A COMPARATIVE ANALYSIS OF FACTORS AFFECTING CHILD MORTALITY IN PAKISTAN AND PROVINCES: BINOMIAL LOGISTIC REGRESSION ANALYSIS

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AUTHORSHIP STATEMENT

I Sarah Rabbani solemnly declare and affirm on oath that I myself have authored this M.Phil Thesis with my own work and means, and I have not used any further means except those I have explicitly mentioned in this report. All items copied from internet or other written sources have been properly mentioned in quotation marks and with a reference to the source of citation.

Sarah Rabbani D/O Rao Zahoor Rabbani

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TABLE OF CONTENTS

Certificate I
Acknowledgement II
Dedication III
Table of Contents IV
List of Tables VI
List of Figure VII
Abbreviation and Acronyms VIII
Abstract IX

1. INTRODUCTION 1

1.1.Scope of Study 5
1.2.Significance of Study 6
1.3.Research Questions 6
1.4.Objectives of Study 7
1.5.Hypotheses 8
1.6.Methodology 9
1.7.Plan of the Study 9

2. LITERATURE REVIEW 10

2.1.Introduction 10
2.2.International Based Literature Review 11
2.3.Pakistan Based Literature Review 22
2.4.Conclusion 28

3. METHODOLOGY 29

3.1.Introduction 29
3.2.Model of Child Mortality for Pakistan 29
3.3.Child Mortality Model for Provinces 36
3.4.Data 40
3.5.Maximum Likelihood Method of Estimation for Model 41

5.2.1.Bernolli Sampling 42
3.6.Diagnostic Tests 43
3.6.1.Wald Test 43
3.6.2.Coefficient of Determination R-square(R^2) 44
3.7.Conclusion 44

4. RESULTS AND DISCUSSION 45

4.1.Introduction 45
4.2.Child Mortality by Age in Pakistan and Provinces 46
4.3.Estimation of Child Mortality Model for Pakistan and Provinces 50
4.3.1.Child Mortality in Pakistan 51
4.3.2.Child Mortality in Punjab 54
4.3.3.Child Mortality in Sindh 55
4.3.4.Child Mortality in Khyber Pakhtunkhwa 56
4.3.5.Child Mortality in Baluchistan 57
4.4.Discussion 58
4.5.Conclusion 62

5. CONCLUSION AND POLICY RECOMMENDATION 64

5.1.Introduction 64
5.2.Findings 64
5.3.Policy and Recommendation 66
5.4.Further Research Opportunities 67

REFERENCES 68

List of Tables

Table	Title	Page No.
Table 4.1	Total Number and Ratio of Child Mortality by Age in Pakistan and Provinces	48
Table 4.2	Results of Child Mortality: Binary Logistic Regression (Odd Ratio-OR)	52

List of Figure

Figure	Title	Page No.
Figure 4.1	Proportion of Child Mortality in Provinces and Pakistan	49

ABBREVIATIONS AND ACRONYMS

HDI	Human Development Index
KPK	Khyber Pakhtunkhwa
MDG	Millennium Development Goal
MLM	Maximum Likelihood Method
PDHS	Pakistan Demographic and Health Survey
PES	Pakistan Economic Survey
UNDP	United Nation Development Program
UNICEF	United Nation International Children's Emergency Fund
WHO	World Health Organization

Abstract

The aim of this thesis is to investigate determinants of child mortality in the Pakistan and Provinces, such as Punjab, Sindh, Khyber Pakhtunkhwa and Baluchistan. The Pakistan is amongst one of the five countries who has the highest child mortality rates in the world. Between and within country, literature on the subject has found extensive variation in causes of child death.

The analysis is conducted using 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 found that neo-natal mortality rate is high for Pakistan as well as for four provinces. In econometric analysis, binary logit models are estimated using maximum likelihood method (MLM) to estimate factors of child mortality for Pakistan, Punjab, Sindh, KPK and Baluchistan separately. The study puts particular emphasis on the effect of wealth, mothers' education, exposure to media and ethnicity. Effect of wealth, and exposure to media found significant determinants of child mortality in Pakistan and Punjab. While ethnicity found to be significant in Sindh and Baluchistan. Mothers' education found significant only in Pakistan. Knowledge on condition of a subject at national and local level gives a prerequisite for shaping efficient policies addressing the problem.

Key word: Child mortality, PDHS, Binary Logit model, Maximum Likelihood Method (MLM), Pakistan, Punjab, Sindh, KPK, Baluchistan.

Chapter 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 (United Nations High Commissioner for Human Rights, 2008) is the right to health. Improvements 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, Child Survival Progress, 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 (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.

World Development Report (1993) observed that "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."

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 a child mortality in a low income countries is approximately 18 times higher than child mortality in high income countries (WHO, 2011). According to

[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.

analyses done by Lozano et al. (2011), 50% 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%, Nigeria 13%, Pakistan 6%, Democratic Republic of the Congo 6% and China 4% (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 analyze 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, Hallquist and Lynch (2011) appreciated Mosley and Chen work but these factors then also be pointed out by Macassa et.al., (2011) and criticized 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 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, Hobcraft et al., 1985, Amouzou and Hill 2003) finds that mothers' age and education are significant

determinants of child mortality (Hobcraft et al., 1985) and urbanization also determine child mortality significantly (Amouzou and Hill 2003).

Arulampalam and Bhalotra (2006) has measured child mortality in fifteen states of India and found that there is high rate of child death in thirteen out of fifteen states. This high child death rate exist in those families where there has already been child death occurred. 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 analyzed factors that affect infant and child mortality, these studies examined infant and child mortality separately (Zahid 1996, Bennet 1999, 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, 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 at provincial level, so these differences needs to be examined for child mortality. Measuring child mortality at provincial level for Pakistan provides a better picture to examine its factors. Reasons behind provincial disparities in child mortality are known very little so this study will be

helpful for assessing those factors. There are several reasons to analyze child mortality at provincial level and to have comparative analysis: first and foremost reason is that there are ethnic differences, social and cultural differences among the provinces of Pakistan. Secondly, due to the above mentioned differences child mortality rate and factor causing child mortality will be different in each province. Finally it would be helpful for monitoring population, healthcare programs, policies and evaluating them separately for each province.

1.1 Scope of Study:

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). But not a single study has been conducted on measuring child mortality for all provinces of Pakistan. This study contribute in literature through analyzing child mortality at in Pakistan and examining child mortality provincial level separately. This analysis provide better understanding of the factors that affect child mortality individually at provincial level. 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, Hobcraft et al., 1985, 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, Haines 2010). So this study plays an important role in examining child mortality.

1.2 Significance of study:

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. As each province has its own cultural values and socio-economic characteristics so study helps to depict those differences and show that different policies play different role in each province respectively, and there should be few different policies for each province which would work effectively in that particular area.

1.3 Research Questions:

- Which factors determine child mortality in four provinces and Pakistan?
- How study determine child mortality rate for all provinces and in Pakistan, separately?

- Is child mortality differently affected by wealth index for Pakistan and as well as for provinces?
- Does ethnicity affect child mortality in a different way in Pakistan and separately for all provinces?
- Do exposure to media and other covariates affect child mortality differently for Pakistan and in all provinces separately?

1.4 Objective of Study:

This study has a primary aim to analyze the socio-economic and demographic factors that affect child mortality in all provinces separately. The variation of different determinants of child mortality among provinces and Pakistan are specified in different objectives as follows:

- This study also intends to analyze effect of exposure to media and wealth index on child mortality separately for province wise and for Pakistan.
- Study emphasis to examine the influence of ethnicity on child mortality at provincial level and 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 provinces individually as well as in Pakistan.

1.5 Hypotheses:

Hypotheses for the study of factors affecting child mortality at provincial level and also at over all Pakistan are as follows:

- **Hypothesis I:**

H_0: There is no relationship between wealth index and child mortality for all provinces and Pakistan.

