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CURATIVE HEALTH CARE UTILIZATION IN GHANA
A multinomial analysis of equitable access opportunities

by

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Abstract

In this paper we provide an overview of the curative health care system in Ghana, discuss the determinants of its utilization, and simulate utilization patterns under alternative access policies. The figures point to two major challenges to improve access, viz. the geographical coverage of health facilities and health workers, and the financing of necessary health care of the poor. Ghana has a fair number of facilities (about 1 per 10,000 inhabitants and per 140 km2) but doctors are scarce (about 1 per 11,000 inhabitants) and both are highly unevenly spread in favor of urbanized regions. Almost one third of the population lives outside a 5-km radius of medical assistants and nurses, while one quarter is more than 15 km away from a doctor, who is the preferred health care provider when available. Moreover, the private cost of consultation and treatment is significant and shows large variation, restricting access to necessary health care for the poor. We use multinominal logit and probit techniques to explore opportunities to improve access. Simulations show positive, but modest, effects of reducing the distance to orthodox facilities in rural area and of replacing part of the private cost by national health insurance with income dependent premium. Thus, at the current stage of development, the provision of adequate health care at affordable prices to all remains a formidable challenge.

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Section 1
Introduction

The health of the people is very important for a country and its government because of the direct and indirect relationships that exist between health, productivity and equitable development. Ghana, after independence, has implemented several policies aimed at improving the health status of the population. The seven-year and five-year development plans, as well as various programs and projects in the 1980s and 1990s contained policies to reduce the economic burden of disease, with a focus on the morbidity, mortality and malnutrition among children. In particular, the economic reforms and structural adjustment programs that have been pursued since 1983 have been accompanied by social reforms in the health sector. These reforms put more emphasis on primary health care, considered health policy in a holistic manner, and stressed the importance of prevention. The Government of Ghana embarked on a health sector reform in the early 1990s to improve the accessibility and quality of services, and to promote equitable access. The new Health Service Act (525) of 1996 and the current Medium Term Health Strategy based on the Vision 2020 program are further geared towards an efficient health delivery system in order to improve the health of all Ghanaians.

Notwithstanding the reforms and despite positive trends in several health indicators, the health situation in Ghana has remained unsatisfactory. For example, since independence the mortality rate of children under 5 years has successfully been reduced from 215 per 1000 in 1960 to 157 in 1980 and further to 109 in 1999 (World Bank, 2001). Likewise, live expectancy at birth has increased from 45 years in 1960 to 53 in 1980 and further to 58 in 1999. However, these recent figures still reflect poor average health conditions in the country.

When the situation is compared to the health targets of the Medium Term Health Strategy (World Bank, 1997), it appears that the success is mixed. Some targets remain far-off (e.g., the maternal mortality rate of 210 per 100,000 live birth in 1998 was still more than double the targeted level of 100 in 2001), others are fairly well met (e.g., the targeted child mortality rate and life expectancy are 100, and 60, respectively), and, finally, some are even surpassed (e.g., in 1998 five percent of the young children was severely malnourished against a targeted level of 8 percent, GSS and MI, 1999).

Ghana, like most developing countries, wants to move to better and more efficient health care utilization. An extensive literature exists on whether and how this could be achieved (Culyer and Newhouse, 2000). A major issue is how to take advantage of the allocative efficiency of markets through competition in the health sector. In developing countries the efficiency of health care markets is typically hampered by several factors, including the insufficient popular knowledge on health and on the effectiveness of health care, and the external effects of communicable, often endemic diseases. Furthermore, competition in health care markets is hindered by set-up costs in both the education of health professionals such as doctors and nurses, and the construction of hospitals, clinics (esp. in rural areas), and health infrastructure for safe drinking water and sanitation. In addition, health care insurance on a scale much larger than the extended family is practically absent, which adds to problems of efficient health care provision.

Thus, Government action seems necessary to improve efficiency in the supply of health information, infrastructure, health care and health insurance. Appropriate policies could also promote equity through better access to health infrastructure, better access to health care in rural areas and extended insurance options for unexpected large health care expenses to all.

To foster the health of its population, Ghana has set up an extensive network of public health care facilities (hospitals, clinics, health centers etc.) offering subsidized health care to the general public. In this way the public sector supplies both health care as well as health insurance in kind. Yet, the current public health care system still has a bias towards hospitals in urban areas supplying curative care, and puts less emphasis on basic health care in rural areas and on prevention (Canagarajah and Ye, 2001). In the past decade local communities have become more involved in health programs through direct provision of services to their members as well as through prevention and health promotion initiatives. Notwithstanding these efforts, many rural communities in Ghana still experience high levels of morbidity and mortality due to lack of access to and poor utilization of health services, poor coverage of child welfare services and lack of technical support for initiating their own health programs (Obuobi and Ahmad, 1998). In addition to supplying subsidized public health care, the Government of Ghana has realized the importance of health education and adequate insurance for an efficient and equitable access to health care. It has therefore implemented a School Health Education Program (SHEP) and is currently exploring the possibilities of a National Health Insurance Scheme (NHIS).

The health care delivery system in Ghana continues to face major challenges. These include the inadequacy and lack of quality of health facilities and health personnel, the limited supply of essential drugs, the unsanitary environment, and the under-utilization of services due to insufficient knowledge, poverty and high costs for households.

To reduce the financial burden of the Government, Ghana has in 1985 introduced user charges for health care services and full cost recovery for drugs, popularly known as the 'Cash and Carry' system. These cost-sharing measures, consistent with the Bamako Initiative (Ofori-Adjei, 1990), has increased the availability of medicines and probably removed some apparent inefficiencies, in particular those related with well-known moral hazard problems of excess demand for highly subsidized care. At the same time, however, they also made orthodox health care financially less accessible for the very poor. As a consequence, new types of behavior and health practices have emerged such as delays in seeking care, part purchase and sharing of prescribed drugs, self-medication by way of using other left over drugs (Asenso-Okyere et al., 1998).

In the above perspective it is important to identify opportunities for an efficient and equitable increase of health care utilization in Ghana, especially in the poorer segments of the population. The current paper wants to contribute to this by the presentation of recent data on the supply and demand of curative health care, and by an empirical exploration of the opportunities for a more equitable access to health care.

The paper is structured as follows. In section 2 we give a brief description of the health care system in Ghana, and present information on the utilization of its different elements. Subsequently, in section 3 we present a discrete choice based utility model to explain the choice of health care provider from the characteristics of both the provider and the client. The data and results are discussed in section 4. Special attention is given to constraints related to equitable access to health care providers, and cost recovery through public and private means

of financing and insurance. In particular, we present three simulations, one that reduces the distance to orthodox health care providers, one that replaces part of the private cost by a national health insurance with income dependent premium, and one that combines these two. The final section concludes and puts the results in a policy perspective.

