DEMAND FOR HEALTH SERVICES IN RWANDA: AN ECONOMETRIC ANALYSIS

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DECLARATION

This thesis is my original work and has not been presented for a degree in any other university.

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The responsibility for errors and views expressed in this thesis is entirely mine.

ABBREVIATIONS

AERC	African Economic Research Consortium
CBHIs	Community Based Health Insurance schemes
CFA	Control Function Approach
CHUB	Centre Hospitalo-universitaire de Butare
EAC	East African Community
EDPRS	Economic Development and Poverty Reduction Strategies
EICV	Enquête intégrée des conditions de vies des ménages
FBO	Faith Based Organizations
GDP	Gross Domestic Product
FRW	Francs Rwandais (Rwandan Francs)
IIA	Independence of Irrelevant Alternatives
Ksh	Kenyan shillings
MDG	Millennium Development Goals
MMI	Military Medical Insurance
MOH	Ministry of Health
NISR	National Institute of Statistics Rwanda
NRH	National Referral Hospitals
OOPE	Out-of-Pocket Expenditure
RAMA	La Rwandaise d'Assurance Maladie
THE	Total Health Expenditure
USD	United States Dollars
ULK	Université Libre de Kigali
WB	World Bank
WHO	World Health Organization
2SRI	Two Stage Residual Inclusion

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ABSTRACT

Since 2000s a number of health sector reforms were introduced in Rwanda aiming at increasing health care access. Despite these reforms there has not been a corresponding increase in demand for health services, as only about 30 percent of the sick persons use modern care. The objective of this thesis is to examine factors influencing health care demand in Rwanda and recommend appropriate measures that could be taken to improve utilization of health services. The source of data is the Integrated Household Living Conditions Survey (EICV2) conducted in 2005 by the National Institute of Statistics Rwanda (NISR). Structural models of outpatient care, inpatient care and choice of service provider are estimated to measure demand effects of economic and other factors. The usefulness of considering different aspects of demand is to examine whether demand effects vary with types of health services and across health providers.

The findings indicate that health insurance is a significant determinant of demand for health care. In addition, price of health care and household income are important determinants of utilization of health care. User fees are a major financial barrier to health care access in Rwanda. Being female is found to increase the probability of seeking outpatient health care but decreases the probability of being admitted for inpatient care. The results suggest that as household income increases, the patients shift from public to private health facilities where quality is high.

A number of policy recommendations emerge from these findings. First, the government should reduce out-of-pocket health care expenditures through subsidies to public health facilities. Since an increase in income allows the patient to shift to private facilities, the government should also consider subsidizing private health facilities to enable low-income household's access care in private sector. Moreover, government should reduce the premiums for Community Based Health

Insurance Schemes (CBHIs) to increase or maintain high their coverage. Finally, since distance remains a key determinant of access to health care in Rwanda, there is need to improve geographical accessibility to health facilities across regions by upgrading and expanding transportation infrastructure in the country.

CHAPTER ONE: INTRODUCTION

Health is an important feature of human capital which is positively related to different aspects of economic outcomes at both macroeconomic and individual levels. Holding other factors constant, an individual's health status is enhanced by the amount of medical care. Health care, an input into health production is valued only when it has a positive marginal product. However, given information imperfections in health care markets, patients are at risk of consuming worthless services. This is one reason for government intervention in health care markets through direct provision of services or through regulatory mechanisms, such as Public Health Acts that govern both the public and private health sectors. In Rwanda, as in other African countries, the majority of the population relies on public health facilities.

Section 1.1 presents the background information, while section 1.2 describes health indicators in Rwanda. Section 1.3 discusses the levels of health care utilization, and section 1.4 presents the research problem. Section 1.5 presents the study objectives while section 1.6 provides the justification of the study highlighting the key knowledge gaps the study intends to address. Finally, section 1.7 presents the organization of the thesis.

1.1 Background

The Grossman (1972) model provides insights into analyzing an important aspect of human capital, health, and its effect on productivity, earnings and labor supply. The model is based on Becker's (1965) household-production concept. The premise of this theory is that an increase in a person's stock of health raises his or her productivity in both market and non-

market activities. As the Grossman model suggests, health is a vital aspect of human capital, and an important input into market and non-market production. Health is both capital and consumption good. Health as capital good determines the total amount of time available for market and non-market activities and increases the stock of health that reduces the amount of time lost from productive activities. Health is a consumption good because it enables people to enjoy life without or with less pain.

There are large productivity and wages benefits of better health. Research on HIV and AIDS from Kenya and South Africa showed that workers receiving anti-retroviral treatment had higher incomes than their untreated counterparts even though both groups reported lower productivity than those without the virus (Alsan et al., 2006). A study of adult infection in malaria endemic areas found that the disease reduced labour supply by about 5 percent (Bloom and Canning, 2004). Krishna (2006) analyzing the cost of burden of treatment found that ill health was a major contributing factor to declines in the household welfare. Further evidence shows that child malnutrition reduces adult wages through impaired educational attainment and adult health problems. There is evidence to show that sickness can have adverse effects on learning, and that these impacts can later influence economic outcomes in life (Bhargava et al., 2001). Better health can make workers more productive, either through fewer days off or through increased productivity while working. Improved nutrition and reduced disease, particularly in early childhood, leads to improved cognitive development, enhancing the ability to learn. Healthy children also gain more from school because they have fewer days absent due to ill health.

While health is determined by many factors including medical care, food, housing conditions and exercising, it is accepted that medical care is one of the key determinants in health production function (McKeown, 1976). Santerre and Neun, (2010) argued that much as a firm uses various inputs, such as capital and labor to manufacture a product, an individual uses health care inputs to produce health. When other factors are held constant, an individual health status indicates the maximum amount of health that can be generated from the quantity of medical care consumed.

Considering the importance of medical care, both policymakers and researchers have directed much attention to the question of how broad access to health services can be ensured (Lindelow, 2005). Early policy and research initiatives focused on the need to improve physical access through an expansion of the network of health facilities. This consisted of improving health care delivery organizations including health care professionals, equipments, and buildings for service delivery. A growing literature on health care has, however, point out that supply is not sufficient and this means that providing maximum access to health care remains a challenge for governments in many low income countries.

Health care demand refers to an individual willingness and readiness to give up something he/she values in exchange for a particular type of care that the individual desires (Wagstaff, 1986). Health care covers a variety of services (outpatient, inpatient, preventive…) that intervene at any time during the life time period from birth (or conception in some cases) to death and involve treatments ranging from prevention services of disease to providing palliative care (Santerre and Neun, 2010). Individuals make various choices about medical

care. They decide when to visit a doctor, whether or not to go ahead with a surgery, whether to immunize children, and how often to have checkups. The decision-making process is crucial since it may involve gathering experience from friends, physicians, and of course foregoing other types of consumption that could be financed with the resources used to purchase medical care (Wagstaff, 1986). Demand for health care is different from need for health care. Purchasing health care is conditional on exchange or transaction made between parties while a need describes a subjectively determined level of goods or services (housing, food, health care) required to meet some standards and not necessarily defined in relation with resources possessed by the individual in need. Thus, the need for health care is independent from economic considerations and does not imply an economic transaction.

Conceptually, demand for health care depends on factors that affect individual's desire for better health. Individuals need to possess good health because it gives them an opportunity to feel better and work at their maximum level of performance. Having good health enables people to spend most of the available time doing things they desire and that bring personal satisfaction and interest such as holding a job and earning money or spending time in leisure activities. Holding all other factors constant, utilization of health care generates better health. Bitler and Shi (2006) argue that interest in health care use and access is based on the belief that increases in health care demand and access lead to better health. A number of studies have documented that having a usual source of care[1] leads to an improvement in health status (Cabana and Jee, 2004). Starfield and Shi (2004) present evidence that using health services over time is one of the factors that lead to fewer health problems among the

[1] Having a usual source of care is having a place to go when sick, such as a medical doctor's office, health post…

population groups while McGinnis et al., (2002) stated that non-use of health care explains a portion of the disparities in population health status.

In different countries, morbidity and vulnerability are explained by insufficient or late visits to health facilities by patients. This is why in developed countries, medical associations provide guidelines for how often people should undertake medical consultations or tests to improve or maintain their health status. In this perspective, health is easily improved if utilization of health care is associated with prevention or detection of disease at early stages. For instance, the American Academy of Pediatric Dentistry recommends annual visits for children, with the first visit to occur by the age of 12 months (American Academy of Pediatric Dentistry, 2003). The recommendations for women over age 40 include a screening for breast cancer once every one or two years. Similarly, recommendations that all American adults not already diagnosed with hyper-tension should have their blood pressure checked at least every two years. The lack of access to health care leads to fewer use of health services that leads to morbidity, and consequently to more use of emergency rooms which would have been avoided by seeing a doctor for an outpatient visit. Examples of chronic conditions that are sensitive to receipt of earlier visits include pediatric and adult asthma, congestive heart failure, hyper-tension, and uncontrolled diabetes (Billings and Weinick, 2003).

In Rwanda, access to health care has been identified as an important objective in formulating public policies since good health is recognized as a necessary condition to enjoy economic and social opportunities. The country has developed a health care setting open to all Rwandans and that is accessible to everyone regardless of socioeconomic status. For

instance, in the Rwanda Economic Development and Poverty Reduction Strategy (EDPRS, 2008), access to health care is one of the strategies of eradicating poverty. The strategy's objective is to promote health care to the entire population, increasing geographical accessibility, increase the availability and affordability of drugs, and improve the quality of services. Increased accessibility to health care has several benefits particularly among the poor segments of the population (World Bank, 2001a). The Millennium Development Goals (MDGs) also recognize health as an essential ingredient in social and economic progress for any country.

However, despite the improvement in access to health care through Community Based Health Insurance Schemes (CBHIs) and other insurance providers, it is not known why health care utilization has remained low in Rwanda. Probably, people with lower income or who live in poor areas of the country are likely to use fewer health services and therefore lead to a lower average utilization rate. The differences in income levels, location, regions and other socioeconomic factors could then limit access to medical care. Other sources of unequal health care access might be related to educational levels and employment status, etc. Further, if illness is legitimately well defined by medical reports which occur after consultations and tests, individuals may fall sick and not seek health services or not even recognize that there is a need for visiting a physician given the sickness (Valongueiro, 2002). Thus, an investigation of the key drivers of demand for health care in the country may be of value to the success of policy-making and promotion of health of the population.

1.2 Health Indicators

In the last decade, economic growth as measured by Gross Domestic Product (GDP) and a number of health indicators showed strong positive correlation in Rwanda. The country achieved sustained economic growth with an average GDP growth of 8.1 percent between 2005 and 2012. Per capita GDP grew from USD 235 in 2003 to USD 582.6 in 2011 (World Bank, 2013). Over the period 2005/06 and 2010/11, poverty at national level reduced by 11.8 percent, from 56.7 percent in 2005 to 44.9 percent in 2011 (Republic of Rwanda, 2011). This contrasted with the poverty reduction experienced over the period 2000/01 to 2005/06, from 58.9 percent in 2001 to 56.7 percent in 2005, where economic growth was slow.

Because of different health sector reforms, the country has experienced significant improvements in a number of health indicators. For instance, malaria morbidity in children reduced significantly from 37.31 percent in 2007 to 15.01 percent in 2010 (WB, 2011). Also, after an initial surge following the genocide, under-five mortality, the probability of death per 1,000 live births significantly decreased, from 196 in 2000 to 152 in 2005, 103 in 2007 and 76 in 2011 (World Bank, 2011). Since 2000, health indicators have continually improved and the predictions show that the improvement will continue in the future (Sekabaraga et al., 2009).

Other improvements in selected health care indicators have been witnessed as shown in Table 1.1. Infant mortality reduced from 107/1000 in 2000 to 55/1000 in 2010 while life expectancy at birth increased from 48.5 years in 2000 to 55 years in 2010 (WB, 2011).

Table 1.1: Trends in Selected Health Indicators

Indicators	2000	2005	2006	2011
Under-five mortality (1000 births)	196	153	103	76
Infant mortality (per 1000)	107	86	62	50
Delivery in health facility (%)	27	28	45	57
Fully- immunized, 12-23 months (%)	76	75	80	83
Access to safe drinking water (%)	40	34	41	43
Life expectancy at birth, total (years)	48.5	52.2	53	55
Maternal mortality, per 100,000	1300	650	580	383[2]

Source: NISR (2008, 2010), Hong et al., (2009) and World Bank (2011), DHS 2000-2011.

Since 2000, maternal mortality ratio including deaths during pregnancy, childbirth and post-pregnancy has been declining at an annual rate of 6.4 percent to reach 383 per 100,000 in 2010 (MOH, 2010). This improvement is associated with MOH recruitment and training of health workers to provide family planning, education and counseling to men and women throughout the country.

Table 1.2 presents a comparison of the health indicators in selected East African countries. In 2010, maternal mortality rate in Rwanda was 383 per 100,000 live births compared to 590 and 430 for Kenya and Uganda respectively. Similarly, infant mortality rate per 1000 live births also performed better compared to the ones for Kenya and Uganda over the same period. However, despite the general improvement in a number of health indicators, the country still falls below the MDGs of improving maternal health. To achieve the Target it would be necessary to increase the number of women giving birth in a health-care facility from 57 percent to the World Health Organization (WHO) Target of 90 per cent (WHO, 2007).

[2] The maternal mortality rate is for the year 2010

Table 1.2: Comparison of key Health Indicators between Rwanda and Selected EAC Countries (2010)

	Rwanda	Kenya	Uganda
Population (in millions)	10.4	39.8	32.7
Per capita GDP (Current US $)	509.4	774.9	488.2
Life expectancy at birth (years)	55.3	59.48	53
Proportion of doctors to 1,000 people	0.5	0,14	0.08
Proportion of nurses to 1,000 people	0.7/1,000	2/1,000	-
Infant Mortality (per 1000 live births)	50	63	80
Under 5 mortality rate (per 1,000 live births)	76	122	124
Maternal mortality (100,000 live births)	383	590	430
Rate of enrollment in insurance	95	-	-

Source: World Bank (2011), NISR (2008)

In order to increase access to health care and provide financial protection against impoverishment due to catastrophic illness, the government of Rwanda implemented a social health insurance policy to cover people employed in the formal sector (MOH, 2009). In addition, CBHIs were established to offer financial protection to the rest of the population not covered by the social health insurance scheme. The government established CBHIs commonly known as 'Mutuelles', the social health insurance scheme comprising 'La Rwandaise d'Assurance Maladie' (RAMA) and the Military Medical Insurance (MMI). RAMA insurance scheme was established in 2001 to cover public servants and their dependants while MMI is an institution-based health insurance scheme managed within the Ministry of Defense. Under CBHIs, each individual pays an annual premium of about $ 4.5 (Republic of Rwanda, 2011). The members receive treatment from accredited public health facilities for uncomplicated cases while complicated cases are referred to the district hospitals. Patients pay a mandatory co-payment of 10 percent of the total cost of the health

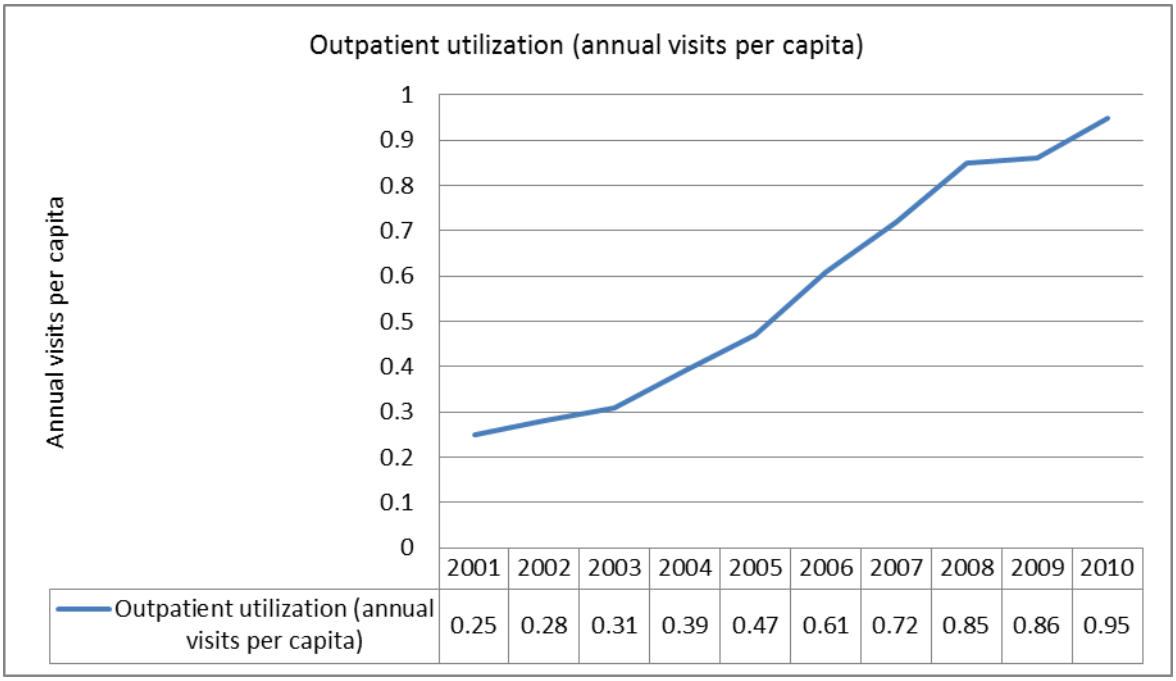
services to the provider, usually on a fee-for-service basis. The fee is designed to generate additional funds for the health facility and to discourage unnecessary consumption of health services.

In addition to the above schemes, government increased the budget allocation for the public health sector. The increase in allocation was to address the supply sides especially in constructing new health facilities and recruiting additional health personnel. However, the annual public expenditure on health increased to only reach 24.1 percent of the total health care expenditure in 2010 (MOH, annual report 2010; World Bank, 2011). As the government allocation of health expenditure has a direct impact on out-of-pocket expenditure (OOPE), households continue financing their health services privately. Thus, the poor who account for about 45 percent of the Rwandan population cannot afford the OOPE and instead consume less health care. In addition, those who are poor have other competing expenditures of their incomes and this does not encourage utilization of health care.

1.3 Utilization of Health Services

While it is not easy to measure access to health care and to determine how much access to health care is desirable, it is argued that information on health services utilization is an important measure of access (Brown et al., 2002). Utilization of health care services can be measured by estimating outpatient visits per capita which measures the number of visits to health facilities per capita and per year. Several studies have demonstrated that outpatient utilization rates increase when barriers to using health services are removed by bringing services closer to the people or reducing user fees (WHO, 2007).

Figure 1.1: Utilization of Health Care in Rwanda, 2001-2010



	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Outpatient utilization (annual visits per capita)	0.25	0.28	0.31	0.39	0.47	0.61	0.72	0.85	0.86	0.95

Source: MOH (2008a, 2008b, 2009), WHO (2011)

Various health financing and other investment reforms in the country have contributed to improvements in outpatient utilization rates, which increased by more than 30 percent between 2007 and 2010. However, the rate is still far behind the ones for other African countries with comparable burden of disease relating to health problems such as diarrheal malaria, HIV and AIDS. For instance, in 2007, the average Rwandan made 0.72 visits to physician compared to an average of 1.8 visits for Malawi and 5.8 visits for Seychelles (Table 1.3). The level of morbidity in the country would rather lead to a higher utilization rate. This suggests that despite the investments and policies in health sector in Rwanda, a number of barriers to health care exist. These might include income, user fee, distance to health care providers and organizational constraints. According to the National Institute of Statistics Rwanda (NISR), 2012, the level of extreme poverty was 24.1 percent in 2010

while private funding was 32.2 percent of the total health expenditure. This implies that some services may be expensive for certain income groups or simply some individuals may lack the minimal OOPE necessary to access health care.

Table 1.3: Utilization of Outpatient Services for Selected African Countries, 2007

Country	Outpatient utilization (annual visits per capita)
Rwanda	0.72
Malawi	1.8
Seychelles	5.84
Egypt	3.5
Burkina Faso	0.22

Source: MOH (2008a), WHO (2011) and World Bank (2007)

1.4 Statement of Research Problem

The impact of health care utilization for countries, households and individuals is a subject of considerable interest. Emerging evidence indicate that lower health care utilization is negatively related to the national income because of morbidity and mortality due to inadequate or late visits to health facilities by patients. Limited access to health care leads to low usage of health services that leads to a range of vulnerability in life. Since health care is an input to the health production function, one way of acquiring good health is improving access to health care.

To increase access to health services, the government of Rwanda initiated a number of health policies and other economic stimulus efforts some of them targeting supply-side of the market while other policies were aimed at increasing services utilization. The policies included Vision 2020, EDPRS 2008-2012, One-Cow-One-Family, Social Security Policy 2009 and Health Policy 2004 (Ministry of Health, 2009). These policies were meant to

increase access to health services and hence improve ultimately the health status of the population. The reforms were also meant to strengthen the health care system and make it more accessible (MOH, 2005). Despite these reforms, less than two out of five sick people seek formal health care in Rwanda (NISR, 2011). Yet the country is burdened by simple diseases and chronic morbidities that can be overcome by adequate utilization of the available services[3]. The ineffectiveness of previous policies aiming at increasing health care utilization is due to their implementation without adequate evidence as to factors influencing health service utilization in Rwanda.

