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What Determines Health Care Utilization in Zambia?

BY

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Abstract

This study aims to ascertain factors that affect health care service utilisation in Zambia. The study is driven by the fact that despite Zambia recording impressive and improved health indicators for the period 2004 to 2012, the distributional use of health care services has been low against the expectation of high utilisation rate. Studies that have attempted to analyse factors that affect health care service use have used one-part models. This created a methodological deficiency in that unobserved factors, such as, agency relationship between patients and doctors are not captured by these one-part models. The Zero-Truncated-Poisson model is used in this study to capture the unobserved heterogeneities in determining health care service utilisation.

The study used both average marginal effects and hurdle results to interpret the findings. It was found that age, distance, waiting time, insurance and health status have an effect on health care service utilisation. However, place of residence, sex, religion, marital status, education, household size, quality of health care, income and cost of health care services do not have a significant influence on health care service utilisation. A surprising finding was that distance and waiting time had a counter-intuitive positive effect on health care use as against an expected negative sign, but were statistically different from zero. This could have been as a result of the fact that most of the facility visits were at referral facilities.

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I'm finally deeply indebted to my family for all the financial and moral support they gave me. They include my beautiful wife, Mwitwa Kambafwile Tembo, my son, Mphatso Tembo, my parents, brothers and sister. Above all Iam eternally indebted to my Almighty God for His countless mercies and blessings.

Dedication

I dedicate this work to my beloved wife, Mwitwa Kambafwile Tembo, and my son, Mphatso Tembo.

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LIST OF ACRONYMS

CBoH	Central Board of Health
CSO	Central Statistical Office
DHMT	District Health Management Team
HBM	Health Belief Model
HIV	Human Immune Deficiency Virus
LCM	Latent Class Models
LCMS	Living Conditions and Monitoring Survey
LDCs	Less Developing Countries
MDGs	Millennium Development Goals
MoH	Ministry of Health
MoF	Ministry of Finance
RESET	Ramsey Regression Equation Specification Error Test
SSA	Sub-Saharan-Africa
STI	Sexually Transmitted Disease
TB	Tuberculosis
UNICEF	United Nations Children's Fund
WHO	World Health Organisation
ZDHS	Zambia Demographic Health Survey
ZHHEUS	Zambia Household Health Expenditure and Utilisation Survey

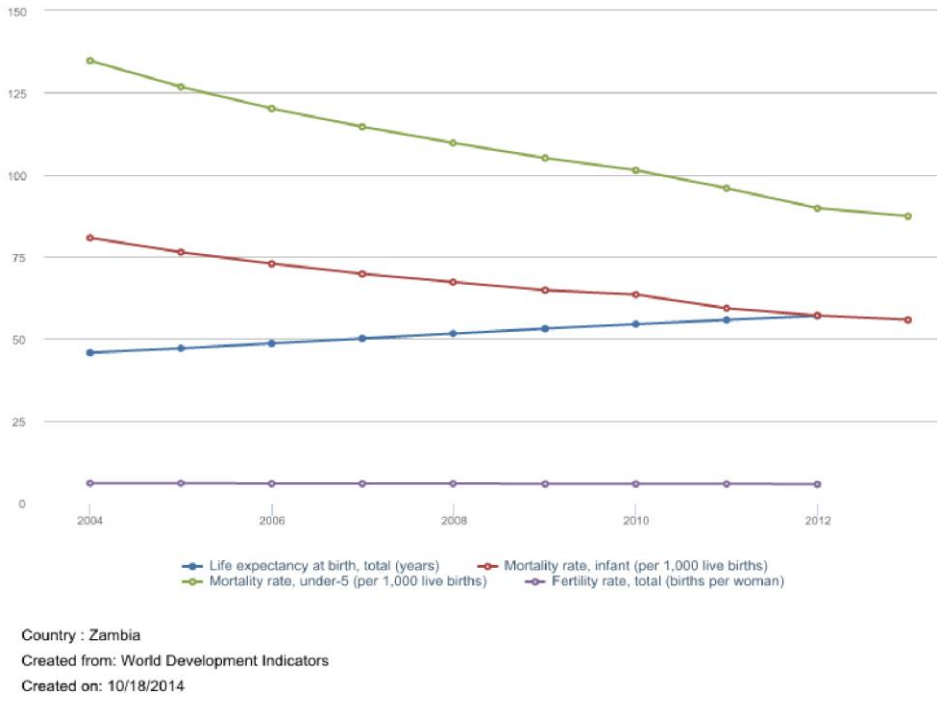
CHAPTER ONE

INTRODUCTION AND BACKGROUND TO STUDY

1.0 Introduction

Zambia, like most Less Developed Countries (LDCs), is characterised by pronounced poverty, poor nutrition, high mortalities, huge disease burden, low literacy rate with health indicators below the international trends (Todaro and Smith, 2005). Figure 1 shows trends in health outcomes between 2004 and 2012.

Figure 1: Health indicators 2004-2012



The figure above was generated from World Development Indicators. Life expectancy increased from 45.8 years in 2004 to 58 years in 2014; The Under-5 mortality rate declined from 135 in 2004 to 87 in 2013 per 1000 live births; The Infant mortality rate improved from 81 in 2004 to 56 in 2013 per 1000 live births; The Fertility rate declined from 6 in 2004 to 5.7 in 2012; Number of reported mortality from malaria decreased by more than half from 8289 in 2004 to 3702 in 2012; The maternal mortality rate has declined from 430 to 280 per 100,000 women between 2005 and 2013 [World Bank(2014) and WHO (2014)]. The above improvements have been attributed to the many interventions, such as the health sector reforms and improvements in the health care delivery system aimed at expanding health care services

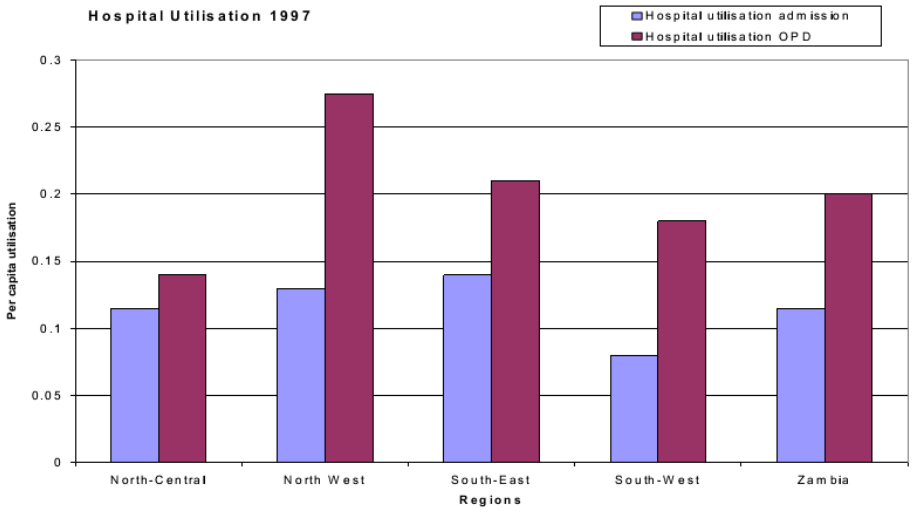
in Zambia (ZDHS, 2010). However, the utilisation of health facilities has remained very low (LCMS (2010); Venkatesh, (2002); Zyaambo et al. (2012); Bonfrer et al. (2012) and Phiri &Ataguba, (2013)). This is against the expectation that with significant improvement in health outcomes, utilisation of health care services should be high.

Zambia has been experiencing widespread inequalities and inequities in accessing and utilising most public services, such as health care services. WHO (2014) defines health inequalities as "differences in health status or in distribution of health determinants between different population groups outside control of the individuals". Inequity on the other hand, is defined as the "uneven distribution of health determinants that may be unnecessary and avoidable as well as unjust, so that resulting health inequalities lead to inequity in health", inequalities in use of health care services show some under-utilisation of services (Ibid). Therefore, inequality in the use of health care services and the existence of an inverse relationship between those who need the services most (i.e. the very poor) and their very low rates of the utilisation are widely pronounced (Ataguba et al. 2013). The utilisation of health care services as defined by WHO (2014) "Proportion of patients visiting or admitted to a health-care facility coming from a particular catchment area". According to WHO for health care service utilisation, an arbitrary minimum threshold is usually set at the minimum proportion of patients who must come from a catchment population owing to the epidemiological patterns or incidence of disease .Thus, the uneven distributional use of health care services translates into differences in health status and health outcomes across the population . Cheelo & Knut (2005), argue that a dominant disease in the disease burden possess a crucial role in determining the measure of utilisation. According to LCMS III (2003), 37 per cent of the reported out-patient cases attended to at government health facilities were due to malaria, causing about 23 per cent of total mortalities annually. The second most dominant disease is the respiratory infections (non-pneumonia) which makes up 21 per cent of out-patient cases attended to causing approximately 11 per cent of total mortalities per year (LCMS III).Epidemiological patterns are described in terms of malaria and respiratory infections which take up 58 per cent of the disease burden. LCMS III calculates the utilisation rate with a 0.5 threshold as total reported cases of malaria and respiratory infections combined per 1000 of the population. Any value below the 0.5 threshold is considered to be low utilisation level, and above 0.5 is high utilisation rate. The incidences of disease are argued as the measure of health care utilisation. Masiye et al. (2005) also used the attendance rate at health facility level before and after the re-introduction of user- fees as a proxy for modelling utilisation of health care services in Zambia.

Health Management Information System (HMIS) in early 2000 at district level improved data availability on health care service use. The utilisation according to Central Board of Health (CBoH) (1997), can be ascertained on the basis of admissions at health facility level or from the attendance volumes for the Out Patient Department per capita or within a specified time frame.

Figure 2: Health Care Utilisation in Zambia

Hospital utilisation (regional data) 1997



Source: CBoH/Danida, Hospital Assessment Study 1997

According to WHO (2015), health care services utilisation threshold is set in accordance with the prevailing incidence of the disease. The vertical axis is the ratio of reported cases to catchment population (CBoH, 1997). It is observed that both Out Patient Department (OPD) and admissions per capita, utilisation is below the 0.5 threshold showing low utilisation of health care. LCMS (2010) indicates approximately 0.3 per capita utilisation indicating low use of health care services.

Phiri and Ataguba (2013), established that socio-economic based inequalities in the distributional use of health care services in Zambia is still high against the fact that, in the same period (2004-2012), health outcomes significantly improved. Primary health facilities are pro-poor, while secondary and tertiary facilities are pro-rich (Zyaambo et al., 2012). The observed uneven distributional use of health care services would reasonably be expected to take a nose dive with improvements in health indicators as the utilisation of health care services positively correlated with health outcomes. Zambia is experiencing pro-poor inequalities in the

distributional use of public primary health care services and a pro-rich inequality in the use of secondary and tertiary level health care services (Zyaambo et al. (2012); Bonfrer et al. (2012) and Phiri & Ataguba (2013)).Hjortsberg and Seshamani (2002) argue that despite the health reforms that began in 1991, the impression regarding usage levels in quality health care services in Zambia declined. The utilisation of health care services was shown by the attendance rates of health facility visits which plummeted. The Zambia Demographic Health Survey (ZDHS (2012)) estimates that health care utilisation among Zambian population is low despite a high disease burden and improved income profile of the country.

Background of the study

Zambia is a landlocked country and covers a land area of approximately 743,390 square kilometres. The total population of Zambia is close to 14,638,505 people. Close to 46.2 per cent of the population is below the age of 14, 48.5 per cent are between 14 and 54 years and 5.3 per cent are over 54 years. Approximately 60 per cent of Zambia's population live in rural areas (CSO (2011) and (World Bank, 2014). The literacy rate has been decreasing rapidly from 80.2 percent in 2010 to 62.5 per cent in 2014 (UNICEF, 2014). Close to 62 percent of the population in Zambia live below the poverty datum line (World Bank, 2014). This high income poverty has implications on the ability to pay for health care services. The high income poverty, uniform user fee charges for secondary and tertiary health care services aggravates the already existing inequality in health care use (Phiri and Ataguba(2013); Ataguba and McIntyre, 2013)). Zambia experiences a high rate of unemployment of approximately 15 per cent (CSO, 2014).

Zambia is among the countries in Sub-Saharan Africa that has lagged behind in meeting the health related Millennium Development Goals (UNICEF, 2012).This means that access to and hence the use of health care services is undesirable. This is in spite of incidences of malaria taking and upward trend from about 344 in 2012 to close to 359 in 2013, with respiratory diseases (non-pneumonia) incidence rate increasing from approximately 328 in 2012 to 359 in 2013 (Zambia Economic Report, 2013). While Zambia's health indicators are impressive, they lag behind international trends evidenced by the fact that Zambia has failed to meet the health related Millennium Development Goals.

Zambia's Health Delivery System

The health delivery system at the provision point of health care is pluralist in approach. The system comprises of formal health care facilities (i.e., public and private hospitals and clinics),

traditional healers, spiritualists and faith healers. The formal health facilities are mostly run by the government, missions, Non-Governmental Organisations (NGOs) and private. Conversely, close to 90 per cent of health facilities are owned by the government. Health facilities in Zambia are spatially distributed which makes access to health care services problematic. The health delivery system incorporates both the provision and financing of the health care services. The financing sources include the government, collaborating partners (donors), the private sector, NGOs and private households. The government, through public taxes, contributes the highest percentage towards Zambia's health care expenditure, while the private sector and households contribute 33 per cent and about 14 per cent is funded by donors and collaborating partners (Zambia Economic Report, 2013). Traditional healers in Zambia are categorised as herbalists, spiritualists or faith healers and are recognised under their association, Traditional Health Practitioners Association of Zambia (Manenga et al., 2006).

The health delivery system is arranged in a pyramidal structure with a strict referral system. The health facilities are inadequate in number, as most health facilities tend to have vast catchment areas. At the bottom of the pyramid are health posts which are mostly found in rural and peri-urban areas. Health posts and clinics then follow and are referred to as primary health care facilities, as they are the first point of contact by health care seekers. Primary health care facilities are highly characterised with very long queues.

The first contact at a health facility is often initiated by the seriousness of the disease, knowledge of the aliment by the health care seeker and their close family members or colleagues. The subsequent procedures and medical decisions are made by the health practitioners. This is what is referred to as agency relationship between patients and clinicians. The agency relationship also known as asymmetric information, and occurs where the principal is well informed about the matter at hand and takes advantage of the agent (patient) for purposes of gain (Gravelle & Rees,2004).Secondary health facilities include district, general and provisional hospitals. These facilities are sometimes called referral hospitals. Tertiary hospitals feature at the top of the pyramid as they provide specialised health care services with complex medical equipment. Tertiary hospitals are teaching hospitals and enjoy large budgetary allocations. The referral system is designed in such a way that a health care seeker begins medical service acquision at primary health facilities and services at this level are free. When cases become complicated and cannot be handled by the primary health facilities, such cases are referred either directly to the tertiary level or secondary health facility

level. At the secondary and tertiary facility level a service fee is charged for all medical procedures.

The health delivery system has gone through a number of health sector reforms in an attempt to make the sector efficient and effective in delivering equitable, quality and cost effective health care services as close to the family as possible (Ministry of Health (MoH), 2013).

Access to and utilisation of health care services is positively correlated with health outcomes, such as life expectancy. Zambia's health indicators have tremendously improved despite communicable and non-communicable diseases taking an upward trend. The disease burden has thus increased (MoH, 2012). Figure 1 shows an improvement in health indictors, such as, life expectancy of 57 years in 2012 compared to 47 years in 2004. The infant mortality per 1000 live births declined to 55.8 from 95 in 2004; the fertility rate was 6.3 births per woman in 2004 but dropped to 5.3 in 2012; the maternal mortality fell from 430 to 280 in the same period (World Bank, 2014).However, the improved indicators lagged behind the international trends. The Zambia Demographic Health Survey (ZDHS, 2012) reported that health care utilisation among the Zambian population as measured by incidences of malaria and respiratory infections at selected health facilities against the expected use was low (i.e. 0.35 below a 0.5 threshold). The ZDHS (2015) report revealed that this trend has not changed.

MoH adopted an integrated health care delivery system that received an increased budgetary allocation from central government. The aim was to improve the quality of health care. Therefore, health facilities were rehabilitated and health facilities were restocked with modern medical equipment. The coverage of health facilities was widened by building more hospitals and health centres. However, the utilisation of health care services still took a downward trend (Kabaso et al. 2006). In spite of Zambia moving to a lower-middle income status (World Bank, 2010), low utilisation of health care services as measured by patient-flow method (attendance rate) was recorded when the fee-for-service system was introduced (MoH, 2011). The introduction of 100 percent subsidy on primary health care in 2011 with a view to improve utilisation of health care services saw attendance rates at health care facilities increasing (MoH, 2012).Despite the improvements in attendance at health facilities, Phiri& Ataguba (2013) argue that the many interventions have not translated into corresponding reductions in inequalities/inequities which shows that the population does not receive health when needed.

