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Factors Determine the Infant Mortality in Punjab

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I dedicate my thesis to my beloved niece Zanaib.

Abstract (100-200 words)

In Pakistan majority of population has no access to basic health facilities. Infant and child mortality is the best indicator to examine the health status of the children in a society. It is also an important index to evaluate the socio-economic development. High level of infant and child mortality means poor government policies for improving the nation's health and discourages the socio-economic development. This indicates the poor health status of its nation and becomes a big challenge for demographers, policy makers and politicians to introduce such a program to reduce the health problems particularly in the field of infant mortality and morbidity.

The unhealthy facilities in Pakistan by the public sector and private sector have adverse effects on the quality of life. This has not only affected the health of a population but also on their productivity and contribution in economic growth so diseases are not just the microbiological incident. In Pakistan political instability, poverty, unavailability of health facilities, less knowledge to utilize the health facilities, frequent pregnancies, polluted environment, unhealthy water and poor sanitary conditions are the main factors for increasing deaths. Cultural factors are also an important indicator to define the health status of a population.

Keeping in view the maternal and child's health status, this study is proposed to find out the relationship between socio-economic variables and infants death.

Keywords: Infant mortality; Punjab; women education; Punjab; Pakistan; logistic regression; Poverty; Working status

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List of Abbreviations:

USAID	United States Agency for International Development
NIPS	National Institute of Population Studies
PDHS	Pakistan Demography and Health Survey
PDS	Pakistan Demography Survey
PIHS	Pakistan Integrated Household Survey
FBS	Federal Bureau of Statistics
FANA	Federally Administered Northern Areas
FATA	Federally Administered Tribal Areas
MOPW	Ministry of Population Welfare
TFR	Total Fertility Rate
GDP	Gross Domestic Product
UNICEF	United Nations International Children's Emergency Fund

Chapter No 1

Introduction

Children are the builders of a nation. Healthy nations can grow and prosper with healthy children. Infant mortality is the important index to evaluate the health policies in a society and social-economic development. The health status of the children in a society can be examined with the help of infant and child mortality. High level of mortality indicates the poor health policies and lack of government abilities to improve the health condition of a nation. As many other developing countries, Pakistan is also facing the problem of high infant mortality.

Infant mortality rate have been sharply decreased in most of the developing countries, however every year above 12 million children in developing countries and many more are living in poor health conditions. Child malnutrition, ignorance, poverty and insecure environment still exist in these countries (Hobcraft.et.al, 1984).

Infant death is probably the most unwanted event for a family. Infant mortality rate is defined as the risk for a new born child to die before its first birthday. There was a large decline in infant and child mortality rate since after the Word War II resulting from both the improvement in standards of living as well as national and international health programs, public health activity and polices (Hill, 1989). In developing countries, pace of mortality has changed for the last three decades. The effects on pace of child mortality decline due to the poor economic condition and policies of structural stabilization in many developing countries in Latin America and Africa on behest of the World Bank. Some economist argued that structural adjustment and economic stabilization designed in poor economic conditions of a country causes increase in child mortality rate (because these programs consists of reducing government spending for the welfare of population), increase in food prices and also responsible for the changes in exchange rates hence leads rapid decrease in family income (UNICEF, 1989).

Pakistan is the sixth most populous country in the world. The rapid increase in population is because of high total fertility rate (TFR) in Pakistan. TFR is 4.1 children per woman and Pakistan is among the nations having highest birth rate of children, but unfortunately their death rate is also still very high. IMR is 78 per 1000 births recently and declined from 101 in 1991 while it was 77 in 2001. Compared to the others countries in South Asia infant mortality rate are very high in Pakistan (PDHS, 06-07).

Death is imminent for everyone sooner or later, who is living. People from developed countries have large success in postponing deaths whereas in the developing countries, a large decline has been observed in mortality rate for the last three or four decades but infant and child mortality remains still very high. In Pakistan, every eleventh child who is born alive dies before reaching their fifth birthday. The under-five mortality rate for children is 94 per 1000 live births.

At the beginning of 1980, people from most developing countries were very optimistic about child survival in high mortality. No doubt immunization level has been increased greatly to reduce the infant mortality from diarrhea and malaria but in 1970 it is much faster than in 1980.

In Pakistan the majority of the women are living under the poverty line so it is impossible for them to eat sufficient food. These women are malnutrition and anemic, and lead an unhealthy life. Medical experts are of the view that the women need extra vitamins, proteins, iron and energy by getting some extra food during pregnancy. Women have not only have to support herself but also for the living organism i.e. child. Healthy women have healthy children. Unfortunately women have not provided adequate food during their pregnancy because of poor economic conditions in rural areas. Such unhealthy circumstances lead to unhealthy child and mother. The unhealthy status of a mother and weak economic conditions are closely linked to the infant and child mortality (Ali, 2001).

Infant and child mortality rate in rural areas is high than the urban areas in Pakistan. The differentials in infant and child mortality could be mostly due to concentration of health centers and medical facilities in urban areas. This study is an effort to identify the correlation between infant mortality and social-economic variables like wealth status, crowding, sanitation and water supply, mother's working status and education. Infant and child death rate was found very low in high wealth status as compared to the low wealth status in Pakistan (PDHS, 2006-07) thus their exist a negative correlation between wealth status and child mortality. The child mortality is higher among those mothers who live in a house where room crowding is greater than four. There is a positive relationship exists in crowding and child death. Water quality is considered as one of the important factor in mortality and morbidity of children. Water born diseases are major causes of infant death in Pakistan. The sanitary contamination is also an important factor that influences the morbidity and mortality of children (PDS, 2005).

As much as research developed, it is shown that some countries with low GDP have succeeded to achieve low mortality rate. New advanced technologies especially through media, people are much aware by treating some of the fatal childhood diseases like malaria, dehydration and diarrhea at minimum cost. International agencies and public health departments also have most effective agenda and have aid to minimize the child mortality in low income countries influential and systematic (Ruzicka and Hansluwha, 1982).

A significant decline has been observed until the late 1970s but thereafter, the decline in infant mortality between 1980 and 2000 slowed down and then there was no further decrease up to 2008. Infant mortality appears to be stagnated. Pakistan is one of those countries where reduction in infant mortality has been very slow. The economy of Pakistan has been affected a lot by social factors such as population size and education system. Government and semi-government institutions make their decision and further policies based upon the results of research (Sathar, 1991).

1.1. Aim and scope:

As Pakistan is one of the most populated countries in the world. The rapid increase in population is due to the continually decline in mortality rate and it has a high fertility. Researchers and policy makers were mostly concentrating on fertility rate and neglecting the mortality trend. This study of determinants of infant mortality in Punjab is to draw attention of demographers and researcher towards this important area. Punjab is the most populated area of Pakistan and infant mortality is one of the major components in growth rate of population in Pakistan. The studies of infant and child mortality itself contribute to reducing fertility.

The objective of study is to find out the factors determinants the infant mortality rate and study the association of socio-economic and demography variables with infant mortality in Punjab. For this author used estimators which are available from the recent surveys like Pakistan Demography and Health surveys (PDHS) and focused on the period from 2006 to 2007.

1.2. Motivation and Questions/Problems:

The motivation of this study is to investigate the factors determining the infant mortality in Pakistan and role of socio-economic variables on infant mortality in Punjab. In particularly, the author focuses on the socio-economic variables in determinants of infant mortality.

The research questions are

➢ Significant role of socio-economic variables in determinant of infant mortality rate in Punjab?

➢ Female education has a positive impact on infants' survival in Punjab?

1.3. Methods and Material:

Medical research and social science approach are two possible methods for the study determinants of infant mortality in Pakistan. In medical research approach focuses on biological process and social science approach focuses on the social economic variables have impact on early child deaths and no identification by any biological process thus medical approach has not paid any attention on the underlying cause. Mosley and Chen (1984) integrated the two methods and proposed the unifying framework integrating of biological and social variables.

Mosley-Chen approach consists of the determinants that influence directly to the risk of mortality and morbidity in children. Mosley-Chen has emphasis on the factors which influenced the health development. The basic feature of this framework is to study all proximate determinants which affect the child survival.

The Mosley-Chen framework is considered the comprehensive and most widely used for analysis of infant and child mortality. The factors at individual, household and community level operate by the determinants which influence the infant and child mortality. Mosley-Chen also include maternal fertility variables, environment variables and the pathway that how socio-economic variables affect infant and child's health.

The proximate determinants consists of maternal factors (birth intervals, age at birth); nutrient insufficiency (unavailability of nutrient to mother and infant during pregnancy); uses of health care services and environmental factors (food contagion for household, contamination of water, household crowding). It should be measured in those researches which are based on the population. Socio-economic determinants operate by the proximate determinants and divided into three categories the individual level, the household level and the community level (Mosley and Chen, 1984).

Chapter No 2

Theoretical Background

2.1. Previous Research

Infant mortality rate is tremendously high in Pakistan and it is also an important indicator to measure the health policy, yet it is ignored and very little literature published in context of determinants of infant and child mortality in Pakistan. In this reference a few studies were conducted but these have consisted of limited variables and have not clearly depicted the theoretical framework of their study. These studies also have not mostly used the national level survey data (Agha, 2000).

This study is an analysis of factors and the determinants the infant mortality in the province of Pakistan (Punjab) and socio-economic variables are employed from the data nationally representative based on Demography and Health survey.

2.2. Theoretical Framework

The study of infant and child mortality is considered to be the most important variable for assessment of population health, programs and policies (Johansson 2004). Infant mortality is used as the most responsible and frequent variable for measure of the economic and social development of a country (M.Stroobant, 2001).

Pakistan is among the most populated countries in the world and its population is approximately 160 million in 2006 (PDHS, 06-07). Growth rate of population is 1.9 percent per annum and has reduced a lot from 3.7 percent per year in 1960s. Major portion (two third) of its population is rural area and 41 percent of its population consists below the age of 15 (NIPS, 2007).

Chishtie and Faisal stated that father and grandmother play a dominant role of neonatal place for care seeking outside the home while role of mother is insignificant. In 44% of the cases, hospitals are not the facility of choice even in emergencies. 97% population show attitude for preferring doctor while a greater part of population took the neonatal to doctor in case of emergency thus concluded that preference for seeking medical treatment is very high in Pakistan (Chishtie and Faisel, 2003).

In Pakistan a larger part of women have low social status. Women's social independence has an important indicator of infant and child's health and it was improved at the start of 1960s but these processes were reversed by the government encouragement in early 1980s. In neonatal period male mortality is greater than the female mortality where as female have less advantage except births and the age under five years (Agha, 2000).

2.2.1 Effects of Infant mortality on Fertility

The relationship between fertility and mortality is considered to be the most significant area of interest for population research. Some of the demographers like Taylor argued that role of child mortality can play an important determinant of fertility. Hence to control population successfully there should be reduction in child mortality. The child mortality and population control programs can reduce fertility through biological mechanism. Better survivors of infants would smooth the progress of lactation and prolong the entire birth interval (T.P Schultz, 1972).

Fertility rate is very high and far above the replacement level. Pakistan population is still away from two generations if it would attain the replacement fertility level as the population policy of the government is to reduce fertility up to the replacement level in 2020 (MOPW, 2002).

Many researchers found high fertility in those women who have lost children as compared to those women whose children have survived in Turkey, Egypt, Taiwan and India (Chowdhury, 1976). Hassan argued that the same relationship of mortality and fertility exist in Pakistan and conclude the rise in fertility because of replacing died children (S.S. Hassan, 1967).

Total fertility rate has been decreased from 5.4 children in 1990-91 to 4.1 children in 2006-07 and a large difference in fertility rate was found by the wealth status and level of women's education. The difference between uneducated and high educated women is 2.5 children per women and between poorest and richest women are 3 children per women. The previous research explains that high risk is attached with the short birth interval and in Pakistan one out of three children birth take within 24 months after the previous birth (PIHS 2005).

Fertility preferences depend on the number of children as well as on the composition of the children. Most of the couples wanted to have both sex of children but in Pakistan male child has a strong preference than female child and entertain a better health facility and nutrition. 65 percent of women with three male children wanted no more children in future (Alauddin.et.al, 1976).