H_1: There is significant relationship between wealth index and child mortality for all provinces and Pakistan.

- **Hypothesis II:**

H_0: Ethnicity has no affect on child mortality in province wise and in Pakistan.

H_2: Ethnicity significantly affect child mortality in province wise and in Pakistan.

- **Hypothesis III:**

H_0: There is no relationship between mothers' education and child mortality in all provinces and Pakistan.

H_3: There is significant relationship between mothers' education and child mortality in all provinces and Pakistan.

- **Hypothesis IV:**

H_0: There is no relationship between exposure to media and child mortality for all provinces and Pakistan.

H_4: There is significant relationship between exposure to media and child mortality for all provinces and Pakistan.

1.6 Methodology:

The study comprises of the analysis of factor affecting child mortality in five models, for Pakistan, Punjab, Sindh, KPK and Baluchistan. 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 analyze the behavior of independent variables with dependent variable. The parameters of these models are estimated by using maximum likelihood estimation.

1.7 Plan of study:

Plan for this study is designed as follows; first chapter is introduction of the study, second chapter consists of review of literature, third chapter cover methodology of study, forth chapter includes results and discussion for study and last chapter is on conclusion and policy recommendation.

Chapter 2

Literature Review

2.1 Introduction:

The literature has been reviewed to determine the current and previous understanding on child mortality and to observe the present situation of global and national policies and strategy discourse on child mortality. Literature review included research papers on background features of child mortality. An overview of the literature has determined the gaps and areas in which factors of child mortality can contribute to learning. That makes the study on child mortality more laborious but all the more important too.

This chapter commenced with a very concise examination of the literature on child mortality. The first section of this chapter deals with the literature given on international level that provides the framework to analyze the child mortality. Child mortality is affected by the wide range of factors and through international literature this study can see the picture of regional disparities, that there is regional disparity within a state that should also be included when determining child mortality. The second section consist of the literature conducted in Pakistan both by Pakistani authors and as well as by foreign authors. By analyzing Pakistani literature one can examine the true picture of child health status in Pakistan and in particular child mortality. There has been work done on child mortality at district level or city level but not collectively at provincial level that

also needs to be highlighted. So this study fills that gap. The last section of this chapter has concluding remarks about the literature done up till now.

2.2 International Based Literature Review:

Porath (1976) has examined fertility response to child mortality of Israel. Child mortality may also affect age at marriage and other aspects of household structure that have a bearing on fertility but main focus of this study is particularly on fertility. Micro data have been used in this study collected from fertility section of labor force survey (LFS) of 1971 on Israel. The probability that given birth was a last birth taken as dependent variable and independent variables were; mother's years of schooling, mother's birth place, mother's age at time of birth, birth order, and preceding birth interval. The estimations taken out in two ways: 1. Contingency tables, and 2. regression analysis and for regression analysis study used logit estimates results of both tabular and regression analysis showed that high child mortality reduced the probability that given birth was a last birth, and hence reduced intervals between birth, so couples with more children have more likely to have higher child mortality and shorter time period of preceding birth interval than those with few children.

Hobcraft et al., (1984) have probed socio economic factors of infant and child mortality. The study aimed to consider socioeconomic differences in neonatal, post neonatal and child mortality separately in 28 countries and data have been collected from world fertility survey (WFS). To see the impact of independent variables on different mortality level, multivariate log-linear rate models were used and estimated by maximum likelihood method. The variables used in the analysis were mother's education; mother's

working status, husbands' occupation, husband's education place of residence neo natal mortality post neonatal mortality and child mortality. The results indicated that mothers' education played a vital role in determining child mortality in all the 28 states while education of husband has no direct effect on child mortality but it could affect education of women which would in result affect child mortality. Husband's occupation significantly affect mortality rate in tropical Africa and south-east Asia. Mother's working status affect infant mortality in Srilanka significantly.

Hobcraft et al., (1985) have probed a comparative analysis of demographic determinants of infant and child mortality. The results has been drawn from tabulation and regression analysis of information on infant and child mortality from 39 world fertility survey (WFS) (39 developing countries) for the regression analysis, log-linear regression models has been specified for each country at every level of mortality and these models estimates have been found through maximum likelihood method. To check whether there existed any systematic variation between or among countries, a schematic representation of distributions of parameters for each variable has been drawn. The numbers of explanatory variables were; sex of child, birth order of child, age of mother at birth, birth intervals, mothers education. The results showed teenage mother's child births has higher risk of child mortality in all countries. If child spacing factor has been controlled then age and birth order effect became weakness and it has been significant in all 39 developing countries.

Blau (1986) has analyzed the fertility, child nutrition and child mortality in Nicaragua. Malnutrition has been identified as a major cause of infant and child mortality

in developing countries operating by increasing a child vulnerability to infections and diarrheal diseases and raising the probability of death from these diseases. The main purpose of this study was to identify key variables that can accelerate at once the decline of fertility and mortality rates and the improvement of child motivational status in developing countries. The data used in this study were collected in a household survey carried out in Nicaragua during 1977-1978. This study used linear regression methods to measure child nutritional status. The results of study showed that effects of income, education and wage rate on fertility are insignificant in the rural in contrast to the urban in restricted sample. The education, income and wage coefficient estimates in the unrestricted sample are all significant. The results suggested that urban labor market opportunities for women provide means for women to bring home earnings that may be devoted mare intensively than other family income to child nutrition. In rural areas income may be more required restraint in general so that women's earning would not be earmarked for child nutrition.

Gupta (1990) has probed determinants of child mortality and death clustering in rural Punjab, India. This paper mainly focused on behavioral determinants of child mortality even though it was also considering biological and socio-economic characteristics but examined behavioral determinants mainly because there exist a strong tendency within families for child deaths in cluster even after controlling biological and socio-economic determinants. The data used in this study was drawn from surveys of Khanna study of 1984 of Ludhiana District, Punjab, India. The data were estimated through logit regression and explanatory variables were; child-care factors, mother's education, sanitation and hygiene, biological factors, preceding and succeeding birth

intervals, income per head, high caste, size of landholding, media exposure (television owned), child sibling died below age 5 while child death at various ages taken as dependent variable. The results of above study showed that child whose sibling died in childhood were more likely to have high probability of child dying which shows that there is as a death clustering within the families as women who have child deaths in her family more likely to experienced high child mortality.

Razzaque et al., (1990) have studied the sustained effects of 1974-75 famine on infant and child mortality in rural area of Bangladesh. This famine was caused due to severe monsoon flooding in 1974 in Bangladesh which destroyed more than half of annual rice crop. The data has been taken from demographic surveillance system (DSS) of 19-14-82 which has maintained by international centre for diarrheal disease research Bangladesh (DCDDR,B). Variables included in study were famine born, famine conceived, non-famine, mother's age, child sex, economic status of household and child mortality. Firstly, bivariate analysis has been done to examine each factors effect separately and then multivariate logistic regression conducted to see the net effect of all explanatory variables on child mortality. Here non-famine group considered as reference group, then results indicated that mortality rate is higher in famine born children up to their second year of life while mortality was higher to famine conceived children but up to their first year of life. And ultimately child mortality vanished after the two years of child life in all the associates of famine.

Sandiford et al., (1995) have investigated the impact of women's literacy on child health and its interaction with access to health service. The main objective of this was to

recruit any female resident of Masaya province aged 25-49 who become literate through adult education provided that she had also given birth to at least one live infant. This study used primary data and primary data taken through women interviews. Estimates taken from coal's and demeny's west model life tables using trussell's variant of brass method. Results of this study showed that percentage of children who had died was constantly lower for women in the adult education and proper schooling groups than in the illiterate group and overall the ratio of children who had died was 16 percent lower among mothers in the adult education group than among those of illiterate women. They also indicated that women who became literate through attendance at primary school are significantly better off than the illiterate. A better understanding of the physiological and social effects of female literacy that bring about child health improvements may have fundamental implication for the plan of health interventions.

