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SOCIO-ECONOMIC FACTORS OF CHILDHOOD IMMUNIZATION IN PAKISTAN

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Abstract

This study examines the impact of socio-economic determinants of childhood immunization in Pakistan. The study uses the data of PSLM 2014-15. Data of the children in the age group of 1 to 2 years is included in the study because at least one year is needed to be fully immunized. To explore the relationship between socioeconomic factors and childhood immunization, binary logistic regression is used. The results indicate that boys are preferred for childhood immunization as compared to girls in Pakistan. In this study, father education is found to be a significant variable on childhood immunization in Pakistan. Landholding by household shows a positive and significant effect on childhood immunization. Results of the study also reveal that childhood immunization is positively associated with a mother's working status. Working women are more responsible than their non-working counterparts. Children living in Punjab are more likely to be immunized since Punjab province is relatively developed than other provinces of Pakistan. The distance from health facilities has a negative influence on child immunization. Children born in Govt. hospitals or private hospitals have a greater probability to be immunized. This study also explores province wise childhood immunization as the results tend to be significant. Children living in Punjab tend to have a higher probability to be immunized.

Keywords: Immunization, Land Ownership, health facility, Income, Employment.
JEL Code: I11, Q15, D31

1. Introduction

Health is a key element of economic development along with other factors. The human development index (HDI) is considered one of the best indicators of economic development. The human development index (HDI) consists of three indicators i.e. longevity, knowledge and command over resources needed for a decent life. Longevity is measured by health at birth. It means that longevity (health indicator of HDI) contributes 33% to the measure of economic development (HDR, 1990). So, health is a necessary element for being more productive. A healthy person contributes more to economic growth. There are two ways to focus on the effects of child immunization that results in the improvement of productivity; direct effect and indirect effect. There is a strong and positive relationship between good health and economic growth by two channels; First, good health is important for an increase in productivity directly.

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Second, health also contributes to good educational achievements which lead to strengthening the economy through Research and development.

Finlay (2007) analyzed the impacts of health on economic development in two different ways: the direct effect of health and the incentive effect i.e. indirect effect. The direct effect shows that healthy people may have high returns than others. According to the incentive effect, life expectancy is positively related to good health can improve their living standard by enhancing their education level. The indirect role of health is via investment in education which is positive to growth.

The rate of death is very high among children in Pakistan. 8.7% of children of total birth in Pakistan die before reaching 5 years old which is very high as compared to the world. Although this death rate has been falling due to expanding healthcare facilities, however, progress has been slow and the government of Pakistan has to do more in spending for healthcare because the target of Sustainable Development Goals (SDGs) 2015 is to reduce fewer than 52/ 1000. In the case of Polio, Pakistan is not considered a safe country (USAID, 2012). Since these diseases are contributing so much to morbidity and mortality rates, prevention programs are needed. The progress to reduce infant mortality has been slow in Pakistan because of many factors. Less awareness of mothers regarding nutritional needs is one of the factors. Pakistan's progress in reducing child mortality is very disappointing (Shoukat *et al.* 2015). On the one hand, less educated mothers have very little awareness about the effects of diseases in children and on the other hand, they can't afford high-cost treatment in private hands, as their income is very low. So, awareness about preventive measures of health in children should spread by the government of Pakistan and should be adopted by people. The Expanded Program of Immunization (EPI) was started in Pakistan in 1978 for the protection of early age deaths by immunizing them against childhood diseases that are tuberculosis, poliomyelitis, diphtheria, pertussis, tetanus and measles. Bärnighausen *et al*. (2014) discussed that gains in health and care-related productivity of immunization programs which is necessary for microeconomic evaluations were named as 'narrow' benefits, while some additional benefits of immunization were categorized as 'broad' benefits.

As it is known that children are future of every nation and future depends on the health of the children. Child health may be considered as a key indicator of economic development and a wide range of literature explores the socioeconomic determinants affecting child health. Pakistan is at number six in the world due to its population size. Child health status in Pakistan is very disappointing and the child mortality rate in Pakistan is very high. For children under the age of five one out of eleven children dies in Pakistan (USAID, 2012). The crucial causes of under-five child mortality in Pakistan are diarrhea, pneumonia and different infections. Pakistan's progress in reducing child mortality is very disappointing (Shoukat *et al.*, 2015).