Although economic theory offers potential factors that influence demand for health care, there is lack of quantitative assessment of their effects in Rwanda. Evidence on these factors is needed in implementing policies designed to improve health service utilization in the country. To my knowledge, there are no studies in Rwanda that have been done in recent years to determine factors influencing health care demand. The only available evidence on this is from studies by Jayaraman et al., (2008) and Shimeles (2010) which focused on maternal health care and on effects of CBHIs at the district level. In countries in which estimates of demand for health care exist, research results provide conflicting evidence to demand effects of price, income and insurance across different types of health services. For instance, outpatient services might respond differently to price, income changes or insurance status as compared to the demand for inpatient services (see Leibowitz et al., 1985 and

[3] 43 percent of deliveries are not assisted by skilled staff and 24 percent of children are underweight (Dhillon et al, 2011). 64 percent of women between 15 and 49 years (the sexual active age) do not use modern contraceptive methods while 37 percent of population lives in extreme poverty (Republic of Rwanda, 2010). Hundred cases of sexual and gender based violence are reported (Republic of Rwanda, 2010), vulnerable households (headed by women, widows and children) represented 43 percent of all households in 2008 and the access to safe drinking water represented 41 percent in rural areas in 2007 (Hong et al., 2009).

Newhouse et al., 1993). With this, to investigate the determinants of demand for health care, it is important to estimate separate demand functions for different category of health services.

In addition to identifying the factors influencing demand for health care, it is important to examine the determinants of facility choice. This is necessary so as to establish a complete picture of health seeking behavior of patients at different stages of the care decision process (see Mwabu, 1986). In Kenya, Muriithi (2013) found that more than 70 percent of the respondents did not seek health care from government health facilities despite the fact that these facilities were the closest to them. Moreover, the private health facilities visited were more expensive than the closest, public health facilities. Thus the information on facility choice and on decision to use health care can help a lot in explaining health service utilization in Rwanda. The thesis provides the above kinds of evidence.

1.5 Study Objectives

The broad aim of this thesis is to examine the factors affecting health seeking behavior in Rwanda.

The specific objectives of the study are:

- To estimate the factors that influence demand for health care services;
- To examine whether the effects of covariates vary by types of health services;
- To estimate the factors affecting the choice of service providers; and
- To suggest policy recommendations based on the study findings.

1.6 Justification of the Study

The estimates of demand for health care reported in the literature vary widely, especially when health care is disaggregated by types of services (Hunt-McCool et al., 1994). Ringel et al., (2002) show that some of the health care demand determinants vary according to the types of health care. For instance, demand for outpatient services might respond differently to price, income changes or insurance status as compared to other types of health services (see Leibowitz et al., 1985; and Newhouse et al., 1993). Therefore, to assess the determinants of demand for health care, it is necessary to estimate demand for health care for outpatient and inpatient and choice. The usefulness of considering different aspects of demand is that it is valuable for policy formulation because we should expect that demand for a specific service responds to a factor in a different way (Ringel et al., 2002). Most of studies on demand for health care have neglected this aspect and have focused either on the decision to seek health care (Mocan et al., 2004; Lépine and Nestour, 2008; Feng and Yangyang, 2008) or on the choice of health providers (Jayaraman et al., 2008; Kaija and Okwi, 2011 and Awoyemi et al., 2011).

Despite various health sector reforms aimed at increasing utilization of health services in Rwanda, utilization still remains low. As already noted, while Rwanda bears a high level of disease burden, the corresponding level of utilization would be expected to be high. This implies that other factors may be hindering service utilization. Since the implementation of health sector reforms, there has not been any attempt to estimate demand for health services and choice of service providers in Rwanda. Thus, the thesis explores patterns of health utilization and facility choice after reforms.

The thesis also addresses general issues that arise in the estimation of health care demand models using robust estimation methods. We have already noted the inconsistencies in demand effects of price, time, and insurance in the literature that need reconciling (see Ringel et al., 2002; Manning et al., 1987). Because no consensus has emerged on the issues, this thesis presents new evidence on the factors affecting demand for health care using data from Rwanda. Further, differences in health care use patterns observed across regions and locations limit generalization of the results available in the literature. Most of the studies in East Africa are geographically limited by being implemented only in some parts of a particular country (Mwabu et al, 2003; Randall and Mwabu, 2004; Odwee et al, 2006). This study extends the analysis by using a nationally representative data covering urban and rural locations as well as all the 5 regions of the country to test their effect on demand for health care in Rwanda.

Most studies on demand for health care have not addressed the problems of endogeneity (reverse causality) and heterogeneity (variation in the estimated effect size due to unobservables). Failure to address these problems leads to biased estimates (Greene, 2007; Rosenzweig and Wolpin, 1988; Kioko, 2008; Kabubo-Mariara et al., 2009; and Lawson, 2004). Hunt-McCool et al., (1994) pointed out that differences in data, model specification, and/or empirical methods can contribute to diversity the demand estimates and hinder clarity in health care financing policies. The thesis addresses these estimation problems, providing rigorous evidence on health care demand determinants that policy-makers in Rwanda can use to improve health service utilization across all the regions of the country.

1.7 Organization of the Thesis

This thesis is organized into 7 chapters. The first chapter presents the background to the study, formulates the research problem and outlines the relevance of the study. Chapter 2 describes the health care system and financing in Rwanda providing the institutional setting for the study. Chapter 3 presents a review of relevant literature on demand for health care services and choice of service providers while Chapter 4 discusses the study methodology. Specifically, the chapter examines the conceptual framework, the model specifications as well as the empirical models for estimating the demand for health care services and the choice of health service providers. The chapter further discusses two key estimation issues: endogeneity and heterogeneity. It also discusses the data used in the study as well as the definitions and measurements of variables of interest for the econometric models. Chapter 5 reports the empirical findings of the thesis, while Chapter 6 discusses the findings in relation to the existing literature. Chapter 7 presents the summary, and policy recommendations based on the study findings and highlights areas for further research.

CHAPTER TWO: HEALTH CARE SYSTEM AND FINACING IN RWANDA

2.1 Introduction

This chapter presents the Rwandan health care system and its financing mechanisms. The objective is to assess the way health providers offer services across regions and how the services are financed. The two issues are crucial for demand for health services because they relate respectively to the supply side of health care and the financial barriers faced by patients in Rwanda. The chapter discusses the different types of providers that exist in the country including public, private, and faith based organizations (FBO) and then looks at the different levels of the government health facilities network (central, intermediate and operational) and how these facilities are regionally distributed. The chapter also discusses government policy for improving financial access to health care through a pioneered micro-insurance scheme and the public health expenditure. We note however that, despite the efforts, the OOPE is still one of the largest sources of health care funding and thus, remains a constraint to use health care.

The chapter provides a description of the health care system and financing in Rwanda. Section 2.2 examines the health care system while section 2.3 discusses the health financing mechanisms.

2.2 Health Care System

Health sector in Rwanda consists of heterogeneous system of providers consisting of public, private, and FBO. The Ministry of Health (MOH) is responsible for health services delivery through health facilities which are distributed regionally. Health facilities are classified

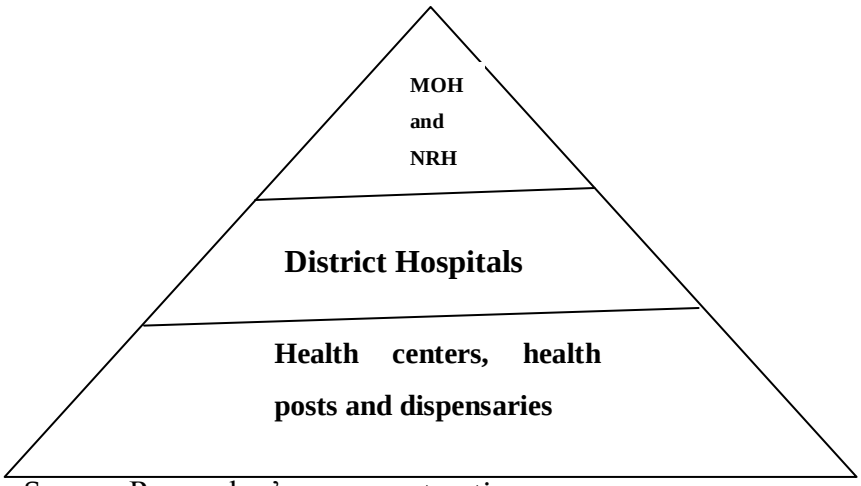
according to the sub-sector they belong to; official or public if they belong to the government and private or FBO and according to the type of health care they deliver, location and size. In 2012, the public health facilities accounted for about 64 percent of the total number of health facilities in the country while the private sector, mission organizations and other semi-private managed the remaining 36 percent of health facilities (Republic of Rwanda, 2012).

Figure 2.1 shows that the Rwanda public health care system is a 3 part pyramidal structure consisting of: central, intermediate and operational health facilities (WHO, 2010). Mwabu (1989a) provides the economic rationale for such structure. The central level comprises several departments of MOH and 4 national referral hospitals (NRHs). The central level is in charge of formulating health policies, strategic planning, high-level technical supervision, monitoring and evaluation of the health sector as well as coordinating resources at the national level. The NRHs provide the highest level of health services and function as referral centers for district hospitals. They deliver more advanced services and focus on curative, specialized care and medical tests as compared to districts hospitals. Within the Rwandan health system, the NRHs are at the apex. Two of the four NRHs; 'Centre Hopitalo-Universitaire de Butare' (CHUB) and Centre Hospitalo-Universitaire de Kigali' (CHUK) also serve as teaching institutions. Ndera hospital is the referral hospital for mental health while Kanombe Military hospital and Kacyiru Police hospital cover the surrounding civilian population in addition to the Rwandese Defense Forces and the National Police staff **(**MOH, 2010).

The intermediate level serves facilities at the district level and is responsible for guiding and supervising the delivery of services at district level. It is responsible for administrative, logistical and technical supervision of all health facilities within each district. Districts hospitals offer intermediate care including inpatient services in internal medicine, pediatrics, obstetrics and gynecology and minor surgery because being staffed mainly with general practitioners, auxiliary nurses and nurse-assistants. However, some hospitals, although providing general health services offer medical care for certain specific types of illness.

The operational level consists of health facilities which offer primary health care delivered by health centers, health posts and dispensaries whose number in a specific locality depends on administrative and political decisions (Republic of Rwanda, 2010). Health centers, health posts and dispensaries offer a minimum package of services including preventive activities such as consultation, ante-natal care and family planning counseling. The services also include curative activities, including consultations, nutritional rehabilitation, minor surgical interventions, and laboratory testing. The system of public providers is conceived in a way that beneficiaries first seek health care through their local health care centers and then, if necessary, get appropriate referrals to a district hospital (both out-patient consultations and inpatient stay).

Figure 2.1: Public Health Sector Structure in Rwanda



Source: Researcher's own construction

The number of public health facilities in Rwanda at the end of 2011 (Table 2.1) was 720 compared to 579 in 2010. Out of the 720 public health facilities, 61.3 percent were health centers, 5.6 percent district hospitals, 17.3 percent health posts and 13.1 percent dispensaries. The increase was motivated by the need to improve physical access to health care by increasing the number of health facilities. However, the expansion of health facilities network pointed out that supply is not sufficient to improve utilization of health care. This is why there is a need to investigate the other determinants of demand for health care. Table 2.1 shows that there is wide spread disparity of health facilities in the country. For instance southern region has more facilities compared to the rest of other regions. This suggests that there might be a geographical unequal distribution of health facilities (Endo, 2004).

Table 2.1: Distribution of Public Health Facilities by Level and Region, 2011

Region	Central/NRH	Intermediate	Operational	Total
Kigali region	3	4	117	124
Northern region	-	9	140	149
Southern region	1	12	172	184
Western region	-	10	145	156
Eastern region	-	6	101	107
Total	4	41	575	720

Source: MOH (2012)

The above distribution of health facilities meant to ensure efficiency of health care delivery and accessibility of the available health infrastructures. However, despite substantial efforts by the government for provision of health services, various problems related to access of health care remain. A population is defined as having access to health care if the service can be reached within one hour walking[4]. Although geographical access to health facilities has been improved, approximately 40 percent of the population still has to travel more than one hour to reach the nearest health facility (NISR, 2006). The unequal distribution of health facilities may also be a deterrent of choice among the quality service providers. An increase of the distance to a particular health facility from the area of residence would induce an increase of the chances of a patient to choose self-treatment rather than any other service provider because of the extra cost to travel to the source of treatment from home.

In addition to public health facilities, private health facilities also play an important role in service provision. Since 1995, the private sector in Rwanda has grown considerably and accounts for more than 50 percent of the facilities located in Kigali. These facilities provide

[4] The MOH target is that each patient from any region be able to reach a public facility at most after one hour walking from home

both inpatient and outpatient care while a few of them offer specialized services. Some of the private health institutions receive subsidies from the government to improve service delivery and are classified as semi-private health facilities (Republic of Rwanda, 2010). The subsidy benefits are in form of financial resources and human resources. The aim is to bridge infrastructure gap and help in mobilizing additional financial and technical resources for the health sector. They are run by various religious groups and non-profit associations.

The provision of services is guided by three strategies; decentralization of health service delivery, development of the primary health care system and increased community participation in the management and financing of health services (Ministry of Health, 2008a). Decentralization of service delivery has increased the role of local governments (districts) in service delivery leaving the central government to focus on policy formulation, regulation and support to local governments through capacity building, financing, monitoring and evaluation (Republic of Rwanda, 2008). The districts are responsible for the delivery of public services. Fiscal decentralization, an essential component of Rwanda's decentralization reforms, has created new fiscal relations between population and districts. This includes block grants to districts through the Local Authority Budget Support Fund, earmarked transfers to districts for health services, and other transfers to districts. The province links the district development planning with national policies and programs and supervises implementation of the national policy in the districts within the province, coordinates governance issues in the province, monitors and evaluates service delivery.

The second strategy is to increase the number of health facilities for primary health services in different areas. Providers in health care are specialized physicians, general practitioners or

medical doctors, registered nurses and other technical medical personnel (Republic of Rwanda, 2010). The third strategy is the participation of the community in health facility management. In different areas, there are health promoters at village unit level (Abajyanama b'ubizima), who are specifically trained to teach basic hygiene, good nutrition and preventive care to communities through house visits. Although they are not required to have any formal medical training, they provide necessary advice to household heads and members to report early to a close health facility for preventive care or treatment in case of any illness. Nevertheless, even with the above additional efforts, utilization of health care did not increase as it would be expected.

2.3 Health Sector Financing

Rwanda has a modern health system, with autonomous facilities that are funded by the government on the basis of their performance. The country moved from a faith-based service delivery model in the colonial period to a model guided by the WHO, the Bamako Initiative with the development of local models of primary health care that are managed and financed by communities (Sekabaraga et al., 2009). Health care facilities in the public health system are financed through funds allocated by central and district governments.

To improve financing of health care, the government pioneered a micro-insurance scheme (CBHIs) in 2003. CBHI schemes have evolved in response to low levels of utilization of health services. In addition, the Government introduced a mechanism of performance-based financing to provide incentives to health facilities to ensure quality of services. CBHIs and performance-based financing are two complementary schemes. Both aim to shift health

financing mechanisms from inputs-based towards output or results-based mechanisms (Sekabaraga et al., 2009).

Table 2.2 shows the main sources of financing health care between 1998 and 2010 in Rwanda. There is an increasing trend of the public sources of health financing between 1998 and 2003 followed by a rise and fall between 2003 and 2010. The main source of health care funds was from donors through the budget support which contributed 43.7% of the total health expenditure in 2010. The second largest source of funding is the OOPE by households, which also shows an increasing trend from 25 percent in 2006 to 32.2 percent in 2010. The share of domestic resources to public health expenditure increased to reach 24.1 percent 2010 while external funding increased from 42 percent to 43.7 percent between 2002 and 2010 (Republic of Rwanda, MOH report 2008).

Although Government funding has increased over years, funding of health care in Rwanda is still highly dependent on external funding. Donors' share of financing in Rwanda exceeds 40 percent of total health expenditure (THE) and is among the largest in African countries when considering external resources flowing to the health sector (Dhillon et al., 2011). High dependence on external funding raises some concerns about the sustainability of health financing in the country. External aid flows were to support Rwanda reconstruction after the 1994 war and genocide, but these might not continue because the country is supposed to have built the necessary domestic funding capacity. In the absence of external funding, the OOPE would be the main source of financing, and this would negatively affect utilization of health care because of increased financial barrier.

Table 2.2: Sources of Health Financing, 1998-2010

Sources	1998	2000	2002	2003	2006	2008	2009	2010
Total Health Expenditure (THE) per capita in USD	10.4	9.5	9.9	16.9	33.9	34.1	36.5	44.1
THE as percent of nominal GDP	5	4	4	9	11	13.9	9.5	9.4
Public Financing (%)	10	18	25	32	22	28	20.1	24.1
Private Financing (%)	40	30	42	21	25	36	34.1	32.2
Donors Financing (%)	50	52	33	42	53	36	45.6	43.7
Health budget as National budget (%)	6.9	5.9	6.3	8.2	12.6	9.1	10.2	11.5

Source: MOH, annual report 2010; WB, 2011 and Dhillon et al., 2011.

Health insurance is also increasingly becoming an important source of financing health care in the country. However, the co-payments from RAMA, CBHIs and other insurance providers' account for less than 5 percent of total health care expenditure in Rwanda (MOH, 2008a). Table 2.3 shows that in 2010, 91 percent of the population was covered by CBHs. The coverage by CBHIs rose from 44 percent in 2005 to 91 in 2010, but fell to 73 percent in 2013. The decline was largely due to the increase in premium rate. The growth in CBHIs coverage benefited from the support by policy-makers to make it an integral part of the country's health program. The system was designed as a policy instrument in order to enhance affordability, accessibility and equitable financing of health sector (MOH, 2009).

Table 2.3: Trends in CBHIs Coverage Rate, 2003 to 2013

Year	CBHs coverage rate
2001	-
2002	-
2003	7
2004	27
2005	44
2006	73
2007	75
2008	85
2009	86
2010	91
2011	90.7
2012	80.7
2013	73

Source: MOH (2008a; 2009-2013); WHO, 2011).

If majority of people in Rwanda are covered by the CBHIs, the programme was not enough to increase health care utilization. The programme might even further alienate the extreme poor from utilizing health services for at least two main reasons. First, the level of premium; $ 4.5 per year and per person is considered to be too high for the very poor and large size households so that given a choice they would rather defer seeking treatment until it becomes unavoidable. Second, even if people become members of CBHIs, they might not utilize health services since they are not entirely free because there are other costs met by patients that include co-payment, transportation cost and drugs (Shimeles, 2010). In addition, CBHIs members do not have a free choice of provider based on the perceived quality of health care because the system imposes on them to first seek medical treatment from their local public health center and request for referrals, which are very often not easy to get. This suggests that despite the sustained efforts by the government, health financing remains a major

challenge and can be accounted for among the factors that hinder utilization of health care in Rwanda.

CHAPTER THREE: LITERATURE REVIEW

3.1 Introduction

This chapter reviews the literature in the area of health care demand. To justify the different approaches used in the methodology, we first discuss the main theories that inform health care demand modeling: consumer theory, asymmetric information theory and choice theory. This is followed by the relevant empirical literature on demand for health care and choice of service providers. The chapter concludes with an overview of the literature that highlights the gaps the study intends to address.

Specifically, section 3.2 presents a review of theoretical literature while section 3.3 presents the empirical review of literature on demand for health services. Section 3.4 reviews empirical studies on choice of service providers while section 3.5 provides an overview of the literature and highlights the gaps in the literature.

3.2 Theoretical Literature

The aim of this review is to identify relevant approaches in the analysis of demand for health care.

3.2.1 Consumer Theory

Microeconomic theory states that economic agents, including patients behave optimally, i.e. they choose the option providing the highest benefit from those available to them (Jehle and Reny, 2001; Varian, 2010). This assumes that the consumer is aware of all available alternatives and is able to evaluate them.

In health economics, the assumption is that individuals have a given income to finance their health production factors and other consumption activities. The models assume that individuals derive utility from consumption of both medical services and other commodities (Santerre and Neun, 2010). The early users of these models were Heller (1982) and Akin et al., (1986). These and subsequent models were version of the Grossman (1972) health production-consumption model where the consumer maximizes an inter-temporal utility given a life cycle budget constraint. Health services entered the utility function indirectly through health capital. The budget constraint in the model was the discounted lifetime income. In this model, health care is a consumption good as individual derives utility from being healthy and investment good since being healthy enables an individual to participate in economic activities and hence earn income.

According to Grossman (1972), an individual inherits an initial stock of health that depreciates with age and can be restored by investment. The individual will therefore demand health care to increase the initial health stock as long as marginal cost of investment in health is lower than the marginal rate of return. The consumption of health care will continue until the equilibrium is reached (where marginal cost of the investment is equal to the marginal return). However, the assumption of certainty is not realistic since it is hard to compute the marginal rate of return in terms of extra-healthy days and marginal cost in terms of extra-expense on health care. If marginal return and marginal cost were easily computable, rational individuals would evaluate the extra-amount to be spent to obtain an extra-healthy day and the extra-resources to be gained as a result of the extra-healthy days and thus indirectly choose a life span.