2.2.2 Economic Condition and Infant mortality

Pakistan has done a lot of progress in different sectors (agricultural, services and manufacturing) of an economy. The growth rate has been increased a lot over the last five years. The performance of the economy of Pakistan has increased continuously and has a best spell of its growth. Fiscal year 2006-07 indicates that Pakistan's economy has on its way to success. Pakistan has experienced the best GDP growth rate in 2003-07 and the economic growth rate is 7 percent in 2006-07 along with the strict monetary policy (an increase in the interest rate) but still infant mortality rate is very high. The long term economic growth has based on the smooth economic policies, economic environment and the structural reforms. Pakistan economy's performance based on half decade has stable

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and stable and appears that it will continue more then the medium term (Government of Pakistan, 2007).

The population of Pakistan has rapidly increased in the last five decades. For this economic gains faced a lot of problem as per capita income has not increased as compared to the increase in GDP between 1960 and 2006. Unemployment raised 11 times over the last three or four decades. About 52 million of population is illiterate although literacy rate has increased since early 1960s (NIPS, 2005).

The rapid increase in population is not only constraints the economy of Pakistan but also adversely affects the health facilities and programs. The present conditions of health in Pakistan is that there is one hospital for 170,000 people, one doctor for 1300 persons and only one nurse for 4600 people. In rural areas one basic health centre is available for 19,000 persons and only one maternal and one child care centre is available for 4,400 or more than newborns and mothers (Government of Pakistan, 2007). Whereas In India one nurse for 2,250 people even Sri Lanka, Kenya, Indonesia and Thailand have a better nursing ratio. In developed countries this ratio has reduced a lot and have rang of 150-200 people (Nursing talent, 2008).

According to the American Public Health Association infant mortality rate in U.S is 6.9 per 1000 live births and 28000 children died in infant period before reaching their first birthday in 2000 and infant mortality rate is more than twice as compared to Sweden (American Public Health Association, 2004).

2.2.3 Female Education and Infant mortality

Education of mother plays an important role in determinants of infant and child mortality. According to Cochrace parental education is an important source of infant mortality differential and this association has been found universally (Cochrane, 1980). A strong positive association has been observed in Pakistan between mother's education and infant survivals while father's education has less importance. (Adam and Cleland, 1984).

Literacy rate has been improved a lot over the past two decades yet the status of women in Pakistan has not been fundamentally improved in the last two or three decades only some improvements have achieved but this progress has not corresponded the remarkable grain in autonomy of women (Jalil and Sathar, 2000).

In Pakistan a large part of female population is uneducated and high proportion of these uneducated women are from rural areas. Highly educated mothers in rural areas bring a large decline in infant and child mortality and low level of education (primary or less education) by mothers in rural areas do not decrease infant and child mortality whereas on the other hand urban mothers produce a lot of change in the child mortality. So there exists an inverse relationship between mother's education and child mortality. Attainment of education also brings fairness in attitude and behavior likes easy to take better care of lesser children (S. Mubashir Ali, 2001).

2.2.4 Nutrition and Infant mortality

Yimer used Family Survey data of Southern Nations Nationalities and People's Region. In order to identify the risk factors of malnutrition in children multivariate and bivariate technique were deployed and concluded that 42% child were underweight and 12% were died. Nutritional status of children in long term affected by the women's education and household economic status in socio-economic variables whereas birth interval, age at birth were associated with demographic variables (Yimer, 2000).

Smith in his article explored the relationship between nutrition and child growth in Papua New Guinea in different environments. Smith re-analyzed the data of National Nutrition Survey (1982-83) and concluded that most of geographical variations in the child growth were due to dietary, environment, agricultural, socioeconomic and demographic variables (Muller and Smith, 1999).

In northern areas of Pakistan iodine deficiency is prevalent. About 25 percent of live births in northern areas are low birth weight. Iron deficiency, pregnancy complications and calories-protein malnutrition takes the population in vulnerable conditions (Govt. of Pakistan, 1997).

2.2.5 Diseases and Infant mortality

Most of the deaths occur in under-five age. Mortality is in the first year of the birth especially in the initial months due to the infectious diseases such as pneumonia, malaria, asthma, diarrhea and malnutrition. A larger part of under-five mortality in Pakistan falls within the neonatal period. The study between the infant mortality rate and child mortality rate suggests that deaths in neonatal mortality are exclusively due to the sepsis, asphyxia and premature births whereas in post-neonatal mortality diarrhea, pneumonia is common cause of death (PDHS, 06-07).

Women with less ability to take care of their children and to protect them from different diseases has adversely affect of their survival. If child has survived in the first year of life in Pakistan; its future prospects of survival are much higher. Sepsis (14 percent), asphyxia (22 percent), diarrhea (11 percent), unhealthy water and lack of sanitation and health facilities are also the majors factors associated with the high infant mortality. Child survival is closely linked to the timing, spacing and number of births and to the reproductive health of mother. Early, late and closed spaced pregnancies are major contribution to high infant and child mortality especially where health care facilities are scarce(Hobcraft and Mcdonald, 1985).

2.2.6 Biological variables and Infant mortality

Diseases are considered to be the variables that directly affect infant mortality where as socio-economic variables are considered to be indirect variables. Social, economic and

environment variables have strong affects on post-neonatal mortality as compared to the neonatal mortality. Poverty, malnutrition, decline in breast feeding.

Several of biological factors like birth interval and birth weight are important in determinants of infant and child mortality. There exists an association between infant deaths and birth interval. This association is more significant in the post-neonatal period and not during the period of neonatal whereas low birth weight has significantly decreased in the probability of child survival during the neonatal period of infant mortality. The pattern of this association leads to low birth weight and competition of sibling care. Sibling competition appears more important factors in the short birth intervals on the child survival. Failure of Breast feeding (Lactate) is strong frightening of child survival. If lactation failure in first month of life then babies were bottle-fed otherwise child have died because of starvation and bottle feeding had a negative effects on the quality heath child in the first year of life. Biological factors have very much significant effect on infant and child mortality (Das Gupta, 1990).

Mother's current age, parity and age at birth have a significant impact on child survival. There was a positive relationship between mother's age at birth and infant mortality and mortality is very high in the teenage mothers so it is a need to discourage teenage marriages, consequent pregnancy and encourage mother's education. These should also be improved awareness among mothers to high risk of late and early pregnancies (Johansson, 2004).

Birth interval has a strong positive correlation with the child's survival as the birth interval increases infant child has greater chance of survival. Probability of survival under five mortality is almost double in the children whose birth interval are four or more years against the children born with the interval less then two years (PDHS, 06-07).

It is very common in populations that higher mortality is associated with the first birth as compared to the later births. Birth size is also bearing higher mortality in infant and child

mortality. Child with small birth size has less chances of survival in the first year of life and has 68 percent high risk of mortality than average birth size (Stoeckel, 1972).

Country Assistance Plan (2001-2003) by the Asian Development Bank has given a strategy to Pakistan to reduce infant mortality and total fertility rate but only limited improvement has been accomplished. Infant mortality reduced from 124 in 1980 to 90 in 1999 per 1000 births which is still very high and population growth rate of Pakistan (1.9 percent per annum) is among the highest and reduced well from the level of 3.7 percent per annum in the year of 1960s which keeps a lot of pressure to provide social health activities and services as well as on employment opportunities in labor market (Asian Development Bank, 2000).

Chapter No 3

Infant Mortality in Punjab

Mortality differential has been observed in social-economic variables in Pakistan such as residential differential. Populations from urban areas have much lower mortality than rural areas. In urban areas health care programs were developed and quality health facility introduced but in rural areas poorer services available. Historically rural mortality has been very high than the urban mortality. In Pakistan big percentage of population are living in rural areas but now the proportion of population living in the urban areas has also increased rapidly from 28.2 Percentage in 1991 to 36.94 Percent in 2006 (Agha, 2000).

Infant mortality is unacceptably high in Pakistan and is a continuous challenge to public health programmers and professionals. There were various programs like Primary Health Care, National Program for Family and Child survival Project to improve the health of children but these programs have not made significant impact. Infant deaths consist of major portion of deaths in the neonatal period. Deaths in neonatal period were more than 60 percent of all infant deaths. Infant mortality declined from 86 in 1992- 96 to 78 in 2002-06 as well as under five mortality decline 103 in 1992- 96 to 94 in 2002-06. The level of infant and child mortality varies from different groups of population. Some of these reasons are due to socio-economic variables and others are due to the biological variables (PDHS, 2006-07).

Study of neonatal and post neonatal mortality in infant mortality provide a better index of health development program or health policies than the conventional child mortality rate. Infant mortality deaths are very sensitive to the health condition in post-neonatal rate. Hence an assessment or contribution of these components in infant mortality rate gives a better index of development particularly in maternal and child health than the child mortality (Stoeckel and Alaudddin, 1972).

Neonatal, post-neonatal, infant and under five mortality rates for five year periods preceding survey (PDHS 06-07)

	Neonatal Mortality	Post-neonatal Mortality	Infant Mortality	Under five Mortality
PDHS-06 deaths per 1000 live births	54	24	78	94
Percentage of Infant Mortality	68.3	30.7	100	….
Percentage of Under five Mortality	57.4	25.5	82.9	100

Above table show the neonatal, post-neonatal, infant and under five mortality during different surveys in Pakistan. Infant mortality is still very high in Pakistan. Infant mortality consists on both neonatal mortality and post neonatal mortality but neonatal mortality has strong impact on Infant mortality. The above table shows the pattern that most of the deaths in infant mortality and under-five mortality occur during the first month of birth. Hence infant mortality and under five mortality suggest that if a child survive during the first year of birth than the chances of survival are much higher.

One of the major reasons of morality in Pakistan is lack of knowledge among adult population for reorganization the warning signs of neonatal illness in which an immediate care is essential. The awareness level pertaining to warning signs of neonatal illness have not been measured according to standard indicators (Chishtie and Faisel, 2003).

There exists a strong relationship between life expectancy and infant child mortality so changes in life expectancy are closely linked to the changes in child mortality. The increase in life expectation does contain both declines in infant mortality as well as in adult mortality. A substantial decrease in living standards has linked in declaration to raise mortality rates. During the twentieth century the social-economical factors have

become more reinforced with the infant and child mortality when a large decline has been observed in infant mortality in those developed countries where economic and social development has progressed a lot (Sathar, 1991).

One of the important indicators to explain the high infant mortality is high fertility. Birth space and frequent pregnancies are closely associated with the high fertility rate. The decline has been observed in the fertility rate but this decline has also concentrated in the rural areas. In Pakistan 40 percent of births were occurred under two years in 1996-97 so the improvement in births interval should increase the chances of child survival (Alauddin.et.al, 1976).

3.1. Maternal Characteristic in Infant mortality

In this study author measures the socio-economic variables, behavioral and biological determinants of infant mortality in Pakistan. The larger part of clustering infant deaths is elucidated by the mother's abilities, her characteristics, education, work status, income and wealth. Father's education and occupation are also involved in determinants of this type of clustering of deaths but usually mothers are known as the basic and prime careers for children so mother's characteristics and abilities are most significant for child health and strongly influence to postpone the child death (Das Gupta, 1990).

Mothers are known to be the basic provider of health care because of her innate emotions to take care of their children. The behavior of a mother is to take care of their children and also provide some basic health facilities. This is an important determinant of infant and child mortality. Such kind of behavior varies from educated mother to an uneducated mother (Das Gupta, 1990).

People in Pakistani society are very much close to religion so sexual activities only take place after marriages. Marriages are universal in Pakistan and once women get married, it is considered to be stable. Women's age to expose of child birth affects the fertility

levels. Thus marriage age is an important indicator of fertility levels as well as in infant mortality (Ahmad, 1969). The age at marriages has been increased by six months from 18.6 years in 1991 to 19.2 in 2007. Girls are physically not too much strong as the boys so she has a high mortality rate. Girls have more probability of disease and death in her all the stages of life from childhood to childbearing age. In Punjab, mothers having no education have large percentage of small babies at birth as compared to the mothers having high education (PDHS, 2006-07).

The major objective of health care programs and policies are to check and promote the child and maternal health. There are three important indicators of reproductive health; parental care, postnatal care and care during delivery. Parental health care quality can be evaluated by the visits of parental to health care centre. In Pakistan there has a considerable improvement in parental care over the last ten years. The proportion of mothers has received parental health care from health centre and health providers are 61 percent while it was only 33 percent in 1996 (PDHS, 2006-07).

In rural areas of Pakistan, 28 percent of pregnant women make four or more visits to the health centre during their pregnancies whereas in urban areas 48 percent (more than twice) have parental visits. The percentage of women having parental care visits also increased over the past ten years (Stoeckel, 1970)..