Mozumeler et al., (1998) have analyzed the determinants of infant and child mortality in rural Bangladesh. The main objective of this study was to examine the factors associated with changes in infant and child mortality and to investigate the role of family planning the expanded program on immunization, environmental conditions and health service used on child mortality. Data for this study include demographic and other relevant information about 14,100 children born between 1983 and 1991. Data on ownership of consumer durables and capital goods in the household, sources of safe water for drinking and distance from the service delivery points were available from cross-sectional surveys conducted in the project area. Multivariate logistic regression procedures have been used to analyze the levels and trends in infant and child mortality and the factors associated with these levels and trends. The results of the multivariate

logistic regression showed the effects of socio-demographic temporal and programmatic factors on infant mortality, education of the mothers and fathers reproductive dynamic specifically. The findings of the study confirmed that longer birth interval plays a significant role in reducing child mortality and primary health care services was also associated with reduced hazard. There was significant relationship between childhood immunization and reduced child mortality, access to tube well water and objectives of the family planning play a unique role in improving child survival.

El-ghannam (2003) has probed global problems of child malnutrition and mortality in different world regions. The study aimed to explain and explore effect of social, demographic economic, and health factors on child malnutrition and child mortality rate among different regions in globe. The data collected for this study from united nations statistical years books 2000, united nations demographic years book 2000, social indicators of development by world bank 2000 and world development deports 2000. The study took data on 191 states from all over the globe. Variables in the study were child malnutrition, child mortality, illiteracy, unemployment, poverty, fertility level, family size, GNP, household income, food consumption, protein consumption, maternal mortality rate and population per physician. Descriptive analysis and correlation coefficient analysis was used to analyze the data and draw results. The results drawn from analysis showed that social factors, demographic factors such as family size, fatality rate, health factors and food consumption were positively significantly associated with child mortality and malnutrition in regions Sub-Saharan Africa, Asia and Americans while insignificant in regions such as Europe, Middle East and North Africa. The other

variables such as GNP, income and protein consumption have negative association with dependent variable in all over the globe except for Europe and Central Asia region.

Becher et al., (2004) have probed risk factors of infant and child mortality in rural Burkina Faso. The study aimed to identify the effect of risk factors of child mortality in typical rural settings in sub Saharan Africa, and data for the study has been taken from demographic and health survey and demographic surveillance system (DSS) from 1992 to 1999 on 39 villages around noun, western Burkina FASD. Cox regression model, a proportional hazard model, was used to detect the effect of demographic, ethnic, collective and reproductive on child mortality and explanatory variables were; year of birth, child sex, ethnic group, religion, age of months at birth, season of birth, twin birth, birth order, access to health care, time to birth of next sibling, vital status of mother, and time since last sibling was born and vital status of last sibling. Results showed that death of mother and birth time was strongest risk factors affecting infant mortality and all other variables were also significantly related to mortality. But overall mortality reduced during 1993-1999.

Harttgen and Misselhorn (2006) have examined child morality and under nutrition is South Asia and Sub Saharan Africa. The main objectives of the study was to analyze the determinants of child morality and under nutrition in both areas and under nutrition bore similar and in what ways do these factors have differing fact an them. Data has been taken from Demographic and Health Survey (DHS) of different years on five developing states of South Asia and Sub Saharan Africa; Bangladesh (2000) India (1999), Uganda (1995), and Zimbabwe (1994). Descriptive analyses have done and setup a two level

model: Proportional hazard model and logit regression has also been done for this purpose children morality and under nutrition. Variables taken for this study were: age of mother, sex of child, breastfeeding, first born, birth interval household size, no. of children, asset index, mother's age at marriage, mother's BMI, health facility index, distance to health facilities, public infra structure index, primary education, secondary education, children with fever, sanitation, all these were explanatory variables. The results showed that access to health and infra structure index played a vital role in determining child morality while wealth index, educational and health seeking behavior of health has an important role for anthropometric shortfalls. There was large difference in magnitude of the coefficient between both regions as determinants were discernable between countries. Even through for analysis data set was combined of all states of both regions but there still was a significant difference between two regions.

Ogbe (2008) has probed exclusive breast feeding and children immunization as demographic determinants of child mortality in Delta States of Nigeria. The aim of study was to find the degree of child coverage in delta state and examine the level that exclusive breast feeding practiced among reproductive women in delta state. The ex-post facto design was used for this purpose. The primary data has been used for study collected through questionnaire and interviews and for this multi-stage sampling technique combined with ballot and systematic method applied. The study instrument was standardized multi topic household survey instrument designed by Grosh and Glewe (2002). The multiple regression analysis used to analyzed the relationship between child immunization and exclusive breast feeding with child mortality, and both covariates are

taken as independent variables. The results showed that child immunization coverage and exclusive breast feeding were not significantly related to child mortality.

Kembo and Van-Ginneken (2009) have probed determinants of infant and child mortality in Zimbabwe. The aim of study was to explore impact of material socioeconomic and sanitation variable on infant and child mortality. The data used in this study was taken from Zimbabwe demographic and health survey (ZDHS) of 2005-06. Explanatory variables for the analysis was maternal factors, child birth, order birth interval, mothers' age, child sex, type of birth, socio economic factors, mothers education, fathers education, wealth index, place of residence, sanitation system, source of drinking water and type of toilet. While child and infant mortality taken as dependent variable. The multivariate hazard analysis has been used to analyze data. The results of study explained that order and birth interval significantly related to infant mortality and improved sanitation facilities reduced infant mortality. Father's education has affected child mortality but not infant mortality and mothers' education was not significantly related to child mortality. Determinants affected differently to both infant mortality and child mortality such as birth order, birth interval, mothers age and type of birth affective factors of infant mortality rather than child mortality. Finding showed the importance of birth spacing and emphasized on use of fact family planning methods.

Haines (2010) has analyzed the issue of using infant and child mortality as an indicator of inequality in United States in twentieth century. The study used micro data from 1900 and 1910 Integrated Public Use Micro Samples (IPUMS), data published by Birth Registration Area in 1920's and Linked Birth and Infant Death Files from national

Center for Health Statistics for 1991. The result of all these surveys showed that infant mortality inclined by socio economic factors such as father and mother education and working status, ethnicity, race, income of house hold, and place residence, but inequality remained the same over 20th century in United States.

Quamrul and at al., (2010) have analyzed effect of demographic characteristics on neonatal, post neonatal, infant and child mortality. The data for this study was conducted from November to December 2007 of Natore Sadar Upazila in Natore district of Bangladesh and explanatory variables in this study were; age of mother at marriage, birth order and interval, breast feeding, and duration of marriage. All these variables were tested at all level of child mortality through contingency analysis and logistic regression. Chi-square results showed that age at marriage, birth interval and breast feeding were significantly positively associated with neonatal and post neonatal mortality. According to logistic regression, breast feeding influence neonatal while duration of marriage and child birth order and interval affected post neonatal mortality. Child and infant mortality was highly significantly affected by all the explanatory variables.

Kabir et al., (2011) have analyzed early childhood mortality and factors affecting this in Bangladesh. The main objective of the study was to examine demographic, socioeconomic and health care determinates of childhood mortality rate in Bangladesh. The study used data from Bangladesh demographic and health survey of 2004 and analyze it through logistic regression on the set of independent variables as mother's age at birth, child sex, birth interval, birth order, no. of living children, place of residence, region, mothers educational level, source of drinking water, access to safe sanitation,

habit of reading newspaper and magazine and TT injection during pregnancy. The results presented that birth interval, birth order, and no. of living children significantly affects childhood mortality. In addition mother's education, source of drinking water, access to safe sanitation, exposure to media, also affect childhood mortality positively.