3.2.2 Information Asymmetry Theory

Asymmetric information refers to a situation where two market participants have different levels of information and the information they possess affects each one's behavior in a transaction. For instance, the buyer can have information about the prices of similar items in the market while the seller probably has information about the quality of the item (Auronen, 2003). There exist two forms of asymmetric information; adverse selection and moral hazard. Adverse selection (prior information to the deal) occurs when the seller values the good more highly than the buyer, because the seller has a better knowledge of the value of the good. Due to this, the seller is not willing to offer the good for any price lower than the proper value the seller knows it has. On the other hand, the buyer, who is not sure of the value of good, is unwilling to pay more than the expected value of the good taking into account the possibility of getting a bad quality. Moral hazard (inability to control behavior after the deal) occurs when after the transaction is done, one of the parties to the deal may be more careless and thus does not behave as stated in the deal. For instance, a person possessing insurance against theft may be less careful about closing the windows when leaving the house. Here, it is not the prior information that either party has, but the inability of the insurance provider to control and monitor increased risk-taking behavior that creates the potential for market failure. While in adverse selection the seller is usually the one possessing more information, moral hazard usually has the buyer having too much control.

Information asymmetry in health care can be analyzed using 2 different levels (Pauly, 1968). First, uncertainty in terms of the quantity and type of the required health service with the need to consult a physician who holds the necessary information. This significantly erodes

the consumer's sovereignty over the consumption decision. Second, health insurance being an instrument for health financing is needed to reduce the high amount of out-of-pocket payments. The third party payments can increase the demand for health services (Shmanske, 1996). Because health insurance reduces the price of health care, patients may continue to demand health services as long as the marginal service is greater than the marginal cost and in this case consumers will demand more care than they would otherwise.

The effect of insurance on health care can also be analyzed through the substitution and income effects associated with a price change as part of it is being paid by the insurance provider. According to the substitution effect, a decrease in the price of medical care due to insurance causes the consumer to substitute the higher priced goods and purchase more health services (Santerre and Neun, 2010). That is, a rational individual behavior would substitute the cheap services for the expensive ones. As a result, the quantity of medical services demanded increases as price decreases with health insurance. According to the income effect, a decrease of price of a commodity increases the real purchasing power of the consumer. Given that medical care is assumed to be a normal good (that is, the quantity demanded of medical services increases with income), the quantity demanded of medical services increases with the rise in purchasing power.

In addition, because the consumer pays only part or none of the additional cost of services, he or she may carelessly take damaging actions and avoid healthful ones or delay health care visits (Shmanske, 1996). As a result, the consumer's stock of health may depreciate, and require more health care in future. Therefore, having information about the probability of poor health, which the insurer cannot observe, risk-averse individuals will buy more

generous insurance to compensate their incomes against catastrophic shocks (Koç, 2004). However, the behavior of demanding more health care with insurance than without insurance is not of moral perfidy, but of rational economic conduct since the additional cost is spread over all other purchasers of that insurance provider (Pauly, 1968).

Because of information asymmetry, health service market needs a special attention since with insurance, the demand for health services can be determined by health problems or by insurance coverage. Pauly (1968) added that this phenomenon depends on rational economic behavior and the presence of elasticity in the demand for hospital services. However, the amount of medical services that an insured individual receives may be rationed in several ways: the insurer may allow only normal expenses, where normality means roughly what would have been purchased even in the absence of insurance; the professional ethics of physicians may not allow them to prescribe treatment where the gain is primarily for leisure rather than in health improvement; the patient may be willing to behave according to commonly accepted norms and may not demand additional medical services when the price of these services is lowered because of insurance (Arrow, 1968).

3.2.3 Choice Theory

Choice theory attempts to model the decision process of an individual in a particular context. To some degree, all decisions or even most of the actions we take in life, involve choice (Thurstone, 1927). In choice models, decision makers choose among a set of alternatives. To fit within a discrete choice framework, the set of alternatives needs to exhibit three characteristics: (i) alternatives need to be mutually exclusive (a consumer picks only one alternative among those available), (ii) alternatives must be exhaustive (their number is well

known i.e. they are 2, 3, 4…), and (iii) the number of alternatives must be finite (their number is relatively small so that the consumer is aware of all alternatives).

Choice models are derived from random utility model framework in which decision makers are assumed to be utility maximizers. The basic setup is that a decision maker, labeled *n*, faces a choice among *J* alternatives. The decision maker obtains a certain level of utility from each alternative. The utility that decision maker n obtains from any alternative *j* is U_{nj},(*j* = 1… *J)*. This utility is known to the decision maker but not to the analyst. The decision maker chooses the alternative with the highest utility: choose alternative *i* if and only if $U_{ni} > U_{nj}$ *for j* being different from *i*. The choice probability is *Pni* = Prob (*Uni* >*Unj*) = Prob (*Uni- Unj* > 0), which depends only on the difference in utility and not its absolute level. The fact that only differences in utility matter has implications for the identification of discrete choice models. In particular, it means that the choices made are not based on the alternatives, but rather on the characteristics or attributes of the alternatives (Luce, 1959). Ben-Akiva and Lerman (1985) stated that the attractiveness of an alternative is evaluated in terms of a vector of attributes.

In the last decades, the literature on demand for health has been growing in the developing countries where the focus has not only been confined to quantities of health services purchased, but also to the provider's choice. The two aspects are elaborated by Akin et al., 1986; Mwabu, 1986, 1989b; Mwabu et al., 1993; Mwabu et al., 2003; Acton, 1975 and Sahn et al., 2003). These studies hinge on the utility maximization in the consumption of health goods and other goods (Ssewanyana et al., 2004). Based on these studies, there are three possible different decisions to make. First, the decision on whether or not individual reports

illness or injury. Second, the decision whether or not to seek formal health care when ill or injured and third, the choice of health care provider once the decision to seek health service is made (see Mwabu, 1986).

Assuming the case where an individual reports illness and then decides to seek formal health care, two different demand functions can be analyzed. First, the quantity of health care demanded when the demand variable is continuous or the probability of seeking health care when the demand variable is discrete. This kind of analysis includes both outpatient and inpatient services (see Lépine and Nestour, 2008; Mwabu et al., 2003; Mocan et al., 2004; and Hahn, 1994). Second, the demand function is analyzed through the choice of health care provider. Mwabu (1989b) and Sahn (2003) show that individuals are able to choose from a set of choices of health facilities, where each facility-choice leads to a potential improvement in expected health for a given price level. But again, the price of an alternative health facility includes both monetary and non-monetary costs. Considering this new variable, the rational decision-maker chooses the alternative that yields the highest expected utility (Muriithi, 2009).

Among other factors, patients may base their choices for institutions that are less expensive if they are not able to judge quality of health care directly, believing that the profit motive of institutions might have adverse health consequences (Arrow, 1963). He argues that non-profit health facilities play a role in helping patients to judge quality in the health care markets which are characterized by information asymmetry. The idea was discussed by Leonard (2002) and Leonard and Zivin (2005) where information asymmetry was found to be reduced with outcome contingent contracts. The foundation of the framework is that the

patient pays for service after treatment where the arrangement of payment between patient and the provider is made after observing the provider's effort; a signal of the providers' quality, thus resolving the information uncertainty about making visits to this specific health provider.

3.3 Empirical Literature

This section reviews the empirical literature by evaluating previous studies that are relevant to this thesis. It mainly presents commonalities and controversies in the literature to highlight the gaps to address.

3.3.1 Demand for Health Services

Numerous studies have attempted to empirically quantify how much health care people consume, the types of health care they use, and the timing of that care. Given that demand for treatment is not determined by the individual alone, several studies have investigated the household and community factors. Lépine and Nestour (2008) controlling for the unobserved effects at the household and community level that affect health seeking behavior show that household economic status and quality of health care are important determinants of the probability of seeking treatment from a qualified provider. In addition, transportation cost was found to be an important determinant of the likelihood of seeking care as an increase of the average transport cost decreased the likelihood to seek curative care by 25 percent. The paper did not however control for endogeneity of insurance.

There is an extensive literature in health economics that sought to estimate the elasticity of income on demand for health services. Most of the literature show that demand for medical

care was income inelastic indicating that medical care was a necessity good (Mocan et al., 2004). The positive sign of the elasticity indicates that as income increases, demand for health services also increases. However, the literature was inconclusive but noted that income effects vary widely across studies and by the nature. Ringel et al., (2002) reports that income elasticity of demand using cross-section data ranges between 0 to 0.2. This kind of magnitude suggests however that the effect of income on demand is relatively small. The difference in estimates across time frames relies on the inclusion of the effects of changes in medical technology that use long time series data (Ringel et al., 2002). Income elasticities based on cross-sectional data or on time series data covering a relatively short period assumes that the level of available medical technology is constant. As real income in the population increases, the aggregate demand for new medical technologies and new treatment approaches rises as well. Thus, from the previous studies on the effect of income, no consensus has emerged, and the debate on whether health care is a luxury or necessity good continues (Blomqvist and Carter, 1997).

To account for the price effect at different levels of visits rather than the average effect obtained using Ordinary Least of Squares (OLS), Mwabu et al., (2003) used quantile regression method to analyze the effects of price on demand for health services in Kenya. The fees were found to have a negative effect on demand for health care but differing across the quantiles. The findings established that an increase of 10 shillings reduced visits by 0.2 percent. Clearly, the price elasticity of demand for medical care was found to be small in magnitude and consistent with Akin et al., (1986) and Sauerborn et al., (1994). The study did not however address the endogeneity and heterogeneity problems to produce unbiased estimates.

Other researchers investigated the role of price of health care on different types of health services. Newhouse and Phelps (1974) estimated the effect of price on inpatient services and found that the quantity of services, measured by the length of hospitalization period was not very responsive to changes in price. A one percent increase in the price of a hospitalization led to a 0.1 percent reduction in the use of hospitalization services (Ringel et al., 2002). In another study, Newhouse and Phelps (1976) measured the effects of price on both the inpatient and outpatient services. The results suggested that as the price of health care increases by 1%, the demand for inpatient service would reduce by 0.1% while demand for outpatient service would reduce by 0.17%. The results showed that there is difference in price elasticity between the two health services. In a related study, Leibowitz et al., (1985) pointed out that the price change has a significant effect on demand for outpatient services while price change has no effect on the quantity of services demanded for inpatient health care.

A similar study by Newhouse et al., (1993) showed that the demand for outpatient services was more price sensitive than the demand for hospital stays. Ellis et al., (1994) used multi-stage discrete choice models to estimate separately demand for inpatient and outpatient services. The results established that inpatient care was less price responsive than outpatient care. Other studies investigated price effect to analyze the extent to which various types of medical services serve as substitutes or complements in consumption of health care. While Davis and Russell (1972) and Gold (1984) found positive cross-price elasticity between the price of inpatient services and outpatient services implying that the two goods were substitutes, Freiberg and Scutchfield (1976) reported different results. The study concluded that there was no-substitution between these two types of hospital services. At the other

extreme, Manning et al., (1987) found evidence that the two goods were complements in consumption. In the case of substitute goods, as the price of inpatient services at a hospital increases, consumers were shown to rely on outpatient services to save money. Evidence from the reviewed literature shows that the effect of price on health care differ widely suggesting that other studies are informative if they estimate outpatient and inpatient demand functions separately.

A few studies have examined the effect of time price on demand for health care. Time prices associated with demand for health care include the time spent and the value of the time. The variable is defined to include treatment time, waiting time and travel time which encompasses the cost of travel and the opportunity cost of time. The study by Janssen (1992) found that a one percent increase in the time price of medical care leads to a 0.11 percent decrease in the probability of demand for health care from formal health facility. This finding is important because consumers would likely have high opportunity costs of time. In this case, time costs become important in determining patterns of use of health care. This is why some people who are eligible to receive health care from a cheap but crowded hospital choose to use other providers that require an additional payment provided they deliver quality and quick services.

The growth of health insurance, both public and private, has had a strong impact on the demand for medical care. Several studies have documented the impact of insurance on demand for health care and found that the effect of insurance on utilization varies across the population, the level and type of coverage (see Buchmueller et al., 2005; Barros and Galdeano, 2008). The study by Hahn (1994) found that uninsured households had lower average rates

of utilization compared to persons with private or Medicaid coverage. Those with Medicaid for the full year were found to have the highest rate of health care utilization while the uninsured persons were found to have the lowest mean utilization for all types of services. In a similar study, Barros and Galdeano (2008) estimated the effect of private health insurance coverage beyond a National Health System on the demand for several health services in Portugal. The study estimated the impact of having additional coverage on the demand for 3 different health services; the number of visits, number of blood and urine tests, and the probability of visiting a dentist. The results showed large positive effects of coverage for the number of visits and tests.

Similar findings are reported by Jones et al., (2006) who found private insurance to be positively associated with the probability of health visits in Ireland, Italy, Portugal, Spain and the United Kingdom. Moreira and Barros (2009) reported similar results of the impact of double health insurance coverage on demand for health services. Results show that double insurance increases utilization of health care. Another study by Shimeles (2010) examined the effects of a CBHI on health care utilization at district level in Rwanda. The study used the matching estimator to address the endogenity problem. As in Hahn (1994), higher utilization of health care services was reported among the insured than in uninsured households. The results indicate that CBHI has a strong positive impact on access to health care. The results were consistent with the findings by Newhouse, 1981; Saksena et al., 2010; Rashad and Markowitz, 2009; Jutting, 2005 which found that insurance was an important factor in explaining health seeking behavior.

Other studies however found that insurance may have little effect on demand for health care depending on geographical locations (Buchmueller et al., 2005). Cunningham and Kemper

(1998) documented that in areas where there exist a well-functioning health care system, the lack or reduction of insurance coverage may not imply a significant lack of access to care. The expansion of coverage would then result in smaller changes in utilization than in locations where the uninsured have fewer options. For instance, Mwabu et al., (2003) reported a negative effect of insurance suggesting that insured people make fewer visits to health facilities relative to uninsured people. The reason for this unlikely result was that people with insurance may have better health endowments and, thus, demand fewer health care relative to uninsured people. However, none of the studies controlled for heterogeneity of insurance. Since the effect of insurance on utilization may vary across population, geographical location, the level and type of insurance coverage, health care demand research needs to handle the problem of heterogeneities to produce reliable estimates.

Feng and Yangyang (2008) examined the effect of education on demand for health care and revealed a causal and positive relationship between education and health care use. It is interesting to note that researchers have focused specifically on the effect of medical knowledge on the demand for medical care. Unlike the results for general education, a positive relationship appears to exist between consumers' medical knowledge and the demand for medical care. This means that consumers with more particular health information tend to consume more medical services. For instance, Kenkel (1990) reported that consumers' medical knowledge is positively related to the probability of visiting a physician for medical care while Hsieh and Lin (1997) stated that elderly with greater understanding of health issues are more likely to acquire preventive medical care. The results were consistent with those reported by (Mwabu et al., 2003; Lawnson, 2004; Gertler

and van der Gaag, 1990) who found that education is an important variable in explaining the health seeking behavior for both men and women.

However, some other studies reported a negative relationship between education and demand for health care suggesting that as education level increases, less health care is demanded. Feldstein (2005) using health expenditures as a proxy of demand for health care pointed out that people aged 45 to 64 with higher educational levels have fewer average health expenditures than those of the same age but with a lower educational level. The result firstly pointed out that while people with high education level have higher expenditures for physician visits, these expenditures are offset by minor hospital expenditures and thereby contribute to a decreased overall health care total expenditure or demand for health services.

Other studies on demand for health services have focused on specific health services such as maternal health care (see Dairo and Owoyokun, 2010; Yang et al., 2010; Magadi et al., 2000), pediatric care (see Colle and Grossman, 1978), and delivery services for women (see Idris et al., 2006). Dairo and Owoyokun (2010) showed that location, religion, and age were the main determinants of antenatal care visits. Women in urban areas were more than 2 times likely to attend antenatal clinic than women in rural areas. Women aged 25 years and older were more than 2 times more likely to utilize antenatal than women who were 25 years or younger. Kistiana (2009) reported comparable findings in Indonesia. The study found that women's exposure to media, their age, birth order and place of residence had significant positive relationship with the utilization of antenatal care. The woman's and husband's education showed a strong relationship with maternal health care utilization. The results further showed that most of the social, economic and demographic variables were

significantly associated with utilization of antenatal care. However, most of the above studies were geographically limited. A clear picture of the factors would necessitate controlling for areas of residence; whether urban or rural and regions as well as social, economic and demographic factors to test the difference of the location effects on demand for health care.

Research has shown that knowledge on utilization of antenatal care services among pregnant women plays a significant role (Yang et al., 2010). Limited knowledge on the availability of ante-natal services contributed to low utilization. A similar study by Magadi et al., (2000) found that the use of antenatal care depended on a range of socio-economic, cultural and reproductive factors. The study showed that proximity to antenatal clinic was important in explaining antenatal visits. The results also found wide variation in the use of antenatal care between rural and urban communities. Coll and Grossman (1978) examined the determinants of pediatric care utilization. Mother's schooling and the number of children in a family were important determinants of pediatric care utilization. Family size was found to negatively influence utilization of health care while mother's schooling was found to have a positive effect.

3.3.2 Choice of Service Provider

Most studies that examined the determinants of choice of service providers employed discrete choice models. The models estimated include; the multinomial logit used by Akin et al., (1986), Deininger and Mpunga (2005), and Mbanefoh and Soyibo (1994); multinomial probit, used by Akin et al., (1998); mixed multinomial logit, used by Mwabu et al., (1993), Mwabu, (1989b), and Lindelow (2005); and nested logit, used by Sahn et al., (2003) and

Ssewanyana et al., (2004). Subsequently, in their studies, Bolduc et al., (1996) and Dow (1995) have suggested alternative model specifications including the multinomial probit and nested multinomial logit, which are not burdened by the independence of irrelevant alternatives (IIA), an assumption of no-correlation of the error terms of the different choices.

Researchers are increasingly adopting the nested multinomial logit model as alternative approach for estimating the choice of health providers because the specification is an extension to the simple multinomial discrete choice model (Ssewanyana et al., (2004); Ajakaiye and Mwabu (2007); Muriithi (2009). The nested multinomial logit allows correlation among similar sub-groups like between private and public health providers but not with sub-groups of differing alternatives such as no-care or self-treatment. Getler and Van der Gaag (1990) applied the model where the utility function was specified to be linear in health status and quadratic consumption of non-health goods. He found that the specification was consistent with a well-ordered preferences demand equations. Mwabu et al., (1993) employed the same framework to estimate an indirect utility function of the choice of health provider using data from Kenya.

Several studies have examined the role of price of health care in the choice of alternative providers (Sahn et al., 2003 and Akin et al., 1995). Their findings confirmed that if we control for quality of care, the price plays a significant role in the choice of service providers. However, the magnitude was found to be very small especially for public facilities. For instance doubling the price of public facilities would induce a decline in the probability of their use by 0.10 while doubling the price of private clinics would be accompanied by a large increase in the use of public clinics. Similar findings were reported

by Mwabu et al., (1993) where a 10 percentage increase in the price of public health facility would reduce demand by only 1% while increasing the price of private facilities by 10 percentage would reduce demand in private facilities by more than 15 percentage. Ssewanyana et al., (2004) documented that the low responsiveness to prices for public health facilities suggests that increasing user fees could generate more revenue for public health care providers without significantly reducing demand. Comparable results are reported by Muriithi (2009) who found user fees to be significantly correlated with the use of alternatives health facilities. All the reported results show that on average, higher user fee charges reduce the probability of visiting any of the health facilities in the study areas.

Studies related to the effect of price on the choice of service providers were inconclusive because some of them reported insignificant price effect. Kaija and Okwi (2011) found that the effect of price on choice of any health facility was insignificant. This finding was attributable to the information asymmetry between the consumer and provider where consumer often does not have enough room information to make his own decision but has to rely on the prescriptions by the physicians. The insignificant price results were in line with with Lacriox and Alilhonou (1982); World Bank (1987); and Akin et al., (1998) who found the price to have little effect on choice of providers. Most of the papers on choice of health care did not address the endogeneity and heterogeneity issues that might be the reason of the revealed inconsistencies.

Other studies have examined the role of nonmonetary factors in determining the choice of health care providers (Acton, 1975 and Mwabu, 1989b). Both studies used a utility maximization model to develop predictions for free and non-free care of user fees in New

York and Kenya respectively. The results showed that non-monetary factors such as distance to health care from home, a proxy for price of health care influences the choice of alternative health facilities. In support of this view Awoyemi et al., (2011) reported a negative and significant effect of the distance to hospital from the area of residence on the utilization of both public and private hospitals. The results implied that the longer the distance to the hospital from home, the less the utilization of private hospitals and the more the people living in rural areas would show preference for no-care or self-treatment. The results were consistent with the findings by Ssewanyana et al., (2004) who found a negative effect of distance to health service provider suggesting that the probability of seeking care from any formal provider decreases with distance. However, Mwabu, et al., (2003) found distance to have had little effect on demand for health care services. The plausible reason for this finding was that majority of people reported residing within 3 km of a health facility suggesting that health facilities in the study area were accessible to the population.

