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RABBANI, SARAH and Qayyum, Abdul

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SARAH RABBANI and ABDUL QAYYUM

This study is investigated determinants of child mortality in the Pakistan. The Pakistan is amongst one of the five countries who have the highest child mortality rates in the world. Literature on the subject has found extensive variation in causes of child death. We used micro-data of Pakistan Demographic Health Survey (PDHS) of 2006-07 collected by National Institute of Population Studies (NIPS). In the descriptive analysis, it is founded that neonatal mortality rate is high for Pakistan. In econometric analysis, binary logit model was estimated using Maximum Likelihood Method (MLM). The study puts particular emphasis on the effect of wealth, mother' education, exposure to media and ethnicity. Effect of mothers' education, wealth, and exposure to media found significant determinants of child mortality in Pakistan. Knowledge on condition of a subject at national and local level gives a prerequisite for shaping efficient polices addressing the Problem.

Keyword: Child Mortality, PDHS, Binary Logit Model, Maximum Likelihood Method (MLM), Pakistan,

1. INTRODUCTION

The heated topic today's era is health status of countries, if people of a nation are healthy then so is the nation. The basic part of the Human Rights declaration of 1948 is the right to health [United Nations High Commissioner for Human Rights (2008)]. Improvement in health is a moral duty for policy makers all over the world, at the international level as well as the nationwide and local level. Children are asset of a country so counted as the future human capital, and every child has a right to have better life. One can have better life when they survive earlier years of their life or in other words can survive before reaching the age of five. So it is important to have a deeper look that can a child survive its initial years of life, that are very sensitive and crucial years of a child.

In 2000, the global community has decided to reduce the child mortality rate by two-thirds between 1990 and 2015. In 2012, under five mortality is around 6.6 million, with a rate of just about 18,000 per day [UNICEF (2013)]. If current trends of child death remain continue then it is hard to meet the Millennium Development Goal 4—that is to reduce child mortality rate by two-third between 1990–2015. If reduction in child mortality continues with the current pace then MDG 4 will meet its target by 2028

Sarah Rabbani <sarah.rabbani7@yahoo.com> completed MPhil Econometrics from the Pakistan Institute of Development Economics (PIDE), Islamabad. Abdul Qayyum <qayyumdr@gmail.com> is Joint Director, Pakistan Institute of Development Economics, Islamabad.

[UNICEF (2013)]. With less than one year left until the deadline and the target has still not been achieved in few countries. So innermost question is therefore to identify the factors that cause child mortality.

> "An initial index of child health is infant mortality rate and is taken to be a highly significant predictor of a country's economic performance. Over the past few decades, infant and child mortality fell everywhere in the world but the health outcome varied across countries and regions mainly because of income growth, improvements in medical technology/public health and spread of knowledge." [World Development Report (1993)].

That means child mortality[1] is an important social problem it is not only affected by the biological factors but is also great influenced from economic and cultural factors. Child mortality also helps in examining the living standard, social and economic status of a country. So there is need to acquire more knowledge and research to get to know how these factors affect child mortality in developing countries. Child mortality is not such a big problem in developed countries as it is in developing countries, especially in middle and low income countries.

Child mortality needs more closer look, when it comes to Pakistan because Pakistan is among those countries that ranking is very low in health. Pakistan ranks at 146 out of 187 on the Human Development Index (HDI)[2] by the United Nations Development Programme [UNDP (2013)], and particularly the health status of children in Pakistan is worse.

The probability of child mortality in a low income countries is approximately 18 times higher than child mortality in high income countries [WHO (2011)]. According to analyses done by Lozano, *et al*. (2011), 50 percent of child deaths occur in five countries; India, Nigeria, Democratic Republic of the Congo, Pakistan and China. And this half of world child deaths distributed as; India 22 percent, Nigeria 13 percent, Pakistan 6 percent, Democratic Republic of the Congo 6 percent and China 4 percent (UNICEF, 2013). So child mortality is as such not a problem for developed countries as it is for developing nations.

Mosley and Chen (1984) in their study of child survival in developing countries provides analytical framework. They present a structure that analyse factors of child mortality which deals with both biological and socio-economic factors. But Mosley and Chen_framework emphasis more on the individual level decision making and neglect cultural environment and geographical factors which also plays a great role in determining the child health and in particular child mortality. Macassa, *et al*., (2011) appreciated Mosley and Chen work but these factors then also be pointed out by Macassa, *et al*. (2011) and criticised for not including these above mentioned factors in Mosely and Chen framework.

