

**SOCIOECONOMIC FACTORS OF EARLY CHILDHOOD
MORTALITY IN ETHIOPIA: EVIDENCE FROM DEMOGRAPHIC
AND HEALTH SURVEY**

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Socioeconomic Factors of Early Childhood Mortality in Ethiopia: Evidence from Demographic and Health Survey

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Abstract

Childhood mortality rates are important summary indicators of social development, quality of life, overall health, maternal health and welfare. Childhood deaths are mainly caused by preventable and communicable diseases and poor coverage of health, especially in the case of underdeveloped countries. This implies the socioeconomic nature of the issue besides its intrinsic health nature. This study identifies the socioeconomic factors causing childhood mortality in Ethiopia based on the Ethiopian Demographic and Health Survey conducted in 2005. Identifying the important factors will help in policy formulation and intervention designing, should the country meet reduction of the infant and child mortality rates to the one set by the Millennium Development Goals. This study employs a probit model to identify these socioeconomic factors and finds maternal education, maternal age at first birth, age of the child and size of the household to significantly and negatively affect child mortality. On the other hand, twin births and male children are found to have a higher relative chance of dying before seeing their fifth birthday. Based on the findings, the study suggests some recommendation for designing intervention and policy formulations.

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I. Introduction:

High levels of infant and child mortality are among the typical characteristics of least developed and developing countries. Child mortality is one manifestation of the poor socioeconomic conditions that a certain community or a country in general faces. Infant and child mortality rate is an indicator that is becoming more popular and is commonly quoted on the agendas of public health and international development agencies. Mutunga (2007) credits the United Nation's Millennium Development Goals (MGDs)² for the renewed attentions to the indicator.

Infant and child mortality has this socioeconomic nature as most such deaths result from diarrhea, respiratory infections, malaria, measles and other immunizable childhood infections, which are preventable and curable in high-income economies. There is a visible correlation between the level of development of a society and the infant and child mortality rates. For instance, ten million infants and children under the age of five die each year with large variation in under five mortality rate across regions and countries; developing countries having the highest, according to Espo 2002 (as cited by Mutunga 2007).

The situation of early childhood mortality in Ethiopia has improved between the years 1990 and 2008. For instance, the under five mortality rate³ declined from 210 in 1990 to 109 in 2008 (UNICWF). Despite this drop in childhood mortality, the current rate is still too high to be comfortable with and turn attention to other issues.

As mentioned above, Ethiopia is performing poorly in reducing childhood mortality, despite the fact that most of the causes of early childhood deaths are preventable diseases. Improving the living standard and environmental conditions could easily prevent incidence of these diseases and significantly reduce deaths. On the other hand, a neglected environment is a threat for health of both children and adults. According to Iram and Butt (2008), root of infant mortality is in the uneven distribution of resources or lack of resources.

Poverty also influences health because it largely determines an individual's environmental risks, as well as access to resources to deal with those risks (Mutunga 2007). Households with better income are able to afford better health care as well as housing and sanitary conditions, such as clean water and toilet facilities.

The objective of this study is to identify the socioeconomic determinants of child mortality in Ethiopia, bearing the fact that childhood mortality is of socioeconomic issue in addition to its intrinsic health nature. Specifically we try to identify how the personal characteristics of the mother and the living environment affect the chance of a child's survival or death.

Our research analyzes the data from the Ethiopian Demographic and Health Survey (EDHS) to identify the structural relationship between child mortality and personal and household conditions that the child lives in. Based on the discrete nature of the dependent variable, we employed a discrete choice model to model the problem.

² One of the goals of the MGDs is to reduce the level of child mortality to two-thirds of what it was in the year 1990 by 2015

³ The rates of childhood mortality are expressed as the number of deaths before the age of five per 1,000 live births.

Section II below summarizes some of the literatures in childhood mortality. Then the descriptive analysis is presented in section III. In section IV we have the empirical analysis and findings. And finally section V concludes and gives some recommendation of the study.

II. Summary of Related Studies:

Mutunga (2007) set the theoretical framework for analysis of childhood mortality as health production function following Schultz (1984). This function captures the structural relationship between health outcomes and the household's behavioral variables, such as nutrition, breastfeeding, child spacing, etc. In the framework of health production function, childhood mortality risks depend on both observed health inputs and unobserved biological endowments on frailty.