Individual and household characteristics play an important role in choosing the service providers (Linndelow, 2002). Research has shown that household characteristics such as age influence the choice of service providers. Old age tended to be associated with a decrease in the probability of seeking care from a public hospital or health post. Relative to the category of children under the age of 5 years, the group aged 50 years and above were found to be less likely to seek care from private clinics but was more likely to obtain care from public clinics and hospitals (Kaija and Okwi, 2011). Other studies showed that old age tended to be associated with an increase in the probability of seeking care from a traditional medical practitioner and a decrease in the probability of care being sought at a hospital

(Linndelow, 2002). The research showed that the most important effect was the shift away from consultation at a health post to no-consultation as age increased.

Research has reported inconclusive evidence on gender effect (Ssewanyana et al., 2004; Mwabu et al., 1993; Sahn et al., 2003 and Hutchinson, 1999). Although distance and user fees reduced access to health care, men were less constrained by distance than women. Males were less likely to seek care from public facilities relative to no-care, and the researcher considered that the differences in education were the main reason (Wong et al., 1987). In most studies, relative to the self- treatment option, females were more likely to seek care from public health facilities compared to men who had high probability of seeking care from private health facilities. Men's demand for private health care monotonically increased with age and reflecting that as men age they encounter increasingly serious illnesses that can only be treated by the better equipped private facilities. As with females, the probability of men seeking government health care started to decline as they aged (Lawson, 2003). In some other studies however, gender effect on alternative choices was ambiguous leading to a narrowing of the gap of gender disparities. There was no evidence of gender differences in health care seeking (Ssewanyana et al., 2004). Gender disparities were also examined for children. The findings were such that if income plays an important role in raising the health care demand for children, boys were more likely to seek care when in richer households and less care when in poorer households than girls (Ssewanyana et al., 2004).

The role of income in choosing alternative choices has been highlighted by many authors. For instance, Heller (1982) showed that the choice of service providers was inelastic to

income. In addition, the choice of service provider among low income earners and high income individuals differed significantly. An increase in household income level was associated with a reduction in seeking treatment from public health facilities and consequently an increase in demand for private health services. Such behavior is quite rational given that it is well known that with higher incomes, access to high quality service in private facilities become possible. Similar findings established that women from wealthy households were more likely to deliver a child at hospital assisted by medical personnel (Jayaraman et al., 2008. This implied that household income is an important factor in explaining the choice of service delivery. However, Linndelow (2002) reported insignificant difference between poor and non-poor on the choice of alternative health facilities. This was explained by the complex way through which income variable is measured in the model. Income proxied by total expenditure first entered directly in the model, but also through income-price interaction, and finally, through opportunity cost of time. Since the role of income differed across studies and services provider, more studies are needed.

Other studies have included the household size in the determinants of choice of service providers (Sahn et al., 2003). The effect of household size on the choice of alternative providers was found to be significant. The negative effect of household size confirmed the notion of competition for resources in larger households. Individuals from large size households were less likely to choose private health facilities probably due to high costs. Households with large number of people are financially limited and thus not likely to seek care from private clinics due to high costs and instead rely on self-treatment at home.

Only a few studies focused on the influence of the area of residence on choosing the place of delivery (Idris et al., 2006). The area of residence was an important driver influencing a woman's decision to deliver at hospital rather than delivering home. Women living in urban areas were more likely to deliver at health facility than women in rural areas. Possibly, this was supported by the fact that health services were more accessible in urban locations compared to their rural counterparts. In supporting this view, Umurungi (2010) reported that place of residence was important in influencing a woman's decision to deliver at a hospital. Again, women living in urban locations were more likely to deliver at health centers than women in rural areas.

3.4 Overview of the Literature

Results from empirical studies have differed in several ways. Some of the studies reviewed found a statistically significant or insignificant positive relationship between income and demand for health care. The results showed inconsistency in terms of the effect of price, time price, insurance and other variables (see Yode, 1989; Akin et al., 1986 and Sauerborn et al., 1994 and Chernichovsky and Meesook, 1986). Because no consensus has emerged, this thesis seeks to present new evidence of the determinants of demand for health services in Rwanda. Also we are not aware of any recent study that has been done for Rwanda despite the numerous changes that have taken place since 2000. Therefore, another investigation would be helpful to better understand the effects of different factors on demand for health care using the Rwandan data.

Evidence from the literature show that demand for health care studies focused only on the demand for outpatient (Mwabu et al., 2003; Lépine and Nestour, 2008). Very few papers

looked at both demand for outpatient and demand for inpatient (Cheng and Vahid, 2010; Heller, 1982). Leibowitz et al., (1985) and Newhouse et al., (1993) reported that there is large inconsistency in estimates when demand for health care is applied to different types of health services. Leibowitz et al., (1985) pointed out that the price change has a significant effect on demand for outpatient services while it has no effect on the quantity of services demanded for inpatient health care. This heterogeneity suggests that estimating separate demand functions for each category of health service could be more informative. When looking at the literature in health economics especially from developing countries and Africa, it is clear that this aspect was neglected. The study seeks to fill this important research gap. The thesis hypothesizes that there might be difference on the effect of independent variables across types of health care.

Most of the studies on demand for health care focused either on the quantity of health care (see Mocan et al., 2004; Hotchkiss et al., 2004; Feng et al., 2008; Lépine and Nestour, 2008; Hahn, 1994) or on the choice of service providers (see Akin et al., 1986; Mwabu, 1989b; Mwabu et.al., 1993; Acton, 1975; Sahn et al., 2003 and Ssewanyana et al., 2004). However, health seeking behavior is made on a number of dimensions (see Mwabu, 1986). First, there is a choice of whether or not to seek formal medical care followed by the choice of what kinds of health care a patient wishes to receive, including outpatient and inpatient services. Second, having made these choices, consumers then choose the type of provider facility to visit; public, private... While some of these input decisions might be based on recommendations made by the physicians, such recommendations may be altered with the expected price levels, incomes, insurance and other individual characteristics. Thus, for a comprehensive understanding of health seeking behavior phenomena, the analysis should

focus on both of the two aspects. This means that a clear understanding of health seeking behavior can be obtained when in addition to identifying the factors influencing demand for health care, the determinants of choice of health facility are also examined.

Further, because of information asymmetry, health insurance is potentially endogenous to demand for health care models. Endogeneity of insurance is due to the reverse causality between insurance and demand for health care. Most studies on demand for health care services did not address the problems of endogeneity and heterogeneity to ensure that the measured effects of the independent variables are unbiased and consistent. This is particularly the case for previous studies conducted in East African countries. The inconclusive results might have been obtained due to un-addressed estimation issues. The study fills the gap by controlling for endogeneity and heterogeneity. It uses the two stage residual inclusion (2SRI) regression and the control function approach (CFA) to deal with endogeneity and heterogeneity problems.

CHAPTER FOUR: METHODOLOGY

4.1 Introduction

The chapter gives an exposition of various theoretical and empirical approaches to estimating demand for health care services and choice of health providers. We first discuss the fact that the decision to seek formal medical treatment is based on maximization of utility given constraints. Because the choice of health service provider is a discrete decision, probabilistic choice models are shown to be a better way for estimating choice of service provider. Based on the data set, there are four sources of health care in Rwanda; self-medication, public providers, private providers and semi-private providers. The chapter proceeds with a discussion of the 2 estimations issues: endogeneity and heterogeneity, highlighting ways of handling them. Finally, the chapter presents the definition and measurement of variables.

4.2 Theoretical Framework

The demand for health care is a derived demand because people desire good health. Health care is demanded only as an input into the production of health, and the level of demand for services is determined by the extent to which they satisfy the individual's underlying preference for health. As an input into production of health, health care is required to maintain or improve a certain health stock. The idea that health care is not a direct but derived good was first discussed by Grossman (1972). In Grossman model, health is demanded for consumption and investment purposes. As a consumption good, health care enters directly into the consumer's utility function. The individual derives utility from consumption of both health goods and non-health goods. Specifically, medical care helps to

produce health, which in turn generates utility (Santerre and Neun, 2010). Thus, utility can be specified as a function of the quantity of medical care. As an investment commodity, ill health reduces the time available to engage in both market and non-market activities. Health as capital commodity, depreciates over time at an increasing rate with age (Tompa, 2002). This is why, investment is needed to restore or maintain initial health stock through health production function that include inputs such as health care, exercise and appropriate nutrition.

Faced with an episode of illness or injury, the individual has three decision levels to make. First, the individual decides whether or not to report an illness. Second, an individual decides whether or not to seek health care conditional on a positive report of illness. Consulting a formal health care facility increases the individual's health stock, but improved health is achieved at the cost of medical expenses and the reduced consumption of non-health goods. As discussed earlier, the decision to consult a physician is done by evaluating the marginal benefits and costs of improving health status. Third, conditional on the decision to seek health care, an individual must choose the type of health care provider to visit (Gertler and van der Gaag, 1990; Mwabu, 1986; Sahn et al., 2003; and Randall and Mwabu, 2004).

4.2.1 Modeling the Demand for Health Services

Following Grossman's (1972a and b), individuals maximize their utility over health and other goods subject to market and non-market factors. Health is one of the several commodities over which individuals have well-defined preferences. The market factors include availability of health inputs and their prices, insurance and household income. The

non market factors include household characteristics, location or distance and individual characteristics such as age, education, health status, and the perception they have about the quality of health services (Appleton and Song, 1999; Ajakaiye and Mwabu, 2007; Bategeka, 2009). Assuming that health care is a consumption good, the consumer's problem can be expressed as:

$$Max\, U = U(H, Z, X, Y) \tag{1}$$

where U is the utility derived from consumption of different goods; Y is the health related goods that yield utility to the sick person and improve health status; H is the health production function; Z stands for health inputs such as health care while X represents all other goods and services.

The utility function is maximized subject to the following constraints:

$$B = XP_x + YP_y + ZP_z \tag{2}$$

$$H = H(Z, I, S, C, A, h_s, P_h, N_O) \tag{3}$$

Where

Z is defined as in equation (1) and I is household characteristics including insurance; S is the socio-demographic variables including age, sex and education; C stands for community characteristics including distance to health facility; A is the household asset; h_s is the size of the household; P_h is the price of health while N_o is the household non-observable characteristics. In the first constraint, B is the exogenous income and P_x, P_y and P_z are, respectively, the prices of health neutral goods (such as clothing), health related consumer good Z (such as health care) and health investment good Y such as exercising.

The maximization problem is then expressed as:

$$Max\, U = U(H, Z, X, Y)$$

$$\text{Given } H = H(Z, I, S, C, A, h_s, P_h, N_O) \quad (4)$$

s.t.

$$B = XP_x + YP_y + ZP_z)$$

Solving the maximization problem yields a demand function for health care specified as:

$$D_h = f(I, B, A, S, C, h_s, P_h, N_o) \quad (5)$$

Where D_h refers to the demand for health care; I is health insurance; B is the budget or income; A stands for household asset and S stands for socio-demographic variables. C represents the community characteristics including distance to health facility; h_s is the household composition; P_h is the price of health care and N_o is the household non-observable characteristics.

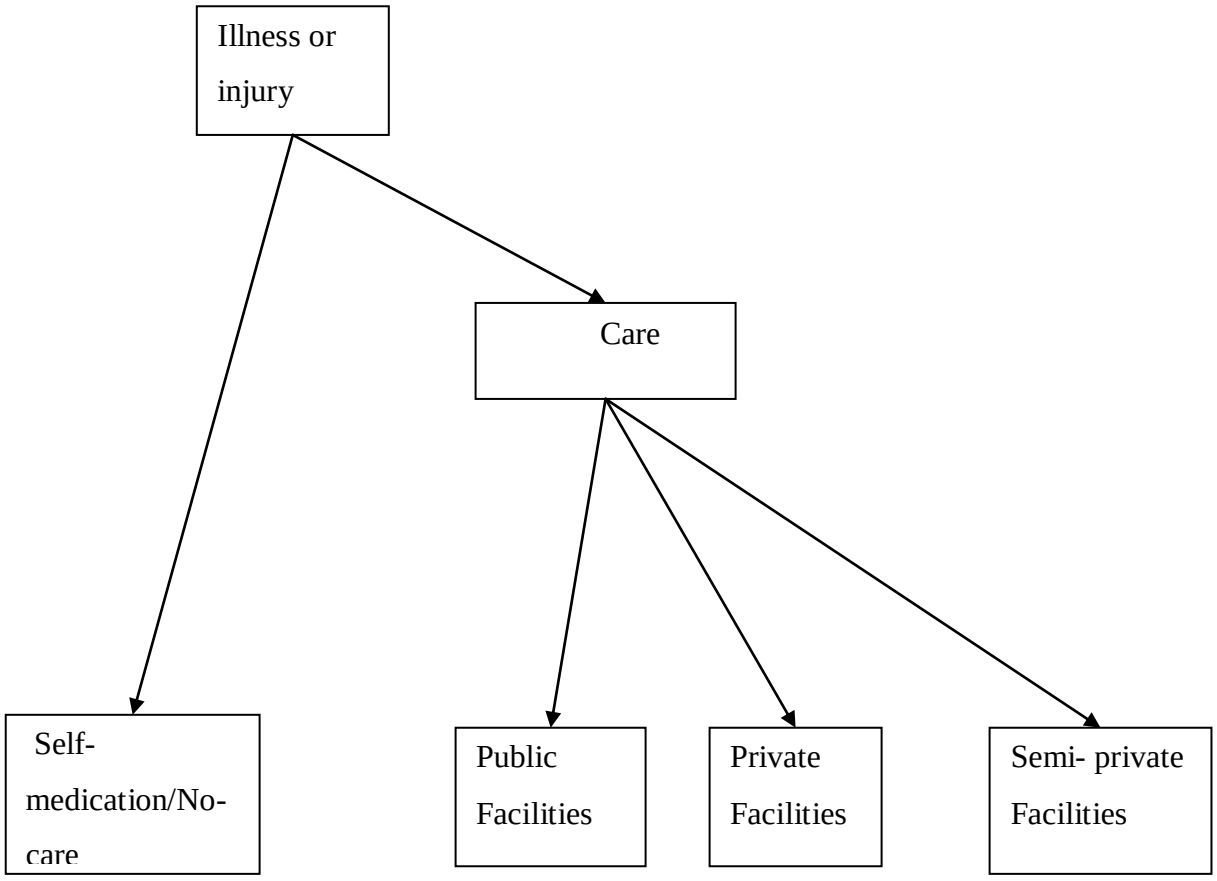
Equation (5) is a structural health care demand equation that includes an endogenous variable among the independent variables. That is, the model describes demand for health care for both outpatient and inpatient for an individual. The endogenous variable is health insurance because of reverse causality between demand for health care and insurance while exogenous variables include monetary prices for health care, income, age, gender, educational attainment of the individual, household size, location as well as regions. In this study, the demand for health care is discrete rather than continuous because health care is either sought or not. In equations (1) and (2), health investment good is purchased only for the purpose of improving health so that it enters an individual's utility function only through *H*.

In the demand for health service model, insurance is assumed to improve access to health services. In addition, the heterogeneity of health insurance due to non-linear interaction of demand for health services with unobservable and omitted variables could bias the estimates. The study assumes that demand for health services has only one endogenous variable. The two stage residuals inclusion (2SRI) regression method is used to compute unbiased and consistent estimates. Hence, we will need instruments for insurance in order to estimate the effect of insurance on demand for health services (Bound et al, 1995). The instrument for health insurance is a factor that affects insurance without influencing directly the demand for health services. From the EICV 2005, dataset used in this study, the identified instruments for health insurance are the employment status and community health association membership, both of which are arguably exogenous. Employment status depends on the labor market conditions that an individual cannot influence. Furthermore, membership into community health association is determined by peer pressure and social sanctions over which an individual has little power.

4.2.2 Modeling the Choice of Service Provider

In this study, we assume that an individual selects a service provider conditional on having decided to seek formal health care. The framework is based on Gertler et al., (1987), and Ssewanyana et al., (2004). Because the choice of health service provider is a discrete type of decision, probabilistic choice models are a better theoretical representation for estimating choice of service provider (McFadden, 1981). The assumption is that in the event of illness, a household's decision to seek medical treatment for a sick member can be viewed as being influenced by the household's own characteristics and attributes of the available health care providers.

Figure 4.1: The Choices of Service Provider when ill



Source: Researcher's own construction

Based on the data set, the choice structure in Rwanda comprises four choices of health care providers; self-medication/no-care, public providers, private providers and semi-private providers. When ill or injured, an individual chooses whether or not to seek health care and once the decision is made, the patient chooses one of the four available alternatives as shown in figure 4.1 above.

The alternatives might include no-care, self-care, pharmacy, public clinics/hospitals, private hospitals/clinics, semi-private hospitals/clinics and others. In this study choices are limited

to one consultation only. If several consultations were made in the last 15 days, answers referred to the last consultation. Because the number of observations in some cases was small, the alternatives were grouped into four options: (1) Self-medication including no-care, pharmacy/drug shop and traditional healers (See Odwee et al, 2006; Kaija and Okwi, 2011 and Lawson, 2004). (2) Public facilities including all government health providers; hospital, clinics, dispensaries and health centres. (3) Private facilities; privately owned hospital, clinics, dispensaries and health centres. (4) Semi-private facilities owned by private but subsidized by the government. This group includes the faith-based facilities run by religious organizations such as the Catholic, Protestant or others.

The patient then chooses the provider option that maximizes his/her utility given the individual's illness, the fee charged by a particular provider and the level of income. With some modifications, the utility function of the choice model is expressed as in Ssewanyana et al., (2004) as follows:

$$U_{ij} = U_{ij}(H_{ij}, E_{ij}) \tag{6}$$

where H_j is the level of health expected by individual i after being treated by j^{th} service provider (or treatment in j^{th} place); E_j are expenditures in all other goods given that the j^{th} choice is made. The consumer decides first to demand care against no-care. Conditional on this decision, the individual chooses the provider expected to yield the highest satisfaction level. Supposing that there are J+1 feasible alternative (where j = 0, alternative being self-care or no-care), then, the unconditional utility maximization will be given by:

$$U^* = \max (U_o, U_1 ..., U_j) \tag{7}$$

Where U^* is the highest level of utility the individual can obtain. This is obtained by comparing the different utility levels obtainable from each alternative facility, varying from 0 to j.

Based on equation (6), the health production function can be formulated as:

$$H_{ij} = h(S_i, Q_j) + \varepsilon_{ij} \quad (8)$$

where H_{ij} is the improvement in health by individual i after being treated by the j^{th} provider, which is a function of individuals characteristics including age, sex, education etc., household level factors including insurance, household size and other socioeconomic characteristics of the household head, S_i represents specific factors to a provider such as qualified health staff, Q_j represents unobservable heterogeneity characteristics at individual, household and facility level while ε_{ij} is the error term. In case of self-medication option, H_{ij} is equal to zero because we assume that there is no improvement in health status for those who do not consume formal health services.

After consulting j^{th} provider, the disposable income by the individual i^{th} is a function of her/his individual income, B_i; and the charge, C_j, that she/he pays at the j^{th} provider representing both direct costs such as user fees and indirect costs such as transportation cost to the health facility from home. The relationship is expressed as:

$$Di_{ij} = f(B_i - C_j) \quad (9)$$

The equation states that the individual i^{th} disposable income D_{ij} when j^{th} provider is chosen is a function of the individual income B_i and the direct and indirect charges C_j at the j^{th} provider.

Substituting equations (9) and (8) into (6) gives the conditional utility function expressed as:

$$U_{ij} = h_{ij}(S_i, Q_j) + f(B_i - C_j) + \varepsilon_{ij} \quad (10)$$

The equation says that the maximum utility by individual i is obtained by choosing the j[th] service provider taking into consideration the individual budget (income), direct costs such as charges by the provider and the indirect costs such as the transportation costs. The other variables in equation (10) are explained as in equations (8-9).

Noting the deterministic part of equation (10) as V_{ij}, the equation can further be expressed as:

$$U_{ij} = V_{ij} + \varepsilon_{ij} \quad (11)$$

where the i[th] individual chooses the j[th] health service provider from which he/she expects to get the greatest level of utility. Any service provider is chosen if the expected utility is higher than the satisfaction that could be derived from all other service providers. Then, an individual chooses the alternative that maximizes the welfare utility which also reflects his/her future health state. He or she chooses an alternative from a set of j's, $j \in J = \{0,1,...,m\}$ where 0 is no-care (self-medication) and j=1… m are the other choice alternatives. The provider j will be chosen by individual if:

$$\boldsymbol{U}_{ij} > \boldsymbol{U}_{ik} \text{ where } j \neq k \text{ and j, k} \in \text{J} \quad (12)$$

Equation (12) says that individual i will choose the health service provider j if and only if the expected utility from health service provided by the j[th] provider is strictly greater than the expected utility from any other health service providers. This means that the probability of a given medical care provider against all other providers is:

$$P_{MC} = P(U_{MC} \geq U_{OTHER})$$
$$= P[V_{MC} + \varepsilon_{MC} \geq V_{OTHER} + \varepsilon_{OTHER})$$

$$= P[V_{MC} - V_{OTHER} \geq \varepsilon_{OTHER} - \varepsilon_{MC}] \quad (13)$$

where P_{MC} = probability of choosing a given medical care provider, U_{MC} = the utility from the visited medical provider and U_{OTHER} = the utility from all other medical providers.

