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A MODEL OF THE DEMAND FOR MEDICAL AND HEALTH SERVICES IN PENINSULAR MALAYSIA

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Abstract—This paper provides an empirical analysis of the determinants of the demand for medical services in Peninsular Malaysia. After elaborating a theoretical model of household demand for medical care in Section II an econometric model is specified and estimated in Sections III, IV, and V. The results indicate that *total* medical demand, as measured by the absolute volume of outpatient and inpatient consumption, is highly inelastic to the cash price and to the cost in time of utilization. Total medical demand is also inelastic with respect to income. Yet consumers are clearly responsive to the relative prices of alternative sources of medical care. Consumers are also sensitive to the way in which the time of utilization is spent, with high travel and treatment time causing reduced demand for services.

I. INTRODUCTION

A common goal of most public sector health care systems in developing countries (LDCs) is to ensure that an adequate amount of medical care is available to the entire population. Differences in location, urban or rural, or in income level should not prevent an individual from obtaining medical care in the event of illness. It is not surprising then, that the literature on the economics of health care in LDCs should focus disproportionately on the substantive problems of *supplying* medical services in a resource-poor economy. The factors underlying the demand for medical care are taken for granted. The policy of subsidized medical care suggests a belief that the demand curve is highly elastic. Policies aimed at reducing the necessary travel time to a clinic and shortening the average waiting and treatment time suggest a belief that the demand for medical care is also elastic with respect to the time price of care. By reducing the price of medical consumption sufficiently, the expectation is also that most illnesses will be seen at a health clinic through the self-referral of the patient. Yet few studies have ever tested the validity of these demand assumptions in the context of a developing country.

This paper presents a theoretical and econometric model of the demand for medical care, and empirically tests the following issues concerning such demand on data obtained from a 1975 household survey in Peninsular Malaysia. Specifically, is household demand for outpatient and inpatient care sensitive to its cost in time and financial resources? Are the principal consumers of medical care those groups with the highest rate of illness? Is the demand for medical care elastic to income? We also examine several aspects of the demand for medical care that are peculiar to a developing country. What factors lead households to seek treatment from traditional medical practitioners rather than from modern medical facilities? What explains a household's choice of a private rather than public outpatient clinic? Malaysia is a society made up of three ethnic groups with strikingly different cultures—Malays, Chinese, and Indians. Does the pattern of demand differ across these groups?

Examination of these issues for the Malaysian public health system is of particular policy relevance. Within the last 20 years, Malaysia has developed a comparatively dense network of hospitals, health centers and midwife clinics in the urban and rural areas. Extensive reliance is placed on medical auxiliaries for diagnosis and treatment at the primary outpatient clinic level, particularly in rural areas. This has ostensibly reduced the queueing costs associated with a physician-based system. Mobile medical teams regularly fan out from the health center to provide care to the dispersed rural population. As a consequence, the mean time cost of utilizing a government outpatient clinic is only one hour. The fees for service are heavily subsidized and a household spends an average of only U.S. $0.15 relative to an average household *per capita* income of U.S. $470. If Malaysia has been successful in providing an adequate network of medical care [1], one should find that the importance of the cash price and the time cost of care as barriers to medical consumption would be very small. This analysis provides evidence on this hypothesis.

Section II briefly develops a theoretical model that suggests some of the difficulties in estimating normal price and income effects on the demand for medical care. Section III discusses the specification of the econometric model. Section IV describes the data and the methodology applied in estimating the model and the results are discussed in Section V.

II. THE THEORETICAL MODEL

The primary objective of the theoretical model is to isolate the basic behavioral and physiological relationships underlying the demand for medical care. In particular, it will be shown that factors which differentiate this demand from that of other goods renders it impossible to conclusively argue that the price and income effects that apply for most normal goods will apply to the demand for medical care.

The demand for medical care, whether it be preventive or curative, derives from a more fundamental demand for good health. Preventive services are consumed in the expectation that the cost of prevention is significantly lower than the expected cost of illness. The demand for curative care is associated with the symptoms of possible illness and is made in the hope of being cured, for the alleviation of pain, or for the medical assurance that the symptoms are not significant. This suggests that the demand for medical services will be influenced both by an individual's perceived state of health—i.e. the frequency of illness (morbidity)—and by the economic factors which are likely to underlie the demand for any commodity such as income or the set of market prices. Yet an individual's health status is dependent on these economic factors, and is influenced by an individual's other consumption choices. Particularly in LDCs, we might expect that the capacity to afford more medical care would be associated with a capacity to afford the kinds of other consumption which would reduce the frequency of illness.

Specifically, several factors determine the quality of an individual's health status. The quality of the external environment—the virulence and prevalence of pathenogenic agents—determines the general level of risk of illness. Greater consumption of clothing, shelter, nutrients, treated water, etc. provide more insulation against these risks while strengthening the body's ability to resist infection. Consumption of preventive health services may provide immunological resistance, and/or improve the individual's hygienic behavior.

Yet there are limits to a person's ability to insulate against or 'prevent' illness. An individual's age influences the likelihood of illness. In developing countries, one might hypothesize a U-shaped relationship between age and morbidity. There are high risks in the infant and toddler years. In later years, bodily aging may be conceptually perceived as the depreciation of human capital. The likelihood of malfunction increases with age. Medical inputs may restore some of the lost capital [2].

Assume an individual's health status H is produced according to the function

$$H = H(x, k, A, E, e) \quad (1)$$

where k are preventive services, x a composite commodity of other goods and services, A is the age of the individual, E measures the hygienic quality of the environment and e is a measure of the virulence of disease agents in the community. In the short run, A, E and e are exogenous to the individual [3]. One would expect that the healthier the individual (in terms of H), the less the need for *curative* medical services—both due to the reduced frequency and lesser severity of illness. In other words, it is assumed that the minimum level of 'necessary' curative consumption, denoted m, is inversely related to H,

$$m = G(H) = g(x, K; A, E, e), \quad (2)$$

where it is assumed that g_x, $g_k < 0$, $g_{xk} < 0$ and g_{xx}, $g_{kk} > 0$ [4]. Consumption of m is necessitated by illness, either for treatment or for the alleviation of pain. Naturally, individuals may differ in the acceptable threshold of pain that can be borne without seeking outside medical care. What is important for the model is that consumption of m is *necessary*, arising as a consequence of illness, and is less for healthy individuals.

Yet morbidity is not the only factor accounting for the level of medical expenditure. There exists a wide variation in the quality and quantity of medical services consumed by individuals with exactly the same illness or of equivalent health status. This reflects the role of economic factors and/or differences in preference for health relative to other goods and services. The excess of *total* observed medical consumption, M, over m, represents discretionary purchases of an additional quantity or quality of medical care, and will be denoted as m' where $m' = M\text{-}m$.

Note that the consumption of m' is not indispensable. As in the case of the hypochondriac it may be provoked by something other than a real physiological need; it may represent a demand arising from a minor illness that other persons would not consider significant enough to warrant medical attention. Alternatively it may constitute demand for additional medical quality or comfort.

Empirically, it is hard to distinguish m and m'. One only observes M. A given outpatient stay may be necessitated by morbidity but may include the consumption of a higher quality or greater quantity of care. The conceptual importance of this distinction relates to the fact that the economic factors which allow for greater consumption of m' also will produce better health and lower m. Consequently, the effect of changes in economic variables on demand for medical care M will be ambiguous precisely because of these underlying relationships. This distinguishes the present model from the simpler model of Acton, where consumption decisions on m are purely discretionary, and where implicitly, all factors influencing H are wholly exogenous to the individual.

This may be captured in the following model of consumer choice. Assume an individual derives utility, U, from three kinds of goods and services; preventive health services, k, discretionary medical care, m', and

$$U = U(k, x, m') \quad (3)$$

where U_x, $U_{m'}$, $U_k > 0$, U_{xx}, U_{kk}, $U_{m'm'} < 0$ and U_{xk}, $U_{km'}$, and $U_{xm'} > 0$. We assume that an individual derives no utility from m, the necessary component of demand for curative service. In effect, consumption of m is an overhead cost of survival, determined from equation (2).

An individual's choices are constrained by the level of nonearned income, y, and of wage earnings, wT, where w is the hourly wage rate and T is the total amount of time available for market and own production of goods and services. Following Acton's model, it is assumed that consumption of k, M and x not only involves a cash outlay, measured by the respective prices P_k, P_m, P_x, but also an outlay of time and thus a loss in earnings. This takes account of the possible importance of time relative to price as a primary deterrent to utilization in a heavily subsidized medical system. If the time inputs of consuming k, M and x are t, s and v respectively, an individual faces the budget constraint:

$$(P_k + wt)k + (P_m + ws)(m + m'a) + (P_x + wv)x < Y = y + wT. \quad (4)$$

Maximizing the utility function (3) subject to (2) and (4) is equivalent to maximizing the Lagrangian expression

$$L = U(x, k, m') + \lambda[(y + wT) - (P_k + wt)k - [(P_m + ws)(g(x, k) + m')] - (P_x + wv)x]. \quad (5)$$

The first-order conditions for a maximum are:

$$\frac{U_x}{(P_x + wv) + (P_m + ws)g_x} = \frac{U_k}{(P_k + wt) + (P_m + ws)g_k} = \frac{U_{m'}}{P_m + ws} = \lambda. \quad (6)$$

These suggest the nature of the interaction between k and x and necessary curative consumption, m. Since consumption of k or x reduces the rate of illness and thus the need for m, the net price of consuming k or x is the own cash and time price *less* the induced savings in expenditure on m, e.g.

$$(P_x + wv) + (P_m + ws)g_x < (P_x + wv) \quad (7)$$

since $g_x < 0$ [5].

