

**East Africa Collaborative Ph.D. Program
in Economics and Management**

**Role of Insurance in the Demand for
Healthcare in Rwanda:
A Household Level Investigation**

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Preface

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Role of Insurance in the Demand for Healthcare in Rwanda: A Household Level Investigation

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Abstract

In the 2000s the Government of Rwanda initiated health sector reforms aimed at increasing access to healthcare. Despite these reforms there has not been a corresponding increase in demand for health services, as only about 30 per cent of the sick use modern care (NISR, 2011). The objective of this paper is to examine the factors influencing outpatient care demand in Rwanda and suggest appropriate measures 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). A structural model of demand for healthcare is estimated to measure demand effects of covariates. The findings indicate that health insurance is a significant determinant of outpatient medical care. In addition, the price of healthcare and household income are among the main drivers of utilization of healthcare. Women are more likely to seek outpatient healthcare. Two main policy recommendations emerge from these findings. First, the government should reduce out-of-pocket healthcare expenditures (OOPE) through subsidies for public health facilities. Second, the government should reduce the premiums for Community Based Health Insurance Schemes (CBHIs) to increase coverage rates.

Keywords: Outpatient, health insurance, user fees, logit model.

JEL Classification Codes: I10; I11; I12; I13; D12;

1. Introduction

The theoretical model for analyzing human capital and health and its effect on productivity, earnings and labor supply was first developed in Grossman (1972a). 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. There exist large productivity and wages benefits of better health. 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 diseases, particularly in early childhood, lead to improved cognitive development, enhancing the ability to learn. Healthy children also gain more from school because they are absent on fewer days 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 the health production function (McKeown, 1976). Santerre and Neun (2010) argue that much as a firm uses various inputs such as capital and labor to manufacture a product, an individual uses healthcare inputs to produce health. When other factors are held constant, an individual's 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 (Lindelov, 2002). 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 healthcare delivery including healthcare professionals, equipment and buildings. A growing literature on healthcare, however, points out that supply is not sufficient and this means that providing maximum access to healthcare remains a challenge for governments in many low income countries.

In Rwanda, access to healthcare was identified as an important objective in formulating public policies since good health is recognized as a necessary condition for enjoying economic and social opportunities. The country has developed a healthcare setting open to all Rwandans that is accessible to everyone regardless of socioeconomic status. For instance, in the Rwanda Economic Development and Poverty Reduction Strategy (EDPRS, 2008), access to healthcare is one of the strategies for eradicating poverty. The strategy's objective is to promote healthcare to the entire population, increasing geographical accessibility, increasing the availability and affordability of drugs and improving the quality of services. Increased accessibility to healthcare has several benefits particularly among the poor segments of the population (the World Bank, 2001). The Millennium Development Goals (MDGs) also recognize health as an essential ingredient in social and economic progress for any country. However, despite improvements in access to healthcare through Community Based Health Insurance Schemes (CBHIs) and other insurance providers, it is not known why healthcare utilization has remained low in Rwanda.

To increase access to health services, the Government of Rwanda has initiated a number of health policies and other economic stimulus efforts some of them targeting the supply-side of the market while other policies are aimed at increasing service utilization. The policies include Vision 2020, Economic Development and Poverty Reduction Strategy (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 ultimately improve the health status of the population. The reforms were also meant to strengthen the healthcare system and make it more accessible. Despite these reforms, less than two out of five sick people seek formal healthcare in Rwanda (NISR, 2011). The ineffectiveness of previous policies aimed at increasing healthcare utilization is due to their implementation without adequate evidence about the factors influencing health service utilization in Rwanda. The aim of this study is to examine the factors that influence demand for outpatient healthcare services in Rwanda.

Although economic theory offers potential factors that influence demand for healthcare, there is lack of a 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, no studies have been done in Rwanda in recent years to determine factors influencing healthcare demand. The only available evidence on this is from studies by Jayaraman et al. (2008) and Shimeles (2010) which focus on maternal healthcare and on effects of CBHIs at the district level. In countries in which estimates of demand for healthcare exist, research results provide conflicting evidence of the demand effects of price, income and insurance suggesting that more studies are needed.

