Exploiting subjective information to understand impoverished children's use of health care*

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Abstract

Understanding what drives households to seek medical services is challenging because the factors affecting the perceived benefits and costs of professional health care can be the same. In this paper, we disentangle the channels through which different factors affect the use of medical services, whether through perceived benefits and/or costs. We do this by exploiting data on why individuals have not visited a health care professional. Amongst a sample of impoverished Colombian households, we find that health knowledge reduces the use of medical services through decreasing mothers' perceived benefits of seeking professional care for ill children; birth parity, distance to health facilities and violent shocks all decrease medical care use due to increasing the perceived costs; and education decreases both the perceived benefits and costs, with no overall effect on use. We propose two specification tests, both of which our model passes, as well as a series of robustness checks.

Keywords: Identification, Subjective information, Health care use

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1 Introduction

Governments and international organizations see health care services as an important element to improve individual's health and alleviate poverty (World Bank, 2004; WHO Commission on Macroeconomics and Health, 2001). Expenditure on the health sector has been associated with low levels of mortality and malnutrition amongst children living on a dollar a day (Wagstaff, 2003). In line with this evidence, several middle income countries (e.g., Argentina, Brazil, China, Colombia, India, Mexico, Vietnam) have carried out reforms to improve the access to health care of their poor citizens. Similarly, many developing countries have implemented conditional cash transfer programs that pay mothers for taking their children to preventive health care visits (Fiszbein and Schady, 2009).

The success of interventions to improve the delivery of health care depends crucially on a detailed understanding of the determinants of individuals' health care use. Despite the large body of empirical research on this issue, questions about the relative importance of income, prices, education, or health knowledge and the channels through which they operate, remain unanswered. Identification of the relevant channels is challenging because individuals weigh benefits and costs when deciding to use professional health care, and many variables are likely to be correlated with both components. For instance, in the case of children, more educated mothers are more able to provide self-care at home (which decreases the benefits of seeking professional care for ill children) but they face a higher opportunity cost of time (which increases costs) and might also be more aware of their rights to use public services and able to exercise them more effectively (which decreases costs). Since most of empirical studies on health care use are based on reduced form models -see Jones (2000) for a review- they provide estimates of the net effect of the variables analyzed but offer little guidance as to the channels (benefits or costs) through which they affect individuals' health care use.

Crucial to this paper is the definition of gross and net benefits of professional health care. The net benefit is simply the difference between the utility achieved when obtaining professional health care and the utility of self-care. Individuals decide whether or not to visit a health care professional based on the net benefit of doing so. A key component of the net benefit is the

cost of obtaining professional health care (transportation costs, fees, etc). These costs are put aside when defining the gross benefit of professional health care: the difference between the utility of professional health care and self-care, in the hypothetical case where the costs of obtaining professional health care are zero. By combining the estimates of net and gross benefits, we can advance in the identification challenge that we mentioned above (whether a given variable affects the benefit and/or cost of health care). This is because the gross benefit of professional health care leaves the costs aside.

In this paper, we focus on the benefits (both gross and net) of professional health care as mothers perceive them rather than the actual ones. The perceived benefit of medical care is an important piece of information to date overlooked in the empirical literature, which has generally emphasized the supply barriers of access to these services (distance to facilities, cost of obtaining care, etc). However, for a mother to take her child to a health facility, the benefits in terms of the child's health must be perceived. Hence, this subjective evaluation acts as a precondition that makes up the demand of health care (Musgrove, 2007; WHO, 2005)[1]

Focusing on "perceived" rather than "actual" benefits is important because individuals' decisions are based on subjective rather than objective valuations and perception and reality are not always aligned. For instance, in Rajasthan the quality of health services may impact health but does not seem to impact people's perception of their own health or of the health care system (Banerjee, *et al.*, 2004). Delavande and Kohler (2009) show that individuals overestimate mortality probabilities in Malawi and Jensen (2010) finds that impoverished students underestimate the returns to schooling in the Dominican Republic.

While perceived net benefits of professional health care can be inferred from individual's choices on health care use (or that of their parents), measuring the gross benefits remains more challenging. To do this, we exploit the mother's response to a question regarding why her child was not seen by a doctor or other health care professional when faced with an illness episode.

[1] "When a child is ill […], someone in the household must recognize that there is a problem, provide appropriate care, identify signs indicating that the child needs medical care, take the child to a health worker [...]. Without all this, even the best health centre will get poor results" (WHO 2005).

Questions of this type are available in many surveys but have been rarely exploited. We provide a simple model of health care use that is useful to link the response to this question to the perceived gross benefits of professional health care use. In addition, we provide two specification tests that validate our approach, including how we measure the gross benefits of professional health care use.

Our paper is related to a recent line of economic research that incorporates subjective information in empirical models. Most of this work relates to the measurement and validation of subjective expectations of income, investment returns, mortality, and education choices.[2] Less work has been done incorporating subjective data into economic models (see Delavande, 2008; Kaufmann and Pistaferri, 2009, for exceptions). Respondents in both developed and developing countries have been shown to answer expectations questions in a meaningful way (see Manski, 2004; Delavande *et al.,* 2011 and Attanasio, 2009). Subjective data apart from expectations might also be useful (Manski 2004). For example, Bonke and Browning (2009 and 2011) ask households whether they pool income and use this information to explain the share of individual consumption. Carlin *et al.* (2006) use managers' answers to survey questions on what aspects of their external environment inhibit the firm's operation/growth and conclude that these variables are useful measures of constraints to growth. Griffith and Nesheim (2008) incorporate attitudinal questions on households' preferences and beliefs to disentangle household's willingness to pay for organic food into willingness to pay for health, environment, or higher quality. More recent papers use beliefs elicited from respondents to explain risk-taking behaviours (De Paula *et al.*, 2011) or to identify time preference parameters (Mahajan and Tarozzi, 2011).

