NON-COMMUNICABLE DISEASES IN KENYA: ECONOMIC EFFECTS AND RISK FACTORS

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DECLARATION

This thesis is my original work and has not been submitted for award of a degree in any other university

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ABSTRACT

Non-communicable diseases (NCDs) have been on the rise in Kenya over the past decade. However their potential effects on household welfare are unavailable despite strong evidence of economic and social consequences from developed countries. The high expenditures for managing NCDs expose households to risks of financial catastrophe and poverty. Catastrophic expenditures occur when households are forced to dis-save or sell off assets to meet hospital bills or medical care. Although catastrophic expenditures may impoverish households, they enable them to consume essential medical care, thus slowing down the decline in income and labour productivity that is common among NCD patients. However, the patients hardly regain pre-NCD productivity levels even after treatment due to the debilitating nature of most NCDs, this could make catastrophic health expenditures by household on NCDs a poverty risk factor.

Using the Kenya household health expenditure and service utilization data collected in 2007, this study uses two stage residual inclusion, control function and instrumental variable approach to investigate the effects of NCDs on household income, contribution of NCDs to household catastrophic spending in Kenya. The main finding is that NCDs have a much bigger toll on household income than the general ailments. While general ailments reduce household income by 13.63 per cent, NCDs reduce income by 28.64 percent. In addition, households with NCDs are 51.35 per cent more likely to incur catastrophic expenditures compared to households afflicted by communicable diseases. The odds of impoverishment are 48.97 per cent higher among NCD households compared to households that suffer from general illnesses.

The study further examines the major risk factors for NCDs with a view of unravelling the interventions for addressing the rising prevalence of these diseases. The results show that low

intake of fruits and vegetables, cigarette smoking, alcohol consumption and household income are some of the major NCD risk factors. The thesis further explores the role of social interactions in the spread of NCDs, an aspect which has largely been ignored in economics literature. The findings show that social interactions have significant effects on household health.

This study recommends that the health care system in Kenya needs to develop mechanisms to promote preventive care for NCDs through control of NCDs risk factors, since preventive health is cost effective than curative health. Effective public policies such as community based routine screening for NCDs are required to address the raising prevalence of NCDs beside individual and household policies. Development of a health financing strategy (social protection and resources pooling) should be a high priority for the Kenya Ministry of Health and development partners.

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DEDICATION

I dedicate this thesis to my family: Jacob, Jacinta, Liz, Mary, Jane, Ann, Peter, John, Abigale and Phineas. Special gratitude goes to my loving parents, Jacob Mwai and Jacinta Wangari, for your constant encouragement that keeps ringing in my ears. To my siblings Liz, Mary, Jane, Ann, Peter and John, you have a very special place in my heart for being by my side throughout the journey of my studies.

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ACRONYMS

AERC	African Economic Research Consortium
AOP	Annual Operating Procedures
BP	Blood Pressure
Catah	Catastrophic Expenditure
CBHI	Community Based Health Insurance
CDs	Communicable Diseases
CVD	Cardiovascular Disease
FY	Financial Year
GDP	Gross Domestic Product
GOK	Government of Kenya
HBM	Health Belief Model
HIV/AIDs	Human Immunodeficiency Virus/Acquired Immunodeficiency Syndrome
HSSF	Health Sector Service Fund
IV	Instrumental Variable
KCBHFA	Kenya Community Based Health Financing Association
KEMRI	Kenya Medical Research Institute
KEMSA	Kenya Medical Supplies Agency
KES	Kenya Shilling
KHEUS	Kenya Household Expenditure and Utilization Survey
KIPPRA	Kenya Institute for Public Policy Research and Analysis
KMTC	Kenya Medical Training College
LMICs	Low and Medium Income Countries
MDGs	Millennium Development Goals
MOH	Ministry of Health
MoMS	Ministry of Medical Services
MoPHS	Ministry of Public Health and Sanitation
NCDs	Non-Communicable Diseases

NGO	Non-Governmental Organization
NHA	National Health Accounts
NHIF	National Health Insurance Fund
NHSP I	National Health Strategic Plan I
NHSSP II	National Health Sector Strategic Plan II
OOP	Out of Pocket Expenditure
PRB	Population Reference Bureau
STI	Sexually Transmitted Disease
TB	Tuberculosis
THE	Total Health Expenditure
UNDP	United Nations Development Programme
WHO	World Health Organization

CHAPTER ONE: INTRODUCTION

1.0 Background

Non-communicable diseases (NCDs) are fast becoming a big healthcare challenge in the world. They are presently competing with traditionally leading killer diseases in death toll. The topmost killer NCDs are various types of cancers, chronic respiratory illnesses, stroke and cardiovascular diseases (Maina, 2009).

For centuries, communicable diseases were the main causes of death around the world. Life expectancy was often limited by uncontrollable epidemics of communicable diseases. After the Second World War, medical research achievements in vaccines and antibiotics coupled with improvements in living standards ushered in a new era of managing communicable diseases (WHO, 2002a; Tawa *et al,* 2011). Unfortunately, NCDs began building up within the new era imposing huge healthcare burdens particularly on developed economies. Due to their high prevalence in high income countries, NCDs came to be referred to as the "diseases of the rich".

From the late 1990s, developing countries started to experience an epidemiological change characterized by an increase in the prevalence of NCDs. By 2000, NCDs had already become a big challenge to many developing economies as shown in Table 1.1. The impact of NCDs on household survival and incomes may be higher in developing countries given that these countries lack surveillance data to estimate the actual household effects of these diseases (Parkin *et al,* 2008).

Table 1.1: Prevalence of NCDs compared to other diseases in developing countries over time

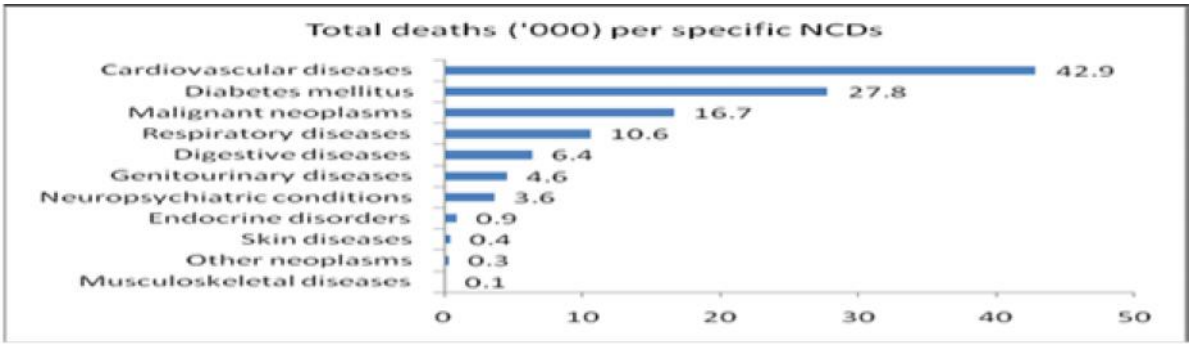
Year	Non-Communicable Diseases	Communicable Diseases	Injuries
1990	47%	42%	11%
2000	56%	33%	11%
2020*	69%	17%	14%

*Source: Boutayeb A. and Boutayeb S, 2005. * estimate.*

Even though infectious diseases such as malaria, pneumonia, diarrhoea and peri-natal complications continue to threaten health care management systems in developing countries, predictions show that by 2020 NCDs will account for over 70 per cent of the health care burden in these countries. Projections show that at least seven out of 10 deaths in developing countries by this 2020 will be related to NCD causes (WHO, 2002b). This trend is worrying because developing countries have to deal with the twin challenge of infectious and non-communicable disease burden with limited resources. The high cost of treatment and care for NCD patients impacts negatively on household income and welfare as shown later in this thesis.

In 2005, major NCDs accounted for 60% of all deaths and 47% of the global burden of disease (WHO, 2006). WHO (2004) had earlier raised alarm over the potential effects of NCDs in low- and middle-income countries predicting that NCDs would claim an estimated 35 million people worldwide in 2005. The direct and indirect effects of the deaths on household welfare and income are enormous. By 2020, if serious measures will not have been taken to reverse the trend NCDs will account for 73% of all deaths as well as 60% of global burden of diseases (WHO, 2006)

Figure 1.1: Leading killer diseases among NCDs in Kenya, 2006.



Source: World Health Organization, 2006

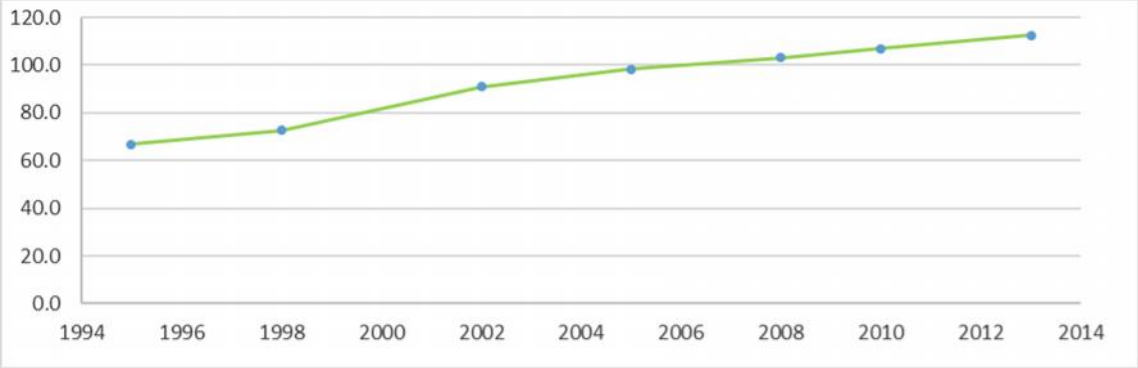
Murray *et al,* (2003), observe that for developing countries to effectively curb the rising prevalence of NCDs it is necessary to invest in preventive health care and enforce strict

controls on known NCD drivers such as alcohol and inactivity. They warn that failure to address these factors would lead to astronomical negative impact on developing world economies.

1.1 NCDs Situation in Kenya

The burden of NCDs has been rising in Kenya, as shown by Figure 1.2. This raising trend have seen NCDs emerge to account for over 32 per cent of the annual total disease-related deaths in the country (WHO, 2002a).

Figure 1.2: Total NCD deaths ('000) over time in Kenya.



Source: World Health Organization, 2011 and Republic of Kenya, 2013

Between 2005 and 2007, NCDs accounted for over half of the top 20 causes of disease-related deaths in Kenya. They were also the main causes of morbidity in the country (Republic of Kenya, 2007a). Malignant neoplasm (cancer), cardiovascular attacks, respiratory ailments and diabetes are NCD-related illnesses, and together they are responsible for most of disease-related deaths in Kenya as seen from Figure 1.1. In addition, over half of all patients admitted in all the major hospitals[1] in the country suffer from NCD-related ailments. Diabetes accounts for the largest proportion of these cases at 23.3 per cent (Republic of Kenya, 2010 b).

[1] Levels five and six hospitals

In Africa and Asia over 80,000 new cases of cancer are diagnosed each year (Kenya Department of Research, 2011). The situation of cancer in Kenya is made dire by lack of medical specialists, a large number of new cases emerging each year and high costs of treatment that are mainly financed from out-of-pocket expenditures (International Atomic Energy Agency, (2010).

The rising cases of NCD-mortality could be attributed to changing lifestyles as incomes improve with economic growth. Other factors include unhealthy diets, lower physical activities, and a rise in the use of products such as alcohol and tobacco that raise the probability of developing NCDs (Tawa *et al*, 2011).

1.1.1 Socio-economic and health impacts of NCDs in Kenya

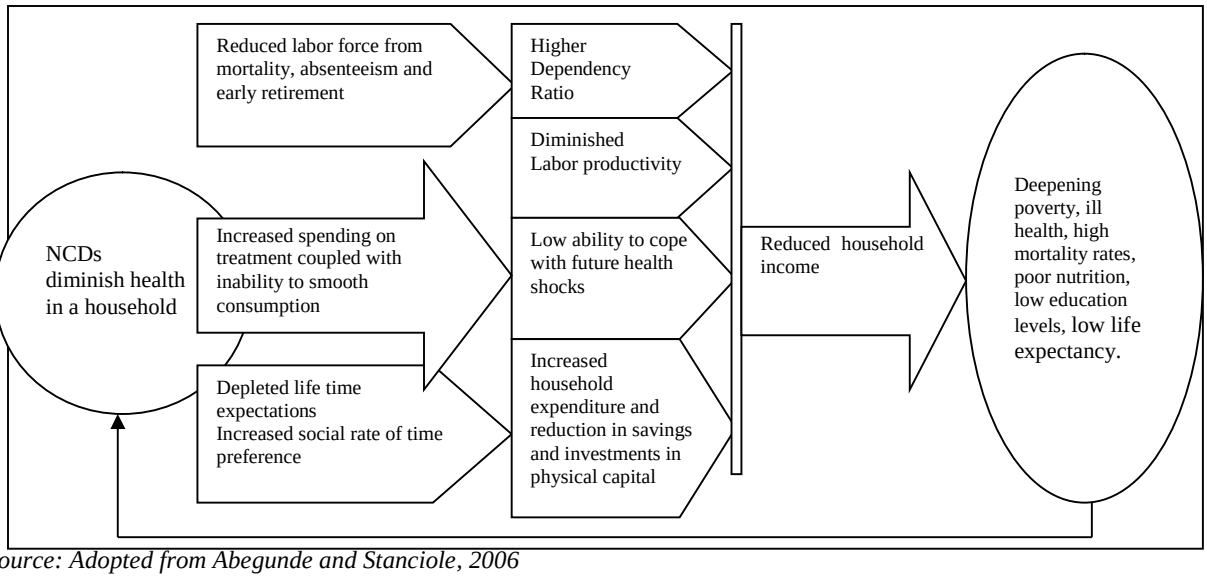
The economic, social and health burden of NCDs on households and the economy at large is unclear. There is only limited empirical evidence on the burden, while awareness within the general populace on the problem of NCDs is low. The Ministry of Health has never designated a programme or budget for addressing cancer and other non-communicable diseases that are silent killers. This clearly illustrates the low priority given to addressing NCDs at the policy level in spite of the dangers of these diseases (Republic of Kenya, 2011).

NCDs have a distinctively slow progression such that their patients do not die immediately. Affected individuals may go down in health for a long time before they die. Even with treatment, rarely do patients of chronic NCDs regain optimal health and productivity. Though most NCDs are curable if detected early, rarely do patients seek early treatment. They only do so when the disease has turned chronic. The health cost and care of chronic NCD patients often erode a household's financial resources pushing them into poverty (Republic of Kenya, 2011)

1.1.2. Microeconomic Impact of NCDs

NCDs erode a household's current income and reduce the future productivity of the patients (Lopez-Cassanovas and Rivera, 2005). By lowering households' incomes, spending power and production capacity, NCDs slow down economic growth. The potential linkages between NCDs and microeconomic variables are shown in Figure 1.3 as captured by Abegunde and Stanciole (2006).

Figure 1.3: Linkage between NCDs and microeconomic variables.



Source: Adopted from Abegunde and Stanciole, 2006

Households are increasingly bearing the burden of NCDs without the benefit of insurance or support from employers. The burden is both financial and social. The costs of treatment and care thin out disposable incomes leaving families with less to spend on other crucial needs such as food and education (Gertler and Gruber, 2002; Moodley *et al*, 2007; Gaillard 2009; Mbanya *et al*, 2010). Feenberg and Skinner (1994) and Waters (2004) find a direct relationship between prevalence of disease and household health expenditures.

The treatment of NCDs is expensive in terms of medication and care for the patients, and this usually places low income families at a disadvantage (Gottret and Schieber, 2006). When poor households are affected by NCDs they are more likely to slide into poverty.

A household's expenditure on care and treatment of diseases including NCDs is directly determined by its income, wealth level and existing social networks (Wild *et al.* 2004). In developing countries, most poor households forego spending on healthcare to cater for other crucial needs like food, thereby placing themselves at higher risks of fatalities when the diseases become untreatable (Russel 2004). Consequently, most of the poor households sink deeper into poverty as productivity of the sick members in a family decline coupled with low survival rate (Maina, 2009). Krishna (2007) and Doorslaer *et al,* (2006) found that on average approximately 75 percent of individuals who slide into poverty in small and medium income economies of Africa and Asia are pushed by financial pressures of healthcare burden. Himmelstein *et al,* (2006) observed that the situation is not any different in the United States of America which is a rich economy. Over 50 per cent of individuals declared bankrupt there blame their misfortune on huge healthcare spending.

Xu *et al,* (2003) found that between 2 to 10 per cent of households worldwide face unmanageable healthcare spending, and the situation could be worse in Southern Asia and sub-Saharan Africa. The two regions contribute nearly half of the deaths and Disability Adjusted Life Years (DALYs) experienced globally (WHO, 2004; 2005). This burden hurts economic growth in these regions through diversion of resources to healthcare. Mahal *et al,* (2005) finds similar results in NCDs healthcare spending. It reduces households' ability to save and hurts economic growth in the long-run.

In the past, NCDs were characterized as diseases of the rich and the elderly. Today, they are affecting the youth, most of whom make up the working population (Murthy and Sastry,

2005; Leeder *et al,* 2004) denying the economy the much needed human capital for growth These are critical policy issues that should be given attention for they point to an urgent need to control and manage the spread of NCDs.

Although NCD cases are under-reported in Kenya, their burden is rising as shown in Figure 1.2. Shone *et al,* (2011), argues that this upward trend will challenge policymakers when devising intervention measures to reverse it, unless corrective measures are taken immediately. They stress on evidence-based studies to help track prevalence rates, estimate the cost of healthcare needed, and inform on NCD healthcare management strategies.

1.2 The Research Problem

The burden of NCDs is rising in Kenya. NCDs such as cancer, diabetes and cardiovascular disease are becoming more prevalent. The population as well as the government lacks adequate awareness and knowledge on impact of suspected risk factors, and the control of the spread of NCDs (Tawa *et al,* 2011). The Global Medicine (2011) report indicates that most NCDs in Kenya are detected late due to lack of awareness, and this makes their treatment very costly. The Millennium Development Goals (MDGs) have not prioritized NCDs prevention and control, and neither has the government in its Vision 2030. Late detection of NCDs increases their prevalence and mortality, besides making their treatment and the care for patients expensive. For example, cervical cancer has become a leading killer of women, yet it is curable if detected and treated early enough. This problem of information asymmetry should be addressed in order to stem a looming crisis (Republic of Kenya 2011).

The low attention and prioritization of NCD prevention and control in Kenya may be attributed to lack of understanding and empirical limitations on the impact of these diseases on individuals, households and economy. It may also be linked to the fact that there are few studies relating to NCDs in Kenya and developing countries at large. There exists a wide

evidence gap in this area as noted by Maina, (2009) . This gap in empirical studies was also highlighted earlier by Lown *et al,* (2006) who examined 416 issues or 8857 articles in the New England Journal of Medicine for the period 1997 – 2004. Out of these, only 2.28 per cent focused on health issues in developing countries, and only 0.26 per cent paid attention to NCDs. This study intends to address this research gap

The few studies on NCDs in developing countries fail to identify the actual income losses to individuals and households affected by these diseases (Hyman *et al,* 2006). NCDs can result in substantial losses when healthcare costs escalate. However, estimates of the direct healthcare costs and productivity losses are unavailable in developing countries (Honore and Lleras-muney, 2004; Simon *et al,* 2002

Reviewed studies have downplayed the other effects of NCDs in a household beyond the out-of-pocket spending on care and treatment. Large health expenditures may have negative effects on consumption behaviour and welfare of a household. Catastrophic expenditures force households to forgo basic needs and push them to poverty. In evaluating economic effects of NCDs, it is necessary to go beyond out-of-pocket health care expenses and look at the impact of healthcare expenditures on household finance and productivity. Most poor households are unable to meet medical expenses associated with NCDs because their treatment is protracted and expensive. Without treatment, NCDs undermine individual and household productivity and income.

Some households sell off some of their assets or draw on past savings to meet medical expenses and healthcare of NCD patients. Capital consumption has long-term effects on a household's ability to pay[2] for consumption goods as well as future health care expenditures

2 Ideally, increased spending on health care and treatment should restore health, increase human capital and hence positive effects on productivity; however this is mostly not the case for NCDs on developing countries since they are

(Kyobutungi *et al*, 2008). This too has implications on a household's productivity and income.

At present, NCDs might be pushing more households into poverty when compared to communicable illnesses. However, information on this trend is lacking in Kenya as in most developing countries..

The efforts towards prevention of NCDs in Kenya are inadequate. This may be because of inadequate understanding of the contribution of suspected risk factors to NCDs. Addressing the risk factors associated with these diseases may present a cheaper and long-term solution to the problem of rising cases of NCDs. An analysis of NCD risk factors may present an entry point for policy solutions aimed at taming these diseases. Narayan *et al*, (2006) observes that most deaths among persons with diabetes could be avoided if governments addressed the risk factors in developed countries. This requires adequate understanding of the contribution of the known risk factors to NCDs. Such an analysis should go further and evaluate the influence of social interactions on NCDs prevalence, an aspect that is somewhat treated lightly or ignored in economic literature.

1.1 Research questions

In spite of the increasing burden of NCDs, there is little empirical evidence assessing their economic effects and risk factors in Kenya. The purpose of this study is to fill this gap by addressing the following research questions:

i) What are the effects of NCDs on household income?

diagnosed late (advanced stage) and hence there is low chance of recovery to full health and full productivity even with huge expenditures on treatment

ii) What is the contribution of NCDs to household catastrophic expenditure and impoverishment?

iii) What are the risk factors associated with NCDs in Kenya?

1.2 Objectives of the Study

The main objective of this study is to investigate the economic effects of NCDs on households in Kenya, and the risk factors associated with the disease. The specific objectives are to:

i) Estimate the effects of NCDs on household income

ii) Estimate the contribution of NCDs to household catastrophic spending and to household impoverishment

iii) Examine the risk factors associated with NCDs.

1.3 Justification for the study

The prevalence of NCDs is increasing worldwide, but more so in developing countries. The myth that NCDs only affect the rich and the elderly has been dispelled by empirical evidence to the contrary. The poor and the young in developing nations are increasingly falling victim to the disease (Maina, 2009). Furthermore, NCDs could be leading to huge welfare losses at both the individual and household levels. At the individual level, NCDs reduce the health and productivity of their patients. At the household level, these diseases erode a household's savings and other assets through healthcare expenditures. Both channels impoverish households.

NCD prevention and control has not been a priority as seen in the Millennium Development Goals (MDGs) and Kenya's Vision 2030. As a developmental and societal issue of grave concern, control and prevention of these diseases deserve to be prioritized by governments

and health care agencies. Unfortunately, there is only limited information on the magnitude of the problem of NCDs, particularly in developing countries including Kenya.

Today there are more cases of emerging NCDs than in the past. Therefore, studies on NCDs should be continuous to monitor the situation. This study is important for it sheds light on some of the reasons for the increased prevalence and incidence of NCDs in Kenya, reasons that might as well apply to other parts of the world. The government in Kenya is developing a national strategy and policy for the prevention and control of NCDs. This study could inform this process by providing evidence the magnitude of the burden and effects of NCDs in Kenya

1.6 Organization of the study

This thesis is organized into six chapters. The first chapter presents the background information, research problem, objectives of the study, and the policy relevance or justification of the study. Chapter 2 gives an overview of the healthcare system and NCDs response in Kenya. Chapter 3 presents a review of literature relevant to the study, and chapter 4 is the analytical and modelling section of the thesis. Chapter 5 presents empirical results and their discussion. Lastly, chapter 6 summarizes the thesis and gives a conclusion, policy implications of the work and areas of further research.

CHAPTER 2

2.0 OVERVIEW OF KENYA'S HELTHCARE SYSTEM AND RESPONSE TO NCDs

2.1 Public health and organization of the Ministry of Health in Kenya

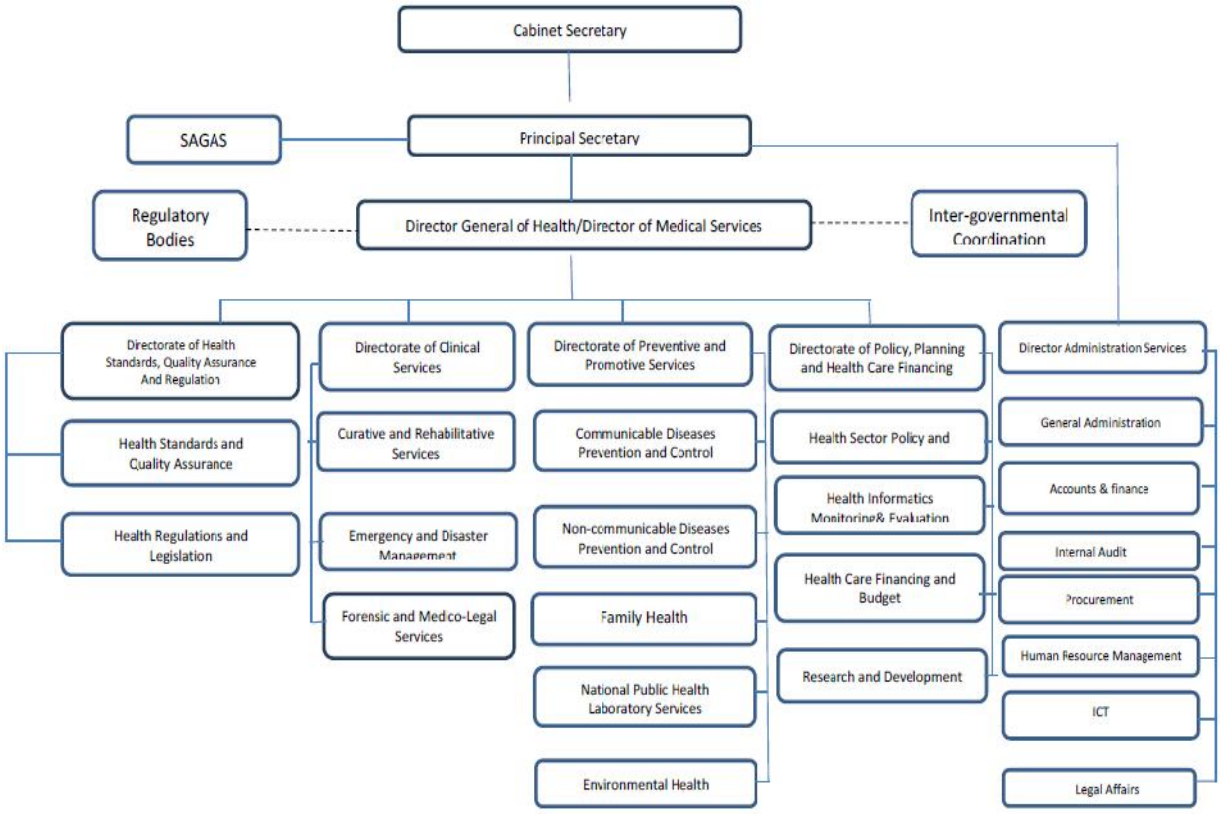
The provision of public health services in Kenya has been under the Ministry of Health (MOH). Since independence in 1963, the healthcare delivery system in Kenya has been centralized. Decisions are made at the MOH head office and communicated down to provincial and district medical officers. But from 2010, things have changed with promulgation of a new constitution that ushered in a new system of devolved government. Health services have been devolved to the newly created county governments except for the referral hospitals (Republic of Kenya 2010e). Healthcare provision is now in four tiers. At the bottom are community health services comprising of dispensaries that give primary healthcare. At the next level are health centers and maternity homes. The third tier has county referral hospitals that are also called level four hospitals. These were previously called district hospitals. At the top are national hospitals that handle specialized cases referred to them by the other levels of healthcare providers. The county governments are responsible for the first three levels while the national government is responsible for national referral hospitals (Republic of Kenya 2012).

Devolution of health services to the counties has faced many challenges resulting from unpreparedness of county governments to take up the devolved functions. The Kenya Service Availability and Readiness Assessment Mapping (SARAM) report of 2013 shows that county health facilities provide on average 37 per cent of the essential NCD healthcare package. Furthermore, only 13% of the facilities stock essential products such as insulin injections, and only 4.9 per cent of the facilities provide NCD healthcare services[3]. NCD general services

[3] The package includes health promotion and education on NCDs, screening, rehabilitation, education and monitoring of health and safety in workplaces, and of food eaten.

readiness index in counties is less than 34 per cent, but 73 per cent for communicable disease. The county governments in general fall short in well trained human resource, and in efficient management systems (Republic of Kenya 2013). For this reason, most NCDs are referred to national hospitals of the Ministry of Health. Figure 2.1 shows the structure of the ministry.

Figure 2.1 Organizational structure of the Ministry of Health in Kenya



[4] *Source: Ministry of Health, 2014*

The Directorate of Preventive and Promotive Services is in charge of prevention and treatment health care interventions, including prevention of NCDs.

4 SAGAs = Semi-Autonomous Government Agencies such as Kenya Medical Supplies Agency, Kenya Medical Research Institute, Kenya Medical Training College, National Hospital Insurance Fund, Kenyatta National Hospital, Moi Teaching and Referral Hospital, Government Chemist, Pharmacy and Poisons Board, Radiation Protection Board, ,Referral Hospitals Authority, National AIDS Control Council

2.2 Health status in Kenya

2.2.1 The burden of diseases in Kenya

In the past, communicable diseases presented the largest burden of disease in Kenya. Malaria has been a leading killer disease followed by pneumonia, HIV/AIDS and tuberculosis (Republic of Kenya, 2011; 2012). However, over the last 20 years NCDs such as heart disease and cancer have become big killers in the country. In 2012, cancer took the third position after pneumonia and malaria in death toll. Table 2.2 shows the major causes of mortality by province for the year 2012.

Table 2.1: Causes of mortality by province in Kenya.

Cause of death	Nairobi	Central	Western	Coast	Nyanza	Eastern	Rift valley	N. Eastern	Total
Malaria	831	786	5872	1443	4520	2672	2395	227	18746
Pneumonia	1971	4680	1964	1236	2383	2410	4288	79	19011
AIDS	865	1310	1686	900	1579	869	2204	23	9436
Cancer	1041	1993	1985	859	2092	1492	2341	60	11863
Heart Disease	1438	615	390	278	854	1063	816	38	5492
Tuberculosis	1190	1121	1133	787	1637	1632	1629	113	9236
Anaemia	459	793	1329	1029	1288	833	1128	72	6931
Meningitis	694	556	373	322	849	377	776	21	3968
Road accidents	797	721	243	432	707	536	977	44	4457
Other accidents	1156	534	325	366	405	432	903	10	4131

Source: Economic Survey, 2013

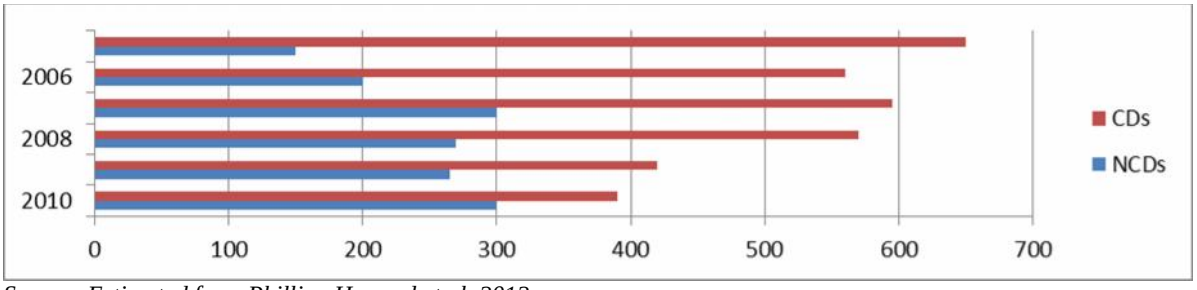
Nairobi Province had highest incidence of heart diseases, while Rift Valley had the highest number of cancer cases. Nyanza reported the highest number of anaemia and meningitis cases. The North Eastern province had the fewest reported cases of all killer diseases probably because of its low population and poor data collection infrastructure. In total, NCDs accounted for over 33 per cent of all deaths. This shows considerable increase in the burden of NCDs from 22 per cent in 2002 which could be explained by the changes in lifestyles coupled with the increase in urbanisation and globalization where more people are adopting sedentary lifes (WHO, 2002a).

