ISID-PHFI Collaborative Research Programme

Working Paper
No: 157

PARENTAL EDUCATION AND INFANT MORTALITY IN INDIA: Understanding the Regional Differences

Pradeep Kumar Choudhury

PUBLIC HEALTH FOUNDATION OF INDIA

ISID

November 2013

ISID
Working Paper
157

ISID-PHFI Collaborative Research Programme

PARENTAL EDUCATION AND INFANT MORTALITY IN INDIA: Understanding the Regional Differences

Pradeep Kumar Choudhury

ISID

Institute for Studies in Industrial Development

4, Institutional Area, Vasant Kunj Phase II, New Delhi - 110 070

Phone: +91 11 2676 4600 / 2689 1111*; Fax:* +91 11 2612 2448

E-mail: info@isid.org.in; *Website:* http://isid.org.in

November 2013

ISID Working Papers are meant to disseminate the tentative results and findings obtained from the ongoing research activities at the Institute and to attract comments and suggestions which may kindly be addressed to the author(s).

CONTENTS

List of Tables

List of Figures

PARENTAL EDUCATION AND INFANT MORTALITY IN INDIA: Understanding the Regional Differences

Pradeep Kumar Choudhury ∗

[***Abstract***: *Using data from the National Family Health Survey (2005-06), this study examines the effect of parental education in the regional variation of infant mortality in India. Although, research evidences show that mother's educations have a strong effect on reducing the mortality of young children, systematic attempts to understand the role of parental education in the regional variation, are limited. Similarly, there is hardly any attempt to examine the impact of mother's exposure to mass media and her socioeconomic empowerment (factors that are closely related to the education) on the risk of infant mortality in the regional level. Thus, the need for this study lies with the argument that the role of parent's education and other related factors in reducing infant mortality differ significantly with the region, classified here as Empowered Action Group (EAG)-Non-EAG states, and rural-urban. While the overall infant mortality is 57 in major states of India, the analysis shows that it varies enormously by parental education and regions. The regression results show that both mother's and father's education are significantly associated in reducing the infant mortality across the regions and major states of India, although the relative effect of different levels of education of the parents varies between EAG-Non-EAG states and rural-urban regions. Similarly, it is also evident that the children born to the mothers having any kind of exposure to the mass media have lower probability of death in their infant stage compared to the children born to the mothers having no mass media exposure and it works more effectively in the regions that are underdeveloped such as EAG states and rural areas. The analyses of the findings suggest that the low level of female education is a major hindrance to reduce the infant death in rural India and EAG states than that of urban India and Non-EAG states respectively. The results are very robust to different potential confounding factors including socio-economic, demographic, accessibility to health care, and sanitation related variables. The policy implication of the study include, obviously, providing education to the parents, particularly to the mothers of backward regions or states. Besides parent's education, attempt should also be made to increase the scope of getting mass media exposure and higher level of socioeconomic empowerment of the mother to reduce the infant mortality in India.]*

Keywords: Parental Education, Infant Mortality; Regional Variation; India

∗ Assistant Professor, Institute for Studies in Industrial Development, New Delhi. E-mail: pradeep.hcu@gmail.com

Acknowledgement: I am thankful to Dr Jagannatha Behera from CSRD, JNU, Dr Indranil Mukhopadhyay from PHFI, and faculty members from ISID for their valuable suggestions. However, the usual disclaimers apply.

1. Introduction

Infant Mortality Rate (IMR) which is defined as the deaths of infants of age less than one year per thousand live births is considered as a sensitive indicator of living and socio-economic conditions of a country. The high IMR of a country indicates the unmet health needs, unfavourable environmental factors, and low health and socio-economic status of its population. It is also considered as one of the indicators under the Millennium Development Goal (MDG) four i.e., to reduce the child mortality by two-thirds between 1990 and 2015. The latest mortality estimates for the year 2011 in India indicates an IMR of 44 which is higher than the global figure of 40 in the corresponding year (Registrar General of India, 2011a; World Health Statistics, 2012). Further, within India the infant mortality rate varies widely across different regions and states. In 2011, the IMR is 48 in rural areas and 29 in urban areas. Similarly, it varies from 12 in the state of Kerala to 59 in Madhya Pradesh. As per the latest National Family Health Survey (NFHS-3), the data base on which the present study is based on, for all India level the IMR is reported to be 57 and it varies from 62 in rural areas to 41 in urban areas and among the states, it is highest in Uttar Pradesh (73) and lowest in Kerala and Goa (15).

What factors contribute to such variations is not being examined in detail in a cohesive framework in India. However, the cross country literature, have found that the regional diversity, socio-economic and demographic factors can be the cause of such variations (Wang, 2003). Quite a few studies have argued that education is the most influenced factor in differentiating the infant and child mortality levels within all the socioeconomic factors (Mondal *et al,* 2009). In the developing world, including India, there is now clear evidence of differentials in child survival rates associated with the education of mothers (Ware, 1984; Basu and Stephenson, 2005). Although majority of the scholars working in this domain have analysed the pattern of infant and child mortality rate by mother's education (Caldwell, 1979, 1994; Cladwell and McDonald, 1982; Desai and Alva, 1998; Gakidou *et al,* 2010; Papageorgiou and Stoytcheva, 2012; Saikia *et al,* 2013), there is very little investigation on the impact of father's education and the aggregate level of education of the parents on it. Similarly, very little is known about the relationship between mother's mass media exposure and socioeconomic empowerment on mortality and health status of the child. Though a couple of studies have emphasized the rural-urban disparities in the infant and child mortality rate and the factors contributing to these in India (e.g., Saikia *et al,* 2013), perhaps no attempt is made to examine the differences by EAG and Non-EAG states, which is an important classification made by the Government of India on the basis of crucial health indicators[1].

In light of these caveats, this study examines the role of parental education, controlling for other factors, on the infant mortality rate in India using NFHS-3 data collected in the year 2005-06. In the present phrase of development in India, examining these concerns are having particular interest because 1) the movement towards universal health coverage instituted by

[1] Detail is given in section 3 on data and methodology.

government of India targets for reducing health related mortality in the regional level by strengthening the social determinants of health, including education 2) special effort is being given in the health policy domain to bridge the regional gap in the infant mortality by creating awareness through mass media and other informal education to the mothers, with a special focus on rural region and backward states. For example, the programme on National Rural Health Mission (NRHM) targets to reduce the IMR in rural region by involving local communities in the process. The paper examines the regional aspect of this by grouping the major states of India into EAG and non-EAG states and also by dividing these states into rural and urban region. The main purpose of the study is to ascertain the nature of cross-sectional (regional level) relationship of infant mortality rate with educational levels of the parents. The importance of carrying out this study also lies with the widely argued fact that the empirical studies on infant and child mortality at the regional level or geographic location are more informative for designing health policies of a country.

The rest of the paper is organised as follows: The studies on the impact of parental education and other related variables on infant mortality in India and rest of the world are reviewed in section 2. Section 3 describes the data and methodology used in the study. Section 4 discuses the empirical results. These include: (a) region wise differentials of IMR by parental education; (b) examining the impact of mother's and father's education and other socioeconomic and demographic factors on IMR in the regional level in India using logit model. Section 5 concludes.

2. Past Research

How does education (particularly parental education) matter for infant and child mortality and health status of the child? Quite a few number of studies (Calwell, 1979, 1994; Cladwell and McDonald, 1982; Rama Rao *et al*, 1997; Desai and Alva, 1998; Das and Dey, 2003; Khasakhala, 2003; Kravdal, 2004; Gakidou *et al*, 2010; Papageorgiou and Stoytcheva, 2012; Saikia *et al*, 2013) in this domain have shown a negative relationship between maternal education and infant and child mortality, although the amount of education required to produce a significant reduction in mortality differs from culture to culture. However, given the close link between education and other positive socio-economic conditions, researchers differ in their propensity to move beyond this correlation to argue that education causes low infant and child mortality. It is well established in the literature that education is linked to family socioeconomic condition, which in itself has an impact on child mortality and health status. But above and beyond this, the parent's education is expected to bring about certain changes in individual behaviour that results a positive impact on child mortality and health. Using the fixed effect model, the study by Desai and Alva (1998) shows a consistent negative relationship between maternal education and the probability of infant death. However, the result of the logistic regression, introducing direct controls for some of the socio-economic variables reduces the effect of maternal education on infant mortality. For example, introducing controls for husband's education and access to piped water and toilet attenuate the impact of maternal education on infant mortality. Gakidou *et al*, (2010) have estimated the

contribution of improvements in women's education to reduction in child mortality using the data of 219 countries, gathered between 1953 and 2008. The coefficient for women's education implied that for every 1 year of increase in the education of women of reproductive age, the child mortality decreased by 9.5 per cent. In south Asia, the expansion of women's education accounted for 39.1 per cent of the reduction in the number of child deaths.

Mother education emerges as the single most important determinant of child health-care utilisation in India when the influences of other intervening factors are controlled (Govindasamy and Ramesh, 1997). The empirical results show that a higher level of maternal education results in improved child survival because health services that effectively prevent fatal childhood diseases are used to a greater extent by mothers with higher education than by those with little or no education. Educated women with at least middle schooling are nearly eight times more likely to receive antenatal care for their births than illiterate women, and literate women with less than middle schooling are more than three times as likely. Similarly, births to women who have completed middle school are five to eight times more likely to receive maternal care as compared to births among illiterate women. Papageorgiou and Stoytcheva (2012) have examined the relationship between female human capital inequality and infant mortality using female-specific education Gini coefficients for 108 countries, in addition to their average female education. The results show that higher education inequality among women leads to substantially higher infant mortality. The study suggests that if infant mortality reduction is a priority for policy makers, then educating the least educated women is a priority. Kapoor (2010) has examined the socio-economic determinants of the reducing infant mortality rate in India using a panel dataset of 666 districts from the 1991 and 2001 census. The results of the Quantile regression technique show that female literacy has a negative and statistically significant effect on infant mortality. One per cent increase in female literacy is associated with a 23 per cent drop in IMR. Thus, educating more females leads to significant reductions in IMR across the districts, though the relative effect varies. The findings of this study clearly demonstrate the role of woman's empowerment (measured in terms of their educational level) in reducing infant mortality and the results are strongest in districts with high levels of IMR.