By totally differentiating the first-order equation system, one may solve for the effect on x, k, m and m' of changes in the cash and time outlay parameters (P_k, P_m, P_x, s, t, v), wage rate w, and non-earned income level y. These results are described in fuller detail in an earlier paper by the author [6]. Presently, the implications of the model for the empirically observable demand for curative services $M = (m + m')$ are examined.

(1) As one would expect, if the consumer has maximized utility (such that the second-order conditions are satisfied) the own-price effects for preventive health services (k), non-medical consumption (x), and discretionary medical consumption (m') are negative. An increase in price will reduce the demand for these goods. However, the sign of the own-cash price effect on non-discretionary medical consumption (m) is ambiguous. Since

$$\frac{d_M}{dP_m} = \frac{d_{m'}}{dP_m} + \frac{d_m}{dP_m} \quad \text{and} \quad \frac{d_m}{dP_m} = g_x\frac{d_x}{dP_m} + g_k\frac{d_k}{dP_m}, \quad (8)$$

the cross-price effects

$$\frac{d_x}{dP_m} \quad \text{and} \quad \frac{d_k}{dP_m}$$

must be determined in order to know the effect of an increase in the price of medical care on the total demand for medical care M, viz.,

$$\frac{d_M}{dP_m}.$$

The sign of these latter terms is a priori indeterminate. It can be argued that it is likely, though not certain, that

$$\frac{d_M}{dP_m}$$

is negative.

(2) The income effect on M, $\partial M/\partial y$, ($\bar{p}$ = constant) is uncertain. An increase in income will increase the demand for m', but also lead to a lower rate of illness (though increased demand for k and x) and as a consequence, a *reduced* demand for m.

(3) The effect of a change in the amount of *time* required to consume any good is equivalent to the effect of an increase in the cash price of that good, multiplied by a factor of w.

In summary, this model suggests one can offer unambiguous hypotheses *only* on the effect of changing the cash or time requirements of consuming k, m' and x. Since the demand for curative services M is affected by the externality of consumption of k and x on the frequency of illness, the effect of changes in the wage rate and of own time and cash prices on the total consumption of medical care, M, will be ambiguous. Higher income both raises the curative care, while lowering the medical need. Though increases in the cost of medical care may induce the consumer to substitute x and k, the real income effect lowers the ability to purchase x and k, and as a consequence, may increase the need for m. This would be particularly true where environmental factors cause a high morbidity burden on the population, so that initial consumption of m is high.

III. ECONOMETRIC SPECIFICATION

In adapting the theoretical model to the data available for analysis, several factors and relationships must be considered. First, a model of *household* medical demand is necessarily more complex than that for an individual. The head of a household makes decisions bearing on the consumption patterns of all household members and the consumption of medical care is influenced by the structure of morbidity within the family.

Second, it is difficult to differentiate empirically between the demand for 'necessary' and 'discretionary' curative medical care, m and m', respectively. Such a distinction would necessitate a medical appraisal of the physiological necessity of each outpatient visit or of each component of medical expenditure, and this is an almost impossible data requirement. Typically, only quantitative measures of the components of M are available, such as the number of outpatient visits, inpatient stays, or consultations with a traditional practitioner. No easy correspondence exists between these components and m and m'. For example, in Malaysia, an individual may respond to a severe illness by using either a public or a higher cost, private clinic. For the particular symptoms, both clinics may offer the same medical treatment. It is conceivable that the private clinic is perceived as of higher quality and that the choice of a private clinic does reflect consumption of some m' as well as m. Alternatively, the choice of a private clinic may simply be the consumer's response to the relative time and cash prices of the two sources of care and reflect only consumption of m.

Third, the theoretical model does not consider the technological and physiological complementarities that may exist between alternative sources and types of medical care. Such complementarities coexist with the normal potential for substitution as between different types of care, and must be considered in specifying the econometric model [7]. Finally, there are institutional aspects particular to an LDC setting that need to be included in the model.

Thus, the econometric model will focus on the determinants of consumption of particular components of medical and health demand in Malaysia: outpatient care—public, private and traditional, inpatient care, the type of obstetrical care and prenatal health care. This means that one can make only broad inferences concerning the impact of particular economic variables on total curative demand, M or preventive demand, k [8].

1. *Outpatient model*

Assume a member of the household displays the symptoms of an illness. The head of the household must decide whether the potential severity of the illness, with its associated cost in pain and potential disability, warrants the purchase of medical services [9]. In general, the family must decide the preferred point of entry into the primary health care market, public or private.

Through its network of public hospitals and Health Centers, the Malaysian government provides fairly easy access to primary medical care at highly subsidized rates. In the rural areas, mobile medical teams of medical auxiliaries and maternal–child health nurses regularly extend this network to those smaller villages without a fixed-site health clinic [10]. In larger rural towns and urban areas, the household may go to a private physician's clinic [11]. Practitioners of traditional medicine are an alternative source of care [12]. Households are likely to view these sources as differing in quality. In the public clinic system, the patient is likely to be examined by a medical auxiliary, rather than by a doctor, particularly in the rural areas. Although there is evidence that the quality and effectiveness of the primary diagnosis obtained from a physician and the auxiliary are comparable [13], households may still prefer the assurance of a physician, and thus choose a private clinic.

The econometric model of outpatient demand focuses on the three principal decisions that are made. First, equation (A) (Table 1) examines the factors which determine whether outpatient care was sought at all, either in the month prior to the sample interview, or in the previous year. Second, equations (B) and (C) (Table 1) focus on the kind of medical care purchased: (a) among those households which have purchased both private and public outpatient services, the determinants of the likelihood of usage of a public outpatient clinic are examined; and (b) the determinants of whether a traditional medical practitioner will be used in general, or in the event of a serious illness. Note that use of a traditional practitioner does not preclude a household from having used a modern medical clinic; in fact, such households consume approximately the same level of modern outpatient services as other households [14].

Third, the model focuses on the quantity of outpatient care consumed (No. OPVVIS). The data allow estimation of separate demand equations for the quantity of private, public and total modern outpatient care consumed over the previous 12 months [15], where the sample in each estimation is restricted to only the set of households that used the respective source of care [equations D, E and F (Table 1)]. The definitions of the variables in the following specification and their respective means and standard deviations are defined in Appendix Table I. The functional forms are discussed in Section III.

The rationale for this specification may be briefly outlined. The theoretical model suggests the importance of evaluating the sensitivity of medical consumption to family income [16], the price of alternative sources of health and medical care and the price of other commodities, where price measures are inclusive of the time cost of utilization. Where relevant, measures of the time cost and cash fees associated with *both* public and private care have been included. The estimated coefficients on these economic variables will shed light on the following issues: (a) the degree of substitutability of private and public sources of modern outpatient care, (b) whether households seek alternative sources of medical care with changes in the prices they perceive for these services, (c) whether there is a clear progression in preference toward public and ultimately private outpatient care as household income rises, (d) whether the time cost of utilization of medical care effectively operates as an additional price of medical care and lastly, (e) whether patients attach differing degrees of utility or disutility to time spent in waiting, treatment and transportation.

No data was available on the price of nonmedical commodities, of preventive care and of the cost of traditional practitioner's services. This will impute bias in the estimated coefficients and excessive conservatism in testing for their significance. Although one can only guess, the effect is probably to overestimate the value of the measured coefficients of the income and price variables [17].

The theoretical model suggests the necessity of distinguishing the effect of physiological need on the demand for curative care from those factors which independently influence the quality and quantity of medical consumption. If data were available on the degree of household morbidity, the income and price variables could capture the latter factors. For example, the sample data underlying the studies of Acton and Grossman included self-evaluations of health status. [18] Lacking household-specific medical need data, alternative measures are relied upon to proxy the likelihood of illness at the community, household and individual levels.

Community morbidity rates are mirrored by the level of infant mortality experienced by the household's ethnic group (Chinese, Malay or Indian) in the administrative district of its residence. The health risks associated with the household's own environment are proxied by the quality of the family's sewage disposal system (HYG.SEW) and by the quality of its water supply (UNHYG.H20). At the individual level, one would expect a U-shaped relationship between age and morbidity. For a family of a given size, the greater the fraction of household members at the *extremes* of the age distribution, the greater the medical need. A set of variables measuring the number of household members in the age groups 0–4, 5–15, 16–45 and over 45 have been included. These variables also adjust for the effect of family size differences on demand. Since one might find that parents attach a different priority to the health of boys relative to girls, the number of boys and girls, ages 0–4 are entered as separate variables.

Other factors also influence the decision to utilize an outpatient clinic. In choosing among clinics, the household may be influenced by their perception of the likelihood of being treated by a physician rather than paramedic. Based on past household experience, a variable (EXPECT.MD) to proxy this expectation has been developed. Furthermore, once a visit is made to a primary modern outpatient clinic, whether private or governmental, the physician may recommend the advisability of further treatment.