Merike and Mojekw (2012) have examined environmental determinants of child mortality in Nigeria. The data has been taken from Nigeria demographic and health survey (NDHS) 2008 and national bureau of statistics (NBS) 2009. For analysis, firstly principle component analysis has been done and then multiple regression analysis done. Immunization, low polluting fuel, education, household income, disposal practice, refuse disposal, rich household, unsafe water, proximity to dump site, employment status, child mortality. The results showed that all the environmental characteristics have significantly affected the child mortality and mainly study showed that encouragement of usage of cleaner fuel source would lower child mortality.

Susuman (2012) has probed child mortality rate in Ethiopia. The main focus of the study was not only to find the absolute death rate of children but to notify the forces that cause change in death rate of child as in the overall child mortality rate has declined in Ethiopia over time and main purpose of this paper was to analyze the decline in child mortality in Ethiopia. Data had been carried out from Ethiopian demographic and health survey (EDHS) of 2000 and 2005. Independent variables were; size of child, sex of child, age of mother at birth, birth order, duration of breast feeding, preceding birth interval wealth index, multiplicity of birth and dependent variable is child mortality at neonatal, post neonatal, and infant. And results of their socio economic and demographic variables

has been checked out through brass and trusell method of estimation, and findings of these methods clearly defined that neonatal and postnatal mortality has declined, but neo child mortality rate were still high in Ethiopia according to brass model women age 20-34 was accurate age and have less child mortality.

Amouzou and Hill (2003) have analyzed child mortality and its socio-economic status in Sub-Saharan Africa. The main emphasis of this paper was to check under five child mortality trends and their association between socio economic status of Sub-Saharan Africa. Secondary form of data have been used in this study from 1960 to 2000 and taken from World Bank Development indicators data base. Independent variables used in this study were; per capita income, literacy and urbanization to check relationship with child mortality. Descriptive analysis is also done in this study with multivariate regression and for multivariate regression random effect model has been used as it was panel data. The results shows consistent negative relationship between under five mortality rate (U5MR) urbanization and per-capita income, while there is significant positive association of U5MR with illiteracy. Illiteracy and urban effect demolished during last decade but income effect has increased.

2.3 Pakistan Based Literature Review:

Afzal et al., (1976) have probed fertility and infant child morality in a Lahore suburb. The main objectives of study were to analyze fertility experiences in relation to infant child morality for mothers and examine differentials in the level of fertility and child morality by income level, educational some other demographic variables. The variables used in this study were mothers' age at marriage, duration of marriage, family

income, educational level of mother, education of father, child ever born and child morality. One approach used for analysis was cross-tabular analysis to find out level of fertility, child mortality and their variation. And secondly multiple regression analysis carried out on child ever born and child mortality as dependent variable respectively and correlation coefficient matrix has also been made. The results indicated duration of marriage and educated level play significant positive role to children ever born and father's education not found significantly affecting fertility there was positive association between children ever born and no of child deaths. Child mortality was positively associated with age of mother but insignificant. Similarly family income and after duration of marriage were also positively significantly explains the child mortality.

Soomro (1981) has examined the indirect estimates of infant child mortality in Pakistan of 1975 and there compared it with the same results drawn in 1968 to see whether there was any change in infant child mortality. The data drawn from Pakistan fertility survey of 1975 which maintained by population division of Govt. of Pakistan, and from 1968 national impact survey which also undertaken by population division. Firstly, brass technique along with coale-demeny model life table was used. And then estimates of q_x and e_o^o was estimated from West model life table. Correction method of Krally-Norris modification to show current trends of mortality at the time of survey through average child mortality obtained from brass technique. Variables used in study were age of mother, place of residence, sex of child and child mortality. The results of study indicated that child mortality was higher in 1968 and it was expected that it would be lower in 1975 but it turned out in other direction that mortality was higher 1975 too. Higher rate of male child mortality have seen for mother age group 15-19 and 30-49 in

1968 than 1975. And mortality found lower in urban areas than rural areas at both times, 1968 and 1975 and it also found that female mortality was higher than that of male.

Rukanuddin (1982) has probed infant child morality and son preference as factors influencing fertility in Pakistan. The study concerned about the desire of the parents to have children but particularly sons, which results having high fertility rate in those couples who have either no son or having less number of sons. The main aim of the study was to examine effect of both son preferences and infant mortality on fertility behaviors. The technique used in this study is multiple classification analysis using data from Pakistan National Impact Survey 1968-69. Three models with different dependent variables have been specified: 1. total no of line births, 2. birth interval to next parity, and 3. Parity progression ratio to next parity, and estimated with independent variables; proportion of the female children among survivors, no of deaths prior to specific parity, sex of infant death of birth, no of male death prior to specific parity, education of mother, place of residence, adequacy of family living. The results of the study clearly showed that those couples who lost their male child wanted to have more children rather than those who lost female child which ultimately showed that sex of child and so preferences plays a vital role in determining fertility behavior of couples.

Zahid (1996) has analyzed mother's health seeking behavior and childhood mortality in Pakistan. Health seeking behaviors included consulting physician during prenatal, neonatal and post natal period. The main objectives of the study were: 1. examine pattern of health seeking behavior of mother and effect on childhood mortality, 2. compare effects of socioeconomic factors through demographic and health seeking

behavior on childhood mortality, and 3. to find out relationship between health seeking behavior and childhood mortality after controlling for demographic and socio-economic factors. The data used in this study are taken from Pakistan Demographic and Health Survey (PHDS) of 1990-91. Bivariate analysis has been done to see the possible relationship between dependent and independent variables while logistic regression run to analyze the net effect of each explanatory variables on infant and child mortality. Explanatory variables used in study are; maternal education, place of residence, sex differentials, place of delivery, breast feeding, immunization effect, drinking water supply, toilet facility, age of mother at birth, birth order of child. Results of study showed that mother's education and health care factors affect child, neonatal and infant mortality significantly, mother's high education reduces child mortality. At first and higher birth order mortality rate was higher than second and third order. So to decrease child mortality health services made accessible to people and educational status of population should be increased.

Shah et al., (1998) have examined the relationship between consanguinity and child mortality the risk that was faced by families. It was difficult to examine or isolate the effect of consanguinity on child mortality from other factors such as socio-economic or parental characteristics. But the main objective of the study was to examine effect of consanguinity on all stages of child mortality such as neonatal, infant and child hood stages. Data were taken from Pakistan demographic and health survey of 1991. Control variables were, mother's education, age of mother, no. of live birth, mother's work experience, fathers' education, mother's place of residence before age 12, and mothers' province of current residence. Binomial logistic regression analysis has been carried out

to see the effect of consanguinity on child mortality. Multivariate analyses showed that who were married with first cousin were more likely to experience deaths of child than others. So the education of first cousin marriages would reduce the parents suffering of losing their child before the age of five.

Bennett (1999) has probed correlates of child mortality in Pakistan. The main purpose of the study was the see the child mortality and its covariates in the low income stratum living in Rawalpindi Pakistan. The study used data from health care provides survey of 1992 of Rawalpindi, Pakistan, and used univariate cox proportional hazard models and multivariate cox proportional hazard analysis to see the individual effect of independent variable and simultaneous effect on child mortality respectively. Explanatory variables used in this study were; mother's past and present residence, religion, other's and father's occupation and their education status, income, type of toilet, child sex, children ever born, birth order and interval, mother's age at birth, mother's current age, contraceptive use in past, mother's age at marriage, type of garbage disposal, no. of rooms, possession of TV and refrigerator. Results showed that non economic factors affect more to child mortality, hygienic conditions, contraceptive use, current age and age at marriage of mother all have significant relation to child mortality.

Ali (2001) has identified the poverty and child mortality in Pakistan. The objective of the study was to identify correlates of child mortality and its relationship with poverty. The analysis of this study based on the Pakistan Socio-Economic Survey (PSES) data of 1999. The technique of Multiple Classification Analysis (MCA) was used to analyze the data. Independent variables used in his study were; mother's education,

mother's employment status, housing crowding, housing condition, socioeconomic condition (electricity, gas), housing sanitation, and nutritional status. The results showed all variables have significant relationship with child mortality as expected except food poverty, electricity and mother's work participation in rural areas showed in different direction which results in higher child mortality in rural than urban areas.