This has put equity issues at the forefront of the government's agenda as it has recognised that high level of inequalities and inequities in the utilisation of health care services. Therefore,

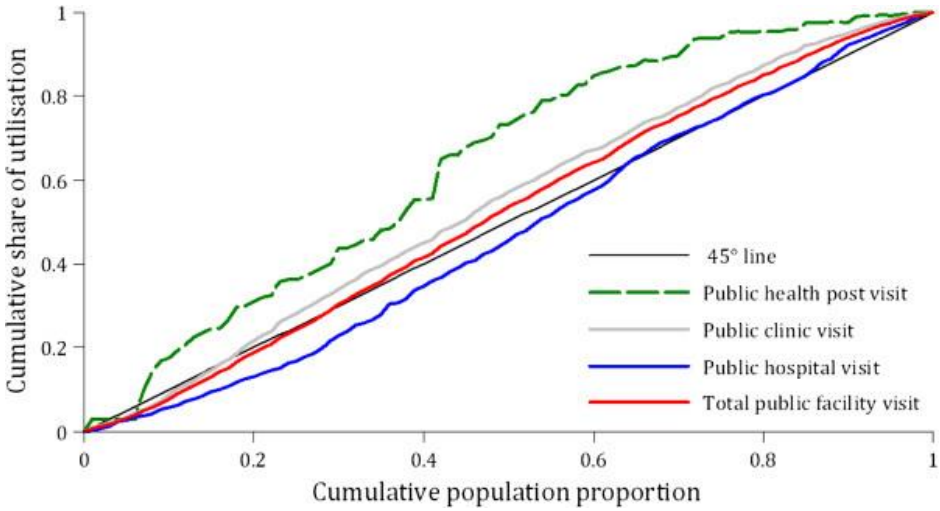
equity in health care services has been given top priority in government's 2030 country vision. As a direct consequence, a clearly spelt out mission statement for health care delivery: "To ensure equitable, cost-effective quality health care as close to the family as possible" (MoH, 2013).

The health care delivery system was decentralised in 1996 and some of the roles of the MoH were transferred to a semi-autonomous Central Board of Health (CBoH) at provincial level. At district level, District Health Management Teams (DHMT) were formed with a view to increasing access to health care services as well as increasing distribution of medical supplies and health interventions (MoH, 2003). Finally, the Zambia Living Conditions Monitoring Surveys reported that the proportion of individuals in the population who reported an illness or injuries was a meagre 15 percent of the people in rural areas and about 12 percent in urban area (CSO, 2010). Lusaka province had the lowest proportion of individuals reporting an illness or injuries. The utilisation of health care services, is in this case, ascertained by the incidences of disease against the percentage of the reported cases (attendance rate) within the population. Therefore, the expectation that with improved health indicators, the distributional use of health care services should be high is not holding for Zambia.

Inequality in health care utilisation in Zambia

Concentration curves and indices are some of the methods used in measuring inequalities or inequities in the utilisation of health care services, thus highlighting the pro-poor and pro-rich distribution of public health service use (Todaro, 2005).Appendix A1 explains the use of concentration curves in interpreting inequalities/inequalities. Using the above analysis and some statistical estimations, Phiri and Ataguba (2013) using the 2010 ZDHS data, found that there was a higher percentage of the poor who self-reported illnesses three months prior to the survey. The utilisation of public health clinics was at 56 percent and hospitals at 42 percent the improvement in health indicators, the utilisation of health care services remains unacceptably low. Phiri and Ataguba (2013) in Figure 3 below, further argue that health post facilities are largely used by the poor as its use is above the equality line and concentration curves of all facilities as well as public clinics are also above the 45^0 line, implying that its use is to the advantage of the poor. Conversely, concentration curves for public hospitals use is below the 45^0 line, showing that the utilisation of hospital facilities is mostly by the rich (pro-rich).

Figure 3: Statistical graphical result of Inequalities in health care service use



Concentration curves for health care the utilisation in Zambia, 2010

Phiri & Ataguba: *International Journal for Equity in Health*

Determinants of health-seeking behaviour in Zambia

Indeed, while factors that determine health service utilisation have been ascertained by a considerable body of literature, a puzzle exists in Zambia that, while health indicators are improving, the utilisation rate for health care services is low. This is against the background that stakeholders in the provision of health care have made serious efforts to increase access to health care. Demographic and socio-economic factors could possibly explain Zambia's health care utilisation phenomenon. Demographic factors include: sex, marital status and age. Socio-economic factors include; education, income, family size, religion and health insurance (Andersen, 1973).

The observed health-seeking behaviour in Zambia is that, on average, an average Zambian seeks health care depending on the severity of illness or when the people are really sick, otherwise self-medicate with formal or traditional medicines, take no treatment or rather go to spiritual or faith healers, public or private formal health care (Hjortsberg and Seshamani, 2000). Multiple treatment options are rampant in Zambia. Traditional healers' services and self-medication are important sources of health care in Zambia. What services health providers offer and perceptions that households have on the effectiveness of the service also determines the health care options. Socio-cultural, demographic and socio-economic factors have an influence on the use of health care services in Zambia (Hjortsberg and Seshamani, 2000).

Perceived quality of health care as by health seekers or those that are nursing a terminally ill person plays a very important role in health care utilisation. Wake et al. (2005) used drug availability, waiting time, cleanliness of health facilities, perceived health outcomes and staff attitude to measure health care quality. Thus, an examination of the current drivers of demand for health care in Zambia is a very important exercise for purposes of making substantial improvements in incorporating these new drivers, if any, into health policy reforms in order to realise the vision of health care delivery in an equitable and cost-effective manner as close to the family as possible. This will thus increase the utilisation of health care services.

1.1 Statement of the Problem

Zambia has made tremendous progress in improving the health of its population as shown by the improved health indicators. Although Zambia has recorded progressive development in the health sector (such as improvements in health care delivery shown but the improvements in the health indicators), inequalities and inequities in health care use have remained high as shown by the unequal distributional and low use of health care services (Zyaambo et al., 2012; Bonfrer et al., 2012 & Phiri and Ataguba, 2013). This is a paradox that while the utilisation of health care services is low, health indicators are improving. Therefore, if determinants for health care demand are examined and factored into the health delivery policy, more positive developments in health indicators may be realised. Distributional inequalities/inequities in the use of health care services have been empirically verified in Zambia. Zyaambo et al. (2012) argue that there exist widespread inequalities in the utilisation of secondary and tertiary health facilities, as such facilities are generally used by those that can afford to pay for the services. This finding is complemented by Phiri and Ataguba (2013) whose study empirically verified not only the existence of inequalities in the distributional use of health facilities to be pro-rich at the higher facility level, but that they are also used by the poor at the primary level. Masiye et al. (2008) and Seshamani (2000) used out-patient facility attendance rate and verified low utilisation of health care services.

Access to and utilisation of health care services by a representative health consumer in Zambia involves an agency relationship between the patient and health care provider. This agency problem occurs when health care seekers make the initial decision to seek health care, depending on the knowledge and severity of the disease, but subsequent decisions on treatment are made by the clinicians. The empirical effect of this agency relationship is latent in the health care system and cannot be observed. These unobserved factors or heterogeneities nonetheless,

have an influence on the utilisation of health care services (Akin et al., 1985). Most research studies have used the probability models, such as the logistic models, in examining the determinants of health care use (Zyaambo et al (2012), Bonfrer et al. (2012), Stekelenburg (2004), Daura et al. (2003)). The observed asymmetric information inherent in the health delivery system and other unobserved factors are totally missed in logit and probit models. The other methods which have been used lacked the capacity to capture the unobserved factors and have neglected the factors that may influence the use of health care services. The empirical model adopted in this study has the capacity to determine robust estimates capturing these critical unobserved factors. The empirical facts underlying this investigation are that even though health indicators are improving utilisation of health care services is low as shown by the disparity between the actual use of health care services in a catchment population measured by the attendance rate for cases of malaria and respiratory infections per 1000 of the population, and the expected utilisation proxied by the incidence rate of the dominant disease. According to MoH (2014) report, utilisation rate remained at 0.35 against a threshold of 0.5 showing that utilisation of health care services (malaria and respiratory infections attendance rate against the expected attendance forecasted by the incidence rate of the said diseases) was low.

1.2 Objectives of the study

1.2.1 General objective

The broad objective of this study is to model the determinants of health care utilisation and distributional inequalities in the use of health care services in Zambia.

1.2.2 Specific objectives

Specifically, the study seeks to analyse the following:

(1) To identify the socio-economic-demographic factors that determine the utilisation of health care services.

(2) To shed more light on (and hopefully resolve) the observed paradox of co-existence of improved health status outcomes amidst low utilisation and distributional inequalities in access to health care services in Zambia.

(3) To apply a more robust two-part model that remedies the methodological weaknesses in previous studies that used one-part logistic regressions. This would enhance the precision and remove bias in model parameters estimates.

(4) To expose and understand the unexpected paradox that, so far, improved health outcomes are not automatically translating into improved health care utilisation.

1.3 Research Questions

(1) How do socio-economic-demographic factors, such as income, access to health insurance, family size, education, marital status, health status, sex, age, place of residence, affect the use of health care services?

(2) How does the quality of health care determined by length of waiting time, availability of drugs and medical equipment, privacy during medical examinations as well as staff attitude, affect the utilisation of health care services?

(3) What accounts for the apparent paradox of the co-existence of improved health status outcomes amidst low utilisation and distributional inequalities in access to health care services in Zambia?

1.4 Operational Hypotheses to be tested

The hypothesis that this study seeks to test is whether or not the explanatory variables are predictors of health care service utilisation in Zambia.

The study, therefore, hinges on the following hypotheses:

(1) Insurance, income, education and age influence the utilisation of health care services positively.

(2) Place of residence and distance to a health facility positively determines demand for health care.

(3) Religious belief negatively affect the use of health care services.

(4) The quality of health care has a positive effect on health care service utilisation.

(5) Marital status and health status affect use of health care services positively.

1.5 Justification of the study

Zambia has experienced changes in epidemiological polarisation amidst higher inequalities/inequities in the utilisation of health care services. Therefore, policy makers need

sufficient and accurate knowledge on the drivers of health care utilisation so that appropriate policies encompassing these drivers may be designed to improve health care service utilisation rate and the general health of the population. The importance of this study, therefore, lies in the use of Zambia Household Health Expenditure Utilisation Survey (ZHHEUS) (2014) data within the framework of the agency relationship in the use of health care services. The unobserved heterogeneities will be captured within the framework of the hurdle model (truncated count data model) which has no distributional assumptions or conditions. Most studies on the utilisation of health care services in Zambia have been carried out using either a logistic or probit one-part model (Stekellenbug (2004) and Daura et al. (2003)). The inability of the one-part probability models to capture the agency relationship between doctors and patients, as argued by Cameron and Trivedi (2005) exposes inconsistencies and biases in estimates. Logit and probit models also fail to handle mix-truncated variables with several zeros which is common when dealing with utilisation studies. Seshamani (2000), in the study on Impact of User Fees and Health sector reforms on Health Facilities Attendance in Zambia, examined the different factors that may have contributed to the declining trends in the utilisation, but did not derive rigorous quantitative assessments due to data constraints. This methodological deficiency in studies on utilisation of health care services can adequately be addressed by the use of the double hurdle model also known as Zero-Truncated-Count-Data model (two-part models) that fittingly capture the unobserved heterogeneities and estimates the determinants of health care service use efficiently. Therefore, understanding the factors that determine utilisation of health care services is likely to improve health care service use, thereby enhancing health outcomes even further. With increased utilisation, the health indicators, which are already improving would improve even further or even exceed international standards. This research, therefore, also sets a clear area of study in micro-econometrics and health economics for further research in the subject.

1.7 Outline of the dissertation

The dissertation is divided into five chapters. Chapter 1 covers the introduction of the research and outlines the background of the study, research problem, research objectives and questions, and justification. Chapter 2 delves into the theoretical and empirical literature elaborating on the determinants for health care service utilisation. Chapter 3 constitutes not only theoretical and empirical model specification, but also the definition and justification of variables employed in this study. The chapter also presents the econometric methodology to be employed

in ascertaining the demand for health care services. Chapter 4 presents the estimation, interpretation and discussion of the study's empirical results. Chapter 5 concludes with policy recommendations and suggestions for further research.

CHAPTER TWO

LITERATURE REVIEW

2.0 Introduction

This particular section of the study reviews both the theoretical and empirical underpinnings, and arguments on the factors that determine demand for health care services in Zambia. The chapter defines utilisation of health care services with reference to Zambia. The section further discusses theoretical models that justify the inclusion of variables that aid in examining the utilisation of health care services in Zambia. The section finally links theoretically justified variables with empirical findings on the theoretically justified variables.

2.2Theoretical and empirical literature review

The health-seeking behaviour of a representative consumer in Zambia depicts that the central aim of a consumer of health care services and other composite goods is to maximise utility of the services they demand. In case of health services, the utility frequently refers to preventing one's stock of health from falling to dangerously low levels and risking death, avoidance of permanent disability in cases of injury, recovery from an illness as well as accepting medical procedures that prolong life expectancy. This observed behaviour can be explained by standard microeconomic theory. In order to determine the drivers of health care demand in Zambia this research will model the consumption behaviour of a representative consumer. Health care services will be taken as a consumption good and not as an investment good. Within this conceptual framework of standard microeconomic theory, the following are assumed:

(1) A representative consumer of health care services in Zambia is rational, that is, always aims to maximise utility.
(2) The ordinary demand curve for health care services is downward sloping.
(3) Ceteris paribus assumption hold, that is, all other factors, except income and price, are held constant.

2.2.1 Utility maximization model

According to standard microeconomic theory, an individual maximises utility subject to a budget constraint, given that an individual is maximising utility (u) which is the function of

health care services (h) and a composite of other goods (x) and total income of (Y). A rational Zambian representative consumer will thus:

(1) Maximise $u = u(h, x)$ subject to Y

If the whole income is exhausted, an individual's income will equal cost as follows:

(2) $Y = ph + jx$

Assuming that a rational consumer derives utility directly from the consumption of health care services, just like the utility that is derived from the consumption of apples,

where: $h =$ Constant quality units of health care services

$p =$ Price of health care services

$x =$ Composite of other goods

$j =$ Price of other composite goods

$Y =$ Individual's income.

It is the hypothesis of the model that once the Zambian representative consumer is modelled, the Marshallian demand function will be derived. This demand function will be the function of market prices and income as follows: $D_i = f(prices, income)$.

Standard microeconomic theory shows that the utilisation of health care services is directly related to prices and income. The income considered here is disposable income. This theoretical model is appropriate in explaining the observed influence that price and income have on the use of health care services in Zambia.

2.2.2 Price of health care services

There is a debate in the empirical literature on the impact of prices of health care services on the level of health care utilisation. The total cost outlay for accessing health care services has in theory been found to be a determinant of health care utilisation. The price of health care services in this study is defined as the charges for consultation, administration, drugs and laboratory tests. The impact of fee-for-service or user fees on health service use in Zambia was found to be inversely related (Masiye et al., 2008). Mwikisa et al. (2000) in a study of the 1996 health expenditure survey in Zambia argue that with the introduction of health user fees 60 per cent of the households claimed that user fees in fact prevented them from the utilising health care services. Masiye et al. (2008) in a study on the removal of user fees at primary health care

level in Zambia supported Mwikisa et al. (2000) that the attendance rate under the Out-Patient Department increased when user fees were abolished. In their studies on user fees in health care delivery in Zambia, (Daura et al. (2003) and Hjortsberg (2003)), also supplied evidence that a significant portion of Zambian population could not seek health care as a consequence of their inability to pay user fees. In these particular findings, changes of direct costs of health care services means that the price of health care services is inversely proportional to the quantity of health care services utilised. However, this conclusion should be interpreted with caution as health care depending on the severity of illness, price and need, health care costs would not prevent an individual from seeking medical care. Masiye et al. (2008) agree with Van Etten's (1972) empirical findings in a comparative study involving the utilisation of two hospitals in Tanzania, one public and the other run by the mission. The public hospital charged no fee and the mission hospital charged a fee. It was established that despite the existence of larger private health facilities compared to the government health facilities, smaller public hospitals treated three times as many out-patients and twice the in-patient number in a calendar year. The opposite was the case in Bangladesh in a study on rural health care providers in Bangladesh, Claquin (1981) showed that out of five health care centres, the most expensive enjoyed the highest utilisation rate. Heller's (1976) empirical findings of a survey in Malaysia tally with those of Claquin (1981) on the issues of out-patients. Heller (1976) concluded that the demand for outpatient care was not sensitive to its cash price, but was sensitive to the cash price of other health providers.

When a representative health service consumer (accessing health care) faces certain direct costs relating to transport, drugs, diagnostic costs (i.e. surgery, laboratory and x-rays) and accommodation costs. The cost of accessing health care in Zambia is, therefore, also influenced by this array of costs (Hjortsberg & Seshamani, 2003).

Pielemeier (1975), in a study of payment methods for health care services in Lesotho, found that payment methods affect the true cost of health care for patients. Conventional medical practitioners charged less for a service and accepted partial payments whereas foreign medical practitioners demanded total cost of the health care be settled at once. This constrains the health seekers from accessing health care services. It allows households to budget for these partial payments as the cost is well specified in contrast to native practitioners who charge per treatment obtained. Conventional medical practitioners' costs may seem to be low but predicting the total number of visits for the duration of the illness may not be possible (Ngubane, 1981).

A study by Cosminsky (1972) on health care utilisation in Guatemala found that staff at a Guatemalan public hospital solicited for a bribe to have some patients admitted otherwise they would claim there were bed spaces available for in-patients. It is, therefore, not an easy or simple task to ascertain the actual fee charged for a service received as latent costs and, sometimes, some illegal costs are incurred by health care seekers, such as, bribing clinicians in an attempt to receive health care service fast.

2.2.3 Income

As a result of income poverty which currently stands at approximately 62 per cent the representative consumer in Zambia is expected to be sensitive to diverting extra income to purchase health care services unless an illness is severe. This income poverty has direct implications for the demand for health care services, therefore, health care options are not sought based on efficacy but costs and the ability to pay. This may be compounded by the fact that despite Zambia graduating to a Lower Middle Income status, translating that the per capita income of a representative consumer increased (World Bank 2013), but use of health care services still remained low in the same period (ZDHS). Households with steady sources of income utilised health care services more than those that did not (Wake et al., 2003). In another study on health care the utilisation in Kalabo, Zambia, Stekelenburg (2004) further established that income plays a crucial role in determining health care use where cost-sharing financing is available. The argument finds its place in the consensus in the literature that income has an influence on health care demand.