In the American context, Feldstein [19] argues that there is some limited technical substitutability between inpatient and ambulatory care, both in terms of whether hospitalization occurs at all, and, if it does, in the length of inpatient stay. Further, he suggests the hospitalization decision is jointly made by the patient and physician. In Malaysia, the use of a public hospital system's limited inpatient capacity is effectively rationed according to the degree of medical need [20]. As a consequence, the patient's role in the hospitalization decision is more limited. In only a small fraction of cases does the physician present the patient with the choice of hospitalization relative to ambulatory care, and even the decision on the length of inpatient stay is largely medically determined. Where patient participation occurs, it more likely reflects fears of hospitalization or of cultural 'distance' than economic opportunity cost considerations and is likely to manifest itself in the familiar problem of 'runaways' from hospitals (a problem more common in African countries). We have included the cash and time cost of an inpatient stay to test for any substitutability in demand for outpatient care, although this will not pick up any cultural resistance to hospitalization.

Outpatient visits are often required as a *complement* to a completed inpatient stay. The physician asks the patient to return for periodic examinations. This suggests inclusion of a variable proxying inpatient stays as an independent variable. Unfortunately, the present data is not dated and does not allow us to distinguish the sequencing of the inpatient stays and outpatient visits reported in the 12 months prior to the interview. The variable IPSTAY proxies the likelihood of an inpatient stay. Since this variable is endogenous to our model, the resulting outpatient equation system was estimated using a simultaneous equation estimation procedure—two-stage least squares (TSLS).

Finally, there may be cultural differences in family resource allocation decisions on medical care across Malaysia's three principal ethnic groups. The effect of membership in a particular ethnic group on medical demand by different age groups is included in the specification.

2. *Inpatient model*

The structural equation for the demand for inpatient services is comparable in structure to the outpatient model, though there are some important differences (equation G, Table 1).

The dependent variable in this equation is dichotomous—whether or not a hospitalization occurred in the previous 12 months. Although no information was available on all inpatient stays, 97% of households had one or less visits, and it appeared more appropriate to use an estimation procedure that allows for the heteroscedastic characteristic of a dichotomous dependent variable.

This specification tests for the sensitivityof inpatient demand to changes in the time and cash prices of inpatient care, changes in the price of outpatient services and to changes to income. For the reasons outlined above, one would not hypothesize substantial price or income elasticity of demand. Several other factors are also relevant. Normally an inpatient stay follows an initial outpatient visit. Households with frequent outpatient visits may have a higher likelihood of hospitalization. Ideally, one would desire an estimate of the number of outpatient visits in the previous period; lacking this, the endogenous variable, No. OPVIS is included, and two-stage least squares (TSLS) is used to estimate this equation.

Second, in cases where the principal opportunity cost of utilization is the cost of child care rather than lost earnings the price measures used in the outpatient model may prove inadequate. Similarly, an average time cost per episode may not capture the potentially high variance in time costs to a farmer over the growing season. Two additional measures of cost are included: the dependency ratio (DPNDCY) (as a proxy for the cost of child care) and a dummy variable for whether the household head is a farmer (AGRICUL) (see Appendix Table 1).

Finally, obstetrical care is one area of inpatient demand where the patient has a substantial degree of discretion. Although districts vary in the quality of the available obstetrical care, it is generally possible for any woman to be hospitalized for a birth if she so desires. The choice of birth attendant—traditional village midwife, government midwife or government physician—and place of delivery—hospital, health center or home—are determined by the family, except where complications are expected (equations H, I and J, Table 1). The observed choice may partially reflect the demand for m'. Only where traditional preferences strongly dominate would this hypothesis be questionable. Since these choices may be identified from our data for all women in the sample with deliveries in the previous year, it is possible to test the income sensitivity of this demand. Unfortunately, there is no information on the relative price of higher quality maternity care [21].

3. *Preventive health services*

Since Malaysian public health institutions purport to provde an integrated program of maternal–child health, dental and school health services, it is possible to evaluate the factors which determine the consumption of some of these services. In particular, the level of demand for prenatal care at a government health center is examined. This is the only measure of consumption of preventive services (k) included in this study. The factors underlying the level of school health services consumed reflect more the criteria underlying public sector provision than household demand considerations. The model specification reflects the considerations underlying the earlier outpatient model (equation K, Table 1). Since there is no specific data on the time and fees required for prenatal care, our price estimates for outpatient clinic visits are used as proxies.

4. *Price variables*

Since prices are central to the model's specifications, it is important to describe their measurement.

Table 1. Specification of econometric model

	Use or not of outpatient service (OP.VISIT) (A)	Share of government outpatient visits of household in total outpatient visits (No.OPVIS.GV) (No.OPVIS) (B)	Visit to a traditional practitioner (TRAD.VIS) (C)	Number of government outpatient visits (No.OPVIS.GV) (D)	Number of private outpatient visits (No.OPVIS.PR) (E)	Number of outpatient visits (No.OPVIS.TOT) (F)	Occurrence of an inpatient stay (IP.STAY) (G)	Occurrence of hospital delivery (HOSP.DELIV) (H)	Use of modern practitioner in delivery (MOD.PRACT. DELIV) (I)	Use of physician in delivery (MD.DELIV) (J)	Number of pre-natal visits (PRENATGV) (K)
Probability of an inpatient visit (PR.IPSTAY)	×	×		×	×	×					
Average outpatient fee (OPFEE)	×		×			×	×				
Average outpatient fee in a government clinic (OPFEEGV)				×	×						×
Average outpatient fee in a private clinic (OPFEEPR)				×	×						×
Average waiting time in an outpatient clinic (OPWAIT.-TIME)	×		×			×	×				
Average waiting time in a government outpatient clinic (OPWAIT.TIMEGV)				×	×						
Average waiting time in a private outpatient clinic (OPWAIT.TIMEPR)				×	×						
Average travel time to outpatient clinic (OPTRAV.TIME)	×		×			×	×				
Average travel time to government outpatient clinic (OPTRAV.TIMEGV)				×	×						
Average travel time to private outpatient clinic (OPTRAV.TIMEPR)				×	×						
Average treatment time in an outpatient clinic (OPTREAT.TIME)	×		×			×	×				
Average treatment time in a government outpatient clinic (OPTREAT.TIMEGV)				×	×						
Average treatment time in a private outpatient clinic (OPTREAT.TIMEPR)				×	×						
Total monthly household cash income (INCOME)	×	×	×	×	×	×	×	×	×	×	×
Average cash outlay per inpatient day (IPFEE)	×			×	×		×				

Total time required for outpatient visit (OPTIME)			×								
Average inpatient stay (IPTIME)	×			×	×		×				
Urbanization index (CITYSIZE)	×	×	×	×	×	×	×	×	×	×	×
Number of boys in household, aged 0–4 (BOYS 0–4)	×	×	×	×	×	×	×				
Number of girls in household, aged 0–4 (GIRLS 0–4)	×	×	×	×	×	×	×				
Number of children in household aged 5–15 (CH 5–15)	×	×	×	×	×	×	×				
Number of adults in household under age 45 (ADULT ⩽ 45)	×	×	×	×	×	×	×				
Number of adults in household over age 46 (ADULT ⩾ 46)	×	×	×	×	×	×	×				
Index of water supply quality (UNHYG.H20)	×	×	×	×	×	×	×				
Index of sewage disposal used (HYG.SEW)	×	×	×	×	×	×	×				
Infant mortality rate in district (INFMRT)	×	×	×	×	×	×	×				
Private sector medical doctors per capita (PRIV.MD/POP)	×						×				
Probability of seeing a physician during outpatient visit (EXPECT.MD)	×					×					
Probability of seeing a physician during private outpatient visit (EXPECT.MD.PR)					×						
Probability of seeing a physician during government outpatient visit (EXPECT.MD.GV)				×							
Expenditure on health center per capita (MHC$/POP)	×										×
(OPWAIT.TIMEGV/OPWAIT.TIMEPR)		×									
(OPTREAT.TIMEGV/OPTREAT.TIMEPR)		×									
(OPTRAV.TIMEGV/OPTRAV.TIMEPR)		×									
(EXPECT.MD.GV/EXPECT.MD.PR)		×									
Number of traditional Chinese practitioners per capita (CHIN.MD/POP:			×				×				
Dependency ratio in household (DPNDCY)			×					×	×	×	
Total number of outpatient visits (No. OPVIS)							×				
Agriculturalist household (AGRICUL)							×	×	×	×	
Use of traditional practitioner (TRAD.VIS)								×	×	×	
Total time required for private outpatient visit (OPTIMEPR)											×
Total time required for government outpatient visit (OPTIMEGV)											×

In Section II, it was argued that the cost of utilization of any service includes the fee for treatment and drugs and the cost in time required in order to receive the services. The latter include the costs associated with time spent in transportation, waiting and treatment. It is the *perceived* rather than the actual price that is relevant for explaining household behavior, *ex ante*. Thus, one might anticipate household-specific prices based on the household's location relative to the different sources of care and its past experience with each. Yet the *ex ante* perceived price is difficult to measure *ex post*, since the household's perceptions have been revised through the experience of utilization.

In the survey, households were asked the time required for transportation, waiting, and treatment and the cash outlay for drugs and treatment associated with *each* outpatient clinic visit made by members of the household during the preceding month [22]. For each household, the average cash outlay and time requirements are calculated separately for private and government outpatient clinics. This effectively assumes that recent experience is representative of the prices which motivated outpatient decisions throughout the previous year. This is an important assumption. If invalid, our price elasticity measures are open to serious question [23, 24]. Since many households had no outpatient experience in the previous month, one is forced to impute from the data on user families the perceived prices for the nonusers. For any nonuser household one may associate the mean price and time variables associated with its ethnic group and location (urban or rural). Estimates of the mean cash outlay for a public and private outpatient clinic visit confirm the highly subsidized character of the former–M$0.41 relative to M$5.06 or (U.S.$0.19 relative to U.S.$2.30).