Kiros and Hogan (2001) have examined the role of parental education in reducing excess child mortality in Africa. Trends in child mortality by parental education for the period 1979-1994 shows that it is highest among children born to illiterate parents and decreases with both mother's and father's education. The results of Poisson regression model show a significant reduction in number of children dead with the parents having any level of education compared to when both parents are illiterate. Even after controlling the additional covariates like urban-rural, food crisis and war intensity, the effect of parental education in reducing number of child deaths remained consistent and strongly significant. Both mother's and father's education are found to have independent significant impacts in reducing child mortality. Child mortality is highest among children born to illiterate mothers and illiterate fathers. Singh-Manoux *et al*, (2008) have examined the association between adult education and child mortality using NFHS-2 data collected in 1998-99. The results show that compared

to those with no education, 9 or more years of education for the head of household and the spouse was associated with lower child mortality. The study has suggested that adult education has a protective association with child mortality in India and the confounding factors like caste, household wealth and urbanisation do not modify or completely attenuate this association. Similarly, using NFHS-1 data collected 1992-93, Gunasekaran (2005) has critically analysed the level, trends, differentials and determinants of infant and child mortality in rural India. The multivariate analysis reveals that education of the mother has a significant effect on infant mortality only in the high and low mortality group states. The relative risk of infant mortality among the children of literate mothers was significantly less in the high and low mortality groups as compared to illiterate mothers.

The literature reviewed here confirms that the parent's education (specifically mother's education) helps to reduce infant and child mortality and this is true even after controlling the confounding factors that are linked to education like occupation, economic status etc. Though largely the impact of parent's education on infant and child mortality is clear from the literature, less is talked about its impact by region. Similarly, the handful of studies available on the determinants infant and child mortality in India are narrowly focused by examining the impact of mother's education, without considering many other important variables like father's education, mother's exposure to mass media, and socio-economic empowerment of the mother. Thus, this study may be an extension in this direction in a systematic way.

3. Data and Methods

3.1 Data

The data for this study comes from the 2005-06 National Family Health Survey (NFHS-3), the third and also the latest in the series of these national surveys. It was preceded by NFHS-1 in 1992-93 and NFHS-2 in 1998-99. The NFHS is a large scale, cross-sectional, multi-round survey conducted in a nationally representative sample of households throughout India. The NFHS surveys were conducted under the stewardship of the Ministry of Health and Family Welfare, Government of India with the objective to provide national and state level estimates of fertility, family planning, infant and child mortality, reproductive and child health, nutrition of women and children, the quality of health and welfare services, and socioeconomic conditions.

NFHS 3, the data set on which this paper is based on, interviewed a sample of 1,24,385 women age 15-49 and 74,369 men age 15-54 in 1,09,041 households from all 29 states. The survey has used standardised questionnaires (household questionnaire, women's questionnaire, and men's questionnaire), sample designs and field procedures to collect the information and a detailed description of the survey design of NFHS-3 is given in the national report (IIPS and ORC Macro, 2007). The fieldwork was conducted in two phases between November 2005 and August 2006. The individual women response rate, i.e., the

number of completed interviews per 100 eligible women identified in the households, was 95 per cent for all India (93% in urban areas and 96% in rural areas). Similarly, the response rate for eligible men was 87 per cent for the country as a whole (85% in urban areas and 90% in rural areas).

For the present analysis, the data is gathered from the household questionnaire and the women questionnaire. Since the focus of this study is on infant mortality, the information on the number of children who were born, survived, or died is of particular concern. The survey had asked all women age 15-49 to provide a complete history of their births including for each live birth, the sex, month and year of birth, survival status, and age at the time of the survey or age at death. Age at death was recorded in days for children dying in the first month of life, in months for other children dying before their second birthday, and in years for children dying at later ages. The data on birth history allows for estimates of IMR for all India and also in the regional level. The women questionnaire was also designed to provide their background characteristics, antenatal, delivery and post natal care, and child immunization and feeding practices, some of which are used as exposure variables in the analysis. Information on some of the socio-economic variables like the availability of toilet facilities, source of drinking water etc. used in the analysis were drawn from the household questionnaire.

The base sample for the present study constitutes 57,175 children born in the last five years preceding the survey (i.e. in the period of 2000-2005) in major states of India[2]. These were children born to ever-married women aged 15-49 for whom the information was collected in the survey. Out of the total children born during this period, 3,269 children have died before their first birthday. Thus, the infant mortality rate turned out to be 57 per 1,000 live births, which is considered as the dependent variable for the empirical analysis. It is a dummy variable and takes value 1, if the infant is died and 0, if the infant is alive.

Besides analysing the differences of IMR exist in rural and urban regions by parental education, the study has also examined the disparities between EAG and Non-EAG states of India. The EAG states were formed in the Ministry of Health and Family Welfare (MoHFW) in March 2001 especially to ensure population stabilisation and intersectoral convergence and these are the states with high fertility rates and weak socio-demographic indicators. The

[2] The major states (22 in total) include Andhra Pradesh, Assam, Bihar, Chhattisgarh, Delhi, Goa, Gujarat, Haryana, Himachal Pradesh, Jammu and Kashmir, Jharkhand, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Odisha, Punjab, Rajasthan, Tamil Nadu, Uttarakhand and Uttar Pradesh, and West Bengal. Seven North-Eastern states excluded from the analysis are Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim and Tripura. These states are having some geographical disadvantages as they are located in hilly region and also concentrated with tribal population. Thus, the government of India treats this region separately when making the policies and programmes of the country. These states consist only about 1.2 per cent of India's population as per 2011 census.

objective of classifying EAG states were to facilitate the creation of area-specific programmes, with special emphasis on eight states that have been lagging behind in containing population growth to manageable limits. These include eight states namely Bihar, Chhattisgarh, Jharkhand, Odisha, Madhya Pradesh, Rajasthan, Uttarakhand, and Uttar Pradesh. However, Assam (another north-eastern state) is included to it as it is having similar characteristics. The analysis in this case examines the concern of 'Does the impact of parental education on IMR differ in the sates with different socio-economic settings?' The sample for the EAG and Non-EAG states are 33,073 and 24,102 children respectively born in the period 1-59 months preceding the survey. Similarly, the sample sizes in the rural and urban regions are 42,533 and 14,642 children respectively.

3.2 Methods

The analysis is carried out in two levels. First, the levels of infant mortality rate is presented by different levels of education of the mother, father, and parents (educational attainment of father and mother taken together) for major states of India, and also two groups of states (EAG and Non-EAG). In each of these regions the pattern of infant mortality rate is discussed by place of residence (rural-urban). It will provide a descriptive picture on the issue. Second, four different binary logistic regression models are fitted to examine the impact of parental education on infant death. The first three models examine the relationship between infant death and parental education without controlling for other variables. The first model examines the effect of mother's education alone, *model 2* analyses the impact of father's education alone whereas the third model looks at the effect of both father and mother education on the risk of infant death.

Model 4 extends *model 3* through the addition of potential confounding factors including mother's exposure to mass media, socio-economic empowerment of the mother, economic status of the household, working status of the mother, drinking water and sanitation facility, accessibility to health care, mother's age, birth order of the child, size of the household, and caste. Each of these models is estimated for EAG and Non-EAG states, and rural-urban locations, to examine the role of parental education on infant mortality by region. In the literature, it has been argued that education is one of many indices of socio-economic status and that the strong positive relationship between education and infant and child mortality rate is merely a reflection of the fact that educated parents come from wealthier families, live in urban settings where health care is more accessible. Thus, controlling for the possible impact of other socio-economic variables is an important part of the exercise to determine if the positive impact of education on infant and child mortality is robust. Notation and definition, and the summary statistics of explanatory variables used in the analysis are given in *Table A1* and *Table A2* respectively, in appendix.

Inclusion of different explanatory variables in the logit model is elucidated here in detail.

Parent's Education: One of the primary interests of the study is to empirically estimate the effect of parent's education on infant mortality rate. It is observed that the parents with lower level of education are having higher infant mortality rate. Quite a few number of studies have examined the impact of mother's education on IMR assuming that mother's education is more important in reducing IMR comparison to father's education. Mothers having higher educational attainment can care their new born child well than the mothers having lower level education, which declines the IMR. Similarly, educated mother are aware of the proper antenatal care i.e. the regular medical and nursing care recommended for women during pregnancy, which has significant impact on reducing IMR. It is expected that the parents with higher level of education prefer institutional delivery, do not follow taboos and superstitions in caring their baby, which helps in reducing the IMR. More clearly, parents with higher level of education are generally better informed about the antenatal and postnatal care than the parents with less level of education. To examine this fact, education level of both father and mother are used in the analyses separately, which are classified into four groups: (a) illiterate or having no education; (b) elementary level of education i.e., having 1 to 8 years of schooling[3]; (c) secondary level of education i.e., having 9 to 10 years of schooling; and (d) senior secondary and above level of education - having 11 or more years of schooling.

Mother's Exposure to Mass Media: Higher exposure to the mass media of the mother may be regarded as an important factor in reducing the IMR. Mothers who are listening radio, reading newspapers, watching television, participating in street plays etc. are more aware about their children's health care compared to the mothers without this knowledge. The informal learning of the mothers from mass media (mainly through advertisements and public awareness campaigns) helps for better antenatal and postnatal care. It may be expected that the mass media is an important source of information on health related issues even for the illiterate mothers. The mother's exposure to mass media in the present analysis include their involvement in three different mass media instruments like reading newspapers, watching television and listening radio. The mass media exposure is taken as a dummy variable, 1 if the mother listen radio, read newspaper and watch television at least once a week, and 0, if mother does not listen radio, does not read newspaper and does not watch television even once in a week.

Socio-Economic Empowerment of the Mother: It is expected that the socio-economic empowerment of the mother may have a significant effect in determining the IMR. This is mainly because the mother having higher socio-economic empowerment have greater chances of taking decision about their health care and also on their children's health care. For example, they can decide to take proper antenatal care and also to deliver their children in the

[3] Taking 1 to 8 years of schooling (elementary level of education) as a category has a special significance in the Indian context. This is considered as the compulsory level of education that must be given free of cost to all citizens of the country.

hospital. Women who do not avail proper health care have a fair chance of delivering premature baby, which leads to infant death. Hence, the mother's socio-economic empowerment is included as one of the explanatory variables in the logit analysis. This is calculated by considering the decision taken by the mother alone on four different socio-economic aspects. These include: decision on mother's health care, decision on large and daily household purchases, decision on spending husband's money, and decision on visit to family and relatives. The level of socio-economic empowerment is classified as a dummy variable, takes 1 if the mother has taken decision alone at least in one aspect, and 0, if mother alone has not taken decision in any of the four aspects.