The contribution of our paper to this literature is the use of subjective information on mothers' health care seeking behaviour to identify the channels through which variables affect health care use. For instance, on the one hand we find that education decreases the gross benefits of health care use, as one would expect if more educated mothers are better able to provide self-care. On

[2] The list of papers would be too long to cite here but some of the early work include Dominitz and Manski (1996), Hurd and McGarry (2002).

the other hand, we find that education does not change perceived net benefits. Putting both results together, we can conclude that education is negatively correlated with the costs of obtaining professional health care. Another example is birth parity which can affect the gross benefits (because mothers have more experience with children of lower birth order) or the costs (higher opportunity cost of time because mothers are busier with more children). We find that birth order affects the net benefits but not the gross benefits, which leads us to rule out the first explanation in favour of the second.

The data for this study come from the baseline survey to evaluate the Colombian conditional cash transfer program *Familias en Acción* (Attanasio *et al.*, 2003). This dataset is very suitable for two reasons. First, it includes information that allows us to measure children's illness and the mothers' subjective assessment of the benefits of using professional care. Second, it is a particularly rich dataset that allows us to analyze the effect of some interesting variables such as mother's health knowledge.

The remainder of the paper is organized as follows. The next section discusses the basic theoretical model, the econometric specification, and the specification tests. Section 3 describes the data set and how exactly we measure the variables of interest: children's illness and mothers' perception of the benefits of professional health care. The empirical results are presented in Section 4, jointly with some robustness analyses. Section 5 summarizes the main results and concludes.

2 Model

2.1 Model outline

In this section, we outline a model to explain whether a carer (parent, grandparent, etc) chooses to take her child to a health care professional or chooses self-care instead. The model formalizes the concept of perceived gross benefits of professional health care. We use it to explain how mothers' subjective responses on why she did not take her child to a health professional can be used to measure her perceived gross benefits of professional health care.

We assume that the household comprises a carer and an ill child. The carer's utility function is $U(h,c)$, where h is the child's health and c denotes non-health related consumption. The child's health production function is given by $h = h(\tilde{a}, x, h_0)$, where x is a vector of health inputs that includes self-care and professional care, $x = (x_{SC}, x_{PC})$, $\tilde{a}$ is a vector that determines the productivity of these inputs and h_0 denotes the realization of the health shock that triggers child illness.

The carer is not certain about the productivity of x_{SC} but she has a distribution function over it, $dF^{SC}_{\tilde{a}|\Theta,h_0}(a \mid \Theta, h_0)$, which depends crucially on the carer's information set about health issues, Θ. Therefore, the carer will choose the amount of self-care x_{SC} to maximize the expected utility

$$x_{SC}^{\ *} = \arg\max_{x_{SC}} \int U\big(h(a, x_{SC}, h_0), y - p x_{SC}\big) dF^{SC}_{\tilde{a}|\Theta,h_0}(a \mid \Theta, h_0), \tag{1}$$

where y denotes household income and p denotes the price of home remedies, over-the-counter medicines, and other self-care inputs. The indirect utility function of self-care is given by

$$V^{SC}(h_0, p, y, \Theta) = \int U\Big(h(a, x_{SC}^{\ *}, h_0), y - p x_{SC}^{\ *}\Big) dF^{SC}_{\tilde{a}|\Theta,h_0}(a \mid \Theta, h_0). \tag{2}$$

Regarding professional health care, the carer does not decide on the amount of care but simply on whether or not to take the child to professional health services. We assume that the carer has a distribution function over future health after visiting a health care professional, $dF^{PC}_{h|\Theta,h_0}(h \mid \Theta, h_0)$, that might come from previous experience and will depend on the initial level of health h_0. The cost of professional health care is given by c and includes the price of professional consultations, prescribed medicines, travelling costs, etc. The expected utility from using professional care is given by:

$$V^{PC}(h_0, c, y, \Theta) = \int U(h, y - c) dF^{PC}_{h|\Theta,h_0}(h \mid \Theta, h_0). \tag{3}$$

The comparison between $V^{SC}(h_0, p, y, \Theta)$ and $V^{PC}(h_0, c, y, \Theta)$ determines whether or not the carer takes the child for professional health care.

We can now define the gross benefits of professional health care as the difference between the utility from professional health care under the hypothetical scenario that the cost of receiving it was zero and the utility derived from self-care. In terms of the model, the gross benefits of professional health care are:

$$\overset{*}{GB} = V^{PC}(h_0, 0, y, \Theta) - V^{SC}(h_0, p, y, \Theta). \tag{4}$$

In contrast, the net benefit of professional health is given by:

$$\overset{*}{NB} = V^{PC}(h_0, c, y, \Theta) - V^{SC}(h_0, p, y, \Theta), \tag{5}$$

which is different from the gross benefits because the indirect utility of professional health care depends on its cost c.

2.2 Measuring gross and net benefits of professional health care

In our empirical setting, the gross and net benefits of professional care are latent variables: they cannot be measured directly but we can construct binary variables, *GB* and *NB*, which equal 1 if the respective benefit is above some threshold (which we normalize to zero) and 0 otherwise. For *NB,* we simply assume that the carer seeks professional health care if the perceived net benefits of this type of care are positive. Therefore, the binary variable *NB* equals 1 if the child is seen by a health care professional, and it equals 0 otherwise.

In order to construct *GB*, we exploit responses to survey questions as to why the carer did not seek professional health care in the event of the child being ill. A complete set of possible responses is given in subsection 3.3 but for the time being it is enough to consider that most of them convey that professional health care was too costly (in a broad sense). If so, it means that the child would have seen a health care professional if it had been less costly. In other words, there is some $c' < c$ for which $V^{PC}(h_0, c', y, \Theta) > V^{SC}(h_0, p, y, \Theta)$. In turn, this implies that the gross benefits from professional health care are positive ($\overset{*}{GB} = V^{PC}(h_0, 0, y, \Theta) - V^{SC}(h_0, p, y, \Theta) > 0$). In that case, the binary variable that measures whether the gross benefits from professional health care are positive, *GB*, equals 1. If the response indicates that the gross benefits from professional health care are not positive (for instance, if the mother

reports that professional care was not needed) then *GB* equals 0. Clearly, *GB* necessarily equals 1 whenever *NB* equals 1.

