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Willingness to Pay For the Quality and Intensity of Medical Care: Evidence from Low Income Households in Ghana

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Abstract

This paper presents estimates of willingness to pay for medical care, including the quality and intensity of medical treatment sought in response to illness or injury. The empirical analysis is based on some 5000 observations on the behavior of low income households in Ghana in 1986. The results indicate that the decision to seek medical treatment is responsive to household income. Prices have significant but inelastic influences on the choice among types of treatment and the intensity of treatment sought. Availability of treatment has a substantial effect upon the types of treatment and the utilization of facilities. These results are robust to changes in the structure of the estimating model.

I. INTRODUCTION

Important choices about the organization of health care systems and the role of government in the provision of health care depend crucially upon consumer demand for health services as well as the efficacy of those services in promoting the well being of citizens. Particularly in the context of developing countries, where available public resources are so scarce, credible estimates of the private value of subsidized treatment are needed to establish priorities for public budgeting. Knowledge of household demands for service is also of real importance in setting public prices for government-provided medical services --to balance out, or at least to recognize, the objectives of cost recovery and those of broad availability. Finally, factors affecting utilization, such as cost and accessibility, are of real practical importance in facility design and location.

This paper provides estimates of the factors affecting the choice among different kinds and intensities of medical treatment in response to illness or injury. We also estimate households' compensated demands, or willingness to pay, for these attributes of medical care. In the empirical analysis, particular attention is paid to three important theoretical and measurement issues.

First, the decision to seek medical treatment and the intensity of treatment sought is responsive to an **ex ante** evaluation of the seriousness of the illness or injury, not to some outcome of the treatment measured **ex post**. Yet virtually all measures of the seriousness of illness are taken retrospectively in cross sectional data after any medical treatment or convalescent care has been utilized.

Second, the decision to seek treatment in response to illness or injury includes qualitative and quantitative dimensions. It includes joint or sequential decisions about the type of treatment to be sought and the intensity with which that treatment is utilized. Presumably individual choice in these various dimensions is responsive to the cost and availability of treatments.

Third, the costs of medical services are borne by consumers in highly complex ways, depending upon the type of facility chosen, the number of consultations or treatments sought, the seriousness of the illness or injury, and government policy with respect to subsidy or insurance. In addition to these out-of-pocket costs, treatment typically involves the expenditure of monetary and time costs in transportation. These access costs may be particularly important in developing countries, especially in rural areas, where certain types of treatment may be unavailable at any reasonable transport cost. The notion of "price" for medical services is complex, especially in developing countries. Again, **ex post**, we only observe the attributes chosen and the expenditures incurred, not the **ex ante** menu of alternatives and their prices available to the consumer at the time choice is made.

Households' willingness to pay for health care and the effect of increasing prices of modern health services on utilization rates by low income consumers, especially in rural areas, are a major policy concern in many countries in

Africa. For example, in December 1990 the government in Kenya increased user fees in the public health system, but it was forced to reconsider the structure of prices after a few months in response to public pressure.

Ghana has been collecting user fees in the public health system since 1983; in 1987 fees represented 15 percent of the government recurrent budget for health. Utilization of public health services in Ghana has been falling in absolute terms --from 10-11 million outpatient visits annually in 1973 to half that number in 1987. The imposition of significant user fees in 1985 and reductions in the quality of public services are suggested as contributors to the recent decline. The drop in utilization rates since 1985 is more significant and permanent in rural areas than in urban areas. This paper presents empirical results indicating the sensitivity of consumer choice to access, income, prices and quality of health care --information needed for the evaluation of policy alternatives in the health sector.

The data used for this analysis are well suited to the difficulty of drawing meaningful inferences about these complex measurement issues in consumer choice. The analysis is conducted using cross sectional data on the observed behavior of Ghanaian households --typically low income households --in response to illness or injury. The empirical analysis is based upon the observed choices of about 5000 individuals in 1987.

Section II below sketches out the basic model of behavior and motivates the two empirical analyses outlined in Section III. Section IV exercises the model and suggests ways in which it could be used to inform health policy in developing countries.

II. THE MODEL

Following many others (see Cameron, et al [1988] for a recent example), we assume that consumers derive utility from their health status, H, a numeraire good, X, and leisure, L:

$$(1) \qquad U = U(H,X,L) \quad .$$

The form of this function has been the subject of intense speculation (see Viscusi and Evans [1990] for a recent review). Consider an individual who has suffered an illness or injury. The subsequent health status of that person is related to a vector of preexisting exogenous factors (e.g., health capital, severity of illness, etc.), denoted by A, and the quality (T) and intensity (N) of medical care chosen:

$$(2) \qquad H = H(T,N;A) \quad .$$

Now consider the cost of health care in the market. An individual with some given illness or injury can choose a type of treatment, T, and an intensity of treatment, N, by making expenditures, E:

(3) $E = P(T,N;A)$

Equation (3) is the hedonic price relation between the qualities and attributes of medical treatment and its price. The general character of hedonic prices has been well known for a decade, and there exists an extensive literature (see Rosen, 1974). In a competitive market, the price function represents the envelope of consumers' bids for different combinations of treatment and money, depending upon the seriousness of illness. In any case, the price function is a reduced form relation reflecting both supply and demand. The market-wide hedonic function, or the hedonic price rule for medical services, is exogenous to the decisions of individual consumers.

Associated with the choice of a quality of health care (say a type of medical facility) and a quantity (say a frequency of consultation) is a time expenditure, M(T,N). If working hours are fixed, non-work time ($\bar{L}$) is spent on leisure (L) or health care,

(4) $\bar{L} = L + M$.

Consumer income, Y, is spent on health care or on the numeraire good, whose price if equal to one.

(5) $Y = X + E$.

Thus, in general, a consumer of income Y chooses T, N and X to maximize (1) subject to (2), (4) and (5). By substitution, the indirect utility function is:

(6) $U\{H(T,N;A), Y - P(T,N;A), \bar{L} - M(T,N)\}$.

In equilibrium the consumer will equate the marginal productivity of both T and N in the production of health care to its marginal cost in terms of goods and time,

(7) $$\frac{\partial H}{\partial T} = \frac{U_X}{U_H}\frac{\partial P}{\partial T} + \frac{U_L}{U_H}\frac{\partial M}{\partial T}$$

$$\frac{\partial H}{\partial N} = \frac{U_X}{U_H}\frac{\partial P}{\partial N} + \frac{U_L}{U_H}\frac{\partial M}{\partial N}$$

Note that (6) is a well behaved utility function conditional upon exogenous health factors and prices. For a given state of nature A, utility is increasing in household income, net of expenditures on health care, and in the quality and intensity of medical care. By assumption, the selection of T, N and X represents the complete range of consumer choice in the market.

Given this representation of consumer behavior, there are several empirical issues involved in exercising the model. First, the model requires knowledge of the seriousness of the illness or accident, a measure of the seriousness of illness that is not derived ex post after treatment.

Second, the model requires knowledge of the menu of prices and alternatives available to the consumer, that is, the form and the parameters of the hedonic price function P.

Third, it requires knowledge of the form and the parameters of the utility function itself.

These issues are considered in the empirical analysis which follows.

III. THE DATA

The empirical analysis in this paper is based upon the behavior of a cross section Ghanaian households surveyed in 1987 by the World Bank sponsored Ghana Living Standard Survey. We analyze some 5000 households who reported that a member had been ill or injured during the previous four weeks.[1] For each individual, the survey reports the severity of the illness or injury (measured retrospectively by the number of days the individual was unable to perform normal activities), the type of treatment sought, the frequency of consultation with the provider of treatment, and the expenditures made for treatment. Table 1 summarizes data on individuals in the household sample self-reported as sick or injured. Of the 5049 sick or injured people, 2206 --almost half --sought some form of treatment.