The analysis of demand for health care differs slightly from the conventional economic theory of demand analysis. Microeconomic consumer theory asserts that a rise in income for normal goods causes an increase in consumption of most of these goods including health care (Varian, 2002). It is, however, not easy to ascertain the demand for health care prior to consumption due to fluctuations in income. Regarding health care services, an increase in income may enhance capacity of households to purchase health enhancing goods, such as good nutritional diets and taking preventive care. Such buys would improve the health of a household and reduce the number of visits to a health facility. It must also be noted that such increases in income may also result in the purchase of health choices, such as, alcohol and tobacco which in the long term are detrimental to health and may have implications on the use of health care services.

In a studies on the utilisation of health care services in Malaysia and Philippines, respectively, Heller (1976) and Akin et al. (1985) argue that increases in income for Malaysian households did not change the demand for health care services. However, an increase in income has a redirecting effect on demand from public health care services towards demand for private health care services. This is due to the perception that private health care is superior in quality to that of public health care. Taylor (1994), argue that despite access to health care services not being problematic in developed countries, low income households are restrained from using health care services . Young (1981), established that people in rural areas have several ways of financing health care services, such as selling animals and obtaining credit from friends and relatives. Hence, such households are able to purchase health care services easily. Okediji (1975) argue that the possession of valuable/marketable assets improves health directly and reduces time cost of households. Where facilities, such as electricity is available, investment in assets like heating and freezing appliances reduces exposure to bacteria, therefore, reduces demand for health care services.

Zambia's health provision points are very congested and characterised by long queues. The waiting time from the arrival of a health care seeker to being seen by a clinician is usually on average very long (Seshamani, 2006; Wake et al. 2003). Standard microeconomic theory is limited in this respect. It does not incorporate the cost of the time element. The Acton model however does take into account the opportunity costs of time in modelling the cost of using health care.

Acton (1973, 1975a and 1975b) argue that there are time dimension costs that accompany consumption activities. Masiye et al (2008) also observes that health facilities in Zambia are regularly vulnerable to drug shortages, which results in health facilities prescribing drugs which can only be bought from private drug stores or pharmacies. This situation has other time related implications that mould the health-seeking behaviuor of a representative Zambian consumer. Acton, therefore, incorporates these miscellaneous time costs as follows:

(3) Maximise $u = u(h, x)$ subject to equation 4

(4) $(p + wt)h + (j + wk)x \leq Y = y + wT$

The miscellaneous time costs enter an individual cost function.

(5) where $t =$ Time price per unit of health care services

$j =$ Money price per unit of composite goods

$k =$ Time price per unit of other composite goods

$y =$ Unearned income

$T =$ Total time available for market activities and household production.

Acton's model is simply an analogue of maximising utility of only one of the two goods (h, x) and the consumption of them is related to (p, j) and (t, k). Time in the model is monetized by the prevailing minimum wage (Zweifel, 2000).

Assumptions:

(1) The household has some endowment of time to be shared between consumption of other composite goods and health care services.

(2)The model uses the concept of full-income which is the sum of cash income and unearned income form time endowment.

The intuition of Acton's model is that time cost is a rationing mechanism depending on the health financing system. If health care services are financed by insurance or through public expenditure programs (such as primary health care in Zambia is100 percent subsidised), the out-of-pocket-expenditure of a health care seeker breaks down to zero (MoH, 2012).

Acton further uses the comparative static analysis derived which is from the cash price of health care service and unearned income (opportunity cost) as follows:

(6) $\varepsilon_{hp} = (p/\theta)\varepsilon_{h\theta}$

(7) $\varepsilon_{ht} = (wt/\theta)\varepsilon_{h\theta}$

where: $\theta = (p + wt)$, is the full price of health care services.

$\varepsilon_{hp} =$ Elasticity of demand for health care services with respect to money price

$\varepsilon_{ht} =$ Elasticity of demand for health care services with respect to time price

$\varepsilon_{h\theta} =$ Elasticity of demand for health care services with respect to full price of health care services.

The relationship between ε_{ht} and ε_{hp} is the same as the relationship between wt and p.

If $t \rangle p$ it implies that $\varepsilon_{ht} \rangle \varepsilon_{hp}$

If $wt \leq p$ then $\varepsilon_{ht} \leq \varepsilon_{hp}$

If $wt \geq p$ then $\varepsilon_{ht} \geq \varepsilon_{hp}$

Model conclusions

The model concludes that demand for health service only takes into account market prices and total income. Standard microeconomic theory considers disposable income only while Acton adds the opportunity cost of utilising health care services which is the unearned income proxied by waiting time in coming up with total income.

Demand for health care services becomes more sensitive to time costs as coinsurance and subsidies on health care services push out-of-pocket expenditure to zero. Time in this particular case does not go to zero. This implies that in the case of users of free health care services waiting and transportation times are critical components as compared to the higher level facilities for which out-of-pocket expenditure is not zero; which means that employment status, income and other factors may determine the demand for health care expenditure. The model asserts that an increase in unearned income has a positive effect on the utilisation of health care services.

Conversely, an increase in earned income causes usage of free health care facilities to drop. This is particularly due to the fact that as wages increase, so does the ability to purchase more health care services as well as the opportunity cost of time to the health seeker. This means that health facilities that offer free health care and are associated with long waiting become less attractive to individuals with increasing income who prefer to pay private practitioners. In other words, demand for health care is redirected from public providers to private hospitals.

2.2.4 Waiting time at a health facility

Health facilities in Zambia, especially the publicly-owned facilities, are characterised by long waiting times as a result of long queues. Hjortsberg et al. (2000), in a study of health expenditure survey in Zambia, established that waiting time negatively affects the utilisation of health care services. The variable has most impact on public health care facilities, and has the least impact on private and mission health care facilities.

There has been heated debate in the literature as to whether waiting time is one of the determinants of health care utilisation. Gesler (1976) defines waiting time as "forgone earning

of all people involved in the health facility visits". Therefore, waiting time in this context is taken as the opportunity cost of waiting for a service at a health facility. Waiting begins initially with diagnosis requirements then laboratory tests whose results take several days and then the dispensing of available or prescription of unavailable drugs. More often than not, a health care seeker, depending on the severity of the illness, is accompanied by a helper. Lasker (1981) in a study in Ivory Coast argues that public health facilities are often crowded and people may wait for hours only to be attended to for very few minutes. Lasker (Ibid) established that waiting time has an influence on the use of health care. The longer the waiting time, the lower the use of health care services and vice-versa.

Cosminsky (1982) and Heller (1976) argue to the contrary that waiting time is not a deterrent in the use of health care services and is rather accepted by health seekers as a rare opportunity to socialise. The manner in which benches and chairs are arranged may or may not facilitate socialisation. Waiting time in itself is not a variable of great importance but the actual cost of an individual waiting to receive treatment at a health facility is critical, as waiting imposes economic costs of some sorts. Because health care seekers are considered rational, they are more likely to seek out health care services with both cash costs and waiting time costs are minimised (Gesler, 1976). Therefore, due to the opportunity costs involved, health care seekers are more likely to pay private practitioners or seek traditional healers' services rather than incurring longer waiting time at a public health facility (Guilkey et al, 1981).

Standard microeconomic theory and the Acton model cannot exhaustively explain the health-seeking behaviour in Zambia due to their inherent weaknesses. The models do not consider other drivers of health care utilisation, such as the agency problem, which is inherent in the health delivery system and causes market failure; demographic and socio-cultural factors are also not considered. However, the demographic elements as well as cultural and religious factors are cited as possible factors that determine health care demand. The other factors mentioned can, however, not be evaluated within the field of economics but through the use of psychological, sociological and behavioural economics studies.

2.3 Rosenstock's Health Belief Model (HBM)

The observed health-seeking behaviour on which this model is based is that an individual is likely to use health care services founded on the perception of the benefit they might accrue from the visit. A representative health care service consumer in Zambia generally has a pluralist approach in accessing multiple health care. The providers include; formal health providers,

spiritualists and traditional health practitioners. The perceived benefits from a visit (which include; availability of drugs, medical equipment and health status improvement) influences the use of health care services (Wake at al., 2003). The cost of transportation, medical diagnosis (such as laboratory tests and x-rays) may prevent health seekers from accessing health care services. The HBM attempts to explain the prevailing phenomenon as follows:

The HBM (Rosenstock, Strecher and Becker, 1994; Figure 1) was adopted from Wolinsky (1988) and explains why the United States Public Health care services program of medical screening was unsuccessful. The reasoning behind the HBM is that the health behaviour of an individual seeking health care is determined by their perceptions about an illness and the availability of the health care services and providers in mitigating its occurrence. The HBM – model is based on the following four strands:

(1) Perceived susceptibility

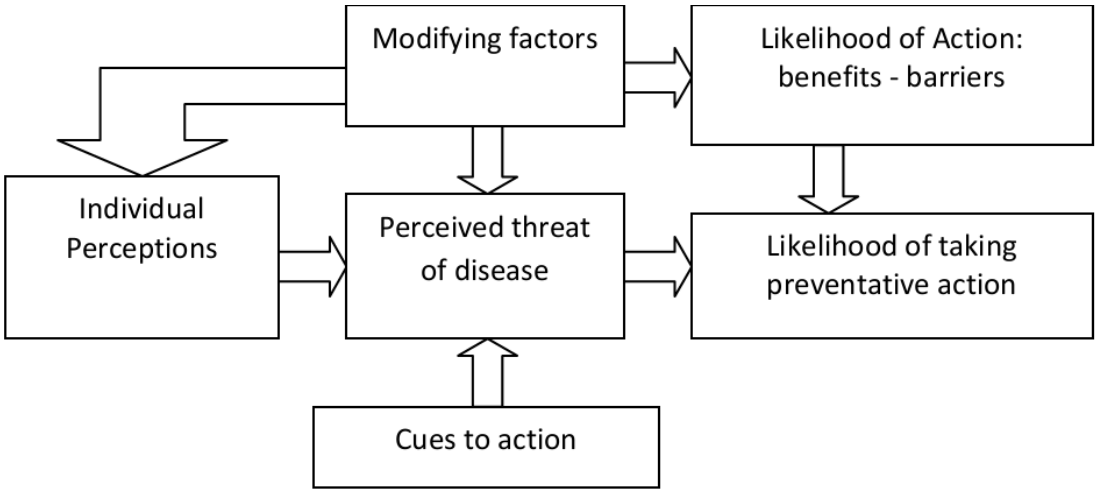
(2)Perceived severity or seriousness of the disease

(3) Perceived impediments or barriers to accessing treatment

(4) Perceived benefits of utilising health care services

The model further explains that singly or interactively these perceptions determines the demand for health care services. The four aforementioned grounds on which the model is built explain the possible factors that are critical to the issue of health care utilisation in Zambia. These include; age, gender, income, place of residence, socio-cultural and religious factors, among others. Figure 1 shows how the different strands of the HBM interact.

Figure 4: Rosenstock's Health Belief Model (Adopted from Wolinsky 1988)



Source: Rebhan (2008) Health care utilisation: Understanding and applying theories and models of health care seeking behaviour

Perceived susceptibility

Rosenstock's model asserts that individuals who are risk averse towards health develop a healthier behaviour, such as going to the gym, exercising and eating healthier diets, as well as avoiding poor demand for health choices. Therefore, risk averse individuals tend to have healthier lives and place less demand on health care services.

Perception on the severity of disease

The belief about the threat or seriousness of an illness emanates either from information education communication about health or medical information due to tele-health or perceived inconveniences the disease would bring. For instance, a person earning a wage who fears contracting an illness such as malaria would fear losing his wages and putting his family in financial distress. Such a person would therefore take preventive measures (such as sleeping under a treated mosquito net or seeking medical care immediately) in the event of symptoms of malaria such as high fever and headache developing.

Perceived benefits of utilising health care services

The perception that an individual has about the efficacy and quality of treatment, health care personnel, and qualifications of medical practitioners may determine whether patients utilise available health care services or alternative forms of treatment.

Perceived impediments or barriers to accessing treatment

Barriers to accessing health care can be perceived or actual impediments which have a potential negative impact on acquiring a particular medical intervention. These may include: perceived medical errors occurring in the course of a medical intervention, such as sustaining a permanent disability as a result of the amputation of a leg due to an injury; psychological draw-backs such as discrimination as well as time and financial demands in accessing health care.

Cues to action

The information from electronic and print media, relatives and friendly or reputable citizens may have an impetus on accessing preventive care. The probability of preventive care reduces these cues. Wolinsky (1988) argues that an individual's decision to use health care services is contextually determined. This model is largely reflective of Zambia health-seeking behaviour but it lacks recognition of the agency problem that is rampant in the country where health practitioners are given the ultimate authority to dictate all health care decisions.

Model conclusions

The model concludes that the cost of accessing health care services prevents health seekers from accessing health care services. The quality of health care is proxied by the length of waiting time, clinicians' qualifications, and availability of drugs and attitude of staff influence health-seeking behaviour.

2.3.2 Quality of health care

A representative health service consumer in Zambia is more likely to use health care services regardless of quality associated with health care. Private health care is viewed as being of high quality compared to public health care (Wake et al. (2003). This is contrary to the fact that 90 per cent of health care provision is offered by the government and these public health facilities receive referrals from private health facilities despite quality issues (MoH (2012); Daura et al. (2003), Hjortsberg and Seshamani (2000)). Wake et al. (2005) in a study on private health care providers in the Lusaka district of Zambia established that health seekers prefer private health care as public health facilities are unreliable and lack essential drugs.

Frankenberg (1976) in a study of traditional healers in Lusaka, Zambia, established that the main reason people visited traditional healers is due to "others had failed". Akin et al. (1985) in a study on the demand for primary health care services in the third world countries, established that a health centre with well-staffed medical personnel, appropriate pricing, availability of medicines, requiring less of waiting time and having an elaborate examination policy, were perceived to be of higher quality and were more likely to be used. Young (1981) agreeing with [Akin et al., (1985); Daura et al., (2003); Hjortsberg & Seshamani (2000)], argues that traditional healing, and formal health care (i.e. government and private health care) are treated as equally viable alternatives although their inherent qualities are not considered equal. Health care seekers find it appropriate to substitute a cheaper, low-quality health care for expensive, higher-quality health care. Thus, health care quality is directly related to the use of health care services. Lashman (1975), in a study of rural health care utilisation in the Democratic Republic of Congo (then called Zaire) argues that perceived quality influences the use of health care. It was established that in some cultures, mission facilities that did not charge any fee for their service were perceived to be of poor quality. When fee-for-service charges were introduced by mission hospitals, they were perceived as having improved in quality and they experienced an unprecedented increase in demand for their health care services.

The observed health-seeking behaviour in Zambia cannot be fully explained by the Rosenstock HBM, as it excludes factors such as: marital status, and other health status which impact on the use of health care services (Stekelenbug, 2004). Andersen's (1973) health-seeking model explains some of determinants of health care use which are not captured by HBM.

2.4 Andersen's health-seeking model

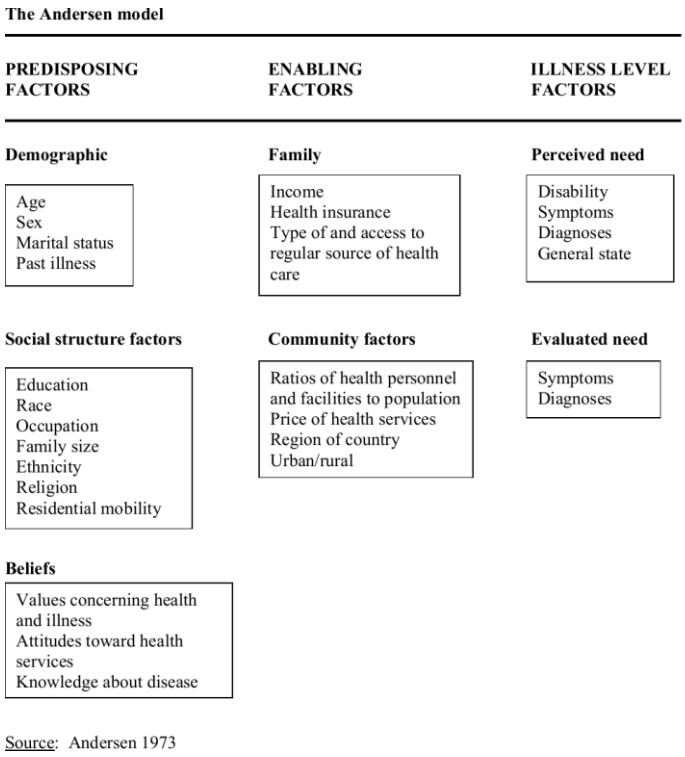
The model is premised on the three main categories of determinants of health care use, namely; predisposing factors, enabling factors and illness level factors. The model assumes that these categories influence health service use. The model is also constructed on the assumption that health care seekers' only source of health care are formal health facilities. Having reviewed criticism about his initial 1968 model, Andersen made improvements and based the model on three categories namely: need, enabling and predisposing factors.

Predisposing factors

The beliefs, social structure and demographics are the sub-groups of the predisposing factors. Demographic factors includes; age, gender, marital status and the history of the past illness or

episodes of illness. Social factors include; education, race occupation, household size, ethnicity and religion. The last sub-factors under predisposing factors is the belief category which elaborates that health care is driven by values attached to health and illness, and knowledge of the disease.