There are extensive studies on the determinants of infant and child mortality. Earlier studies showed that there is a significant impact of socioeconomic factors [Porath (1976), Hobcraft, *et al*. (1984), El-ghannam (2003), Kembo and Van (2009)], demographic factors [Hobcraft (1985), Oybe (2008), Quamrul, *et al*. (2010)], and

[1]Probability of death a child before reaching to the age of five.

[2]HDI is a composite measure of human development consisting of indicators of health, education and income.

environmental factors [Merike and Mojekwu (2012)] on infant and child mortality. Various studies has been conducted on different regions of world separately and collectively to show the effect of different factors on child and infant mortality [Hobcraft *et al*. (1984, 1985), Amouzou and Hill (2003)] finds that mothers' age and education are significant determinants of child mortality [Hobcraft, *et al*. (1985)] and urbanisation also determine child mortality significantly [Amouzou and Hill (2003)].

Another study also showed death clustering in same house, means study found that in one house there exist more than one child death [Gupta (1990)]. Ethnicity is an important determinant of child mortality and many studies have shown that ethnicity affects child mortality [Brockerhoff and Hewett (2007), Haines (2010)]. "Yet, it is difficult to identify the mechanisms that explain observed differences, and these are not necessarily the same for different populations" [Fazzio, *et al*. (2011)].

Few studies on child mortality in Pakistan have analysed factors that affect infant and child mortality, these studies examined infant and child mortality separately [Zahid (1996), Bennet (1999), and Ali (2001)]. Other studies with data from different regions of Pakistan have shown strong association between child mortality rate and factors that affect child mortality [Afzal, *et al*. (1976), and Akhtar, *et al*. (2005)]. The study conducted on determinants of child health according to the variation across geographical and ecological zone of Pakistan [Arif and Arif (2012)].

Within Pakistan, there exist ethnic and social differences so these differences need to be examined for child mortality. Finally it would be helpful for monitoring population, healthcare programs, policies and evaluating them.

There has been much work done on child mortality in Pakistan. Few studies have been conducted in Pakistan that has measured child mortality in different cities and provinces of Pakistan individually [Afzal, *et al*. (1976), Shehzad (2006), and Khan, *et al*. (2009)]. This study contribute in literature through analysing child mortality in Pakistan. The study also includes impact of four important explanatory variables; ethnicity, wealth index, exposure to media and mothers' education on child mortality. Exposure to media, wealth index and mothers' education are important variables because child mortality is major problem for poor households that have low living standard [Hobcraft, *et al*. (1984, 1985), and Arif and Arif (2012)]. Ethnicity has its own importance in a way that socio-cultural practices differ among different ethnic groups and could have an effect on child mortality [Brockerhoff and Hewett (2007) and Haines (2010)]. So this study plays an important role in examining child mortality.

Child mortality is well thought to be one of the indicators of a nations' welfare, because it reflects social, demographic and economic circumstances in which children (and others in the social order) live as well as their health care. Child mortality is currently a gigantic problem especially for developing countries and particularly for Pakistan. Child mortality has decreased from 70.5 per thousand to 69.0 per thousand in 2010-11 to 2011-2012 [PES, Pakistan Economic Survey (2011)] and Pakistan is ranked at number 26 for child mortality [UNICEF (2013)]. This study will also help in determining how to reduce child mortality more effectively. The study has scope for providing basis for few vital policy implications.

This study intends to analyse effect of exposure to media and wealth index on child mortality for Pakistan. Study emphasis to examine the influence of ethnicity on

child mortality for Pakistan. Last objective of study is to examine the effect of other covariates such as mothers' education, place of residence, child sex, mothers' age, birth order, and birth interval on child mortality in Pakistan. Micro data is used to attain the objective of the study and collected from Pakistan demographic and health survey (PDHS) of 2006-07. Logistic regression has been used to analyse the behaviour of independent variables with dependent variable. The parameters for model is estimated by using maximum likelihood estimation.

After introduction second section deals with model and estimation techniques. The section three includes results and discussion and last section deals conclusions and policy recommendations.

2. METHODOLOGY

This section deals to specify model of child mortality and estimation techniques along with diagnostic tests. The next section discuss the data source and working sample for the model to be estimated for determinants of child mortality.

2.1. Model of Child Mortality for Pakistan

We give a brief description of the model used for child mortality and the binary logistic regression that is estimated through maximum likelihood ratio because child mortality (dependent variable) is in binary form (0, 1). It has been examined in earlier studies that mothers' education has negative relationship and affects child mortality significantly [Hobcraft, *et al*. (1984), Sandiford, *et al*. (1995), Zahid (1996) and Kabir, *et al*. (2011)], while on other hand mothers' age also has negative relationship with child mortality but it found significant in some studies [Hobcraft, *et al*. (1985) and Susuman (2012) and insignificant in other studies [Afzal, *et al*. (1976)].