The equation says that a given medical care provider is chosen if the expected utility once visited is greater than the utility from any other health providers. For instance, an individual will choose a public health facility for treatment if

$$\begin{aligned} P_{PUB} &= P(U_{PUB} \geq U_{OTHERtype}) \\ &= P[V_{PUB} + \varepsilon_{PUB} \geq V_{OTHERTYPE} + \varepsilon_{OTHERTYPE}] \\ &= P[V_{PUB} - V_{OTHERTYPE} \geq \varepsilon_{OTHERTYPE} - \varepsilon_{PUB}] \end{aligned} \quad (14)$$

where P_{UB} = probability of choosing public medical care provider, and U_{OTHER} = the utility from all other medical providers. That is, a public health facility is chosen if the utility to be derived once visited is greater than the utility from any other type of service providers.

Conversely, a private health facility will be chosen for treatment if the utility to be derived once visited is greater than the utility from any other type of health facilities. This is expressed as in equation 15:

$$\begin{aligned} P_{RI} &= P(U_{PRI} \geq U_{OTHERtype}) \\ &= P[V_{PRI} + \mu_{PRI} \geq V_{OTHERTYPE} + \varepsilon_{OTHERTYPE}] \\ &P[V_{PRI} - V_{OTHERTYPE} \geq \varepsilon_{OTHERTYPE} - \varepsilon_{PRI}] \end{aligned} \quad (15)$$

where P_{RI} = probability of choosing a private medical care provider, U_{OTHER}= the utility from other all other medical providers.

If in equation (10) $h(S_i, Q_j)$ is linear in S_i and Q_j, we can denote the coefficient vectors of S_i by δ_j and those for Q_j will be denoted by γ_j which might vary across alternative providers. To avoid responsiveness of prices being independent of income we consider a non-linear specification of $f(B_i - C_j)$ (See Gertler et al., 1987, Gertler and Van der Gaa, 1990 and Ssewanyana et al., 2004). As specified in Sahn et al., (2003) and Ssewanyana et al., (2004) we employ a quadratic utility function linear in health goods and quadratic in the logs of consumptions of non-health goods. This is given by:

$$f(B_i - C_j) = \phi_1 \ln(B_i - C_j) + \phi_2 [\ln(B_i - C_j)]^2 \quad (16)$$

where ϕ_s are assumed to be equal across provider options. Sahn et al., (2003) shows further that the equation can be reduced to

$$f(B_i - C_j) \approx \kappa_1 [\ln(B_i) - C_j / B_i] + \kappa_2 [\ln(B_i)^2 - 2\ln(B_i)(C_j / B_i)] \quad (17)$$

The equation (17) shows that the functional form for prices and income is quadratic in the logs of net income.

Given that ln (B_i) and ln $(B_i)^2$ are constant across provider options it is better to use the difference in utilities, V_{ij}-V_{i0}, where V_{i0} is a reference utility, which in this case refers to no-care and can be normalized to zero.

Then, the equation to estimate is obtained by getting the difference in utilities as shown in equation (18) below

$$V_{ij} - V_{i0} = \delta S_i + \gamma Q_j + \kappa_1 (-C_j / B_i) - \kappa_2 [2\ln(B_i)(C_j / B_i)] \quad (18)$$

4.3 Empirical Models

Based on the theoretical frameworks, two models were estimated: the demand for health care and the choice of service providers. Because the demand for health care can be outpatient or inpatient, we estimate each model separately using the same empirical specification.

4.3.1 Demand for Medical Services

In this study, demand for health services refers to any curative outpatient or inpatient service provided by a physician or any other medical staff. Outpatient services include physician visits and medical tests while inpatient services relate to all medical services received by patients during hospital stays. Given the dichotomous nature of the outpatient and inpatient care, the estimation adopts a binary discrete model, where health care is either sought or not. Assuming that the errors are distributed logistically, we adopt a Logit regression method to estimate both outpatient and inpatient health care demands. The dependent variable takes any two values; l if individual uses health services and 0 representing the individuals who did not use any health services. The logit regression is also preferred because most of the studies in demand for health services use logit regression (See Lépine and Nestour, 2008 and Hahn, 1994). This relationship can be expressed as:

$$Y_i = \begin{cases} 1 \text{ if the event takes place (the individual seeks outpatient or inpatient service)} \\ 0 \text{ if the event has not taken place (the individual has not sought treatment)} \end{cases}$$

Equation (5) expressing the demand for health care can be rewritten as:

$$y^{*}_{i} = x_i'\beta + \varepsilon_i \quad (19)$$

where y^{*}_{i} is a latent variable showing the probability that medical care is or not sought, x_i' is a vector of characteristics related to the individual, household and community, and ε_i is the error term.

Y = 1 if $y^{*}_{i} > 0$ i.e. $(x_i'\beta + \varepsilon_i) > 0$

and Y = 0 if $y^{*}_{i} < 0$ i.e. $(x_i'\beta + \varepsilon_i) < 0$

The values 0 and 1 are used because they allow the definition of probability of occurrence of an event as the mathematical expectation of the variable Y. This can be expressed as:

$$E[Y_i] = \Pr(Y_i = 1) * 1 + \Pr(Y_i) * 0 = \Pr(Y_i = 1) = \pi_i \quad (20)$$

This equation shows that we need to compute the probability of occurrence (Y=1) over the probability of no-occurrence (Y=0). Assuming that the error term has an extreme value distribution, this can be done using the logit relation as shown by equation 21.

$$\Pr(Y_i=1) = \frac{\exp(\beta_0 + \beta_1 X_{1i} + \beta_2 X_{2i} + ... + \beta_k X_{ki})}{1 + \exp(\beta_0 + \beta_1 X_{1i} + \beta_2 X_{2i} + ... + \beta_k X_{ki})} \quad (21)$$

In terms of the log-odds, the above expression can be reformulated as

$$\ln\left[\frac{\Pr(Y_i = 1)}{1 - \Pr(Y_i = 1)}\right] = \ln\left[\frac{\Pr(Y_i = 1)}{\Pr(Y_i = 0)}\right] = \ln\left[\frac{\pi_i}{1 - \pi_i}\right] = \beta_0 + \sum_{j=1}^{k} \beta_j X_{ji} = \log it(\pi_i) \quad (22)$$

Which is can be expressed as:

$$\log it(\pi_i) = \beta_0 + \sum_{j=1}^{3} \beta_j X_{ji} = \beta_0 + \beta_1 X_{1i} + \beta_2 X_{2i} + \beta_3 X_{3i} + \varepsilon_i \quad (23)$$

where

Y_i is an indicator for the choice of modern health care (outpatient - inpatient medical care) by the i^{th} household member,

X_{1i} = Vector of characteristics related to individuals like age, education and sex,

X_{2i} = Vector of characteristics related to household such as income, insurance,

X_{3i} = Vector of characteristics related to community level characteristics such as medical specialist, and the distance from household to health facility.

If in equation (23) $\beta_j > 0$, then an increase in X_{ji} (for instance the household income), while all other exogenous variables remain unchanged will increase the log-odds ratio of individual i seeking health services. If $\beta_j < 0$, then an increase in X_{ji} (for example the user fee), will reduce the log-odds ratio. If $\beta_j = 0$, then the variable has no effect. It should be noted that equation (23) is employed when individual data are not available, which is not the case in this study. The equation has been presented for the sake of completeness in our exposition of the discrete choice models for analysis of health care choices.

However, in the case of expression (21), the βs indicate the changes in logistic index with the sign of β indicating the direction of the eventual change in the probability of seeking care from a given health facility. Equation (23) is the structural form of the probabilistic health care demand function. In this equation as in the recent literature, one of the independent variables, health insurance is endogenous and the estimation has to address this

problem. Endogeneity is due to the reverse causality between health insurance and demand for health care. So, in order to obtain unbiased and consistent estimates, instrumentation of the endogenous variable is required. The instrumental variable should be correlated with the endogenous regressor but unrelated directly to the dependent variable (Ajakaiye and Mwabu, 2007).

4.3.2 Choice of Health Service Provider

Analyzing the demand for health care by only focusing on whether or not a sick individual seeks health care can lead to incomplete analysis of the demand function because it does not consider valuable information on the choices of health service provider. The model commonly used in the empirical literature to estimate the choice of health provider is Multinomial logit (see Li, 1996; Lawson, 2004). The problem of this model is that it imposes the property of independence of irrelevant alternatives (IIA), an assumption of no-correlation between the error terms of the different choices.

The assumption of IIA states that the odds of facility type *i* being chosen over facility type *k* are independent of the availability alternatives other than *i* and *k*. An interesting feature is that the odd of choosing a given alternative does not depend on how many alternatives there are in total because each alternative has its own value independent of the other alternatives. With this, we would expect that if there were three options, and one were removed, people would still choose among the remaining two in the same proportion as they did when there were three. The model cannot be appropriately applied when there are different degrees of substitutability or complementarity among the various choices. The alternative model in this case is the nested logit allowing the correlation of some of the choices.

However, given the nature of the choice structure in Rwanda and considering that the data set used in this study contains a one-level four choices of health care providers self-treatment, public, private and semi-private, we cannot use the nested logit model[5]. Instead, we adopt Multinomial logit model to estimate the choice of service providers. This option is supported by McFadden (1981) who argued that Multinomial Logit should be used when outcome categories are plausibly independent for each one of the decision makers. In addition, the Hausman test for IIA showed that the 4 alternatives are independent[6] (See Appendix Table A4). Moreover, the test statistic cannot reject the null, i.e., the choice alternatives are uncorrelated (see also Hausman and MacFadden, 1984).

In estimating the choice model, we assume that each individual has four different providers available: the nearest public provider, the nearest private provider, the nearest semi-private provider and the self-medication alternative. Self-medication includes traditional healers, no-care as well as retail drug shops (Odwee et al., 2006).

Given the assumption, the probability that the j^{th} provider is chosen given other providers is expressed as in Scott Long (1997), Kaija and Okwi (2011) and Lawson (2004) as follows:

$$\Pr(Y_i = j / x_i) = \frac{\exp(x_i \beta_j)}{1 + \sum_{j=2}^{J} \exp(x_i \beta_j)}, \; j > 1 \qquad (24)$$

Where *i* refers to the individual in a household; j indexes the service provider (self-medication, public, private or semi-private and X_i are covariates including income, user fees,

[5] To be used, Nested Logit requires a two-level sub groups with possibility of correlation of different choice alternatives. For instance, the two levels would be public and private health providers (first level) and each one being divided into hospitals and clinics (second level).

[6] We conducted the test for IIA as reported in table A4 in the appendix. The test performed on the independence of the four alternatives was conclusive showing that the alternatives are independent.

health insurance. β_j are the parameters to estimate. β_j is constrained to equal zero because one is the reference alternative ($\beta_1 = 0$). We use this model to test the hypothesis that the effect of determinants (such as income, insurance, and household size) will differ across service providers.

Marginal effects can be computed for all the independent variables in order to obtain probability that a particular provider or alternative will yield the greatest amount of utility. The marginal effect of a variable *x* on alternative *j* refers to a change in the probability of individual *i* choosing alternative *j* in response to a change in the variable *x*. This can be computed using the multinomial logit functional form as:

$$\frac{\partial \Pr(Y=1)}{\partial X_i} = \Pr(Y_j = 1)[\beta_{j,x} - \sum_{j=1}^{J} \beta_{j,x} \Pr(Y_j = 1), j > 1 \quad (25)$$

where β_{jk} are the alternative specific coefficients associated with variable *x*. In this case, we observe that the marginal effects depend on the values of all explanatory variables and the coefficients for each outcome.

4.4 Estimation Issues

In estimating equations (23) and (24), a number of issues including endogeneity and heterogeneity arise (Greene, 1997). It is therefore imperative to address them before the estimations are undertaken.

4.4.1 Endogeneity

Health insurance in equations (23) and (24) is endogenous to the dependent variable. Thus, estimating the equations without taking into account this problem might encounter the problem of simultaneity which is due to the possibility of reverse causality between demand functions and health insurance.

Endogeneity of health insurance arises because the decision to purchase health insurance and the utilization of health services are intertwined. First, since insurance reduces the effective price of medical care, insured people tend to consume more health services (Rashad and Markowitz, 2009). Second, even if individuals cannot perfectly predict their future health needs, they are likely to have information about their health status that could lead them to anticipate higher use of health services, and then decide to buy health insurance. Thus, health care utilization not only depends on the individual's health insurance coverage, but also the level of coverage may be influenced by anticipated utilization of health services (Jutting, 2004). Manning et al., (1987) argue that treating insurance as exogenous in demand for health care models produces biased results. This is because people who anticipate consuming more health services have an obvious incentive to obtain insurance cover either by selecting a more generous option at the place of employment by working for an employer with a generous insurance plan, or by purchasing privately a generous coverage.

In this study, the source of endogeneity is twofold. First, households with pre-existing health condition may self-select themselves into the insurance program raising the problem of

moral hazard. Second, those who are insured may tend to use more health care services given that they are cheap.

Existing literature suggests useful methods for dealing with the endogeneity problem. Among the common approaches to this problem is the use of two 2SRI regression method which is appropriate for non-linear models. The procedure is used to address the problems relating to measurement error, simultaneity and omitted variables. This method requires identification an observable variable or instrument that is correlated with the endogenous variable but uncorrelated with the error-term (Mwabu, 2008; Kioko, 2008; Ajakaiye and Mwabu, 2007; Rosenzweig and Schultz, 1982; Strauss and Thomas, 1995; and Wooldridge, 2002).

The problem however, is to identify an observable variable, z_i, that satisfies two conditions. First, the selected variable is uncorrelated with the error-term. This means that $cov(z_i, \varepsilon) = 0$, that is, z_i is exogenous in the estimation of the endogenous equation (see Wooldridge, 2002; Behrman and Deolalikar, 1988; Griliches and Mairess, 1998; and Ackerberg and Caves, 2003). The second requirement involves the relationship between the identified instrument, zi, and demand for health services. This means that the identified variable should not have an impact on health insurance; i.e., z_i must be relevant. This requires regressing health insurance against all the exogenous variables, including the instrument (Wooldridge, 2002; Greene, 2007; Jowett et al., 2004). In the first regression, the variables should have significant coefficients when the choice variable is regressed on the identifying variable together with all other exogenous variables (Ackerberg and Caves, 2003; Baum and Schaffer, 2003). In the first stage, we estimated the reduced-form of health insurance on all

exogenous variables including the instrumental variables. The second stage regressed demand for health care on all independent variables plus insurance and insurance residuals obtained from the first stage regression (Terza et al., 2008 and Palmer et al., 2008).

Following Ajakaiye and Mwabu (2007); Mwabu (2008); Kabubo-Mariara et al., 2009 and Bhasin and Bentum, (2010), we can re-formulate the demand for health services in the form of simultaneous equation as:

$$D = \delta_d Z_1 + \beta_j I_j + \varepsilon_{ij} \text{ ,j=1...2} \quad (25)$$

$$\boldsymbol{I} = \delta_j \boldsymbol{Z} \ + \varepsilon_2 \quad (26)$$

where D and I are demand for health care and health insurance respectively. Z is a vector of independent variables, consisting of Z_1 covariates that belong to the demand for health services function and a vector of instrumental variables that affect insurance but have no direct impact on demand for health services. δ and β are parameters to be estimated and ε is a disturbance term. Equation (25) is the structural equation to be estimated while equation (26) is the linear projection of the potentially endogenous variable *I*, on all the exogenous variables. The system of equations assumes that there is only one endogenous regressor in the demand equation.

The major challenge of the instrumental variable approach is the challenge of obtaining valid instrument for identifying the effect of endogenous variables in a structural model. Once potential instrument is identified, it is important to test for its suitability by assessing whether it has three properties: relevance, strength and exogeneity of instruments (Stock, 2010; Kabubo-Mariara et al., 2009). An instrument satisfying all three properties is said to be strong and valid instrument. As used in Meer and Harvey (2004), after testing for validity

and strength, the variables employment status and community health association membership were used as instrument for insurance.

We tested for the endogeneity of insurance and the validity of instruments. First, we carried out the test for endogeneity of health insurance. If insurance is exogenous, there would be no justification to estimate the structural model of demand for health care, because the logit models would yield unbiased estimates. We used the Durbin-Wu-Hausman test. In the three models the results showed that the Durbin-Wu-Hausman statistic values were significant at the 10 percent level.

We also conducted the Wald test of exogeneity of the insurance variable which showed that the values were significant at the 1 percent level. We then rejected the null hypothesis of exogenous insurance. Second, the coefficients of insurance residuals variable were also significant at the 1 percent level to the demand for medical care services. Third, we tested the impact of the instruments on the dependent variable. These were found to be insignificant. Fourth, the strength of the instruments was tested by considering the impact of the instruments on endogenous variable. As the coefficients on instruments were large and significant at the 1 percent level, the instruments were strong. In addition, we conducted the F-test to check the role of the instruments on the endogenous variable. While an F-statistic of at least 10 is recommended (Kioko, 2008; Staiger and Stock, 1997), the minimum Eigen value statistic for F-test was 133.04 suggesting that the null hypothesis of weak instrument had to be rejected.

In addition, for model 2 and 3, we had two instruments and only one endogenous variable; there was then possibility of over-identification of the structural model. This means that one

or more instruments may be correlated with the stochastic error-term (Wooldrige, 2002). It was then necessary to test if the models were correctly specified and that the instruments are valid. We carried out the Sargan and Basmann tests of over- identifying restrictions. The Sargan test of over-identifying restrictions was (0.280429; p-value = 0.5964) while the Basmann test of over-identification restrictions was (0.280251; p-value = 0.5965) for inpatient model. In the choice of provider's model the tests values were (0.45036; p-value= 0.5732) and (0.45024; p-value = 0.5733) respectively. With these values, the results could not reject the null hypotheses of no-correlation and instead suggested that the instruments were valid and uncorrelated with the stochastic error-term. This was further supported by the F-test for excluded instruments suggesting that the instruments in the two models had a non-zero and significant joint impact on health insurance. These results were further in favor of estimating structural rather than reduced forms demand for inpatient medical care and choice of service providers.

To address the problem of endogeneity of insurance in provider choice's model, we used Waters (1999a). A reduced-form of health insurance demand was estimated using logistic regression by including all independent variables in the demand equation and the instrumental variables. We then generated the predicted values and included them in the choice of provider's equation together with the actual observed values of the insurance variable. If the null hypothesis that the coefficient of the predicted values of health insurance is equal to zero cannot be rejected, then there is no severe correlation between health insurance variable and the error-term. This would mean that, insurance is an exogenous variable (Waters 1999a). The instrumental variables in the choice model included the current employment status (government employee, private employee and self-employed) and the

relationship to household head. The tests of instruments validity were carried out in the same way as in the outpatient and inpatient models.

4.4.2 Heterogeneity

A second estimation issue is the heterogeneity bias which arises from unobserved factors interacting with the variable of interest and thus biasing the results. These are some unobservable preferences and health endowments of individuals that influence their demand for health care (Schultz, 2008; Kabubo-Mariara et al., 2009). Even with valid instruments, it is not easy in practice to separate the impact of endogenous variable from the effect of unobservables in a structural model. Failure to take into account heterogeneity could lead to unreliable estimates.

In this study, heterogeneity may arise from at least three sources. First, a risk reduction effect; where the preferred level of utilization is greater because of the financial certainty created by insurance than under uncertainty (Meza, 1983). Second, an access effect; where the insurance may extend an individual's opportunity set by giving access to health care that would not otherwise be available to them. Nyman (1999) argued that the pooling effect of insurance provides access to expensive medical technologies that would not be affordable. Third, an income transfer effect where insurance creates an ex-post transfer of income from the healthy to the ill and this may increase utilization through an income effect on the demand for medical care (Nyman, 1999). The three sources relate to reasons known by the individual but not by the researcher from which health insurance may affect demand for health services.

To handle the problem of heterogeneity, we used the Control Function approach (CFA) (Florens et al., 2008). This involved estimating a reduced form insurance residual (I*) where the inclusion of the residuals is identical to the one obtained by 2SRI using an instrument for insurance. Assuming the unobserved component is linear in the insurance residual (I*), we introduced an interaction term (of the insurance and its residual (II*)) as a second control variable to eliminate endogeneity bias even if in the case where the reduced form insurance is heteroscedastic (Card, 2001).

Introducing the control function variables (insurance residual and interaction) yields equation (27).

$$D = \beta_0 + \delta_d Z_1 + \tau I^* + \gamma II^* + \varepsilon_1 \quad (27)$$

Where I* is the fitted residuals from the reduced form of the insurance variable, which is explained by Z_1; all other variables are as defined earlier. τI^* captures the non-linear indirect effects of insurance (I) on demand for health services (D), because the fitted residuals serve as a control for unobservable variables which are correlated with insurance. Inclusion of both I* and the interaction term II* control for the effects of unobservable factors and therefore purge the coefficients of the structural equation of the effects of the unobservables (Card 2001, Ajakaiye and Mwabu 2007). If any unobservable variable is linear in I*, it is only the intercept in equation (27) that is affected by the unobservables and therefore the 2SRI estimates are efficient without the interaction term (II*). The 2SRI estimates will be unbiased and consistent if at least one of two conditions holds: First, the expected value of the interaction between insurance and its fitted residuals is zero. Second,

the expectation of the interaction between insurance and the fitted residuals is linear (Wooldridge, 1997).