Household Economic Status: Economic status of the household is expected to matter significantly in determining the level of IMR. Poor households may not afford the health care (both ante antenatal and postnatal) properly, which leads to infant death. Contrary, households with higher economic status able to avail better health care by spending a good proportion of their income. Usually, rich households keep the expenditure on health in the priority list of their household budget. Further, poor families go for more number of children as they consider them as the future asset of their households, which is not the case among rich families. To examine this, economic status of the household measured in terms of wealth index is included as an explanatory variable in the logit model. The wealth index was constructed from household-level data, using Principal Components Analysis (PCA). The input information for this analysis came from household ownership of items ranging from furniture and vehicles; to dwelling characteristics such as water source, sanitation facilities, and the home's construction materials; and to whether a household member had a bank or post office account[4]. The wealth quintiles were classified into lowest, second, middle, fourth and highest in the original data file. However, for the present analysis it is categorised as poor (considering lowest and second together), middle, and rich (taking fourth and highest together).

Working Status of the Mother: Whether the mother is working or not may influence the level of IMR. It is commonly perceived that the infant whose mother is working in the job market has a higher chance of death, mainly because the mother does not get time to take care her baby properly. Also, one apparent cost associated with formal work force participation by the mothers of the infants is the necessary abandonment of breastfeeding, which is highly recommended during the first year of the baby to reduce the chance of illness and

[4] The wealth index is based on 33 assets and housing characteristics: household electrification; type of windows; drinking water source; type of toilet facility; type of flooring; material of exterior walls; type of roofing; cooking fuel; house ownership; number of household members per sleeping room; ownership of a bank or post-office account; and ownership of a mattress, a pressure cooker, a chair, a cot/bed, a table, an electric fan, a radio/transistor, a black and white television, a colour television, a sewing machine, a mobile telephone, any other telephone, a computer, a refrigerator, a watch or clock, a bicycle, a motorcycle or scooter, an animal-drawn cart, a car, a water pump, a thresher, and a tractor.

consequently death. Contrary to this, the other possibility is that the probability of infant death is less among working mothers. It is because they are usually educated and aware of their child's health. Further, due to their better economic status (compared to the mothers who are not working) they can afford the health care facilities without much difficulty. Working mothers can also hire some other women to take care of their babies when they go for work. Thus, working status of the mother may have different effects upon the IMR. In the present study, this is used as a dummy variable, i.e. 1, if the mother is working in the job market, and 0, if the mother is not working, i.e. she is a housewife.

Caste[5]: Social category/caste is known to affect many aspects of life in India and is likely to affect levels of infant mortality as well. In India, the social category is broadly classified into four categories namely scheduled caste, scheduled tribe, other backward class, and others/forward caste. Scheduled castes and scheduled tribes, and in some cases other backward classes are castes that the government of India considers as socially and economically backward and in need of special protection from injustice and exploitation. It is generally expected that the children of scheduled caste and, in particular, children of scheduled tribes are at a higher mortality risk compared to the children of other backward classes and forward castes. Some of the effect of caste membership on mortality may be due to the differences in life-style based on traditions and beliefs. Such differences may include customary practices related to childbirth, infant feeding, and health care, and these might have an effect on infant mortality independent of other variables. To find out the effect of caste on IMR, the dummy variable is used in the logit model and takes the value 1, if the children belongs to forward caste or other backward classes families, and 0, otherwise i.e., if the children belongs to scheduled caste or scheduled tribe families.

Sanitation: The sanitation condition of the household measured in terms of the availability of toilet facilities may be regarded as an important determinant of IMR in India. It is expected that the availability of toilet facility in the household can reduce the probability of infant death significantly. To examine this fact, whether the household has a toilet facility or not is included as a dummy variable in the logit model. It is important to note here that besides the availability of toilet facilities, the type and condition of the same is also an important aspect in reducing the IMR. But it is not being considered in the present analysis.

Drinking Water Facility: The quality of drinking water used by the mother and sometimes by the infant plays a crucial role in determining the probability of infant death. Using safe drinking water may reduce the infant death significantly. In the NFHS-3 data respondents to the household questionnaire were asked about the different source of drinking water for the household. These include piped water, tube well water, drug well water and surface water. However, in the present study, these are re-classified into two categories namely piped water

[5] Information on caste was obtained for the head of the household, and women were assumed to have the same caste as the head of the household.

and others (tube well water, drug well water, and surface water taken together) and taken as a dummy variable in the analysis.

Place of Delivery: Place of delivery is also an important determinant of child survival. In many developing countries, including India, several children die owing to the lack of safe delivery facilities. Specifically women from rural region and lower income groups deliver their babies at home with the presence of relatives and neighbours without going for the medical, which is risky both for the mother and the new born baby. On the other hand, it is expected that the women going for institutional deliveries have access to trained medical professional (doctors and nurses) who can take care of both mother and babies if there will be any difficulty. Considering this, the present study has included the accessibility to institutional delivery as a controlling factor in the analysis. It is a dummy variable and takes the value 1, if the mother has gone for an institutional delivery and 0, otherwise.

Mother Age: Age of the mother is an important demographic factor which influences the IMR. Typically, mortality risks are greater for children born to mothers who are too young or too old. The probability of infant death is expected to be higher if the mother's age is usually less than 20 years and more than 30-35 age. More clearly, other things being equal, a mother with higher age (usually maximum of 30-35 years old) giving birth to a baby will have lower risk of dying compared to a mother with less than 20 years old and more than 35 years old. This is due to the fact that, pregnancy in the teenage (normally less than 20 age) and over the age of thirty five of the mother leads to preterm birth of the child which is an important cause of infant death. Mother's age is classified here into four categories namely, less than 20 years old, 20-29 years old, 30-39 years old and 40-49 years old. An attempt was made to include '*mother's age at the time of birth of her child*' instead of (*'mother's age') in the analysis, as the former one is expected* to be more important than latter one in determining IMR. However, it is found to be highly correlated with 'birth order of the child' (included as another explanatory variable in the analysis), hence dropped.

Birth Order of the Child: Birth order may also play a key role in the probability of infant mortality, though the direction of the effect is a priori ambiguous. A number of studies indeed point to a U-shaped effect of birth order, with the probability of infant mortality declining after the first child and increasing again for children of birth order four and higher (Titaley *et al,* 2008 and Uddin and Hossain, 2008). First born children are likely to be raised by parents with limited skills and experience, possibly increasing the risk of infant mortality. Similarly, births of very high order may have mothers who are physically depleted at the time of conception and throughout pregnancy. They are thus more likely than other children to suffer from conditions associated with high mortality risk such as foetal growth retardation and low birth weight. High-order births are also born into families that already have a number of young children who compete for resources and parental care (Pandey *et al,* 1998). Contrary to this, according to the hypothesis of intra-household resource competition, first born children are more likely to capture vital resources such as food and care, thereby reducing their mortality risk (Vos *et al,* 2004). On the other hand, it has been found that first

born children, who are more likely to be born to mothers at younger reproduction ages, experience a higher mortality risk than children of a higher birth order. To account for this effect, the present study has included the birth order of the child in four dummies representing birth orders 2, 3, 4, and 5 and above (≥ 5) with birth order 1 as the reference category.

Household Size: The size of the household is expected to have an impact on the infant survival. Two contrary arguments on this can be posed here. First, the probability of infant death may be higher in the large households. It is mainly because of the lower socio-economic status of these households, as large portion of the income will go for basic consumption. They might not give due emphasis on health care and other related aspects. Second, one can expect a lower probability of infant death in large households, as there will be enough people to take care of the newly born child. To examine this, the total size of the household (a continuous variable) is considered as an explanatory variable in the analysis.

4. Results and Discussion

4.1 Regional Variation of IMR by Parental Education

Table 1 confirms that higher the level of educational attainment of the mother, lower is the level of infant mortality in India during 2000-2005. The IMR among children born to illiterate mothers was 68.5, which is about 2.5 times higher than those born to mothers with 11 or more years of education. The IMR is 54.7 among the children born to mothers having elementary level of education and 41.1 to mothers with secondary level of education. The decline in the IMR is highest between secondary and senior secondary and higher level of education of the mother, reduction of 14.9 points (41.1 to 26.2). It is important to note here that the IMR for the children born to literate mothers is less than the national average which is 57 whereas it is higher (68.5) among illiterate mothers. A mother's education is important in reducing IMR because it facilitates her integration into a society impacted by traditional customs, exposes her information about better nutrition, use of contraceptives to space births and knowledge about childhood illness and treatment (NIMS *et al,* 2012). It is also argued that education makes a mother socially advanced, free from traditional values and changes her pattern of behaving and attitude (Mondal *et al,* 2009). Education may also increase the autonomy of the mother that is necessary to advocate for her child in the household and the outside world.

In India and other such developing societies, father's education plays an important role in earning income, which in turn ensures access to child health facilities. Thus one can expect a direct relationship between father's education and infant death. It is apparent from *Table 1* that higher the educational attainment of the father lower is the level of infant mortality. More clearly, children born to the father's with senior secondary and above level of education experience lowest IMR than that of father's who have elementary and secondary educational level. The large decline in the IMR is seen between the fathers having 1 to 8 years of education and 9 to 10 years of education whereas the difference in the IMR between illiterate

fathers and father's having elementary level of education is minimum. This may reflects the dynamism involved in the education and labour market relationship in India. The scope of getting employment and also the earning does not vary much between illiterate and persons having primary level of education. However, there is not enough literature in supporting the relationship between father education and IMR in India or otherwise, as the studies in this domain are largely focused on mother's education.

Table 1
Infant mortality rates by parent's education in EAG and Non-EAG states of India

Variables	*EAG States*	*Non-EAG States*	*India*
Mother Education			
No education	74.0	54.4	68.5
1-8 years complete	65.9	46.4	54.7
9-10 years complete	51.2	33.9	41.1
> 10 years complete	32.6	22.8	26.2
Father Education			
No education	74.1	52.2	66.6
1-8 years complete	72.1	48.6	60.2
9-10 years complete	60.0	38.4	49.1
> 10 years complete	46.5	28.7	37.5
Total	**67.5**	**42.9**	**57.0**

Source: Authors' calculation from NFHS- 3 Data

While the overall IMR is 57 in major states of India, it varies widely between EAG and Non-EAG states (*Table 1*). As expected, the IMR is higher in EAG states (67.5) compared to Non-EAG states (42.9). This confirms the widely accepted argument that infant mortality is an indicator of the socioeconomic wellbeing of a society. The high infant mortality in EAG states signifies that there exists an unequal distribution of resources between these two regions and thus, a special attention is needed to minimise this gap. Further, studies on infant mortality in India and elsewhere have documented that the regions with lower socioeconomic settings (particularly lack of parental education) are associated with high degree of son preference which leads to excess infant mortality among female children due to preferential treatment in feeding and medical treatment for sons (Arnold, Choe, Roy 1998; Williamson 1976).