Section 2
Curative health care in Ghana: overview of characteristics and utilization

2.1 Characteristics of the health care system

The health care system in Ghana consists of two types of providers, which are here referred to as orthodox and traditional. Orthodox providers have had a formal training in mainstream health care practices as officially taught at universities, are typically clinic or hospital based and prescribe modern medicines. Traditional providers derive their skills from tradition and informal training and, with few exceptions, do their work at their own or the client's home. Their treatment usually takes the form of herbs, plant preparations, and prayers, though it is not uncommon to supplement traditional medication with modern medicines. Table 1 lists the various health care providers in Ghana.

Table 1. Overview of health care providers in Ghana

Type of provider	Provider
Orthodox (formal training; clinic/hospital based; modern medicines)	Doctor Dentist Pharmacist Medical assistant Nurse Midwife
Traditional (traditional informal training; outside clinics; traditional medication)	Herbalist Spiritualist Fetish priest Traditional birth assistant Unsupervised druggist

The orthodox health care comprises the Government health system, as well as NGO's such as the mission, and private for-profit medical practitioners. The Government is currently the main provider of health care services, followed in importance by the mission and then the private for-profit practitioners. The Government health care facilities can be distinguished in four layers depending on the amenities available at the facility: village or community health posts, district clinics, regional hospitals and the two teaching hospitals. The village health posts predominantly provide preventive and primary health care services, while the hospitals are the main providers of curative tertiary health care. In between, the clinics provide a mixture of preventive and curative care and use the regional hospitals for referrals. The regional and the teaching hospitals are usually perceived to be the providers of higher and highest quality respectively. The village posts are staffed by nurses and/or midwifes. Clinics also have medical assistants, urban clinics and hospitals usually also have doctors, while medical specialists work in hospitals only (Agyepong, 1999).

Modern medicines are sold at pharmacies and by licensed chemical sellers who sell over-the-counter medication and other non-prescription drugs. Unlike pharmacists, the

chemical sellers are not professionally trained and are supposed to be supervised by pharmacists from the Pharmacy Council. It is estimated that there are a total of about 1100 pharmacists and 6,000 licensed chemical sellers in the country (Nsowah-Nuamah et al., 2000).

The wide range of traditional practitioners is shown in table 2 (Anyinam, 1991; Obuobi and Ahmad, 1998). They include pure herbalists applying preparations from leaves, roots, barks and other parts of plants, naturopaths and homeopaths, Moslem Mallams and priests, who employ divination, and spiritualists using ritual manipulation in their healing. Unlicensed druggists and traditional birth assistants are also part of the traditional system, as well as a range of other specialized traditional practitioners.

Table 2. Traditional health care providers in Ghana

Practitioner	Activity
Herbalists	Persons versed in the knowledge of herbs and other natural products and their medical uses.
Herbalists-cum-occultists	Herbalists also indulging in occultism in their dealings with patrons.
Neo-herbalist	Herbalists with some education who operate in the urban areas.
Priests, Moslem Mallams, spiritualists	Persons attached to a mosque, church or shrine of a minor deity who act as a medium or messenger for the deity.
Traditional Birth Assistants	Usually old illiterate women (occasionally men) in a community with experience in conducting child birth.
Unsupervised druggists, medicine peddlers	Persons selling modern medicines without mediation of an modern practitioner.
Other unorthodox practitioners	E.g. Bone setters who specialize in fractures, using herbs and other natural products; traditional male circumcisers (Wanzams); charlatans healing through various ways.

Frequently, when ill, Ghanaians also apply self-medication rather than consult a health care provider. This can take two forms. The patient may go to a drug store or a drug peddler and without a prescription from authorized health personnel, buy drugs on the advice from the operators whose knowledge about disease treatment is sometimes questionable (UNICEF, 2000). The other form of self-medication is self-prescription, where the patient buys drugs or herbs on self-advice to treat a particular disease. After the introduction of the payment of user fees for treatment and drugs in 1985, self-medication has become more popular among the entire populace in Ghana as a means to economize on consultation fees and transport costs to health care facilities (Asenso-Okyere et al., 1998). Despite the lack of professional consultation, self-medication for well-known diseases such as malaria can be appropriate.

Not all regions of Ghana are evenly well covered by orthodox health care. Table 3 shows that Greater Accra, Ashanti region and Volta region seem best served. Many health facilities are located in these regions, and also compared to their population size and area they are relatively better off. Least covered by the orthodox health care system in Ghana are the three northern regions, Northern, Upper West and Upper East. Especially the thinly populated Northern region has the highest population per facility or public doctor, and the highest area per facility. This low supply level of health care facilities is also not compensated by an extra large number of outreach sites per facility.

Table 3. Health infrastructure in Ghana by region, 1999

	Hospitals	Clinics and Health centers	Outreach site per facility	Population per facility	Area per facility (km^2)	Population per public doctor*
Western	20	180	6	10,000	143	25,600
Central	15	104	17	15,400	107	32,200
Greater Accra	13	249	21	11,900	50	6,200
Eastern	26	128	10	19,800	168	31,500
Volta	27	450	8	3,500	47	22,100
Ashanti	65	226	6	14,200	138	11,500
Brong Ahafo	24	179	6	10,300	244	25,700
Northern	14	116	11	17,400	524	42,200
Upper West	5	51	14	12,900	105	35,900
Upper East	6	75	5	15,600	184	38,200
Ghana	215	1758	9	11,000	142	15,800

*Doctors working in the public health care system provide some 70 per cent of doctor's consultations. Thus, including private doctors, the population per doctor is probably some 30 per cent lower.
Source : MOH (1999), Canagarajah and Ye (2001), GSS (2001) and own calculations

2.2 Incidence of illness and use of health care

According to the Ghana Living Standards Survey 1998/99, a representative survey among over 25 thousand Ghanaians, in a fortnight period almost one quarter of the population falls ill or suffers from injury, see table 4. The data further indicate that the illness rate is highest in the rural areas of the forest zone, and lowest in the city of Accra.

Table 4. Prevalence of illness and injury, and their severity, Ghana, 1998/99, by locality

	Percentage ill or injured during last two weeks	Percentage of ill or injured that stopped usual activities
Accra	17	68
Other urban	26	62
Rural coastal	26	63
Rural forest	30	66
Rural savannah	24	56
Ghana	26	63

Source: derived from GLSS-4

About two-thirds of the ill or injured stop their usual activities due to their health condition. Furthermore, the average length of a morbidity spell among ill adults is more than 5 days indicating that income reduction due to illness can be considerable (see also Schultz and Tansel, 1997). Remarkably, in the rural savannah area, which comprises the three northern regions with relatively low supply of health care, illness prevalence seems somewhat lower than average, while also a greater share of the ill or injured continued their usual activities**.**

The major cause of illness reported at the public health facilities is malaria, as shown in table 5. Other infectious diseases and injuries are also major health problems in Ghana.