Most studies on demand for healthcare 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 (Rosenzweig and Schultz, 1982; Lawson, 2004; Kabubo-Mariara et al., 2009). Hunt-McCool et al., (1994) point out that differences in data, model specification and/or empirical methods can contribute to diversity in demand estimates and hinder clarity in healthcare financing policies. This paper addresses these estimation problems, providing rigorous evidence on outpatient healthcare demand determinants in Rwanda that policymakers can use for improving health service utilization across all the regions in the country.

2. Literature review

Healthcare service is demanded as an input into the production of health that is part of an individual's utility function together with other goods. Empirically, the analysis of health services examines their determinants based on the microeconomic theory of consumer behavior. These determinants include factors related to individuals, households and community. Numerous studies have attempted to quantify how much healthcare people consume, the types of healthcare they use and the factors underlying the utilization of healthcare.

Several studies have documented the impact of insurance on demand for healthcare 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 Machado, 2008). Hahn's (1994) study 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 healthcare utilization while uninsured persons were found to have the lowest mean utilization for all types of services. In a similar study, Barros and Machado (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 three 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 on 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. Another study by Shimeles (2010) examined the effects of CBHIs on healthcare utilization at the district level in Rwanda. The study used the matching estimator to address the endogeneity problem. As in Hahn (1994), higher utilization of healthcare services was reported among insured as compared to uninsured households. The results indicate that CBHIs had a strong positive impact on access to healthcare. The results were consistent with the findings of Saksena et al. (2010), Rashad and Markowitz (2009) and Jutting (2003) which found that insurance was an important factor in explaining health seeking behavior.

Other studies have, however, found that insurance may have little effect on demand for healthcare depending on geographical locations (Buchmueller et al., 2005). Cunningham and Kemper (1998) document that in areas where a well-functioning healthcare system exists, 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 lesser healthcare 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 and the level and type of insurance coverage, healthcare demand research needs to handle the problem of heterogeneities to produce reliable estimates.

There is extensive literature on health economics that seeks to estimate the elasticity of income on demand for health services. Most of the literature shows that demand for medical care was income inelastic indicating that medical care was a necessity (Mocan et al., 2004). The positive sign of the elasticity indicates that as income increases, demand for health services also increases. However, literature is inconclusive but notes that income effects vary widely across studies, countries and regions. Ringel et al. (2002) report that income elasticity of demand using cross-section data ranges between 0 and 0.2. This kind of magnitude suggests 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 assume 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 increases as well. Thus, from previous studies on the effect of income no consensus has emerged and the debate on whether healthcare is a luxury or necessity 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 the 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 healthcare but it differed across the quantiles. The findings established that an increase of 10 shillings reduced visits by 0.2 per cent. 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. Given that demand for treatment is not determined by an individual alone, several studies have investigated household and community factors. Lépine and Nestour (2008), controlling for the unobserved effects at the household and community levels that affect health seeking behavior show that household economic status and quality of healthcare 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 in the average transport cost decreased the likelihood of seeking curative care by 25 per cent.

Evidence from empirical studies on the relationship between demand for healthcare and its main determinants differs in several ways. In addition, most of the previous studies have assumed an exogenous insurance and do not consider the reverse causality that is more likely to exist between demand for medical care and health insurance. This study provides new evidence on the factors which affect demand for healthcare using data from Rwanda and handles the endogeneity and heterogeneity problems to ensure that the estimates are unbiased and consistent.

3. Methodology

Following Grossman (1972a and 1972b), 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 perceptions that they have about the quality of health services (Appleton and Song, 1999; Ajakaiye and Mwabu, 2007; Bategeka, 2009). Assuming that healthcare is a consumption good, a consumer's problem can be expressed as:

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

where U is the utility derived from consumption of different goods; Y are 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 healthcare while X represents all other goods and services.

The utility function is maximized subject to the following constraints:

$$(2) B = XP_x + YP_y + ZP_z$$

$$(3) H = H(Z, I, S, C, A, h_s, P_h, N_o)$$

where Z is defined as in equation (1) and I is household characteristics including insurance; S is 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 are household non-observable characteristics. In the first constraint, B is the exogenous income and P_x , P_y and P_z are respectively the price of health neutral goods (such as clothing), health related consumer good Z (such as healthcare) and health investment good Y such as exercising.