Habib-Ullah and Zafar (2003) have probed infant child mortality and life expectancy through constructing abridged life table. Data has been taken from Pakistan demographic and health survey of 1999 in this study. And from life tables the function 0q1, 1q4 and e0 were used to estimate mortality level and life expectancy of child and infants. The life expectancy level of child were increasing but at slow rate at birth of child. The mortality could be decreased at both level and life expectancy could be improved more if mother's educational level and ability in them to seek for health services would increased for their children. And in last the child and infant mortality was still high in Pakistan.

Arif et al., (2012) have examined socio-economic determinants of child health in Pakistan. The research objectives of study were to examine geographical variation in disease incidence that how child health varies across different ecological zones which are different in terms of economic status; to examine relationship between child health and economic factors; and to find impact of preventive health care especially child immunization on child illness. The study taken out on the data from Pakistan social and living standard measurement survey (PSLM) of 2009-10 conducted by federal bureau of statistics. Logistic regression carried out to take the result on child mortality. And for this

independent variables used here were child's characteristics: age, sex,; parent's characteristics: mother's age, mother's educational and employment status,; household characteristics: total no. of children born and having construction material, economic factors, poverty status, ownership of agriculture land and livestock, environmental factors, source of drinking water, toilet facilities, access to electricity,; regional characteristics,: health seeking behavior, child immunization. The findings of the study showed positive role of economic factors such as land and live stock with child health, and these were important for child health almost in all zones of rural and urban areas. Child mortality reduced as economic position of household enhanced because better economic status leads to access to better health facilities which in results leads to better health status of child. Same as economic factors, parents' characteristics also have significant impact on child health. This paper contributed in showing the economic status and child health relationship between keeping in view the geographical location.

2.4 Conclusion:

Child health, child mortality in particularly, is an important facet of social development of a country. A study on child mortality in relation to socio-economic and demographic characteristics in Pakistan is useful, as it is helpful in developing efficient policies that tackle the enormous challenges that country faces in improving child health. Literature review on child mortality suggests that a space exists in the previous studies that there may be few variables which needs to be explore in terms of the determinant of child mortality and there may be a need of study to identify the child mortality in Pakistan at provincial level.

Chapter 3

Methodology

3.1 Introduction:

This chapter provides a methodological basis to estimate the child mortality. The first section gives a brief description of the model used for child mortality and that is logistic regression and particularly binary logistic regression that is estimated through maximum likelihood ratio because child mortality(dependent variable) is in binary form (0,1) and this section also presents causes behind using this model. The second section contains variable construction of the model determining the variables to be incorporated in the analysis and the hypotheses are formulated on the basis of the already presented theory, methodical framework and empirical support. The next section gives the data source and working sample for the model to be estimated for determinants of child mortality. The last section provides the diagnostic tests to review the evidence from empirical research.

3.2 Model of Child Mortality for Pakistan:

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 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, 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.

So model for Pakistan is,

$$CM_i = f(\, MA_i, R_i, ME_i, EM_i, E_i, WI_i, BO_i, S_i, BI_i, u_i) \qquad (3.1)$$

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 year 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 = second 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).

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[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)

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

$$prob(Y_i = 1) = \frac{1}{1+e^{-(\alpha+\beta_1 X_1+\beta_2 X_2+\cdots+\beta_k X_k)}} + \epsilon \qquad (3.2)$$

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

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,

$$\frac{p}{1-p} = odd\ ratio = e^{(\alpha+\beta_1 X_1+\beta_2 X_2+\cdots+\beta_k X_k)} \quad (3.3)$$

Multivariate logit measures are applied to find out whether child mortality differentiates among provinces through the above discussed socio-economic and demographic explanatory variables, as hypothesized 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:

$$Ln\left[\frac{(p)}{(1-p)}\right] = a + \sum b_i X_i \quad (3.4)$$

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;

$$ln\left(\frac{p(CM)}{1-p(CM)}\right) = \alpha + \beta_{1i}(MA_i) + \beta_{2i}(R_i) + \beta_{3i}(ME_i) + \beta_{4i}(EM_i) +$$

$$\beta_{5i}(E_i) + \beta_{6i}(WI_i) + \beta_{7i}(BO_i) + \beta_{8i}(S_i) + \beta_{9i}(BI_i) \quad (3.5)$$

$$CM_i = \alpha + \beta_{1i}(MA_i) + \beta_{2i}(R_i) + \beta_{3i}(ME_i) + \beta_{4i}(EM_i) + \beta_{5i}(E_i) +$$

$$\beta_{6i}(WI_i) + \beta_{7i}(BO_i) + \beta_{8i}(S_i) + \beta_{9i}(BI_i) + u_i \quad (3.6)$$

$$u_i \sim 0\ , p_i(1 - p_i)$$[4]

[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).

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).

Theoretical hypothesis for these variables are;

i. $\boldsymbol{H_1}: \beta_3 = 0$

ii. $\boldsymbol{H_2}: \beta_4 = 0$

iii. $\boldsymbol{H_3}: \beta_5 = 0$

iv. $\boldsymbol{H_4}: \beta_6 = 0$

v. $\boldsymbol{H_5}: \beta_1 = \beta_2 = \beta_8 = \beta_9 = 0$

vi. $\boldsymbol{H_6}: \beta_7 = 0$

Theoretical hypothesis for model is;

$\boldsymbol{H_1}: All\ the\ predictors\ have\ no\ relationship\ with\ Child\ Mortality.$

3.3 Child Mortality Model for Provinces:

As described for Pakistan model, has binary choice outcome, same as all provinces of Pakistan has the binary choice outcome variable. So keeping in view that child mortality has discrete outcome, logit model will also apply for all the four provinces of Pakistan. And for that matter four different models need to be define that describes factors that

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

affect child mortality in provinces. So functional form of these four model for provinces formulate in the same way as functional form of Pakistan model has been formulated.

Model for Punjab:

$$CMP_{ipunjab} = [\alpha_{i1}][\beta_{i1}(MAP) + \beta_{i2}(RP) + \beta_{i3}(MEP) + \beta_{i4}(EMP) + \beta_{i5}(EP) + \beta_{i6}(WIP) + \beta_{i7}(BOP) + \beta_{i8}(SP) + \beta_{i9}(BIP)]\,[u_{i1}] \quad (3.7)$$

$$[u_{i1}] \sim 0\,, p_i(1 - p_i)^5$$

Model for Sindh:

$$CMP_{isindh} = [\alpha_{i2}][\gamma_{i1}(MAP) + \gamma_{i2}(RP) + \gamma_{i3}(MEP) + \gamma_{i4}(EMP) + \gamma_{i5}(EP) + \gamma_{i6}(WIP) + \gamma_{i7}(BOP) + \gamma_{i8}(SP) + \gamma_{i9}(BIP)]\,[u_{i2}] \quad (3.8)$$

$$[u_{i2}] \sim 0\,, p_i(1 - p_i)$$

Model for Khyber Pakhtunkhwa:

$$CMP_{ikpk} = [\alpha_{i3}][\delta_{i1}(MAP) + \delta_{i2}(RP) + \delta_{i3}(MEP) + \delta_{i4}(EMP) + \delta_{i5}(EP) + \delta_{i6}(WIP) + \delta_{i7}(BOP) + \delta_{i8}(SP) + \delta_{i9}(BIP)]\,[u_{i3}] \quad (3.9)$$

$$[u_{i3}] \sim 0\,, p_i(1 - p_i)$$

[5] 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)

Model for Baluchistan:

$$CMP_{ibaluchistan} = [\alpha_{i4}][\vartheta_{i1}(MAP) + \vartheta_{i2}(RP) + \vartheta_{i3}(MEP) + \vartheta_{i4}(EMP) + \vartheta_{i5}(EP) + \vartheta_{i6}(WIP) + \vartheta_{i7}(BOP) + \vartheta_{i8}(SP) + \vartheta_{i9}(BIP)]\,[u_{i4}] \quad (3.10)$$

$$[u_{i4}] \sim 0\,, p_i(1 - p_i)$$[6]

Where,

$P =$ Provinces, representing each province of Pakistan that are Punjab, Sindh, KPK, and Baluchistan.

