ILLNESS AND CHOICE OF TREATMENT IN URBAN AND RURAL ETHIOPIA

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Abstract

Using large data set from a nationally representative sample of households and discrete choice models, we examine the effect of access to roads, transport and liquidity on seeking treatment for illness and health care provider choice in urban and rural Ethiopia. The results indicate that access to roads and public transport are important determinants of the decision to seek treatment for illness by the rural residents. We also find evidence that distance to all weather road, access to public transport and access to liquidity have a strong effect on the utilization of private healthcare facilities. The significance of distance to all weather roads in healthcare utilization is especially appealing in terms of policy design because it implies that construction of multi-purpose road networks can compensate for the absence of healthcare facilities in the proximity.

Keywords: Illness; healthcare choice; accessibility; liquidity constraint; discrete choice models; sample selection

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1. Introduction

People in developed countries often visit healthcare facilities not only when they are sick but also for regular checkups. In developing countries on the other hand, many people do not seek treatment in the formal medical facilities even when they are sick let alone for routine check-ups. While access and affordability could be important factors influencing healthcare decisions in developing countries, awareness and socio-cultural beliefs could as well be important. Access is often limited because of poor infrastructure and limited distribution of healthcare facilities. Private healthcare facilities are often limited to urban areas that may not be easily accessible to the rural population because of poor road and transport facilities. Government healthcare facilities that provide low-cost healthcare services are often available in the rural areas but their distribution is usually uneven and their quality is low (Chaya, 2007). Traditional healthcare services are also widely practiced in a number of developing countries, particularly in the rural areas. For example, WHO (2008) estimates that up to 80% of the people in some Asian and African countries rely on traditional medicine for primary healthcare. When traditional and modern healthcare services coexist side by side, therefore, efforts to expand modern healthcare may not always produce the desired result. Understanding the factors that influence people's choices between alternative sources of healthcare service will thus be useful inputs into the process of developing effective healthcare services in developing countries.

Some recent empirical studies examined the influence of both the demand and supply side factors on healthcare choices in developing countries (e.g., Amaghionyeodiwe, 2008; Sepehri, 2008; Habtom and Ruys, 2007). The demand side factors include income, patient and household characteristics while the supply side factors include various measures of physical access and quality of healthcare providers. The most commonly analyzed measure of physical access to healthcare is distance to healthcare facilities. While physical access could also be influenced by the availability of transport facilities, the direct effect of such facilities has attracted little attention in empirical analysis of healthcare choice in developing countries. Easier access to road networks and public transport allows more convenient and quicker travel to towns or cities where more or better treatment options are often available and hence may influence healthcare decisions.

Using large survey data from a nationally representative sample of households, this paper examines the effect of access to road networks, means of transportation

and liquidity[3] status on seeking treatment for illness and health care provider choice in rural and urban Ethiopia. We also analyze the effects of distance to health centers and the standard household and individual characteristics like income, asset ownership and education on choice of treatment for illness. We estimate selection probit models for seeking treatment for illness and multinomial logit models for healthcare provider choice, allowing for household level cluster-robust standard errors.

This paper contributes to the literature on the determinants of healthcare usage in developing countries by examining the direct effects of access to transport networks and liquidity that have not been investigated in existing literature in developing counties. Although healthcare services in the public facilities in Ethiopia as in many other developing countries are mostly provided free of charge or at nominal costs, getting there and financing food and accommodation for self and company require some money and hence household's access to liquidity at the time a member gets sick is important. However, to the best of our knowledge, there are no studies that examine the direct effect of liquidity constraints on healthcare utilization in developing countries.

Our empirical results indicate that access to roads and public transport are important determinants of the decision to seek treatment for illness by the rural residents. We also find evidence that distance to all weather road, access to public transport and access to liquidity have a strong effect on the utilization of private healthcare facilities. The significance of distance to all weather roads in healthcare utilization has important policy implication because it suggests that it may be possible to improve healthcare utilization not only by expanding healthcare facilities in the rural areas but also by building more roads. This may help the resource-constrained policy makers to reprioritize the budget so as to focus more on improving the quality of healthcare facilities and expansion of road networks (since roads are needed for non-health aspects of well-being as well) by scaling back the construction of new healthcare facilities.

The next section briefly describes the healthcare system in Ethiopia. That is followed by a brief review of the literature on healthcare utilization and provider choice focusing on the research in developing countries. Section 4 briefly describes the theoretical context and the empirical methodology followed in this paper. In section 5 we describe the data and present summary statistics for the

[3] Household's access to liquidity is defined in terms of the household's ability to obtain 100 Birr within a week if needed. Birr is the name of the Ethiopian currency and 1USD currently buys about 18 Birr.

variables used in the empirical models. Estimation results are presented in section 6 while section 7 concludes.

2. Health Care System of Ethiopia

With annual per capita expenditure on healthcare in PPP of about $23.00 (WHO, 2012), Ethiopia is one of the countries that spend the least on healthcare services in Africa. The average healthcare expenditure in comparable countries like Kenya and Ghana is almost five times higher. The meager resources allocated for the healthcare services are also reflected in the poor state of the healthcare infrastructure in the country. According to the Ministry of Health of Ethiopia (2010), the healthcare infrastructure in Ethiopia[4] consisted of 195 hospitals, 13,850 health centers, and health posts[5], 2,853 clinics and 1,322 pharmacies and drug shops in 2009[6]. The total number of beds in the hospitals was 15,111 for a hospital bed-population ratio of less than 2 beds per 10,000 which is among the lowest in the world.

The public sector dominates the provision of health care services in the country with nearly 75% of the hospitals being run by the ministry of health or other government agencies like the ministry of defense (MOH, 2010). About 20% of the hospitals are privately owned while the remaining 5% are run by NGOs. Health centers, health stations and health posts are almost exclusively owned by the government while the clinics are owned either by the private sector (90%) or NGOs (10%). The public health care facilities provide healthcare services at nominal prices or free of charge depending on the economic status of the patient. Most of the NGO facilities also provide subsidized health care services while the private facilities charge the market prices.

In terms of location, almost all the hospitals in the country are in the big cities and towns, 21% being in the capital city (MOH, 2010). Health centers are available both in small and large towns as well as some rural areas but their distribution and quality is uneven. Health posts are almost exclusively rural health outlets but mostly lack the necessary human resources and supplies to provide

[4] Based on the projections from the latest population census conducted in May 2007, Ethiopia's population would be about 84 million in July, 2012 (CSA, 2011).

[5] The health centers have more services and human resources than health posts. Healthcare facilities which used to be reported as "health stations" have been phased out or upgraded to health centers or downgraded to health posts as of 2009 (MOH, 2010).

[6] This is the latest year for which data on the number of both private and public healthcare facilities and their personnel are available.

anything more meaningful than referring the visitors (patients) to the nearest health center. The private clinics are mostly located in the urban areas where they can find people who can afford the higher prices that they often charge.

One of the reasons for the very low per capita healthcare utilization rate in Ethiopia (see MOH, 2008, Collier et al, 2003) could be these supply side constraints as reflected in the limited availability and uneven distribution of the healthcare facilities. While 85% of the country's population lives in rural areas most of the healthcare facilities are located in urban areas. The road networks and transport facilities that connect the rural areas to the towns and cities are underdeveloped and often deteriorate during the rainy season (Chaya, 2007). The distribution of these transport facilities is also uneven leading to people living in or near the towns having a comparative advantage over those who live in the remote areas.

Perhaps believing that distance is an important factor affecting the healthcare utilization rate in the country, the focus of the government's health care policy over the recent years has been to expand the physical access to health facilities (Collier et.al, 2003) largely by building large number of health posts as close to the people as possible. For example, the number of health posts has expanded from 1,432 in 2003 to 12,488 in 2009 while the number of health centers increased from 451 to 1,362 over the same period (see MOH 2008 and 2010). The government has also been constructing some rural road networks but the overwhelming emphasis on expanding the physical access could potentially be at the expense of quality as some evidence appears to indicate (see for example USAID, 2008). Now the question is can't the government scale back the construction of the new healthcare facilities and invest more in the quality of the existing facilities and more road networks that serve not only the healthcare needs of the public but also other aspects of their livelihood like access to markets? Answering this question requires analyzing the role of road networks in healthcare utilization of the public, and that is one of the key purposes of this study.

