A STUDY ON

CHILD MORTALITY IN INDIA

A Report submitted for the Degree of Master of Science in Statistics to the department of Statistics of University of Allahabad

By:

Yashjeet Pratap Singh

DEPARTMENT OF STATISTICS,

UNIVERSITY OF ALLAHABAD, PRAYAGRAJ 211002

A project report on

A Statistical Analysis on Child Mortality in India

Major Project

Year 2022

UNDER SUPERVISION:

Dr. G Madhusudan

(Assistant professor)

Department of Statistics

SUBMITTED BY:

Yashjeet Pratap Singh

M.Sc. Statistics (4th SEM)

Enrolment: U2075022

DEPARTMENT OF STATISTICS

UNIVERSITY OF ALLAHABAD

PRAYAGRAJ 211002

<u>Certificate</u>

This is to certify that the project entitled "**A statistical study on child mortality in India**" submitted to University of Allahabad in fulfillment of the requirements for the award of the degree of **Master of Science** in Statistics is the project work carried out by **Ms. Yashjeet Pratap Singh** under my guidance and supervision and that it has not formed before the basis for the award of any degree.

The candidate has put the required attendance as per the ordinance of University of Allahabad, Uttar Pradesh.

Prof. Shekhar Shrivastav

(Head of Department, Statistics)

University of Allahabad

Dr. G Madhusudan

(Assistant Professor)

Department of Statistics

University of Allahabad

Acknowledgement

It is time to pen down my deep depth of gratitude to my project supervisor **Dr. G. Madhusudan** Assistant professor**,** Department of Statistics University of Allahabad who gave me the opportunity to do this project the topic **A Statistical study on the Child Mortality in India,** whose valuable guidance and kind supervision helped me in doing a lot of research and I came to know about so many things. He not only enabled me to evolve and shape my ideas regarding the subject of my project but also taught me the basic rudiments of research and to get it in shape.

I am pleased to express thanks place on record, my thankfulness to **Prof. Shekhar Shrivastav** Head of Department, University of Allahabad, for providing the facilities required to do my project. I wish to render my profound sense of gratitude to my venerable teachers of the Department named **Dr. Pramendra Singh Pundir**, **Dr. Girish Chandra, Dr. Abhay Pratap Pandey, Dr. Prashant Kumar** and **Dr. Priyanka Singh** for their constant support and fruitful suggestions during the different phases of my project.

I would like to thanks **Mr. Amit Kumar** for his continuous encouragement and support. I am also thankful to **Mr. Himanshu Katyan** for creating interest and motivate to explore and implementation of my abilities in use while carrying this project.

This project would not have been possible without **Mr. Saurabh Kumar Singh,** research scholar and **Mr. Ojasvi Singh,** research scholar, who spared all the time that I needed for discussions, queries and instruction, from her busy academic and personal schedule and guiding me from time to time throughout this project.

I am also very much grateful to my friends **Sayed faizul Abbas, Shreyash Mishra** and all other my seniors and classmates who also helped me a lot in gathering information, they gave me different ideas in making this project unique.

I owe thanks to a very special person, my lovely brother **Vishvjeet Singh**, my cousins **Aradhya, Abhi,** my Uncle and aunt for his continued and unfailing love, valuable support and prayers.

Finally, I would like to acknowledge the people who mean the world to me, my parents, who taught me to dream big, and were constant source of support throughout my work.

Thank you, Almighty God,

(Yashjeet Pratap Singh)

Abstract

This study uses data from the "National Family Health Survey (NFHS IV) 2015 of India" to investigate the predictors of child (age 1-4 years] mortality in a developing country like India. The cross-tabulation and multiple logistic regression techniques have been used to estimate the predictors of child mortality. The cross-tabulation analysis shows that parents' education is the vital factor associated with child mortality risk but in logistic regression analysis only the father's education has been found significant to reducing child mortality. Occupation of father has been found a significant characteristic in both analyses, further mother's education, birth order has substantial impact on child mortality in India.

The cross-tabulation analysis shows that that mortality rate was highest (5.55%) for children of illiterate mothers and lowest (2.11%) among mothers with higher education. In the logistic regression analysis, education of both parents and occupation of mothers were found statistically significant to reduction in child mortality rate. The result also revealed that mothers' wealth index, age at first birth and usual of place of residence have substantial impact on child mortality in India.

Finally, these findings specified that an increase in parents' education, improve health care services which should in turn raise child survival and should decrease child mortality in India.

Key words: Infant mortality, Child mortality, predictors, wealth index, logistic regression.

Content

Chapter 1
Introduction

1.1 General introduction

Children play a vital role for the nation's social welfare, in this characteristic study related to children's situation is the main interest for the planners of a country. Infant and child mortality are important indicators for a socio-economic welfare of a country. Thus, it is very important to know the child health and death perspective in the nation. Mortality analysis is one that solve the purpose and it analyse the behaviour of deaths of infant and child.

Children mortality is considered as a direct and one of the most important indicators of health in a country. There are mainly five indicators of child mortality. They are as follow: Under 5 Mortality rate (U5MR), Child Mortality Rate (CMR), Neonatal (<28 days), Post neonatal (28-365 days) and Infant (<1 year) mortality rate. which are components of U5MR (UNICEF 2015). These indicators are measured as the number of per 1000 live births.

Reducing infant and child mortality has been a major priority of public health for a few decades now. Globally, there has been a rapid decline in infant and child mortality, but the burden is still high in low and middle-income countries. The global U5MR declined from 91 deaths per 1000 live births in 1990 to 39 deaths per 1000 live births in 2019 (UN 2019). There has been a slow decline of Infant and child mortality rates in India over the past decades. India was ranked 48th out of 89 countries on Infant mortality rate (UN 2019). India failed miserably in its attempt to achieve the MDG 5 target, which led to huge implications as India accounted for almost 20% of world's infant deaths (UNICEF 201 7). The National Family Health Survey (NFHS) estimates show a gradual decline in infant and child mortality in India.

China and India shared same child mortality rate (CMR) and infant mortality rate (IMR) as well during 1950-55, however China has a rapid reduction in above stated indicators. A six-times decline in infant mortality in China and only three times in India during 2000-2005, whereas infant mortality in 1950-55 was 190 in India and 195 in China over 1000 live births. In India, IMR & U5MR declined gradually from 86 per 1,000 live births and 119 per 1,000 live births in 1992 to 35 per 1,000 live births and 42 per 1,000 live births respectively (IIPS 1995 & IIPS and NFHS 2019). India witnessed an approximate 1.2 million Under 5 deaths, the highest among the world (Liu et al. 2016).