$CMP =$ child mortality, it is constructed in binary form(0,1). As, 0 = 'child is alive' and, 1 = 'child is dead'.

$MAP =$ mothers' age, this variable is described in five year 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.

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

$MEP =$ mothers' education, this variable shows the different level of formal education of mother. It has assigned values as, 0 = no education of mother, 1 =

[6] Assumption of u_i for Sindh, KPK and Baluchistan are same as for Pakistan and Punjab error term has.

primary educational level of mother, 2 = second educational level of mother and, 3 = higher education of mother.

$EMP =$ 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.

$EP =$ 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.

$WIP =$ wealth index, this index is used to show the economic and living standard as well of mother and house. It is classified as, 1 = poorest, 2 = poorer, 3 = middle, 4 = richer and, 5 = richest.

$BOP =$ birth order, it tells the order of the child(first, second, third etc order of birth) that at what place a child had among his/her sibling.

$SP =$ child sex, this variable is also defined in binary form. As, 1 = male child and, 0 = female child.

$BIP =$ birth interval, this variable shows the spacing between the children. To capture the interval between children months has been imputed.

3.4 Data:

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 Pakistan (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[7] were composed at the time of the survey. Total number of observation on child mortality rate are 9178 and distributed across provinces as follows: 3705 is the total number of observation in Punjab, 2649 in Sindh, 1787, in KPK and in Baluchistan 1036 observations reported. 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. This total number of observations is then distributed across provinces as follows: 2883 is the total number of observation in Punjab, 2100 in Sindh, 1427 in KPK and in Baluchistan 815 observations reported.

[7] 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)

3.5 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. And parameter for such models estimated through maximum likelihood method (MLM), R. A. Fisher has introduced the method of maximum likelihood in 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 maximizes $L(\theta|x)$. That is, $\hat{\theta}_{mle}$ solves,

$$\max_{\theta} L(\theta|x) \tag{3.11}$$

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

$$\ln L\,(\theta|x) = \ln(\prod_{i=1}^{n} f(x_i;\ \theta)) = \sum_{i=1}^{n} \ln f\,(x_i;\theta) \tag{3.12}$$

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

$$S(\theta|x) = \frac{\partial \ln L\,(\theta|x)}{\partial\,\theta} \tag{3.13}$$

By definition, the MLE satisfies,

$$S\left(\hat{\theta}_{mle}\middle|x\right) = 0 \tag{3.14}$$

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

$$S(\theta|x) = \sum_{i=1}^{n} \frac{\partial \ln f\,(x_i\,;\,\theta)}{\partial\,\theta} = \sum_{i=1}^{n} S\,(\theta|x_i) \tag{3.15}$$

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.

3.5.1 Bernoulli Sampling:

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

$$f\,(x\,;\,\theta) = L\,(\theta|x) = \prod_{i=1}^{n} \theta^{x_i}\,(1-\,\theta)^{1-\,x_i} = \theta^{\sum_{i=1}^{n} x_i}\,1-\,\theta^{n-\,\sum_{i=1}^{n} x_i} \tag{3.16}$$

The log-likelihood function is,

$$lnL\,(\theta|x) = \ln\,(\,\theta^{\sum_{i=1}^{n} x_i}\,1-\,\theta^{n-\,\sum_{i=1}^{n} x_i}) \tag{3.17}$$

Open log function,

$$= \sum_{i=1}^{n} x_i \ln(\theta) + \,(n-\,\sum_{i=1}^{n} x_i)\ln(1-\,\theta) \tag{3.18}$$

The score function for the Bernoulli log-likelihood is,

$$S(\theta|x) = \frac{\partial \ln L(\theta|x)}{\partial \theta} = \frac{1}{\theta}\sum_{i=1}^{n} x_i - \frac{1}{1-\theta}\left(n - \sum_{i=1}^{n} x_i\right) \quad (3.19)$$

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

$$\hat{\theta}_{mle} = \frac{1}{n}\sum_{i=1}^{n} x_i \quad (3.20)$$

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

3.6 Diagnostic Test:

3.6.1 Wald Test:

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:

$$wald = \left[\frac{\beta}{s.e_b}\right]^2 \quad (3.21)$$

which has *chi-square* distribution with 1 degree of freedom. Null and alternative hypothesis for Wald test are:

H_0: β=0 (insignificant)

H_a: β≠0 (significant)

3.6.2 Coefficient of determination R-square(R^2):

R-square(R^2) test the goodness of fit of the whole model. For binary logistic regression MacFadden R^2 and Cox and Snell R^2 is used to check the goodness of fit for the model.

The MacFadden R^2 is,

$$R^2_{McF} = 1 - \frac{ln(L_M)}{ln(L_O)} \tag{3.23}$$

The Cox and Snell R^2 is,

$$R^2_{C\&S} = 1 - \left(\frac{L_O}{L_M}\right)^{\frac{2}{n}} \tag{3.22}$$

3.7 Conclusion:

This chapter provided the model to analyze child mortality in provinces separately and Pakistan as well through a binary choice model, where the dependent variable has just two possible outcomes, one or zero. Here in this study binary logit model used in the light of previous applied empirical work. So five model are described in this chapter, one for Pakistan and four separate model for each province. These five models then estimated through maximum likelihood method, has Bernoulli distribution, and logistic distribution is the extension of Bernoulli distribution. To carried out estimates for logit model the cross section data has been taken form PDHS and estimated through maximum likelihood method.

Chapter 4

Results and Discussion

4.1 Introduction:

Results underscores the primacy of addressing child mortality on provincial level and as well as for Pakistan through factors that it. 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 and four provinces of 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.

This chapter contains the detail discussion on results of factors affecting child mortality. First section consists on the result for Pakistan, child death by age ratio in Pakistan and diagnostic test on Pakistan model. Second section comprises of the results of Punjab and the same ratio and diagnostic test done for this model. Third part of this chapter deals with the model for Sindh and also mention the ratio of child death by age and diagnostic test for child mortality in Sindh. Fourth portion contains results, child death by age fraction and diagnostics for province Khyber Pakhton Khan. Fifth section shows the child mortality relation to control variables, its diagnostic test and percentage

of child death by age in Baluchistan. And last part gives the in detail discussion on all these models.

4.2 Child Mortality by Age in Pakistan and Provinces:

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 shows the ratio of death by age of child mortality in Pakistan and four provinces of 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 and for all provinces as well. 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% in Pakistan, 65.8% in Punjab, 62.8% in Sindh, 56.6% in KPK and 52.1% in Baluchistan child deaths occur during the neonatal period.

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%, 28.7%, 29.9%, 39.2% and 37.9% for Pakistan, Punjab, Sindh, KPK and Baluchistan respectively, 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%, 0.7% and 0 for Pakistan, Punjab and Baluchistan respectively. While for Sindh when child is turning to age three is the lowest

death rate of child, that is 0%. In KPK lowest deaths' of child occur when child is turning to age three and four, that is 0.8% at both level.