Table 5. Incidence of illnesses and injuries reported at public health facilities (percent, Ghana, 1994)

Incidence of illness	22.4
– Malaria	14.6
– Upper Respiratory Tract Infections	3.0
– Diarrhoea	1.9
– Skin diseases	1.8
– Intestinal worms	1.1
Involved in accidents	1.7

Source: Word Bank (1997)

The health care utilization by the ill and injured people is summarized in table 6. The last column indicates that when suffering from illness, eight percent of the population neither consults a health care provider nor buys any medicine. The figures further show that self-medication is nowadays by far the most common form in Ghana to cope with illness or injury. As much as half of the ill buys medicines without consulting a health care provider. In particular, in case of the most prevalent disease malaria, many people recognize the symptoms and buy medicines without prescription. In rural areas self-medication is more often chosen than in urban areas, probably because access to health care is more problematic.

Table 6. Health care utilization by ill or injured people (percent, Ghana, 1998/99)

	Urban		Rural		
Treatment	Stopped*	Continued	Stopped	Continued	All
No treatment	4.3	11.1	6.6	11.4	7.9
Self medication	31.4	57.0	45.4	62.9	48.6
Consulted health care provider	64.3	31.9	48.0	25.7	43.5
- Doctor	43.9	16.8	18.6	6.8	20.1
- Medical assistant	3.9	2.6	11.5	6.4	7.7
- Pharmacist	4.6	5.4	0.9	0.5	2.1
- Nurse	5.7	3.5	9.3	4.8	6.8
- Midwife	1.3	0.4	0.9	0.5	0.8
- Traditional or other health provider	5.0	3.2	6.8	6.6	6.0
	100	100	100	100	100

*Stopped=persons who stopped usual activities during illness or injury; Continued=persons who continued usual activities.

Source: Computed from GLSS-4 (N= 6621 persons ill or injured of total sample of 25581).

Another salient feature of the health care utilization is the modest role of the traditional health care providers. Traditional providers are consulted by at most 14 per cent of the persons who consulted a health care provider. However, due to the activities of unlicensed druggists and medicine peddlers, also part of those who chose self-medication may not be covered by orthodox health care. Of the orthodox health care providers, doctors are most often consulted, and in particular in urban areas they provide half or more of the consultations.

The differences in behavior between those who could continue their usual activities and those who had to stop these due to their illness are also remarkable. Consultations are much more common in the latter group, especially in urban area where almost two thirds consult a health care provider (as compared to less than one third of the persons who could continue their usual activities). In addition, those who stopped their activities have a much higher

propensity to consult a doctor rather than other providers, and, again this difference is particularly significant in urban area. Conversely, those who were ill and continued their usual activities are more involved in self-medication and about 11 per cent report no treatment at all for their illness, both in rural and in urban area.

The apparent differences in health care utilization suggest that a client's consultation behavior depends on the severity of the illness, and on differences in health care supply. For example, in urban areas, three quarters of the consultations is with a doctor or pharmacist, rather than with another provider. As doctors and pharmacists are much more often posted in urban area, the lower consultation rates in rural area probably reflects their unavailability. Accordingly, medical assistants, nurses, and traditional providers are more often consulted in rural areas. Yet, as regards traditional healers, the distance to a doctor seems not the only reason for their consultation. Traditional health care is also not uncommon in urban areas, where practically everyone lives within one hour travel from a doctor (GSS, 1998).

A little more than half of the health care consultations took place in public health facilities, as shown in table 7. In particular, the majority of doctors, medical assistants and nurses are consulted in public health facilities, though the share of the private sector is also considerable. From the last three columns of the table it appears that at the time of the survey 80 percent of the consultations took place in a hospital or clinic. The others seeking a health consultation went to a variety of other facilities, most notably the maternity health centers (for consulting midwifes) and the private homes of traditional healers and their clients.

Table 7. Characteristics of place of consultation (percent, Ghana, 1998/99)

Health care provider	Public	Private	Hospital	Clinic	Other facility
- Doctor	71	29	67	32	2
- Medical assistant	58	42	6	77	17
- Pharmacist	4	96	0	95*	5
- Nurse	55	45	12	73	15
- Midwife	30	70	17	39	43
- Traditional practitioner	2	98	0	4	96
Average, all consultations	53	47	35	45	20

* Pharmacy

Source: Computed from GLSS-4 (total sample N= 2877 consultations)

Consulting a doctor takes on average 4 hours including travel time, see table 8. This is considerably longer than the average time spent for consulting another health provider. Apparently Ghanaians find it worthwhile to spend more time for consulting a doctor. The average distance to a doctor is also larger than to a medical assistant or nurse. The average distances to health care providers mentioned in the table are rather large and hide a considerable dispersion. Ghanaians on average live about 16 km from a health care facility where they can consult a doctor, but fortunately more than half of them live within 5 km from such facility. By the same token, almost half of the Ghanaians can not consult a doctor within 5 km, which corresponds to a 1 hour walking distance, and a quarter even lives more than 15 km from a facility where a doctor can be consulted. These figures already take into account that in rural Ghana doctors, medical assistants and nurse often visit local clinics or health posts for consultation. Within the same 5-km radius, medical assistants and nurses are more often available, and they may take over part of the demand for modern health care

consultations. However, in rural Ghana still more than a third of the population (37 percent) is not well covered by the orthodox health care system, living more than 5 km away from a health facility where a doctor, medical assistant or a nurse can be consulted, maybe even only part of the time. In contrast, traditional health providers are present almost everywhere in Ghana, and also chemical stores or drugstores are widely available to buy medicines for self-medication.

Table 8. Characteristics of private costs of treatment: time and distance, Ghana 1998/99

	Consultation and travel time (hrs)	Distance to provider* (km)	Population within 5 km (%)	Population more than 15 km away (%)
Self-medication	-	7	78	10
Doctor	4.0	16	55	24
Medical assistant	2.8	11	68	13
Pharmacist	1.3	26	44	38
Nurse	2.5	10	71	11
Midwife	2.7	14	69	12
Traditional practitioner	1.8	3	96	1

*The distance to doctors, medical assistants and nurses equals the distance to a facility where such health care provider can be consulted, even when only part of the time.
Source: Computed from GLSS-4 household and community questionnaire

The health expenses of households[1] for self-medication or health care consultations, shown in table 9, make clear that self-medication is on average the cheapest alternative. Not only are costs for consultation and travel avoided, also the expenses for medicines are lowest. A health care consultation did cost on average almost 16 thousand cedis (or about 6.6 USD). Visiting a doctor is on average the most expensive alternative, for all three cost items shown in the table, with average total costs of 23 thousand cedis (almost 10 USD). A consultation of a medical assistant or midwife is on average about half this amount, and consulting a nurse or a traditional provider is on average again considerably cheaper.