Place of residence is used as measure of access to health care services in few studies [Hobcraft, *et al*. (1984)] and it also plays significant role in determining child mortality as those living in urban areas are found to have low child mortality than rural areas [Soomoro (1981) and Hobcraft, *et al*. (1984)].

Wealth index used as an indicator for showing economic condition of house in this study, and this explanatory variable also used to show economic status of household in previous studies and in those studies this found play significant role in lowering child mortality [Harthgen and Misselhorn (2006) and Susuman (2012)]. Index is constructed on source of drinking water, type of toilet, type of cooking fuel, house has electricity, gas, possession of telephone and refrigerator, this sort of index has been used in previous studies while source of drinking water, type of toilet and sanitation have individually used as determinants of child mortality in previous studies [Bennet (1999), Ali (2001) and Merike and Mojekwu (2012)] and in few studies these variables plays vital and significant role in determining child mortality [Zahid (1996), Mozumeler, *et al*. (1998), Kembo and Van (2009) and Arif and Arif (2012)].

All the factors used in making of wealth index indicating towards the absence of necessities in most poor houses and may also important factor of causing child mortality, in this study expected direction of wealth index is positive and significant. Ethnicity

mostly used or literally mean cultural values and shows the cultural differences among different states or within state. But in PDHS data it use languages speak in households to show cultural differences among households of Pakistan.

In previous studies it shows that different ethnic groups affect child mortality differently and significantly [Brockerhoff and Hewett (2007) and Haines (2010)]. Birth order may has significant relationship with child mortality and in past studies it showed that at higher birth order child mortality is high rather than second and third birth order [Zahid (1996), Becher, *et al*. (2004) and Quamrul, *et al*. (2010)].

Presence of radio and television at house used as proxy for control variable exposure to media, and in few past studies it was inversely related to child mortality [Gupta (1990) and Bennet (1999)] and in few studies existence and reading of newspaper and magazine as proxy for exposure to media and it was also significantly affecting child mortality [Kabir, *et al*. (2011)].

Birth spacing is also an important variables discussed in earlier studies and in those studies both are negatively associated to child mortality [Porath (1976), Hobcraft, *et al*. (1985), and Mozumeler, *et al*. (1996)] that large birth interval may reduces child mortality [Oybe (2008) Kembo and Van (2009) and Arif and Arif (2012)]. Sex of child showed in prior studies that child mortality associated with girl child was higher than boy child [Rukanuddin (1982) and Susuman (2012)] and in this study it may also results in the same direction but expected signs can differ among provinces.

The function of child mortality for Pakistan is,

$$CM_i = f(MA_i, R_i, ME_i, EM_i, E_i, WI_i, BO_i, S_i, BI_i, u_i) \quad \ldots \quad \ldots \quad \ldots \quad (2.1)$$

Where,

CM = Child Mortality, it is constructed in binary form (0, 1). As, 0 = 'child is alive' and, 1 = 'child is dead'.

MA = Mothers' Age, this variable is described in five years group of age and divided in 7 groups keeping in view the age group of mothers'. So variable is classified as, 1 = 15-19 years, 2 = 20-24 years, 3 = 25-29 years, 4 = 30-34 years, 5 = 35-39 years, 6 = 40-44 years and, 7 = 45-49 years.

R = Place of residence, this variable is defined in binary form. Defined as, 1 = urban area and, 0 = rural area.

ME = Mothers' Education, this variable shows the different level of formal education of mother. It has assigned values as, 0 = no education of mother, 1 = primary educational level of mother, 2 = secondary educational level of mother and, 3 = higher education of mother.

EM = Exposure to Media, presence of television at home is used as proxy for this variable. As, 1 = TV at home and, 0 = no TV at home.

E = Ethnicity, so data use 'language' of the household to describe this variable as it shows the culture through mother tongue of the particular household. It is defined as, 1 = Urdu, 2 = Punjabi, 3 = Sindhi, 4 = Pashto, 5 = Balochi, 6 = English, 7 = Barauhi, 8 = Siraiki, 9 = Hindko, 10 = Kashmiri, 11 = Pahari, 12 = Potowari, 13 = Marwari, and 14 = Farsi.

WI = Wealth Index, this index is used to show the economic and living standard of mother and as well of house.[3] It is classified as, 1 = poorest, 2 = poorer, 3 = middle, 4 = richer and, 5 = richest.

BO = Birth Order, it tells the order of the child (first, second, third etc. order of birth) that at what place a child has among his/her sibling.

