such as cryptococcal meningitis or cytomegalo retinitis (which are opportunistic infections). This article further indicated that a more effective therapy would be advantageous by inducing negative direct costs if it results in a decreased need for symptomatic therapy or support services or if it leads to a relative decrease in the number of HIV-related complications. This is an indication that economic analysis will become important as the prevalence of AIDS grows while scarce resources must be allocated to an ever-growing number of demands.

An article by Simpson (1995) demonstrated that costs and health outcomes in AIDS therapy faced by providers were adequacy of staff, practice time, experience, clinic location, technical performance, charges and supplementary services.

As alluded to by Simpson (1995), cost-effectiveness ratios represent differences in both costs and outcomes for similar populations receiving different treatment. All disease-related costs and benefits for HIV disease should be included in costing. This usually means that all future

costs and effects must be included because AIDS is a syndrome characterised by multiple acute episodes of care, and prior episodes may affect risk of future ones. It is therefore difficult to isolate resource use for routine provision of services for these patients and for care provided because of specific events or drug therapies.

In the scarcity of resources, these results could be used to set priorities and explore new alternatives to improve HIV patient care. This work is aimed at exploring the new alternatives for improving HIV patient care as well as efficient use of limited resources.

The previous work reviewed in this chapter forms a guide and a platform on which the work in this dissertation is developed.

2.5 Limitations of A CEA

- CEA uses a single natural outcome measure. It therefore allows for comparison within but not between therapeutic groups.
- CEA includes only one outcome measure, while in reality an intervention may result in more than one outcome, for example, increased length of life, reduced pain, or increased mobility.
- Another example would be that; treatment with fluid and electrolytes, and drugs alone without investigations, may improve quality of life as well especially if these drugs are not administered intravenously or as enema. On the other hand, investigations especially invasive ones may cause pain and negatively affect the quality of life even if they may be the most cost-effective alternative.

Chapter Three

Extent of HIV/AIDS in Zambia

3.1 Country setting

Zambia is a landlocked country located in south-central Africa between latitudes 8 and 18 degrees south of the equator, and between longitudes 22 and 34 degrees east of the Greenwich meridian. The mean altitude rises about 1200m above sea level and has a surface area of 752,614 square kilometres. Its population is estimated to be 10.3 million. Zambia has a population pyramid structure with the majority of its population below the age of 49. The population aged between 15 and 49 was estimated to be at 4,102,000 as at 1999 (CSO, 2000). This depicts a youthful population structure. This age group was considered because it is the most vulnerable to the HIV/AIDS infection in Zambia.

The annual population growth rate was 2.4% in the period 1990 to 1998. The average annual growth rate of urban population between 1990 and 1998 was 2.7%. The GNP per capita in 1997 was estimated to be US\$370 while the GNP per capita average annual growth rate between 1996 and 1997 was 1.8% (UNAIDS/WHO, 2000). Its economy depends on mining and agriculture. The main mineral natural resources include copper, cobalt, zinc, and many others in small proportions. Copper accounts for approximately 80 percent of the country's export earnings. Some 75 percent of Zambia's population is engaged in agriculture, largely subsistence farming. The main agriculture crops are sugar cane, maize, groundnuts, coffee, cotton, sunflower and beans. The other major industries that contribute to its economy are tourism, energy and fishing. There are also small industries for manufacturing, clothing, construction and forestry.

As at 1999 the crude birth rate was 42 births per thousand, which is relatively a high number. The impact of HIV has contributed greatly to the crude death rate of 20 deaths per thousand. This is among the highest in the world. The infant mortality rate has more than tripled to a staggering figure of 80 per thousand live births. The life expectancy at birth has also reduced drastically to 40 years (UNAIDS/ECA, 2000).

The health system in the country comprises community health services, clinics and primary hospitals offering primary health care. Secondary hospitals offer specialised services to complicated cases and are also centres for education. A tertiary hospital is also the centre for specialised cases and education.