Socio-economic variables such as cultural, social, economic, community and religion factors are considered to be exogenous. Biomedical factors like breastfeeding patterns, hygiene, etc. are modeled as endogenous and as having direct effect on health outcomes, while that of socio-economic ones as indirect as they work through the biomedical factors (Mutunga 2007)

Table 1: Summary of related empirical studies

| Study | Data source and Model(s) fitted | Results | | | Discussion |
|--|---|-------------------------------|----------------|---------------|---|
| | | Significant variables | Resulting sign | Expected sign | |
| Fitsum (2009), socioeconomic determinants of childhood mortality in rural Ethiopia | Ethiopian Rural Household Survey (ERHS) <i>Probit</i> model | Non-food per-head consumption | (-) | (-) | Household size and the education of the household head yielded unexpected sign. |
| | | Household size | (-) | (+) | |
| | | Safe water | (-) | (-) | |
| | | Education of household head | (+) | (-) | |
| Iram and Butt (2008), socioeconomic factors of childhood mortality in Pakistan | Pakistan Integrated Household Data (PIHD) Sequential <i>probit</i> model | Maternal Educated | (-) | (-) | Age at marriage is positive for early and late ages negative in between. Safe water was found to be positive and insignificant. |
| | | Working mother | (+) | (+) | |
| | | Age at marriage | (+) | (+) | |
| | | Child is male | (-) | (+) | |
| | | Child vaccinated | (-) | (-) | |
| | | Access to sanitation | (-) | (-) | |
| Mutunga (2007), environmental determinants of child mortality in Kenya | Kenyan Demographic and Health Survey (KDHS) | Child is male | (+) | (+) | The finding suggests that larger households have better chance of child survival, which is unexpected. |
| | | Child is twin | (+) | (+) | |
| | | Square of maternal age | (+) | (+) | |
| | Weilbull (parametric) and Cox (Semi-parametric) | Household size | (-) | (+) | |
| | | Maternal age | (-) | (-) | |
| | | Maternal education | (-) | (-) | |
| | | Safe water | (-) | (-) | |
| | | Access to sanitation | (-) | (-) | |
| | | Less polluting fuel | (-) | (-) | |
| | | Income | (-) | (-) | |

(cont.)

| Study | Data source and Model(s) fitted | Results | | | Discussion |
|--|--|-------------------------------|----------------|---------------|---|
| | | Significant variables | Resulting sign | Expected sign | |
| Ladusingh and Singh (2006), place, community education, sex and child mortality in north-east India | Indian National Family Health Survey (INFHS) | Maternal education | (-) | (-) | Access to sanitation is proxied by availability of toilet for the household. Community elders are considered due to their role in making decisions regarding community level infrastructures. |
| | | Education of community elders | (-) | (-) | |
| | Multilevel logistic model | Child is male | (+) | (+) | |
| | | Working mother | (+) | (+) | |
| | | Maternal age | (-) | (-) | |
| | | Have toilet | (-) | (-) | |
| | | High standard of living | (-) | (-) | |
| Jacoby and Wang (2004), child mortality in rural China | China National Health Survey (CNHS) | Safe water | (-) | (-) | Education stands for universal primary education for female |
| | | Maternal Education | (-) | (-) | |
| | Competing risk model | | | | |
| Klaauw and Wang (2004), child mortality in rural India | Indian National Health Survey (INHS) | Maternal education | (-) | (-) | Inclusion of electricity is unique for this study. |
| | | Indoor pollution | (+) | (+) | |
| | | Electricity | (-) | (-) | |
| | Flexible duration model | Sanitation | (-) | (-) | |
| Gebremariam (2001), studied diarrheal (which is major cause of morbidity and mortality of children in many developing countries) morbidity among young children in Eritrea | Eritrean Demographic and Health Survey (ErDHS) | Child age | (-) | (-) | The material the floor, which is related to in-house sanitation, is made of is unique for this study, it is significant and positive. |
| | | Household size | (+) | (+) | |
| | | Dirt floor | (+) | (+) | |
| | Logistic regression | Have toilet | (-) | (-) | |
| | | Maternal education | (-) | (-) | |
| | | Live in the rural | (+) | (+) | |

Several socioeconomic factors have been found to be associated with infant and child mortality in the developing countries. However, the relative importance of these socioeconomic factors varies from society to society based on their level of development (Iram and Butt 2008).

Many empirical studies also show that health outcome is a result of different socioeconomic inputs. The results of the studies reviewed above confirm this claim. Besides confirming this argument, the studies also identify the direction of influence of these socioeconomic factors. The empirical literatures show that socioeconomic and environmental conditions are very important in explaining infant and child mortality in many developing countries. Almost in cases, the role of mother's education is important. Some of the studies argue that maternal education can affect child mortality in two ways. The first way is that educated mothers are more health conscious and they take a better care of their children, while the second channel is that education delays the age that the woman gives her first birth. The other important attributes of a household with respect to childhood mortality are sanitation (represented by availability of toilet), access to safe drinking water, economic status of the household (income) and location of the household (urban versus rural). The gender of the child was also considered to be important factor of child mortality in some of the studies despite contradicting results.

