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IMPACT OF SOCIOECONOMIC DETERMINANTS ON INFANT MORTALITY IN PAKISTAN

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ABSTRACT

The recent study was carried out to estimate the impact of socioeconomic, demographic and the aspect of health status on child mortality in Pakistan. The data for the study was collected from the PSLM (Pakistan Social and Living Standard measurement survey) for the year 2011-12. The data were analyzed through cross-tabulation and binary logistic model using MLE (Maximum likelihood estimation) technique. Overall, 13216 households were selected for the analysis. The result of the study of the cross-tabulation shows that the overall child mortality was low in Baluchistan province, the maximum number of children survived in Punjab province further, and the child mortality was low in an urban area where 290 children died out of 3984 houses as compared to rural area household in Pakistan. Child mortality was high among females than males in Pakistan. The result of binary logistics shows that out of the total independent variable, nine variables significantly affect child mortality in Pakistan, location of the household, gender, education of father, education of mother, income and mother feeding, positively associated the infant mortality; all these aspects reduce the chance of child mortality, while there was a less likely chance that child survives in Punjab, Sindh as compared to KPK in Pakistan. In the case of Baluchistan, there was also the same situation as KPK in terms of child mortality. Infant mortality was high in female children compared to male children, which means there is a less likely chance of surviving among the female child than the male child. All other variables were insignificant in Pakistan. It is suggested that the central authority provide basic children and mothers health facilities at minimum cost to the rural areas of Pakistan.

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INTRODUCTION

Infant means a newly born child, while infant mortality means the death of a child within one year of age; infant mortality is one of the Millennium Development Goals, i.e. MDG-4 (Rezaei et al., 2015). The infant mortality rate or child mortality is considered the most authentic measure to highlight the well-being of society (Buckley, 2003). In recent times, it has been a major worldwide health issue facing almost every nation. Poverty and ignorance are the basic causes of the high death rate among newly born and small-aged children worldwide, especially in third-world nations. The basic indicators of social development, human being and health status are infant mortality (Ahmad et al., 2000). It is time to take serious steps to overcome such an important issue for both developed and developing nations of the world and make effective health policies. The infant mortality rate is high among the poor nation of the world compared to those nations with high per capita income. Lack of resources and unequal distribution of wealth are other causes of the high death rate among the less developed nation. Four to five million children die every year within the first month of their birth. This shows that every minute, seven to eight newly born children lose their life (WHO, 2012). This is a serious issue faced by both worlds, but the magnitudes are different in both worlds. 96% of children from developing nations die at a very early age of their birth, while only 4% belong to developed nations. The causes of such a high infant death rate among poor nations are the attack of fatal diseases at an early age and the treatment to save their children. The situation in south Asia is very unhealthy in this regard, where one child among the ten dies not even celebrating their fifth birthday, while this rate is one over 143 children in developed nations. Diarrhea, malaria and measles have caused 70% of children's deaths worldwide. Lack of proper food is another cause of infant mortality in third-world nations. Reducing infant mortality has been a global challenge throughout the thirty years.

Overall the world the infant mortality rate has decreased. In 1990 this rate was 65 deaths among 1000 live birth, but in 2017 this rate is come down to 29 deaths per 1000 live birth.

The number of infant mortalities decreased from 8.8 million in 1990 to only 4.1 million in 2017 (WHO, 2012). Many socioeconomic, mother health status and housing status factors are directly or indirectly involved in high infant mortality in developing nations. However, the role of these magnitudes is different in different situations and nations (Gubhaju et al., 1991). The current infant mortality rate in Pakistan was 59.109 death per life in 2020, and this rate was 60.290 per death in 2019. This infant mortality rate decreased by 1.89 in 2019 (macro trends). So, the condition of Pakistan regarding this is improving with the passage of time. So, some issues related to this area of research are left by the researcher for upcoming researchers. The study's main objective was to determine and empirically investigate the impact of Socioeconomic, Demographic and health status on the infant mortality rate in Pakistan. Pena-Boquete et al. (2019) investigated the determinants of child mortality in Kazakhstan by using the Logistic model. Independent variables include region, mother education, No of households, No of children, age of mother, and household head education. The study's findings show the curvilinear relationship between child mortality and mother age. It depicts the higher risk of mortality with both older and younger ages of the mother, no of children and infant mortality are positively related, as no of children increases the risk of infant mortality increase. The numbers of households are also positively associated with infant mortality; the no of household greater the chance of infant mortality. The region of the household is also a significant variable; infant mortality is higher in the case of rural areas. Education in the household is significantly negatively associated with child mortality; higher education of the household head lowers child mortality, but the mother's education is an insignificant variable with a negative sign.

Thikeo et al. (2017) examined the factors affecting infant mortality. And the data was taken from the Lao population and housing census. The binary logistic regression model is used to determine the association between the dependent variable (infant mortality) and independent variables such as region, family size, language, household education, gender of the household, electricity, type of energy, type of latrine and source of water. The regression results show that the number of children under five is significant and positively affects infant mortality. The more under-five children, the higher infant mortality will be. Female households significantly and negatively contribute to infant mortality; Infant mortality is higher among poor families as compared to rich families. In rural areas, infant mortality is higher and lower in urban areas. There is a positive relationship between the education of household heads and infant mortality. There is a statistically insignificant and positive association between infant mortality and the high-skill profession of the household. Electricity is also a significant determinant of infant mortality; the presence of electricity reduces the chance of infant mortality. In the case of the sanitation factor, the source of drinking water is a significant determinant of infant mortality; safe drinking water reduces the risk of infant mortality. There is a negative association between infant mortality and a better latrine system. The number of households living in a room is also significant and positively related to infant mortality.

Jeetendha (2017) carried a research that examined the trends and determinants of infant mortality in the Empowered Action group state of India. Data was taken from demographic and health surveys, and Cox proportional hazard model was used for the analysis. Results of the study indicate the trends of infant mortality, which considerably decrease in India. Determinants of infant mortality include socioeconomic and demographic factors. A recent study shows that mother education is negatively related to infant mortality, and children having educated mothers are at lower risk than illiterate mothers. There is a significant association between infant mortality and birth order and birth interval, higher birth order is related to lower infant mortality, and shorter birth interval contributes to a high risk of mortality. Economic status is also a significant indicator of infant mortality; lower health expenditure increases the probability of infant mortality. Health facilities are also a significant variable, and it has a negative association with infant mortality. Safe drinking water and sanitation facilities reduce the risk of infant mortality. There is also a regional difference found. The rate of infant mortality is different in different regions.