Immunizations are a set of shots and drops (also called vaccinations) given to children at different stages of their age to keep them safe from dangerous diseases. Kroger *et al*. (2015) were of the view that there are two major causes of preventing disability and death from infectious disease are sanitation and immunization. The artificially injecting substance that produces immunity in the human body may be passive or active. Active immunization is a process by

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which the body is induced to develop protection in the way of disease. Temporary protection via exogenously produced antibodies is called passive immunization.

Immunization can reduce the death rate on the one hand and protect against disability from infections on the other hand. Immunization in children, by process of vaccination, is the most effective health intervention to curtail mortality, disability and morbidity in children. By injecting vaccinations, we can reduce human suffering about health and increase their life expectancy. Immunization is considered a beneficial health investment because it increases the productivity of human beings. The process of vaccinations in children has been proven to reduce many deaths around the world occurring each year. The dynamics of the vaccination process remain very complex and are dependent on demand and supply factors. The six diseases which need vaccinations are diphtheria, pertussis, tetanus, measles, poliomyelitis, and tuberculosis.

Expanded Program on Immunization (EPI) started in 1978 in Pakistan. Owais *et al.*, (2013) discussed expanded programs on immunization in Pakistan especially to eradicate polio and strategies to improve the coverage. They discussed that EPI in Pakistan contributed a lot to reduce preventable diseases since 1978. There were more cases of polio registered in Pakistan than in any other country in 2011. However, this number decreased to 58 in 2012. They focused on several socio-economic inequalities related to childhood immunization. District level childhood immunization coverage was very important to improve the immunization situation in Pakistan. Investment in child immunization programs in developing countries has increased over the last two decades. This is due to the introduction of new vaccines against major diseases as well as the growth of a new financing system through the Government and NGOs. Spending growth has, in turn, strengthened the importance of rigorous justification of the value of investing in immunization. Bloom *et al*. (2004) suggest that good health is positively related, and has a significant effect on economic growth even not include the effect of the experience of the workforce. Arif & Arif (2012) discussed child heath which is a prerequisite for good education and both factors simultaneously contribute to economic development. Many socioeconomic factors have a strong influence on child health. Child health is considered to be positively related to household income. It means that low income affects child health badly via malnutrition, bad hygienic situations, lack of information about benefits of immunization and lack of health services. The objective of the study is to examine the socio-economic determinants of childhood immunization in Pakistan. The rest of the study is structured as: Section 2 includes studies on childhood immunization. Section 3 gives us the research methodology. Section 4 analyzes the results of the logit regression. Section 5 concludes the whole study along with policy implications. Section 6 gives limitations of the study and further research suggestions.

2. Reflections on the Debate

This section discusses the work done by other research scholars across the world on childhood immunization. These studies aim to find the socioeconomic factors of childhood immunization.

Noh et al. (2020) investigated the factors that influence the timely and complete childhood immunization by collecting data through a survey for the period 2013 to 2014 from mental and child health programs in Sindh province of Pakistan. Authors find out that the level of parent's education, number of living children, age of the child, the source regarding the information of child and mother health, assistance during delivery as well as the number of antenatal care were

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associated with basic immunization. As a whole, in Pakistan, the full basic immunization was still low.

Anokye et al. (2018) examined the socio-demographic factors of childhood immunization through a survey from two hundred and eighty caregivers/mothers at Child Welfare Clinic in Koforidua, Ghana. The authors concluded that being divorced and working part-time have a positive and significant influence on immunization incompletion. Women who had divorced were three times less likely to complete the immunization as compared to those who were married, cohabiting as well as widowed. Further, they recommended that the Ministry of health should take measures i.e. public education to inspire mothers to complete the immunization schedule.

Khan and Aslam (2017) attempted to examine the socio-institutional and regional aspects of childhood immunization in Pakistan. Pakistan Demographic Health Survey (PDHS) 2006-2007 was used for having data of 8731 observations. A binary logistic method was employed for data analysis. He analyzed regional diversity based on four provinces, like Punjab, Sindh, Baluchistan and KPK. The ethnicity of house old as an important variable is used in the study as a proxy of social institutions. The results show that the ethnicity of social institutions has a strong impact on child immunization. The results exhibit that children of Punjabi speaking families are more immunized than the children of Urdu, Sindhi, Pashtu and barohi speaking families. Pashto speaking families do not focused on child immunization. People living in Sindh, KPK and Baluchistan were less conscious about complete childhood immunization as compared to that of Punjab. The parents of the Children, born in hospitals follow a complete immunization Programme. Educated women also focused on and know the importance of childhood immunization.