2.2.2 Health burden outcome indicators in Kenya

Life expectancy in Kenya dropped from 54.7 years in 1999 to 53 in 2006. It improved to 57 years in 2010 with females living slightly longer (57 years) than males by one year (PRB, 2010). Morbidity and mortality rates in the country are mainly driven by the underlying household and individual characteristics, epidemiological and other environmental characteristics, and health systems. The individual level factors that are of importance in this regard include level of maternal education and nutritional status. Environmental determinants include access to clean water, adequate sanitation, soil degradation, and safety from a variety of disease vectors that thrive in certain ecological systems (WHO, 2009). The health system factors relate to ease of accessing and utilizing health services. It also includes a system's responsiveness to people's needs especially the poor and the less fortunate.

While some of the heath indicators mentioned above have improved over the years, others have worsened. Figure 2.3 shows the trends in mortality in Kenya associated with communicable and non-communicable diseases:

Figure 2.2: Communicable and NCD mortality rates per 100,000 of population in Kenya



Source: Estimated from Phillips-Howard et al, 2012

There are more new NCD cases reported in Kenya today than in the past (Republic of Kenya, 2011). Statistics show that 82,000 new cancer cases are diagnosed each year, and over 200 people die daily from various types of cancer (Departmental Committee on Health, 2011). According to the International Atomic Energy Agency (2010) the cancer situation in Kenya is

dire. The country lacks adequate medical cancer specialists. There are only three oncologists in the country, and this translates to one oncologist for every 12 million people (Republic of Kenya, 2011). The three oncologists are incapable of effectively handling the huge and ever growing number of cancer cases in the country. The disease accounts for over 18,000 deaths in Kenya annually. A majority of the patients are said to be in their most productive years.

2.3 Healthcare financing in Kenya

Healthcare financing in Kenya has a demand[5] side that includes household out-of-pocket payments, private health insurance and national/public health insurance, and a supply[6] side that includes government, donor and private sector finance. Private funds predominate in the sector[7] even though the share of this sector to total health sector resources has decreased from a high of 54 per cent in 2001/02 to 34 per cent in 2010/11. Comparatively, public sector financing has remained constant over the past decade at about 29 per cent, while donor funding has increased over the years from 16 per cent in 2001/02 to 33 per cent in 2010/11 (Republic of Kenya, 2011).

Kenya largely depends on donors to fund key health programs such as the HIV/AIDS. This threatens the sustainability of programs in the long run should donors pull out (Baruwa, 2010). In addition, some categories of diseases among them NCDs do not attract donor interest and, therefore, only receive limited funding from donors. In such cases the households and the private sector shoulder the entire financing burden (KDMIC, 2011).

At least 60 per cent of donor funds to the health sector are channelled through NGOs. This method is administratively costly and inefficient. The push now is for donors to channel

5 Buys health care provided through supply side financing

6 Finances human resource, operations and maintenance, drug and supplies as well as infrastructure

7 These include households' of of-pocket spending and private insurances

funds through the established government systems in line with the Paris Declaration and the health sector Code of Conduct (GOK and Health Systems 20/20, 2010).

Private spending including out-of-pocket expenditures declined between 2001/2 and 2005/6 at a time when treatment costs shot up. As treatment costs rise beyond a certain limit, access to healthcare especially by the poor households decline. According to the 2007 Kenya Household Health Expenditure and Utilization Survey (Republic of Kenya, 2009), 17 per cent of the sick do not seek care when unwell. 49 per cent of these cited financial barriers as the reason they ignore health services. Of those who were admitted in healthcare facilities covered by the survey, 14.3 per cent had to dispose of their assets or borrow to pay for medical bills (Republic of Kenya, 2009).

The government budget allocation to the health sector has been way below the minimum of 15 per cent recommended by the Abuja Declaration. Consequently, public health facilities are unable to offer affordable and easily accessible healthcare (including care and treatment of NCDs) to all households as per Vision 2030 commitment. The quality of healthcare in public health facilities has become compromised. The situation is worsened by low and declining donor financial commitments to the sector (WHO, 2005; Tawa, 2011). The capacity of the public health sector to deal with communicable and non-communicable diseases is weak. Due to shortage of medical supplies, infrastructure, human resources and fund for non-communicable diseases.

2.3.1 Budgetary allocations to the health sector in Kenya

Government allocations to the Ministry of Health have been growing in nominal terms over time except in a few years. In 2011/12 for instance, the sector received Kshs 49.7 billion up from Kshs 19.1 billion (in absolute terms) in 2004/05 as shown in Table 2.4. However, the allocations as a percentage of government expenditures remain low ranging between 5.48 and

6.10 percent. The government's commitment in the Abuja Declaration is to increase this ratio to 15 per cent. The total expenditure by the Ministry of Health as a percentage of GDP has oscillated between 1 .5 and 1.7 percent over the last five years (see Table 2.4).

Table 2.2: Total government allocations to the health sector in Kenya, 2004-2012

Description	2004/05	2005/06	2006/07	2007/08	2008/9	2009/10	2010/11	2011/12
Recurrent (KShs. Millions)	17,417	19,765	23,437	22,745	25,552	28,184	33,325	34,424
Development (KShs. Millions)	1,741	3,242	12,884	11,609	9,293	18,827	12,396	15,290
Total (KShs. Millions)	19,158	23,007	36,321	34,354	34,845	47,011	45,721	49,715
Annual growth of MOH expenditures (%)		20.09%	57.87%	-5.42%	1.43%	34.91%	-2.74%	8.74%
Total MOH expenditures as a % of government expenditures	6.10%	5.70%	7.60%	6.40%	6.00%	6.90%	6.30%	5.48%
Total MOH expenditures as a percentage of GDP	1.6%	1.5%	1.5%	1.5%	1.7%	1.7%	1.7%	1.7%

Source: Louma et al, 2010, and Republic of Kenya, 2012

2.3.2 Health financing reforms in Kenya

Since 1994, Kenya has relied heavily on the Health Policy Framework in pursuit of its healthcare agenda. The Health Policy Framework came in the wake of increased disease burden across households. Its motto is to offer "quality healthcare that is acceptable, affordable and accessible to all." The roll-out of the framework was divided into two five-year strategic plans: the National Health Sector Strategic Plan I (NHSSP I) (1999 — 2004) (Republic of Kenya 1999), and the National Health Sector Strategic Plan II (NHSSP II) (2005 to 2010) (Republic of Kenya 2005). A review of NHSSP I show that not much was achieved during that period (KNBS and ICF Macro, 2004). The bulk of the achievements of the framework occurred during the NHSSP II, this could be due to time lag between when a policy is effected and when the results/ outcome are realised.

The key goals of NHSSP II are to cut inequalities in access to healthcare with a view to reverse the downward trend observed in health-related impact and outcome indicators. However, the goals do not focus on NCDs. Thus, a vast majority of the population do not have access to basic NCD-care and the cost of treating NCDs is high. In general, patients do not know their rights with regard to access to quality health care (Republic of Kenya, (2010c). Although the newly enacted Constitution (2010) has enshrined citizens' right of access to quality healthcare (including NCDs care and treatment) in the Bill of Rights, public awareness of their rights is low (Republic of Kenya 2010).

The user fees payments that were introduced in public health facilities in late 1980s have continued to date providing invaluable additional revenue to the public healthcare system. The payments support critical health-sector programs in times of severe budget constraints. However, the user fee system has not been able to cushion the poor from financial burden arising from care and treatment of NCDs. NCD households are not shielded from catastrophic spending and some are likely to be impoverished. User-fees create barriers to accessing healthcare especially for the poor and the vulnerable. The viability of this approach as a financing mechanism is limited by the widespread poverty and inability to pay among a large section of the Kenyan households (Republic of Kenya, 2005).

NHSSP II emphasises healthy life-styles across households in order to decrease the burden of disease. It also advocates community health. The Kenya Essential Package of Health (KEPH) has been introduced in the sector to address user fee waivers. However, the waivers do not cover fees in the treatment of NCDs (Chuma and Okungu, 2011).

Health care services offered in dispensaries and health centres became free for all citizens (except for a minimal registration fee of Kshs 10 to 20 which is also waived for poor households) in June 2004 as part of the KEPH (Carrin et al, 2007). Under this strategy

commonly referred to as the 10/20 policy—children aged below five years accessed treatment free of charge in public health facilities. General treatment for some diseases including malaria and tuberculosis as well as maternity services and vaccinations in dispensaries and health centres was also made free. The healthcare facilities were expected to absorb the cost of treatment. This policy intended to ease the financial burden on poor households and make health services accessible in all parts of the country. It provided a big shift in healthcare financing in Kenya affecting especially the poor households. Republic of Kenya, (2010c). Even though the waivers were intended to benefit the poor, the well-to-do have been noticed enjoying the free healthcare services (Republic of Kenya, 2010b). It is their right as citizens

The 10/20 policy had a direct effect by increasing access to healthcare services, the gains were not sustained, since the quality of care declined in most facilities due to lack and loss of funds. Most of the free-care facilities were unable to buy supplementary drug and non-medical supplies, pay the support staff or pay allowances for staff undertaking outreach activities (Chuma *et al,* 2009). In addition, lower level facilities lacked the capacity to diagnose NCDs (which are anyway not covered under the waiver mechanism) and complicated CDs. Therefore the 10/20 policy did not quite cushion poor household against financial burden of health expenditure.

In early 2004, the government introduced a Social Health Insurance Bill intended to cover each citizen in comprehensive healthcare plan thereby shield households from catastrophic expenditures. The Bill proposed huge increases in the statutory health contributions. After much debate in and outside parliament the Bill was rejected.

In 2010, the government rolled out the Health Sector Services Fund (HSSF) marking yet another milestone in the healthcare reform history. HSSF aimed to disburse funds directly to lower level health facilities to enable them improve on services previously covered by user

fees. The program has not worked well and as mentioned earlier, lower level health facilities are financially handicapped. A summary of the policy reforms in health care financing since independence are outlined in Table 2.3.

Table 2.3: Health sector reforms in Kenya, 1965-2013

Period	Policy
1965	User fees introduced during the colonial period abolished in all public health facilities. Health services provided for free and funded primarily through general taxes.
1989	User fees re- introduced in all government health facilities.
1990	User fees suspended in all public health facilities.
1991	User fees re-introduced in 1991 in phases starting with hospitals going down to health centres and clinics. Children under 5 years of age were exempted from payment as were special conditions/services like immunization and tuberculosis.
2004	User fees abolished in dispensaries and health centres. A registration fee of KShs 10 and KShs 20 (10/20 policy) introduced. Children under 5, the poor, and special conditions/services such as malaria and tuberculosis exempted from payment.
2007	Delivery fees in health centres and dispensaries abolished but no funds allocated for this services by the national government. Provisions made for waivers and exemptions for the poor and vulnerable people as well as those suffering from chronic illnesses.
2010	The Health Sector Services Fund (HSSF) introduced to compensate facilities for lost revenues following removal of user fees. Dispensaries and health centres start receiving funds directly into their bank accounts from the treasury.
2010	Health service delivery (other than in referral hospitals) decentralized from the national to county governments as provided for in the 2010 Constitution.
2013	All fees for deliveries in public health facilities abolished and funds allocated in the health budget for the services.

Source: Chuma and Okungu, 2011, and Republic of Kenya, 2013

The government has not had any programme or health budget to address NCDs. As shown in Table 2.3, the health financing reforms in the country have traditionally concentrated on the prevention and control of communicable diseases. Subsequently, investments in the prevention and control of NCDs are low and programmes to address their risk factors are weak. The scourge of non-communicable diseases is on the rise and it might overwhelm the country in the near future.

Health insurance could shield households from the rising burden of health expenditures but as seen in section 2.4, health insurance schemes in Kenya do not adequately cater for long-term illnesses.

2.4 Health insurance in Kenya

Health insurance in Kenya is provided by both private and public entities. There are three types of private health insurance providers in Kenya:

(a) General insurance companies involved in a wide range of insurance policies but to a small extent insure people against ill health;

(b) Medical schemes by healthcare providers. Some clinics and hospitals offer premium care to clients even though the same services are open to non-premium customers at a fee;

(c) Third party medical schemes provided by healthcare facilities on behalf of employers. These are also known as health management organizations. (see Kimani *et al*, 2004 for more on medical insurance).

Private health insurance is expensive and only the wealthy urban population buys the premiums. Moreover, most private health insurance companies often reject NCD covers. The few that accept to cover such set premiums beyond the reach of many households. Consequently, people suffering from long-term illnesses are often not insured and have to depend on out-of-pocket expenditures for their healthcare. Most of them rely on public care which is cheaper but inefficient (Chuma and Okungu, 2011).

Public health insurance is offered by the National Hospital Insurance Fund (NHIF). The membership to the public insurance agency is mandatory for all workers in formal employment and voluntary for informal sector workers. NHIF only covers inpatient health care costs based on approved rates, while patients top up any fees above the NHIF cover using out-of-pocket payments. In addition, members meet their outpatient fees. Hence, the financial protection by NHIF is not comprehensive enough and quite inadequate for patients that seek healthcare in private, or in both private and public facilities (Kimani *et al*, 2004). It

is estimated that only 9.8 per cent of the population have some form of health insurance coverage. Of these, 7.1 per cent are members of the NHIF while the rest are covered by the other forms of schemes mentioned above (Republic of Kenya, 2009).

A relatively new form of insurance in Kenya is the Community-Based Health Insurance (CBHI). The first of such insurance scheme was established in 1999. However schemes have limited coverage (Kimani *et al,* 2012). According to the Kenya Community-Based Health Financing Association there were 38 Community-Based Health Financing schemes with 100,510 principal members and 470,550 insured beneficiaries by 2011. These schemes mainly operate in rural areas and are relatively small thereby undermining the potential for risk pooling and cross-subsidization (Chuma and Okungu, 2011).

2.5 Implications of cost-sharing to NCDs treatment in Kenya

The revenue generated through cost sharing has been growing steadily over time. This growth may reflect an improvement in revenue collection through changes such as computerization in hospitals, but it may also indicate fee increases. Higher costs for healthcare have negative implications for NCDs screening and treatment. The trend in revenue growth from cost-sharing is shown in Table 2.5 for the period 2007/08 to 2010/12.

Table 2.4: Growth in cost sharing revenue in Kenya (%)

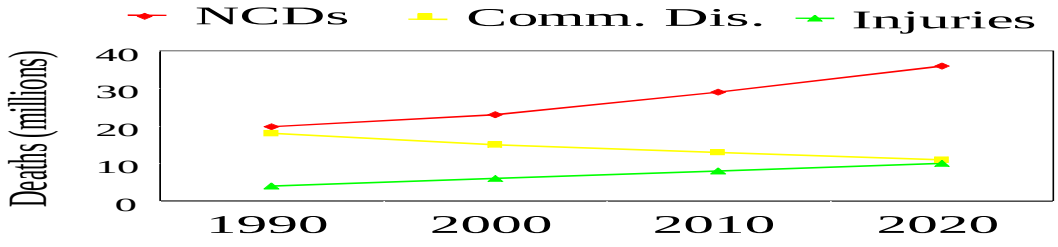
Financial year	**Total revenue (KShs Millions)**	**Growth rate (%)**
2007/08	1,572	
2008/09	1,800	14
2009/10	1,572	11
2010/11	1,800	14
2010/12	2,500	38

Source: Louma et al, 2010, and Republic of Kenya, 2012

2.6 Trends in communicable diseases and NCDs in Kenya

Over the past two centuries key shifts in medical technology have dramatically reduced the prevalence of communicable diseases (WHO, 2010). Nevertheless, communicable diseases account for 67 per cent of annual deaths in sub-Saharan Africa. In Kenya communicable diseases are claiming fewer lives today (see Figure 2.3) as a result of the improvements in living standards, access to healthcare and treatment, and high rates of immunization and vaccination (Kimani, 2012; Phillips-Howard *et al* , 2012). Mortality rates from non-communicable diseases are highest in developing countries contrary to the popularly held view that developed regions experience more deaths from NCDs with NCDs accounting for 32 per cent of the deaths in sub-Saharan Africa. The risk of dying from an NCD is highest in populations with wider youthful age structures such as is common in Africa (United nation, 2012). Figure 2.3 show the rising burden of NCDs in kenya compared to communicable diseases.

Figure 2.3: Trends in communicable and non – communicable diseases in developing countries



Source: Adopted from Songer, 2000

NCDs may be associated with bigger social, economic and financial burden than most communicable diseases since they are more expensive to manage. NCDs reduce productivity of patients and put them on drugs and treatment for a lifetime (Chadha *et al,* 1997). The

burden of the disease increase all the more when they cause death in the most productive age, or to bread winners pushing the dependants into poverty.

The trend of NCDs shown in figure 2.3 could be attributed to lifestyle change occasioned by urbanization and economic growth. As more households enter high and middle income levels, they become more exposed to the risks of developing NCDs. This is probably because they become more sedentary, eat more unhealthy foods that are unbalanced, and smoke and consume more alcohol.

There are misunderstandings relating to NCDs that probably contribute to their neglect in policies (Tawa *et al,* 2012). WHO (2005) global report dispels various notions and misconception relating to NCDs in an attempt to bring them into health agenda in developing economies. Some of the common misconceptions and the corresponding realities are presented in Table 2.6.

Table 2.5 Myths and realities of NCDs

Myth	**Reality**
Mainly affect high income countries.	Four out of five NCDs cases are in low and medium income countries (LMICs).
LMICs should concentrate efforts in the control of infectious diseases before NCDs.	LMICs are at the centre of both old and new CDs as well as NCDs, with NCDs presenting a big challenge.
NCDs primarily affect the old people.	Almost half of NCD deaths occur in people under 70 years and one quarter of all NCD deaths occur in people below 40 years.
NCDs mainly affect the rich.	Both the rich and the poor are likely patients of NCDs with equal likelihood to die from these diseases.
NCDs mainly affect men.	NCDs including heart disease affect both gender almost equally.
NCDs are the result of unhealthy lifestyles.	Individual responsibility can have its full effect only where individuals have equitable access to healthy life and are supported to make healthy choices.
NCDs are not preventable.	Eliminating the major risk factors of NCDs would prevent at least 80per cent of all cases.

Myth	Reality
NCDs prevention and control is too expensive.	A full range of NCDs prevention interventions are very cost effective for all regions of the world.
"My uncle smoked and was overweight and he lived to 100".	In any population there will be a certain number of people who do not demonstrate the typical patterns seen in the vast majority.
Everyone has to die of something.	Death does not have to be premature or triggered.

Source: WHO, 2005.

2.7 Response to NCDs in Kenya

The response to NCDs in the Kenya started receiving much attention around 2003. Before then it was felt that NCDs do not pose any major health threat in developing nations (Republic of Kenya 2011). The first major step in this direction was the signing of WHO's Resolution 53.17 of 2002 prioritizing the fight against NCDs. Within the year, Kenya set a desk at the Ministry of Health to assist in planning and marking world NCD days such as the World Tuberculosis Day, World Diabetes Day and Cancer Awareness Day, but no funds were allocated or program started to address treatment, prevention and control of NCDs (Maina, 2009).

In 2003 the desk actively discussed tobacco control and the treaty on tobacco that WHO passed in May 2003. Kenya signed and ratified the treaty on June 24th 2004 becoming the second country to sign and ratify the treaty (Republic of Kenya 2011). In 2004/05 the desk spearheaded the fight against NCDs at the Ministry of Health and teamed up with the National Tobacco Free Initiative to lobby for an Act of Parliament to control smoking. In 2006, the first Tobacco Bill was tabled in Parliament seeking to regulate tobacco use and trade. But key players in the industry intensively lobbied against the Bill, and it did not pass into law (Republic of Kenya, 2012).

In 2007 the Ministry of Health created a division of NCDs. However, the division was neither anchored in law nor included in the annual operating plans (AOPs) of the ministry. It received no budget allocation. In 2007/08 the division came up with its first AOP but it was not adopted by the ministry immediately. The AOP formed the basis for active advocacy on NCD risk factors, their control and regulation. In 2008/9 the ministry adopted the AOP and gave the division its first allocation of KShs 9 million.

Four programs, each with a technical working group, were set up in the division for the control and prevention of cancer, diabetes, injury, and tobacco and substance abuse. The working groups together formed the national forum on NCDs. The National Diabetes Summit was also established to spearhead discussions on prevention approaches to NCDs. The Summit set up the East African Convention[8] to offer a channel for sharing information and lobbying for funding among the East African partners. The efforts attracted donor interests, and in 2009 Kenya received a five-year grant of 1.3 million Euros to offer comprehensive care programs for diabetes in over 70 facilities (Ngugi *et al,* 2011). This was a big boost to diabetes and hypertension patients. This grant and the government subsidy on insulin saw the price of insulin fall from KShs 2,000 in 2007 to Kshs 500 in 2010 (Kimani, 2012).

Another milestone in the work of the division was reintroduction of the Tobacco Bill in Parliament in 2011. This time round it passed into law. Due to government interest and push by donors, the Tobacco Control Act came into force in the same year. The Act restricted smoking to designated areas and required warning messages on tobacco products. The Act also anchored the Division of NCDs prevention in law and mandated it to solicit for funds (Republic of Kenya, 2011).

8 Three conventions have been held to date: The National Diabetes Convention in Nairobi in 2010; the Diabetes Summit in Kampala Uganda in 2011; ant the Diabetes Summit in Arusha Tanzania 2011.

Further efforts geared towards fighting NCDs include the National Diabetes Strategy 2011, and the National Cancer Control Act 2012. The government has also rolled out the national clinical guidelines for diabetes, cancer and cardiovascular disease management, and a strategy on integrating NCDs care and treatment into other health services (Republic of Kenya, 2013).

In 2012, the ministry embarked on the development of the 3rd Kenya Health Sector Strategic and Investment Plan (KHSSP III). The plan has, as its goal, 'accelerating attainment of health impact goals' as defined in the Kenya Health Policy. The mission of this strategic plan is "to deliberately build progressive, responsive and sustainable technologically-driven, evidence-based and client-centred health system for accelerated attainment of highest standard of health to all Kenyans". KHSSP III has prioritized the fight against NCDs in its objective two and five. These strategic objectives are to "halt, and reverse rising burden on Non Communicable Conditions and minimize exposure to health risk factors". The health sector aims to attain these strategic objectives by focusing on the implementation of a broad based health and related services that impact on the health of Kenyans (Republic of Kenya, 2013).

The efforts in prevention and control of NCDs have come a long way in Kenya, but much more is needed to curtail the ever raising prevalence of these diseases.

CHAPTER THREE

3.0 LITERATURE REVIEW

3.1 Introduction

Over the past years, there have been attempts to analyse the effect of ill-health on household welfare, income and productivity. However many empirical studies (*see* section 3.3) in developing countries have mostly focused on the impact of infectious disease on individuals and household. This has led to few empirical studies relating to the impact of non-communicable disease on household welfare and income, as well as the effects of health expenditures on NCDs on households. The case is however different in developed countries where there is high interest on studies related to NCDs as shown by availability of studies on impact of NCDs both at the national, household and individual levels. This chapter reviews literature on NCDs from developed and developing countries. Section 3.2 presents theoretical literature while Section 3.3 present a review of empirical literature on effects of NCDs on household income, vulnerability due to NCD risk among households and risk factors to NCDs. Section 3.4 present literature overview.

3.2 Theoretical literature

This section describes various theories, approaches and models which could be used to analyse health care access and utilization, and their effects on individuals and households.

Human capital theory

The human capital theory explains human behaviour from an economic perspective. It posits that human behaviour is driven by a desire to have tangible and intangible goods. Skills, health and education are some examples of intangible goods. Individuals invest in health and training to increase their life value (Becker, 1962).

Becker (1962) investigated the incentive of firms and workers to invest in human capital development such as in training, education and health. The study concluded that in the human capital theory, optimal investments in human capital are made during young age. Though this may lower earnings due to direct costs and opportunity cost of work, the investment increase net earnings in future since good health raise worker's productivity.

Grossman (1972), presents a new theory based on human capital theory that treats medical care as endogenous. The model explains that individuals invest in health stock through utilization of medical care services. Using a typical demand function, Grossman shows that each individual ranks various combinations of goods and services that give him utility. The individual is assumed to maximize utility subject to various constrains, among them income. Thus, when an individual invests in stock of knowledge he knows that his productivity and incomes will rise in future. With the high incomes the individual will then be able to buy more goods and services that give him higher utility. Grossman (2004) further argues improvements in health not only raise an individual's productivity but also affect markets and household productivity. He concludes that health is demanded as a consumption commodity that yields utility, and as an investment commodity that increases productivity, since good health increases the time allocated for production by individual and household, and it also save time lost by care givers.

Human capital theory is useful in the analysis of individual behaviour of demand and investment. It has been used to analyse addiction as a consistent plan to maximize utility over time by Becker and Murphy (1988). It has also been used to analyse the role of family in the demand for health care by Bolin *et al, (*2002). The family model accounts for interactions between people in a household, and the roles they play in production of own and household health. The theory argues that although a family structure may change over a life cycle, the

individuals that a person lives with influence his choice and behaviour. Therefore, own income and a family's joint resources determine an individual's health production function.

Social capital theory

Social capital theory was developed by Portes in 1998. It is as an analogue of the human capital theory applied in a social setting. It is anchored on the fact that human beings do not live in isolation but in social structures that consist of family and friends. These social structures lead to organizations such as churches, recreational groups and political outfits that give some satisfaction to the individual. Through these social organizations, individuals exchange information, provide support to each other (e.g, resource pooling), and work together to achieve goals deemed beneficial to all members.

Macinko and Starfield (2001) used the social capital theory to evaluate the link between health outcomes and social economic status. They found that health outcomes are strongly correlated to the scale of income inequality in society, and not to the levels of absolute incomes. Their findings further show that health status is not determined by material deprivation but by social inequality.

The Health Belief Model

The health belief model was developed in the 1950's by a group of psychologists as a conceptual framework to study the failure of individuals to adapt disease preventive measures such as screening and vaccination. The model is based on the psychological theory that argues that human behaviour depends largely upon an individual's estimation of the likelihood of achieving a goal, and the value he places on the goal.

Janz and Becker (1984) reviewed some empirical literature relating to the application of the health belief model to a variety of preventive measures such as screening for breast cancer

and genetic disorders, and vaccination found large support for the model. Though limited to attitudes and beliefs the model is, nevertheless, appropriate in explaining an individual's health behaviour. This model focuses on four main aspects:

(i)Perceived susceptibility: This is a subjective perception and view of an individual's risk of developing a disease. The view stems from the notion that people's feelings of vulnerability to a situation, including ill-health, vary widely. This view has been redefined in medical considerations to include assessments of beliefs and susceptibility relating to illness and health risks in general. (ii) Perceived severity: This is the individual's feeling and ability to assess the seriousness or severity of developing a disease, or leaving it untreated. Individuals consider the pain, disability or death from a disease. They also consider social concerns such as family life and social relationships, and the effect of the disease on productivity. (iii) Perceived benefits: Although the recognition of an individual's susceptibility to a certain condition perceived to be severe is linked to a force that leads to behaviour, it does not give any defined course of action that the individual is likely to take. The course of action is hypothesized to depend on an individual's beliefs concerning the effectiveness of the various measures that are feasible in the reduction of illness, and the associated threat. Therefore, an individual who is "sufficiently threatened" can be expected to adopt health recommended actions, unless the individual perceives those actions as unfeasible or not efficacious. (iv) Perceived barriers: These are the aspects that lead an individual to avoid recommended behaviours or actions. If a certain aspect of health has some potential negative effects, it may hinder adoption of recommended actions. These barriers are assumed to lead to some cost-benefit analysis that assists individuals in weighing the effectiveness of some recommended health actions. The health actions are further analysed on cost, risk (e.g, adverse effects), spite (e.g, painful) and time consumption.

Approaches to intra-household interactions

The unitary household model was developed by Becker (1965). It is an important tool in understanding decision-making within households. The model is also referred to as the 'Benevolent Dictator' model, or the 'common preferences' model. It is also known as the ‘altruism’ model in some literature. The model characterizes household behaviour by one household welfare function that consists of the sum of all household members’ preferences. Maximizing the utility function subject to the appropriate household budget constraints gives rise to demand functions for goods consumed by the household, including leisure. The assumption of one household welfare function representing the preferences of all household members has been criticised as incompatible with individual choices of household members. It aggregates different preferences.

Pitt, Rosenzweig and Hassan (1990) find merit in the unitary household model because of its ability to explain two important aspects of household behaviour - apportionment of goods among individual household members, and decisions relating to the quantity of goods consumed by the household in totality. The model also finds favour with Lundberg and Pollak, (1996). They argue that the model assumes rational behaviour and does not imply prejudice in the household.

Chiappori (1992) and Apps and Rees (1997) argue that the unitary model is not based on individualism. Individualism is central to micro-economics. Decisions relating to choices should be determined by individuals themselves rather than by groups even where the group members share preferences collectively. Due to this shortcoming new models have been developed based on cooperative and non-cooperative approaches. These new models take into account individual decision-making. The foremost in the new models is the “collective” household model pioneered by Chiappori (1988, 1992). The model also goes by the name

"bargaining model", a name derived from game theory. It assumes that only intra-household decisions are Pareto-efficient.

Collective household models can be classified into two broad categories - cooperative and non-cooperative. Under the first classification, the unitary household model is a special case of the more general class of cooperative models (Chiappori *et al,* 1993). In the non-cooperative household models, it is hypothesized that individuals cannot enter into biding and enforceable agreements with each other. Hence, individual choices and actions are determined by other individuals' choices. This notion has kept the unitary model relevant in economic analysis (see Ulph (1988), Lundberg and Pollack (1992) and Katz (1992

In the cooperative household models, it is assumed that individuals make the choice to cooperate with others so as to make a unitary household. They cooperate when the utility levels related to a unitary household overshadow the utility from a disunited entity. Collective models hypothesize that a household's decision-making results in Pareto efficient outcomes. Individual preferences are assumed to be based on utility functions of individual household members and not pooled. Cooperative models view household decision-making in reference to each household member's bargaining power.