III. Descriptive Analysis:

According to CSA (2005) the Ethiopia Demographic and Health Survey (EDHS) was conducted under the auspices of the Ministry of Health and implemented by Central Statistical Agency (CSA). The first ever Demographic and Health Survey (DHS) in Ethiopia was conducted in 2000. The primary objective of the 2005 EDHS was to provide up-to-date information for policy makers, planners, researchers and programme managers, which would allow guidance in the planning, implementation, monitoring and evaluation of population and health programmes in the country.

The information obtained from the EDHS, in conjunction with statistical information obtained from the Welfare Monitoring Survey (WMS) and Household Income, Consumption and Expenditure Survey (HICES), will provide critical information for the monitoring and evaluation of the country's Plan for Accelerated and Sustained Development to End Poverty (PASDEP), the various sector development policies and programmes, and assist in the monitoring of the progress towards meeting the Millennium Development Goals (MDGs). The 2005 EDHS information on the population and health situation, covering topics on family planning, fertility levels and determinants, fertility preferences, infant, child, adult and maternal mortality, maternal and child health, nutrition, malaria, women's empowerment, and knowledge of HIV/AIDS (ibid).

The target population for this study is children below five years of age and their mothers. The study subjects considered for this study are women in the reproductive age (between 15 and 49 years). The average age of these women is 32 years. The sample was drawn from nine regional states and two city-administrations in a nationally representative way. Among these sample units, 87 percent are from rural areas while the remaining 13 percent are from urban.

When we look at the educational status, the majority (around 81 percent) have no education. Fourteen percent attended primary education, 5 percent attended secondary and only less than one percent attended higher education. The situation of access to safe water is much better than that of education. Fifty-nine percent reported to have access to safe water while the remaining 41

percent does not. On the contrary, majority of the respondents do not have any form of toilet while the remaining minority, the 34 percent, has some sort of toilet facility.

Table 2: Sampling distribution by region

| Region | Freq. | Percent |
|-------------------|--------|---------|
| Tigray | 1,469 | 9.91 |
| Afar | 880 | 5.94 |
| Amhara | 2,313 | 15.61 |
| Oromiya | 2,786 | 18.8 |
| Somali | 858 | 5.79 |
| Benishangul-Gumuz | 1,133 | 7.64 |
| SNNP | 2,680 | 18.08 |
| Gambela | 783 | 5.28 |
| Harari | 741 | 5 |
| Addis Ababa | 537 | 3.62 |
| Dire Dawa | 642 | 4.33 |
| Total | 14,822 | 100 |

Source: Own computation using EDHS-2005 data

Availability of electricity concentrates around urban areas. From our respondents, only thirteen percent have electricity. When considering the main materials from which the floor materials of the houses is made, 91 percent of the houses have dirt floor where the remaining 9 percent are made from either wood planks, parquet, vinyl, cement or carpet.

Table 3: Percentage of households having access to electricity by type of place of residence

| Type of place of residence | Percentage of households having access to electricity |
|----------------------------|---|
| Urban | 78 |
| Rural | 3 |
| Total sample | 13 |

Source: Own computation using EDHS-2005 data

A typical household has around six while the smallest stand at one and the maximum at nineteen. Eighty-three percent of these households have male heads. On the average, women give their birth at around their 18th birthday, but the minimum age of giving first birth is reported to be 9 years while the maximum is 40 years. For this study we eliminated those who reported to have given their first births at ages below 12.

The children of interest are composed of almost similar proportion in terms of gender, with 53 and 47 percent for male and female children respectively. On the other hand, only 3 percent of them are twins.

The variables considered in the econometric model are summarized in table 4. The dependent variable is defined to be one if a child dies before the age of five and zero if the child is below five and still alive at the time of the survey. By this definition, we eliminated those who lived to see their fifth birthday.

The explanatory variables are of three type, the first one being maternal characteristics such as the educational attainment of the mother, her age when giving her first birth and the square of the maternal age at first birth (Iram and Butt, 2008; Mutunga,2007; Ladusingh and Singh, 2006; Jacoby and Wang, 2004; Klaauw and Wang, 2004 and Gebremariam 2001).

In order to control for the child related biological characteristics, we included a second group variables, namely whether or not the child is a twin, the age of the child and child gender. (Iram and Butt, 2008; Mutunga, 2007; Ladusingh and Singh, 2006 and Gebremariam 2001).