2.3 Empirical implementation

We use the latent random utility framework to obtain an empirical model for the binary variables *GB* and *NB*. We assume linearity of the indirect utility functions $V^{PC}(h_0, 0, y, \Theta) - V^{SC}(h_0, p, y, \Theta) = \alpha Z$ and $V^{PC}(h_0, c, y, \Theta) - V^{SC}(h_0, p, y, \Theta) = \beta_1 Z + \beta_2 c$) and add error terms, ε and ν, respectively to each equation. Moreover, we consider that GB and NB are only observed if the child is perceived as ill by the carer, meaning that we need to account for this selection. In particular, I_i equals 1 if child i is ill and 0 otherwise. This allows us to define the empirical model for the gross benefit of professional health care, which is given by:

$$\begin{aligned} I_i &= \mathbb{1}[\gamma W_i + u_i > 0] \\ GB_i &= \mathbb{1}[\alpha Z_i + \varepsilon_i > 0] \qquad \text{if } I_i > 0 \end{aligned} \tag{6}$$

where W_i is a vector of covariates that might potentially explain child illness, u_i is an error term, and 1[.] is an indicator function that takes value 1 when the condition in parentheses holds, and 0 otherwise. The model for the net benefit of health care use is as follows:

$$\begin{aligned} I_i &= \mathbb{1}[\gamma W_i + u_i > 0] \\ NB_i &= \mathbb{1}[\beta_1 Z_i + \beta_2 c_i + \nu_i > 0] \qquad \text{if } I_i > 0 \end{aligned} \tag{7}$$

We assume that the joint distribution of the error terms u_i and ε_i (as well as u_i and ν_i) is bivariate standard Normal and it is characterized by a correlation parameter $\rho_{u\varepsilon}$ ($\rho_{u\nu}$). Identification of the model requires us to impose exclusion restrictions on Z. Our identification strategy is presented and justified in Section 3.

It is important to note one important robustness property of the gross benefit model. If some components of the costs, c_i, are unobserved to the econometrician, the estimates of β_1 in the net benefit model (Eq. 7) might be biased because those unobserved components might be

correlated with Z_i. Fortunately, this bias will not affect the estimates of α in the gross benefit model because by construction the cost c is not part of equation (6). For instance, less educated people might live further away from the health care provider and thus face a higher transportation cost. If the transportation costs are unobserved, this will bias the estimates of education in Eq. (7). However, this will not be a problem in the gross benefit model.

2.4 Specification testing

The above discussion lends itself to design a simple specification test. If the cost variables, c_i, are entered into Eq. (6) and found to be statistically significant, then it can be taken as evidence that the gross benefit model is misspecified. Consequently, it will be reassuring if we fail to reject that the coefficients associated with the cost variables are zero.

Another simple specification test is to include variables measuring illness severity in the *GB* model. If the model is correctly specified (and GB is well measured), one would expect the gross benefits from professional health care to be higher for more severe illnesses. We report on these two tests in subsection 4.3.

3 Data

3.1 Sample

The data come from the baseline survey of *Familias en Acción* (FA), a conditional cash transfer program implemented by the Colombian government.[3] Participation was at the municipality level, and the sample comprises both types of municipalities, participants and non-participants. All included municipalities are rural, relatively poor, and have fewer than 100,000 inhabitants, representing the type of municipalities targeted by the FA program. The households included in the sample are those belonging to the poorest level of socio-economic

[3] The program provides monetary transfers to mothers in beneficiary families, conditional on having completed some requirements: a) children under 7 years old 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.

status according to a proxy-means test widely used in Colombia called SISBEN[4]: 96% of households live under the poverty line.[5] The data were collected between June and November 2002. The information from the household survey is complemented with municipal information on infrastructures and social conditions provided by local authorities. More details about the sample and the FA program can be obtained from Attanasio *et al.* (2003). Our analysis is restricted to children aged 0 to 6 years as health care information was not collected for older children. After deleting observations with missing information in the variables of interest, the final sample is composed of 6,309 children living in 117 rural or semi-urban municipalities.

In order to implement the empirical model, we need to define key variables and create indicators for those that are not directly available. We describe our strategy in the next subsections.

3.2 Measurement of child illness

Mother's recognition of child illness is a precondition for valuing the potential benefits of professional care. The FA survey asks mothers about their children's morbidity in the two weeks prior to the interview. Table 1 shows that approximately 15.3% of children in our sample suffered from diarrhoea, 44.4% had acute respiratory infection with fever, and 17.1% had some other illnesses during the reference period. In total, these figures imply that 56.3% of children experienced an illness episode. Some of these episodes might be minor, could be treated at home by their parents, and might not require professional health care. For example, a child with mild diarrhoea may be cured at home using oral rehydration therapy.

Insert Table 1

[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 is used for the targeting social programs. Households in SISBEN level 1 are the poorest and SISBEN level 6 are the richest. See Vélez *et al.* (1999) for more information.

[5] This poverty line is standard in rural Colombia and equals to 149,052 pesos per capita per month at the time of the survey.

3.3 Measuring mother's perception of gross benefits of medical care

As expected, we do not observe mothers' perceived benefits of medical care, and consequently we need to infer it from the data. This is done differently for those who took the child for curative care in the reference period (15 days prior to the interview) and those who did not. For the former, we simply assume that if the child was taken to professional medical care it was because the perceived gross benefits of doing so were positive. For the latter, we use mothers' responses to the question *Why did you not seek medical care for your child during the previous two weeks?* to infer whether the perceived gross benefits were positive or not. The lower panel of Table 2 summarizes the possible answers. The most important responses are *I did not consider it necessary (*56%) and *I could not afford it* (28.7%). Other answers such as distance to health care providers or lack of available time were reported by a small percentage of mothers.

Insert Table 2

According to the framework of analysis in Section 2, we classify a mother as perceiving positive gross benefits to professional health care for her child if the main reason for not taking the child to a medical facility during the reference period was any of the following: *I did not know where to go*; *I could not afford it; I had no time*; *medical services are far from here.*[6] On the contrary, a mother is classified as perceiving non-positive gross benefits of medical care if the reason for her not seeking care was *I did not consider it necessary.*[7] Table 2 reports the distribution of these responses.

