# Unravelling the determinants of health care use[*]

Begoña Álvarez

(Universidad de Vigo)

Marcos Vera-Hernández

(University College London and Institute for Fiscal Studies)

April 2007

### Abstract

In this paper we provide a model and data structure to identify the determinants of health care use by low income children, and the channels through which they operate. The most distinguishing feature of our approach is that we decompose the decision to use health care into three stages. The advantage of our approach is that variables can influence each stage differently. We find that children living in towns with higher prevalence of violence are in higher need of health care but violence decreases the probability that the child will use health care conditional of the mother perceiving that health care will provide positive gross benefits. We also find that knowledge about self-care (measured by the percentage of women in the village that knows how to treat diarrhoea and by mother's education) decreases the probability that the mother perceives positive gross profits of obtaining health care. These relations are unmasked if we use a standard Probit model.

# 1. INTRODUCTION

Poor children in most countries have the worst health outcomes. Several findings suggest that the adverse health effects of poverty accumulate over children's lives by affecting their future productivity and earnings, causing in that way an intergenerational poverty trap (Strauss and Thomas, 1998; Case et al., 2002; Currie and Stabile, 2003). This problem is particularly acute in developing countries, where the high incidence of malnutrition and infectious diseases in childhood seriously compromises the well-being of future generations.

Experience shows that access to good quality and heavily subsidized health services can help vulnerable people to break out of this poverty trap (World Bank, 2004, Commission on Macroeconomics and Health of the World Health Organization, 2001). In order to target appropriate health programmes at those most in need, it is very important to detect the barriers that prevent them from accessing health services. This is the scope of this paper.

Most of analyses interpret the access-to-care problem for poor children as a supply side phenomenon related to the availability of services or the opportunity of use. However, in contexts of deprivation, the demand side of access also plays a crucial role. For a mother to take the child to a health facility, she must be aware of its benefits in terms of the child's health. This subjective evaluation, probably determined by mother's education as well as public interventions that disseminate health related information, is an important missing piece of information in the empirical analysis of health care use.

The main contribution of this paper is to provide a model and data structure to identify the determinants of the use of health care by poor children and the channels through which they operate. The most distinguishing feature of our approach is that we decompose the decision to use health care into three stages. The first stage determines the child's need for health care. Conditional on need, the second stage determines the mother's perception of the benefits of professional care. Finally, the third stage determines the child's use of professional health care conditional on the previous stages of decision. The main benefit behind this approach is that the variables and, consequently, the policies that affect each stage are different. Furthermore, this structure may provide information to identify

2

complementarities among these policies in order to result in enhanced health care use by children.

In addition to explicitly modelling mother's perception, two other concerns are addressed in our modelling approach. Firstly, careful attention is paid to the definition of need for health care. In most empirical studies need is assimilated to illness (e.g. Dow, 1996; Akin et al., 1998). This implies that the analysis has to be restricted to curative services utilization. But, when interest focuses on children, this restriction seems unsatisfactory, because preventive care which is crucial at this stage of life [1]. To overcome this limitation, we assume a broader concept of need for health care that includes both curative and preventive dimensions.

Our second concern deals with the identification of the determinants of each stage of decision. Selection bias may be an issue in this model if unobservable variables affecting the different stages of the decision are correlated. If this occurs, marginal effects from conditional estimates of the equation for use will be biased. To account for this potential source of bias, we specify a trivariate probit model with endogenous selection. The model is identified through exclusion restrictions.

The empirical analysis is carried out with Colombian data. There are several considerations that make this analysis in Colombia important. These considerations are not unique to Colombia but are also relevant for other developing countries. In 1993, Colombia iniciated a health reforms in response to efficiency, equity and quality problems in the delivery of medical services. The most important achievement of this reform was the enrollment of a large number of poor people into a subsidized health insurance system which targets low-income families and is financed through general taxes. However, one decade after, the lower income classes still face important barriers of access to health services. About 42.6% of total population is not insured under any system (Rodríguez-Monguío and Infante, 2003).

---

[1] Promoting access to preventive health care is a popular policy option in resource constrained environments. Recently, families in developing countries are being paid for taking their children to regular medical check-ups. This is the case of Colombia, Costa Rica, Nicaraguas, Honduras, Brasil, Jamaica, Mexico, and Turkey (Vermehren, 2003).

The data for this study come from the Baseline Survey to evaluate the Colombian Program *Familias en Acción* (Attanasio *et al*, 2003). This dataset is very suitable for three reasons. Firstly, it targets poor population in rural and semi-urban areas. Secondly, it includes information that allows us to measure the different stages of health care use. Thirdly, it offers a wide variety of variables that allows us to implement the identification strategy to deal with endogenous selection.

The remainder of the paper is organized as follows. The next section discusses the basic theoretical model as well as the econometric specification of the two equation model. The third section describes the institutional setting and the data sets. The empirical results are presented in the fourth section.

## 2. MODELLING STRATEGY

When studying health care utilization, careful attention should be paid on the modelling of non-users behaviour. This is because the ocurrence of no contact with health care services can be attributed to either a situation in which the individual does not need health care, or to a corner solution which means that, at the prevaliling prices and income, health care is not consumed. This has motivated some authors to decompose the decision process into two stages (e.g. Dow, 1996; Akin *et al.* 1998). The first stage determines the need and the second stage determines the use of services conditional on being in need. Generally, these models are estimated focusing only on curative care. Then, need is assimilated to illness. But, when interest focuses on children, this modelling approach is incomplete for two reasons. First, it requires excluding preventive care which is crucial in childhood [2]. Second, this modelling structure does not address explicitly the mother's role in the decision process, in particular the information that she has regarding self-treatment, as well as her beliefs about the benefits provided by professional health care. Our analysis tries to overcome these two

---

[2] Promoting access to preventive health care is a popular policy option in resource constrained environments. Recently, families in developing countries are being paid for taking their children to regular medical check-ups. This is the case of Colombia, Costa Rica, Nicaraguas, Honduras, Brasil, Jamaica, Mexico, and Turkey (Vermehren, 2003).

limitations.

