Does Poverty Influence The Child Survival ?
Evidence from National Family Health Surveys

Introduction

Despite remarkable progress in lowering infant and child mortality during the 20th century, there are growing evidences that the fruits of this progress are not being shared equally by the different segments of the population. Rather, the number of studies has consistently shown that the lower socio-economic groups in all societies have been and continue to be characterized by an extremely obvious disadvantage in the case of new born infant survival in its first year of life (Stockwell and Goza, 1994).

Infant mortality in India was close to 300 per 1000 live births in the early decades of the 19th century. But, the decline of infant mortality was slow in the 19th century and it accelerated during 20th century. Despite the fact that as mortality is declining and economic growth is accelerating, Indian infants and children are still experiencing high risk of mortality than many other countries. Recently conducted study by "Save the Children UK", compares child mortality in a country to its national income per person. They used a wealth index and survival index and ranked 41 countries according to performance in utilization of resources in boosting the child survival rates. Bangladesh and Nepal were two of the top 10 performers in the case of low child mortality although their national income was much less. The report states that the link between poverty and child mortality is very strong and countries could use existing resources to improve survival prospects of children (The times of India 21/02/2008).

In India the absolute number of poor remains very large. The National Sample Survey Organization (NSSO) survey (1999-2000), shows that out of a total population of 997 million, the number of poor people was about 260 million. Thus the number of poor in India is almost equal to the current population of the United States of America. The Millennium Development Goals (MDG) aim to reduce global poverty, improve the lives of the poor and increase the pace of development in a sustainable manner.

The situation is further aggravated with the fact that half of all our children under age of five in the country are malnourished, stunted and 43 percent are underweight and around more than half of the children in the country do not receive complete immunization and majority of births (62 percent) are still home delivery (NFHS-3).On the other hand, the National Population Policy (NNP), 2000 has set a goal of reducing infant mortality rate to 30 by the year 2010 and the United Nation millennium development goals also have set a target of two-thirds reduction in under five mortality by 2010. Reconciling the slower pace of achievement and goals poses a challenge to health policy managers,

because infant and child mortality rates vary vastly across the different class of the Indian population. Poverty, health and education form a vicious circle. As poor people are less likely to have access to good food and medical care, they have more children to compensate for the risks of child deaths. There is also link between female literacy and child mortality.

Review of literature

During the past decade, a number of research studies have been done on the large set of socio-economic variables (place of residence, education, occupation, dwelling characteristics) and readily measured bio-demographic determinants (birth order, maternal age, birth spacing, breastfeeding and nutrition) of child survival. Among these different socio-economic variables a few studies have given emphasis on the association between parental as well as mother's education (Scrimshaw, 1978; Simmons et al., 1982; Caldwell, 1979). A large set of country-specific studies, in addition to Caldwell's Nigerian research, has demonstrated a strong association between maternal education and child survival. That is children of illiterate mother are more likely to die early than children of literate mothers. (Cochrane, Leslie, and O'Hara, 1982).There has also been considerable emphasis on bio-demographic determinants of child survival, particularly on maternal demographic characteristics (Hobcraft, McDonald, and Rutstein, 1985; Pebley and Stupp, 1987) and child nutrition (Malaysian evidence in DaVanzo, Butz, and Habicht, 1983). Other related analysis have considered the effect of household sanitation and hygiene on child mortality (Butz, Hahicht,and DaVanzo , 1984; Martin et al., 1983; Merrick, 1985; Victoria, Smith, and Vaughn, 1986).

Mosley and Chen (1984) analytical framework has been most widely used for studying determinants of child survival in developing countries. The framework considered five categories of proximate determinants namely, maternal factors (age, parity, birth intervals); environmental contamination (air, food, water etc); nutrient deficiency; injury (accidental, intentional); and personal illness control (preventive measures and treatment). A number of studies have examined empirical evidences concerning the influence of demographic and socioeconomic factors on child survival (Hobcraft, 1984; Clealand, 1988; Das Gupta, 1990).

Amin (1990) mentioned that control over resources and female autonomy can determine the quality of care offered to children and hence the level of overall mortality. That is a woman who belong higher economic class may be higher autonomy, may have higher decision-making power in the household, more access to household resources and have free mobility. Therefore, when her children fall sick, she is more likely to take

decision on her own about the treatment needed and about the good place where to take the child for treatment (Singh A. 2008).