Table 9. Characteristics of private costs of treatment: expenses (cedis), Ghana, 1998/99

Treatment	Consultation Fee	Medicines	Travel cost	Total cost
Self medication	–	3708	-	3708
Consulted health care provider	6097	8504	1166	15776
- Doctor	8927	12299	1835	23061
- Medical assistant	5169	5232	630	11031
- Pharmacist	660	5551	268	6478
- Nurse	3463	5530	676	9670
- Midwife	5037	6422	549	12008
- Traditional health consultant	2838	4682	561	8081

Source: Computed from GLSS-4 (N=3253 self-medicated people; N= 2914 persons ill or injured who consulted a health care provider of total sample of 25581 people).

[1] According to the GLSS-4, private health expenses are paid by the head of household (80 per cent of the cases), by another household member (16 per cent), or by a relative (3 per cent). Finance through employers or other non-relatives is very exceptional.

2.3 Equitable access opportunities

The above overview of curative health care utilization in Ghana is illustrative of the challenges posed to the health care system in Ghana. First, despite a fair overall number of health facilities in the country, a considerable part of the rural population has only limited access to health care. More than a third of the rural population lacks access to a modern health care provider within 5 km and more than two-third lacks access within 5 km to a doctor, which is the preferred health care provider when available. Clearly, for an equitable access to health care the number of health workers and facilities would need to be augmented, in particular in rural areas.

Secondly, the health care costs for households are significant and their variation is large. The cost of consultation in case of severe illnesses or bad injuries may be prohibitive for the poor, in both urban and rural area. Thus, equitable access to health care could be improved through a health care insurance that covers access to a well-defined set of basic health care treatments at an affordable premium. The current subsidized health care supply by public and non-profit health facilities can be considered as an attempt to such equitable access, but suffers from incomplete coverage, geographically as well as financially, while subsidies tend to favor expensive tertiary care.

Thus there seems to be scope for improving the access to health care in Ghana. The current inequality in access can significantly impinge on the use of health care and on the health status of the people of Ghana. In the remainder of the paper we investigate empirically to what extent health care use is determined by proximity to health care providers and by private costs and simulate what would be the effect of expanding the network of facilities and of the introduction of an insurance.

Section 3
Modeling curative health care utilization

3.1 The choice model

In health economics it is common to employ multinomial models to explain the utilization of curative health care (see, for example, the survey by Jones, 2000). Consider a Ghanaian suffering from illness or injury. Treatments are indexed j and we let j = 1 refer to non-treatment or self-medication, while j = 2, 3, 4 refer to treatment by a doctor or pharmacist, a medical assistant or nurse or midwife, and a traditional health practitioner, respectively. Treatments include both the consultation (if any) and the medication (if any).

The well being U_j of a person presumably depends on his consumption C_j of non-health goods and services, and on his health H_j. This relation is represented by a utility function u.

$$U_j = u(C_j, H_j) \qquad (1)$$

Suppose further that the person's health H_j depends on the treatment c_j received from provider j, on the access a_j to the respective health care provider (reflecting proximity)[2], and on individual characteristics z that are independent of the type of treatment (e.g. gender, age, education, severity of illness, urban-rural locality).

$$H_j = h(c_j, a_j, z) \qquad (2)$$

Now let m be the person's income, which defines his net income m_j available for consumption C_j after payment of the cost e_j of treatment j[3].

$$m_j = m - e_j \qquad (3)$$

Then, conditional on the choice for health care j and provided that he can afford the chosen treatment ($m_j > 0$), the demand for other goods and services C_j derives from the maximization of utility $u(C_j, H_j)$ subject to the budget constraint $P\ C_j = m_j$, with P denoting the price index of non-health consumption. By implication, the non-health consumption C_j when treatment j is chosen will equal

$$C_j = m_j / P = (m - e_j) / P \qquad (4)$$

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[2] Typically, proximity is inversely related to distance and travel time to the particular provider.

[3] Note that the expense $e_{ij} = p_j\ c_{ij}$ of person i for treatment j is the product of the price p_j and the amount c_{ij} of care received. To interpret observed differences in e_{ij}, two cases are of particular interest: each treatment consists of a given amount of care ($c_{ij} = c_j$ for all i), or, there is a fixed unit price for health care ($p_j = p$ for all j). In the former case $e_{ij} = p_j\ c_j$ and there are no differences among providers of the same treatment. Alternatively, when $e_{ij} = p\ c_{ij}$, all differences in cost (both those between providers of the same treatment and those between treatments) are proportional to the amount of care. We will see that the two interpretations lead to different approaches for the imputation of costs of treatments not chosen.

Thus, one can define conditional indirect utility functions V_j by $V_j(P, m_j; H_j) = u(m_j / P; H_j)$[4], and ill persons will choose the treatment j with the highest value for V_j, j = 1, 2, 3, 4.

$$max \quad \{ V_1, V_2, V_3, V_4 \} \tag{5}$$

By the discrete choice nature, health care demand models like (5) can only identify relative propensities of choosing one of the alternatives. Consequently, a normalization rule is needed. We follow common practice in the health economics literature and use self-medication j = 1 for this purpose.

3.2 Econometric model

In the application, we employ simple semi-logarithmic forms for the utility and the health production function of equation (1) and (2).

$$\begin{aligned} U_j &= \beta_C \, log(1 + C_j) + H_j \\ H_j &= \beta_{0j} + \beta_H \, log(1 + c_j) + \beta_A \, a_j + \beta_j \, z \end{aligned} \tag{6}$$

with normalization $\beta_{01} = \beta_1 = 0$.

The forms are linear in the parameters, which are presumably expected to be nonnegative, except for the treatment specific effects β_j that represent health differentials due to individual characteristics z. Substituting for optimal non-health consumption C_j, see equation (4), and adding a disturbance term ε_j, specification (6) leads to the following indirect utilities.

$$V_j = \beta_{0j} + \beta_C \, log[1 + (m - e_j) / P] + \beta_c \, log(1 + c_j) + \beta_A \, a_j + \beta_j \, z + \varepsilon_j \tag{7}$$

Adding the subscript i for individuals where appropriate, this equation reads

$$V_{ij} = \mu_{ij} + \varepsilon_{ij} \tag{8}$$

where μ_{ij} is the expected utility of client i when choosing alternative j

$$\mu_{ij} = \beta_{0j} + \beta_C \, log[1 + (m_i - e_{ij}) / P] + \beta_H \, log(1 + c_{ij}) + \beta_A \, a_{ij} + \beta_j \, z_i$$

Accordingly, the propensity for a sick person i to choose the treatment k is described through the probability Π_{ik} that the utility V_{ik} exceeds the utility V_{ij} of any of the alternative treatments j. Clearly, this probability depends on the distributional assumptions of the disturbance ε_{ij}. For example, when ε_{ij} are identically and independently distributed according

