Preliminary Version. Comments Welcome.

Parental Bargaining, Health Inputs and Child Mortality in India

Pushkar Maitra*
Department of Economics
Monash University
Clayton Campus
P.O. Box 11E
VIC 3800
Australia
Email: Pushkar.Maitra@BusEco.monash.edu.au

Abstract

The primary objective of this paper is to examine the relationship between the use of health care (use of prenatal care and hospital delivery) and child health (measured by child mortality) in India. I develop a framework where parents care about the health of their children but cannot directly affect child health by their actions. Instead they can, through their actions, affect health inputs. Parental bargaining affects decisions about the use of prenatal care and hospital delivery, which in turn are likely to affect child mortality. I jointly estimate the decision to use prenatal care, the decision to deliver the baby in hospital and child mortality. The estimation methodology allows us to account for unobserved heterogeneity and self-selection in the use of health inputs. The estimation results show that: (1) a woman's education has a stronger effect on health care usage relative to that of her husband; (2) a woman's control over household resources (ability to keep money aside) has a significant effect on health care usage; (3) both prenatal care and hospital delivery significantly reduces the hazard of child mortality; and (4) not accounting for unobserved heterogeneity and self selection in the use of health inputs results in under-estimation of the effect of health inputs on child mortality.

JEL Classification:

Key Words: Prenatal care, Hospital Delivery, Child Mortality, Bargaining, India.

* Funding provided by the Australian Research Council Discovery Grant Scheme and the Faculty Research Grant Scheme, Faculty of Business and Economics, Monash University.

1. Introduction

The primary objective of this paper is to examine the relationship between the status of women in the household, the use of health care and its effect on child mortality in India.[1] In doing so it combines two important issues: (1) the relationship between the status of women within the household and the use of health care; and (2) the relationship between the use of health care and child mortality.

The first issue that this paper examines is the relationship between the status of women within the household and the use of health care. This is closely related to the large volume of literature that now exists on the analysis of the household. Empirical analysis of household behaviour has, traditionally, been based on the idea that family members maximise a single utility function – the unitary household or common preference model. The assumption of common preference ordering among family members, underlying such analysis, can be traced back to Becker (1981). While this approach has proved useful for its elegance and analytical tractability, the underlying hypothesis of a single utility function encompassing all family members has been increasingly challenged in recent years. Such challenges have included attempts at modelling individual utility to incorporate divergent and conflicting preference of different family members. See for example Manser & Brown (1980), McElroy & Horney (1981), Chiappori (1988, (1992) and Browning & Chiappori (1998). Crucial to the notion of non-unitary models of the household is the notion of power (Pollak (1994)).[2] Much of the empirical work using bargaining models has tested the resource pooling implication of the unitary model. Failure to accept the

[1] The terms status, power, control are all used to refer to the position of the woman within the household and the society (more broadly). In this paper I will use the terms inter-changeably.

[2] See Schultz (1990), Thomas (1990), Kanbur & Haddad (1994), Lundberg & Pollak (1994), Hoddinott & Haddad (1995), Lundberg, Pollak & Wales (1997), Frankenberg & Thomas (1998), Phipps & Burton (1998), Quisumbing & Maluccio (2000), Maitra & Ray (2001) for interesting applications using data set from different countries.

hypothesis of resource pooling generally leads to the conclusion that there exists some sort of bargaining process within the household.

The issue of how a woman's status within the household affects individual and household outcomes (like expenditure patterns, child health and education) has been of great interest to social scientists. This literature in recent years has been extended to examine the fertility effects of spousal differences. In the demography literature it has long been argued that males and females differ in their desires regarding fertility and family planning (Mason & Taj (1987); Pritchett (1994)). Empirically it has been observed that male and female preferences both significantly affect fertility and family planning (Freedman, Freedman & Thornton (1980); Thomson, McDonald & Bumpass (1990); Bankole (1995); Thomson (1997); Dodoo (1998)).

The second broad area of research that this paper examines is the relationship between health outcomes and the use of health care. The specific health outcome that I consider is child mortality. Health outcomes are assumed to be determined by a process where health inputs (for example food and nutrition or medical care) are converted into health outcomes using some form of production technology. Under the assumption that utility maximizing rational individuals attach some positive value to good health outcomes, this implies that goods are demanded not only because they directly contribute to increasing utility, but also because they are essential in the production of other goods like child health, which in turn have direct benefits. For example, expecting women value prenatal care because it is expected that such care will improve the health of her not yet born child. In estimating the effect of health inputs on child mortality, it is important to take into account the issue of self-selection in the use of health inputs. Consider a pregnant woman who is of frail health (private information to the woman). Knowing that she is of frail health, she more likely to

seek early prenatal care compared to her counterpart who is of robust health. Ignoring this self-selection would result in an underestimate of the effect of prenatal care on the child health outcome. What this essentially implies that health inputs is endogenous in the health outcome (child mortality) regression. To account for this potential endogeneity, I estimate a model where child health outcomes are jointly estimated with a behavioural model where the health inputs are themselves choices. See Panis & Lillard (1994) for more on the estimation methodology used. I focus on two particular health inputs – decision to choose to have prenatal care and the decision to deliver the baby in a hospital.

The last few decades has seen massive improvements in the availability and access to reproductive and maternal health care in India. For example during the late 1990's 42% of the births were delivered by a doctor or a health professional, up from 34% in the late 1980's. Infant (0 – 1) and young children (0 – 4) mortality rates have also dropped significantly over the past two decades – for example the infant mortality rates have fallen from 133 deaths per 1000 births in 1972-74 to 80 in 1990-92 and the mortality rates of young children have declined from 53 to 26 deaths per 1000 over the same period (World Bank (1996)). However the position of women in the traditional Indian household continues to be poor. Most women continue to have very little authority within the household and few opportunities outside the household. Women in India are often prevented from working outside the home and prevented from travelling outside the home unless accompanied by an elder relative, both of which have severe implications for their access to health care. Social norms (particularly in North India) result in a reluctance to have women and girls examined by an outsider, particularly a male doctor. Efforts to deliver antenatal services to pregnant women are frequently hindered by the prevailing attitudes towards

pregnancy (pregnancy is not regarded as condition that requires special care) and pregnant women are often unaware of the need for routine care (during pregnancy and up to six weeks after delivery) and that maternity care is available from female health workers at sub-centres. The program that provides iron and folic acid tablets to women (a key component of antenatal care) has been unsuccessful because of delivery bottlenecks. Only 25% of all deliveries take place in health facilities. In rural areas deliveries are often at home in the presence of female family members and traditional birth attendants (*dais*), in unhygienic conditions, increasing the chance of infection in both the mother and the child. I pay particular emphasis on the status of the woman in the household and use of health inputs. It is clear that anything that increases the power of women within the household is likely to directly increase the use of health inputs and indirectly reduce child mortality.

Before proceeding further, let me briefly summarise the results. First, a woman's education has a stronger effect on health care usage relative to that of her husband; second, a woman's control over household resources has a significant effect on health care usage; third, both prenatal care and hospital delivery significantly reduces the hazard of child mortality; and finally not accounting for unobserved heterogeneity and self selection in the use of health inputs results in under-estimation of the effect of health inputs on child mortality.

2. Methodology

Assume that parents make decisions regarding the quality (health attainment or educational attainment) of their children and parental utility is derived from both market consumption goods that are purchased from the market (X) and home-produced or non-market goods (Z). The quality outcome of the child may be regarded

as a home produced good. The non-market good Z is produced according to the following production function

$$Z = Z\left(X, \Omega\right) \tag{1}$$

where Ω denotes the household's production efficiency parameter. The utility of the mother (m) and the father (f) are denoted by U^m and U^f and their reservation utility levels are $\overline{U}^m$ and $\overline{U}^f$. The reservation utility level of $i\left(i = m, f\right)$ depends on the vector of prices p, unearned or asset incomes A_i and a set of extra-household environmental parameters α_i (see McElroy (1990)), so that

$$\overline{U}^i = \overline{U}^i\left(p, A_i; \alpha_i\right); i = m, f \tag{2}$$

The two parents (m and f) then choose X and Z to maximize

$$V = \left[U^m\left(X, Z\right) - \overline{U}^m\left(p, A_m; \alpha_m\right)\right] * \left[U^f\left(X, Z\right) - \overline{U}^f\left(p, A_f; \alpha_f\right)\right] \tag{3}$$

subject to the full income constraint

$$pX = w_m T_m + w_f T_f + A_m + A_f \tag{4}$$

and the household production function given by equation (1). Here w_i is the wage rate for individual i and T_i is the time endowment for individual i.