## 2.1 Three stage model

Following most of literature on child health, we assume that parents (typically the mother) decide whether or not to seek professional health care. In our analysis, we consider this outcome as the result of a three- stage decision process. The first stage is driven by a process that determines the child's need for some type of health care[3], i.e. it determines the capacity of the child's health (present or future) to be improved through either care provided at home or care provided by professional health services. This process depends on observable variables such as the child's biological characteristics (e.g. age, sex, birth order, etc.), parents' and household variables (e.g. parents' education and age, household income, etc.), the institutional regulations on preventive health care, and unobserved variables such as health shocks.

Once need has been determined, the mother is responsible for making the decision of whether external support from the health system is required. Assume the mother has the following utility function

$$U = U(h, y), \tag{1}$$

where $h$ denotes the expected child's health stream (present and future) and $y$ denotes household income. For any given level of health, the mother evaluates whether the child's health stream may improve through a visit to a professional health provider. Let us denote by $h^*$ the expected health stream after receiving professional treatment, where

$$h^* = h_o + b^* \tag{2}$$

$h_0$ represents the child's health stream with self-care or no-care and $b^*$ denotes perceived

---

[3]Most empirical literature assimilates need to current health status. According to Culyer (1976) and Williams (1974, 1978), need can be defined as the capacity to benefit for health care. From this point of view, health status would be an over-simplistic measure of need because future health can be also improved through the current use of preventive care (Wagstaff and Van Doorslaer 2000). This is extremely important in developing countries where policy makers strongly promote preventive health care in childhood.

improvement in child's health achieved through a visit to a professional health provider. The mother will seek professional care if $b^* > 0$, i.e. if she perceives that professional health care increases child's health. Since the evaluation is made in a context of imperfect information, it is based on the mother's own perception of the benefits of curative and/or preventive health care. Then, it is expected that $h^*$ depends on the availability of health information.

Conditional on having perceived a positive benefit of health care, the third stage of models the mother's decision on whether or not taking the child to a professional health provider which is undertaken by comparing cost and benefits of using health services. The net gains may be modelled as,

$$m^* = U(h^*, y - p) - U(h_0, y), \tag{3}$$

where $p$ denotes the price of health care which in our setting includes costs associated to transportation to the health care provider.

From this framework we may derive an empirical model composed of three equations representing the determination of child's need for health care $(s_i^*)$, the mother's perception of the benefits of professional care $(b_i^*)$ and the net gains of using health services $(m_i^*)$, i.e.

$$
\begin{align}
s_i^* &= x_i'\alpha + \nu_i, \tag{4}\\
b_i^* &= z_i'\beta + \varepsilon_i \quad \text{if } s_i^* > 0 \tag{5}\\
m_i^* &= w_i'\gamma + \eta_i \quad \text{if } s_i^* > 0 \text{ and } b_i^* > 0, \tag{6}
\end{align}
$$

where $x_i$, $z_i$, and $w_i$ are vectors that includes child $i$'s characteristics, household' characteristics and health information.

The latent variables $s_i^*$, $b_i^*$ and $m_i^*$ are unobserved in practice, but we observe binary indicators, $s_i$, $b_i$ and $m_i$, that relate to them through the following observability rules: $s_i = 1(s_i^* > 0)$, $b_i = 1(b_i^* > 0)$ and $m_i = 1(m_i^* > 0)$. In particular, $s_i$ equals 1 if the child needs some health care and equals 0 otherwise; $b_i$ equals 1 if the mother perceives positive benefits of professional health care; and $m_i$ equals 1 if the child effectively uses professional health care.

We assume that the joint distribution of the error terms $\nu_i, \varepsilon_i$ and $\eta_i$ is trivariate standard Normal and it is characterised by three free correlations $\rho_1$, $\rho_2$ and $\rho_3$. That is, there may be unobservable community, family and child specific components influencing the determination of children's need for care, mother's perception of the benefits of health care and the effective use of health care. These include, for example, unmeasured health knowledge, quality of services, preferences towards health care, risk aversion, subjective valuation of healthiness, time preference, unmeasured demographics, etc.. Under this assumption, equations (4) to (6) constitute a trivariate probit model with sample selection. The likelihood function is given in the appendix. Estimation by maximum likelihood requires evaluation of trivariate standard Normal distribution functions. To solve this computational problem, we use simulated maximum likelihood (GHK simulator). Nonparametric identification of the model requires to impose exclusion restrictions, that is, at least one variable in $x_i$ should not be contained in $z_i$ and $w_i$, and at least one variable in $z_i$ should not be contained in $w_i$. Our identification strategy is presented in section.

## 2.2 Two-stage model

The model above requires to observe whether or not the mother perceives that positive benefits from professional health care, are bigger than zero, $b_i$. In Section 3, we will present our strategy to measure $b_i$. However, it is useful to consider a simpler two-stage model that does not require to observe $b_i$. The two-stage model is defined as:

$$s_i^* = x_i'\alpha + \nu_i, \tag{7}$$

$$u_i^* = w_i'\delta + \theta_i \quad \text{if } s_i^* > 0 \tag{8}$$

This model collapses in the last equation (8) the last two equation from the previous model (5) and (6). The benefit is that one does not need to observe $b_{i.}$, the cost is that one cannot dissentangle the determinants of the perception of the benefits from professional health care from the variables that determine the use of professional health care once the mother perceives positive benefits from health care. Section 4 will show the importance of

this.