As the table indicates, those who reported illness or injury also reported that they had lost almost four days from normal activity during the four week period. Those who sought medical attention were more severely disabled and reported almost five days lost. The average age of those reported ill was 23-24 years, but about three eighths of the sample consisted of children under 12 years of age.

The 5049 sick or injured individuals averaged about 0.84 consultations each for medical treatment. The 2206 individuals who actually sought treatment averaged almost two consultations each. Those who sought treatment at

[1]At various points in this analysis, statistical results are reported for different subsamples of the 5481 households initially surveyed in 176 geographical clusters. Differences in sample sizes reflect missing or incomplete data for individuals. The results reported in Appendix Table A1 are based upon 5432 observations, while the hedonic analysis in Section IV A is based upon 5049 observations. The analysis of choice of treatment in Section IV B is based upon 5025 observations (since, for example, it appears that treatment alternatives did not exist for 24 households surveyed).

TABLE 1

Summary data on ill or injured individuals: mean values
(Standard deviations in parentheses)

	All ill injured	All who seek treatment
Exogenous factors:		
A retrospective severity	3.674	4.684
(Days ill/injured)	(4.86)	(5.28)
Age	23.42	21.481
(Years)	(20.58)	(19.50)
Child	0.375	0.413
(1=less than 12 years)	(0.48)	(0.49)
Sex	0.511	0.523
(1=female)	(0.50)	(0.50)
Ill	0.969	0.969
(1=yes)	(0.174)	(0.17)
Treatment factors: N,T		
No consultation	0.563	
(1=yes)	(0.50)	
Private consultation	0.175	0.401
(1=yes)	(0.38)	(0.49)
Number of consultations	0.837	1.914
	(1.29)	(1.21)
Conditional number of consultations	1.914	1.914
	(1.21)	(1.21)
Number of consultations by type of treatment		
Hospital consultations	1.960	1.960
(out-patient)	(1.35)	(1.35)
Hospital consultations	1.877	1.877
(in-patient)	(1.12)	(1.12)
Dispensary consultations	1.711	1.711
	(0.98)	(0.98)
Pharmacy consultations	2.259	2.259
	(1.36)	(1.36)
Clinic consultations	2.00	2.00
	(1.21)	(1.21)
Other consultations	1.738	1.738
	(1.15)	(1.15)
Sample size	5049	2206

dispensaries averaged about 1.7 consultations while those who sought treatment at pharmacies averaged almost 2.3 consultations.

Table 2 provides more infoormation about the type of treatment facility and the characteristics of those providing primary care to those individuals who sought treatment at the various types of facilities. Doctors are seen principally in hospitals and clinics; nurses and medical assistants are seen principally in clinics. The "other" category includes midwives and traditional medicine.

Figure 1 reports the distribution of expenditures in Cedis, the local currency, made by households in response to illness or injury. These expenditures include out-of-pocket costs for consultations and medicines and the cost of transportation to the site of treatment. As indicated, about 9 percent of those reported ill made no health expenditures during the four week period. Another 22 percent spent less than 100 Cedis on treatment.[2] The distribution has a long tail, and there are a few households which incurred large health care expenditures.

Table 3 provides more detail on the medical costs incurred by the surveyed households. It presents the distribution of costs, and the components of those costs, by the number of consultations made. As expected, each of the components of cost increases with the number of consultations. The cost of medicine is a large fraction of total costs --about sixty percent --at all intensities of treatment. Transportation costs average 8 to 13 percent of the total costs incurred in treating illnesses.

IV. EMPIRICAL ANALYSIS

The cross sectional survey of Ghanaian households is used to estimate the parameters of equation (6), the compensated demand for type of treatment and for intensity of treatment. This involves estimating the hedonic function, equation (3), as well as the indirect utility function.

Before undertaking this analysis, we first estimate the severity of illness. As noted, the cost of treatment and the well being of the consumer vary with exogenous factors (e.g., 'health capital') and the seriousness of their illnesses or injuries (e.g., the extent of their 'bad luck'). The information on the latter available in this cross section is retrospective rather than prospective. The information reported in Table 1 is the number of days an individual was incapacitated during a four week period --asked after the period was over and after any medical care was utilized. (As noted previously, the retrospective nature of measures of the seriousness of illness or injury is common to virtually all cross sectional surveys of the seriousness of illness).

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[2]By way of comparison, per capita incomes in Ghana averaged about 70,000 Cedis in 1987.

TABLE 2

Type of treatment facility by qualifications of those providing treatment

	Type of Treatment						
Qualifications	Hospital (in patient)	Hospital (outpatient)	Dispensary	Pharmacy	Clinic	Other	Total
Doctor	96	829	3	0	295	0	1223
Nurse	1	28	4	0	195	15	243
Medical assist.	1	15	21	2	568	18	625
Midwife	0	1	0	1	10	23	35
Pharmacist	0	1	9	55	8	1	74
Other	0	0	1	0	1	4	6
TOTAL	98	874	38	58	1077	61	2206

Figure 1 here

(graph)

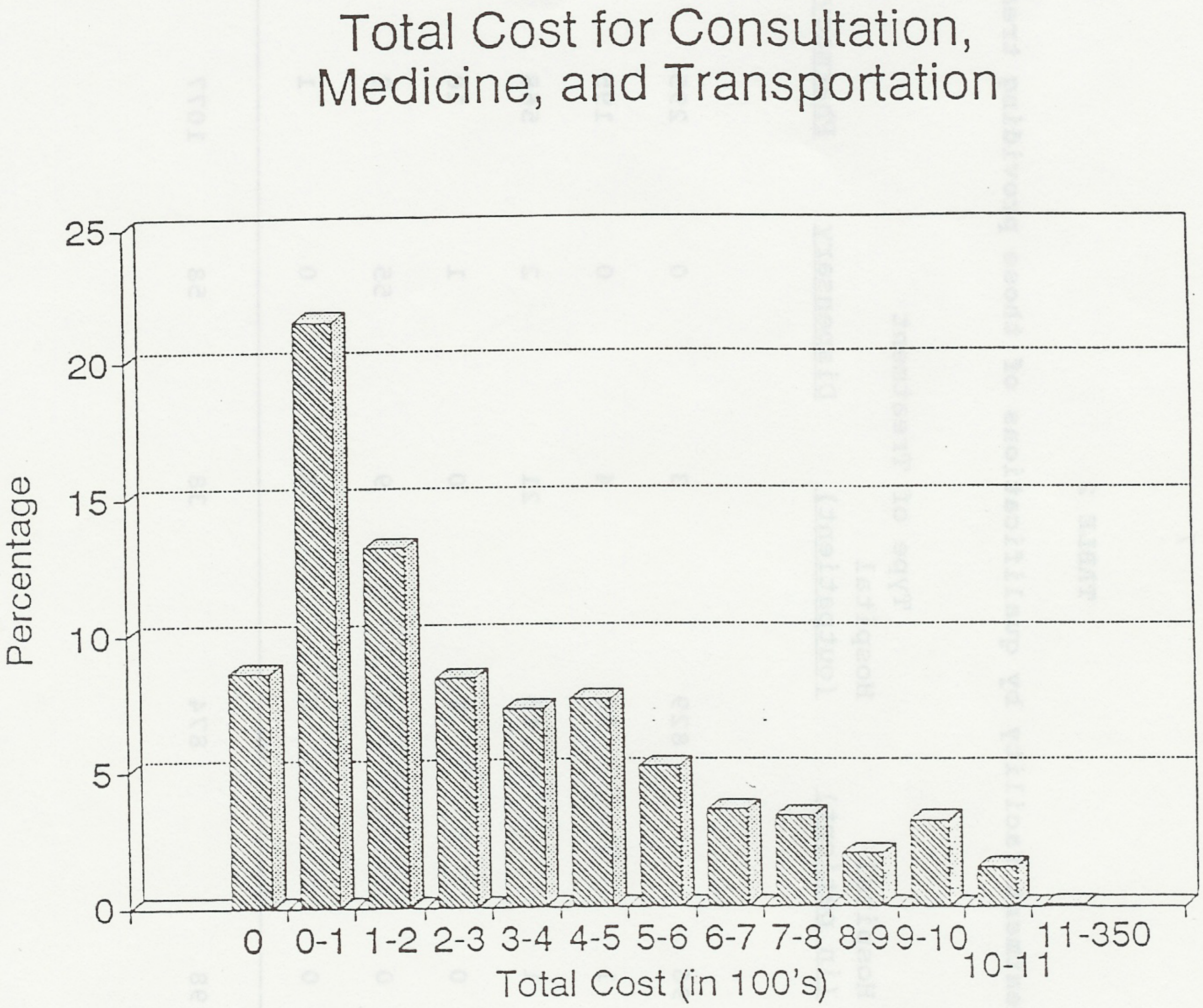

TABLE 3

Average costs incurred in treating illness or injury (in 1987 Cedis)