The percentage of birth place with healthy facilities has significantly improved almost doubled during the last ten years. It is increased from 17 percent in 1996 to 34 percent in 05. Major portion of the mothers in Pakistan are not deliver their babies in health facility and 65 percent births take place at home (PDS, 2005).

Timely checkup is an important indicator to measure the complications for infant and mother. 43 percent mothers received the postnatal care after their last birth. Poor feeding and breast feeding have also the adverse affects in the nutritional status as well as on child's health. In Pakistan 70 percent of newborn babies are entertained with breastfed with in one day of their births (PDS, 2005).

It is noticed that an important variable for determinant of infant mortality is child weight. The child having low birth weight has greater chances of its deaths. Low birth weight has associated with high risk of facing diseases and having a low risk of survival. Child born in a clean hygienic place also decreases his/her mortality rate (Stoeckel and Alauddin, 1972).

International Conference on Population development in 1994 was stressed to reduce infant mortality rate to 50 per 1000 births up to the year 2000 to improve the health facilities of the population but unfortunately Pakistan has very high infant mortality rate and still even in 2006-07 it is 78 per 1000 births and has not achieved its target (Hakim et. al., 2001).

3.2. Socio-economic Variables and infant mortality in Punjab

Two-third of population (67 percent) lives in rural areas of Pakistan. A larger part of children are born and bought up in rural areas with lack of necessary facilities taking the start of their life with unhealthy living conditions, unsatisfactory sanitary conditions and multiple disadvantages (PDHS, 2006-07).

Infant mortality rate is higher among the poor people. There are various definitions for explaining the meaning of poverty but according to the demographers infant and child mortality are the important indicators to measure poverty. It is measured by the high infant and child mortality thus these variables are considered to be the compliments variables and it is commonly observed in developing countries that infant and child mortality rate is higher among poor people as compared to the non poor (Mosley and Chen, 1984).

Socio-economic status is an important indicator of infant and child mortality. Children deaths are higher than in those households that are below the poverty line and large difference was found in a comparison of infant deaths in different wealth status. Child

mortality is higher among those mothers household crowding per room is 2 or less persons. This household crowding also reflects the positive correlation with the infant death (Ali, 2001).

Quality of healthy water and sanitation conditions are known to be the most important factor of child's mortality. In Pakistan water born disease play a major role in number of death and life expectancy will be increased by two years if these diseases were eradicated (Ali, 2001).

Significant differences in access of basic facilities (nutrition, healthy water, sanitation and income) in different regions have contributed a lot in increasing infant and child mortality. This social-economic discrimination has resulted from a large attention of political instability, poor economic management and political power in different regions (Cochrane, 1980).

In this study an effort is made to find out the linkages between infant mortality and poverty, household crowding, unhealthy water, sanitation condition, father's occupation, mother's education, age at birth and working status. Mother's behaviors to provide basic health facility and natural feelings of love to her children are important determinant of infant mortality. These behavioral differentials may be affected by the level of education and working status.

Chapter No 4

Theoretical Model

In this chapter the author represents the theoretical model for analysis of infant mortality in Punjab. The first section describes the introduction of the theoretical model. In section 4.2 explains the theoretical frame work of this model. Section 4.3, 4.4 and 4.5 deals with the variables involve in this analysis. Section 3.6 discusses the data source of this study.

4.1 Introduction

Quantitative approach is very important and necessary tool for social economic research. The major objective of this approach is to apply the statistical techniques, build models, testing the hypothesis, have the results and made some conclusions based on the results. This approach also provides bases to the economists and researchers for development and procedure (Weinreich, 1996).

Quantitative approach has great importance in social and natural sciences. It is usually apply in the field of medicine, business, education and social marketing to get quantifiable results. In quantitative approach, core part of population is estimated and the results are more compatible and generalized to the whole population and also these results are easily comparable, reliable and precise.

In Quantitative approach we generate hypothesis to find out the relationship between the variables by collecting data, generating the models, analyzing data and interpret these results. Tables and graphs are another way to represent the results and data of social economic variables for this a lot of soft ways are applied.

In social sciences approach, the independent variables describe the socio-economic variables which influence the infant and child mortality and in medical science approach independent variables describe the nutrition and environment in morbidity and mortality (Johansson, 2004). A number of socio-economic variables are examined to find the determinants of infant mortality in Punjab. The major aspect of this method is to integrate both social and medical science.

4.2 Mosley and Chen

In this study the author selected Mosley and Chen frame work for the reason that it is greatly benefited for the health sector and most commonly used in infant and child mortality secondly it is the integration of two different research methods social and medical sciences. The important feature of this framework is that it indicates the variables that influence the infant mortality directly like maternal characteristics. Mother's education raised their abilities to provide health care facilities with the help of nutrition and better care of child during pregnancy and early stages of life (Mosley and Chen, 1984).

A lot of statistical technique has been commonly used before Mosley and Chen frame work so they provide conceptual frame work for social and medical researchers after integrating the proximate determinants and background factor and they combine it in different steps. In first step take background factors and then emerge with proximate determinants and at the end obtain a reduced form model which associates with background factor and infant mortality **(Stroobant, 2001).**

Mosley and Chen in their article argue that in social science research focuses in mortality where as medical science focuses on specific disease and morbidity, which is most important variable. This article is designed to develop analytic frame work that combines these two research methodologies and introduce only one outcome variable in which mortality and morbidity are integrated. The basic concept behind their analytic frame work is that all socio-economic factors at the community, household or individual levels

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have to operate through proximate determinants. The proximate determinants affect directly the disease risk and result disease underlying mechanism.

Mosley and Chen conclude that Davis and Blake in their fertility research gave the concept of proximate determinants analytic frame work. They argue that fertility level is affected by changing of the social factors. There are proximate determinants (intermediate variable) influences the level of fertility operates by more than one of three groups of total eleven variables. These three groups are a) Awareness of sexual intercourse b) Conception risk due to sexual intercourse c) Probability of the live birth specified conception (Mosley and Chen, 1984).

Mosley and Chen's approach is however very influential and it is the back bone for the studies of child survival explicitly or implicitly. Their frame work of proximate determinant is as like as in economics deal with household health production function.

The single out which comes from health status variable measures morbidity and mortality for disease burden. Mosley and Chen forecast that their frame work cannot be measured quantitatively but the effect of the change of proximate determinant can be estimated by the method developed during study of fertility by David and Blake.

4.3 The dependent Variable:

In most of the research in social science mortality behaves like a dependent variable because deaths are unusual and rare events and it is easily calculated (Mosley & Chen, 1984, p- 29). So in this analysis the author also take infant deaths as dependent variable.

4.4 Proximate variables for health

These proximate determinants are the basis through which socio-economic process and affect child health. It should be measured in those researches which are based on the population. It should also represent the mechanism under which these variables influenced the disease and affects health status of infant and child mortality. These proximate determinants can be arranged in five categories (Mosley & Chen, 1984).
:

- Maternal fertility factors (Birth interval, age at birth etc)
- Environmental contamination (food, water, air, soil, vectors from insects)
- Insufficiency of Nutrients (protein, calories) and personal illness control
- Injury (accidental, deliberate)
- Personal disease control (preventive checks, medical measurement and treatment)

4.4.1 Maternal factors
The maternal factors consist of birth interval and age at marriage and birth. These factors are generally measured directly.

4.4.2 Environmental contamination
Environmental Contamination consists of usually measured by microbiological examination of environment and it reflects different ways of spreading disease. These diseases can play an important role to evaluate the environmental pollution like cold, pneumonia usually represents the air infections, diarrhea diseases are caused by the water and food born infections and tetanus diseases in neonatal are spread by the soil and skin (Mosley & Chen, 1984 p-32).

EC not only a influenced the health status of infants directly with the help of various diseases but also it has some effects indirectly. Various diseases are attached with the household crowding (no of persons per room) unhealthy water is also attached with the

source to get water (well, pond, hand pump) lack of toilet facilities is also one of the major causes of environmental contamination.

4.4.3 Nutritional deficiency

Nutritional deficiency represents the deficiency of the major components of nutrients (vitamins, protein and micro minerals) intake by an infant/child. Infant child is affected by the nutritional deficiency not only the availability of nutrients but also access to the mother's food during pregnancy. Mother's food during lactation affects the quality and quantity of breast milk. These are measured not only directly by the biochemical analysis of the food but also by the physical assessment (Mosley & Chen, 1984).

4.4.4 Injury:

Injuries mostly consist of the physical disabilities and burns whereas frequencies of injuries from accident are mostly depending on the risk environment of the population.

4.4.5 Personal illness:

Preventive checks and measurement and medical treatments are the component of the personal illness. This also includes the behavior towards the modern medical practice to the treatment of disease. Quality of health care during pregnancy, childbirth and all kind of therapies are also assessed in this variable (Mosley & Chen, 1984).

4.5 Socio-economic Determinants

Socio-economic determinants or independent variables describe the path way that how these variables influence the infant mortality.

4.5.1 Individual level variables

Parental assets have important determinants of infant and child survival. The important elements of parent's productivity are ability to take care of infants and provide healthcare facilities. Father's skills/ability usually measured by the education level and it influence infant and child mortality through his productivity. There exist a strong positive correlation between better level of father's education and high wages especially in urban areas. Father's education plays an important role in child survival as it can influence the preferences and attitude towards consumption of goods as well as easy access to the health care facilities and better medical treatments (Agha, 2000).

Mother's ability/skills are quite different from the father's productivity. Maternal education can increased her efficiency with the help of child care and preventive measurements during pregnancy. The level of maternal education may increase her skills, nutrition and disease treatment. Maternal factors like birth order, child space, and age at birth are also affected by the education of the mother. Thus productivity of the mother like contraception, hygiene and nutrition are directly influenced by mother's education (Martin et al, 1983).

4.5.2 Household level variables

The quality of goods and services at household level operates through the proximate determinants. Availability of fresh food influenced the child survival by affecting nutrients. Quality food is an important check against diseases. Access of clean water, poor ventilation, house hold crowding are the major causes of the environment pollution. Poor housing quality increases the food contagion as there are poor storage facilities and

lack of sanitation and Unhealthy water facility increases the bacterial diseases (Mosley and Chen, 1984).

4.5.3 Community level variables:

Different communities have large differences in access to the resources. In rural areas variables have very strong impact on the child survival by affected seasonal food crop, quality and quantity of water, sanitation facility and absence of toilet, weather conditions and physical infrastructure. In population of some countries these difference exists at regional's level. Cultural difference also exists between regions in Pakistan. In South Asia male children entertain preferred treatment in respect of getting better health facility and nutrition from their parents (Das Gupta, 1987).

4.6 Data source

This study analysis the survey based data from Pakistan Demography and Health Survey (PDHS 2006-07). This survey was conducted by the National Institute of Population Studies (NIPS) with the financial support by United States Agency for International Development (USAID). Technical support for this survey is provided by the Measure DHS program. Pakistan Demographic and Health Survey 2006-07 (PDHS) is the largest survey with nationally representative sample of 95,441 households. Birth distributions of women (15-49 ever married) samples are 39,049 from Pakistan in which 16,303 observations are from the Punjab.

The sample size is designed in order to provide and estimate the different demographic and health variables. This nationally representative survey PDHS 2006-07 provides information on national, rural, urban and regional levels. One of the major objectives of this survey is to present a reliable estimate on child and maternal mortality ratio at national level.

In the survey of PDHS (2006-07) sample based on population of Pakistan in area of Federally Administered Northern Areas (FANA) and Federally Administered Tribal

Areas (FATA) was not included due to the constrained military, political and security reason.

MAP OF PAKISTAN

(Shaded areas were not surveyed in the 2006-07 Pakistan Demographic and Health Survey.)