In Tables 2 and 3, we show the relation between these responses and objective variables. The results support clearly the validity of the responses. For instance, we find that the percentage of children whose mother responded that *I could not afford it* as the reason for not seeking

[6] Note that we treat all of these responses in the same way and we do not make any distinction depending on the response.

[7] We also include in this category 4% of children for whom the mother responded that they were not sick, although the mother had previously indicated (in the morbidity questionnaire) that the child had been sick. We interpret this as very low severity illness and hence the mother perceiving non-positive gross benefits from professional health care.

professional care decreases with mother's education (Table 2) and with household income (Table 3). Likewise, Table 3 shows that the percentage of children whose mothers reply that they lived too far from a health care provider increases with reported distance (in minutes) from the household to the nearest health care provider.

Insert Table 3

Table 4 summarizes the main results relating to children's illness, mothers' perceived positive gross benefits of medical services and use of medical services. In summary, 56.3% of children in our sample were classified as being ill during the two weeks previous to the interview; roughly 57.7% of their mothers perceived positive benefits of seeking professional health care but only 32.4% of them took their children to a health professional.

Insert Table 4

Figure 1 plots the prevalence of child's illness, the percentage of mothers who perceive positive gross benefits of medical care and the percentage of children who used health services by child's age. Note that the proportion of ill children is very high in the first months of life. Children aged 0–2 have underdeveloped immune systems and are relatively more vulnerable to infections and disease. These are also the ages at which mortality risk is the highest. The prevalence of illness decreases with age but remains high with percentages greater than 40% at older ages. It is also remarkable to note the magnitude of the gap between child's illness prevalence and mother's perception of positive gross benefits of professional care at all ages.

Insert Figure 1

3.4 Explanatory variables

The variables used in the analysis are described in Table 5. Child characteristics include age (in months), age squared, sex, birth order and height-for-age z-score which is an indicator of long term health (see for instance WHO Working Group, 1986; Strauss and Thomas, 1998; Behrman and Rosenzweig, 2002). In line with the model in section 2, we include household income and we represent the household's information set using mother's education, along with the percentage of women in the municipality who are knowledgeable on how to treat

diarrhoea.[8]

In order to measure the costs of professional health care, we include whether or not the child is covered by health insurance, the average travel time in the municipality to the nearest health centre, and the number of health centres per 1,000 inhabitants. Other municipality level variables are whether FA is operative in the municipality at the time of the survey, and whether there have been recent events of violence (caused by illegal armed groups) in the municipality.

Insert Table 5

3.5 Exclusion restriction

In order to identify the sample selection model (Eqs. 6 and 7), we need at least one variable that has a non-zero coefficient in the selection equation (child illness) and that can be excluded from the benefit equations. We use the altitude of the municipality for this purpose because altitude has been shown to affect child's health due to its relation to climate, temperature and availability of vectors that transmit diseases (see Bitrán *et al.* 2000; Mariani and Gragnolati, 2006). We believe it to be very plausible that altitude will not affect mother's perception of professional health care, especially as we condition on mother's education and household income. Moreover, in Table A of the appendix, we show that altitude is uncorrelated (joint significance p-vale equals to 0.40) with a wide array of health infrastructure variables. This is important since these variables could affect health care use which, in turn, might affect health information.

In subsection 4.3, we show that we obtain similar results using a different modelling approach that does not require an exclusion restriction.

[8] This variable is derived from a couple of questions on whether one should increase, maintain or decrease fluids and food given to a child who has diarrhoea. We use the variable at the municipality level to alleviate endogeneity concerns.

4 Empirical results

4.1 GB and NB model estimates

Table 6 displays the maximum likelihood estimates of Eqs. (6) and (7) outlined in Section 2. Columns 2 and 3 report the estimates on the selection equation for child illness and the GB equation, respectively; columns 4 and 5 report the corresponding estimates for the NB model. As indicated above, the GB dependent variable takes the value one if the mother perceived positive benefits of taking the child to a health professional and zero otherwise (see details in subsection 3.3) and the NB indicator takes the value one if the child was taken to a health professional and zero otherwise. The comparison of estimates in columns 3 and 5 allows us, first, to show that our results from the GB estimation provide different insights from those obtained using standard approaches that just focus on children's use of professional health care. Second, the comparison permits us to identify the variables that affect medical care use through the costs. This is possible because NB is a function of both GB and the costs of professional health care and, in column 2, we have already learnt about GB.

Insert Table 6

Our first set of results relate to variables associated with the carer's information set such as knowledge on health issues and education. We find that both gross and net benefits of professional health care are lower in municipalities with a larger percentage of mothers who know how to treat diarrhoea (columns 3 and 5 of Table 6). This result is consistent with health knowledge increasing the productivity of self-care, and with previous studies on the health improving effect of health education programs (e.g. Ahmed *et al.*, 2003; Alderman, 2007; Galasso and Umapathi, 2009; Manandhar *et al.*, 2004; Edgeworth and Collins, 2006; Linnemayr and Alderman, 2011; Fitzsimons *et al.,* 2012). The fact that we find the same result in the GB and NB model strengthens the interpretation of the estimates as coming from the productivity of self-care rather than a spurious correlation between health knowledge and the cost of professional health care (see the last paragraph of subsection 2.3).

Consistent with the above, we find that the gross benefits of professional health care are

smaller for more educated mothers (Table 6, column 3), which also seems to indicate that education increases the productivity of self-care (as health related knowledge does). This is in line with Glewwe (1999) who found that formal schooling help mothers in the diagnosis and treatment of children with health problems, and with Thomas *et al.* (1991) and Rosenzweig and Schultz (1982) who found that education and health services are substitutes. In contrast, maternal education does not explain professional health care use (NB model). Hence it must be that a countervailing force exists by which education and unobserved health care costs are negatively correlated. For instance, more educated mothers might be more aware of their rights and the fees they have to pay.[9] Because costs are mostly unobserved to the econometrician, the education estimates in the NB model are prone to omitted variable bias. This highlights the importance of the GB model in which, by construction, the costs of professional health care are not relevant.

Together, the results on health knowledge and education suggest that while providing self-care to ill children seems to be a deliberate decision for more educated mothers (as a result of their higher self-care skills), it may be more of a forced decision for less educated mothers because they face higher costs of access to medical services. This entails important consequences for children's health since self-care has been identified as a positive health behaviour only for those households with a recognisable level of human capital (Edgeworth and Collins, 2006).