Sharaf and Rashad (2018) analyzed the inequalities of infant mortality and their trend using cross-sectional data from national demographic and health surveys. In the study, multiple logistic regressions were used to estimate the inequalities. Results of the study indicate the negative relation between infant mortality and the standard of living. Independent variables include the gender of the child has two categories, male and female; region, with two categories, urban and rural. Economic status includes water sources with two categories; availability to safe drinking water and other is no access to safe drinking water. Other variables include health care, the mother's educational level, employment status, the mother's nutritional status, and birth interval. In the study, a concentration index was used for the time element, multivariate regression was performed, and results showed a different rate of infant mortality in different periods. The study's findings showed that multiple births result in higher infant mortality compared to single birth and may be due to premature birth or lower birth weight. A shorter birth interval is also positively related to infant mortality; a shorter birth interval is associated with higher infant mortality, and using healthcare facilities during pregnancy reduces the chance of infant mortality. There is no significant association between a mother's education and infant mortality, but infant mortality is lower among mothers with post-secondary education. The economic status of the household is also significantly related to infant mortality. Infant mortality is lower among rich families than in poor families. The region is also a significant contributor to infant mortality; infant mortality is higher in rural areas than in urban areas. Results showed no association between infant mortality and water facility, no children also contribute to infant mortality, and two children under five are at greater risk of dying. Child sex, mother working, and mother's nutritional status are statistically insignificant.

Kumar et al. (2017) investigated the social and demographic determinants of under-five-year mortality in rural Agra, India. The study's main purpose was to determine the quantum of child mortality and the social factors associated with cited

deaths. The cross-sectional data of the study was analyzed through a multistage random sampling technique through selected community Development Block Sainyan, district Agra, India, among child population aged less than 5 years. By surveying 8355 families, 185 deaths were reported among the child population. It was found that a higher number of deaths among the children belonged to joint families where socioeconomic status was low. The neonatal, post-neonatal and infant mortality rates were 33.55/1000, 40.78/1000 and 74.33/1000 live birth, respectively. The mortality rate of children aged 1-5 years was 10.6/1000 in the same age group, while the mortality rate of children aged 0-5 years was 22.39/1000 in discussed age group, 185 children who were died, from which 52.7% of children were un-immunized while other 35.6% were partially immunized. Finally, a study suggested strengthening the population's female literacy and socioeconomic well-being.

Koshy and Guru (1999) studied the direct and indirect effects of six variables on infant mortality. For this purpose, six hundred couple from central India has been interviewed. The path analysis results showed that the type of delivery attendant strongly influences the infant mortality, which negatively and directly impacts the dependent variable. Parental socioeconomic status strongly and negatively affects infant mortality. It affects the mortality through the mother's age, health status, type of delivery attendant, and hygiene. The health status of a mother has a significant and negative impact on infant mortality. Mother age at marriage indirectly and negatively affect the IM. This study shows that IM is higher among joint families and lower in separate family situations. It has a negative effect on IM. Khan (1993) tried to shed light on the cultural determinants of infant mortality in India. This research indicates the non-medical cause of infant mortality; it describes the association between infant mortality and sociocultural variable. The study shows lower maternal age is the risk factor for infant mortality. Delivery assistance and place of birth are also very influential; delivery assistance by untrained health professional increase the chance of infant mortality, and when delivery is conducted at home, it is also a risk factor for infant mortality. Breastfeeding also positively contributes to the infant's survival, especially when initiated just after birth. The study shows that poverty is a very influential variable; with access to poverty, one cannot avail the health facilities. This study shows that rest after and before delivery positively contributes to infant survival. Marriage at an early age is also a risk factor for infant mortality.

Shil et al. (2016) conducted research on factors of infant mortality in India. The main objective of the research was to explore the gap and factors of the infant mortality rate in India. The data was taken from the national family health survey of 2005-06 and applied multivariate analysis to identify the determinants of infant death. The appropriate weighted sampling was also supplemented to perform the complete analysis. The study revealed that the hazard of death from the central region was 28% higher among women than in other regions. Besides that, the women with a parity of more than 5 had the highest hazard of infant death rate relative to all women with a parity of two or fewer. Empowerment and working status of the women was significantly reducing infant death. Childbearing at an immature age and shorter spacing were the great risks of infant death. Moreover study suggested that to further improvements in the infant and child health sector, the government and policy maker should focus more on raising the marriage age and awareness regarding lesser children with adequate birth spacing by promoting contraceptive seminars and awareness, particularly in rural areas.

Rezaei et al. (2015) studied to determine the main factors affecting IM in developing countries. The effect of per capita GDP, the public spending as a percentage of total health expenditure and female labor participation on IM through GLS random effect. The result of the study shows that the fertility rate is positively and significantly related to IM. While GDP is negatively related to IM, higher GDP results in lower infant mortality. There is a significant and negative relationship between public spending and IM, and there is no significant relationship between IM and female labor force participation. Finally, GDP per capita, total fertility and public health expenditure are significant determinants of IM.

Damghanian et al. (2014) investigated the socioeconomic determinants of infant mortality in Iran. The cross-sectional data of the health record is collected and used in the Blinder-Oaxaca method. The results showed that there is an inverse relationship between infant mortality and socioeconomic group. Mother education is the most significant variable and positively contributes to infant survival. The higher the mother's education greater the chance of infant survival. And there is also a negative relationship between birth weight and infant mortality and a positive association between breastfeeding and infant survival, children who were breastfed were at lower risk of dying than those who were not breastfed. Location, child sex and high-risk pregnancies are statistically insignificant. Kusneniwar et al. (2013) studied the determinants of infant mortality in a rural Medchal region of Andhra Prades, India. The analysis of the study was univariate, where a binary logistic model was applied to indicate the significant factors of infant mortality. The extracted finding showed that the infant mortality rate remained relatively constant at 43, despite the significant increase in organization deliveries in the study area. Socioeconomic variables such as household economic status, health, and education and environmental variables such as availability of pure drinking water, washroom, sanitation and use of fresh cooking oil are significant contributors to infant survival.