Adedire *et al.* (2016) analyzed the coverage of immunization and its determinants among children in a district of Nigeria. This was a cross-sectional study and 750 mothers were selected in a sample whose children had age of 12-23 months. The sample was selected through two stages of cluster sampling. Data for this study purpose was obtained through semi-structured questionnaires including items regarding socio-demographic characteristics. Descriptive analysis was done in that study and frequencies were used to sum up the results. Moreover the bivariate analysis and multivariable logit model applied to find out the association. Results indicated that routine immunization is still below the target of the World Health Organization (WHO) in the selected area of study.

Mukungwa (2015) examined the determinants of full immunization of children in the age of 12-23 months in Zimbabwe. Data for this purpose was collected from Zimbabwe demographic and health survey. This data was used to explore the factors of full immunization in the age group of 12-23 month children. For the aim of data analysis, multivariate logit regression was applied. Only 978 children were selected. Results of this study revealed that educated mothers were more focused on childhood immunization. Children with high birth order have fewer chances to be immunized. Children born in hospitals either govt. hospital or private hospital has more chance to be immunized.

Rammohan & Awofeso (2015) discussed the vaccination propensity of a child in India. This study focused on the district level for DPT3 and measles because in both cases immunization of children was not good in India. Immunization in both cases was done premature or delayed. The

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data source of the study was an Indian district level household survey (DLHS-3) of 2008. The sample consists of 42157 children aged 12-60 month. The results of the study found income per capita was the appropriate element that explains the above situation. The second social element of the finding of the study was the mother education which has a positive and significant relation with childhood immunization.

Awadh *et al.* (2014) investigated the impact of educational intervention on parent's knowledge regarding immunization. This cross-sectional study used a single group pre and post-test intervention survey among the parents in Malaysia. Changes in scores were measured through a validated questionnaire. For the comparison of knowledge differences before and after the intervention, Wilcoxon signed ranks test and the McNamara x2 test was used in that study. The sample consisted of seventy-three parents and the majority of them were mothers having 87.7%. As compares to baseline results the immunization knowledge significantly increased as a result of the intervention.

Abebaw (2013) discussed the socio-economic factors of child immunization. For that purpose, data is collected from the rural area of Ethiopia. Child immunization is linked with childbirth order, sex, health, education and racial variety. The logit model is used to test these variables and their results show that in primary education, the household structure is positively related while gender is not significantly correlated with inoculation. Village ethnic diversity has a negative impact on child's vaccination.

Arif & Arif (2012) had examined the socioeconomic determinants of child health in Pakistan by using the 2004-05 PSLM survey. 13540 children had been identified by PSLM in under five-year children. The sample data was divided into nine rural area zones. Moreover, urban areas were divided into two categories; Major urban centres and other urban centres. The logistic regression model was used to analyze this relationship. The findings of this study indicated that economic factor like land and livestock holding has its positive and significant impact on child health. Having land and livestock is a symbol of livelihood in rural areas.

Lauridsen (2011) discussed the causes of childhood immunization inequality in India. The results show the various reasons for immunization inequality. Mother education found to be the important factor of childhood immunization inequality. It was also found that the role of per capita income was very important in this study as a reason for this inequality of childhood immunization. This study used binary logistic technique for data analysis and the data source was the National family health survey-3 of 2005-06.

Siddiqi *et al.* (2010) evaluated the relationship between the knowledge of mothers about EPI vaccination and their infant's coverage in Karachi, Pakistan. Cross-sectional primary data were used of 210 mothers who have identified 7 EPI diseases. The descriptive analysis had been taken for comparing results. This study found that Mothers have no information about immunization programs in peri-urban Karachi. The result of the study was that the education of the mother was significant for childhood immunization.

Bondy (2009) has estimated the factors of immunization of children. For this research purpose, the data was obtained from the National Demographic Health Survey (NDHS) of the Philippines in 2003. Multinomial logistic regression was carried out to undertake this study. This study stated that less educated and those mothers who did not attend required antenatal have fewer chances to become conscious about childhood immunization. It was suggested that the transfer of

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knowledge to mothers should be increased to improve childhood immunization in the Philippines.