Figure 5: Anderson health-seeking model



Source: Andersen 1973

Enabling factors

These factors are the catalyst to the use of health care .The quality of health social network and social support are key in the determination of health care use. The sub-factors under the enabling category include: place of residence (i.e. region /rural or urban), family, insurance, type and access to health care. The other category of enabling factors is the ratio of personnel and health facilities to the catchment population. This data was, however, not collected in the survey.

Illness level factors

The level of illness can be referred to as the severity of disease and includes; perceived need and evaluated need.

Perceived need

Andersen refers to the perceived needs as those actual needs that are personally experienced needs. It is the degree of satisfaction that health care seekers derive from the health service and health personnel. These include, according to Andersen (1995), symptoms of the illness, disability, diagnosis and the general state of an individual health care seeker. Generally in Zambia, people seek medical care only when the condition is critical and symptoms of disease develop. Health care is further sought after other options of care have been attempted, such as no treatment at all, self-treatment or traditional healers to an extent that the health of an individual degenerates to a point of seeking delayed treatment.

Evaluated needs

These are needs that arise basically as a consequence of specialist advice and diagnosis. Andersen (1995) argues that the degree to which professionally determined needs satisfy the perceived needs is what is crucial to health care demand. In part and intuitively, Anderson model recognises the agency relationship between a health seeker and specialist doctors' advice. Andersen 's (1995) model however lacks the capacity to capture its dynamic character, as patient satisfaction is critical for repetitive health care demand .The multiplicity of factors in Andersen's (1995) model depicts the ability of the model to capture an array of factors that drive health service utilisation. The model's inadequacies are compensated by Rosenstein HBM which fully explains the psychological and sociological factors that influence demand for health care.

Model conclusions

Anderson's (1995) health-seeking model concludes that the place of residence, sex of a health seeker, marital status, health status and religion all have an influence on the demand for health care services.

2.4.1 Religion

The Zambia delivery system acknowledges the role that supplementary health provision play, such as, traditional and faith healers' roles in delivering health care to the population (MoH, 2015).This goes to show how these supplementary health providers influence health service use. The studies of (Stekelenburg (2004); Hjortsberg & Seshamani (2005) and Spring (1986)) on health care seeking behaviour established that religion, culture and traditional beliefs offer an explanation on the level of health care utilisation in Zambia.

Social exclusions (which are religion, cultural beliefs and tradition) play a leading role in compromising the health of some members of the society. The United States Department of Health, Education and Welfare (1979) study on the effects of tradition and culture on health care utilisation in the Middle East found that illnesses were categorised as those caused by demons and evil spirits. Such illnesses would not be subjected to conventional medicines, thus negatively influencing demand for health care services. Levinson (1974) argues that communities that discriminate against females result in the very low likelihood of females being taken to a health facility as compared with their male counterparts, as females are not considered sufficiently valuable to a household. On the contrary, Schiller & Levin (1988), in a study of the relationship between religion and health care utilisation, established that there is no relationship between the two.

2.4.2 Sex

The ratio of male to female in Zambia is approximately 1 to 3 (CSO, 2010).With this population ratio it can be assumed that more Zambian women and girls use the country's health care services than men and boys. In the same correlation that exists between poverty and health, women and children are the worst affected by poverty [Living Conditions Monitoring Survey (LCMS) (2010)]. This, therefore, has implications for the levels of health care use by gender. The ZHHEUS survey data shows, however, that 62.7 per cent of health service users were male as against the expectation that more females use health care services. A study on the effects of sex on health care use in India found that a greater percentage of sick males below the age of 15 were taken for treatment than females at different stages of illness (Coyaji, 1981).Chen et al. (1981) agree with Coyaji (1981) in a study on health care services utilisation in Bangladesh which found that males used health care more than females. (Heller and Darke, 1979) also contends that gender has an influence on health service use but established that on average females use more of health care services than males.

2.4.3 Patient's marital status

The observed health-seeking behaviour of a representative Zambian health consumer regardless of gender shows that 71.4 per cent of the health care users are either separated, cohabiting, widowed or divorced (ZHHEUS, 2014). Therefore, there is an assumption that marital status might have implications for the use of health care services.

There are differences in health care use across the different categories. Nolan (2000) in a study of General Practitioners (GP) visiting in Ireland, established that married, widowed and

divorced people use more health care services than single people. The research, therefore, expects a positive relationship between health service use by the married, divorced and widowed and a negative relation with singles. Heller (1985) supports Nolan (2000), and argues that marital status has an influence on the level of health care service utilisation. However, Akin et al. (1985) found that marital status of a health care seeker has no significant effect on the level of health care service use.

2.4.4 Health status/ needs

Health needs, as well as the severity of an illness, also influence the demand for and, therefore, the utilisation of health care services. A presentative Zambian health service consumer, does not care about their health needs only if there exist a perceived need for medical care as a result of identifiable symptoms. Stekelenburg (2004), in a study on health care use in Kalabo, Zambia, established that depending on the severity of the illness, a representative health consumer in Zambia uses health care services more when the condition is serious. As long as one is not bedridden, self-treatment through the use of traditional or conventional medicines is may be preferred otherwise no treatment at all is sought (Seshamani, 2000).

(Akin et al., 1985) and Lashman (1975)), in studies on determinants of health care demand in Zaire, found that hookworm was rarely reported as an illness as people accepted the condition as normal and uncontrollable. A study cited by Myers (1982) on the measure of differences between real and perceived health needs in Guatemala found that perceived needs are directly connected to socioeconomic status, ethnicity and education level. Therefore, perceived needs for health care is not easy to control for in most health demand studies in literature. Muller (1986) argues that with a better health status, the utilisation of health care services will be reduced as little need in health care exists. Rubel (1966) argue that the severity and length of an illness determines the choice of a health care provider. The more severe a health condition, the more one utilises health care services. Gerdtham's (1997) study on Equity in Health Care Utilisation in Sweden agrees with the empirical findings of (Rubel (1966); Seshamani (2000); Myers (1982) and (Akin et al., (1985)), and established that physical or the health status are important factors leading to a visit to general practitioner. Keeler's (1992) study on Effects of Cost Sharing on Use of Medical Services and Health found that need factors, such as, health status, to be significant drivers of health care use using panel data.

2.4.5 Distance to a health facility

Health facilities in Zambia do not meet the 5 kilometres radius coverage requirement of the WHO. Health facilities in Zambia are not located close to their intended beneficiaries and therefore, health seekers cover long distances to reach them. The distances differ between urban and rural areas. A representative rural health seeker covers longer distances to a health facility than an urban health seeker. (Hjortsberg & Seshamani, (2005) and Wake et al. (2003)) established that the distance to a health facility has an influence on the use of that health facility and is inversely related to health service use. Despite the distance to a health facility playing a critical role in households accessing health care services, distances to health facilities play a small part in health care service utilisation in Zambia (Mwikisa et al, 2000).

Akin et al. (1985) hypothesised a non-linear, negative relationship between distance and health care utilisation. This means that the further the health facility is from its catchment population, the more likely health seekers under-utilise it. Gish (1975) agrees with Akin et al. (1985) in a survey in Tanzania which established that 50 per cent of the outpatient users at a public health facility came from a distance of approximately five miles radius, and a further 30 per cent travelled a distance of between five to ten miles. Opuku (1996) in agreement with the negative relationship between use of health care and distance and argue that health care use is influenced by transportation and the distance to a health centre. A study on health utilisation on a village in Indian showed that 80 per cent of households used a local health center and only about 4 per cent of the nearby village households utilised the facility (Datta and Ram, 1976). Datta and Ram's (1976) argument is in agreement with Gish's (1975) findings that distance and health care utilisation are inversely related. Travel time, as a proxy of distance, was found to have a negative and statistically not different from zero.

2.4.6 Health care insurance

At the moment Zambia's health delivery system is not financed by any form of social security system. An insurance financing trial was implemented in the period 1995 to 1998 but without success. The premiums were paid quarterly per household and the utilisation seemed to have risen in selected public health facilities (Masiye, 2008). Private medical insurance is rapidly becoming common though only a very small fraction of the population can afford it. Close to 98 per cent of the health seekers in the ZHHEUS admitted to having some form of health insurance.

Social security or co-insurance has become common in less developed countries (LDCs) and its central aim is to increase access to health care services. Where social security is unevenly spread or incomplete, as is the case in Zambia, notable differences in the utilisation of health care services exhibiting some health inequalities (Roemer, 1973). In a study of social security coverage and the utilisation in selected countries (U.S. DHHS SAA report, 1981) reported that with social health insurance in place, social insurance facilities received high levels of general practitioner (GP) visits than those without. Young (1981), in a study on treatment choices in Mexico argue that use of health care services increase as coverage for social health insurance increases. Gruber and Hanratty (1995) in a study on Labour-Market Effects of Introducing National Health Insurance in Canada, agree with (Roemer (1973); DHHS SAA report (1981) and Young (1981)), and argue that health insurance has a direct relationship with health care utilisation.

2.4.7 Household size

Zambian households are generally large as a result of the extended family set up. The study generally expects a positive relationship between household size and health care utilisation. With high epidemiological polarisation for both communicable and non-communicable diseases in Zambia, larger households have greater exposure to respiratory diseases and other communicable diseases (MoH, 2012). Hence, the utilisation of health care services is expected to be high. Therefore, household size is expected to have an impact on health service utilisation. The structure and size of a household affects either the choice of health care provider or the demand for health care services. The overall household health needs are proportional to the household size and age distribution of the entire household, as well as the ability of individual members to contribute to the household income basket. Popkin and Solon (1976) argue that the size of a household has a direct bearing on the health of a household and is positively related to health care use. The per capita household income is affected by the household size so is the nutritional per capita of household members. This therefore, compromises the capacity of meeting individual household member's health needs.

Even though the Andersen model partly explains factors that influence health care use in Zambia, the assumption of single sourcing of health care from formal health facilities does not apply to Zambia. This is because the health delivery system in Zambia has several health care providers namely: Formal health facilities, traditional and faith healers. WHO (2002) established that 80 per cent of Africa's population use traditional medicine. The model does not discuss in detail the implications of age and education in relation to health service use. The

Grossman model attempts to explain the relationship between health and education and technically uses age as a proxy to explain that the decline in health triggers demand for health care services.

2.4.8 Place of residence

The health care facilities in Zambia are distantly covered. The rural and peri-urban areas have uneven distribution of health care facilities. Urban areas have a good coverage of secondary and tertiary health care facilities (i.e. secondary and tertiary hospitals), while rural and peri-urban population are mostly served by health posts and health centres. Primary health facilities, which are common in rural areas do not charge fees in accessing health care. This, therefore, is expected to have influence on health care utilisation. Zyaambo et al. (2012), in a study on Health Inequalities in Rural Zambia established that, there were inequalities in the distributional use of health care services in rural areas. In other words, health care use in rural was tilted towards primary health care as opposed to higher health facilities. This is despite some health care seekers being referred to secondary and tertiary health facilities.

Vera-Hernandez (1999) in a study on "Duplicate coverage and demand for health care. The case of Catalonia," argue that place of residence has significant influence on health care utilisation. Wagstaff (1986) in support of Vera-Hernandez (1999) argues that place of residence is mostly a proxy for access to health care services, hence, have some impact on health care service use. WHO (2003) also agree with studies by Wagstaff (1986) and Vera-Hernandez (1999) that urban population uses health care more than those in rural areas.

2.5 Human capital model

The genesis of the human capital model dates back to the work of Mushkin (1962) who attempted to evaluate the relationship between health and education as capital goods using the human capital theory. Becker (1965) and Ben-Porath (1967) argue that the health of an individual affects both market and non-market productivity. Grossman (1972), using the household production function, and the Mushkin procedure, considered the demand for health care services as both an investment commodity as well as consumption activity. Grossman (1972a, 1972b) further argued that health capital is distinct from other forms of human capital, in that, its stock depletes with time (age).

Assumptions of the model

(a) A consumer is considered rational and desirous of maximising utility over a bundle of commodities. Alternatively, it means that an individual enjoys a continuum of healthy days due to the stock of good health.

(b) An individual is born with and owns a stock of health which degenerates over time at an increasing rate and the stock can be increased by investing in health capital.

(c) Death ensues if the stock of health falls below the minimum level and an individual chooses the length of his life.

(d) Households produce gross investment in health by means of household production function which is a function of time and other market goods.

(e) The health of individuals is not exogenous but is a function of resources directed towards its production, thus health is demanded as an investment good and a consumption commodity.

Below is the compressed version of the Grossman model whose detailed derivations are attached to the appendix:

(8) An individual is maximising $u = u(\varphi_o H_{0,}, ..., \varphi_n H_n, Z_0, ..., Z_n)$

(9) Subject to

$$\sum_{i=0}^{n}\left[p_i h_i + j_i x_i + W_i(TH_i + T_i + TL_i)/(1+r)^i \right] = \sum_{i=0}^{n}\left[W_i \delta /(1+r)^i \right] + A_0 = R$$

The intuition behind this mathematical expression is that part of the income and wealth is used for medical care and market activities(such as dwelling, recreation, cigarette and alcohol) use up the total income and wealth and part of it is the cost of illness which should equal wealth plus the present value earnings. Therefore, the budget constraint states that discounted costs of life time consumption (which is in form of money and time costs) equals an individual's life time discounted income.

The household production relationship (which states that the net investment in health and other composite goods equals gross investment less depreciation) is stated as follows:

(10) $H_{i+1} - H_i = I_i - \tau_i H_i$

where: $\tau =$ depreciation rate which is exogenous but varies with life cycle or age.

Consumers produce gross investment in health and other composite goods in accordance with their household production function below.

$I_i = I_i(M_i, TH_i, E_i)$.

As additional investment is required to keep on expanding the stock of health from period to period, this investment in health should supersede the rate of deterioration of health. If this investment does not increase at a faster rate as to replenish the deteriorating health stock, death becomes inevitable.

(11) $Z_i = Z_i(X_i, T_i, E_i)$. As additional pleasure giving goods and services, where:

$H_0 =$ Initial stock of health at birth

$\varphi =$ Health service flow per unit of health capital in the i^{th} time period

$Z_i =$ Consumption of composite goods in i^{th} time period

$j_i =$ Price of composite goods producing Z_i

$p_i =$ Price of health care

$M_i =$ Quantity of health care

$X_i =$ Goods used to produce Z_i

$TH_i =$ Time resource used to produce health

$T_i =$ Time resource used to produce composite goods

$TL_i =$ Lost time due to illness

$r =$ Prevailing market interest rate

$\delta = TW_i + TH_i + T_i + TL_i$, Denotes the aggregate of the time available in the time period

i. $TW_i =$ Hours of work

$A_0 =$ Discounted property income (initial income)

I_i = Gross investment in health

τ = Depreciation of health stock

E_i = Stock of human capital

The Grossman model highlights the critical relationship that the marginal cost of investment in health must be equal to the marginal return to the investment.

(12) $\omega_i + \alpha_i = r + \gamma_{i-1} + \delta_i$

where:

ω_i = The pecuniary return or the marginal money rate of return to investment in health.

Marginal psychic return to improved health, consumption return of health care services.

r = Prevailing rate of interest rate which is the opportunity cost of investing in health as opposed to their composite goods.

γ_{t-1} = Percentage change in the marginal cost of health investments.

τ_i = Rate of depreciation of health stock

The LHS of equation 12 represents the total rate of return on the investment in health and the RHS represents the health capital of price of gross investment. If $\alpha_i = 0$ then there is zero utility that is derived from the consumption of health care and health care is considered to be an investment good. This enables the model to treat the consumption and investment aspects of health care separately.

The investment model dimension of health care happens when $\alpha_i = 0$ in equation 10 which only occurs if the result of returns from healthy days and psychic return to health is zero.

With $\alpha_i = 0$ therefore the model will be as follows:

(13) $(W_i G_i)/(\phi_{i-1}) = \omega = r - \gamma_{i-1} + \delta_i$, this means that the total number of sick and healthy days equal to a unit.

Recall from equation 9 variable definition that:

$\delta = TW_i + TH_i + T_i + TL_i$, Time available in the i^{th} time period. Intuitively, if sick time was not included then total time endowment to a household would not be exhausted.

where:

$W_i =$ Daily wage rate

$G_i =$ Marginal product of health capital (Increase in the number of healthy days due to a unit increase in the stock of health capital)

$\phi_{i-1} =$ Marginal cost of gross investment in health in the last period in time and cash money costs.

$G_i = \frac{\partial h_i}{\partial H_i} = -\left(\frac{\partial TL_i}{\partial H_i}\right)$, the marginal product of stock of health in the process of producing healthy days.

The model traces the effect of the demographic factor of age and socioeconomic factors (income and education) on the demand for health capital and health care. Given the magnitude of W_i and ϕ_{i-1} in equation 11, age increases ω, provides incentives for an individual to opt for lower health stock in order to increase marginal product of health (G_i) with a view to remaining in steady state. The equilibrium point will, therefore, be the point at which marginal gross investment in health equals discounted marginal benefits or marginal rate of return. With a lower stock of health, an individual requires more investment in his/her health capital thus the effect of age on the demand for health care service purchases elasticity of the demand curve for health capital investment with respect to price of health capital investment as shown in equation 9(i).

While age is considered a proxy for the depreciation rate of health capital stock, an inverse relationship exists between the demand for health capital and age. On the other hand, if the demand for health investment is inelastic (like people on life saving drugs, such as insulin and ARVs) with respect to the opportunity cost then demand for market-purchased health care is positively related to age. Stekellenbug (2004) study on health service utilisation in Kalabo, Zambia found that age increases the knowledge of disease which in turn engenders the use of health care services. As wage rate (W_i) increases, the marginal money rate of return or the marginal product of health increases in equation 11,meaning that, the number of healthy days

increases and cost of missing work due to illness consequently increases. Further, as the wage rate increases, the opportunity of household health production with own time increases as opposed to seeking medical care.