## 3. DATA, VARIABLES, AND IDENTIFICATION STRATEGY

### 3.1 Data

The data used in this paper come from the baseline survey of *Familias en Acción* (SFA) -a program implemented by the Colombian government to incentive human capital accumulation among poor children living in small municipalities- collected in the summer of 2002. The municipalities targeted for the program, and therefore for the survey, verify the following requirements: i) have less than 100.000 individuals and are not the capital of a Regional Department, ii) have at least a bank, iii) have a minimum level of health and education infrastructure and iv) the major have shown interest in participating in *Familias en Acción* and have complied with the administrative task to participate in the program.

To obtain the sample, the municipalities were classified in 25 strata according to geographical region, population size living in the urban part of the municipality, the value of a synthetical index for quality of life as well as education and health infrastructure. Within each strata, two primary sampling units were randomly selected among those were the *Familias en Accion* program was operating or was going to operate. A primary sampling unit corresponds to a municipality in most of the cases, but comprises two municipalities when they are small. Within each strata, two towns were selected among those were the *Familias en Accion* program was not going to operate. The control towns were chosen as the most similar ones to the randomly chosen treatment towns acording to population size, percentage of households living in the urban part of the municipality, and index of quality of life. Within each municipality, a sample of households eligible to participate in *Familias en Accion* was collected. Eligible households were those registered in SISBEN[4] 1 as of De-

---

[4]The System for the Selection of Beneficiaries of Social Programs (SISBEN) is an indicator of economic well being that is routinely collected in Colombia and that is used for the targeting of all welfare programs, most heavily for health subsidies established by Colombia's Social Security Law, as well as for the pricing of utilities. The principal tool of SISBEN is a household survey comprising sixty-to questions on the head of

cember 1999, and have children less than 18. Although the sample is not representative of the whole Colombian population, it is a valuable source of information about the poorest sector of population. About 96.6% of households live under the poverty line[5]. More details about the sampling can be obtained from Attanasio et al (2003).

Our analysis restricts to children ages 0 to 5. Children beyond age 5 are excluded since care received by children may be dictated in part by school regulations. For children in this sample we observe a rich set of information including the household socio-demographic structure, dwelling conditions, household assets, mother's education, use of health care services, children's anthropometric indicators and household income, among others. There are 5146 children below 6 years old in our sample, living in 122 municipalities.

## 3.2 Measuring need for health care, perceived benefits of health services and use

The first variable of interest in our analysis is the children's need for health care. In this paper, we use a wide concept that refers to need for any type of health care, curative or preventive, provided at health facilities or at home[6]. In particular, we classify a child as having curative need if she had at least one common symptom suggestive of acute respiratory infection (diagnosed as fever with cough), diarrhea or other illnesses during the two weeks preceding the date of the interview.

In our empirical analysis, we classify a child as being in need for preventive care if,

household education achievement, children educational attendance, dwelling conditions, etc, which disclose and measure levels of poverty and whose responses when precessed generate a family-level composite quality-of-life indicator. Responses to survey questions are weighted and combined so as to generate for each family a score between 0 and 100 which allows to classify them in one of six SISBEN levels. Only those with scores in levels 1 and 2 are generally eligible for social subsidies.

[5]The authors use a poverty line that is standard in rural Colombia and equals to 149,052 pesos per capita per month.

[6]Still, we might be losing some dimensions of the theoretical concept of need. For instance, Culyer and Wagstaff (1993) define need for health care as the minimum amount of resources required to exhaust capacity to benefit. Though very appealing, we cannot find a way to implement their concept of need.

two weeks before the interview, she had not complied with the recommended vaccinations and preventive check-ups for her age. The SFA information on prevention is derived from vaccination and Growth & Development cards that register the dates that vaccinations were administered and preventive health care visits done. If the mother could not show a card, she is asked for vaccinations and preventive visits in the last 12 months. This information allows us to compute the actual number of G&D check-ups that a child has had during the last 12 months as well as the diphtere-pertussis-and-tetanus (DPT) vaccination doses she has received up to the moment to the interview.[7] By comparing this information with the recommended visits established by the national guideline we determine whether or not the child needs preventive care.[8] Table 1 summarizes the national guidelines on preventive health care visits (Growth & Development check-ups) and vaccinations. In our sample, 23.09 % of children were delayed in vaccinations and 39.96 % had not complied with the annual scheduled visits of growth and development. These figures imply that only 44.56% of children were up-to-date with both inmunizations and G&D check-ups.

The second variable of interest is the mother's perception of the child's need. This information is recovered from mothers' answers to the questions on children's health care use. About 22.60% of children used health services during the two weeks previous to the interview. The remaining 87.40 % were asked about the main reason for not using medical care. Table 3 summarizes this information. Roughly 78 % of caretakers declared that "*the child did not need it*" or "*the child was not ill*". Financial constraints were reported as the main reason for not seeking health care by 15.74% in the sample. Problems of access related to distance to health provider or transportation precluded 2.7% of children from using health care[9]. The remaining children did not use health care due to parent's time constraints or other reasons, such as tastes. Our measure of caretaker's perception of need

---

[7]Other vaccinations are administered together with the DPT vaccine.

[8]Norma Técnica para la Detección Temprana de Alteraciones del Crecimiento y Desarrollo (Colombian Ministry of Health)

[9]These results are consistent with other studies based on different dataset that show that financial restrictions and distance to health providers remain as the main problem to access health services (Homedes and Ugalde, 2005).

is a binary variable equal to one if either the child used health care in the past two weeks or the reason for not seeking care was other than "*the child did not need it*" or "*the child was not ill*".