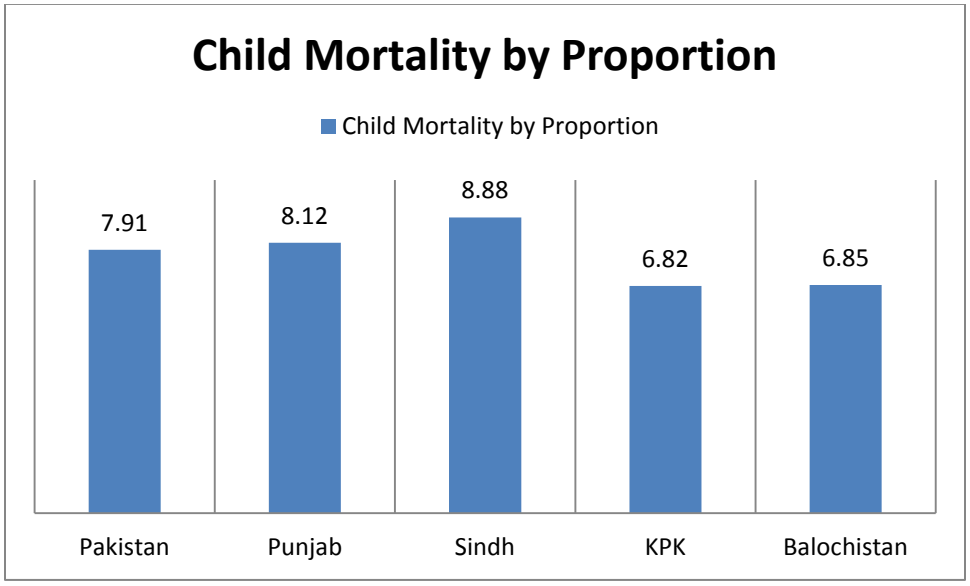
In Pakistan and all provinces the child mortality is high at birth time of child when a child has not reached to a month. In above results it can be seen that in Pakistan and all provinces (Punjab, Sindh, KPK and Baluchistan) most of the child deaths occur at time of birth or in first 28 days of birth,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

Table No. 4.1 Total Number and Ratio of Child Mortality by Age in Pakistan and Provinces

	Pakistan		PUNJAB		SINDH		KPK		BALUCHISTAN	
Age at death (Days and Years)	**Number of Children death (N)**	**%age of Children Death**	**Number of Children death (N)**	**%age of Children Death**	**Number of Children death (N)**	**%age of Children Death**	**Number of Children death (N)**	**%age of Children Death**	**Number of Children death (N)**	**%age of Children Death**
At Birth (0 up to 28)[8]	425	62%	199	65.8%	147	62.8%	69	56.6%	37	52.1
< 28[9] up to 1	232	31.9%	86	28.7%	70	29.9%	48	39.2%	27	37.9%
< 1 up to 2	30	4.1%	9	3.0%	14	5.9%	3	2.4%	4	5.6%
< 2 up to 3	9	1.2%	5	1.7%	0	0%	1	0.8%	3	4.2%
< 3 up to 4	6	0.8%	2	0.7%	3	1.3%	1	0.8%	0	0%
Total	729	100%	301	100%	234	100%	122	100%	71	100%

[8] Time period from child birth to first 28 days.
[9] ibid

Figure 4.1 Proportion of Child Mortality in Province and Pakistan



These proportion are drawn from the above table. Above ratios showing the cases in provinces and Pakistan that has high child death rate and that ratio moves with the population size. On the other hand these proportion shows the proportion by which these death are occurring in province wise and Pakistan. These proportion helps in making better understanding to see that which area has high child mortality and needs to look more closely its factors.

According to these ratio child mortality rate is high in Sindh than any other province and Pakistan. After sindh there comes Punjab and then Pakistan where child mortality is high. If these proportion compares with the ratio in table 4.1 then child mortality is high in Pakistan and Punjab but that is because of the population distribution.

4.3 Estimation of Child Mortality Model for Pakistan and Provinces:

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. Neo natal 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 (Neo-natal 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, 3.7, 3.8, 3.9, 3.10 for Pakistan, Punjab, Sindh, KPK and Baluchistan respectively. 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, Punjab, Sindh, KPK and Baluchistan.

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 tabulated value of *3.841* at 5% significance level and *2.706* at 10% 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, and for Punjab 0.014 and 0.043, for Sindh 0.013 and 0.036, for KPK 0.005 and 0.044, lastly for Baluchistan, R-square is 0.042 and MacFadden R-square is 0.107. 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.

4.3.1 Child Mortality in Pakistan:

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% level of significance while mothers' age and mothers' education are significant at 10% 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 No. 4.2 Results of Child Mortality : Binary Logistic Regression (Odd Ratios OR)

Variable	Pakistan	Pakistan	Punjab	Punjab (OR)	Sindh	Sindh (OR)	KPK	KPK (OR)	Baluchistan	Baluchistan (OR)
MA	-0.081* (2.722)	0.922*	-0.005 (0.004)	0.995	-0.171* (3.265)	0.843*	-	-	-0.342** (4.436)	0.710**
R	-0.111 (0.902)	0.894	-0.040 (0.049)	0.961	-0.116 (0.281)	0.891	-	-	-0.512 (1.213)	0.599
ME	-0.119* (2.794)	0.888*	-0.109 (1.118)	0.897	-0.210 (2.262)	0.811	0.129 (0.690)	1.138	-16.784 (0.000)	5.13×10^{-8}
EM	-0.088** (6.817)	0.916**	-0.098** (5.706)	0.907**	-0.039 (0.289)	0.962	-0.110 (1.133)	0.896	-0.472 (1.102)	0.624
E	0.004 (2.466)	1.004	-0.010 (1.058)	0.99	0.005* (3.324)	1.005*	-0.018 (1.183)	0.982	0.014** (5.550)	1.014**
WI	-0.142** (9.955)	0.868**	-0.227** (10.406)	0.797**	-0.040 (0.220)	0.961	-0.128 (1.615)	0.879	0.041 (0.039)	1.042
BO	0.035 (1.875)	1.035	0.023 (0.346)	1.023	0.093** (4.202)	1.097**	-	-	0.017 (0.038)	1.017
S	-0.046 (0.255)	0.955	0.009 (0.004)	1.009	-0.043 (0.071)	0.958	-	-	-0.323 (1.205)	0.724
BI	-0.010** (12.053)	0.99**	-0.010** (5.143)	0.99**	-0.013** (4.974)	0.987**	-0.012* (2.828)	0.988*	-0.002 (0.054)	0.998
Constant	-1.661** (77.796)	0.189**	-1.546** (24.827)	0.213**	-1.730** (27.980)	0.177**	-1.993** (32.465)	0.136**	-0.940 (2.188)	0.391
Cox-Snell R-square	0.009	-	0.014	-	0.013	-	0.005	-	0.042	-
Macfadden R-square	0.026	-	0.043	-	0.036	-	0.044	-	0.107	-

Note: (**) coefficient significance at 5%, (*) coefficient significance at 10%.

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% 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%. 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.

4.3.2 Child Mortality in Punjab:

According to the chi-square value for variables, as it can be observed in Table 4.2, for Punjab, that exposure to media(TV), wealth index and preceding birth interval are significant 5% level of significance. Remaining variables that are mothers' age, mothers' education, place of residence, ethnicity, birth order and child sex turn out to be insignificant because calculated chi-square for these variables is less then tabulated chi-square.

Exposure to media has coefficient value of 9.8% with odd ratio of 0.907 as seen in Table 4.2, that shows having TV at home reduces child mortality by 0.907 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.

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 0.797 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.

When there exist birth interval between current child and previous child then probability of child mortality is 1%. 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.

4.3.3 Child Mortality in Sindh:

Variables that reject null hypothesis and concluded as significant are birth order and preceding birth interval at 5% level of significance while mothers' age and ethnicity at 10% level of significance. These results are according to the chi-square value of variables for Sindh, as it can be seen from Table 4.2. Remaining variables that are mothers' education, place of residence, exposure to media(TV), wealth index, 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.

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 0.843 times as mothers' age group rises from 15-49. so it also indicates that mothers belong to the age groups of 25-29 to 45-49 have low chance of child death before age five. As mothers' age increases child death rate reduces, showing that higher mothers' age has better way to take care of their children.

Ethnicity has positive association with child mortality in Sindh. That means sindhi language has an impact on child mortality and child belongs to sindhi speaking mother has 1.005 times more chances of death than child of mother with any other language.