Model conclusions

(1) Increase in wage rate or earned income causes the demand for health capital to rise as marginal productivity of capital is high. This raises the demand for health care services as purchase of health care is substituted for household health production with own time. Demand for health care is positively related to income by substitution effect. However, the demand for market-produced health care services is positively related but is conditioned upon the elasticity restrictions.

(2) Education is considered to have an influence on demand for health care services. As the number of years of education shifts, the demand for health care services shifts outwards. The model concludes that the demand for health care services is positively related to education.

(3) Demand for health capital is inversely related to age.

2.5.1 Age and Age squared

Life expectancy at birth in Zambia has improved since 2004 from approximately 47 years to 58 years (World Development Indicators, 2015). The large proportion of Zambia's population lies in the age group of between 15 years and 45 year (CSO, 2010). According to the LCMS (2012) report, the age group of between 15 years and 45 years reports the highest number of cases at health facilities which agrees with the ZHHEUS (2014) dataset. Age is, therefore, predicted to have implications for the level of the utilisation of health care services in Zambia. (Hjortsberg and Seshamani, (2005); Stekelenbug (2004)), in studies on health service utilisation in Zambia, argue that age is positively related to the level of health service use.

Akin et al. (1985), argue that age has an effect on health. Because demand for health care is a derived demand, age is of interest in determining health care use. Nolan (2006) in a study on Dynamic Analysis of General Practitioner (GP) Visiting in Ireland, established that age is positively correlated with the use of health care services. Murthy (1981) agrees with Nolan's (2006) findings that age contributes to the trends in health service use. The older one is, the more one's health stock decreases, hence, the need to restock it through medical care increases. Age is, therefore, found to have some implications for the use of health care services in Zambia. Age_sqd, a variable realised by squaring the variable Age, was meant to ascertain the quadratic

relationship between Age-sqd and the level of health care utilisation. This is because, as one grows older, more medical care is utilised. When the maximum use is reached (i.e. a point where death occurs), less of health care services are used.

2.5.2 Education

Formal education in Zambia ranges from pre-school, primary school, secondary, college and university. The literacy rate stands at 62 per cent (UNICEF, 2014). ZHHEUS (2014) shows that approximately 67 percent of the interviewed households have primary education, 25 per cent secondary education and 3 per cent college and less than 1 per cent has university education.

Education has been found to be related to a number of other determinants of demand for health care services such as type of occupation, income, wealth accumulation and choice of living which are also important components of household health production function (Grossman, 1972). Cochrane et al. (1980) argue that education (knowledge) and beliefs (culturally derived values) about a particular illness, self-care, health providers and healthy living styles are key factors that positively drive the level of health care demand and the utilisation positively. Cochrane et al. (1980) however, is not clear about whether or not the education discussed is formal or informal. Nolan (2006), using the pooled data of three years on a study on GP Reimbursement and visiting Behaviour in Ireland, established that the level of education is a predictor of practitioner visiting, hence, the use of health care services. It is further argued that individuals with more levels of education demanded more of health care than the reference category. In agreement, Welsh (1970 and Okediji (1975) argue that education has a positive effect on health and health outcome, as educated people use more health care. Akin et al. (1985) in a study on health care utilisation in Philippians, found that mother's education was a critical driver of demand for her child's medical care and that approximately 45 percent of the the uneducated mothers had relied on self – treatment as compared to 30 percent self –treatment cases for the educated mothers. Akin et al. (1976) argue to the contrary that less educated people use more traditional practitioners but as years of education increase, more public conventional medical practitioners are visited. In this research, therefore, it is expected that education is positively related to health service use.

The short-comings of the Grossman model is the non-applicability of the assumption that health seekers are the sole decision makers on health choices and treatment. The non-inclusion of the agency relationship as observed in the Zambia health delivery system. The health-seeking

behaviour in Zambia is explained partially using Grossman model. On the capacity to capture such an unobserved heterogeneity (Cameron and Trivedi (2005) and Cameron & Trivedi (1986)) suggest us of the hurdle model specification.

Conceptual framework

Having examined the data generating process for the number of visits in this study, as well as the health seeking behaviour in Zambia, the following conceptual framework will be used: The observed number of visits with several zero observations which rapidly fall to its minimum fits the count data models. The mixture and truncated values of the facility visits may fits in truncated (hurdle model).

Let y_i be the number of visits to a health facility (count variable) in the count distribution and x_i be a vector of independent variables designated as: $x_i^{'} = [x_{i1}, x_{i2}, ..., x_{ik}]$, the magnitude of this vector is $(1 \times k)$

$y_i = f(y_i \,|[x_{i1}, x_{i2}, ..., x_{ik}], \beta_0, \beta_j)$, the number of visits are conditioned on the probability of not visiting health facility (β_0), probability of visiting a health facility (β_j) and the other independent variables x_i . The functions enter the function in two parts, hence a restriction for positive visits is made (i.e. Truncating at zero count model). The following model will, thus, be used:

$$f(y_i \,|x_i; \beta_0, \beta_j) = \begin{cases} f_0(0|x_i; \beta_0, y_i = 0) \\ [1 - f_0(0|x_i; \beta_0)]^* \left[\sum_{j=1}^{P} \left[\frac{f_j(y_i|x_i; \beta_j, v_i^j)}{1 - P(y_i = 0|x_i; \beta_j, v_i^j \,\&\, y_i = 1,2,....,N)} \right] \hat{\gamma}_j \right] \end{cases}$$

where: x_i is the independent variables that are considered to influence health care use, the probability of not visiting health facility conditioned on the covariates and probability of visiting health care facilities and $\hat{\gamma}_j$ is the estimated value of the unobserved heterogeneities (which is capturing the effect of agency relationship present in the health delivery system). Detailed derivations are in Appendix A1.

2.8 Conclusion

In a nutshell, the operational definition of utilisation of health care services has been coined in the light of this research with an analysis of the theoretical and empirical literature review on

the drivers of health care demand. Standard microeconomic theory, behavioural economic and psychological theories were used in justifying the inclusion of variables. The subsequent chapter lays out how the research was designed in examining the unobserved factors that determine health care use. Variable measurements and specifications are made clearly outlining the methodologies applied in realising the research objectives.

CHAPETR THREE

METHODOLOGY

3.1 Introduction

This section of the study outlines the methodology and procedures adopted in measuring the variables of interest. The chapter lays the foundation for the model adopted and the econometric procedure used. The methodology relies heavily on the theoretical and empirical literature review. This chapter also outlines the data sources and their relevance, with particular attention to data type, area under study, statement of the problem, research questions, theoretical and empirical literature on health care utilisation. The whole essence of this chapter is to operationalise the research objectives.

3.2 Data Sources

The data used in this research is from Zambia Household Health Expenditure and Utilisation Survey, and is cross-sectional. The data is representative as it was collected from all ten provinces of Zambia. The survey was conducted by CSO in collaboration with the University of Zambia's Department of Economics and Ministry of Health. Data was collected from both rural and urban areas. A detailed electronic questionnaire was administered. The survey captured both qualitative and quantitative data on the household use of health care services. Socio-economic and demographic variables were collected in the survey. A total of about 59,000 household members were captured in the survey. The study made restrictions and concentrated only on household members who had been ill four weeks prior to the survey. A total of 9,194 household members were ill four weeks prior to the survey and this became the sample of interest. However, age, religion, residence, out-patient –expenditure, quality of health care, visits, education and sex had missing values. The study made further adjustments to the initial sample and dropped the missing variables. The sample size of 3,174 remained and is used in this research. Therefore, the dataset used has sufficient information to address the research problem at hand. The study uses STATA version 12.0 for all its estimations as a result of its versatility and appropriateness for cross-sectional data. The study uses the number of visits as an indicator of health service utilisation. The data generating process for the number

of visits is a mixture-truncated variable characterised by several zeros falling rapidly to zero. Therefore the appropriate data generating process are count-data, namely: Poisson and Negative Binomial.

3.3 Count models

Verbeek (2009) defines count data models as probability data generation processes whose frequency within a specified time frame rapidly falls to zero, and in which data is discrete and of ordered value. Count data models, according to Verbeek (2009), are applicable where frequency of visits, to say, a health centre or shopping mall within a specified time period occurs. The counts, according to Verbeek, should have a substantial number of zero observations in the model. The ZHHEUS data number of visits, the observed data generating process of number visits to a health facility is in agreement with Verbeek specification of count models.

3.3.1 Poisson Model

The observations for the Poisson model are discrete and ordered in value with a substantial number of zero observations (Verbeek, 2009).This is also due to a percentage of the interviewees in the study that responded that they had not visited a health facility four weeks prior to the study. Green (2012) further argues that where the likelihood of occurrence (visit to a health facility, i.e. utilisation) is low, the Poisson and Negative binomial regression models are appropriate. The Poisson and Negative binomial regression models are appropriate because, unlike logistic models, capture unobserved factors as well as restrict observations to positive values. This argument is in agreement with the observed low use of health care services in Zambia [Zyaambo et al. (2012), Bonfrer et al. (2012), Phiri and Ataguba (2013), Masiye et al (2008) & Seshamani (2005)].

Let $y_i = \{0,1,2,.....,N\}$

where $y_i =$ Outcome variable (number of visits to a health facility) taking values $0,1,2,.....,N$

The expected value of y_i given x_i is as follows:

(1) $E\{y_i|x_i\} = \exp\{x_i'\beta\}$ where: $x_i =$ Observed individual characteristics such as seriousness of illness and health care belief (Determinants of health care utilisation in Zambia as discussed in the literature review).

(2) Let $\eta_i = \exp\left\{x_i^{'}\beta\right\}$

where $\eta_i =$ the expected or mean of the Poisson distribution and there are no negative observations as number of visits are positive. Stekellenbug (2004) in a study on the utilisation of health care services in Kalabo, Zambia argues that the utilisation of health care services is either considered as the number of admissions per capita or the OPD attendance rate. This intuitively means that the health care seeker in Zambia can only have discrete and positive visits to a health facility. Equation 16 basically shows the expected visits to a health facility within a four week period conditioned on the determinants of health care utilisation such as demographic factors, unobserved heterogeneity. Therefore the Poisson regression model specification is as follows:

$$(3)\ P\left\{y_i = y\left|x_i\right.\right\} = \frac{\exp\left[\left\{-\eta_i\right\}\eta_i^{y_i}\right]}{y!}$$

The disadvantage of the Poisson specification as a model of preference for the study of the utilisation models is that the conditional variance of y_i given x_i equals the expected value of y_i given x_i. This equality designates an equi-dispersion of visits to health facilities. This implies that visits to a health facility in a given period are equally spread. In most cases, this might not be the case in Zambia where the need for health services occurs unexpectedly. In other words, visits to a health facility cannot be spread equally.

$$Var(y_i\left|x_i\right.) = \exp\left\{x_i^{'}\beta\right\} = \eta_i$$

In choosing an appropriate count-data model, the specification test, over-dispersion test will be carried out. In an event that the equi-dispersion test fails, the negative binomial model remains an alternative.

3.1.2 Negative Binomial

Cameron and Trivedi (1986) argue that the equi-dispersion of visits can be solved by imposing conditional variance restriction in an attempt to avoid the equality of variance and mean of the Poisson distribution as follows:

$$(4)\ Var\left\{y_i\left|x_i\right.\right\} = (1+\delta^2)\exp\left\{x_i^{'}\beta\right\} \text{ where } \delta^2 > 0$$

The imposed distributional condition allows for over-dispersion of health facility visits relative to the Poisson regression model. With this variance distribution assumption, if valid, negative binomial estimates are more efficient and consistent than the Poisson estimates (Cameron and Trivedi, 1986). A dispersion test is carried out to verify the conditional relationship between conditional variance and mean. Equality between conditional variance and mean implies that the Poisson model is appropriate. If it is not, the negative binomial is considered.

The presence of zero responses in the dataset and the truncation in the number of visits results in inconsistent and biased estimates. Health care seeking behaviour in Zambia is characterised by the agency relationship between doctors and patients. The count-data estimates are, therefore, not appropriate in themselves in explaining the factors that determine health care use or unobserved heterogeneity to be specific (Cameron and Trivedi, 1996). The unobserved factors are those factors that were held ceteris paribus in the modelling of demand function of a representative health care consumer (Silver-Santos, 1986).Lindsay and Lesperance (1995) argue that the only possible remedial measure to deal with the problem of inconsistency and biases as a consequence of an unobserved factor/s is to use the double-hurdle model. The double hurdle makes a distributional assumption that the data generating function is a mixture model, a combination of both continuous and discrete probability distribution. The hurdle-model, therefore, has the capacity to capture the unobserved factors. Verbeek (2009) and Cameron & Trivedi (2005) refer to the double-hurdle model as a mixture model that captures the unobserved heterogeneities. Therefore, the double-hurdle model seems appropriate in explaining the observed health-seeking behaviour of a representative health service consumer in Zambia. In other words, the unobserved factors as a result of the presence of agency relation as well as the presence of several zeros in the number of visits are captured by the hurdle model.

3.2 Double-Hurdle (Zero-Truncated Model) Model Specification

Hilbe (2011) argues that hurdle-models are also called the Zero-Truncated-Models. These models have the capacity to capture the unobserved factors specified and discussed in this research. In the double-hurdle specification, the assumption of holding all other factors constant, such as the agency relationship are relaxed. The observed agency relationship between doctor and patient in the health delivery system in Zambia can, thus, be modelled using mixture models in which unobserved heterogeneities are captured [Cameron & Trivedi (1986), Santos-Silva (2003) and Cameron & Trivedi (2005)]. The truncation occurs at a zero-count distribution using either the Poisson or the negative binomial, depending on the over-

dispersion test. This is done within the double hurdle model framework (Cameron & Trivedi, 2005), as follows:

(5) Let y_i be the number of visits to a health facility (count variable) in the count distribution and x_i be a vector of independent variables designated as:

$x_i^{'} = [x_{i1}, x_{i2}, ..., x_{ik}]$, the magnitude of this vector is $(1 \times k)$

(6) Let the functions $f_0(.)$ [This can either be a Poisson or Negative binomial], and $f_1(.)$ [This can also be discrete probability functions, logit or probit]. The function $f_0(.)$ manages the first decision by the patient and $f_1(.)$ administers the truncated-at-zero-count distribution model after a dispersion test is conducted on the dataset.

Therefore, a critical analysis should be taken as to which of the latent users of health care services are referred to. The users can either be in the actual population or in the truncated sample for positive values (Santos-Silva, 2003). The distributional assumptions are, therefore, made on these sub-groups. Cameron and Trivedi (2005) offered further support of the research of Santos-Silva (2003) in endogenous sampling that the problem of unobserved heterogeneity in health care utilisation studies can be accounted for in a manner as follows: The first procedure is to use equation 21 as an appropriate probability for analysing truncated- at-zero-count distribution. However, if overall population probability $f(y_i|x_i)$ is specified as Latent Class Model (LCM), which is the case in this study in which distributional assumption of the data generating process for the unobserved factors is made on the dataset representative of the actual population, the model is specified as follows:

$$(19) \qquad \hat{\gamma}_j = \sum_{j=1}^{p} \left[\frac{1 - P(y_i = 0 | x_i, v_i^j, \beta_j)}{\left[1 - (\sum_{j=1}^{p} \gamma_j P(y_i = 0 | x_i, \beta_j, v_i^j) \right]} \right] \gamma_j$$

Equation of the mixture of probability in truncated population.

$$(7) \qquad f(y_i|x_i) = \sum_{j=1}^{p} \gamma_j f_j(y_i|x_i, \beta_j, v_i^j)$$

Santos-Silva (2003) specified the hurdle in the presence of unobserved heterogeneity after limiting the mix truncated variable (number of visits) to greater than zero. The distribution $f_1(y_i|x_i)$ derived from equation 19 as in appendix A1 (Equations 13-16) become:

(21) $$\hat{\gamma}_j = \sum_{j=1}^{p} \left[\frac{1 - P(y_i = 0|x_i, v_i^j, \beta_j)}{\left[1 - (\sum_{j=1}^{p} \gamma_j P(y_i = 0|x_i, \beta_j, v_i^j) \right]} \right] \gamma_j$$

(8) $$f_s(y_i|x_i, \beta) = \sum_{j=1}^{p} \left[\frac{f_j(y_i|x_i, v_i^j, \beta_j)}{\left[1 - (\sum_{j=1}^{p} \gamma_j P(y_i = 0|x_i, \beta_j, v_i^j) \right]} \right] \gamma_j$$

The unobserved factors in the population generates another latent class. The intuitive assumption of equation 31 is that the unobserved heterogeneity of factors are those of people in the actual population, hence, the assumption which is made is that of the distribution of the unobserved factors in the population. This is what is referred to as the Latent Class Modelling (LCM).

(9) The other latent class is given as follows:

$$f_s(y_i|x_i, \beta) = \sum_{j=1}^{p} \left[f_j^s(y_i|x_i, v_i^j, \beta_j) \right] \hat{\gamma}_j$$

$f_j^s(y_i|x_i, v_i^j, \beta_j)$, and $\hat{\gamma}_j$

Equation 32 explains that the unobserved factors are for individuals in a truncated population restricting the number of visits to positive and discrete. This assumption is also applicable to the truncated population.

Therefore the empirical question in the use of double-hurdle models in examining health care utilisation in Zambia may be framed as follows: Which mixture model is appropriate when specifying the second part of the hurdle-model between equation 31 and equation 32?