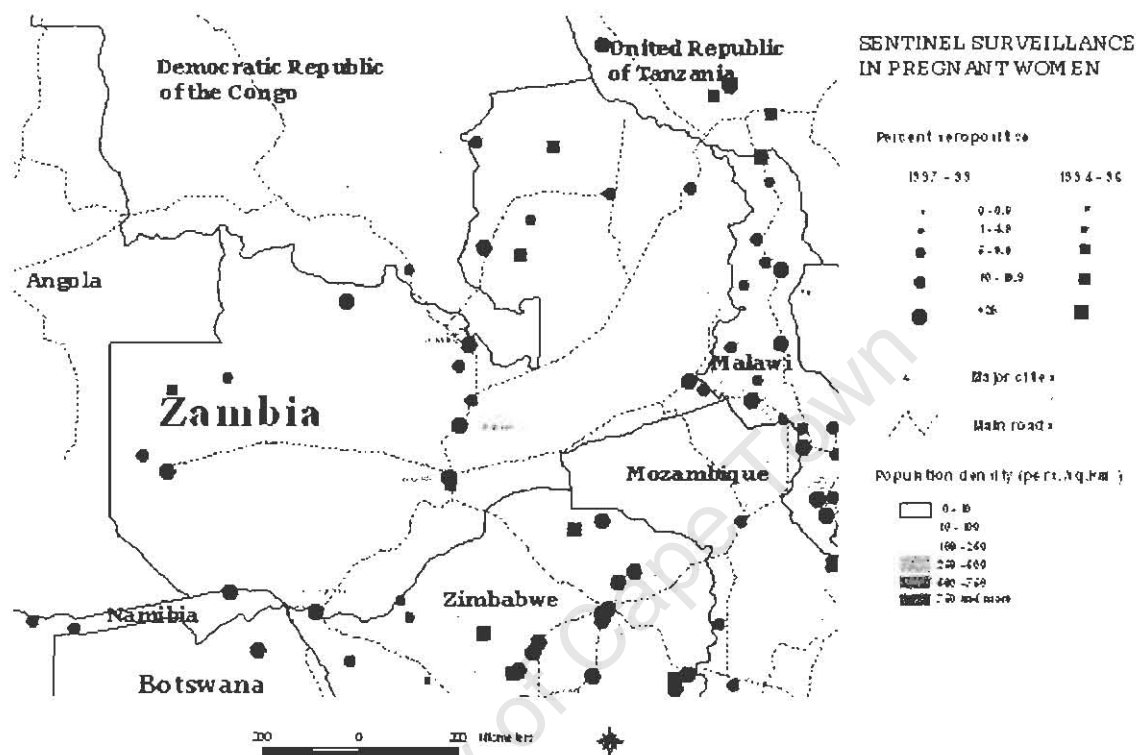
3.2 HIV epidemiology

Human immunodeficiency virus and acquired immune deficiency syndrome is a global problem that had a total of 34.3 million people worldwide living with the disease by the end of 1999 (UNAIDS, 2000). Of these people, 24.72 million are found in Africa, out of which 24.5 million are actually in Sub-Saharan Africa (UNAIDS, 2000). This, therefore, implies that slightly above three-quarters of the world's HIV/AIDS infection is harbored by this region in Africa, which includes Zambia.

HIV prevalence among antenatal women in Lusaka and Ndola (two major urban cities in Zambia) increased from 5% in 1985 to 27% in 1992 and remained stable until 1998. However, the prevalence ranged from 5% to 31% among the patients tested in 18 sites in 1998 (UNAIDS/E CA, 2000). There is a difference in the prevalence rate between rural and urban areas, 10% and 21% respectively, as at 1992 (Fylkesnes et al, 1994). The prevalence is highest in the age group between 15 and 35. However, within this group, the females are on

the younger side than their male counterparts. The current adult HIV prevalence rate is 19.7% as at April 2001 (HIV/AIDS, 2001).

Figure 3.1: Sentinel surveillance in pregnant mother comparing two periods; 1994-6, 1997-9 (UNAIDS/ECA, 2000; 231).



3.3 Impact of the epidemic

HIV is now the leading cause of death in Africa, and the fourth-largest cause of death worldwide (Kumaranayake et al, 2000). The HIV/AIDS epidemic has had a high impact on all the social and economic sectors of the country. The number of cases of AIDS has increased steadily due to the high prevalence of HIV stated earlier on. This is attributed to the fact that the majority of the people infected lie between the ages of 15 and 49 as revealed by the HIV/AIDS (2001) October-November report. Management of these patients is very complex and costly. This is because routine AIDS therapy requires expensive drugs to treat many opportunistic infections and other illnesses that arise.