S = Child Sex, this variable is also defined in binary form. As, 1 = male child and, 0 = female child.

BI = Birth Interval, this variable shows the spacing between the children. To capture the interval between children months has been imputed.

Child Mortality (CM) specified in dichotomous form as in 0, 1 form, same as dependent variable some of explanatory variables are also in discrete form such as sex of child (S), exposure to media (EM), and place of residence (R). While other explanatory variables are specified in continuous form (as in these are not in 0, 1 form), so in this study discrete choice model is specified because of limited dependent variable or discrete outcome. Other reason using this model is that it constraints predicted values to lie between 0 and 1 [Johnston and Dinardo (1997)].

Since model in the study presented is discrete choice model so parameters measured or presented through logit model and it has logistic distribution:

$$prob(Y_i = 1) = \frac{1}{1+e^{-(\alpha+\beta_1 X_1+\beta_2 X_2+\cdots+\beta_k X_k)}} + \epsilon \quad \ldots \quad \ldots \quad \ldots \quad (2.2)$$

Another name for the logit is log-odds, odds are determined from probabilities and range between 0 and infinity. Odds are defined as the ratio of the probability of success and the probability of failure. The odds of success are, Odds (success) = p/(1-p) or p/q and the odds of failure are, Odds (failure) = q/p

Logistic regression is in reality an ordinary regression using the logit as the response variable. A logit is defined as the log base e (log) of the odds,

Logit (*p*) = *log* (*odds*) = *log* (*p*/*q*)

Next, we compute the odds ratio, the odds ratio can be computed by raising **e** to the power of the logistic coefficient.

Odd Ratio = e^b Or also written as,

$$\frac{p}{1-p} = odd\ ratio = e^{(\alpha+\beta_1 X_1+\beta_2 X_2+\cdots+\beta_k X_k)} \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (2.3)$$

Multivariate logit measures are applied to find out whether child mortality differentiates among provinces through the above discussed socio-economic and

[3] Economic status of mother and house is captured through wealth index. Five categories (poorest, poorer, middle, richer and richest) are defined here to show the living status of mother and these categories have been defined through wealth index. Principle component analysis (PCA) is used to make that wealth index that can also be called as economic status variable.

The variables that are included to make the wealth index are; type of flooring, refrigerator, water supply, type of vehicle, sanitation facilities, persons per sleeping room, electricity, ownership of agricultural land, radio, Television, domestic servant, country specific items and telephone. All these variables has their own importance individually to determine child mortality but collectively these variables also improves the status of living and helps in determining the living standard of house and the economic status of mother. (DHS-comparative report 6, wealth index)

demographic explanatory variables, as hypothesised and mostly earlier discussed studies also used logit model for estimation because of the same specification of the model [Porath (1976), Zahid (1996), Harthgen and Misselhorn (2006), Kabir, *et al.* (2011), and Arif and Arif (2012)].

The multivariate logit model can be presented as:

$$Ln\left[\frac{(p)}{(1-p)}\right] = a + \sum b_i X_i \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (2.4)$$

Where p is the probability of child mortality under the age of five. While a and bi are regression coefficients, and Xi are the control variables, this can also be written as;

$$ln\left(\frac{p(CM)}{1-p(CM)}\right) = \alpha + \beta_{1i}(MA_i) + \beta_{2i}(R_i) + \beta_{3i}(ME_i) + \beta_{4i}(EM_i) + \beta_{5i}(E_i) + \beta_{6i}(WI_i) + \beta_{7i}(BO_i) + \beta_{8i}(S_i) + \beta_{9i}(BI_i) \quad \ldots \quad \ldots \quad (2.5)$$

$$CM_i = \alpha + \beta_{1i}(MA_i) + \beta_{2i}(R_i) + \beta_{3i}(ME_i) + \beta_{4i}(EM_i) + \beta_{5i}(E_i) + \beta_{6i}(WI_i) + \beta_{7i}(BO_i) + \beta_{8i}(S_i) + \beta_{9i}(BI_i) + u_i \quad \ldots \quad \ldots \quad (2.6)$$
$$u_i \sim 0\,, p_i(1 - p_i)^4$$

Where, dependent variable represents as log of child mortality for the ith child of household (h), α denotes the constant term, all β's denote coefficients associated with explanatory variables. This model is specifically for the estimation of limited dependent variable as in this study child mortality specified as dummy variable (binary form).