Approaches to assessing catastrophic expenditure in a household

Berki (1986) pioneered the work on catastrophic health expenditures. Since then various definitions of catastrophic health expenditure have come up. An expenditure on medical care becomes financially catastrophic when it endangers the family's ability to maintain its customary standard of living (Berki 1986). When health care costs and expenditures are too large they may constitute large portion of a household's budget. This may in turn affect the consumption of other household goods and services. Berki's approach therefore relates to the opportunity cost of health expenditure. However, there is no scientific consensus on what

proportion constitutes catastrophic. Berki, (1986), Waters *et al*, (2004) and Xu *et al*, (2003) estimate anything above 40, 10 and 30 per cent, respectively, of a household's ability to pay as catastrophic.

There are two major approaches related to the measurement of catastrophic health expenditure in the literature. The first approach considers OOP that exceeds some fraction of household income, total expenditure or capacity to pay in a given period, usually one year (Van Doorslaer et al, 2007). A household's capacity to pay is measured as the remaining income after basic subsistence needs have been met, or the combined survival income for all household members less the household's consumption spending.

Berki, (1986), assumed that households experience catastrophic expenditures when their health expenditure exceeds 40 percent of the household's capacity to pay. Florens *et al*, *(*2008) criticize this approach arguing it ignores the likely variations in the capacity of households to cope with health care costs such as savings, assets, credit, transfers and loans.

The second approach states that catastrophic health expenditure occurs when health expenditure exceeds some fraction of a household's annual income or total expenditure. Van Doorslaer *et al* (2007) focused on payments that severely disrupt a household living standard as catastrophic using 30 percent of the household ability to pay. Such payments absorb a large fraction of household resources. Wyszewianski (1987) considers healthcare expenditure in the region of $10,000 annually to be catastrophic.

Wagstaff and Van Doorslaer (2003) observe that the ethical position on how to measure catastrophic expenditure is that no one ought to spend more than a given fraction of income on health care. They recommend their approach to researchers interested in showing associations between the state of poverty and the state of health catastrophic expenditure in

the absence of health insurance. They conclude that high health expenditures on health care can erode a household's living standards.

Chollet and Betley (1987) go further to define catastrophic exposure. This is a situation where health expenditure exceeds a household's disposable income, or is beyond non-insurable risk threshold. Stiglith (1988) finds it subjective to try assigning numerical values in defining catastrophic risks arguing that the fundamentals differ with countries.

Household Vulnerability to poverty in the face of NCDs

In developing countries, about 54 per cent of healthcare financing is by households through out-of-pocket expenses. Government financing is low at only 20 to 35 per cent of total health budget. Medical insurance covers less than 10 per cent of the population, and mostly through employers (Republic of Kenya, 2010 a).

NCDs are associated with financial burden of medical bills which soar in case a patient has to seek advanced treatment abroad. The diseases entail life-long usage of expensive drugs (Murray and Lopez, 1996). The burden is also seen in lost production and time spent in care. Women bear a bigger burden as care-givers for they forego income. Healthcare has an opportunity cost (Russell, 1996).

The burden of NCDs pushes poor households deeper into poverty. The situation is aggravated if the illness results in the death of a productive member of a family. Households will ordinarily have to pay for care and treatment costs even if the patient dies while undergoing treatment as Mahel *et al* (2005) found in India. The lost income reduces a household's purchasing power for other goods and services catalyzing poverty (Abegunde *et al*, 2007). Ghaffar *et al*, (2004) shows those households in lower income levels have little or nothing to spend on healthcare. They risk sliding deeper into poverty when exposed to NCDs.

In principal, no one should be pushed into poverty or further into poverty by healthcare expenses. Wagstaff (2008) argues that impoverishment captures how far people are pushed below the poverty line as a result of health care costs. It also measures the probability that health spending can push poor households deeper into poverty. The study concludes that besides estimating the likelihood of catastrophic spending, it is important to go beyond and assess the likelihood of households becoming impoverished by health care and treatment costs.

Households bearing the burden of NCDs experience welfare loss that varies with severity of the disease. Poor households may experience food insecurity and low education attainments when NCDs strike. Some households liquidate precious assets such as land to meet medical bills. Berki (1986) finds a positive relationship between health care costs and prevalence of catastrophic spending.

Governments may not be fully aware of the damage that NCDs inflict on households. Subsequently, mitigating interventions are inadequate in most countries as observed by Flores *et al,* (2008) and Xu *et al,* (2003). Governments need to put in place policies to cushion households from the adverse effects of NCDs as recommended by Su *et al,* (2006). Abegunde *et al,* (2007) warn that if this is not done billions of GDP will be lost from heart diseases and diabetes in growing economies.

Prevalence of NCDs and risk factors

In the second half of the 20th century, big milestones were achieved in healthcare provision globally (WHO 2008). Nguyen *et al,* (2011) argue that with progress in industrialization and urbanization the incidence and mortality from communicable diseases and poor nutrition are declining. However, the in the same period NCDs have been on the rising more so in developing countries posing a challenge in health programming (Murray and Lopez, 1996).

There are predictions that NCDs will continue to rise in the coming years causing at least 9 million deaths every year among people aged below 60 years in sub-Saharan Africa (Mbanya, 2010). Gaziano (2005) finds that at least 21 million productive years are lost due to Cardio-vascular diseases (CVD) within sub-Saharan countries. Alberti *et al,* (2006) project that Diabetes Mellitus (DM) will double by 2025. NCDs account for 23 per cent of ailment-related deaths in African economies (Meusel, 2008). According to a WHO (2005) study, seven out of every ten deaths in poor nations will be as a result of NCDs by 2020. The death toll from NCDs in Africa will be higher than from communicable diseases in future.

Olshansky and Ault (1986) and Bonita *et al,* (2001) indicate that more individuals, populations and communities are adopting unhealthy lifestyles that promote the development of NCDs. As households become better endowed financially they become more exposed to NCDs. WHO (2002a) projects that deaths caused by NCDs will rise by 77 per cent between 1990 and 2020 on account of urbanization and life style changes in developing countries. Abegunde *et al,* (2007) links NCDs prevalence to low physical activity and low vegetable intake.

Various social-economic factors such as poor diets, excessive alcohol consumption and cigarette smoking are additional risk factors. Addictions to tobacco and alcohol are on the rise contributing to high prevalence of NCDs in developing nations (Omran, 1971).

Unwin *et al,* (1999) and Alberts *et al,* (2005) attribute the rise in NCDs to low incomes and poor nutrition. Food rich in saturated fats, salt and calories is unhealthy. Elgoni *et al* (2008) links hypertension to high salt intake. The disease is known to cause at least 59 per cent of CVDs deaths in poor countries (Dennison *et al,* 2007).

Lack of physical activity compounds the dangers of unhealthy diets. It encourages cholesterol in the blood. Cardiovascular deaths are associated with rising blood glucose. While increased

consumption of tobacco and alcohol products is associated with High Blood Pressure (BP) (Unwin *et al,* 1999). These are lifestyle behaviours that may explain the increase in the prevalence of NCDs. WHO (2002) and Boutayeb (2006) note that these risk factors together explain close to 95 per cent of NCDs prevalence. Socio-demographic factors such as gender, age, ethnicity, level of education and work status are also thought to contribute to NCDs. Unfortunately, they are outside the control of an individual.

Boutayeb and Boutayeb (2005) argue that NCD risk factors are country specific and vary in form and presentation. Unwin (2006), Yusuf *et al,* (2004) and Gupta *et al,* (2006) show that major NCDs operate through a cluster of common risk factors. For instance, poverty predisposes individuals to chronic NCDs (Hussain *et al,* 2005, Rugg, 2008). An underweight born child is likely to develop an NCD later in life (Barker, 2004). Harding (2001) observes that poor nutrition of a mother during foetal development leads to the born child developing an NCD later in life.

Reyes (2005) and Tawa *et al,* (2011) argue that there is a link between urbanization, globalization and the prevalence of NCDs through lifestyle changes. Diabetes and hypertension are more prevalent in urban of Africa. Urban areas are characterized by rising cases of obesity, sedentary lifestyles and poor dietary habits (Gill and Cooper, 2008; Steyn *et al,* 1997; Fox, 2010; Moodley and Rambiritch, 2007) all of which encourage NCDs. Puoane *et al,* (2005) find obesity to be the top trigger of most NCDs. Norman *et al,* (2007) argues that cultural perceptions that portray overweight women as attractive or of higher social status play a role in the spread of NCDs in Africa.

Social interactions and NCDs

It is important to analyse individual behaviour and characteristics in reference to the behaviour and characteristics of the group that the individuals interacts with (Becker, 1974).

This is the notion of social interactions. Although social interactions are considered in sociological and anthropological studies and economic literature of early nineteenth century, they are largely ignored in modern economic analysis. Becker (1974) concludes that failure to account for social interactions when, say, estimating production or consumption functions leads to biased results.

Social interactions occur whenever an individual or a household in a group or neighbourhood affects other households' choices directly without the intermediation of the market. This manifests social effects on the members of the group or neighbourhood (Hartmann *et al*, 2008). NCDs risk factors are acquired or enhanced in a group context. Caudill and Kong (2001), Larsen *et al.* (2009) and Quigley and Collins (1999), show that individuals increase alcohol consumption when they keep company of heavy drinkers. Engels and Knibbe (2000) highlight that alcohol and tobacco smoking give social identity, and a sense of belonging to and connecting to friends and peers. Sun and Green (2003) concur and argue that alcohol consumption and smoking are social in nature, and people generally consider other people's drinking patterns and behaviours in determining their own consumption levels. Galea *et al.* (2007) observes that neighbourhoods with a high median income experience a higher likelihood of marijuana and alcohol consumption but not cigarette smoking due to peer effects. These cases suggest that social interactions with peers or neighbours affect an individual's or a household's decision-making.

Harakeh *et al,* (2007) examine whether cigarette smokers are influenced by their social networks. Results show that smokers are likely to smoke and continue smoking in social settings that they consider to be warm and friendly. Many are the times when individuals impulsively mimic the behavior of role models without recognizing that they are so doing (Van Baaren, 2003). This is a form of social interaction mediated through observation.

Eating food together plays a social role in our lives. The quantity of food consumed is related to the social environment within which it is eaten (Hermans *et al*, 2009). If this social influence is not controlled for in modelling human behaviour, the estimated parameters become biased. Dijksterhuis (2005) observes that failure to take into account social interactions is to ignore the social glue that makes people social animals. De Waal (2001) concludes that social interactions are the primary force behind modelling. Modelling is a desire to be like others and to belong to groups.

A household's exposure to NCD risk factors could be influenced by decisions taken by others in a social network. Social networks are made up of individuals or households with strong ties and likelihood of exchanging information with each other, these include relatives, friends and neighbours.(Foster and Rosenzweig (1995).

Bandura (1977, 1986) concludes that social interactions play a role in the development and maintenance of addictive behaviors such as cigarette smoking and consumption of alcohol, and that they merit consideration.

Although social interactions influence decision-making at individual and household levels, empirical literature is scant (Gathiaka, 2010). Many empirical studies (e.g, Reddy, 2003 and Elgoni *et al*, 2008) fail to account for social interactions when estimating health production and demand functions. Bonita *et al*, (2001), Gill and Cooper (2008), Fox (2010), and Tawa *et al*, (2011), fail to account for the effect of social interactions on NCD prevalence. The failure leads to biased parameter estimates (Kimenyi *et al*, 2006).

3.3 Empirical literature

Effects of NCDS on household income

Households are increasingly bearing the burden of NCDs without the benefit of insurance or support from employers. In India, for example, Townsend (1995) and Gertler and Gruber (2002) find that formal organizations take only a small portion of the risks associated with NCDs. Subsequently, households bear the social and financial burden of non-communicable diseases. The studies conclude that the burden is substantial when the disease becomes long-term, and households are forced to set aside a budget to cater for health care costs. In some situations, healthcare and treatment costs rise beyond what households can afford[9] forcing them to give up consumption of some basic goods. This is referred to as catastrophic spending (Xu *et al*, 2003; Wagstaf and van Doorslaer, 2003).

Garg (1998), O'Donnell *et al*, (2005) and Fun and Zick (2005) find that in Asia and other developing economies, households often slide into poverty when health costs escalate. Health costs reduce a household's disposable income due to lost earnings and low productivity.

In India, Suhrcke *et al*, (2006), Pradhan (2002) and Narayanan *et al*, (2000) observe that households carry a bigger burden when faced with chronic ailments. The studies show that at least 25 per cent of people hospitalized from chronic diseases end up poorer, with some incurring huge debts (Peters *et al.* 2002). Loan defaults are highest among people relying on out-of-pocket to pay their healthcare bills (WHO, 2006).

Catastrophic Spending in Healthcare

[9] This is referred to as catastrophic spending by Wagstaf and van Doorslaer, 2003

Pradhan and Prescott's (2002) simulation analysis of catastrophic risks among households in Indonesia confirms catastrophic spending among households. From an examination of household survey data for 59 countries Asia, Xu *et al*, (2003) finds that any spending on healthcare in a household that exceeds 30-40 per cent of a family's income is catastrophic.

In Kenya, healthcare costs are relatively high and many families incur debts to finance healthcare (Republic of Kenya, 2009). At times children are withdrawn from school so that households can pay for healthcare costs using schools fees. Parents are also known to withdraw children from school to attend ailing household members. A similar trend is observed in Uganda where teenage youth in families affected by HIV/AIDS terminate schooling prematurely in order to raise money to meet healthcare costs (Asingwire, 2000). This highlights the devastating effects of health care costs to household survival and living standards in East Africa.

In India, Nugent (2008) finds that the main source of healthcare finance in a household in the event of a chronic disease is savings. Savings account for 40-50 per cent of the total healthcare expenditure in households experiencing a chronic disease. Financial assistance from friends and relatives contribute 10-15 per cent. The study further finds that families in India also borrow loans and sell off assets to finance NCDs care and treatment. Poor households here find it hard to raise funds to meet healthcare costs.

In developing countries, the cost of NCD drugs accounts for about 50 per cent of OOP expenditure on healthcare. Furthermore, the drugs are not readily accessible (Garg and Karan, 2009). In Kenya he proportion of OOP expenditure is higher for diabetes and hypertension at 58 and 64 per cent, respectively. While consultation fees range between 5 and 12 per cent of total spending on healthcare (Maina, 2009).

Health insurance could cushion households from catastrophic health spending (Knaul *et al,* 2006; Lamiraud *et al,* 2005; Limwattananon *et al,* 2007). Ever since Popul Health Insurance scheme was introduced in Mexico in 2001 the incidence of catastrophic health spending has dropped significantly (Gakidou *et al,* 2006). The same happened in Thailand after the introduction of universal health care scheme in 2003 (Limwattananon *et al,* 2007). However Mahal, et al, 2010 found that, an ordinary household in India becomes vulnerable to poverty in case of an NCD attack, this was explained by low government subsidies coupled with low coverage of health insurance for poor households.

3.4 Overview of the reviewed literature

The reviewed literature relates to effects of NCDS on household income, vulnerability to poverty due to NCDs, prevalence and NCD risk factors. The survey shows that economic effects of ill health contrast widely depending on the type of illness and household characteristics (Mahal *et al ,* 2005; Wagstaf and van Doorslaer, 2003; Kioko, 2008). The welfare loss arising from the presence of an NCD in a household is greater compared to the loss arising from a communicable disease (Garg, 1998; Fun and Zick, 2005). NCDs have a substantial effect on individual and household income. They reduce individual as well as household productivity leading to loss of output and income (Mahel *et al,* 2005, Tawa *et al,* 2011).

Assessments of catastrophic health expenditures show the impact of these costs on poor households. However, they are arbitrary and they set different thresholds in defining catastrophic expenditure. While some studies consider the share of OOP expenditure in a household, others measure the incidence and extent of OOP health spending across countries of different economic status (see Wagstaff and van Doorslaer (2003) and Xu *et al,* (2006) for Vietnam; Mendola *et al,* (2007) for Western Balkans; Saksena *et al,* (2006) and Xu *et al ,*

(2006) for Kenya; Cavagnero *et al* , 2006) for Argentina; O'Donnel *et al,* (2005) for Asia; van Doorslair *et al,* (2007) for Asia; and, Lee (2011) for Korea). Others evaluate both actual and potential incidence of catastrophic spending (see Saksena *et al,* (2006). Saksena *et al,* (2006) brings out the difference between households that seek healthcare and those that do not. These studies conclude that catastrophic health expenditures increase the likelihood of a household to slide into poverty.

The studies fail to show to what extent catastrophic spending causes financial hardships to households. One household may spend heavily on healthcare but not slide into poverty, while another household is thrown into poverty by a small healthcare expense. There is a gap in the literature on the pressure put on households by healthcare spending, especially spending on NCDs. The gap hinders a clear understanding of the effects of NCDs on households.

Available literature mainly relates to high income countries (O'Donnell *et al,* 2005, 2008; Feenberg and Skinner, 1994; Waters, 2004) and does not give indication on the potential or effect of NCDs on household incomes in poor countries. This is a shortcoming in view of the wide difference between household structures in high and low income countries. As a result, there is little evidence on the impact of NCDs on household incomes in poor countries.

The literature shows that catastrophic health expenditures increase the likelihood of individuals to sell their assets including physical capital to pay for health care costs (Xu, *et al,* 2003 and Mahal *et al,* 2010). This leads to impoverishment. Even though reviewed studies have attempted to assess the effects of catastrophic expenditures on households (Van Doorslaer *et al,* 2007; Saksena *et al,* 2006), there is no empirical evidence linking catastrophic expenses to household poverty. Theoretically, catastrophic health care costs can

lead to poverty reduction if the patient regains in productivity after treatment. If the income[10] gain after treatment is higher than the health care cost incurred, the individual or household may experience a reduction in poverty (Tawa *et al,* 20011). However, in case of a NCDs full health and productivity are not restored even after treatment.

NCDs care and treatment consume financial resources over a long period of time. This threatens individual and household economic survival. The effects of these diseases should be evaluated separately from communicable diseases, but available literature has failed to do so.

The literature has highlighted various behavioural and economic risk factors to NCDs (Dennison *et al,* 2007; Gill and Cooper, 2008; Bonita *et al,* 2001; Fox, 2010). They include low fruit intake, high alcohol, cigarette smoking, salt and fat intake, low physical activity, age, genetic factors, overweight, gender, ethnicity, level of education and work status (Elgoni *et al,* 2008; Moodley and Rambiritch, 2007; and Norman *et al,* 2007). However, evidence on the African context is lacking, particularly from Kenya.

Studies on risk factors for specific NCDs in low income developing countries such as Vietnam, Indonesia, Bangladesh, Zambia and Malawi (Pampel, 2005; Ng *et al* , 2006; and Zaman *et al* , 2001) do not have any concrete list of NCDs risk factors that could be addressed in a policy to deal with the diseases. Nevertheless, they highlight the need to evaluate country specific prevalence of various risk factors to NCDs.

Social interactions have been shown to be important in individual and household decision-making as they influence choices. Adam Smith recognized passions in economic behaviour but down-played their role arguing that the greater part of men is not frequently under the influence of such interactions (Smith, 1937). Veblen argued that "social interactions are the

[10] After treatment income is expected to increase due to increased productivity on account of restored health.

very stuff of life that dominates everything else" (Veblen, 1934). Therefore, in understanding the risk and mitigating factors in the spread of NCDs there is need to assess the role of social interactions. Available literature does not seem to pay attention to this aspect.

This thesis is an attempt to fill some of the identified gaps by exploring the economic effects of NCDs, and the risk factors in Kenya controlling for social interactions. The information herein has important policy implications.

CHAPTER FOUR

4.0 METHODOLOGY

4.1 Theoretical models

According to the unitary household model of consumer behaviour, the household is assumed to behave as if it maximizes a single price-independent social utility function subject to a family budget constraint (Becker, 1965). Household choices are determined jointly implying household members have identical preferences, or that within a household there is a single decision maker who makes choices for the entire household. The choices maximize utility of all the household members and satisfy the Beckerian notion of caring (Becker, 1974).

Household members whose characteristics are given by h are assumed to derive utility from the consumption of goods c .Total household income Y is the sum of incomes earned by each household member (labour income, $l_i w_i$ and non-labour income, y_i), and the income earned by the household members jointly, y_j, (Becker, 1974). Hence a household with members $i \in \{1, 2...n\}$ is faced with the following utility maximization problem:

$$MaxU = \tilde{u}(c,h) \quad \text{subject to} \qquad Y = \sum_{i=1}^{n} l_i w_i + \sum_{i=1}^{n} y_i + y_j \qquad (1)$$

Labour income $l_i w_i$ consists of wages and salaries. Non-labour income y_i includes rent, dividends, interest, inheritance, lottery prizes, investment income, spouse's income and transfer payments[11]. Assuming income is pooled and individual members in a household have identical preferences, the solution to this utility maximization problem yields the household

[11] These are payments from government to individuals including age and retirement benefits, disability insurance and other welfare benefits.

consumption function in terms of price, *p*, total household income, Y , and household characteristics, h, as shown in equation 2.

$$c_1 = f(p, Y, h) \qquad (2)$$

Due to the shortcoming of the unitary model as argued by Chiappori (1992) and Apps and Rees (1997) collective household models have been developed. Assume that the utility function of individual household member is given by $U^i = \tilde{u}^i(c^1, c^2 ... c^n, h)$ where c^s (s = 1, 2...n), and h represents individual consumption function and household characteristics, respectively. Pareto efficiency for a household with s members is found by solving the following maximization problem:

$$\begin{aligned} MaxW &= W[\tilde{u}^1(c^1, c^2 ..., c^n, h) \ ..., \ \tilde{u}^n(c^1, c^2 ..., c^n, h)] \\ &\text{or} \\ MaxW &= W[\tilde{u}^1 ..., \ \tilde{u}^n] \end{aligned} \qquad (3)$$

W[·] is a price-dependent household aggregate utility function, and the maximization is subject to the household budget constraint. The budget constraint is an increasing function of utility of each household member, $\tilde{u}^1$ to $\tilde{u}^n$. The solution to the maximization problem is a marshallian demand function for each household member. The covariates of the demand function are price, joint and individual income, and household characteristics.

4.2 Empirical models

4.2.1 Household welfare models

Following Gravelle and Rees (2004) on duality, household demand or consumption decision can be expressed in terms of expenditure or cost function that specifies the money needed by a household to maximize its utility. Assuming that the influence of household characteristics on income is the same across all households, then household income is a function of a vector

of household characteristics (h) such as age, household size, and gender of the household head. It is also determined by the epidemiological environment of the household. This last factor can be represented by prevalence of NCDs (ncd) or sickness (S).

This study assumed that changes in household income are accounted for by its characteristics, the epidemiological environment, and institutional factors such as education. Institutional effects may alter household productivity or its behaviour towards prevention and treatment of an illness. Following Kioko (2008), Mwabu (2007, 2009), Wooldridge (1997, 2002) and in line with Laxmanayan (2004) with appropriate modifications, this study examined the effect of NCDs on household income. Equation 4 assesses the effect of sickness (S) on household income.

$$\ln Y = a_1 S + \sum_{j=2}^{n} a_j h_j + £_1 \quad (4)$$

$$s = \sum_{i=1}^{n} b_i h_i + £_2 \quad (5)$$

Where lnY is log of household income, s is sickness variable that captures the presence of a disease in a household regardless of type, and h_j is a vector of exogenous variables. h_i is a vector of exogenous variables consisting of instrumental variables that affect sickness, but have no significant effect on household income. h_i are covariates belonging to the income equation 4. a_1, a_j and b_i are parameters to be estimated while $£_1$ and $£_2$ are the disturbance terms. The model is estimated using data of healthy people, and people suffering from communicable and non-communicable diseases.

The study also estimated an income equation using two sub-samples. The first sub-sample consisted of households with healthy individuals and individuals with an NCD. The second sub-sample comprised of households with people suffering from a communicable and a NCDs. The essence of having these two sub-samples was to determine whether the effects of

the two disease types differ significantly across households. Equation 6 captures the differences.

$$\ln Y = c_1 ncd + \sum_{j=2}^{n} c_j z_j + £_a \quad (6)$$

$$ncd = \sum_{i=1}^{n} d_i z_i + £_b \quad (7)$$

Where lnY is the log of household income as defined earlier, *ncd* is a variable for epidemiological environment (presence of a non- communicable disease), z_j is a vector of exogenous variables, z_i is a vector of exogenous variables that are instrumental for NCDs. Z_i are covariates belonging to the income equation. c_1, c_i and d_i are parameters to be estimated, and $£_a$ and $£_b$ are the disturbance terms. In equations 4, 5, 6 and 7 we assume that there is only one endogenous explanatory variable in either equation which captures the epidemiological environment[12] of a household.

4.2.2 Household catastrophic spending and impoverishment models

This study adopted the methodology of Mahal *et al,* (2010) and Xu *et al,* (2003) to estimate the contribution of NCDs to catastrophic expenditure. Catastrophic spending occurs when health expenditure exceeds a household's ability to pay. Ability to pay is defined as household consumption spending less combined survival income for all household members. Equation 8 is an expression for catastrophic expenditure.

$$M_j = \frac{th_j}{T_{cj} - n_j p} \quad (8)$$

[12] Captured by presence of Sickness or NCD variable in the estimable models

Where M_j is the proportion of health spending to total household consumption less combined survival income for all household members. An M_j above 30 per cent[13] indicates catastrophic spending. The numerator th_j is the total health spending for household j. In the denominator, T_{cj} is total household consumption, n is household size and p is a poverty line indicator.

The study also assessed the extent to which NCD presence affects the probability of a household to incur catastrophic expenditure. Equation 9 estimates this relationship. A policy variable proxied by household acquisition of a health insurance is included in the model. An insured household has a lower probability of incurring a catastrophic expenditure in the event of an NCD. The estimable model for catastrophic spending is expressed as;

$$c_{sj} = \sim_0 + \sim_i ncd_j + \quad ins_j + \mathrm{a}_j h_j + \mathrm{3}_j \qquad (9)$$

Where c_{sj} is a dummy variable taking the value of 1 for households that have incurred catastrophic spending. ncd_j is a dummy variable for presence of an NCD, ins_j is a dummy variable of whether a household has acquired a health insurance policy, h_j is a vector of household characteristics, and α_i, β and λ, are parameters to be estimated. υ_j is the disturbance term.

The study investigated whether health spending on NCDs impoverishes households. Equations 10 and 11 establish this relationship.

[13] This threshold have been used in this study for comparative reason with other studies done in developing countries such as Mahel *et al* 2010, Maina and Chuma 2012. This threshold also relate to the definition of poverty which uses a 30% threshold of food consumption beyond which a household is classified as poor (Laura and Mabli 2010).

$$^{pc}T_{sj} = \frac{T_{sj}}{n_j} \quad (10)$$

$$^{npc}T_{sj} = \frac{T_{sj} - h_j}{n_j} \quad (11)$$

Where $^{pc}T_{sj}$, T_{sj} , and $^{npc}T_{sj}$ are per capita household spending, total household spending, and net per capita household spending, respectively. h_j is health spending and n_j is household size.

Household health expenses will be considered impoverishing if the gross household per capita spending exceeds household poverty line[14] level of expenditure and net household per capita spending[15] is less than the household poverty level of expenditure.

Equation 12 estimates household impoverishment due to NCDs. Health insurance variable is included as an institution factor that could reduce household risk of impoverishment.

$$I_{sj} = \sim_0 + \sim_1 ncd_j + ins_j + \mathrm{a}_j h_j + \mathrm{3}_j \quad (12)$$

Where I_{sj} is a dummy variable indicative of whether a household experienced impoverishment; ncd_{ij} is a dummy variable indicating catastrophic spending (above the 30% threshold) due to an NCD in a household; ins is the insurance dummy, and h_j are other

[14] Household size multiplied by one dollar per day (one dollar per day was used to define the poverty line).

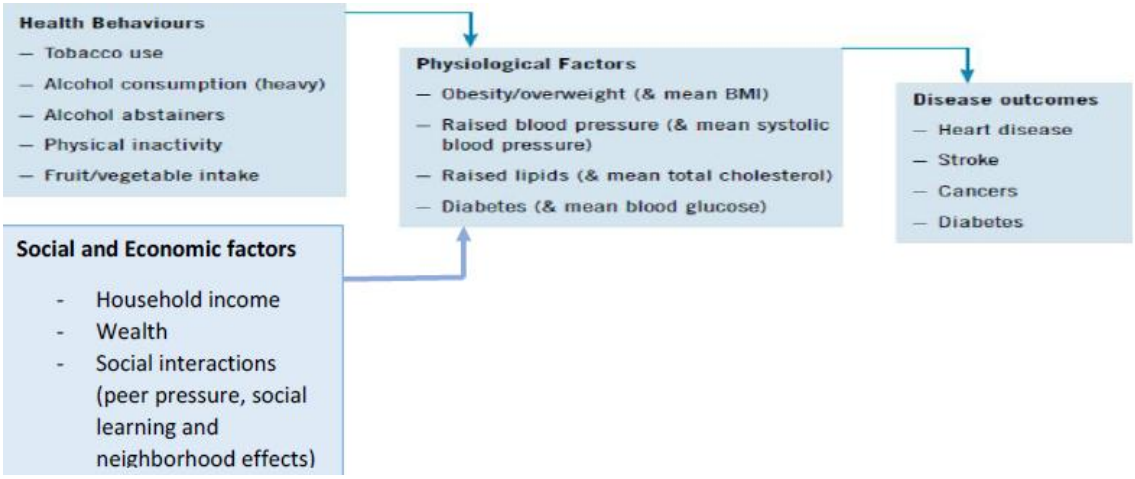
[15] Net household per capita spending is defined as household total expenditure less health expenditure divided by household size

household characteristics. α_i, β and λ, are parameters to be estimated, and υ is the disturbance term.

4.2.3 Models of NCD risk factors

NCD risk factors include obesity, physical inactivity, low consumption of vegetables and fruits, excessive consumption of alcohol and tobacco products, and high cholesterol in the blood (WHO, 2005). Figure 4.1 provides a conceptual framework of factors associated with NCDs. These associated factors are classified into two categories: physiological and behavioural factors which include social interactions (WHO, 2002a). Health behaviours and associated factors may increase or decrease the prevalence of physiological factors and subsequently NCDs depending on the nature of the health behaviour. For instance in figure 4.1 tobacco use, alcohol consumption may increase physiological factors while alcohol abstainers, physical activity and fruit and vegetable intake may reduce physiological factors and NCDs

Figure 4.1 Conceptual framework of NCD risk factors



Source: Adopted from the Framingham Offspring studies and Bhargava (2003) with modification.

The study evaluated specific risk factors for major NCDs in Kenya. The NCDs include cancer (malignant neoplasm), cardiovascular disease (CVD), diabetes mellitus, and chronic

obstructive pulmonary disease as reported in the 2007 Kenya Household Expenditures and Utilization survey.

The study used a modified health production function to estimate the effect of the identified risk factors on NCD prevalence. The interest was in whether the presence of an NCD can be explained by the identified risk factors controlling for other factors that may cause variation in NCD prevalence. The controls include household income and social environment.