Santos-Silva (2003) and Cameron and Trivedi (2005) answer this question by stating: When dealing with positive values, count data, like the number of visits to a health facility, assumption on unobserved factors in truncated population should be made therefore the appropriate latent class model should be specified as regression equation 32 condensed as in

equation 33 for cross-sectional data [Cameron & Trivedi (2005), and Santos-Silva (2003)]. Therefore, the hurdle deals with the principal-agent problem and the latent class model accounts for positive values for health care visits. The latent model provides flexibility for the second stage of the hurdle making very small probability of misspecification of the distributional assumption of the unobserved heterogeneity, as shown in equation 23, below:

$$(23)\ f_s(y_i|x_i,\beta)=\sum_{j=1}^{p}\left[\frac{f_j(y_i|x_i,v_i^j,\beta_j)}{\left[1-P(y_i=0|x_i,\beta_j,v_i^j)\right]}\right]\hat{\gamma}_j$$

3.3 Empirical Model

The empirical methodology is, therefore, specified as follows:

Let y_i be the dependent variable (visits to a health facility) and $x_i^{'}=[x_{i1},x_{i2},.....,x_{ik}]$ be the vector of independent variables which are theoretically considered as determinants of health care utilisation of magnitude $(1\times k)$

Assumptions:

(i) $f_0(.)$ - and $f_1(.)$ are discrete probability functions

(ii) $f_0(.)$ - manages the first part of the hurdle truncated-at-zero-count distribution.

(iii) $f_1(.)$ - is the latent class model manages the process after the hurdle has been crossed.

The probability function y_i is thus empirically addressed as follows:

$$(10)\ f(y_i|x_i;\beta_0,\beta_j)=\begin{cases} f_0(0|x_i;\beta_0,y_i=0) \\ \left[1-f_0(0|x_i;\beta_0)\right]*\left[\sum_{j=1}^{p}\left[\frac{f_j(y_i|x_i;\beta_j,v_i^j)}{1-P(y_i=0|x_i;\beta_j,v_i^j\ \&\ y_i=1,2,.....,N)}\right]\hat{\gamma}_j\right] \end{cases}$$

The LHS of equation 34 appendix A1 is a binary model estimation and the second stage is where the model is restricted to positive visits by a patient to a general practitioner. In other words, the hurdle (The two part-model) in equation 23, takes a count data model on the LHS. The LHS [$f(y_i|x_i;\beta_0,\beta_j)$], means that the number of visits to a health facility conditioned on the covariates, x_i and β_0 (the probability of not visiting a health facility), which enters as a binary probability model, the top equation on the RHS of equation 23. The lower equation of

RHS of equation 23 is a truncated model at zero count data for only positive facility visits. The whole equation 23 is the empirical model that the study is using.

The distributional assumption of unobserved heterogeneity is that the probability density function in truncated-at-zero count data, (Cameron & Trivedi (2005) and Santos-Silva (2003)), in studies on Hurdle models argue that the truncated data with greater than zero restriction provides statistical flexibility and captures some unobserved heterogeneity. Therefore, the outlined empirical double-hurdle Model is appropriate in explaining the observed health-seeking behaviour in Zambia.

3.4 Definition and measurement of variables

This sub-section of the study is aimed at elaborating the way in which variables are defined and measured. The section will further explain how proxies were selected.

3.4.1 Dependent variable (Vst)

The number of visits to a health facility is a proxy for health service utilisation. The number of visits is used as a dependent-mix variable truncated with several zeros. The visits fall rapidly from their maximum observation to zero. Visits to a health facility are discrete and non-negative. The out-patients data (i.e. number of visits), were collected on a four-week basis while data on admissions were collected on a twelve-month basis. This resulted in modelling problems as the two dataset could not be used simultaneously as proxies for utilisation. Therefore, out-patients visits were used as proxy for utilisation of health of health care services.

3.4.2 Explanatory variables

Quality of health care (Qlty)

The quality of health care in the survey was captured as attitude of staff, cleanliness of the facility, outcome of the visit, availability of drugs and length of waiting time. The study uses the availability of drugs as a proxy for quality of health care, as it is easy to model.

Age and Age_sqd

Age is a continuous variable ranging from zero (those who were below one year) to 99 years. The average age was 21.7 years. Age squared which is named Age_sqd is the square of the age of each health care user. The average age squared is 792.4 years.

Insurance (insur_dummy)

Insurance in this study is measured as a dummy variable. A variable name insur_dummy uses value 1 to mean a health seeker has some form of insurance and 0 if they do not. The variable shows the difference in health service use between patients with insurance and those without.

Place of residence (residence)

The variable named 'residence' is a dummy variable capturing place of residence. The variable is given a code 1 if a health care seeker lived in rural areas and 0 if urban. Only 32.96% of health care seekers lived in urban areas compared to 67.04% who lived in rural areas. In other words, this means that health care seekers who live in rural areas are more likely to use health services compared to those who live in urban areas.

Education (education)

Education, named as education is measured as the number of years of education. The variable takes the values of 0, 7, 12, 14 and 16, representing no education, primary, secondary, college and university education respectively.

Income (total_hh_income_monthly)

Household disposable income, named as income_hh_monthly, is used as a proxy for total household income as modelled in the conceptual framework by Acton (1973). This is because the survey did not capture the opportunity cost of time when seeking health care to account for the total income.

Religion (religion)

Religion is taken as a dummy variable. Despite the survey capturing several categorical variables, such as Christian (Catholic), Christians (Protestant), Christians (Jehovah's Witness), Muslim, Atheist, Traditionalist and others, the study generated two categories:

(1) Christian for all Christian categories
(2) Otherwise for all other religions other than Christianity

Code 1 is applied to a health seeker who belongs to Christianity and 0 if they are not.

Health Status (Hst)

Health status is captured as categorical variable taking values 1 to 4 as very good, good, satisfactory and poor, respectively. 51 per cent of health seekers had good health, 21 per cent had very good health, 17 per cent had satisfactory health and 11 per cent had poor health.

Marital status (Mst_dummy)

Marital status is captured as a contrast variable. The survey captured marital status of a health seeker as single, married, separated, cohabiting, widowed and divorced. The variable Mst_dummy was given code 1 if married and zero if not.

Cost of health care (out_patient_exp)

The variable named as out_patient_exp is the total cost of utilising a health care service that includes transportation, drugs, accommodation and food. This variable captures the cost of health care the utilisation for out-patients only.

Distance to health facility (dst)

The variable ‘dst’ captures the actual distance in kilometres to a health care facility one-way. The ‘dst’ captured in the survey had a lot of missing values as the respondents were ignorant of the distance involved.

Waiting time (waitt)

Waiting time, named as ‘waitt’, is a continuous variable measured in hours. It is taken as the time that elapses between arrival at a health facility and being seen by a clinician.

Household size (HHsz)

Household size, denoted as ‘HHsz’, is a continuous variable and was captured as the number of household members captured in the survey. Household size is a continuous variable measured by the number of household members. In this study a household member is considered to be one who lives with the said household on a continuous basis for six months.

Sex (sex)

Sex is taken as a dummy variable coded as 1 if male and 0 if female. The variable shows the differences in the utilisation of health care services by gender.

3.5 Conclusion

This particular section of the study concentrated on the procedures applied in establishing the factors that determine health care service utilisation in Zambia. The Zero-Truncated-Model or Hurdle-Model to be estimated was specified and all the variables to be used were modelled, and their relevance justified. The nature of the data that is used in providing solutions to the research questions raised in this study was also discussed. The subsequent chapter will further elaborate the estimates of the Zero-Truncated-Model and interprets the findings.

CHAPTER FOUR

ESTIMATION, PRESENTATION AND INTERPRETATION OF RESULTS

4.1 Introduction

This chapter of the study focuses on estimating the models specified in chapter three for examining the determinants of health care utilisation after carrying out appropriate diagnostic tests. It estimates the results of health care utilisation, being the number of visits (i.e. Out-Patients Department) which is explained by the quality of health care, demographic and socio-economic factors. The justification and relevance of the explanatory variables are discussed as well as the influence of the results on health service utilisation. The over-dispersion test is discussed, then the double-hurdle model for factors that affect health service use which capture the unobserved heterogeneity is extensively discussed.

4.1.1 Descriptive statistics for health service utilisation in Zambia

The statistical output gives a synopsis of the distribution of variables considered in this study. The tabulations are figures of persons that were sick and sought health care as shown in table 4.1: Summary statistics.

4.1.2 Vst

The maximum number of visits for the health care seeker in Zambia four weeks prior to the survey is four. It is observed that approximately 98% of health care seekers only visited health facilities. It is further noted that less than 3% of the health care seekers had two to four visits.

4.1.3 Marital Status (Mst)

Marital status of the health care seeker in this research is taken as a categorical variable which indicates differences in health service use as a result of gender. Marital status, is thus, divided into two, for purposes of this study, taking married (2), comparing grouped non -marital status responses in the survey, such as never married, cohabiting, divorced, separated and widowed. The collected survey data shows that approximately 55% of the health care seekers were married and about 45% were not married.

Table 4.1**: Summary statistics**

Variable	Observations	Mean	Std. Deviation	Min	Max
total_hh_income_monthly	3174	112.27	384.05	0	11666.67
Vst	3174	1.03	0.19	1	4
residence	3174	0.67	0.4701	0	1
Sex	3174	1.312	0.4636	1	2
Age	3174	29.7	21.58	4	95
Age_sqd	3174	1347.41	1631.06	16	9025
HHsz	3174	6.15	2.68	1	27
Qlty	3174	70	20	6	100
insur_dummy	3174	0.18	0.18	0	1
religion	3174	0.98	0.15	0	1
out_patient_exp	3174	23.47	205.42	0	7122
education	3174	8.33	2.9	0	16
Mst_dummy	3174	0.4	0.49	0	1
Hst	3174	2.21	0.9	1	5
dst	3174	12.77	18.63	0	250
waitt	3174	26.9	37.46	0	360

4.1.4 Income

Income in this study considers income as a factor that promotes access to and utilisation of health care services. Income for health care seekers is not grouped into income sub-groups. The main aim is to establish individual health seeker's income, and how such income impacts on health service utilisation. Approximately 65 % of health seekers had monthly disposable income of ZMK1000. Those with limited income are at the same time the ones who seek health care services the most.

4.1.5 Sex

The study found out that of the 3174 health care users in Zambia, 69 % were males and 31% were females. This is against the expectation that females in any age group utilise health services more than their male counterparts.

4.1.6 Age and Age_sqd

Age is a continuous variable taking values from 0 to 99 years. The majority of the household members who were ill four-weeks prior to the survey were below the age of 40, and accounted for 58.7 per cent. The Age is 29.7 years. This suggests that there is a positive relationship between Age and health care use. The older one becomes, the more health care is utilised. There is no absolute evidence of a quadratic relationship from the statistical description. The Age_sqd which is the square of Age range from 16 to 9025 with an average of 1347.41. Age squared is used to ascertain the quadratic relationship between health care utilisation and age. A representative health care seeker is expected to increase health care use with increase in age and at some point, health care utilisation declines. This is, however, not the case with health care use.

4.2 Results and statistical tests carried out.

4.2.1 Results of the tests carried out

When the Poisson and Negative Binomial models were subjected to the over-dispersion test, the research concluded that the Poisson was an appropriate count-data-model for the double-hurdle model. After carrying out the count-data-specification test (i.e. over-dispersion test), the Zero-Truncated-Model (Hurdle) Model was a Poisson. However, some variables that were considered vital and theoretically justified to having implications for health service utilisation were, however, found to be insignificant.

4.2.2 Diagnostic Tests

The report on tests conducted in estimating consistent and robust results are as follows:

Over-dispersion Test

This test was carried out to determine which count-data generation process between Poisson and Negative Binomial qualifies in the two-part empirical model. The hypothesis is set out as follows:

Ho: $\alpha = 0$ (Negative Binomial)

H1: $\alpha \neq 0$ (Poisson)

The significance α (Alpha) in the output for Negative Binomial is the test for over-dispersion. The test was aimed at making the appropriate distributional assumptions for positive values (number of visits to a physician) to be used in the zero truncated model for the unobserved heterogeneity [Hilbe (2011); Cameron & Trivedi (2005) and Santos-Silva (2003)]. The Alpha with a coefficient value of $2.26X10^{-23}$ Chibar2 value of 0 and P-Value of 1 rejected Ho and, therefore, concluded that a Poisson is an appropriate count-data model to be used in the Zero-Truncated-Model.

Multicollinearity Test

To avoid linear dependence among covariates, the correlation test is most commonly conducted. The rule is that correlation results greater than 0.8 show multicollinearity while correlation results greater than 0.9 show perfect multicollinearity. The remedial measure is dropping one of the collinear covariates (Gujarati, 1995). The absolute correlation coefficient between Age and Age_sqd was, 0.9673, as per Appendix A7. When Age_sqd was dropped, all the absolute correlation coefficients values were below 0.8, indicating absence of multicollinearity in Appendix A9.

Goodness of Fit-Test / Misspecification Test

A misspecification test was conducted to make sure that the problem of endogeneity, due to omitted variables if present, is corrected (Wooldridge, 2002). Endogeneity results in biased estimates, therefore, the results tend not to be Best Linear Unbiased Estimates (BLUE).

Ho: Model fits data

H1: Model does not fit data

The Zero-Truncated Poisson model for health care utilisation had a Likelihood Ratio chi2 of 2855.81, significant at 1% level significance with a Prob > chi2 = 0.0000. In other words, we fail to reject Ho, therefore, a conclusion that the model fits data is reached. The Pseudo R2 of 0.7718 indicates that the model best fits the data. This, therefore, means that 77.18% of the variations in the utilisation of health care services are predicted by the explanatory variables considered in the study. The predictive power of the model meagrely falls by 0.0015 per cent when the model was estimated without insignificant variable, shown in Appendix A11. This

shows that, the eight insignificant variables: sex, marital status, income, costs, household size, education, religion and quality of health care have a very small influence on predictive power of health care services utilisation model.

Heteroscedasticity test

The data used in this study is cross-sectional and the data type generally faces the problem of heteroscedasticity. However, this test is not necessary for the Zero-Truncated-Models because in using the Poisson count-data-model, the Poisson model meets the equality condition between conditional variance and conditional mean (Hilbe, 2011). This means that the variance is constant confirming homoscedasticity. The adopted Zero-Truncated–Poisson is a homoscedastic model in which variance does not change with changes in covariates. In other words, the variance of the error term is not a function of covariates. When the test was attempted in STATA using the command "estat hottest" a return code report, (321), was recorded indicating that the requested action could not be performed. This report supports Hilbe (2011) argument that heteroscedasticity test for truncated models is not necessary.

Ho: Constant variance (Homoscedasticity)

H1: Heteroscedasticity

In other words, adopting a Poisson model, which is homoscedastic, means that we fail to reject Ho concluding that there is no heteroscedasticity.

4.2.3 Zero-Truncated-Poisson regression results

Age and Age squared

Age was found to be significant at 5% level of significance and has a positive impact on the utilisation of health care services. The reported coefficient of age is 0.0106, meaning that, for those with positive health facility visits, for every additional year, individuals will have 1.06% more visits to a health facility. It also means that for every additional year, individuals with positive visits to a health facility will increase their health facility visits by 0.000669.The finding that age has a positive influence on health service utilisation is consistent with (Murthy (1981) and Nolan (2006)) findings a representative health service consumer in Zambia increase their utilisation of medical services as they grow older.

Table 4.2: Results of the Model estimated (Appendix A8 and A10)

Variable	Zero-Truncated-Poisson results		Average marginal effects	
	coefficient	P-value	coefficient	P-value
total_hh_income_monthly	-0.000194 (0.000348)	0.578	-0.0000123 (0.0000221)	0.578
Sex	0.277 (0.229)	0.227	0.0175393 (0.014613)	0.230
Age	0.0106** (0.00531)	0.047	0.000669* (0.0003421)	0.051
HHsz	0.0359 (0.0360)	0.318	0.0022759 (0.0022903)	0.320
Qlty	0.00184 (0.00490)	0.707	0.0001168 (0.0003105)	0.707
insur_dummy	1.268*** (0.366)	0.001	0.077468** (0.0249039)	0.002
religion	0.282 (0.713)	0.693	0.0178413 (0.0451582)	0.693
out_patient_exp	0.000179 (0.000171)	0.294	0.0000114 (0.0000109)	0.296
education	0.0271 (0.0388)	0.485	0.0017173 (0.0024644)	0.686
Mst_dummy	-0.130 (0.247)	0.598	-0.0082514 (0.0156665)	0.598
Hst	0.482*** (0.112)	0.0000	0.0305476*** (0.0076652)	0.0000
dst	0.0118*** (0.00243)	0.0000	0.000746*** (0.0001676)	0.0000
waitt	0.00449** (0.00199)	0.026	0.000281** (0.0001291)	0.029
residence	-0.0975 (0.232)	0.674	-0.0061725 (0.0146869)	0.674
Constant	-5.821*** (1.032)	0.0000	-	-

Number of observations	=	3174
Pseudo R2	=	0.7718
LR chi2(14)	=	2855.81
Prob> chi R2	=	0.0000
Log-likelihood ratio	=	-422.26113

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Insurance

This variable was found to be statistically significant at 5% level of significance and has a positive influence on health care service utilisation. The coefficient value of 1.223378 means that individuals with positive health facility visits, will have approximately 122.3 % more visits if they had some form of health insurance, than if they did not. This is an interesting result that shows the moral hazard involved for the insured health care seekers. This means that there is an abuse in the use of health care services when an individual gets health insurance. The marginal effect results shows that, on average, an individual with positive health visits and who has health insurance, will have 0.077 more visits than those who do not. The findings are consistent with those of (Masiye et al. (2008); U.S. DHHS SAA report (1981) and Young (1981)) that health insurance increases access to health care.