Liwin et al. (2013) studied the effect of household and community context on mortality among children under five years of age in Sierra Leone, as evidenced by the 2013 Demographic and Health Survey. The study's objective was to examine the consequences of household and community on the risk of death for children under the age of five in Sierra Leone. The data was obtained from Sierra Leone Demographic and Health Survey 2013 to estimate the probability of dying and to examine the determinants of mortality using discrete-time event history analysis at a multivariate level. Results revealed that individual child characteristics, the mother's education and community-level factors simultaneously affect the risk of infant and child mortality. The significant clustering of communities with a high risk of mortality determined in the

Eastern region shows that children living in this region had a higher risk of mortality than those living in other regions. On the basis of extracted results, the study suggested that policymakers and program managers should emphasise assisting mothers through family planning programs to increase birth intervals and access to healthcare services for mothers and their children. Similarly, targeted interventions are to be followed in order to reduce childhood mortality in most of the affected regions of Sierra Leone.

Thiombiano et al. (2013) conducted research on the impact of parental union dissolution on child mortality and schooling in Burkina Faso. They tried to inspect the consequences of widowhood and a mother's divorce on the mortality risk of children under five and the likelihood of their primary schooling. They took the data of 2000 migrants from the Urban Integration Survey of Burkina Faso. Using Kaplan-Meier and Piecewise exponential models, they extracted that after controlling the various other factors, children belonging to broken family experience a high risk of under-five mortality and are less likely to enter school than children of intact families. According to them, these consequences are very strong and significant during the first two years after the divorce. They also found that the father's death greatly reduces the child's likelihood of entering school, but it does not affect the estimated mortality rate of the children. Studies suggest that the children of the broken family go through a precarious situation, so attention should be paid to their specific needs to improve their well-being, particularly during the first two years of divorce.

Maitra and Rammohan (2011) studied to shed light on gender discrimination among female children and also found an association between nutrition. Data was taken from the Indian National family health, and the food survey and logit model were used in this study. The Results of the study show that a male child is at greater risk of mortality than a female child. Twin children with low birth weight and higher birth order are associated with low survival probability. Father education is a signification variable, while mother education is negligible effect on infant mortality, especially when mother education is more than primary. There is a significant association between child survival and mother employment. In the case of survival probability, there is a gender difference, but in the case of nutrition outcome, there is no gender difference. The probability of child survival is different in different regions.

Kayigamba (2009) researched determinants of infant mortality in Rwanda by utilizing the data from Third Rwanda Demographic and Health Survey 2005. The analysis involved children under the age of one who was born between 2000 and 2005 by applying the cross-tabulation method. The study used regression as the main analysis tool to investigate the effect of the selected predictor on infant mortality. The result showed that children in the western Province of Rwanda reported a lower risk of dying than in the Kigali region of Rwanda. Mother's education positively contributes to reducing infant mortality. All other predictors showed hypothetically expected results. The study recommended investing in the public health care sector to improve environmental sanitation in physical structure and change hygiene practices. This study was not exhaustive at all. Further studies need to be conducted to determine the mechanisms through which residence (western Rwanda and wealth index), women's education, household master plan (pure drinking water, toilet facility and sanitation) and seminars are to be conducted for awareness purposes, particularly at the rural level.

Tymicki (2009) examined infant and childhood mortality in Poland. The first objective is to evaluate the framework of infant mortality that contains an appraisal of the theoretical framework. The covariates were applied to check mortality for the first 60 months of life. Second, some new empirical evidence comes from the longitudinal reconstitution of church registers of Bejsce parish. The analysis includes a hazard model for testing infant mortality over the first 60 months of life and investigates a reconstruction of descriptive measures of infant and childhood mortality. Studies showed that male infants have more mortality risks than female infants during their first year of life. Mother's age does not closely affect the child's survival life, but in comparison, a child belonging to a mother aged 15-18 years has a lower mortality risk as compared to a child belonging to a mother aged 19-25 and 26-35. The hazard model showed that male infant mortality risks are 51% and female infant mortality risks are 41% during their first 12 years of life but less in life after that. Similarly, orphans or children without parents had more risks of mortality in contrast to those whose parents were alive.

Mahmood (2002) studied the determinant of neonatal and post-neonatal mortality in Pakistan from the data of the Demographic and Health Survey of Pakistan conducted in 1991. The main aim was to examine how socioeconomic factors affect infant and child survival through demographic, environmental nutrition healthcare factors. The finding of the study had not fully supported the hypothesis that socioeconomic factors affect infant and child survival. And the study found that father education had a stronger effect on neonatal mortality than mother education. However, mother education had a strong effect on improving the child's survival in rural areas. In demographic determinants, the preceding birth interval was the most significant effect on child survival. Parental care services and mothers' shorter birth intervals had significantly improved child survival, particularly in rural areas. The finding suggested the rise in parental education, improved water supply, awareness and motivating mothers regarding health care services for parental and post-neonatal care were the most important steps to improve neonatal and post-neonatal mortality in rural areas of Pakistan.

Zahid (1996) examined the mother's behavior regarding health-seeking and child mortality in Pakistan using data from the Demographic and Health Survey (1990-91). The study indicates that mothers aged 20 years or less contribute to higher neonatal, infant and child mortality rates. Child and infant mortality were similarly higher among first and higher-order births compared to second and third. This study indicated that longer birth intervals significantly contribute to infant survival and negatively contribute to infant mortality. Moreover, the mother's education had a significant effect on the neonatal survival of the infant and child. So as the education of the mother increases, the possibility of mortality decreases, contributing to infant survival. The study also found that delivery assistance, antenatal care and place of birth were

statistically significant; delivery assisted by a health professional reduced the risk of infant and child mortality. The antenatal care by the mother and delivery conducted at the hospital reduce the risk of child and infant mortality. The researcher suggests that improving the educational facilities for the whole population, especially female education, should be improved. Secondly, the health care services should be improved and available to all populations for publicity of health care practices.