As a solution to this problem one obtains a reduced form demand equation for children's health $\left(H\right)$ – the specific child quality variable that I consider in this paper, which depends on prices (p), individual unearned income (A), the household production efficiency parameter (Ω) and variables that reflect the bargaining power of each member within the household, so that

$$H^* = H^*\left(p, A_m, A_f; \alpha_m, \alpha_f, \Omega\right) \tag{5}$$

An empirical version of equation (5) is

$$H^* = H^*(p, \phi; \Omega) \tag{6}$$

where ϕ is the set of variables reflecting each member's relative authority and power within the household that affects the demand for goods. The set of variables in ϕ will include unearned income of the different members (A_i) and the extra environmental parameters (α_i). From an empirical point of view, any variable that reflects relative authority or bargaining power within the household is a candidate for ϕ.

This paper is concerned with child health. In analysing child health I make the assumption that bargaining between parents does not directly affect child health. What this bargaining does affect is health inputs, which in turn affects child health. So rather than determining child health (H) directly, parental bargaining (maximising (3) subject to the budget constraint in (4)) determines the amount of health care (C), so that instead of estimating equation (6) I estimate

$$C^* = C^*(p, \phi; \Omega) \tag{7}$$

I now postulate a child health production function

$$H^* = H^*(I, X, C, S) \tag{8}$$

The specific measure of child health that I consider in this paper is child mortality. Therefore child mortality is assumed to depend on a set of child specific characteristics (I), a set of parental and household characteristics (X), on health inputs (C) and on health services available in the village (S).

I estimate the child health production function (equation (8)) taking into account the potential endogeneity of health inputs (equation (7)) and estimate a model where child health outcomes are jointly estimated with a behavioural model where the health inputs are themselves choices. The estimation methodology used follows Panis

& Lillard (1994). The estimation methodology allows me to account for mother specific unobserved heterogeneity. These are common to all children born to the same mother and are essentially mother specific health endowments, like genetic traits or biological characteristics that might make some women more susceptible to infection and thereby increase the risk to all children born to this woman. These endowments are known to the woman but are unobserved to the researcher. Not accounting for unobserved heterogeneity introduces potential bias in the estimates.

The decision on health care usage will be estimated by two probits: choice of prenatal care and hospital delivery. I define two binary variables *PRENATAL* and *HOSPDEL* as follows:

$$PRENATAL = \begin{cases} 1 \text{ if the woman chooses to have pre-natal care} \\ 0 \text{ otherwise} \end{cases}$$

$$HOSPDEL = \begin{cases} 1 \text{ if the woman chooses to deliver the baby in a hospital} \\ 0 \text{ otherwise} \end{cases}$$

Both the decision to have prenatal care and the decision to deliver the baby in a hospital depends on a set individual/child level characteristics (I), parental and household characteristics (X), a set of variables measuring the relative power or the husband and the wife (ϕ), a set of supply side variables (S) and a term that captures unobserved heterogeneity (η), that is assumed to apply to all children born to the same mother. This mother specific error term (mother-specific unobserved heterogeneity) may be correlated with all other heterogeneity terms. Denote $\widetilde{Z}_i = (X_i, \phi_i, S_i); i = 1,2$ as the relevant vector of explanatory variables in the equations characterising demand for prenatal care $(i = 1)$ and the decision to have the baby in a

hospital $(i=2)$.[3] The heterogeneity components are assumed to be uncorrelated with the other covariates. So the estimated equations are as follows:

$$\begin{aligned} PRENATAL &= \alpha_0 + \alpha_1 \widetilde{Z}_1 + \eta_1 + \varepsilon_1 \\ HOSPDEL &= \beta_0 + \beta_1 \widetilde{Z}_2 + \eta_2 + \varepsilon_2 \end{aligned} \tag{9}$$

All other residual variation is captured by ε with $\varepsilon_i \sim IIDN(0,1); i=1,2$. The likelihood functions in the two cases are therefore given by:

$$\begin{aligned} L^1(\eta_1) &= \begin{cases} \Phi\left(\alpha_0 + \alpha_1 \widetilde{Z}_1 + \eta_1\right) & \text{if prenatal care was ever used} \\ 1 - \Phi\left(\alpha_0 + \alpha_1 \widetilde{Z}_1 + \eta_1\right) & \text{if prenatal care was never used} \end{cases} \\ L^2(\eta_2) &= \begin{cases} \Phi\left(\beta_0 + \beta_1 \widetilde{Z}_2 + \eta_2\right) & \text{if the child was born in a hospital} \\ 1 - \Phi\left(\beta_0 + \beta_1 \widetilde{Z}_2 + \eta_2\right) & \text{if the child was born elsewhere} \end{cases} \end{aligned} \tag{10}$$

Child mortality is modelled as a failure time process represented by a log hazard of duration equation. The model is one of proportional hazard with covariates and unobserved heterogeneity shifting the baseline hazard. The log hazard of mortality for a child at time *t* is given by

$$\ln h(t) = \gamma_0 + \gamma_1 T(t) + \gamma_2 \widetilde{Z}_3 + \eta_3 + \varepsilon_3 \tag{11}$$

Here $\widetilde{Z}_3$ denotes a set of individual (I), parental and household characteristics X_3 and a set of health inputs (*C* including *PRENATAL* and *HOSPDEL*) that affect the hazard of child mortality. $T(t)$ is a spline in time beginning with the time the child enters the risk of dying (in this case the moment the child is born). Let us denote the time at which the child enters the risk of dying by t_0 and subdivide the duration $t - t_0$ into *K* discrete periods. Then the baseline log hazard function is defined as a spline or a piecewise linear function and the log hazard of the event will have different slopes over the duration. The baseline hazard function can therefore be written as:

[3] Note that the set of explanatory variables are equation specific.

$$\gamma_0 + \gamma_1 T(t) = \gamma_0 + \sum_{k=1}^{K} \gamma_{1k} T_k(t) \tag{12}$$

The baseline hazard function is therefore the sum of the effects of the various sources of time dependence within the period of risk for an individual and the resulting log hazard equation is piecewise linear in time since the individual enters the risk of the event. η_3 captures unobserved heterogeneity, assumed to be uncorrelated with the set of explanatory variables. All other residual variation is captured by ε_3 with $\varepsilon_3 \sim IIDN(0,1)$. The conditional likelihood of child mortality is therefore given by

$$L^3(\eta_3) = \begin{cases} S^c = \Gamma\left(t, Z\left(t^c\right), \eta_3\right) & \text{if the child is alive at the survey date (censored)} \\ S^u = \Gamma\left(t, Z\left(t^u\right), \eta_3\right) & \text{if the child is dead at the survey date (uncensored)} \end{cases} \tag{13}$$

When both inputs are treated as endogenous, the joint marginal likelihood can be written as:

$$\int_{\eta_1}\int_{\eta_2}\int_{\eta_3} \left[\prod L^1(\eta_1) \prod L^2(\eta_2) \prod L^3(\eta_3)\right] f(\eta_1, \eta_2, \eta_3) d\eta_1 d\eta_2 d\eta_3 \tag{14}$$

where $f(\eta_1, \eta_2, \eta_3)$ denotes the joint distribution of the unobserved heterogeneity components. Here $f(\eta_1, \eta_2, \eta_3)$ is assumed to be a three dimensional normal distribution characterised as follows:

$$\begin{pmatrix} \eta_1 \\ \eta_2 \\ \eta_3 \end{pmatrix} \sim N\left(\begin{bmatrix} 0 \\ 0 \\ 0 \end{bmatrix}, \begin{bmatrix} \sigma_1^2 & & \\ \rho_{12}\sigma_1\sigma_2 & \sigma_2^2 & \\ \rho_{13}\sigma_1\sigma_3 & \rho_{23}\sigma_2\sigma_3 & \sigma_3^2 \end{bmatrix}\right) \tag{15}$$

The full specification model is estimated jointly using Full Information Maximum Likelihood (FIML) method.