The study also controlled for the effects of social interactions on NCDs prevalence following Becker (1974) and Bandura (1977, 1986). Social interactions are hypothesized to take place in social networks based on geographic proximity and other vicinity factors (Balsa et al, 2014, 2010; Bandiera and Rasul, 2006). A household takes actions on the basis of dominant opinions and behaviours in the neighbourhood or among peers (DeGiorgi, Pellizzari and Redaelli, 2009; Eisenkopf, 2010). In the health production specification we include neighbourhood variables. The coefficients of these variables show the effect of average exposure to behaviour on a household's health status. Following Wooldridge (1997), Niringiye (2010) and Green (2012) with appropriate modifications, the estimable models are specified in equations 13 and 14.

$$ncd = c_0 + c_1 Z_i^{'} + \ _i X_i^{'} + \sim_i \bar{W}_{is} + £_i \quad (13)$$

$$Z_i = \text{a} K_j^{'} + \ \ _j X_i^{'} + \sim_j \bar{W}_{is} + £_j \quad (14)$$

Where ncd is as defined earlier in equation 6, $Z_i^{'}$ is a vector of endogenous variables, and $X_i^{'}$ is a vector of exogenous variables. $K_i^{'}$ is a vector of exogenous variables that are instruments for $Z_i^{'}$. $\bar{W}_{is}$ is a vector of social interaction variables in village s. Since social interactions are not observable they are proxied by the means of alcohol consumption, cigarette smoking,

vegetables and fruits consumption, all measured at the district level[16]. Household i's observation in each respect is excluded in calculation of its pertinent mean. c_0 c_1 ~ and ª are the estimated parameters. While £$_i$ and ε_j are the disturbance terms.

Household income (Y) is an exogenous variable in equation 13. Although it is defined by past consumption and leisure choices, the study assumed that individuals base their consumption decisions on longer term view of their present and future incomes, perhaps a notion of lifetime wealth or a notion of wealth over a reasonably long time horizon. The study theorised that households and individual consume a portion of their life time income (permanent income[17]) in each period and thus the average propensity to consume would equal the marginal propensity to consume. Consumption in this case depends on permanent income and it is exogenous (Friedman 1957 and. Mankiw 2013).

Equation 13 is assumed to have multiple endogenous regressors these are alcohol consumption, smoking and vegetable intake variable. Equation 14 specifies reduced form equations for all the endogenous variables in the vector $Z_i^{'}$ in equation (13). The data used and the estimation issues are discussed in section 4.3.

4.3 Data and Estimation Issues

4.3.1 Data source and description

This study used the 2007 Kenya Household Expenditure and Utilization Survey. The survey had targeted 8,844 households, 6072 from rural areas and 2772 from the urban. 8,423

[16]The district was used as a proxy for village/ neighborhood. Districts have become counties in the new constitutional dispensation.

[17] Friedman's permanent-income hypothesis. Consumption depends mainly on permanent income. Consumer's use saving and borrowing to smooth consumption in the face of transitory fluctuations in income- see Mankiw 2013.

households and 39,798 individuals responded to the survey giving a response rate of 96 per cent. The survey mapped the 8 provinces of Kenya into 737 clusters, 506 (68.7per cent) in rural areas and 231(31.3 per cent) in the urban. The households interviewed followed the National Sample Survey Evaluation Programme four (NASSEP IV) as the 2003 Household Survey to the extent possible.

4.3.2 Endogeneity

Endogeneity is a problem often encountered when estimating equations presented in sections 4.1 to 4.3 using survey data. Endogeneity occur whenever there is correlation between the variable of interest and the error term. In the mentioned equations there was the likelihood of the health inputs being correlated with the residual[18] terms. Failure to control the problem of endogeneity leads to biased parameter estimates.

Econometric methods of two stage residual inclusion (2SRI) and instrumental variable (IV) are used to address the problem of endogeneity. Hausman (1978) augues 2SRI is a good method for the control of endogeneity in linear and nonlinear models. It is a two-step procedure: the first step is to calculate residuals in a reduced form estimation, and then insert the residuals as additional regressors in a second stage regression. In this model, also referred to as the control function (CF) approach or two stage residual inclusion with extensions, testing the null hypothesis of exogeneity of a subset of regressors is similar to a variable addition test for the equality to zero of the coefficient of the first stage residuals in the second stage reduced equation. Results of the instrumental variable method are similar to those of the 2SRI in linear models. The IV method is, however, simpler in nonlinear models IV and 2SRI estimation results are not similar as in linear models.

[18] The residual terms comprised of white noise and unobservable health endowments

Wooldridge (2002, 2011) and Terza *et al*, (2008) observe that the use of IV in nonlinear models is neither simple nor outright. The two steps estimators are in general not consistent with structural parameters of interest. In handling endogeneity in nonlinear models most researchers have preferred using parametric distributional assumptions on both the endogenous regressors and the outcome variables. The Maximum Likelihood Estimator (MLE) method is then used to infer the values of the parameters of interest and the exogeneity status of the regressors. The results are, however, invalid. MLE relies on the assumption of a particular distribution that generates the observed random variables. Any failure in the distributional assumptions makes MLE estimates not robust and inconsistent, particularly in small samples (Greene, 2012).

Some studies fail to differentiate between 2SRI and IV approach in estimating nonlinear functions. For instance, Smale and Mason (2014) applied 2SRI in their study of the effect of hybrid seeds on the economic wellbeing of smallholder maize farmers in Zambia without differentiating between IV and 2SRI.

Wooldridge (2011) has a class of control function or 2SRI tests for exogeneity in multiple and possibly discrete regression models. The conceptual and computational simplicity of the two-step approach to exogeneity testing in nonlinear models makes it easier to use. There are several applications of models with multiple endogenous regressors in applied micro-econometrics. Deb and Trivedi (1997), Mullahy (1997), Van Ophem (2000), Bratti and Miranda (2011), Miranda (2004) are some examples dealing with endogenous binary regressors.

Some recent studies have focused on multiple endogenous regressors. Deb and Trivedi (2006) offered a simulation based full maximum likelihood method for single equation models. Zimmer (2010) applied the two-step procedure following the methodological

contribution of Terza *et al*, (2008). Terza *et al*, (2008) maintains that in many non-linear contexts changing predicted endogenous variables in the second stage leads to inconsistent estimators. They recommend the 2SRI model when looking for a valid inference including exogeneity tests.

This study checks whether exogeneity tests based on 2SRI are viable in multiple endogeneity cases. Such models are easier to implement especially with respect to the alternative method of maximum likelihood which requires iterations and intensive computations. The approach used follows the two different proposals by Terza (2008) and Deb and Trivedi (2006). The study also used IV method to control the problem of endogeneity when dealing with linear functions presented in equation 4 and 6.

Endogeneity in Household welfare models

In estimating equations 4 and 6 on household income, endogeneity was a likely problem arising from simultaneity or bi-directional causality between household income and sickness. An NCD can reduce household productivity and income. An increase in income increases the likelihood of a household developing an NCD, even though an increase in income increases the household's ability to seek prompt treatment or to adopt preventive measures.

This study used the econometric methods of 2SRI and instrumental variable (IV) to address the problem of endogeneity in household welfare models. The distance to the nearest health facility instrumented NCD and general sickness. Equations 4, 6, 9 and 11 were exactly identified.

In estimating the models (Equations 4, 6, 9 and 11), this study notes that the Linear Probability Model (LPM) when applied on nonlinear functions does not consistently estimate the structural parameters as it does for linear models. LPM estimated probabilities are

unbounded on the unit interval, and *"this creates a possibility of predicted probabilities that lie outside the [0, 1] interval, which is nonsensical, and of negative variances",* (Heckman Undated p5). The second limitation is heteroscedasticity of the error term. *"Conventional advice points to probit as the standard remedy, which bound the maximum likelihood estimated probabilities on the unit interval" (Horace and Oaxaca, 2006 p2).* NCD, catastrophic and impoverishment are binary outcome variables rather than continuous variables, this study uses the probit model which hypothesize presence of an underlying, continuous ("latent") variable which is not observed by the researcher. The advantage with this formulation is that the explanatory variables can have a linear effect on the latent variable which could range from minus to plus infinity, while the observed variable only takes values of, 0 and 1. (Greene 2012)

Endogeneity and NCDs risk factors

In estimating equation (12), the problem of endogeneity was encountered where NCD and general sickness were endogenous. In evaluating the risk factors to NCDs, alcohol intake, cigarette smoking, as well as fruits and vegetables consumption were potentially endogenous. If the endogeneity problem is not addressed the estimates become inconsistent. The instrumental variable (IV) method offers a possible solution to this challenge.

When evaluating the response of an individual to treatment, endogeneity is likely to arise due to unobserved heterogeneity such as individual characteristics or behaviour. The unobserved factor affects both the treatment and outcome variables.

Testing for validity of instruments

Locating a suitable instrument that just identifies the structural equation is a major problem in controlling for endogeneity using the IV method. Once probable instruments are identified it

is always necessary to test for their validity. Validity checks establish whether the instruments possess the three characteristics of good instruments. A good instrument is highly correlated to the endogenous variable and has no direct casual effect on the outcome measure (Greenland 2000 and Mariara *et al,* 2009). It is exogeneous in a model specification. An instrument that fits the criteria is deemed to be valid and strong.

This study assessed the validity of the instruments in line with Nelson and Startz (1990) and Staiger and Stock (1997). We conducted several diagnostics test based on the F-test for joint significance of probable instruments. Excise tax was found to be a good instrument for vegetables and fruits intake, alcohol consumption as well as cigarette smoking. Broad taxes (which are prices) including excise taxes, percentage excise taxes, value added taxes and state mark-ups have been suggested as potential instruments for alcohol consumption and cigarette smoking. They have been applied in studies such as Baltagi (2002), Young (2001), David *et al*, (1989), Chaloupka *et al.* (1993), Bardsley and Olekalns (1999), and Keeler *et al,* (1993).

An instrument that is strongly correlated with a particular endogenous variable and is not correlated with dependent variable is deemed to be a valid instrument.

4.3.3 Heterogeneity

Even with valid instruments heterogeneity can render estimated parameters unreliable and lead to wrong inferences (Mwabu, 2009). Heterogeneity occurs when unobservable variables interact with the variables of interest. It introduces error in the effect of the variable on the outcome. Heterogeneity in health demand and production functions may arise from the presence of exogenous health factors unknown or unobserved by the researcher, but known by the household (Rosenzweig and Schultz, 1983).

In this study heterogeneity in health demand and production functions is thought to arise from several sources. First, it could stem from the behaviour of household members who when

they expect to suffer from an NCD or other health problem seek preventive measures. These preventive measures may affect the presence or absence of a disease in future. They may also influence change of lifestyles e.g, start consuming vegetables and fruits, or stop alcohol consumption and cigarette smoking. Religious beliefs may also strengthen preventive measures.

Secondly, there are inherited characteristics that predispose individuals to NCDs. Some genetic factors make some individuals more prone to obesity, and to NCDs than others.

The third source is the complementarities between NCD and the explanatory variables. For example, if body weight raises the probability of having an NCD then a household may deliberately cut down on consumption of weight enhancers such as meat, oil and fats. Fourthly, there are unobservable factors that influence household spending and income.

To address the problem of heterogeneity, the study has applied the control function approach[19] (Florens *et al*, 2008). This involves adding interaction terms of the variables of interest (sickness, NCD, and specific NCD risk factors) and their respective residuals in the second stage regression. The interaction term controls for the interaction effect of the unobserved factor on a covariate. It therefore purges the coefficients in the structural equation of the unobservables (Mwabu and Ajakaiye 2007, Card 2001).

4.4 Hypotheses to be tested

This study tested various hypotheses. The hypotheses are: (1) NCDs have no effects on household income; (2) health expenditure on NCDs does not affect the likelihood of a household incurring catastrophic expenditure; (3) the presence of NCD has no effect on the likelihood of a household being impoverished or pushed below poverty line; and, (4) the

[19] Also referred to as the two stage residual inclusion approach with extensions

presence of risk factors has no effect on presence of NCDs. To test the first hypothesis a household income equation is estimated using NCD covariates. This is with a view to identify the effect of NCDs on income. The second hypothesis is tested by estimating the determinants of catastrophic health expenditures paying special interest on catastrophic health expenditures due to NCDs. The third hypothesis is tested by examining the factors that affect the likelihood of a household becoming impoverished by health expenditures especially expenditures on NCD treatment and care. While the last hypothesis is tested by investigating NCDs risk factors and how the factors affect the likelihood of developing an NCD.

4.5 Definition and measurement of variables

This section provides a definition of variables used in the various models. The dependent variables are: log of household income, dummies for household catastrophic expenditure, presence of an NCD in a household, and household impoverishment on account of sickness or NCD presence. The explanatory variables are: health status of a household (captured by presence of general sickness and NCD), education, age, household size, location, distance to the nearest health facility, mean district consumption of alcohol, cigarettes, fruits and vegetables, gender and other controls.

Total household income

Total household income was estimated from total household expenditure on health and non-health goods and services. In the Survey, household income data combines many income sources including wages, salaries, profits and income from sale of crops and assets all of which are measured with error. Their aggregation can give a misleading estimate of income, hence the choice of expenditure to estimate household income. Using the whole data set the study has estimated the effect of sickness on income. From a sample of the sick only the study has estimated the effect of NCDs on household income. This estimation distinguishes

communicable and non-communicable diseases. The income of NCD-affected households has been compared with incomes of disease free household using a sample of NCD-sick and healthy households.

Catastrophic health spending

Catastrophic health spending takes a value of 1 if a household experienced catastrophic health spending and 0 otherwise. Catastrophic spending is defined as occurring when health expenditure of a given household exceeds a certain defined measure of ability to pay[20]. A threshold of 30 per cent of total household income is applied in this study. Beyond the threshold healthcare expenditure strains a household to a point of impoverishment.

Presence of an NCD in a household

The dummy for NCD in a household show the epidemiological status of a household. The variable takes a value of 1 if a household member reported having an NCD and 0 otherwise.

Household impoverishment due to health expenditure

Household impoverishment variable takes a value of 1 if a household is impoverished by health spending, and 0 otherwise. Household health expenses will be considered to be impoverishing if the gross household per capita spending exceeds household poverty line level of expenditure and the net household per capita spending is less than the household poverty line level of expenditure.

Health status of the household

The health status of the household is revealed by the presence or absence of sickness. The interest in this study is on presence or absence of an NCD in a household. The effect of

[20] Household consumption spending less combined survival income for all household members

sickness on income is expected to be negative. As the incidence of, say, an NCD increase the welfare of a household deteriorates. Sickness has a positive effect on catastrophic spending and household impoverishment. As the incidence of NCDs rise the likelihood of a household incurring catastrophic health spending and becoming impoverished also increase.

Level of education

The level of education for the household head is a continuous variable of the total number of years spent at school by a household member. Although education could mitigate the effects of sickness, it could also do the opposite. The latter is true in situations where education raises the risk of developing some sickness or exposes a household to a lifestyle that increases the chance of developing a disease. Thus, the sign of education parameter in an income equation is unpredictable.

Age

Income has been shown to decline with age as people retire coupled with low productivity at old age. In addition, health risks rise directly in proportion to age. It is hypothesised that age is positively related to NCDs prevalence (Tawa *et al* 2011). In reality age can have a direct or an inverse effect on household income (Pscharopoulous, 1994). For this reason, our models have age and its square term in order to capture the non-linear effect of age on income.

Household size

The size of a household can determine its labour endowment, and hence its income. In a collective household where resources are pooled together the presence of many income-earning individuals can impact on household welfare in a big way.

Location

Generally, urban areas have higher incomes and lower poverty levels compared to rural areas. Hence, a person living in an urban area can be expected to have a higher welfare, ceteris paribus. The location variable takes a value of 1 for urban and 0 otherwise. However, urban residence may expose a household to the risks of NCDs than rural residence. Thus, urban residence may have a positive effect on both income and NCD prevalence.

Distance to the nearest health facility

Distance to the nearest[21] health facility has been used to instrument sickness, especially from an NCD. The effect of distance on income can be expected to be negative, and positive on sickness. If travelling a greater distance discourages patients from using formal sector facilities, then distance encourages NCD illnesses to become chronic. In remote rural areas health facilities are far apart and most people travel a long distance to get to the nearest facility. In addition, knowledge on healthcare is low in these areas.

Closeness to a health facility may increase its use and health knowledge. Households in close proximity of a heath facility can be expected to adopt disease preventive measures thereby reducing their disease incidence and prevalence. The effect of distance on income can be expected to be negative, and indeterminate on household catastrophic expenditure.

Distance to the nearest health facility is an explanatory variable in the NCD risk factor equation. It is a proxy for a bundle of health or medical services available to a household including health information[22]. To this extent travelling a greater distance may discourage use of medical services by households residing away from a health facility. Such households can

[21] The motivation to use distance to the nearest health facility is derived from Gertler et al. (1987)

[22] Health information include information on preventions, care and treatment of disease

be assumed to have less information on prevention, care and treatment of NCDs. Consequently, they have a higher chance of contracting an NCD.

Mean district consumption of alcohol, cigarettes, fruits and vegetables

The mean district consumption of alcohol, cigarette smoking, and fruits and vegetables intake are additional risk factors to NCDs. They are proxies of the effect of social interactions on alcohol consumption, cigarette smoking, and fruits and vegetables consumption. Household consumption behaviours that expose them to the risk of developing NCDs are propagated and reinforced through social interactions. The interactions are in form of imitating peers, observing neighbours, or word of mouth. They have an indirect bearing on the health status of a household. The signs of these variables on the estimated functions are unpredictable a priori.

Gender

The variable sex captures gender effects on household income. It takes a value of 1 for male and 0 otherwise. From the reviewed literature, the effect of gender on the outcome variables is unpredictable a priori.

There are other variables used in various models are controls. Table 4.1 defines the variables in the various models and gives their expected signs.

Table 4.1: Definition of variables used in the regression models

Variables	Variable description	Expected sign			
		Income equation	Catastrophic exp. equation	Impoverishment equation	NCDs Risk factors
Sickness	Household report having had any sickness 4 weeks prior to the survey (Dummy, presence of any disease =1, 0 otherwise)	Negative	Positive	Positive	
Location	Dummy, urban =1, 0 otherwise.	Positive	Indeterminate	Indeterminate	Positive
Household size	Total number of members of a household	Positive	Indeterminate	Indeterminate	
Log of years of experience	Log of years of work experience	Positive	Negative	Negative	
Log square of years' experience	Log of years of work experience squared	Positive	Negative	Negative	
Household head working status	Dummy, working house head=1, 0 otherwise	Positive	Negative	Negative	
Years of schooling	Total number of years of schooling	Indeterminate	Negative	Negative	Negative
Sex	Dummy, male =1, 0 otherwise	Uncertain	Uncertain	Uncertain	Uncertain
Distance to facility	Distance to the nearest health facility in kilometres	Uncertain	Uncertain	Uncertain	Positive
Age	Age in years	Uncertain	Uncertain	Uncertain	Positive
Age squared	Age squared	Negative	Negative	Negative	
NCD	Dummy, presence of NCD =1, 0 otherwise	Negative	Positive	Positive	
Health insurance	Dummy, health insurance =1, 0 otherwise	Uncertain	Negative	Negative	
Out of pocket expenditure	Total health cost incurred by a household seeking health service	Uncertain	Positive	Positive	
Log household income	Log total household expenditure on health and non-health goods & services				Positive
Employment	Dummy, employed =1, 0 otherwise				Indeterminate
Alcohol variable	Dummy, consumed alcohol regularly =1, 0 otherwise				Positive
Fruits and vegetables	Dummy, consumed fruits and vegetables regularly=1, 0 otherwise				Negative
Marital status	Dummy, M arried =1, 0 otherwise	Negative	Uncertain	Uncertain	Uncertain
Cigarette smoking	Dummy, smoked cigarette regularly =1 , 0 otherwise				Positive
Mean alcohol consumption	Mean alcohol consumption in a district				Indeterminate
Mean cigarette smoking	Mean cigarettes smoking in a district				Indeterminate
Mean fruits and vegetables consumption	Mean fruits and vegetables consumption in a district				Indeterminate

CHAPTER FIVE

5.0 RESULTS AND DISCUSSION

5.1 Introduction

This chapter reports on the parameter estimates of the models discussed in Chapter 4. Each of the models was estimated using three data sub-samples. Equation 4 and 6 evaluates the factors affecting household income which is used in this study as a welfare measure. The variables of interest are general sickness and non-communicable diseases. Social demographic characteristics are controls. We first estimated the impact of sickness on household income regardless of the disease type -whether NCD or CD. This was followed by an estimate of an income equation from a sub-sample of households without any NCD case and those reporting an NCD disease. Thirdly, we estimated the income equation from a sub-sample of households affected by NCDs and those affected by CDs. The essence of using three sub-samples was to determine whether the effects of NCDs differ significantly between households without any illness, households afflicted by NCDs, and households affected by communicable diseases.

The chapter starts with descriptive statistics for each of the models and the corresponding empirical results. The second part of the chapter discusses the contribution of NCDs to catastrophic spending and household impoverishment. The factors that explain the likelihood of a household to incur catastrophic expenditure are evaluated as well as the contribution of catastrophic expenditure to household impoverishment. In this study the variables of interest is NCDs. The last section of the chapter discusses NCDs risk factors.

5.2 Descriptive statistics for household income model

This section presents the descriptive statistics for the dependent and independent variables used in estimating the income equation (equation 4, 5, 6, and 7). The respondents in the survey had a mean age of was 29.42 years. Their average schooling was 7.49 years and the average household size was 5.21 persons. About 39.39 per cent of the respondents were married, and 21.09 per cent of household heads were working. 35.45 per cent of the households reported illness, with 12.27 per cent of the sick suffering from NCDs. Further statistics are provided in Table 5.1.

Table 5.1: Descriptive statistics of variables included in the income equation

Variable	Observations	Mean	Std. Dev.	Minimum	Maximum
Log of household income (Dependent variable)	37981	8.7437	1.1159	0	15.3853
Region (urban=1)	37996	0.2833	0.4506	0	1
Household size	37981	5.2117	2.398	1	15
Age	37509	29.416	22.9161	15	108
Age squared	37509	1390.38	1721.613	0	11664
Log years of experience	37992	2.802	1.1615	0	4.3171
Log years of experience squared	37992	4.7508	1.2131	0	6.6374
Working status of head	37981	0.2193	0.4138	0	1
Years of schooling	26764	7.4886	4.7213	0	29
Married	37509	0.3939	0.4886	0	1
Male	37996	0.4432	0.4968	0	1
Distance to nearest health facility	19794	1.4443	1.0403	0	6.6859
Health insurance	36538	0.09997	0.04554	0	1
Sickness	37996	0.3545	0.4784	0	1
Chronic illness	37397	0.1227	0.4784	0	1

Source: Author's computation

Table 5.1 further shows that the majority (71.67 per cent) of the households were residing in rural areas. The mean log of the household income was 8.74, while on average household members travelled a distance of 1.44 kilometres to access health services from the nearest health facility. There was a marginal difference in the number of male and female in the survey with 44.32 per cent of the respondent's being male and 55.68 were female.

5.2.1 The impact of sickness on household income

Coefficients of variables in semi logarithmic functions are interpreted as percentage effects by multiplying the coefficients by 100. But this is only correct for continuous variables. Results would be misleading for dummy variables. To resolve the problem Halverson and Palmquist (1980) suggested a transformation where the relative effect of a dummy variable is expressed as $\exp(\ )-1$, and the percentage effect is $100*\{\exp(\ )-1\}$. Our results are interpreted following the approach suggested by Halvorsen and Palmquist (1980).

The results of OLS regression of equation 4 shows that sickness impacts on household income negatively. The OLS results reported in column 2 have not controlled for endogeneity and heterogeneity problems. Although the IV regression results presented in column 3 controls for endogeneity making the results more preferable than OLS, they do not control for heterogeneity. On the others hand control function approach (2SRI with extensions) controls for both endogeneity and heterogeneity making the results more preferable to those of OLS and IV.

Two stage least squares method was applied in the estimation of equation 4 and the results are shown in Table 5.2, column three. The instrument used to identify the equation 4 was distance to the nearest health facility. The coefficient on sickness variable is negative and significant implying that presence of sickness in a household reduces household income by 5.16 percent[23]. These results are consistent with Kioko (2008); Mahal et al, (2010) and Laxminaraya (2004) who found that households derive disutility from illness. Apart from years of schooling and gender all the other variables have the expected sign and are significant at 10 per cent level.

[23] $100*\{\exp(0.0503)-1\}=5.16$

Table 5.2: Estimates of the impact of sickness on household income

Dependent variable is log of household income	Estimation methods		
Explanatory Variables	OLS (1)	IV (2)	Control function approach (3)
Sickness	-0.0503* [0.0503]	-0.1363** [0.0493]	-0.0851** [0.0050]
Urban	0.0276*** [0.0051]	0.0278*** [0.0051]	0.0276*** [0.0051]
Age	0.0014* [0.0006]	0.0014*** [0.0005]	0.0011** [0.00057]
Age squared	-0.0366** [0.0075]	-0.002** [0. 0086]	-0.0034** [0.0061]
Household size	0.0028)*** [0.0009]	0.0017 [0.0010]	0.0044*** [0.0012]
Log years of experience	0.2754*** [0.0151]	0.2821*** [0.0156]	0.2761*** [0.0151]
Log years of experience squared	0.0391*** [0.0008]	0.0387*** [0.0009]	0.0390** [0.0008]
Working status household head	0.0104* [0.0062]	0.0102* [0.0063]	0.0093 [0.0062]
Years of schooling	-0.0005 [0.0005]	-0.0008 [0.0005]	-0.0001 [0.0006]
Married	0.0133* [0.0046]	0.1342** [0.0051]	0.0113* [0.0056]
Male	0.0029 [0.0041]	0.0005 [0.0045]	0.0074 [0.0048]
Sick residual			-0.1586** [3.2523]
Sick*residual			0.2460*** [0.0707]
Constant	3.2856*** [0.0689]	3.2725*** [0.0697]	3.2523*** [0.0697]
Durbin Wu – Hausman		3.1018*	
R-squared	0.0915	0.0910	0.0916
sample size	26624	26624	26624

Source: Author's computation. Note: ***, ** and * show significance at 1%, 5% and 10% respectively. Standard errors are in parenthesis.

The control function approach controls for the heterogeneity in the income equation (Wooldridge, 2002; Mwabu, 2009). These results are represented in Table 5.2, column 4. The results indicate sickness is a significant determinant of household income, and that its effect is negative. The income of a household afflicted by sickness is 8.89 percent[24] lower than for a

[24] $100*\{\exp(0.0851)-1\}=8.89$

household free from sickness. In addition, the coefficient on sickness residual is statistically significant confirming that the sickness dummy is endogenous.

Location of residence has a significant and positive effect on household income as predicted. Households that reside in urban areas have 3.04 per cent higher income compared to those living in rural areas. Marital status is significantly and positively associated with household income. The income of a household with husband and wife has 1.15 per cent higher income compared to a single person's household. Married individuals often receive spousal support, and this has positive effects on household income.

Working status is positively related to income though the coefficient is insignificant at 10 per cent. Work experience as measured by the number of years a person has worked in a certain job is positive and highly significant in the three models. This suggests that income rises with work experience.

5.2.3 The impact of NCDs on household income

Table 5.3 presents estimation results of the impact of NCDs on household income. The results presented are from OLS, instrumental variables and control function approach methods using data from a sub-sample of households with the individuals affected by NCDs and households that reported no illness. The variable of interest is NCD dummy whose coefficient captures the effect of NCDs on income.

Based on control function approach estimations for reasons cited above, the income loss to households due to NCDs is higher than losses from other disease types. NCD sickness is

associated with a 33.16 percent[25] reduction in household income. This is higher than the 8.89 per cent reported in Table 5.2 column 4. NCDs are associated with higher welfare losses. The results are consistent with those of Brummet *et al,* (2011) that conclude that NCD ailments reduce household income significantly. This is as a results of lowered earnings occasioned lower productivity. NCDs also influence other social economic factors negatively further reducing household welfare, these social economic factors hours committed to working and leisure. The prolonged care and treatment period associated with NCDs has an opportunity cost in lost income and purchasing power.

Table 5.3: Estimates of the impact of NCDs on household income using a data sub-sample of households reporting NCDs and those without any illness

Dependent variable is log of household income	**Estimation Methods**		
Explanatory Variables	**OLS (1)**	**IV (2)**	**Control function approach (3)**
Non-communicable diseases	-0.1533** [0.0075]	-0.1247** [0.0538]	-0.2864*** [0.0504]
Urban	0.0339*** [0.0053]	0.0361*** [0.0062]	0.0331*** [0.0053]
Household size	0.0360*** [0.0009]	0.0047* [0.0019]	0.0032** [0.0009]
Log years of experience	0.2901*** [0.0160]	0.2849*** [0.0178]	0.2867*** [0.0161]
Log years of experience squared	0.0383*** [0.0008]	0.0384*** [0.0009]	0.0385*** [0.0009]
Working status of household head	0.0032 [0.0064]	0.0049 [0.0133]	0.0066 [0.0065]
Years of schooling	0.00132 [0.0008]	0.0002 [0.0005]	0.0001 [0.0005]
Married	0.0140** [0.0050]	0.0036 [0.01576]	0.0176*** [0.0054]
Male	0.0046 [0.0043]	0.0088 [0.0078]	0.0027 [0.0044]
Ncd residual			0.0605** [0.0362]
Ncd* residual			0.0914**

[25] $100*\{\exp(0.2864)-1\}=33.16$

Dependent variable is log of household income	Estimation Methods		
Explanatory Variables	**OLS (1)**	**IV (2)**	**Control function approach (3)**
			[0.0734]
Constant	3.214*** [0.0731]	3.2301*** [0.0773]	3.2349*** [0.0735]
Durbin Wu – Hausman		1.5039**	
R-squared	0.0913	0.0844	0.0954
Sample size	23442	23442	23442

Source: Author's computation. Note: ***, ** and * represent significance at 1%, 5% and 10% respectively. Standard errors are in parenthesis.

5.2.4 The impacts of communicable and NCDs on household income

To further understand the effect of NCDs on household income relative to other illnesses, this section discusses the results obtained from estimating equation 6 using a sub-sample data of households that reported illness. Households without any illness were excluded so as to analyse only those households affected by NCDs and communicable diseases.

Table 5.4: Estimates of the impact of NCDs on household income using a sample of households reporting sickness.