	Consultation and/or hospital fee	Cost of medicine	Cost of transport	Total
A. Number of consultations				
one	269.90	528.91	78.34	877.15
two	300.11	758.34	119.05	1177.50
three	321.90	876.43	158.54	1356.87
four-or-more	472.29	995.44	211.90	1679.63
B. Type of treatment				
Hospital inpatient	2294.39	2348.98	505.51	5148.88
Hospital outpatient	232.29	726.46	156.43	1115.18
Dispensary	298.95	671.84	69.47	1040.26
Pharmacy	70.17	508.28	17.59	596.04
Clinic	265.21	598.07	75.49	938.77
Other	46.56	648.69	53.11	748.36

Note: 300 Cedis was approximately one U.S. dollar in 1987 at free market rates. The official rate was about 176 Cedis to one U.S. dollar.

We address this issue by forming a prospective estimate of the seriousness of illness or injury using only information available at the time of its occurrence. We thus form an instrument for the seriousness of illness or injury; the instrument depends in no way upon the course of treatment actually undertaken or any other subsequent event. The details of this analysis are presented in Appendix A. To distinguish this instrument from the raw data, we denote it by $\hat{A}$. We denote the set of exogenous factors at the time of the illness or injury by A^*. In particular, a component of this vector is $\hat{A}$, "prospective days lost" due to illness or injury.

A. The Hedonic Expenditure Relationship

For the sample of ill or injured individuals described in Table 1, we estimate the relationship between health care expenditures and choice of treatment and intensity, holding other things constant.

We have no strong prior about the form of the expenditure relationship. We thus estimate expenditure relations using the generalized method first proposed by Box and Cox [1964].

Define the following family of transformations of the dependent variable P representing total expenditures or the total cost of treatment:

$$(7) \quad P^{(\lambda)} = [(P + \lambda_2)^{\lambda_1 - 1}]/\lambda_1 \qquad for\ \lambda_1 \neq 0 \quad .$$
$$= \log\ (P + \lambda_2) \qquad for\ \lambda_1 = 0 \quad .$$

The family of transformations generated by λ_1 and λ_2 is well defined for all $P > \lambda_2$. If it is assumed that for the regression equation

$$(8) \quad P^{(\lambda)} = f(T,\ N; A*) + u \quad ,$$

the u's are normally distributed with mean zero and constant variance, the parameters of the model may be estimated by standard maximum likelihood techniques.

Equation (8), assumed linear in the parameters, is estimated by a two-dimensional grid search over λ_1, and λ_2. Included in the model is $\hat{A}^*$, the prospective severity of the illness or injury, as well as the age and sex of the person. N and T are measured by the number of consultations and the type of treatment facility chosen by the individual. In addition, we include a set of dummy variables signifying the geographical location (cluster) of each household.

It has been shown (see Box and Cox [1964]) that the log likelihood function $L(\lambda_1, \lambda_2, \beta)$, computed from λ_1, λ_2 and the parameter vector β, is proportional to L^*:

$$(9) \quad L^*(\lambda_1,\lambda_2,\beta) = -(1/2C)\ \log(RSS/C)+(\lambda_1 - 1)\ \Sigma\ \log(P_i + \lambda_2) \quad ,$$

where C is the number of observations and RSS is the residual sum of squares from the regression, equation (8), conditional upon λ_1 and λ_2.

Table 4 summarizes the grid search over L*. It presents the value of L* at various values of λ_1 and λ_2. The function is rather flat, but it is least negative at the values of λ_1=0.20 and λ_2=0.01.

Table 5 reports the coefficient estimates from the Box-Cox regressions for λ_1=0.20 and λ_2=0.01. For the sample of all ill or injured individuals, health expenditures vary with the severity of the affliction and the age of the individual. They are also greater for those ill than for those injured.

Aggregate expenditures are also lower for those who do not seek medical consultation. They also vary substantially with the type of treatment sought and with the number of consultations. The order of magnitude of the coefficients is sensible. Additional consultations are more expensive for hospital in-patients than for outpatients, and are more expensive at dispensaries than at clinics.

The results reported in Table 5 can be used to simulate the menu of alternative types of treatment and their prices facing individual consumers. For each type of treatment physically available but unchosen by an individual, we use the coefficients in Table 5 to estimate its price. In this way we estimate the prices of those alternatives rejected by consumers.[3]

B. **The Choice Model**

As noted in equation (6), the mixed direct-indirect utility function is of the form

$$(10) \quad U = U\{H(T,N;\hat{A})\ ,\ Y-P(T,N;\hat{A})\ ,\ \overline{L}-M(T,N)\} \quad ,$$

where all variables are, in principle, observable. We consider the case where T is an index of I distinct types of treatment, T_i, i=1,...,I. Similarly we represent the intensity of treatment by the number of consultations J an individual chooses, N_j, j=1,...,J. Let C(i,j) represent the choice of treatment T_i at intensity N_j. Self treatment is indexed as C(0,0) and the choice of some medical treatment is C(i,j). For an individual of income Y whose severity of illness or injury is $\hat{A}$, U_{ij} represents the utility derived from C(i,j). We assume the utility function is stochastic

[3]The physical availability of alternatives is estimated for each of the 176 geographical clusters. If any individual in a given cluster utilizes one of the six types of treatment, it is assumed to be physically available to all residents in that cluster. The accessibility of these alternatives is measured by the cluster average time, distance, and out of pocket travel costs for each alternative.

TABLE 4

Maximum likelihood estimates of non-linear parameters for Box-Cox model

$$P^{(\lambda)} = \begin{cases} [(P + \lambda_2)^{\lambda_1 - 1}]/\lambda_1 & \text{for } \lambda_1 \neq 0 \\ \log(P + \lambda_2) & \text{for } \lambda_1 = 0 \end{cases}$$

Value of log likelihood function L*

λ_1	λ_2 0.01	0.05	0.10	0.20	0.40
-1.00	-66784.1	-60009.1	-57091.7	-54103.1	-512614
-0.80	-58213.3	-52927.7	-50649.0	-48367.9	-460846
-0.60	-49958.5	-46148.1	-44498.3	-42841.0	-411752
-0.40	-42226.8	-39845.6	-38800.9	-37742.0	-366682
-0.20	-35417.7	-34341.5	-33849.0	-33337.9	-328089
0	-30307.1	-30250.5	-30197.0	-30125.2	-300358
0.20	-27994.4	-28404.4	-28565.1	-28714.9	-288532
0.40	-28385.4	-28791.4	-28963.2	-29132.5	-292994
0.60	-30318.3	-30598.4	-30719.0	-30839.7	-309609
0.80	-33147.5	-33288.1	-33348.8	-33409.8	-334714
1.00	-36599.8	-36599.8	-36599.8	-36599.8	-365998