Lindeboom *et al.* (2008) examined the issue of child health concerning parental education in the United Kingdom. The data source of the study was National Child Health Development. Results of the study showed both parental and maternal education positively related to the height of children. Parental education affects child health via the behaviour of parents and cares about children. Economic factors like income also contribute towards child health positively.

Reyhan & Khan (2006) discussed the causes of malnutrition among under five years in Bangladesh. This study found the demographic, health-related, socio-economic and environmental causes of under-five children in Bangladesh. The study uses data, given in the secondary form of the Bangladesh demographic and health survey of 199-2000. Cox's linear logistic regression was applied for data analysis. The results show that nearly 45% of children are suffering from malnutrition.

Xie & Dow (2005) researched child immunization through longitudinal data in china. China has experienced rapid economic change due to poor public health conditions, privatization of the public health sector and high-income growth. They concluded that wealth has less effect on the immunization rate rather the rapid economic transition leads to enhance educational spending having more effect on the immunization rate.

3. Research Methodology

3.1 Theoretical Framework

Andersen & Newman (1973) developed a model related to health care utilization. This model was based on three types of factors which are as under:

Predisposing characteristics: The characteristics of individuals which are preventive. Education, nature of the occupation, social interactions, and culture which one adopt. Attitudes, values, and knowledge about health care and Age and Gender.

Enabling Factors: The aspects of obtaining care which is explained as the resources and awareness to access health services, income, health insurance, travel, extent and quality of social relationships. Health personnel and facilities, waiting time and psychological characteristics also included.

Need Factors: The most immediate cause of health service use, from functional and health problems that generate the need for health care services.

There are several socio-economic factors affecting childhood immunization explained in literature such as parental education especially maternal education, age of mother at birth, region, infant's weight, sex of child, living standard, the income of the household, awareness about child immunization especially to mother. Abebaw (2013) includes child age, sex, mother's education, racial variety and regional disparity as some important variables of child immunization. Yu Hu, et al (2013) suggests that a mother's occupation, place of delivery and mother's education determine child immunization. Borooah (2009) gave importance to gender disparity as an important determinant of childhood immunization. The dependent variable is childhood immunization in this study. The general form of the model is given as under:

$$Y_i = \alpha + \beta X_i + \varepsilon_i \quad \textbf{(1)}$$

Where:

Y_t= 1, if child is immunized

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Y_t =0, if the child is not immunized

ε_i = stochastic term

3.2 Model

The econometric model of this study is:

$$IMU = \beta_o + \beta_1 GN + \beta_2 Med + \beta_3 MWS + \beta_4 \ln I + \beta_5 Fed + \beta_6 BP + \beta_7 MAg + \beta_8 Dstn + \beta_9 PR + \beta_{10} L + \varepsilon_i \quad \textbf{(2)}$$

Where:
IMU=Childhood immunization
GN= Gender of child
Med= Mother's Education
MWS= Mother's working status
I= Income of household
Fed= Father's Education
BP= Birth Place of the child
Mag= Mother's Age
Dist= Distance of Health facility from home
PR= Province
L= Ownership of Land

ε_i = Error term

3.3 Description of Variables

Measurement of dependent and independent variables is given as under:

3.3.1 Dependent Variable

Complete immunization of children is taken as the dependent variable. Preventive care through vaccination at the early age of a child may reduce the chances of child morbidity A basic vaccination criterion is used for complete immunization which is given in Table 1. It means that if a child has received all the required doses of vaccinations, he/she is considered completely immunized. Childhood immunization is a binary variable in nature which means that child is immunized or not immunized. In the previous years, there was a series of vaccination given in the following table like BCG. DPT and anti-measles doses. It is a world wide program supported by WHO and UNICEF.