Research further suggests that an increase in economic status leads to higher investments in children development program. At the same time the economic status of household has little effect on infant mortality but it is inversely related to mortality in early childhood (Casterline et. al 1989). Thus, child mortality can be reduced with the reduction of poverty of the household. As economy grows up the health status of children also improved but improvement is not uniform over the entire population. What is even more surprising is that the disparity has widened even as India has experienced record growth rates and a steady decline in poverty.

Need for the study

In India out of per 1000 live births, 57 children are not able to celebrate their first birthday and the infant mortality rate is 70 for poorest wealth quintile and it is 2.5 times higher than richest quintile. But out of 1000 live births there are 32 children within age one to four died in poorest wealth quintile and it is more than six times higher than richest wealth quintile (NFHS-3).

There are number of studies that have been shown the association between poverty and child survival. The economic status of household has less effect on infant mortality but it has strong relation between mortality in early childhood (Casterline et. al, 1989). Many researchers have used wealth index and explained the relationship between poverty, inequality and child survival in developing countries. However, no studies have been done using NFHS data to analyze relationship between wealth index and child survival in India. In this context, the present study tries to explore the association between poverty and child survival in India. In addition to that inequality is also examined in different quintiles.

The sample registration systems (SRS) reveal a declining trend of estimates of child mortality since 1993. This declining behavior shows in overall population. But the declining behavior is not uniform over wealth quintile. So there must be some inequality exists. The Gini concentration index and Lorenz curve helps us to find out the value and pattern of inequality in child mortality over wealth quintile.

Objective of the Study

The overall objective of this paper is to investigate whether poverty is the cause of differential in infant and child survival. However, specific objectives of the paper are as follows:

1. To examine the nature and pattern of relationship between poverty and child mortality.
2. To analyze the extent of inequality pattern in the child deaths and live births over different wealth quintiles.

Methods and materials

This paper is based on different rounds of National Family Health Survey data conducted in India (NFHS-1'1992-93', NFHS-2'1998-99' and NFHS-3'2005-06'). The survey collected demographic, socio-economic and health information from a nationally representative households. The analysis is based on ever-married women aged 15 to 49. NFHS provides a wide range of information including birth history, household facilities, socio-economic characteristics, child feeding practices, reproductive and child health care, etc. Detailed information on survival status of each and every child and information on preventive and curative measures for the children that were alive at the time of survey has been collected from their mothers. We use data on births taken place during the last five years preceding the survey.

The survey asked several questions from head of the household regarding housing characteristics and household assets. Each household asset is assigned a weight (factor score) generated through Principal Component Analysis, and the resulting asset scores are standardized in relation to normal distribution with mean 0 and variance 1 (Gwatkin et al.2000). Each household is then assigned a score for each asset, and the scores were summed for each household. Individuals are ranking according to the score of the household in which they reside. The sample is then divided into quintiles i.e. in five groups.

To know the level, researchers have used several definitions to represent child mortality. In the present study percentage of infant or child deaths over live births in last five years preceding the survey have used, i.e. number of deaths (Infant or child) per hundred live births. This indicator used only for comparison purpose in different rounds of NFHS according wealth quintile. viz. child having lower quintile and those having higher quintile.

The Lorenz curve and Gini concentration index have used for computing the inequality of child deaths and births over different wealth quintiles for two important demographic variables i.e. sex of child and place of residence. Also, we use the survival models to estimate the probability of survival beyond a specific duration of time. In this study, we want to assess the relation between the distributions of survival time of children with their socio-economic characteristics. So it is appropriate to use Cox proportional hazard model to adjust the estimates for the important confounding variables. The constructed wealth index is utilized in explaining differential in childhood mortality using

Cox proportional hazard model. This model assumes that the hazard of the study group is proportional to that of the underlying survival distribution. The dependent variable considered in the Cox regression is occurrence of death of a child within the age interval 1-4 years. And the independent variables include several bio-demographic like that (age at delivery, birth order and birth interval) and socio-economic (Religion, place of residence, mass media exposure, couple education, occupation and wealth index) variables. Further, for better understanding and to get clear visual picture of the wealth differential in child mortality and inequality, survival and Lorenz curves are plotted.