NWFP:	North West Frontier Province
FATA:	Federally Administrative Tribal Area
FANA:	Federally Administrative Northern Area
AJK:	Azad Jammu & Kashmir
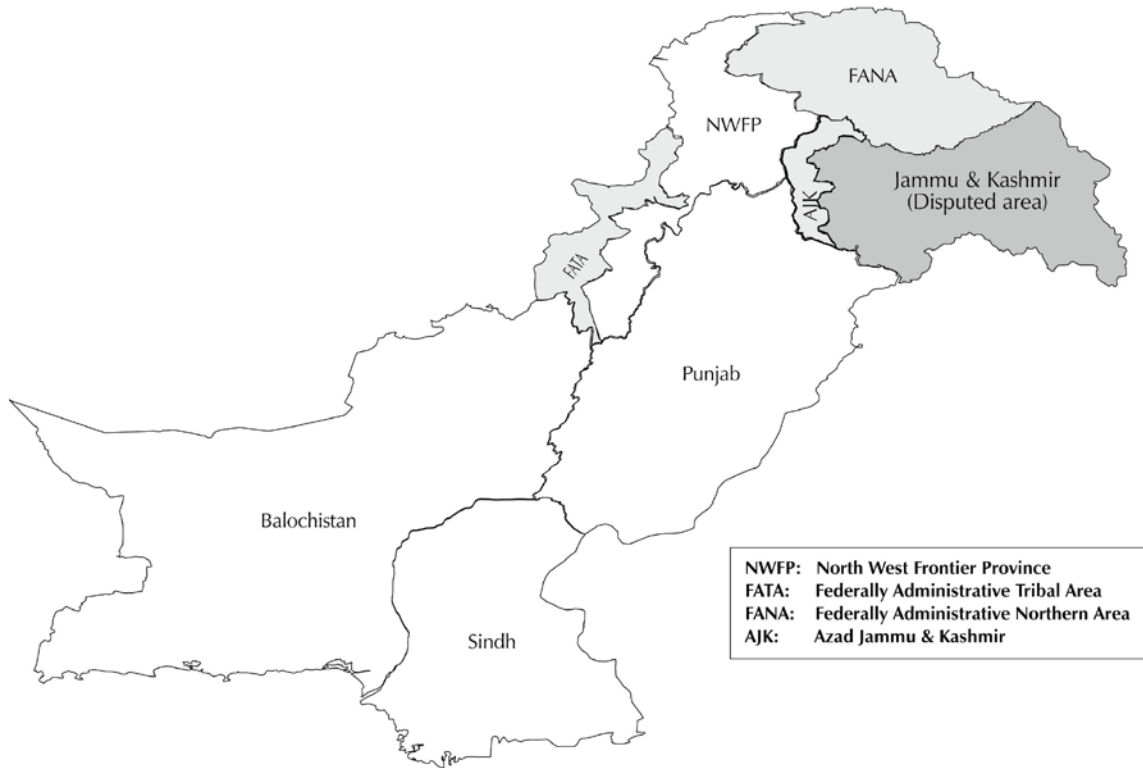
Source: PDHS 2006-07 p- xxvi
http://www.measuredhs.com/pubs/pub_details.cfm?ID=783&ctry_id=31&SrchTp=ctry

Chapter No 5
Empirical Model

This chapter describes the empirical model of infant mortality in Punjab. Section 4.1 will explain that empirical building strategy. In this chapter variables are also described in detail.

5.1 Model building strategy

In this study infant mortality is studied by using logistic regression model and the primary concern of this study is to find out the significance of maternal characteristics in infant mortality in Punjab and find out the role of social economic variables in determinant of infant mortality. For this generalized equations are as under.

$$\text{Logit } q_4 = b_0 + b_1X_1 + b_1X_2 + b_3X_3 + ...b_kX_k$$

The equation includes the variables of socio-economic variables and demography variables. Maternal factors like parents education, mother's age at birth, births interval, infant gender, no of siblings, women's working status, birth order and age at marriage. It also includes the household characteristic like sanitation facility, drinking water supply, no of households, socio-economic status.

So my model in this study is

Infant Mortality = B_0 + B_1* sub region+ B_2* sex of child +B_2*mother's employment status+ B_2*social economic status + B_2* no of person in house+ B_2*sanitary facility+ B_2*drinking water + B_1*mother education + B_2* father's education+ B_2*marriage age B_2*birth interval+ B_2*birth interval+ B_2* no of sibling + B_2*birth order

5.2 Variables

In social science study especially in the field of fertility, mortality and morbidity, there are a lot of independent (predicted) variables that make a joint effect on the dependent (predictor) variable. In demography and health surveys the main demographic variables are age, sex and education but besides these there are a variety of variables that have also strong impact on outcome some of them have weak effects on outcome thus in this study the predicted variables that have jointly effect on infant mortality in Punjab are as follow.

5.2.1Household education

Education is a positive investment for every country which never loses. In all developing and developed countries, education plays an important role. It is one of the basic social factors that directly affect the level of mortality, fertility and sterile conditions. As much as education level of a country is high their, hygienic level is also high. People are well aware about preventions and well known about how to cure from diseases (Das Gupta, 1990).

Education increases our vision to understand the problem, enhance our potential ability, gives new ideas, able to understand the changing life styles and increases quality of life. It also makes us able to understand and participated in the political and social activities. Education affects directly to their general attitude towards the different problems of diseases and they are more skilled and have more knowledge about health of infant and children. If the household are educated then surely their hygienic conditions are better than non educated. In general education also helps to increase the income of household and decrease poverty. Literacy rate in a society increased nutritious and health status not only for household but also for the whole society. Education also plays an important role in the development of the country (S.M.Ali, 2001).

a) No education

b) Primary education

c) Secondary education

c) Higher education

Level of education has a negative effect on infant mortality so when there is an increase in the level of education infant mortality decreases whereas no education has a strong positive effect on infant mortality.

5.2.2 Household composition

Another predictor variable is household composition by house hold we mean as a group of people either related or unrelated live in a same living conditions and standards often they are a family. There is a head of the household who arranges all foods, clothing, medicines and education. All the other members are bounded to be follow him where they like or not, a positive change in the level of household affects collectively on the development of a country by changing in schooling, medicine, clothing also have an impact on the aggregate level of a country (S.M.Ali, 2001).

In developing countries like Pakistan joint family system is strongly followed. Middle class and low income families follow this system more than high income families. They are forced to live with their in laws or with the relatives because they are not able to afford separate living. The head of house hold earns the money and all the family depends on him so their low income level increases their mortality rate as well as fertility rate. The atmosphere is contaminated because they cannot maintain a very hygienic atmosphere (PDHS, 2006-07).

In 2006-07 PDHS data shows the average household size is almost 7 persons. It is very important intermediate variable of infant mortality if the household is overcrowded then obviously it leads to unhygienic conditions which will infect the infants and children health status and causes disease and illness. When the no of household increases it automatically decreases the income level and brought poverty and due to this poverty they have unaffordable treatment which will lead to serious diseases and at last death. This variable is further classified In 3 categories

a) 5 or less persons live per house.

b) 6 to 10 persons live per house.

c) More than 10 persons live per house.

The health condition depends on these different categories as number of person per house increases, health status decreased. It is to be expected in Punjab that there is a positive relationship between number of persons and infant mortality.

5.2.3 Household condition/characteristics

Housing condition means the availability of the basic hygienic facilities with these conditions to measure the general living conditions of the household and infant. This is also included with healthy drinking water and condition of sanitation facilities.

Household characteristic is another source to affect health status of surrounding of the household. It is also affected by the region in which area household live e.g. in rural areas or in urban areas. Healthy water and good sanitation condition is very good for human survival and healthy life. In urban areas people have lacking the facility of basic sanitation and healthy and safe water. Sanitation, proper dispose of wastages, the community cleanliness, wide hygienic, proper transport system, easily access to health centre and doctors play an important role in infant mortality (S.M.Ali, 2001).

5.2.4 Water supply

Healthy drinking waters means source from water is collected, treatment to make it drink and the facilities of good hygienic atmosphere like they have safe water to drink. Major source of drinking water in urban areas is pipe water while in rural areas major part use water which comes from tube well and hand pumps (S.M.Ali, 2001). Water supply is divided into further categories

a) Water pump

b) Water tube well

c) Water tap

d) Water unknown

e) Water Surface

Water from hand pump and motor pump has positive impact on infant mortality whereas water from tube well has a positive relationship with infant mortality in Punjab.

5.2.5 Sanitation facility

Sanitation facilities mean presence of separate latrine, underground sewerage system. In this study this composite variable is further divided into five more categorize. The availability of no sanitation facility, pit toilet, flush toilet and good toilet. It is very verse situation of Pakistan that 3 out of 10 households have no toilet facilities (DHS, 2007). In this category sanitation is divided into further more categories

a) No toilet

b) Pit toilet

c) Flush toilet system

d) Good toilet

Household conditions have directly effects on the health status of infant, children and all the household if the wastage has not properly disposed then the environment is polluted and the risk of serious contagious fatal disease increases like diarrhea and other gastroenteritis disease and it cannot be prevented because of the contaminated atmosphere and unhygienic condition of the household. No toilet has a positive effect on the infant mortality where as pit flush and good toilet has a negative effect on infant mortality in Punjab.

5.2.6 Wealth status

Wealth is to be measures the source of household to meet life comforts, emergencies and absorb economic shocks by using social economic measures. Social economic status and

health has very strongly related to each other and affects household health directly. The income inequality (wealth gap) is very large in Pakistan and in this study divided into different categories the richest status, rich status, middle status, poor status and the poorest status. These social categories affect the health status by different access to health care facilities in respect of nutrition and living necessaries. High wealth status associated with good health facilities and has negative impact on the infant mortality whereas poor wealth status has a positive relationship infant mortality (PDHS, 2006-07).

In this study wealth status has divided into different categories

a) The poorest wealth status

b) Poor wealth status

c) Middle wealth status

d) Rich wealth status

e) The richest wealth status

Wealth status has affected a lot in infant mortality so there is a negative relationship between rich wealth status and infant deaths.

5.2.7 Mother's education

Education of a mother is a very important variable between predicted variables .It has a very strong effect on mortality and fertility of the children. Mother in a house has a strong control on food and hygienic conditions so if women are well educated and well aware about the health care of infants and household resulted in a health status of household increases. Educated mothers are not only blessing for the household but also for the whole nation (Das Gupta, 1990).

Educated mother provides better health status, nutritious and hygienic conditions. Women know very well about the basic principles of infant health care, family planning methods also about her fertility level. An educated mother can prevent the disease more seriously and more conscious about the health status of infants and household. An educated woman gives first aid initially and also manages proper dispose of wastage to make the environment clean that decreases the mortality level. By acquiring education, women have more vision about the health status and prevention from diseases. Besides this, education helps a lot to understand the advantages of regular check up during pregnancy and after delivery. This is a basic factor which under controls the infant mortality rate through regular check up because at early age a infant is on high risk and escaped children from fatal diseases with regular check up. Women consult to doctors, hospitals, internet to upgrade the health conditions and to minimize the mortality level. As a matter of fact in Pakistan rural and urban areas most of the mothers are uneducated and illiterate about the hygienic conditions and did not know how to improve the health status of infants (M.Ali, 2001). So In this study mother's education is further classified in 4 categories.

a) No education

b) Primary education

c) Secondary education

c) Higher education

Level of education has a negative effect on infant mortality so when there is an increase in the level of education infant mortality decreases whereas no education has a strong positive effect on infant mortality.

5.2.8 Employment status

Usually variable working status of women variable takes as dichotomous variable as working and not working. If women participate in the labor force then she not only earn income but also increased vision to understand the problems and predicted the disease elements in the child. Women also raise the standard of living of the family with the help of working with their husband. The relationship between health of a child and women's working status depends upon the nature of work, regularity of job, income and working environment. Women has secured job has a great positive growing result on living standards, children's brought up and education and hence automatically decreases the mortality rate due to the understanding of the diseases and health principles (Hobcraft et al, 1984).

But beside these, women's work participation has more disadvantages than its advantages. The children of working women are less rearing to those of nonworking so there is a great risk of sickness and death to the children of employed mothers and spend less time to the status of child health care and their children, less under observation or simply neglected to those who are more under observation to their mothers. It is obvious and a fact that the women who is all the day at home has a keen observation on her children and mother is the best instructor of her child in the world so working women has to sacrifice more about the health status of household and always remain in stress and more conscious about her child S.M.Ali, 2001).

Women working status is divided into two different categories.

Employed

Unemployed

Working status has a positive effect on infant mortality in Punjab.

5.2.9 Birth interval

An important variable for mortality is the birth interval. If the child has close birth interval then have more chances to raise the disease level as well as infant deaths.

The birth interval is an important to provide the information of child and mother's health by birth spacing pattern. The average birth interval in Pakistan is 29 months and short birth interval (21 months) was observed in those mothers having age 15-19 (PDHS, 2007).