Although, in both the regions mother's education is inversely related with IMR, the rate of decline by levels of education varies. With the increase in the mother's level of education, the IMR has declined fast in EAG states compared to non-EAG states. For example, the decline in the IMR is 18.6 and 16.7 points with the increase in the years of education from 1-8 years to 9-10 years and then more than 10 years of education respectively in EAG states. The respective figures are 12.5 and 11.1 in Non-EAG states. Similarly, educational attainment of the father has an inverse relationship with the IMR in both EAG and Non-EAG states. The pattern in the decline of IMR with father's education is more or less same with the pattern of mother's education, except the case of no education to elementary level of education. The pattern of

infant death by parental education in EAG and Non-EAG states (*Table 1*) spells out the following: first, the role parental education in reducing the infant death differs with the socioeconomic settings of the regions and interestingly, the reduction is higher in the underdeveloped region than that of developed region. Second, irrespective of region, getting compulsory level of education by the mother helps to reduce the infant death whereas it does not matter much in case of fathers. Thus, the recent goal for providing 1-8 years of schooling through Right to Education (RTE) Act 2009 in India should specifically focus on reducing the gender inequality in education by targeting the women for reducing the infant death, in addition to the other objectives specified in the act.

The rural-urban differential of infant mortality has been well documented in the context of many developed and developing countries. A few research studies on infant and child mortality in India have shown that the risk of infant death is relatively low in urban areas as compared to rural areas (Gupta 1990; NIMS *et al,* 2012; Saikia *et al,* 2013). Narrating the reasons, studies have found that parent's education plays an important role. Illiterate parents in the rural region go for early marriage of their children (particularly daughters) which further leads to high risk of infant death. Very young mothers (particularly under the age of 20) may experience difficult pregnancies and deliveries because of their physical immaturity. They are also likely to have limited knowledge and confidence in caring for infants and young children (Pandey *et al,* 1998). The study by Babson and Clarke (1983) have found that in the neonatal period, a significantly greater overall mortality occurred in infants born to the younger mothers and the reason was to give birth of low weight babies.

As shown in *Table 2*, for major states of India, EAG and Non-EAG states, the IMR in rural region is higher than that of urban region. But, surprisingly, the rural-urban gap in the IMR is higher for Non-EAG states (18.3) compared to EAG states, which is 9.9 points. Usually, it is expected that the rural-urban difference in IMR is less for the states with higher socio-economic developments. This may be explained by the fact that the Non-EAG states have given due focus on urban development neglecting rural region, which is an ongoing policy debate in most of the developing countries, including India. Though, in both rural and urban regions of EAG and Non-EAG states, the IMR declines with the increase in mother's educational attainment, the pattern of reduction provides some interesting picture (*Table 2*). First, the IMR among the children born to illiterate mothers is 3.1 and 1.7 times higher than those born to mothers with post secondary level of education in urban and rural region respectively in EAG states. But, for Non-EAG states it is 2 times higher both in urban and rural region. This reveals the extent of rural-urban gap in the IMR by mother's educational attainment between EAG and Non-EAG states. More clearly, the change in the levels of IMR by mother's education is more or less same in rural area in both EAG and Non-EAG states, whereas the patterns of change in IMR differ widely in the urban region. *Table 2* shows that in the urban region of EAG states the IMR declines by 16.6 points with the increase in the

Table 2
Infant mortality rates by parents education and region in EAG and Non EAG states of India

Variables	*EAG states*		*Non-EAG states*		*India*	
	Rural	*Urban*	*Rural*	*Urban*	*Rural*	*Urban*
Mother Education						
No education	73.0	81.1	58.5	40.4	69.2	64.1
1-8 years complete	66.3	64.5	48.5	41.4	56.8	49.2
9-10 years complete	55.1	42.4	40.5	25.5	47.3	30.9
> 10 years complete	41.5	25.8	28.7	19.6	33.2	21.7
Father Education						
No education	73.6	77.6	55.9	35.8	67.8	60.0
1-8 years complete	70.3	75.6	55.3	31.8	65.8	55.7
9-10 years complete	61.1	55.2	45.2	30.8	55.2	42.8
> 10 years complete	53.1	32.9	33.7	24.3	44.8	27.3
Parents Education						
Both are Illiterate	73.1	86.2	52.0	35.6	67.2	66.1
Both have completed > 10 years	37.8	27.7	17.4	22.5	26.1	24.5
Total	**69.1**	**59.2**	**49.5**	**31.2**	**61.7**	**43.0**

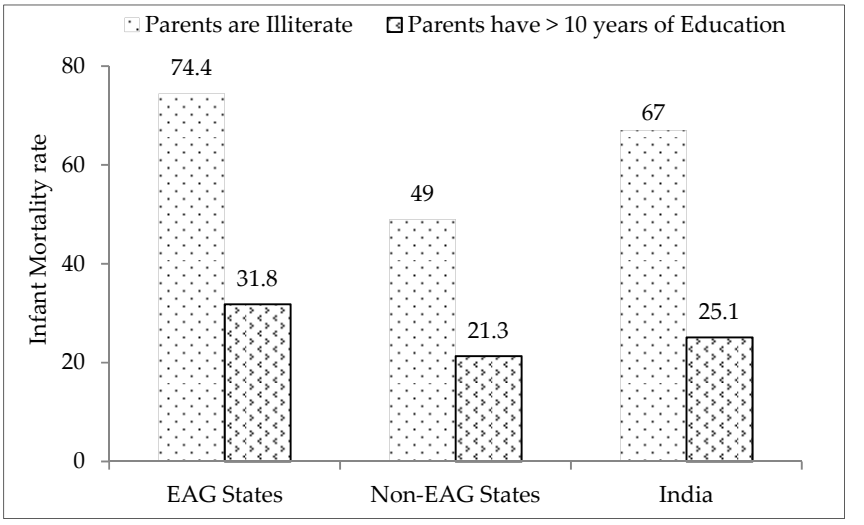
Source: Author's calculation from NFHS-3 data.

mother's education form illiterate to elementary, whereas in urban region of Non-EAG states there is no change in the IMR among children born to illiterate mothers and mothers with elementary level of education and further studies are needed to see the reasons of this.

Like mother's education, increase in the father's educational level also reduces the IMR both in rural and urban region in EAG states, Non-EAG states and major states of India (*Table 2*). In all the cases, the reduction is minimum with the increase in the father's educational level from illiterate to elementary level of education. The fall of IMR is more or less same with the further increase in the educational level of the father (i.e. from 1-8 years of schooling to 9-10 years of schooling and then to more than 10 years of schooling) in all the cases, except urban region of Non-EAG states, where the reduction in IMR is only one point between 1-8 years and 9-10 years of schooling. Thus, as *Table 2* shows, the attainment of secondary and above level of education by fathers matter more in the reduction of IMR than attaining compulsory level of schooling. More clearly, there is not much difference in IMR level among children born to illiterate fathers and father having elementary level of education in the regional level in India.

To relate the parent's education (father and mother education taken together) with the infant mortality rate in the regional level, their level of education were combined and categorised as (a) both are illiterate, and (b) both have senior secondary and above level of education and is presented in *Figure 1*. The cases where either of the parents is illiterate and both of them have some level of education (i.e. less than 11 years of schooling) are excluded from this particular analysis. The intention in this case was to find out the difference in the IMR with two extreme

Figure 1
Infant Mortality Rate by Parents Education and Region



level of education of the parents, i.e., both of them are illiterate and both of them have more than 10 years of schooling by region. As expected, the IMR has reduced by 24.7 points, 15.7 points and 20.1 points in EAG states, Non-EAG states and major states of India respectively when parents educational level changes from 'illiterate' to 'both have senior secondary and above level of education' as shown in Fig. 1. In comparison to the individual level of education of the father and mother, their combined education reduces the IMR to a greater extent. This is in conjunction with a study from Africa by Kiros and Hogan (2001) that reports a significant reduction of children death with the parents having any level of education compared to when both parents are illiterate.

4.2 Role of Parental Education in the Regional variation of IMR: Logit Estimates

We now turn to analyse the role of parental education in the regional variation of infant mortally using logit models. To check the sensitivity of the results four sets of regressions are estimated. The first three models examine the relationship between infant death and parental education without controlling for other variables, whereas the fourth model analyses the impact of parent's education by controlling the potential confounding factors. In each case, five different equations are estimated to examine the relative risk of infant death by regions. These models include one each for EAG, Non-EAG and major states of India; and within major states of India, two separate equations are estimated to examine the rural-urban differences. The equations have considered 'whether the infant has died or not' as dependent variable and parent's education (mother and father separately), mother's exposure to mass media, socio-economic empowerment of the mother, other related socio-economic factors, accessibility to health care, and demographic characteristics as explanatory variables. The

notation and definition of the variables are given in *Table A1* in appendix. The logit results are presented in *Table 3 & 4* and are discussed under the following headings.