Our results also shed light on the importance of birth order. Column 5 in Table 6 shows that higher birth order children are less likely to use medical services. There are two possible explanations for this effect. First, mothers might acquire self-care skills and health knowledge through their older children and thus perceive less benefit from seeking professional care for their younger children. Second, mothers may face higher time/income restrictions when they have several children which make access medical services more difficult. The estimates of the

[9] Indeed, different education groups can have different costs of accessing different health services due to differential targeting. Examples include Thomas *et al.* (1996) and Frankenberg (1995) who show that uneducated households benefit more from certain services (the availability of antibiotics, immunization services, government health services) but educated households benefit more from other (maternity and childbirth services). Heterogeneity of access costs according to education group and type of service can potentially explain this (Alderman and Lavy, 1996).

GB model rule out the former hypothesis in favour of the latter as birth order is not statistically significant in column 3 of Table 6, but it is in column 5.

Variables related to the affordability of professional health care (insurance, income and distance to health care providers) only affect the net benefits of professional health care. In particular, we find a positive and significant effect of health insurance and a negative and significant effect of distance to the nearest health care provider on children's health care use. This confirms that these variables affect professional health care use only through their effect on costs.[10] Similarly, the occurrence of events of violence in the municipality decreases health care use due to an increase in health care costs, probably because health facilities are destroyed and/or health personnel might leave the affected villages.

Altitude and its square term, which are excluded from the benefit equations, are jointly significant at the 1% level in the child illness selection equation. The estimated correlations between the error terms of the selection equation and the equations for gross and net benefits ($\rho_{u\varepsilon}$ and ρ_{uv}) are not statistically different from zero, which suggests that sample selection may not be a serious issue in this sample. Consistent with this, we find that the results of Probit models on the selected sample (Table B of the appendix) are similar to the ones in Table 6.

4.2 Specification tests

As our theoretical model made clear, the cost of health care should not affect mothers' perceived benefits of professional health care (see subsection 2.4 on specification testing). Indeed, we find that variables relating to the cost of professional health care (insurance, distance to health providers and availability of health providers) do not explain perceived gross benefits (Table 6, column 3). This is clearly supportive of our model and consequently how we measure mother's perceived gross benefits.

[10] We are abstracting from possible endogeneity of health insurance caused by adverse selection. However, this might not be a serious concern in this sample given that insurance is not significant in the illness equation.

Another natural specification test is that GB should be larger for more severe child illness episodes. To test the plausibility of this hypothesis, we re-estimated the baseline model by controlling for the severity of child illness. For this purpose we use four alternative set of indicators: 1) whether illness restricted normal child activity or not; 2) whether illness restricted normal child activity and, if so, whether the child remained in bed or not; 3) the number of reported illness (one vs. two or more); 4) the child's morbidity profile during the reference period. Specifications (1) to (4) in Table 7 (Panel A) confirm that, regardless the type of indicator we use, severity of illness has a positive and significant effect on the probability that the mother perceives positive gross benefits of professional health care. Also we find that the child's morbidity profiles for which the mother perceives the highest benefits of seeking professional care are those that combine both diarrhoea and respiratory illness.

Insert Table 7

4.3 Robustness of results

The model estimated in subsection 4.1 requires an exclusion restriction, the validity of which cannot be tested. Instead, to assess the robustness of our results, we compare our estimates with those obtained from a multinomial Probit model that does not require any exclusion restriction. The dependent variable in the multinomial model takes three possible outcomes: 0, if the child was not ill during the reference period; 1, if the child was ill but the mother did not perceive positive benefits of taking him to the doctor/nurse; and 2, if the child was ill and the mother perceived positive benefits of seeking professional care. In Table 8, we compare the marginal effects of the multinomial Probit with those of the GB model. The marginal effect is computed on the joint probability that the child is ill and that the mother perceives positive gross benefits. Overall, we observe that the estimated effects are robust in terms of magnitude and significance in both models, which supports the validity of our identification strategy.[11]

Insert Table 8

[11] The marginal effect of the percentage of women in the municipality who know how to treat diarrhoea is negative but not significant. This is because we show the marginal effect for the joint probability of *I=1 & GB =1* on Table 8, and the coefficient of the percentage of women who know how to treat diarrhoea is positive (but not significant) in the selection equation in Table 6.

The second robustness analysis relates to the effect of mother's education. The education estimates of the GB model might be biased downwards if children whose mother is more educated have less severe illness episodes. To investigate whether this is an important feature in our sample, we re-estimate the baseline model for GB by adding interactions between mother's education and a dummy variable for whether the illness restricted the child's normal activity. Panel B in Table 7 reports the results. To facilitate interpretation, Figure 2 plots the estimated conditional probabilities of perceiving positive gross benefits of seeking professional care for the categories defined by the interactions. We observe that for a given severity level, more educated mothers have a lower probability of perceiving positive gross benefits of seeking professional care for their children than less educated mothers. Note, however, that when illness restricts children's normal activity, differences between mothers with some primary education and mothers with higher education almost disappear though they remain high with respect to illiterate mothers.

[Insert Figure 2]

5 Conclusion

In this paper, we explore the determinants of the mothers' perceived gross benefits of medical care. This concept is empirically implemented using mothers' responses as to why they did not seek professional medical care when faced with a child illness episode. We show that a better understanding of the mechanisms through which different factors affect health care use is obtained by comparing the results of the gross benefit model with those of the more standard net benefit model. We also provide two simple specification tests and assess the robustness of our results.

We find that mothers with more education and better knowledge of health issues have smaller gross benefits of professional health care, presumably because they can provide better self-care. In the case of education, this does not imply that more educated mothers are less likely to use health care services, possibly because education and health care costs are negatively correlated. We also find that higher birth orders are less likely to use health care services, not because

their mothers have accumulated more self-care expertise but rather because their mothers face higher time/income constraints. As expected, health insurance, occurrence of violent episodes in the municipality and distance to health facilities affect health care use because they affect the costs, rather than the benefits.