2.2. Maximum Likelihood Method of Estimation for Model

It has been already discussed that this study uses discrete choice model, it has dependent variable in dummy form and also some of independent variables are also in binary form so here used logit model for the estimation. The models 2.5 estimated through Maximum Likelihood Method (MLM), initially introduced Fisher (1922). He was the first person who originally presented the numerical procedure for MLM in 1912. ML method particularly used for the estimation of parameters of discrete choice model (multinomial limited dependent variable). Because MLM usually gives the consistent, unbiased and efficient estimates for the model which follows the distribution that is Bernoulli distribution. For the large sample size, as used in the study, MLM estimates converges to the true value of the parameters. Through MLM the parameters of interest are estimated correctly and having small variance which adds to the significance and reliability in the results.

Formally, the maximum likelihood estimator, denoted $\hat{\theta}_{mle}$, is the value of θ that maximises $L(\theta|x)$. That is, $\hat{\theta}_{mle}$ solves,

$$\max_{\theta} L(\theta|x) \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots (2.11)$$

With random sampling, the log-likelihood has the particularly simple form,

[4]Dichotomous outcome variable given x expresses as $y = p(x) + u$. If $y = 1$ then $u = 1 - p(x)$with probability $p(x)$, and if $y = 0$ then $u = -p(x)$ with probability $1 - p(x)$. Thus, u has a distribution with mean 0 and variance equal to $p(x)[1 - p(x)]$. (David W. Hosmer and Jr. Stanley Lemeshow).

Mean equal to θ with variance equal to $I(\theta) = -E\left[\frac{\partial^2 l}{\partial\theta\,\partial\theta'}\right]$ (Johnstan and Dinardo).

$$\ln L\,(\theta|x) = \ln(\prod_{i=1}^{n} f(x_i;\,\theta)) = \sum_{i=1}^{n} \ln f\,(x_i;\theta) \quad \ldots \quad \ldots \quad \ldots (2.12)$$

The vector of derivatives of the log-likelihood function is called the score vector and is denoted,

$$S(\theta|x) = \frac{\partial \ln L\,(\theta|x)}{\partial\,\theta} \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots (2.13)$$

By definition, the MLE satisfies,

$$S\left(\hat{\theta}_{mle}\middle|x\right) = 0 \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots (2.14)$$

Under random sampling the score for the sample becomes the sum of the scores for each observation x_i:

$$S(\theta|x) = \sum_{i=1}^{n} \frac{\partial \ln f\,(x_i\,;\,\theta)}{\partial\,\theta} = \sum_{i=1}^{n} S\,(\theta|x_i) \quad \ldots \quad \ldots \quad \ldots \quad \ldots (2.15)$$

Where, $S\,(\theta|x_i) = \frac{\partial \ln f\,(x_i\,;\,\theta)}{\partial\,\theta} \partial \ln f\,(x_i\,;\,\theta)$ is the score associated with x_i.

Bernoulli Sampling

Let X_1,...,X_n be an iid sample with X_i ~ Bernoulli (θ). The joint density function is given by,

$$f\,(x\,;\,\theta) = L\,(\theta|x) = \prod_{i=1}^{n} \theta^{x_i}\,(1-\,\theta)^{1-\,x_i} = \theta^{\sum_{i=1}^{n} x_i}\,1-\,\theta^{n-\sum_{i=1}^{n} x_i} \quad \ldots (2.16)$$

The log-likelihood function is,

$$lnL\,(\theta|x) = \ln\,(\,\theta^{\sum_{i=1}^{n} x_i}\,1-\,\theta^{n-\sum_{i=1}^{n} x_i}) \quad \ldots \quad \ldots \quad \ldots \quad \ldots (2.17)$$

Open log function,

$$= \sum_{i=1}^{n} x_i \ln(\theta) + \,(n-\,\sum_{i=1}^{n} x_i) \ln(1-\,\theta) \quad \ldots \quad \ldots \quad \ldots \quad \ldots (2.18)$$

The score function for the Bernoulli log-likelihood is,

$$S(\theta|x) = \frac{\partial \ln L\,(\theta|x)}{\partial\,\theta} = \frac{1}{\theta}\sum_{i=1}^{n} x_i - \frac{1}{1-\theta}\,(n-\,\sum_{i=1}^{n} x_i) \quad \ldots \quad \ldots (2.19)$$

The MLE satisfies, $S\left(\hat{\theta}_{mle}\middle|x\right) = 0$ produces the MLE,

$$\hat{\theta}_{mle} = \frac{1}{n}\sum_{i=1}^{n} x_i \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots (2.20)$$

Hence, the sample average is the MLE for θ in the Bernoulli model.