Sindhi children have higher mortality rate and children born to Sindhi women society are at larger risk of dying before age five than children born to women of other ethnicities.

Birth order has positive relationship with child mortality representing that there is high child mortality level with the higher birth order. It is showing that occurrence of child mortality in later birth order is 1.097 times higher than earlier births (1st or 2nd order birth).

When there exist birth interval between current child and previous child then probability of child mortality is 1%. 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.

4.3.4 Child Mortality in Khyber PakhtunKhwa:

According to the chi-square value for variables as it can be seen in Table 4.2, for KPK, that reject null hypothesis and concluded as significant is preceding birth interval at 10% level of significance. Remaining variables that are mothers' education, exposure to media(TV), wealth index, and ethnicity accept null hypothesis that says these variables are insignificant because calculated chi-square for these variables is less then tabulated chi-square.

When there exist birth interval between current child and previous child then probability of child mortality is 1.2%. 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.

4.3.5 Child Mortality in Baluchistan:

Baluchistan model estimated as it can be seen in Table 4.2, according to the chi-square value for variables that reject null hypothesis and concluded as significant are mothers' age and ethnicity at 5% level of significance. Remaining variables that are place of residence, mothers' education, exposure to media(TV), wealth index, preceding birth interval, 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.

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 0.71 times as mothers' age group rises from 15-49. so it also indicates that mothers belong to the age groups of 25-29 to 45-49 have low chance of child death before age five. As mothers' age increases child death rate reduces, showing that higher mothers' age has better way to take care of their children.

Ethnicity has positive impact on child mortality in Baluchi. That means baluchi language has an impact on child mortality and child belongs to baluchi speaking mother has 1.014 times more chances of death than child of mother with any other language. People belong to this language has higher mortality rate for children, child mortality

differentials by ethnicity show that children born to women of Baluchi society are at larger risk of dying at all possible ages than children born to women of other ethnicities.

4.4 Discussion:

This study also shown the factors that point out the reasons behind the high child mortality rate over all for Pakistan and also for the all provinces individually. In Pakistan and provinces particulars 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 programs 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. But in this study there is a point that should be noticed that exposure to media has significant association in Pakistan and Punjab but not in other provinces.

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 and Punjab. That in these two models, 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. This is the only variable which has shown significant relationship with child mortality in Pakistan, Punjab, Sindh and KPK except for Baluchistan. It has no role in Baluchistan in determining the high rate of child mortality.

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 health 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. Mother education has significant association with child mortality only for Pakistan while for all provinces of Pakistan it has no significant association. 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, Sindh

and Baluchistan while not significant in Punjab and KPK that take similar to the results by Afzal et al., (1976) who also concluded mothers' age as insignificant in his study.

Birth order is also a demographic variable according to previous studies and has significant and positive relationship with child mortality. Such as studies by Zahid (1996), Becher et al,. (2004). According to their study high birth order have high child mortality and same results are concluded in this study. There are different reason for that, one of them is that mother has to look after the other children so that child (later child) get less attention and care from mother and other reason could be that mother do not has good health and strength as she has at the time of birth of her/his elder brother/sister of that later child, so child born as weak one and having health issues from the starting day he/she born. Birth order is only significant in province of Sindh.

Ethnicity is generally used to show the cultural differences but in this study particularly it has used language to show the cultural differences between different provinces of Pakistan that how different households differentiate through different languages. This variables has not been used in previous studies that has been carried out in Pakistan. And ethnicity only has significant and positive relationship with child mortality in province of Sindh and Baluchistan, in other models of Punjab, KPK and Pakistan it is not significantly related to child mortality. This significant shows that mothers who speak Baluchi and Sindhi language have higher rate of child mortality than mothers of other languages in these provinces. Ethnic association is very little in both provinces.

There is significance positive impact for Sindhi and Baluchi mothers to child mortality that is because education level in these provinces is lower than other two provinces (Punjab and KPK) and in result know how about child health and mother health in these provinces is lower especially to the community who speaks Sindhi and Baluchi. This relationship between ethnicity and child mortality rate are similar to few studies conducted in some areas of Africa by Brockerhoff and Hewett (2007) and Haines (2010).

4.5 Conclusion:

This chapter comprises of the estimation of five models, these model are for Pakistan, Punjab, Sindh, KPK and Baluchistan. Logistic regression has been used to model Pakistan and four provinces of Pakistan. In logistic regression particularly binary logistic model with binomial distribution has used to model these five model. All these model are then estimated through maximum likelihood estimation that has Bernoulli distribution.

Gupta (1990), Ali (2001) and Susuman (2012) have shown wealth index and exposure to media as significant and important factors of child mortality. Estimated results of Pakistan and Punjab are quiet similar to their results, as exposure to media and wealth index is only significant in Pakistan and Punjab. Brockerhoff and Hewett (2007) and Haines (2010) showed significant effect of ethnicity on reducing child mortality in different areas of Africa, similar to these results Sindh and Baluchistan showed the same pattern. Baluchistan is the only province that has not significant results for birth interval, while birth interval is the only variable that is significant for other four model and depicts

the same results as showed by Hobcraft et al., (1985) and Porath (1976) that birth interval reduce child mortality.

Chapter 5

Conclusion and Policy Recommendations

5.1 Introduction:

Now-a-days there is heated discussion going on child mortality in news and in many organization 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% 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. So this study attempts to make a useful contribution to the already existing literature through measuring child mortality not only in Pakistan but also examining it for four provinces - Punjab, Sindh, Khyber Pakhtunkhwa and Baluchistan.

5.2 Findings:

This study attempts to examine child mortality and its correlates through using data from Pakistan Demographic Health Survey (PDHS) 2006-07. The sample of the study restricted to children of age under five years (0-4) and PDHS has identified 9177 children of this age group. For this study, the 2006-07 PDHS sample is divided into five groups; Pakistan, Punjab, Sindh, KPK and Baluchistan. And this data then modeled in binary logit models and estimated with the help of maximum likelihood method (MLM).

In study many factors have been pointed out that contributes in determining child mortality. This study also helps in examining child deaths not only in Pakistan but also in provinces of Pakistan separately to examine the factors that plays different role in provinces of Pakistan. And it has been shown that there are few variables that are not significant in Pakistan but they contributed significantly for provinces of Pakistan in determining child mortality.

Such as birth order and ethnicity are variables that has association with child mortality in provinces of Sindh and Baluchistan but has no significant result for Pakistan. Even there are few variables that has association only in Pakistan but does not affect the child mortality in provinces of Pakistan such as mothers' education. Few variables that contributed in determining and has same significant association with child mortality in Pakistan and as well as for provinces of Pakistan are exposure to media, wealth index, birth interval, mothers' age and mothers' education. There are few variables that have similar and significant association in different provinces. Ethnicity has similar results (regarding sign and significance) in Sindh and Baluchistan whereas in Punjab, KPK and Sindh birth interval plays that role.

This study clear the situation of child mortality and also determines the factors that causes the child deaths for Pakistan and four provinces of Pakistan individually 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.

5.3 Policy Recommendations:

The aim of this study has been to examine determinants of child mortality in Pakistan and provinces, with a particular attention on wealth, exposure to media, mothers' education and ethnicity. Internationally recognized 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 minimize 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.[10]
- 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.

[10] This policy should be of focal point by Government of Pakistan but it needs more attention for the Punjab provincial government than other provinces, because it found significant in that province rather not in other provinces.

- 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.[11]

5.4 Further Research Opportunities:

The study has not capture the effect of health variables such as lactation, access to health facilities, use of contraception on child mortality in each province individually. All these variables has been studied in previous studies but effect of these variables is only seen for Pakistan. So there is also need to study these variables individually at provincial level also.

[11] KPK has only a significant variable that is birth interval - also significant for other provinces and Pakistan except Baluchistan. So main focus of that policy should be at provincial level than national level.

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