For infant and young children, the risk of dying is closely related to the environment where they live, because they are ill equipped to deal with infection. Inadequate food and lack of elementary hygiene are the other factors. While a baby is in her mother's womb, the health and the nutrition of the mother, her age, the number of children she already had, the interval between them and the care during pregnancy, etc. have profound influence on child survival. Inadequate care during delivery, incomplete or no immunization, inadequate or no breast feeding and improper supplement feeding practices further enhance the hazard to a child. Thus, the determinants of child survival vary according to various socio-economic, cultural, demographic and health care factors

The availability of service pattern at different levels of service point indicates that maternal and child health service still seems to depend upon a routine care with limited facilities and low-level medical interventions. Moreover, services for maternal health care meant focus on providing antenatal, childbirth, and postnatal care, while for child health care meant focus on treatment of acute respiratory infection with a high rate of antibiotic and treatment of diarrhoea with a low supply of ORS till recent past, particularly in the rural areas. The policy of providing quality services like care of women with obstetric complications and of newborns with complications is even a recent policy. Its implementation is not effective due to health facilities without skilled manpower, equipment, and drugs at primary health care units. Moreover. the provision of doctors is only in the district hospitals and primary health centres. Most of the maternal deaths or child deaths occur in the community. It simply urges that whatever services and interferences are proposed in the policy need to be focused at the community level.

The policy of bringing awareness about the complications during and after pregnancies among family and community members is not properly implemented. Newborn care, particularly at the community level, is yet to be put in place according to the guidelines of the National Neonatal Health Strategy that was formulated in 2004 (WHO, South Asian). It can be said that poor implementation of strategies is one of the main reasons for the low level of utilization of maternal and child health services in India.

Indian government initiated the National Rural Health Mission (NRHM) in 2005, to improve the quality of health care for poor, women, children and especially for those who residing in rural areas. The crucial goal of NRHM were to decline IMR and Maternal Mortality Ratio (MMR), to improve public health services such as child health, women health, sanitation, immunization, water, nutrition, limitation from communicable, non-communicable and widespread diseases among many.

Therefore, study of the overall picture of a child survival is the prime interest for the demographers and survival analysis provides a platform to move further in the same line. Regression models are helpful to understand the socio-economic, demographic, biological and environmental determinants of mortality especially infant and child under-five mortality as discussed above.

1.2 Definition and basic concept

A mortality rate is a measure of the frequency of occurrences of death in a defined population during a specified interval. Mortality rate is typically expressed in units of deaths per 1,000 live births in a year; thus, a mortality rate of 9.5 in a population of 10,000 would mean 950 deaths per year in that population.

It is applied to the whole population; therefore, can be misleading.

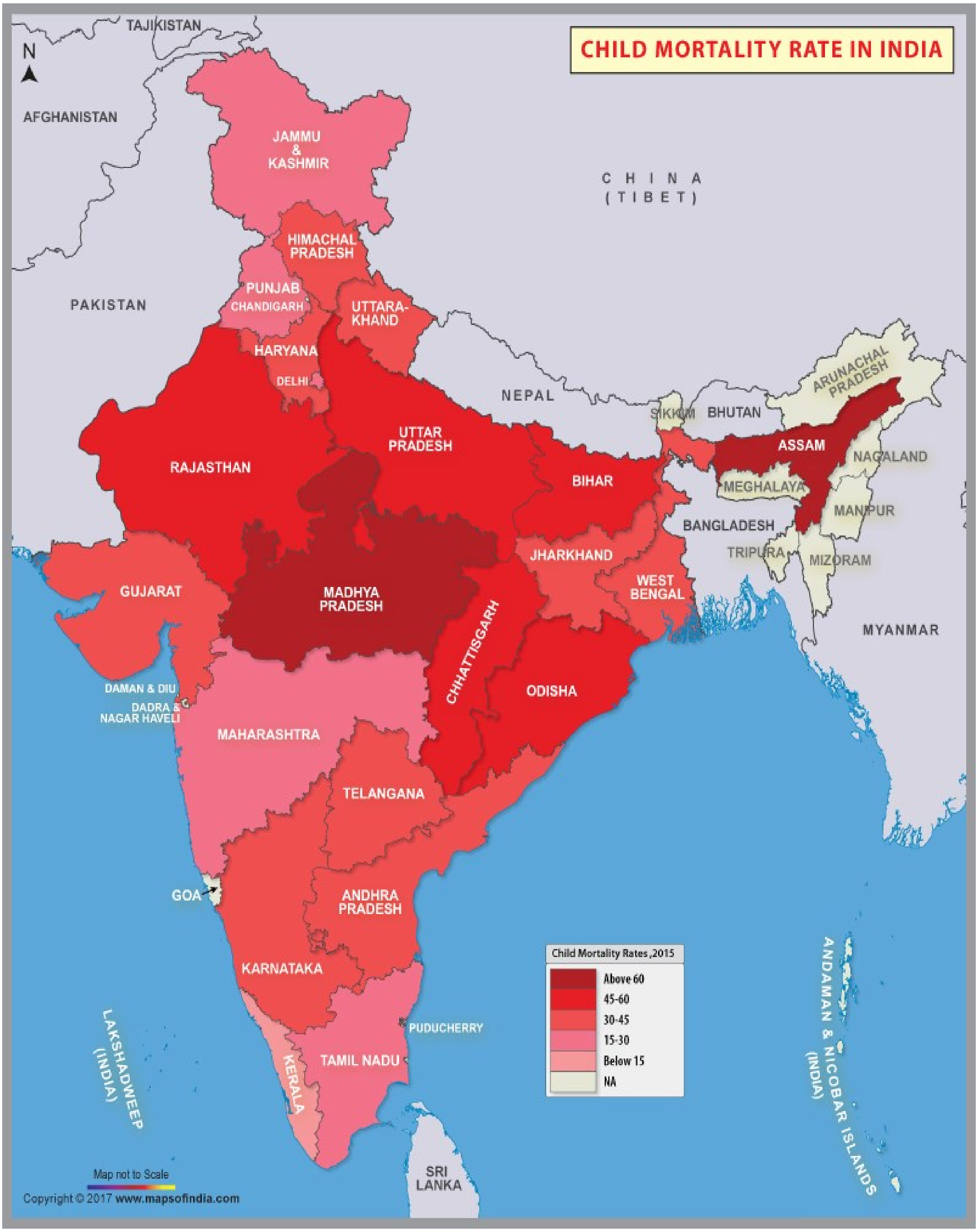
It is well said that the well-being of societies is directly linked to the health and survival of mothers and children. When mothers survive and thrive, their children survive and thrive. When both mothers and children survive and thrive, the societies in which they live prosper. The survival and well-being of mothers and children are not only important in their own right, but is also central to solving much broader economic, social and developmental challenges. When mothers and children die or are sick, their families, communities and nations suffer as well. Improving the survival and well-being of mothers and children will not only increase the health of societies, it will also decrease inequity and poverty. In this study we mainly focus on the most widespread mortality rate and many research have been occupying to overcome and improving the dashboard of the level of the socio-economic and health system so a suitable living and working environment for the nation for many decades.