R-square (R^2) test the goodness of fit of the whole model. For binary logistic regression Mac Fadden R^2 and Cox and Snell R^2 is used to check the goodness of fit for the model. Hypothesis testing that coefficient of an independent variable is significantly different from zero means variable is significant or insignificant. If calculated value of Wald statistics is greater than table value of chi-square then coefficient reject H_0 and concluded as significant and vice versa for insignificance. The Wald statistic for the coefficient is used:

$$wald = \left[\frac{\beta}{s.e_b}\right]^2 \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots (2.21)$$

which has *chi-square* distribution with 1 degree of freedom.

Micro data is used in this study which is collected from Pakistan Demographic and Health Survey (PDHS) of 2006-07 conducted by National Institute of Population Studies (NIPS) and Macro International Incorporation. The 2006-07 PDHS is the largest household-based survey ever conducted in Pakistan. The PDHS collected information about all the members of each household, including socioeconomic characteristics, such as levels of education, health status.

The 2006-07 PDHS question more than 10,000 ever-married women between the ages of 15-49 from whom information on birth history, household, their marital status, their level of education, health service usage and child health care information[5] were composed at the time of the survey. Total number of observation on child mortality rate are 9178. But estimating model for child mortality, ignoring missing number of observation, total number of observation used for analysis of child mortality in Pakistan are 7225.

4. RESULTS AND DISCUSSION

Results underscores the primacy of addressing child mortality for Pakistan through factors. The study is based upon quantitative analysis. The results have been obtained by applying binary logistic regression analysis. Results showed relationship between child mortality (dependent variable) with mothers' education, mothers' age in groups, place of residence, has TV, ethnicity, wealth index, birth order, child sex, preceding birth order (independent variables). The study carried out on the factors of child mortality in Pakistan. Some of the variables has positive relationship and few has negative relationship and it is to mention that not all variables are significant, as few of them are insignificant.

4.1. Child Mortality by Age in Pakistan

According to existing literature, most of child deaths occur from the day he/she born up till he/she reaches at age five, that is called as child mortality. So it is of great importance to show the child death by age ratio. The subsequent Table 4.1 shows the ratio of death by age of child mortality in Pakistan. All these estimation for the study carried out by using SPSS software package.

As it can be observed Table 4.1 most of the deaths of children occur during the time of their birth or during the first 28 days of their births before they turn to a month in Pakistan. The time period in which death of baby occur from the time of their birth to first 28 days of his/her birth is also known as Neonatal Mortality. So 62 percent in Pakistan, child deaths occur during the neonatal period.

[5]Information about the causes of child deaths was gathered with a verbal autopsy (VA) questionnaire. This questionnaire was used in households where a death of child under age five years or a stillbirth was reported in 2005 or later. The questions elicited details about the illness and causes of death from parents and other who are present when the child died. [PDHS (2006-07)].

Table 4.1

Total Number and Ratio of Child Mortality by Age in Pakistan

Age at Death (Days and Years)	Number of Children Death (N)	Percentage of Children Death
At Birth (0 up to 28)[6]	425	62%
< 28[7] up to 1	232	31.9%
< 1 up to 2	30	4.1%
< 2 up to 3	9	1.2%
< 3 up to 4	6	0.8%
Total	729	100%

After neonatal mortality the high death rate occur between the age of 29 days older (about a month) to a year that is 31.9 percent for Pakistan, that is the second highest death ratio of child death. The lowest deaths' of child occur during the period when she/he is turning to age four, that is 0.8 percent for Pakistan.

In Pakistan the child mortality is high at birth time of child when a child has not reached to a month. In above results it can be seen that in Pakistan most of the child deaths occur at time of birth or in first 28 days of birth, that is also known as neonatal mortality [Khan, *et al*. (2009)].

4.2. Estimation of Child Mortality Model for Pakistan

The reason behind the highest death rate of child during the neonatal time period could be many such as sanitation system, public health facilities, access to clean drinking water, mothers' age, low mothers' education, less exposure to media (such as TV, Radio, magazine) or economic condition of house. Neonatal deaths are higher because youngest are more vulnerable to the diseases and other contributing factors that affect child mortality than at the other stages of mortality or ages of the child mortality until he/she reaches at age of five. Many of the factors that indicated has also been discussed in previous studies and show that all these factors contributed in determining high rate of child death during first 28 days (Neonatal mortality period).

The causal factors used in study to check their effect on child mortality are mothers' age, place of residence, mothers' education, exposure to media (television), ethnicity, wealth index, birth order, child sex and preceding birth interval. So logistic regression is used because child mortality is a binary variable and some of explanatory variables are also in binary form such as television, child sex and place of residence and estimates of these variables are then estimated according to the binary logistic model as described in previous chapter, and can be seen in Equation 3.6 for Pakistan. Maximum likelihood estimation with Bernoulli distribution, as shown in Equation 3.20, used to estimate these binary logistic models. The Table 4.2 shows the relationship between child mortality and independent variables for Pakistan.