The last dependent variable is an indicator variable that equals to one if the child had at least one contact with health care services. Contacts can take place in ambulatory clinics, hospitals, emergency rooms, health centers or other public or private clinics. The type of service required may be either curative or preventive (regular check-ups or vaccinations). Table 2 shows that prevention was the main reason for using health care for approximately 45.3% of Colombian children.

Table 4 reports summary statistics for all the measures of children's need for health care, perception of need and use of medical services. About 81% of children in our sample were considered to be in need for health care during the two weeks previous to the interview. In only half of those cases the mother perceived positive benefits to take the the child to professional health care and only 57% of those that perceived positive benefits from professional health care used medical care.

### 3.3 Identification strategy

In order to control for potential endogenous selection in need and perception, we have to impose a set of exclusion restrictions to obtain non-parametric identification. In particular, we need that at least one variable affecting children's need for health care has no direct effect on both the mother's perception and the child's effective use of services. Similarly, we need that at least one variable in the equation of mother's perception can be excluded from the use equation.

Our identification strategy exploits information on two institutional aspects: a) regulation on preventive care for children; and b) the nursery program *Hogares Comunitarios*.

**Regulation on preventive care for children.**—

In Figure 1, we observe that need by age exhibits a sawtooth pattern. The proportion of children in need for health care starts very high, with percentages close to 100%, then follows

11

a decreasing trend that falls sharply around the 40 months of age reaching values between 60-70% The proportion jumps up again at the age of 64 months taking values higher than 85%. Our identification strategy relies on the fact that the jumps in this variable reflects, at least in part, the intensity of recommended prevention. That is, different intensities of prevention established by the institutional calendar imply different levels of need for health care in children.

To implement this idea, we calculate the children's age two weeks before the interview, that is just in the moment in which they are classified as having/not having need of health care. To control for the jumps in the intensity of prevention, we construct a new variable, $IP_i$, that assigns to child $i$ the corresponding intensity of preventive care recommended for her age, i.e.:

$$IP_i = \sum_{j \in J} 1(age\_child_i \in age\_group_j) * A_j$$

where $J = \{<1 \text{ year}, 1 \text{ year}, 2 \text{ years}, 3 \text{ years}, 4 \text{ years}, 5 \text{ years}\}$ and $A_j$ represents the number of preventive appointments (G&D and vaccination) recommended for a child that, at the beginning of the reference period (i.e. two weeks before the interview) was in the age group $j$. Figure 2 shows that the discontinuities in the relationship between the variable $IP$ and the child's age can be matched to the discontinuities between need for health care and age. The key identifying assumption that underlies estimation using prevention intensity as an instrument is that any effect of age on need is adequately controlled by the smooth functions of age included in the set of regressors. If this assumption is reasonable, then the discontinuities in the probability of need for different ages is likely due to the institutional recommendations.

To use $IP$ as an instrument, we must still provide arguments that it can be convincingly excluded from the perception and use stages. ... In our specification we include child's age polynomials in these two equations. These variables capture the possibility that a mother's perception of the benefits of professional care and her decision to take the child to the doctor vary with the child age nonlinearly but smoothly. We believe that, conditional on need, mother's perceptions and use of services will not change abruptly with respect to the

12

child's age, and this is what we exploit in our identification strategy.

**Non-medical health information.—**

The second instrument we use to identify the stage of mother's subjective perception is a source of health information other than that provided by health professionals. In particular, we use the community informational spillovers generated by the program *Hogares Comunitarios de Bienestar Familiar (HCBF)*.

The HCBF is a large nutrition programme in rural Colombia which started between 1984 and 1986. This programme is based on community nurseries where poor children receive food (purchased by the government) and child care from one of the mothers in the community. The *madre comunitaria* (or community mother) has to satisfy some criteria, such as having basic education, a large enough house and having been certified by the regional office of the ICBF. Each *madre* receives up to 15 children whose families pay a small monthly fee. The programme objectives included the improvement of the nutricional status of poor children as well as the provision of child care that could stimulate labour force participation of women and the generation of additional income (see Attanasio and Vera-Hernández, 2007 for results on the evaluation of this programme).

We use the average experience of *madre comunitarias* in the municipality as an exclusion restriction that is part of $z$ but not $w$. The idea is that a more experienced *madre comunitaria* should alert mothers of when their child will benefit of professional health care. At the same time, the program *Hogares Comunitarios* is not part of the health services and is not related to the Ministry of Health, and as such we assume that the *experience of madre comunitarias* will not directly related to either the quantity or quality of health care infrastructure that would be difficult to exclude from the last stage.

**4.2.2 Explanatory variables.—**

Table 3 presents a descriptive analysis of the main variables used in the analysis. There are a common set of variables that we include in the three equations: child's characteristics (such as sex, age, birth order and height-for-age, as a proxy for child's long-term health),

mother's and household characteristics and geographical characteristics.

A second set of variables refers to mother and household characteristics and includes mother's age and her educational level. The effect of mother's age is difficult to predict. Older women may have greater experience in relation to child health, but experience may lead to opposite effects: i) a positive effect on the likelihood of using pediatric health care, in particular preventive care, due to better information about its benefits, ii) a negative effect on the likelihood of using curative services because of their higher knowledge about home remedies.

The impact of maternal education on children's health and pediatric care use may operate through different channels, such as the efficiency in child's health production, the knowledge of health practices, attitudes or preferences toward health and medical care (Colle and Grossman, 1978, Thomas et al., 1991, Glewwe, 1999). More educated women provide better home assistance and identify when to seek attention outside home.

Besides school education, we include two variables capturing specific other sources of health information. The SFA asks mothers about two interesting aspects: a) their attendance to talks on hygiene, nutrition, vaccines or prenatal care; and b) their knowledge on how to proceed when the child has diarrhoea. We use the municipality average of this responses to measure the availability of health related knowledge in the municipality. Using this information at the individual level would raise endogeneity concerns because individuals that have recently visited a health care professional are more likely to have acquired health related information.