Dependent variable is log of household income	Estimation methods		
Explanatory Variables	**OLS (1)**	**IV (2)**	**Control function approach (3)**
NCD	-0.1669* [0.0100]	-0.2138** [0.3341]	-0.2317*** [0.0360]
Urban	0.0143 [0.0120]	0.0102 [0.0140]	0.0141 [0.0120]
Household size	0.0028 [0.0022]	0.0032 [0.0024]	0.0031 [0.0021]
Log years of experience	0.5742*** [0.0409]	0.5954*** [0.0499]	0.5655*** [0.4108]
Log years of experience squared	0.0248** [0.0022]	0.0244*** [0.0025]	0.0254*** [0.0022]
Working status of household head	0.0035 [0.0124]	0.034 [0.0325]	0.0128 [0.0128]
Years of schooling	0.0063 [0.0010]	0.0018 [0.0016]	0.0012 [0.0010]
Married	0.0169* [0.0010]	0.0601* [0.4317]	0.0277* [0.0113]

Dependent variable is log of household income	Estimation methods		
Explanatory Variables	**OLS (1)**	**IV (2)**	**Control function approach (3)**
Male	0.0055 [0.0102]	0.0003 [0.0125]	0.0038 [0.0103]
Ncd residual			0.1451** [0.0485]
Ncd* residual			0.1237** [0.0625]
Constant	1.6686*** [0.1880]	1.7204*** [0.2168]	1.8510*** [0.1893]
Durbin Wu – Hausman		1.3427**	
R-squared	0.0907	0.0884	0.0902
Sample size	5375	4956	4944

Source: Author's computation. Note: ***, ** and * represent significance at 1%, 5% and 10% respectively. Standard errors are in parenthesis

As shown in Table 5.4 the coefficient of NCD is negative and significant. The relationship between household income and NCD presence in a household is inverse. The incomes of households with an NCD case are 26.07[26] per cent lower than households with a communicable illness. This indicates that the loss in household income due to NCDs is greater relative to losses from communicable diseases. This could be attributable to the high treatment cost of NCDs and well as lost labours hours by household members offering care to the affected member/s of the society.

The results of the income models in the three sub-samples indicate that poor health lowers household productivity and income. Households affected by sickness of any type have been found to have lower incomes relative to disease free households. Further, the results illustrate that although ill health lowers household income in general. Households afflicted by NCDs experience greater income loss relative to households reporting general illnesses.

[26] $100*\{\exp(0.2317)-1\}=26.07$

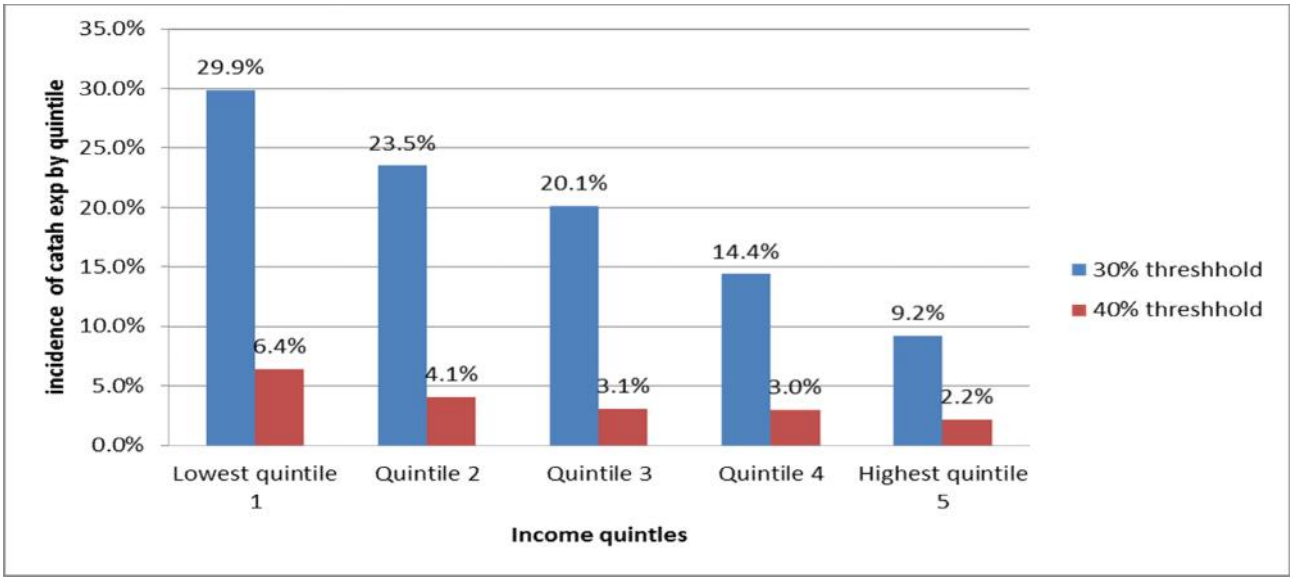
5.3 NCDs and catastrophic expenditure

This section addresses the contribution of NCDs to catastrophic expenditure. It starts with descriptive statistic on catastrophic expenditure and thereafter provides marginal effects of sickness, and NCDs in particular on catastrophic expenditure. The odd ratios are presented in appendix B.

5.3.1 Descriptive statistics for the catastrophic expenditure model

This section addresses the contribution of health spending on NCDs to catastrophic expenses by households. A threshold of 30 per cent of total household income was applied in determining catastrophic expenditure. It indicates the level at which a household is forced to forego basic needs, de-save and incur debt to meet healthcare and treatment costs. At this or higher level of expenditure on healthcare alone a household can become impoverished in the long run as observed by Mahal *et al*, (2010) and Xu *et al*, (2003). Figure 5.1 reports the incidence of catastrophic spending by quintile at 30 per cent and 40 per cent thresholds.

Figure 5.1 Incidence of household catastrophic spending by income levels

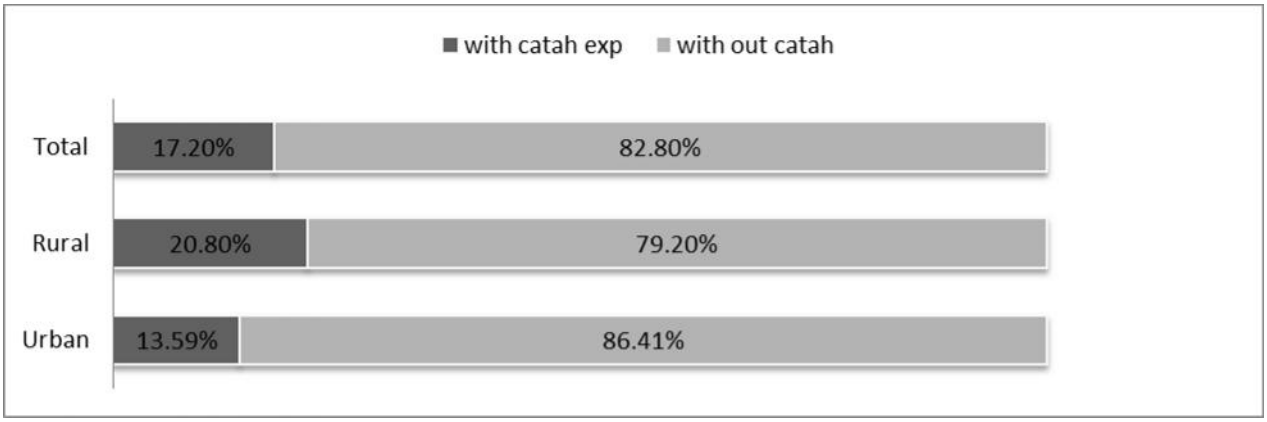


Source: Author's computation

Figure 5.2 show that 17.20 per cent of the household incur catastrophic expenditure. The lowest quintile captures household in the lowest income bracket while the highest quintile consist of households in the highest income bracket The lowest quintile has the highest number of households experiencing catastrophic expenditure as shown in Figure 5.1. The highest quintile has the least incidence of catastrophic expenditure irrespective of the threshold. The results are in line with those of Xu *et al,* (2006) and Chuma and Maina (2012). Using 2003 data Xu *et al,* (2006) found the incidence of catastrophic expenditure to be 20 per cent in the lowest income quintile, and 5 percent among households in the highest quintile. Chuma and Maina (2012) found catastrophic expenses of 8.7 per cent in the lowest quintile households, and 2.9 per cent in the richest quintile in general.

Rural areas have the highest number of households incurring catastrophic expenditure at 20.80 per cent. In urban areas only 13.59 per cent of the households incur catastrophic expenditure as shown in Figure 5.2. This could be explained by income differences between rural and urban households, with urban households having higher incomes than rural household (Tawa *et al,* 2011).

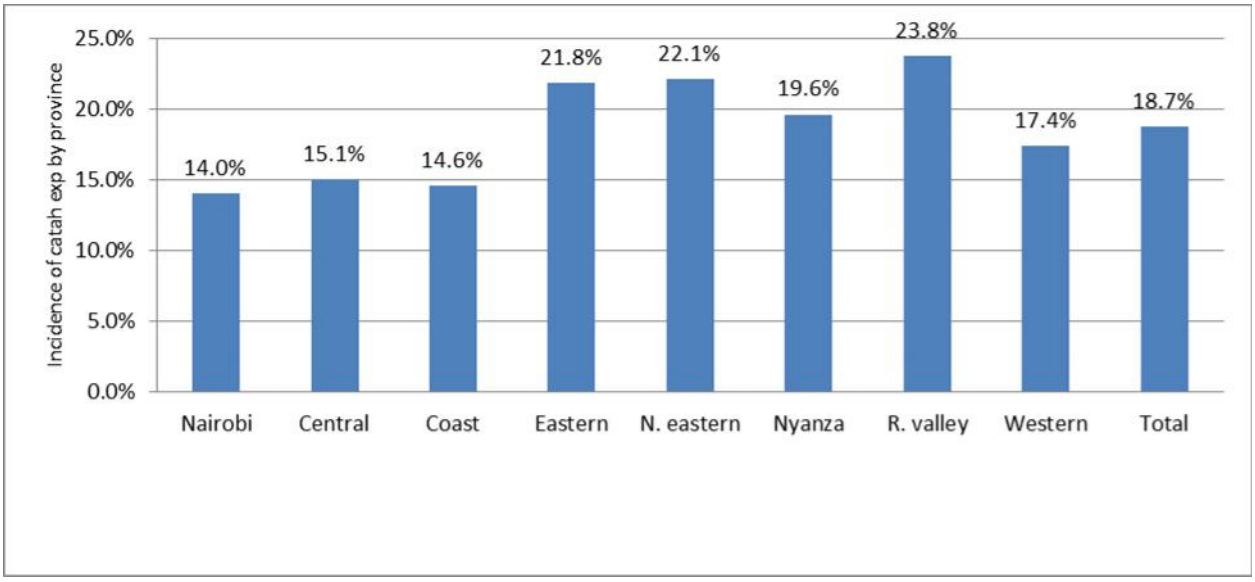
Figure 5.2 Incidence of household catastrophic spending by cluster type



Source: Author's computation

Figure 5.3 presents the incidence of catastrophic spending by regions. Rift Valley has the highest presence of catastrophic expenditures at 23.8 per cent followed by North Eastern at 22.1 per cent. Nairobi has the least at 14 per cent. This may be explained by the relatively higher incomes in Nairobi compared to other provinces of Kenya. In addition, a fairly big number of Nairobi residents are in formal employment which increases their likelihood of having some form of protection (e.g, health insurance). The fact that Nairobi could have relatively higher incomes and health insurance coverage may explain the lower incidence of catastrophic health spending in Nairobi.

Figure 5.3 Presence of household catastrophic spending by provinces

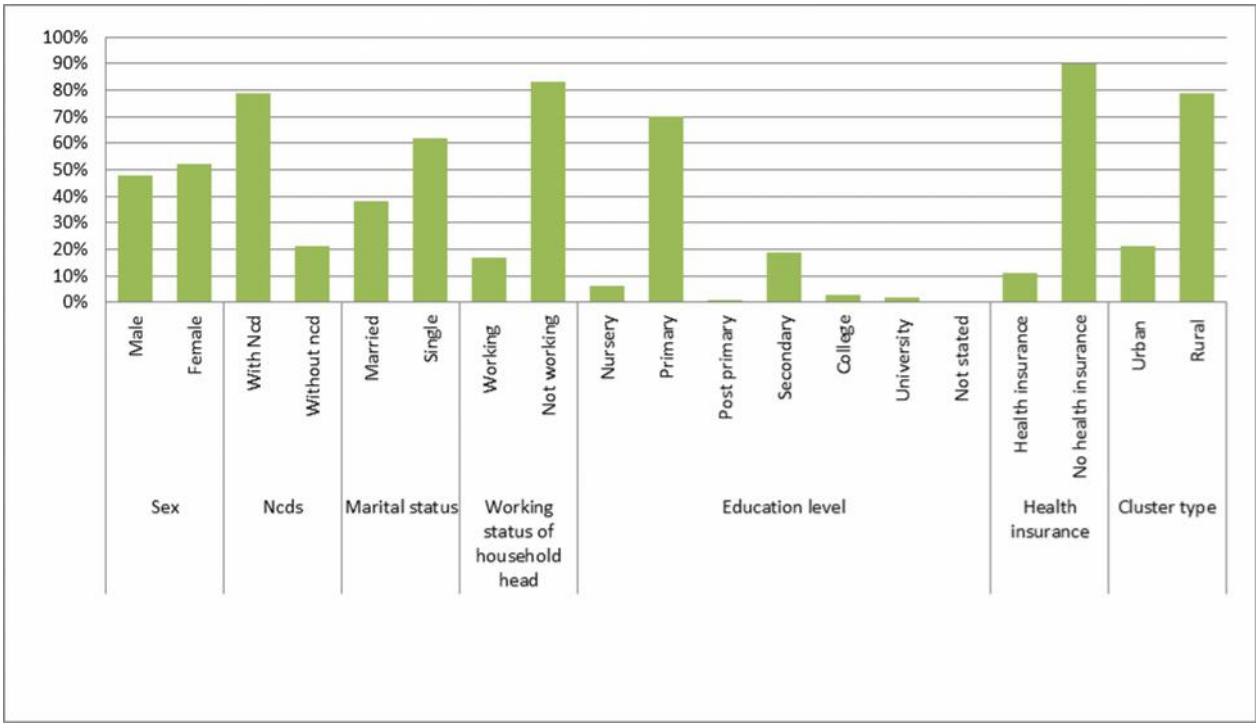


Source: Author's computation.

Figure 5.4 presents a summary of the social, demographic and economic characteristics of households that experienced catastrophic expenditure. 21 per cent of these were affected by NCDs. The distribution of NCDs showed marginal variation by sex with 48 per cent of the

patients being male, and 52 per cent female. Majority of the affected households were from rural areas at 79 per cent. 69.7 per cent of them had primary education. Households where the head did not have formal employment reported the highest incidence of catastrophic expenditure.

Figure 5.4 Characteristics of those who incurred catastrophic expenditure



Source: Author's computation

5.3.2 Sickness and catastrophic expenditure

Table 5.5 presents the factors that determine catastrophic health spending in a household. The main variable of interest is sickness. In the probit model (1) its coefficient is insignificant even though positive before controlling for heterogeneity and endogeneity. After the controls the coefficient is both positive and significant as shown in the control function estimates (*see* column 4).

Table 5.5: Marginal effects of factors explaining catastrophic expenditure

	Estimation methods		
Explanatory Variables	**Probit (1)**	**2SRI (2)**	**Control function approach (3)**
Urban	-0.0550***	-0.0572***	-0.0545***
	[0.0064]	[0.0064]	[0.0064]
Household size	-0.0004	-0.0021*	-0.0432**
	[0 .0013]	[0 .0014]	[0.0016]
Age	0 .0057	| 0 .0041	0.0013
	[0 .0008]	[0.0008]	[0.0083]
Age squared	0.0012	-0.0004	-0.0013
	[0.0001]	[0 .0001]	[0.0083]
Years of schooling	-0.0034*	-0.0263**	-0.0341***
	[0.0008]	[0.0008]	[0.0009]
Health insurance	0.0311**	0.0321***	0.0313***
	[0.0054	[0.0054]	[0.0054]
Sickness	0.0050	0.3764***	0.2567***
	[0 .0073]	[0.0687]	[0.0695]
Married	-0.0317***	-0.0325***	-0.0259**
	[0.0081]	[0 .0081]	[0.0082]
Male	-0.0042	0.0064	-0.0056
	[0 .0059]	[0.0062]	[0.0065]
Sick residual		-0.2659***	0 .1937***
		[0.0518]	[0.0861]
Sick* residual			-0.3655***
			[0 .0699]
Sample size	17031	17031	17031

Source: Author's computation. Note: ***, ** and * represent significance at 1%, 5% and 10% respectively. Standard errors are in parenthesis.

From the control function approach results in column 4 the odds of incurring catastrophic expenditure are 25.67 higher with illness than with no illness. Living in an urban area is associated with a 5.45 per cent reduction in the odds of incurring catastrophic expenditure. This could be explained by the higher incomes observed in urban areas.

O'Donnell *et al,* (2005) findings show that people from large households have a high chance of getting sick. This study found the opposite. Household size reduces the odds of incurring catastrophic expenditure by 4.32 per cent. In developing countries a large family is an insurance

against catastrophic expenditure. The pool of resources from family members cushions the household from the negative consequences of high health expenses.

5.3.3 Contribution of NCDs to catastrophic expenditure

This section discusses the characteristics associated with catastrophic health expenditure. The variable of interest is NCD. Its coefficient captures the likelihood of incurring catastrophic expenditure. The results for the three estimation methods are presented in Table 5.6

In the probit estimates in column 2 the NCD variable has a positive and significant coefficient. Its magnitude is low but improves after controlling for endogeneity and heterogeneity of NCD variable. In the two stage residual inclusion method presented in column 3 the coefficient of the NCD residual is significant confirming the presence of endogeneity. Controlling of endogeneity problem improves the coefficient of NCD.

Table 5.6: Marginal effects of factors determining catastrophic spending using data from a sub-sample of households with healthy and NCD-sick persons

	Estimation methods		
Explanatory Variables	**Probit (1)**	**2SRI (2)**	**Control function approach (3)**
Ncd	0.1590** [0.0123[	0.4261*** [0.0908]	0.4136*** [0.0924]
Household size	-0.0491** [0.0014]	-0.0462*** [0.0017]	-0.0048** [0.0014]
Age	-0.0001 [0.0009]	-0.0003 [0.0009]	-0.0020 [0.0010
Age squared	0.0091 [0.0001]	-0.0036 [0.0002]	-0.0036 [0.0002]
Years of schooling	-0.0091* [0.0009[	| -0.0263** [0.0009]]	-0.0271*** [0.0009]
Health insurance	0.0330*** [0.0057]	0.0338*** [0.0057]	0.0335*** [0.0057]
Urban residence	-0.0592*** [0.0070]	-0.0623*** [0.0070]	-0.0615*** [0.0071]

	Estimation methods		
Explanatory Variables	**Probit (1)**	**2SRI (2)**	**Control function approach (3)**
Married	-0.0337*** [0.0092]	-0.0309** [0.0090]	-0.0311** [0.0090]
Male	-0.0066 [0.0065[	-0.0021 [0.0066]	-0.0034 [0.0068]
Ncd residual		-0.1923** [0.0640]	-0.1201** [0.1086]
Ncd *residual			-0.0727 [0.0883]
Sample size	14390	14390	14390

Source: author's computation Note: ***, ** and * represent significance at level 1%, 5% and 10% respectively; standard errors are in parenthesis

Heterogeneity is not a problem in this estimation. The coefficient of the NCD residual is significant but the coefficient on the interaction term (ncd*residual as shown on column 4) is insignificant. Therefore, the estimated results of 2SRI are also reliable. The results of the 2SRI as shown in column 3 in Table 5.6 indicate that the odds of a household incurring catastrophic expenditure are 42.61 higher if the household has an NCD patient than in a case of no illness. This implies that having an NCD raises the likelihood of incurring huge health expenditures. The results are consistent with those of Mahel *et al,* (2010) and Tawa *et al,* (2011) that found that being affected by an NCD increases the likelihood of a household to experience health expenditures that can cripple its sustenance.

5.3.4 NCDs versus CDs in catastrophic expenditure

This section presents the results of the contribution of NCDs to catastrophic expenditure benchmarked against other illnesses. The estimates are obtained from a sub-sample of households that reported illness. Households with no illness were excluded from the sub-sample so as to generate an analytical sub-sample consisting of households with an NCD and a communicable disease.

Table 5.7 presents estimates results from three models- probit, 2SRI and CF. Although the coefficient of the NCD variable in the probit model as shown in column 2 has the expected sign, the magnitude is lower before controlling for endogeneity. Its significance and magnitude improve after controlling for endogeneity as shown in column 3. The coefficient on the interaction term as reported in column 4 is insignificant confirming that heterogeneity is not a problem in the 2SRI specification and the estimates reported in column 3 are reliable. The results also show that among households with an illness, those afflicted by NCDs have a relatively higher chance of incurring catastrophic expenditure. The estimates as shown in column 3 indicate that the odds of incurring catastrophic expenditure are 51.35 higher if the illness is an NCD than if it is a communicable disease

This confirms that an NCD attack is more likely to drive a household to incur catastrophic expenditure much more than a CD. Hence, the welfare loss from NCDs far outstrips the gains lost from communicable diseases.

Estimation results from this sub-sample further show that age is a significant determinant of catastrophic expenditure. The odds of incurring catastrophic expenditure rise with age. One year raise in an individual's age raises the odds of incurring catastrophic expenditure by 1.16 per cent This may be explained by the fact that as a person ages the stock of health reduces making him or her more prone to diseases, and more so to NCDs. Since NCDs require life time care and treatment they force households to commit resources in disease management for a long period. This increases the likelihood of a household to incur catastrophic spending. In addition, as one ages their productivity declines concomitantly with income. Declining income coupled with

increased presence of NCDs explain the direct relationship between age and incidence of catastrophic expenditure.

Table 5.7: Marginal effects of factors explaining catastrophic expenditure from a sub-sample of households reporting illness.

	Estimation methods		
Explanatory Variables	**Probit (1)**	**2SRI (2)**	**Control function approach (3)**
Ncd	0.1682** [0.0137]	0.5135*** [0.1399]	0.5064*** [0.1409]
Household size	-0.0063** [0.0027]	0.0030* [0.0037]	0.0023 [0.0037]
Age	0.0021 [0.0016]	0 .0100** [0.0026]	0.0102** [0.0026]
Age squared	0.0025 [0.0002]	0.0016 [0.0002]	0.0015 [0.0001]
Years of schooling	-0.0055** [0.0016]	-0.0043** [0.0016]	-0.0041** [0.0016]
Health insurance	0.0281** [0.0143]	0.0198** [0.0147]	0.0188** [0.0146]
Urban residence	-0.0865*** [0.0134]	-0.0456*** [0.0178]	-0.0459** [0.0178]
Married	-0.0352** [0.0160]	-0.0562*** [0.0168]	-0.0546** [0.0168]
Male	0.0162* [0 .0127]	0.0153* [0.0127]	0.0133 [0.0127]
Ncd residual		0.7770*** [0.2051]	0.6069*** [0.2114]
Ncd* residual			0.0660 [0.0820]
Sample size	4397	4397	4397

Source: Author's computation. Note ***, ** and * represent significance at level 1%, 5% and 10% respectively. Standard errors are in parenthesis.

5.4 NCDs and household impoverishment

Health spending on NCDs contributes to household impoverishment. Health expenses are considered impoverishing if the gross household per capita spending exceeds household poverty line level of expenditure and net household per capita spending[27] is less than the household

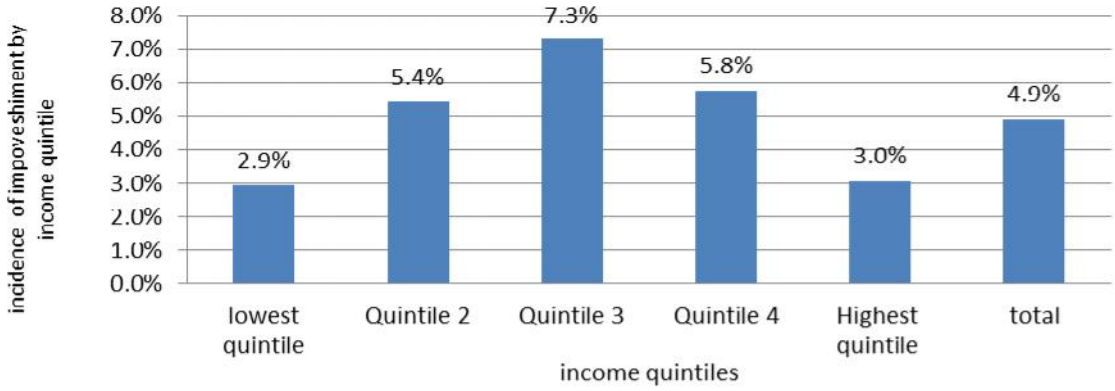
[27] Net household per capita spending is defined as household income minus health expenditure divided by household size

poverty line level of expenditure *(see section 4.2.2).* The regression results presented in Table 5.7 shows the marginal effects of the factors determining household impoverishment. The results on the odd ratios have been presented in Appendix B.

5.4.1 Descriptive statistics for household impoverishment model

Figure 5.5 shows the incidence of household impoverishment from healthcare spending by income quintiles. The results indicate that 4.9 per cent of the households that seek health care services become impoverished. The lowest quintile has the lowest incidence of impoverishment at 2.9 per cent. This is explained by the fact that households in this quintile are already poor. Their income is below the poverty line even before making health payments. Middle-income households in the third quintile have the highest incidence of impoverishment at 7.3 percent. They are the most affected by health expenditures.

Figure 5.5 Incidence of impoverishment by income quintiles



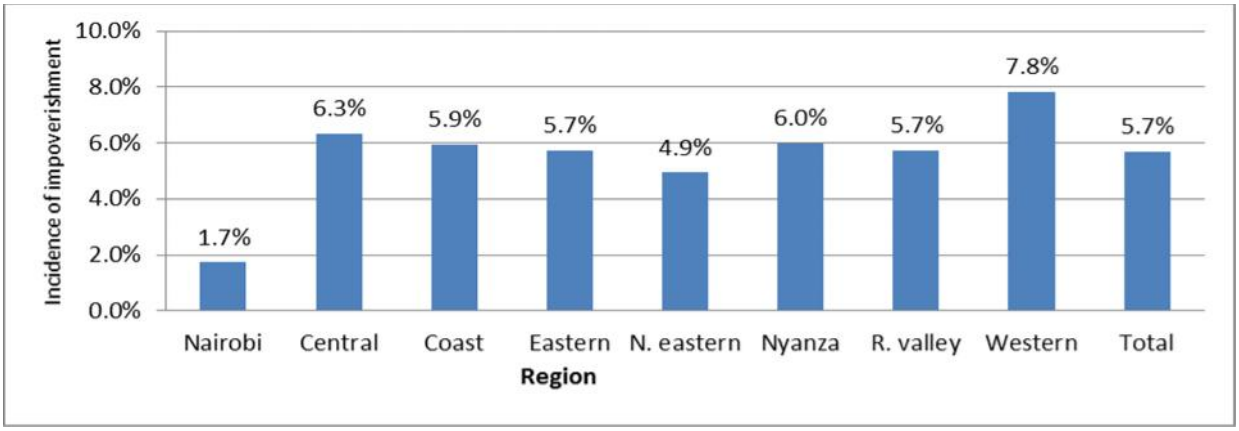
Source: Author's computation

These results are consistent with the findings of Xu *et al,* (2006) which show that 3.5 per cent of households that use health services are impoverished but not in the lowest quintile. Chuma and

Maina (2012) have similar findings that show 5 per cent of households that utilized health care in Kenya in 2007 became impoverished.

Figure 5.6 indicates that Western Province has the highest impoverishment rate at 7.8 per cent, followed by Central Province at 6.3 per cent. In the Rift Valley 5.7 per cent of the households have been impoverished by catastrophic payments. This rate is lower than for Central, Coast or Nyanza province. Nairobi Province has the least impoverishment rate at 1.7 per cent. Nairobi has relatively higher income on average than other regions.

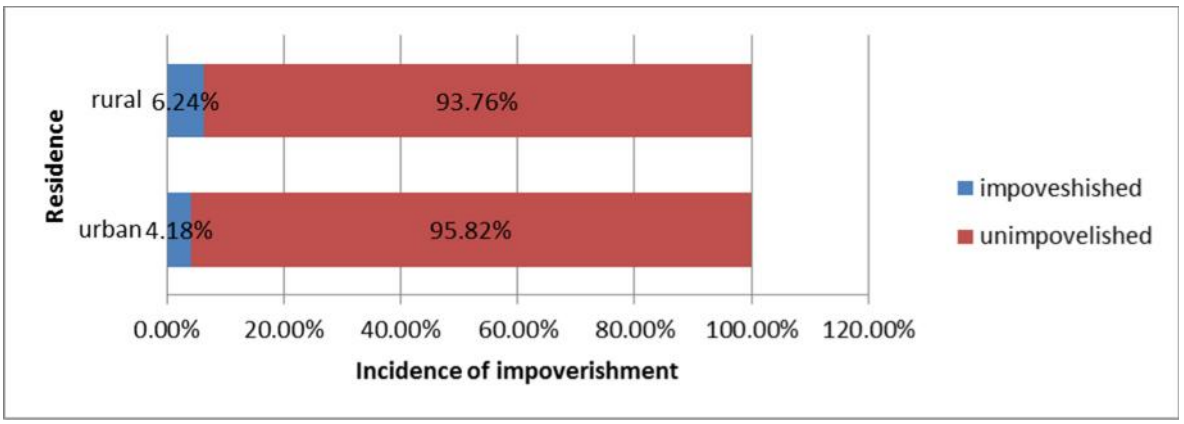
Figure 5.6 Incidence of impoverishment by province



Source: Author's computation

As illustrated in Figure 5.7 rural households are the most impoverished by health expenditures at 6.24 per cent. Urban households have an impoverishment rate of 4.18 per cent. The findings are similar to those obtained by Mahal *et al,* (2010). Rural households in India are relatively more impoverished by health expenditures when compared to households in urban areas.