Principal Component Analysis (PCA)

PCA is a multivariate statistical technique used to reduce the number of variables in a data set into a smaller number of 'dimensions'. In mathematical terms, from an initial set of n correlated variables, PCA creates uncorrelated indices or components, where each component is a linear weighted combination of the initial variables. For example, from a set of variables X_1 through to X_n,

$$PC_1=a_{11}X_1+a_{12}X_2+\ldots\ldots+a_{1n}X_n$$

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$$PC_m=a_{m1}X_1+a_{m2}X_2+\ldots\ldots+a_{mn}X_n$$

Where, a_{mn} represents the weight for the m^{th} principal component and the n^{th} variable. The weight for each principal component are given by there eigenvectors of the correlation matrix. If our data are standardized, the eigenvectors are the co-variance matrix of that data (Seema Vyas and Lilani Kumaranayake, 2006). The World Bank, in the series of 'Socio-economic differences in health, nutrition, and population, 'has also constructed PCA based asset indices using Demographic Health Survey (DHS) data (e.g. Gwatkin et al. 2000).

Poverty

The World Bank's definition of the poverty line for under developed countries, like India, is US$ 1/day/person or US $365 per year. On this basis our planners decided this definition of "Poverty Line". The official estimates of the poverty line are based on a norm of 2400 calories per capita per day for rural areas and 2100 per capita per day for urban areas. This paper deals poverty as a minimum standard of living. Accordingly lowest wealth quintile is selected as below poverty line (BPL) population.

Lorenz Curve and Gini Concentration Index

The concept of the Lorentz curve was used basically to measure the distribution of income or wealth area. It was developed by Lorenz in 1905. Like other curves we have to prepare a frequency distribution of units according to independent variables. If there is no

concentration of population, we would get straight line passing through origin when cumulative proportion of (Y_i) is plotted against cumulative proportion of (X_i).
The Gini index measures the distribution of one variable relative to another variable. Gini concentration index measures the proportion of the total area under the diagonal and that lies in the area between the diagonal and the Lorenz curve. Thus this formula expresses the area on the graph contained between the curve and the diagonal. The value of index is the proportion of entire area below the diagonal (line of equality). Gini concentration is

$$G = \sum_{i=1}^{n} X_i \, Y_{i+1} - \sum_{i=1}^{n} X_{i+1} \, Y_i$$

Where, X_i and Y_i is the respective cumulative proportions of births and child deaths and 'n' is the number of class intervals or unit. This index varies from zero where the child deaths are evenly distributed to almost one when the deaths are concentrated in one unit.

Cox Proportional Hazard Model

Cox (1972) first suggested that the models in which factors related to lifetime have a multiplicative effect on the hazard function. These models are called proportional hazard model. The hazard rate at time t is-

$$h\,(t\,/x) = [h_0(t)\,]\,\exp(\,b_1X_1 + b_2X_2 + \ldots\, b_kX_k\,)$$

Where $h_0(t)$ = the baseline hazard or hazard for an individual when the value of all the independent variables equal zero. X_i= ith independent variable and bi the ith unknown coefficient.

The hazard function is a measure of the potential of the event to occur at a particular time t, given that the event did not yet occur. Larger value of the hazard function indicates greater potential for the event to occur.
There are few assumptions behind this model

1. Observation should be independent.
2. Hazards ratio should be constant across time i.e. the proportionality of hazards from one case to another should not vary over time.

Results

Levels and trends of infant and under five mortality

There has been growing concern that infant deaths are highly sensitive of sex differential among children and also affected by place of residence, but at the same time, household economic conditions also play a significant role. Hence, an attempt has been made to bring out the variation in infants death with sex and place of residence according to discrepancies in wealth quintiles. Infant deaths are decreasing over the period of time.

Table 1 shows the number of births, infant deaths and child deaths in last five years preceding the survey for NFHS-1, NFHS-2 and NFHS-3, for India. In the same flow, table 2 gives the distribution of live births during five-year preceding the survey by sex and place of residence in different wealth quintiles, for different rounds of National Family Health Survey.

Table 3 reveals that infant deaths in India have declined from 7.4 percent in 1988-1992 to 5.5 percent deaths in 2001-2005. The infant deaths are highest in the poorest wealth quintile in all the three rounds of NFHS, and depict a decreasing trend by increasing the wealth index. In NFHS-3, infant deaths are around seven percent in the lowest wealth quintile, which has reduced considerably with increasing wealth index (2.9 percent in the richest wealth quintile). In case of male infant deaths it is 9.6 percent for the poorest and only 4.7 percent among the richest. The percent of infant deaths were less among females compare to males for different wealth quintile in NFHS-1. The pattern in sex differentials in deaths during infancy across different wealth quintiles remains by and large the same in NFHS-2 and NFHS-3.