In this study this variable is divided into different categories

a) 1 to 3 (years)

b) 4 to 6 (years)

c) 7 to 10 (years)

d) More than 11 years

When there is an increase in birth interval infant mortality decreases so there is a negative relationship between the birth interval and infant mortality

5.2.10 Birth order

Birth order is also important variable. A child at first birth and last birth has high mortality rate and high risk of diseases as compared to those who is born between them. because at early age mother first experience to handle it at last birth she is physically not able to do all the exercises for infant better health and for her good health status.

a) First birth

b) 2 to 4

c) 5 to 8

d) 9 or more

So it means that there is a negative relationship between birth order and infant deaths.

5.2.11 Mother's age at birth

Mother's age at first birth directly affects the fertility and mortality as well. Childbearing at early age contributes a lot in infant mortality and increase risk to affect child and mother health (Das Gupta, 1990). Women in urban areas have their births one year later than the women in rural areas in Pakistan.

In this study mother age at birth is divided into different categories

a) Less than 19 (months)

b) 19 to 25 (months)

c) 26 or more (months)

Mother's age has a positive relationship with infant mortality when it is under the age of 18 years and when there is an increase in mother's age it has become a negative relationship with the mortality.

5.2.12 Marital status

Pakistan like Islamic country, marriage is considered a religion and social compulsion.

In Pakistan half of the women are married before reaching their age of 18 years. Women having higher education are usually preferred to delay their marriage more than 6 years as compared to no education (PDHS, 2007). Thus, the age of first marriage plays a considerable role in the fertility and mortality.

In this study marriage age is divided into three different categories.

a) Less than 19 (months)

b) 19 to 24 (months)

c) 25 or more (months)

In Punjab women up to the age of 24 years has a positive relationship with infant mortality.

5.2.13 Sex of the child

Two aspects of sex differential mortality are found. One is biological difference and other is treated difference in male or female. High risk of infant mortality is associated with females and this is attributed to the preference for boys (Das Gupta, 1990). Male is significantly less probability of dying in the whole period of childhood than the female. In the age of childhood environmental and behavioral variables play an important role in child survival.

So these are the variables in which I am interesting to find out the association with the infant mortality. In this study all the variables are converted into the dummy variables and there is also one reference category in each variable.

Variable	Explanation	Variable	Explanation
Mothers Education	1= No education (Reference category) 2=Primary education 3= Secondary education 4= Higher education	Age at Birth	1= 18 or less (Reference category) 2= 19 to 25 3= 26 or more
Social Economic Status	1= Poorest wealth status (Reference category) 2= Poor wealth status 3= Middle wealth status 4= Rich wealth status 5= Richest wealth status	Number of Siblings	1= No sibling (Reference category) 2= 1 to 4 siblings 3= 5 to 8 siblings 4= 9 or more siblings
Mother's Employment Status	1= Employed (Reference category) 0= Un Employed	Sex of Child	1= Male (Reference category) 2= Female
Sub Region	1= Capital city (Reference category) 2= Country yard 3= Town 4= Small city	Marital Status	1= Less than 19 (months) (Reference category) 2= 19 to 24 (months) 3= 25 or more (months)
Father's Education	1= No education (Reference category) 2=Primary education 3= Secondary education 4= Higher education	Birth Order	1= First birth (Reference category) 2= 2 to 4 3= 5 to 7 4= 8 or more

Chapter No 6

Statistical Tools

This chapter describes the statistical tools employed to determine the infant mortality in Pakistan. Logistic regression model is used to estimate the empirical model in chapter 4.
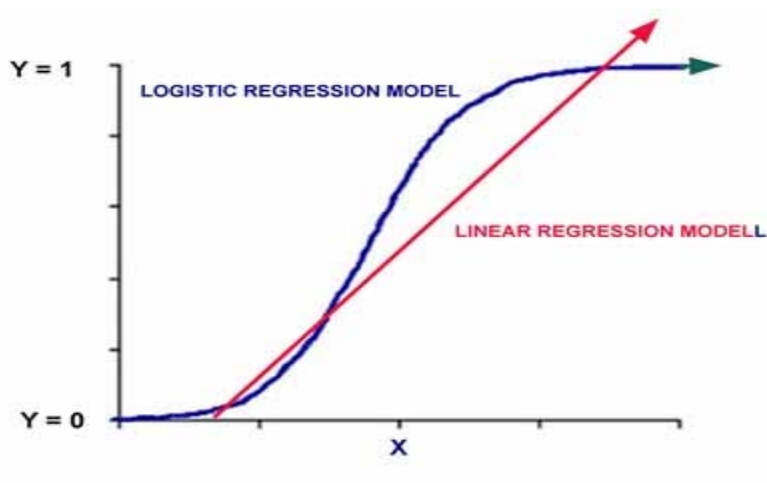
6.1 Logistic regression model

Logistic regression is used when dependent variable is in a dichotomy and independent variable can assume each and every value. It can be used to estimate the response variable on the basis of categorical (social class), continuous (age) and dichotomy (Yes/No) variables and also find out the variation in dependent variable which is explained by the independent variables. It also ranks the independent variables according to the relative importance. In logistic regression continues variable can not be used as dependent variable. The impact of independent variables is explained in the terms of odds ratio. Logistic regression estimates odd of an event by applying maximum likelihood estimation after transform the predicted variable into logit variable. Logistic regression does not calculate changes in dependent itself but in the log odds of dependent (Applied Logistic Regression by Hosmer and Lemeshow).

Logistic regression has very much parallel to the Ordinary Least Square (OLS) regression. It estimate the beta's coefficient, standardized logit coefficient (which one of the independent variable is more important to the dependent variable), co-efficient of determination (R^2). Independent variables take any form in logistic regression so there is no assumption of the distribution of explanatory variables. Logistic regression does not assume the absence of hetroscadasticity and the linear relationship of the independent variables. It also does not assume the normal distribution.

Logistic Regression: http://luna.cas.usf.edu/~mbrannic/files/regression/Logistic.html

Logistic regression also applied on the ordinal data (ordinal categories) variables having more than two categories, these variables were usually found in surveys. The area of interest of this study is infant mortality and outcome of infant mortality is not continuous.

6.2 Logistic Curve:

Source: http://faculty.chass.ncsu.edu/garson/PA765/logistic.htm

$$P = e^{a+bX} / 1 + e^{a+bX}$$

The logistic curve shows that it is better for the binary dependent variables coded value 0 and 1 because it lies between 0 and 1 whereas OLS regression may estimate the value greater than 1 and less than 0.

6.3 Logistic regression equation

$$z = b_0 + b_1X_1 + b_2X_2 + ... + b_kX_k$$

Where

z = Logit (log odds) of the dependent variable

b0 = constant

There are k independent (X) variables.

The logistic regression coefficients b_1, $b_{2...}$ are called parameter estimates

In this study logistic regression estimates a discrete outcome from different social, economic and demographic variables that may be discrete, dichotomous, and continuous variables. Logistic regression is preferred to estimate the dependent or respond variable where independent or explanatory variables are continuous or mix of categorical and mix variables. The purpose of logistic regression is to estimate the categorical outcome for individuals. To accomplish this objective a model is required which consists of all independent variables and useful to estimate the response variable.

Logistic Regression:http://userwww.sfsu.edu/~efc/classes/biol710/logistic/logisticreg.htm

The outcome of this study is infant deaths and logistic regression model is used for this analysis. Logistic regression used the violation of the assumption of independent observations and variables tend to be correlated. Sibling deaths having the same risks associated with health of a mother, reproductive behavior and household crowding (Agha, 2000).Some mothers having experience of multiples infant mortality whereas others having no experience (Gupta, 1987). This assumption has a significance influenced on birth interval and infant mortality.

Chapter No 7

Results

Table: 7.a

Distribution of births by province and place of residence in Pakistan

Province:

Punjab	41.75
Sindh	27.13
NWFP	19.50
Baluchistan	11.62

Residence

Urban	36.94
Rural	63.06

Total	100

Table no 7.a represents the birth distribution in provinces and rural/urban areas of Pakistan. A greater part of total births occurred in the rural areas it is 63.6% whereas only 36.9% of births are belong to the urban areas. Punjab is the most populated province in Pakistan. A major portion of birth occurred in this province consists of 41.7 % of total births 27.1% in Sindh, North West Frontier Province (N.W.F.P) consists of 19.5% and 11.6% in Baluchistan.

Table 7.b

Percentage distribution of women and men age 15--49 by level of education in Punjab

Education level in Punjab	Women (Percentage)	Men (Percentage)
No education	67.24	37.66
Primary level	15.55	18.18
Secondary level	12.61	31.41
Higher level	4.60	12.75
Total	100	100

Graph 7.b
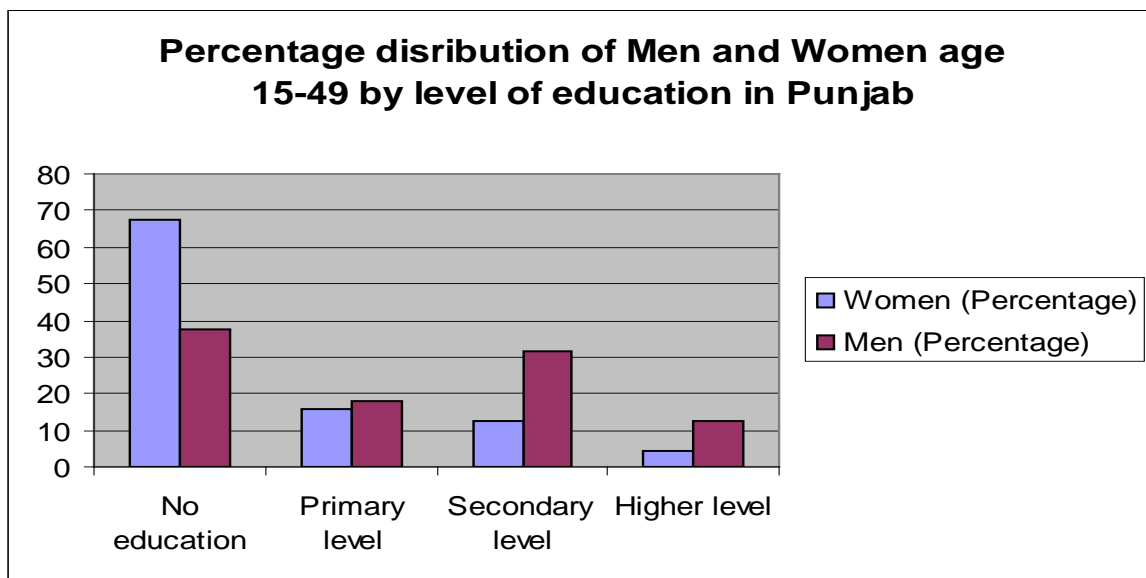
This table and graph shows the major portion of population is uneducated and women are more uneducated than men about 67 % of women are uneducated in Punjab compare to 37% in men whereas men are greater than the women in respect of attaining education.

Table: 7.c

The distribution of births by Region, Sub region, Sex of child, Mother's education, Women's working status, Mother's age at marriage, Mother's age at birth, Birth interval, Wealth index, Water supply in Punjab, Sanitation facility.

	Punjab (Percentage distribution)
Region	**(n=16303)**
Rural	64.40
Urban	35.60
Sub Region	
Capital City	19.26
Small City	14.21
Town	2.13
Country Yard	64.40
Sex of Child	
Male	52.16
Female	47.84
Mother's Education	
No education	37.66
Primary education	18.18
Secondary education	31.39
Higher education	12.77
Working Status	
Employed	30.93
Un-employed	69.07

Mother's Age at Marriage

18 or less	62.43
19-24	31.79
25 or more	5.78

Mother's Age at Birth

18 or less	36.56
19-25	54.15
26 or more	9.29

Birth Interval

18 or less	26.66
19-36	17.45
36 or more	55.89

Wealth Index

Poorest	16.88
Poor	17.11
Middle	22.61
Rich	23.03
Richest	20.37

Water (drinking) Supply

Tap in house	39.91
Water from tube well	43.87
Hand pump in house	7.40
Water outside house	4.48
Water others	4.34

Sanitation Facilities

No Facility	26.02
Pit toilet	4.96
Flush and underground sewerage	61.25
Other and open sewerage system	7.77

The difference of births shows the substantial difference in social-economic variables like Mother's education, Father's education, Sanitation facility, wealth status, sex of child, Women's working status, Water supply in rural/urban areas. About 64.5% of births occurred in rural areas as compared to the 35% of urban births, in which only 19.2% births are from Capital city. Nearly 43% births occur in the rich and richest family whereas 34% of births are from poor families in Punjab and 22% are from the middle families.