3. Literature

Several studies have examined the factors that influence healthcare choices both in developed and developing countries. The most common determinants of healthcare utilization can broadly be classified into the demand-side factors and supply-side factors. According to Ensor and Cooper (2004) the demand-side

factors include income, education and awareness, attitudes and norms, opportunity costs of seeking healthcare, availability of substitutes and their prices, type and severity of illness, and various socio-demographic characteristics of the individual, the household and the community. On the other hand the supply-side factors include various measures of availability and quality such as distance to healthcare facilities, travel time, waiting time, number and qualification of the staff, availability of equipment and medical supplies. Other factors like price of healthcare service and rationing reflect the interaction between demand and supply sides. The role of each of these has been empirically examined in one form or another.

Demand side factors like access to and type of health insurance, health status, income and education are the dominant determinants of healthcare utilization in the United States where healthcare is largely financed through private or group health insurance schemes (e.g., see Sharma et.al, 2003; Manning et al, 1987; Leclere, 1994). Geographic and spatial factors are also important in the rural areas of the US (for example see Arcury et al, 2005; Nemet and Bailey, 2000). In other developed countries, where healthcare is largely financed through public health care schemes like the UK or Germany, healthcare utilization is also influenced by the supply side factors like access to and nature of transport facilities as well as distance to the healthcare facilities (See for example Field and Briggs, 2001; Pohlmeier and Ulrich, 1995). According to Ensor and Cooper (2004), demand side barriers to healthcare utilization in developed countries are particularly important for vulnerable groups like the poor and the elderly.

Explaining healthcare utilization behavior appears to be more complex in developing countries than in the developed countries. The much more pervasive use of self-care and traditional medicine, the still evolving process of modern medicine, the more complicated cultural attitudes and socio-economic conditions make it harder to accurately model healthcare utilization behavior in these countries (Kroeger, 1983). Yet, a large number of studies, with varying levels of methodological rigor and area of emphasis, have examined the determinants of healthcare utilization in developing countries. While some of these studies analyzed healthcare utilization as a binary outcome variable capturing as to whether healthcare service was sought or not (e.g. Mwabu et al 1993; Develay et al, 1996; Appleton 1998; Collier et al 2003, Pillai et al, 2003; Sepehri et al 2008), others analyzed the frequency of visits to a doctor or medical facilities (e.g. Trivedi 2002; Chang and Trivedi, 2003). Even a larger number of studies have examined the factors that influence the choice of healthcare provider in developing countries (e.g. Amaghionyeodiwe 2008; Habtom and Ruys 2007;

Thuan et al 2008; Leonard 2007; Borah 2006; Akin et al 1998; e.g. Bolduc et al 1996; Tembon 1996).

Distance to healthcare facilities and income are the most commonly analyzed determinants of healthcare utilization in developing countries. In an African context, the effect of distance on healthcare usage was analyzed, for example, by Appleton (1998) and Buor (2003) for Kenya and Ghana, respectively. Both studies found out that distance has a strong negative effect on healthcare utilization. Another study by Collier et al (2003) found a similar negative association between distance and usage in a sample of rural districts in Ethiopia. Collier et al as well as Buor also found positive association between healthcare usage and household income. Some of these studies also show that education may positively influences healthcare utilization in developing countries (Collier et al, 2003; Appleton, 1998). The effects of user fees and transport cost on utilization of healthcare were analyzed by Develay et al (1996) but found theoretically implausible positive effects for both variables as did Buor (2003) for waiting time and transport cost in Ghana. According to Collier et al as well as Mwabu et al (1993) quality of healthcare services is another important factor that positively influences health care usage.

A number of other studies examined the effects of income, distance, education, user fees, waiting time, travel time, and quality of service on the choice of healthcare provider in Africa. For example, Habtom and Ruys (2007) found household income to have significant positive effect on the utilization of private medical facilities for profit and no significant effect on the utilization of public or non-profit catholic healthcare facilities in Eritrea. Their study also found education to have positive effect on utilization of both private and public facilities while user fees and transport costs had negative effect. Similar findings were obtained for the effect of user fees and education by Asfaw (2003) in a rural Ethiopian village. Another study by Amaghionyeodiwe (2008) showed negative relationship between distance and user fees and utilization of both public and private clinics and hospitals in Nigeria. Quality was found to have a positive influence on utilization of both private and public facilities by Amaghionyeodiwe (2008) as well as Akin et al (1995) for Nigeria. Similar findings were reported for the effect of quality and distance on provider choice by Bolduc (1996) for Benin, Leonard (2007) for Tanzania and Tembon (1996) for Cameron.

While almost all of the studies of healthcare utilization in developing countries essentially analyzed healthcare usage by the people with some kind of self-reported illnesses, only a few of them recognized and attempted to address the

selectivity problem that could arise due to the self-reported nature of the illness and treatment data. Selectivity may arise because those people who are more likely to report illness may actually end up being those who care and know more about their health status and hence are more likely to seek treatment. Therefore, parameters estimates based on the data from the sample with self-reported illnesses may be biased. In the context of a binary healthcare utilization model, the selectivity problem was addressed by Appleton (1998) and Collier et al (2003). Appleton finds selectivity to be unimportant in a binary choice probit model for seeking treatment in Kenya while Collier et al find it to be significant in a data from rural Ethiopia.

This paper attempts to expand the literature in this area by estimating selectivity-corrected binary choice model for healthcare usage and multinomial logit model for provider choice. The focus of analysis is on the effect of access to transport networks and access to liquidity on healthcare usage that has not been directly examined in the existing literature in developing countries. Access to transport facilities is represented by distance to all weather roads and the available means of traveling to the healthcare center. Access to liquidity is captured by the ability to raise 100 Birr within a week if needed. In the absence of formal credit markets for personal finances in Ethiopia, people will have to rely on their friends or social networks to raise the money that may be needed for emergency and understanding the role of liquidity constraints in healthcare utilization may indirectly explain the degree to which the informal networks are able to cover the role of modern credit facilities.

4. Theoretical Context and Methods

The theoretical framework for healthcare utilization has been formulated by a number of studies before as summarized for example in Behrman and Deolalakiar (1988). Considering a health care system consisting of j alternative providers, an individual faces $j+1$ alternatives including self-care (not seeking outside treatment) as $j+1^{th}$ option. Hence, the utility individual i expects to derive from choosing treatment alternative j may be stated as

$$u_{ij} = u_{ij}(c_{ij}, h_{ij}), \qquad (1)$$

where h_{ij} is the health status of individual i after receiving treatment from alternative j and c_{ij} is a composite good representing the value of all goods and services consumed other than healthcare. The health status for individual i, h_{ij}, is

assumed to depend on initial health status h_0, a vector of individual characteristics ($\boldsymbol{x}$) like sex, age and education as well as the vector of provider characteristics ($\mathbf{z}_{ij}$) like accessibility, affordability and quality of services it provides as defined for example by Mwabu et al (1993),

$$h_{ij} = h_{ij}(h_0, x_i, z_{ij}). \tag{2}$$

The budget constraint may also be stated as

$$y_i = c_{ij} + p_{ij}, \tag{3}$$

where p_{ij} represents both the direct costs of transport and treatment as well as opportunity costs of time spent in seeking treatment at provider j.