1.2.1 Child Mortality Rate

Child mortality is the mortality of children of under the age of 5. Child mortality rate is defined as the number of deaths of the children at the age between 1st birthday and 5th birthday per 1000 live births. The crude death rate at all India level has declined significantly from 14.9 to 12.5 during 1971 to 1981 and thereafter from 9.8 to 6.0 during 1991 to 2019. The decline has been steeper in rural areas as compared to urban areas. The child mortality rate has depicted a appreciable decline from 51.9 in 1971 to 41.2 in 1981 and from 26.5 in 1991 to 8.6 in 2019. In 2019, about 48.4 percent of the deaths were institutional and 51.6 percent received medical attention other than in institutions (SRS_STAT_2019). U5MR declined gradually from 119 per 1,000 live births in 1992 to 42 per 1,000 live births (IIPS 1995 & IIPS and NFHS 2019). India witnessed an approximate 1.2 million Under 5 deaths, the highest among the world (Liu et al. 2016). However, at this current rate of decline, Sample Registration Survey (SRS) targets might not be achieved in a majority oof Indian districts by 2030. For a large and diverse country like India, it is thus important to examine improvement in child survival at the lowest possible geographical level and reduce inequalities in child death by gender, region, wealth, class and caste.

There are a number of causes of infant and child mortality, the literacy of the mother and infant, inadequate prenatal and medical care plays an important role. Women's status and disparities of wealth are also reflected in infant mortality rates. In areas where women have few rights and where there is a large income difference between the poor and the wealthy, infant mortality rates tend to be high. Contributing to the problem are poor education and limited access to birth control, both of which lead to high numbers of births per mother and short intervals between births. High-frequency births allow less recovery time for mothers and entail potential food shortages in poor families. When women are educated, they are more likely to give birth at later ages and to seek better health care and better education for their children, including their daughters.

In the chapter, outcome variable is the time of children survival from their birth to survey which is quantified in months. Data utilized in this chapter is also taken from the third phase of the National Family Health Survey (NFHS IV) of India.


CHILD MORTALITY RATE IN INDIA
N
TAJIKISTAN
AFGHANISTAN
PAKISTAN
CHINA (TIBET)
NEPAL
BHUTAN
BANGLADESH
MYANMAR
SRI LANKA
JAMMU & KASHMIR
HIMACHAL PRADESH
PUNJAB
CHANDIGARH
UTTARA-KHAND
HARYANA
DELHI
UTTAR PRADESH
RAJASTHAN
BIHAR
SIKKIM
ARUNACHAL PRADESH
ASSAM
NAGALAND
MEGHALAYA
MANIPUR
TRIPURA
MIZORAM
JHARKHAND
WEST BENGAL
GUJARAT
MADHYA PRADESH
CHHATTISGARH
ODISHA
DAMAN & DIU
DADRA & NAGAR HAVELI
MAHARASHTRA
TELANGANA
GOA
ANDHRA PRADESH
KARNATAKA
PUDUCHERRY
TAMIL NADU
KERALA
LAKSHADWEEP (INDIA)
ANDAMAN & NICOBAR ISLANDS (INDIA)
Child Mortality Rates ,2015
Above 60
45-60
30-45
15-30
Below 15
NA
Map not to Scale
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1.3 Review of literature

There has been a great deal of studies regarding child mortality in India. Some studies tried to explain the causes of decline in child mortality where some were focused to find out the risk factors of child mortality. Interests were also shown in sub area and national estimates of child mortality. Overall, there exists quite a few literatures on socioeconomic and geographical variations in neonatal, infant, child and under 5 mortalities in the recent years.

A number of scholarly works have argued that the problem of health services can be divided into two factors: demand factor and supply factor (conceptual framework). On the demand side, societal, cultural, economic and individual factors (like education, income, status of women, individual attitude and punctuality to seek health services, family size, sex preference and nature of socio-cultural setting etc) influence the demand and utilization of maternal and child health services. And on the supply side, management of adequate, affordable and qualitative services are most essential to encourage people to utilize maternal and child health services. The literature on maternal and child health services has been reviewed.

One study, conducted by Boehmer and Williamson (1996), focused on the impacts of different aspects of women's status on level of infant mortality. Their study was based on a sample of 96 countries with data from 1990 analysed in a model developed based on gender stratification theory and industrialism theory. Their explanatory variables included measures of the level of economic development using the log of purchasing power of currencies estimates of gross domestic product per capita, women's educational status (illiteracy, school enrolments), women's political status (years with the right to vote, percent of seats in parliament), women's economic status, women's autonomy and independence within the family (age married, contraceptive prevalence, income inequality, percent of the population in urban areas, access to sanitation and health services, infants with low birth weights, percent of infants breast-fed, and per capita calorie supply. It was found that female secondary school enrolments had the strongest negative relationship with infant mortality and crude birth rates the strongest positive effect. Women's economic activity also negatively affected infant mortality.

Binary logistics and MLM were used for estimation of econometric and it was suggested that knowledge of local level areas and their population is fundamental for shaping effective policies to resolve the mortality problem. Furthermore, it was suggested that social aspects like awareness, exposure to media, and mother education are the most influential factors to decrease child mortality.

1.4 Objectives

- The purpose of this section is to focus on those approaches which used data analytics as a core to reduce child mortality rates.
- In this study an attempt has been made to examine the predictors of child mortality in India.
- The specific objectives of this study are: to identify the factors which is affecting the Infant and child mortality and suggested the viable strategies to reduce the child mortality and improve the health services.
- The main objective of the study is to contribute to the understanding of the determinants of the utilization of maternal and child health services in India.

Chapter 2

A Framework of the Determinants for Infant and Child mortality

2.1 Data and data structure

The data used in this study was collected from the fourth round of the Demographic and Health Survey (DHS) for India popularly known as the National Family Health Survey 4 conducted in 2015-2016 by International Institute for Population Sciences, Mumbai under the stewardship of the ministry of health and family welfare MoHFW, government of India.

The 2015-2016 National Family Health Survey is a national representative survey and was based on 1,315,617 children born to 699,686 women in 601,509 households with a response rate of 98%. The survey included 425,563 households from rural areas and 175,946 households from urban areas. In all the sample households, all women age 15-49 who are usual members of the selected households or who spent the night before the survey in the selected households were eligible to be interviewed in the survey. In about 15 percent of the sample households, all men age 15-54 who are usual members of the selected households or who spent the night before the survey in the selected households were eligible to be interviewed in the survey.