Health status

The health status of a representative health service consumer was also found statistically significant at 1% level of significance and as expected had a positive influence. Its coefficient of 0.482 in the hurdle results means that for those individuals with positive health practitioner visits and whose health is poor to very poor, they will have 48.2 % more health visits than if their health status was average to very good. The average marginal effect suggests that with a unit deterioration of health status of an individual with positive health visits, an individual is expected to have approximately 0.0305 more visits to a health facility. The findings and the signs reported are as expected and agree with the findings of (Gerdtham (1997); Akin et al. (1985) and Rebel (1966)), that the worse the health status of an individual, the more health care services they consume.

Distance

The one-way distance to a health facility was found to be statistically different from zero at a 1% level of significance and had an unexpected positive influence on health service utilisation. The coefficient under the Zero-Truncated-Poisson results of 0.0118 implies that those individuals with positive health facility visits and given one-way distance to health facility, will have 1.18 more visits. The average marginal effect of distance on health care service use is that for every unit increase in distance to a health facility, individuals with positive health visits will have 0.0007463 more facility visits. This is an interesting result in the light of the expectation that the closer a family resides to a health facility, the more health care services they are expected to consume. This result could be attributed to the fact that, in the same period,

the health status variable was highly significant and a positive sign, denoting that, on average, the health of respondents was very poor. With such poor health conditions, most cases are referred to secondary and tertiary hospitals which are very far from the primary health facilities which are the first point of contact. The results are not in agreement with the findings of (Opuku (1996); Gish (1985) and Akin et al. (1985)), that health care use is negatively related to distance to a health facility.

Waiting time

The time that one waits to be attended to at a health facility was found to be statistically significant at 5% level of significance with a positive impact on the level of health facility use. With a positive unexpected coefficient sign of 0.0044, an individual will use 0.44% more visits to clinicians. Average marginal effect results mean that for individuals with positive health facility visits, a unit hourly change in waiting time, will cause them to make 0.00028 more visits to a health facility. The empirical findings is at variance with the findings of (Cosminsky (1982) and Heller (1976)), that waiting time has no effect on health service utilisation. However, findings on waiting time in this study are in agreement with those of Guilkey et al. (1981) that long waiting periods have a positive impact on the use of other forms of health care, such as private facilities, traditional and spiritual healers. In other words, over 80 per cent of the health care seekers in this study visited public health facilities, the long waiting times due to long queues, has a redirect demand from public health facilities to other health care options.

Sex

The variable sex was found to be insignificant. The insignificance of the variable might be attributed to the fact that, there is no segregation by gender in the use of health care services in Zambia. Studies in Asia by [Chen et al. (1981) and Coyaji (1981)] on Health care use, where males are considered more valuable than female, men used more of health care than females.

Education

The variable education as a number of years of education was found insignificant. The reason for the statistical equality of education to zero could be due to the low literacy rate which is appropriately 62 per cent (UNICEF, 2014). [Cochrane (1980) and Akin et al. (1976)], in studies on demand for health care argue that the higher the levels of education, the more health care one demands. However, this is not the case for this study, where 66.07% had primary education and less close to 24% had secondary education.

Marital Status

Marital status was found to be insignificant in the study. What could have accounted for this is that more than 60% of the health seekers were not married. The manner in which the variable was captured had many categories, such as cohabiting, separated, divorced, widowed and married. The manner in which the dummy was generated by combining the non-married categories into one might have affected the results.

Place of residence

The variable residence, was statistically not different from zero. The expected result is that the nearer one is lives to the health facility, the more likely one is to use health care services. Rural area are poorly covered with health care facilities resulting in an expected low use of health care services. However, 67.04% of health care seekers in this study came from the rural areas. The major cause of place of residence not having an influence on health care utilisation is inconclusive.

Income

The variable income was found not statistically different from zero. The reason for the insignificance could be that, income fluctuations, especially upward adjustment causes redirection of demand for health care towards health facility perceived as superior in quality. In other words, the quantity of health care due to income changes (i.e. the number of facility visits) does not change significantly. This is in line with studies by [Heller (1976) and Claquin (1981)] who argue that changes have a redirecting impact on health care use from one health care provider to alternative providers.

Cost of health care

The cost of health care, which include: transportation, accommodation, food, drugs, administration charges and laboratory. The variable was found insignificant at all levels. In accessing health care services, there are a lot of other illegal costs, such as bribes to have laboratory tests, admission beds, booking for surgery which mostly take at least four months. The magnitude of the costs, as a result of concealment of such illegal costs, under-estimates the actual cost involved in utilising health care. The insignificance of the cost variable is in line with the findings by Cosminsky (1976).

Quality of health care

The variable, quality of health care was found to be insignificant. The non-impact of quality of health care could be attributed to the nature of the variable. The variable is highly subjective without measurability consensus in literature. Therefore, measure for quality of health care (i.e. availability of drugs), could have been ineffective in capturing quality.

Household size

Household size was not statistically different from zero. This could have been due to the fact that more than 90% of the health care seekers had a household of not more than six members with a maximum of twenty seven. Studies that have found household size to have implications for health care use, such as, Popkin and Solon (1976), did not give the threshold of what is considered a large household.

Religion

The variable religion was found to have no impact on health care utilisation. What could have accounted for this is that, despite Zambia being a Christian nation, it tolerates other forms of religious beliefs. Representative health service consumers in Zambia are not religious extremists, but flexible on issues that could be affect by their faith (i.e. use of health care services).

4.3 Conclusion

The chapter presented the estimations and results of determinants of health care utilisation in Zambia. The descriptive statistics indicated that the thirteen variables are sources of health care use. Descriptive statistics could not nevertheless be counted on, as such statistics were not subjected to significance tests. The over-dispersion test was carried out and the Poisson model was found to be an appropriate count-data model and was used in the hurdle specification or the Zero-Truncated-Model Poisson. The hurdle regression showed that out of the thirteen variables, only five variables account for health care service utilisation in Zambia. These are; insurance, age, distance, waiting time and health status. The Pseudo R-squared showed that approximately 77.18 per cent of the variations in health care utilisation is explained by age, health status, insurance, waiting time and distance to a health facility. Hurdle estimations as well as average marginal effects of significant covariates were used to interpret the results. The goodness of fit-test showed that the model fits the data well. Further, when the model was

estimated using the significant variables only, the predictive power of the model only declined by 0.0015% indicating that the model fits the data in explaining health care use. These factors aid policy formulation which is based on the influence of these factors on health care utilisation. Age, health status, insurance, distance to health facility and waiting time accounts for the co-existence of the paradox of low health care utilisation and improved health outcomes. The hypothesis that health care service use is influenced by socio-economic-demographic factors, such as; age, insurance, health status, distance and waiting time were found to have an impact on health care service utilisation. However, waiting time and distance had counter-intuitive signs from the expected negative signs. The counter-intuitive signs could have resulted from the fact that a 67.04 % of health care seekers in the study came from rural areas which usually have only primary health centres, and facilities are sparsely located causing distance covered to be long. In other words, because a larger percentage of health care users in the study are from rural areas with primary health centres, a larger percentage of the 67.04% could have been referred to secondary and tertiary hospital which are even further. Further, the Zero-Truncated Poisson model (i.e. Double-Hurdle Model), passed the goodness of fit test (i.e. misspecification test), the model bridged the methodological deficiency observed, hence, capturing the unobserved heterogeneities. The next chapter presents the synopsis of and conclusion to this research. Finally, appropriate policy recommendations are made on how to handle drivers of health care the utilisation in Zambia.

CHAPTER FIVE

CONCLUSIONS AND POLICY IMPLICATIONS

5.1 Introduction

This study examines the factors that affect the demand for health care utilisation in Zambia. It provides empirical evidence of the socio-economic-demographic factors that affect the health-seeking behaviour of a representative Zambian health service consumer. The study further provides a solution to managing the methodological deficiency in determining health care demand in the light of the observed agency problem within Zambia's health delivery system. Finally, areas that require further research and as well as limitations of this research are discussed.

5.2 Summary of main findings

The research was triggered by the paradox that "Why does the utilisation of Zambia's health care services remain low despite its improving health indicators?" Further, the observed general practitioner and patient relationship (asymmetric information) in the health delivery system in Zambia and the methodological deficiency of studies on health care service utilisation that do not capture such factors also motivated this study. The hurdle-model was found to be ideal model to attempt to filling this methodological deficiency and explaining the observed phenomenon. Number of visits to a health facility was adopted as a proxy for health care utilisation which is, a dependent variable. Fourteen explanatory variables representing socio-economic-demographic characteristics were adopted. The results based on a Poisson hurdle Model show the effects that: sex, age, insurance, health status, costs of seeking health care, education, household size, place of residence, marital status, waiting time, religion, waiting time, income and distance have on health care service utilisation.

5.3 Policy implications

The analysis made in this study is crucial for policy-making. The findings of this study are important in that they establish the role that socio-economic-demographic factors play in determining health service utilisation levels in Zambia. Factors that are significant in explaining health care utilisation levels should be incorporated into policies within the health delivery system in order to improve health care delivery hence utilisation. Since health issues

cut across all sectors of the economy, a sector-wide approach should be adopted to include factors that are significant in an attempt to improve health service use throughout Zambia. Policy makers should consider putting in place measures that will encourage both insurance companies to increase coverage of health insurance and the government itself to come up with a National Health Insurance Policy that will reduce the massive health expenditure incurred by households, and this may improve access to and utilisation of health care services**.**

With an improvement in the life expectancy of Zambians, health policy makers should be ready for the implications that this will have on health service use. The findings show that as they grow older, individuals use more health care services. Policy makers should improve services associated with increased life expectancy rates. Provisions that aid the aged to access health care should also be put in place. The study showed that a consumer's distance from a health facility also has a positive influence on health care service utilisation. Health care services at primary health facilities should be improved to avoid referral to fee-paying secondary and tertiary hospitals. Capacity building,(This include; health facility staff, especially clinicians and the availability of equipment) should be carried out so that waiting times at public health facilities are reduced to prevent redirection of demand for health care services to private practitioners, traditional and spiritual healers. Finally, since the explanatory variables were determining the number of visits to a health facilities when a representative health consumer is ill, the model can be utilised for forecasting and simulation purposes in the formulation of health policies. For instance, by introducing social security insurance, a representative health care seeker is expected to increase general practitioners' visits by 0.08.

5.4 Areas for further research and limitations of the study

The limitation noted on the dataset is that the number of visits were collected in the form of out-patient and admissions. Out-patients were collected over a four-week period, while the admissions were collected over a twelve month period. This resulted in modelling problems as the two data points could not be combined. Therefore, in future studies, it is recommended that the two variables should be collected within the same time frame. The study could also have allowed for admission episodes to be analysed, as health care services may also be ascertained via a patient's admission history which could have been possible, had the variables been collected over the same time frame. Despite the theoretical justification that income had an effect on health service use, monthly household disposable income was found to have no such effect. The conceptual modelled income was calculated as total income that included unearned

income proxied by the opportunity cost of waiting at a health facility. This opportunity cost was not collected in the survey. Therefore, future studies and surveys should include this vital cost.

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APPENDIX A1: Mathematical derivations of the hurdle model

(1) Depending on the over-dispersion test, a Poisson or Negative binomial is appropriate for $f_0(.)$.The second part of hurdle or decision can be specified as a binary logit or probit depending on the distributional assumption of the error terms (Winelmann, 2004).

$$f(y_i|x_i;\beta_0,\beta_1) = \begin{cases} f_0(0|x_i;\beta_0, y_i=0) \\ (1-f_0(0|x_i,\beta_0)\times f_1(y_i|\mathrm{x_i};\beta_1; y_i>0) \end{cases}$$

The distribution of the unobserved heterogeneity is arbitrary with a gamma distribution.

(2) Gurmu and Trivedi (1992) argue that if $f(y_i|x_i)$ is the density function of an i^{th} individual in the population of target, the probability of this person utilising health care services can thus be expressed as follows:

$$f(y_i|x_i; y_i>0) = f_1(y_i|x_i) = \frac{f(y_i|x_i)}{P(y_i>0|x_i)}$$

Where: $y_i = 1,2,.....,N$

$f(y_i|x_i)$, is the probability function in the actual population.

(11) Where: $P(y_i>0|x_i) = f(y_i|x_i) = \sum_{j=1}^{p}\gamma_j f_j(y_i|x_i,\beta_j,v_i^j)$

(12) Substituting equation 22 and 23 into equation 21, the resulting compounded equation is therefore:

$$f_1(y_i|x_i,\beta) = \left[\frac{\sum_{j=1}^{p}\gamma_j f_j(y_i|x_i,\beta_j,v_i^j)}{\sum_{j=1}^{p}\gamma_j P(y_i>0,v_i^j,\beta_j)}\right]$$

(13) Factoring out γ_j and $\sum_{j=1}^{P}$ the function reduces to:

$$f_1(y_i|x_i,\beta)=\sum_{j=1}^{p}\left[\frac{f_j(y_i|x_i,\beta_j,v_i^j)}{\left[1-(\sum_{j=1}^{p}\gamma_j P(y_i=0|x_i,\beta_j,v_i^j)\right]}\right]\gamma_j$$

(14) For simplicity purposes and without loss of generality, multiplying $\left[1-(\sum_{j=1}^{p}\gamma_j P(y_i=0|x_i,\beta_j,v_i^j)\right]$ on both denominator and numerator, then we have:

$$(15)\quad f_1(y_i|x_i,\beta)=\sum_{j=1}^{p}\left[\frac{f_j(y_i|x_i,\beta_j,v_i^j)*\left[1-(\sum_{j=1}^{p}\gamma_j P(y_i=0|x_i,\beta_j,v_i^j)\right]}{\left[1-(\sum_{j=1}^{p}\gamma_j P(y_i=0|x_i,\beta_j,v_i^j)\right]*\left[1-(\sum_{j=1}^{p}\gamma_j P(y_i=0|x_i,\beta_j,v_i^j)\right]}\right]\gamma_j$$

(16) Equation 27 can be further be simplified to:

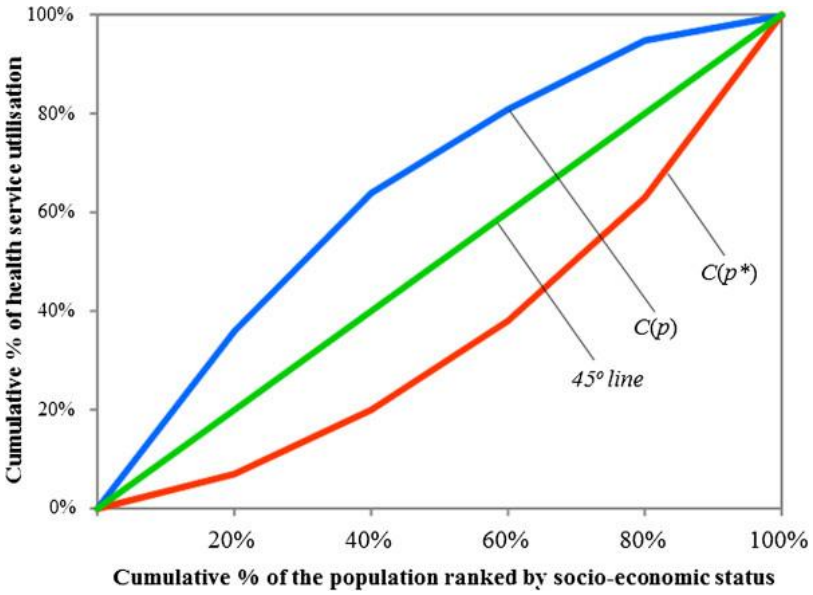
$$f_1(y_i|x_i,\beta)=\sum_{j=1}^{p}\left[\frac{f_j(y_i|x_i,\beta_j,v_i^j)}{\left[1-(\sum_{j=1}^{p}\gamma_j P(y_i=0|x_i,\beta_j,v_i^j)\right]}\right]\hat{\gamma}_j,$$ this expressed can further be reduced to:

$$(17)\quad f_1(y_i|x_i,\beta)=\sum_{j=1}^{p}\left[f_j^s(y_i|x_i;v_i^j,\beta_j)\right]\hat{\gamma}_j$$

Equation 29 intuitively means that the probability of the j^{th} component distribution is in the sample and can be expressed as follows:

APPENDIX A2: Graphical elaboration of inequalities/inequalities in health service use

Figure 2: Determination of Inequalities/Inequities in health care service use

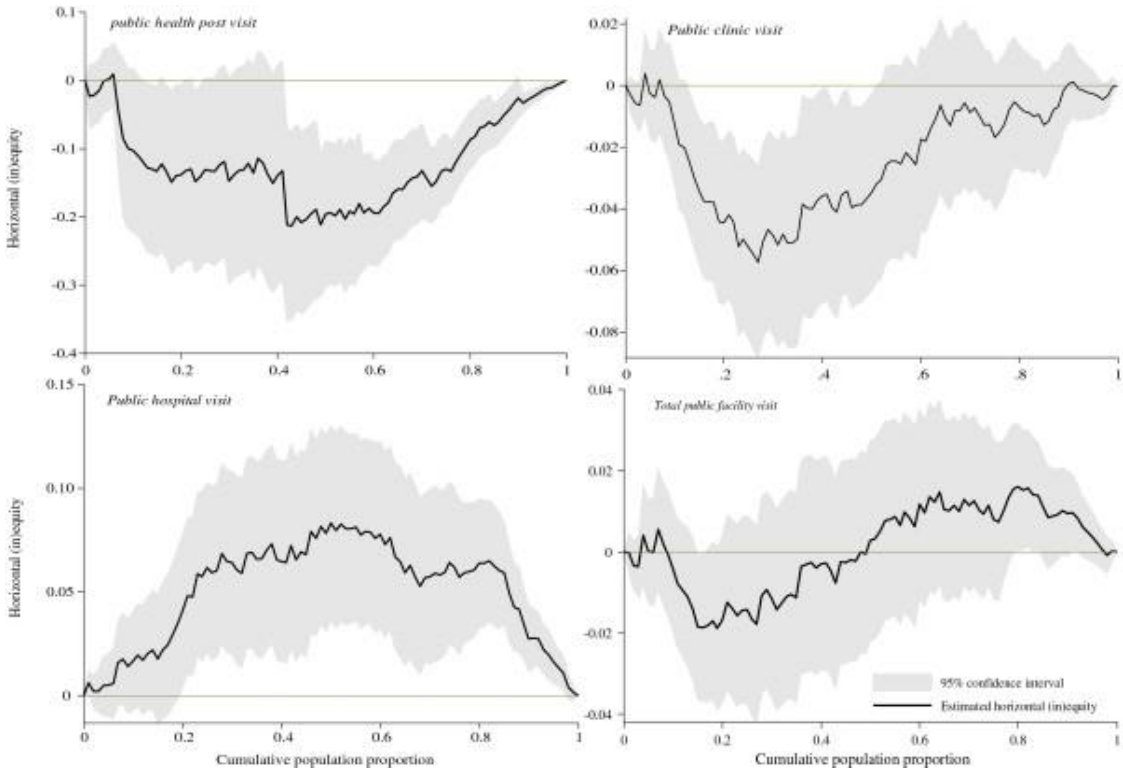


Source: Phiri & Ataguba (2013)

Concentration curves is plotted in the cumulative share of heath variable (age-sex standard the utilisation) and share of households in a population (Ordered from the poorest to the richest) space.

