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The Demand for Health Care

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Introduction

The information generated from health-care demand analysis has a number of potential applications. It can be used to improve access to health services because it shows the factors that affect health service utilization such as household income, distance to health facilities, service availability, health insurance, and prices of the services offered. Moreover, demand analysis can help identify factors that affect patients’ perceptions of the quality of medical care, enabling policy makers to implement interventions to change patterns of health service usage in socially desired ways. These issues are important because health care helps the population only when it is used to maintain and promote health or to cure or prevent illnesses. Information on demand patterns could further be used to improve equity in health outcomes because it reveals social groups that are excluded from basic health care due to poverty or other factors. Such health care can then be delivered to vulnerable groups through targeted interventions. Thus, evidence on demand patterns provides policy makers with the information they need to address efficiency and equity issues in health care. Broadly conceived, health-care demand analysis includes investigations into behaviors and practices that improve health.

The article first reviews a unified model of health-care demand that links health service utilization to health production. The analytical and policy strengths of this model lie in the breadth of the issues it is capable of analyzing. It covers demand for marketable commodities, e.g., immunizations and medical treatments, and for non-tradeable inputs into health, such as behavioral changes that promote health. Next, related models of health-care demand are reviewed, emphasizing their policy value and estimation methods. The final section of the article provides perspectives on future research in the modeling of health-care demand.

The Unified Model of Health-Care Demand

Consumer Preferences, Budget Constraints, and Health-Care Use

The economic approach to the analysis of health-care utilization is based on three ideas. The first idea is that people know what they can do to maintain health and prevent or cure illnesses, and they are capable of ranking the actions that can be taken. In other words, people are endowed with the abilities or preferences for ranking health services. The second idea is that the material means that people possess, such as income and assets, limit the type and intensity of the actions they can take to maintain or promote health. This limitation arises from the fact that health services, like other goods, have prices that consumers must pay directly or indirectly given limited incomes or assets. The third idea is that, faced with...
this limitation, people try to do the best for themselves. Expressed strongly, the idea says that people make choices and behave in ways that enable them to maximize the benefits from health-care consumption given their income or wealth. This maximization hypothesis is the cornerstone of much economic analysis, including demand analysis. Not surprisingly, the hypothesis is the subject of intense debate in the health-care demand literature. Since individuals and households possess limited information about health care, the assumption that this care is optimally used to confront illnesses is too strong. For example, the assumption is contradicted by consumption behaviors that harm health, such as smoking, drug abuse, and unhealthy eating habits. Economists have to date not been able to respond convincingly to the persistent criticism that people do not possess the ability and the information required to engage in optimizing behavior. However, in order to derive the strong prediction of demand theory, that people respond to price incentives, a view on optimization assumption is required. Economists generally assume that people behave as if their purpose in life is to do the best for themselves using their scarce resources. This assumption permits a straightforward derivation of policy relevant prediction of demand models that is generally in agreement with everyday experience. For example, the models predict that people will reduce consumption of health-care services if health-care prices are increased, provided that other factors such as income and the disease environment remain the same. Policy makers can use estimation results from these models to set appropriate prices for health-care services. Indeed, information on demand parameters is essential for evidence-based financing of health services.

The Unified Model

The unified model of health-care demand was developed by Grossman (1972) and Rosenzweig and Schultz (1982). An important property of the model is that the production of health is embedded in the utility maximizing behavior of a household member. The household member is assumed to have preferences over health-neutral goods, health-related goods, and over the health status. To simplify the analysis, it is usually assumed that the household members share the same preferences about health care and other commodities. Under this assumption, all household members act as one unit when demanding health-care services so that the utility function of any member can be expressed as:

\[ U = U(X, Y, H) \]  

where,

- \( X \) = a vector of health-neutral goods, i.e., commodities or services that yield utility, \( U \), to an individual but have no direct effect on health status of the person demanding the goods, for example, bus transport or consumption of electricity;
- \( Y \) = a vector of health-related goods that impact on the utility of an individual and also affect his or her health status, e.g., quantity of smoking and alcohol consumption or sports activities;
- \( H \) = health status of an individual.