When the unobserved components are not mean-independent of the instrumental variable, there is need to add more controls to ensure that the conditional expectation of the unobserved components are still linear functions of insurance residuals but a change in insurance shifts the relationship between demand for health care services and the unobservables. To handle this potential problem, we have to add two more sets of controls to our model, the interaction of the insurance residual with the instrument (i*Z) and an interaction of insurance, the residual and the instrument (ii*Z). Equation (27) will therefore become:

$$D = \beta + \tau \delta_d + \gamma_0 I + \gamma_1 I^* + \gamma_2 II^* + \gamma_3 I^*Z + \gamma_4 II^*Z + \mu \quad (28)$$

4.5 Data

The data used in this thesis is drawn from the Integrated Household Living Conditions survey (EICV2) conducted in 2005 by the National Institute of Statistics of Rwanda (NISR). This nationally representative survey collected data from 7,620 households and 34,819 individuals. Data was collected at the household and the individual level. The EICV2 aimed at enabling the government to assess the impact of the different implemented policies and programs in improving the living conditions of the population in general.

The survey covered all the 30 districts in Rwanda and collected data on a wide spectrum of socioeconomic indicators, labour, housing, health, agriculture, debt, livestock, expenditure and consumption in different areas, regions and locations of the country. Household level

information included consumption expenditures on health, OOPE (consultation; laboratory tests; hospitalization; and medication costs). Individual level information included socio-economic indicators and insurance status. There were also a number of community variables such as distance to the nearest health facility.

To improve reliability of data, the recall period for the use of health services was 2 weeks prior to the survey. In this thesis, demand for health care services was estimated for a single visit because the survey did not capture multi-visits to health facilities. Hence, the demand for outpatient and inpatient services and the choice of service provider are limited to the last consultation or admission.

In order to estimate the demand for health care services and the choice of service providers we constructed three analytical sub-samples for outpatient demand, inpatient demand and choice of service providers. The sub-samples were derived from the full sample of 7,620 households and 34,819 individuals (NISR, 2006). We considered this data set although collected in 2005 as suitable for capturing the demand effects because household dynamics and responses do not change too frequently.

4.6 Definitions and Measurement of Variables

4.6.1 Dependent Variables

In this study, three types of health care models are estimated: demand for outpatient health care, demand for inpatient health services and the choice of service provider. The demand for outpatient care is a binary variable taking the value of 1 if the individual sought health care two weeks prior to the survey and 0 otherwise. Similarly, the demand for inpatient care is binary with the value 1 if the individual reported having been admitted to a hospital two weeks

prior to the survey at any health facility and 0 otherwise. The choice of health service provider refers to the type of the last health facility visited by the household member among the four available choices. As discussed earlier, based on the data set, four types of health care sources were used by patients; public health facilities, private health facilities, semi-private health facilities and the self-medication.

4.6.2 Explanatory Variables

The explanatory variables used to estimate the models include the household size, distance to the facility from household, quality of health care, transportation cost, user fees, area of residence and regions, health insurance coverage. We also included the socio-economic factors including the level of education, gender, marital status, age, and household income.

Income was proxied by total household expenditure. It was estimated from total monthly household consumption expenditures deflated by a regional price index comprising education, food and no-food, health, water and electricity, and other expenditures. Household expenditures are more often used than current income because they reflect permanent income which is expected to be more stable. In this thesis income is expected to be positively associated with demand for health care and the choices of service provider.

The quality aspect was proxied by the presence of specialist doctor and assigned a value of 1 if the visited health facility had a specialist doctor and 0 otherwise. Quality of health care is expected to improve health care utilization and to influence positively the choice of service provider because quality of services might increase the demand by attracting the new users or improving the intensity of service use by existing users. Distance to the health facility from household was measured by the number of kilometers from the area of residence to the

health facility. Distance to the service provider from home would discourage the use of services because it is an additional cost to the price of health care services. Household size was measured in terms of the number of household members in a house. As household size increases, the use of health services is expected to decline (Sahn et al., 2003).

We also included individual characteristics such as age, sex, and education to capture the differences in the need for health care per individual. Gender is taken as a binary variable with male taking the value of 1 and female 0. We introduced the educational dummies to capture the differences in demand for health care based on the level of attainment namely primary, secondary and tertiary, no-education being the reference group. Evidence from the literature indicates that education has a positive effect on demand for health services. The effect of education on choice of service provider is also assumed to be positive. The age of the individual is hypothesized to have a positive effect on demand for health care services. We generated the age squared to capture experience in seeking treatment and choosing services providers.

Health insurance is hypothesized to have a positive effect on demand for health care and choice of service provider. About 43 percent of households in the sample had health insurance coverage from four different insurance schemes (RAMA, MHI, Employer and other insurance providers). We constructed the health insurance variable as a dummy variable taking the value 1 if the individual was insured by any of the four insurance schemes and 0 otherwise. User fees measured as the total amount spent on the last medical consultation for both insured and non-insured. In this thesis user fees is hypothesized to have a negative relationship with the demand for health care and choice variable.

Other variables included are location and regions. Location is a dummy variable taking the value of 1 if urban residence and 0 otherwise. Urban and rural residents could reasonably be expected to behave differently in seeking health care, we have to test for such differences. Differences in demand for health care between regions are also controlled for by introducing regional dummy variables. The regional dummies capture any differences in demand for health care due to some shocks at the regional level and any other variation in characteristics across regions which can potentially influence the use of health services or the choice of health service provider. We constructed 4 regional dummies Kigali, West, North and South regions. Eastern region is used as the reference region.

To control for heterogeneity, we have constructed an interaction term; residuals of insurance times insurance. We hypothesize a positive association between the interaction term and demand for health care services. The explanatory variables and the sign of their expected impact for the three models are presented in Table 4.1.

Table 4.1 Definitions and Measurements of Variables

Variable	Variable code	Variable description	Expected signs of variables based on theory and literature		
			Demand for outpatient health care services	**Demand for inpatient health care services**	**Choice of service providers**
Income	tt- income	Total household expenditure measured in Rwandan Francs	Positive	Positive	Positive
No education (=1) (Reference case)	N-educ	= 1 if household member has never been to school; 0 otherwise	Uncertain	Uncertain	Uncertain
Primary school (=1)	Pr-sch	=1 if household member attained primary school; 0 otherwise	Positive	Positive	Positive
Secondary (=1)	Sec-sch	=1 if household member attained secondary school; 0 otherwise	Positive	Positive	Positive
Tertiary (=1)	Tert-sch	=1 if household member attained post-secondary school; 0 otherwise	Positive	Positive	Positive
Age	Age	Respondent's age in years	Positive	Positive	Uncertain
Age^2	Age^2	Respondent's age in years squared	Uncertain	Uncertain	Uncertain
Gender	Gender	Gender = 1 if respondent is male, and 0 otherwise	Uncertain	Uncertain	Uncertain
User fees	Userfees	The total cost of treatment paid to the health facility for consultation, treatment and drugs	Negative	Negative	Negative
Household size	hh-size	Total number of people in a house living together	Negative	Negative	Negative
Health insurance	Hinsurance	Insurance =1 if the individual is insured, and zero otherwise	Positive	Positive	Positive
Quality of health care	Quality	Quality=1 if medical specialist in the visited health facility exists, and 0 otherwise	Positive	Positive	Positive
Marital status	M-status	Marital status=1 if married, and 0 otherwise	Positive	Positive	Positive

Variable	Variable code	Variable description	Expected signs of variables based on theory and literature		
			Demand for outpatient health care services	**Demand for inpatient health care services**	**Choice of service providers**
Transportation expenses	Costransport	Cost of transport from area of residence to the facility in Rwandan Francs	Negative	Negative	Negative
Location (urban and rural)	Milieu	Location=1 if urban, and 0 otherwise	Uncertain	Uncertain	Uncertain
Easter region (=1) (Reference case)	E-re	= 1 if household member stays in Eastern region; 0 otherwise	Uncertain	Uncertain	Uncertain
Kigali region	K-re	= 1 if household member stays in Kigali region; 0 otherwise	Uncertain	Uncertain	Uncertain
Northern region	N-re	= 1 if household member stays in Northern region; 0 otherwise	Uncertain	Uncertain	Uncertain
Western region	W-re	= 1 if household member stays in Western region; 0 otherwise	Uncertain	Uncertain	Uncertain
Southern region	S-re	= 1 if household member stays in Southern region; 0 otherwise	Uncertain	Uncertain	Uncertain
Insurance residuals	Ires	Generalized residuals generated from the variable insurance	Positive	Positive	Positive
Insurance interacted with residuals	Ire*sinsu	Interaction of insurance variable with insurance residuals	Positive	Positive	Positive

Source: Researcher's own construction

CHAPTER FIVE: RESULTS

5.1 Introduction

In this chapter, empirical results of demand for health care and choice of service providers are presented. We first report the descriptive statistics related to the 3 models. For each model, the logit coefficients (marginal changes in the logit index) and marginal effects (marginal changes in probabilities) are reported. Elasticities of demand with respect to selected independent variables are also presented. Binary logit regression was used to estimate probabilistic demands for outpatient and inpatient care while multinomial logit was used to estimate the provider choice's model. Section 5.2 presents the summary statistics of the variables used in the three models while section 5.3 reports empirical and simulations results.

5.2 Descriptive Statistics

5.2.1 Summary Statistics for the key Sample Variables

The sample used in this thesis consisted of 52.9 percent females and 47.51 percent males. Due to consequences of genocide the country has a high female population number including widows and single women apart from those married. The majority of population is young with a mean age of 25.9 years. The mean age of the head of household is 41.4 years, the minimum age being 21.3 years. This suggests that a number of households are headed by young people. Rwandan family size is quite large with a mean of the household size of 6.1 persons. At least 23 percent of the respondents had a primary certificate, 3.7 had at least a high school certificate, while 72.5 of people in the sample had no-education. This high percentage of non-educated persons is probably due to the fact that 78% of the respondents were picked from the rural area. About 50 percent of the respondents were single while 29.4 percent were married, 7.93 percent were widowed while 2.3 percent are separated or divorced.

Table 5.1: Summary Statistics

	Number of observations	Mean	Standard deviation
Income (proxied by the total expenditure) in FRW	28018	649,235.3	1,403,884
User fees per visit in FRW	5,044	393.16	2703.984
Quality of care (=1)	28,018	0.305	0.46
Insurance (=1)	28,003	0.431	0.495
Distance to health facility in kilometers	19,040	5.4	5.111
Household size	28,018	6.121	2.47
Age in years	28,018	25.902	16.815
Male (=1)	28,018	0.469	0.499
Urban (=1)	28,018	0.242	0.428
Kigali (=1)	28,018	0.156	0.363
Southern (=1)	28,018	0.240	0.427
Western (=1)	28,018	0.243	0.429
Northern (=1)	28,018	0.152	0.359
Transportation costs in FRW	27,992	17.409	456.67
No education (=1)	22,134	0.65	0.78
Primary (=1)	6,444	0.44	0.41
Secondary (=1)	1,028	0.32	0.23
Tertiary (=1)	425	0.25	0.29
Employment status (=1)	27,995	0.45	0.497
Married (=1)	28018	0.322	0.467

Source: Researcher's own construction

5.2.2 Variables included in the Outpatient Care Model

In the sub-sample used to estimate the demand for outpatient medical care, 41.2 percent of the respondents were males and 58.7 percent were females. The mean age of the respondents was 31.9 years with a maximum of 97 years. The mean household size was 5.6 persons while the mean distance from home to health facility visited was 5.5 kilometers. Among the people who reported a health problem in the 2 weeks prior to the survey, 28.2 percent sought formal health care. The rest of the respondents did not seek treatment because some bought drugs and others relied on self-medication and traditional healers. About 78 percent of respondents were from rural areas while 22 were from urban areas. 28 percent of individuals who used outpatient medical services were from the Southern region while the Western, Kigali and Northern represented 23.3 percent, 13.1 percent and 12.3 percent respectively.

The mean expenditure (a proxy for income of the households) of people who used outpatient medical care was Francs Rwandais (FRW) 545,062 with a standard deviation of 1,330,971 while the mean income for the all sample was FRW 649,235.3 with a standard deviation of 1,403,884. ($ 1= FRW 694) on March 15, 2014).

Table 5.2: Variables for the Outpatient Care Model

Variable	Number of observations	Mean	Standard deviation
Proportion of individuals who sought outpatient care 2 weeks prior to the survey	1543	0.055	0.22
Income proxied by the total expenditure in FRW	5,040	545,062	1,330,971
User fees in FRW	5,040	1,006.5	2,723.27
Quality of health care (=1)	5,040	0.3	0.45
Insurance (=1)	5,040	0.43	0.48
Distance to health facility in kilometers	3,536	5.5	5.1
Household hold size in number	5,040	5.6	2.45
Age in years	5,040	31.9	19.26
Male (=1)	5,040	0.4	0.49
Urban (=1)	5,040	0.2	0.41
Kigali (=1)	5,040	0.1	0.33
Southern (=1)	5,040	0.2	0.44
Western (=1)	5,040	0.2	0.42
Northern (=1)	5,040	0.123	0.32
No education (=1)	1,599	0.37	0.76
Primary (=1)	2,444	0.35	0.39
Secondary (=1)	843	0.56	0.45
Tertiary (=1)	154	0.28	0.34
Employment status	5,037	0.5	0.5

Source: Researcher's own construction

5.2.3 Variables for Inpatient Care Model

In the sub-sample used to estimate the demand for inpatient health care services males accounted for 55.9 percent while females accounted for 44.1 percent. The mean distance to health facility from the residence area was 5.5 kilometers and 27.2 percent of respondents were admitted in facilities having medical specialist. About 27 percent of people who used inpatient health care services had a primary certificate, 5.8 had at least a high school certificate, while 67.2 had no-education.

About 57.7 percent of respondents were insured while 42.3 of respondents did not have insurance. The mean household size was 5.8 persons per household while 45.5 persons were married. The mean income of the households who used inpatient medical care was FRW 796,654.8 with a standard deviation of 1,868,306.

Table 5.3: Variables Included in the Inpatient Care Model

Variable	Number of observations	Mean	Standard deviation
Proportion of individuals who sought inpatient care 2 weeks prior to the survey	187	0.0066	0.0814
Income proxied by the total expenditure in FRW	1,543	796,769.5	1,868,906
User fees in FRW	1,543	0.7	0.45
Insurance (=1)	1,543	0.57	0.49
Distance to health facility in kilometers	1,542	5.55	6.23
Age in years	1,543	31.59	17.87
Male (=1)	1,543	0.39	0.48
Urban (=1)	1,543	0.26	0.44
Kigali (=1)	1,543	0.16	0.37
Southern (=1)	1,543	0.23	0.42
Western (=1)	1,543	0.23	0.42
Northern (=1)	1,543	0.14	0.35
Transportation costs in FRW	1,543	273.33	1,900.88
No education (=1)	577	0.36	0.87
Primary (=1)	551	0.39	0.58
Secondary (=1)	322	0.25	0.38
Tertiary (=1)	96	0.19	0.41
Employment status	1,542	0.44	0.49
Married (=1)	1,543	0.45	0.49

Source: Researcher's own construction

5.3 Estimation Results

5.3.1 Introduction

This section presents econometric results from the three models. The results are presented in Tables 5.4-5.10.

5.3.2 Demand for Outpatient Health Services

In Table 5.4, the Wald chi2 tests measuring the goodness of fit indicate that the estimated models give an adequate description of the data because it is highly significant implying that all models parameters are jointly different from zero. The 2SRI results are reported in columns (4-5) in Table 5.4 while the first stage regression estimates are given in Table A1 in the Appendix. The results show that user fee is a significant determinant of demand for outpatient health care. Its coefficient is negative and significant at the 1 percent level. This means that while holding all other factors constant, increasing user fee by 1 FRW would decrease the log odds of using outpatient health services by 0.98. The coefficient on distance to health facility is negative and significant at the 1 percent level suggesting that everything remaining the same, a kilometer increase in distance to a health facility reduces the log odds of outpatient visit by 0.072. Although people reported residing on average within 5.5 km of a health facility from home, there is evidence that distance has remained a hindrance to health care utilization.

The coefficient on income is positive and significant at the 1 percent level. This suggests that while all others factors are held constant, if income were to increase by 1 FRW, the log odds of seeking outpatient health care would increase by 0.0004. The result implies that individuals with high incomes are more likely to seek outpatient medical services relative to low-income earners. Income remains an important factor affecting demand for outpatient care even with insurance coverage because there are other costs that individuals have to meet including travel costs and the co-payment. As expected, the coefficient on household size is negative and significant at the

10 percent level. An extra household member is associated with 0.004 reduction in the log odds of seeking outpatient care.

The coefficients on primary, secondary and tertiary education attainments are positive and statistically significant. The reference educational level is no-education. The coefficients indicate a positive association between demand for outpatient health care and schooling. It is important to notice that although the coefficient on tertiary education is positive and significant, it has a smaller magnitude than the one for secondary level. This might be caused by the fact that people with higher level of education, have various activities, hence leaving them with little time to sick medical attention.

Unexpectedly, the coefficient on quality of health care proxied by the existence of specialist doctor in a health facility was found to be negative and statistically insignificant. This could suggest that the presence of a specialist doctor is not enough to guarantee quality of health care. Other quality aspects such as drugs availability and courtesy of personnel among others may not have improved. Thus, availability of specialist doctor personnel should be accompanied by improvements in other perceived attributes of quality of health care to improve health care demand.

The coefficient on health insurance is positive and significant at the 1 percent level suggesting that health insurance is an important determinant of outpatient health services. Relative to uninsured, being insured increases the log odds of the use of outpatient care by 0.921 when other factors are held constant. It implies that insured patients are more likely to use outpatient services than uninsured. The coefficient on gender is negative and significant at the 1 percent level. This means that relative to females, males are less likely to use outpatient health care services. Being male lowers the log odds of seeking outpatient care by 0.023 ceteris paribus. The reason for this

may be greater health needs (including antenatal care, delivery, post-delivery, and fertility control services) in the female sub-sample.

The results show that there are regional differences in outpatient demand. For instance, the coefficient on the Northern region is positive and significant at the 1 percent level implying that staying in the Northern region as compared to Eastern region increases the log odds of outpatient medical services by 0.17. Eastern region is more economically developed and is the comparison region.

Table 5.4 in columns 6-7 presents results of demand for outpatient care after correcting for heterogeneity of insurance. Due to the inclusion of insurance residuals and interaction of insurance residuals and insurance, the results remain close to those discussed above. Although different in magnitudes, they are close to the 2SRI results in terms of signs of coefficients. The significance of the coefficient on insurance residuals suggests that insurance is endogenous to outpatient medical demand care. The coefficient on the interaction of the insurance residuals and insurance is significant at the 1 percent level indicating the presence of heterogeneity arising from interaction of insurance with unobserved determinants of demand for outpatient. Thus, the CFA is the best model for investigating demand for outpatient care in Rwanda.

For comparison purpose, the baseline model estimates are also presented in columns (2-3). They appear to be weaker than 2SRI results since the coefficient on health insurance increases from 0.49 to 0.9 across model specifications (moving from logit to 2SRI) while the z-value remains statistically significant. This shows that treating insurance as exogenous highly understates its impact on demand for outpatient medical care. We can thus conclude that insurance is an important determinant of utilization of outpatient medical services in Rwanda. Other results in the logit model show that income coefficient is positive and significant at the 1 percent level

while user fees coefficient is negative and significant at the 1 percent level. The coefficient on household size is negative and significant at the 5 percent level.

The coefficient on age is positive and significant. It implies that if age were to increase by 1 additional year, the log odds of demand for outpatient care would increase by 0.013 all other factors remaining constant. Aging is associated with an increase in functional limitation and in the increase of prevalence of chronic conditions. Consequently, as people age, they tend to use more hospital services and prescription medicines. The age squared was included to capture nonlinearities. Its coefficient was negative and significant at the 5 percent level. The result implies that as individual ages, the demand for outpatient increases but as age continues to increase, demand for health care falls. This suggests that the relationship between aging and utilization of health care is not a direct one. Increased longevity might be a result of the postponement of disease onset or a steady rate of functional loss. Although the old people may have a high rate of hospital visits, but the increase in the use of some drugs may reduce the prevalence of some other conditions and their associated utilization. The other possible explanation for this behavior is related to the life income of an individual which increases, stabilizes and then falls when an individual gets retired with age.