Table 3
Logit Estimates of Infant Death by Parental Education (Model 1 to 3)

Variable	*EAG States (Odds Ratio)*	*Non-EAG States (Odds Ratio)*	*India (Odds Ratio)*		
			Rural	*Urban*	*Total*
Model 1					
Moth_elem	0.88*	0.88	0.87*	0.81***	0.81***
	(0.06)	(0.08)	(0.08)	(0.05)	(0.04)
Moth_sec	0.68***	0.62***	0.57***	0.63***	0.58***
	(0.06)	(0.06)	(0.06)	(0.05)	(0.04)
Moth_higher	0.38***	0.40***	0.35***	0.43***	0.35***
	(0.05)	(0.05)	(0.04)	(0.06)	(0.03)
Log-Likelihood	-5413.0	-3563.6	-2900.6	-6108.2	-9017.7
Constant	-2.53	-2.93	-2.78	-2.62	-2.65
Observations	22778	21821	17152	27447	44599
Model 2					
Fath_elem	1.04	0.86*	0.78**	1.01	0.92
	(0.07)	(0.08)	(0.09)	(0.07)	(0.05)
Fath_sec	0.78***	0.75	0.74***	0.74***	0.72***
	(0.06)	(0.07)	(0.08)	(0.05)	(0.04)
Fath_higher	0.57***	0.48***	0.46***	0.59***	0.50***
	(0.05)	(0.05)	(0.05)	(0.05)	(0.03)
Log-Likelihood	-5332.6	-3560.8	-2894.4	-6039.1	-8954.1
Constant	-2.53	-2.92	-2.79	-2.63	-2.66
Observations	22449	21672	17000	27121	44121
Model 3					
Moth_elem	0.91*	0.91	0.89*	0.83***	0.83***
	(0.07)	(0.08)	(0.09)	(0.06)	(0.05)
Moth_sec	0.77***	0.66***	0.58***	0.70***	0.63***
	(0.07)	(0.07)	(0.07)	(0.06)	(0.04)
Moth_higher	0.45***	0.47***	0.37***	0.50***	0.40***
	(0.07)	(0.07)	(0.06)	(0.08)	(0.04)
Fath_elem	1.07	0.94	0.86	1.08	1.00
	(0.08)	(0.09)	(0.10)	(0.07)	(0.06)
Fath_sec	0.86**	0.93	0.98	0.86**	0.90*
	(0.06)	(0.10)	(0.11)	(0.06)	(0.05)
Fath_higher	0.82*	0.76**	0.89*	0.80**	0.83**
	(0.09)	(0.11)	(0.13)	(0.08)	(0.07)
Log-Likelihood	-5317.2	-3544.7	-2869.2	-6023.2	-8904.6
Constant	-2.51	-2.88	-2.73	-2.59	-2.62
Observations	22447	21672	16998	27121	44119

Notes: (a) * P ≤ 0.10, ** P ≤ 0.05, *** P ≤ 0.01 (b) The entries in parenthesis refer to standard error.
Source: Author's self-computation.

Table 4
Logit Estimates of Infant Death by Parental Education (Model 4)

Variable	*EAG States (Odds Ratio)*	*Non-EAG States (Odds Ratio)*	*India (Odds Ratio)*		
			Rural	*Urban*	*Total*
Moth_elem	0.76***	0.94	0.78***	0.83*	0.80***
	(0.08)	(0.12)	(0.07)	(0.11)	(0.06)
Moth_sec	0.62***	0.65***	0.64***	0.55***	0.59***
	(0.08)	(0.10)	(0.08)	(0.09)	(0.06)
Moth_higher	0.37***	0.49***	0.51***	0.36***	0.40***
	(0.08)	(0.11)	(0.12)	(0.08)	(0.06)
Fath_elem	1.05	0.99	1.08	0.90	1.03
	(0.10)	(0.13)	(0.09)	(0.14)	(0.08)
Fath_sec	0.95	0.83*	0.90*	0.82*	0.85*
	(0.09)	(0.17)	(0.10)	(0.14)	(0.08)
Fath_higher	0.73*	0.64*	0.72*	0.65*	0.67*
	(0.14)	(0.19)	(0.15)	(0.17)	(0.12)
Moth_medexp	0.81**	0.92*	0.70*	0.92*	0.81*
	(0.08)	(0.11)	(0.08)	(0.18)	(0.08)
Moth_empw	0.78***	1.00	0.85**	0.84***	0.83***
	(0.06)	(0.10)	(0.06)	(0.08)	(0.05)
Middle_income	1.00	0.86*	0.93*	0.92	0.92*
	(0.10)	(0.12)	(0.09)	(0.17)	(0.07)
Rich	0.98	0.78*	0.77**	0.95*	0.90*
	(0.13)	(0.13)	(0.10)	(0.15)	(0.09)
Moth_working	0.90*	0.93*	0.86**	0.98*	0.90**
	(0.06)	(0.08)	(0.06)	(0.08)	(0.05)
Caste	0.92*	0.96*	0.98*	0.95	0.97*
	(0.07)	(0.11)	(0.07)	(0.10)	(0.06)
Dwater_pipe	0.90	0.96	0.84**	0.78**	0.80**
	(0.09)	(0.10)	(0.08)	(0.08)	(0.05)
Toilet_Facility	0.94	0.82*	0.80**	0.98*	0.90*
	(0.04)	(0.10)	(0.08)	(0.15)	(0.07)
Delivery_place	0.92**	0.77**	0.85**	0.83**	0.82**
	(0.11)	(0.11)	(0.10)	(0.10)	(0.07)
Moth_20_29	0.66***	0.76*	0.67***	0.88	0.70***
	(0.11)	(0.17)	(0.10)	(0.28)	(0.09)
Moth_30_39	0.51***	0.46***	0.45***	0.70*	0.49***
	(0.10)	(0.12)	(0.08)	(0.24)	(0.08)
Moth_40_49	0.39***	0.82	0.55***	0.20**	0.47***
	(0.11)	(0.32)	(0.13)	(0.13)	(0.11)
Birth_Order_2	0.75***	0.76**	0.73***	0.77**	0.74***
	(0.08)	(0.09)	(0.07)	(0.10)	(0.06)
Birth_Order_3	0.74***	0.84*	0.74***	0.90	0.79***
	(0.09)	(0.13)	(0.08)	(0.15)	(0.07)

Variable	*EAG States (Odds Ratio)*	*Non-EAG States (Odds Ratio)*	*India (Odds Ratio)*		
			Rural	*Urban*	*Total*
Birth_Order_4	0.96	1.08	1.03	1.03	1.03*
	(0.12)	(0.21)	(0.13)	(0.21)	(0.11)
Birth_Order≥5	1.39***	1.67***	1.42***	2.09***	1.55***
	(0.18)	(0.35)	(0.18)	(0.42)	(0.17)
HH_size	0.91***	0.90***	0.93***	0.89***	0.92***
	(0.01)	(0.02)	(0.01)	(0.02)	(0.01)
Log-Likelihood	-3355.1	-2033.9	-2624.8	-1782.3	-5429.3
Constant	-1.34	-1.62	-1.43	-1.83	-1.46
Observations	19824	18429	23118	15135	38253

Notes: (a) * P ≤ 0.10, ** P ≤ 0.05, *** P ≤ 0.01 (b) The entries in parenthesis refer to standard error.
Source: Author's self-computation.

4.2.1 Effect of Mother's Education

The strong association between mothers' education and infant/child mortality is considered as one of the most consistent and powerful finding in public health (Caldwell, 1979; Bicego 1993; Ozaltin *et al,* 2010). A large body of research suggests that a casual relationship exists between maternal education and childhood health and mortality. In the past 30 years, many hypotheses have been proposed for the mechanisms through which increased education could lead to reductions in child mortality, including individual effects through improved use of health services, economic advantages, empowerment and independence of women, and community level effects (Gakidou *et al,* 2010). Caldwell (1979) suggested that educated mothers are more likely to shift from a 'fatalistic' acceptance of health outcomes towards the implementation of simple-health promoting practices. This often includes an increased capacity to manipulate modern medical systems.

Consistent with other studies, the results for major states of India as reported in *Table 3* (*model 1 and model 3*) shows that, mother's education has a significant effect on reducing the probability of infant death. Children of mothers who attended compulsory level of schooling i.e. elementary are less likely to die than are children of mothers who are illiterate. Children of mothers with senior-secondary and above level of education are the least likely to experience infant deaths. Similar finding is noticed in several studies undertaken both in India and international context (Desai and Alva, 1998; Mondal *et al,* 2009; Adeyele and Ofoegbu, 2013; Saikia *et al,* 2013). In EAG and Non-EAG states and also in rural and urban regions the relative risk of infant mortality among the children born to educated mothers is considerably less as compared to the illiterate mothers, except mother's elementary education in Non-EAG states, which is statistically not significant. Furthermore, as expected, the probability of infant death declines with increasing the levels of education of the mothers. More clearly, children born to the mothers having more than 10 years of education (considered as the highest level of education in the analysis) have least risk of dying than the children born to the mothers having lower levels of education i.e. mothers with the educational level of elementary and

secondary, in all the regions (rural-urban and EAG-Non-EAG states). Also, the effect of mother's education on the probability of infant death shows the expected results when taken together with father's education (*Model 3*). It is usually expected that mother's education is correlated with father's education and hence taken together may altered the results, which is not the case in the present analysis. Even after controlling for the cofounding factors, the effects of mother's education in reducing number of infant deaths remained consistent and strongly significant (*Model 4*). All four regression models suggested a significant reduction in the infant death in the regional level in India with the increase in the mother's education. This strongly calls for educating mothers to reduce the infant death in India, irrespective of regions.

Logit estimates show that attending compulsory schooling (elementary level of education) by the mother reduces the infant death in EAG states whereas it does not matter in Non-EAG states, as it is statistically not significant (*Model 1, 3 and 4*). However, the relative risk of infant mortality among the children born to the mothers having 9 to10 years of schooling is lower in Non-EAG states as compared to EAG states. The difference in the odds ratio is highest in *Model 3* i.e., 11 percentage points. But the secondary and above level of education of the mother matters more in EAG states than Non-EAG states in reducing the infant death. Thus, attaining above compulsory level of education by the mother matters more in reducing the probability in infant death in Non-EAG states, whereas in EAG-states, all levels of education matters. This may be due to the fact that in relatively developed states, there may not be much difference between the mothers having no education and having compulsory level of education on reducing infant death.

Studying the role of parental education (particularly mother's education) on infant mortality in rural and urban regions is extremely important in Indian context. It is because of the fact that 1) the infant mortality rate in rural India is significantly higher than urban India and 2) the female literacy rate is lower in rural areas compared to urban regions. According to the 2011 census of India, the IMR is 66 is urban region and 38 in rural region. Similarly, the female literacy is 79.1 in urban areas and 57.9 in rural areas. The attempt to find the effect of mother's education on infant death by region may address the concern that the low level female education is a major hindrance for the rural India to reduce its infant death to that of urban India. This is found to be true in the present analysis. The logit estimates in *Model 4* show that for all level of education of the mother the probability of infant death is lower in urban region as compared to rural region. The difference in the odds ratio being highest (30 percentage points) in case of mothers attainted above secondary level of education. However, the results in *Model 1 and 3* gives mixed results.