Finally, the third group of variables whose impact on the chances of child mortality are analyzed are those of the household characteristics. These household characteristics are type of place of residence (rural versus urban), number of family members (i.e. the household size), the household's access to toilet, safe water and electricity, the type of material from which the floor of the house is made of as well as the nature of the cooking fuel used by the household. These variables are selected based on the finding of the studies Fitsum, 2009; Iram and Butt, 2008; Mutunga, 2007; Ladusingh and Singh, 2006; Jacoby and Wang, 2004; Klaauw and Wang, 2004 and Gebremariam 2001.

Table 4: Descriptive statistics of the selected variables

| Variable | Mean | Std. Dev. |
|---|-------------|------------------|
| <i>Dependent variable</i> | | |
| Child mortality (1=child is dead before age five, 0= child survived fifth birthday) | 0.3927 | 0.4884 |
| <i>Explanatory Variables</i> | | |
| Maternal characteristics | | |
| Education level is primary (1=yes, 0=no) | 0.1348 | 0.3415 |
| Education level is secondary (1=yes, 0=no) | 0.0488 | 0.2156 |
| Education level is higher (1=yes, 0=no) | 0.0055 | 0.0737 |
| Age at first birth | 18.2833 | 3.6108 |
| Square of Age at first birth | 347.3151 | 147.1833 |
| Child characteristics | | |
| Child is twin (1=yes, 0=no) | 0.0312 | 0.1740 |
| Age of the child | 1.5381 | 1.4757 |
| Child is male (1=yes, 0=no) | 0.5277 | 0.4993 |
| Household characteristics | | |
| Type of residence (1=rural, 0=urban) | 0.8680 | 0.3385 |
| Household size | 5.9840 | 2.1743 |
| Have access to safe water (1=yes, 0=no) | 0.5854 | 0.4927 |
| Have toilet facility (1=yes, 0=no) | 0.3414 | 0.4742 |
| Have electricity (1=yes, 0=no) | 0.1288 | 0.3350 |
| The floor material is dirt (1=yes, 0=no) | 0.9107 | 0.2852 |
| Uses cooking fuel that is polluting (1=yes, 0=no) | 0.9592 | 0.1978 |

Source: Own computation using EDHS-2005 data

Unlike the other studies, we did not directly include variables that indicate the income level or the living standard of the household. This is inspite of the fact that the EDHS has a wealth index.

We choose to exclude this index since we already have included some of the components of the index as they are, such as toilet facility, access to safe water, type of materials that the residential house is made of, etc. so that our model will not suffer from multicollinearity.

IV. Empirical Findings:

i. Model Specification

The dependent variable in this study is whether an under five child is alive or not. In this case death before the age of five is reported as one and zero otherwise, hence, the dependent variable is a dichotomous variable with outcomes 0 and 1. We therefore, employed the *probit* model recognizing the discrete choice nature of the response variable.

Let the observed outcome be y_i . According to Verbeek (2002), the underlying latent variable y_i^* , which is the unobserved threshold level that marks between a certain child's survival or not of the fifth birthday, is a function of observed personal and socioeconomic factors, say x_i , and unobserved characteristics, say ε_i , for individual i . This can be expressed in equation form as:

$$y_i^* = x_i' \beta + \varepsilon_i, \quad \varepsilon_i \sim NID(0,1)$$

If this threshold level is set to zero, without loss of generality, then the *probit* model can be fully described as:

$$y_i^* = x_i' \beta + \varepsilon_i, \quad \varepsilon_i \sim NID(0,1)$$

$$y_i = \begin{cases} 1 & \text{if } y_i^* > 0 \\ 0 & \text{if } y_i^* \leq 0 \end{cases}$$

A *probit* model with robust standard errors and clustered by region is estimated by employing the method of the maximum likelihood estimation technique. We clustered the regression by region to account for some similarities *within* each region following Cameron and Trivedi (2010). The results of this estimation are reported in the following section.

ii. Discussion of Results

Following the estimation of the *probit* model for under-five mortality using maternal characteristics, children characteristics as well as the situation of the household that the children live in, the results reported by table 5 are found. In-line with most studies in the area (see for instance Iram and Butt, 2008; Mutunga, 2007; Ladusingh and Singh, 2006; Jacoby and Wang, 2004; Klaauw and Wang, 2004 and Gebremariam, 2001) maternal education is an important factor affecting childhood mortality. Maternal education is a significant factor that affects childhood mortality negatively. **The marginal effect of maternal education on the probability of a child's survival increases with the level of education, as education level advances from primary to secondary and to higher education.**

Maternal education is important in reducing childhood mortality since better educated mothers can give a better care to their children as well as earn better income to satisfy the children's

nutrition, sanitary and medical needs. The other channel in which education can affect childhood mortality and fertility is that girls attending school will delay marriage and early pregnancy.