As the number of cases of this epidemic continues to rise, access to quality health care becomes important. Access population indicators to health care were estimated at 52% in 1996 as the percentage of HIV/AIDS patients with access to health services (UNIADS/WHO, 2000). As a result of this high prevalence rate, the HIV/AIDS (2000) October-November report estimates the number of deaths between 1996 and 1999 due to AIDS in both adults and children to be 650,000. These deaths result in a lot of orphans and widows left behind. This increases the burden that orphans and partners left behind have to cope with emotionally and financially. If both partners have died, orphans and relatives have to bear these costs. Many of the surviving partners who are also infected are struggling to survive. They are in need of care too. Orphans too are left without parental care (lost mother or both parents). The impact falls on all socio-economic structures of the country. This implies loss of human resource, which is felt most in labour intensive industries and work places like the ministry of health, education, defence and indeed elsewhere as training human resource is difficult considering a huge loss at one time.

Despite the huge financial demands of treating HIV/AIDS related illness per say, the hospital faces a lot of other illness competing for the same resource. These are classified as major and other conditions. The major conditions comprise of pulmonary tuberculosis, diabetes mellitus, meningitis, cardiac and renal diseases, hypertension, and epilepsy (Annual report, 1999). Other conditions that also compete for resources at the same institute are peptic ulcer diseases, anaemia, respiratory tract infections, urinary tract infections, and various cancers (Annual report, 1999).

The financial support of the government to UTH is in form of a grant.

3.4 HIV/AIDS policy

In Zambia, there is a high level structure in support of the national response to the HIV/AIDS epidemic. Examples are national AIDS committee/commission, inter- ministerial committee, and presidential level bodies. A strategic framework for the national response to HIV/AIDS also exists, it comprises national strategic plan on HIV/AIDS with clearly identified priorities.

Geographical priority areas include districts along the main routes; seasonal workers in rural areas, districts and towns that experience frequent cross-border traders.

Priority subpopulation includes people living with AIDS, orphans in and out of school, commercial sex workers, private sector women and men.

The interventions that are put in place are; promotion of multi sectored response, promotion of behaviour change, mix of STI/HIV/AIDS, voluntary counselling and testing, reducing mother-to-child transmission, home based care of people living with HIV/AIDS, community-based support for orphans and vulnerable children.

The above policy on HIV/AIDS supported by the national government can be achieved by the hospital in question as it is contained in its mission statement. It's mission statement is “to provide cost-effective health care function as a national referral centre, train health care providers, and conduct research to enhance understating of existing health problems and for the development of science” (Annual report, 1999).

3.5 Conclusion

The population aged between 15 and 49 is the most affected by the HIV/AIDS epidemic in Zambia. The crude death rate of 20 deaths per thousand is among the highest in the world. This has drastically dropped the life expectancy at birth to 40 years. There are 24.5 million people in Sub-Saharan Africa living with the disease. The adult HIV prevalence is high at 19.7% for Zambia. This situation may continue the trends in the death patterns that reached an alarming figure of 650,000 due to AIDS between 1996 and 1999. Thus, the impact of care for those left behind falls on all socio-economic structures of the country. Fortunately, a national HIV/AIDS strategic plan exists for the country with appropriate interventions.

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Chapter four

Methodology

This chapter presents the methodology used in this study. The chapter is organised as follows; Section 4.1 presents the study area, Section 4.2 discusses the perspective of the study, Section 4.3 gives a description of the alternatives and Section 4.4 enumerates the conceptual framework. Section 4.5 presents cost computations, while Section 4.6 gives the sensitivity analysis. Section 4.7 presents effectiveness measure and sampling, Section 4.8 gives the criterion for cost-effectiveness analysis, and finally Section 4.9 elaborates on the limitations of the study.