METHODOLOGY

Sample Size and Source of Data

Data for the current study were collected from Pakistan social and living standard measurement Surveys (PSLM, 2011-2012). National data set collected by the Federal Bureau of Statistics for regular intervals. This data is cross-sectional and has much information at a micro level in Pakistan. The total numbers of observations in Pakistan are 13216, in Punjab 5755, in Sindh 3754, in KP 2453, and in Baluchistan 1254 observations are collected. In the case of the region, the total observations in urban areas are 5689, and in rural areas, 7527 observations are collected.

Data Analysis Techniques

According to the objective of the study Consistent, data like frequency distribution, cross-tabulation and binary logistic model have been used. The dependent variable was not continuous; due to this reason, the simple regression model using the Ordinary Least Square technique cannot be used. The maximum likelihood technique for the discrete variable has been used. A binary logistic model was used to estimate the factors affecting child mortality by MLE (Maximum Likelihood Estimation) technique.

Estimation of Logistic model

Like all regression analyses, logistic regression is a predictive analysis. Logistic regression describes data and explains the relationship between one dependent binary variable and one or more nominal, ordinal, interval or ratio-level independent variables. A binary logistic model for the estimation of factors affecting child mortality through (MLE) Maximum Likelihood Estimation technique has also been used.

Theoretical Model for Infant Mortality in the Study Area

The theoretical model of child mortality contains so many variables, like child mortality = f (location of the household, education of mother, father education, the income of the household, province, sanitation system, source of water, taxied injection, birthplace, gender of the child, mother feeding, employment status, electricity connection, dwelling type).

Econometric Model for Child Mortality

As the dependent variable is categorical in nature, such that the child is alive or not, so due to this reason we used the logit model to find out the impact of independent variables over the dependent variable, which is child mortality.

The logit model is given as:

$$\text{Logit}(P) = \ln(P/1-P) \quad (1)$$

The value of "p" which is a real number lies between 0 and 1, so the desired model is

$$\ln(P/1-P) = \beta_o+\beta_1X_1 +\dots. +\beta_K X_K. \quad (2)$$

If we write this model according to child mortality model then this model looks like that,

$$\ln(p/1-p) = \alpha+ \beta_1X_1+ \beta_2X_2 + \beta_3 X_3+ \beta_4D_1 +\beta_5D_2+ \dots\beta_{20}D_{17}+ ei \quad (3)$$

Where,

ln = natural logarithm

α = constant

P= probability that child is alive, 1-p= probability that child is not alive, x = number of variables.

k = number of observations. β_1……. β_{21} = regression coefficient should be estimated.

Description of the Variables

Dependent variable:

Infant mortality is a Dependent variable which is defined as death before reaching the first year of life or the no of death occurring within the first year of life. It is a categorical variable; it has two categories, such as is the child alive or not. D = child mortality, D = 1, if the child alive, D_1= 0, if child not alive

Independent Variables: X_1= Income (Pak. Rs.), X_2 = Education of the father in year, X_3 = Education of the mother in year

Dummy variable: D_1=location of household (urban and rural), D_2= Gender of household head, D_3= province

D_4 =electricity connection, D_5=Mother feedingD_6 = ToxoidinjectionD_7 = Dwelling type (independent house /compound), D_8 = post-natal careD_9 = water source D_{10} = SanitationD_{11} =birthplace

D_{12} = Gender of the child, D_{13}= Employment status, ei= error term.

RESULTS AND DISCUSSIONS

There were some frequency distribution tables of location, province, gender of the child, gender of the household head, education of father, education of mother, employment status, sanitation, electricity, dwelling type, postnatal checkup, mother feeding, water source, and taxied injection.

The Table 1 shows the distribution of households based on their region in Pakistan. The total number of households included in our study is 13216 in numbers. Out of the total, 5689 (43%) belongs to urban areas, and 7527 (57%) belongs to rural area.

The Table 2 shows the overall distribution of household, in which 5755 (43.5) % of household belongs to Punjab, 3754 (28.4%) belongs to Sindh, 2453 (18.6%) household belongs to KP and 1254 (9.5%) households are from Baluchistan.

The Table 3 shows the distribution of households based on the gender of the household head. According to table No.3, 12794 (96.8%) households are those where the head is male, while 422 (3.2) % of households, where a female head, and the total number of observations including male and female are 13216.

Table 4 shows the distribution of households based on the father's education. In this Table, 4912 (38.1%) households show that the father is uneducated and total 2100 (15%) have

primary education. 1600 observation shows middle, 12% of the total, and 2244 observation shows high school education which is 17% of the total. The 945 (7.2%) household shows that the father's education is inter. 1415 number of observation shows a degree or higher education which is 10%, and the total observation is 13216.

Table 1. Frequency distribution based on region of the household.

Region	Frequency	Percent
Urban	5689	43.0
Rural	7527	57.0
Total	13216	100

Source: Pakistan Social and Living Standard Measurement (PSLM, 2011-12).

Table 2. Frequency distribution based on province of the household.

Province	Frequency	Percent
Punjab	5755	43.5
Sindh	3754	28.4
KPK	2453	18.6
Baluchistan	1254	9.5
Total	13216	100

Source: Pakistan Social and Living Standard Measurement (PSLM, 2011-12).

Table 3. Frequency distribution based on gender of the household head.

Gender	Frequency	Percent
Male	12794	96.8
Female	422	3.2
Total	13216	100

Source: Pakistan Social and Living Standard Measurement, (PSLM, 2011-12).

Table 4. Frequency distribution based on education of father.

Father education	Frequency	Percent
Uneducated	4912	38.1
Primary	2100	15.9
Middle	1600	12.1
High	2244	17
Inter	945	7.2
Degree or higher	1415	10.7

Source: Pakistan Social and Living Standard Measurement (PSLM, 2011-12).

Table 5. Frequency distribution based on education of mother.

Mother education	Frequency	Percent
Uneducated	9412	72.1
Primary	978	7.4
Middle	881	6.7
High	1025	7.8
Inter	453	3.4
Degree or higher	467	3.5

Source: Pakistan Social and Living Standard Measurement (PSLM, 2011-12).