The primary reason for joint estimation is self-selection. Women who demand health care (prenatal care or choose hospital delivery) might not necessarily be a random subset of all mothers. It might be that these women are those who anticipate

complications at birth or other factors that might lead to an increased risk of child mortality and hence are more like to seek health care (remember that health is private information to the woman and unobserved to the researcher). This could be termed as adverse self-selection. It could also be the case that these women might be low risk women, with a strong preference for healthy children. This could be termed as favourable self-selection.[4] What this implies is that the correlation between the heterogeneity terms in the demand for health care equations (equations characterising demand for prenatal care and hospital delivery) and the child mortality equations could be non-zero, i.e. $Cov(\eta_1, \eta_2) \neq 0; Cov(\eta_1, \eta_3) \neq 0; Cov(\eta_2, \eta_3) \neq 0$. However, conditional on all the heterogeneity terms, the equations are independent and the conditional joint likelihood can be obtained simply by multiplying the individual conditional likelihoods (equation (14)).

3. Data and Descriptive Statistics

The analysis is based on the National Family and Health Survey 1999 data from India. Because of reasons specified later, I restrict the analysis to the sample of women residing in rural areas. The survey collected information on prenatal care and place of delivery for children born in the three years preceding the survey and this leaves me with a sample of 18614 children born to 13284 women.

The women were asked whether they went for antenatal check up during pregnancy. I use the response to this question to examine the demand for prenatal care. In 48.77% of cases, the woman went for prenatal care. Respondents were also asked about the place of delivery. The majority of children (77.07%) were born at home – either at the respondent's home, or in their parents' home or in someone else's

[4] The definition adverse self-selection and favourable self-selection follow Panis & Lillard (1994).

home. 22.72% of the children were born in hospital/health centre/dispensary. The remaining were born elsewhere. 92.76% of the children are alive at the time of the survey and the average age at death (for children that have died) is 3.29 months. Table 1 presents descriptive statistics for the variables of interest. Note that the sample used is not national: I use data from 15 states – Andhra Pradesh, Bihar, Gujarat, Haryana, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Orissa, Punjab, Rajasthan, Sikkim, Tamil Nadu, West Bengal and Uttar Pradesh.

3.1 Measures of Bargaining

Economic analysis of bargaining power within the household has typically focussed on economic resources that are exogenous to labour supply. They include assets, both current and those brought into marriage (Quisumbing (1994); Doss (1999); Frankenberg & Thomas (1998); Beegle, Frankenberg & Thomas (2001)), unearned income (Schultz (1990); Thomas (1990)) or transfer payments and welfare receipts (Lundberg, Pollak & Wales (1997)). Only recently however economists have started using other (non-economic) factors that affect the bargaining power within the household. These include legal rights, educational attainment, skills and knowledge. It must be noted that the sociological/demographic literature has long used non-economic criteria to characterise the status of women (and hence the relative bargaining power of the different members) within the household. These can be broadly classified into the following two categories: (1) exposure to and interactions with the outside world and (2) degree of autonomy for women within the household (see Dyson & Moore (1983); Basu (1989)). In this paper I use the educational attainment of the husband the wife and sociological/demographic measures of the

status of the woman within the household as measures of bargaining power, rather than using economic resources.[5]

Educational Attainment of Husband and Wife:

There exists a large literature that documents that increased female education is associated with significant improvements in child health and increased probability of using prenatal care and institutional delivery. There is also a fair amount of evidence that suggests that the magnitude of the correlation between reproductive health outcomes and female education is bigger than the corresponding correlations with male education. This empirical result forms the basis for the argument that education is a measure of power and the more powerful women assert preferences for increased use of prenatal care, increased institutional delivery and lower infant mortality. Moreover since each of these variables of interest are primarily the domain of women, it follows that women benefit more directly from these investments compared to their husbands. The educational attainment of the woman and that of her husband could therefore be used as a measure of relative power within the household. I include three dummies for the highest level of education attained by the wife and three dummies of the highest level of education attained by the husband. Including educational attainment of the husband and the wife as explanatory variables allows me to test the hypothesis that the female education has a stronger correlation compared to male education on increased prenatal care, increased institutional delivery and reduced

[5] The use of economic resources as measures of power could result in other problems. For example, Frankenberg & Thomas (1998) and Beegle, Frankenberg & Thomas (2001) use assets owned by individuals within the household as measure of power. They argue that asset ownership is an indicator of power over decision-making. In particular they focus on assets brought to marriage by the husband and the wife. In their study, using data from Indonesia, this is a fair measure because a number of studies have documented that in Indonesia, resources brought to marriage by a woman tend to remain in her control – even if the marriage dissolves and reverts back to her family if she dies leaving behind no heirs. In the Indian context the woman often ceases to have control over the resources she brings into marriage (in the form of dowry).

infant mortality. The descriptive statistics presented in Table 1 show that the majority of women (67.80%) are illiterate and 35.13% of the husbands' are illiterate. Note that 25.62% of the husbands' have secondary schooling or higher, compared to only 8.61% of women.

Sociological/Demographic Measures of Power:

Following Dyson & Moore (1983) and Basu (1989), I use two sets of criteria to characterise the status of women within the household. The first is the exposure to and interactions with the outside world. To capture this effect I include a set of dummy variables: whether the woman needs permission to visit family and friends; whether the woman needs permission to go to the market; whether the husband hits the woman if she goes out without informing him. The second is the degree of autonomy for the women (freedom of movements, control over resources, say in matters relating to fertility and family planning and not be subject to domestic violence). To capture this effect I include a set of dummy variables: whether the woman is able to have money set aside (control over household resources); whether the woman has say in decision regarding cooking, obtaining health care, purchasing jewellery, staying with the family; whether the husband hits the woman if she is unfaithful, if her family does not provide money, if she neglects house or children or if she does not cook properly. The use of the last set of variables follows Rao (1997) who finds that in India domestic violence (wife beating) is often used to exert power within the household.

Defined in this way the power of the woman within the household is likely to be higher if the woman has a role to play in decisions regarding cooking, health care, purchase of jewellery and staying with family and if the woman is able to set money aside (indicative of control over resources). On the other hand the power of the

woman within the household is likely to be lower if the woman requires permission to visit family or go to the market or if the husband hits the woman. The descriptive statistics presented in Table 1 shed interesting light on the relative power of men and women within the household. 48.73% of the respondents have control over household resources and are able to set money aside. 69.9% of the women have some say over cooking decisions in the household, 34.83% of the women have some say over health care decisions. On the other hand 73% of the women need permission to go to the market and 83% of the women need permission to visit family.

3.2 Explanatory Variables Used

Both the decision to have prenatal care and the decision to deliver the baby in a hospital depends on a set individual characteristics (I), a set of parental and household characteristics (X), a set of variables measuring the relative power or the husband and the wife (ϕ), a set of supply side variables (*S* where information is available). The individual characteristic included are: the birth order of the child and the age of the woman and her husband at the time of birth. In the hospital delivery regressions, I include two other birth specific variables: whether the woman chose to have prenatal care and whether there were any danger signs during pregnancy. The parental and household characteristics included are: the highest level of education attained by the mother and the father, primary occupation of the father, state of residence, religion and ethnicity and variables that are indicative of information availability for the mother (whether the woman reads newspaper and watches television at least once a week). The set of variables measuring the relative power of the husband and wife are as specified in Section 3. I use the availability of services variables to identify the prenatal care and the hospital delivery equations. Prenatal

care is identified by the presence of a Sub-centre in the village, the presence of a Primary Health Centre in the Village, the presence of a Community Health Centre in the Village, the presence of a Government Dispensary in the village and finally the presence of a private clinic in the village. Hospital delivery is identified by the presence of a Government Hospital in the village and the presence of a Private Hospital in the village. The presence of a Primary Health Centre in the village is included in both the prenatal care and hospital delivery regressions. Since the availability of services information is available only for the rural sample, the analysis is restricted to the rural sample.

The individual characteristics included in the child mortality regressions include the gender of the child, the birth order of the child, the age of the mother at the time of the birth and other variables that could potentially affect the hazard of child mortality: the size of the child at birth, whether a health worker visited the woman when she was pregnant, whether the woman chose to have prenatal care, whether the child was born in a hospital, whether there were any danger signs during pregnancy, whether the woman was given iron tablets and tetanus shots during pregnancy. Parental/household level characteristics include the highest educational attainment of the woman and her husband, the main source of drinking water for the household, the type of toilet in the household, whether the household has electricity, and variables that are indicative of information availability for the mother (whether the woman reads newspaper and watches television at least once a week). Village level (community) characteristics include the health services available in the village and distance to the nearest town, district headquarters, nearest railway station, nearest transport and all weather road. The baseline hazards are specified as splines. The baseline hazard measures the duration dependence for survival and for subsequent

birth – the time varying risk of child mortality. The time dependency starts once the child is born. Several specifications of the baseline hazard were tried and I finally chose the one that fitted the data best – with one node at 1 month.