Maximizing (1) subject to (2) and (3) and substituting the resulting reduced form demand functions for h_{ij} and c_{ij} back into the conditional utility function leads to the standard conditional indirect utility function that may be stated as

$$v_{ij} = v_{ij}(h_0, x_i, z_{ij}, y_i, p_{ij}). \tag{4}$$

Equation (4) represents the maximum utility individual i can derive by seeking treatment at provider j, controlling for initial health status h_0, a vector of individual characteristics x_i, provider characteristics $\boldsymbol{z}_{ij}$, income y_i, and direct and opportunity costs of treatment p_{ij}. In practice, however, some of the factors that influence utility may not be observable and restating the utility function by adding these random components (ε_{ij}) to the indirect utility provides the basis for the empirical model:

$$U_{ij} = v_{ij}(.) + \varepsilon_{ij}\ . \tag{5}$$

Denoting healthcare provider alternatives available for individual i by d, alternative j will be chosen over alternative k if j provides at least as much utility as k, i.e. the probability that j is chosen over k is given as,

$$\begin{aligned} P(d_i = j) &= P[U_{ij} \geq U_{ik}], \text{ for all } j \neq k. \\ &= P[v_{ij}(.) + \varepsilon_{ij} \geq v_{ik}(.) + \varepsilon_{ik}], \text{ for all } j \neq k. \\ &= P[\varepsilon_{ik} - \varepsilon_{ij} \leq v_{ij} - v_{ik}], \text{ for all } j \neq k. \end{aligned} \tag{6}$$

Assuming that the errors are distributed as type I extreme value and v_{ij} is linear in its arguments, the probabilities in (6) can be modeled as multinomial logit.

For empirical analysis in this paper, the alternative sources of healthcare service are classified into five categories consisting of self-treatment, government facilities, private facilities (including NGO facilities), pharmacy, and other facilities that include traditional healers. Self-treatment (no formal treatment) is taken as the benchmark option for which the vector of coefficients is normalized to zero. Among the arguments in v_{ij} our analysis focuses on two of the access variables: distance to all weather roads and availability of public transport, and one of the household characteristics: an indicator for liquidity constraint or access to finance. We expect distance to all weather roads to have negative influence on the utilization of all healthcare facilities but for the rural sample it is expected to have larger negative effect on the utilization of private healthcare facilities that are mostly located in larger cities and hence require road networks to attract rural residents. Similarly, availability of public transport is expected to have positive influence on the utilization of the healthcare facilities its effect being larger for the usage of private facilities by the rural residents. The indicator for access to liquidity that takes a value of 1 if the household can obtain at least 100 Birr within a week if it wants and 0 otherwise is expected to have positive influence on utilization of all the facilities but intuitively its effect is anticipated to be larger on the usage of the private healthcare facilities that mostly charge the market price as opposed to the government facilities that provide the services at nominal prices or free of charge.

Our healthcare provider choice models also include some of the most commonly analyzed determinants of healthcare usage such as distance to health centers, individual and household characteristics such as age, gender, marital status, education, employment status, occupation, income, and assets owned. We estimate our models both with and without region fixed effects to see if our results are influenced by some unobserved differences in the access and quality of services across the administrative regions of the country. We also correct the standard errors for the household level clustering since the household characteristics included in the econometric models are similar for the members of the same household.

The binary choice probit model of healthcare utilization we estimate in the first part of our econometric analysis can be thought of as a special case where all the four sources of formal health care are lumped together against the self-care option. The dependent variable in this case is a dichotomous variable that takes a

value of 1 if the person chose to seek outside treatment in any of public or private facilities, pharmacy or other facilities. The regressors in the probit equations are similar to those that are included in the multinomial healthcare provider choice models. To account for selectivity bias that could arise as a result of common unobserved influences on the tendency to report an illness and seek treatment, we jointly estimate the treatment equation along with a binary outcome equation for illness specified as probit.[7] The illness equation includes some additional regressors like sources of drinking water, type of toilet facilities, sources of cooking fuel and lighting that are thought to influence the health status of household members. The data and variables used for estimation of the empirical models are described in the next section.

5. Data

Analysis in this paper is based on data from the Ethiopian Welfare Monitoring Survey (WMS) conducted in the year 2000 by the central statistical agency of Ethiopia (henceforth WMS2000). WMS2000 was a nationally representative survey of 17,285 households in the rural areas and 8,643 households in urban areas proportionately distributed across the 11 regions of the country on the basis of their population size. The rural sample includes about 83,390 individuals with complete information while the urban sample includes 38,931 individuals with complete data. The data contain reasonably detailed information on the characteristics of the household and its members as well the community and the environment they live in. The data also contain information on incidence of illness and type of treatments sought, household income and key assets owned, education and basic demographics for each member of the household, employment status and occupation for each member older than 9, type of dwelling and type of access to water, energy and toilet facilities, distance to health center, distance to dry and all weather roads and type of transport to health centers as well as an indicator for access to finance. The names and description of the variables of interest are presented in Table 1.

[7] See, for example, Wooldridge (2010), Chapters 15-16 and 19, for further details on multinomial logit model and binary probit regression with selection.

Table 1: Names and descriptions of the variables used in the models

Variable	Description
Dependent variables (Last 2 Months)	
Illness in last 2 months	= 1 if person had health problem in last 2 months
Seek treatment	= 1 if person sought treatment in last 2 months (if ill)
Health care choice(for persons who reported health problems over the last two months)	
Self-treatment (benchmark)	= 1 if person did not seek outside treatment
Government facilities	= 1 if person used health care services provided by government
Private facilities	= 1 if person used health care service provided by private/mission/NGO facilities
Pharmacy	= 1 if person was treated at Pharmacy
Other facilities	= 1 if person used other sources of treatment
Explanatory variables	
Distance to health center[a]	Distance to health center in kilometers
Distance to all weather road[a]	Distance to all weather road (AWR) in kilometers
Age	Age in years
Male	= 1 if person is male
Household size[a]	Household size
Married	= 1 if person is currently married
Primary education	= 1 if education of person is at least primary complete
Access to liquidity[a]	= 1 if household can get 100 Birr within a week
House ownership[a]	= 1 if household owned a house a year ago
Low income (Benchmark)[a]	= 1 if monthly income is from 0 to 80 Birr
Lower middle income[a]	= 1 if monthly income is from 81 to 180 Birr
Middle income[a]	= 1 if monthly income is from 181 to 395 Birr
High income[a]	= 1 if monthly income is from 396 to 9100 Birr
Number of cattle[a]	Number of cattle owned
Number of equines[a]	Number of Equines owned
Number of sheep[a]	Number of sheep/goats owned
Occupation (differential groups for urban vs. rural)	
Service and sales	= 1 if occupation in service and sales
Agriculture	= 1 if occupation is in agriculture
Craft and trade	= 1 if occupation in craft and trade
Plant and machine	= 1 if occupation in plant and machine
Laborer	= 1 if the person is laborer
Other occupation – rural	= 1 if occupation is other (for rural resident)
Other occupation – urban	= 1 if occupation is other(urban resident)
Young	= 1 if person is younger than 10
Unemployed	= 1 if person is unemployed

Variable	Description
Means of transport to health center	
On foot[a]	= 1 if transportation to health center is on foot
Public transport[a]	= 1 if transport to health center is public
Animal and other transport[a]	= 1 if transport to health center is on animals or other
Water, toilet, lighting and cooking	
Unprotected water[a]	= 1 if household uses unprotected water
Flush toilet[a]	= 1 if household uses flush toilet
Pit-latrine toilet[a]	= 1 if household uses pit-latrine toilet
Other (control)[a]	= 1 for other toilets
Number of rooms[a]	Number of rooms in the house
Kerosene[a]	= 1 if lighting source is kerosene
Electricity[a]	= 1 if lighting source is electricity
Other lighting[a]	= 1 for other sources of lighting
Natural fuel[a]	= 1 if household uses natural fuel for cooking
Other fuel[a]	= 1 if household uses other sources of fuel for cooking
Living standard[a]	= 1 if self-assessed general living standard decreased over last year
Fixed effects	
Killil fixed effects[a]	Dummy variables for 11 major regions

Source: Welfare Monitoring Survey (WMS)- Ethiopia (2000).

[a] Indicates household level variables.