2.2 description of the variables

Outcomes variables- Infant and Child mortality have taken as the binary outcome variables. The variables have recoded as success or failure depending on their survival status. Death is considered as a failure and survival as the success. The age at death (in month, CMC) is used to generate the outcome variables.

For creating the variable for the Infant mortality rate children who died within the first birthday have recoded as the failure and those who survived have recoded as success and child mortality rate children who died between 1^{st} and 5^{th} birthday have recoded as the failure and those who survived have recoded as success.

Independent variables- The socioeconomic and demographic and biological variables used as independent variables. In this study includes place of residence (urban/rural) religion (hindu, muslim and others), sex of child (male/female), place of delivery (home, hospital/clinic, others), wealth index, education of mother, education of father, occupation of mother, occupation of father, birth order, complication during birth, alcohol use (yes/no).

Estimating Mortality Rate

For estimating the indicators of child mortality, the standard formulas have been used. The respective numerator is divided by the denominator and multiply by 1000 to get the mortality rates. The mortality rates have been calculated for five-year periods preceding the date of the survey.

2.3 Methods

SPSS was used to process and analyse the collected primary data from field survey. Mainly, univariate analysis is used to estimate percentages and frequency distribution, bivariate is used to observe the association between utilization level of maternal and child health services and explanatory variables. Binary logistic regression is used to identify the possible determinant; that would affect the utilization level of the maternal and child health services since response variables are of binary nature. Basically, logistic regression is widely used to establish the relationship between response and explanatory variables.

2.3.1 Cross-Tabulation analysis

Cross tabulation also referred to as contingency tables or crosstabs — group variables together and enable researchers to understand the correlation between the different variables. By showing how correlations change from one group of variables to another, cross tabulation allows for the identification of patterns, trends, and probabilities within data sets.

When it comes to analysing survey response data, cross tabulation reports depict the relationship between two or more survey questions. Survey administrators are provided with a detailed comparison of how different groups of respondents answered particular questions.

Cross tabulations are data tables that display not only the results of the entire group of respondents, but also the results from specifically defined subgroups.

The interlinkage between Child mortality and socio-economic, bio-demographic and maternal health care variables have been tested by applying cross-tabulation analysis. The cross-tabulation analysis is an important in first step for studying the relationship between mortality with several characteristics. However, such analyses fail to address mortality predictors completely because of ignoring other covariates. Hence multiple logistic regression approach is also adopted in order to estimate independent effects of each variable while controlled for others. Multiple logistic regression analysis is carried out for the child according to the age at death. This analysis considered all the covariates that were found significant in cross-tabulation analysis.

2.3.2 Logistic Regression

Logistic regression is one of the suitable statistical methods to be applied to other variables. Binary logistic regression has been used for this study since all of the response variables are in binary nature i.e. like yes or no etc. The primary difference between linear regression and logistic regression is that logistic regression's range is bounded between 0 and 1. In addition, as opposed to linear regression, logistic regression does not require a linear relationship between inputs and output variables. This is due to applying a nonlinear log transformation to the odds ratio.

Types of Logistic Regression

1. Binary Logistic Regression

The categorical response has only two 2 possible outcomes. Example: Spam or Not

2. Multinomial Logistic Regression

Three or more categories without ordering. Example: Predicting which food is preferred more (Veg, Non-Veg, Vegan)

3. Ordinal Logistic Regression

Three or more categories with ordering. Example: Movie rating from 1 to 5

The basic equation of logistic regression is:

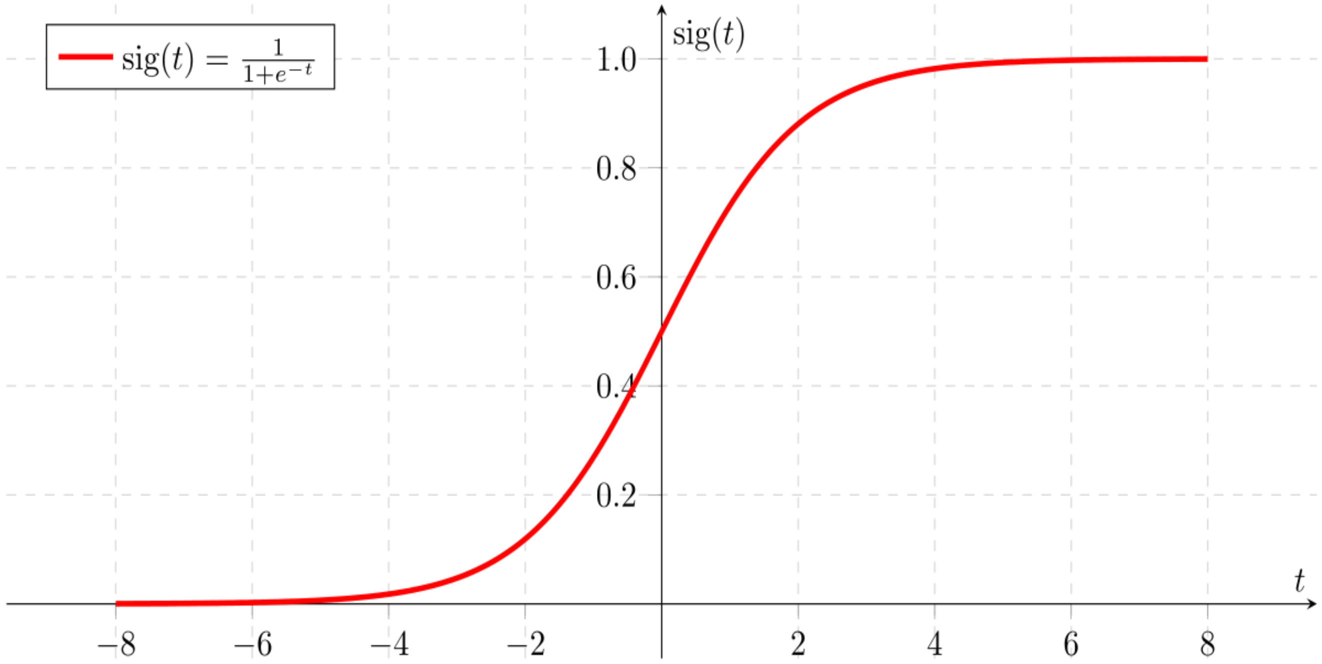
$$P = \frac{1}{1+ e^{-z}} \text{-----------------} \quad (1)$$

Where P is an estimated probability. In this present study, P denotes the probability of utilization of various maternal and child health services in terms of specified explanatory variables; X_1. X_2, ------X_k, b_0, b_1, -----b_k, are regression coefficients. Z is the predictor variable and e is the natural log i.e. 2.71828. An alternative form of this equation is:

$$P = \frac{1}{1+e^{-z}} = \frac{e^z}{1+e^z} \text{--------------} \quad (2)$$

When z becomes infinitely negative, e^z becomes infinitely small, so that P approaches unity.