4. Results

I now turn to the regression results. I estimate three sets of regressions: probit equation characterising the demand for prenatal care, probit equation characterising hospital delivery and hazard equation characterising child mortality.

Self-selection in the demand for prenatal care is reflected in the correlation between the heterogeneity components in the prenatal care and child mortality regressions $\left(\rho_{\eta_1\eta_3}\right)$ and self-selection in hospital deliveries is found in the correlation between the heterogeneity components in the hospital delivery and child mortality regressions $\left(\rho_{\eta_2\eta_3}\right)$. I also allow for correlation between the heterogeneity components in the prenatal care and hospital delivery regressions $\left(\rho_{\eta_1\eta_2}\right)$. These estimates are presented in Table 2 – diagonal elements are standard deviation and the off-diagonal elements are correlation coefficients. Note that the estimates of the heterogeneity structure correspond to the full specification under the assumption of endogenous prenatal care and hospital delivery. The correlations are always statistically significant. The statistical significance of the estimates of the correlation between the heterogeneity coefficients implies that there is evidence of self-selection in the use of both prenatal care and the choice of hospital delivery.

4.1 Demand for Prenatal Care and Hospital Delivery

I start with the probit regressions for demand for prenatal care and hospital delivery. The dependent variables in both cases are binary variables:

$$PRENATAL = \begin{cases} 1 \text{ if the woman chooses to have pre-natal care} \\ 0 \text{ otherwise} \end{cases}$$

$$HOSPDEL = \begin{cases} 1 \text{ if the woman chooses to deliver the baby in a hospital} \\ 0 \text{ otherwise} \end{cases}$$

I present the coefficient estimates and the standard errors in Table 3 for the demand for prenatal care regressions and in Table 4 for the hospital delivery regressions.

Both the respondent's educational attainment and her husband's educational attainment have significant positive effects on the demand for prenatal care and hospital delivery. Relative to the baseline category (that the woman has no education or that her educational attainment is missing), if the highest education attainment by the woman is primary school, middle school or secondary school or higher attainment increases the probability that the woman demands prenatal care by 11.81 percentage points, 16.15 percentage points and 24.71 percentage points respectively.[6] Husband's educational attainment also has a significant and positive effect on the demand for prenatal care. Relative to the baseline category, if the highest educational attainment of the husband is primary school, middle school or secondary school or higher attainment increases the demand for prenatal care by 6.15 percentage points, 10.80 percentage points and 10.02 percentage points respectively. At every level of educational attainment the highest level of education attained by the woman has a stronger effect on the demand for prenatal care compared to the highest level of education attained by the husband – verified using standard χ^2 tests for equality of education effects at each level. Turning to the hospital delivery regressions, I find that

[6] These probabilities are computed by holding all other explanatory variables at their respective means.

the probability of hospital delivery is higher (relative to the reference category of no schooling) by 5.67 percentage points if the highest education attainment by the woman is primary school, higher by 6.81 percentage points if the highest educational attainment by the woman is middle school and is higher by 11.34 percentage points if the highest education attained by the woman is secondary school or higher. Educational attainment by the husband has a similar positive and statistically significant effect on hospital delivery, though the effect is generally not as strong. The coefficient estimates show that the probability of hospital delivery is higher by 2.07 percentage points if the highest education attained by the husband is primary school, is higher by 5.55 percentage points if the highest education attained by the husband is middle school and is higher by 5.29 percentage points if the highest education attained by the husband is secondary school or higher. While generally the null hypothesis of equality of education effects is rejected at every level of educational attainment. The only exception is when the highest education attained by the respondent and her husband is middle school.[7]

I find that several of the variables that measure the power of women within the household have significant effects on the demand for prenatal care. Control over resources (if the woman is able to set money aside) or if the woman has a role to play in the household decisions regarding health care both increase the demand for prenatal care. Both of these variables are indicative of more power for the woman within the household. On the other hand the demand for prenatal care is lower if a woman requires permission to visit her family or the market or if the husband hits the woman

[7] Beegle, Frankenberg & Thomas (2001) use education of the wife relative to her husband as an indicator of power. Specifically they examine whether a women who are better educated than their husbands are more or less likely to demand prenatal care holding all other observable characteristics constant. I also included a dummy variable to indicate whether the woman is more educated compared to her husband as an additional explanatory variable – but this variable turned out to be not statistically significant and the marginal probability associated with this variable was also very small. I therefore ignored this variable from the set of explanatory variables.

if she is unfaithful, each of which are indicative of low power for the woman within the household. Control over resources by the woman (if the woman is able to set money aside) also has a positive and statistically significant effect on the probability of hospital delivery. The probability of hospital delivery is significantly lower if the husband hits the woman if her family does not provide money, which again is indicative of low power for the woman within the household. It is worth noting that the bargaining power variables are jointly significant in both the prenatal care and the hospital delivery regressions.

Turning to the other results, we find that both the demand for prenatal care and the probability of hospital delivery are lower for children of higher birth order (children born later) and interestingly the effect is monotonic. Both the demand for prenatal care and the probability of hospital delivery are significantly higher if the woman watches television at least once a week. Additionally, the demand for prenatal care is significantly higher if the woman reads newspaper at least once a week. Note that reading news paper at least once a week increases the probability of hospital delivery, though the effect is not statistically significant. Watching television and reading the newspaper are indicative of information availability and these results imply that access to information increases the demand for prenatal care and hospital delivery.

The age of the woman at the time of birth has a statistically significant effect on the demand for prenatal care and on hospital delivery. Relative to women aged 15 – 19 at the time of delivery, the demand for prenatal care and the probability of hospital delivery is higher for women aged 20 or higher. The effect of the age of the husband at the time of birth on the demand for prenatal care and hospital delivery is however not as strong – in fact none of the age of the husband dummies are

statistically significant in explaining the probability of hospital delivery. Interestingly notice that the primary occupation of the husband does not generally affect the demand for prenatal care or hospital delivery – the only exception is that the demand for prenatal care is significantly lower of the father is self employed in agriculture.

There are significant regional variations in the demand for prenatal care and the probability of hospital delivery, captured by the state dummies that are included as additional explanatory variables. Remember that the reference category is that the household resides in the state of Uttar Pradesh, the largest state in India. All of the state dummies are positive and with the exception of Bihar are all statistically significant. Turning to the hospital delivery regressions, I find similar evidence of regional variation. Relative to a woman residing in Uttar Pradesh, the probability of hospital delivery is significantly lower for a woman residing in Haryana and significantly higher in Andhra Pradesh, Gujarat, Kerala, Maharashtra, Rajasthan, Sikkim, Tamil Nadu and West Bengal.

There are also significant religious and ethnic differences in the demand for prenatal care and the probability of hospital delivery. The demand for prenatal care is higher for Sikhs and lower for Buddhists and the probability of hospital delivery is higher for Sikhs and lower for Buddhists and Muslims. Both the demand for prenatal care and the probability of hospital delivery is lower for women belonging to a Scheduled Caste or a Scheduled Tribe.

Does service availability have a significant effect on the demand for prenatal care and on hospital delivery? The regression results show that the presence of a Primary Health Centre in the village has a positive and statistically significant effect on the demand for prenatal care. None of the other supply side variables are statistically significant and interestingly the presence of a community health centre in

the village and a government dispensary within the village actually appear to reduce the demand for prenatal care. Turning to the hospital delivery regressions, the presence of a private hospital in the village increases the probability of hospital delivery. None of the other supply side variables are statistically significant in several cases the presence of specific health services (presence of a government hospital in the and the presence of a primary health centre in the village) appear to reduce the probability of hospital delivery, though the effect is never statistically significant.[8]

Finally it is worth noting that women who went for prenatal care have a significantly higher probability of choosing to deliver the child in a hospital and the probability of hospital delivery is significantly higher if the woman had danger signs during pregnancy.

4.2 Child Mortality

I now turn to the child mortality regressions. The coefficient estimates and the t-ratios are presented in Tables 5. A negative coefficient estimate implies that the relevant variable reduces the hazard of child mortality and a positive estimated coefficient implies that the relevant variable increases the hazard of child mortality.

In each case two sets of results are presented. In Model I we ignore the potential endogeneity of prenatal care and hospital delivery in the child mortality regression and Model II presents the estimates from the joint estimation, taking into account the heterogeneity structure.