Note: Table entries are the maximized log likelihood function L* at alternative values of λ_1 and λ_2. RSS is computed from the ordinary least squares estimate of equation (8) using the variables reported in Table 5.

$$L^* = -1/2\ C \log(RSS/C) + (\lambda_1 - 1) \sum_i \log(P_i + \lambda_2)$$

TABLE 5

Hedonic expenditure functions: generalized Box-Cox regression (t ratios in parentheses)

Coefficient[a]	Coefficient	t-Ratio
Exogenous factors: A*		
prospective severity: Â (prospective days lost)	0.130	1.70
Age (Years)	0.020	4.50
Sex (1=female)	0.156	1.13
Ill (1=yes)	2.410	5.92
Treatment factors: T,N		
No consultation (1=yes)	-3.225	13.21
Private consultation (1=yes)	0.212	0.90
Number of consultations, N, times a dummy variable for treatment at:		
Hospital (outpatient)	1.334	11.83
Hospital (inpatient)	3.057	13.76
Dispensary	0.669	1.52
Pharmacy	0.413	1.53
Clinic	0.941	9.33
Other	0.708	2.19
Intercept	6.001	4.43
λ_1	0.20	
λ_2	0.01	
R^2	0.343	
Sample size	5082	

a The regression also includes dummy variables representing each of 176 geographical clusters.

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

where V_{ij} is the systematic component and ϵ is an additive error term.

If the set of C(i,j) alternatives is partitioned into k subsets $s^1, s^2, \ldots, s^k$ and if ϵ is assumed to follow the extreme value distribution within each subset, it is by now well known (e.g., McFadden [1978], Train [1986]) that the probabilities π_{tn} for treatment type t and intensity n may be expressed as

$$(12) \quad \pi_{tn} = \frac{e^{V_{tn}/(1-\sigma_k)} \left[\sum_{j \epsilon s^k} e^{V_{jn}/(1-\sigma_k)}\right]^{-\sigma_k}}{\left[\sum_m \left[\sum_{j \epsilon s^m} e^{V_{jm}/(1-\sigma_m)}\right]^{(1-\sigma_m)}\right]} \quad ,$$

where the $(1-\sigma)$ terms measure the correlation of error terms within each subset.

In the empirical analysis, we distinguish among six types of treatment (hospital-inpatient, hospital-outpatient, dispensary, pharmacy, clinic, and other), and we consider four intensities of treatment (one, two, three, and four-or-more consultations). Together with the self treatment option, there are potentially 25 alternatives for each individual (6x4+1) or as many as 127,050 distinct alternatives (25x5082). In fact, the number of alternatives is much smaller (56,445) since all residential clusters do not have access to each of the six types of treatment.[4]

We assume the error term follows the generalized extreme value distribution and test whether the general model of choice can be nested according to the schematic indicated in Figure 2.

As the figure indicates, the choice of type and intensity of medical treatment is modelled in three interdependent components: the choice between self treatment or professional treatment; the choice among the types or qualities of professional treatment; the choice of the frequency of consultations. These choice probabilities can be expressed in terms of marginal and conditional probabilities:

$$(13) \quad \pi_{stn} = \pi_{n|ts} \; \pi_{t|s} \; \pi_s$$

where π_s is the probability of seeking professional treatment and $(1-\pi_s)$ is the probability of self-treatment. From (11) and the assumed generalized extreme value distribution for ϵ

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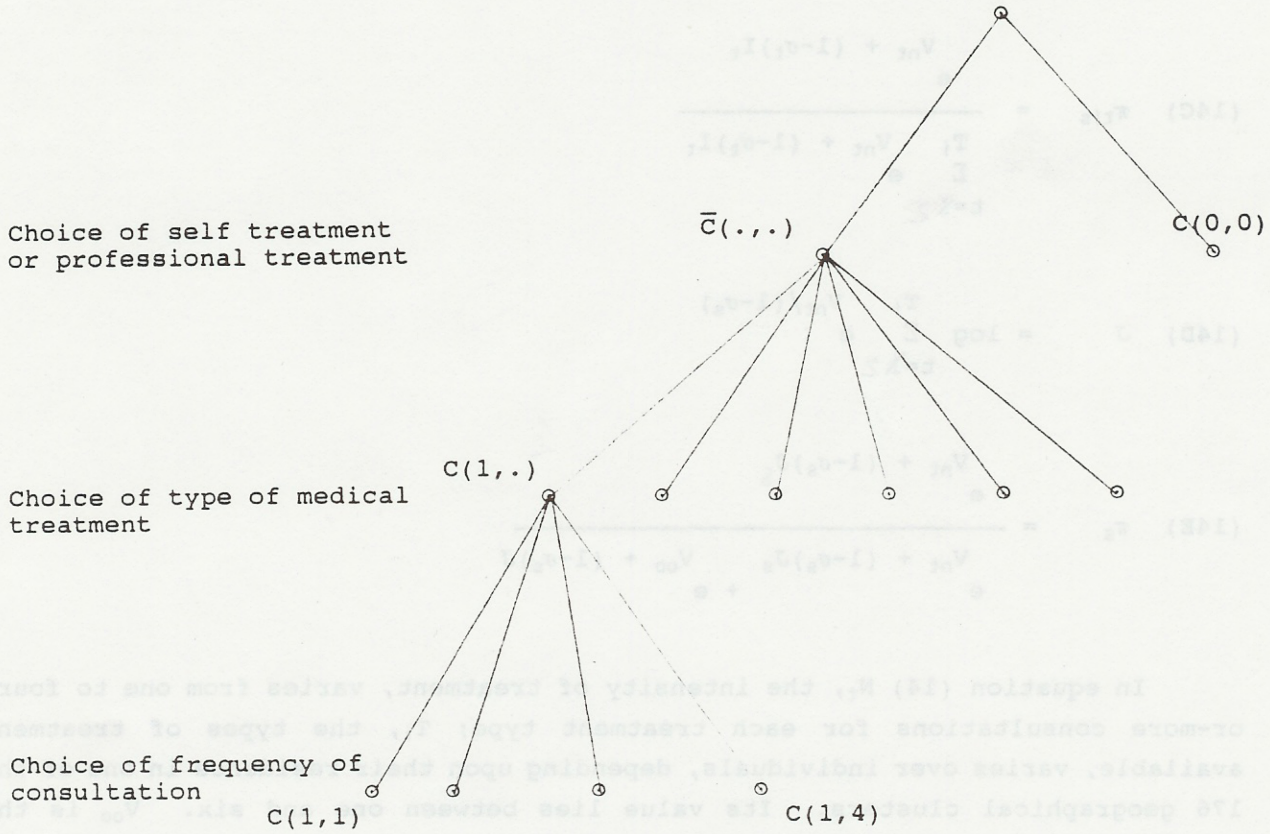
[4]Footnote 3 indicates the method used to estimate the availability of treatment alternatives for each geographical cluster. On average, there are about 2.7 treatment alternatives available to each individual.

FIGURE 2

Schematic of nested logit model of health care choice
C(n,t) = choice of treatment



(14A) $$\pi_{n/ts} = \frac{e^{V_{nt}}}{\sum_{n=1}^{N_t} e^{V_{nt}}}$$

(14B) $$I_t = \log \sum_{n=1}^{N_t} e^{V_{nt}/(1-\sigma_t)}$$

(14C) $$\pi_{t|s} = \frac{e^{V_{nt} + (1-\sigma_t) I_t}}{\sum_{t=1}^{T_i} e^{V_{nt} + (1-\sigma_t) I_t}}$$

(14D) $$J = \log \sum_{t=1}^{T_i} e^{V_{nt}/(1-\sigma_s)}$$

(14E) $$\pi_s = \frac{e^{V_{nt} + (1-\sigma_s) J}}{e^{V_{nt} + (1-\sigma_s) J_s} + e^{V_{oo} + (1-\sigma_s) J}}$$

In equation (14) N_t, the intensity of treatment, varies from one to four-or-more consultations for each treatment type; T_i, the types of treatment available, varies over individuals, depending upon their residence in one of the 176 geographical clusters. Its value lies between one and six. V_{oo} is the utility obtained from self-treatment; σ_s, σ_t and the parameters of the systematic component of household utility V_{nt} are estimated. It is assumed that V_{nt} is linear in parameters.