The sigmoid function of logistic regression analysis



Given $P = \frac{1}{1+e^{-z}}$ Then,

$$\frac{P}{1-P} = e^z \text{ ---------------- (3)}$$

Taking natural logs on both sides, it can be got

$$\text{Log}\,\frac{P}{1-P} = z \text{ -------------- (4)}$$

The quantity $\frac{P}{1-P}$ is called the "odds" and Log $\frac{P}{1-P}$ is called the log odds or the logit.

Thus Odds

$$\frac{P}{1-P} = \Omega \text{ ----------------(5)}$$

It is customary to use odd ratio to compare the relative change in response variable with respect to explanatory variables.

2.3.3 Odd Ratio

An odds ratio (OR) is a measure of association between an exposure and an outcome. The OR represents the odds that an outcome will occur given a particular exposure, compared to the odds of the outcome occurring in the absence of that exposure.

Odds ratios are used to compare the relative odds of the occurrence of the outcome of interest (e.g., disease or disorder), given exposure to the variable of interest (e.g., health characteristic, aspect of medical history). The odds ratio can also be used to determine whether a particular exposure is a risk factor for a particular outcome, and to compare the magnitude of various risk factors for that outcome.

- OR=1 Exposure does not affect odds of outcome
- OR>1 Exposure associated with higher odds of outcome
- OR<1 Exposure associated with lower odds of outcome

2.3.3 Chi Square Test

Chi-Square test has been used to observe whether the explanatory variables have a significant and predictable association with the response variables.

The primary use of the chi-square test is to examine whether two variables are independent or not. Typically, in social science research, we're interested in finding factors that are dependent upon each other—education and income, occupation and prestige, age and voting behaviour. By ruling out independence of the two variables, the chi-square can be used to assess whether two variables are, in fact, dependent or not. More generally, we say that one variable is "not correlated with" or "independent of" the other if an increase in one variable is not associated with an increase in the another. If two variables are correlated, their values tend to move together, either in the same or in the opposite direction. Chi-square examines a special kind of correlation: that between two nominal variables.

It can be test by the following formula:

$$\text{Chi-Square} = \sum \left[\frac{(O_i - E_i)^2}{E_i^2} \right]$$

Where,

O_i = Observed frequencies

E_i = Expected frequencies

There are two main kinds of chi-square tests:

the test of independence, which asks a question of relationship, such as, "Is there a relationship between student sex and course choice?".

goodness-of-fit test, which asks something like "How well does the coin in my hand match a theoretically fair coin?".

Chi-square analysis is applied to categorical variables and is especially useful when those variables are nominal (where order doesn't matter, like marital status or gender).

Independence

When considering student sex and course choice, a χ^2 test for independence could be used. To do this test, the researcher would collect data on

the two chosen variables (sex and courses picked) and then compare the frequencies at which male and female students select among the offered classes using the formula given above and a χ^2 statistical table.

If there is no relationship between sex and course selection (that is, if they are independent), then the actual frequencies at which male and female students select each offered course should be expected to be approximately equal, or conversely, the proportion of male and female students in any selected course should be approximately equal to the proportion of male and female students in the sample.

A χ^2 test for independence can tell us how likely it is that random chance can explain any observed difference between the actual frequencies in the data and these theoretical expectations.

Goodness-of-Fit

χ^2 provides a way to test how well a sample of data matches the (known or assumed) characteristics of the larger population that the sample is intended to represent. This is known as goodness of fit. If the sample data do not fit the expected properties of the population that we are interested in, then we would not want to use this sample to draw conclusions about the larger population.

For example, consider an imaginary coin with exactly a 50/50 chance of landing heads or tails and a real coin that you toss 100 times. If this coin is fair, then it will also have an equal probability of landing on either side, and the expected result of tossing the coin 100 times is that heads will come up 50 times and tails will come up 50 times.

In this case, χ^2 can tell us how well the actual results of 100 coin flips compare to the theoretical model that a fair coin will give 50/50 results. The actual toss could come up 50/50, or 60/40, or even 90/10. The farther away the actual results of the 100 tosses is from 50/50, the less good the fit of this set of tosses is to the theoretical expectation of 50/50, and the more likely we might conclude that this coin is not actually a fair coin.

When to Use a Chi-Square Test

A chi-square test is used to help determine if observed results are in line with expected results, and to rule out that observations are due to chance. A chi-square test is appropriate for this when the data being analysed is from a random sample, and when the variable in question is a categorical variable. A categorical variable is one that consists of selections such as type of car, race, educational attainment, male vs. female, how much somebody likes a political candidate (from very much to very little), etc.

These types of data are often collected via survey responses or questionnaires. Therefore, chi-square analysis is often most useful in analysing this type of data.

What Is a Chi-square Test Used For?

Chi-square is a statistical test used to examine the differences between categorical variables from a random sample in order to judge goodness of fit between expected and observed results.

Null Hypothesis:

There is no any significant association between explanatory variables and responsive variables in tabular data.

Alternative Hypothesis:

There is a significant association between explanatory variables and responsive variables in tabular data.

Decision rule:

Null hypothesis should be accepted if the calculated value emerges less than to table. value at given level of significance with (c-1) (r-1) degrees of freedom. But, if the calculated value of chi-square is greater than the table value at given level of significance with (c-1) (r-1) degrees of freedom, null hypothesis should not be accepted.

2.4 Software use

1. Microsoft Excel

Microsoft excel is created by Microsoft that uses spreadsheets to unify numbers and data with formulas and functions for the windows and Mac. Excel analysis is global around the world and used by businesses of all sizes to perform financial analysis.

Excel is typically used to organize data and perform financial analysis. It is enriched by the large scale of supplied functions used across all business functions, Statistical, Mathematical function and at companies from small to large. Users can arrange data in the spreadsheet using graphing tools, pivot tables and formulas. The spreadsheet application also has a macro programming language called Visual Basic for Applications (VBA).

2. IBM SPSS

SPSS Statistics is a statistical software suite developed by IBM provides a plethora of statistics programs, visualization designer, data management and advanced analytics. It was developed by IBM SPSS in 2009.

There are handful of statistical methods that can be leveraged in SPSS, including:

- Descriptive statistics, including methodologies such as frequencies, cross-tabulation and descriptive ratio statistics.
- Bivariate statistics, including methodologies such as analysis of variance (ANOVA), means, correlation and nonparametric tests.
- Numeral outcome, prediction such as linear regression.
- Prediction for identifying groups including methodologies such as cluster analysis and factor analysis.