Turning to the coefficient estimates (presented in Table 5), it is worth noting that: (1) both prenatal care and hospital delivery reduce the hazard of child mortality,

[8] One should however be careful in drawing inferences from these supply side variables, because of potential endogeneity problems associated with health services. See Rosenzweig & Wolpin (1986). They argue that that government programs are often responsive to local health characteristics and hence they could be demand driven rather than supply driven.

the effect of hospital delivery is weaker and (2) not accounting for unobserved heterogeneity and self selection in the use of health inputs results in under-estimation of the effect of health inputs on child mortality. A look at the coefficient estimates presented in Table 5 confirm both of these observations. Remember Model I was estimated under the assumption that prenatal care and hospital delivery are exogenous. The effect of prenatal care and hospital delivery on are both are both negative (–0.3322 and –0.0382 respectively), though statistically significant only in the prenatal care regressions, but it is an underestimate of the true effect presented in Model II (–0.5115 and –0.3667 respectively). It is therefore clear that failure to account for self-selection and ignoring the correlation between the heterogeneity terms results in significant underestimation of the true beneficial effect of prenatal care and hospital delivery on child health. In discussing the rest of the results, I will focus only on Model II.

Let me now examine the other results. Interestingly while educational attainment of the woman and that of her husband reduces the hazard of child mortality, the effects are generally not statistically significant. Educational attainment of the woman has a statistically significant effect on the hazard of child mortality only if the highest education attained by the woman is secondary school or higher (and even in this case it is statistically significant only at the 10% level). Likewise the husband's education is statistically significant (but only at the 10% level) and only if the highest education attained by the husband is secondary schooling or higher. There is therefore some evidence of a threshold level of education that must be attained before educational attainment has a statistically significant effect on the hazard of child mortality.

The age of the mother at the time of birth has a significant effect on the hazard of child mortality. The hazard of child mortality is significantly lower if the age of the woman at the time of the birth is between 20 – 39.

There is evidence of regional and religious differences in the hazard of child mortality. The hazard of child mortality is significantly lower for residents of Kerala and Sikkim. Interestingly the hazard of child mortality is low for Muslim households.

The size of the child at birth has a statistically significant effect on the hazard of child mortality. The regression estimates show that the hazard of child mortality is significantly lower if the size of the child at birth is average and significantly higher if the size of the child at birth is very small. A very small child could be indicative of severe health problems in the mother and/or the child and hence associated with higher child mortality levels. The hazard of child mortality is significantly lower if a health worker visited the woman during pregnancy or if the woman was given tetanus shots while pregnant.

The availability of health services does not appear to have a particularly strong effect on the hazard of child mortality. The regressions results show that the hazard of child mortality is significantly lower if there is a sub-centre in the village and is interestingly significantly higher if there is a community health centre in the village. Again one must be wary of interpreting these coefficient estimates because of the sort of endogeneity problems discussed above.

Finally it is worth noting that the gender of the child dummy, though positive is not statistically significant. This implies that there is no statistically significant difference in the child mortality rates between boys and girls.

5. Conclusion

The primary objective of this paper is to examine the relationship between the use of health care and child health in India. I develop a framework where parents care about the health of their children but cannot directly affect child health by their actions. Instead they can, through their actions, affect health inputs. Parental bargaining affects decisions about the use of prenatal care and hospital delivery, which in turn are likely to affect child mortality. I jointly estimate the decision to use prenatal care, the decision to deliver the baby in hospital and child mortality. The primary reason for joint estimation is self-selection. Women who demand health care (prenatal care or choose hospital delivery) might not necessarily be a random subset of all mothers. It might be that these women are those who anticipate complications at birth or other factors that might lead to an increased risk of child mortality and hence are more like to seek health care (remember that health is private information to the woman and unobserved to the researcher). It could also be the case that these women might be low risk women, with a strong preference for healthy children. Both prenatal care and hospital delivery significantly reduces the hazard of child mortality and the coefficient estimates show that failure to account for self-selection and ignoring the correlation between the heterogeneity terms results in significant underestimation of the true beneficial effect of prenatal care and hospital delivery on child health. Turning to the other results, I find that a woman's education has a stronger effect on health care usage relative to that of her husband. A woman's control over household resources (ability to keep money aside) has a significant positive effect on both the demand for prenatal care and the probability of hospital delivery, and the demand for prenatal care is significantly higher if the woman has say in decisions regarding health care.

From a policy point of view this is an extremely important issue. Both researchers and policy makers agree that increasing the stock of human capital is essential to increase the rate of growth of any economy. Good health is now regarded as a basic pre-requisite for human capital formation and thereby increasing the income levels in a country. Poor child health therefore has long-term implications in the form of poor adult health and low levels human capital formation. The finding hat increased use of health inputs (like prenatal care or hospital birth) have significantly positive effect on child health, implies that one could possibly have identified an extremely important policy instrument.

References:

Bankole, A. (1995): "Desired Fertility and Fertility Behaviour among the Yoruba of Nigeria: A Study of Couple Preferences and Subsequent Fertility", *Population Studies*, **49**(2): 317-328.

Basu, A. (1989): Cultural Differences in the Status of Women in India. In A. B. a. P. Desai (Ed.), *Population Transition in India*. New Delhi: B. R. Publishing Co.

Becker, G. S. (1981): *A Treatise on the Family*. Cambridge: Harvard University Press.

Beegle, K., Frankenberg, E. & Thomas, D. (2001): "Bargaining Power Within Couples and Use of Prenatal and Delivery Care in Indonesia", *Studies in Family Planning*, **32**(2): 130-146.

Browning, M. & Chiappori, P. A. (1998): "Efficient Intra Household Allocations: A General Characterisation and Empirical Tests", *Econometrica*, **66**(6): 1241-1278.

Chiappori, P. A. (1988): "Rational Household Labour Supply", *Econometrica*, **56**(1): 63-89.

Chiappori, P. A. (1992): "Collective Labour Supply and Welfare", *Journal of Political Economy*, **100**(3): 437-467.

Dodoo, F. N. A. (1998): "Men Matter: Additive and Interactive Gendered Preferences and Reproductive Behavior in Kenya", *Demography*, **35**(2): 229-242.

Doss, C. R. (1999): Intra-household Resource Allocation in Ghana: The Impact of the Distribution of Asset Ownership within the Household. In G. H. a. V. B. Peters, J. (Ed.), *Food security, diversification and resource management: Refocusing the role of agriculture? Proceedings of the Twenty-third International Conference of Agricultural Economists held at Sacramento, California, 10-16 August 1997*: 309-316. Ashgate: Aldershot, U.K. and Brookfield, Vt.

Dyson, T. & Moore, M. (1983): "On Kinship Structure, Female Autonomy and Demographic Behaviour in India", *Population and Development Review*, **9**(1): 5-60.

Frankenberg, E. & Thomas, D. (1998): "Measuring Power": Mimeo: RAND.

Freedman, R., Freedman, D. S. & Thornton, A. (1980): "Changes in Fertility Expectations and Preferences between 1962 and 1977: Their Relation to Final Parity", *Demography*, **17**(4): 365-178.

Hoddinott, J. & Haddad, L. (1995): "Does Female Income Share Influence Household Expenditures? Evidence from Cote d'Ivoire", *Oxford Bulletin of Economics and Statistics*, **57**(1): 77-95.

Kanbur, R. & Haddad, L. (1994): "Are Better Off Households More Unequal or Less Unequal: A Bargaining Theoretic Approach to 'Kuznets' Effects at the Micro Level", *Oxford Economic Papers*, **46**(3): 445-458.

Lundberg, S. & Pollak, R. A. (1994): "Non Cooperative Bargaining Models of Marriage", *American Economic Review: Papers and Proceedings*, **84**(2): 132-137.

Lundberg, S., Pollak, R. A. & Wales, T. (1997): "Do Husbands and Wives Pool Their Resources? Evidence from the UK Child Benefit", *Journal of Human Resources*, **32**(3): 463-480.

Maitra, P. & Ray, R. (2001): "Household Resources, Expenditure Patterns and Resource Pooling: Evidence from South Africa and Pakistan": Mimeo, University of Tasmania.