As stated in the previous section, the illness equation and treatment equations are jointly estimated to control for selectivity problem. WMS2000 gathered detailed information on illness and treatment for a period of 2 months preceding the date of interview. The incidence of illness by region, age group, income and gender is presented in Table 2. About 29% of the individuals in the rural sample and about 22% in the urban sample reported at least one incidence of illness over the period. Prevalence of illness was the highest among the elderly (60 or older) about 47.5% of them reporting to have been sick at least once over the last two months. Incidence of illness was also high among the under-five children 35% of which were reported to have been sick over the two months' period. The incidence of illness also appears to increase with the falling income, 30% of the individuals belonging to the lowest income households reporting some kind of illness whereas only 22% of those who belong to the top income class having suffered some illness over the previous two months. In addition, women appear to be slightly more vulnerable to disease than men.

Table 2: Health problems by age, gender and income group

Rural vs. urban	
Rural	29.0
Urban	21.6
By age group	
Age 0 to 4	35.38
Age 5 to 16	17.08
Age 16 to 59	28.24
Age 60 and over	47.52
By income class	
Low Income	29.75
Low Middle Income	28.66
Middle Income	25.43
High Income	21.78
By gender	
Female	27.89
Male	25.38
Total	26.68

Source: Computed from WMS-Ethiopia (2000).

There is a marked difference in utilization of health care between urban and rural areas as shown in Table 3. Among those who reported illness in the rural Ethiopia, almost 60% did not seek any kind of formal treatment whereas only 30% of those who reported an illness in urban areas did not seek outside treatment. This appears to be quite high even by African standards. For example, only 7 to 8% of those who reported illness in a Nigerian sample failed to seek outside treatment (Amaghionyeodiwe, 2008). Among those who sought treatment nearly half visited government facilities both in urban and rural areas but utilization of private facilities is proportionately higher in urban areas. About 17% of those who sought treatment from the rural areas visited private facilities while 26% of the healthcare users from the urban areas visited private providers. This is not surprising since the private facilities are mostly available in urban areas and the urban residents are at a comparative advantage in terms of location and perhaps ability to afford the higher prices that the private facilities often charge. On the other hand, reliance on pharmacy and other sources of healthcare is proportionately higher among the rural users than urban users (32% versus 20%). The 'other' category mostly includes the traditional healers that are more

prevalent in the rural areas than the urban areas. However, on the basis of these data (some of which could be reporting error) the overall reliance on traditional healers doesn't seem to be as high as generally presumed in the context of developing countries as cited for example in WHO (2008).

Table 3: Health care facility choice of individuals reporting health problems

Facility choice	Rural	Urban
Self-Care	59.93	30.41
Government	20.42	37.48
Private	6.75	18.34
Pharmacy	6.02	7.50
Other	6.87	6.26
Total (%)	100	100
Total (Obs.)	24205	8428

Source: Computed from WMS-Ethiopia (2000).

The summary statistics for the rest of the variables used in both the healthcare utilization and illness equations are presented in Table 4. As stated before our key variables of interest are access to roads and means of transport to healthcare facilities. The WMS2000 data contain information on the distance of the household unit in the sample from the nearest dry weather road and nearest all-weather road both measured in kilometers (kms). However, we think that all-weather roads are better measures of access to transport than dry weather roads since the later often become dysfunctional during the rainy season which could run for several months in some parts of the country. Therefore, we include distance to all-weather roads as a regressor in healthcare utilization models. In the rural areas represented by the sample of households in the WMS2000 data, the average distance from all weather roads is 12.5kms with considerable variation as reflected in the large standard deviation. Not surprisingly, the mean distance from all weather roads in urban areas is much smaller (less than half a kilometer) but there is a large variation in the urban areas as well. The average distance to the nearest health center is about 9kms in the rural areas and 1.5kms in the urban areas again with considerable variation.

Table 4: Summary statistics for the variables used in the econometric models

	Rural (Obs.=83390)		Urban (Obs.=38931)	
Variable	Mean	Std. Dev.	Mean	Std. Dev.
Illness in last 2 months	0.290	0.454	0.216	0.412
Seek treatment[a]	0.401	0.490	0.696	0.460
Distance to health center	8.977	9.899	1.465	3.349
Distance to all wealth. road	12.537	16.699	0.391	3.295
Public transport	0.035	0.184	0.077	0.267
Animal and other transport	0.138	0.345	0.166	0.372
Transport on foot	0.827	0.380	0.756	0.429
Access to liquidity	0.707	0.455	0.686	0.464
Age	21.082	18.375	23.164	17.480
Age squared	782.097	1219.64	842.082	1209.93
Male	0.497	0.500	0.450	0.498
Household size	5.924	2.283	5.930	2.696
Married	0.325	0.468	0.258	0.437
Married*age	12.238	19.417	9.992	18.226
Primary education	0.032	0.177	0.360	0.480
House ownership	0.938	0.242	0.542	0.498
Low income (Benchmark)	0.251	0.434	0.152	0.359
Lower middle income	0.204	0.403	0.288	0.453
Middle income	0.128	0.334	0.451	0.498
High income	0.097	0.295	0.043	0.203
Number of cattle	4.400	9.173	1.265	16.877
Number of equines	1.047	13.837	0.333	10.535
Number of sheep	3.818	12.352	1.002	10.845
Service and sales			0.087	0.281
Agriculture	0.189	0.391		
Craft and trade			0.064	0.245
Plant and machine			0.012	0.110
Laborer	0.206	0.404	0.077	0.267
Young	0.343	0.394	0.230	0.421
Unemployed	0.227	0.419	0.459	0.498
Other occupation - rural	0.035	0.184		
Other occupation - urban			0.071	0.257
Unprotected water	0.798	0.402	0.065	0.247
Flush toilet	0.007	0.085	0.086	0.280
Pit-latrine toilet	0.108	0.311	0.699	0.459
Other (control)	0.884	0.320	0.215	0.411
Number of rooms	1.595	0.939	2.558	2.060
Kerosene	0.703	0.457	0.187	0.390
Electricity	0.015	0.120	0.789	0.408
Other lighting	0.282	0.450	0.024	0.154
Natural fuel	0.961	0.193	0.591	0.492
Other fuel	0.039	0.193	0.409	0.492
Living standard	0.413	0.492	0.318	0.466

Source: Computed from WMS-Ethiopia (2000).

[a] There are 24205 and 8428 observations for the rural and urban samples, respectively.

The other indicator of access to transport facilities whose effect we examine in our empirical models for healthcare utilization is the means of transport the household members usually use to travel to the healthcare centers. Apparently, the most common means of transport to the nearest health center is on foot almost 83% of the rural and 76% of the urban respondents stating it as the available means of transport. About 4% of the rural and 8% of the urban households stated that they use public transport to travel to the nearest health center. Other means of transport including animals and perhaps some private cars account for 14% of the rural and 17% of the urban means of traveling to a health center.

Another variable we focus on in our econometric analysis is an indicator for access to liquidity at the household level capturing the response to a question asking whether the household can raise at least 100 Birr within a week if needed. The proportion of households that positively responded to this question is roughly equal in rural and urban areas (71% for rural vs. 69% for urban) which is somewhat surprising given the general observation that financial services in developing countries are much more developed in urban areas than the rural areas. This also appears to be inconsistent with the information on income that shows much smaller proportion of urban respondents than rural respondents falling in the lowest income category (15% for urban vs. 25% for rural). However, it could mean that the rural residents are socially closer and ready to help each other than the urban residents. The results for the effects of these and a large set of control variables on healthcare usage and provider choice are presented in the next section.

6. Estimation Results

6.1. Treatment for illness

The first set of results we present in this section are for a probit model representing utilization of outside healthcare service by those people who reported an incidence of illness over the past two months at the time of the survey. We present results from four specifications. The base specification (Spec 1) controls for key access measures, demographic and socio-economic factors. Specification 2 adds livestock variables, while Spec 3 additionally includes occupational effects. To account for the possible influence of unobserved regional characteristics on our estimates, we have estimated the models both with

and without 'Killil'[8] fixed effects. Thus, Spec 4 includes the full set of controls, including Killil fixed effects. We have also corrected the standard errors for within household correlations since the household level characteristics are the same for the members of the same household. To avoid the potential selection bias that could arise because of common unobserved influences on the probability of reporting an illness and the probability of seeking treatment we use the Heckman-type maximum likelihood approach to jointly estimate the binary outcome illness equations and healthcare utilization equations.