4.1 Study area

The university teaching hospital is the biggest tertiary hospital in Zambia located in the south-eastern part of the Ridgeway plateau of Lusaka. It is funded by the ministry of health and falls under the central board of health. It has a catchment area of approximately 10.3 million people. It is divided into four patient care departments namely medicine, surgery, paediatrics and child health, and obstetrics and gynaecology. It has more than five sub-specialties, a lot of laboratories and support services. Its services range from primary health care, psychiatry, alternative therapies (physiotherapy, occupation, speech etc) to highly specialised care like hip replacements.

The department of medicine has a total of 10 wards. Each ward has a bed capacity of approximately 46 beds. One of the wards is used in the study, out of which HIV/AIDS diarrhoea patients occupy 16 beds.

4.2 Perspective of the study

The data is described from the university teaching hospital's point of view. Effectiveness data was collected from the hospital records. Cost data were collected from the manufacturers and constructors, and from the hospital in order to obtain good estimates.

4.3 Boundaries of the study

- ❖ The study was conducted at UHT alone.
- ❖ Adult CDD and HIV/AIDS patients above the age of 15 were selected.
- ❖ These patients were treated at UTH in a specified period of one year.

A systematic random sampling was performed in order to avoid bias in allocating the patients to any of the two management strategies.

4.4 Description of alternatives

In Zambia, HIV/AIDS patients with diarrhoea diseases are initially seen at primary health care facilities or clinics. Complicated cases are then referred to the hospitals based in Lusaka or other hospitals countrywide. The most complicated ones are finally referred to university teaching hospital, the biggest referral hospital. These adult referral patients are first seen at UTH adult filter clinic. At this point, those isolated to be medical patients (CDD inclusive) are sent to adult casualty medical admission ward. A physician who makes the diagnosis of specific diseases including CDD sees these patients again. The supporting staff including nurses institute treatment for these patients based on the orders made by a physician. In addition to other orders, the treatment for CDD patients also includes two management strategies, which are:

- i) Fluid, electrolytes, and drugs;
- ii) Fluid, electrolytes, investigations and/or drugs.

since they allow greater flexibility in relating the use of services to costs and patient characteristics, although the method was time consuming and expensive to perform. This method was utilized when costing recurrent costs as well as some overheads like kitchen (meals per day per patient). The comparison between the two methods was done in order to obtain good cost estimates. Donated items were costed as well. Only a percentage of these costs were allocated to the patients with CDD based on number of beds occupied by these patients out of total number of beds in the medical ward. Only one medical ward in the whole department of medicine was used in the study.

4.6.1 Capital costs and annualization

Capital costs that are relevant to this CEA are buildings, medical equipment and furniture, and vehicles. Capital costs are annualized using a discount rate of 5% and the assumption that the expected years of life are, 30 years for buildings and five years for medical equipment, furniture and vehicles.

4.6.2 Recurrent costs

Recurrent costs that were collected using data capturing sheets are drugs and medical supplies (syringes, needles, fluids, canulars, laboratory specimen bottles, slides and reagents), buildings' operational costs, vehicles' running costs and diagnostic tests. In terms of personnel, an assumption was made on doctors' time spent on diarrhoea patients using experienced doctor's estimates. A questionnaire was used to collect information from the nursing staff in order to determine how much of their time is taken up in caring for these patients.

5.1.1.1 Buildings

The cost of replacing a three-storey building was US\$859,449.00 (ZMK3,265,906,250.00). The cost for a ward on the third level with a total surface area of 36.67 x 16.33 square meters was US\$286,483.00 (ZMK1,086,635,417.00). To annualise these costs, we apply the formula $E = K/A (n,r)$, where E is the equivalent annual cost, K is the purchase price (construction price in this case) and A (n,r) is the annuity factor at n years and rate r. Therefore, the annual equivalent is US\$18,636.07, and the cost allocated to diarrhoea patients occupying 8/23 fraction of the ward is US\$6,482.11 (ZMK24,632,018.00).