Births in uneducated mothers are very high about more than 35% of births lies in this category whereas 18.2% of births are in those mothers having primary education and only 12.7% of births are from higher education. Larger proportions about 61 % of births are from the family having flush toilet sanitation facility compare to the 5% of births having the facility of pit toilet. Births from availing no toilet facility are 26%.

Nearly 30% of births are in employed women in whereas 70% of births are from unemployed women working status in Punjab. Drinking water supply almost shows that 40% of the families use water which came from tap and water from tube well is big source to provide water supply in the area of Punjab and more than 80% of births occur in these categories.

In Pakistan marriages are held in early ages nearly 62% of women are marriages at the age under than 19 years and only 5% of women are married more than 25 years. In area of Punjab more than 36.5% of births are taken under the age of 19 years and above 50% of births are between the ages of 19 to 25 years. Nearly 25% of births are less than the

length of the birth interval less than 18 months and more than 55.9% of births interval are more than 3 years.

Analysis of the socio economic and demographic variables and infant mortality in Punjab

In appendix I show the roll of socio-economic variables and demographic variables in infant mortality in Punjab.

Infant mortality in different region of Punjab shows that it is much higher in the town and has significant positive effects on the infant mortality whereas capital city has negative effects on infant mortality.

Infant mortality is affected a lot with the level of women education in Punjab. Primary, secondary and higher education has negative impact on infant mortality in Punjab. This results show that when there is an increase in the level of education infant mortality goes down. Infant mortality in secondary level education is 22.5% lower than the women having no education. Education up to the secondary level has a significantly negative relationship with the infant mortality in Punjab.

This model also shows the relationship of infant mortality and household characteristic. Sanitation facility has also negative impact on infant mortality. This result shows that infant mortality is negative associated with the availability of toilet facility. Good sanitation facilities have a significant negative impact on the infant mortality and it is 51.8% more significant negatively associated with infant mortality then there is no toilet facility. In Punjab, ratio of child survival is much higher in those families having good financial positions. The result shows that unknown source of drinking water play an important role in Infant mortality in Punjab and it is 43% more positively significant than the source from tube well.

Wealth status has played an important role in infant mortality and this result explains the positive relationship between the poverty and infant mortality while middle and rich status shows the significant negative relationship between them. Rich wealth status is 42.5% more significant than women belong to the poorest wealth status

In appendix I also show the results of infant mortality and biological variables.
Women marriage ages between 19 to 24 years are positive associated with infant mortality and the age more than 24 years a negative relationship is found but this relationship is not significantly associated with infant deaths. Birth ages between 19 to 25 years are significant negative associated with infant mortality in Punjab. This result also shows the significant impact of birth intervals on infant mortality. Birth ages between 19 to 25 years are 17.26% negatively significantly associated with the Birth age less than 18 or less. As there is an increase in the birth interval infant mortality reduced and found a negative relationship between infant deaths and birth interval. Birth interval between 4 to 6 years and 7 to 10 years are significant negative effect on infant mortality in Punjab.

Birth order has play an significantly associated with the infant mortality in Punjab.
Number of siblings 4 or less have a significant negative impact on infant mortality but no of siblings between 5 to 8 has a large significant positive effect on infant mortality in Punjab. No of siblings more than 8 also have a significant positive associated with infant mortality in Punjab. The result shows the significant negative relationship between birth order and infant mortality in Punjab.

infant_mor~y	Nature of relationship	Coef.	P>|z|	t 5% Significant
town	Positive	0.4025185	0.0070	significant
workingsta~s	Positive	0.1766108	0.0000	significant
d_middle_w~3	Negative	0.2791706	0.0040	significant
d_rich_wea~4	Negative	0.3455715	0.0010	significant
d_richest_~5	Negative	0.4250094	0.0010	significant
d_good_toi~t	Negative	0.5180895	0.0000	significant
water_unkn~n	Positive	0.4371117	0.0010	significant
d_s_wedu	Negative	0.2218436	0.0350	significant
d_19to25_b~e	Negative	0.172628	0.0010	significant
bir_inter_~6	Negative	0.338401	0.0000	significant
bir_inter~10	Negative	0.3777594	0.0080	significant
d_1to4_sib~g	Negative	0.1670326	0.0170	significant
d_5to8_sib~g	Positive	0.6172816	0.0000	significant
d_9ormore_~g	Positive	1.172367	0.0000	significant
d_2to4_order	Negative	0.3170429	0.0000	significant
d_5to8_order	Negative	0.4024862	0.0010	significant
d_9ormore_~r	Negative	0.9439845	0.0000	significant
_cons	Negative	1.830692	0.0000	significant

So these are the socio economics variables that play a significant role in determinant of infant mortality in Punjab at 5% level of significance.

Conclusion

In fact infant mortality is very high but it seems to appear the favorable conditions for child survival in urban areas. Infant mortality remains very high as government has paid less attention to improve health care facility in the population. The quality of health care facilities that a child receives from their parents directly affects on the chances of its survival. This also includes mother's care about hygiene, nutrition and sanitation. The role of the cultural factor like having access to modern medical facility but giving less attention to the health of the child needs to be improved.

The demography and health survey based data indicate that mother's education, social status and women's autonomy is an important and significant factor affecting infant mortality. Major part of women's population lives in rural areas and has less knowledge of utilization health and medical facilities and also have less confidence to utilization of available opportunities. Women's autonomy enables mothers to take quick decision for better health of infant child. Higher social status also improves the health care for infant. This study indicates that with the help of mother's education there is an increase in the child care and reduction in the infant mortality rate. Educated mothers overcome the barriers of social status, low autonomy and low wealth status. This study also illustrates the pathways under which mother's education affects the infant mortality. This study has a strong evidence to support that women's education is one of the most important and effective way to reduce the infant mortality in Pakistan.

The level of poverty has been continuously increasing since 1990. The structural adjustment programme (1988-89) had adversely affected purchasing power of the population but also affect the infant and child mortality in Pakistan. Infant mortality rate has increased 91 per 1000 live births in late 1980s to 103 in 1993-94 (Mubashir Ali, 2001). Pakistan is also lagging behind in social sector and majority of its population is illiterate. Although female education has got a lot of importance, in infant and child mortality and established in various studies yet women's literacy rate is very low and there exist a high risk of child survival. Mother's education up to the secondary level may

contribute a lot in survival of a child. Provision to reduce household crowding and better nutrition helps a lot in reducing infant and child mortality. Women's work status also contributes the high risk in child survival.

Social Action Programme (SAP) has been started in 1993 to re-establish the situation in the field of health and nutrition sector especially in rural areas of Pakistan. A lot of resources have been utilized and made a lot of efforts but cannot get the desired results. In rural areas an immediate attention is required to improve the health status of population and decrease the risk of infant mortality (S.M.Ali, 2001).

A large percentage of population in Pakistan does not have access to medical care, awareness to prevent them from diseases and live in conditions where there is a lack of sanitation, while a small proportion of families have easy access. A major percentage of births occur to those parents who are not living a quality life, poor, having little education, polluted drinking water, inadequate living conditions and lack of sanitation facilities and all these factors are effectively associated with the death of a child in first year of his life. The government policy to increase the economic growth has become an escort of significant difference between regions and in different socio-economic groups.

The purpose of this study is to find out the factors which are relatively more effective in child survival. Mother's education and social economic status has strong negative relationship between infant mortality in Punjab. These are the most important variable than other social-economic variables. High infant mortality is also strongly associated with the short birth intervals. An improvement in social and economic status of women brings the long term decline in infant mortality.

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Appendix 1

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Logistic regression                              Number of obs   =      16302
                                                 LR chi2(37)     =     489.89
                                                 Prob > chi2     =     0.0000
Log likelihood = -5390.9322                      Pseudo R2       =     0.0435