The health production technology of the individual is given by:

\[ H = F(Y, Z, \mu) \]  

where,

- \( Z \) = a vector of health services or health investment goods, such as medical care and immunizations that affect health status directly;
- \( \mu \) = a random component of health due either to genetic or environmental conditions.

The goods represented by vectors \( Y \) and \( Z \) in eqns \([1]\) and \([2]\) may also be viewed as health inputs into the production of health.

An individual acts as if his or her purpose is to maximize eqn \([1]\) given eqn \([2]\) subject to a linear budget constraint of the form:

\[ I = XP_x + YP_y + ZP_z \]  

where,

- \( I \) is exogenous income;
- \( P_x, P_y, \) and \( P_z \) are, respectively, the vectors of prices of the health-neutral goods, \( X \), health-related consumer goods, \( Y \), and health investment goods, \( Z \).

Notice from eqns \([1]\) and \([2]\) that the vector of health investment goods, \( Z \), enters an individual's utility function only through \( H \).

Equation \([2]\) describes health production at the individual level. As noted previously, the health production function is imbedded in the utility function. Expressions \([1]\)–\([3]\) can be manipulated to yield the demand functions of the following general form

\[ X = D_x(P_x, P_y, P_z, I, \mu) \]  
\[ Y = D_y(P_x, P_y, P_z, I, \mu) \]  
\[ Z = D_z(P_x, P_y, P_z, I, \mu) \]  

In the ensuing discussion, reference is made mainly to eqn \([4.3]\) above, as it is the only direct demand function for health services in the equation system \([4.1]-[4.3]\). Equation \([4.3]\) states that the empirical health service demand, i.e., the observed health service utilization pattern, is a
As previously noted, the motivation for the unified model by households in consultation with health-care providers. The quantities of the inputs used to produce it are determined by household decisions, which are influenced by their own health status. Thus, the amount of health produced and the demands and behaviors are inputs into the production of health-care services. Through eqn [2], the direct effects of medical treatments can be revealed, while eqn [4.3] shows the effects of medical treatments on the estimated impact of health-care services on health. That is, in order to accurately predict the demand for health care, called the cross-price effect. An interesting cross-effect that can be estimated is the impact of the price of a health-neutral good on health-care demand. This cross-price effect, like all price effects, manifests itself through the budget constraint. It is possible to demonstrate through further manipulation of eqn [4.3] that efficacy of medical care is a key parameter in demand predictions. That is, in order to accurately predict the demand for health services, information is needed both on the effectiveness of medical treatments and on the estimated impacts of prices and incomes.

The estimates of the parameters of the unified model can reveal through eqn [2], the direct effects of medical care services (Z) on health, thus helping both policy makers and households to prioritize medical care expenditures. The estimates could further be used to assess the impacts of a whole range of behaviors (Y) on health. The unified demand model has been used to investigate determinants of birth weight in both developed and developing countries. For example, in the United States, Rosenzweig and Schultz (1982), showed that smoking during pregnancy and delay in using prenatal care reduce birth weight. African evidence generated using the model shows that tetanus immunization during pregnancy is associated with improvements in birth weight (Dow et al., 1999).

Reduced-Form Demand Models

Under the assumption that health-care consumption improves health, there is no need to estimate equation [2]. In that case, only the demand for health care, such as equation [4.3] needs to be estimated. The estimation can properly be accomplished using a simpler method such as the ordinary least squares (OLS). The demand specifications of this kind are known as reduced-forms because the underlying causal processes are not analyzed.

There are many situations where reduced-form demand functions for health care are appropriate to estimate. If it is known, for instance, that treatment for a particular disease such as tuberculosis is effective in curing the disease, the policy interest there is to identify the factors influencing the demand for TB treatment, rather than an assessment of its efficacy. Similarly, if the effectiveness of a particular vaccine is already established, the issue of policy interest is the estimation of demand for the vaccine, not whether the vaccine works. In reduced-form demand specifications where health status is included in the utility function, the health status can also depend on household characteristics such as education and gender. These characteristics are easy to incorporate in a reduced-form health-care demand, such as eqn [4.3].