The same methodology was applied to estimate the perceived price of an inpatient stay for the household. For the 211 hoseholds with at least one inpatient stay in the previous 12 months, time is measured by the average number of days per stay (IPTIME). The perceived daily inpatient fee is similarly estimated. The means of these variables for each ethnic group in the rural and urban areas are assumed to be the inpatient price measures of the remaining 1253 non-user households. Though still highly subsidized, the daily inpatient fee is not negligible, averaging M$8.62 per day.

In the theoretical model, the time cost equals the loss in wage income due to the allocation of time to medical consumption. Although this is unambiguous for a wage-earning individual, the opportunity cost of time in a household with dependents and nonearners will depend on *who* is ill and whether or not an earner accompanies the patient. In the LDC, the opportunity cost is also likely to depend on the type of job, season and form of remuneration at the time of the visit.

A time cost measure is estimated, where the time of utilization was weighted by a measure of foregone earnings. Assumptions were made concerning the number of working minutes per month, and total household cash income was used to calculate a time cost per minute. The assumption that an earner accompanied the ill member of the household was arbitrarily made. Since the resulting time cost variables proved highly correlated with cash income [25], inclusion of both variables resulted in multicollinearity. Thus, the time of utilization is also included, *unweighted* by foregone earnings. This will imply an omitted variable error bias in the econometric estimates, which might tend to yield coefficients biased to zero. However, there is evidence [26] that an even greater bias would have arisen due to the error in estimating the opportunity cost of the time of utilization. One effect of the specification is that the cash income variable may capture both a positive income effect and a negative time cost effect (even if our 'medical need' variables have taken account of the effect of income on morbidity).

Another difficulty with these price measures is that they do not fully capture the relative 'accessibility' of health facilities. Precise data on the *ex ante* perceived cost of utilization would implicitly take account of whether a particular district contained an outpatient facility or whether it was regularly visited by a mobile team. If not, the cost in transportation to another district would simply be relatively high. Yet if the cost was so high as to discourage any use, our user data would be biased in its composition. It would not differentiate between those nonusers who were effectively precluded from utilization, from those who simply chose not to consume. The mean time estimates for public and private facilities, 64.9 and 61.3 min respectively, would thus be underestimated.

This is likely to be a significant problem for a model of health services demand in developing countries. In general, private physicians' clinics exist only in urban centers, and the density of the network of government clinics is of questionable adequacy. However, Malaysia is relatively advanced in its provision of rural health facilities, primarily because the Malay majority is predominantly rural. Nevertheless, reasonable accessibility cannot be assumed. To correct for this possible bias in the price measures used, variables measuring the density of health capacity are included. This problem arises only in the equations which examine the factors which discriminate between users and nonusers. Four variables are included: the rates of health center expenditure *per capita* [27], the population per hospital bed, the number of modern private sector physicians *per capita* in the household's district, and the number of traditional Chinese practitioners *per capita* [28].

Finally, an obvious limitation on this analysis is that the household experience underlying the observed data may not contain sufficient variation to estimate the demand curve over all ranges of price and time cost. Similarly, the price of government medical care in Malaysia is sufficiently subsidized that inferences on the price elasticity of demand for government care at price levels equal to that of a private clinic are not possible. This is less of a problem for our total outpatient demand equations since the price measure in these equations is the average price experienced by a household in its use of both private and public care. This price measure has greater variability.

IV. THE DATA AND METHODOLOGY

This section describes the sources of data used for the analysis and the econometric methodology applied. The survey data used in the analysis were designed in connection with a World Bank research project to identify the primary beneficiaries of public expenditure and to assess whether and how public expenditure serves to redistribute income. Detailed questions were asked concerning the range and frequency of access to, or utilization of, each category of public utilities, etc. In addition to the sectoral-specific data, background data was collected as to the family composition, income sources, race and religion of each household.

The survey's sampling frame, designed by the Department of Statistics of Peninsular Malaysia, was stratified by town size and geographic region. Sampling was in two stages, circular and random with 160 primary sampling units. The achieved sample, which was 79% of the drawn sample, conformed very closely to the 1970 Household Census parameters for race, town size, region and so forth. It included 640 urban and 825 rural households drawn from the 11 states of Peninsular Malaysia. Broken down by ethnic group, 854 Malay, 452 Chinese, 148 Indian and 11 other households were included [29]. It encompassed households at all income levels. The mean per capita household income level of the five income quintiles in the sample was U.S.$110, 203, 290, 437 and 1236 respectively (with an overall mean of U.S.$471).

The simultaneous equations system model is estimated using two-stage least squares (TSLS). The use of cross-sectional data for estimating the demand equations in (11) and (12) suggests the possibility of heteroscedasticity. After estimating the second stage of the TSLS estimation, an estimate of the variance of the disturbance was calculated by income quintiles for each ethnic group and these were judged to be significantly different so as to require a generalized least squares estimation to correct for heteroscedasticity. Thus, for (11) and (12), each observation on each variable X_{ij}, was divided by V_{ij}, the estimated standard deviation of the disturbance for the ith ethnic group and jth income quintile. The cash income quintile cutoff points were calculated for the sample as a whole and applied to each of the ethnic groups.

In estimating the demand equations for inpatient care, for the likelihood of outpatient care, for obstetrical quality and for the likelihood of usage of a traditional medical practitioner, (equations G, A, H and C), heteroscedasticity arises as a consequence of a dichotomous dependent variables. Using a maximum-likelihood estimation procedure, a logit model of the form:

$$\log_e\left[\frac{P(Y=1)}{1-P(Y=1))}\right] = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \ldots + \beta_n x_n + \epsilon \qquad (9)$$

was used to estimate these equations, where $P(Y = 1)$ is the probability that the Yth event has occurred [30]. In equation (B), $P(Y)$ is estimated directly, where $P(Y = 1)$ is the fraction of total outpatient visits made to a public outpatient clinic, for all users of both private and public care. The logit model in (9) was then estimated directly by TSLS after transforming the dependent variable.

V. RESULTS

The econometric results are presented in Tables 2–4. Table 2 provides estimates of the demand model differentiating users from non-users of outpatient and traditional care. Table 3 presents estimates of the determinants of the quantity of public, private and total outpatient services demanded and Table 4 presents estimates of the demand for quality in obstetrical care, and the demand for preventive health services. The following discussion will highlight the impact on the structure of medical and health services demand of the time and cash costs of utilization, income, morbidity, ethnic group and technological complimentarities.

1. *Cash price effects*

The results suggest that the demand for outpatient and inpatient care is highly inelastic to cash price. From Table 2, cash price does not prove to be a factor differentiating users from nonusers of modern medical care, whether outpatient or inpatient. Neither is the total quantity of outpatient services consumed significantly influenced by the cash price (Table 3, equations 5, 6). The estimated elasticities of demand range from −0.15 for public outpatient clinics to −0.04 for total outpatient demand [31].

Nevertheless, in their choice among medical alternatives, consumers are clearly responsive to the relative cash prices of private and public outpatient clinics (Table 3, equations 1–4). The cross elasticity of demand for public care due to changes in the private outpatient prices is approximately +0.15. Perhaps because the mean and variance of public sector prices are quite low relative to private sector prices, variations in public sector prices have a smaller impact on the demand for private outpatient clinics. Among those households that have used both kinds of clinics, a higher perceived ratio in the price of public relative to private care reduced the probability of a public clinic visit (significant at an 18% level) [32].

Relative price effects are also relevant in differentiating those households that have used a traditional practitioner in normal circumstances or in the event of a severe illness. The cross elasticities of demand for traditional care due to a change in modern outpatient prices are 0.05 and 0.17 respectively (Table 2, equations 3 and 4).

The price inelasticity of demand for inpatient care is not surprising. Particularly where the rate schedule is deliberately subsidized for lower income groups, the cash burden of hospitalization never becomes large enough to prevent hospitalization. The decision to hospitalize reflects a decision by a medical doctor, not the household.