Manser, M. & Brown, M. (1980): "Marriage and Household Decision Making: A Bargaining Analysis", *International Economic Review*, **21**(3): 31-44.
Mason, K. O. & Taj, A. M. (1987): "Differences between Women's and Men's Reproductive Goals in. Developing Countries", *Population and Development Review*, **13**(4): 611-638.
McElroy, M. (1990): "The Empirical Content of Nash-Bargained Household Behavior", *Journal of Human Resources*, **25**(4): 559-583.
McElroy, M. & Horney, M. (1981): "Nash Bargained Household Decisions", *International Economic Review*, **22**(2): 333-350.
Panis, C. W. A. & Lillard, L. A. (1994): "Health Inputs and Child Mortality: Malaysia", *Journal of Health Economics*, **13**: 455-489.
Phipps, S. A. & Burton, P. S. (1998): "What's Mine Is Yours? The Influence of Male and Female Incomes on Patterns of Household Expenditure", *Economica*, **65**(260): 599-613.
Pollak, R. A. (1994): "For Better or Worse: The Roles of Power in Models of Distribution within Marriage", *American Economic Review: Papers and Proceedings*, **84**(2): 148-152.
Pritchett, L. H. (1994): "Desired Fertility and the Impact of Population Policies", *Population and Development Review*, **20**(1): 1-55.
Quisumbing, A. R. (1994): "Intergenerational Transfers in Philippine Rice Villages: Gender Differences in Traditional Inheritance Customs", *Journal of Development Economics*, **43**(2): 167-195.
Quisumbing, A. R. & Maluccio, J. (2000): "Intrahousehold Allocation and Gender Relations: New Empirical Evidence". Washington D.C.: International Food Policy Research Institute Discussion Paper.
Rao, V. (1997): "Wife-Beating in Rural South India: A Qualitative and Econometric Analysis", *Social Science and Medicine*, **44**(8): 1169-1180.
Rosenzweig, M. R. & Wolpin, K. I. (1986): "Evaluating the Effects of Optimally Distributed Public Programs: Child Health and Family Planning Interventions", *American Economic Review*, **76**: 470-482.
Schultz, T. P. (1990): "Testing the Neo Classical Model of Family Labour Supply and Fertility", *Journal of Human Resources*, **25**(4): 599-634.
Thomas, D. (1990): "Intra Household Resource Allocation: An Inferential Approach", *Journal of Human Resources*, **25**(4): 635-664.
Thomson, E. (1997): "Couple Childbearing Desires, Intentions, and Births", *Demography*, **34**(3): 343-354.
Thomson, E., McDonald, E. & Bumpass, L. L. (1990): "Fertility Desires and Fertility: Hers, His, and Theirs", *Demography*, **27**(4): 579-588.
World Bank. (1996): *Improving Women's Health in India*. Washington D.C.: World Bank.

Table 1: Selected Descriptive Statistics

	Sample Size	Mean	Standard Deviation
Mother Level Variables			
Residence: Andhra Pradesh	13284	0.0445	0.2062
Residence: Bihar	13284	0.1452	0.3523
Residence: Gujarat	13284	0.0447	0.2066
Residence: Haryana	13284	0.0439	0.2049
Residence: Karnataka	13284	0.0010	0.0319
Residence: Kerala	13284	0.0283	0.1659
Residence: Madhya Pradesh	13284	0.1207	0.3257
Residence: Maharashtra	13284	0.0412	0.1986
Residence: Orissa	13284	0.0660	0.2482
Residence: Punjab	13284	0.0345	0.1826
Residence: Rajasthan	13284	0.1321	0.3386
Residence: Sikkim	13284	0.0219	0.1462
Residence: Tamil Nadu	13284	0.0400	0.1960
Residence: West Bengal	13284	0.0421	0.2007
Residence: Andhra Pradesh	13284	0.1941	0.3955
Source of drinking water: Piped into residence	13284	0.0972	0.2962
Source of drinking water: Public tap	13284	0.1043	0.3056
Source of drinking water: Private hand pump	13284	0.2134	0.4097
Source of drinking water: Public hand pump	13284	0.2922	0.4548
Source of drinking water: Private open well	13284	0.0704	0.2559
Source of drinking water: Public open well	13284	0.1538	0.3608
Toilet: Own flush toilet	13284	0.0672	0.2503
Toilet: Own pit toilet/latrine	13284	0.0663	0.2488
No toilet facilities at home	13284	0.8480	0.3590
Woman Reads Newspaper at least once a week	13284	0.1138	0.3176
Woman watches television at least once a week	13284	0.2808	0.4494
Has electricity	13284	0.4681	0.4990
Religion: Hindu	13284	0.8410	0.3657
Religion: Muslim	13284	0.1070	0.3091
Religion: Christian	13284	0.0141	0.1180
Religion: Sikh	13284	0.0252	0.1567
Religion: Buddhist	13284	0.0095	0.0968
Scheduled Caste/Schedules Tribe	13284	0.3357	0.4722
Other backward caste	13284	0.3386	0.4733
Woman or Jointly with Husband decides what to cook	13284	0.6990	0.4587
Woman or Jointly with Husband decides on Health Care	13284	0.3483	0.4765
Woman or Jointly with Husband decides on jewellery purchase	13284	0.3044	0.4602
Woman or Jointly with Husband decides about respondent staying with family	13284	0.2806	0.4493
Permission needed to go to market	13284	0.7269	0.4456
Permission needed to visit relatives or friends	13284	0.8292	0.3764
Allowed to have money set aside	13284	0.4873	0.4999
Husband may hit wife if she is unfaithful	13284	0.3840	0.4864
Husband may hit wife if her family does not give money	13284	0.0652	0.2469
Husband may hit wife if she goes out without telling him	13284	0.3785	0.4850
Husband may hit wife if she neglects house or children	13284	0.3923	0.4883

Husband may hit wife if she does not cook properly	13284	0.2759	0.4470
Highest Education of Woman: Primary School	13284	0.1640	0.3703
Highest Education of Woman: Middle School	13284	0.0719	0.2584
Highest Education of Woman: Secondary School or Higher	13284	0.0861	0.2805
Highest Education of Husband: Primary School	13284	0.2454	0.4303
Highest Education of Husband: Middle School	13284	0.1471	0.3543
Highest Education of Husband: Secondary School or Higher	13284	0.2562	0.4365
Sub-centre in village	13284	0.3626	0.4808
Primary health centre in village	13284	0.1445	0.3516
Community health centre in village	13284	0.0920	0.2891
Government dispensary in village	13284	0.1358	0.3425
Private clinic in village	13284	0.2770	0.4476
Government hospital in village	13284	0.0390	0.1936
Private hospital in village	13284	0.0680	0.2518
Child Level Variables			
Age of Respondent at time of birth: 20 – 24	18614	0.3832	0.4862
Age of Respondent at time of birth: 25 – 29	18614	0.2909	0.4542
Age of Respondent at time of birth: 30 – 34	18614	0.1296	0.3359
Age of Respondent at time of birth: 35 – 39	18614	0.0509	0.2197
Age of Respondent at time of birth: 40 – 44	18614	0.0148	0.1209
Age of Respondent at time of birth: 45 – 49	18614	0.0045	0.0666
Age of Husband at time of birth: 15 – 19	18614	0.1218	0.3271
Age of Husband at time of birth: 20 – 24	18614	0.3082	0.4617
Age of Husband at time of birth: 25 – 29	18614	0.2631	0.4403
Age of Husband at time of birth: 30 – 34	18614	0.1663	0.3724
Age of Husband at time of birth: 35 – 39	18614	0.0275	0.1634
Age of Husband at time of birth: More than 44	18614	0.0321	0.1762
Child dead at the time of the survey	18614	0.0724	0.2591
Age at death*	18614	3.2992	5.7511
Hospital delivery	18614	0.2262	0.4184
Size at birth average	18614	0.1245	0.3302
Size at birth smaller than average	18614	0.6156	0.4865
Size at birth very small	18614	0.2032	0.4024
Child is a Girl	18614	0.4810	0.4997
Went for prenatal check up	18614	0.4877	0.4999
Prenatal visit by health worker	18614	0.1859	0.3891
Danger signs in pregnancy	18614	0.1584	0.3652
Received delivery care	18614	0.1937	0.3952
Received new born care	18614	0.1733	0.3785
Given Iron tablets during pregnancy	18614	0.4967	0.5000
Given tetanus shot during pregnancy	18614	0.6966	0.4598