5.1.1.2 Vehicles

Costing of a vehicle for in patients is necessary as these patients are in most circumstances brought in acute state with an ambulance. The cost of replacing a vehicle such as a Toyota Hiace 2200 petrol panel min-bus utilised as an ambulance is US\$ 23,148.00 (ZMK87,962,400). The ambulance is allocated to the whole medical ward and is run by the transport department. The fraction attributed to diarrhoea patients from the whole departmental vehicle cost was calculated to be US\$5,346.57 (ZMK20,316,966.00). Using the annualization formula, the cost that represents the annual proportion of vehicle cost allocated to these adult HIV patients with diarrhoea is US\$1,859.68 (ZMK7,066,784.00).

5.1.1.3 Medical equipment and furniture

This section presents the costs of medical equipment and furniture related to HIV/AIDS adult diarrhoea patients in the medical ward. The annual cost of medical equipment and furniture is US\$2,455.26 (K9,329,988.00). Using the annualization formula, the annual equivalent of US\$567.10 (ZMK2,154,980.00) for the medical equipment and furniture is

5.1.2.2 Drugs

The total cost of drugs for management strategy 1 was US\$898.27 (ZMK3,413,426.00), and for management strategy 2 was US\$301.50 (ZMK1,145,700.00). Fluids and electrolytes were also included in this category since they are a form of medication. The costs are based on actual price and dosages obtained from the patients' individual records. Since most of the drugs are purchased in bulk (per 1000 tablets), the cost of each wholesale price (per 1000) was divided by this quantity in order to obtain the price of each tablet. The price was in turn multiplied by a specific quantity of tablets (dosage) in order to arrive at the amount for a full course of treatment per drug. This can place in the equation $\text{cost price}/1000 \text{ tablets} = X$, (price of each tablet), $X*Y = \text{total cost of a specific drug}$ (Y being the quantity of drugs consumed).

5.1.2.3 Personnel

Medical care of diarrhoea patients is labour intensive and as such, personnel is one of the most important resources. Thus, to care for these patients, a team of 3 doctors, 11 nurses, 2 administration officers (clerks), 1 pharmacist and 2 laboratory support staff were involved.

Each of the doctors takes, on average, 20 minutes to fully examine a diarrhoea patient (including subsequent visits) under strategy 1, and an average of 30 minutes for strategy 2 to determine the effective course of their management in a day. The amount of money spent on these patients in terms of doctors' time is US\$355.26 (ZMK1,349,988.00) for strategy 1, and US\$532.89 (ZMK2,024,982.00) for strategy 2 per annum.

Nursing care time was determined by a standardised questionnaire (see appendix A). The aim was to assess how much time is spent on diarrhoea patients and subsequently allocate

allocated to patients managed under strategy 1 is US\$43.40 (ZMK164,920.00), and US\$25.23 (ZMK95,874) for strategy 2. The kitchen costs allocated to these patients are US\$57.52 (ZMK218,576.00) for strategy 1 and US\$33.44 (ZMK127,072.00) for strategy 2.

Table 5.1 below shows the various annual costs in US dollars allocated to the two management strategies. There were a total of 43 patients belonging to management strategy 1 and 25 patients managed as strategy 2, this gives us a total of 68 patients altogether.

Table 5.1: Total annual costs allocated to each strategy in US\$

COST DESCRIPTION	STRATEGY 1, US\$	% OF TOTAL	STRATEGY 2, US\$	% OF TOTAL
(a) Personnel-Doctors	355.26	4.3%	532.89	10.4%
(salaries) -Nurses	868.42	10.5%	432.21	8.5%
-Laboratory	0	0%	134.25	2.6%
-Pharmacist	42.44	0.5%	24.67	0.5%
(b) Medical supplies and drugs				
-Medical supplies	308.74	3.7%	291.25	5.7%
-Drugs	898.27	10.8%	301.50	5.9%
Total recurrent cost	2,473.13	29.9%	1,716.77	33.6%
(c) Capital costs-Buildings	4,098.98	49.5%	2383.13	46.8%
-Vehicle	1,175.97	14.2%	683.70	13.4%
-Equipment/ furniture	144.78	1.8%	84.18	1.7%
Total capital costs	5,419.73	65.5%	3,151.01	62%
(d) Overheads-Cleaning	104.19	1.3%	60.57	1.2%
-Administration	54.02	0.7%	31.41	0.6%
-Lighting	69.89	0.8%	40.64	0.8%
-Water	55.56	0.7%	32.30	0.6%
-Laundry	43.40	0.5%	25.23	0.5%
-Kitchen	57.52	0.7%	33.44	0.7%
Total overheads	384.58	4.7%	223.59	4.4%
Grand Total	8,277.44	100%	5,091.37	100%

Table 5.1 represents separate costs for each strategy. The percentage represents the fraction of each cost out of the grand total. Summary of total costs for both strategies combined is given in appendix B.