Table 6. Frequency distribution based on education of employment.

Employment status	Frequency	Percent
Unemployed	576	4.4
Employer	249	1.9
Self-employee	2416	18.3
Paid employee	7401	56.0
Other	2574	19.5
Total	13216	100

Source: Pakistan Social and Living Standard Measurement (PSLM, 2011-12).

The Table 5 shows the distribution of households based on the mother's education. Out of the total, 9412 observation shows that the mother is uneducated, which is 72.1%; 978 mothers are primarily educated, which is 7.4%; 881 observation shows middle education, which is 6.7% of the total, and 1025 high education. 453 observation shows inter pass mother is 3.4%, 467 or 3.5% shows degree or higher education.

The Table 6 shows the distribution based on employment status; there are five categories of employment status. Out of the total, the number of households belonging to the unemployed is 576, while the number of employers is 249. On the other hand, the number of self-employed and paid employees are 2416 and 7401 respectively. The household belonging to other categories are 2574 in number.

The Table 6 shows the child mortality based on the province of the household; it shows that in Punjab, 3758 households are those in which there is no child mortality, and child mortality exists in 449 household total no of household in Punjab are 4207. Sindh province child mortality is not persistent in 306 number of household, and there is child mortality in 2658 households. In the case of KP, child mortality is present in 116 households, while 1788 households are those with no child mortality. The total no of household in Khyber Pakhtunkhwa are 1904. In Baluchistan province, child mortality is present among 38 households, while in 987 families, child mortality does not exist; the total no of observations in Baluchistan is 1025. Child mortality is high in Punjab and lower in Baluchistan, and child mortality is higher in Sindh than KP.

The Table 8 shows child mortality based on regions. The total numbers of observations in rural areas are 5826 and in urban areas is 4274. In rural areas, child mortality is among 619 households, while in urban areas, it is among 290; child mortality is higher in rural areas compared to urban areas.

The Table 9 shows the cross-tabulation of child mortality based on the gender of the household head. This table shows that child mortality is higher where the gender of the head is male; on the other hand, child mortality is lower among the female that is 23. The total numbers of observation where the head is male are 9840, and 260 where the head is female.

Table 7. Cross tabulation of infant mortality based on province of the household head.

Child mortality	Punjab	Sindh	Khyber Pakhtunkhwa	Baluchistan	Total
Yes	3758	2658	1788	987	9191
No	449	306	116	38	909
Total	4207	2964	1904	1025	10100

Source: Pakistan Social and Living Standard Measurement (PSLM, 2011-12).

Table 8. Cross tabulation of infant mortality based on province of the household head.

Region	Yes	No	Total
Rural	5207	619	5826
Urban	3984	290	4274
Total	9191	909	10100

Data Source: Pakistan Social and Living Standard Measurement (PSLM, 2011-12).

Table 9. Cross tabulation of infant mortality based on gender of the household head.

Child mortality	Gender of head		Total
Is child alive	Male	Female	
Yes	8954	237	9191
No	886	23	909
Total	9840	260	10100

Data Source: Pakistan Social and Living Standard Measurement (PSLM, 2011-12).

Table 10. Cross tabulation of infant mortality based on availability of electricity to the household head.

Is child alive	Electricity connection		Total
	Yes	No	
Yes	8395	796	9191
No	804	105	909
Total	9199	901	10100

Data Source: Pakistan Social and Living Standard Measurement (PSLM, 2011-12).

Table 11. Cross tabulation of infant mortality based on availability of drinking water to the household head.

Is child alive	Piped water	Other sources	Total
Yes	2998	6193	9191
No	211	698	909
Total	3209	6891	10100

Data Source: Pakistan Social and Living Standard Measurement (PSLM, 2011-12).

The Table 10 shows child mortality based on electricity connections; child mortality is higher where an electricity connection is available. Child mortality is low where electricity connection is not available, as shown by no 105. The total number of houses where electricity connections are available is 9199, and the total number of houses where electricity connections are not available is 909. Table 11 shows a cross-tabulation of child mortality and the source of drinking water. This tabulation shows that child mortality is 211 in the case of piped water and child mortality is 698 in the case of other sources. Child mortality is lower in the case of piped water and high in the case of other sources. The total no of observations for piped water is 3209 and 6891 for other sources.

Cross-tabulation for child mortality and sewerage system is shown in the Table 12. Child mortality in the case of an underground drain system is 526, child mortality is 383 in the case of no system, and the total no of observations is 3664. Child mortality is high in the case of an underground drainage system and lower in the case of no system.

The Table 13 shows a cross-tabulation of child mortality based on taxoid injection in pregnancy. According to the table, the total no of observations in the case of taxiod injection is 2914. The cases of no taxiod injection are 2165. Child mortality is 241 in the case of taxiod injection and 189 in the case of no taxiod injection; child mortality is high in the case of taxiod injection and low in the case of no taxiod injections.

Table 14 shows the cross-tabulation of child mortality based on the number of injections, the numbers of injection are six, the total no of observations are 2791, 0 indicates no child immunization, here child mortality is 1, the total no of observations are 4. And in the case of 1 injection, the total number of observations is 111, child mortality is 10, and 101 shows no child mortality. In the case of 2 injections, the total observations are 1040, child mortality is 90, and the 950 number shows no child mortality. In the case of 3 injections, the total observations are 1034, child mortality is 82, and 952 shows no child mortality. In the case of 4 injections, the total observations are 275, and child mortality is 18,257, showing no child mortality. For the fifth injection, the total observation is 314, child mortality is 26, and 288 observations show no child mortality. In the case of the sixth injection total number of observations is 13; out of it, 12 show no child mortality, and 1 shows child mortality.

The Table 15 shows the cross-tabulation for child mortality and postnatal checkup. In the case of postnatal checkup, the total number of observations is 1402; in this case, child mortality is 118, and 1284 shows no child mortality. On the other hand total no of observations in the case of no postnatal checkup is 3651, and child mortality is 305, while 3346 shows no child mortality. Child mortality is high in the case of no postnatal checkup as compared to the postnatal checkup.