Estimated average marginal effects for covariates in the treatment equations for the rural and urban samples are reported in Tables 5 and 6, respectively. We provide parameter estimates for selected treatment equations in Table A1 in the Appendix A.[9] Results from Wald test for independent equations (ρ = rho = 0) show evidence of selectivity for the rural results and urban results with Killil fixed effects (see bottom of Table A1). In addition, models with Killil fixed effects dominate those without Killil effects for rural and urban samples in terms of both Akaike Information Criterion (AIC) and Bayesian Information Criterion (BIC). Therefore, our discussion of the results mostly focuses on the estimates with Killil fixed effects.

Consistent with many other studies on healthcare utilization in developing countries reviewed previously, physical access to healthcare facilities seems to be an important determinant of seeking treatment for illness in rural but not in urban Ethiopia. Distance to the nearest health center has highly significant negative effect on the decision to seek treatment after falling ill in rural Ethiopia and the absolute magnitude of the coefficient actually increases, albeit slightly, when we control for Killil fixed effects. We observe the same pattern in the estimated coefficient of distance to all weather roads for the rural sample. While the coefficient of access to all weather roads is smaller in absolute magnitude it is negative and highly significant both with and without killil fixed effects. Availability of public transport to the nearest health center also has a significant positive effect on the decision to seek treatment. On the other hand, none of these measures of physical access to healthcare are significant in the urban healthcare utilization equations. This is not surprising given that physical access is less of an issue in urban areas compared to the demand side issues like affordability.

[8] ' Killil' refers to an administrative region in Ethiopia. There are 11 administrative regions including two city administrations (Addis Ababa and Dire Dawa). Killil 1 or Tigray is the excluded category.
[9] Results for the illness equation (akin to first stage estimates) are available from the authors.

Table 5: Average marginal effects of covariates on probability of seeking treatment for illness Probit model with selection (Rural, obs.= 83390)

Variable	Spec 1	Spec 2	Spec 3	Spec 4
Distance to health center/10	-0.0101***	-0.0095***	-0.0093***	-0.0114***
Distance to all weather road/10	-0.0050***	-0.0049***	-0.0049***	-0.0058***
Public transport	0.0245***	0.0243***	0.0220***	0.0204**
Animal plus other	-0.0277***	-0.0276***	-0.0300***	-0.0285***
Liquidity constraint	-0.0066*	-0.0059	-0.0054	0.0017
Age in years/10	-0.0057***	-0.0056***	0.0002	0.0001
Male	0.0060**	0.0061**	0.0032	0.0045
Household size/10	-0.0377***	-0.0360***	-0.0333***	-0.0380***
Married	0.0496***	0.0493***	0.0410***	0.0413***
Primary education	0.0372***	0.0372***	0.0327***	0.0298***
Lower-middle income	0.0203***	0.0205***	0.0215***	0.0197***
Middle income	0.0284***	0.0293***	0.0300***	0.0309***
High income	0.0415***	0.0426***	0.0423***	0.0450***
Living standard	0.0044	0.0046	0.0047	0.0080**
Age-squared and Age*Married	Yes	Yes	Yes	Yes
Livestock variables		Yes	Yes	Yes
occupation dummies			Yes	Yes
Killil effects				Yes
- Log likelihood	64344	64336	64194	63310
Degrees of freedom	40	46	54	74
AIC	128768	128765	128495	126769
BIC	129142	129194	12899	127460

*, **, and *** indicates that the average marginal effect is statistically significantly different from zero at the 10%, 5%, and 1% , respectively.

The statistics at the bottom of the table pertain to coefficient estimates from the seek treatment and illness equations.

The selection equation additionally includes the water, toilet, lighting and cooking variables identified in Table 1.

Table 6: Average marginal effects of covariates on probability of seeking treatment for illness Probit model with selection (Urban, obs.=38931)

Variable	Spec 1	Spec 2	Spec 3	Spec 4
Distance to health center/10	-0.017	-0.0169	-0.0178	-0.0083
Distance to all weather road/10	-0.0014	-0.0015	-0.002	0.004
Public transport	-0.0067	-0.0065	-0.0063	0.0111
Animal plus other	-0.0296	-0.0295	-0.032	-0.0123*
Liquidity constraint	0.0545***	0.0545***	0.0559**	0.0075
Age in years/10	-0.0143**	-0.0144**	-0.0187***	0.0220***
Male	0.0281***	0.0280***	0.0263***	-0.0098*
Household size/10	-0.0075	-0.0078	-0.0074	-0.0775***
Married	0.0328	0.0328	0.037	0.0493***
Primary education	0.0200***	0.0201***	0.0177**	-0.0008
Lower-middle income	0.0248	0.0248	0.0255	-0.0061
Middle income	0.0463*	0.0463*	0.0487*	0.0079
High income	0.0565*	0.0563*	0.0589*	0.0228
Living standard	-0.0222**	-0.0222**	-0.0225**	0.0046
Own house	0.0062	0.006	0.0071	-0.0042
Age-squared and Age*Married	Yes	Yes	Yes	Yes
Livestock variables		Yes	Yes	Yes
occupation dummies			Yes	Yes
Killil effects				Yes
- Log likelihood	24503	24501	24401	23752
Degrees of freedom	42	48	60	80
AIC	49090	49098	48922	47664
BIC	49450	49510	49436	48349

*, **, and *** indicates that the average marginal effect is statistically significantly different from zero at the 10%, 5%, and 1%, respectively.

The statistics at the bottom of the table pertain to coefficient estimates from the seek treatment and illness equations.

The selection equation additionally includes the water, toilet, lighting and cooking variables identified in Table 1.

One variable related to access to transport that appears to have statistically significant but somewhat counterintuitive sign both in rural and urban equations is the use of animal or other forms of transport. According to these results, those who have to use animals or other non-public means of transport are less likely to seek treatment for illness both in rural and urban areas compared to the benchmark category that have to walk to the healthcare centers. This result could be capturing the possibility that for these people the healthcare centers are too

inaccessible that they had to resort to animals and other forms of transport to get there. If they don't have sufficient access to these forms of transport, however, they may not be able to get to the healthcare centers even if they are sick and hence we may observe the negative relationship.

Overall, however, access to roads and public transport appears to significantly influence the utilization of healthcare in rural Ethiopia. While the average marginal effect of reducing the distance to all weather roads on the probability of seeking treatment is small in absolute magnitude (see Table 5), it is not substantially different from the average marginal effect of reducing the distance to the healthcare center. According to our estimates for the rural sample, reducing the distance to the nearest healthcare center by 1 kilometer increases the probability of seeking treatment for illness by 0.11% on average whereas reducing the distance to all weather roads by 1 kilometer increases the probability of seeking treatment by 0.06%. These estimated effects for the rural sample imply that, given the respective sample standard deviations of about 10 and 17 kilometers for distance to nearest health center and all weather roads, reducing either the distance to the nearest healthcare center by one standard deviation or distance to all weather roads by one standard deviation increases the probability of seeking treatment by about one percent, all else equal. Also, those who report they can use public transport to travel to the nearest healthcare center are at least 2% more likely to seek treatment for illness than those who have to walk.

These results indicate that there is some degree of substitutability between reducing the distance to healthcare facilities by building more or making the existing facilities more accessible by building road networks and making public transport accessible. Therefore, when policy makers operate with tight budget as in Ethiopia, they could reprioritize the budget so as to focus on building smaller number of healthcare facilities and save resources for building multi-purpose road networks and improve the quality of the existing healthcare facilities.