In case of urban-rural differentials in the proportion of infant deaths, it is evident from table 3 that infants in rural areas are less likely to survive than their urban counter parts till their first year of life. However, proportion of infant deaths across the different wealth quintiles reveals a constant decline over different rounds of NFHS. The difference in percentage infant deaths between rural and urban is decreasing with time and the same decreasing pattern is experienced by the lowest to the highest wealth quintiles also.

Table 4 depicts percentage of under-five deaths during five-year preceding different rounds of NFHS by sex and place of residence in different wealth quintiles. The under five deaths includes child deaths (deaths in age group1-4) and infant deaths. The trend in percentage of under five deaths reveals almost a similar pattern as observed in case of infant deaths (Table 3). The overall under five deaths in NFHS-1 was 8.8 percent, which has declined to 7.8 and 6.3 percent in NFHS-2 and NFHS-3 respectively. It is worth mentioning that the pattern of decline in proportion of under five deaths is not uniform across different wealth quintiles.

A relatively larger decline in under five mortality in the poorest wealth quintile seems to be resulted in accordance with ongoing programmatic efforts in the last two decades, though the existing levels demand more concerted efforts.

Inequality in pattern of child deaths

A number of recent studies have explored the relationship between economic status of household and mortality during infancy and childhood at micro level, but the programmatic response to address the survival of children require pattern of

homogeneity/heterogeneity in the association across different socio-economic groups. Therefore an attempt has been made in this section to analyze the extent of inequality in child mortality by sex of child and place of residence.

Table 5 reveals Gini concentration ratio for infant, child and under-five deaths by sex and place of residence, National Family Health Survey-1, 2 and 3, India. In comparison to infant and under five deaths, there is higher inequality among the children of age 1-4. The Lorenz curve also depict that overall inequaility in child mortality is higher in NFHS-1. The values of inequalities have been narrowed in NFHS-2 and remains constant in NFHS-3 (Figure 1). The pattern of inequality in death of children is not uniform across male and female. In case of male child the inequality pattern is same in NFHS-1 and NFHS-3, but it is relatively higher in NFHS-2 (Figure 2). In case of child mortality among females, level of inequality increases over time and it is found to be the highest (0.34) in NFHS-3 (Figure-3).

Lorenz curve showing the inequality in deaths among children born in urban areas explain the highest inequality in child mortality for NFHS-1 (0.41) but the nature of curve depicts decreasing pattern in the inequality over time (Figure4).

Figure 5 shows that the inequality in child mortality in rural area is lower in NFHS-1 and it is more or less constant in NFHS-2 and NFHS-3.

Cox Regression Analysis

This section deals with application of Cox proportional hazard model to examine adjusted effect of economic well being- measure in terms of wealth quintiles of household. For this purpose, a number of socio-economic and demographic predictors have been included in the model. The dependent variable is occurrence of death of a child within the age interval 1-4 years and the major covariates include a number of bio-demographic (sex of the child, age at delivery, birth order and birth interval) and socio-economic (place of residence, religion, mass media exposure, couple education and occupation, wealth quintiles) variables.

The findings of the Cox regression model (presented in Table 6) reveal adjusted effect of different predictors including wealth quintiles on child mortality. The risk of child deaths is significantly lower for children of mothers who belong to Middle, Richer and Richest wealth quintile in comparison to those belonging to the lowest wealth quintile. Children of mothers coming from the richest wealth quintile are over four times less likely to face the risk of deaths during age 1-4 than among children of mothers coming from the poorest wealth quintile.

Other important predictors of child mortality are birth order (4 and above), parental education (both illiterate) and birth interval (below 3 years). The risk of child mortality is higher in higher order births in comparison to first order births. The risk of mortality is 54 percent lesser for that child whose parents are literate in comparison to illiterate parent's child. For that child whose birth interval is more than 18 months, they have less likelihood to die in comparison to less than 18 months birth interval. The difference in cumulative survival curve for different wealth quintile shows that there is significant difference in survival among the children to mothers coming from different wealth quintiles (Figure 6).