Wald statistics is used to test the significance level of coefficient of explanatory variables. Wald statistics has *chi-square* distribution with 1 degree of freedom and

[6] Time period from child birth to first 28 days.

[7] Ibid.

tabulated value of *3.841* at 5 percent significance level and *2.706* at 10 percent level of significance. In Table 4.2 *chi-square* value given in the parentheses with each coefficient to show their significance.

Cox and Snell is *R*-square and MacFadden *R*-square and there values as seen in Table 4.2, for Pakistan are 0.009 and 0.026. For cross-section data lower the value of R-square better the model is, so value of both *R*-square that estimated for the study are showing that all model are good fit.

Pakistan model estimated as it can be seen from Table 4.2, according to the chi-square value for variables of Pakistan that reject null hypothesis and concluded as significant are exposure to media (TV), wealth index and preceding birth interval at 5 percent level of significance while mothers' age and mothers' education are significant at 10 percent level of significance. Remaining variables that are place of residence, ethnicity, birth order and child sex accept null hypothesis that says these variables are insignificant because calculated chi-square for these variables is less then tabulated chi-square.

Table 4.2

Results of Child Mortality: Binary Logistic Regression (Odd Ratios)

Variable	**Pakistan**		**Pakistan (OR)**
MA	-0.081*	(2.722)	0.922*
R	-0.111	(0.902)	0.894
ME	-0.119*	(2.794)	0.888*
EM	-0.088**	(6.817)	0.916**
E	0.004	(2.466)	1.004
WI	-0.142**	(9.955)	0.868**
BO	0.035	(1.875)	1.035
S	-0.046	(0.255)	0.955
BI	-0.010**	(12.053)	0.99**
Constant	-1.661**	(77.796)	0.189**
Cox-Snell *R*-Square	= 0.009		
MacFadden *R*-Square	= 0.026		

Note: (**) coefficient significant at 5 percent and (*) coefficient significant at 10 percent.

Mothers' age group is defined in seven groups; 15-19, 20-24, 25-29, 30-34, 35-39, 40-44, 45-49. the probability of dying of child decreases by 0.992 times as mothers' age rises from 15-49. As mothers' age increases child death rate reduces, showing that higher mothers' age has better way to take care of their children. Child born to mother who has attained higher education level is 0.88 times less chances of death than those mothers who has attained only primary education level. So more the mother of child is educated there will be more chances of child to survive.

Exposure to media has coefficient value of 8.8 percent with odd ratio of 0.995 as seen in Table 4.2, that shows having TV at home reduces child mortality by 0.995 times than not having TV. So this ratio of having TV indicates that there is low level of child mortality in houses where there is TV. That depicts that presence of TV at home is considered as advantage for child life. Because mother may be more aware of child's health care needs and takes good care of her child.

Wealth index has negative relationship with child mortality that means as wealth index shifts from poorest to poorer to middle to richer to richest, child mortality level would decrease by 0.867 times with a shift in each level of wealth index. This odd ratio depicts that poor people have higher chances of child mortality than middle and rich people. Children of higher economic status are less likely to die at young age. When there exist birth interval between current child and previous child then probability of child mortality is 1 percent. These results are negatively related to child mortality, and odd ratio indicating that child survival ratio increase by 0.99 times in children who has large birth spacing time between preceding births than those children who has less birth spacing between them.

This study also showed the factors that point out the reasons behind the high child mortality rate over all for Pakistan. In Pakistan reason behind the high child mortality rate and particularly when child born is exposure to media, wealth index, birth interval, mother's age, mother education, ethnicity, birth order and exposure to media.

Exposure to media is represented through having TV at house and those mothers who have TV at their houses have less chances to child mortality because when they have TV at houses there is more capacity that mother of child and other house members gets the informative news or updates regarding child health. As in now-a-days there are many news are going on TV telling people that Pakistan is still facing the high child mortality rate even though they are sixth atomic power but they cannot able to lower child mortality rate to the level it should be. And other awareness programmes shown on TV that child should be vaccine and proper health facilities should be provided to the child and mother. When mother is having a baby proper take care of mother should be taken by other members. In previous studies conducted by Gupta (1990) and Bennet (1999) also present that exposure to media whether it is through TV, Radio or magazine have a significant impact in reducing child mortality.