Per capita expenditure is used as a measure of long-run income since it is considered a good proxy for permanent income.

The full price of health care can be decomposed in monetary costs, travel costs and time costs. The Law 100 created a national universal health insurance ....system which is composed of four tiers: i) a contribution social system financed by mandatory payroll taxes, ii) a subsidized[10] social system wich targets low-income families and is financed with

---

[10]In the contributed and subsidized systems, the affiliated individual chooses a pro-profit health insurance company (EPS) whose ownership may be public, private or mixed. The EPS, in turn, contracts health

general taxes. Eligibility for the subsidized system is based on the individual's income, and local county governments are responsible for identifying and enrolling low-income people in special sickness funds. Those not covered in the subsidized sytem receive health care mainly through the network of public hospitals. One-quarter to one-third of the Colombian health care system is financed through co-payments (Castano et al., 2002 Health Policy and Planning). In our sample, only 59% of children have formal insurance coverage[11]. Since the identification and enrollment of low-income people in the subsidized system corresponds to county governments, rather than individuals, we assume these variables as exogenous in our model. We also include distance to the nearest health care centre in the municipality.

We include a binary variable that indicates whether or not the household is receiving payments of the conditional transfer program Familias en Acción at the time of the survey. This is a program implemented by the Colombian government to foster human capital accumulation among poor children living in small municipalities. The program provides monetary transfers to mothers in beneficiary families, conditional on having completed some requirements: a) children under seven should be taken to growth and development check-ups; b) children between 7 and 17 years old should regularly attend school. Mothers are also encouraged to attend courses on hygiene, vaccination and contraception. Although at the time of this survey, the programme had been operating during a short period, it is important to control for its effect in our model as it is likely to affect health behavior.

Social violence is also controlled for. We include a variable indicating whether or not there was a curfew in the municipality when the interviewers collected the data.

All continous variables are standarized for the estimation.

---

services with a network of service providers (IPS). These IPS may also be on any form of ownership, public, for profit or non-profit. Althouth the basic package of services delivered to the contributory and subsidized were expected to be equal by 2001, this aim has not been achieved.

[11] Eligibility and enrollment of individuals in the subsidized system depends on the individual's income, the administrative capacity of the local goverment to identify low-income individuals, the county's budget, and the economic cost of the system (see Trujillo, 2003 for additional information).

# 5. EMPIRICAL RESULTS

The sample used in this work are likely to exhibit potential intra-cluster correlation within each municipality, because they are based on stratified sample survey methodology, with municipalities as the primary sampling unit. This correlation must be taken into account to obtain correct sampling variances of the regression coefficients, otherwise the statistical significance of estimated coefficients may be overstated. In our estimates, we use "cluster robust" standard errors obtained by adapting the so-called Eicker-White robust variance estimator to handle clustered data.

We will present estimation results of the three-stage and the two-stage model. The three stage one is our favourite one as it allows to study what determines the perceived benefits from professional health care. However, we also show the results of the two-stage model because the econometrician does not need to observe $b_i$ to implement it. For the sake of comparison, we also present the estimation results of standard probit models for unconditional use of health care. That is, in this specification, the group of non-users includes those who have not perceived the need for health care during the reference period and those who have perceived it but have not obtained the care. As the main purpose of our paper is to show that the three and two stage models can unmask relations that more simple models will not, we only show those tables where there are differences between these models that are worth mentioning. The complete set of results is available in the appendix. Notice that the coefficients shown for continous variables are on the standarized variables.

Table 5.1 show the coefficients of the variable of violence in the municipality. The coefficient of the variable violence in the probit model is negative but not statistically significant different from zero at 5%. The three stage model shows us a more complex picture. Problems of violence in the municipality increases the need for health care, but it decreases the use of health care conditional on the perceived benefits from professional health care being larger than zero. In this case, the two-stage model provide us with results similar to the three stage model.

Table 5.1 Violence in the municipality

16

|                   | Need    | Perception | Use     |
|-------------------|---------|------------|---------|
| Standard probit   | —       | —          | -0.122  |
|                   |         |            | (0.079) |
| Two-stage model   | 0.132   |            | -0.140  |
|                   | (0.065) |            | (0.081) |
| Three-stage model | 0.144   | -0.053     | -0.205  |
|                   | (0.063) | (0.061)    | (0.110) |

Table 5.2 and 5.3 are interesting because they show the benefits of the three-stage model relative to the two-stage model. Table 5.2 show that the perceived benefits from professional health care are smaller in municipalities where a higher proportion of mothers know how to treat diarrhoea. Similarly, Table 5.3 shows that the perceived benefits from professinal health care are smaller for mothers with higher education. These two results are consistent with the idea that the second stage of the three-stage model is actually measuring the perceived benefits from professinal health care, and consequently, it is decreasing in variables that increases the mother's knowledge about how to treat illnesses. Comparing across models, mother's education plays a more clear role in the three stage model than in either the two-stage or the standard probit mdel where they would not be statistically different from zero at 5%. The use of the three stage model also helps to interpret why these variables influence health care.