When concentration is above the 45^0 equality line, then health care is concentrated among the poor, and it would be among the rich if below the equality line. The concentration indices (CIs) falls in the range $[-1,+1]$. When $CI > 0$, population health care the utilisation is concentrated among the rich (pro-rich) and if $CI < 0$, health care use is concentrated among the poor hence pro-poor.

APPENDIX A3: Statistical graphical results showing the determination of horizontal equity



Horizontal inequity curves for health care the utilisation in Zambia, 2010.

Source: Phiri & Ataguba: International Journal for Equity in Health

APPENDIX A4: Negative-Binomial results for test of Over-dispersion

```
. nbreg Vst residence Age Age_sqd HHsz insur_dummy sex  total_hh_income_monthly Mst_dummy Hst religion education out_patient_exp Qlty dst waitt  /*Using the alpha Ho:
>  over-dispersion(NB) & H1: Equi-dispersion (Poisson)*/

Fitting Poisson model:

Iteration 0:   log likelihood = -3245.8425
Iteration 1:   log likelihood = -3245.8425

Fitting constant-only model:

Iteration 0:   log likelihood = -4470.6702
Iteration 1:   log likelihood = -3247.5598
Iteration 2:   log likelihood = -3247.5598

Fitting full model:

Iteration 0:   log likelihood = -3245.8429
Iteration 1:   log likelihood = -3245.8425
Iteration 2:   log likelihood = -3245.8425

Negative binomial regression                    Number of obs   =       3174
                                                LR chi2(15)     =       3.43
Dispersion     = mean                           Prob > chi2     =     0.9991
Log likelihood = -3245.8425                     Pseudo R2       =     0.0005
```

Vst	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
residence	-.0064508	.040514	-0.16	0.873	-.0858569	.0729552
Age	.0012727	.0043444	0.29	0.770	-.0072423	.0097877
Age_sqd	-.0000106	.0000521	-0.20	0.839	-.0001128	.0000916
HHsz	.0009095	.0066791	0.14	0.892	-.0121813	.0140002
insur_dummy	.0573212	.1001359	0.57	0.567	-.1389416	.2535841
sex	.0106857	.0418338	0.26	0.798	-.0713071	.0926785
total_hh_income_monthly	-4.46e-06	.0000462	-0.10	0.923	-.000095	.0000861
Mst_dummy	-.012254	.0527005	-0.23	0.816	-.115545	.091037
Hst	.0160879	.0208792	0.77	0.441	-.0248345	.0570103
religion	.0114108	.1193331	0.10	0.924	-.2224778	.2452993
education	.0002504	.0073061	0.03	0.973	-.0140692	.0145701
out_patient_exp	.0000317	.0000781	0.41	0.685	-.0001214	.0001848
Qlty	.0000721	.0008828	0.08	0.935	-.0016582	.0018024
dst	.000967	.0009414	1.03	0.304	-.0008781	.0028122
waitt	.0001642	.000471	0.35	0.727	-.0007591	.0010874
_cons	-.0753474	.1770312	-0.43	0.670	-.4223222	.2716274
/lnalpha	-52.1456	.			.	.
alpha	2.26e-23	.			.	.

```
Likelihood-ratio test of alpha=0:  chibar2(01) =    0.00 Prob>=chibar2 = 1.000
```

APPENDIX A5: Zero-Truncated-Poisson output

VARIABLES	Vst
residence	-0.0975
	(0.232)
Age	0.0106**
	(0.00531)
HHsz	0.0359
	(0.0360)
insur_dummy	1.223***
	(0.376)
sex	0.277
	(0.229)
total_hh_income_monthly	-0.000194
	(0.000348)
Mst_dummy	-0.130
	(0.247)
Hst	0.482***
	(0.112)
religion	0.282
	(0.713)
education	0.0271
	(0.0388)
out_patient_exp	0.000179
	(0.000171)
Qlty	0.00184
	(0.00490)
dst	0.0118***
	(0.00243)
waitt	0.00444**
	(0.00200)
Constant	-5.821***
	(1.032)
Observations	3,174

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

APPENDIX A6: STATA Zero-Truncated-Poisson output

```
. ztp Vst residence Age Age_sqd HHsz insur_dummy sex  total_hh_income_monthly Mst_dummy Hst religion education out_patient_exp Qlty dst waitt if Vst>0

Iteration 0:   log likelihood = -1846.8697
Iteration 1:   log likelihood = -453.88407
Iteration 2:   log likelihood = -426.16573
Iteration 3:   log likelihood = -421.56562
Iteration 4:   log likelihood = -421.51488
Iteration 5:   log likelihood = -421.51477
Iteration 6:   log likelihood = -421.51477

Zero-truncated Poisson regression               Number of obs   =       3174
                                                LR chi2(15)     =    2857.30
                                                Prob > chi2     =     0.0000
Log likelihood = -421.51477                     Pseudo R2       =     0.7722
```

Vst	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
residence	-.0917065	.2317343	-0.40	0.692	-.5458974	.3624845
Age	.035932	.0216577	1.66	0.097	-.0065162	.0783802
Age_sqd	-.0003055	.000256	-1.19	0.233	-.0008073	.0001963
HHsz	.0339466	.0359701	0.94	0.345	-.0365535	.1044468
insur_dummy	1.231746	.3764374	3.27	0.001	.4939424	1.96955
sex	.2685195	.2311283	1.16	0.245	-.1844837	.7215227
total_hh_income_monthly	-.0001779	.0003468	-0.51	0.608	-.0008577	.0005018
Mst_dummy	-.2516266	.2617681	-0.96	0.336	-.7646827	.2614295
Hst	.4858905	.1116427	4.35	0.000	.2670749	.7047061
religion	.285228	.7131416	0.40	0.689	-1.112504	1.68296
education	.0120137	.0407855	0.29	0.768	-.0679245	.0919518
out_patient_exp	.0001857	.0001701	1.09	0.275	-.0001477	.0005192
Qlty	.0020041	.004898	0.41	0.682	-.0075957	.011604
dst	.0118473	.0024323	4.87	0.000	.0070802	.0166145
waitt	.004432	.0019969	2.22	0.026	.0005182	.0083459
_cons	-6.003649	1.042498	-5.76	0.000	-8.046908	-3.960389

APPENDIX A7: STATA Correlation matrix of coefficients of ztp model

```
. vce,corr

Correlation matrix of coefficients of ztp model
```

e(V)	Vst reside~e	Age	Age_sqd	HHsz	insur_~y	sex	total_~y	Mst_du~y	Hst	religion	educat~n	out_pa~p	Qlty	dst	waitt
Vst															
residence	1.0000														
Age	0.0212	1.0000													
Age_sqd	-0.0127	-0.9673	1.0000												
HHsz	-0.0735	0.0035	0.0453	1.0000											
insur_dummy	0.2395	0.0266	-0.0193	0.0343	1.0000										
sex	0.0755	-0.0911	0.0077	-0.0174	-0.0141	1.0000									
total_hh_i~y	-0.0907	0.0431	-0.0405	-0.0913	0.0315	-0.0721	1.0000								
Mst_dummy	-0.0874	-0.4691	0.3639	-0.0650	-0.0228	0.3562	-0.0688	1.0000							
Hst	-0.0238	-0.0600	-0.0234	-0.0189	0.0755	-0.0027	0.0195	0.0876	1.0000						
religion	0.0175	0.0159	-0.0074	-0.0636	-0.0287	-0.0786	0.0003	-0.0327	0.0254	1.0000					
education	0.2324	-0.3255	0.2948	0.0081	-0.1612	0.2570	-0.0894	0.0471	0.0900	-0.0193	1.0000				
out_patien~p	0.1086	0.0258	-0.0362	-0.0381	-0.1464	-0.0509	-0.0369	-0.0836	-0.0777	-0.0050	0.0052	1.0000			
Qlty	0.0387	0.0060	-0.0260	0.0042	-0.0493	0.0436	0.0004	0.0232	0.0861	0.0052	0.0541	0.0669	1.0000		
dst	-0.2052	0.0467	-0.0184	0.1283	0.0147	-0.1386	0.0193	-0.0962	-0.1839	0.0394	-0.0550	0.0193	0.0422	1.0000	
waitt	0.0769	0.0032	-0.0042	0.0187	0.0809	0.0018	-0.0105	-0.0405	0.0266	-0.0202	0.0725	-0.0418	0.0637	-0.1757	1.0000
_cons	-0.2466	-0.1391	0.1568	-0.1754	-0.0169	-0.3271	0.0406	-0.0152	-0.3066	-0.6434	-0.3654	0.0101	-0.3945	0.0117	-0.1140

e(V)	Vst _cons
Vst	
_cons	1.0000

APPENDIX A8: STATA Zero-Truncated-Poisson output without multicollinearity

```
. ztp Vst residence Age HHsz insur_dummy sex  total_hh_income_monthly Mst_dummy Hst religion education out_patient_exp Qlty dst waitt if Vst>0

Iteration 0:   log likelihood = -1846.9083
Iteration 1:   log likelihood = -454.08258
Iteration 2:   log likelihood = -426.80572
Iteration 3:   log likelihood = -422.30985
Iteration 4:   log likelihood = -422.26124
Iteration 5:   log likelihood = -422.26113
Iteration 6:   log likelihood = -422.26113

Zero-truncated Poisson regression               Number of obs   =       3174
                                                LR chi2(14)     =    2855.81
                                                Prob > chi2     =     0.0000
Log likelihood = -422.26113                     Pseudo R2       =     0.7718
```

Vst	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
residence	-.0974764	.231774	-0.42	0.674	-.551745	.3567922
Age	.0105654	.0053103	1.99	0.047	.0001573	.0209735
HHsz	.0359406	.0360061	1.00	0.318	-.03463	.1065112
insur_dummy	1.223378	.3764595	3.25	0.001	.4855308	1.961225
sex	.2769805	.2293491	1.21	0.227	-.1725354	.7264965
total_hh_income_monthly	-.0001936	.0003479	-0.56	0.578	-.0008755	.0004882
Mst_dummy	-.1303059	.2471123	-0.53	0.598	-.6146371	.3540252
Hst	.4824083	.1121411	4.30	0.000	.2626159	.7022007
religion	.2817496	.7126733	0.40	0.693	-1.115064	1.678564
education	.0271189	.0388332	0.70	0.485	-.0489927	.1032305
out_patient_exp	.0001794	.0001708	1.05	0.294	-.0001553	.0005141
Qlty	.0018446	.0049011	0.38	0.707	-.0077614	.0114507
dst	.0117859	.0024315	4.85	0.000	.0070203	.0165516
waitt	.0044383	.0019961	2.22	0.026	.000526	.0083505
_cons	-5.821228	1.031716	-5.64	0.000	-7.843355	-3.799101

APPENDIX A9: STATA Correlation matrix of coefficients of ztp model after dropping Age-sqd

```
. vce,corr

Correlation matrix of coefficients of ztp model
```

e(V)	Vst reside~e	Age	HHsz	insur_~y	sex	total_~y	Mst_du~y	Hst	religion	educat~n	out_pa~p	Qlty	dst	waitt	_cons
Vst															
residence	1.0000														
Age	0.0304	1.0000													
HHsz	-0.0785	0.1865	1.0000												
insur_dummy	0.2470	0.0344	0.0303	1.0000											
sex	0.0758	-0.3039	-0.0148	-0.0156	1.0000										
total_hh_i~y	-0.0872	0.0156	-0.0914	0.0325	-0.0719	1.0000									
Mst_dummy	-0.0857	-0.5054	-0.0765	-0.0176	0.3720	-0.0546	1.0000								
Hst	-0.0260	-0.3397	-0.0139	0.0769	0.0013	0.0141	0.1032	1.0000							
religion	0.0200	0.0356	-0.0685	-0.0274	-0.0780	-0.0007	-0.0310	0.0218	1.0000						
education	0.2447	-0.1664	-0.0002	-0.1515	0.2654	-0.0793	-0.0828	0.1058	-0.0113	1.0000					
out_patien~p	0.1097	-0.0365	-0.0325	-0.1483	-0.0572	-0.0415	-0.0729	-0.0849	-0.0056	0.0209	1.0000				
Qlty	0.0362	-0.0799	0.0026	-0.0559	0.0450	0.0003	0.0341	0.0820	0.0036	0.0737	0.0672	1.0000			
dst	-0.2046	0.1213	0.1366	0.0115	-0.1384	0.0221	-0.1014	-0.1932	0.0567	-0.0538	0.0231	0.0458	1.0000		
waitt	0.0829	-0.0005	0.0200	0.0843	-0.0015	-0.0152	-0.0416	0.0293	-0.0178	0.0754	-0.0362	0.0649	-0.1849	1.0000	
_cons	-0.2451	0.0549	-0.1838	-0.0174	-0.3380	0.0478	-0.0766	-0.3063	-0.6501	-0.4425	0.0162	-0.3950	0.0036	-0.1170	1.0000

APPENDIX A10: STATA Zero-Average Marginal Effects

```
. margins, dydx(*)

Average marginal effects                        Number of obs   =       3174
Model VCE    : OIM

Expression   : Predicted number of events, predict()
dy/dx w.r.t. : residence Age HHsz insur_dummy sex total_hh_income_monthly Mst_dummy Hst religion education out_patient_exp Qlty dst waitt
```

	Delta-method dy/dx	Std. Err.	z	P>|z|	[95% Conf.	Interval]
residence	-.0061725	.0146869	-0.42	0.674	-.0349584	.0226133
Age	.000669	.0003421	1.96	0.051	-1.55e-06	.0013396
HHsz	.0022759	.0022903	0.99	0.320	-.002213	.0067647
insur_dummy	.0774681	.0249039	3.11	0.002	.0286573	.1262788
sex	.0175393	.014613	1.20	0.230	-.0111016	.0461801
total_hh_income_monthly	-.0000123	.0000221	-0.56	0.578	-.0000555	.000031
Mst_dummy	-.0082514	.0156665	-0.53	0.598	-.0389571	.0224544
Hst	.0305476	.0076652	3.99	0.000	.0155241	.045571
religion	.0178413	.0451582	0.40	0.693	-.0706673	.1063498
education	.0017173	.0024644	0.70	0.486	-.0031128	.0065473
out_patient_exp	.0000114	.0000109	1.05	0.296	-9.92e-06	.0000326
Qlty	.0001168	.0003105	0.38	0.707	-.0004918	.0007254
dst	.0007463	.0001676	4.45	0.000	.0004179	.0010747
waitt	.000281	.0001291	2.18	0.029	.0000281	.000534

APPENDIX A11: STATA Zero-Truncated-Poisson output with only significant variables

```
. ztp Vst Age insur_dummy Hst dst waitt if Vst>0

Iteration 0:   log likelihood = -1847.2781
Iteration 1:   log likelihood = -455.63905
Iteration 2:   log likelihood = -429.04323
Iteration 3:   log likelihood = -425.05804
Iteration 4:   log likelihood = -425.02632
Iteration 5:   log likelihood = -425.02627
Iteration 6:   log likelihood = -425.02627

Zero-truncated Poisson regression               Number of obs   =       3174
                                                LR chi2(5)      =    2850.28
                                                Prob > chi2     =     0.0000
Log likelihood = -425.02627                     Pseudo R2       =     0.7703
```

Vst	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
Age	.0099064	.0043443	2.28	0.023	.0013917	.0184212
insur_dummy	1.369344	.3491391	3.92	0.000	.6850441	2.053644
Hst	.4925703	.1095003	4.50	0.000	.2779536	.707187
dst	.0113234	.0023841	4.75	0.000	.0066506	.0159961
waitt	.0044774	.0019578	2.29	0.022	.0006402	.0083146
_cons	-4.725791	.319494	-14.79	0.000	-5.351987	-4.099594