Summary of findings and conclusions

An analysis of gender differences in concentration of deaths during early childhood (age 1-4) and variations by urban and rural places of residence reveal that the inequality in deaths of children is not uniform across male and female. In case of male child the inequality pattern is same in NFHS-1 and NFHS-3, but it is relatively higher in NFHS-2. On contrary, for the child mortality among females the level of inequality increases over time with the highest value of GINI concentration index in NFHS-3.

Children of mothers coming from the richest wealth quintile are less likely to face the risk of deaths during age 1-4 than among children of mothers coming from the poorest wealth. The difference in cumulative survival curve for different wealth quintile shows that there is significant difference in survival among the children to mothers coming from higher wealth quintiles, which clearly justify the presumption of increasing concentration of deaths during infancy and clearly childhood among women coming from lower strata of society. These findings clearly reveal a need to intensify the child survival programme among socio economically marginalized group preferably by using lowest wealth quintile of NFHS-3 as cut-off.

Reference:

1. *Amin S. (1990)*, "The effect of women's status on sex differentials in infant and child mortality in South Asia", *Genus*, XLVI (3-4), 55-69.
2. *Bonilla-Chacin, M. and J. Hammer. 1999.* "Life and Death Among the Poorest." *Working paper. World Bank, Washington, DC.*
3. *Caldwell, J. c. 1979);* Education as a factor in mortality decline: An examination of Nigerian data. *Population studies 23; 395-413.*
4. *Cleland and van Ginneken, loc (1988). cit.in fn.11; and J.Hobcraft*, 'Indirect health interventions with reference to family planning and breast feeding', Paper presented at a seminar on 'Child Survival Programs: Issues for the 1990; (John Hopkins University, Baltimore).
5. *Cochrane, S. H., J. Leslie, and O'Hara, 1982.* Parental education and child health: Intra country evidence. *Health Policy and Education 2; 213-250.*
6. *DaVanzo, J., W. P. Butz, and Habicht, 1983;* How biological and behavioral influences on mortality in Malaysia vary during the first year of life. *Population Studies 37; 381-402.*
7. *Filmer, D. and L. Pritchett. 1999.* "The Effect of Household Wealth on educational Attainment: Evidence From 35 Countries." *Population and Development Review 25:85-120.2001*
8. *Gupta, M.D (1990):* "Death Clustering, Mother's Education and Determinants of Child Mortality in Rural Punjab, India", *Population Studies*, *44,pp 489-505.*
9. *Gwatkin et al.2000.* Socio-economic differences in Ethiopia. Health, Nutrition, and Population in Ethiopia. Washington,
10. *Hobcraft J.N., Mcdonald J.W. and Rutstein S.O. (1984),* "Socio Economic Factors in Infant and Child Mortality Across Maternal Comparision, *Population Studies*, 37(2), 193-223
11. *Hobcraft, McDonald, and Rutstein, 1985.* Demographic determinants of infant and early child mortality: A comparative analysis. Population Studies 39; 363-386.
12. *John B. Casterline at el. 1989*: Household Income and Child Survival in Egypt. *Demography,Vol 26.*
13. *Martin et al.1983:* Covariates of child mortality in the Philippines Indonesia and Pakistan: Analysis based on hazard models. *Population Studies 37,; 417-432.*
14. *Merrick,T. W. 1985.* Effect of piped water on early childhood mortality in urban Brazil, 1970-76. *Demography 22; 1-23.*
15. *Mosley, W.H and Chen, L.C, 1984*, An analytical framework for the study of child survival in developing countries, A supplement to *Population and Development Review,*10: 24-45.
16. *Palloni A., Millman S.* (1986), "Effects of inter birth intervals and breast feeding on infant and early childhood mortality", *Population Studies,* 40(2), 215-236.
17. *Pebley, A. R., and P. W. Stupp, 1987.* Reproductive patterns and child mortality in Guatemala. *Demography 24; 43-60.*
18. *Preston,S. H. 1985a.* Mortality in childhood: Lessons from WFS.Pp.253-272 in J. Cleland and J. Hobcraft (eds.), *Reproductive Change in Developing Countries.* Oxford; Oxford University Press.
19. *Scrimshaw, 1978; Simmons et al., 1982:* "Infant mortality and behavior in the regulation of family size," PDR 4 no. 3(September):389-404.
20. *Seema Vyas and Lilani Kumaranayake(2006):* Constructing socio-economic ststus indices: how to use PCA.
21. *Sen A. (1988),* "Family and food: sex bias in poverty" in *Srinivasan T.N.*, Bardhan P.K. (eds.), *Rural Poverty in South Asia*, Ithaca, New York.
22. *Singh A., A. Hazra, F.Ram.2008."* Women's Autonomy and Sex Differential in Child Mortality in India", *Genus, LXII(3-4); 55-75.*
23. *Stockwell, Edward G., Franklin W. Goza, Verl O. Luse, and Yunan Jiang 1994* "Trends in the relationship between infant mortality and socioeconomic status in metropolitan Ohio, 1960- 1990." *Population Research and Policy Review 13: 399- 10. Stockwell, Edward G., Marcia Bedard, David*
24. *The times of India 21/02/2008:* Child mortality: India's record worse than Bangladesh.
25. *Victoria, Smith, and Vaughn, 1986.* Social and environmental influences on child mortality in Brazil: Logistic regression analysis of data from census files. *Journal of Biological Sciences 18; 87-101.*
26. *Wagstaff, A. 2000.* "Socioeconomic Inequalities in Child Mortality: Comparisons Across Nine Developing Countries." *Bulletin of the World Health Organization 78:19-29.*
27. *Wagstaff, A. and N. Watanabe. 2000.* "Socioeconomic Inequalities in Child Malnutrition in the Developing World." *Policy Research Working Paper No. 2434. World Bank, Washington DC.*