Table 6 summarizes the model and the coefficient estimates for equation (14). Panel A analyzes the intensity of treatment, conditional upon seeking professional treatment. It depends upon the cost of that intensity of treatment. For each individual seeking treatment, the cost of one, two, three and four-or-more consultations for that treatment is estimated from the hedonic equation reported in Table 5. The hedonic price variable clearly affects the number of consultations chosen and the intensity of treatment. The price variable is significantly different from zero at about the 0.06 level. The interaction terms between $\hat{A}$ and the dummy variables for two, three, and four-or-more consultations are also highly significant. The pattern clearly indicates that those with more serious illnesses or injuries are more likely to choose a greater intensity of treatment. The alternative-specific dummy variables are highly significant; ceteris paribus, they indicate that more frequent consultations are less likely to be chosen.

Panel B analyzes the choice of type or quality of treatment. The choice among types of treatment, for those seeking professional consultation, is significantly related to the estimated price for the first visit. Again, this price estimate is obtained using the coefficients reported in Table 5. To this price we add the cluster average transport cost to each alternative treatment type. The type of treatment sought is also highly responsive to the travel time required for that treatment. There are only minor differences in treatment type with the severity of the illness or with the presence of medical personnel. Ceteris paribus, the probability of seeking treatment at a private facility is lower.

The estimated value of $(1-\sigma_t)$ is insignificantly different from zero, and σ_t is not significantly different from one. The point estimate of σ_t is greater than one, but this is inconsistent with utility maximization (see McFadden [1978]). The second column of Table 6 presents the same conditional model reestimated with $(1-\sigma_t)$ constrained to equal zero. The coefficients of the other variables change very little when the insignificant $(1-\sigma_t)$ term is dropped. The conditional model of choice of treatment with σ_t equal to one "fits the data" as well and is globally consistent with utility maximization theory.

The finding that σ_t is not different from one implies that anticipated frequencies of consultation do not affect the choice of type of treatment, and that these aspects of the choice problem can be considered sequentially. Households behave as if they choose a type of treatment and subsequently select an intensity of treatment.

Panel C analyzes the choice between professional consultation and self-treatment. This choice is highly responsive to household income (measured as per capita household consumption). The probability of seeking professional treatment, holding constant the seriousness of illness or injury, increases with income, but at a decreasing rate. More seriously ill or injured individuals are also much more likely to choose professional consultation. The estimate of $(1-\sigma_s)$ is 0.33 and, in this case, the estimate is significantly different from zero and one. This finding suggests that the choice to seek medical consultation depends upon the types of medical care which are available to the household, their costs and accessibility, and the severity of illness or injury.

The robustness of these results is indicated in several appendix tables.[5]

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[5]Appendix Table A2 presents 12 alternative variants of the results reported in Panel A of Table 6. These variants include several representations of household income and per capita income as determinants of the choice of frequency of consultation. Appendix Table A3 presents six alternative variants of the results reported in Panel B. These variants include representations of household income as a determinant of the choice of type of treatment. Appendix Table A4 presents five alternative variants of the results reported in Panel C, again including representations of household income and per capita income as determinants of the decision to seek professional treatment.

TABLE 6
Nested logit estimates of choice of type and intensity of medical treatment (t ratios in parentheses)
$\pi_{stn} = \pi_{n|ts} \quad \pi_{t|s} \quad \pi_s$

	Unconstrained	Constrained, σ_t=1
A. Frequency of consultation, $\pi_{n\|ts}$		
Cost: P(t,n;A*) (Cedis x 10^3)	-0.053 (1.86)	
Â x two consultations	0.113 (4.25)	
Â x three consultations	0.122 (3.64)	
Â x four consultations	0.232 (7.00)	
Two consultations	-1.057 (8.91)	
Three consultations	-1.746 (11.23)	
Four consultations	-2.245 (13.03)	
B. Type of treatment, $\pi_{t\|s}$		
Cost of first visit: P(t,1;A*) (Cedis x 10^3)	-0.453 (8.21)	-0.325 (5.12)
Time: M(t,1) (Minutes x 10^2)	-0.342 (4.76)	-0.352 (4.92)
Â x hospital inpatient	0.120 (1.23)	0.124 (1.27)
Â x hospital outpatient	-0.023 (0.25)	-0.005 (0.06)
Â x dispensary	0.469 (0.40)	0.046 (0.40)
Â x pharmacy	0.192 (1.74)	0.189 (1.70)
Â x clinic	0.028 (0.33)	0.028 (0.33)

TABLE 6
(Continued)

Nested logit estimates of choice of type and intensity of medical treatment (t ratios in parentheses)

$\pi_{stn} = \pi_{n|ts} \; \pi_{t|s} \; \pi_s$

	Unconstrained	Constrained, σ_t=1
Doctor available (1=yes)	0.072 (0.27)	0.078 (0.29)
Professional available (1=yes)	0.180 (0.70)	0.195 (0.76)
Private facility (1=yes)	-0.335 (3.19)	-0.338 (3.20)
Hospital inpatient	2.127 (7.95)	2.213 (8.81)
Hospital outpatient	0.714 (1.38)	0.715 (1.39)
Dispensary	0.278 (0.50)	0.304 (0.54)
Pharmacy	2.091 (7.56)	2.102 (7.60)
Clinic	1.062 (2.34)	1.073 (2.36)
$(1-\sigma_t)$	-2.634 (1.21)	0

C. Self or professional treatment, π_s

Household income x consultation (per capita x 10^5)		0.673 (6.73)
Income squared x consultation (per capita x 10^{11})		-0.807 (3.34)
$\hat{A}$ x professional consultation		0.164 (7.96)
Consultation		-1.418 (12.42)
$(1-\sigma_s)$		0.327 (4.56)

TABLE 6
(Continued)

Nested logit estimates of choice of type and intensity of medical treatment (t ratios in parentheses)

$\pi_{stn} = \pi_{n|ts} \quad \pi_{t|s} \quad \pi_s$

D. Samples and significance

	Sample size	χ^2
Frequencies of consultation	8824	789.51
Number of individuals seeking consultations	2206	
Types of treatment	6003	664.72
Number of individuals seeking treatment	2206	
Self or professional treatment	10050	216.52
number of individuals choosing	5025	
Total number of choices observed	56445	

V. Implications for Consumer Choice

Estimates of the utility functions and the compensated demands permit an investigation of the effects of exogenous changes in circumstances upon demand for the quality and quantity of medical care and upon consumer willingness to pay for medical services. For example, the effects of income upon demand can be simulated in a straightforward way. The effects of price changes are more complex, since price exerts a direct effect on both the choice of intensity of treatment and the type of treatment, and also exerts an indirect effect upon the decision to seek professional treatment (by modifying the value of J, the so-called inclusive value) in the upper branch of the nested choice. The effects of more serious illness or injury upon demand are more complex still, since the seriousness of illness affects choice directly at all three levels and also affects the decision to seek treatment indirectly (again, by changing the value of the inclusive value).