Table 1: Childhood Immunization Schedule

Child Age	Previous format	New format
At birth time	Polio drops; BCG (anti-TB)	BCG (anti-TB) + Polio 0
Week-6	Polio drops; DPT-I; Hepatitis-I	Polio 1 + Pentavalent 1
Week-10	Polio drops; DPT-II; Hepatitis-II	Polio 2 + Pentavalent 2

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Week-14	Polio drops; DPT-III; Hepatitis-III	Polio 3 + Pentavalent 3
Month-9	anti-measles vaccine	Measles 1
Month 12-15		Measles 2

By 2010, the Govt. has introduced PENTA (Pertussis, Tetanus, Diphtheria, Hemophilus Influenza B and Hepatitis B) along with Measles 2 for the improvement of childhood immunization (Table 1).

3.3.2 Independent Variables

Gender of Child

Child gender is an important social factor that is important for childhood immunization. Because sons are more valuable than daughters in Pakistani society. Having a baby boy is a value addition for their parents because they are considered the earning hand for their parents. The results of the study show that there is selective neglect of the children of certain sex and for boys and girls differentially operating birth-order combinations (Pande, 2003). Girls were being neglected to be immunized against preventable diseases and their likelihood of receiving a nutritious diet (Borooah, 2009).

Mother's Education

The education of the mother is a vital factor in childhood immunization. Mother education is divided into primary education, secondary education, higher education and illiterate. If a mother is educated and has knowledge about the benefits of immunization then she ensures the immunization of their children. Educated mothers are likely to have more exposure to make their children immunized. This study will explore whether an increase in mother education contributes towards childhood immunization or not. Subhani *et al*. (2015) discussed that uneducated mothers are not focused on childhood immunization. So, there is a need to build infrastructure for female education. Mother education plays an important role in childhood immunization (Bondy, 2009).

Mother's Working Status

A mother's employment plays an important role in child immunization. The mother's employment status is divided into two categories i.e., yes or no. Normally, a working woman in Pakistan, not only responsible for job tasks but also for taking care of her home. In paying these duties, she becomes responsible and mature about their children being immunized. A mother's working status means that either mother is employed or not. She has some income in her hand if she is employed somewhere. This employment gives her confidence and some earning to spend on childhood immunization.

Income of household

Household Income is another important variable of childhood immunization in Pakistan. The yearly based income of the household is included in the analysis. This study used income in log form to observe the effect of percentage change in income on the probability change in childhood immunization in Pakistan. Children of rich parents are more likely to be immunized. The per capita income was an important determinant to explain the inequality in childhood immunization (Lauridsen, 2011).

Father's Education

Father's education is a necessity of society. Because often father is the head of the home. If the father of the child is educated and well aware of the benefits of immunization, then children are

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more likely to be immunized. Educated fathers are lenient and flexible in their behaviour therefore likely to have more exposure to make their children immunized. This study will explore whether an increase in father education contributes towards childhood immunization. Father education is divided into subcategories as primary education, secondary education, higher education and illiterate.

Birth Place of child

The place of delivery of the child is another important independent variable. Theoretically, children born in govt. hospitals or private hospitals have more chances to get immunized. Children born in homes shows conservative behaviour of parents therefore they are less likely to be immunized. This study will analyze the impact of the birthplace of child and immunization. PSLM questionnaire divided the birthplace of the child into govt. hospital, private hospitals, homes and other places.

Mother's Age

There is no doubt that younger mothers are expected to be more active and enthusiastic about childhood immunization but elder mothers are considered as more experienced and well aware of the benefits of childhood immunization. Elder mothers are expected to make a good decision about childhood immunization. This study also discusses the relationship between the mother's age and childhood immunization.

Distance from Healthcare centre

The probability to be immunized of a child is expected to be less if the health centres are far away from home where he/she lives. As the distance from home increases, it will become difficult to reach at health centre soon. The case becomes more severe if parents have no conveyance.

Province

Four provinces of Pakistan are considered an important determinant of childhood immunization. Baluchistan is a relatively underdeveloped province in the healthcare sector of Pakistan as compared to other provinces like Punjab, Sindh and KPK. So, it is expected that children living in Baluchistan are less likely to be immunized.

Ownership of Land

Ownership of land is an economic variable and is a symbol of economic wellbeing. The parents who have a holding of land have much income to manage the health facilities for their children. Parents usually more than 3 or four children, therefore, are not able to afford the expense if they have no ownership of land, especially in villages.