2. *Time effects*

From the theoretical model, changes in the time cost of a visit, regardless of how the time is spent, should have an effect on demand comparable to a change in the cash price of a visit. Yet there is a conventional wisdom among medical sociologists and practitioners that patients do not regard the time spent in transportation to and from a clinic, in the waiting room and in treatment with equal levels of

Table 2. Econometric estimates on the probability of outpatient and inpatient demand

Equation number	1		2		3		4		5	
Dependent variable	OP VISIT (in PREV. YEAR)		OP VISIT (in PREV. MONTH)		PR. USE TRAD. PRACT.		PR. USE TRAD. PRAC. for SEVERE ILLNESS		IPSTAY	
Independent variable	β	t	β	t	β	t	β	t	β	t
Endogenous										
OP.VIS									0.030	1.11
PR.IPSTAY	3.887	2.11	2.524	2.73						
Exodenous										
OPFEE	0.009	0.14	0.026	0.80	0.036	1.43	0.20	2.54		
OPTREAT.TIME }	−1.539	−0.84	−0.317	−0.32					0.77	0.71
OPWAIT.TIME (100 }	−0.350	−0.48	0.134	0.35					0.49	1.05
OPTRAV.TIME minutes) }	0.321	0.44	−0.200	−0.47					−0.35	−0.63
INCOME (in M$1000)	0.046	0.18	0.073	0.68	−0.38	−2.12	−0.36	−0.89	0.032	0.25
CITYSIZE	−0.30	−2.37	−0.089	−1.34	−0.12	−1.82	0.05	0.30	−0.052	−0.66
OPTIME (in 100 min.)					0.42	1.62	−0.21	−0.38		
BOYS 0–4	0.124	0.42	−0.024	−0.17	−0.16	−1.28	−0.11	−0.39	0.441	3.34
GIRLS 0–4	0.26	1.14	0.12	1.07	0.08	0.64	−0.20	−0.69	0.442	3.19
CH 5–15	0.194	1.94	0.09	1.74	0.24	3.00	0.04	0.22	0.072	−0.77
ADULT ≤ 45	0.080	0.85	−0.052	−1.14	−0.002	−0.04	−0.07	−0.62	0.120	1.94
ADULT ≥ 46	−0.045	−0.29	0.030	0.35	0.21	2.47	−0.01	−0.44	0.183	1.69
EXPECT.MD.	−0.37	−0.97	−0.027	−0.12						
UNHYG.H_2O	−0.643	−2.57	−0.22	−1.49	0.33	1.99	0.39	1.08	−0.076	−0.38
HYG.SEW	0.412	1.07	0.08	0.48	−0.43	−2.31	0.16	0.37		
INFMRT	−0.02	−1.60	−0.007	−1.03	0.02	3.67	0.05	3.46	0.015	2.23
IPTIME	−0.004	−0.29	−0.007	−0.86					0.001	0.07
IPFEE	−0.30	−1.85	−0.012	−1.53					0.001	0.10
PRIV.MD/POP	−0.25	−2.31	−0.19	−2.93					0.331	1.23
CHIN.MD/POP					0.11	1.27	−0.87	−3.57	0.991	3.87
MCH$/POP	0.139	3.08	0.016	0.79						
DPNDCY RAT.					−0.62	−1.15	−1.34	−0.90	0.999	1.39
CHINESE	0.592	1.58	0.140	0.71	1.45	6.63	0.15	0.28	0.331	1.23
INDIAN	0.195	0.35	−0.161	−0.58	−0.61	−2.14	−1.37	−2.60	0.991	3.87
OPFEE.PR									−0.001	−0.01
OPFEE.GV									0.054	0.61
AGRICUL									−0.228	−1.00
CONSTANT	3.806	3.59	0.384	0.66	−2.55	−5.48	−0.83	−0.72	−3.91	−6.49
R^2	0.009		0.062		0.10		0.28		0.09	
N	1315		1315		1342		241		1315	
Estimation Procedure	LOGIT: MLE TSLS		LOGIT: MLE TSLS		LOGIT: MLE TSLS		LOGIT: MLE TSLS		LOGIT: MLE TSLS	

delight or displeasure. The present specification distinguishes these time components to test this hypothesis.

As with the cash price variable, the probabilities of an outpatient visit, of hospitalization and the total number of outpatient visits are notably unresponsive to the total time required. Although the coefficient of time in treatment has a statistically negative impact on outpatient visits, the elasticity to time is less than −0.10.

Yet in their choice among alternative sources of care, households reveal a clear preference *against* time spent in transportation and treatment and *for* time spent in waiting. Among households using both government and private clinics, the greater the amount of travel time or treatment time in government clinics relative to that in private clinics, the *lower* the utilization of government clinics. The reverse is true of waiting time. These results are statistically significant. The same results also emerge from the signs of these time variables in the separate equations for the total demand for government or private outpatient care (although the coefficients are statistically less significant, see Table 3, equations 1–3).

Nevertheless, the negative impact of travel time is not highly elastic. This may simply reflect that Malaysia's rural health network is sufficiently dense that the travel time is not excessive for most citizens. Mobile medical teams sharply reduce the mean travel time throughout the system. The negative response to treatment time is in part surprising. Although there may be pain associated with treatment, one would have expected a positive preference for longer examinations. With respect to the positive value associated with waiting time, Malaysian households may like the chance for 'socializing' associated with outpatient clinic use [33]. It is also interesting that among households using both government and private clinics, it is the relative *transport* time requirements rather than the relative time requirements for *treatment* and *waiting* that proves important in the choice of a public rather than private clinic; the higher the relative time spent in transportation to a government clinic, the lower the probability of usage.

Other evidence exists which supports the conventional wisdom that transport time or physical accessibility may operate as a deterrent to consumption. The demand for traditional practitioners is positively influenced by higher time requirements of modern outpatient clinics. Since one of the reputed advantages of traditional practitioners is the convenience and informality of access, time may, at the margin shift demand away from the modern medical system. Furthermore, since we were forced to use mean price estimates for nonuser households, extreme levels in perceived time cost and its effect on nonutilization are not captured by the time variable. It is in the rural areas that the time cost issue would be most pressing. The significant positive relationship between the measure of the density of rural medical supply used in this study—the *per capita* expenditure on Main and SubHealth Centers—and the probability of outpatient usage supports the conventional wisdom. It may also be one explanation for why the coefficient of the urbanization index suggests rural households have a lower level of outpatient demand.

3. *Interactions of inpatient and outpatient care*

The hypothesized technological complementarity between inpatient and outpatient care is verified principally in one direction—hospitalization results in greater usage of outpatient clinics, with a slightly stronger effect on public outpatient clinics (Table 3, equations 1–3). Households that frequently use outpatient services are slightly more likely to be hospitalized (Table 2, equation 5).

Neither do the results suggest significant *ex ante* substitutability between inpatient and outpatient care. The effect of an *increase* in the daily inpatient fee is to *decrease* the number and likelihood of *outpatient* visits, particularly government clinic visits. This might reflect the complementarity mentioned above, but since inpatient demand is found to be inelastic to its own-price, this is unlikely.

4. *Income effects*

There are several consequences of an increase in income on *household* consumption of medical care. First, the results indicate it will have only a minor impact on whether or not the household seeks medical care or on the total quantity of outpatient care consumed by the household. Since the effect of an increase in household income implies both positive income and negative price effects on medical demand (even if one has taken account of the indirect effect of medical need), the estimated coefficient of the income variable is *not* indicative of the narrow income effect of the theoretical model. This is particularly the case in the absence of a measure of the time cost of medical care that takes account of which member of the household spends the time in obtaining medical care and without taking account of family size differences (see below).

Second, increases in income strongly increase the consumption of prenatal care (Table 4), and perhaps by inference, the demand for other preventive goods and services. At higher income levels, households clearly shift their demand from public to private outpatient clinics (Table 3, equation 4). Since the mean utilization time for public and private clinics is comparable, the shift to the former clinics is presumably not a response to a lower opportunity cost of time for their utilization. For obstetrical care, there is a shift to deliveries within a hospital by physicians or Western-trained nurses, as opposed to home deliveries by local village midwives (Table 4). These results indirectly suggest a positive income effect on m'.

These results are confirmed by a study by Heller [34] on the mean level of consumption of several medical and preventive services by income quintile. It is clear that the level of medical care utilization is approximately the same across income quintiles. Unlike most other developing countries, income does not operate as a barrier to access to medical care. However, it is also clear that if one takes account of differences in family size across income groups, the mean level of outpatient and preventive services consumption *per capita* rises from 1.3 for the lowest quintile to 2.1 for the highest. The number of prenatal visits per birth rises from 2.7 to 7.0. Inpatient care *per capita* is far less sensitive to income, with no systematic pattern of higher consumption across income

Table 3. Econometric estimates on the demand for outpatient care

Equation number		1		2		3		4		5		6	
Dependent variable		No. OP. VIS. GV		No. OP VIS. GV		No. OP. VIS. PR		Prob. of public outpatient visit		No. OP. VIS. TOT		No. OP. VIS. TOT	
Independent variable		β	t	β	t	β	t	β	t	β	t	β	t
Endogenous													
PR. IPSTAY		17.8	5.37	18.28	5.83	12.49	3.49	0.059	0.69	25.503	6.67	23.45	6.61
Exogenous													
OP FEE PR		0.205	0.91	0.156	0.72	−0.090	−0.58			} 0.041	−0.28	} −0.038	−0.26
OP FEE GV		−0.148	−0.56	−0.033	−0.12	−0.046	−0.21						
OPTREAT.TIME GV		−0.025	−0.46	−0.051	−0.93	0.072	0.58			} −0.101	−2.01	} −0.114	−2.31
OPTREAT.TIME PR		0.006	0.11	0.004	0.07	−0.54	−0.80						
OPWAIT.TIME GV		0.020	1.24	0.011	0.72	−0.023	−1.32			} 0.010	0.60	} 0.006	0.35
OPWAIT.TIME PR		−0.024	−0.77	−0.031	−1.00	0.027	1.38						
OPTRAV.TIME GV		−0.014	−0.78	−0.017	−1.01	−0.024	−1.17			} −0.015	−0.87	} −0.012	−0.71
OPTRAV.TIME PR		0.059	2.19	0.068	2.53	−0.014	−0.92						
INCOME (in M$1000)		−1.571	−2.58	−1.764	−2.86	0.695	1.81	−0.225	−2.03	0.489	1.08	0.256	0.57
CITYSIZE		−0.842	−2.67	−0.84	−2.72	−0.080	−0.31	0.000	0.02	−0.132	−0.43	−0.161	−0.52
BOYS 0–4	TOTAL	−1.43	−2.58			−1.818	−3.14	0.223	1.92	−2.43	−3.85		
	MALAY			−1.100	−1.83							−1.66	−2.53
	CHINESE			−2.021	−0.54							−3.609	−1.80
	INDIAN			−2.195	−1.37							−3.890	−1.31
GIRLS 0–4	TOTAL	−0.82	−1.89			−1.189	−2.43	0.008	0.08	−0.99	−1.98		
	MALAY			−0.684	−1.300							−0.729	−1.28
	CHINESE			−1.319	−0.72							−1.399	−0.59
	INDIAN			−0.007	0.41							−1.037	−0.18
CH 5–15	TOTAL	0.154	0.75			0.412	1.97	−0.049	−1.15	0.275	1.19		
	MALAY			0.24	0.875							0.082	0.31
	CHINESE			−0.013	−0.604							0.86	1.72
	INDIAN			0.183	0.607							1.082	1.49
ADULT ⩽ 45	TOTAL	0.271	1.44			0.358	1.69	−0.039	−0.96	0.283	1.33		
	MALAY			0.389	1.69							0.485	1.93
	CHINESE			−0.330	−0.21							0.497	0.04
	INDIAN			−1.00	−2.67							−2.12	−3.16