In SPSS, the process of manipulating, analysing and pulling data is very simple. SPSS helps researchers to set up model easily because most of the process is automated.

3. Microsoft word

Microsoft word is an application to use the process of format, manipulate, save, print and share a text-based document. It is arguably the most popular word processor on the planet. That's because it's the part of Microsoft office suite and also available to stand-alone.

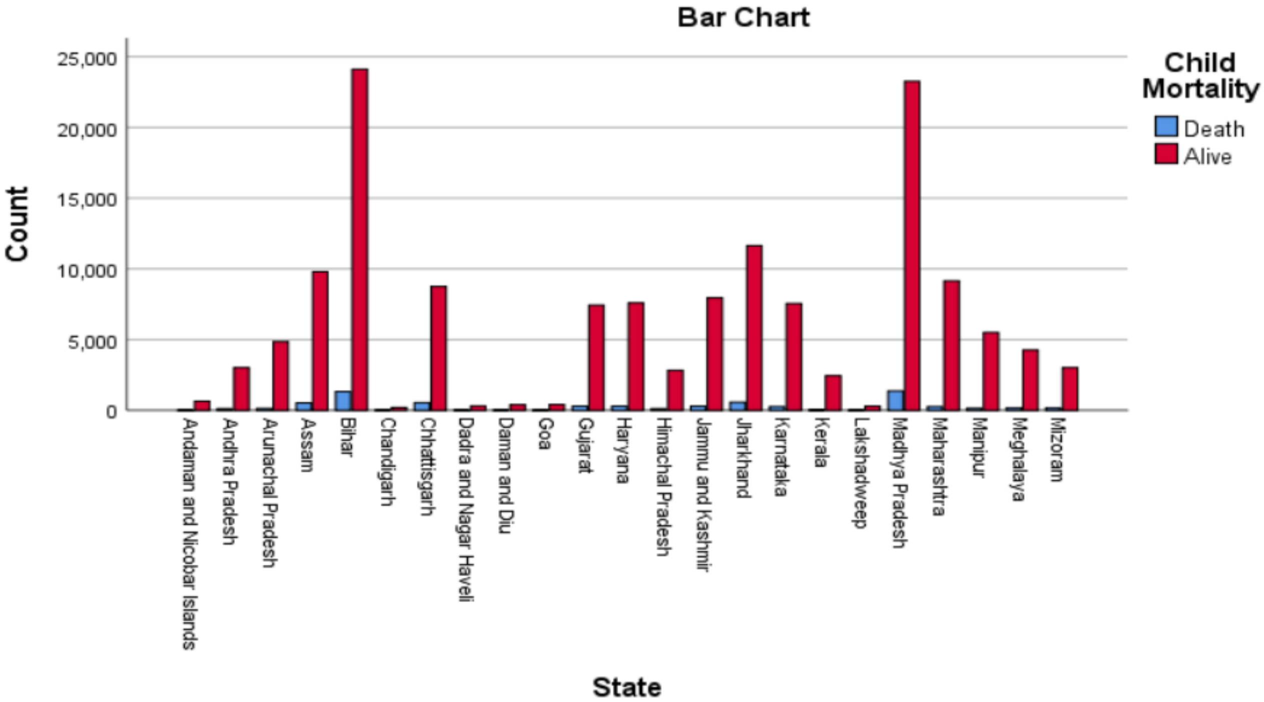
MS word is use for make the professional quality documents, letters, reports etc. it has advanced features which is allow to format and edit in the best possible way.

Chapter 4

Result and Discussion

4.1 Results

Child Mortality among the different states in India



Inferences that have been drawn as regards child mortality rate for biological factors and socio-economic factors in the tables and effect of these variables on the survival status of infants are outlined below:

The observed CMR observed for the biological and socio-economic determinants for the India region are found to be in the same direction as has been studied by NFHS 4.

Table 1. Distribution of child mortality according to selected variables

Selected Variables	Number of children Dead	Alive	Total	Percent of death	Chi-square (χ^2)
Education of mother					
Illiterate	2606	44282	46888	5.55	
Primary	1137	20881	22018	5.16	450.76**
Secondary	2534	68215	70749	3.71	
Higher	258	11958	12216	2.11	
Education of father					
Illiterate	334	4870	5204	6.41	
Primary	207	3696	3903	5.3	97.72**
Secondary	583	14126	14709	3.96	
Higher	75	3174	3249	2.3	
Occupation of father					
Not Working	5410	120802	126212	4.28	
Professional	62	1819	1881	3.29	
Clerical/Sales	112	3204	3316	3.37	19.65**
Agriculture	465	9084	9549	4.86	
Manual	486	10427	10913	4.45	
Wealth index					
Poorest	2574	41246	43820	1.7	
Poorer	1729	34461	36190	1.1	
Middle	1073	28324	29397	0.7	592.40*
Richer	763	23464	24227	0.5	
Richest	396	17841	18237	0.3	
Religion					
Hindu	4798	102010	106808	4.49	
Muslim	1092	24554	25646	4.25	
Christian	466	13157	13623	3.42	55.89**

Sikh	16	489	505	3.16	
Other	163	5126	5289	3.08	
Place of residence					
Urban	1127	32041	33168	3.39	84.43**
Rural	5408	113295	118703	4.55	
Birth order					
First	2533	53727	56260	4.5	186.68**
2-3	2644	69172	71816	3.68	
4^+	1358	22437	23795	5.7	
Complication during birth					
No	864	31979	32843	2.63	3.405
Yes	1407	56458	57865	2.43	
Sex of child					
Male	3664	75145	78809	4.64	47.68**
Female	2871	70191	73062	3.89	
Place of delivery					
Home	2124	35719	37843	5.61	
Hospital/clinic	3211	79905	83116	3.86	209.96**
Other	1200	29712	30912	3.88	
Drink Alcohol					
Yes	259	4262	4521	5.72	23
No	6276	141074	147350	4.25	

Single Covariate Analysis for child mortality:

The results of the logistic model fitted to each of the covariates are presented in tables from 2.1 to 2.7 and the overall results are presented in Table 2.10.