Table 12. Cross tabulation of infant mortality based on availability of sewerage system to the household head.

Is child alive	Sewerage system		Total
	Yes, underground drain	No system	
Yes	5910	3281	9191
No	526	383	909
Total	6436	3664	10100

Source: Pakistan Social and Living Standard Measurement (PSLM, 2011-12).

Table 13. Cross tabulation of infant mortality based on taxoid injection in pregnancy.

Is child alive	Taxoid injection in pregnancy		Total
	Yes	No	
Yes	2673	1976	9191
No	241	189	909
Total	2914	2165	10100

Source: Pakistan Social and Living Standard Measurement (PSLM, 2011-12).

Table 14. Cross tabulation of infant mortality based on number of injections.

Is child alive	No of injection							Total
	0	1	2	3	4	5	6	
Yes	3	101	950	952	257	288	12	2563
No	1	10	90	82	18	26	1	228
Total	4	111	1040	1034	275	314	13	2791

Source: Pakistan Social and Living Standard Measurement (PSLM, 2011-12).

Table 15. Cross tabulation of infant mortality based on postnatal checkup of mother during pregnancy.

Is child alive	Postnatal checkup		Total
	Yes	No	
Yes	1284	3346	4630
No	118	305	423
Total	1402	3651	5053

Source: Pakistan Social and Living Standard Measurement (PSLM, 2011-12).

The table 16 shows the cross-tabulation of child mortality based on checkup centre, this table shows that child mortality is 32 in the case of home doctor/LHW/LHV and observation 254 shows that there is no child mortality, total no of observations in this case, are 286. In the case of government hospitals and clinics, child mortality is 36, 410 shows the alive child, and the total number of observations is 446. The third is the case of private hospitals and clinics here. The total number of observations is 667, of which 53 show child mortality and 614 show no child mortality. Child mortality is high in the case of private hospitals and clinics and lower in the case of home doctors/LHW/LHV.

The Table 17 shows a cross-tabulation of child mortality and mother feeding. The total number of observations in the case of mother feeding is 4372. 345 household shows no child mortality, and this number is 4027. Only 78 households are those where child mortality was found. In the case of other sources, the total number of observations is 681,78 showing that the child is not alive, and 603 showing no child mortality. Child mortality is high in the case of mother feeding and lower in the case of other sources.

In the Table 18, cross-tabulation of child mortality based on the gender of the child, the total no of observations in the case of the male child is 5486, child mortality is 516, and no of the child alive is 4670. In the case of females, the total number of observations is 4614. Out of it, 4221 show no child mortality, and 393 show child mortality. Child mortality is high in male children than in females.

The Table 19 shows the cross-tabulation of child mortality and taxiod injection for a child. The total number of observations in the case of taxiod injection is 2513, and according to this table, 204 shows child mortality, and 2309 show no child mortality. In the case of no taxiod injection total no of observations is 2001. Out of it, 178 shows child mortality, and 1823 show no child mortality. Child mortality is high in the case of taxiod injection compared to no taxiod injection.

The Table 20 shows the cross-tabulation of child mortality and dwelling type. The total number of observations in the case of an independent house/compound is 8436,739, showing child mortality and 7697, showing no child mortality. Child mortality is170 in the case of other types, and 1494 shows no child mortality. Child mortality is high in the case of the independent house as compared to other types.

The table 21 shows the cross-tabulation of child mortality based on father education, total observation for six categories of father education is 10087, child mortality for uneducated is 407, and 3264 shows no child mortality, 181 shows the child mortality for primary educated and fighter 1470 shows no child mortality, 114 is child mortality for middle education of father where 1117 shows no child mortality, 123 is child mortality for high education, and 1598 shows no child mortality, 45 is child mortality for inter, and 704 shows no child mortality, 38 is child mortality for the degree or higher education, and 1026 shows no child mortality. Child mortality is higher in the case of no father education and is lower for the degree or higher education.

Table 16. Cross tabulation of infant mortality based on checkup center.

Is child alive	Checkup center			Total
	Home /Doctor/LHW/LHV	Govt /Hosp/clinic	Private /Hosp/clinic	
Yes	254	410	614	1278
No	32	36	53	121
Total	286	446	667	1399

Source: Pakistan Social and Living Standard Measurement (PSLM, 2011-12).

Table 17. Cross Tabulation of infant mortality based on checkup center.

Is child alive	Mother feeding		Total
	Yes, BF only	Other sources	
Yes	4027	603	4630
No	345	78	423
Total	4372	681	5053

Data Source: Pakistan Social and Living Standard Measurement (PSLM, 2011-12).

Table 18. Cross tabulation of infant mortality based on gender of the child.

Is child alive	Male	Female	Total
Yes	4970	4221	9191
No	516	393	909
Total	5486	4614	10100

Data Source: Pakistan Social and Living Standard Measurement (PSLM, 2011-12).

Table 19. Cross tabulation of infant mortality based child immunization.

Is child alive	Child immunization		Total
	Yes	No	
Yes	2309	1823	4132
No	204	178	382
Total	2513	2001	4514

Data Source: Pakistan Social and Living Standard Measurement (PSLM, 2011-12).

Table 20. Cross tabulation of infant mortality based on dwelling type.

Is child alive	Dwelling type		Total
	Independent house/compound	Other	
Yes	7697	1494	9191
No	739	170	909
Total	8436	1664	10100

Source: Pakistan Social and Living Standard Measurement (PSLM, 2011-12).

Table 21. Cross tabulation of infant mortality based on education of the father.

Is child alive	Education of father						Total
	uneducated	Primary	Middle	high	Inter	Degree or higher	
yes	3264	1470	1117	1598	704	1026	9179
no	407	181	114	123	45	38	908
total	3671	3671	1231	1721	749	1064	10087

Source: Pakistan Social and Living Standard Measurement (PSLM, 2011-12).

Table 22. Cross tabulation of infant mortality based on education of mother.

Is child alive	Education of mother						Total
	uneducated	Primary	Middle	high	Inter	Degree or higher	
yes	6729	626	584	679	285	283	9186
no	716	84	40	40	22	6	908
total	7445	710	624	719	307	289	10094

Source: Pakistan Social and Living Standard Measurement (PSLM, 2011-12).