3.4 Data Source

The data source of this study is the Pakistan Social and Living Standards Measurement (PSLM) survey 2014-15. It is conducted every year by the Pakistan Bureau of Statistics. This survey provides the data of social and economic indicators. This study uses the data of 23683 children who are under the age group of 1 to 2 years. Information on the proportion of children being immunized under the age group of 1 to 2 years for this study including social factors (child gender, mother's education, and mother's age, Father's education) economic characteristics (Household income(yearly), ownership of agricultural land and mother's job status), Demographic characteristics (region, province and distance from health facility), Birthplace also one of the factors.

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Childhood immunization is the dependent variable in this study. The data of this variable are collected by PSLM through Child health cards to attain information about the children to be immunized or not. If the health cards are not available by the parents, the mother's recall will be a good instrument to rely upon. This study used the data belongs to the children age group of 1 to 2 years old. Because at least 12 months are required to be fully immunized. PSLM take mother's education in different classes and professional-level education as described in the questionnaire of PSLM (2014-15). This study manipulates in this case in a way that the father and mother of the child are either illiterate, having primary education, having secondary education or having higher education. This study also takes the log of household income yearly to check the percentage effect of household income on childhood immunization. Data on the birthplace of the child and distance of child's home from health facility are taken as collected by Pakistan bureau of statistics via PSLM Questionnaire.

4. Empirical Results

4.1 Descriptive Analysis

Descriptive analysis of the study gives us the information in frequency as well as in percentages about the dependent and all the independent variables. The following tables show this type of information.

Table 2: Summary Statistics of Selected Variables

Variable	Frequency	Percentage
Child immunization		
No	451	1.90
Yes	23232	98.10
Child gender		
Male child	11967	50.53
Female child	11716	49.47
Mother education		
Illiterate	17147	72.40
Primary education	2531	10.69
Secondary education	2646	11.17
Higher education	1359	5.74
Mother Employment Status		
Yes	6260	26.43
No	17423	73.57
Region		
Urban	3997	16.88
Rural	19686	83.12
Father education		
Illiterate	9066	38.28
Primary education	4280	18.07

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Secondary education	7078	29.89
Higher education	3259	13.76
Birthplace		
Home	13569	57.98
Govt. hospital	3176	13.57
Private hospital	6586	28.14
Others	72	0.31
Distance from health facility		
0 -14min	8836	37.31
15- 29 min	8308	35.08
30 – 44min	3588	15.15
45-59	1023	4.32
60+ min	1928	8.14
Province		
Punjab	9593	40.51
Sindh	6346	26.80
KPK	3620	15.29
Baluchistan	4124	17.41
Land ownership		
Yes	7812	32.99
No	15871	67.01

Table 2 shows 50.53% of children are male and 49.47% are female in the data. It also shows that 83.12% of children living in rural areas and 16.88% in urban areas. Regional wise distribution of the data under age 1 to 2-year children is given in the table below which shows a greater proportion of children under study relates to rural area About 83% children are the residents of rural areas and 17% children are the residents of urban areas. Most mothers are illiterate. The proportion of illiterate mothers in the study is 72.40%. On the other side, about 98% of children in the study is immunized which shows a very weak relationship between education and children's immunization. Table 2 shows 38% of fathers are illiterate and the remaining 62% of fathers are educated at different levels. Province wise distribution of children under this study is given the table 2. About 40% of children live in Punjab, 26.80% lives in Sindh, 15 % lives in KPK and 17% live in Baluchistan.

This section aims to show the percentage distribution of childhood immunization and independent variables separately with their disaggregation.

Child gender is an important determinant of childhood immunization because boys are considered to be more productive than girls therefore are more likely to be immunized than girls in Pakistan. The information about the percentage distribution of male and female children to be immunized is given in Table 3.

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Table 3: Sample Distribution of Childhood Immunization and Gender of the Child

Children immunization	Gender of children		
	Male	Female	Total
No	208(0.88)	243(1.02)	451(1.9)
Yes	11759(49.65)	11443(48.31)	23232(98.1)
Total	11967	11716	23683

Note: percentages are given in parenthesis

Mother education is one of the sub-objectives of this study to analyze childhood immunization. Before data analysis, this study explores some descriptive analysis at this stage as in the following Table 4.