Table 2.1 RESULTS OF THE LOGISTIC REGRESSION MODEL FITTED TO COVARIATE TYPE OF PLACE OF RESIDENCE

Covariate	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I. for Exp(B)	
							Lower	Upper
Type of place of residence	-.305	.033	83.823	1	.000	.737	.690	.787
Constant	3.653	.062	3449.727	1	.000	38.582		

Table 2.2 RESULTS OF THE LOGISTIC REGRESSION MODEL FITTED TO COVARIATE FATHER'S OCCUPATION

Covariate	B	S.E.	Wald	df	Sig	Exp(B)	95% C.I. for EXP(B)	
							Lower	Upper
Father's occupation	-.015	.010	2.275	1	.131	.985	.966	1.005
Constant	3.125	.020	24223.413	1	.000	22.765		

Table 2.3 RESULTS OF THE LOGISTIC REGRESSION MODEL FITTED TO COVARIATE FATHER'S EDUCATION

Covariate	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I. for EXP(B)	
							Lower	Upper
Father's education	.296	.030	95.283	1	.000	1.344	1.267	1.427
Constant	2.636	.050	2734.713	1	.000	13.962		

Table 2.4 RESULTS OF THE LOGISTIC REGRESSION MODEL FITTED TO COVARIATE MOTHER'S EDUCATION

Covariate	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I. for EXP(B)	
							Lower	Upper
Mother's education	.261	.013	422.722	1	.000	1.298	1.266	1.330
Constant	2.789	.019	22381.026	1	.000	16.271		

Table 2.5 RESULTS OF THE LOGISTIC REGRESSION MODEL FITTED TO COVARIATE BIRTH ORDER

Covariate	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I. for EXP(B)	
							Lower	Upper
Birth order	-.073	.018	16.357	1	.000	0.929	0.897	0.963
Constant	3.234	.035	8406.370	1	.000	25.377		

.

Table 2.6 RESULTS OF THE LOGISTIC REGRESSION MODEL FITTED TO COVARIATE DRINK ALCOHOL

Covariate	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I. for EXP(B)	
							Lower	Upper
Drinks alcohol	-.312	.065	22.823	1	.000	0.73	.644	.832
Constant	3.113	.013	58212.055	1	.000	22.478		

Table 2.7 RESULTS OF THE LOGISTIC REGRESSION MODEL FITTED TO COVARIATE COMPLICACY DURING THE PREGNANCY

Covariate	B	S.E.	Wald	df	Sig.	Exp (B)	95% C.I. for EXP(B)	
							Lower	Upper
Complication during pregnancy	.081	.044	3.403	1	.065	1.084	.995	1.181
Constant	3.611	.034	10971.191	1	.000	37.013		

Table 2.8 RESULTS OF THE LOGISTIC REGRESSION MODEL FITTED TO COVARIATE WEALTH INDEX

Covariate	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I. for EXP(B)	
							Lower	Upper
Wealth Index	.242	.010	571.260	1	.000	1.274	1.249	1.299
Constant	2.524	.026	9703.088	1	.000	12.483		

Table 2.9 RESULTS OF THE LOGISTIC REGRESSION MODEL FITTED TO COVARIATE SEX OF CHILD

Covariate	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I. for EXP(B)	
							Lower	Upper
Sex of child	.176	.025	47.579	1	.000	1.192	1.134	1.253
Constant	2.845	.039	5369.839	1	.000	17.204		

Table 2.10 (SINGLE COVARIATE ANALYSIS)

Covariate	B	S.E	Wald	df	Sig.	Exp(B)	95% C.I. for EXP(B)	
							Lower	Upper
Type of place of residence	-.305	.033	83.823	1	.000	.737	.690	.787
Father's occupation	-.015	.010	2.275	1	.131	.985	.966	1.005
Father’s education	.296	.030	95.283	1	.000	1.344	1.267	1.427
Mother's education	.261	.013	422.722	1	.000	1.298	1.266	1.330
Wealth Index	.242	.010	571.260	1	.000	1.274	1.249	1.299
Birth order	-.073	.018	16.357	1	.000	0.929	0.897	0.963
Sex of child	.176	.025	47.579	1	.000	1.192	1.134	1.253
Drinks alcohol	-.312	.065	22.823	1	.000	0.73	.644	0.832
Complication during pregnancy	.081	.044	3.403	1	.065	1.084	.995	1.181

As observed from the table for single covariate analysis, it is clear that the significant single covariates are type of place of residence, father and mothers’ education, wealth index, birth order, sex of child and drinks alcohol and so these variables with exp (B) more than 2 (i.e. odds more than double) may be ascribed to inflating Child mortality rate.

Multiple Logistic Regression Analysis of Child Mortality

The results of the multiple logistic regressions that exploit all the biological and socio-economic determinants have been presented in Table 2.8

Table 2.11 Result of multiple logistic regression analysis

Variables	β	*S.E*	Odds Ratio (OR)	95% Confidence Interval of OR	
				Lower Limit	Upper Limit
Education of Mother					
Illiterate	-	-	1.00		
Primary	-0.118	1.271	0.89	0.074	10.800
Secondary and above	-0.287	1.186	0.75	0.073	7.669
Education of Father					
Illiterate	-	-	1.00		
Primary	-0.428	0.252	0.345	0.267	0.444
Secondary	-0.351	0.250	0.422	0.323	0.552
Higher	-0.240	0.213	0.573	0.449	0.730
Occupation of Father					
No occupation	-	-	1.00		
Professional	1.369	0.713	3.930	0.972	15.888
Clerical/Sales	0.494	1.172	1.639	0.165	16.310
Manual	0.533	0.735	1.703	0.404	7.178
Other	0.296	0.635	0.744	0.214	2.582
Wealth Index					
Poorest	-	-	1.00		
Poorer	-1.045	1.234	0.352	0.031	3.951
Middle	-0.754	1.081	0.470	0.057	3.913
Richer	0.118	0.973	1.125	0.167	7.580
Richest	-0.260	1.013	0.771	0.106	5.617
Birth order					
First	-	-	1.00		
2-3	0.191	0.150	1.210		
More than 3	0.377	0.135	1.458	1.120	1.900
Drinking alcohol					
No	-		1.00		
Yes	-1.750	0.925	0.174	0.028	1.065

Complicacy during Pregnancy No Yes	- 0.109	- 0.480	1.00 1.115	 0.435	 2.857

4.2 Discussion

In this section, we examine the predictors of child mortality. Child mortality reflects a country's level of socio-economic development and quality of life. India has witnessed a large decline in child mortality during the last two decades. The child mortality varies according to socio-economic, health care and bio-demographic characteristics of the population concerned. There are many predictors of child mortality in a particular group of variables and it is necessary to analyse them separately in order to get the idea about the insight variation of that particular type of variables.