The above argument is also confirmed by one of our findings that the maternal age at first birth has significant and negative impact on childhood mortality. This means that the older the women are when giving their first birth, the higher the chances are for the children to survive their fifth birthday. This also confirms the finding of Mutunga, (2007) and Ladusingh and Singh (2006).

Table 5: Estimation results of the *probit* model

| Variable | Coefficients | Marginal effects |
|---------------------------------------|------------------------|-------------------------|
| Constant term | 3.3816 (0.3751)*** | |
| Primary education | -0.4971 (0.0609)*** | -0.1723 (0.0183)*** |
| Secondary education | -0.9467 (0.0760)*** | -0.2779 (0.0178) *** |
| Higher education | -1.1456 (0.0847)*** | -0.3010 (0.0151) *** |
| Maternal age at first birth | -0.2412 (0.0280)*** | -0.0910 (0.0109) *** |
| Square of Maternal age at first birth | 0.0048 (0.0006)*** | 0.0018 (0.0003) *** |
| Child is twin | 0.7943 (0.1006)*** | 0.3085 (0.0367) *** |
| Child age | -0.3661 (0.0140)*** | -0.1381 (0.0048) *** |
| Child is male | 0.1204 (0.0246)*** | 0.0453 (0.0092) *** |
| Live in rural | -0.0900 (0.0807) | -0.0343 (0.0311) |
| Household size | -0.0568 (0.0075)*** | -0.0214 (0.0029) *** |
| Access to safe water | 0.0274 (0.0380) | 0.0103 (0.0142) |
| Has toilet | 0.0661 (0.0389)* | 0.0250 (0.0147)* |
| Has Electricity | 0.0372 (0.0554) | 0.0141 (0.0211) |
| Dirt floor | -0.0288 (0.0786) | -0.0109 (0.0299) |
| Polluting cooking fuel | 0.0152 (0.1075) | 0.0057 (0.0403) |
| Number of observations | | 14623 |
| Correctly classified | | 71.67% |

Source: Own computation using EDHS-2005 data

Notes: Standard errors in parenthesis. Coefficients are significant at *10 percent, ** 5 percent and *** 1 percent.

The square of the maternal age at first birth is significant and positive. This indicates that very early and very delayed first births contribute significantly to the increased chances of under five mortality.

The biological controls for the child specific characteristic are also found to be significant. The results suggest that twins and male children have higher chance of mortality before reaching five as compared to single births and female children respectively. On the other hand, the probability of dying before the age of five declines as the children grow older as indicated by the negative coefficient of the variable child age. The finding that male children are biologically more disadvantaged than female children is in-line with the findings of Mutunga, (2007) and Ladusingh and Singh (2006); while it contradicts that of Iram and Butt (2008). Mutunga, (2007) also found this higher probabilities of death of twins than single births. The age of the child is also found to be negatively related with childhood diarrheal morbidity study of Gebremariam (2001).

In line with Fitsum (2009) and Mutunga (2007), the size of a household is significantly and negatively related to childhood mortality, meaning that children in larger households have a better chance of surviving to see their fifth birthday. This finding is explained by Fitsum (2009) as the possibility of improved child care from the members of the extended family members of larger households. **The argument also suggests the possibility that larger households could be the wealthier ones.**

V. Conclusion and Recommendation:

Based on the findings of our analysis we conclude that sending girls to school will improve the situation of childhood mortality. The government and its development partners should exert their at most effort to ensure universal access to education as well as to mobilize the society to send their children, especially girls to school.

Programs designed to tackle this problem should also have information, education and communication sub-programs targeted at creating awareness about the problems of early marriage and early pregnancy. This approach could be integrated with motivating parents to send their girls to school, as schooling contributes to delaying marriage and pregnancy.

Due to the vulnerability of twins and male children, extra attention must be given while caring to children. More obviously, younger children also need more attention and care than older ones. The reducing effect of household size, as explained in the previous section, could be due to the care extended to the child by the grandparents or bigger brothers and sisters. This suggests that extra care for children is beneficial for their survival.

In general we suggest that interventions designed to reduce infant and child mortality should pay attention to these socioeconomic factors of childhood mortality along with the preventive and curative healthcare interventions. The nationally representative data gives us a general picture, but interventions should consider the peculiarities of each society and villages while designing and implementing interventions, hence, there is a need to conduct specific studies for specific area of intervention.

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