Table 7 provides a summary of some of the implications of this analysis. Panel A reports estimates of the probabilities of consultation by type and number, given the current availability of treatment facilities to these households. The first column reports the predictions at the (unconditional) mean values of the sample characteristics. As the column indicates, at the sample averages, about 56 percent of households seek no medical treatment. About 22 percent choose one consultation and 12 percent choose two consultations. Slightly less than 6 percent choose three consultations. Twenty percent of households are treated at clinics and about 16 percent are treated as hospital outpatients.

Column 2 presents the predicted probabilities for individuals more sickly or disabled than the average person in the sample. Specifically it presents probabilities estimated for individuals whose "prospective days disabled" is one standard deviation greater than average. (From Table 1, this is about 4.86 additional days lost due to illness or injury). For these afflicted individuals, the probability of seeking medical treatment is increased from 44 percent to 64 percent, and the average number of consultations doubles from about 0.8 to 1.6. For those seeking treatment, the average number of consultations is predicted to be 2.5.

The change in treatment patterns is also substantial. The demand for treatment in clinics increases by more than 80 percent and the demand for treatment in hospital outpatient facilities increases by almost a third. Significantly, the probabilities of seeking treatment at all other types of facilities declines.

TABLE 7

Predicted choice of quality and intensity of medical treatment

	Predictions at conditional means	"Sicker person"	"Higher income"	"Lower income"
A. Given current availability of facilities				
1. Intensity of treatment				
No consultation	0.556	0.361	0.483	0.642
One consultations	0.218	0.203	0.254	0.176
Two consultations	0.116	0.188	0.135	0.094
Three consultations	0.058	0.099	0.068	0.042
Four-or-more	0.052	0.149	0.068	0.042
	1.000	1.000	1.000	1.000
2. Quality of treatment				
No consultation	0.556	0.361	0.483	0.642
Hospital inpatient	0.003	0.002	0.003	0.002
Hospital outpatient	0.161	0.213	0.188	0.130
Dispensary	0.022	0.016	0.026	0.018
Pharmacy	0.021	0.019	0.024	0.016
Clinic	0.198	0.357	0.230	0.160
Traditional	0.040	0.033	0.046	0.031
	1.000	1.000	1.000	1.000
B. Given general availability of the average facilities				
1. Intensity of treatment				
No consultation	0.341	0.158	0.238	0.426
One consultation	0.323	0.268	0.374	0.282
Two consultation	0.172	0.248	0.200	0.150
Three consultation	0.087	0.130	0.100	0.075
Four-or-more	0.077	0.196	0.089	0.067
	1.000	1.000	1.000	1.000
2. Quality of treatment				
No consultation	0.313	0.158	0.238	0.426
Hospital inpatient	0.004	0.003	0.005	0.004
Hospital outpatient	0.249	0.280	0.277	0.208
Dispensary	0.034	0.021	0.038	0.028
Pharmacy	0.032	0.025	0.036	0.027
Clinic	0.306	0.471	0.340	0.256
Traditional	0.061	0.043	0.068	0.051
	1.000	1.000	1.000	1.000

Note: A "sicker" person is defined as one whose prospective severity of illness is one standard deviation greater than the average. Those of "higher" and "lower" income are defined as persons whose per capita household incomes are one standard deviation above and below the mean, respectively.

Columns three and four present the probabilities estimated for households of higher and lower incomes respectively. Higher and lower income households are defined, respectively, as those whose per capita consumption is one standard deviation above or below the average.

Fifty two percent of higher income households are predicted to seek medical treatment if afflicted with the average illness in this sample, while only 36 percent of low income households seek medical treatment. The average number of consultations for high income households is predicted to be about one; for low income households it is about 0.7.

Higher income households are much more likely to receive treatment in clinics or hospitals than are low income households.

Panel B of Table 7 indicates how the physical availability of facilities affects utilization. For this simulation, we assume that each of the six types of treatment is available to each household with the sample average characteristics. This is effected by using a value of J, the inclusive value, computed from the conditional averages for each treatment type, rather than the average value of J in the sample.[6]

The increased utilization predicted by increased availability is substantial. On average, the probability of seeking treatment would increase by more than half, from 44 percent to 68 percent, and the average number of consultations would increase by almost a third. For sicker individuals, the probability of seeking treatment would increase from 64 percent to 84 percent, and the probability of receiving treatment at a clinic would increase by 11 percentage points.

Increased availability of treatment facilities clearly affects the utilization of facilities, especially by those sicker and those of lower incomes.

Table 8 indicates the importance of price in affecting household choice of quality and intensity of treatment. Price has a direct effect upon the number of consultations chosen and upon the type of treatment sought, and an indirect effect (through J) upon the choice of self treatment or professional care. As indicated in Table 8, the price effects are rather small.

Column one in Table 8 presents the own price elasticities of choice associated with a change in a single price, holding other prices constant. For example, if the average price of the first consultation increases by ten percent and all other prices remain the same, the choice of one consultation declines by 0.19 percent. Column two presents the elasticities of choice assuming all prices increase. The entries in the two columns are quite similar. The elasticity of intensity of treatment is quite small, but it rises with intensity of treatment. The elasticities of the choice of treatment type are good bit larger. Despite the small elasticities of choice of consultations, the elasticity of total

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[6]Note from equation (14D) that J is the logarithm of the sum over treatment types of exp(Xß). In the sample, the average value of J is 0.429. The logarithm of the sum of the average exp(Xß) over all six treatment types is 3.104.

TABLE 8

Estimated price elasticities of intensity and quality of treatment

	Price elasticities: Change in own price	Price elasticities: Change in all prices
A. Intensity of treatment		
No consultation	--.---	0.071
One consultation	-0.019	-0.018
Two consultations	-0.041	-0.040
Three consultations	-0.081	-0.079
Four consultations	-0.132	-0.130
B. Quality of treatment		
Hospital inpatient	-1.818	-1.801
Hospital outpatient	-0.252	-0.250
Dispensary	-0.339	-0.336
Pharmacy	-0.202	-0.200
Clinic	-0.181	-0.180
Other	-0.224	-0.221
C. Elasticity of health care expenditures	--.---	-0.264

expenditures exceeds $-1/4$. In response to higher prices, households economize very little in the number of consultations sought, but they are somewhat more likely to choose less expensive types of treatment.

Table 9 illustrates the substitution between patient care in hospitals and treatment at clinics in response to variations in accessibility and price. The cross elasticities with respect to price and time are highly significant, but rather small. They are certainly not negligible.

Again, the robustness of these results is verified in several appendix tables. Of particular concern is the possible correlation between measures of the cost of treatment and the alternative-specific dummy variables indicating frequency and type of consultation. Appendix Table A5 presents a complete nested logit model of choice which excludes the alternative-specific dummy variables and which includes a representation of household income in all three levels. As compared to the results reported in Table 6, the significance levels of the price variables are increased, but the significance of the models as a whole declines substantially when the alternative-specific intercepts are excluded.

Finally, Appendix Tables A6 and A7 present the price and choice elasticities estimated from this other model. As compared to the results reported in the text, the price effects estimated from this model on the choice of intensity of treatment are somewhat larger and the price effects upon the choice of treatment type are somewhat smaller. The price elasticities estimated from both models are generally rather small.

VI. CONCLUSIONS

This paper presents a complete model of the choice of the quality and intensity of medical care and estimates the parameters of that model using a sample of low income households in Ghana. The model requires estimating some measure of the severity of illness or injury of individuals in the absence of medical care. It also requires estimating the menu of alternative facility characteristics and their prices facing each consumer of medical services.

The empirical model considers the choice of self-treatment or professional care, the choice of type of treatment (measured by the type of facility), and the frequency of consultation.