4.2.2 Effect of Father's Education

As we have already discussed, several studies have attempted to estimate the impact of mother's education on child health and mortality related issues, including the infant death. However, the impact of father's education on these aspects is less explored. This is mainly

because of the established hypothesis that the mothers play a pivotal role in taking care of the babies in their early days of birth, which of course decides the child health and mortality status to greater extent. But in the changing context, the role of fathers in taking care of their babies, even in the early days of their birth is a reality, though this is more seen in urban region than that of rural region. Thus, one can expect the role of father's education and awareness on his child's health status and mortality. This is found to be true to some extend in the present analysis. The estimated regression results presented in *Table 4* show that the probability of infant death is less for the children whose fathers have secondary, senior secondary and higher level of education compared to the children whose fathers are illiterate. In *model 3 and 4* attending elementary level of education by the father does not matter in reducing the risk of infant death as the coefficients are statistically not significant. However, in *model 2*, the impact of elementary education of the father on infant death is negative and statistically significant in Non-EAG states and rural region. Similarly, for major states of India, infants of the father having elementary level of education experience lower risk of dying than the infants of illiterate fathers (although this result did not reach statistical significance). The probability of infant death is lower for the children whose fathers have secondary level of education as compared to the fathers having elementary level of education. Similarly, the infant death is found to be less among the children whose fathers' having senior secondary and above level of education than having secondary level of education. Attaining senior secondary and above level of education by the father significantly reduces the probability of infant death across all the regions and major states of India. These results suggests for providing minimum of secondary and above level of education to the fathers for an effective reduction of Infant mortality in India.

Comparing the results between EAG and Non-EAG states, it is found that the effect of the highest level of education of the father (i.e. senior secondary and above level of education) on infant death is found to be significantly higher among Non-EAG states than EAG states, the difference in the odds ratio being 9 percentage points after controlling the confounding factors (*Model 4*). The odds ratio of the secondary level of education of the father (Fath_sec) is statistically significant in EAG states in *Model 2 and 3* but statistically not significant in *Model 4*. Thus, though all level of education of the father matters in Non-EAG states, attaining compulsory and above senior secondary level of education matters in EAG states in reducing infant death. As expected, the effect of father's education on reducing infant death is higher in urban region compared to rural region when controlled for other variables. But the effect of secondary level of education of the father on the probability of infant death is statistically not significant in urban region.

4.2.3 Effect of Mother's Mass Media Exposure and Socio-Economic Empowerment

It is expected that controlling all other factors, a mother's exposure to different mass media may reduce the mortality of her children. It may be due the fact that women who are exposed to mass media such as television, radio and newspaper are likely to have access to information on health-care services and ways of enhancing maternal and child health.

Mother's exposure to mass media may also act as an indicator of the economic status of the household. In this analysis, a woman is considered to be exposed to mass media if she listens to radio or watches television or read newspaper at least once a week. Logit estimates show that the children born to the mothers having any kind of exposure to the mass media have lower probability of death in their infant stage compared to the children born to the mothers having no mass media exposure. It is found to be true in all the five equations estimated in the present analysis and the coefficients are statistically significant at 10 per cent level of significance. Interestingly, the effect of mass media exposure on the probability of infant mortality is higher in EAG states than Non-EAG states, the odds ratio being 0.81 and 0.86 respectively. Similarly, mother's mass media exposure considerably reduces the probability of infant death in rural region as compared to urban region. Thus, the results strongly suggest that mother's engagement with the mass media such as watching television, listening radio and reading news paper is an important factor in reducing infant mortality across the regions. This works more effectively in the regions of lower socio-economic status of the people like EAG states and in rural region.

Another important factor which is statistically significant in the determination of infant mortality in EAG and major states and also in rural and urban region is the socio-economic empowerment of the mother. Surprisingly, it turned out to be statistically not significant in Non-EAG states. The result obtained from the analysis may be interpreted as follows: the relative risk of infant mortality is relatively lower if mother alone take decision on different socio-economic aspects of the family (such as mother's health care expenditure, decision on large and daily household purchases, decision on spending husband's money, and decision on visit to family and relatives) as compared to the mother alone does not take such decisions. Similar finding was revealed in a study by Adeyele and Ofoegbu (2013) in Nigerian context. Thus, mothers should be allowed to take decisions on both social and economic matters of the family which will lower down the risk of infant death. This clearly supports the fact that education gives women the power and the confidence to take decision-making into their own hands which helps further to reduce the infant mortality. It is important to note that in EAG states, the effect is higher (than Non-EAG states) and statistically significant at 1 per cent level of significance. Between rural and urban region, the effect is higher in the latter one which supports the general expectation.

4.2.4 Effect of Other Controlling Factors

The other controlling factors included in the logit estimation can broadly be categorised as socio-economic (economic status of the household measured in terms of wealth index, mother's working status, and caste), sanitation (in terms of availability of toilet facility), sources of drinking water, place of delivery, demographic factors (mother's age, birth order of the child, and size of the household).

Among the socio-economic factors, the impact of working status of the mother on the probability of infant death gives some interesting findings. The children born to the working

mothers have lower probability of dying in the infant stage as compared to the children born to the mothers who are not engaged in the job market. Contrary to this, the study by Mustafa and Odimegwu (2008) shows that the risk of infant death is more for the children born to mother working in the agriculture compared to those whose mothers are not working. The finding of the present study does not go with the general assumption that the mothers who are not working in the job market provides better care to their new born children, which reduces the probability of their death in the early ages. The finding rather supports the fact that working mothers have better socio-economic status and also aware of better health care facilities that keeps their children in good health. It is interesting to note that the effect of the mother's working condition on reducing the probability of infant death is higher in EAG states and rural areas compared to Non-EAG states and urban region. This may be due the fact that in these regions the difference in the awareness and other related aspects differs considerably between mothers engaged in the labour force and not engaged in the labour force. Thus, this suggests for encouraging the women to engage in the labour force (particularly in rural region and EAG states) to reduce the infant mortality. As expected, the logit results show that with the increase in the economic status of the households the probability of infant death declines. However, it is surprising to note that it is statistically not significant in EAG states and urban region. The social category/caste of the mother gives the expected results. In all the five estimated equations, children born to scheduled caste and scheduled tribe households have higher probability of dying in the infant stage compared to the children born to forward caste and other backward classes. The effect of caste in the urban region is found to be statistically not significant.

Access to toilet (particularly, a flush or pit toilet) is potentially a very important determinant of infant and child mortality in developing countries, including India. Children in the households that lack such access could have higher probability of affecting with diseases tetanus and digestive disorders than other children (Puffer and Serrano 1973; United Nations, 1985). Quite a few studies have examined the impact of the availability and in some cases the quality of toilet facility on the probability of infant and child mortality, both in India and international context and have found that the access to toilet facilities in household considerably reduces the infant and child mortality (Pandey *et al,* 1998; Kembo and Ginneken, 2009; Mondal *et al*, 2009). The logit estimates in the present analysis reveals the similar finding. However, the impact of the availability of toilet facility in EAG states is found to be statistically not significant. The impact of toilet facility towards reducing the infant mortality in rural region is higher than urban region. The value of odds ratio in rural region is 0.77 whereas it is 0.98 in urban region. This convey the message that the providing toilet facility in rural areas may work as an effective panacea to reduce the infant mortality. It is important to note that the proportion of households without any toilet facility is much greater in rural areas (74%) than in urban areas (17%) in 2005-06.

The effect of the source of drinking water—used as a dummy variable (takes the value 1, if piped water and 0, if from other sources like tube well, drug well and surface) shows the expected result in all the five models. Children born to the households having access to pipe

drinking water are less likely to die in their infant stage compared to the children born to the households getting drinking water from other sources. Quite a few studies in developing and underdeveloped countries have revealed the similar findings (Hossain and Islam, 2008; Kembo and Ginneken, 2009). The effect of the sources of drinking water in reducing the probability of infant death is higher in urban region than that of rural region. However, the coefficients of the sources of drinking water in EAG and non-EAG states are found to be statistically not significant.

It is evident from the result that (*model 4, Table 4*) the probability of infant death is lower among the mothers who have gone for institutional deliveries as compared to the mothers who have delivered their babies in the home. The value of the odds ratio is 0.82 for major states of India. Similarly, there is also an inverse relationship between the place of delivery and the risk of infant death in the regional level. However, as expected, the effect is higher in urban region than that of rural region. It may be due to the fact that the existing hospitals in the rural region are lacking the trained medical professionals than that of urban region. Thus, the new born babies in the rural hospitals are not getting proper care which leads for infant deaths. Also, the effect of institutional delivery on reducing the risk of infant death is higher in Non-EAG states as compared to EAG states. The result may imply the availability of better quality health care services in the Non-EAG states in India compared to EAG states.

Demographic characteristics may have an effect on the probability of infant death. In the present analysis four different demographic factors are considered in the logit estimation. These are age of the mother, birth order of the child, and size of the household. The supporting arguments for including these variables in the estimation are given in section 3 on data and methodology. Logit estimates clearly demonstrate that the probability of infant death is lower for the children born to the older mothers (age more than 20) as compared to younger mothers, age being less than 20. This is true for all the five equations estimated in this study. But the coefficient for the urban region is statistically not significant, which may be due to the considerably lees sample size in this group i.e., less than 2 per cent. The relative risk of infant mortality declines further with the increase in the mother's age from 20-29 to 30-39 and the coefficients are statistically significant at 1 per cent level, except the urban region which is significant at 10 per cent level of significance. Increase in the mother's age from 30-39 to 40-49 gives mixed results for different regions of India. In case of major states, and rural region the risk of infant mortality increases whereas in urban region and EAG states it declines. The coefficient associated with Non-EAG states is statistically not significant. In each case the effect of mother's age on infant mortality is found to be higher in rural region and EAG states as compared to urban region and non-EAG states respectively. The results analysed here partially supports the general argument that the children born to mothers under 20 or around 40 years old are likely to have elevated risks of mortality. Very young mothers may experience difficult pregnancies and deliveries because of their physical immaturity. They are also likely to have limited knowledge and confidence in caring for infants and young children. Women around 40 years old may also experience age-related problems during pregnancy and delivery (Pandey *et al*, 1998). A similar picture emerges in a

study by Babson and Clarke (1983). They have found that in the neonatal period, a significantly greater overall mortality occurred in infants born to the younger mothers and the reason was to give birth of low weight babies by younger mothers.