As expected, health insurance and distance to health facilities affect health care use because they affect the costs, rather than the perceived gross benefits. This is not only interesting in itself but it also validates our approach because, by definition, cost related variables should not explain the perceived gross benefits. Another specification test passed by our model is that the perceived gross benefits of professional health care are larger for more severe illness episodes.

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Table 1: Prevalence of child illness by mother's educational attainment

	Mother's schooling			
	No formal education	Less than primary	Primary or more	All
Type of illness				
Diarrhoea	142	461	364	967
	(16.21)	(15.38)	(14.94)	(15.33)
Respiratory illness	405	1,317	1,081	2,803
	(46.23)	(43.94)	(44.38)	(44.43)
Other illnesses	138	489	454	1,081
	(15.75)	(16.32)	(18.64)	(17.13)
Prevalence of illness	492	1,674	1,388	3,554
	(56.16)	(55.86)	(56.98)	(56.33)
Total children	876	2,997	2,436	6,309

Note: Percentages are given in parenthesis

Table 2: Use of professional health care and reasons for non-use among ill children

	Mother's schooling			
	No formal education	Less than primary	Primary or more	All
Users of professional health care	157	501	495	1,153
	(31.91)	(29.93)	(35.66)	(32.44)
Non-users of professional health care	335	1,173	893	2,401
	(68.09)	(70.07)	(64.34)	(67.56)
Reason for non-use as reported by the mother:				
I did not consider it necessary	144	618	581	1,343
	(42.99)	(52.69)	(65.06)	(55.94)
The child was not ill	18	76	64	158
	(5.37)	(6.48)	(7.17)	(6.58)
Health provider is too far from here	20	45	33	98
	(5.97)	(3.84)	(3.70)	(4.08)
I could not afford it	140	373	177	690
	(41.79)	(31.80)	(19.82)	(28.74)
I had no time	4	26	13	43
	(1.19)	(2.22)	(1.46)	(1.79)
Other reasons	9	35	25	69
	(2.69)	(2.98)	(2.80)	(2.87)
Total number of ill children	492	1,674	1,388	3,554

Note: Percentages are given in parenthesis

Table 3: Selected reasons for not seeking professional health care by per capita household income and time to the nearest health centre (sample of ill children)

	Per capita household income (quantile)				Average time to the nearest health centre (quantile)			
Reason reported by the mother	10%	25%	50%	100%	10%	25%	50%	100%
I did not consider it necessary	48.91	51.99	53.89	59.95	58.17	52.29	54.36	57.13
The child was not ill	6.88	6.37	6.59	6.57	6.37	6.86	7.38	6.17
Health provider is too far away	3.26	5.57	3.72	3.98	2.79	2.94	5.13	5.13
I could not afford it	35.87	32.10	30.07	25.26	20.08	29.41	27.48	27.48

Note: Percentages are computed on the 3,554 children that had an illness episode in the 15 days prior to the interview.

Table 4: Child illness, mother's perception of positive benefits of medical care and child use of health services by mothers' educational attainment

	Mother's schooling			
	No formal education	Less than primary	Primary or more	All
Prevalence of child illness	492	1,674	1,388	3,554
(% over total sample)	(56.16)	(55.86)	(56.98)	(56.33)
Mother perceives positive gross benefits of medical care	330	980	743	2,053
(% over total sample)	(37.67)	(32.70)	(30.50)	(32.54)
[% over ill children]	[67.07]	[58.54]	[53.53]	[57.77]
Use of health services (positive net benefits)	157	501	495	1,153
(% over total sample)	(17.92)	(16.72)	(20.32)	(18.28)
[% over ill children]	[31.91]	[29.93]	[35.66]	[32.44]
Total children	876	2,997	2,436	6,309

Table 5: Summary of descriptive statistics

	Mean	Std.
Child variables		
Girl	0.480	-
Age (in months) x 10^{-1}	4.108	2.014
Birth order	5.609	2.048
Height-for-age z-score	-1.216	1.146
Mother and household variables		
Age x 10^{-2}	0.310	0.074
No formal education	0.139	-
Incomplete primary education	0.475	-
Complete primary education or higher	0.386	-
Per capita household monthly income in dollars x 10^{-2}	0.176	0.187
Health insurance (subsidized system)	0.600	-
Enrolment in Familias en Acción program	0.313	-
Municipal variables		
Prop. of women who knows treatment for diarrhoea	0.216	0.090
Average time to the nearest health facility (minutes) x 10^{-2}	0.384	0.411
Health centres per 1,000 inhab.	0.272	0.264
Social violence in the municipality	0.681	-
Average altitude of the municipality (in meters) x 10^{-3}	0.612	0.731

Table 6: Bivariate probit models for GB and NB with sample selection

	Baseline models			
	GB model		NB model	
	Selection equation (child illness)	Positive gross benefits	Selection equation (child illness)	Positive net benefits (Use of health care)
Child variables				
Girl	-0.001	-0.002	-0.0002	0.041
	(0.030)	(0.036)	(0.030)	(0.045)
Child age (months)	0.015	0.175***	0.015	-0.238***
	(0.037)	(0.044)	(0.037)	(0.047)
Child age squared	-0.010	0.021***	-0.010	0.024***
	(0.004)	(0.005)	(0.004)	(0.006)
Birth order	-0.002	-0.003	-0.002	-0.025*
	(0.009)	(0.011)	(0.009)	(0.013)
Height-for-age	-0.027*	-0.014	-0.027*	0.035*
	(0.015)	(0.020)	(0.015)	(0.019)
Mother and household variables				
Mother's age	-0.894	-2.054	-1.018	0.243
	(1.354)	(1.438)	(1.372)	(1.558)
Mother's age squared	1.965**	2.750	2.150	-0.381
	(1.900)	(2.085)	(1.943)	(2.422)
Some primary education	0.026	-0.196***	0.027	-0.103
	(0.056)	(0.069)	(0.056)	(0.074)
Primary education or higher	0.056	-0.310***	0.058	-0.029
	(0.060)	(0.072)	(0.060)	(0.093)
Per capital household income	-0.060	-0.115	-0.062	0.230*
	(0.115)	(0.138)	(0.116)	(0.128)
Health insurance coverage	-0.033	0.077	-0.033	0.483***
	(0.046)	(0.053)	(0.046)	(0.064)
Enrolment in Familias en Acción	-0.049	-0.046	-0.049	0.130
	(0.058)	(0.056)	(0.058)	(0.083)
Municipal variables				
Prop. of women who know how to treat diarrhoea	0.490	-0.860**	0.481	-0.906**
	(0.300)	(0.416)	(0.300)	(0.462)
Average time to the nearest health centre	0.001	-0.001	0.001	-0.006***
	(0.001)	(0.001)	(0.001)	(0.001)
Health centres per 1,000 inhab.	-0.183*	0.100	-0.184*	-0.057
	(0.110)	(0.109)	(0.110)	(0.140)
Violence in the municipality	-0.039	0.009	-0.036	-0.140*
	(0.057)	(0.065)	(0.057)	(0.081)
Altitude	-0.358***	---	-0.360***	---
	(0.109)		(0.114)	
Altitude squared	0.094*	---	0.096*	---
	(0.049)		(0.051)	
N	6,309	3,554	6,309	3,554
P-value of the Wald test for ρ=0	0.223		0.452	