Table 1: Number of live births, infant deaths, child deaths and under five deaths in the five-year preceding different rounds of National Family Health Survey, India.

Data Sources	Births*	Infant deaths	Child deaths	Under five deaths
NFHS-1 (1992-93)	61112	4518	867	5385
NFHS-2 (1998-99)	55695	3611	761	4372
NFHS-3 (2005-06)	56438	3106	465	3571

*last five years preceding the survey.
All are the weighted frequencies.

Table 2: Number of live births in the five-year preceding the survey by sex and place of residence in different wealth quintiles, different rounds of National Family Health Survey, India.

Wealth Quintile	Number of Live Births														
	Male			Female			Urban			Rural			Combined		
	NFHS 1	NFHS 2	NFHS 3	NFHS 1	NFHS 2	NFHS 3	NFHS 1	NFHS 2	NFHS 3	NFHS 1	NFHS 2	NFHS 3	NFHS 1	NFHS 2	NFHS 3
Poorest	7597	6026	7357	7123	5684	7020	1323	521	681	13397	11190	13695	14720	11710	14377
Poorer	7449	6399	6505	7206	6287	6149	1806	843	1184	12848	11843	11470	14655	12686	12654
Middle	6390	5836	5825	6078	5666	5356	2576	2030	2365	9892	9471	8816	12467	11501	11181
Richer	5194	5344	5375	4820	4758	4779	3678	3896	4354	6335	6206	5800	10014	10102	10154
Richest	4704	5170	4354	4553	4525	3718	4486	4946	5718	4771	4749	2354	9257	9695	8072
Total	31332	28775	29415	29780	26920	27022	13869	12235	14303	47244	43460	42135	61112	55695	56438

Note: All the cases are weighted.

Table 3: Percentage of infant deaths among live births occurred in five-years preceding to the different rounds of National Family Health Survey by sex of child and place of residence in different wealth quintiles, India.

Wealth Quintile	Percentage Infant Deaths														
	Male			Female			Urban			Rural			Combined		
	NFHS 1	NFHS 2	NFHS 3	NFHS 1	NFHS 2	NFHS 3	NFHS 1	NFHS 2	NFHS 3	NFHS 1	NFHS 2	NFHS 3	NFHS 1	NFHS 2	NFHS 3
Poorest	9.6	8.6	6.7	8.7	8.0	7.0	8.0	7.3	6.3	9.3	8.4	6.8	9.2	8.3	6.8
Poorer	9.4	7.5	6.6	8.5	7.7	6.8	7.4	5.2	5.9	9.2	7.8	6.8	9.0	7.6	6.7
Middle	7.0	6.5	5.4	6.8	6.5	5.5	4.6	5.6	4.6	7.5	6.7	5.7	6.9	6.5	5.5
Richer	6.0	5.0	4.5	4.9	5.3	4.1	4.9	4.4	4.5	5.8	5.6	4.1	5.5	5.2	4.3
Richest	4.7	4.5	3.0	5.0	3.8	2.8	4.3	3.8	2.7	5.3	4.5	3.4	4.9	4.2	2.9
Total	7.7	6.5	5.5	7.1	6.4	5.6	5.3	4.6	4.0	8.0	7.0	6.0	7.4	6.5	5.5

Table 4: Percentage of under five deaths among live births occurred in five-years preceding to the different rounds of National Family Health Survey by sex of child and place of residence in different wealth quintiles, India.