The other potentially critical issue for utilization of healthcare in developing countries could be access to finance at the time of need. While assets owned and reported monthly income could capture the overall resource profile of the household, they do not necessarily show that the household will have the necessary cash available to finance travel, accommodation and sometimes treatment costs of the emergency illnesses. We have estimated the effects of the indicators for both income and access to liquidity along with ownership of livestock assets and a house in the urban areas. While the effects of assets owned are generally insignificant in both rural and urban healthcare usage equations, the

probability of seeking treatment for illness appears to be increasing with rising income profile of the household in the rural areas. The results for urban residents are somewhat mixed, the statistical significance of the effect of income profile essentially vanishing when we control for Killil fixed effects except in the case of high income whose effect remains at least modestly significant even after we control for Killil fixed effects (see Table 6). Education that in some cases could be a better indicator of income than the reported income itself (because of the underreporting of income in household surveys) also has strong positive effect on the decision to seek treatment for illness, particularly for the rural sample.

On the other hand, the effects of our indicator for access to liquidity are mixed but it is interesting to note that access to liquidity appears to be somewhat more important for utilization of healthcare in urban areas than the rural areas. While the coefficient of access to quick cash is not statistically significant in the rural healthcare utilization equations it is significant and positive in the urban equations where we do not control for Killil fixed effects. This again may have to do with the possibility that the closer personal relationships among the rural residents make it easier for them to raise quick cash at the time of emergency than the urban areas. It could also be because the urban residents rely more on the private healthcare that could be afforded only when one has access to liquidity at the time of sickness. In fact, the results in the next sub-section as well as the descriptive evidence presented in Table 3 appear to support this later possibility. The information presented in Table 3 shows that almost three times more people rely on private healthcare in urban areas than the rural and the results presented in the next subsection show that the average marginal effect of access to liquidity on the usage of private healthcare is about five times larger in urban areas.

6.2 Healthcare provider choice

To analyze the effect of access to roads, means of transport and access to liquidity on the choice of healthcare provider, we estimate multinomial logit models including a similar set of explanatory variables we used in the binary choice probit model for the decision to seek treatment for illness. The available treatment options are classified into five categories consisting of self-care, government facilities, private facilities (including NGO facilities), pharmacy, and other facilities including traditional healers. Self-care (no outside treatment) is taken as the benchmark option. Since the magnitudes of the coefficient estimates from multinomial choice model do not tell much by themselves, our discussion here

focuses on the average marginal effects of our key variables of interest on provider choice.

The average marginal effects of the selected covariates on the choice among the five alternative treatment options are presented in Tables 7 and 8 for rural and urban samples, respectively.[10] Corroborating our findings from our binary choice models for seeking treatment for illness, the average marginal effects from multinomial logit models show that longer distance to health center and all weather roads both lead to higher probability that people in the rural areas will limit themselves to self-care option. Similarly, access to public transport significantly reduces the probability that sick people in the rural areas will opt for self-treatment. Distance to health center has a positive but weakly significant effect on the probability of self-care in urban areas as well. As opposed to our findings from the binary choice model, the average marginal effects from our multinomial models show that access to liquidity has strong negative effect on the choice of self-care both for urban and rural samples, the effect being more than three times stronger for the urban sample. Education and income also have significant negative effect on the probability of choosing self-care the effect in each case being slightly larger for the rural sample. Now, the question is, how do these measures of physical access and financial constraints influence the probability of choosing among alternative forms of outside treatments?

[10] The multinomial logit coefficient estimates with and without Killil fixed effects for both urban and rural samples are available from the authors. In each case, the model with Killil fixed effects dominates the version without killil effects in terms of both AIC and BIC..

Table 7: Average marginal effects of covariates on healthcare provider Choice Multinomial logit model (Rural, obs.=24205)

Choice/Variable	Spec 1	Spec 2	Spec 3	Spec 4
Self-care				
Distance to health center/10	0.0412***	0.0382***	0.0378***	0.0425***
Distance to all weather road/10	0.0189***	0.0184***	0.0182***	0.0185***
Public transport	-0.0924***	-0.0891***	-0.0881***	-0.0762***
Animal plus other	0.0933***	0.0909***	0.0904***	0.0840***
Liquidity constraint	-0.0192**	-0.0215**	-0.0212**	-0.0275***
Age in years/10	0.0201***	0.0196***	0.0337***	0.0320***
Male	-0.0496***	-0.0497***	-0.0310***	-0.0338***
Household size/10	-0.0262	-0.0332	-0.0417**	-0.0160
Married	-0.0743***	-0.0726***	-0.0663***	-0.0680***
Primary education	-0.1748***	-0.1727***	-0.1623***	-0.1318***
Lower-middle income	-0.0505***	-0.0515***	-0.0514***	-0.0502***
Middle income	-0.0863***	-0.0894***	-0.0892***	-0.0952***
High income	-0.1411***	-0.1456***	-0.1450***	-0.1436***
Living standard	0.0085	0.0069	0.0067	-0.0022
Public Facilities				
Distance to health center/10	-0.0417***	-0.0437***	-0.0436***	-0.0459***
Distance to all weather road/10	0.0006	0.0005	0.0005	-0.0015
Public transport	-0.0241	-0.0232	-0.024	-0.014
Animal plus other	-0.0890***	-0.0899***	-0.0896***	-0.0796***
Liquidity constraint	-0.0013	-0.0037	-0.0039	0.0077
Age in years/10	-0.0112***	-0.0115***	-0.0149***	-0.0148***
Male	0.0250***	0.0251***	0.0144**	0.0144**
Household size/10	-0.0068	-0.0131	-0.0096	-0.0155
Married	0.0401***	0.0409***	0.0364***	0.0390***
Primary education	0.1057***	0.1078***	0.1070***	0.0957***
Lower-middle income	0.0325***	0.0322***	0.0323***	0.0304***
Middle income	0.0463***	0.0440***	0.0444***	0.0467***
High income	0.0531***	0.0502***	0.0508***	0.0525***
Living standard	-0.0041	-0.0046	-0.0044	0.0017
Private Facilities (Including NGOs)				
Distance to health center/10	-0.0118***	-0.0103***	-0.0099***	-0.0107***
Distance to all weather road/10	-0.0071***	-0.0070***	-0.0068***	-0.0055**
Public transport	0.0808***	0.0798***	0.0789***	0.0615***
Animal plus other	-0.0138**	-0.0132**	-0.0133**	-0.0151**
Liquidity constraint	0.0124**	0.0141***	0.0142***	0.0117**
Age in years/10	-0.003	-0.0027	-0.0060**	-0.0051**
Male	0.0082**	0.0082**	0.0069*	0.0080**
Household size/10	0.0230**	0.0281***	0.0294***	0.0188*
Married	0.0126*	0.0120*	0.0115*	0.0108*
Primary education	0.0481***	0.0464***	0.0388***	0.0274***
Lower-middle income	0.0097*	0.0098*	0.0095*	0.0101**
Middle income	0.0254***	0.0272***	0.0265***	0.0288***
High income	0.0485***	0.0504***	0.0496***	0.0482***
Living standard	0.0034	0.0039	0.004	0.0066