Demand quantities based on the utility function of the form shown in eqn [1] usually reflect continuous health-care choices of households. That is, the households are assumed to continue to consume the same type of health care but in different quantities when its determinants such as prices and incomes change. However, in many situations, households shift completely from one form of health care to another when demand determinants change the key factors that determine health-care demand, namely, the commodity prices, income, and unobserved parameter μ. This demand function is to be understood as a quantity–price relationship. That is, the function depicts how the utilization of a particular health service is affected by its own prices holding other factors constant. Other relevant factors that can easily be incorporated in the equation include the time prices of using the health service in question and education, age, gender, and location of patients or their households.

Equation [4.3] can be used to estimate the effect of the price of a health service on the demand for that service; this is called the own-price effect. It can also be used to estimate the impact of the price of other goods on the demand for the health service, called the cross-price effect. An interesting cross-effect that can be estimated is the impact of the price of a health-neutral good on health-care demand. This cross-price effect, like all price effects, manifests itself through the budget constraint. It is possible to demonstrate through further manipulation of eqn [4.3] that efficacy of medical care is a key parameter in demand predictions. That is, in order to accurately predict the demand for health services, information is needed both on the effectiveness of medical treatments and on the estimated impacts of prices and incomes.

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**Refinements and Extensions**

In the framework presented in eqns [1]–[4], health-care demands and behaviors are inputs into the production of health. Thus, the amount of health produced and the quantities of the inputs used to produce it are determined by households in consultation with health-care providers. As previously noted, the motivation for the unified model is to answer the policy question: How does utilization of health-care services affect health? In order to answer this question well, eqn [2] must be estimated using a special econometric technique known as the two-stage least squares (TSLS) method (Wooldridge, 2002). In the first stage of the technique, health-care demand equations are estimated using exogenous prices and incomes as explanatory variables. In the second stage, demands predicted from those first-stage equations are used to estimate the health production function (Wooldridge, 2002). This procedure permits a statistically correct identification and measurement of the effect of health-care services on health. Despite the attractiveness of the unified model, the data required for its estimation may not exist. Moreover, by making some reasonable assumptions about the correlation between health-care utilization and health status, much simpler demand models can be specified and estimated.
change. These discrete changes in health-care demands are analyzed using probability models of choice.

### Discrete Choice Health-Care Demands

A large literature exists on discrete choice health-care models (see Culyer and Newhouse, 2000; Sahn et al., 2003). The models have been used extensively to study health service utilization in developed and developing countries. Results from these studies show that changes in relative prices shift households from one health-care sector to another. In particular, an increase in user fees at government health facilities in developing countries has been shown to shift patients from these clinics to traditional and informal medications of low quality. The results suggest that health-care financing methods can have major effects on population health and should be designed with care. Information on health-care-seeking behavior obtained using discrete choice models of health-care demand can help in designing appropriate health-care financing policies. A related and consistent finding from the discrete choice demand literature is that the poor and the vulnerable groups are very sensitive to price changes. Thus, in the event of an increase in the cost of drugs or consultation, for example, health-care utilization by the poor is reduced proportionately more than that of the non-poor. This finding can be used to target public subsidies within the health sector in ways that improve equity in health service utilization. The literature further shows that service quality is a key determinant of patients’ choice of medical facilities and of the intensity at which the facilities are used. Information on determinants of the quality of care can be used to increase health-care utilization by the population without changing the existing service costs. For example, the information can be used to encourage mothers to deliver at the health facilities rather than at home. Despite these advantages of discrete choice models, their estimation can be very demanding in data and skill requirements (see Culyer and Newhouse, 2000).