Table 5.2. Knowledge in the municipality about diarrhoea

|                   | Need    | Perception | Use     |
|-------------------|---------|------------|---------|
| Standard probit   | —       | —          | -0.087  |
|                   |         |            | (0.030) |
| Two-stage model   | -0.042  |            | -0.140  |
|                   | (0.033) |            | (0.081) |
| Three-stage model | -0.047  | -0.083     | -0.055  |
|                   | (0.033) | (0.026)    | (0.089) |

| Table 5.3. Mother's education | | Need | Perception | Use |
|---|---|---|---|---|
| Standard probit | Some primary | — | — | -0.040 |
| | | | | (0.070) |
| | Primary complete or more | — | — | -0.028 |
| | | | | (0.080) |
| Two-stage model | Some primary | -0.099 | | -0.052 |
| | | (0.072) | | (0.071) |
| | Primary complete or more | -0.116 | | -0.033 |
| | | (0.080) | | (0.081) |
| Three-stage model | Some primary | -0.083 | -0.119 | 0.002 |
| | | (0.074) | (0.064) | (0.137) |
| | Primary complete or more | -0.099 | -0.150 | 0.076 |
| | | (0.080) | (0.068) | (0.176) |

Table 5.4 shows the estimates of the coefficient on the binary variable that indicates that the program FA was in place in the municipality at the moment of the baseline survey. Here we do not attempt to do an evaluation of the program that has already been done elsewhere (Attanasio et al 2004 and 2006). The results are interesting because they show how the two and three-stage models provide us with a more complex picture than the standard Probit model. The probit estimates show that the presence fo the program in the municipality is associated with an increase in health care use. The two and three stage models show that this can the program decreased the need for health care and increased health care use conditional on need. These two results are consistent with what we already know about the program. According to (Attanasio et al 2004 and 2006), the program improved children nutrional status and improved the percentage of children that are up to date with preventive Growth and Development check ups. This is consistent with our result in Table 5.4 that the program decreases the need for professional health care at a given point in time. Because the

program pays mothers for taking the kids to preventive health care, the cost of preventive health care decreases considerably with the program. This is associated with the increase in use conditional on need that is reported in Table 5.4. The program does not seem to have influenced the perception of benefits from professional health care.

Table 5.4. Presence of Familias en Accion in the municipality

|  | Need | Perception | Use |
|---|---|---|---|
| Standard probit | — | — | 0.126 |
|  |  |  | (0.072) |
| Two-stage model | -0.301 |  | 0.124 |
|  | (0.065) |  | (0.077) |
| Three-stage model | -0.293 | -0.055 | 0.306 |
|  | (0.062) | (0.065) | (0.126) |

Table 5.5 shows the results on standarized per capita household consumption. According to these results, the probability of health care use conditional on perceiving positive benefits from professional health care is increasing in the level of household consumption. However, consumption does not influence either of the remaining stages. We might have expected to find a negative association between need and household consumption, but we do not find this probably because either we condition on other health status variables such as child's height for age, or because our sample is restricted to poor individuals. It is interesting to note that household consumption does not influence the perceived benefits from professional health care but education does as we showed before.

Table 5.5. Per capita household consumption (in logs)

|  | Need | Perception | Use |
|---|---|---|---|
| Standard probit | — | — | 0.108 |
|  |  |  | (0.027) |
| Two-stage model | 0.018 |  | 0.109 |
|  | (0.023) |  | (0.028) |
| Three-stage model | 0.009 | -0.022 | 0.248 |
|  | (0.025) | (0.022) | (0.078) |

The three-stage model provides a natural way to estimate barriers to health care. The concept of barriers to health care is widely used in the literature but is probably not formally defined. Our interpretation is that barriers to health care are those factors that prevents people from using profesional health care when they wished so. In our context, this is given by the effect of variables such as distance to the facilities, household consumption, health insurance, on the probability of using health care conditional on the perceived benefits from professional health care being positive (marginal effects). It is interesting to note that the parameters that we are after cannot be identified solely from an experiment. For instance, a cash transfer to households is likely to influence both need for health care and the use of health care conditional on need. Consequently, a model is necessary to dissentangle the effect that will have in each of these stages. At the same time, nothing prevents using randomized variables as part of the regressors of the model.

## CONCLUSIONS

In this paper we propose a three stage model for the demand for health care to unravel the determinants of health care use. In the first stage, the need for health care is determined. In the second stage, the mother perceives whether or not the benefits from professional health care are positive. In the third stage, the mother decides whether or not to use health care conditional on the second stage. In an application to a sample of poor Colombian children, the three stage model unravel shows that municipality violence, mother's education, knowledge about treatment diarrhoea, the presence of a conditional cash transfer program

and household consumption are important factors in the demand for health care. The three stage model either helps in the interpretation of the results or unravels relations that more simple models mask.

## REFERENCES

[1] Akin, J.S., D.K. Guilkey and M. McIntosh (1998) "Price Elasticity of Demand for Curative Care with Control for Sample Selectivity of Endogenous Illness: An Analysis for Sri Lanka" *Health Economics* 7: 509-553.

[2] Attanasio, O. et al. (2003) "Baseline Report on the Evaluation of Familias en Accion" Center for the Evaluation of Developing Policies. Institute For Fiscal Studies. (http://www.ifs.org.uk/edepo/wps/familias_accion.pdf)

[3] Baker, D. (1990) "The fetal and infant origins of adult disease" *British Medical Journal* 301, 1111.

[4] Brown, J. and E. Pollitt, (1996) "Malnutrition, Poverty and Intellectual Development" *Scientific American* 274(2), 38-43.

[5] Case, A., D. Lubotsky and C. Paxon (2002) "Economic Status and Health in Childhood: The Origins of the Gradient" *The American Economic Review* 92(5): 1308-1334.

[6] Colle, A. D. and M. Grossman (1978) "Determinants of Pediatric Care Utilization" *The Journal of Human Resources* 13 (suppl.): 115-158.

[7] Currie, J. and M. Stabile (2003) "Socioeconomic Status and Child Health: Why is the Relation Stronger for Older Children" *American Economic Review* 93(5):1813-1923.

[8] Comission on Macroeconomics and Health (2001) "Macroeconomics and Health: investing in health for economic development". Geneva. World Health Organization.