Choice/Variable	Spec 1	Spec 2	Spec 3	Spec 4
Pharmacy				
Distance to health center/10	0.0058**	0.0073***	0.0071**	0.0052*
Distance to all weather road/10	-0.0085***	-0.0082***	-0.0082***	-0.0090***
Public transport	0.0243*	0.0231*	0.0236*	0.0244*
Animal plus other	0.0044	0.005	0.0051	0.005
Liquidity constraint	0.0017	0.0027	0.0026	0.0043
Age in years/10	-0.0030*	-0.0027*	-0.0037	-0.0037
Male	0.0104***	0.0104***	0.0081**	0.0085**
Household size/10	0.0163	0.0183*	0.0198*	0.0166*
Married	0.0135*	0.0127*	0.0125*	0.0130*
Primary education	0.0074	0.0066	0.0075	0.0036
Lower-middle income	0.0157***	0.0160***	0.0161***	0.0152***
Middle income	0.0138**	0.0152**	0.0155**	0.0152**
High income	0.0209***	0.0216***	0.0216***	0.0195**
Living standard	-0.0092**	-0.0086*	-0.0087**	-0.0087**
Other Sources (Including Traditional Care)				
Distance to health center/10	0.0064***	0.0086***	0.0086***	0.0089***
Distance to all weather road/10	-0.0039**	-0.0037**	-0.0036**	-0.0025
Public transport	0.0113	0.0095	0.0096	0.0043
Animal plus other	0.0051	0.0073	0.0074	0.0057
Liquidity constraint	0.0064	0.0084*	0.0083*	0.0038
Age in years/10	-0.0030*	-0.0027	-0.0091***	-0.0083***
Male	0.0060*	0.0061*	0.0017	0.003
Household size/10	-0.0063	-0.0001	0.0021	-0.0039
Married	0.008	0.007	0.0059	0.0052
Primary education	0.0137	0.012	0.009	0.0051
Lower-middle income	-0.0073	-0.0064	-0.0065	-0.0054
Middle income	0.0007	0.003	0.0029	0.0045
High income	0.0188**	0.0234**	0.0230**	0.0234**
Living standard	0.0014	0.0024	0.0024	0.0025
Other controls used in all regressions				
Age-squared and Age*Married	Yes	Yes	Yes	Yes
Livestock variables		Yes	Yes	Yes
occupation dummies			Yes	Yes
Killil effects				Yes
- Log likelihood	27370	27323	27278	26565
Degrees of freedom	72	84	100	140
AIC	54884	54814	54756	53411
BIC	55467	55494	55566	54544

*, **, and *** indicates that the average marginal effect is statistically significantly different from zero at the 10%, 5%, and 1%, respectively.
The statistics at the bottom of the table pertain to coefficient estimates from multinomial logit regressions.

Table 8: Average marginal effects of covariates on healthcare provider choice Multinomial logit model (Urban, obs.=8428)

Choice/Variable	Spec 1	Spec 2	Spec 3	Spec 4
Self-care				
Distance to health center/10	0.0927*	0.0922*	0.0905*	0.0717*
Distance to all weather road/10	-0.0048	-0.0047	-0.0028	0.0043
Public transport	0.0134	0.0132	0.0119	-0.0411*
Animal plus other	0.0672***	0.0670***	0.0669***	0.0360**
Liquidity constraint	-0.0879***	-0.0880***	-0.0844***	-0.0762***
Age in years/10	0.0244***	0.0245***	0.0185***	0.0098*
Male	-0.0450***	-0.0450***	-0.0377***	-0.0328***
Household size/10	0.0694**	0.0703**	0.0618**	0.0559**
Married	-0.1003***	-0.1004***	-0.0940***	-0.0775***
Primary education	-0.012	-0.0122	-0.0156	-0.0377***
Lower-middle income	-0.0319	-0.0318	-0.031	-0.0367
Middle income	-0.0785***	-0.0787***	-0.0779***	-0.0768***
High income	-0.1062***	-0.1060***	-0.1031***	-0.0992***
Living standard	0.0316**	0.0316**	0.0302**	0.0298**
Own house	-0.0238*	-0.0235*	-0.0243*	0.0142
Public Facilities				
Distance to health center/10	-0.0593	-0.059	-0.0591	-0.031
Distance to all weather road/10	0.0102	0.01	0.0087	0.0122
Public transport	-0.0237	-0.0236	-0.0233	0.0285
Animal plus other	-0.1056***	-0.1055***	-0.1039***	-0.0633***
Liquidity constraint	0.0198	0.0198	0.0171	0.0115
Age in years/10	-0.0224***	-0.0225***	-0.0136**	-0.0042
Male	0.0206*	0.0205*	0.0190*	0.0129
Household size/10	-0.0422	-0.0433	-0.04	-0.0126
Married	0.0676***	0.0677***	0.0660***	0.0453**
Primary education	-0.0155	-0.0151	-0.015	0.013
Lower-middle income	-0.0008	-0.001	-0.0017	0.0051
Middle income	0.0149	0.015	0.0131	0.0063
High income	0.0114	0.0111	0.0076	-0.008
Living standard	-0.016	-0.016	-0.0151	-0.0124
Own house	0.0178	0.0173	0.0164	-0.0256*
Private Facilities (Including NGOs)				
Distance to health center/10	-0.0787**	-0.0783*	-0.0774*	-0.0780**
Distance to all weather road/10	0.0013	0.0012	0.0015	-0.0012
Public transport	0.0419*	0.0423*	0.0431*	0.0346
Animal plus other	0.0323**	0.0325**	0.0319**	0.0224
Liquidity constraint	0.0613***	0.0611***	0.0609***	0.0584***
Age in years/10	0.0059	0.0059	0.005	0.002
Male	0.0026	0.0025	0.0022	0.0038
Household size/10	-0.0178	-0.0179	-0.0179	-0.0301
Married	-0.0119	-0.0119	-0.0125	-0.0034
Primary education	0.0302***	0.0303***	0.0318***	0.0239**
Lower-middle income	0.0212	0.0211	0.0211	0.0225
Middle income	0.0482**	0.0480**	0.0487**	0.0509**
High income	0.0929***	0.0928***	0.0931***	0.0986***
Living standard	-0.0306***	-0.0304***	-0.0305***	-0.0294***
Own house	-0.0107	-0.0109	-0.0105	-0.0025

Choice/Variable	Spec 1	Spec 2	Spec 3	Spec 4
Pharmacy				
Distance to health center/10	0.0068	0.0068	0.0078	0.0018
Distance to all weather road/10	-0.0072	-0.0072	-0.0079	-0.0142
Public transport	-0.0314***	-0.0315***	-0.0315***	-0.0158
Animal plus other	-0.0411***	-0.0411***	-0.0412***	-0.0293***
Liquidity constraint	-0.0066	-0.0064	-0.0067	-0.0065
Age in years/10	-0.0059**	-0.0059**	-0.0081**	-0.0025
Male	0.0075	0.0076	0.0049	0.0039
Household size/10	0.0182	0.0183	0.022	0.0209
Married	0.0254*	0.0255*	0.0231*	0.0087
Primary education	-0.0128*	-0.0129*	-0.012	-0.006
Lower-middle income	0.0164	0.0167	0.0167	0.016
Middle income	0.0057	0.006	0.0062	0.0113
High income	0.0036	0.0036	0.0045	0.0109
Living standard	0.0150*	0.0149*	0.0151*	0.0126
Own house	0.0227***	0.0229***	0.0234***	0.0118
Other sources (Including Traditional Care)				
Distance to health center/10	0.0384***	0.0383***	0.0381***	0.0354***
Distance to all weather road/10	0.0006	0.0007	0.0005	-0.0011
Public transport	-0.0002	-0.0004	-0.0002	-0.0062
Animal plus other	0.0473***	0.0471***	0.0464***	0.0341***
Liquidity constraint	0.0134*	0.0135*	0.0131*	0.0128*
Age in years/10	-0.0019	-0.0019	-0.0018	-0.005
Male	0.0142**	0.0143**	0.0116**	0.0122**
Household size/10	-0.0275*	-0.0272	-0.0259	-0.0341**
Married	0.0192**	0.0192**	0.0174*	0.0268**
Primary education	0.01	0.01	0.0108	0.0068
Lower-middle income	-0.0049	-0.005	-0.005	-0.0069
Middle income	0.0097	0.0098	0.0099	0.0082
High income	-0.0017	-0.0016	-0.0021	-0.0024
Living standard	0	-0.0001	0.0003	-0.0006
Own house	-0.006	-0.0057	-0.0049	0.0022
Other controls used in all regressions				
Age-squared and Age*Married	Yes	Yes	Yes	Yes
Livestock variables		Yes	Yes	Yes
occupation dummies			Yes	Yes
Killil effects				Yes
- Log likelihood	11501	11498	11475	11039
Degrees of freedom	76	88	112	152
AIC	23154	23173	23174	22382
BIC	23689	23791	23962	23452

*, **, and *** indicates that the average marginal effect is statistically significantly different from zero at the 10%, 5%, and 1%, respectively.

The statistics at the bottom of the table pertain to coefficient estimates from multinomial logit regressions.