ADULT ⩾ 46 TOTAL	−0.175	−0.52			−0.030	−0.09	−0.35	−0.52	−0.27	−.71		
MALAY			−0.778	−1.9							−0.659	−1.53
CHINESE			0.40	2.04							0.71	2.03
INDIAN			1.35	2.58							0.95	1.77
(MD.GV/MD.PRIV)							0.42	2.30				
EXPECT.MD.GV	−0.234	−0.28							} 0.748	0.80	} 0.854	0.93
EXPECT.MD.PRIV					1.05	0.61						
UNHYG.H_2O	0.188	0.32	0.36	0.61	−1.104	−1.92	0.033	0.24	−0.409	−0.63	−0.360	−0.55
HYG.SEW	−0.807	−1.08	−0.622	−0.83	−1.03	−1.47	−0.022	−0.16	−2.28	−2.64	−1.87	−2.18
INFMRT	−0.048	−1.88	−0.57	−2.365	−0.007	−0.24	0.005	0.68	−0.067	−2.39	−0.067	−2.48
IPTIME	0.024	0.69	0.018	0.52	0.024	0.51	−0.001	−0.22	−0.012	−0.31	−0.017	−0.44
IPFEE	−0.08	−2.36	−0.087	−2.64	−0.016	−0.55	0.002	2.05	−0.081	−2.06	−0.063	−1.63
(OP.FEE.GV/OP.FEE.PR)							−0.221	−1.30				
(OPTREAT.TIME.GV/OPTREAT.TIME.PR)							−0.282	−2.33				
(OPWAIT.TIME.GV/OPWAIT.TIME.PR)							0.006	2.49				
(OPTRAV.TIME.GV/OPTRAV.TIME.PR)							−0.092	−1.35				
CHINESE	−0.242	−0.256			2.789	3.02	−0.33	−1.83	1.69	1.74		
INDIAN	−1.27	−1.00			−1.191	−1.00	−0.185	−0.701	−3.35	−2.52		
CONSTANT	8.18	3.28	8.97	3.82	3.13	1.05	−0.053	−0.1	10.03	4.14	10.19	4.50
R^2	0.16		0.176		0.18		0.19		0.14		0.16	
N	995		995		586		(347)		(1175)		(1175)	
ESTIMATION PROCEDURE	GLS-TSLS		GLS-TSLS		GLS-TSLS		LOGIT: M.L.E.		GLS-TSLS		GLS-TSLS	
Sample	Class of households who have used a government outpatient service at least once				Class of households who have used a private outpatient clinic at least once		Set of households which have used both a private and government clinic at least once		Class of households who have had at least one outpatient visit			

* Dependent Variable equals $\log(P(t)/1\text{-}P(t))$ where $P(t)$ is the probability of a public outpatient visit, $1\text{-}P(t)$, the probability of a private outpatient visit.

† These variables were estimated through the use of multiplicative dummy terms. For example, for the variable 'BOYSO-4', three variables were included: (i) var A = BOYSO-4, (ii) var B = var A for the Chinese, 0. otherwise, (iii) var C = var A for the Indians, 0. otherwise. The marginal coefficient for the effect of an additional toddler boy on the demand of the Malays is β_A, for the demand of the Chinese $\beta_A + \beta_B$ and on the demand of the Indians $\beta_A + \beta_C$. In presenting the results in this and subsequent tables, we have already made the above addition for all multiplicative dummy expressions in order to facilitate the interpretation of the results. The t statistic displayed corresponds to β_A, β_B or β_C, etc. For any given set of multiplicative dummies, the *nonstarred* term is equivalent to variable A in the above example.

Table 4. Econometric estimation of the demand for alternative maternity services

Dependent variable / Independent variable	Maternity care demand* HOSP. DELIV.		MOD. PRACT. DELIV.		M.D. DELIV.		PRENATGV	
	β	t	β	t	β	t	β	t
Endogenous								
TRAD.VIS	−0.99	−1.98	−0.93	−2.27	0.629	−2.94		
Exogenous								
OP FEE PR							0.006	0.03
OP FEE GV							−0.55	−1.32
OPTIME GV							−0.012	−1.08
OPTIMEPR							−0.018	−0.97
INCOME (in M$1000)	1.01	1.56	0.36	0.62	1.16	1.99	2.16	2.21
CITYSIZE	−0.17	−0.89	0.15	0.74	−0.39	−2.35	0.18	0.77
DPNDCY	−1.65	−1.48						
AGRICUL	−0.48	−1.12	−0.92	−2.20	−0.78	−1.74		
MCHS/POP (in M$1000)							0.47	0.005
CHINESE	2.96	5.69	2.300	3.02	1.13	2.62	−1.01	−1.21
INDIAN	2.98	4.30	2.02	1.93	1.44	2.58	0.13	0.14
CONSTANT	0.20	0.22	0.79	1.05	−0.181	−0.30	4.35	2.24
R^2	0.45		0.20		0.28		0.053	
N	194		194		194		194	
ESTIMATION PROCEDURE	LOGIT: M.L.E.		LOGIT: M.L.E.		LOGIT: M.L.E.		GLS	

quintiles. In summary, income is not a barrier to access, but clearly does influence the level and structure of per capita medical consumption, particularly for discretionary medical demand.

5. *Expectations concerning the quality of outpatient care*

The results suggest that the likelihood of being seen by a physician has only a small, and statistically insignificant positive effect on total usage of outpatient care. However, households do significantly respond in their choice between public and private clinics to a higher probability of care from a physician rather than a paramedic.

6. *Health status and the demand for medical services*

The results suggest that higher levels of community morbidity (as proxied by the infant mortality rate) do not lead to substantially higher utilization of medical resources. Specifically, an increase in the rate of illness (a) *reduces* the likelihood a household will seeek outpatient care, and (b) has a significant negative impact on the demand for modern outpatient services, but it (c) does increase the likelihood of inpatient care, and of recourse to a traditional medical practitioner. The infant mortality rate appears to reflect the socioeconomic correlates of higher morbidity households; their lower income and socioeconomic status lead to lower demand for outpatient care, despite the higher 'medical need' (which may not be perceived as such).

The theoretical model hypothesized that the degree of medical need would be related to the age structure of the household. The coefficient of the age bracket variables measure the marginal effect on demand of an additional household member in that bracket. As above, the effect of differences in morbidity across age groups is more apparent in explaining the pattern of inpatient rather than outpatient demand. The effect of an additional child in the 0–4 age group on the probability of hospitalization is 0.44. It falls below zero for the 5–15 age group, then rises for the 16–45 age group to 0.12 and then to 0.18 for the over 45 age group.

The pattern of outpatient demand across age groups is inconsistent with the above hypothesis. It is precisely the dependent, high morbidity groups in the 0–4 and over 45 age groups that consume the *smallest* level of outpatient care (Table 3, equation 5). Only the coefficients of the 5–15 and 16–45 age groups enter with positive coefficients. The pattern is less clear-cut by ethnic groups. The Malays conform to this pattern, with clear relative discrimination in consumption against all but the 15–45 age groups. The dependent populations in particular have decisively lower marginal consumption levels. Both Chinese and Indians appear to discriminate against the 0–4 groups, whereas 5-15, and over 45 age groups have a clearly positive marginal consumption rate.

Thus, only to the extent that the dependent age groups are more likely to be ill with severe illnesses requiring hospitalization will morbidity be reflected in the pattern of medical demand. In these instances, families may perceive few other options and in fact, the options may be taken out of their hands by clinic physicians. Yet the results imply that the household chooses to treat a significant fraction of minor illnesses for the dependent age groups within the home. It will not be translated into outpatient demand. It is the school children and the household members in the working age-groups that are more likely to consume outpatient services, despite their presumably lower relative morbidity rate. Only the Chinese deviate from this pattern, excepting the 0–4 age groups.

Two other points emerge from the results. First, it is the age groups 5–15 and over 45 that are most likely to use traditional sources of medical care. The latter result is not surprising; the older age groups are more likely to have confidence in such forms of treatment and be less interested in time-saving modern medical treatments. Traditional practitioners may absorb a significant share of the illness induced demand within this age group. The former result is less easily explained.