The maximization problem is then expressed as:

$$(4) \text{ Max } U = U(H, Z, X, Y)$$

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

$$\text{s.t. } B = XP_x + YP_y + ZP_z$$

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

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

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

Equation (5) is a structural outpatient healthcare demand equation that includes an endogenous variable among the independent variables. The endogenous variable is health insurance because of reverse causality between demand for healthcare and insurance while exogenous variables include monetary prices for healthcare, income, age, gender, educational attainment of the individual, household size, location as well as regions. In this study, the demand for outpatient care is discrete rather than continuous because patients seek or do not seek healthcare. In equations (1) and (2), a 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 outpatient model, insurance is assumed to improve access to health services. In addition, the heterogeneity of health insurance due to a 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. In this study, demand for outpatient refers to any curative outpatient service provided by a physician or any other medical staff. Given the dichotomous nature of the outpatient care, the estimation adopts a binary discrete model, where healthcare is either sought or not. Assuming that the errors are distributed logistically, we adopt a logit regression method to estimate both outpatient and inpatient healthcare demands. The dependent variable takes any two values: 1 if an individual uses outpatient healthcare and 0 representing individuals who did not use any health services. The logit regression is also preferred because most of the studies on demand for health services use logit regression (see Hahn, 1994; Lépine and Nestour, 2008). This relationship can be expressed as:

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

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

$$(6) \quad y^*_i = x_i' \beta + \varepsilon_i$$

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

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

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

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:

$$(7) \quad E[Y_i] = \Pr(Y_i = 1) * 1 + \Pr(Y_i) * 0 = \Pr(Y_i = 1) = \pi_i$$

Equation (7) 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:

$$(8) \quad \Pr(Y_i=1) = \frac{\exp(\beta_0 + \beta_1 X_{1i} + \beta_2 X_{2i} + \dots + \beta_k X_{ki})}{1 + \exp(\beta_0 + \beta_1 X_{1i} + \beta_2 X_{2i} + \dots + \beta_k X_{ki})}$$

In terms of the log-odds, equation (8) can be reformulated as:

$$(9) \quad \left[\ln \frac{\Pr(Y_i = 1)}{1 - \Pr(Y_i = 1)} \right] = \left[\ln \frac{\Pr(Y_i = 1)}{\Pr(Y_i = 0)} \right] = \ln \left[\frac{\pi_i}{1 - \pi_i} \right] = \beta_0 + \sum_{j=1}^k \beta_j X_{ji} = \text{logit}(\pi_i)$$

which can be expressed as:

$$(10) \quad \log it(\pi_i) = \beta_0 + \sum_{j=1}^3 \beta_j X_{ji} = \beta_0 + \beta_1 X_{1i} + \beta_2 X_{2i} + \beta_3 X_{3i} + \varepsilon_i$$

where

Y_i is an indicator for the choice of modern healthcare (outpatient) by the i^{th} household member,

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

X_{2i} = Vector of characteristics related to a household such as income and 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 (10), $\beta_j > 0$, then an increase in X_{ji} (for instance, 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, user fee), will reduce the log-odds ratio. If $\beta_j = 0$, then the variable has no effect.

However, in the case of equation (10), β s indicate changes in the 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 (10) is the structural form of the probabilistic healthcare demand function. In this equation as in 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 healthcare. 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).

Health insurance in equation (10) 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, healthcare utilization not only depends on an individual's health insurance coverage, but the level of coverage may also be influenced by anticipated utilization of health services (Jutting, 2004). Manning et al. (1987) argue that treating insurance as exogenous in demand for healthcare 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 a generous coverage privately.

Existing literature suggests useful methods for dealing with the endogeneity problem. Among the common approaches to this problem is the use of Two Stages Residuals Inclusion (2SRI) regression method which is appropriate for non-linear models. The procedure is used to address problems relating to measurement error, simultaneity and omitted variables. This method requires identifying an observable variable or instrument that is correlated with the endogenous variable but uncorrelated with the error-term (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 Mairesse, 1998; and Akerberg and Caves, 2003). The second requirement involves the relationship between the identified instrument, z_i , and demand for health services. This means that the identified variable should not have an impact on health insurance, that is, z_i must be relevant. This requires regressing health insurance against all the exogenous variables, including the instrument (Wooldridge, 2002; Jowett et al., 2004; Greene, 2007). 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 (Akerberg and Caves, 2003). In the first stage, we estimated the reduced-form of health insurance on all exogenous variables including instrumental variables. The second stage regressed demand for healthcare 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) and Kabubo-Mariara et al. (2009), we can reformulate the demand for health services in the form of simultaneous equations as:

$$(11) \quad D = \delta_d Z_1 + \beta_j I_j + \varepsilon_{ij}, j=1...2$$

$$(12) \quad I = \delta_j Z + \varepsilon_2$$

where D and I are demand for healthcare 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 (11) is the structural equation to be estimated while equation (12) 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 a valid instrument for identifying the effect of endogenous variables in a structural model.

Once the 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 (Kabubo-Mariara et al., 2009; Stock, 2010). An instrument satisfying all three properties is said to be a 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 an 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 will be no justification to estimate the structural model of demand for healthcare, because the logit models will yield unbiased estimates. We used the Durbin-Wu-Hausman test. The results showed that the Durbin-Wu-Hausman statistic values were significant at the 10 per cent level.

We also conducted the Wald test of exogeneity of the insurance variable which showed that the values were significant at the 1 per cent level. We then rejected the null hypothesis of exogenous insurance. Second, the coefficients of insurance residuals variable were also significant at the 1 per cent 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 the endogenous variable. As the coefficients of instruments were large and significant at the 1 per cent 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 (Staiger and Stock, 1997; Kioko, 2008), the minimum Eigen value statistic for F-test was 133.04 suggesting that the null hypothesis of weak instrument had to be rejected.

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 healthcare (Schultz, 2008; Kabubo-Mariara et al., 2009). Even with valid instruments, in practice it is not easy to separate the impact of endogenous variables 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 healthcare that would not otherwise be available. Nyman (2005) has argued that the pooling effect of insurance provides access to expensive medical technologies that would otherwise 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, 2005). The three sources relate to reasons known by an individual but not by the researcher because of 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 of insurance residual (I^*) where the inclusion of the residuals is identical to the one obtained by 2SRI using an instrument for insurance. Assuming that the unobserved component was 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 in the case where the reduced form insurance was heteroscedastic (Card, 2001).

Introducing the control function variables (insurance residual and interaction) gives:

$$(13) D = \beta_0 + \delta_a Z_1 + \tau I^* + \gamma II^* + \varepsilon_1$$

where I^* are 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 (13) that is affected by the unobservable 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 0. Second, the expectation of the interaction between insurance and the fitted residuals is linear.

The data used in this paper 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 individual levels. EICV2 aimed at enabling the government to assess the impact of its different policies and programs which had been implemented for 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, labor, 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 and OOP (consultation; laboratory tests; hospitalization; and medication costs). Individual level information included socioeconomic indicators and insurance status. There were also a number of community variables such as distance to the nearest health facility. To improve the reliability of the data, the recall period for the use of health services was two weeks prior to the survey. In this paper, demand for healthcare services was estimated for a single visit because the survey did not capture multi-visits to health facilities. Hence, the demand for outpatient care was limited to the last consultation or admission.

4. Results and discussion

In Table 1, 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 the model's parameters are jointly different from 0. The 2SRI results are reported in columns 4-5 of Table 1 while the first stage regression estimates are given in Table A2 in the Appendix. Columns 6-7 in Table 1 present 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 the 2SRI results in terms of signs of coefficients although they are different in magnitude. The significance of the coefficient on insurance residuals suggests that insurance is endogenous to outpatient medical care. The coefficient on the interaction of the insurance residuals and insurance is significant at the 1 per cent level indicating the presence of heterogeneity arising from an interaction of insurance with unobserved determinants of demand for outpatient care. For comparison purposes, the baseline model (logit) estimates are also presented in columns 2-3. They appear to be weaker than the 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.

Table 1. 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 healthcare (=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

Explanatory variables	Baseline Estimate	z-statistics	2SRI Estimates	z-statistics	Control Function Estimates	z-statistics
Northern region (=1)	0.195	3.25***	0.17	3.54***	0.164	2.73**
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 the 1, 5 and 10 levels respectively

Source: Researcher's construction.