------------------------------------------------------------------------------
 infant_mor~y |     Coef.    Std. Err.      z     P>|z|    [95% Conf. Interval]
--------------+---------------------------------------------------------------
 capital_city |  -.0400234   .0679418    -0.59   0.556    -.1731869      .09314
   small_city |   .1200678   .0733075     1.64   0.101    -.0236124    .2637479
         town |   .4025185   .1494733     2.69   0.007     .1095563    .6954808
 female_child |  -.0955889   .0512425    -1.87   0.062    -.1960224    .0048445
 workingsta~s |   .1766108    .041265     4.28   0.000     .0957329    .2574887
 d_poor_wea~2 |   .0136046   .0820775     0.17   0.868    -.1472644    .1744735
 d_middle_w~3 |  -.2791706   .0978723    -2.85   0.004    -.4709969   -.0873444
 d_rich_wea~4 |  -.3455715   .1078286    -3.20   0.001    -.5569117   -.1342313
 d_richest_~5 |  -.4250094   .1241636    -3.42   0.001    -.6683655   -.1816532
 d_6to10_pe~n |   .0240819   .0562516     0.43   0.669    -.0861692    .1343331
 d_more10_p~n |    .075075   .0844086     0.89   0.374    -.0903629    .2405129
 d_pit_toilet |  -.2618903   .1966974    -1.33   0.183    -.6474101    .1236295
 d_flush_to~t |  -.0335232   .0814057    -0.41   0.680    -.1930754     .126029
 d_good_toi~t |  -.5180895   .1294482    -4.00   0.000    -.7718033   -.2643758
   water_pump |   .0055423   .0623534     0.09   0.929    -.1166681    .1277527
   water_well |  -.1762616   .3403915    -0.52   0.605    -.8434167    .4908936
 water_surf~_ |  -.0283468   .1563213    -0.18   0.856     -.334731    .2780374
 water_unkn~n |   .4371117   .1269167     3.44   0.001     .1883596    .6858637
     d_p_wedu |  -.0993391   .0802873    -1.24   0.216    -.2566993    .0580212
     d_s_wedu |  -.2218436   .1049948    -2.11   0.035    -.4276296   -.0160577
     d_h_wedu |  -.1011233   .1673431    -0.60   0.546    -.4291099    .2268632
        d_m_p |   .0569574   .0733355     0.78   0.437    -.0867774    .2006923
        d_m_s |   .0414667   .0613182     0.68   0.499    -.0787147    .1616482
        d_m_h |   .0192266   .0920727     0.21   0.835    -.1612325    .1996857
 d_25ormore~e |  -.0890351   .1163328    -0.77   0.444    -.3170431    .1389729
 d_19to24_m~e |   .0545558   .0574497     0.95   0.342    -.0580436    .1671552
 d_19to25_b~e |   -.172628   .0536973    -3.21   0.001    -.2778728   -.0673832
 d_26ormore~e |   -.146365   .1217416    -1.20   0.229     -.384974    .0922441