### Information Imperfections and the Demand for Health Care

In the unified demand model and its variants, households are assumed to possess perfect information about all aspects of medical care, such as the prices being charged at different health facilities, and the quality or efficacy of the services offered. In a setting in which households are imperfectly informed about medical care, quality is an overriding determinant of demand. Health care is sought because it increases the probability of maintaining good health or of being cured or the probability of preventing an illness (see Leonard, 2003).

If households have little or no information about the benefits of health services, they might not use them even when provided free of charge. Thus, institutions that help households to learn about health-care quality can have an important impact on demand. The agency relationship that universally exists between the patient and a health-care provider is the prime example of an institution that ideally solves the information problem just noted. That is, since a health-care provider is trained in diagnosis and treatment of illness, she is knowledgeable enough to decide the type and quantity of care for the patient upon being consulted. However, even in a situation where the provider has full information about disease diagnosis and treatment, she cannot accurately predict the effect of treatment prescribed, because the patient might not comply with that treatment. As regards the patient, he too cannot tell whether the provider is using her medical expertise to the fullest extent possible or in his best interest. Thus, in practice, the standard agency relationship presented in the literature does little to assure either the provider or the patient as to the quality of care being provided. The reason is that health-care quality, i.e., the probability of prescribed treatment maintaining health or curing a disease, also depends on unobservable efforts of both the caregiver and the patient. Leonard (2003) has shown that an implicit contract between the caregiver and the patient that allows the cost of treatment to be paid after its effect on illness has been observed improves the standard agency relationship, thereby increasing the demand for health care. The outcome-contingent payment mechanism increases demand, both because it reduces the patient’s risk of receiving ineffective treatment and because it provides an incentive for the caregiver to provide quality treatment so that she can be paid.

The market for health-care services offered by traditional healers, particularly in Africa, offers an excellent opportunity to study the effect of outcome-contingent payment mechanisms on health-care demand. The healers are able to enforce the implicit contract surrounding the outcome-contingent payment method because of the powers that social belief systems in some societies ascribe to them. For example, in many rural communities in Africa, healers are believed to have the power to harm patients who refuse to pay agreed fees after successful treatment. Because of their fear of this power, patients pay treatment fees voluntarily after being cured. Leonard (2003) shows that poor households in rural Cameroon rely importantly on traditional healers for medical treatments. Patients from poor households preferred traditional healers partly because of the outcome-contingent contracts that offered them a form of credit, and partly due to the quality of the healers’ services, as measured by the unobservable effort they devoted to treating long-lasting illnesses. As producers
of health, patients and households work better with healers than with modern health caregivers to treat chronic illnesses.

One may doubt whether outcome-contingent payment systems are applicable in other settings. However, there is evidence that equivalent payment systems can be designed. For example, the Grameen bank model of credit extension to poor people, especially women, without them offering any collateral, which originally started in Bangladesh (Yunus, 2006), has some parallels with the outcome-contingent payment for traditional medicine in Africa. In a Grameen bank context, the peer pressure to honor a loan agreement and the social networks through which the borrower is monitored guarantee repayment, whereas in the traditional medicine context, credit repayment is ensured by the collective belief that the healer has the power to harm defaulters. In both cases, institutions play a role in repayment. In the African context, the debtor is anonymous, but the sharing of the common belief as to the powers of the healers leads to repayment. In the context of a Grameen (i.e., village) bank, the debtor is known to peers and to other village members, and this puts pressure on the debtor not to defray the loan to avoid punishment such as ostracism from a group. The great lesson from the Grameen model of credit extension for health-care financing is that there are substitutes to collaterals in the credit market. Because nonpayment of credit by a group member can reduce creditworthiness of the whole group, the group has an incentive to devise mechanisms to help a lender recover a loan. Thus, group reputation, which is valued in the marketplace, serves as a collateral for credit. Yunus (2006) has strongly argued that institutions might exist or could be created that can allow extension of credit to beggars with a small risk of default.