[9] Glewwe, P. (1999) "Why Does Mother's Schooling Raise Child Health in Developing Countries? Evidence from Morocco" *The Journal of Human Resources*, 34(1): 124-159.

[10] Lavy, V., J. Strauss, D. Thomas and P. de Vreyer (1996) "Quality of Health Car, Survival and Health Outcomes in Ghana" *Journal of Health Economics* 15: 333-457.

[11] Martorell, R. and J. Habicht (1986) "Growth in Early Childhood in Developing Countries" in Falkner, F. and J. Tanner (eds), "Human Growth: A Comprehensive Treatise" 2nd edition, Vol 3. Methodology: Ecological, Genetic, and nutritional effects on Growth. New Work and London, Plenum Press, pp 241-263.

[12] Montoya, M.D. (2002) "Socio-Economic Health Inequalities in Brazil: Gender and Age Effects" *Health Economics* 11: 141-154.

[13] Ordóñez Gómez, M. and R. Murad (2002) "La Salud de los niños menores de cinco años en Colombia. Estudio en profundidad de la Encuesta Nacional de Demografia y Salud". Profamilia

[14] Mwabu, G., M. Ainsworth and A. Nyamete (1993) "Quality of Medical Care and Choice of Medical Treatment in Kenya: An Empirical Analysis" *The Journal of Human Resources*, 28(4).

[15] Onis, M., Fongillo, E. and M. Blossner (2000) "Is malnutrition declining? An analysis of changes in level of malnutrition since 1980" Bulletin of the World Health Organization 78(10), 1222-33.

[16] Plaza B., A.B. Barona and N. Hearst (2001) "Managed Competition for the Poor or Poorly Managed Competition? Lessons from the Colombian Health Reform Experience" *Health Policy and Planning*, 16(Suppl 2): 44-51.

[17] Rodríguez-Monguío, R. and A. Infante (2003) "Universal Health Care for Colombians 10 Years after Law 100: Challenges and Opportunities" *Health Policy*, (in press)

[18] Savedoff (2000)........

[19] Strauss, J. and D. Thomas (1995a) "Human Resources: Empirical Modelling of Household and family decisions", in Handbook of development economics, Vol. 3A. Eds.: T. Srinivasan and J. Behrman. Amsterdam: North Holland Press, pp 1883-2023.

[20] Strauss, J. and D. Thomas (1998) "Healh, Nutrition and Economic Development" *Journal of Economic Literature* 36(2): 766-817.

[21] Thomas, D., J. Strauss and M.H. Henriques (1991) "How Does Mother's Education Affect Child Height?" *The Journal of Human Resources*, 26(2): 183-211.

[22] van de Ven, W. and B. van Praag (1981) "The Demand for Deductibles in Private Health Insurance: A Probit Model with Sample Selection" *Journal of Econometrics*, 17: 229...

[23] Vermehren, A. (2003) "Conditional Cash Transfer Programs. An Effective Tool for Reaching the Poorest and Most Vulnerable." En Breve. Worldbank. Available at http://www1.worldbank.org/sp/safetynets/publications/cct.asp

[24] Wagstaff, A. (2003). "Child Health on a Dollar a Day: Some Tentative Cross-Country Comparisons", *Social Science and Medicine*, 57: 1529-1538.

[25] Wagstaff, A. and E. Van Doorslaer (2000). "Equity in Health Care Finance and Delivery", in Culyer, A. and J. Newhouse (eds) Handbook of Health Economics, vol. 1, pp. 1803-1862.

[26] Culyer, A. (1976) "Need and the National Health Service: Economics and Social Choice. (Martin Robertson, Oxford).

[27] Williams, A. (1974) "Need as a demand concept (with special reference to health)", in A. Culyer, ed., Economics Policies and Social Goals: Aspectsof Public Choice (Martin Robertson, London).

[28] Williams, A. (1978) "Need - an economic exegenesis", in: A. Culyer and K. Wright, eds. Economic Aspects of Health Services (Martin Robertson, London).

# APPENDIX

$$s_i^* = x_i'\alpha + \nu_i, \tag{9}$$

$$b_i^* = z_i'\beta + \varepsilon_i \quad \text{if } s_i^* > 0 \tag{10}$$

$$m_i^* = w_i'\gamma + \eta_i \quad \text{if } s_i^* > 0 \text{ and } b_i^* > 0, \tag{11}$$

The contribution to the likelihood function for individual $i$ if she does not have any need for health care is:

$$\int_{-\infty}^{-x_i'\alpha} f_v(\nu_i)d\nu_i$$

The contribution to the likelihood function for individual $i$ if she does have some need for health care but does not have positive gross profits from professional health care is

$$\int_{-x_i'\alpha}^{+\infty} \int_{-\infty}^{-z_i'\beta} f_{v\varepsilon}(\nu_i, \varepsilon_i)d\varepsilon_i d\nu_i$$

The contribution to the likelihood function for individual $i$ if she has some need for health care and positive gross profits from professional health care but she does not use health care is:

$$\int_{-x_i'\alpha}^{+\infty} \int_{-z_i'\beta}^{+\infty} \int_{-\infty}^{-w_i'\gamma} f_{v\varepsilon\eta}(\nu_i, \varepsilon_i, \eta_i)d\varepsilon_i d\nu_i d\eta_i$$

The contribution to the likelihood function for individual $i$ if she has some need for health care, positive gross profits from professional health care and does use health care is:

$$\int_{-x_i'\alpha}^{+\infty} \int_{-z_i'\beta}^{+\infty} \int_{-w_i'\gamma}^{+\infty} f_{v\varepsilon\eta}(\nu_i, \varepsilon_i, \eta_i)d\varepsilon_i d\nu_i d\eta_i$$

25

TABLE 1: Child preventive care timetable

| Age | Growth and development check-ups | | Vaccines | |
| | Number | Periodicity | Number | Doses |
| --- | --- | --- | --- | --- |
| <1 year | 4 | Every 2 months | 13 | 1 tuberculosis, 3 hepatitis B 3 DPT, 3 polio, 3 meningitis |
| 1 year | 3 | Every 3 months | 4 | 1 measles-mimps-rubella, 1 meningitis, 1 DPT, 1 polio |
| 2 years | 2 | Every 5 months | – | – |
| 3 years | 1 | – | – | – |
| 4 years | 1 | – | – | – |
| 5 years | 2 | Every 5 months | 2 | 1 polio, 1 DPT |

Source: Ministerio de Salud colombiano. Vaccines include diphteria-tetanus-pertussis (DTP), polio, measles-mimps-rubella, Haemophilus influezae type B).