Wealth Quintile	Percentage Under-five Deaths														
	Male			Female			Urban			Rural			Combined		
	NFHS 1	NFHS 2	NFHS 3	NFHS 1	NFHS 2	NFHS 3	NFHS 1	NFHS 2	NFHS 3	NFHS 1	NFHS 2	NFHS 3	NFHS 1	NFHS 2	NFHS 3
Poorest	11.3	10.5	7.6	11.1	10.9	8.8	10.4	10.6	7.5	11.3	10.7	8.2	11.2	10.7	8.2
Poorer	10.8	8.7	7.5	11.0	10.3	8.1	9.0	6.8	7.0	11.2	9.7	7.9	10.9	9.5	7.8
Middle	8.0	7.4	5.9	8.4	8.0	6.4	5.7	6.8	5.2	8.8	7.9	6.4	8.2	7.7	6.2
Richer	6.4	5.4	4.8	5.9	6.2	4.4	5.3	4.9	4.9	6.7	6.3	4.4	6.2	5.7	4.6
Richest	5.1	4.9	3.2	5.7	4.4	2.9	4.6	4.3	2.9	6.1	5.0	3.5	5.4	4.7	3.1
Total	8.8	7.5	6.1	8.9	8.2	6.6	6.1	5.4	4.5	9.6	8.6	7.0	8.8	7.8	6.3

Table 5: Gini concentration index for Infant, Child and Under-five deaths by sex and place of residence, based on different rounds of National Family Health Survey, India

Gini Index	Infant			Child			Under-five		
	NFHS1	NFHS2	NFHS3	NFHS1	NFHS2	NFHS3	NFHS1	NFHS2	NFHS3
Combined	0.13	0.13	0.14	**0.23**	**0.30**	**0.30**	0.14	0.16	0.16
Male	0.13	0.13	0.13	**0.27**	**0.32**	**0.25**	0.15	0.15	0.14
Female	0.12	0.13	0.15	**0.20**	**0.28**	**0.34**	0.14	0.16	0.18
Urban	0.11	0.09	0.16	**0.42**	**0.31**	**0.29**	0.15	0.13	0.17
Rural	0.10	0.10	0.09	**0.16**	**0.25**	**0.25**	0.11	0.13	0.11

Table 6: Relative risk of child mortality (during age 1-4 years) by some selected background characteristics, National Family Health Survey, 2005-06, India.

Independent Variable	Category	Exp(B)
Wealth Quintile	Poorest	R
	Poorer	0.762
	Middle	0.538*
	Richer	0.451*
	Richest	0.219*
Place of residence	Urban	R
	Rural	0.884
Sex of the child	Male	R
	Female	1.04
Religion	Hindu	R
	Muslim	0.633**
	Other	1.385***
Birth order	1	R
	2-3	1.741*
	4+	2.066*
couple education	Both illiterate	R
	Only father literate	0.909
	Only mother literate	0.256*
	Both literate	0.457*
Mass media exposure	No	R
	Yes	0.996
Mother's age at birth (Years)	<=19	
	20-34	0.855
	35+	0.788
Birth interval (Months)	<18	R
	18-35	0.572*
	36-59	0.411*
Working status of mother	No	R
	Yes	0.835

* $p < 0.01$; ** $p < 0.05$; *** $p < 0.1$, R= Reference category,

Figure1: Lorenz curve showing inequality in overall child mortality in NFHS-1, NFHS-2 and NFHS-3, India.

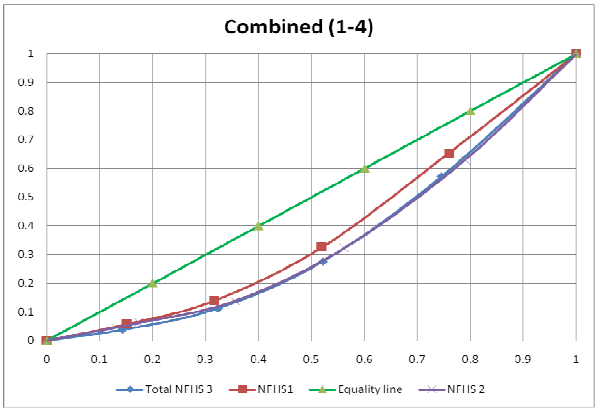

Figure2: Lorenz curve showing inequality in male child mortality in NFHS-1, NFHS-2 and NFHS-3, India.