Second, there is the interesting result that households provide a smaller level of outpatient care to boys, aged 0–4 than girls (Table 3, equations 1, 3 and 5). This may indicate that girls are less healthy, perhaps as a consequence of receiving a smaller level of resources within the family. For serious illnesses warranting hospitalization, the probability that a toddler or infant will be hospitalized is independent of sex.

Finally, it has been argued that a household's risk of illness is likely to be exacerbated in an unhygienic environment. Econometically, this relationship may be blurred by the correlation between environmental quality and the household's socioeconomic status. This possibly explains the mixed results obtained in the model. Specifically, environmental factors do not influence the probability of hospitalization. Families with hygienic water supplies have a *higher* (lower) probability of usage of modern (traditional) outpatient services. Similarly, despite higher rates of illness in rural areas, families from a rural district will consume approximately two government outpatient visits *less* than a family from an urban district, though this effect is not picked up on the total outpatient visits equation. Among environmental variables only the coefficient on the measure of access to sanitary modes of waste disposal is consistent with the hypothesized fall in outpatient usage with improved environmental conditions. Again, these results suggest that families with greater medical need are *less* likely to be the principal consumers of outpatient services in Malaysia.

7. *Ethnic differences in the demand for medical care*

Ranked simply by the relative volume of outpatient visits or inpatient stays per household, Indians clearly dominate other ethnic groups with the Chinese next in order [35]. Yet if one adjusts for demographic and socioeconomic factors as in the econometric model, the ethnic intercept terms suggest a different ranking in the level of outpatient consumption by the three groups (Table 2, equation 5; Table 3, equations 1 and 5); the Chinese dominate the rank ordering of the intercept terms for *total* outpatient visits, followed by the Malays; the Indians dominate the demand for hospitalization followed by the Chinese. The Chinese clearly dominate in the demand for revealed traditional practitioner usage. In Table 2, equation (3) the Chinese intercept term is the highest. Since the Chinese in Malaysia are highly urbanized, this may also explain why the probability of usage is highest in the urban areas.

VI. CONCLUSION

Several conclusions emerge from this study. First, total medical demand, as measured by the absolute volume of outpatient and inpatient consumption, appears highly inelastic to cash price, income or time cost. Yet consumers are clearly responsive in their choice among *alternative sources* of medical care to their relative prices. Cross-price elasticities prove significant, not only to cash price but to the relative travel time necessary for the consumption of medical care. Similarly, as income rises, households shift their demand away from traditional practitioners toward modern medical sources of care. Private physicians' clinics appear to be preferred to public clinics, with further increases in income.

Second, the results suggest the importance of the way in which the time required to use medical services is spent. The negative effect of transportation time provides support for the conventional wisdom concerning the deterrent effect of distance on utilization. However, the results do not support the argument that the queueing that characterizes government outpatient clinics drives patients to private clinics.

Third, the results indicate that the pattern of demand by age group does not correspond to the hypothesized U-shaped relationship between morbidity and age. Since the demand for inpatient care appears to be correlated with morbidity, it appears that a household exercises considerable latitude in responding to morbidity that is neither severe nor clearly urgent. The consequence of allowing this morbidity to remain untreated is an important policy question. If it proved a matter of policy concern, particularly for the 0–4 age groups, it may suggest the need for other programs complementary to the present self-referral system for curative care.

Finally, Malaysia has successfully elaborated an innovative medical system embodying the use of paramedical workers, mobile medical teams, a referral mechanism and a network of health centers [36]. The most important finding of this study is that this delivery system has been extremely effective in reaching out to provide medical and preventive health services to the most disadvantaged groups in the society. Neither income nor time cost appears a significant barrier to access or to the utilization of medical care. This finding holds across ethnic groups, in both urban and rural areas. It suggests that the Malaysian model of health delivery may constitute an effective instrument for redistributing income in developing countries.

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1. Many studies have shown that the pool of consumers at an outpatient clinic in the rural areas of LDCs are drawn disproportionately from households residing within a 4–5 mile radius of the clinics. See Bryant J. *Health and the Developing World*. Cornell Univ. Press, New York, 1969 and King M., *Medical Care in the Developing World*. Oxford Univ. Press, Nairobi, 1968. In the paper focussing on the United States, Acton has demonstrated some elasticity in demand for OEO-sponsored health services with respect to time.
2. For an elaboration of a model of the latter, see Grossman M. *The Demand for Health: A Theoretical and Empirical Investigation*. Columbia Univ. Press, New York, 1972.
3. In the long run, the family is in position to change both E and e, either by investment or migration.
4. The greater the level of preventive expenditure, the smaller the likelihood of morbidity, though there are decreasing returns to such investment. It is possible that $g_x > 0$, particularly in a developed country setting. High medical risk consumption may be income elastic.

5. These net prices may be negative for the initial increments of consumption of k and x. However, in equilibrium one must assume that the marginal effect of k and x on m, g_k and g_x are sufficiently small that

$$(\pi_3 + wv) + (\pi_2 + ws)g_x > 0$$

and

$$(\pi_1 + wk) + (\pi_2 + ws)g_k > 0.$$

6. Heller Peter S. A model of the demand for medical and health services in West Malaysia. CRED Discussion Paper No. 62, University of Michigan, 1976.
7. It is often suggested that patients will go to both the modern and traditional practitioner; the former is said to treat the symptoms, the latter the root cause of the illness. See Fabrega H. Medical Anthropology. *Yearbook of Anthropology*. Similarly, the technology of treatment may necessitate that outpatient visits be made after hospitalization.
8. A single measure of demand is empirically difficult to construct and would necessitate some means of weighting the separate components of medical consumption for their qualitative and quantitative differences. Simply adding outpatient visits does not lead even to a satisfactory measure of total outpatient demand. There are, undoubtedly qualitative differences between public, private, and traditional clinic care. A shift from traditional to public, public to private and perhaps outpatient to inpatient care would probably be associated with an increase in M, if it were a quality-adjusted measure. By focusing on measures of M that are not quality-adjusted, our results would underestimate the effect of an increase in income or price on the demand for m' and thus M.
9. Obviously, in an emergency, this decision may be taken out of the hands of the household decision maker.
10. Heller Peter S. Issues in the costing of public sector outputs: the health and medical services in W. Malaysia. IBRD Staff Working Paper No. 207, 1975.
11. Unlike any developing countries, private physicians' clinics are found in many of the large rural towns of West Malaysia.
12. It is also possible that for mild illnesses, households rely on their own devices for treatment, possibly going to a grocery store or pharmacy for aspirin or other easily available drugs. Our survey did not include questions on this component of demand for health-related goods and services.
13. W. H. O. *Special Report on the Study of Local Health Services, Malaysia, 1973*. W. H. O. Document No. 400ZE.
14. Among households that have used a traditional practitioner in the previous 12 months, 90% have also used a modern outpatient clinic and the mean number of such visits is 12.1. Among households that have used a traditional practitioner in the event of a serious illness, 85% have also used a modern outpatient clinic in the previous 12 months, with the mean number of visits equalling 9.3.
15. Unfortunately, our sample data do not allow us to examine the quantity of traditional medical services.
16. Our measure of income does not capture the impact of permanent income variations.
17. We would not expect a significant correlation between the prices of other goods and services (x) and that of outpatient care, so that the omitted variable bias is primarily in overestimating the variance of the estimated coefficient. We would expect a positive correlation between the perceived price of preventive health services, the level of household income and the price of curative medical services. If the cross-price effect of preventive services on the consumption of curative care is positive, the coefficients of the price of curative care and of household income on the demand for curative care will be overestimated.
18. In Grossman's sample, persons were asked whether their health status was poor, fair, good or excellent and he used this question to index the amount of health capital possessed by an individual. See Grossman, *op. cit.* Acton's measure was probably superior. His variable measured the number of chronic health conditions that limit activity. (See Acton, *op. cit.*).
19. Feldstein M. Hospital cost inflation: a study of Nonprofit price dynamics. *Am. Econ. Rev.*, **61**, 853, 1971.
20. Private inpatient facilities exist only in Penang and Kuala Lumpur.
21. Since one would expect a positive correlation between the perceived price of higher quality maternity care and our income measures, and a negative coefficient of such a price variable on demand, the coefficients of the income variable will probably be underestimated.
22. In our sample, there were no more than 5 outpatient visits per family in the previous month.
23. It should be noted that the mix of government facilities on which user data is available for any household will obviously differ according to the household's experience. One family may exclusively use Main or Sub-Health Centers; another may use District hospital outpatient clinics. Our methodology implicitly assumes that this is representative of the mix of facilities used in general by the household.
24. For example, cash outlay for public outpatient visits is extremely low—M$0.41. If, for a large proportion of households, drug costs are the significant element in the cash costs of the visits (fees being negligible), it is arguable whether one can assume that the outlays for drugs experienced in the past are reasonable proxies for the *ex ante* expected cash outlay for an outpatient visit.
25. The correlation coefficient between cash income and the estimated time costs of (a) an inpatient stay, (b) a public outpatient visit and (c) a private outpatient visit are 0.86, 0.88 and 0.71 respectively.
26. Acton has argued that such an omission will bias the estimated effect of time to zero, if the time of utilization, s, and the opportunity cost of time, w, are negatively correlated. However, w and s have only negligible correlation; the correlations between cash income and (a) IPTIME, (b) OPTIMEGV, (c) OPTIMEPR equal −0.01, 0.03, −0.01, respectively. Moreover, Acton's study found that the bias due to the error in measuring the opportunity cost of time is greater than the bias caused by omitting it from the specification. Acton J. Demand for health care when time price vary more than money prices. Memo R-1189-OEO/NYC, Rand Corp., 1973.
27. We have used the level of expenditure on Main and SubHealth Centers, rather than the number of health centers as the numerator, since the latter does not correct for differences in the staff size of health centers.
28. The data on the number of traditional Chinese practitioners were compiled from a detailed survey by Melinda Meade and were generously made available. Unfortunately, we lack data on the number of traditional Malay practitioners (*bomoh*).
29. For a more precise description of the sampling frame and survey characteristics, see Meerman J. *Public Expenditure in Malaysia*, Oxford Univ. Press, New York, 1979.
30. See Kmenta J. *Elements of Econometrics*, pp. 462–463. MacMillan, New York, 1971 and DuMouschell W. *The Regression of the Dichotomous Dependent Variable*. Institute of Social Research, University of Michigan, Ann Arbor (unpublished).
31. The means of the variables are listed in Appendix Table 1 and the reported point elasticities may be de-

rived from these and the reported coefficients (e.g. if y and x are the dependent and independent variables, respectively, and β the coefficient, the elasticity will equal (β_x/y).