26

TABLE 2: Need for health care

| | Mother's schooling | | | |
|---|---|---|---|---|
| | No formal education | Less than primary | Primary or more | All |
| Illness | | | | |
|     Diarrhoea | 17.02 | 16.43 | 15.79 | 16.28 |
|     Respiratory illness | 48.17 | 44.73 | 45.84 | 45.65 |
|     Other illnesses | 16.49 | 17.07 | 18.60 | 15.55 |
| Prevention | | | | |
|     Delay in vaccinations | 31.28 | 23.13 | 18.35 | 22.70 |
|     Incomplete G&D check-ups | 44.24 | 37.57 | 34.87 | 38.48 |
| *Need for health care (curative or preventive)* | 84.82 | 81.08 | 80.34 | 81.36 |
|     *Only curative* | 20.29 | 24.53 | 28.25 | 25.26 |
|     *Only preventive* | 25.52 | 23.13 | 21.25 | 22.79 |
|     *Both* | 37.31 | 31.62 | 29.78 | 31.79 |
| N | 764 | 2495 | 1887 | 5146 |

Source: Baseline survey of Familias en Acción, 2002.

TABLE 3: Children's use of health care: reasons for contact and no-contact

| | Mother's schooling | | | |
| | No formal education | Less than primary | Primary or more | All |
|---|---|---|---|---|
| # Children who used health care | 162 | 521 | 478 | 1,161 |
| Main reason for contact (% over users) | | | | |
| Illness | 67.90 | 66.41 | 64.43 | 65.72 |
| Vaccination or G&D check-up | 15.43 | 17.08 | 17.16 | 16.88 |
| Other (screening, control....) | 14.67 | 16.51 | 18.41 | 17.4 |
| # Children who did not use health care | 602 | 1,974 | 1,409 | 3,985 |
| Main reason for no contact (% over non-users) | | | | |
| No need | 25.91 | 33.69 | 39.82 | 34.68 |
| Not ill | 42.86 | 43.11 | 43.86 | 43.34 |
| Distance to health provider | 3.32 | 2.79 | 2.13 | 2.63 |
| Time constraints | 0.83 | 1.17 | 0.85 | 1.00 |
| Monetary constraints | 24.95 | 17.02 | 10.50 | 15.91 |
| Other reasons | 2.00 | 2.23 | 2.76 | 2.39 |
| N | 764 | 2,495 | 1,887 | 5,146 |

TABLE 4: Children's need for health care, mothers' perception and use of services

|  | Yes | No |
|---|---|---|
| Need for care | 4187 | 959 |
| (% over total children) | (81.36) | (18.64) |
| Perception of the benefits of formal health care | 2037 | |
| (% over those in need for care) | (50.24) | |
| Use of health care | 1161 | |
| (% over those who perceive benefits) | (57) | |

TABLE 5: Descriptive statistics of explanatory variables

| | Users | | Non-users | | All | |
|---|---|---|---|---|---|---|
| | Mean | Std. | Mean | Std. | Mean | Std. |
| Child characteristics | | | | | | |
| Girl | 0.497 | | 0.481 | | 0.484 | |
| Age (in months) | 38.022 | | 42.086 | | 41.341 | |
| Birth order | 5.373 | | 5.520 | | 5.487 | |
| Height-for-age | -1.176 | | -1.261 | | -1.242 | |
| Affiliated to the subsidized system | 0.699 | | 0.566 | | 0.596 | |
| Mother and household characteristics | | | | | | |
| Age | 31.074 | | 31.184 | | 31.158 | |
| No formal education | 0.139 | | 0.151 | | 0.148 | |
| Primary education (incomplete) | 0.448 | | 0.495 | | 0.485 | |
| Primary education (complete) | 0.194 | | 0.178 | | 0.182 | |
| More than primary education | 0.217 | | 0.175 | | 0.185 | |
| Per capita total consumption | 4.182 | | 4.054 | | 4.082 | |
| ♯ female adults in the household | 1.196 | | 1.172 | | 1.177 | |
| Participation in Familias en Acción | 0.355 | | 0.313 | | 0.323 | |
| Municipal variables | | | | | | |
| % of women who attended talks on health issues | 0.356 | | 0.308 | | 0.319 | |
| % of women who knows treatment for diarrhea | 0.216 | | 0.211 | | 0.213 | |
| ♯ health centers (per 100,000 inhabitants) | 4.314 | | 3.900 | | 3.994 | |
| Urban area | | | | | | |
| Rural disperse area | 0.411 | | 0.499 | | 0.479 | |
| Rural concentrated area | 0.081 | | 0.107 | | 0.101 | |
| Region: Atlántico | 0.4203 | | 0.366 | | 0.378 | |
| Oriental | 0.217 | | 0.208 | | 0.210 | |
| Central | 0.237 | | 0.289 | | 0.277 | |
| Pacífico | 0.125 | | 0.136 | | 0.133 | |