Consistent with the findings in many other empirical studies of provider choice in developing countries, our results show that distance to health center has statistically strong negative effect on the utilization of both private and public healthcare facilities by the rural residents, its effect being much larger in the case of public facilities. Distance to health center also appears to have a modestly significant negative effect on the utilization of private facilities by the urban residents. It also appears that distance to health center encourages people to resort to other sources of treatment including traditional care. The marginal effect of distance to health center on other sources of healthcare is consistently positive and strongly significant both for the rural and urban samples. It is not surprising that people may resort to traditional and other forms of informal care when the formal sources are inaccessible.

On the other hand, according to these results neither the distance to all weather roads nor access to public transport has significant effect on the utilization of public health care facilities. However, both have statistically strong effect on the utilization of private healthcare facilities by the rural residents. For example, the results indicate that availability of public transport to the rural residents may increase the probability of seeking treatment in a private facility by 6% to 8%. These findings are consistent with the fact that private facilities are almost exclusively located in urban areas and the rural residents can only make effective use of these facilities if they have accessible roads and means of transport.

Access to liquidity has strong positive effect on the probability of choice of private facilities for both the rural and urban samples the magnitude of the effect being much larger for the urban sample (1.2% in the rural vs. 5.8% in the urban areas). On the other hand, the probability of utilization of public facilities is not significantly affected by household's ability to raise quick cash when needed. This is consistent with the fact that public healthcare is generally provided free of charge or at low cost while only money can buy the private health care services. However, this is not fully supported by our findings about the effects of income and education both of which could be considered as measures of the overall financial capability of the household although they may not be sources of quick liquidity.

According to our results education has significant positive effect on the probability of choosing public facilities only among the rural residents while it significantly affects the probability of choosing private facilities both by the rural and urban residents. In fact, for the rural sample the effect of education on the probability of using public facilities is more than three times larger than its effect

on the probability of using private facilities. This may indicate that the effect of education on healthcare utilization comes largely through its effect on health awareness rather than its effect on financial capability. The effect of income follows similar pattern to that of education. It has significant positive effect on the probability of utilization of private facilities by both urban and rural residents whereas it has significant effect on the usage of public facilities only for the rural sample.

In general, for public facilities, physical presence rather than transport facilities or access to finance seem to be more important whereas for private facilities both means of transport and access to liquidity seem to be important. On the basis of these results, therefore, expanding transport facilities (along perhaps with financial services) will facilitate increasing exposure of both the rural and urban residents to private healthcare options. While private healthcare is generally expensive and could be unaffordable for most people in Ethiopia, making it more physically accessible to those who can afford it could help the government release some resources for improvement in the quality of the existing public healthcare facilities and expansion of transport facilities.

7. Conclusion

This paper examines the effect of access to roads, transport and liquidity on seeking treatment for illness and health care provider choice in urban and rural Ethiopia. We estimate selection probit models for seeking treatment for illness and multinomial logit models for healthcare provider choice controlling for a large set of individual and household characteristics. Our analysis is based on a large data set from a nationally representative sample of households.

Our results from the selection probit models indicate that access to roads and public transport are important determinants of the decision to seek treatment for illness by the rural residents but not for the urban residents. According to our estimates for the rural sample, reducing the distance to the nearest all weather road by one kilometer increases the probability of seeking treatment for illness by 0.06%. Also, those who report they can use public transport to travel to the nearest healthcare center are at least 2% more likely to seek treatment for illness than those who have to walk. We do not find strong evidence that liquidity constraint is a major factor influencing the decision to seek treatment, particularly in rural areas. This makes sense in a country where healthcare is largely provided by the state free of charge or at nominal charges. On the other hand, results from

multinomial logit models for healthcare provider choice indicate that distance to all weather road, access to public transport and access to liquidity have stronger effect on the utilization of private facilities than public facilities. These results are consistent with the fact that private healthcare facilities are almost exclusively urban-based and are mostly utilized by those who have access to transport and liquidity.

The results imply that it may be possible to improve healthcare utilization not only by focusing on expanding healthcare facilities in the rural areas but by expanding the road networks as well. The significance of distance to all weather roads is appealing in terms of policy design because it implies that construction of road networks can compensate for the absence of healthcare facilities in the proximity. This may help the policy makers to reprioritize the budget so as to focus more on improving the quality of the healthcare facilities and expansion of road networks (since roads are needed for non-health aspects of well-being as well) by scaling back the construction of new healthcare facilities. This is particularly relevant in Ethiopian context where the government has been focusing on building large number of public healthcare centers and health posts (MOH, 2010) but the quality of the facilities is quite low both in terms of human resources, equipment and medical supplies. Expansion of road networks will also enhance the utilization of private healthcare by the rural residents encouraging the later to take a more significant role in the provision of healthcare services in the country.

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Table A1: Parameter estimates from probit model with binary selection for seeking treatment

Variables	Rural (83390 obs.)		Urban (38931 obs.)	
	Spec3	Spec4	Spec3	Spec4
Distance to health center/10	-0.0477***	-0.0584***	-0.0932	-0.0342
	(0.011)	(0.011)	(0.065)	(0.039)
Distance to all weather road/10	-0.0248***	-0.0299***	-0.0105	0.0165
	(0.006)	(0.006)	(0.039)	(0.032)
Public transport	0.1124***	0.1046**	-0.0337	0.0457
	(0.039)	(0.043)	(0.076)	(0.041)
Animal plus other	-0.1531***	-0.1466***	-0.1588***	-0.0507***
	(0.025)	(0.026)	(0.056)	(0.027)
Liquidity constraint	-0.0276	0.0087	0.2776***	0.0309
	(0.018)	(0.019)	(0.043)	(0.037)
Age in years/10	-0.0482**	-0.0507**	-0.1072***	0.0823***
	(0.019)	(0.020)	(0.041)	(0.030)
Age-squared/100	0.0105***	0.0109***	0.0041	0.0026
	(0.002)	(0.002)	(0.005)	(0.003)
Male	0.0166	0.0229	0.1395***	-0.0405
	(0.014)	(0.015)	(0.030)	(0.025)
Household size/10	-0.1700***	-0.1954***	-0.0391	-0.3200***
	(0.040)	(0.040)	(0.120)	(0.052)
Married	0.2093***	0.2122***	0.3358**	0.2415***
	(0.038)	(0.040)	(0.138)	(0.065)
Married*Age/10	0.0038	0.0048	-0.0466**	-0.0152
	(0.009)	(0.010)	(0.023)	(0.014)
Primary education	0.1670***	0.1531***	0.0946**	-0.0034
	(0.041)	(0.044)	(0.043)	(0.029)
Lower-middle income	0.1099***	0.1012***	0.1124***	-0.0250
	(0.022)	(0.022)	(0.067)	(0.050)
Middle income	0.1533***	0.1587***	0.2277***	0.0325
	(0.024)	(0.026)	(0.068)	(0.051)
High income	0.2160***	0.2311***	0.2834***	0.0943***
	(0.031)	(0.034)	(0.080)	(0.056)
Living standard	0.0242	0.0413**	-0.1154***	0.0190
	(0.017)	(0.017)	(0.040)	(0.027)
Own house			0.0372	-0.0174
			(0.044)	(0.025)
Livestock variables	Yes	Yes	Yes	Yes
Occupation dummies	Yes	Yes	Yes	Yes
Killil effects		Yes		Yes
Rho	0.940	.923	-0.537	.943
P-value for testing rho = 0	<0.0001	<0.0001	<0.164	<0.0001
-Log likelihood	64194	63311	24401	23752
Degrees of freedom	54	74	60	80
AIC	83390	83390	38931	38931
BIC	64194	63311	24401	23752

Cluster-robust standard errors are shown within parenthesis.

*, **, and *** indicates that the average marginal effect is statistically significantly different from zero at the 10%, 5%, and 1%, respectively.

The binary illness status selection equation (estimates not shown) additionally controls for the water, toilet, lighting and cooking variables identified in Table 1.