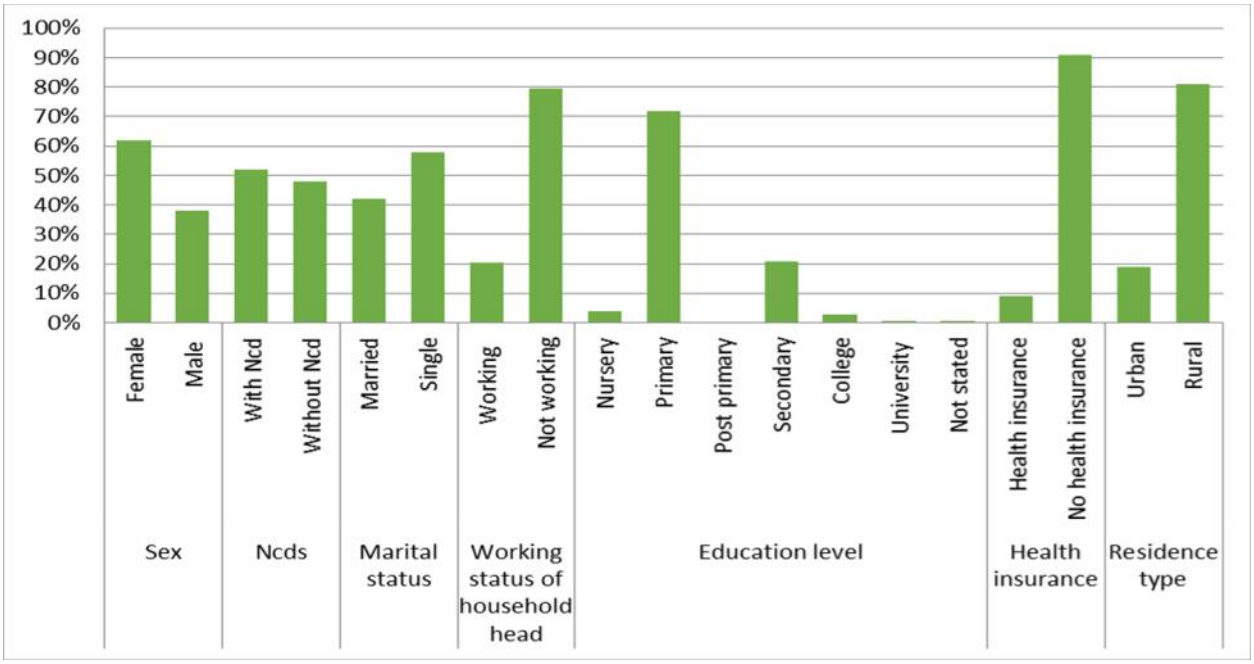
Figure 5.7 Incidence of impoverishment by location



Source: Author's computation

Characteristics of those impoverished by catastrophic health expenditure are shown in Figure 5.8. The figure shows that 62 per cent were females. Among these 52 per cent had NCDs, 91 per cent did not have any form of health insurance, and 81 per cent lived in the rural areas.

Figure 5.8 Characteristics of households that were impoverished by catastrophic health expenditures



Source: Author's computation

About 79.3 per cent of affected households had heads that were not in formal employment. Majority of the household heads had primary education with only 0.6 per cent having attained university education. Low education can easily lead to impoverishment in a household in the event of catastrophic health spending.

Only 42 per cent of households of the married suffered impoverishment compared to 60 per cent of singles. The singles are more affected by catastrophic health spending than the married.

5.4.2 Contribution of sickness and NCDs to household impoverishment

The potential risk of NCDs to impoverish households has been discussed. This section addresses this issue in more detail by examining the extent to which different NCDs influence household impoverishment. Table 5.8 presents regression results of indicators of household impoverishment by disease category. The categories are NCD and non-NCD. The estimates are from probit regression, two stage residual inclusion (2SRI), and control function approach.

Table 5.8: Marginal effects of factors explaining household risk to impoverishment due to sickness.

	Estimation methods		
Explanatory Variables	**Probit (1)**	**2SRI (2)**	**Control function approach (3)**
Urban	-0.0328*** [0.0047]	-0.0305*** [0.0047]	-0.0306*** [0.0048]
Household size	-0.0045*** [0.0011]	-0.0026** [0.0022]	0.0028** [0.0012]
Years of schooling	-0.0048 [0.00054]	-0.0001 [0.0006]	-0.0001 [0.0005]
Health insurance	0.0212** [0.0043]	0.0213*** [0.0043]	0.02146** [0.0043]
Sickness	0.0518** [0.0060]	0.2519*** [0.0461]	0.2465*** [0.0461]
Married	0.0161** [0.0072]	-0.0042 [0.0055]	-0.0056 [0.0058]
Male	-0.0100* [0.0047]	-0.0055 [0.0048]	-0.006 [0.0048]
Sick residual		-0.1244*** [0.0226]	-0.0875** [0.0490]
Sick residual*sickness			0.0434 [0.0510]

	Estimation methods		
Explanatory Variables	**Probit (1)**	**2SRI (2)**	**Control function approach (3)**
Sample size	8976	8953	8953
R-squared	0.0686	0.0751	0.0751

Source: Author's computation. Note: ***, ** and * represent significance at 1%, 5% and 10% respectively. Standard errors are in parenthesis.

The probit estimates improve after controlling for endogeneity as shown in the 2SRI results. The CF approach controls for both endogeneity and heterogeneity. The coefficient of sickness residual is significant while that of the interaction term is insignificant. Thus, heterogeneity is not a major problem and estimates of 2SRI are reliable. The odds of a household being impoverished by catastrophic OOP expenditure are 25.19 as shown by the coefficient on sickness in the 2SRI estimates.

We further compared the risk to impoverishment associated with health spending in case of an NCD versus other illnesses. Using a sample of households with an NCD and households with a communicable disease, the regression results are presented in Table 5.9.

Table 5.9: Marginal effects of factors explaining household risk of impoverishment due to NCDs from a sub-sample of households with NCDs and CDs cases

	Estimation methods		
Explanatory Variables	**Probit (1)**	**2SRI (2)**	**Control function approach (3)**
Urban	-0.0730*** [0.0033]	-0.0489*** [0.0140]	-0.0490*** [0.0014]
Household size	-0.0048** [0.0024]	-0.0018*** [0.0033]	0.0018*** [0.0033]
Age	0.0007 [0.0015]	0.0069** [0.0026]	0.0069** [0.0027]
Age squared	-0.0001 [0.00002]	-0.0002 [0.00002]	-0.0002 [0.0002]
Years of schooling	-0.0048** [0.0017]	-0.0067** [0.0017]	-0.0036** [0.0017]
Employment	0.0044 [0.0043]	-0.0098** [0.0047]	-0.0098** [0.0047]
Health insurance	0.0141** [0.0106]	0.0109 [0.0107]	0.0109 [0.0107]
Ncd	0.2268**	0.3058**	0.3045**

	Estimation methods		
Explanatory Variables	**Probit (1)**	**2SRI (2)**	**Control function approach (3)**
	[0.0172]	[0.1619]	[0.1619]
Married	-0.0176 [0.0127]	-0.0059 [0.0133]	-0.0060 [0.0134]
Male	0.0069 [0.0108]	0.0084 [0.0107]	0.0084 [0.0107]
Ncd residual		-0.5716** [0.1987]	-0.5644** [0.2064]
Ncd* residual			0.0099 [0.0763]
Sample size	6747	6747	6747

Source: Author's computation. Note: ***, ** and * represent significance at 1%, 5% and 10% respectively. Standard errors are in parenthesis.

The results of the models that were estimated illustrate that the favoured model is the 2SRI presented in column three, which has controlled for the problem of endogeneity. Heterogeneity was not a major problem in the estimation, this is confirmed by the coefficient on the interactions term (ncd*residual) reported in column 4 which is not significant. The probit results had understated the effects of NCD on impoverishment levels prior to controlling for endogeneity (*see* column 2). The results indicate (*see* column 3) that the odds of a household being impoverished due to OOP expenditures are 30.58 higher with NCDs than with communicable diseases. By comparison, the odds of a household being impoverished due to NCDs are about 5.39 per cent[28] greater compared to all illnesses regardless of the type (i.e. NCDs or non NCD). These results strongly indicate that the risks of impoverishment associated with health spending on NCDs greatly increased the likelihood of falling into poverty than the risk imposed by communicable diseases.

Lastly to further understand the contribution of NCDs to household impoverishment, the study makes use of a sample consisting of the households affected by NCDs and NCDs-free

[28] Difference between the NCD coefficient reported in table 5.9 and sickness coefficient presented in table 5.8

households. The results from three models are presented in Table 5.10. The first model presented in column two shows that the odds of a household being impoverished are 19.31 percent higher than those associated with disease free households. The result improves in the 2SRI approach (shown in column 3) which controls for endogeneity and further improves with control function approach presented in column 4 after controlling for the endogeneity and heterogeneity.

The favoured model in this study is presented in column 4 (control function approach), which shows that the odds of being impoverished due to NCDs are nearly double compared with NCDs-free households. The results (see, *column 4*) indicate that the odds of a household being impoverished are 48.97 higher with an NCD relative to disease free households. The results are consistent with our earlier finding that when the focus is on the risks of impoverishment associated with health spending, NCDs greatly increased the likelihood of falling into poverty, and they led to larger welfare losses compared with communicable diseases.

Table 5.10: Marginal effects of factors explaining household risk of impoverishment for sample of households with and without persons suffering from NCDs

	Estimation methods		
Explanatory Variables	**Probit (1)**	**2SRI (2)**	**Control function approach (3)**
Urban	-0.0307*** [0.0056]	-0.0317*** [0.0054]	-0.0321*** [0.0054]
Household size	-0.0056*** [0.0013]	-0.0046*** [0.0014]	-0.0040** [0.0014]
Age	0.0002 [0.0007]	0.0002 [0.0007]	-0.0002 [0.0008]
Age squared	0.0001 [0.00001]	-0.0007 [0.00001]	-0.0006 [0.00001]
Years of schooling	-0.0006 [0.0007]	-0.0005 [0.0069]	-0.0039 [0.0007]
Health insurance	0.0176*** [0.0046]	0.0170*** [0.0046]	0.0160*** [0.0046]
Ncd	0.1931**	0.4385**	0.4897**

	Estimation methods		
Explanatory Variables	**Probit (1)**	**2SRI (2)**	**Control function approach (3)**
	[0.0162]	[0.1618]	[0.1628]
Married	-0.0012 [0.0075]	-0.0004 [0.0059]	-0.0001 [0.0075]
Male	-0.0105 [0.0055]	-0.0068 [0.0059]	-0.0045 [0.0060]
Ncd residual		-0.0837** [0.0503]	-0.1680** [0.0631]
Ncd* residual			0.0861* [0.0396]
Sample size	6747	6747	6747

Source: author's computation Note: ***, ** and * represent significance at 1%, 5% and 10% respectively and standard errors are in parenthesis

5.5 NCDs Risk Factors

This section explores the association between NCDs and NCD risk factors. It starts with the descriptive statistics of the sample, and then presents the estimation results and their interpretation.

5.5.1 Descriptive statistics for NCDs risk factors model

Table 5.11 presents the social demographic characteristics of the respondents in the survey. The reported age had a wide spread with a mean of 30 years, standard error of 22, and highest age at 108 years. 52 per cent of the respondents were females. 32 per cent of the respondents reported consuming some quantity of vegetables and fruits; 12 per cent reported consuming alcohol (beer, wine and traditional brews), and 8 per cent were smokers. 62 per cent were not married while 79 per cent lived in rural areas. 69.7 per cent reported having attained primary-school education, and only 1.3 per cent had acquired university education.

Table 5.11: Social demographic characteristics of the survey respondents

Characteristic	**Measurement**	**Percentage**
Sex	Female	52%
	Male	48%

Characteristic	Measurement	Percentage
Vegetable and fruits intake	Consumes vegetables and fruits regularly	32%
	Does not consume vegetables and fruits regularly	68%
Residence	Urban	21%
	Rural	79%
Alcohol consumption	Consumes alcohol	12%
	Does not consume alcohol	88%
Cigarette smoking	Smokes cigarettes	8%
	Does not smoke cigarettes	92%
NCD	Has an NCD	21%
	Does not have any NCD	79%
Marital status	Married	38%
	Single	62%
Highest education level attained	Nursery	5.6%
	Primary	69.7%
	Post primary	0.8%
	Secondary	18.8%
	College	3.1%
	University	1.6%
	Not stated	0.4%
Age	Maximum	108
	Mean	30
	Standard error	22

Source: Author's computation.

5.5.2 Regression analysis

Table 5.12 presents results from estimation of equation 12. Column 2 shows the contribution of suspected risk factors to NCDs. Columns 3 and 4 show the 2SRI and CF approach estimates controlling for endogeneity and heterogeneity.

Results from the probit model presented in (*see, column 2 of Table 5.12*) show that except for alcohol and cigarette dummy, fruits and vegetable, mean district alcohol consumption and cigarette smoking variables, all the other coefficients are significant. In addition, apart from dummy variable for fruits and vegetable intake, age squared, mean district alcohol consumption, cigarette smoking, fruits and vegetable consumption variables all the other variables have the

expected sign. This is prior to controlling for endogeneity and heterogeneity issues in the estimation.

However endogeneity is controlled for in the 2SRI estimates presented in column 3, all the potential identifiers were not correlated with NCDs. They were also strongly correlated with the specific endogenous variables that they were instrumenting. The strength of the instruments was tested through assessing their impact on specific endogenous variables. Their coefficients were found to be significant (see Appendix A). By fitting the residuals of the reduced form equations for cigarette smoking, alcohol consumption, and vegetable intake in the structural equation 12 the residuals served as controls for unobservable factors that could be correlated with NCDs as in Mwabu and Ajakaiye 2007 and Mwabu 2009.

Table 5.12: Contribution of specific risk factors to NCDs prevalence in Kenya (Dependent variable is NCD dummy)

	Estimation method		
Explanatory Variable	**Probit (1)**	**2SRI (2)**	**Control function approach (3)**
Age	0.0265** [0.0016]	0.0058* [0.0120]	0.0053* [0.0064]
Age squared	-0.0102* [0.0142]	0.0141** [0.0120)	0.0243*** [0.0112]
Urban	0.0387** [0.0034]	0.0915** [0.0404]	0.0542** [0.0269]
Female	0.0162** [0.0026]	0.1099** [0.0446]	0.0741** [0.0373]
Log household income	0.0039* [0.0014]	0.0824*** [0.0197]	0.0420*** [0.0120]
Years of schooling	0.0100* (0.034)	-0.0100* (0.0027)	-0.0101* (0.0283)
Alcohol dummy	0.0166 [0.0185]	-0.0583** [0.0924]	0.2038** [0.0243]
Cigarette dummy	0.0043 [0.0052]	0.3674*** [0.2095]	0.5139*** [0.3210]
Fruits/vegetable dummy	0.0039 [0.0029]	-0.6210*** [0.0681]	-0.6677*** [0.0646]
Mean district alcohol consumption	-0.0017 [0.0015]	0.0195** [0.0138]	0.0849** [0.0076]
Mean district cigarette consumption	-0.0019 [0.0018]	-0.0418** [0.0148]	0.0303** [0.0096]
Mean district fruits and vegetables	0.0132**	0.1205**	-0.0640**

	Estimation method		
Explanatory Variable	**Probit (1)**	**2SRI (2)**	**Control function approach (3)**
consumption	[0.0019]	[0.0281]	[0.0183]
Distance to health facility	0.0502*** [0.0170]	0.1737** [0 .0885]	0.0775** [0.0328]
Alcohol residual		-0.0670** [0.2127]	-0.0766** [0 .4525]
Cigarette residual		-0.2222*** [0.0913]	-0.1344*** [0.0543]
Fruits and vegetables residual		0.4714*** [0.1181]	0.1363** [0.0640]
Cigarette* residual			0.0229 [0.0233]
Fruits/vegetables* residual			0.3764*** [0.0926]
Alcohol* residual			-0.0945** [0.0675]
Sample size	32721	32721	32721

Source: Author's computation. Note: ***, ** and * represent significance at 1%, 5% and 10%, respectively. Standard errors are in parenthesis.

The inclusion of residuals in the 2SRI regression served as a confirmation test for endogeneity and heterogeneity in the specified models. Since the residuals of cigarette smoking, income, alcohol consumption and vegetable intake were significant, it confirmed the presence of endogeneity resulting from unobservable factors not known to the researcher, but which affect the likelihood of developing an NCD.

To control for heterogeneity the residuals were interacted with their corresponding endogenous variables and included as additional variables in estimating the structural equation. Thus, alcohol consumption variable was interacted with its residual, cigarette smoking variable with its corresponding residual, and similarly for vegetable intake.

The interaction terms in alcohol consumption and vegetable intake were significant. This confirms the presence of heterogeneity arising from the interaction of these endogenous variables with unobservable NCD risk factors. An example of the unobservable is genetics that compound

the effect of risk factors predisposing a household much more to NCDs. The coefficient on the interaction term between cigarette smoking and its residual is insignificant suggesting that heterogeneity is not a major problem in cigarette smoking.

NCDs risk factors

The probability of getting an NCD is linked to social, behavioural and biological risk factors. Accurate identification of factors is important in formulating suitable interventions to fight NCDs. The CF estimates shows the coefficient on income to be positive and significant. This suggests that high income households have a higher risk of developing NCDs. However, probability of reporting an NCD increases at a decreasing rate as income increases. Thus, the wealthiest people have a lower risk of developing an NCD. Where a one unit change in household income ceteris paribus is associated with a "0.0420/mean of household income[29]", increase in the odds of reporting an NCD. These results have also been confirmed by the direction of relationship (see *Appendix B, Table B9*) as income changes. These findings are consistent with Wilensky and Satcher (2009) and North Carolina State Center for Health Statistics 2009 report. According to the report low-income households are more likely to develop NCDs than high-income households. NCDs such as kidney disease, coronary heart disease and diabetes are more likely to be found in poor households.

Poor households are more exposed to behavioural risks associated with NCDs more than the affluent households. They indulge in behaviours that put their health to risk such as overconsumption of alcohol, eating unhealthy diets, and low access to health services and health

[29] $NCD = \sim \log y; \frac{\partial NCD}{\partial y} = \frac{\sim}{y} = \frac{0.042}{\bar{y}}$ where y is household income

information on NCDs prevention and treatment (Williams and Collins, 2009). This leads Pritchett and summers (1996) and Creese (1992) to conclude that "wealthier is healthier". The poor have been observed not to commit any new income that they receive to health improving or disease preventive activities. They often attend to other competing needs.

This study found that smoking and alcohol intake are the most prominent risk factors for NCDs. Smoking and alcohol consumption increase the likelihood of developing an NCD by 51.39 and 20.38 per cent, respectively. The results are consistent with those of Shona *et al*, (2011) and Ahmed *et al*, (2009) who highlighted that developing countries are increasingly becoming exposed to behavioural risks associated with NCDs. As incomes increase coupled with industrialization and economic growth, the incidence of NCDs also increase. This will increase the health burden in these countries.

Consumption of vegetables and fruits reduce the likelihood of developing NCDs by 66.77 per cent. Low intake of fruits and vegetables is a risk factor in the development of NCDs in Kenya. The results are consistent with those of WHO (2002b) that found low fruit and vegetable intake to contribute to the development of approximately 41 per cent of NCDs such as coronary heart disease and ischaemic stroke. WHO (2005) and Nguyen *et al*, (2011) estimate that a person can reduce the likelihood of developing an NCD by close to 71 per cent through increasing the intake of vegetables and fruits.

The estimates in Table 5.12 further show that prevalence of NCDs is associated with neighbourhood variables proxied by district mean of alcohol consumption, cigarette smoking, and vegetable and fruit intake. A one percent rise in the mean consumption of alcohol and cigarette smoking in a district raises the likelihood of an NCD incidence in a household residing

in the district by 8.49 and 3.03 per cent, respectively. These findings are suggestive of social interactions that exposed a household to behavioural risk factors such as alcohol consumption and cigarette smoking. The social interactions could be in form of peer effects, social learning or neighbourhood effects. The results are consistent with those of Larsen *et al,* (2010), Caudill and Kong (2001) and Suls and Green (2003). These studies conclude that alcohol and cigarette consumption are social activities, and people generally monitor other people's drinking or smoking patterns to form their own patterns. These social effects have negative implications on an individual's and household's health.

A one percent rise in the mean consumption of fruits and vegetables intake in a district reduces the likelihood of NCD incidence in a household residing in the district by 6.40 per cent. The findings are suggestive of positive social effects in behaviour that promote health and nutrition. They confirm the findings of Herman *et al,* (2003) that food and eating play an important role in people's social lives particularly when household members eat with or in the presence of other people. Therefore, the social context within which food is eaten has implications on the nutritional value of the food. It determines the type and amounts of food consumed, and this have an effect on the household health status.

Hermans *et al,* (2009) investigated food intake by young women and the nature of social interactions between them with a view to model the relationship between social interactions and the quality of food consumed. The study found that social interactions affect the type and amount of food consumed by individuals in a group. Specifically, the study showed that young women adjust their food intake to those of others that they eat with.

The study further established a link between the risk of developing an NCD and social demographic characteristics including age, gender, years of schooling, and area of residence[30]. Living in an urban setting is associated with a 5.42 per cent likelihood of developing an NCD. Urban lifestyle is associated with a cluster of risk factors due to low levels of physical activity, higher incomes that promote risky behaviours such as smoking and consumption of processed foods with high fat content. Tawa *et al,* (2011) confirm that living in an urban setting is characterized by high risk factor clustering that increase the likelihood of having an NCD.

Table 5.12 further shows that aging in Kenya is associated with a 2.99 per cent increase in the likelihood of developing an NCD. These results are consistent with Kabir *et al*, (2003) and Dalstra *et al,* (2006) observation that the presence of NCDs increased with age. This is not surprising because as age advances, age-related biological risk factors catch up. As they get super-imposed upon cumulative life style behavioural risk factors (e.g cigarette smoking, wealth accumulation…etc.), these factors raise the probability of developing and NCD in later years. Ahamed *et al,* (2009) arrives at the same conclusion from a survey of NCD risk factors in several Asian countries using multi-site approach. Their study noted that risk factors clustering was directly associated with age.

In Kenya being female increases the likelihood of having an NCD by 7.41 percent. The results are consistent with those of Tawa *et al,* (2011) that show a positive link between female gender and NCD. Taylor (2007) and Lima *et al,* (2013) find being female significantly associated with heart diseases.

[30] Area of residence in the survey data was classified as urban cluster or rural cluster

The study findings in Table 5.12 show that distance to the nearest health facility is positively associated with NCDs. An increase of an extra kilometre in the distance between a household and the nearest health facility is associated with a 7.75 per cent increase in the likelihood of a household developing an NCD case. Distance reduces access to health services. Lack of access to health services bundles including health promotion and preventing information increase the odds of a household reporting an NCD. The results are in line with Onokerhoraye (1999), Tanser (2006) and Angel-Urdinola *et al,* (2008). These studies have it that spatial dimensions are important in determining health care utilization. Accessibility is a strategic factor contributing to the use of health care facilities. Thus, the greater the distance to the nearest health facility the less likely are users to seek medical services.

Lastly, years of schooling are associated with a 1.01 per cent reduction in the likelihood of having an NCD. The findings are consistent with Minh *et al,* (2009) whose study in Vietnam found that higher education is linked to low probability of risk factor clustering. Higher education increases awareness and capacity to take preventive interventions and actions against NCDs.

However, the findings contradict those of US Bureau of Labour (2006) and De Gergorio and Lee (2002). According to these studies, an increase in educational qualifications attainment is associated with a higher probability of having an NCD. The studies argue that higher education is highly correlated with income, urban life, affluence, greater consumption of alcohol, cigarettes, and engagement in risky behaviours.

CHAPTER SIX

SUMMARY, CONCLUSIONS AND POLICY IMPLICATIONS

6.1 Summary and conclusions

This study identified and described the effect of NCDs on household welfare[31], catastrophic health spending, and household impoverishment. It also dwelt on the most common risk factors for NCDs in Kenya. The study paints a picture of the future of NCDs epidemiology in the country. It is a source of information for future healthcare policy agenda in Kenya.

Literature shows that NCDs hurt household incomes due to the associated treatment costs and care. However, much of the evidence is from developed countries with little information on the effect of NCDs on household income in developing countries. In the past, communicable diseases topped healthcare policies in developing countries due to their wide spread and impact. But in recent years NCDs have emerged strongly in developing countries raising the need for research on their impact on household income.

The rise in NCDs in developing economies is linked to sedentary lifestyles, poor nutrition, smoking and alcohol intake. NCDs are no longer viewed as diseases of the rich or of developed economies. There is increasing awareness that NCDs affect the poor as well as the rich in developing as well as rich economies.

In the fight against the scourge of NCDs, the Ministry of Health in Kenya and the Department of NCDs need a clear and evidence-based plan of action. This study provides information relating to NCDs in relation to their impact on household income. This study also informs on the

[31] Welfare was assessed in terms of household income, and the likelihood of catastrophic spending and household impoverishment.

contribution of NCDs to catastrophic health spending, and shows whether the expenditure on NCDs is a poverty risk factor to households. The risk factors to NCDs in Kenya are also reported with a view to provide evidence which can be used to develop mitigating channels in the fight against NCDs.

The study used the Kenya Household Expenditure and Utilization Survey of 2007 in its analysis. One of the innovations of this study is the control of endogeneity and heterogeneity in the estimations. Endogeneity and heterogeneity arise as a result of complementarities between the unobservables and the variables of interest (viz, household income, NCDs, and risk factors). The study adopted a combination of approaches that include the instrumental variable (IV) approach, two-stage residual inclusion (2SRI) method, and the control function (CF) approach (also referred to us 2SRI with extension) to control for endogeneity and heterogeneity.

To examine the effects of NCDs on household income the study used four samples comprising of: the entire data set, a sub-sample of households with sick and healthy individuals, a sub-sample of households with healthy as well as NCD-sick individuals, and a sub-sample of households with sick individuals irrespective of the disease type. The findings show that ailments reduce household income by as much as 13.63 per cent. Disease imposes an economic burden on household through reduction of the welfare. Intuitively, households with a sick member are likely to experience lower income than those without.

NCDs are associated with 28.64 per cent reduction in household income. When compared to communicable diseases, the study finds that NCDs are associated with a 23.17 per cent drop in income compared to a household that reported a communicable disease. The burden of disease is huge if a household or a member is affected by an NCD as household income is greatly eroded.

The results confirm that although poor health lowers household's incomes relative to good health, the effect is higher if that poor health is as a result of an NCD than if it was the case with other diseases. In view of this empirical evidence, efforts to reduce the presence of NCDs in a household provide additional utility by increasing income.

The study investigated the determinants of catastrophic health spending in a household with special focus on the NCDs. Controlling for heterogeneity and endogeneity, the results revealed that sickness in general increases the likelihood of a household to incur catastrophic expenditure by 25.67 per cent. NCDs and communicable diseases contribute significantly in this regard. A household with an NCD case has a 51.35 per cent higher chance of incurring catastrophic expenditure than a household with a communicable disease case. NCDs increase the odds of incurring catastrophic health expenditure by 42.61 per cent.

Thus, households affected by NCDs are more vulnerable and they are more likely to slide into poverty. The odds of being impoverished by sickness are 25.19 per cent. The odds are higher at 48.97 per cent in case of an NCD. Among households with a sick member, the odds of being impoverished are 30.58 per cent higher in NCD cases compared to communicable diseases.

The treatment and care for NCD patients has severe consequences to a household particularly when the disease is chronic. When health spending is large and sustained for a long time it subjects households to impoverishment. Communicable diseases have a lower likelihood of pushing a household into catastrophic spending or abject poverty on account of health spending.

Since illness is not a choice policymakers have to devise ways of cushioning households that are severely affected. There is also need for mitigating measures through addressing the factors that increase the likelihood of getting sick.

This study assessed NCDs risk factors in Kenya with a view to shed light on the path of households, policymakers and researchers as they search for interventions to stem the rising cases of NCDs and their toll on households. The assessment indicates that low intake of fruits and vegetables, cigarette smoking and excessive consumption of alcohol are major risk factors to NCDs. In addition, NCDs in Kenya are associated with socio-economic and demographic factors including income, age, urban residence, education and gender.

Social interactions have bearings on a household's likelihood of developing an NCD. A one percent rise in the mean consumption of alcohol or cigarette smoking in a district raises the likelihood of NCD incidence in a household within the district by 8.49 and 3.03 per cent, respectively. Peer effects in alcohol consumption or cigarette smoking can have adverse effects on a household.

Conversely, a one percent rise in the mean consumption of fruits and vegetables in a district reduce the likelihood of NCD incidence in a household within the district by 6.40 percent. Peer effects in fruits and vegetables intake can have positive effects on a household's nutrition and disease prevention strategies. To this extent, social interactions are important in health productions function and household welfare. Adam Smith recognized this importance way back in the 1930s even though he did not give social interactions much weight (Smith 1937).

Risk factors call for a comprehensive approach to reduce their cumulative negative effects. In addressing the risk factors will be found a solution to the rising prevalence of NCDs.

6.2 Conclusions

NCDs have become the leading causes of morbidity and mortality in Kenya. Their claim on financial and time resources adversely affects household income and welfare. Although all types

of sicknesses have negative effects on household income and welfare, NCDs have more severe impacts. The prolonged treatment and care for chronic NCD patients push households into incurring catastrophic financial expenditures. The steady drain of household resources to pay medical bills coupled with lack of social protection push affected households into poverty. That NCDs only affects the rich and the elderly is a myth. The disease affects the young and the old in developed as well as developing countries.

Kenya has a multitude of NCD risk factors. They present themselves in different forms and combinations. Key among them is low intake of fruits and vegetables, cigarette smoking and alcohol consumption. Other correlates of NCDs include income, age, education, gender and location of residence.

Social interactions play an important role in individual and household health production. Unfortunately, they are only emphasized in such disciplines as sociology. In economics only in the writings of nineteenth century economists (see Pigou 1903, Fisher 1926, Becker 1974, and Veblen 1934) are social interactions given any attention. Modern economic literature has largely ignored them until recently. The significant explanatory power of social interactions in this study is evidence that they matter in economic analysis.

6.2 Policy recommendations

This study has pointed out that health expenditure on NCDs has significant economic losses and poverty impacts on households in Kenya. The government and development partners should put in place measures to stem the rising prevalence of NCDS as an objective in the achievement of Vision 2030 and the Millennium Development Goals (MDGs).

The government and development partners should put in place a health financing plan entailing health insurance and resource pooling as a mean towards social protection. The level of insurance coverage is quite limited in Kenya. This aspect coupled with lack of other credible social safety nets at a time of declining family ties denies households financial support in times of desperation. Without support the burden of NCDs fall entirely on individuals with devastating impact on their standards of living.

The health care system in Kenya needs to develop mechanisms to promote preventive care for NCDs. Preventive health is always better and cost effective than curative health. Effective prevention methods that address the NCD risk factors is preferable to treatment that is not only expensive but also protracted. These preventive measures would include routine screening for NCDs, incentive to promote engagement in physical activities (such as reducing tax for gym facilities) etc…

Alcohol consumption and smoking have been linked to NCDs. Regulating the use of these products merits policy action. The government has initiated steps in the right direction that include banning smoking in public places, limiting opening hours in alcohol outlets but more needs to be done. Smoking and consumption of illicit brews is a big problem in the country affecting the youth and those in the lower socioeconomic groups. Effective public policies are required to reduce smoking and drunkenness so as to reduce the rising incidence and prevalence of NCDs.

Fifth, education has been identified as an important policy variable in the reduction of presence of NCDs in a household. The study shows that education reduces the chances of developing NCDs, hence improvement in the level of education in the public could decrease the households' risk of developing an NCD. It is imperative that the government and other institutions intensify

awareness on NCDs risk factors and prevention strategies. Developing interventions that address exposure to risk factors at village level has a positive impact on individual household health status. There is need to increase public awareness on healthy lifestyles that include consistent consumption of fruits and vegetables. Such an approach would reduce the risks associated with NCDs at community and household levels. With small-scale interventions such as checking against unhealthy diets, controlling excessive alcohol and tobacco use, and engaging the youth in sports and recreation is a sure way to manage NCDs before they become a national disaster.

Human beings are known to be influenced by behaviours of others, particularly peers and neighbours. For this reason, awareness campaigns should reach out to community groups and organizations. Chartrand and Bargh (1999) says that individuals experience "chameleon effect" by mimicking behaviors that they observe from others in what is termed, "Monkey see, monkey do". The campaign against NCD risk factors has to be contextualized in a community setting. Behaviours are shaped in community settings and hence the importance for the awareness campaigns to reach out to community groups and organizations.