On average, higher user fees reduces 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) show that uptake of treatment in Kenyan schools fell from 75 per cent to 19 per cent after fees were introduced. This suggests that the introduction of cost-sharing was responsible for a major part of the reduction in uptake. Similarly, De Bethune et al., (1989) and Yoder (1989) found the price of healthcare to be a significant hindrance to demand for medical services in Swaziland. However, this study confirmed the results by other cross-section studies that demand for healthcare is inelastic to price. Oxaal and Cook (1998) have shown 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 in contact with other educated individuals who have a high demand for healthcare. Social interaction which begins during schooling years continues into the workplace and 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 healthcare which makes the service more affordable than it would be without insurance. The result on insurance finds support in findings from previous studies which addressed the endogeneity problem when estimating the demand effect of insurance (see, for example, 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 this paper reveals that gender is an important factor affecting the use of outpatient health services in Rwanda where females are more likely to use outpatient services as compared to men. The results are in line with those reported by Miller (1994) who argued that females demand more healthcare than males because of their role in childbearing. Miller (1994) adds that some illnesses, such as cardiovascular diseases, osteoporosis, immunologic diseases and Alzheimer's disease are more prevalent in women than men. In line with this, Ahmad (2001) adds that gender differences in healthcare utilization for women were related to specific diseases such as cardiovascular and chronic illnesses.

Some research has shown that women use less outpatient healthcare 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) show 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 the socioeconomic status of the household, time constraints, composition of households, intra-household resource allocation and decision-making, less education and employment and legal or social constraints on access to care, heavy work burdens and the opportunity costs of time in seeking care.

Given these results, a number of recommendations emerge. Since user fees are an impediment to using healthcare 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. From 2003, OOPE gradually increased to reach 32.2 per cent of the total health expenditure in 2010. High OOPE has a variety of negative consequences, including household impoverishment. Subsidies on user fees should target vulnerable groups such as children and women or low income households. The government should also consider subsidizing private health facilities to increase access to high quality services by low income households. The subsidies will help reduce the effect of income inequalities in healthcare utilization.

Health insurance is an important determinant of healthcare seeking behavior in Rwanda. Thus, policies that increase health insurance coverage will substantially increase health service utilization. The 2013 health insurance coverage rate in Rwanda was 73 per cent, the highest in the 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 per cent to 73 per cent. In addition, while with the earlier premium level, healthcare expenditure represented 10 per cent of the total household expenditure holding other factors constant, with the new

premium, the healthcare expenditure for households will represent 26 per cent of the household expenditure. This will cause households to incur catastrophic expenditures and push them into poverty. Further, with an average household size of 6.6 persons, this level of premium per individual does not seem to be sustainable given that 44.9 per cent of the population lives on less than \$ 1 per day.

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APPENDIX TABLES

Table A1: 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	-0.0810	-11.47***	-0.170	-21.46***
Quality of healthcare (=1)	-0.0002	-0.27	-0.008	-0.20
Health insurance (=1)	0.0130	10.20***	0.942	1.99*
Distance to the health facility	-0.0120	-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	-2.40*
Male (=1)	-0.0030	-4.38***	0.149	3.89***
Urban (=1)	-0.0060	-4.71***	-0.391	-4.65***
Kigali region (=1)	-0.0008	-0.46	-0.370	-1.25
Southern region (=1)	-0.0010	-1.27	-0.280	-2.67**
Western region (=1)	0.0006	0.52	0.140	2.01**
Northern region (=1)	0.0050	2.76**	0.317	3.94***
Primary (=1)	0.0001	1.96*	0.001	1.98*
Secondary (=1)	0.0004	2.50**	0.023	2.10*
Tertiary (=1)	0.0006	2.67*	0.006	0.90
Insurance residuals	-	-	0.0054	2.31**

Note: ***, ** and * = significant at the 1, 5, and 10 per cent levels respectively.

Source: Researcher's construction.

Table A2: 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	-1.20
Quality of healthcare (=1)	0.0033	0.0069	0.47
Distance to the health facility	-0.0483	0.0108	-4.47***
Household size	-0.0132	0.0013	-10.58***
Age	0.0072	0.0008	9.20***
Age squared	-0.0001	0.00001	-6.00***
Primary (=1)	0.0023	0.0045	5.10***
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	0.0087	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 the 1, 5 and 10 per cent levels respectively.

Source: Researcher's construction.