Note: Standard errors clustered at municipal level in parentheses (117 municipalities). Constant terms included but not reported. * Significant at 10%. ** Significant at 5%. ***Significant at 1%.

Table 7: Estimated effects of severity of child illness on mothers' perceived gross benefits of professional health care

	(1)	(2)	(3)	(4)	(5)
PANEL A: Alternative definitions of child illness severity					
Restricted activity due to illness (ref: no restricted activity)					
Restricted activity	0.577***				
	(0.082)				
Restricted activity due and stay in bed (ref: no restricted activity)					
Restricted activity, not in bed		0.668***			
		(0.108)			
Restricted activity, in bed		0.821***			
		(0.115)			
Number of illnesses (ref: one illness)					
Two or more illnesses			0.376***		
			(0.070)		
Number and type of illnesses (ref: only diarrhoea)					
Only respiratory illness				-0.095	
				(0.082)	
Only other illness				-0.096	
				(0.099)	
Diarrhoea + respiratory illness				0.300***	
				(0.100)	
Diarrhoea + other illness				0.097	
				(0.141)	
Respiratory illness + other illness				0.199*	
				(0.110)	
Diarrhoea + respiratory illness + other illness				0.582***	
				(0.140)	
PANEL B: Interactions between child illness severity and maternal education (ref: illiterate × restricted activity)					
Illiterate × no restricted activity					-0.621***
					(0.154)
Some primary education × no restricted activity					-0.762***
					(0.142)
Some primary education × restricted activity					-0.261**
					(0.120)
Primary education or higher × no restricted activity					-0.937***
					(0.143)
Primary education or higher × restricted activity					-0.287***
					(0.121)

Note: Probit estimates of GB models are obtained controlling by endogenous sample selection on child illness. All specifications include the set of explanatory variables used in Table 6. Standard errors clustered at municipal level in parentheses. * Significant at 10%. ** Significant at 5%. ***Significant at 1%.

Table 8: Estimated marginal effects of selected variables on Pr(I=1, GB=1)

	Estimated marginal. effects on Prob(I=1, GB=1)	
	Baseline GB model	Multinomial probit
Child age (months)	-0.034**	-0.035**
	(0.015)	(0.014)
Child age squared	0.001	0.001
	(0.002)	(0.002)
Height-for-age	-0.013**	-0.013**
	(0.005)	(0.005)
Some primary education	-0.037*	-0.036
	(0.022)	(0.023)
Primary education or higher	-0.057**	-0.057**
	(0.023)	(0.023)
Prop. of mothers who know how to treat diarrhoea	-0.023	-0.051
	(0.111)	(0.119)

Note: Marginal effects are computed on a reference child defined as a girl whose mother has no formal education, has insurance coverage, does not participate in *Familias en Acción* and lives in a municipality without problems of violence during the reference period. The rest of variables are fixed at their mean values.

Figure 1: Child illness, mother's perception of the benefits of professional care and use of health services by child age