As already noted in section 3, the relation between birth order and infant mortality is not well understood. But it is generally expected that higher birth order (to a certain extent) reduces the mortality risk. The logit results show that the risk of mortality is less for the second and third born child as compared to first born child and it is true in all the five equations. However, the probability of infant death increases with the further increase in the birth order. This confirms the U shape of the relationship between birth order of the child and infant death. The studies in the context of under developed countries like Zimbabwe and Kenya shows similar findings (Mustafa and Odimegwu, 2008; Kembo and Ginneken, 2009). Infants of birth order six or higher are 2.75 times more likely to die in infancy relative to births of order two through five.

The size of the household may have a direct or inverse relationship with the infant mortality. The results for all the five cases here show that the children born in the large households are less likely to die in their infant stage than the children born to small families. This may be due to the fact that the children born to joint families might have got good health care from their elders which help them to be well. On the contrary, children born to small households (usually nuclear families) may not get good health care from other family members which increase their risk of dying in the early stage of their birth. However, this needs to be examined in detail. The logit results show that in the major states of India the probability of female infant mortality is higher than male children and the coefficient is significant at 10 per cent level of significance.

5. Conclusions

The present study has primarily examined the role of mother's and father's education in reducing the infant mortality in EAG-Non-EAG states and rural-urban regions in India. Although the main focus of the paper was to examine the effect of education, an attempt was also made to analyse the impact of mother's exposure to mass media and her socio-economic empowerment that are closely related to education on infant mortality. Besides these, the effect of other confounding factors broadly be categorised as socio-economic (economic status of the household measured in terms of wealth index, mother's working status, and caste), sanitation (in terms of availability of toilet facility), sources of drinking water, accessibility to health care, and demographic factors (mother's age, birth order of the child, and size of the household,) on infant mortality is also examined. The paper has uncovered several interesting findings—some expected and some unexpected.

While the overall infant mortality is 57 in major states of India, the analysis shows that it varies enormously by parental education and regions. As expected, the IMR is higher in rural region and EAG states compared to urban region and Non-EAG states in India. Educational

attainment of both mother and father has an inverse relationship with the IMR in major states of India, EAG -Non-EAG states, and between rural-urban regions. However, there exists a wide regional variation in the rate of decline in the IMR by level of education of the mother and father. The intention to examine the difference in the IMR with two extreme level of education of the parents, i.e., both of them are illiterate and both of them have more than 10 years of schooling shows the expected result and suggests that in comparison to the individual level of education of the father and mother, their combined education reduces the IMR to a greater extent.

The regression results show that both mother's and father's education are significantly associated in reducing the infant mortality across the regions and major states of India, although the relative effect of different levels of education of the parents varies between EAG-Non-EAG states and rural-urban regions. Analysis suggests that attaining above compulsory level of education by the mother matters in reducing the probability in infant death in Non-EAG states, whereas in EAG-states, all levels of education matters. This may be due to the fact that in relatively developed states, there may not be much difference between the mothers having no education and having compulsory level of education on reducing infant death.

As per the father's education is concerned, in most of the cases the effect of elementary education on the risk of infant death is found to be statistically not significant. However, the attaining secondary, senior secondary and higher level education gives the expected results. Thus, it calls for providing minimum of secondary and above level of education to the fathers for an effective reduction of Infant mortality in India. But this result should not be construed as implying that taking up to elementary level of education by the fathers is not important. Rather, it suggests that initiatives should be taken to educate fathers beyond elementary which has a strong effect on reducing infant mortality in India. This study was able to find out that the children born to the mothers having any kind of exposure to the mass media have lower probability of death in their infant stage compared to the children born to the mothers having no mass media exposure and it works more effectively in the regions that are underdeveloped such as EAG states and rural areas. The effect of different controlling factors included in the logit model gives more or less expected results.

The paper concludes that the benefits of parental education in reducing infant death endure even when other socio-economic factors are taken into account. The findings reached in this paper emphasise to provide education to the parents, particularly to mothers of backward regions or states, which are crucial for reducing infant mortality. Besides parent's education attempt should also be made to increase the scope of getting mass media exposure and higher level of socioeconomic empowerment of the mother (two factors that are closely related with education) to reduce the infant mortality in India.

References

Adeyele, I.T. and D.I. Ofoegbu (2013), Infant and Child Mortality in Nigeria: An Impact Analysis, International Journal of Economic Practices and Theories, 3 (2): 122-32.

Babson, S.G., and N.G. Clarke (1983), Relationship between infant death and maternal age. Comparison of sudden infant death incidence with other causes of infant mortality, Journal of Pediatrics, 103 (3): 391-93.

Basu, A. M. and R. Stephenson (2005), Low Levels of Maternal Education and the Proximate Determinants of Childhood Mortality: A Little Learning is Not a Dangerous Thing, Social Science and Medicine, 60 (9): 2011-23.

Bobak, M., H. Pikhart and I. Koupilová (2000), Maternal socioeconomic characteristics and infant mortality from injuries in the Czech Republic 1989–92, Injury Prevention; 6 (3):195-98

Census of India (2011), Primary Census Abstract, Figures at a Glance, New Delhi: Office of the Registrar General of India.

Caldwell, J. (1979), Education as a Factor in Mortality Decline: An Examination of Nigerian Data, Population Studies, 33 (3): 395-413.

Caldwell, J. (1994), How is greater maternal education translated into lower child mortality? Health Transition Review, 4 (2): 224-29.

Caldwell, J. and McDonald, P. (1982), Influence of maternal education on infant and child mortality: levels and causes, Health Policy and Education, 2 (3-4): 251-67.

Das, N.P. and D. Dey (2003), Understanding the causative factors behind stalling of infant mortality in India during the recent period, Demography India, 32 (2): 249-73.

Desai, S. and Soumya Alava (1998), Maternal Education and Child Health: Is there a Strong Causal Relationship? Demography, 35 (1): 71-81.

Gakidou, E., K. Cowling, R. Lozano, and C.J.L. Murray (2010), Increased educational attainment and its effect on child mortality in 175 countries between 1970 and 2009: a systematic analysis, Lancet, 376 (9745): 959-74.

Gemperli, A., P. Vounatsou, I. Kleinschmidt, M. Bagayoko, C. Lengeler, and T. Smith (2004), Spatial Patterns of Infant Mortality in Mali: The Effect of Malaria Endemicity, American Journal of Epidemiology, 159 (1): 64–72.

Govindasamy, P. and B.M. Ramesh (1997), Maternal education and utilization of maternal and child health services in India, NFHS Subject Reports, Number 5, IIPS, Mumbai.

Gunasekaran, S. (2005), Differentials and Determinants of Infant and Child Mortality in Rural India, XXV International Population Conference, Tours, France, July 18-23, http://iussp2005.princeton.edu/papers/51367 (Accessed on 5th December 2012).

Gupta, M.D. (1990), Death Clustering, Mothers' Education and the Determinants of Child Mortality in Rural Punjab, India, Population Studies, 44 (3): 489-505.

Hossain, M. and M. Islam (2008), Effects of Demographic and Household Variables on Infant and Child Under-five Mortality: An Application of Logistic Model, The Internet Journal of Health, 8 (2): 1-9.

International Institute for Population Sciences (IIPS) ORC Macro (2007), National Family Health Survey (NFHS-3), 2005-06: India. Vol. 1, Mumbai: IIPS.

Kapoor, S. (2010), Infant mortality rates in India: District level variations and correlations, http://www.isid.ac.in/~pu/conference/dec_10_conf/Papers/ShrutiKapoor.pdf (Accessed on 5th December 2012)

Kembo, J. and J.K.V. Ginneken (2009), Determinants of infant and child mortality in Zimbabwe: Results of multivariate hazard analysis, Demographic Research 21 (13): 367-84.

Khasakhala, A.A. (2003), Effect of maternal education on infant survival in rural Kenya, Demography India, 30 (2): 93-106.

Kiros, G.E. and D.P. Hogan (2001), War, famine and excess child mortality in Africa: the role of parental education, International Journal of Epidemiology, 30 (3): 4447-55.

Kravdal, Q. (2004), Child mortality in India: The community-level effect of education, Population Studies, 58 (2): 177-92.

NIMS, ICMR and UNICEF (2012), Infant and Child Mortality in India: Levels, Trends and Determinants, National Institute of Medical Statistics, Indian Council of Medical research, and UNICEF India Country Office, New Delhi, India.

Pandey, A., M.K. Choe, N.Y. Luther, D. Sahu, and J. Chand (1998), Infant and Child Mortality in India, National Family Health Survey Subject Reports, Number 11, IIPS, Mumbai.

Papageorgiou, C. and P. Stoytcheva (2012), Education Inequality among Women and Infant Mortality: A cross-country empirical investigation, Progress in Economic Research, Nova Science Publishers, New York, NY. http://www.chrispapageorgiou.com/papers/PS.pdf (Accessed on 5th November 2012)

Puffer, R.R., and Carlos V. Serrano (1973), Patterns of mortality in childhood: Report of the Inter-American Investigation of Mortality in Childhood. Washington, D.C.: Pan American Health Organization.

Rama Rao S., A. Pandey, and K.I. Shajy (1997), Child Mortality in Goa: A cross-sectional analysis, Biodemography and Social Biology, 44 (1-2): 101-10.

Registrar General of India (2011), Sample Registration System Statistical Report, Vital Statistics Division, New Delhi: Office of the Registrar General of India.

Singh, A., P.K. Pathak, R.K. Chauhan, and W. Pan (2011), Infant and Child Mortality in India in the Last Two Decades: A Geospatial Analysis, PLoS ONE, 6 (11): 1-19.

Saikia, N., A. Singh, D. Jasilionis, and F. Ram (2013), Explaining the rural-urban gap in infant mortality in India, Demographic Research, 29 (18): 473-506.

Singh-Manoux, A., A. Dugravot, G. D. Smith, M. Subramanyam, and S.V. Subramanian (2008), Adult education and child mortality in India: the influence of caste, household wealth, and urbanization, Epidemiology, 19 (2): 294-301.

Titaley, C., M.J. Dibley, K. Agho, C.L. Roberts, J. Hall (2008), Determinants of neonatal mortality in Indonesia. BMC Public Health 8:232.

Uddin, J., and Z. Hossain (2008), Predictors of Infant Mortality in a Developing Country, Asian Journal of Epidemiology, 1 (1):1-16.

United Nations (1985), Socio-economic differentials in child mortality in developing countries, Department of International Economic and Social Affairs, New York: United Nations.