[4] Alternatively, after substitution of $(m - e_j)$ for m_j, conditional indirect utilities can be defined as $V_j(P, m, e_j; H_j) = u((m - e_j) / P; H_j)$.

to the Weibull extreme value distribution[5], the difference between two disturbance terms will be logistically distributed, leading to the popular easily computed multinominal logit model.

$$\Pi_{ik} = exp[\mu_{ik}] / \Sigma_j exp[\mu_{ij}] \quad (9)$$

In empirical health care literature this is by far the most frequently estimated specification (see Jones, 2000). Yet, the logit model implies restrictions on the changes in utilization patterns Π_{ij} caused by changes in the expected indirect utilities μ_{ij} from various treatments. In particular, the logit model assumes that all alternatives are equally uncertain and equally affected by unobserved heterogeneity (homoskedastic disturbances), and that the relative preference for any couple of alternatives is independent of the characteristics of the remaining treatments (uncorrelated disturbances). The latter implies that a change of any treatment will only affect the preference for the particular treatment, leaving unaltered the relative importance of the unchanged alternatives. By the same token, when a new treatment becomes available, the logit model assumes that the utilization of all alternatives is decreased in a proportional manner.

To allow for a more flexible response, alternative probability distributions have been proposed that allow for heteroskedastic disturbances, correlated disturbances, or disturbances that are both heteroskedastic and correlated. The latter includes the multinominal probit model, which is considered the most flexible specification[6]. According to the probit specification, the probability that a person chooses the treatment k equals

$$\Pi_{ik} = \int_{A_{ik}} f(\varepsilon,\Sigma) \; d\,\varepsilon \quad (10)$$

where A_{ik} is the area where alternative k yields highest utility

$$A_{ik} = \{\varepsilon \mid [\varepsilon_{ij} - \varepsilon_{ik}] < [\mu_{ik} - \mu_{ij}] \text{ for all } j\}$$

and f is the density of the multivariate Normal distribution with zero mean and (co-) variances Σ.

Clearly, the estimation of the probit model (10) is computationally much more demanding than the estimation of the logit model (9). The required multidimensional integration has hampered application and numerical algorithms for relatively quick and adequate approximations of the probabilities (10) have only recently been developed and tested (Geweke et al., 1994; Hajivassiliou et al., 1996; Bolduc et al., 1996; Powers and Xie, 2000). Our approach here is to estimate the discrete choice model (8) under the two alternative distributional assumptions. The results of the multinominal logit (9) are compared with those of the concomitant probit model (10). But, first, we turn to a commonly encountered data issue.

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[5] The Weibull distribution derives from the cumulative density function $F(\varepsilon_{ij}) = exp[\, exp(-\varepsilon_{ij})\,]$.

[6] Other more flexible distributional assumptions include the nested logit model that allows for correlated disturbances between groups of alternatives, and the generalised logit model with heteroskedastic variances that follow from the cumulative density $F(\varepsilon_{ij}) = exp[exp(-\varepsilon_{ij}/\lambda_j)]$. For a further discussion on these and other alternatives, see Powers and Xie (2000).

3.3 Imputed cost of treatments not chosen

Model estimation requires information on expenses and consumption of all possible treatments for all individuals, which unfortunately are rarely observed. In most cases, and the Ghana Living Standards Survey data are no exception, statistical inference has to be based on information regarding the chosen alternatives only. To overcome this problem the cost of treatments not chosen has to be imputed. It is common practice to estimate hedonic price equations based on the characteristics of the sub-sample of sick persons who received a certain treatment (Gertler et al., 1987; Lavy and Quigley, 1993; Bolduc et al., 1996). This approach implicitly assumes that there are no differences among providers of the same treatment. However, instrumented price equations usually have a very low fit, leaving unexplained the lion's share of the variation in the cost of various treatments. A low fit of instrumented variables can have adverse effects on subsequent statistical inference (Bound et al., 1995). More importantly, in the case of Ghana, the variation of treatment cost might reflect quality differences between health care providers, even if they deliver the same type of treatment. Among those with similar health problems, clients who pay more are probably the ones who receive more care (i.e. longer or higher quality consultation and better medicines). Given a low fit of instrumented on actual prices and given that the level of health care expenses in Ghana might to a large extend be indicative of service quality, our approach to impute cost of treatments not chosen is as follows.

Let e_{ik} be the health expenses of client i who actually seeks treatment k, and let e_{ij} be the imputed expenses would the person have sought the alternative j. Furthermore, let p_j denote the average health expenses of all persons who actually chose treatment j, and, finally, let p denote the overall average health expenses. Now assume that the observed use intensity e_{ik} / p_k is representative of the person's use intensity for all other treatments j. Then, for $j \neq k$, the amount $e_{ij} = (e_{ik} / p_k)\, p_j$ gives the imputed health care expenses. To estimate the imputed health care consumption c_{ij}, we assume that the overall average health expenses p is indicative of the price that would emerge on a competitive market where the various treatments compete freely and benefit similarly from public finance. The diversity of health care utilization in Ghana as described in the previous section suggests that various health care providers can indeed compete and that price differences are probably indicative of service quality. Under these assumptions, the imputed consumption of a person who has chosen treatment k and whose health care expenses equal e_{ik} is defined as follows

$$c_{ij} = (e_{ik} / p_k)\, (p_j / p) \qquad (11)$$

Section 4
Data, estimation strategy and simulation results

4.1 Ghana Living Standards Survey

This study is based on data from the recent fourth round of the Ghana Living Standards Survey (GLSS), a series of large scale representative household surveys conducted by the Ghana Statistical Service (GSS, 2000). The first round was in 1987/88 (GSS, 1989), the second round in 1988/89 (GSS, 1995a), the third round in 1991/92 (GSS, 1995b) and the fourth round in 1998/99 (GSS, 2000). The survey provides a valuable source of detailed data on the various dimensions of living standards in different parts of the population, including the social and economic situation of individuals, households, communities and regions in Ghana. It includes data on demographic characteristics, health, education, economic activities and time use and migration. The survey uses three types of questionnaires to collect data: a household questionnaire, a community questionnaire and a price questionnaire. The analysis employs data from each of these questionnaires.

4.2 Description of variables

Equation (8) defines the discrete choice model to be estimated. As already mentioned we distinguish four types of treatment, letting j = 1 refer to non-treatment or self-medication and j = 2, 3, 4 to treatment by a doctor, a medical assistant or nurse, and a traditional health practitioner, respectively. The explanatory variables include income m_i, provider specific costs of treatment c_{ij} and provider characteristics a_{ij} reflecting the effort required for obtaining the treatment, and, finally, client characteristics z_i that do not vary with the type of treatment. Table 10 gives a brief description and summary statistics of the data.