Wealth index has significant and negative relationship with child mortality and that relationship is similar to many previous studies which has been done by Ali (2001), Susuman (2012), Harthgen and Misselhorn (2006). This indicator shown that those households having less income and low living standards are more likely to be having higher child mortality because those mothers or households are less likely to enjoy the necessities of life such as no clean drinking water, no clean are where they live, no gas and electricity, type of toilets are miserable at these houses. In such type of condition it is very hard to even imagine to live but there are people who are surviving in such conditions. But they are paying their prices in form of high child mortality, children born to poorer family and family who are facing such living standards died before reaching to the age of five. And this variable has significant relation in Pakistan. Child motility rate is negatively related to wealth index and having higher death rate of child where child belong to poor families.

Birth interval is taken as the demographic variable and results of this study are similar with the previous studies by Porath (1976), Hobcraft, *et al*. (1985) and Arif and Arif (2012) that birth spacing is negatively related to child mortality. Mothers having larger birth spacing between their children are more likely to enjoy the longer life of their child rather than those mothers who have small time of birth spacing between children.

Child is more likely to have good health and higher survival chances when has/her mother is well educated. In this study mothers who have completed their primary education are more likely to have lower child mortality. And this lowering of child mortality increases when mother education moves to secondary and higher education respectively. That is because mother who are educated have knowledge how to take care of child and take care of their selves when they are expecting than these mothers who are less educated. Mothers who are educated can read informative updates and prescription given to them and more effectively use these resources in taking care of their child.

Mother age and mother education is kind of linked to each other because higher the mother age there are more chances that mother is educated (Sooner they got married lesser chances to be well educated). And other way around that mothers' of age 25 to 35 are more likely to have healthy baby and know ways to take care of their children because they are more experienced and seen more in their life than those mothers who have age of 15-24. Because they are not considered as mature enough by mind while mother age of 25 or more considered as mature enough and can take good care of their child.

According to the previous studies by Hobraft, *et al*. (1984) Zahid (1996) and Kabir, *et al*. (2011) mothers' education has significant and negative relationship with child mortality and results of this study are same as theirs. This study has similar results to the past studies done on child mortality by Hobcraft, *et al*. (1985) and Susman (2012) for variable of mothers' age. Mothers' age has significant negative relationship with child mortality in Pakistan.

5. CONCLUSIONS AND POLICY RECOMMENDATIONS

This study estimated binary logistic model child mortality in Pakistan with binomial distribution. Model is then estimated through maximum likelihood estimation that has Bernoulli distribution. Estimated results of exposure to media and wealth index is significant in Pakistan. Birth interval is variable that is significant and depicts the same results as showed by Hobcraft, *et al*. (1985) and Porath (1976) that birth interval reduce child mortality.

Now-a-days there is heated discussion going on child mortality in news and in many organisations so it makes child mortality an important issue for Pakistan. The other reason for its importance is that Pakistan is one of the five countries who have half of all under five death. And Pakistan came at third in these five countries with 6 percent of global child death occurrence. Child mortality is important because it is also responsible for the delayed psycho-social development and also reduction of the future human capital that has been dying before they can come into market for use.

Few variables that contributed in determining and has same significant association with child mortality in Pakistan are exposure to media, wealth index, birth interval, mothers' age and mothers' education. This study clear the situation of child mortality and also determines the factors that causes the child deaths for Pakistan and also shows that mostly deaths occur at time of neonatal period of child or at birth time of child (first 28 days). So situation must change if Pakistan wants to achieve the 4^{th} Millennium Development Goals (MDG4) of reducing child mortality by two thirds of 1990 level till year 2015.

The aim of this study has been to examine determinants of child mortality in Pakistan, with a particular attention on wealth, exposure to media, mothers' education and ethnicity. Internationally recognised development goal that is also known by the name of Millennium Development Goal (MDG) is reducing child mortality, and both researchers and policy makers are giving much attention to this subject. So for obtaining further reduction in child mortality, it needs to have a better understanding of both national and local condition and causes of child death. Because child death differ between and within countries. To achieve the 4th Millennium Development Goal—reduction in child mortality—it requires all to teach, identify, understand and implement the right actions to minimise the child mortality rate.

Social policies by Government of Pakistan attempting to promote health care intervention programmes through multimedia, and to make decisions about health investment in future there is need to regularly evaluate these health interventions. Careful consideration be given by the Government of Pakistan to take measures to increase investment in education—particularly female education—and promoting the benefits of formal education, because mothers are considered as first provider of the health care when needed. And that should be considered as part of a policy for reducing child mortality.

The element of policy for Population Policy of Pakistan (2002) and National Maternal, Newborn and Child Health [MNCH (2005)] here is that it should induce women to change the spacing pattern between children.

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