Notes:
*Computed only for the Children that are dead at the time of the survey

Table 2: Heterogeneity Structure Estimates

	η_1	η_2	η_2
Pre Natal Care (η_1)	0.9369 ***		
	(0.0372)		
Hospital Delivery (η_2)	0.1069 *	0.9474 ***	
	(0.0572)	(0.0477)	
Child Mortality (η_3)	0.3489 **	0.4919 ***	0.5682 ***
	(0.1493)	(0.1821)	(0.1253)

Notes:
Standard Errors in Parenthesis. Diagonal elements are standard deviation and the off-diagonal elements are correlation coefficients
Significance: *** = 1%; ** = 5%; * = 10%
Estimates of the heterogeneity structure correspond to the full specification (Model II) under the assumption of endogenous pre-natal care and hospital delivery

Table 3: Demand for Prenatal Care

	Coefficient	Standard Error
CONSTANT	-1.1084 ***	0.1286
Age of Respondent: 20 – 24	0.1056 **	0.0512
Age of Respondent: 25 – 29	0.1545 **	0.0627
Age of Respondent: 30 – 34	0.2266 ***	0.0772
Age of Respondent: 35 – 39	0.2620 ***	0.1
Age of Respondent: 40 – 44	0.2996 **	0.1483
Age of Respondent: 45 – 49	0.2216	0.2433
Highest Education of Woman: Primary School	0.3865 ***	0.0449
Highest Education of Woman: Middle School	0.5559 ***	0.0704
Highest Education of Woman: Secondary School or Higher	0.8971 ***	0.0783
Age of Husband: 15 – 19	-0.2065	0.1945
Age of Husband: 20 – 24	0.0348	0.0751
Age of Husband: 25 – 29	0.1577 **	0.0632
Age of Husband: 30 – 34	0.1424 **	0.0595
Age of Husband: 35 – 39	0.1529 ***	0.0582
Age of Husband: More than 44	-0.0436	0.104
Highest Education of Husband: Primary School	0.2050 ***	0.0377
Highest Education of Husband: Middle School	0.3719 ***	0.0481
Highest Education of Husband: Secondary School or Higher	0.3619 ***	0.0473
Occupation of Husband: Professional/technical/management	0.033	0.1071
Occupation of Husband: Clerical	0.1385	0.141
Occupation of Husband: Sales	0.0256	0.0974
Occupation of Husband: Agriculture – self employed	-0.2513 ***	0.0842
Occupation of Husband: Services	0.0656	0.1133
Occupation of Husband: Skilled manual	-0.058	0.0878
Occupation of Husband: Unskilled manual	-0.1452	0.0917
Birth Order = 2	-0.2518 ***	0.0431
Birth Order = 3	-0.3813 ***	0.0495
Birth Order = 4	-0.4880 ***	0.0597
Birth Order = 5	-0.4940 ***	0.0692
Birth Order >= 6	-0.6558 ***	0.0719
Woman Reads Newspaper at least once a week	0.2166 ***	0.0652
Woman watches television at least once a week	0.4328 ***	0.0385
Woman or Jointly with Husband decides on Health Care	0.0675 *	0.0364
Woman or Jointly with Husband decides what to Cook	-0.0501	0.0347
Woman or Jointly with Husband decides on jewellery purchase	0.0123	0.0438
Woman or Jointly with Husband decides about respondent staying with family	0.012	0.0459
Permission needed to go to market	-0.0723 *	0.0439
Permission needed to visit relatives or friends	-0.0861 *	0.0523
Allowed to have money set aside	0.0971 ***	0.0302
Husband may hit wife if she is unfaithful	-0.0712 **	0.0339
Husband may hit wife if her family does not give money	-0.0723	0.0609
Husband may hit wife if she goes out without telling him	-0.024	0.0426
Husband may hit wife if she neglects house or children	0.0107	0.0477
Husband may hit wife if she does not cook properly	0.017	0.0457
Residence: Andhra Pradesh	2.2733 ***	0.1051

Residence: Bihar	0.0306	0.0572
Residence: Gujarat	1.0295 ***	0.083
Residence: Haryana	0.4712 ***	0.0811
Residence: Karnataka	1.2683 ***	0.3895
Residence: Kerala	2.8513 ***	0.2852
Residence: Madhya Pradesh	0.7995 ***	0.0598
Residence: Maharashtra	1.9508 ***	0.1012
Residence: Orissa	1.4450 ***	0.0795
Residence: Punjab	0.7790 ***	0.1184
Residence: Rajasthan	0.3288 ***	0.06
Residence: Sikkim	1.4493 ***	0.1356
Residence: Tamil Nadu	2.6827 ***	0.1322
Residence: West Bengal	2.3743 ***	0.1043
Religion: Muslim	-0.0153	0.058
Religion: Christian	0.0796	0.1653
Religion: Sikh	0.4134 ***	0.124
Religion: Buddhist	-0.5597 ***	0.1629
Scheduled Caste/Scheduled Tribe	-0.1024 **	0.0413
Other Backward Caste	-0.0268	0.0405
Sub-centre in village	0.0276	0.0383
Primary health centre in village	0.2206 ***	0.0547
Community health centre in village	-0.0715	0.0645
Government dispensary in village	-0.0029	0.0541
Private clinic in village	0.0426	0.0426
Sample Size	18614	
Test for Equality of Education Effect (df = 1)		
Primary School	10.48 [0.0012]	
Middle School	5.47 [0.0194]	
Secondary School or Higher	30.41 [0.0000]	
Joint Test for Significance of "power" variables (df = 12)	29.53 [0.0033]	

Notes:
Significance: *** = 1%; ** = 5%; * = 10%
Figures in Parenthesis: Prob > χ^2(n)

Table 4: Hospital Delivery

	Coefficient	Standard Error
CONSTANT	-1.9039 ***	0.1582
Age of Respondent: 20 – 24	0.2156 ***	0.0577
Age of Respondent: 25 – 29	0.3767 ***	0.0721
Age of Respondent: 30 – 34	0.5491 ***	0.0919
Age of Respondent: 35 – 39	0.6247 ***	0.1258
Age of Respondent: 40 – 44	0.4438 **	0.1975
Age of Respondent: 45 – 49	1.1367 ***	0.2836
Highest Education of Woman: Primary School	0.2593 ***	0.0479
Highest Education of Woman: Middle School	0.3106 ***	0.0679
Highest Education of Woman: Secondary School or Higher	0.5218 ***	0.0779
Age of Husband: 15 – 19	0.1834	0.188
Age of Husband: 20 – 24	0.0664	0.0929
Age of Husband: 25 – 29	0.101	0.0813
Age of Husband: 30 – 34	0.1158	0.0783
Age of Husband: 35 – 39	0.096	0.0781
Age of Husband: More than 44	-0.0134	0.1328
Highest Education of Husband: Primary School	0.1202 ***	0.046
Highest Education of Husband: Middle School	0.2797 ***	0.0542
Highest Education of Husband: Secondary School or Higher	0.2744 ***	0.0544
Occupation of Husband: Professional/technical/management	0.0488	0.1162
Occupation of Husband: Clerical	0.0732	0.1495
Occupation of Husband: Sales	0.1394	0.1072
Occupation of Husband: Agriculture – self employed	-0.1474	0.0965
Occupation of Husband: Services	0.0376	0.1271
Occupation of Husband: Skilled manual	-0.0057	0.0985
Occupation of Husband: Unskilled manual	-0.1597	0.109
Birth Order = 2	-0.5962 ***	0.0477
Birth Order = 3	-0.8033 ***	0.0591
Birth Order = 4	-0.8726 ***	0.0733
Birth Order = 5	-0.9301 ***	0.0891
Birth Order >= 6	-0.9297 ***	0.0935
Woman Reads Newspaper at least once a week	0.0254	0.06
Woman watches television at least once a week	0.3145 ***	0.0414
Woman or Jointly with Husband decides on Health Care	-0.0669	0.0425
Woman or Jointly with Husband decides what to Cook	-0.0574	0.0394
Woman or Jointly with Husband decides on jewellery purchase	0.0316	0.0509
Woman or Jointly with Husband decides about respondent staying with family	0.0511	0.0525
Permission needed to go to market	0.0236	0.05
Permission needed to visit relatives or friends	-0.0884	0.0577
Allowed to have money set aside	0.0686 *	0.0354
Husband may hit wife if she is unfaithful	-0.0661 *	0.0393
Husband may hit wife if her family does not give money	-0.1371 *	0.0743
Husband may hit wife if she goes out without telling him	-0.0363	0.0496
Husband may hit wife if she neglects house or children	0.0547	0.0534
Husband may hit wife if she does not cook properly	0.0055	0.0529
Residence: Andhra Pradesh	0.8139 ***	0.0962
Residence: Bihar	0.0066	0.0715