32. In making these estimates, we assume that all price measures are exogenous to the consumer. Yet it might be argued that the fees set by government and private clinics are income related. We tested this and found a significantly positive effect of cash income on the average household fee to government outpatient clinics *but* this accounts for a negligible fraction (1.45%) of the actual variance in perceived average cash outlay by households.
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34. Heller (1976), *op. cit.*
35. *ibid.*
36. Heller (1975), *op. cit.*

APPENDIX

Table 1. List of variables with means and standard deviations

Variable	Definition	Mean	SD
$IP.STAY_j$ =	1 if household *j* had an inpatient stay during previous 12 months. 0. otherwise	0.17	0.37
$PR.IPSTAY_j$ =	estimated probability of an inpatient stay by household *j* (estimated using maximum likelihood procedure)	0.23	0.18
No. $OPVIS_j$ =	total number of outpatient visits by household *j* in previous 12 months	10.10	11.56
No. $OPVISPR_j$ =	total number of outpatient visits by household *j* to private modern outpatient clinic in previous 12 months	3.12	6.60
No. $OPVISGV_j$ =	total number of outpatient visits by household *j* to government outpatient clinic in previous 12 months	6.98	9.45
$OPWAIT.TIMEGV_j$ =	average number of minutes of waiting time experienced by the household *j* in utilizing a government outpatient clinic in previous 12 months*	33.75	16.1
$OPWAIT.TIME_j$ =	average number of minutes of waiting time experienced by the household *j* in utilizing an outpatient clinic in previous 12 months	28.18	16.41
$OPWAIT.TIMEPR_j$ =	average number of minutes of waiting time experienced by the household *j* in utilizing a private outpatient clinic in previous 12 months*	20.58	8.78
$OPTRAV.TIMEGV_j$ =	average number of minutes of travel time experienced by the household *j* in utilizing a government outpatient clinic in previous 12 months*	23.62	12.92
$OPTRAV.TIMEPR_j$ =	average number of minutes of travel time experienced by the household *j* in utilizing private outpatient clinic in previous 12 months*	30.24	14.25
OPTRAV.TIME =	average number of minutes of travel time experienced by the household *j* in utilizing an outpatient clinic in previous 12 months*	25.18	16.15
$OPTREAT.TIMEGV_j$ =	average number of minutes of treatment time experienced by the household *j* in utilizing a government outpatient clinic in previous 12 months*	7.40	4.30
$OPTREAT.TIMEPR_j$ =	average number of minutes of treatment time experienced by the household *j* in utilizing a private outpatient clinic in previous 12 months*	9.65	4.88
$OPTREAT.TIME_j$ =	average number of minutes of treatment time experienced by the household *j* in utilizing an outpatient clinic in previous 12 months*	8.14	6.15
$OPTIME_j$ =	average number of minutes of travel. waiting and treatment time experienced by the household *j* in utilizing an outpatient clinic in previous 12 months*	59.8	18.8
$IPTIME_j$ =	average number of days per inpatient stay experienced by household *j* in utilizing a government inpatient facility*	11.56	6.83
$OPFEEGV_j$ =	average cash outlay of household *j* in utilizing a government outpatient clinic during previous 12 months*	0.41	0.86
$OPFEEPR_j$ =	average cash outlay of household *j* in utilizing a private medical doctor's clinic during previous 12 months*	5.06	1.62
$IPFEE_j$ =	average cash outlay per day of inpatient stay in utilizing an inpatient service during previous 12 months*	8.62	11.05
$OP.VISIT_t$ =	1 if household had an outpatient visit during period *t*, 0 if not: *t* is defined for this variable as either the previous month or previous year	0.51† 0.89‡	0.50†
TRAD.VIS =	1 if household obtained care from a traditional practitioner during the previous year. 0 if not	0.27	0.44
TRAD.VIS. SEV.ILL =	1 if household sought assistance from a traditional practitioner in the event of a serious illness. 0 if it obtained care from a modern-medical source	0.57	0.50
$OPFEE_j$ =	average cash outlay of household *j* in utilizing a modern outpatient clinic during previous 12 months	2.07	2.34
$INCOME_j$ =	total monthly cash income of household *j* from (i) salaries and wages in cash and kind, (ii) sale of produce, (iii) business, (iv) rent and interest, (v) remittances, pensions and allowances, (vi) scholarships, (vii) monetary value of goods received from outside the household, (viii) monetary value of house rent for owner-occupied houses, (ix) monetary value of food grown or goods produced and consumed at home, (x) monetary value of animals hunted, poultry bred and fish caught and consumed at home	50.8	79.4
CHINESE =	1 if a Chinese household. 0 otherwise		
INDIAN =	1 if an Indian household. 0 otherwise.		
$CITYSIZE_j$ =	1 if household *j* lives in a metropolitan district, 2 if in a large urban center, 3 if in a small urban center, and 4 if in a rural area	3.09	1.16
$BOYSO\text{-}4_j$ =	number of boys in household *j*, aged 0–4 years.	0.36	0.61
$GIRLSO\text{-}4_j$ =	number of girls in household *j*, aged 0–4 years	0.32	0.58
$CHILD5\text{-}15_j$ =	number of children in household *j*, aged 5–15 years	1.33	1.39
ADULTS $\geqslant$ 46 =	number of adults in household *j*, aged 46 or more years	0.81	0.85
ADULTS $\leqslant$ 45 =	number of adults in household *j*, aged 16–45	2.52	1.79
EXPECT.MD =	fraction of all outpatient visits made by family in which treatment was received from a physician*	0.71	0.33
EXPECT.MD.GV =	fraction of all outpatient visits made by family to a government clinic in which treatment was received from a physician*	0.63	0.30
EXPECT.MD.PR =	fraction of all outpatient visits made by family to a private clinic in which treatment was received from physician*	0.91	0.17
UNHYG.H20 =	0 if the household *j* obtains hygienically treated piped water in to the house, 1 otherwise	0.43	0.50
MOD.PRACT.DELIV. =	1 if a birth to household in previous year was attended by a modern practitioner (modern nurse, midwife or physician), 0 if not	0.76	
M.D.DELIV. =	1 if a birth to household in previous year was attended by a physician. 0 if not	0.29	
$HYG.SEW_j$ =	0 if household *j*'s night-soil is disposed of by bucket system, pit, curah, over streams or in fields; 1 if flush disposal system is used.	0.25	0.44
$INFMRT_j$ =	infant mortality rate of household *j*'s racial group in district of residence	40.52	14.58
$MHCS/POP_j$ =	level of main and subhealth expenditure per capita in district of household *j*'s	5.1	3.2
$PRIVMD/POP_j$ =	private sector medical doctors per capita in district of household *j*'s residence (in 10,000 of population)	1.00	1.12
$CHINMD/POP_j$ =	traditional Chinese practitioners per capita in district of household *j*'s residence (in 10,000 of population).	0.76	0.83

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Table 1 (*continued*)

	Mean	SD
$AGRICUL_j$ = 1 if household head or any other member of household *j* is an agriculturalist, 0 otherwise. An agriculturalist is defined as (i) owning more than 1/2 acre of land which is being cultivated by the owner or someone else, or (ii) cultivator of more than 1/2 acre of land who does not own the land, or (iii) owner of livestock who gets more than 1/2 his income from livestock rearing, or (iv) livestock rearer who does not own the livestock but gets more than 1/2 his income from this occupation	0.36	0.48
DPNDCY = ratio of number of children, aged 0–9 to total size of household	0.37	0.24
POVOCC = 1 if the household head is engaged in rubber tapping or is a nonland-holding agricultural laborer, agriculturalist or fisherman	0.50	0.50
$PRENATGV_j$ = number of prenatal visits to a government clinic during the previous 12 months made by a household *j* that had a baby during that period	3.48	4.27
HOSP.DELIV. = 1 if a birth to household in previous year occurred in a hospital, 0 if not	0.46	—

* For households that have not had an outpatient visit or inpatient stay during previous month, the average value of the variable for all household's in household *j*'s ethnic group and city size is used.

† In previous month.

‡ In previous year.