It was noted that the prior to 2007 the Ministry of Health has never designated a programme or budget for addressing cancer and other non-communicable diseases that are silent killers. This clearly illustrates the low priority overtime given to addressing NCDs at the policy level in spite of the dangers of these diseases (Republic of Kenya, 2011). Policymakers should prioritize NCDs prevention if the country is to escape an epidemic. A budget should be set aside for countrywide campaigns to increase awareness on NCDs risk factors and early detection of symptoms with a view to reduce deaths and costs associated with treatment (Republic of Kenya, 2011). .

6.3 Areas for further research

Prevention and care of NCDs is a national, regional, household as well as an individual challenge. More studies should be carried out using disease surveillance data to capture effect of specific NCDs on the household and individual.

Further research should be directed towards identifying community based interventions that could reduce the raising prevalence and incidences of NCDs.

The effects of social interactions on household health status are evident, but this paper has been unable to separate out their specific form. Further research in needed to separate out peer pressure, social learning, and neighbourhood effect from social interactions in health production functions.

REFERENCES

Abegunde, D, Mathers, C, Adam, T …, et al, (2007). The burden and costs of chronic diseases in low - income and middle - income countries, *The Lancet*, 370:1929-38.

Abrevaya J, Hausman J. and Khan, S. (2010) Testing for causal effects in a generalized regression model with endogenous regressors, *Econometrica,* 78(6): 2043- 2061.

Adegunde, D, and Stanciole A. (2006). An estimation of economic impact of chronic non communicable diseases in selected countries. World health organization working paper; Department of chronic diseases and health promotion [http://www.who.int/chp]

Ahmed S, Hadi A, Razzaque A…, (2009) Clustering of chronic non-communicable disease risk factors among selected Asian populations: levels and determinants. NCD supplement Global Health Action Supplement 1.

Ajakaiye O. and G. Mwabu, (2007). The Demand for Reproductive Health Services: Frameworks of Analysis. Mimeo, AERC. Nairobi.

Alberti G, Zimmet P, Shaw J…, *et al.* (2006). The IDF consensus worldwide definition of the Metabolic Syndrome. International Diabetes Federation. Elsevier Group PLC, MONTREAL, Canada

Alberts M, Urdal P, Steyn K…, *et al,* (2005). Prevalence of cardiovascular diseases and associated risk factors in a rural black population of South Africa. *European Journal of Cardiovascular Prevention and Rehabilitation,* 12(4):347-354.

American Diabetes Association, (1998). Economic consequences of diabetes mellitus in the US in 1997. *Diabetes Care*, 21:296–309.

Angel-Urdinola D, Cortez, R. and Tanabe, K. (2008) Equity, Access to Health Care Services and Expenditures on Health in Nicaragua. Health, Nutrition and Population (HNP) Discussion Paper, The International Bank for Reconstruction and Development / The World Bank, accessed at http://siteresources.worldbank.org/HEALTHNUTRITIONANDPOPULATION/Resources/281627-1095698140167/CortezNicaragua Health.pdf

Apps F, and Rees R, (1988) Taxation and the Household. Journal of Public Econ. 35: 355-69.

Apps, P, and Rees, R (1997). Collective Labor Supply and Household Production. *The Journal of Political Economy*, 105(1) (February), 178-190 accessed at http://www.jstor.org/stable/2138876

Asingwire, N (2000). The impact of user fees on equity of access to health services in Aids affected households in the rural Uganda; case study of Tororo District. Network of Ugandan researcher and research users

Balsa A, French M, and Regan T (2014) Relative Deprivation and Risky Behaviors. The *Journal of Human Resources,*49, 446 - 471.

Balsa, I, French, T, and Regan, T. (2010), In Review. Relative Deprivation and Health Compromising Behaviors among Adolescents *Journal of Human Resources*.

Baltagi, H. (2002) Econometrics. New York: Springer

Bandiera O. and Rasul I. (2006). Social networks and technology adoption in Northern Mozambique. *Economic Journal*, 116:869-902.

Bandura, A, 1977. Social Learning Theory. Prentice-Hall, Englewood Cliffs, New Jersey.

Bandura, A, 1986. Social Foundations of Thought and Action. Prentice-Hall, Englewood Cliffs, New Jersey

Bardsley, P, and Olekalns N (1999). Cigarette and tobacco consumption: Have anti-smoking policies made a difference? *The Economic Record,* 75:225-40.

Barker J. (2004). The development origins of adult disease. *Journal of American collage of nutrition,* 6, 588-595

Baruwa E (2010) HIV/AIDS Program Sustainability Analysis: Highlighting the importance of a comprehensive and flexible approach. First Global Symposium on Health Systems Research, Montreux, Switzerland.

Beaglehole, R, Irwin, A, and Prentice, T, (2003). Shaping the Future. World Health Report. World Health Organization, Geneva, Switzerland.

Becker G.S (1962). Investment in human capital: A theoretical analysis. *The journal of political economy,* 70:9-49

Becker G.S and Murphy M (1988). A theory of rational addiction. *The journal of political economy,* 96:675-700

Becker, G. (1965). A theory of the allocation of time *The economic journal,* 75(229) (September): 493-517

Becker, G. (1974). A theory of social interactions *Journal of political economy*, 82 (6) Nov-dec.1063-1093 viewed at http://www.jstor.org/stable/1830662

Berki, E, (1986). A look at catastrophic medical expenses and the poor. *Health Affairs* 5: 139-45

Bhargava, A. (2003). A longitudinal analysis of the risk factors for diabetes and coronary heart disease in the Framingham offspring study. *Population and health metrics,* 1; 3 viewed at http://www.pophealthmetrics.com/content/1/1/3

Bolin K, Jacobson L, and Lindgren B (2002). The family as the health producer – when spouses act strategically. *Journal of health economics,* 21:475-495

Bonita R, De Courten M, Dwyer T…, *et al,* (2001). Surveillance of risk factors for NCDs: the WHO stepwise approach. Geneva

Boutayeb A and Boutayeb S (2005) The burden of non-communicable diseases in developing countries. *International Journal for Equity in Health*, 4:2

Boutayeb A. and Boutayeb S. (2005). The burden of communicable and non-communicable disease in developing countries. *Int J Equity Health,* 4: 2.

Boutayeb A. (2006). The double burden of non-communicable disease in developing countries. *Trans R Soc Trop Med Hyg ,* 100: 191 – 199

Bratti M, Miranda A. (2011). Endogenous treatment effects for count data models with endogenous participation or sample selection, *Health Economics,* 20(9): 1090-1109.

Brummett H, Babyak A, Siegler C…, *et al,* (2011) Systolic Blood Pressure, Socioeconomic Status, and Biobehavioral Risk Factors in a Nationally Representative US Young Adult Sample. Hypertension. 58:161–6

Card, D. (2001). Estimating the Return to Schooling: Progress on Some Persistent Econometric Problems. *Econometrica,* 69(5):1127-60

Carrin G, Eriki P, Adelhardt…, *et al,* (2007). Health financing in Kenya – assessing the social health insurance proposal. South African medical journal, 97: 130-135

Caudill, D, and Kong, H. (2001). Social approval and facilitation in predicting modeling effects in alcohol consumption. *Journal of Substance Abuse,* 13, 425−441.

Cavagnero E. Carrin G. Xu K…, *et al ,* (2006) Health Financing in Argentina: An Empirical Study of Health Care Expenditure and Utilization, Working Paper Series in Innovations in Health Financing, Instituto Nacional de Salud Publica, Mexico.

Chadha, L, Gopinath, N. and Shekhawat, S. (1997). Urban-rural differences in the Prevalence of coronary heart disease and its risk factors in Delhi. *WHO Bulletin,* 75: 31-38

Chaloupka, F. Saffer, J and Grossman, M. (1993) Alcohol-control policies and motor-vehicle fatalities. *Journal of Legal Studies*, 22(1):161–186.

Chartrand, L, and Bargh, A. (1999). The chameleon effect: The perception-behaviour link and social interaction, *Journal of Personality and Social Psychology,* 76, 893-910.

Chiappori P, Haddad L, Hoddinott J…, *et al,* (1993) Unitary versus Collective Models of the Household. Policy Research Working Paper Series, the World Bank. No 1217

Chiappori P.A, (1997), Introducing Household Production in Collective Models of Labor Supply. *Journal of Political Economy,* 105:191

Chiappori, P. A. (1988):Rational Household Labor Supply. *Econometrica,* 56: 63-89.

Chiappori, P. A. (1992). Collective Labor Supply and Welfare. *Journal of Political Economy,* 105: 191-209.

Chollet, D. and Betley, C. (1987). Catastrophic Health Care Cost: who is at risk? In: Where Coverage Ends: Catastrophic Illness and Long- Term Health Care Costs, 1987. Employee Benefit Research Institute.

Chuma J, and Okungu V, (2011). Viewing the Kenyan health system through an equity lens: implication of universal coverage, *International journal for equity in health,* 10:22

Chuma J, Musimbi J, Okungu V…, *et al.* (2009). Reducing user fees for primary health care in Kenya. Policy on paper or policy in practice? Biomed central ltd.

Chuma J, and Maina T (2012), catastrophic health care spending and impoverishment in Kenya. Accessed at http://www.ncbi.nlm.nih.gov/pubmed/23170770

Creese Andrew L. (1992) 'Health is Wealth but also Wealth is Health'. *World Health,* Nov – Dec: 4-5

Cuddington, J. (1993). Modeling the macroeconomic effects of AIDS with an application to Tanzania *World Bank Economic Review,* 7(2):173-89.

Dalstra, J, Kunst, A. and Mackenbach, J. (2006) A comparative appraisal of the relationship of education, income and housing tenure with less than good health among the elderly in Europe. *Social Science and Medicine*, 62: 2046–2060.

David, J, Alonso-Morage a, Borai F…, *et al.* (1989) Latitudinal variation of Adh gene frequencies in Drosophila melanogaster a Mediterranean instability. *Heredity*, 62: 11-16

De Gregorio J, Lee W (2002). Education and income inequality: new evidence from cross-country data. *Rev Income Wealth*, 48: 395-416.

Deb P, Trivedi P.K. (1997) - Demand for Medical Care by the Elderly: A Finite Mixture Approach, *Journal of Applied Econometrics*, 12: 313-336

Deb P, Trivedi P.K. (2006). Specification and simulated likelihood estimation of a non-normal treatment outcome model with selection: application to health care utilization. *Econometrics Journal*, 9: 307.331

DeGiorgi G, Pellizzari M. and Redaelli S. (2009). Be as careful of the company you keep as of the books you read: Peer effects in education and on the labor market. NBER Working Paper Series, Working Paper 14948.

Dennison, R, Peer, N, Steyn, K…, *et al.* (2007). Determinants of Hypertension Care and Control among Peri-Urban black South Africans: The HiHi Study. *Ethnicity & Disease*, 17:484-91.

Departmental committee on health (2011) Policy brief on the situational analysis of cancer in Kenya. Department of research

Doorslaer, E, Donnell, R, Garg…, *et al.* (2006). Effect of payments for health care on poverty estimates in 11 countries in Asia: An analysis of household survey data. *The Lancet, 368* (October 4):1357-64.

Eisenkopf G. (2010). Peer effects, motivation, and learning. *Economics of Education Review*, 29:364-374.

Elgoni, A, Hunter, J, Kaye-Petersen, E…, *et al,* (2008). Health in Gauteng Status Report 2006 / 2007. Johannesburg: Gauteng Department of Health; 2008.

Feenberg, D. and Skinner, J, (1994). The risk and duration of catastrophic health care expenditures. *The Review of Economics and Statistics*, 76(4), 633- 647

Fisher .I. (1926). Mathematical investigation in the theory of value and price. New haven, Yale University press

Florens J, Heckman J, Meghir C ., *et al,* (2008). Identification of treatment effects using control functions in models with continuous, endogenous treatment and heterogeneous effects. *Econometrica, 76(5)1191-1206.*

Flores, G, Krishnakumar,J, O'Donnell, O. and van Doorslaer, E. (2008). Coping with Health Care Costs: Implications for the Measurement of Catastrophic Expenditures and Poverty. *Health Economics*, 17(12):1393-412

Fox, S. (2010). Cardiovascular Disease Risk Factors, Type 2 Diabetes Mellitus, and the Framingham Heart Study. *Trends in Cardiovascular Medicine*, 20:90-5.

Friedman M. (1957). A Theory of the Consumption Function. Princeton: Princeton University

Press

Fun, J. and Zick, D. (2005). The Economic Burden of Health Care, Funeral, and Burial Expenditures at the End of Life. *Journal of Consumer Affairs*, 38(1): 35-55

Gaillard, T, Schuster, D, and Osei, K. (2009). Metabolic Syndrome in Black people of the African diaspora: The paradox of current classification, definition and criteria. *Ethnicity and Diseases*, 19:S2-1-S2-7.

Gajalakshmi,V, Peto, T, Santhanakrishna,T…,*et al*, (2003). Smoking and mortality from tuberculosis and other diseases in India: Retrospective study of 43,000 adult male deaths and 35,000 controls *The Lancet*, 362 (August 16):507-15.

Gakidou E, Lozano R, Gonzalez-pier E…, (2006). Health systems in Mexico 5- assessing the effect of the 2001 to 2006 Mexican health reform ; an interim report card. *Lancet*, 368(9550): 1920 – 1935

Galobardez B, Coatsnza M,Bernstein C…, *et al* , (2003). Trends in risk factors for lifestyle – related diseases by socio economic positions in Geneva, Switzerland, 1993 – 2000: Health inequalities persist, *American journal of public health*, 93(8): 1302 – 1309

Garg, C. (1998). Equity of health sector financing and delivery in India. Viewed at; http://www.hsph.harvard.edu/research/takemi/files/rp144

Garg, C, and Karan, A. (2009). Reducing out-of-pocket expenditures to reduce poverty: a disaggregated analysis at rural-urban and state level in India. *Health Policy & Planning*, 24(2): 116–128.

Gathiaka, J. K, (2010). Social interaction and returns to farm inputs in smallholder agriculture in Kenya. *European scientific journal*, 8 (5)

Gaziano, A, (2005). Cardiovascular Disease in the Developing World and Its Cost-Effective Management, *Circulation*, 112:3547-53.

Gertler P, Locay L, and Sanderson W (1987). Are user fees regressive? The welfare implication of health care financing proposals in Peru. *Journal of econometric*, 36 9supp): 67 – 68

Gertler, P. and Gruber,J. (2002). Insuring consumption against illness. *American Economic Review*, 92(1): 51-70.

Ghaffar,A, Reddy,S.and Singhi, M.(2004). Burden of non-communicable diseases in South Asia. *British Medical Journal*, 328:807-10.

Gill, R. and Cooper,R. (2008). Physical Activity and Prevention of Type 2 Diabetes Mellitus. *Sports Medicine*, 38(10):807-24.

Gottret, P. and Schieber, g. (2006). Health Financing Revisited: A Practitioner's Guide. World Bank. Washington DC.

Gravelle, H. and Rees, R. (2004) Microeconomics. 3rd Edition, Ashford Colour Press, Gosport, Hants, UK

Greene W. 2012. Econometric Analysis. Prentice Hall. USA.

Greene W.H. (1997). Econometric analysis. New Delhi: Prentice-Hall Inc.

Greenland S (2000) Causality theory for policy uses of epidemiological measures. Accessed on 20th may 2013 on http://whqlibdoc.who.int/publications/2002/9241545518_Chap6.2.pdf

Grossman .M (1972). On the concept of health capital and the demand for health. The *Journal of political economy,* 80:223-636

Grossman .M (2004). The demand for health, 30 years later: a very personal retrospective. *Journal of health economics,* 23:629-636

Gupta I, Kandamuthan S, and Upadhaya D (2006). Economic impact of cardiovascular diseases in India. New Delhi: Institute of Economic Growth University of Delhi

Gupta K (2009) Impact of health education interventions program regarding breast self-examination by women in semi-rural area of Mdhya Pradesh. India. Asian pacific journal of cancer prevention: APJCP, PMID 20192594

Gupta, I. (2009). Out-of-pocket Expenditures and Poverty: Estimates from NSS 61st Round. Draft paper. Institute of Economic Growth, New Delhi.

Halverson R and Palmquist R (1980) the Interpretation of Dummy Variables in Semilogarithmic Equations. *The American Economic Review,* 70:474-475

Harakeh Z, Rutger, Van Baan et al .,(2007) imitation of cigarette smoking: An experimental study on smoking in a naturalistic setting. *Drug and alcohol dependence,* 86, 199 - 206

Harding E (2001). The nutritional basis of the foetal origins of adult disease. *International journal of epidemiology,* 10: 15 – 23

Hausman A (1978) Specification Tests in Econometrics. *Econometrica,* 46(6): 61251-1271

Herman, P, Roth, A, and Polivy, J. (2003). Effects of the presence of others on food intake: A normative interpretation. *Psychological Bulletin,* 129, 873-886

Heckman J (undated) Discrete Dependent Variable Models, economics lecture notes, viewed at http://athens.src.uchicago.edu/jenni/Handout_archive/Factor_models/Discr_depvar.pdf

Hermans, R, Engels R, Larsen, J …, et al (2009), Modeling of palatable food intake, the influence of quality of social interaction. *Elsevier*, 52 (2009) 801–804

Himmelstein, E, Warren, D, and Woolhandler, S, (2006). Illness and injury as contributors to bankruptcy. *Health Affairs,* 25(2):74-83

Honore, B. and Lleras-Muney, A. (2004). Bounds in competing risks models and the war on cancer. Working paper. Department of Economics, Princeton University, Princeton.

Horrace W and Oaxaca R (2006) Results on the bias and inconsistency of ordinary least squares for the linear probability model, *Economics Letters,* 90:21 – 327

Hussain A, Rahim A, Azad Khan K., (2005). Type 2 diabetes in rural and urban population: Diverse prevalence and associated risk factors in Bangladesh. *Diabet Med,* 22: 931-937.

Hutubessy, R, Niessen, L, Tomijima, N…, *et al,* (2003). Effectiveness and costs of interventions to lower systolic blood pressure and cholesterol: a global and regional analysis on reduction of cardiovascular-disease risk. *The Lancet,* 361: 717-72.

Hyman, D, Chisholm, R, Kessler,V…, *et al,* (2006). Mental disorders. In Jamison, D, Breman,J, Measham, A…,*et al,* (editors) *Disease Control Priorities in Developing Countries* Washington, D.C.: The World Bank and Oxford University Press, pp. 605-26.

Janz, N and Becker H (1984) the health belief model: a decade later. *Health education quarterly*, 11:1047

Kabir .N (2003) Support for the elderly people, by the elderly people in Bangladesh. In: Kabir M (ed) the elderly contemporary issues. Bangladesh Association of Gerontology. Dhaka, Bangladesh.

Katz, E (1992) linear expenditure systems, children as public goods, and intrahousehold inequality. Discussion paper 104. Development economics research centre, university of Warwick

Keeler, E, Hu, T, Barnett, P…, *et al,* (1993), Taxation, (1993) Regulation, and Addiction: A Demand Function for Cigarettes Based on Time-Series Evidence, *Journal of Health Economics,* 1-18.

Kimani, J, Ettarh, R, Kyobutungi C., *et al,* (2012). Determinants of participation in the public health insurance program among residents of urban slums in Nairobi, Kenya results from cross sectional survey. *BMC health services research*, 12:66

Kimani, D , Muthaka, D, and Manda, D (2004). Health financing through health insurance; the shift from national hospital insurance fund to national social health insurance fund. KIPPRA.

Kioko, U. (2008). The economic burden of malaria in Kenya; A household level investigation, School of economics, university of Nairobi. Nairobi.

Knaul, M. Arreola-Ornelas H, Mendez-Carniado, O…, *et al.* (2006). Health system reform in Mexico four- evidence is good for your health system; policy reform to remedy Catastrophic and impoverishing health spending in Mexico. *Lancet*, 368(9549): 1828 – 1841

KNBS and ICF macro. (2010). Kenya demographic and household survey 2008/9. Calverton, Maryland: KNBS and ICF Macro

Krishna, A. (2007). For reducing poverty faster: Target reasons before people. *World Development*, 35(11):1947-60.

Kyobutungi C, Ziraba A, Ezeh *et al,* (2008) The burden of disease profile of residents of Nairobi's slums: Results from a Demographic Surveillance System. *Population Health Metrics,* 6:1

Lamiraud K, Booyen, F and Scheil-Adlung X (2005). The impact of social health on access to health care, health expenditure and impoverishment: A case study of south Africa. *International labour office*, Geneva

Larsen H, Engels R, Souren P…, et al (2010) Peer influence in a micro-perspective: Imitation of alcoholic and non-alcoholic beverages. *Addictive Behaviors,* 35, 49–52

Laura C and Mabli J (2010) Low-Income Household Spending Patterns and Measures of *Poverty Mathematica Policy Research*, 600 Maryland Avenue, Washington, DC

Laxminarayan, R. (2004) Does reducing malaria improve household living standards? *tropical medicine and international health*, 9(2): 267-271

Lee T, (2011). Paying out of pocket for the health care in Korea; change in catastrophic and poverty impact over the decade. Available at: http://www.hsph.harvard.edu/research/takemi/files/RP254_takemi_journal1_lee.pdf.

Leeder, S, Raymond,S, Greenberg,H…, *et al,* (2004). A Race against Time: The Challenge of Cardiovascular Disease in Developing Countries. New York, NY: Columbia University Press.

Levenson, W, Skerret, P. and Gaziano, M. (2003) Reducing the global burden of cardiovascular disease: The role of risk factors. *Preventive cardiology*, 5: 188-199.

Lima M, Kerr-Côrrea F and Rehm J (2013) Alcohol consumption pattern and Coronary Heart Disease risk in Metropolitan São Paulo: analyses of GENACIS Project. *Revista Brasileira de Epidemiologia,* vol.16 no.1

Limwattananon, S, Tangacharoensathien V and Prakongsai (2007). Catastrophic and poverty impacts of the health payments: results from national household survey in Thailand. Bulletin of WHO, 85(8); 600- 606

Lopez-Cassanovas.G, and Rivera, B. (2005). Health and Economic Growth: Findings and policy implications. Cambridge MA, the MIT Press, pp. 385.

Louma, M, Doherty J, Muchiri S…, *et al,* (2010). Kenya health system assessment. Bethesda, MD; Health system 20/20 project, Abt Associates Inc.

Lown, B. and Banerjee,A. (2006). The developing world in The New England Journal of Medicine. *Globalization and Health,* 2 (3): 1744-8603.

Lundberg S and Pollak R, (1996) Bargaining and distribution in marriage. *The journal of economic perspectives,* 10: 139-158

Lundberg, S and Pollack R (1992) separate spheres bargaining and the marriage market. Paper presented at the IFPRI-world bank conference on intrahousehold resource allocation: policy issues and research methods, Washington, D.C

Macinko, J and Starfield, B (2001). The utility of social capital in research on health determinants. *The Milbank quarterly,* 79: 387-427

Mahal, A, Karan, A, and Engelgau, M. (2010). The economic implication of non-communicable disease for India. HNP discussion paper: World Bank. Washington, DC

Mahal, A, Sakthivel, S. and Nagpal,S. (2005). National Health Accounts for India In *Health Systems in India: Delivery and Financing of Services*, National Commission on Macroeconomics and Health, Ministry of Health and Family Welfare, Government of India, New Delhi, pp. 222-228.

Maina.W. (2009). *Control of non-communicable* disease in Kenya, past present and future. Nairobi: Ministry of health Kenya.

Mankiw G (2013). Understanding Consumer Behavior Worth Publishers, Assessed at https://www2.bc.edu/~murphyro/EC204/PPT/CHAP16.pdf

Mariara J, Mwabu D and Ndeng'e G (2009) the consequances of fertility for child health in Kenya; endogeneity, heterogeneity and the control function approach. AERC

Mbanya, J, Motala, A, Sobgnwi, E…, *et al,* (2010). Diabetes in sub-Saharan Africa. *The Lancet*, 375:2254-66.

Mendola, M, Bredenkamp, C and Gragnolati, M (2007). The impoverishing effect of adverse health events: evidence from the western Balkans, Policy Research Working Paper Series 4444, The World Bank.

Meusel, D, Hoger, C, Cavill, N…, *et al*, (2008). Armstrong T. A framework to monitor and evaluate implementation: Global strategy on diet, physical activity and health. World Health Organization, Geneva, Switzerland.

Minh H, Huong, D, Giang K and Byass P (2009) Economic aspects of chronic diseases in Vietnam. Accessed at http://www.globalhealthaction.net/index.php/gha/article/view/1965/4840

Miranda, A. (2004) - FIML estimation of an endogenous switching model for count data. *Stata Journal.* 4 (1): 40-49

Moodley, M, and Rambiritch, V. (2007). An assessment of the level of knowledge about diabetes mellitus among diabetic patients in a primary health care setting. *South African Family Practice*, 49(10):16-20.

Mullahy, J. (1997). Instrumental variable estimation of count data models: applications to models of cigarette smoking behaviour. *Review of Economics and Statistics,* 79:586 - 593.

Murray C, Lauer A, Hutubessy R…, (2003), Effectiveness and costs of interventions to lower systolic blood pressure and cholesterol: a global and regional analysis on reduction of cardiovascular -disease risk. *Lancet,* 361:717–725

Murray, C. and Lopez, D. (1996). Global Health Statistics: Global Burden of Disease and Injury Series. Volumes I and II. Boston: Harvard School of Public Health.

Murray, L, Lopez,D, Christopher, J.., *et al* , (2005). Global Burden of Disease and Risk Factors. The World Bank and Oxford University Press, New York.

Murthy, K. and Sastry,J. (2005). Economic burden of chronic obstructive pulmonary disease, In Background papers: The Burden of Disease. New Delhi: Ministry of Health and Family Welfare, National Commission on Macroeconomics and Health, pp. 265-74.

Mwabu .G. (2007). Malaria and poverty in Africa. University of Nairobi Press. Nairobi

Mwabu G. (2009). The production of child health in Kenya: A structural model of birth weight. *Journal of African Economies,* 18(2):212-260

Narayan, D, Chambers, R, Shah, M. and Petesch, P. (2000). Voices of the Poor: Crying out for Change. Oxford University Press. New York.

Narayan,V, ,Zhang, A, Kanaya, D…,*et al,* (2006). Diabetes: the pandemic and potential solutions In D. Jamison, J. Breman, A. Measham, G. Alleyne, M. Claeson, D. Evans (editors) Disease Control Priorities in Developing Countries Washington, D.C.: The World Bank and Oxford University Press, pp. 591-603.

Nelson C and Startz R. (1990). The distribution of the instrumental variables estimator and its t-ratio when the instrument is a poor one. *Journal of Business,* 63, 125-140.

Ng N, Stenlund H, Bonita …, *et al,* (2006). Preventable risk factors to NCDs in rural Indonesia: prevalence study using WHO step approach. *Bulletin WHO,* 84; 165 – 170

Ngugi N, Njenga E, Ngugi P…, *et al,* (2011). Regional Differences in Prevalence of Diabetes among Medical Attendees in Kenya. Kenya Diabetes Management and Information Centre, Presented at IDF World Diabetes Congress

Nguyen D,Datar A, Lepine F…,(2011) Active Starvation Responses Mediate Antibiotic Tolerance in Biofilms and Nutrient-Limited Bacteria, *Science*, 334- 982

Niringiye A and Douglason G (2010). Environmental and Socio-economic Determinants of Malaria Prevalence in Uganda. *Research Journal of Environmental and Earth Sciences,* 2(4): 194-198, 2010

Norman, R, Gaziano, T, Laubscher, R…, *et al,* (2007). Estimating the burden of disease attributable to high blood pressure in South Africa in 2000. *South African Medical Journal*, 97(8):692-8.

North Carolina State Center for Health Statistics (2009) Behavioral Risk Factor Surveillance System report. North Carolina Department of Health and Human Services. Accessed at http://www.schs.state.nc.us/SCHS/brfss/2008/index.html

Nugent R, (2008). Chronic Diseases in Developing Countries; Health and Economic Burdens Center for Global Development, Washington, DC, USA

O'Donnell O, van Doorslaer E, Rannan-Eliya R., *et al* , (2008). Who pays for health care in Asia? *Journal of Health Econ.* 27(2): 460–75.

O'Donnell, O, E. van Doorslaer, *et al,* (2005). Explaining the incidence of catastrophic expenditures on health care: Comparative evidence from Asia. EQUITAP Working Paper NO 5, Eramsus University, Rotterdam and IPS, Colombo.

Olshansky, J. and Ault, B. (1986). The fourth stage of the epidemiologic transition: the age of delayed degenerative diseases. *Milbank Memorial Fund Quarterly,* 64: 355-91.

Omran, A. (1971). Epidemiologic Transition. *Milbank Memorial Fund Quarterly,* 49(1): 509-538.

Onokerhoraye, A. (1999) Access and Utilization of Modern Health Care Facilities in the Petroleum-producing Region of Nigeria: The Case of Bayelsa State. Research Paper No. 162, Takemi Program in International Health, Harvard School of Public Health, **Boston.**

Pampel F (2005). Patterns of tobacco use in the early epidemic states: Malawi and Zambia. *American journal of public health*, 95(6): 1009 – 1015.

Parkin D, Sita F, Chirenje M…, *et al*, (2008) Cancer in Indigenous Africans—burden, distribution, and trends *The Lancet Oncol*, 9: 683 - 92

Peters, D, Yazbeck, S, Sharma, R…, *et al*, (2002). Better Health Systems for India's Poor: Findings, Analysis, and Options. Human Development Network, (Health, nutrition, and population series), World Bank. Washington DC.

Phillips-Howard PA, Odhiambo FO, Hamel M, *et al.* (2012) Mortality Trends from 2003 to 2009 among Adolescents and Young Adults in Rural Western Kenya Using a Health and Demographic Surveillance System. PLoS ONE 7:11

Pigou C (1903). Some remarks on utility. *Economic journal*, 13, 19 - 34

Pitt, M, Rosenzweig N and Hassan N (1990). Productivity, Health and Inequality in the Intra - household Distribution of Food in Low-Income Countries. *American Economic Review*, 80: 1139-1156.

Population Reference Bureau. (2010). World population data sheet, viewed at; http://www.prb.org/pdf10/10wpds_eng.pdf

Posner, M, Cupples, A, Gagnon, D…, *et al*, (1993). Healthy people 2000: The rationale and potential efficacy of preventive nutrition in heart disease: The Framingham Offspring-Spouse study. *Arch Intern Med*, 153:1549-1556

Pradhan, M. and Prescott N. (2002). Social Risk Management Options for Medical Care in Indonesia. *Health Economics,* 11:431-46

Pritchett, L, and Lawrence, S (1996). Wealthier is Healthier'. *Journal of Human Resources*, 31(4): 842–868.

Psacharopoulos, G. (1994). Returns to Investment in Education: A Global Update. World *Development*, 9:1325-43.