The distribution of child mortality by socio-economic, bio-demographic, and maternal health care variables is shown in Table 1 (Appendix 1). Among socio-economic variables, maternal education has a strong relationship with child mortality and child survival. Various studies have supported a direct causal relationship between mother's education and child mortality [2606, 1137, 2534, 285]. The result indicates that the child mortality rate was highest (5.55%) for the children of illiterate mothers and lowest (2.11%) for the children whose mother's educational level is secondary and above. It is clear that the child mortality rate decreases with the increase of mother's education. Like mother's education, father's education also plays significant role on child mortality. Father's level of education has been regarded as a valid proxy of income and wealth status of the household in India. It is likely that higher educated people belong to higher economic class. An investigation of the Table reflects that among the total deaths, highest number of deaths (63.3%) is observed for the illiterate father and the lowest number of deaths (2.3%) is observed for the father whose educational level is H.S.C and above. The child mortality rate was also found highest (6.3%) among the children whose father is illiterate and the child mortality was found lowest (2.3%) for the children whose father's education is secondary and above. This result shows that child mortality sharply decreases as the father's educational level increases. So it may be concluded that the risk of child mortality is low for children whose parents are educated. Father's occupation is one of the important Socio-economic characteristics for child mortality. The child mortality rate (4.86%) was found highest for the children whose father's occupation was agriculture and the rate was found lowest (3.37%) for the children of service-holder fathers. This result was similar to previous studies. Wealth index is another important differential factor of child mortality. Children born in households with low wealth index experienced highest mortality. Among the total deaths, about three fifths were found for the children with mother's wealth index. The mortality rate has been observed (0.7%) for the children whose mothers belong to low-income group. The lowest (0.3%) child mortality rate was found among the children whose mothers belong to high wealth index. It is clear that the relation between mother's wealth index & child mortality is negative. Some of the factors which have no significant effect on child mortality are religion, family size, complicacy during pregnancy, place of residence, currently working status of mother.

Among the bio-demographic variables, breastfeeding status was found with significant effect on child mortality. Among the total deaths, 4.3% deaths were found for first birth cohort, 3.68% and 5.7% deaths were found for the birth order 2-3 and 4^{+} respectively. From the child mortality rate, it is clear that mortality increases steadily with birth order. The increase in the child mortality rate with birth order may reflect a more intense competition faced by higher birth order children in terms of care givers time, medical resources, and nutritious food while children needed. The effect of complication during birth, type of births, and sex of child has no significant impact on child mortality.

Now days many of women are fascinated with the drinking alcohol by which the complication of pregnancy slightly increases but does not play significant role. Among the total deaths, 5.72% deaths are founded whose mother addicted with alcohol and 4.25% deaths are recorded whose mother haven't drink alcohol.

In India most of the women used to deliver their children at home. Among the total child deaths, only 5.68% deaths are founded among the children whose birth place is home and 3.86% deaths have been observed among the children whose place of delivery in Hospital/ Clinic. However, the effect of place of delivery on child mortality was not statistically significant.

Table 2 (Appendix 2) presents the estimated coefficients, S.E. and odds ratio for child mortality. In the odds ratio significant variables are indicated by asterisk sign. The significant variables found in cross-tabulation analysis were considered as the covariates of the logistic regression analysis. Though mother's education is one of the most important characteristics for child mortality but in this analysis, mother education was found to have insignificant effect on child mortality. The risk of child mortality was found 66 percent, 58 percent and 43 percent lower for the children whose father's having primary, secondary and higher education as compared to the children of father's who had no education. These results clearly indicated that the risk of child mortality was decreasing with increasing of father's education and it is also found that father's education has significant effect on child mortality. This result may be due to the fact that child mortality mainly effected by environmental factors and an educated father may be more conscious to the environment where child grow up. Father's occupation was found to have significant effect on child mortality. The risk of child mortality was found 1.62 times, 3.5 times, 1.6 times and 1.7 times higher for the children whose father engaged professional, agriculture, clerical/sales and others job respectively as compared to the children whose father engaged in service. This may due to the fact that a service father may be higher educated and he provides better advantage (food, nutrition and health facilities) to his child than other father.

Chapter 5
Summary and Conclusion

1.1 Summary and Conclusion

This study investigates the predictors of child mortality in India. It utilized the nationally representative data from the National Family Health Survey 2014-1015. The body of evidence accumulated during the two decades shows the existence of a relationship between several characteristics and childhood mortality across societies. Both cross-tabulation and multiple logistic regression techniques have been applied to identify the important predictors of child mortality. From these analyses several interesting observations can be made, although the analysis itself was subject to various types of problems including small sample size for mortality analysis. Also, interpretations of the findings appear to be problematic in many cases. Sometimes it is observed that logical or theoretical hypothesis are supported by the results of crude analysis (like cross-tabulation) but are rejected as invalid when checked by those based on refined techniques such as logistic regression. Such a situation may be due to interrelationship between covariates.

The findings suggest that parent's education has been identified the most important socio-economic predictors of child mortality that means mortality rate decrease with increase in both mothers and fathers' education level but in multiple logistic regressions only father's education has significant effect on child mortality. The study indicates that occupation of mothers has no significant impact on child mortality but in both analysis fathers' occupation has played significant role in reducing the risk of child mortality. Some characteristics have no major effect on child mortality these are religion, mother exposure to mass media, place of residence (urban/rural) and currently working status of mother. The association between child mortality and mothers' standard of living index was found to have a significant variable for child mortality. Several bio-demographic variables have a substantial effect on child mortality. Among these variables breastfeeding status and birth order have significant effect on child mortality. The child mortality was found lower for the children who were currently breastfeed. Further the results also investigated that several health care characteristics have a principal effect on child mortality in India.

So, attention should be given to parent education, father's occupation, currently breastfeeding, and maternal health care factors in order to reduce the risk of child mortality in a developing country like India.

Chapter 6
References

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Chapter 6
Appendix

SPSS CODE USED FOR THE ANALYSIS

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LOGISTIC REGRESSION VARIABLES DependentVariable
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  /CRITERIA=PIN(.05) POUT(.10) ITERATE(20) CUT(.5).

LOGISTIC REGRESSION VARIABLES DependentVariable
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  /CRITERIA=PIN(0.05) POUT(0.10) ITERATE(20) CUT(0.5).


LOGISTIC REGRESSION VARIABLES DependentVariable
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  /PRINT=CI(95)
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LOGISTIC REGRESSION VARIABLES DependentVariable
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  /PRINT=CI(95)
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LOGISTIC REGRESSION VARIABLES DependentVariable
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LOGISTIC REGRESSION VARIABLES DependentVariable
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LOGISTIC REGRESSION VARIABLES DependentVariable
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 /PRINT=CI(95)
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LOGISTIC REGRESSION VARIABLES DependentVariable
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 /CONTRAST (fathereducation)=Indicator
 /CONTRAST (medu)=Indicator
 /CONTRAST (Fatheroccupation)=Indicator
 /CONTRAST (bord1)=Indicator
 /CONTRAST (complication)=Indicator
 /CONTRAST (S716)=Indicator
 /SAVE=PRED
 /PRINT=CI(95)
 /CRITERIA=PIN(0.05) POUT(0.10) ITERATE(20) CUT(0.5).
```

THANK YOU