 bir_inter_~6 |   -.338401   .0870518    -3.89   0.000    -.5090193   -.1677826
 bir_inter~10 |  -.3777594   .1428876    -2.64   0.008    -.6578139   -.0977049
 bir_inter_~e |   -.330243   .3801988    -0.87   0.385    -1.075419     .414933
 d_1to4_sib~g |  -.1670326   .0699541    -2.39   0.017    -.3041401   -.0299251
 d_5to8_sib~g |   .6172816   .0730022     8.46   0.000     .4741999    .7603633
 d_9ormore_~g |   1.172367   .0923203    12.70   0.000     .9914227    1.353311
 d_2to4_order |  -.3170429   .0660703    -4.80   0.000    -.4465383   -.1875476
 d_5to8_order |  -.4024862   .1197069    -3.36   0.001    -.6371074   -.1678649
 d_9ormore_~r |  -.9439845    .232712    -4.06   0.000    -1.400092   -.4878773
        _cons |  -1.830692    .143742   -12.74   0.000    -2.112421   -1.548963
------------------------------------------------------------------------------
```

Appendix 11

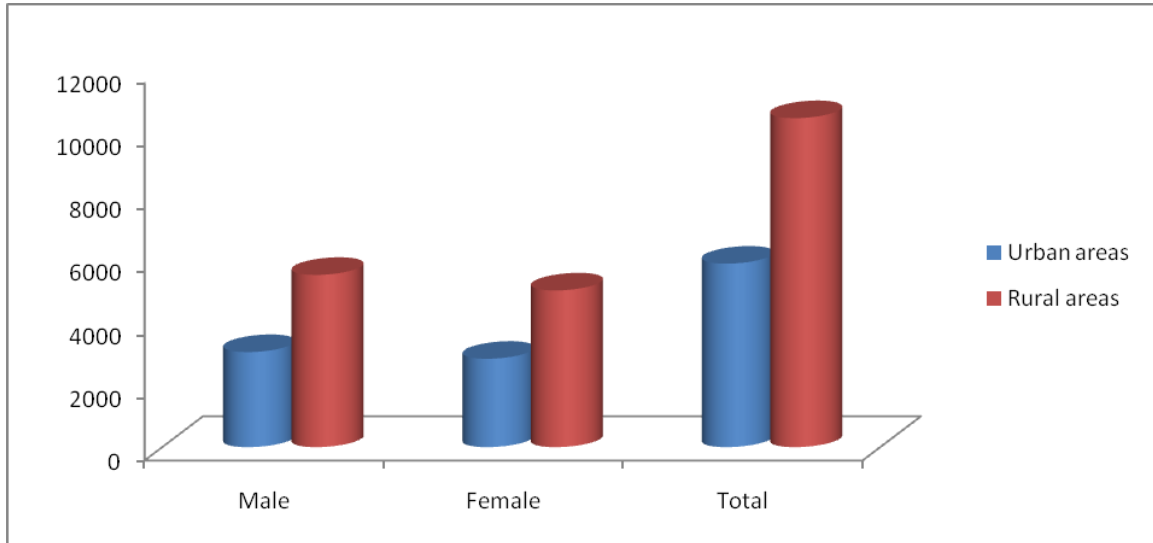**Figure A.1** Graphical distribution of Infant Gender in rural/urban areas of Punjab

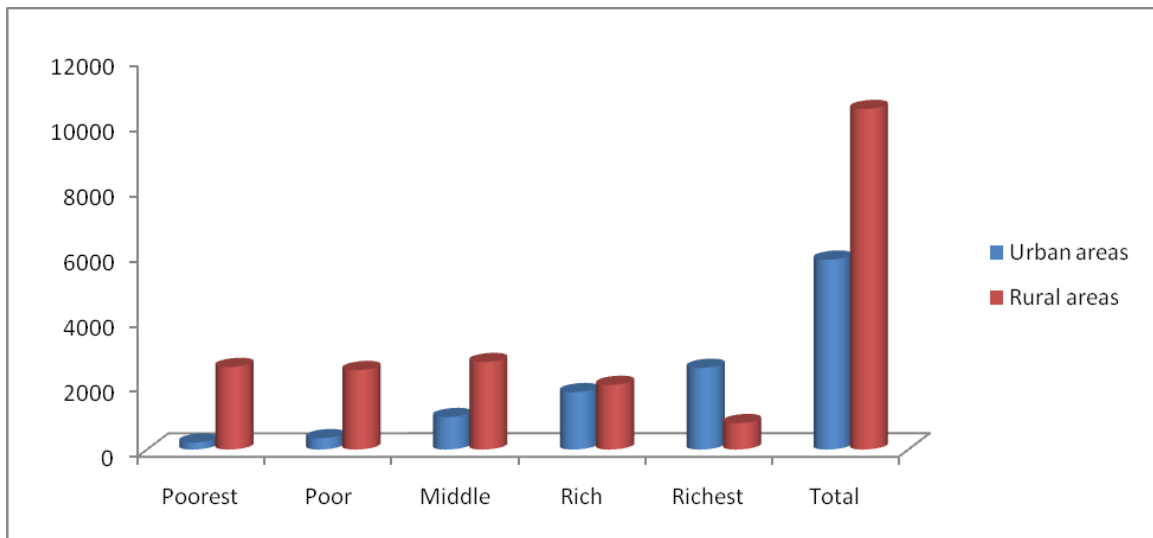**Figure A.2** Graphical distribution of Wealth Status in rural/urban areas of Punjab

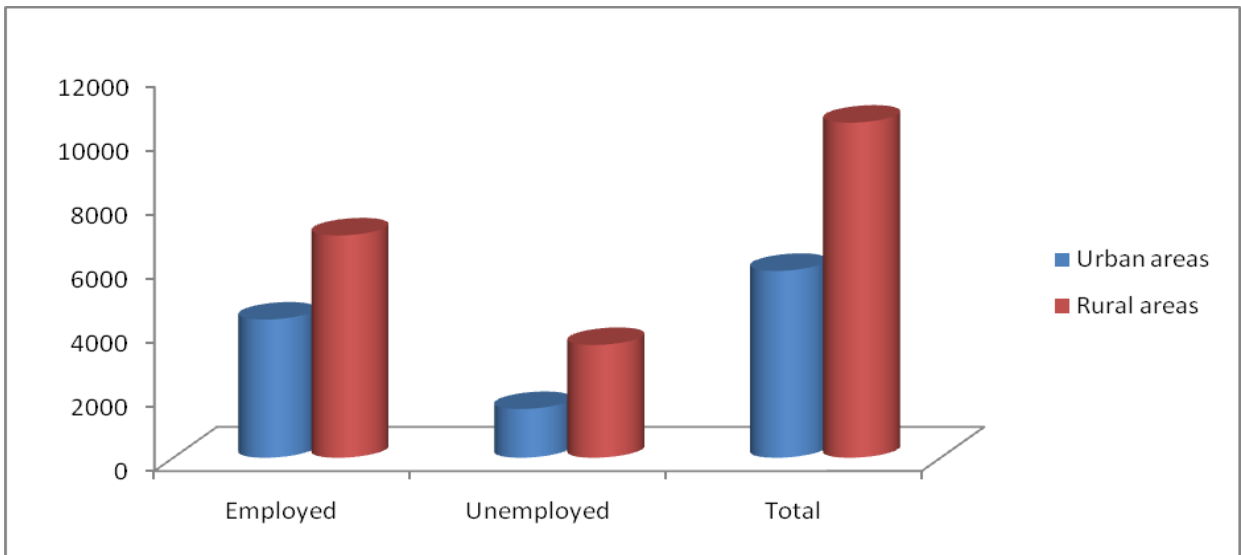**Figure A.3** Graphical distribution of women's employment status in rural/urban areas of Punjab

Figure A.4 Graphical distribution of Level of Mother's Education in rural/urban areas of Punjab
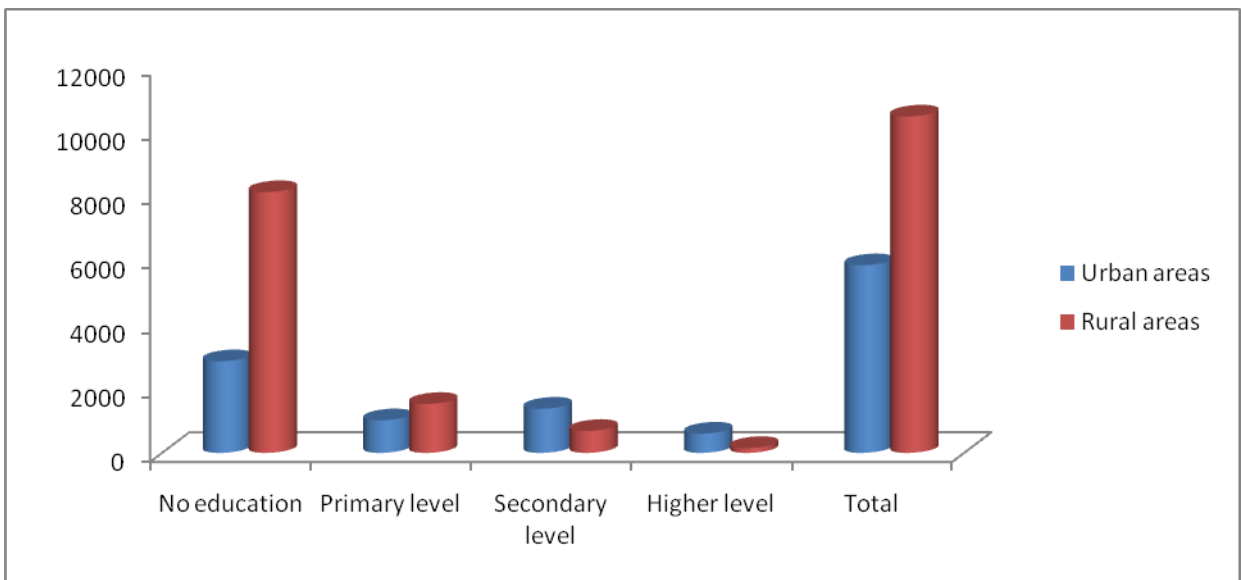
Figure A.5 Graphical distribution of Birth Interval in rural/urban areas of Punjab
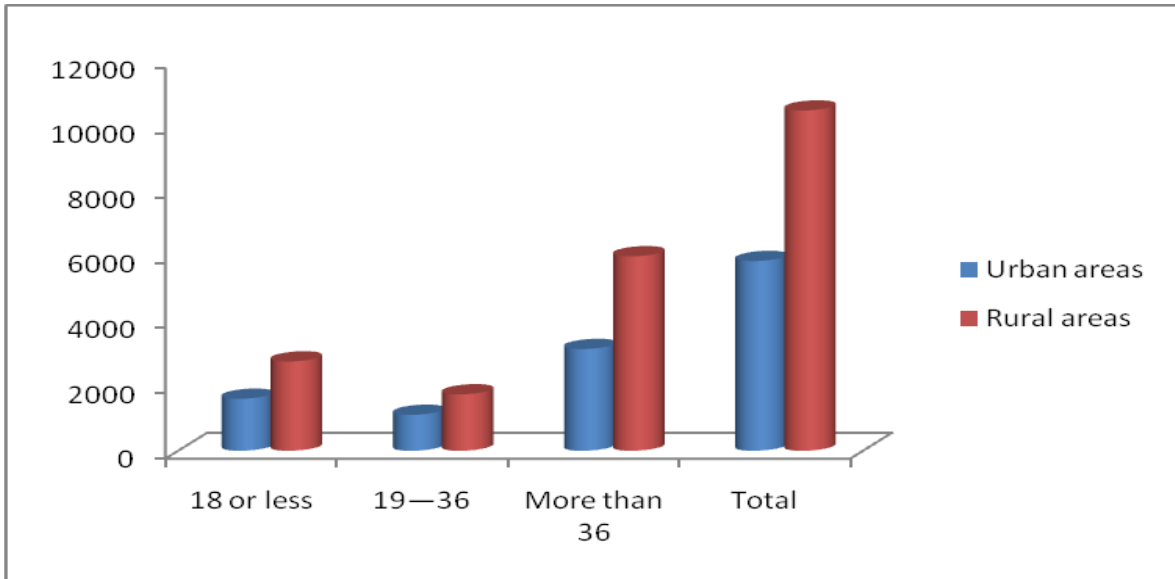
Figure A.6   Graphical distribution of Mother's Age at Birth in rural/urban areas of Punjab
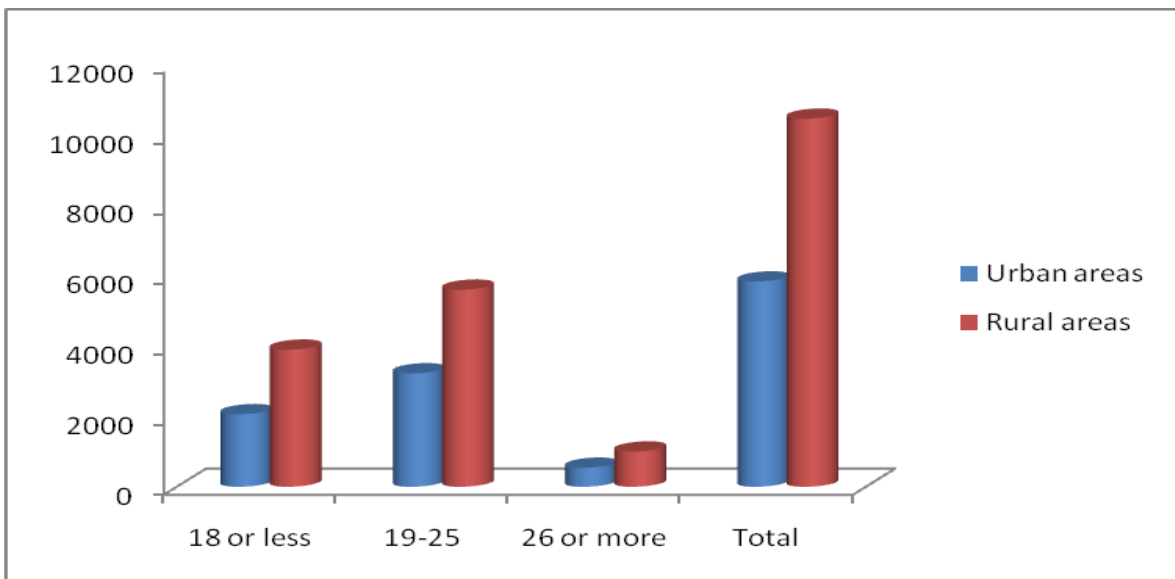
Figure A.7   Graphical distribution of Women's Age at Marriage in rural/urban areas of Punjab
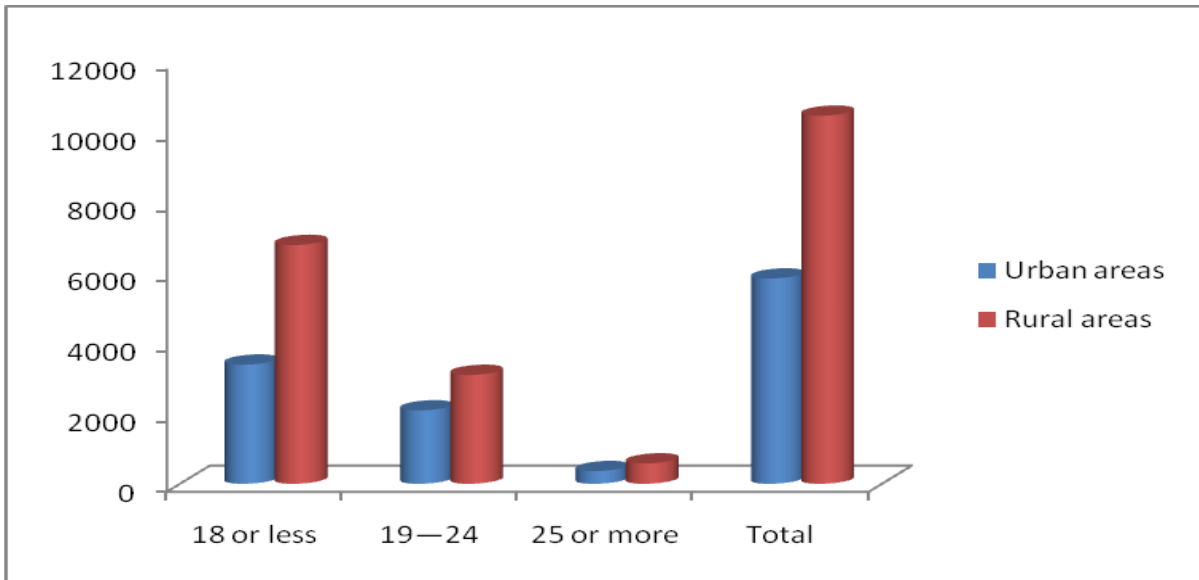
Figure A.8   Graphical distribution of Sibling in rural/urban areas of Punjab
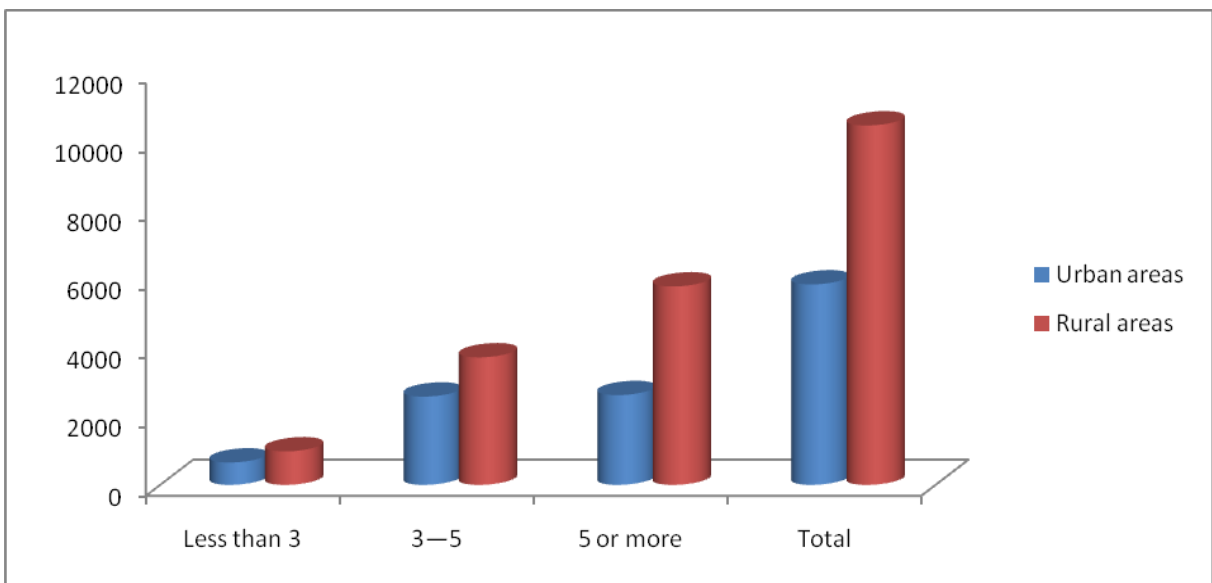
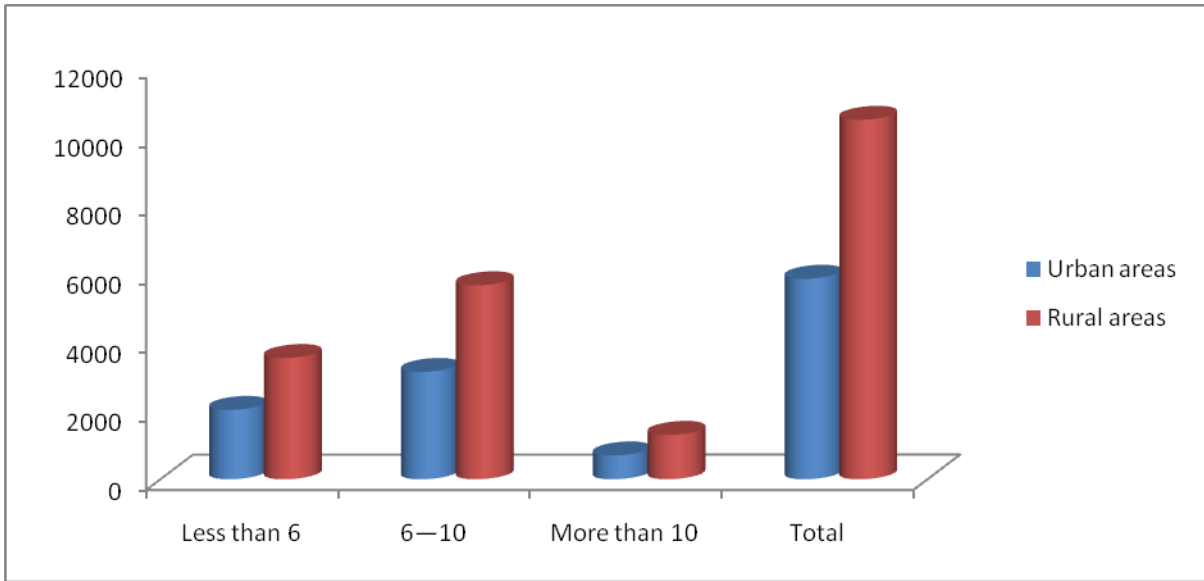**Figure A.9**   Graphical distribution of No of Household in rural/urban areas of Punjab

Figure A.10   Graphical distribution of level of Father Education in rural/urban areas of
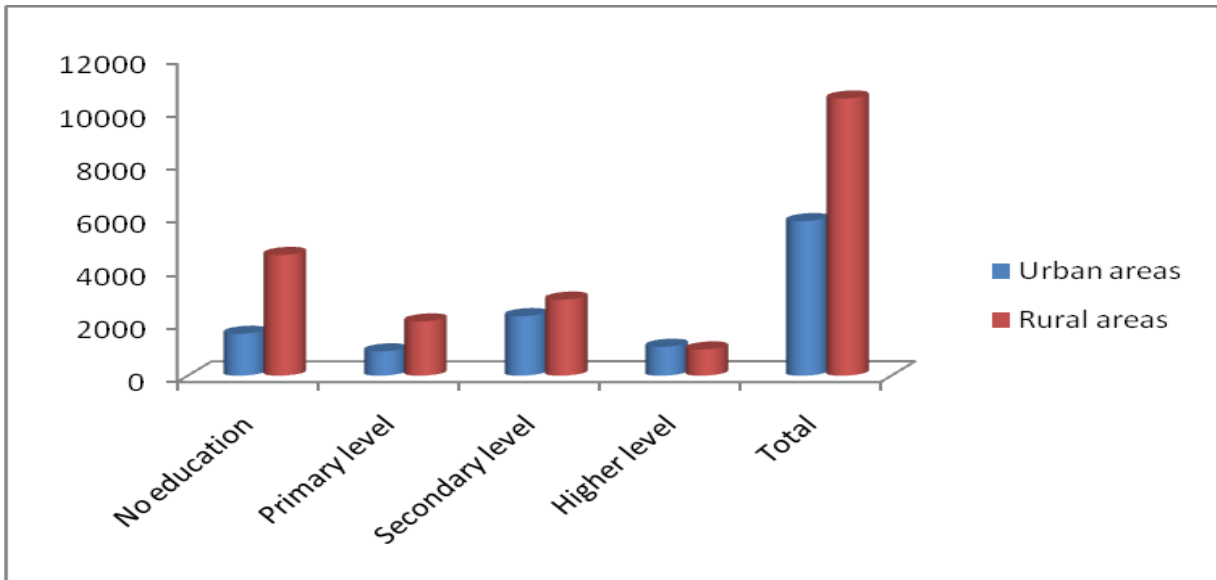   Punjab

Figure A.11   Graphical distribution of Sanitation Facility in rural/urban areas of Punjab
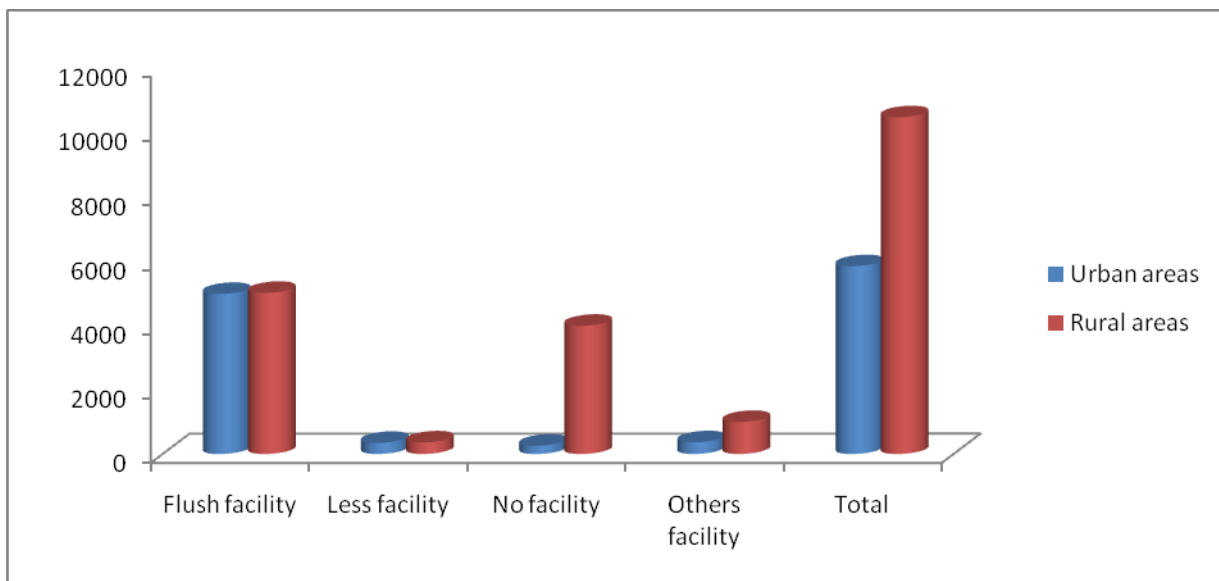

Figure A.12   Graphical distribution of Drinking Water Supply in rural/urban areas of Punjab