For income m_i we take the total expenditure per adult equivalent, expressed in January 1999 Accra prices. We refer to GSS (2000) for the methodology used to estimate the various components. The average indicates that those reported ill during the GLSS-4 have an income of some 3,740 cedis per adult equivalent per day which is about 1.6 USD and only slightly more than 1 USD per capita per day (using the average equivalence scale of 0.78 and the exchange rate of 2,400 from GSS). The average income of the ill is close to the average of the entire GLSS-4 sample and reflects the generally low standard of living in Ghana.

The provider and client specific costs of treatment c_{ij} are imputed from the expenditures e_{ik} on the chosen treatment, according to equation (11) as the product of the observed use intensity (e_{ik} / p_k) and the observed relative prices (p_j / p) of the alternatives. Expenditures e_{ij} have already been discussed in table 9 and consist of the amount paid for consultation, the cost of medication, and the transport cost.

Table 10. Description and summary statistics of variables

Variable	Description	Mean	Std Dev
Response profile			
j=1	self-medication	0.54	
j=2	doctor	0.24	
j=3	medical assistant/nurse	0.15	
j=4	traditional	0.07	
Explanatory variables			
mi	expenditure per adult equivalent (1000 cedis)	52.38	46.96
ei1	(imputed) health expenses: self-medication	3.69	5.83
ei2	(imputed) health expenses: doctor	17.26	18.12
ei3	(imputed) health expenses: medical assistant/nurse	9.52	12.15
ei4	(imputed) health expenses: traditional	7.64	10.25
di1	distance to facility: self-medication	5.53	15.02
di2	distance to facility: doctor	14.82	20.57
di3	distance to facility: medical assistant/nurse	5.34	12.91
di4	distance to facility: traditional	1.46	10.29
ti1	time to facility: self-medication	0.55	1.04
ti2	time to facility: doctor	1.31	1.71
ti3	time to facility: medical assistant/nurse	0.65	1.21
ti4	time to facility: traditional	0.14	0.55
age	Age in years	33.48	20.88
female	gender (=1 if female)	0.58	0.49
schyrs	years of schooling	4.38	3.93
daysill	Days suffered	6.01	3.92
stopped	Have to stop activity	0.64	0.48
commun	Included in community questionnaire (rural area)	0.67	0.47

Source: GLSS-4, N=4800 persons aged 6 and above reported ill during part two weeks.

As regards access to providers we use the information on distance and time collected in the rural communities[7]. The average distance and the average time to reach the various providers are not particularly high, but note the standard deviations of table 10, which reflect large differentials. Access is generally good in urban area, but proximity of health care providers in rural area is much less. For example, more than one half of the rural population lives outside the 15 kilometers radius of a doctor and has to travel more than 3 hours for a consultation. We use the distance and time data to construct two variables $a_{ij} = (a^1_{ij}, a^2_{ij})$. To reflect the idea

[7] By type of provider and by type of facility, the chief of the community and other prominent members were asked: 'Is there a … in this community?' and if the answer is negative: 'How far from here is the nearest…' and 'How long does it take to get there?' The distance to a provider is set equal to the minimal distance to any facility where they have been consulted. This distance is sometimes smaller than the distance to a resident provider, since it is not unusual to consult a non-resident visiting provider at a local facility.

that the role of distance and time is particularly significant when a provider in neither very close nor very remote, the distance variable is transformed into a logistic curve. The proximity indicator ranges between zero to one and was specified as $a^1_{ij} = 1/[1+exp(0.2*dij-3)]$. Consequently, proximity takes the value 0.95 in urban area and when the particular provider is immediately available in rural area, and values 0.5 and 0.95 when the distance is 15 and 30 kilometers, respectively. Indeed, compared to the specification with proximity decreasing linearly with distance (i.e., $a^1_{ij} = -dij$), the logistic transformation gave better results[8]. The second access variable was defined as the reported speed to reach the provider, i.e., $a^2_{ij} = dij / tij$. Those who have to travel to a provider report an average speed near 15 kilometers per hour and, though the variable could only be computed for rural area, variation is considerable.

Finally, as regards client characteristics z_i that do not vary with the type of treatment, we include age, gender, years of education, number of days ill, necessity to stop usual activity, and locality as explanatory variables. In this way we can control for various circumstances when estimating the price- and income-effect (as reflected in the coefficients β_C for $[m_i - e_{ij}]/P$ and β_H for c_{ij}) and the access-effect (as reflected in the coefficients β_A for a_{ij})[9].

4.3 Estimation and simulation results

Parameter estimates of the discrete choice model (8) under the two alternative distributional assumptions (9) and (10) are listed in the annex as table A.1. The estimates of the multinominal logit model (9) and those of the probit model (10) have the expected sign and are generally highly significant. Controlling for client characteristics, both the proximity to health care providers and the cost of treatment appear to have a notable impact on the choice of health care in Ghana.

As regards the effects of client characteristics on health care behavior the estimates have a comprehensible interpretation. For example, the estimated age effects indicate that the elderly in Ghana tend to favor self-medication rather than consult a medical assistant or nurse, while women more often than men choose self-medication rather than consult traditional practitioners. On the other hand, those educated have a clear preference for orthodox health care, and seem indifferent between traditional practitioners and self-medication. The strong effect of schooling on choosing a doctor, medical assistant or nurse is consistent with the idea that education allows people to make better use of modern health care (Mwabu et al., 1993; Bolduc et al., 1996). The coefficients of the number of days ill and the halting of usual activities indicate that those severely ill tend to turn away from self-medication. Finally, the locality effect suggests that the unobserved heterogeneity of the demand for the consultation of a doctor is correlated with urban localities, while the logit

[8] Because of nonlinearity, the value of the parameters of the logistic curve has been fixed. The chosen values gave the best fit among several alternatives, and results appeared robust against alternative choices.

[9] The survey did not include detailed questions on the quality of services (e.g. availability of drugs, community population per health care provider) which is an additional factor determining service choice. Also, there are no details as regards the reason for non-consultation and the type of health problem. Here, the inclusion of the number of days ill and the necessity to stop usual activities as explanatory variables could pick up some of the unobserved heterogeneity due to these factors.

model indicates that there is a similar pattern in rural area as regards the preference for using medical assistants and nurses, which is however not confirmed by the probit estimates.

The alternative specifications generally have the same qualitative implications, though the magnitude of the coefficients differs, and, occasionally, an effect that is significant in one specification is not significant in other specifications. Whether these differences dominate the quantitative consequences of reforms in the health sector will become apparent when considering health care utilization patterns under alternative policies. To this we now turn. As equal access opportunities are of major concern to Ghana, we look at the effects of removing some of the apparent disparities. In particular, we present the results of three simulations that look at the impact of better proximity, the impact of more insurance, and a combination of these two, respectively. The results are summarized in table 11.