The results indicate that, holding the seriousness of the illness constant, household income has an important effect upon the decision to seek medical treatment. The choice among types of treatment is conditioned upon the accessibility of facilities and upon the estimated cost of the first visit to that facility. The choice of the intensity of treatment (i.e., the number of consultations) is responsive to the price of consultations, but the elasticities are quite small. The evidence, based upon a nested logit model, is consistent with the view that households choose the number of consultations only after their choice of treatment type (and that treatment type does not affect the intensity of treatment except through prices). The evidence is also consistent with the

TABLE 9

Substitution between hospital outpatient care and clinics

	Elasticity of choice	
	Hospital outpatient	clinic
A. Price		
Price of hospital outpatient care	−0.252	+0.116
Price of clinics	+0.123	−0.181
B. Time		
Time to hospital outpatient care	−0.134	+0.064
Time to clinic	+0.099	−0.090

view that the choice of seeking professional care is highly responsive to the types of treatment available.

The results indicate that, besides the seriousness of the illness, household income is an important determinant of the demand for the quality and intensity of medical care. The price of medical services, while highly significant statistically, is less important in affecting choice of treatment type and intensity.

The results also indicate that the availability and accessibility of treatment alternatives is very important in affecting the consumption of qualitative and quantitative aspects of medical care, more important (at least in this sample) than prices charged for services.

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APPENDIX A: Measuring the Seriousness of Illness or Injury

The health attributes of individuals can be measured by the physical testing and evaluation of those subjects. It is more common, however, in epidemiological and social science surveys to measure health status by a series of questions about general conditions or about specific illnesses.

In this survey, individuals were asked to indicate if they had been ill or injured within the past four weeks. Those who responded affirmatively were then asked about the seriousness of that illness or injury. Specifically, they were asked to report the number of days they were "unable to carry on [their] usual activities due to illness or injury."

The response to such a question may well indicate the seriousness of the incident of bad health but it surely confuses objective events of illness or injury with treatment activities undertaken in response to exogenous events. **Ceteris paribus**, one expects that individuals who had sought treatment would report fewer days in which they were unable to carry on normal activities, but only in response to the same event or the identical illness of the same severity.

We resolve the ambiguity between objective events and economic decisions by relying upon pre-determined and exogenous information in analyzing the severity of illness or injury.

We form an instrument for the severity of injury ("prospective severity") by regressing the reported severity of illness upon a set of exogenous characteristics of the individuals, the family, and general living arrangements. The details of the estimation are summarized in Table A1. The coefficients reported in the table permit us to estimate "prospective days lost due to illness or injury" using only information available before that illness or injury took place. The instrument is correlated with the severity of the illness, measured **ex post**, but it is not based upon any treatment decisions made by the afflicted individuals.

Table A1 summarizes the regression results. Throughout the text, $\hat{A}$ is used to symbolize the predictions from that regression.

APPENDIX TABLE A1

Estimation of severity of illness as a function of pre-existing social and demographic characteristics dependent variable: days (5432 observations)

Variable*	Coefficient	t ratio
Household income (natural logarithm, in Cedis)	0.365	2.45
Schooling (years)	−0.094	5.76
Child (1=less than 12 years)	−0.083	1.43
Father's schooling (years)	0.024	1.18
Mother's schooling (years)	−0.088	1.97
Age (years)	0.003	11.31
Sex (1=female)	0.086	0.64
Vaccinated (1=yes)	0.043	0.29
Percent sick (same cluster)	−1.307	4.21
Open spell (1=yes)	−1.089	6.28
Intercept	−6.855	1.19
R^2	0.160	

* Note: The model also includes 7 variables indicating dwelling size, 3 variables measuring lighting, 10 measuring access to pure water, 4 measuring toilet facilities, as well as interactions among these amenities. In addition, the model includes dummy variables representing each geographical cluster.

The Dependent variable is the number of days the individual was "unable to carry on ... usual activities due to illness or injury."

APPENDIX TABLE A2: Estimates of intensity of use*
(lower tree)

	1	2	3	4	5	6	7	8	9	10	11	12
Cost: P(t,n:A)	-0.225	-0.178	-0.184	-0.053	-0.054	-0.057	-51.599	-52.330	-46.349	-13.759	-14.639	-13.082
(Cedis x 10^3)	(8.05)	(6.26)	(6.46)	(1.86)	(1.86)	(1.97)	(6.95)	(7.25)	(7.26)	(2.07)	(2.13)	(1.96)
Â x two consultations	-0.082	-0.053	-0.040	0.113	0.112	0.113	-0.086	-0.046	-0.038	0.113	0.112	0.113
	(6.95)	(3.14)	(2.43)	(4.25)	(4.21)	(4.25)	(7.31)	(2.67)	(2.33)	(4.25)	(4.22)	(4.25)
Â x three consultations	-0.194	-0.114	-0.139	0.122	0.122	0.123	-0.206	-0.093	-0.134	0.122	0.123	0.122
	(11.60)	(4.88)	(6.19)	(3.64)	(3.64)	(3.65)	(12.50)	(3.88)	(5.93)	(3.64)	(3.65)	(3.65)
Â x four consultations	-0.145	-0.059	-0.082	0.232	0.232	0.233	-0.166	-0.027	-0.074	0.232	0.232	0.232
	(8.06)	(2.54)	(3.61)	(7.00)	(6.99)	(7.02)	(9.56)	(1.11)	(3.24)	(6.99)	(6.99)	(7.00)
y x two consultations		-0.413			0.213		-0.499			0.179		
($x10^6$)		(2.84)			(1.32)		(3.41)			(1.11)		
y x three consultations		-1.112			-0.012		-1.359			-0.096		
($x10^6$)		(4.98)			(0.06)		(5.99)			(0.43)		
y x four consultations		-1.301			-0.073		-1.712			-0.075		
($x10^6$)		(5.44)			(0.33)		(7.14)			(0.32)		
(y/N) x two consultations			-0.301			-0.114			-0.324			0.023
($x10^5$)			(3.95)			(0.17)			(4.25)			(0.27)
(y/N) x three consultations			-0.414			0.956			-0.479			0.076
($x10^5$)			(4.01)			(0.96)			(4.61)			(0.76)
(y/N) x four consultations			-0.512			1.288			-0.636			0.093
($x10^5$)			(4.51)			(1.26)			(5.58)			(0.90)
two consultations				-1.057	-1.141	-1.045				-1.060	-1.129	-1.043
				(8.91)	(8.47)	(7.69)				18.94)	(8.36)	(7.68)
three consultations				-1.746	-1.741	-1.819				-1.752	-1.711	-1.816
				(11.23)	(9.85)	(10.38)				(11.36)	(9.54)	(10.34)
four consultations				-2.245	-2.273	-2.344				-2.257	-2.222	-2.338
				(13.03)	(11.91)	(12.28)				(13.34)	(11.31)	(12.20)
Log L	-2795.4	-2768.9	-2775.6	-2663.4	-2662.4	-2662.2	-2801.6	-2757.0	-2773.1	-2662.9	-2661.8	-2662.1

* Estimates are based upon choices of 1, 2, 3 or 4-or-more consultations by 2206 individuals who sought treatment. y is household income. y/N is per capita household income.