Puoane, T, Bradley,H, and Hughes, G. (2005). Obesity among South African women. *Human Ecology Special*, 13:91-5.

Rama, P (2010). Borrowing for hospitalization in India MPRA Paper No. 29404 posted 7. March 2011 19:23 UTC; Online at http://mpra.ub.uni-muenchen.de/29404/

Reddy, K. (1993). Cardiovascular disease in India. *World health statistics quarterly*, 46: 101-107

Reddy, S, Panday, S, Swart, D…, *et al*, (2003). The South African Youth Risk Behavior survey 2002. South African Medical Research Council: Cape Town, pp 35-65.

Republic of Kenya, (2013). Economic survey. Kenya National Bureau of statistics, Nairobi.

Republic of Kenya, (2013). Kenya Service Availability and Readiness Assessment Mapping (SARAM) report, Ministry of Health, Mimeograph. Nairobi.

Republic of Kenya, (2012). Economic survey. Kenya National Bureau of statistics, Nairobi.

Republic of Kenya (2012). Kenya Health Policy2012 -2030. Ministry of Medical Services and Ministry of Public Health and Sanitation. Mimeograph. Nairobi.

Republic of Kenya (2011) Call for Action on Non communicable Diseases, First National Forum on Non communicable Diseases, Naivasha.

Republic of Kenya, (2011). Economic survey. Kenya National Bureau of statistics, Nairobi.

Republic of Kenya, (2010a). Kenya national health accounting 2009/10. Ministry of medical services and Ministry of public health and sanitation.

Republic of Kenya, (2010b). Health sector performance; July 2008 to June 2009. Health sector secretariat, Ministries of health.

Republic of Kenya, (2010c). Analysis of performance, analytical review of health progress and systems performance. Kenya health policy framework 1994 to 2010: Ministries of health.

Republic of Kenya (2010d). Kenya Service Provision Assessment Survey. Ministry of health: Nairobi.

Republic of Kenya, (2010e). The Constitution of Kenya, Government Printers. Nairobi.

Republic of Kenya, (2009). Kenya household expenditure and utilization survey report 2007. Ministries of health.

Republic of Kenya, (2007). Public Expenditure Tracking Survey. Ministry of health, Kenya.

Republic of Kenya, (2007), Annual health sector status report. Ministry of health: Nairobi.

Republic of Kenya, (2005). Reversing the trend: The second health sector strategic plan of Kenya. Ministry of health sector secretariat.

Republic of Kenya, (1999). National Health Sector Strategic Plan I, Ministry of health sector secretariat.

Reyes L, and Manalich R (2005). Long term consequences of low birth weight. Kidney Int, 68: S107- 111

Rosenzweig, R, and Schultz P (1983), Estimating a Household Production Function: Heterogeneity, the Demand for Health Inputs, and Their Effects on Birth Weight. *Journal of Political Economy*, 91(5): 723-746

Rugg S, Bailey L and Browning R (2008). Preventing cardiovascular disease in Kentucky; epidemiology, trends and strategies for the future. *Journal of Kentucky Med association*, 106; 149- 161

Russell, S. (2004). The economic burden of illness for households in developing countries: A review of studies focusing on malaria, tuberculosis and HIV/AIDS. *American Journal of Tropical Medicine and Hygiene,* 71(Supplement 2):147-55.

Saksena P, Xu K and Carrin G (2006). The impact of universal insurance program on catastrophic health expenditure; simulation analysis for Kenya. World Health Organization, Geneva

Shona, D, Juan, B, Adebamowo, C…, *et al,* (2011) Non-communicable diseases in sub-Saharan Africa: what we know now *International Journal of Epidemiology*, viewed at http://ije.oxfordjournals.org/content/early/2011/04/27/ije.dyr050.full

Simon, G, Chisholm, D, Treglia,M…, *et al,* (2002). Course of depression, health services costs and work productivity in an international primary care study. *General Hospital Psychiatry,* 24:328-35.

Smale M and Mason N (2014). Hybrid seeds and the economic wellbeing of smallholder maize farmers in Zambia. *The journal of development studies,* 50, 680 - 695

Smith A (1937). The wealth of the nations. New York; Modern library

Songer, T. (2000). Economics and Health South Asian Cardiovascular Research Methodology Workshop University of Pittsburgh

Staiger D and Stock J. (1997). Instrumental variables regression with weak instruments. *Econometrica,* 65, 557-586.

Steyn, K, Katzenellenbogen, J, Bradshaw,D…, *et al,* (1997). Urbanization the risk for chronic diseases of lifestyle in the black population of the Cape Peninsula. *Journal of Cardiovascular Risk,* 4:135-42.

Stiglith, E. (1988). The Economics of the Public Sector. 2nd edition, Norton & Co, New York.

Su, T, Bocar, K, and Flessa, S. (2006). Catastrophic household expenditure for health care in a low-income society: a study from Nouna District, Burkina Faso. *Bulletin of the World Health Organisation,* 84(number 1).

Suhrcke, M. Võrk, A. and Mazzuco,S. (2006). 'The economic consequences of ill health in Estonia'. Copenhagen: WHO Regional Office for Europe. Viewed at www.praxis.ee/data/economic_consequences_of_ill_health_estonia_2.pdf

Suls, J, & Green, P. (2003). Pluralistic ignorance and college student perceptions of gender-specific alcohol norms. *Health Psychology,* 22, 479−486.

Tanser, F. (2006) Methodology for optimising location of new primary health care facilities in rural communities: a case study in KwaZulu-Natal, South Africa. *Journal of Epidemiology and Community Health,* 60(10): 846–850.

Tawa N, Frantz J, and Waggie F (2011). Risk factors to chronic non communicable disease in Mombasa, Kenya: Epidemiological study using WHO step wise approach. *African journal of health science,* 19: 24 – 29

Taylor B, Rehm J, Aburto J., et al (2007) Alcohol, gender, culture and harms in the Americas: PAHO Multicentric Study final report. Washington: Pan American Health Organization.

Teo K, Liu C, Chow K …, *et al,* (2009). Potentially modifiable risk factors associated with myocardial infraction in china: the INTERHEART China study. Heart, 95: 1857 – 1864

Terza, Joseph V. & Basu, Anirban & Rathouz, Paul J. (2008) - Two-stage residual inclusion estimation: Addressing endogeneity in health econometric modelling, *Journal of Health Economics*, 27, 531-543

Townsend, M. (1995). Consumption Insurance: an evaluation of risk-bearing systems in low income economies. *Journal of Economic Perspectives,* 9 (3): 83 102.

Ulph D (1988) New approaches to testing economic models of the household. Carleton University, Ottawa Ontario, Canada.

UNDP, (2011). Sustainability and equity: A better future for all. Human development report, Palgrave Macmillan, New York

Unwin,N, Mugusi, F, Aspray, T…,*et al,* (1999).Tackling the emerging pandemic of non-communicable diseases in sub-Saharan Africa: The essential NCD health intervention project. *Public Health,* 113:141-6.

US Bureau of Labour (2006) Education and income: more learning is key to higher earnings. Occupational outlook quarterly; fall issue. Available from: http://www.bls.gov/opub/ooq/2006/fall/oochart.pdf

Van Baaren, B, (2003). Mimicry: A Social Perspective. Doctoral Dissertation, Radboud University Nijmegen. Ridderkerk, S.I.: Ridderprint.

Van Doorslaer, E, O'Donnell, *et al,* (2007). Catastrophic payments for health care in Asia. *Health Economics,* 16(11): 1159–1184.

Van Ophem, H. (2000) Modeling Selectivity in Count-Data Models *Journal of Business and Economic Statistics,* 18(4): 503-511.

Veblen. T (1934). The theory of the leisure class. New York: modern library

Vermeulen, F. (2002). Collective Household Models: Principles and Main Results. *Journal of Economic Surveys,* 16(4): 533-64. http://ideas.repec.org/a/bla/jecsur/v16y2002i4p533-64.html

Wagstaff A, (2008). Measuring financial protection in health. World Bank, Washington, DC; development research group. Policy research working paper # WPS 4554

Wagstaff, A. (2007). The economic consequences of health shocks: Evidence from Vietnam. *Journal of Health Economics,* 26: 82–100.

Wagstaff, A. and van Doorslaer, E. (2003). Catastrophe and Impoverishment in Paying for Health Care: With Applications to Vietnam 1993-98. *Health Economics,* 12: 921-34.

Waters, H, Anderson, G, Mays, J, (2004). Measuring financial protection in health in the United States. *Health Policy,* 69 (3): 339-349.

WHO (2006) World Health Report - Working together for health Geneva, Switzerland

WHO, (2002a). Non-communicable Diseases in the Southeast Asia Region: A Profile. New Delhi: Southeast Asia Regional Office.

WHO, (2002b). The world health report 2002- Reducing risks, promoting healthy life. Geneva, Switzerland.

WHO, (2004). Death and DALY estimates for 2002 by cause. Geneva http://www.who.int/healthinfo/bod/en/index.html, accessed April 3, 2012.

WHO, (2005). Preventing Chronic Diseases: A Vital Investment. Geneva, Switzerland.

WHO, (2007). *ICD version 2007*. http://www.who.int/classifications/apps/icd/icd10online/, accessed April 15, 2012.

WHO, (2008). The 2008-2013 Action Plan for the Global Strategy for the Prevention and Control of Non-communicable Diseases. Geneva, Switzerland.

WHO, (2009). WHO country cooperation strategy, 2008- to 2013. Nairobi, Kenya

Wild, S, Roglic, G, Green,A…, *et al,* (2004). Global prevalence of diabetes: Estimates for the year 2000 and projections for 2030. *Diabetes Care*, 27(5):1047-53.

Wilensky R, and Satcher D, (2009). Don't forget about the social determinants of health. Health Affairs.28 (2):194-198.

Williams R, and Collins C, (1995). US socioeconomic and racial differences in health patterns and explanations. Annual Review of Sociology, 21:349-386.

Wilson, P, Garrison, R, Castelli,W.., et al, (1980). Prevalence of coronary heart disease in the Framingham Offspring study: Role of lipoprotein cholesterols *Am J Cardiol*, 46:649-654

Wooldridge J. (1997). On two stage least squares estimation of the average treatment effect in a random coefficient model. *Economics Letters*, 56: 129–133

Wooldridge J. (2002). Econometric analysis of cross section and panel data MIT press, Cambridge, England

Wooldridge J. (2011). Quasi maximum likelihood estimation and testing for nonlinear models with endogenous explanatory variables. Department of economics, Michigan State University

World health organization, (2000). The world health report: health systems, improving performance. Geneva

Wyszewianski, L, (1987). Catastrophic Health Expenditures: Toward a Working Definition. In: Where Coverage Ends: Catastrophic Illness and Long- Term Health Care Costs, 1987. Employee Benefit Research Institute

Xu , K, Carrin G, Phuong N…,*et al* , (2006). Health service utilization and financial burden on households in Vietnam: the impact of social health insurance. WHO, Geneva

Xu, D, Evans, K, Murray,C…, *et al,* (2003). Household catastrophic health expenditure: A multi-country analysis *The Lancet*, 362(July 12):111-117.

Young,D (2001) Alcohol Consumption, Beverage Prices And Measurement Error. Department of Agricultural Economics and Economics Montana State University Bozeman, MT 59717-0292

Yusuf S, Hawken S, Ounpuu S, Dans T…, *et al* , (2004) Effect of potentially modifiable risk factors associated with myocardial infarction in 52 countries (the INTER HEART study): case-control study. *The Lancet*, 364(1): 937-52.

Zaman M, Yoshiike N, Rouf R…, *et al,* (2001). Cardiovascular risk factors: distribution and prevalence in rural populations in Bangladesh. *Journal of cardiovascular risk,* 8:103 – 108

Zimmer D (2010) Health insurance and health care demand among the self-employed. *Journal of labour research,* 31: 1-19

APPENDICES

Appendix A

Table A1: Factors influencing fruits and vegetables intake

Determinants of fruits and vegetables intake	OLS estimates	std errors	t- statistic
Age	-0.0912	0.0269	-3.40
Age squared	-0.0063	0.0041	-1.54
Urban	-0.0121	0.0039	-3.11
Male	-0.0025	0.0032	-0.78
Household income	0.4102	0.0206	19.93
Household income squared	-0.0193	0.0011	-7.94
Distance to health facility	-0.0150	0.0150	-1.00
Vegetable and fruits tax	-0.1110	0.0190	-12.65
Cigarette tax	-0.0004	0.0012	-0.34
Alcohol tax	-0.0053	0.0033	-1.60
Mean district alcohol consumption	0.0020	0.0019	1.07
Mean district cigarette consumption	-0.0080	0.0033	-2.45
Mean district vegetable and fruits consumption	0.1471	0.0154	9.58
Constant	-1.1832	0.0980	-12.07
F-test	F(13, 10614) 93.35		
Sample size	10628		
R- squared	0.1015		
Test for the strength of instrument Vegetable and fruits tax=0	F(1, 10614) = 16.63	Prob>F=0.0000	

Source: Author's computation

Table A2: Factors influencing cigarette smoking

Determinants of cigarette smoking	OLS estimates	std errors	t- statistic
Age	0.0049	0.0003	13.90
Age squared	0.0000	0.0000	-7.37
Urban	0.0051	0.0051	1.01
Male	0.0862	0.0042	20.55
Household income	-0.0436	0.0166	-2.63
Household income squared	0.0018	0.0014	1.32
Distance to health facility	0.0012	0.0192	0.06
Vegetable and fruits tax	0.0019	0.0011	1.71
Cigarette tax	-0.2039	0.0096	-2.50
Alcohol tax	0.0212	0.0042	5.06

Determinants of cigarette smoking	OLS estimates	std errors	t- statistic
Mean district alcohol consumption	0.0826	0.0241	3.43
Mean district cigarette consumption	0.0080	0.0042	1.89
Mean district vegetable and fruits consumption	-0.0139	0.0101	-0.69
Constant	0.1612	0.0107	1.27
F-test	F(13,10048)87.33		
Sample size	10062		
R- squared	0.0868		
Test for the strength of instrument ciggertax =0 F(1, 10048)= 13.50 Prob>F=0.0000			

Source: Author's computation

Table A3: Factors associated with presence of NCDs

Determinants of NCDs	OLS estimates	Std errors	t- statistic
Urban	-0.0103	0.0041	-2.5200
Household size	-0.0050	0.0007	-7.1300
Work experience	0.0233	0.0123	1.8900
Work experience squared	-0.0005	0.0007	-0.7800
Household head informal employment	0.0390	0.0048	8.1300
Years of schooling	-0.0004	0.0004	-1.0400
married	0.0506	0.0038	13.3000
Male	-0.0200	0.0033	-6.0100
distancekms_ad21	0.0702	0.0157	4.4600
constant	-0.0737	0.0561	-1.3100
F-test	F(9, 26541)74.11		
Sample size	26551		
R- squared	0.0246		
Test for the strength of instrument, distance to nearest facility =0 F(1, 26541) = 19.93 Prob > F = 0.000			

Source: Author's computation

Table A4: Factors influencing alcohol consumption

Determinants of alcohol consumption	OLS estimates	std errors	t- statistic
Age	0.0298	0.0180	1.65
Age squared	-0.0054	0.0027	-1.96
Urban	-0.0288	0.0026	-11.01
Male	-0.0008	0.0022	-0.36
Household income	0.0157	0.0138	1.14
Household income squared	-0.0005	0.0007	-0.71
Distance to health facility	0.0139	0.0100	1.38

Determinants of alcohol consumption	**OLS estimates**	**std errors**	**t- statistic**
Vegetable and fruits tax	0.0019	0.0006	0.32
Cigarette tax	-0.0968	0.0082	-11.88
Alcohol tax	0.0041	0.0022	1.83
Mean district alcohol consumption	0.0601	0.0013	4.82
Mean district cigarette consumption	0.0013	0.0022	0.61
Mean district vegetable and fruits consumption	0.0410	0.0103	3.98
Constant	0.8765	0.0657	13.35
F-test	F(13, 10614) 74.35		
Sample size	10628		
R- squared	0.1062		
Test for the strength of instrument Alcohol tax =0 F(1, 10614) = 13.22 Prob>F=0.0000			

Source: Author's computation

Appendix B

Table B1: Factors associated with catastrophic spending, sample of healthy and sick from NCDs

Variables	Probit	2SRI	Control function approach
Urban	-0.2377** [0.0293]	-0.2507*** [0.0296]	-0.2472*** [0.0300]
household size	-0.0197*** [0.0054]	-0.0177** [0.0055]	-0.0183** [0.0055]
Age squared	0.0035 [0.0043]	-0.0011 [0 .0046]	-0.0010 [0.0046]
Age	-0.0028 [0.0035]	-0.0010 [0.0035]	-0.0076 [0.0036]
Health insurance	0.1272*** [0.0218]	0.1296*** [0.0218]	0.1290*** [0.0219]
Years of schooling	-0.0113** [0.0034]	-0.0101** [0.0035]	-0.0105** [0.0035]
Married	-0.1318*** [0.0355]	-0.1208*** [0.0357]	-0.1216** [0.0357]
Male	-0.0254 [0.0248]	-0.0081 [0.0255]	-0.0129 [0.0261]
Ncd	0 .5237*** [0.0360]	1.2500*** [0.2444]	1.2163*** [0.2478]
Ncd residual		-0.7405*** [0 .2465]	-0.4624*** [0.4181]
Ncd* residual			-0.2800*** [0.3400]
Constant	-0.9102*** [0.0703]	-0.9482*** [0.0714]	-0.9393*** [0.0722]
R squared	0.0329	0.0712	0.0814
Sample size	14390	14390	14390

Source: author's computation, **Note: ***, ** and * represent significance at 1%, 5% and 10% respectively and standard errors are in parenthesis**

Table B2: Factors associated with catastrophic spending from a sub-sample of only households with sick individuals

Variables	Probit	2SRI	Control function approach
Urban	-0.3139*** [0.0514]	-0.1620** [0.0649]	-0.1630** [0.0650]
Household size	-0.0219** [0.0094]	0.0102* [0.0126]	0.0080 [0.0127]
Age squared	-0.0022 [0.0063]	-0.0056 [0.0001]	0.0008 [0.0001]
Age	0.0072 [0.0054]	0.0339** [0.0089]	0.02827** [0.0090]
Health insurance	0.0971** [0.0493]	0.0687** [0.0509]	0.0652** [0.0508]
Years of schooling	-0.0191* [0.0056]	-0.0148** [0.0056]	-0.0143* [0.0056]
Married	-0.1218*** [0.0554]	-0.1951*** [0.0589]	-0.1900** [0.0587]
Male	0.0559* [0.0438]	0.0530 [0.0438]	0.0462 [0.0440]
Ncd	0.5649*** [0.0456]	-2.1137** [0.7091]	-2.0800*** [0 .7096]
Ncd residual		2.6915*** [0.7107]	2.1048** [0.7332]
Ncd* residual			0.9224** [0.2844]
Constant	-1.0225*** [0.1381]	-0.9187*** [0.1423]	-1.0230*** [0.1461]
R squared	0.0623	0.0655	0677
Sample size	4397	4396	4397

Note: *, ** and * represent significance at 1%, 5% and 10% respectively and standard errors are in parenthesis**

Table B3: Factors associated with catastrophic expenditure from the whole data set

Variables	Probit	2SRI	Control function approach
Urban	-0.2230 [0.0271]	-0.2324*** [0.0272]	-0.2210*** [0.0273]
Household size	-0.0136** [0.0050]	-0.0008 [0.0055]	-0.0167** [0.0060]
Age squared	0.0047 [0.0004]	-0.0002 [0.0001]	-0.0005 [0.0004]
Age	0.0022 [0.0032]	0.0016 [0.0032]	0.0048* [0.0032]
Health insurance	0 .1211*** [0.0209]	0.1249*** [0.0209]	0.1221*** [0.0210]
Years of schooling	-0.0133** [0.0032]	-0.0100** [0.0033]	-0.0133*** [0.0033]
Married	-0.1253*** [0.0323]	-0.1285*** [0.0323]	-0.1024** [0 .0326]
Male	-0.0165 [0.0228]	0.0248 [0.0243]	-0.0220 [0.0253]
Sickness	0 .1849*** [0.0262]	1.2064*** [0.2005]	0.8555*** [0.2079]
Sick residual		-1.0365*** [0.2018]	0.7564** [0.3363]
Sick* residual			-1.8177*** [0.2727]
Constant	-1.0013*** [0.0657]	-1.2466*** [0.0807]	-0.8799*** [0.0979]
R squared	0.0894	0.0705	0.0710
Sample size	17031	17031	17031

Source: author's computation, **Note: ***, ** and * represent significance at 1%, 5% and 10% respectively and standard errors are in parenthesis**

Table B4: Factors associated with household risk of impoverishment for the whole sample

Variables	Probit	2SRI	Control function approach
Urban	-0.3316*** (0.0533)	-0.3082*** (0.0536)	-0.3091*** (0.0537)
household size	-0.0407*** (0.0099)	-0.0232** (0.0104)	-0.0251** (0.0106)
Health insurance	0.1910*** (0.0387)	0.1934*** (0.0388)	0.1942*** (0.0388)
Married	0.1404*** (0.0456)	0.0385 (0.0491)	0.0505 (0.0512)
Male	-0.0863** (0.0428)	-0.0498 (0.0434)	-0.0546 (0.0438)
years of schooling	-0.0044 (0.0049)	-0.0007 (0.0049)	-0.0008 (0.0049)
Sickness	0.4158*** (0.0439)	.4945*** (0.1993)	.4728*** (0.20009)
Sick residual		-1.1277*** (0.2031)	-0.7921** (0.4444)
Sick*residual			-0.3925 (0.4605)
Constant	-2.3373*** (0.1280)	-2.6386*** (0.1392)	-2.5687*** (0.1616)
R squared	0.0686	0.0751	0.0953
Sample size	8976	8953	8953

Source: author's computation, **Note: ***, ** and * represent significance at 1%, 5% and 10% respectively and standard errors are in parenthesis**

Table B5: Factors associated with household risk to impoverishment from a sub-sample of only households with sick persons

Variables	Probit	2SRI	Control function approach
Urban	-0.5830*** (0.0945)	-0.3777*** (0.1183)	-0.3784*** (0.1185)
Household size	-0.0331** (0.0167)	0.0129 (0.0023)	0.0127 (0.0231)
Age squared	-0.00001 (0.0001)	-0.0002 (0.0001)	-0.0002 (0.0001)
Age	0.0055 (0.0107)	0.0493)*** (0.0186)	0.0488** (0.0190)
Health insurance	0.0984 (0.0739)	0.0766 (0.0756)	0.0760 (0.0757)
Formal employment	0.0309 (0.0299)	0.0694*** (0.0329)	0.0694** (0.0329)
Years of schooling	-0.0332** (0.0116)	-0.0258*** (0.0117)	-0.0257** (0.0117)
Married	0.1242 (0.0904)	0.0418 (0.0947)	0.0422 (0.0948)
Male	-0.0484 (0.0760)	-0.0592 (0.0764)	-0.0598 (0.0765)
Ncd	1.1771*** (0.0788)	-2.8425*** (1.4000)	-2.8315** (1.4022)
Ncd residual		4.0292*** (1.4027)	3.9776*** (1.4574)
Ncd*residual			0.0699 (0.5376)
Constant	-2.1077*** (0.2915)	-2.2092*** (0.2958)	-2.2184*** (0.3042)
R squared	0.1974	0.2022	0.2222
Sample size	6747	6747	6747

Source: author's computation, **Note: ***, ** and * represent significance at 1%, 5% and 10% respectively and standard errors are in parenthesis**

Table B6: Factors associated with risk of impoverishment from a sub-sample of households with healthy and NCD sick individuals.

Variables	Probit	2SRI	Control function approach
Urban	-0.3133*** (0.0621)	-0.3248*** (0.0626)	-0.3329*** (0.0627)
Household size	-0.05119*** (0.0116)	-0.0421*** (0.0128)	-0.0364*** (0.0131)
Age squared	0.0001 (0.0001)	-0.0001 (0.0001)	-0.0001 (0.0001)
Age	0.00224 (0.0068)	0.00184 (0.0068)	-0.0020 (0.0070)
Health insurance	0.1600*** (0.0419)	0.1550*** (0.0419)	0.1471*** (0.0422)
Years of schooling	-0.0053 (0.0063)	-0.0042 (0.0063)	-0.0036 (0.0063)
Married	-0.0114 (0.0685)	0.0036 (0.0691)	-0.0008 (0.0692)
Male	-0.0959* (0.0499)	-0.0623 (0.0538)	-0.0414 (0.0547)
NCD	1.0135*** (0.06012)	1.7664*** (0.4554)	1.9153*** (0.4587)
Ncd residual		-0.7629** (0.4577)	-1.5451*** (0.5819)
Ncd*residual			0.7916** (0.0664)
Constant	-2.1021*** (0.1600)	-2.13878*** (0.1615)	-2.1517*** (0.1618)
R squared	0.1504	0.1512	0.1524
Sample size	6747	6747	6747

Source: author's computation, **Note: ***, ** and * represent significance at 1%, 5% and 10% respectively and standard errors are in parenthesis**

Table B7: Marginal effects showing association of specific factors to NCD in Kenya without controlling for social interactions

	Estimation methods		
Variables	**Probit (1)**	**2SRI (2)**	**Control function approach (3)**
Age	0.0028** 0.0011	0.0013 0.0013	0.0010* 0.0006
Urban	0.0103** 0.0037	0.0638* 0.0444	0.0115* 0.0203
Female	0.0165** 0.0030	0.1915** 0.0830	0.3393*** 0.2041
Marital status	-0.0062* 0.0038	-0.0085 0.0254	0.0054 0.0061
Log household income	0.0040** 0.0016	0.2005*** 0.0380	0.0316*** 0.0197
Years of schooling	-0.0100** 0.0034	-0.0100** 0.0027	-0.0101** 0.0008
Alcohol dummy	0.02581 0.0181	-0.9688 0.0308	0.9194** 0.3001
Cigarette dummy	0.0051 0.0057	0.8143** 0.2291	0.8800*** 0.00003
Fruits/veg dummy	0.0084** 0.0031	-0.6840* 0.5008	-0.9346*** 0.0009
Alcohol residual		1.9331 1.6536	-1.0800** 0.8508
Cigarette residual		-0.4015** 0.1416	-0.0916*** 0.0610
Fruits/veg residual		0.3044* 0.2091	0.0622** 0.0463
Alcohol* residual			-0.0462*** 0.0318
Cigarette* residual			0.0021 0.0055
Fruits/veg* residual			0.0996** 0.0666
Sample size	32721	32721	32721

Source: author's computation, Note: *, ** and * represent significance at 1%, 5% and 10% respectively and standard errors are in parenthesis**

Table B8: Contribution of specific risk factors to NCD in Kenya

Variables	Probit (1)	2SRI(2)	Control function approach(3)
Age	0.0244* (0.0009)	-0.0103* (0.0111)	-0.08079* (0.0233)
Urban	0.0873* (0.0304)	-0.5836*** (0.4413)	-0.1513** (0.7281)
Female	-0.1443** (0.0260)	-1.3820** (0.5134)	-4.66255** (1.1222)
Log Household income	0.0348 (0.0133)	1.6537** (0.3218)	3.8117** (0.6974)
Years of schooling	-0.0081* (0.0030)	-0.0768)* (0.0230)	-0.1369* (0.0432)
Mean district alcohol consumption	1.1538* (0.5134)	1.1823* (0.1131)	1.4613** (0.2212)
Mean district cigarette consumption	0.1160* (0.0109)	0.3367** (0.1178)	1.3464** (0.2759)
Mean district fruits and veg consumption	0.0131* (0.0398)	-0.7871** (0.2356)	2.4773*** (0.5907)
Distance kms to nearest health facility	0.3410* (0.0928)	0.8312** (0.2931)	0.1488* (0.5863)
Alcohol consumption	0.2833* (0.2572)	-10.3664** (3.7340)	25.80124*** (3.3916)
Alcohol consumption residual		9.842343** (3.6379)	-26.2897*** (3.6732)
Cigarette smoking	0.0430 (0.0474)	3.3026** (1.1589)	10.5908*** (2.5559)
Cigarette residual		-3.3118** (1.1971)	-10.9982** (2.6557)
Fruits and vegetable consumption	0.0722* (0.0263)	-2.2555** (1.5737)	-11.1119*** (2.9905)
Fruits/vegetable residual		2.5111** (1.7321)	6.6062** (2.9742)
Cigarette *residual			0.1656 (0.6168)
Fruits/vegetable *residual			12.16541** (1.0943)
Alcohol consumption * residual			-5.3557** (1.5283)
Constant	-2.6683*** (0.2811)	-4.1564* (2.6050)	-2.6157*** (3.8829)
R – squared	0.1032	0.1351	0.1735
Sample size	32721	32721	32721

Source: author's computation, **Note: ***, ** and * represent significance at 1%, 5% and 10% respectively and standard errors are in parenthesis**

Table B9: Marginal effects showing association of specific factors to NCD in Kenya (with income and income squared as explanatory variables)

	Estimation methods		
Explanatory Variables	**Probit (1)**	**2SRI (2)**	**Control function approach (3)**
Age	0.0263**	0.0053*	-0.0058**
	(0.0012)	(0.0118)	(0.0064)
Urban	-0.0033*	0.0856***	0.0665 ***
	(0.0034)	(0.0418)	(0.0311)
Female	0.0163**	0.1123***	0.0770**
	(0.0026)	(0.0446)	(0.0378)
Household income	0.0024*	0.0624***	0.0232**
	(0.0001)	(0.0195)	(0.0245)
Household income squared	-0.0004	-0.0042*	-0.0264**
	(0.0001)	(0.0012)	(0.0007)
Alcohol dummy	0.0165*	-0.0850**	-0.0349**
	(0.0183)	(0.0584)	(0.0254)
Cigarette dummy	0.0046	0.3800***	0.5791***
	(0.0051)	(0.2106)	(0.3178)
Fruits/veg dummy	0.0025	-0.5101***	-0.6855***
	(0.0029)	(0.0905)	(0.0163)
mean district alcohol consumption	-0.0017	0.0213**	0.0597**
	(0.0015)	(0.0141)	(0.0072)
mean district cigarette consumption	-0.0019	-0.0412**	-0.0319**
	(0.0018)	(0.0151)	(0.0094)
mean district fruits and veg consumption	0.0131**	0.1226***	0.0602**
	(0.0018)	(0.0281)	(0.0180)
Distance to health facility	0.0498**	0.1741***	0.0995**
	(0.0169)	(0.0886)	(0.0334)
Alcohol residual		-0.0531**	-0.0547**
		(1.3957)	(0.5621)
Cigarette residual		-0.2268***	-0.1374***
		(0.0910)	(0.0521)
Fruits and veg residual		0.4781***	0.1271**
		(0.1167)	(0.0602)
Cigarette*residual			0.0215
			(0.0217)
Fruits/veg* residual			0.3533***
			(0.0217)
Alcohol*residual			-.09182**
			(0.0635)
Sample size	32721	32721	32721

Source: author's computation, **Note: ***, ** and * represent significance at 1%, 5% and 10% respectively and standard errors are in parenthesis**