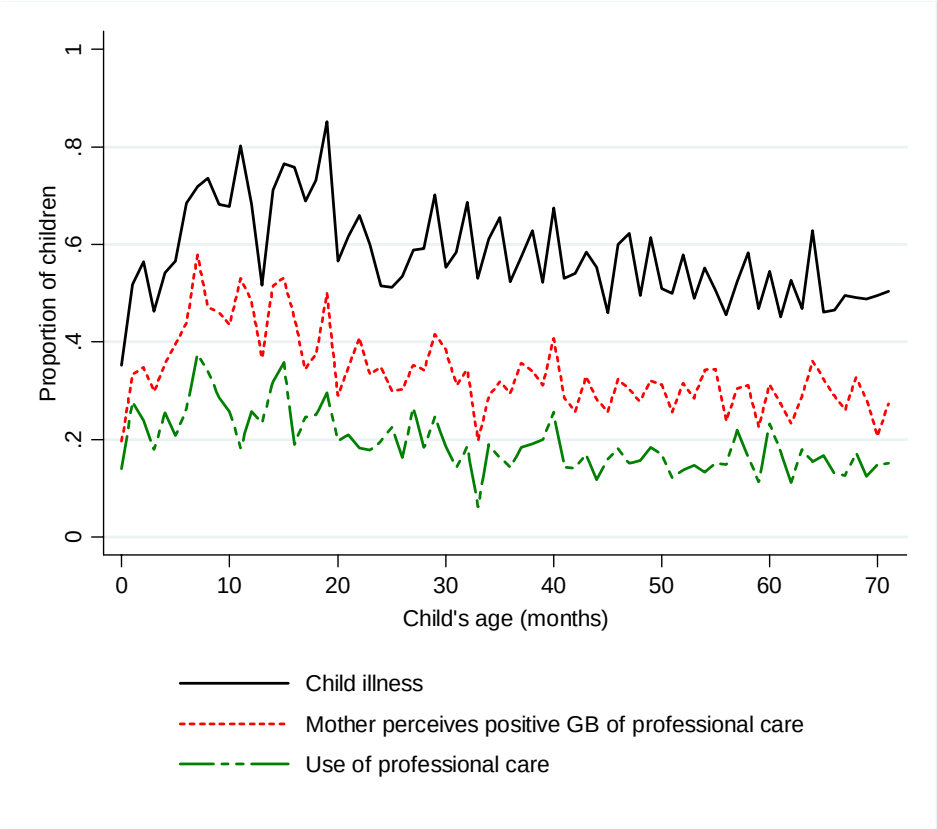
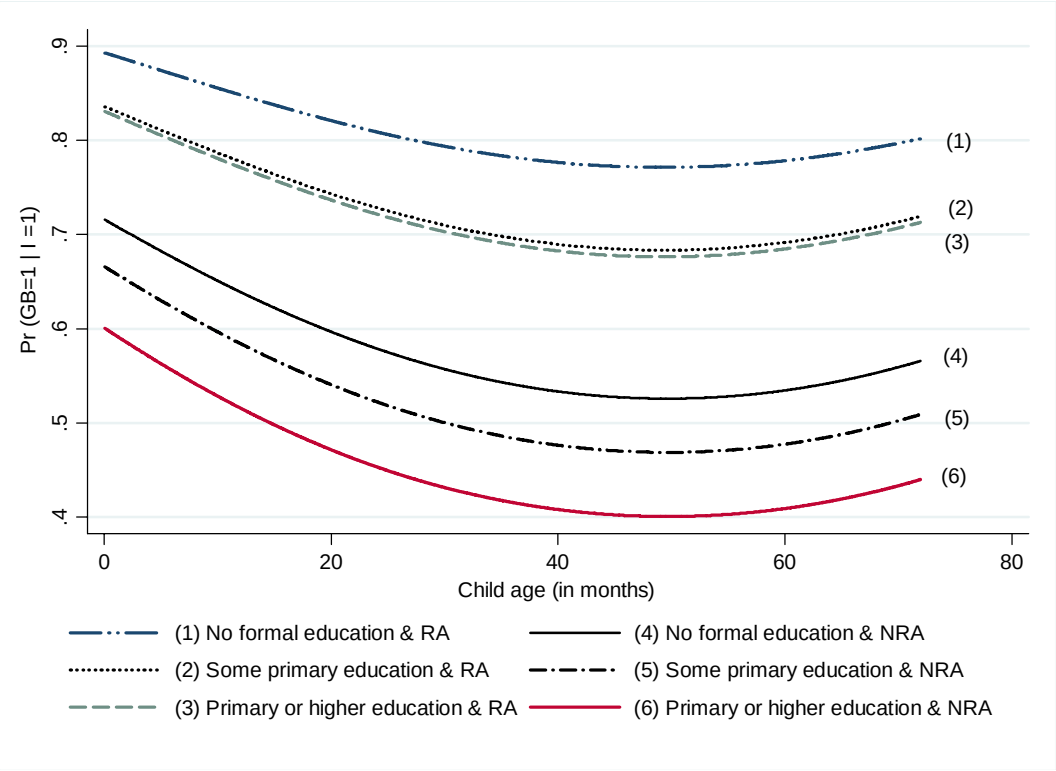


Figure 2: Predicted probabilities of perceiving positive gross benefits of medical care conditioned on child illness: Effect of interactions of maternal education and child illness severity



Note: Conditional probabilities are computed for a reference child defined as a girl, who has insurance coverage, does not participate in Familias en Acción and lives in a municipality without problems of violence. The rest of variables (except age) are fixed at their mean values. RA: illness restricts child's activity; NRA: illness does not restrict child's activity.

6 Appendix

Table A. OLS estimates of altitude of the municipality of residence on health infrastructure variables

	Coef. (s.e.)
Nº of health centres per 1,000 inh.	0.114
	(0.263)
At least one specialist (=1 if yes)	0.069
	(0.277)
At least one obstetrician (=1 if yes)	-0.080
	(0.273)
At least one paediatrician (=1 if yes)	-0.310
	(0.279)
Hours/week of antenatal care	0.0134
	(0.008)
Hours/week of vaccination	0.004
	(0.005)
Hours/week of health information activities	-0.002
	(0.005)
Hours/week of growth and development check-ups	-0.005
	(0.008)
Average waiting time at health centres	-0.001
	(0.002)
Average attendance time at health centres	0.032
	(0.021)
Constant	0.094
	(0.412)
R2	0.092
N	115
F-test for joint significance: F(10,115) = 1.05 p-value=0.404	

Table A. Single Probit estimates of GB and NB models on the sample of ill children

	Positive gross benefits	Positive net benefits (Use of medical services)
Child variables		
Girl	-0.002	0.042
	(0.040)	(0.048)
Child age (months)	-0.186***	-0.242***
	(0.046)	(0.047)
Child age squared	0.019***	0.023***
	(0.006)	(0.006)
Birth order	-0.003	-0.026**
	(0.012)	(0.013)
Height-for-age	-0.026	0.031
	(0.018)	(0.020)
Mother and household variables		
Mother's age	-2.773*	0.008
	(1.505)	(1.551)
Mother's age squared	3.980*	0.080
	(2.125)	(2.405)
Some primary education	-0.213***	-0.102
	(0.072)	(0.079)
Primary education or higher	-0.323***	-0.016
	(0.074)	(0.089)
Per capital household income	-0.158	0.224*
	(0.139)	(0.131)
Health insurance coverage	0.061	0.486***
	(0.057)	(0.055)
Enrolment in Familias en Acción	-0.086	0.116
	(0.060)	(0.089)
Municipal variables		
Prop. of women who know how to treat	-0.969**	-0.940**
diarrhoea	(0.422)	(0.458)
Average time to the nearest health centre	-0.001	-0.006***
	(0.001)	(0.001)
Health centres per 100,000 inhab.	0.027	-0.105
	(0.102)	(0.124)
Violence in the municipality	-0.0005	-0.149*
	(0.071)	(0.080)
N	3,554	

Note: Standard errors clustered at municipal level in parentheses (117 municipalities). Constant terms included but not reported. * Significant at 10%. ** Significant at 5%. ***Significant at 1%.