APPENDIX TABLE A3

Estimates of choice of treatment type*
(intermediate nest)

	1	2	3	4	5	6
Price of first visit ($x10^3$)		-0.325 (5.12)		-0.453 (8.21)		-0.454 (8.13)
Cash price ($x10^3$)	-0.053 (0.15)		-1.298 (0.67)		-1.390 (0.72)	
Transport cost ($x10^3$)	-0.440 (7.92)		-0.445 (8.04)		-0.445 (7.95)	
Transport time ($x10^2$)	-0.343 (4.78)	-0.352 (4.92)	-0.343 (4.78)	-0.342 (4.76)	-0.332 (4.56)	-0.331 (4.54)
Â x hospital inpatient	0.123 (1.26)	0.124 (1.27)	0.115 (1.17)	0.120 (1.23)	0.120 (1.21)	0.126 (1.28)
Â x hospital outpatient	-0.007 (0.09)	-0.005 (0.06)	-0.052 (0.45)	-0.023 (0.25)	-0.050 (0.44)	-0.078 (0.20)
Â x dispensary	0.046 (0.39)	0.046 (0.40)	0.050 (0.42)	0.469 (0.40)	0.064 (0.55)	0.061 (0.52)
Â x pharmacy	0.191 (1.72)	0.189 (1.70)	0.195 (1.77)	0.192 (1.74)	0.214 (1.92)	0.212 (1.90)
Â x clinic	0.029 (0.33)	0.028 (0.33)	0.271 (0.32)	0.028 (0.33)	0.028 (0.32)	0.029 (0.34)
y x inpatient ($x10^6$)					0.023 (0.04)	0.024 (0.04)
y x outpatient ($x10^6$)					0.278 (0.44)	0.279 (0.44)
y x dispensary ($x10^6$)					-1.240 (0.87)	-1.243 (0.88)
y x pharmacy ($x10^6$)					-1.523 (1.32)	-1.519 (1.31)
y x clinic ($x10^6$)					0.303 (0.48)	0.304 (0.48)
Doctor available	0.074 (0.27)	0.078 (0.29)	0.070 (0.26)	0.072 (0.27)	-0.005 (0.02)	-0.003 (0.01)

APPENDIX TABLE A3
(Continued)

Estimates of Choice of Treatment Type*
(intermediate nest)

	1	2	3	4	5	6
Professional available	0.181	0.195	0.181	0.180	0.144	0.142
	(0.71)	(0.76)	(0.70)	(0.70)	(0.56)	(0.55)
Private facility	-0.334	-0.338	-0.337	-0.335	-0.341	-0.338
	(3.18)	(3.20)	(3.20)	(3.19)	(3.24)	(3.22)
Hospital inpatient	2.123	2.213	2.156	2.127	2.074	2.046
	(7.77)	(8.81)	(7.62)	(7.95)	(6.64)	(6.82)
Hospital outpatient	0.735	0.715	0.668	0.714	0.987	1.040
	(1.42)	(1.39)	(1.28)	(1.38)	(1.53)	(1.62)
Dispensary	0.301	0.304	0.232	0.278	0.656	0.699
	(0.54)	(0.54)	(0.41)	(0.50)	(1.06)	(1.14)
Pharmacy	2.101	2.102	2.072	2.091	1.945	1.967
	(7.59)	(7.60)	(7.46)	(7.56)	(6.08)	(6.17)
Clinic	1.076	1.073	1.035	1.062	1.010	1.040
	(2.37)	(2.36)	(2.25)	(2.34)	(1.86)	(1.93)
$(1-\sigma_t)$			-7.785	-2.643	-8.033	-2.339
			(0.66)	(1.21)	(0.68)	(1.07)
log L	-1706.8	-1707.2	-1706.6	-1706.7	-1701.1	-1701.2

* Estimates are based upon choices among as many as 6 types of treatment (hospital inpatient, hospital outpatient, dispensary, pharmacy, clinic, other) by 2206 individuals who sought treatment. There are 6003 choices available, or about 2.7 per individual. The inclusive value, $(1-\sigma_t)$, is computed using model 4, Appendix Table A2. y is household income.

APPENDIX TABLE A4

Alternative estimates of choice between self treatment or medical consultation*

	1	2	3	4	5
Â x consultation	0.097	0.169	0.169	0.164	0.167
	(6.69)	(8.28)	(8.25)	(7.96)	(8.16)
Consultation	-0.850	-1.256	-1.320	-1.418	-1.466
	(11.75)	(11.54)	(12.02)	(12.42)	(12.41)
Household income	0.633	0.567			0.148
($x10^6$)	(6.21)	(5.55)			(6.73)
Household income^2					-0.513
($x10^{12}$)					(4.59)
Per capita income			0.401	0.673	
($x10^5$)			(7.33)	(6.73)	
Per capita income^2				-0.807	
($x10^{11}$)				(3.34)	
($1-\sigma_s$)		0.358	0.347	0.327	0.337
		(5.05)	(4.80)	(4.56)	(4.73)
Log L	-3483.10	-3387.90	-3374.80	-3369.60	-3376.30

* The varibale ($1-\sigma_s$) is computed using model 2, Appendix Table A3.

APPENDIX TABLE A5

Nested logit estimates of choice of type and intensity of medical treatment (t ratios in parentheses)

$$\pi_{stn} = \pi_{n/ts} \quad \pi_{t/s} \quad \pi_s$$

	Unconstrained	Constrained $\sigma_t=1$	Constrained $\sigma_t=\sigma_s=1$
A. Frequency of consultation, $\pi_{n\|ts}$			
Cost: P(t,n;A*) (Cedis x 10^3)	-0.821 (12.19)		
Income x P(t,n;A*) (Cedis x 10^8)	0.847 (2.76)		
Â x P(t,n;A*) (Cedis-days x 10^4)	0.749 (6.66)		
B. Type of treatment, $\pi_{t\|s}$			
Cost of First visit: P(t,1;A*) (Cedis x 10^3)	-0.415 (7.04)	-0.326 (4.96)	
Time (Minutes x 10^2)	-0.296 (4.21)	-0.294 (4.19)	
Income x P(t,n;A*) (Cedis x 10^8)	0.310 (1.90)	0.352 (2.49)	
Doctor available (1=Yes)	1.144 (7.81)	1.192 (9.07)	
Professional available (1=Yes)	1.303 (11.02)	1.305 (11.04)	
Hospital inpatient	-1.952 (7.35)	-2.013 (8.00)	
Â x hospital inpatient	0.099 (1.95)	0.101 (2.02)	
$(1-\sigma_t)$	-0.154 (1.16)	0	

APPENDIX TABLE A5

(Continued)

Nested logit estimates of choice of type and intensity of medical treatment (t ratios in parentheses)

$\pi_{stn} = \pi_{n|ts} \quad \pi_{t|s} \quad \pi_s$

	Unconstrained	Constrained $\sigma_t=1$	Constrained $\sigma_t=\sigma_s=1$
C. Self or professional treatment, π_s			
Cost of first visit: P(t,1;A*) (Cedis x 10^2)		-0.125 (8.60)	-0.123 (8.66)
Income x P(t,1;A*) (Cedis-days x10^3)		-0.246 (8.28)	-0.294 (8.28)
Â x P(t,1;A*) (Cedis-days x 10^3)		0.512 (8.32)	0.510 (8.32)
$(1-\sigma_t)$		-0.013 (1.63)	0

D. Samples and significance

	Sample Size	χ^2
Frequencies of consultation	8824	412.18
Number of individuals seeking consultations	2206	
Types of treatment	6003	567.10
Number of individuals seeking treatment	2206	
Self or professional treatment	10050	420.12
number of individuals choosing	5025	
Total number of choices observed	56445	

TABLE A6

Estimated price elasticities of intensity and quality of treatment

		Price elasticities	
		Change in own price	Change in all prices
A.	**Intensity of treatment**		
	No consultation	--.---	0.374
	One consultation	-0.186	0.311
	Two consultations	-0.350	0.098
	Three consultations	-0.650	-0.236
	Four consultations	-1.130	-0.734
B.	**Quality of treatment**		
	Hospital inpatient	-0.045	-0.011
	Hospital outpatient	-0.050	-0.021
	Dispensary	-0.035	0.005
	Pharmacy	-0.023	0.023
	Clinic	-0.026	0.009
	Other	-0.030	0.009

TABLE A7

Substitution between hospital outpatient care and clinics

	Elasticity of choice	
	Hospital outpatient	Clinic
A. Price		
Price of hospital outpatient care	-0.050	0.017
Price of clinics	-0.008	-0.026
B. Time		
Time to hospital outpatient care	-0.122	0.041
Time to clinic	0.034	-0.094

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