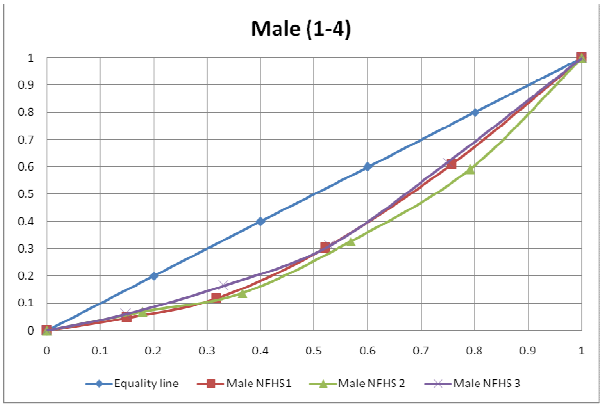

Figure3: Lorenz curve showing inequality in female child mortality in NFHS-1, NFHS-2 and NFHS-3, India.

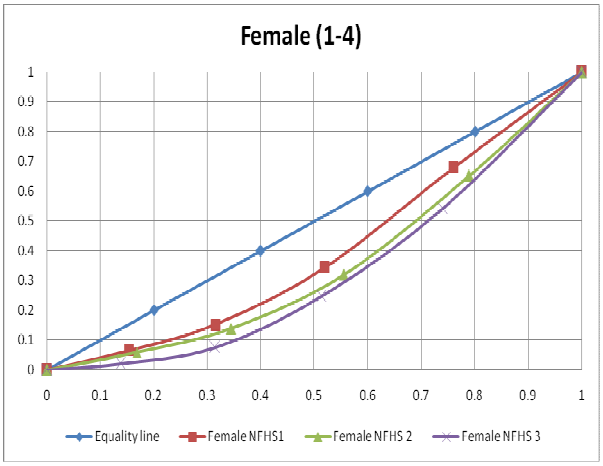

Figure 4: Lorenz curve showing inequality in urban child mortality in NFHS-1, NFHS-2 and NFHS-3, India.

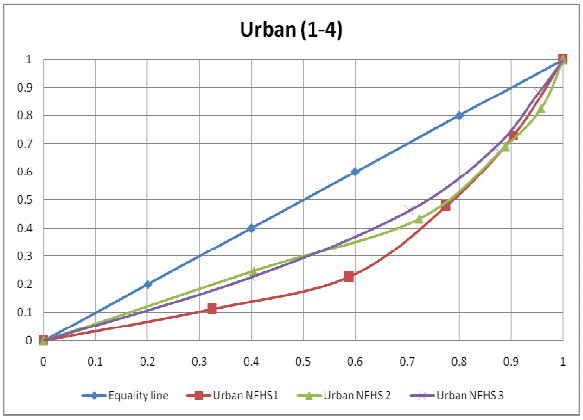

Figure 5: Lorenz curve showing inequality in rural child mortality in NFHS-1, NFHS-2 and NFHS-3, India.

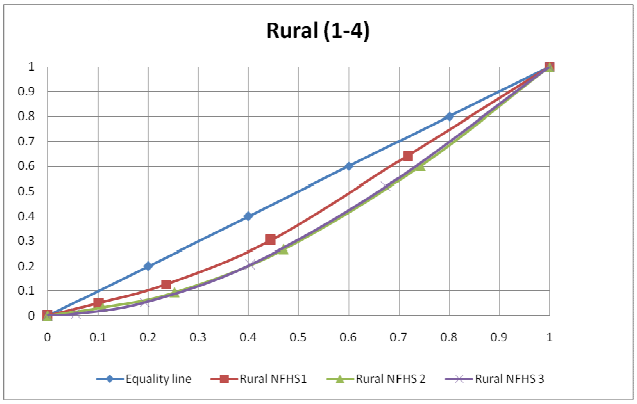

Figure 6: Cumulative survival curves for the child age(1-4) with wealth quintile of household, NFHS-3, India.