Table 23. Cross tabulation of infant mortality based on income groups of the household head.

Is child alive	Income							Total
	1.00	2.00	3.00	4.00	5.00	6.00	7.00	
Yes	531	2482	2206	1311	854	601	1206	9191
No	63	298	245	135	68	29	71	909
Total	594	2780	2451	1446	922	630	1277	10100

Source: Pakistan Social and Living Standard Measurement (PSLM, 2011-12).

The Table 22 shows the cross-tabulation of child mortality based on mother education. The total number of observations for six categories of mother education is 10094. The total number of observations for the uneducated is 744, 716 is child mortality for the uneducated, and 6729 shows no child mortality. The total number of observations is 710 for primary education, 84 is child mortality for primary education, and 626 shows no child mortality. The total no of observations for middle education is 624, 40 is child mortality for middle education, and 584 shows no child mortality. The total number of observations for high is 719,40 showing child mortality, while 679 shows no child mortality. The total no of observations for inter is 307. 22 shows child mortality for inter, and 285 shows no child mortality. Total no of observations for the degree or higher education 289, 6 shows child mortality for the degree or higher education, and 283 shows no mortality. Child mortality is high among uneducated mothers and lower among highly educated.

The Table 23 shows the cross-tabulation of child mortality and income, the total number of observations for income grouping is 10100. There are seven grouping of income. In the first grouping, child mortality is 63, and 531 shows no child mortality. In the second income grouping, child mortality is 298, and 2482 shows no child mortality. In the third income grouping, child mortality is 245, and 2206 shows no child mortality. In the fourth income grouping, child mortality is 135, and 1311 shows no child mortality. In the fifth income grouping, child mortality is 68, and 854 show no child mortality. In the sixth income grouping, child mortality is 29, and 601 shows no child mortality. In the seventh income grouping, child mortality is 71, and 1206 shows no child mortality.

Regression Analysis

Through Regression analysis, a researcher can find out the impact of independent variables over the dependent variable, child mortality. In the highlight of the regression results, the policymaker will be able to construct the policy regarding this problem in the current research study as our dependent variable is qualitative in nature, so in such case, the best and appropriate regression model is the binary logistic regression model. Therefore, we used the binary logistic regression, and its results are explained below.

Significant Variables: The Table 24 shows the impact of major socioeconomic, housing and health status of mothers' aspects over child mortality in Pakistan. The household belongs to the urban areas, and households belonging to Punjab, Sindh, education of father, education of mother, income of the household, mother feeding and the gender of the child significantly affected child mortality in Pakistan.

Insignificant Variables: While all other remaining variables are statistically insignificant in this regard, such as birthplace, employment status, sanitation, postnatal care, electricity, water source, dwelling type and taxied injection.

***Location of the Household**:* The household belongs to urban areas have more likely chance that their child is alive compared to a rural area because its odd ratio is greater than one and statistically significant at a 10% level of significance. We know very well that in urban areas, there are better health facility, no transport issues, and highly qualified medical staff, which reduce the chances of child mortality as compared to rural areas where no such types of facilities are available to the residents of such areas.

Province of the Household: The odd ratio of the household in Punjab is significant and less than one, which indicates that a mother who belongs to Punjab province has less likely chance that their child is alive as compared to KP province. It may be possible that the mothers belongs to KP province are more caring about their health during pregnancy and after delivery than mother in the Punjab province. There is less likely the chance that a mother belongs to Sindh province have a child alive than the KP province mother, because the odd ratio is less than one and significant at a 1% level of significance. The mothers belong to Sindh province are less caring or mothers of KP are more caring about their upcoming child, which reduces the chance of mortality in KP as compared to Sindh.

Gender of the Household Head: Gender of the head is also significant at a 10% level of significance, showing that there is a more likely chance that a child is alive if the gender of the head is female than male. In those families whose heads are female, the chance of infant mortality is low as compared to those where the head is male in Pakistan. It is a common view that the female head is more caring about the health of their children than their counterpart male heads not only in Pakistan but also in the world.

Education of the Father: Education of the father is also significant at a 1% level of significance, and its odd ratio is greater than one, which indicates that households where an additional year of education of the father lead to more likely to alive the child in Pakistan.

Table 24. Results of binary logistic model showing the impact of major socioeconomic, demographic, housing status and the mother health status over the child mortality in Pakistan.

Variables	Coefficient	Odd Ratio	Marginal effect	Z-Statistic
Location	0.296371	1.344969	0.019208	0.061*
punjab	-0.58263	0.558426	-0.04114	0.002***
Sindh	-0.66766	0.512905	-0.05062	0.001***
Baluchistan	0.212453	1.236707	0.013247	0.431
gen_hh	1.242773	3.465211	0.05112	0.087*
Edu father	0.059907	1.061738	0.004001	0.00***
Edu mother	0.04377	1.044742	0.002923	0.019**
log income	0.118024	1.125271	0.007882	0.041**
electrcty_con	-0.08585	0.91773	-0.00557	0.631
mothr_feeding	0.481885	1.619123	0.037571	0.001***
toxi_inj	0.061945	1.063904	0.00415	0.612
dewling_type	0.065107	1.067273	0.004427	0.636
post_net_care	-0.15553	0.85596	-0.01071	0.231
watr_system	0.079926	1.083207	0.005259	0.606
sanitation	0.095495	1.100203	0.006421	0.51
birthplace	-0.01175	0.988317	-0.00079	0.947
birth_plc	-0.12552	0.882036	-0.00855	0.355
gen_chld	-0.17101	0.842813	-0.01139	0.092*
employer	0.347687	1.415789	0.020128	0.629
Self-employed	-0.14518	0.864862	-0.0101	0.721
Paidemployed	0.096398	1.101197	0.006481	0.805
other	0.016671	1.016811	0.001109	0.967
Cont.	0.66132	1.937347	-	0.569
LR chi2 1221.54 (0.0000)	Pseudo R^2 0.20	Number of observations 10310	Log likelihood -1225.0250	

Note: *** Significant at 1%, ** significant at 5 %, * significant at 10%; Source: Author's calculation.