Wang, L. (2003), Determinants of child mortality in LDCs: Empirical findings from demographic and health surveys, Health Policy, 65 (3): 277-99.
Ware, H. (1984), Effects of Maternal Education, Women's Roles, and Child Care on Child Mortality, Population and Development Review, 10 (supplement): 191-214.
World Health Organization (2012), World Health Statistics, Geneva: WHO Press.

Appendix

Table A1
Notation and Definition of the Variables used in the Logit Model

Notation	*Name*	*Definition*
Explanatory Variables		
Mother Education	Education level of the mother (dummy variables)	
Moth_illiterate^{R}	Mother is illiterate	= 1, if mother is illiterate = 0, otherwise
Moth_elem	Mother has elementary level of education	= 1, if mother is having 1 to 8 years of schooling = 0, otherwise
Moth_sec	Mother has secondary level of education	= 1, if mother is having 9 to 10 years of schooling = 0, otherwise
Moth_higher	Mother has senior secondary and above level of education	= 1, if mother is having 11 or more years of schooling = 0, otherwise
Father Education	Education level of the father (dummy variables)	
Fath_illiterate^{R}	Father is illiterate	= 1, if father is illiterate = 0, otherwise
Fath_elem	Father has elementary level of education	= 1, if father is having 1 to 8 years of schooling = 0, otherwise
Fath_sec	Father has secondary level of education	= 1, if father is having 9 to 10 years of schooling = 0, otherwise
Fath_higher	Father has senior secondary and above level of education	= 1, if father is having 11 or more years of schooling = 0, otherwise
Moth_medexp	Mother exposure to media (dummy variable)	= 1, if mother listens radio or watches TV or read news paper = 0, if mother does not listen radio or watches TV or read news paper
Moth_empw	Socio-economic empowerment of the mother (dummy variable)	= 1, if mother alone take decision on different socio-economic aspects of the family = 0, if mother alone does not take decision on different socio-economic aspects of the family
Household Economic Status	Economic Status of the Household (dummy variables)	
Poor^{R}	Household is poor	= 1, if the household is poor = 0, otherwise
Middle_income	Household is lying in the middle income category	= 1, if the household is lying in the middle income category = 0, otherwise
Rich	Household is rich	= 1, if the household is rich

Notation	*Name*	*Definition*
		= 0, otherwise
Moth_working	Working status of the mother	= 1, if the mother is working = 0, otherwise i.e. if the mother is not working
Dwater_pipe	Drinking water facility in the household (dummy variable)	= 1, if the household is getting pipe drinking water = 0, otherwise i.e. if the household is using tube well or drug well or surface water for drinking purpose
Toilet_Facility	Whether the household having toilet or not	= 1, if the household is having toilet = 0, otherwise i.e. the household is not having toilet
Delivery_place	Mother's place of the delivery	= 1, if institutional delivery = 0, otherwise i.e. home delivery
Mother Age	Age of the mother (dummy variables)	
Moth_less_20^{R}	Mother is less than 20 years old	= 1, if the mother is less than 20 years old = 0, otherwise
Moth_20_29	Mother is 20 to 29 years old	= 1, if the mother is 20 to 29 years old = 0, otherwise
Moth_30_39	Mother is 30 to 39 years old	= 1, if the mother is 30 to 39 years old = 0, otherwise
Moth_40_49	Mother is 40 to 49 years old	= 1, if the mother is 40 to 49 years old = 0, otherwise
Birth Order	Birth order of the child (dummy variables)	
Birth_Order_1^{R}	First child of the mother	= 1, if the birth order of the child is 1 = 0, otherwise
Birth_Order_2	Second child of the mother	= 1, if the birth order of the child is 2 = 0, otherwise
Birth_Order_3	Third child of the mother	= 1, if the birth order of the child is 3 = 0, otherwise
Birth_Order_4	Fourth child of the mother	= 1, if the birth order of the child is 4 = 0, otherwise
Birth_Order≥5	Fifth child or more	= 1, if the birth order of the child is 5 or more = 0, otherwise
HH_size	Household size	Total members of the household
Caste	Caste of the students (dummy variables)	= 1, if the student belongs to scheduled castes and scheduled tribes = 0, otherwise (includes students belongs to other backward classes and general category)
Dependent Variable		
IMR	Infant Mortality Rate (dummy variable)	= 1, if the infant has died = 0, otherwise i.e. if the infant is alive

Notes: R used as reference category in the logit estimations, results given in Table 4.

Table A2
Summary Statistics

Variables	*NOB*	*Mean*	*SD*	*Min*	*Max*
Moth_illiterate	44599	0.45	0.50	0	1
Moth_elem	44599	0.21	0.41	0	1
Moth_sec	44599	0.21	0.40	0	1
Moth_higher	44599	0.13	0.34	0	1
Fath_illiterate	44121	0.26	0.44	0	1
Fath_elem	44121	0.22	0.42	0	1
Fath_sec	44121	0.30	0.46	0	1
Fath_higher	44121	0.21	0.41	0	1
Moth_medexp	44550	0.73	0.44	0	1
Moth_empw	43087	0.45	0.50	0	1
Poor	44601	0.38	0.49	0	1
Middle_income	44601	0.19	0.39	0	1
Rich	44601	0.43	0.49	0	1
Moth_working	44601	0.33	0.62	0	1
Caste	42593	0.70	0.46	0	1
Dwater_pipe	41972	0.42	0.49	0	1
Toilet_Facility	41922	0.48	0.50	0	1
Delivery_place	44601	0.45	0.49	0	1
Moth_less_20	44601	0.03	0.16	0	1
Moth_20_29	44601	0.65	0.48	0	1
Moth_30_39	44601	0.29	0.46	0	1
Moth_40_49	44601	0.03	0.17	0	1
Birth_Order_1	44601	0.32	0.47	0	1
Birth_Order_2	44601	0.28	0.45	0	1
Birth_Order_3	44601	0.16	0.37	0	1
Birth_Order_4	44601	0.10	0.30	0	1
Birth_Order≥5	44601	0.14	0.35	0	1
HH_size	44601	6.81	3.29	1	35

Note: The number of observations (NOB) is 44,601 except for some variables with missing information. Means and SD are reported, which were corrected for the differences in sampling probabilities.

List of ISID Working Papers

156 The "Special Category State" Conundrum in Odisha, *Nilmadhab Mohanty*, October 2013

155 *WP02:* Medical Devices Manufacturing Industry in India: Market Structure, Import Intensity and Regulatory Mechanisms, *ISID-PHFI Collaborative Research Programme: Working Paper Series, Pritam Datta, Indranil Mukhopadhyay & Sakthivel Selvaraj*

154 *WP01:* Changing Pattern of Public Expenditure on Health in India: Issues and Challenges, *ISID-PHFI Collaborative Research Programme: Working Paper Series, Shailender Kumar Hooda*

153 *WP2013/04:* Currency Concerns under Uncertainty: Case of China, *Sunanda Sen*

152 *WP2013/03:* Structural Changes in Indian Private Corporate Sector, *M.R. Murthy & K.V.K. Ranganathan*

151 *WP2013/02:* Growth and Structural Changes in Indian Industry: Oraganised Sector, *T.P. Bhat*

150 *WP2013/01:* Economic Growth and Employment Linkages: The Indian Experience, *T.S. Papola*

149 *WP2012/07:* Employment Growth in the Post-Reform Period, *T.S. Papola*

148 *WP2012/06:* Estimation of Private Investment in Manufacturing Sector and Determinants in Indian States, *Jagannath Mallick*

147 *WP2012/05:* Regional Disparities in Growth and Human Development in India, *Satyaki Roy*

146 *WP2012/04:* Social Exclusion and Discrimination in the Labour Market, *T.S. Papola*

145 *WP2012/03:* Changing Factor Incomes in Industries and Occupations: Review of Long Term Trends, *Satyaki Roy*

144 *WP2012/02:* Structural Changes in the Indian Economy: Emerging Patterns and Implications, *T.S. Papola*

143 *WP2012/01:* Managing Global Financial Flows at the Cost of National Autonomy: China and India, *Sunanda Sen*

142 *WP2011/05:* High Non-Wage Employment in India: Revisiting the 'Paradox' in Capitalist Development, *Satyaki Roy*

141 *WP2011/04:* Trends and Patterns in Consumption Expenditure: A Review of Class and Rural-Urban Disparities, *Satyaki Roy*

---

* Most of the working papers are downloadable from the institute's website: http://isidev.nic.in/ or http://isid.org.in/

About the ISID

The Institute for Studies in Industrial Development (ISID), successor to the Corporate Studies Group (CSG), is a national-level policy research organization in the public domain and is affiliated to the Indian Council of Social Science Research (ICSSR). Developing on the initial strength of studying India's industrial regulations, ISID has gained varied expertise in the analysis of the issues thrown up by the changing policy environment. The Institute's research and academic activities are organized under the following broad thematic areas: *Industrialization; Corporate Sector*; *Trade, Investment and Technology*; *Regulatory Mechanism*; *Employment*; *Public Health*; *Media Studies*; and *Other Issues*.

ISID has developed databases on various aspects of the Indian economy, particularly concerning industry and the corporate sector. It has created On-line Indexes of 203 Indian Social Science Journals (OLI) and 18 daily English Newspapers. More than one million scanned images of Press Clippings on diverse social science subjects are available online to scholars and researchers. These databases have been widely acclaimed as valuable sources of information for researchers studying India's socio-economic development.

About the PHFI

The Public Health Foundation of India (PHFI) is a public private initiative that has collaboratively evolved through consultations with multiple constituencies including Indian and international academia, state and central governments, multi & bi-lateral agencies and civil society groups. PHFI is a response to redress the limited institutional capacity in India for strengthening training, research and policy development in the area of Public Health.

Structured as an independent foundation, PHFI adopts a broad, integrative approach to public health, tailoring its endeavours to Indian conditions and bearing relevance to countries facing similar challenges and concerns. The PHFI focuses on broad dimensions of public health that encompass promotive, preventive and therapeutic services, many of which are frequently lost sight of in policy planning as well as in popular understanding.

Institute for Studies in Industrial Development
4, Institutional Area Phase II, Vasant Kunj, New Delhi - 110 070
Phone: +91 11 2676 4600 / 2689 1111; *Fax*: +91 11 2612 2448
E-mail: info@isid.org.in; *Website*: http://isid.org.in

KNOWLEDGE TO ACTION phfi PUBLIC HEALTH FOUNDATION OF INDIA

ISID