Residence: Gujarat	0.7605 ***	0.089
Residence: Haryana	-0.3808 ***	0.1022
Residence: Karnataka	0.4335	0.4353
Residence: Kerala	2.6343 ***	0.175
Residence: Madhya Pradesh	-0.0184	0.0743
Residence: Maharashtra	0.5303 ***	0.0967
Residence: Orissa	0.0464	0.0933
Residence: Punjab	-0.1344	0.1301
Residence: Rajasthan	0.2684 ***	0.0701
Residence: Sikkim	0.4526 ***	0.1423
Residence: Tamil Nadu	1.7587 ***	0.1164
Residence: West Bengal	0.5421 ***	0.0999
Religion: Muslim	-0.2815 ***	0.0689
Religion: Christian	0.0133	0.1739
Religion: Sikh	0.8299 ***	0.134
Religion: Buddhist	-0.3420 *	0.1945
Scheduled Caste/Scheduled Tribe	-0.2682 ***	0.0481
Other Backward Caste	-0.0057	0.0445
Government Hospital in Village	-0.0725	0.1025
Private Hospital in Village	0.1881 **	0.0792
Primary Health Centre in Village	-0.1151 **	0.0572
Danger Signs in Pregnancy	0.2252 ***	0.0442
Chose to have antenatal check up	0.7644 ***	0.0685
Sample Size	18614	
Test for Equality of Education Effect (df = 1)		
Primary School	5.81 [0.0159]	
Middle School	0.28 [0.5958]	
Secondary School or Higher	6.07 [0.0138]	
Joint Test for Significance of "power" variables (df = 12)	23.49 [0.0238]	

Notes:
Significance: *** = 1%; ** = 5%; * = 10%
Figures in Parenthesis: Prob > χ^2(n)

Table 5: Log Hazard of Child Mortality

	Model I		Model II	
	Coefficient	**Standard Error**	**Coefficient**	**Standard Error**
DUR0	-4.1692 ***	0.1058	-4.1526 ***	0.1075
DUR1	-0.0584 ***	0.0074	-0.0576 ***	0.0075
CONSTANT	-0.4161	0.2807	-0.4373	0.2962
Child is a Girl	0.0699	0.057	0.0686	0.0586
Age of Respondent: 20 – 24	-0.2635 ***	0.0869	-0.2497 ***	0.0909
Age of Respondent: 25 – 29	-0.5296 ***	0.1074	-0.5102 ***	0.1123
Age of Respondent: 30 – 34	-0.5533 ***	0.1345	-0.5239 ***	0.1404
Age of Respondent: 35 – 39	-0.4574 ***	0.1677	-0.4180 **	0.1747
Age of Respondent: 40 – 44	-0.1522	0.2167	-0.1286	0.2273
Age of Respondent: 45 – 49	-2.5537 **	1.0342	-2.5034 **	1.0583
Highest Education of Woman: Primary School	-0.1368	0.0936	-0.0989	0.0968
Highest Education of Woman: Middle School	-0.1534	0.1486	-0.0994	0.1547
Highest Education of Woman: Secondary School or Higher	-0.3984 **	0.1831	-0.3171 *	0.1903
Highest Education of Husband: Primary School	0.0639	0.0709	0.0771	0.0742
Highest Education of Husband: Middle School	-0.0857	0.0927	-0.05	0.0972
Highest Education of Husband: Secondary School or Higher	-0.2170 **	0.0912	-0.1860 *	0.0958
Birth Order = 2	-0.0487	0.0855	-0.1029	0.0887
Birth Order = 3	-0.0735	0.0968	-0.1455	0.1012
Birth Order = 4	-0.0611	0.1174	-0.1333	0.1214
Birth Order = 5	-0.0133	0.1362	-0.0909	0.1416
Birth Order >= 6	0.1081	0.1344	0.0241	0.14
Residence: Andhra Pradesh	0.0345	0.183	0.1911	0.1994
Residence: Bihar	-0.107	0.0988	-0.1075	0.1054
Residence: Gujarat	-0.0482	0.1761	0.0583	0.1877
Residence: Haryana	0.1894	0.1728	0.1996	0.1813
Residence: Karnataka	0.0915	0.7365	0.1969	0.7713
Residence: Kerala	-1.2264 ***	0.4129	-1.0699 **	0.504
Residence: Madhya Pradesh	0.132	0.1126	0.1632	0.1201
Residence: Maharashtra	-0.3387 *	0.2016	-0.2211	0.2152
Residence: Orissa	0.1622	0.1347	0.2352	0.1487
Residence: Punjab	0.2722	0.2281	0.3179	0.2429
Residence: Rajasthan	0.021	0.1095	0.0343	0.1169
Residence: Sikkim	-0.8090 **	0.3248	-0.7286 **	0.3418
Residence: Tamil Nadu	-0.3971 *	0.2354	-0.1329	0.2527
Residence: West Bengal	-0.4108 **	0.2043	-0.2704	0.2167
Religion: Muslim	-0.2136 **	0.1084	-0.2267 **	0.1146
Religion: Christian	0.0118	0.3029	0.0374	0.3166
Religion: Sikh	-0.4458	0.2714	-0.362	0.2828
Religion: Buddhist	0.5177	0.3772	0.4727	0.396
Scheduled Caste/Schedules Tribe	0.028	0.0773	0.0133	0.0813
Other Backward Caste	0.046	0.0759	0.0426	0.0796
Has Electricity	-0.0507	0.0722	-0.0561	0.0754

Source of drinking water: Piped into residence	0.0232	0.1561	0.0178	0.1633
Source of drinking water: Public tap	-0.0527	0.501	-0.0761	0.1566
Source of drinking water: Private hand pump	0.1598	0.132	0.1421	0.1378
Source of drinking water: Public hand pump	0.1439	0.1167	0.1251	0.122
Source of drinking water: Private open well	0.0047	0.1599	-0.0151	0.1688
Source of drinking water: Public open well	0.1385	0.1236	0.1184	0.1296
Toilet: Own flush toilet	-0.0832	0.2509	-0.1067	0.2611
Toilet: Own pit toilet/latrine	-0.3503	0.2648	-0.3661	0.275
No toilet facilities at home	-0.1826	0.2113	-0.2083	0.2198
Distance to nearest town	0.0019	0.0022	0.0023	0.0023
Distance to district headquarter	-0.0013	0.0012	-0.0011	0.0012
Distance to nearest railway station	0.0000	0.0013	0.0001	0.0014
Distance to transport	0.0011	0.0015	0.0011	0.0016
Distance to nearest all-weather road	-0.0005	0.0016	-0.0004	0.0016
Sub-centre in village	-0.1265 *	0.0713	-0.1285 *	0.0748
Primary Health centre in village	0.0509	0.1057	0.0605	0.1109
Community Health centre in village	0.2120 *	0.1124	0.2122 *	0.1177
Government Dispensary in village	-0.0047	0.1073	-0.0009	0.1119
Private Clinic in village	0.048	0.0807	0.0462	0.085
Government Hospital in village	-0.087	0.1785	-0.0906	0.1878
Private Hospital in village	0.1335	0.1379	0.1514	0.1461
Size at birth average	-0.4087 ***	0.0837	-0.4153 ***	0.0869
Size at birth smaller than average	-0.1081	0.0933	-0.102	0.097
Size at birth very small	0.4925 ***	0.1089	0.5075 ***	0.1136
Prenatal visit by health worker	-0.1615 *	0.0878	-0.1641 *	0.0907
Danger signs in Pregnancy	-0.0234	0.1228	-0.0041	0.1261
Received Delivery Care	-0.0038	0.1331	-0.0043	0.1363
Received New born Care	0.0748	0.1361	0.0859	0.1388
Given Iron tablets during pregnancy	-0.019	0.0787	-0.0148	0.0813
Given tetanus shot during pregnancy	-0.4528 ***	0.0727	-0.4682 ***	0.0759
Went for prenatal check up	-0.3322 ***	0.0841	-0.5115 ***	0.1287
Hospital delivery	-0.0382	0.1387	-0.3667 ***	0.083

Notes:
Significance: *** = 1%; ** = 5%; * = 10%
Model I: Antenatal care and Hospital Delivery Exogenous.
Model II: Antenatal care and Hospital Delivery Endogenous.