Table 11. Impact of proximity and insurance on health care utilization patterns in Ghana

	self	doctor	nurse	traditional
Sample probabilities				
	0.545	0.240	0.147	0.068
Simulated probabilities				
Logit model				
Proximity	0.531	0.250	0.153	0.065
Insurance	0.511	0.277	0.150	0.062
Combined	0.496	0.288	0.157	0.060
Correlated probit model*				
Proximity	0.534	0.251	0.149	0.067
Insurance	0.523	0.273	0.138	0.066
Combined	0.512	0.284	0.140	0.064
Heteroskedastic probit model*				
Proximity	0.531	0.250	0.152	0.067
Insurance	0.517	0.274	0.142	0.066
Combined	0.504	0.284	0.146	0.066

* See annex table A.1 for estimated variances and covariances of the probit specifications

In the first simulation *'Proximity*' the distance to orthodox health care providers in the rural area is reduced so that all persons can consult a medical assistant or a nurse within a distance of 5 km, while a doctor is assumed to be available within 15 kilometers. The second simulation '*Insurance*' deals with the introduction of a national health insurance with income dependent premium. Here part of the private cost of the orthodox health care is replaced by a subsidy, financed from a flat rate tax[10]. The simulation presumes that one half of the private

[10] Letting θ_j be the subsidy rate on the health care expenditure e_{ij} at the j-th provider, i.e., $e_{ij} = p\,(1-\theta_j)\,c_{ij}$, the flat rate tax rate can be computed as $\tau = \Pi\,\Sigma_i\,\Sigma_j\,\Pi_j\,\theta_j\,e_{ij} / \Sigma_i\,m_i$, where Π is the overall probability of falling ill and Π_j is the average probability for an ill person to choose the j-th provider. Letting $\theta_2 = \theta_3 = 0.5$ and using the sample probabilities gives $\tau = 0.014$. However this rate does not account for the induced increased use of orthodox health care. Since this increase is some 5-15 per cent, we took $\tau = 0.016$.

cost reported in the GLSS-4 is brought under an insurance scheme, and a premium of 1.6 per cent on expenditure would be necessary to finance that scheme. Finally, the third simulation '*Combined*' combines the effects of reducing the distance and insuring half of the private cost.

The outcomes of the simulations appear rather insensitive to the distributional assumptions of the logit and probit specifications. According to the '*Proximity*' simulation, improved access to orthodox health care in rural area increases total demand by a modest 3.5 per cent. Clearly, this increase is entirely located in rural area, where simulated demand increases by more than 10 per cent[11]. The '*Insurance'* simulation indicates that a national health insurance covering half of the current private expenses could increase the demand for doctors by some 15 per cent, whereas there is little effect on the consultation of medical assistants and nurses. In combination, improved access and limited insurance lead to a simulated increase of 10 to 15 per cent in total demand for orthodox health care, which is almost entirely due to a decreased self-medication in favor of a 20 per cent increase of the use of doctors.

The simulations further suggest that the role of traditional practitioners in the health care system is not expected to change much when the access and financing of orthodox health care improves.

[11] Note that the rural population constitutes two thirds of the sample and accounts for only one third of the orthodox health care use.

Section 5
Discussion and conclusion

5.1 Overview of the system

Self-medication is the predominant form of health care is Ghana, while also consultation of traditional practitioners or no treatment at all is not uncommon. Accordingly, the use of orthodox care is limited to less than 40 per cent of those falling ill and this percentage greatly varies among different population groups.

The overview of the health care system in Ghana suggests that equitable access opportunities can be enhanced in two ways. First, there is a need for more health care providers in the rural areas, in particular of doctors, which are already the preferred providers in urban areas. Currently, the overall availability of doctors in Ghana is rather low. The population per doctor in the public sector averages around 16,000, a number that probably reduces to some 11,000 when private doctors are included. The location of the doctors at public facilities shows a clear urban bias, and the location of private doctors most likely shows a similar bias. Health staff is generally reluctant to be posted to more remote, thinly populated and poor area (Agyepong, 1999). The shortage of doctors in Ghana is thus felt in particular in the rural areas of Ghana, which is confirmed by the large distance to a doctor found in the GLSS survey.

A second fact that stands out is the significance of the private contribution to health care. The level and variation of the cost of treatment suggests that the poor, when severely ill cannot afford the necessary care. Here equitable access could be pursued by reforms in the financing of health care such as the introduction of insurance schemes (Asenso-Okeyere, 1995).

5.2 Modeling and simulation results

To address these issues we presented a health care provider choice model and estimated its parameters with the recently published data of the fourth round of the Ghana Living Standard Survey (GSS, 2000). In the spirit of most previous applications (Gertler et al., 1987; Mwabu et al., 1993; Asenso-Okyere et al., 1998; Propper, 2000; Jones, 2000), we first estimated the multinomial logit version of the model. Next we also estimated the concomitant probit model, following the critique on the assumption that health care utilization patterns are homoskedastic and uncorrelated (Bolduc et al., 1996).

The direct imputation of the cost of treatments that have not been chosen was a novel feature of our approach. Imputation was based on the use intensity of the chosen treatment and the relative cost of the alternatives. The approach assumes that the use intensity is similar across treatments and that health care markets in Ghana are reasonable integrated with price differences being indicative of service quality. The approach preserves the variation in the observed health expenditures and avoids problems related to a usually low fit of hedonic pricing of treatments (Gertler et al.., 1987; Bound et al., 1995; Propper, 2000).

The estimates gave satisfactory results in terms of the sign and significance of the parameter estimates, both in the (more restrictive) logit and in the (computationally demanding) probit version. Both the proximity to health care providers and the cost of treatment have a significant impact on the choice of health care in Ghana. Moreover, the estimated effects of client characteristics have a comprehensible interpretation.

Though the magnitude of parameter estimates for the probit specification differ from the logit estimates, this did not make much of a difference in the simulations. In all models, the simulated effects of improving the access to orthodox health care in rural area (medical assistants and nurse within 5 km; doctors within 15 km), or insuring half of the private cost lead to modest increases in the use of orthodox health care. In combination, the simulated demand for orthodox health care increased by 10 to 15 per cent, almost entirely due to a decreased self-medication in favor of a 20 per cent increase of the use of doctors.

The policies discussed could thus increase utilization of the orthodox health care providers in Ghana, and thereby lead to an improvement in the health status of the Ghanaian people (Lavy et al. 1996). Equitable access could further involve the coverage of priority health service interventions, as discussed in the Medium Term Health Strategy (see World Bank, 1997), while charges for non-priority treatments could be increased. Nonetheless, under the reforms considered, relatively cheap self-medication is expected to remain the predominant type of health care, suggesting that a widespread use of modern care would require more than equitable access opportunities. At the current stage of development in Ghana, the provision of adequate health care at an affordable price to all remains a formidable challenge.