Table 5.4: Logistic Demand Estimates for Outpatient Care: Dependent variable is probability of an outpatient visit

Explanatory variables	Baseline Estimates	z-statistics	2SRI Estimates	z-statistics	Control Function Estimates	z-statistics
Household income	0.00030	3.50***	0.0004	3.6***	0.003	3.40***
User fees	-1.108	-26.74***	-0.98	-15.4***	-1.43	-18.9***
Quality of health care (=1)	-0.011	-0.27	-0.01	-0.41	-0.004	-0.11
Health insurance (=1)	0.492	13.26***	0.921	1.87*	4.106	29.29***
Distance to the health facility	-0.434	-8.00***	-0.072	-5.2***	-0.239	-4.29***
Household size	-0.019	-2.52**	0.004	1.79*	-0.017	-2.31**
Age	0.013	2.57**	0.056	1.91*	-0.0008	-0.74
Square age	-0.001	-2.90**	-0.0051	-2.79**	-0.0002	--1.8*
Primary (=1)	0.006	1.89*	0.021	3.2**	0.018	2.4**
Secondary (=1)	0.03	2.9*	0.04	1.95*	0.028	1.99*
Tertiary (=1)	0.002	5.8***	0.008	4.12***	0.067	2.02**
Male (=1)	-0.163	-4.44***	-0.023	-3.66***	-0.148	-3.85***
Urban (=1)	-0.311	-4.19***	-0.34	-5.15***	-0.164	-2.14**
Kigali region (=1)	-0.035	-0.45	-0.07	-1.43	-0.024	-0.26
Southern region (=1)	-0.066	1.23	-0.204	-2.67**	-0.063	-1.18
Western region (=1)	0.027	0.53	0.024	2.4**	0.035	0.68
Northern region (=1)	0.195	3.25***	0.17	3.54***	0.164	2.73**

Explanatory variables	**Baseline Estimates**	**z-statistics**	**2SRI Estimates**	**z-statistics**	**Control Function Estimates**	**z-statistics**
Insurance residuals	-	-	-1.3	-4.7***	-2.869	19.05***
Interaction of insurance and insurance residuals	-	-	-	-	-1.269	-6.88***
Constant	-2.644	-24.56	-1.789	-5.67	-2.411	-25.62
Number of observations =	5040		5040		5040	
Durbin-Wu-Hausman chi-sq			0.054*			
F(1, 5040) =			133.88			
LR chi2(19)	5880.20***		5889.70****		5897.44***	
Log Likelihood	-3020.4388		-3016.3138		-3006.2254	

Note: ***, ** and * = significant at 1%, 5% and 10% level respectively
Source: Researcher's own construction

Marginal Effects

Table 5.5 below shows the marginal effects for variables shown in Table 5.4. A marginal effect measures the percentage change in the probability of using outpatient health services due to a unit change in independent variable. Columns (2-3) show that insurance, income, gender and age are shown to increase the probability of utilizing outpatient health services. For instance, insured individuals have a 0.013 higher probability of using outpatient medical services compared to uninsured persons. Increasing income by one FRW is associated with an increase in the probability of using outpatient health services of 0.00045. Further, the probability of using outpatient medical services increases with age. As user fees increase by 1 FRW, the probability of using outpatient services declines by 0.081 while an increase in the distance to health facility by 1 kilometer reduces the probability of using outpatient health services by 0.012.

The results of the 2SRI model presented in columns (4-5) are stronger than those for the baseline model. The results show that the probability of using outpatient care for insured patients is 0.942 higher than their uninsured counterparts. Thus, insurance is a major determinant of demand for health care. The same effect is reported for household income. As income rises by 1 FRW, the probability of seeking outpatient treatment increases by 0.00083, a tiny but significant demand response to an increase in income.

User fees and distance to the facility are shown to reduce the probability of using outpatient medical services. As the distance to the health facility from household increases by 1 kilometre, the probability of seeking outpatient medical treatment reduces by 0.0535. In terms of location, staying in an urban area reduces the likelihood of demand for outpatient medical services by 0.391 while staying in the Southern or Kigali regions as compared to Eastern region reduces the probability of being an outpatient by 0.28 and 0.37 respectively. Further, being a woman raises the probability of having a medical consultation by 0.14.

Table 5. 5: Marginal Effects for the Determinants of Outpatient Care

Explanatory variables	Baseline Model Marginal Effects	z-statistics	2SRI Marginal Effects	z-statistics
Household income	0.0004	3.46***	0.00083	3.09***
User fees	-0.081	-11.47***	-0.170	-21.46***
Quality of health care (=1)	-0.0002	-0.27	-0.008	-0.20
Health insurance (=1)	0.013	10.20***	0.942	1.99*
Distance to the health facility	-0.012	-6.13***	-0.535	-7.43***
Household size	-0.0004	-2.51**	0.011	0.77
Age	0.0003	2.56**	0.005	2.13**
Square age	-0.0002	-2.13**	-0.00004	-2.4*
Male (=1)	-0.003	-4.38***	0.149	3.89***
Urban (=1)	-0.006	-4.71***	-0.391	-4.65***
Kigali region (=1)	-0.0008	-0.46	-0.37	-1.25
Southern region (=1)	-0.001	-1.27	-0.28	-2.67**
Western region (=1)	0.0006	0.52	0.14	2.01**
Northern region (=1)	0.005	2.76**	0.317	3.94***
Primary (=1)	0.0001	1.96*	0.001	1.98*
Secondary (=1)	0.0004	2.5**	0.023	2.1*
Tertiary (=1)	0.0006	2.67*	0.006	0.9
Insurance residuals	-	-	0.0054	2.31**

Note: ***, ** and * = significant at 1%, 5% and 10% level respectively
Source: researcher's own construction

5.3.4 Demand for Inpatient Health Care

Table 5.6 reports estimates for the baseline model, 2SRI and the CFA regressions. The first stage estimation results are in Table A2 in the Appendix. The measures of goodness of fit indicate that the estimated models are good descriptions of the data.

The 2SRI results presented in columns (4-5) show that the coefficient on gender is positive and significant at the 1 percent level suggesting that being male increases the log odds of being admitted. This result implies that compared to females, males are more likely to be admitted for inpatient care. This is confirmed by descriptive statistics which show that 55.9 percent of people who were hospitalized in the two weeks prior to the survey were men. It is important to notice that the result contrasts with the ones obtained in the outpatient health care model where female were more likely to use outpatient health services. One of the possible explanations would be related to the household decision-making. As heads of households, males make decisions on where to seek health care and are more likely to choose hospitalization than the rest of household members. In addition, women receive some health care when taking children to clinics and thus increase their health stock. This prevents many ailments that could have led them to be admitted. This would further be explained if we take health care as an investment good. Because men seem to invest less in health care, their health stock depreciates faster than women. Further, men's reckless lifestyles might lead them to require hospitalization services more often than women.

The coefficient on health insurance is positive and statistically significant at the 5 percent level suggesting that everything held constant, being insured increases the log odds of using inpatient health care by 4.37. Insurance makes health services cheaper and reduces the incidence of catastrophic health shocks. The coefficient on transportation cost is positive and significant at the 1 percent level. This is contrary to the expectations because we expected a negative sign. The reason for this unexpected sign is that people may accept to pay additional fees to use high quality health facilities located far from their homes. The coefficient on urban residence is

positive and significant at the 1 percent level. This implies that being a resident of an urban area is associated with an increase in the log odds of using inpatient health services. The reason could be that many facilities offering inpatient health care are located in the urban areas.

Hospitalization price exerts negative effect on demand for inpatient health services. Its coefficient is negative and significant at the 1 percent level suggesting that, higher charges reduce the use of inpatient health services. The results suggest that if charges were to increase by 1 FRW, the log odds of using inpatient health care would reduce by 0.42 ceteris paribus. The results indicate that the use of inpatient services varies by regions. For instance, the coefficient on dummy for Kigali region is negative and significant at 10 percent level suggesting that living in Kigali (rather than in Eastern region) reduces the log odds of admissions by 0.041. The possible reason for this is that people living in Kigali have average high incomes which are associated with better diet and consequently better living conditions.

The CFA results presented in columns (6-7) generates results comparable to the ones from 2SRI regression. The coefficient on insurance residuals is positive and significant at the 5 percent level implying that the variable is endogenous to the inpatient health care model. The insignificance of the interaction of the insurance residuals and insurance suggests the absence of unobserved heterogeneity in the inpatient model. This means that the 2SRI model is the best to analyze the use of inpatient health care services in Rwanda. The coefficient on age is positive and significant at the 1 percent level implying that the use of inpatient medical services increases with age.

As in the outpatient case, the baseline model coefficients (columns 2-3) are smaller in magnitude. Demand for inpatient health care is significantly influenced by user fees, health insurance, income, gender, location and some regions. Being insured increases the log odds of being hospitalized by 0.097. User fees, transportation cost and residing in Kigali region compared to Eastern are found to reduce significantly the use of inpatient health services.

Table 5.6: Logistic Demand Function for Inpatient Care: Dependent Variables is Probability of Hospitalization

Explanatory variables	Baseline Estimates	z-statistics	2SRI Estimates	z-statistics	Control Function Estimates	z-statistics
User fees	-0.447	-4.83***	-0.42	-3.81**	-0.081	-3.2**
Household income	0.0003	1.68*	0.0052	2.14*	0.00041	1.8*
Health insurance (=1)	0.097	1.70*	4.37	2.90**	4.91	2.89**
Age	0.0002	0.10	-0.0005	-1.13	0.039	4.31***
Transportation cost	0.0002	7.72***	0.0043	4.91***	1.84	3.5***
Primary (=1)	0.003	2.7**	0.0094	2.61**	0.008	2.89***
Secondary (=1)	0.036	4.7***	0.37	3.8***	0.213	1.99*
Tertiary (=1)	0.007	0.94	0.0024	1.29	0.006	1.52
Male (=1)	0.135	2.35**	0.021	1.94*	0.214	3.52***
Urban (=1)	0.285	3.53***	0.09	4.1***	0.268	3.29***
Kigali region(=1)	-0.586	-4.29***	-0.041	-1.89*	-0.59	-4.28***
Southern region(=1)	-0.171	-1.98**	0.37	0.95	-0.139	-1.59
Western region(=1)	0.058	0.75	-0.03	-2.23*	0.064	0.81
Northern region (=1)	0.03	0.34	-0.076	-2.3*	0.003	0.04
Insurance residuals	-	-	2.315	3.47***	4.965	2.69**
Interaction of insurance and	-	-	-	-	-0.184	-0.65
Number of observations	1543		1543		1543	
Durbin-Wu-Hausman chi-sq			0.071*			
Sargan statistic (overid. of all instruments)			0.280429 (p = 0.5964)			

Explanatory variables	**Baseline Estimates**	**z-statistics**	**2SRI Estimates**	**z-statistics**	**Control Function Estimates**	**z-statistics**
Basmann statistic (overid. of all instruments)			0.280251 (p = 0.5965)			
F(2, 1543)			89.1			
LR ch2(14) =	243.67***		262.72***		285.91***	
Log likelihood=	-975.86862		-978.05517		-966.10846	

Note: ***, ** and * = significant at 1%, 5% and 10% level respectively
Source: Researcher's own construction

Marginal Effects for Determinants of Inpatient Care

Table 5.7 gives the marginal effects for the inpatient health care model. The marginal effects show the probability of using inpatient health care reduces as price of medical care increases. The marginal effect on user fees is negative and significant at the 1 percent level implying that as the price of health care increases by 1 FRW, the probability of using inpatient health care reduces by 0.062. Being female decreases the probability of using inpatient health services by 0.024. Further, disparities between regions are observed where people in Kigali and in Southern regions compared to their Eastern region counterparts have lower probability of using inpatient health services by 0.05 and 0.235. The results for the other covariates have similar interpretations.

Table 5. 7: Marginal Effects for Inpatient Care

Variables	Marginal Effects (Baseline)	z-statistics	2SRI Marginal Effects	z-statistics
User fees	-0.009	-3.18***	-0.062	-2.84***
Household income	0.005	0.45	0.0004	1.5
Health insurance (=1)	0.001	1.67*	0.02	3.41**
Age	0.00006	0.10	-0.034	-1.56
Transportation cost	0.0006	6.64***	0.004	5.9***
Primary (=1)	0.035	2.34**	0.084	3.24**
Secondary (=1)	0.04	1.89*	0.251	4.2***
Tertiary (=1)	0.006	1.45	0.0008	1.43
Male (=1)	0.001	2.32**	0.042	1.89*
Urban (=1)	0.004	2.91**	0.077	3.67***
Kigali region(=1)	-0.004	-6.53***	-0.004	-3.86***
Southern region (=1)	-0.001	-2.22**	0.53	1.33
Western region (=1)	0.0007	0.72	-0.03	-1.97*
Northern region (=1)	0.0003	0.33	-0.025	-1.87*
Marital status (=1)	0.002	2.36**	0.0032	3.24***
Insurance residuals	-	-	0.13	2.4**

Note: ***, ** and * = significant at 1%, 5% and 10% level respectively
Source: Researcher's own construction

5.3.6 Choice of Service Providers

This section presents results of the multinomial logit (ML) model for provider choice. Table 5.8 reports the parameter estimates of factors influencing choice of service provider and their z-statistics while Table 5.9 reports the marginal effects. The choice options are: self-medication, public provider, private provider and semi-public provider. Self-medication is the reference category.

The results show that income is negatively related to the probability of a patient choosing a public provider for either outpatient or inpatient care. Its coefficient is significant at the 5 percent level suggesting that while holding all other variables constant, if income increases by 1 FRW, the log odds of preferring a public provider to self-medication would be expected to reduce by 0.0003. Instead, income is positively associated with the choice of private service providers. The reason for this is that high income individuals perceive that public providers offer lower quality services while private providers offer better quality services. The coefficients on household size have the expected sign but are statistically insignificant.

The coefficients on distance to health facilities are negative and significant at the 5 percent and 1 percent levels respectively for public and semi-private. A similar pattern is observed for the coefficient on distance from home to the private provider. It is negative and statistically significant at the 5 percent level suggesting that an increase of distance by 1 kilometer from home reduces the log odds of choosing private provider relative to self-medication by 0.45.

The price charged affects negatively the choice of private providers. This suggests that as the private hospital/clinic charges increase, patients reduce their visits to private health facilities and shift to self-medication. However, the coefficient on fees for public health facilities is unexpectedly positive and significant at the 1 percent level indicating that the price charged by public health facilities is not enough to discourage the patients since it remains affordable.

Educational attainment is positively associated with the probability of provider choice. The coefficient on secondary is positive and significant at the 1 percent level implying that relative to self-medication having attended secondary education increases the log odds of choosing private hospitals by 0.0234. Gender appears not having a significant effect on service provider. The coefficient on age is negative and significant at the 5 percent level for public health facilities but positive and significant at the 5 percent level for private health facilities. The results imply that as one's age increases, the expected utility of choosing a private provider relative to self-medication increases too. The possible reason is that the increase in age improves income which allows the patient to afford private health care.

The coefficient on insurance is positive and significant for all the three alternatives. Being insured increases the log odds of visiting a private health facility by 3.1 relative to self-medication. The predicted values of insurance were also included in the model to test for endogeneity in the model. As the null hypothesis that the predicted values of insurance are equal to zero is to be rejected, treating insurance as exogenous would yield a severe correlation between health insurance variable and the error-term. This supports the need of estimating a structural model of choice of service providers since health insurance is endogenous to the choice model. Location variable is an important determinant of choice of service providers. The coefficient on location is negative and significant at the 1 percent level for public and semi public but positive and significant at the 1 percent level for private health providers.

Four regional dummies with the Eastern region as the reference region were used to examine regional disparities in the choice of service providers. The coefficient on Kigali is negative and significant at the 5 percent level for public providers. This implies that living in Kigali reduces the log odds of choosing public and semi-private facilities by 0.61 and 1.3 respectively. Patients living in Kigali are less likely to visit a public provider. However, the coefficient on Kigali is

positive and significant at the 5 percent level for the private alternative suggesting that living in Kigali increases the log odds of selecting a private health provider relative to self-treatment. This is not surprising since Kigali residents have relatively high incomes.

Table 5.8: A Multinomial Logit Model of Provider Choice Estimates (*z*-Statistics in parentheses)

Variables	**Public provider** (Coefficient estimates)	**Private provider** (Coefficient estimates)	**Semi-private provider** (Coefficient estimates)
Household income	-0.0003 (-2.67)**	0.0004 (3.01)***	-0.00026 (-0.52)
User fees	0.72 (6.70)***	-0.95 (-6.70)***	0.065 (0.34)
Quality of health care (=1)	-0.209 (-2.73)**	0.409 (2.73)**	-0.169 (-0.84)
Insurance (=1)	0.34 (3.8)***	3.1 (4.3)***	0.345 (1.8)*
Predicted values of insurance	3.15 (2.66)**	3.435 (2.61)**	5.326 (1.91)*
Distance to the health facility	-0.31 (-2.36)**	-0.455 (-2.36)**	-0.956 (-4.06)***
Household size	0.035 (1.37)	-0.0357 (-1.37)	0.0403 (1.27)
Age	-0.009 (-2.48)**	0.009 (2.48)**	-0.007 (-1.39)
Transportation cost	0.00006 (1.16)	-0.00006 (-1.16)	0.00006 (1.12)
Primary (=1)	0.456 (2.9)**	0.011 (1.7)*	0.003 (0.96)
Secondary (=1)	0.675 (3.9)***	0.023 (4.7)***	0.764 (0.67)
Tertiary (=1)	0.0005 (0.9)	0.0002 (5.9)***	0.0005 (2.12)*
Male(=1)	-0.153 (1.22)	0.153 (1.22)	-0.031 (-0.18)
Urban (=1)	-0.82 (-3.22)***	0.821 (3.22)***	-0.85 (-2.69)**

Variables	**Public provider** (Coefficient estimates)	**Private provider** (Coefficient estimates)	**Semi-private provider** (Coefficient estimates)
Kigali region (=1)	-0.6166 (-2.74)**	0.8212 (2.74)**	-1.35 (-4.09)***
Southern region (=1)	0.16 (0.82)	-0.16 (-.82)	0.54 (2.37) **
Western region (=1)	-.1451 (-0.76)	0.145 (0.76)	0.82 (3.67)***
Northern region (=1)	-0.294 (-1.71)	0.29 (1.71)	-0.84 (-3.15)***
Married (=1)	0.146 (1.06)	-0.14 (-1.06)	0.141 (0.72)
Constant	1.116 (3.09)***	-1.11 (-3.09)***	0.49 (1.09)
Number of observations	5036	5036	5036
Durbin-Wu-Hausman chi-sq			0.006*
Sargan statistic (overid. of all instruments)			0.45036 (p = 0.5732)
Basmann statistic (overid. of all instruments)			0.45024 (p = 0.5733)
F(2,5036)			97.2
LR chi2(42)			1535.88***
Log likelihood			3602.8167

Note: ***, ** and * = significant at 1%, 5% and 10% level respectively.
Source: Researcher's own construction

Marginal Effects for Provider Choice Model

Table 5.9 presents the marginal effects for the provider choice model. Considering the public treatment alternative, the results show that a 1 FRW increase in price of health care is associated with a 0.48 decrease in the probability of choosing private provider. The results further show that a 1 FRW increase in fees would increase the probability of choosing the public service providers by 0.09. If this seems surprising, it shows that user fees is not a constraint for using health services from public institutions because they generally charge less as compared to the private ones.

Living in urban areas as compared to rural increases the probability of choice of a private provider by 0.15. This is as expected because urban people earn higher incomes than their rural counterparts and can afford private health services.

Table 5.9: A Multinomial Logit Model of Provider Choice: Marginal Effects (*z*-Statistics in Parentheses)

Variables	Public provider	Private provider	Semi private provider
Household income	-0.0006 (-0.79)	0.0018 (0.03)	-0.002 (-0.07)
User fees	0.0916 (6.38)***	-0.0489 (-6.88)***	-0.229 (-2.04)**
Quality of health care (=1)	0.116 (3.25)***	0.07 (2.48)**	0.024 (0.61)
Distance to the health facility	-0.029 (-0.79)	-0.214 (-2.94)**	-0.299 (-3.53)
Household size	0.0024 (0.44)	-0.183 (-1.74)*	0.260 (1.69)*
Insurance (=1)	0.0035 (3.7)***	0.021 (1.78)*	0.0056 (2.41)**
Predicted values of insurance	0.0043 (4.1)***	0.0042 (1.95)*	0.0083 (2.6)**
Transportation cost	-0.009 (-3.03)***	0.0123 (4.19)***	-0.005 (-4.68)***
No education (=1)	0.033 (1.80)*	-0.0013 (-0.11)	0.82 (0.23)
Primary (=1)	0.065 (2.5)**	0.0004 (1.91)*	0.045 (0.78)
Secondary (=1)	0.005 (2.9)***	0.0041 (3.4)***	0.35 (0.97)
Tertiary (=1)	0.031 (0.9)	0.051 (4.1)***	0.062 (3.5)*
Age	0.0016 (2.05)**	0.2057 (2.46)**	0.005 (4.7)***
Gender (=1)	-0.034 (1.30)	0.036 (-1.05)	-0. 024 (-0.47)

Variables	**Public provider**	**Private provider**	**Semi private provider**
Location (=1)	-0.06 (-2.54)**	0.159 (3.32)***	-0.07 (-1.20)
Kigali region (=1)	-0.011 (-0.77)	0.09 (3.51)***	-0.135 (-3.13)***
Northern region (=1)	-0.0004 (-0.05)	0.042 (2.41)**	-0.081 (-2.67)**
Marital status (=1)	0.0191(0.81)	-0.0476 (-1.09)	0.017 (0.25)

Note: ***, ** and * = significant at 1%, 5% and 10% level respectively
Source: Researcher's own construction

5.3.5 Policy Simulations

Based on empirical results presented in this chapter, we provide a set of policy simulations to illustrate the potential impact of the key policy variables on health service utilization in Rwanda. Economic literature suggests that some policy interventions can significantly affect health seeking behavior. The changes examined are user fees, income, and insurance the factors that are most likely to be affected by government service provision and financing policies. The simulation is guided by the following policy questions. First, to what extent does the increase in the household income affect outpatient demand, inpatient demand and the choice of health providers? Second, to what extent would an expansion of national health insurance towards universal coverage affect outpatient demand, inpatient demand and the choice of private health providers? Third, what would be the effect of a reduction of user fees on demand for health care and on the choice of service providers? The simulation results are presented in Table 5.10.