6.2 Effectiveness

There were a lot of HIV/AIDS diarrhoea patients (20.8%) compared to other HIV/AIDS patient types seen at UTH in the period under review. This indicates a high burden of the disease in Zambia. From the sample, the cure rate was 80% for strategy 2 and 74% for strategy 1. The patients discharged after four days duration contributed to 11.6% for strategy 1 and 12% for strategy 2. Strategy 1 recorded a high percentage of deaths of 14% compared to strategy 2 with 8%. This implies that strategy 2 was a more effective form of patient management.

6.3 Cost-effectiveness

Average costs and cure rates were considered for calculations of cost-effectiveness ratios. The cost-effectiveness ratio for strategy 1 was 260.12 and for strategy 2 was 254.56. Therefore, strategy 2 was more cost-effective compared to strategy 1. CEA is necessary to the Zambian situation, as expenditure should equate effectiveness of the services, especially in the public sector. Since CEA is a tool essential for priority setting in decision-making, the public sector can also benefit from it. This will also reduce the huge costs incurred by the hospital in terms of drugs and lengthy stay of patients, as indicated by high capital costs and overheads. The hospital will also earn a good reputation if there are few deaths recorded. It is also necessary to take into account the limitations of CEA when making a decision based on these computations.

6.4 Sensitivity analysis

The sensitivity analysis was performed on doctors' time by using 30 minutes spent for each management strategy. The ranking of cost-effectiveness that was 269.42 for strategy 1, and

246.86 for strategy 2, did not change. Therefore, strategy 2 remains more cost-effective than strategy 1. This improves the generalisability of the study results.

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literature (Walker et al, 2000). A cost-effective analysis could then be performed to determine the most cost-effective option.

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Appendices

Appendix A

Questionnaire on nursing staff time

Thank you for your time.

1. Name (optional) -----

2. Age (optional) -----

3. Sex (optional) -----

4. How much time do you spend on each patient during a ward round?

(a) < 20 minutes (b) 20 - 40 minutes (c) 40 - 60 minutes

(d) > 60 minutes (e) I don't know

5. How much time do you spend on each diarrhoea patient during a ward round?

(a) < 20 minutes (b) 20 - 40 minutes (c) 40 - 60 minutes

(d) > 60 minutes (e) I don't know

6. How long does it take you to give instructions on oral rehydration therapy to a patient with diarrhoea?

(a) < 20 minutes (b) 20 - 40 minutes (c) 40 - 60 minutes

Appendix B

Summary of costs

Summary of costs that are common to both strategies are given in the table 5.1 below. The table gives the overall costs for the two strategies.

Total annual costs allocated to HIV/AIDS diarrhoea patients

COST DESCRIPTION	ZMK	US\$
(a) Personnel-Doctors	3,375,000.00	888.16
(salaries) Nurses	4,950,000.00	1,302.63
Laboratory technicians	510,144.93	134.25
Pharmacist	255,072.00	67.12
(b) Medical supplies and drugs-Medical supplies	4,679,465.00	1,231.44
Drugs	4,559,126.00	1,199.77
Total recurrent costs	18,328,806.00	4,823.37
(c) Capital costs-Buildings	24,632,018.00	6,482.11
Vehicle	7,066,778.47	1,859.68
Equipment and furniture	870,048.00	228.96
Total capital costs	32,568,850.00	8,570.75
(d) Overheads-Cleaning	626,086.96	164.76
Administration	324,632.35	85.43
Lighting	420,000.00	110.53
Water	333,913.04	87.87
Laundry	260,832.00	68.64
Kitchen	345,648.00	90.96
Total overheads	2,311,122.00	608.19
Grand total amount	53,208,778.00	14,002.31

In the table above, recurrent, capital and overhead costs are tabulated in detail.