The performance-based payment contracts in modern health-care financing systems in industrialized countries are not too different from the outcome-contingent contracts in agrarian, traditional settings because they rely on verification of the quantity and quality of health care provided and on application of commonly agreed rules for reimbursement, backed by an enforceable legislation. Under this system, the patient or his representative knows he would be legally compelled to pay if he defaults, so he pays. Similarly, the caregiver knows he would not be paid if his performance is found to be inadequate; so he tries to put forth a sufficient amount of unobservable effort. This situation is quite similar to the case of traditional medicine in Africa where outcome-based contracts are prevalent.

**Time, Self-Control, and Behavioral Change**

As noted previously, it is fairly straightforward to introduce the time cost in the unified demand model outlined in the section titled ‘The unified model of health-care demand.’ Patients often incur substantial opportunity costs in terms of the time they spend to travel to sources of treatment and to wait for treatment there. Thus, time costs affect health-care demand. However, in the models discussed so far, the effect of time on the health-care decision-making process itself, is rarely analyzed. Instead, what is analyzed is the effect of the time cost on the outcome of that decision process. For example, if the outcome of the decision process is to seek health care outside the home, the time cost will determine the facility chosen, other things constant. Typically, empirical demand analysis of this kind (Sahn et al., 2003) is conducted over short durations in a life cycle, such as 2 weeks or 1–3 months, i.e., the durations over which health service utilization data are available.

However, if health-care decisions are examined from the perspective of the life cycle of an individual, the length of time involved could alter both the benefits expected from health care and the ability to implement health-care decisions made in the previous period. For example, a smoker might decide to quit smoking today, but fail to implement this decision in subsequent periods, a behavior that is inconsistent with his rational decision-making processes at different points in time. People who display this type of behavior are, for obvious reasons, said to have time-inconsistent preferences. The reasons for this behavior might include the nature of time discount rates and attitudes toward risk. Since persons with time-inconsistent preferences lack self-control, with regard to consumption that is harmful to health, a study designed to generate information to help them change behavior should not focus on their demand for addictive substances, but on things that strengthen their decisions against addiction. In the case of smoking, such a study could investigate the effects of smoking bans on smokers’ intentions to quit smoking. Persons who want to quit smoking but cannot do so for lack of self-control, would support bans on cigarettes or increases in cigarette prices (Kan, 2007), because such policies help them achieve their intentions. This is an example of how demand analysis can be used to uncover and implement policies that induce health-improving behaviors. A similar analysis can be extended to socially undesirable lifestyles, such as relationships involving multiple sexual partners that need to be understood when designing policies to control HIV/AIDS (Over et al., 2006).

**Conclusion and Perspectives on Future Research**

This study has demonstrated how health-care demand can be linked to health production so that demand information can be used to design and implement strategies for
improving health. Since the resources available to finance health-care consumption are scarce, it is important to assess effects of such consumption on health. Linking health-care demand estimates to health production facilitates such an assessment. The article has further shown how information asymmetries and risks in health care can be incorporated in the standard models of demand to improve their predictive powers and policy relevance. Future research on health-care demand should focus on these newer modeling efforts, using data from both household surveys and field experiments to test the hypotheses generated by the models.

Although the focus of the chapter has been on microeconomic aspects of health-care demand, macroeconomic models of health care would generate valuable information for formulating national-level policies to improve health. At the international level, research on demand for global public health goods, e.g., the protection against current pandemics such as HIV/AIDS and related diseases such as tuberculosis and cancer, as well the emerging contagious infections such as avian flu and severe acute respiratory syndrome is needed in view of a rapidly globalizing world.

See also: Demand and Supply of Human Resources for Health.

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Demography of Aging

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Introduction

Demography, the scientific study of population, is concerned with distributions of vital rates in populations, sources of variations in these rates or population dynamics, demographic consequences of changes in the structures of populations over time, and population forecasting. Age is an important indicator in demography because it is a critical part of the structure of populations, and it directly affects basic demographic processes of fertility (births), mortality (deaths), and migration. Demography of aging is a subfield of demography that focuses on the older members of a population as well as the processes and consequences of population aging. Research in the demography of aging examines a number of topics, including the state and status of the older population, changes in the

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