The elasticities of demand with respect to insurance and income are positive while own user fee elasticities of demand are negative. The income elasticity of demand is 0.033 for the outpatient services implying that an increase in the household income by 1 percent increases utilization of outpatient care by a mere 0.033 percent while the same proportional income increase is associated with a 0.008 percent increase in the probability of using inpatient services. The insurance elasticities of demand are 0.377 for outpatient services and 0.119 for inpatient health services. The user fee elasticities are -0.317 and -0.098, respectively, for outpatient services and inpatient services. The results show that the demand for health services in Rwanda is inelastic.

Table 5.10: Health Service Elasticities in Rwanda (computed from the structural models)

Policies	**Elasticities**					
Demand Determinants	Probability of Outpatient visits	Probability of Inpatient Care	Probability of Self-medication	Probability of Choosing Public Provider	Probability of Choosing Private Provider	Probability of Choosing a Semi Private Provider
Income	0.033	-0.109	-0.001	0.008	0.018	0.0005
Health insurance coverage	0.377	0.119	-0.23	0.188	0.42	0.065
User fees	-0.317	-0.098	-0.04	-0.16	-0.48	-0.097

Source: Researcher's own construction

The above elasticities were used to investigate the effects of change in selected policy variables on choice of service providers. The results show that there would be little change in the choice of service providers from changes in user fees, insurance and income.

Based on the above elasticities, we performed some simulations. The simulation results show that a 10 percent increase in income would be associated with a 0.33 percent increase in utilization of outpatient health services. If per capita income were to reach $ 1200 (from $ 582.6, the 2011 level) as suggested in the Vision 2020, the use of outpatient health care would increase by 3.49 percent. The same amount of per capita income would reduce reliance on 'self-medication option' by 0.10 percent and increase the choice of private providers by 1.9 percent.

Rwanda intends to build a financially and institutionally sustainable health insurance system that can guarantee insurance coverage for all citizens (Republic of Rwanda, 2010). An increase in insurance to universal coverage (from 43.1 percent, the sample coverage) would increase the utilization rate by 50.1 percent. The same policy would reduce the probability of self-medication by 30.5 percent. Similarly, a 10 percent reduction in user fees due to the universal coverage would increase the probability of an outpatient visit by 3.17 percent. The same policy applied to user fees would reduce the probability of a self-medication by 0.4 percent.

CHAPTER SIX: DISCUSSION

6.1 Introduction

This study employed data from the EICV2 conducted by the NISR in 2005 to assess the factors that are associated with demand for health care and choice of service providers in Rwanda. We used logit and multinomial logit models to estimate effects of factors affecting the use of health services and the choice of health care providers. To control for endogeneity and heterogeneity of insurance, we employed the 2SRI and the CFA methods. In this chapter, we discuss the findings of the thesis with reference to previous health care demand studies.

6.2 Outpatient Care

On average higher user fees reduce the probability of using outpatient health services. This finding is similar to the results reported by Litvack and Bodart (1993); Ridde (2003); Diop et al., (1995) and Manji et al (1992) who report negative effects of user fees on health service uptake. In particular, Manji et al., (1992) showed that uptake of treatment in Kenyan schools fell from 75 percent to 19 percent after fees were introduced. This suggested that the introduction of cost-sharing was responsible for the major part of the reduction in uptake. Similarly, De Bethune et al., (1989) and Yoder, (1989) found the price of health care to be a significant hindrance to demand for medical services in Swaziland. However, this study has confirmed the results by other cross-section studies that demand for health care is inelastic to price. Oxaal and Cook (1998) showed that that the relationship between price and health is inelastic because of failure to disaggregate its effect from the one of income.

The coefficients on education indicate positive association with demand for outpatient health services in Rwanda. The result is consistent with the work of Katz et al., (2001), which showed that, the more individuals get educated, the more they come into contact with other educated

individuals who have a high demand for health care. The social interaction which begins during schooling years continues into the workplace leads to adoption of health-improving behaviors, including health service utilization. The evidence from Rwanda is also in line with Elo (1992) and Blunch (2004) who observed a strong positive association between education and the use of health services.

Insurance is found to be an important determinant of demand for outpatient medical services in Rwanda. Insurance reduces the price of health care which makes the service more affordable than without insurance. The result on insurance finds support in findings from previous studies which addressed the endogeneity problem when estimating demand effect of insurance (see e.g. Rashad and Markowitz, 2009; Shimeles, 2010; Meer and Harvey, 2004). Similar results were reported by Phelps and Newhouse (1974) who used data on co-insurance plans in the United States, Canada and the United Kingdom. The results were such that the level of sensitivity of demand depended on the co-insurance rate.

The evidence presented in the thesis reveals that gender is an important factor affecting the use of outpatient and inpatient health services in Rwanda. Females were more likely to use outpatient services as compared to men but less likely to use inpatient care. The results are in line with those reported by Miller (1994) who argued that females demand more health care than males because of their role in childbearing. Miller (1994) added that some illnesses, such as cardiovascular disease, osteoporosis, immunologic diseases, and Alzheimer's disease are more prevalent in women than men. In line with this, Ahmad (2001) added that the gender differences in health care utilization for women were related to specific diseases such as cardiovascular and chronic illnesses.

Some research has shown that women use less outpatient health care than men because of the time they spend taking care of the elderly and other people with disabilities. Caregivers,

especially women elderly caregivers were found to neglect their own health in order to fulfill this responsibility (Fredman et al., 2008). These responsibilities made it difficult for severely disadvantaged women to take steps to improve their living situations and health behaviors by consuming less health services than men. Similarly, Oxaal and Cook (1998) showed that the constraints to access for poor women and girls made them less likely to have access to appropriate care and to seek adequate treatment. Their paper noted that the range of factors limiting access for women included socio-economic status of households; time constraints; composition of households; intra-household resource allocation and decision-making, less of education and employment; and legal or social constraints on access to care, heavy work burdens and the opportunity costs of time in seeking care.

One finding of this study is that age is a significant factor in explaining demand for outpatient health care. This suggests that the increase of people's age induces more physician services and prescription drugs. The result is in line with the one reported by the American Hospital Association (2001) where people over the age of 65 years experienced nearly three times health care use than the general population in America. The study added that the ratio goes up to nearly four times for people over the age of 75. Other studies however reported different findings with a negative relationship between age and health care use. Mathers (1999) showed that increased longevity can be a result of the delay of disease onset or a steady rate of functional loss. For instance, increased use of glucose-lowering and antihypertensive drugs may reduce complications of diabetes and associated care for some elderly (Nusselder et al., 1996). If the elderly do have a higher rate of being prescribed more drugs, the increase in the use of some drugs may reduce the prevalence of some other conditions and their associated utilization.

6.3 Inpatient Care

Household income has a significant effect on demand for inpatient health services because income level captures the ability to pay. The result implies that people at low income levels are less likely to get admitted than those at middle or high income levels. Tipping (1995) demonstrated that the poor used health services less often than the non-poor. This suggests that health care seeking behaviour is dependent to the socioeconomic status of households. However, the magnitude of its coefficient in all the three models was very small. The empirical estimates in the literature on effects of income on health care demand are consistent with theory. Phelps (1992) found that the demand for health care was relatively insensitive to change in income suggesting that a percent change in income leads to a small change in the demand for health care.

Being insured in Rwanda has been shown to increase the relative chance of using inpatient health services. This result is similar to the findings by Jutting (2004) and Hahn (1994) who showed that payment of part of the health expenditure by a third person can increase the visits and admissions to a health facility. Further, Jowett et al., (2004) reported a high consumption of health care under insurance especially for some health care types including inpatient health services. They added that given high levels of unmet health needs in low-income countries, increased consumption is a desirable policy goal.

Medical charges have a negative effect on demand for inpatient health service in Rwanda, suggesting that higher charges discourage the use of hospitalization services. Everything else held constant, consumers are sensitive to the bill paid for hospitalization services from their pockets. The finding is in line with Feldstein's (1971) work which demonstrated that a percent increase in the OOPE rate led to a reduction in the average hospital stay. However, the level of sensitivity was found to be varying across types of services where inpatient care was more than 3 times less elastic than outpatient care. This is consistent with the research by Manning and

Phelps (1979) who found the elasticity of demand for health services to vary by type of service provided.

Being resident of a urban area in Rwanda is associated with a significant increase in the probability of hospital admissions. The result finds support in Kremer and Miguel (2007) who reported that the disparities between demand for some health services between rural and urban are due to the concentration of facilities in urban areas. The researchers added that the misdistribution of facilities across country explains why residents of the urban location were more likely to have an inpatient health care. Wunderlich et al., (1996) found further evidence that rural residents were more likely to postpone seeking care until an economically or socially convenient moment in Australia. This result suggests that there are different expectations of health care system with rural residents having a different threshold at which they report to health clinics. Another possible reason is that people in rural areas have lower income levels than their urban counterparts because of not having enough employment opportunities. Given the lower level of income, inpatient health care will be less affordable and thus their demand will reduce. Further, Valongueiro (2002) said that great distances between households and health services interfere substantially with the timing of seek health care, especially if it is associated to lower socio-economic status.

6.4 Choice of Service Providers

In provider choice models, income is positively and significantly correlated with the probability of using a private provider for treatment. However, the coefficient of public provider was negative implying that the probability of seeking health care from public provider drops as income increases. The result finds support in Kaija and Okwi (2011) who showed that health seeking behaviour of low and high income individuals differ significantly.

Distance is a significant factor in provider choice in Rwanda. The distance to health care from the area of residence seems to discourage the choice of public and semi-private health facilities. Thus, increasing distance induces an increase of the likelihood of a household member opting for self-treatment. The negative sign is not surprising since the distance to health care is highly related to the transportation cost. Muriithi (2013) showed that an increase in distance induces a payment of some extra cost to travel to the source of treatment as opposed to seeking self-treatment. The results support the findings by Ssewanyana et al., (2004), Lawson (2004) and Awoyemi et al., (2011) who argued that distance reduces the probability of using distant service providers. However, other studies found that the distance to health facility was positively associated with the choice of private health facility (see Bolduc et al., 1996). In this case, distance to private health providers was perceived to be associated with quality of health care.

Insurance is an important factor explaining the choice of public and private treatment alternatives in Rwanda. The finding is comparable to that of Jowett et al., (2004) who reported that individuals with less generous insurance coverage tended to use public providers to a far greater extent than those with a more generous insurance scheme. Age was found to have positive effect on the choice of private health facilities in Rwanda. The results implied that as one ages, the relative chance of choosing a private health provider increases. The reason behind is related to the ability to afford payment because income rises with age. The study did not find meaningful results relating to the effect of gender on the choice of health providers because all the three coefficients of gender were statistically insignificant. Similar findings were reported by Sahn et al., (2003) and Ssewanyana et al., (2004).

The monetary price had a negative and significant impact on the choice of private health facilities. The direct implication is that increasing user charges decreases the likelihood of seeking health care from private health provider relative to self-medication. The findings were in line with Cisse (2006); Yoder (1989); Dow (1995); Mwabu et al., (1993); and Mwabu et al.,

(1989b) who found negative user fees effects on health seeking behavior. The results further showed that regions have an influence on choice of service providers. For instance, the coefficient on Kigali dummy relative to East was positive and significant for the choice of private suggesting that living in Kigali as compared to Eastern region increases the perceived treatment benefit associated with a private health provider. This result finds supports in Brown (2002) who noted that there were regional differences in probabilities of using health facilities.

CHAPTER SEVEN: SUMMARY AND RECOMMENDATIONS

7.1 Introduction

The conclusion is presented in four sections. Section 7.2 is devoted to a summary of the main findings for the three models while section 7.3 presents the policy recommendations based on the key findings. Section 7.4 presents the limitations of the study and suggests some areas for future research.

7.2 Summary

The overall objective of this study was to examine the factors influencing health care seeking behavior and suggest measures for improving utilization of health services in Rwanda. The study was motivated by the fact that after implementation of a number of health sector reforms aimed at increasing the use of health services in the country, utilization of health services has remained low. A clear understanding of the determinants of demand for health services as well as choice of health care providers is necessary to guide the formulation of appropriate health sector policies in Rwanda. We estimated structural equations of demand for outpatient and inpatient care and a structural equation for choice of service providers. One of the key contributions of this study as compared to others in the same strand is that it has taken account of endogeneity and heterogeneity of insurance in estimating its effects on health care demand. In general, the empirical evidence indicates that the demand for medical care is inelastic with respect to userfees and to health insurance.

Demand for outpatient medical care was found to be positively and significantly influenced by income, health insurance, gender and age and negatively associated with user fees, household size, and distance to health facilities. The estimation results show that the monetary price was a significant determinant of demand for outpatient health care in Rwanda.

The demand for inpatient care was found to be affected by a number of variables including health insurance, gender, location, marital status, user fees, transportation cost and regions. While changes in user fee affect admission service, this was found to be less price elastic than outpatient service.

The multinomial logit model was used to analyze patients' choice of health care providers. User fees, distance and transportations cost are negatively correlated with probability of visiting a health care provider for treatment. Being insured is positively associated with the probability of visiting public, semi private and private health facilities for treatment.

7.3 Policy Recommendations

Since user fees are an impediment to using health care in Rwanda, the government should reduce user fees at health facilities through increased budget allocations to all health facilities, particularly in the public sector, where the poor go for medical care. The Government should explore innovative ways of health care financing to financially assist the poor. The voucher system would be one of the ways to reduce the out-of-pocket expenditures (OOPE). From 2003, the OOPE gradually increased to reach 32.2 percent of the total health expenditures in 2010. High OOPE have a variety of negative consequences, including household impoverishment. The subsidies on user fees should target the vulnerable groups, such as children and women or low income households. The government should also consider subsidizing private health facilities to increase access to their high quality services by low income households. The subsidies would help to reduce the effect of income inequalities in health care utilization.

Health insurance is an important determinant of health care seeking behavior in Rwanda. The simulation results show that demand for health care is more sensitive to health insurance than to any other covariate. Thus, policies that increase health insurance coverage would substantially increase health service utilization. The 2013 health insurance coverage rate in Rwanda is 73

percent, the highest in East African Community, but the high premiums associated with this coverage are not sustainable. The government should subsidize health insurance to make it accessible to the most disadvantaged people. The current level of premium of $ 4.5 for CBHIs per year and per person should be reduced. The premium rate more than doubled in 2011, from $ 1.7 to $ 4.5, and this reduced the coverage rate from 91 percent to 73 percent. In addition, while with the earlier premium level, health care expenditure represented 10 percent of the total household expenditure, holding other factors constant, with the new premium, the health care expenditure for household would represent 26 percent of the household health expenditure. This would cause households to incur catastrophic expenditures and push them into poverty. Further, with an average household size of 6.6 persons per household, this level of premium per individual does not seem to be sustainable given that 44.9 percent of the population lives with less than $ 1 per day.

Since distance, location and region-specific factors are important determinants of health seeking behaviour, it is clear that insurance is not the only hindrance to health care access. The government should explore ways of addressing non-insurance barriers to health care in Rwanda. The government could consider implementing the voucher scheme to boost rural incomes in specific regions. Despite widespread insurance coverage, there exists large difference in regional access to health care in Rwanda (Endo, 2004). The government should then ensure a balanced geographical accessibility to health care delivery based on population need. The government should also expand or improve transportation infrastructures such as roads, telecommunication, and other health infrastructures in different areas to make health care providers more accessible.

7.4 Study Limitations and Areas for Further Research

We have used cross-sectional data to analyze the determinants of health care use in Rwanda. The price used in this study is the user fee paid for a single visit. Further research is needed on

determinants of total health expenditure in the country. The evolution of user fees as GDP grows and its effects on demand over time is also worth examining.

Studies on demand for health care employ different methodologies, making comparability of findings difficult. In this study, the quantity of medical care consumed by patients was approximated by single episodes of outpatient and inpatient care. In particular, it was not possible to capture number of consultations made in the last 2 weeks prior to the survey. We captured only the decision to use outpatient, inpatient and type of provider for a single visit. The study ignored complexities that are likely to characterize health seeking behaviour. Further research is recommended on ideal measures of health care utilization.

There is a need for further research in the choice of disaggregated health care alternatives, such as the different types of health professionals, working alone or in groups. The providers can also be disaggregated by facility types such as hospitals and clinics.

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APPENDIX TABLES

Table A1: Determinants of Demand for Health Insurance, First Stage Regression (Demand for Outpatient Care Model)

Explanatory variables	Estimates	Standard errors	z-statistics
Employment status (=1)	0.051	0.0064	7.9***
Household income	0.0034	0.0004	8.5***
User fees	-0.0278	0.0231	-1.2
Quality of health care (=1)	0.0033	0.0069	0.47
Distance to the health facility	-0.0483	0.0108	-4.47***
Household size	-0.0132	0.00125	-10.58***
Age	0.0072	0.00078	9.2***
Age squared	-0.00006	0.00001	-6.0***
Primary (=1)	0.0023	0.0045	5.1***
Secondary (=1)	0.0052	0.0085	0.611
Tertiary (=1)	0.0023	0.0087	0.264
Male (=1)	0.0068	0.0058	1.17
Urban (=1)	0.0847	0.0138	6.13***
Kigali (=1)	-0.0385	0.0129	-2.98***
Southern (=1)	-0.0624	0.0088	-7.04***
Western (=1)	0.0555	0.00878	6.32***
Northern (=1)	0.0582	0.0099	5.87***
Constant	0.325	0.0174	18.62***
Number of observations			5040
F(18, 27934) =			56.19***

Note: ***, ** and * = significant at 1%, 5% and 10% level respectively.

Source: Researcher's own construction

Table A2: Determinants of Demand for Health insurance, First Stage Regression (Demand for Inpatient Care Model)

Explanatory variables	Estimates	Standard errors	z-statistics
Employment status (=1)	0.0309	0.0060	5.15***
Community health association (=1)	0.013	0.0022	5.9***
Household income	0.0056	0.00065	8.61***
User fees	-0.0229	0.0131	-1.74*
Distance to the health facility	-0.048	0.0108	-4.44***
Age	0.0070	0.00078	8.97***
Age squared	-0.00008	0.00001	-8.0***
Primary (=1)	0.0032	0.00045	7.1***
Secondary (=1)	0.0041	0.0039	1.05
Tertiary (=1)	0.00076	0.00067	1.13
Male (=1)	0.0056	0.0058	0.96
Urban (=1)	-0.085	0.0138	6.15***
Kigali (=1)	-0.0422	0.0127	-3.28***
Southern (=1)	-0.00609	0.0088	-6.89***
Western (=1)	0.0586	0.0087	6.71***
Northern (=1)	0.0604	0.0098	6.11***
Transportation cost	- 0.019	0.01	-1.9*
Constant	-0.2391	0.0168	-14.19***
Number of observation=			1543
F(15,32451) =			45.98***

Note: ***, ** and * = significant at 1%, 5% and 10% level respectively

Source: Researcher's own construction

Table A3: Determinants of the demand for Insurance, First Stage Regression (Provider Choice)

Explanatory variables	Estimates	Standard errors	z-statistics
Household income	0.00023	0.00003	8.97***
User fees	-0.0173	0.0106	-1.36
Quality of health care (=1)	0.0152	0.0068	2.23**
Distance to the health facility	-0.0605	0.0107	-5.61***
Household size	0.0142	0.0012	11.39***
Age	0.00063	0.00022	2.83 ***
Age squared	-0.0032	0.00075	-4.2***
Primary (=1)	0.00035	0.000087	4.0***
Current employment status (=1)	0.006	0.0009	6.6***
Relationship to household head (=1)	0.0002	0.00007	2.85**
Secondary (=1)	0.0078	0.0054	1.4
Tertiary (=1)	0.00092	0.001	0.92
Male (=1)	-0.00279	0.00589	-0.47
Urban (=1)	-0.0982	0.0137	-7.16 ***
Kigali (=1)	-0.0282	0.0114	-2.47 **
Southern (=1)	-0.0590	0.0088	-6.7 ***
Western (=1)	0.0582	0.00872	6.67***
Northern (=1)	0.063	0.0083	7.59 ***
Transportation cost	0.0045	0.00037	0.12
Marital status (=1)	0.0942	0.0075	12.44
Constant	-0.359	0.0146	-24.63***
Number of observation=			5040
F(21, 32145) =			68.23***

Note: ***, ** and * = significant at 1%, 5% and 10% level respectively

Source: Researcher's own construction

Table A4: Hausman Test of IIA assumption for the Choice of health provider (N=5036)

Omitted	Chi2	Df	P>chi2	Evidence
Self-medication	-232,000	28	1	for Ho
Public	-240,000	25	1	for Ho
Private	-25.07	28	1	for Ho
Semi private	-274,000	32	1	for Ho

Ho: Odds (outcome J versus outcome K) are independent of other alternatives