Education of fathers plays a very important, positive role in reducing child mortality, and the reason behind this as more and more education gets by the father they become more aware about the health condition of the upcoming child. Mostly the, an educated father is more caring about the health of their wife as well as their children.

***Education of the mother*:** Education of mother and child mortality is negatively related to each other in most of the studies. The education of the mother is significant at a 1% level of significance, and its odd ratio is greater than one, which shows an additional year of schooling of the mother leads to an increase in the more likely the chance that the child is alive in such household. Educated mothers paid more attention to their health during pregnancy, so they used the best available medical facility to give birth to a healthy child. We can also say that more and more education gets by the mother, which will lead to a decrease in the chances of child mortality.

***Income of the household*:** The income of the household is negatively related to the chances of child mortality. The odd ratio of the log of income is greater than one and statistically significant, indicating there is a more likely chance that the child is alive in Pakistan. Income is the major determinant in

almost every research field and positively affects the opponent. More income means the wealthy the household is, which induces them to spend more on the health of their family, which further reduces the chance of child mortality. The inverse will be true if the household has a low income, which leads to an increase in the chance of child mortality. Families with high income will be able to choose the best medical facilities for the pregnant woman of the family and monthly checkups of the pregnant mother, which ultimately reduce child mortality in Pakistan.

Mother feeding: The odd ratio of mother feeding is significant at a 10% level of significance and greater than one, which shows that those mothers who feed their child breast-feeding lead to increase the chance of more likely than the child being alive as compared to those mothers who used other sources of feeding in Pakistan. According to the doctor, mother's milk is a natural antibiotic and enhances the capability of the child to survive many types of diseases. On the other hand, other sources of feeding are not much better at increasing the capability of the child to overcome many diseases.

Gender of the child: The gender of the child is also significant at a 10% level, but its odd ratio is less than one, which shows that female children are less likely to survive as compared to male children in Pakistan. This may be due to gender discrimination between male and female children, or Female children are not as strong as male children. This is the basic reason for high child mortality among female children not only in Pakistan but also in all less developing nations of the world.

Province of the household: The Baluchistan province is statistically insignificant, but theoretically, it means that no matter the mother belongs to Baluchistan or KP province, the child is alive because the odd ratio of Baluchistan province is greater than one.

Insignificant variables: No matter whether the household has an electricity connection or not, there are more likely chances of less surviving among the newborn child in Pakistan because its odd ratio is insignificant. The mother properly injects themselves with TT injection or not but has a more likely chance that their child is alive after the birth. There is no impact of dwelling on child mortality because it is statistically insignificant. Still, actually, it means that no the mother lives in an independent home or combined family system, their child is alive. No matter the mother used the post-natal treatment or not, there are less likely chances that their child will survive after birth. Water type and sanitation are both insignificant, but they demonstrated that no matter the household has piped water or not or has sanitation or not but there are more chances of a child surviving in such types of households in Pakistan. Child birthplace is also insignificant; no matter whether the child is born in government, private or at home, there is a less likely chance that the child who belongs to these families will be alive after birth. The employment status of the household head also plays no role in child mortality in Pakistan, which means no matter the employment status of the household head is, there is more likely chance of a child surviving in Pakistan. Pseudo R^2 shows that a 20% variation in the dependent variable, which is child mortality, is due to the independent variable.

CONCLUSIONS

Out of the total number of households, 96% of the families are those where the household head is male and while 3%families are those where the household head is female. Out of the total number of households, 43% of household belongs to urban areas and while 57% of household belongs to rural areas. Regarding father education, 4912 are uneducated, 2100 have primary education, 1600 have middle education, 2244 are highly educated, 945 are intermediate, and 1415 have a degree or higher education. Out of a total, 4.4% of household are unemployed, 1.9 % are employed 18% are self-employed, 56% are paid employee, and 19.5% belongs to other employment status. Infant mortality is high in Punjab compared to KP and lower in Baluchistan compared to KP; infant mortality is lower in KP compared to Sindh. Infant mortality is high in rural areas, which is 619, as compared to urban areas, which is 290. Infant mortality is high among families who are 886, where the head is male, as compared to female-headed families in which infant mortality is 23. Infant mortality is lower with no electricity connection as compared to the presence of an electricity connection. In the case of a source of water infant mortality is high in the case of other sources of water as compared to piped water. Infant mortality is high in the case of underground drain systems as compared to no sanitation. In our study, Infant mortality is high in the case of taxied injection and less among the mother with no immunization. In the independent family system, infant mortality is high as compared to the joint family system. There is also a difference in infant mortality between male and female children, and infant mortality is high in the case of female children. Mother feeding also has an association with infant mortality; infant mortality is high in the case of mother feeding as compared to other sources.

Infant mortality is different in the case of checkup centres; infant mortality is 32 in the case of a home, 36 in the case of a government center and 53 in the case of a private center, so infant mortality is high in the case of a private center. In this study location of the household is statistically significant at 10%. The result shows that infant mortality is high in rural areas and lower in urban areas. The odd ratio of the province Sindh and Punjab is statistically significant. It indicates that infant mortality is high in Sindh and Punjab as compared to KP, while the odd ratio in Baluchistan is statistically insignificant, and it shows that there is no difference between Baluchistan and KP in this regard. The gender of the household head is statistically significant at 10%, and the result shows that infant mortality is high in the case of the male head as compared to the female head of the families. Education of the father is significant at 1%, and it is negatively related to child mortality, one year of father education increase infant mortality decrease. Education of mother is significant at 1%, and mother education is negatively related to infant mortality; as mother education increase, infant mortality decrease and the lower the mother education higher the infant mortality. The income of the household is significantly negatively related to infant mortality; as the income of the household increase, infant

mortality decrease. The odd ratio of mother feeding is significant at 10%, negatively related to infant mortality. Infant mortality is lower with mother feeding and higher with no mother feeding. In the case of the gender of the child, there is a significant relationship between the two; child mortality is high among female children compared to male children. While all other variables are statistically insignificant, these variables include sanitation, water source, dwelling type, post-natal checkup, TT injection, birthplace, and employment status of the household.

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