5.3 Levels of utilization and finance of health care in Ghana

The data analysis further pointed to ambiguities as regards current levels of utilization and finance of health care. The ambiguities derive from a comparison at the national level of figures used by the Ministry of Health and those reported in the GLSS-4. The latter suggest markedly higher levels of health care utilization and private financing, which complicates the setting of targets and the evaluation of the system.

Almost 10 percent of the persons in the GLSS-4 consulted an orthodox health care provider during the last two weeks, of whom some 60 per cent went to a public (or quasi-public) facility, of whom some 10 per cent was admitted overnight. Assuming that these figures are representative for the population at large this corresponds to an average of about 2.5 outpatient consults per year per person, or 1.5 consults at public facilities. This level of outpatient consultation is much higher than the level reported by the Ministry of Health, stating that 6.6 million outpatient visits took place in 1998, implying an average of less than 0.4 visits per Ghanaian. A similar discrepancy concerns the number of hospital admissions. In the GLSS-4 0.7 percent of the sample was admitted in the preceding two weeks, which would correspond to an average of 18 per cent of the population per year[12]. For 1998, the Ministry of Health reports 482,000 hospital admissions, or less than 3 per cent of the population. Outpatient visits are targeted to increase from 0.4 to 1 per person per year, while hospital

[12] Note however that here the estimate may be imprecise due to the small sample size (180 hospital admissions in a sample of over 26,000 persons).

admissions are targeted to rise from below 3 to 5 per cent of the population. Though these targets are in line with the official figures, the GLSS data suggest that they have long been met. Nonetheless, considering the lack of health care facilities in rural areas and the significant household expenses for health care in the absence of a health insurance, it can be argued that an efficient level of health care use in Ghana is yet above the level reported by the GLSS-4.

The data also indicate that an evaluation of health care utilization in Ghana would benefit from an improved accounting. Health care in public or other non-profit facilities is highly subsidized in Ghana. According to the Ministry of Health, the contributions of households to the budget amounted to only some 33 billion cedis in 1998 or 13 percent of the total recurrent costs. Yet, the survey data analyzed here suggests that equitable access to health care be still hampered by the private cost of treatment. According to the GLSS-4, on average households spent 2750 cedis per person for health care in the two weeks prior to the interview, corresponding to an estimated 72 thousands cedis per person per year, the equivalence of almost 30 USD, of which about one seventh concerns consultation fees at public facilities. This figure suggests that on an annual basis households have paid a total of some 200 billion cedis for consultations at public health care facilities[13]. Even when corrected for inflation, for regional variation of cost, and for local administration cost, these figures suggest that the private contribution to public health facilities in Ghana is much higher than officially administered.

[13] On average a Ghanaian is observed to consult a public doctor about 1.5 times against an average fee of 7 thousand cedis.

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Table A.1 Parameter estimates of the health care utilization model, see equation (8), Ghana 1998/99.
(4800 ill persons aged 6 and above; multinominal logit and probit specifications; t-value in parentheses)

	Logit	Probit	Probit
	Uncorrelated, homoskedastic	Correlated	Heteroskedastic
Income-price effects β_C and β_H			
Non-health consumption	0.378 (9.53)	0.197 (6.34)	0.200 (5.98)
Health consumption	0.555 (4.33)	0.138 (1.56)	0.263 (2.89)
Proximity effects β_A			
Distance	0.805 (6.96)	0.497 (5.92)	0.472 (5.61)
Speed	1.099 (5.17)	0.656 (4.46)	0.629 (4.47)
Provider specific constant β_{0j} (j=2=Doctor; j=3=Medical assistant/Nurse; j=4=Traditional)			
cst2	-2.188 (14.21)	-1.448 (12.37)	-1.321 (8.73)
cst3	-2.640 (15.45)	-1.597 (12.86)	-1.185 (12.60)
cst4	-3.141 (14.03)	-2.491 (13.23)	-8.402 (0.92)
Provider specific effect of individual characteristics β_j			
age2 (Age)	0.159 (0.82)	-0.259 (1.80)	-0.152 (1.25)
age3	-0.847 (3.77)	-0.501 (3.34)	-0.360 (3.24)
age4	0.185 (0.65)	0.108 (0.49)	0.888 (0.71)
sex2 (Female)	0.114 (1.43)	0.103 (1.77)	0.063 (1.25)
sex3	0.083 (0.93)	0.085 (1.35)	0.047 (1.07)
sex4	-0.337 (2.75)	-0.226 (2.58)	-0.845 (0.83)
edu2 (Years of schooling)	0.070 (6.84)	0.057 (7.48)	0.046 (6.48)
edu3	0.044 (3.71)	0.045 (5.67)	0.031 (5.36)
edu4	0.001 (0.05)	-0.003 (0.24)	-0.039 (0.49)
ill2 (Days ill)	0.123 (11.90)	0.086 (10.87)	0.079 (9.32)
ill3	0.055 (4.62)	0.058 (6.29)	0.044 (7.18)
ill4	0.118 (8.10)	0.075 (7.29)	0.206 (1.06)
stp2 (Stopped activity)	1.226 (13.81)	0.969 (15.54)	0.814 (11.68)
stp3	0.988 (9.97)	0.868 (13.64)	0.631 (13.44)
stp4	0.462 (3.62)	0.271 (2.32)	0.455 (1.45)
rur2 (Community survey)	-0.900 (10.36)	-0.579 (8.93)	-0.515 (6.93)
rur3	0.439 (4.14)	-0.139 (1.48)	-0.061 (1.00)
rur4	0.089 (0.64)	0.177 (1.67)	0.710 (0.66)
Co-variances Σ (probit specification)			
var2			0.646 (5.19)
var4			4.585 (0.90)
cov32		0.791 (9.49)	
cov43		-0.530 (0.68)	
Log Likelihood	-4946	-4932	-4934

The Centre for World Food Studies (Dutch acronym SOW-VU) is a research institute related to the Department of Economics and Econometrics of the Vrije Universiteit Amsterdam. It was established in 1977 and engages in quantitative analyses to support national and international policy formulation in the areas of food, agriculture and development cooperation.

SOW-VU's research is directed towards the theoretical and empirical assessment of the mechanisms which determine food production, food consumption and nutritional status. Its main activities concern the design and application of regional and national models which put special emphasis on the food and agricultural sector. An analysis of the behavior and options of socio-economic groups, including their response to price and investment policies and to externally induced changes, can contribute to the evaluation of alternative development strategies.

SOW-VU emphasizes the need to collaborate with local researchers and policy makers and to increase their planning capacity.

SOW-VU's research record consists of a series of staff working papers (for mainly internal use), research memoranda (refereed) and research reports (refereed, prepared through team work).

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