Table 4: Sample Distribution of Childhood Immunization and Mother's Education

Children immunization	Mother's education				
	Illiterate	Primary education	Secondary education	Higher education	Total
No	400(1.69)	23(.097)	22(.092)	6(.025)	451(1.9)
Yes	16747(70.71)	2508(10.59)	2624(11.08)	1353(5.71)	23232(98.1)
Total	17147	2531	2646	1359	23683

Note: percentages are given in parenthesis

Mother working status has an important impact on child immunization. It is fruitful to have a glance at the relationship between childhood immunization and mother working status. The descriptive statistics are given in the following table.

Table 5: Sample Distribution of Childhood Immunization and Mother Working Status

Children immunization	Mother working status		
	Yes	No	Total
No	65(0.27)	386(1.63)	451(1.9)
Yes	6195(26.1	17037(71.94)	23232(98.1)

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	6)		
Total	6260	17423	23683

Note: percentages are given in parenthesis

Land Ownership is an economic variable in this study. It is also one of the sub-objectives of this study and considered an important factor of childhood immunization. Therefore, it is important to show up the descriptive statistics.

Table 6: Sample Distribution of Childhood Immunization and Land Ownership

Children immunization	**Land ownership**		
	Yes	**No**	**Total**
No	141(0.59)	310(1.31)	451(1.9)
Yes	7671(32.39)	15561(65.70)	23232(98.1)
Total	7812	15871	23683

Note: percentages are given in parenthesis

Child immunization is also affected by the father's education. If a father is educated and well aware of the benefits of immunization then children are likely to be more immunized. Educated fathers are lenient and flexible in their behaviour therefore likely to have more exposure to make their children immunized. Table 7 gives a view of father education and childhood immunization.

Table 7: Sample Distribution of Childhood Immunization and Father's Education

Children immunization	**Father's education**				
	Illiterate	**Primary education**	**Secondary education**	**Higher education**	**Total**
No	270(1.14)	71(0.30)	84(0.35)	26(0.11)	451(1.9)
Yes	8796(37.14)	4209(17.77)	6994(29.53)	3233(13.65)	23232(98.1)
Total	9066	4280	7078	3259	23683

Note: percentages are given in parenthesis

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Punjab Province is more developed in the health sector followed by Sindh, KPK and then Baluchistan. Table 8 shows some descriptive statistics of the relationship between childhood immunization and provincial disparity of childhood immunization.

Table 8: Sample Distribution of Childhood Immunization and Province

Children immunization	Province				
	KPK	Punjab	Sindh	Baluchistan	Total
No	63(0.27)	90(0.38)	74(0.31)	224(0.94)	451(1.9)
Yes	3557(15.02)	9503(40.12)	6272(26.48)	3900(16.47)	23232(98.1)
Total	3620	9593	6346	4124	23683

Note: percentages are given in parenthesis

4.2 Results of Logistic regression

Childhood immunization is of qualitative nature variable, whether the child is immunized or not. The dependent variable is categorical and there are several methods available in the literature to specify and analyze the regression models where the dependent variable is 0 or 1 variable. The simplest among all the specifications is the linear probability model. The linear probability model is synonymous with the usual regression model except for the dependent variable (which a dichotomous) and uses the least-squares estimation procedure. Another method, called the "Linear discriminant function", is related to the linear probability model. The other popular method in this direction is the logit model which is based on the standard distribution function. Logistic regression will be applied to determine the relationship between childhood immunization and socio-economic factors. We consider the value of the dependent variable (childhood immunization) is as 1 if the child is immunized and zero if the child is not immunized. The model is selected because childhood immunization, which is the dependent variable, is binary, taking the value 0 and 1

Table 9: Results of Binary logit regression with marginal effects

Child Immunization	Coefficient	Marginal effect	*P*-Value
Child Gender (Male Child as Reference)			

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Female child	-.1637 (.0995)	-.0028 (.001)	0.098 *
Mother Education (Illiterate as Reference)			
Primary education	.155 (.233)	.0025 (.003)	0.505
Secondary education	.044 (.247)	.0007 (.004)	0.858
Higher education	.488 (.471)	.007 (0.005	0.301
Mother Employment Status (Employment as Reference)			
No employment	-.742 (.145)	-.010 (.001)	0.000 ***
Log of household income	.026 (.033)	.0004 (.0005)	0.434
Father Education (Illiterate as Reference)			
Primary education	.368 (.142)	.007 (.002)	0.010 ***
Secondary education	.561 (.140)	.009 (.002)	0.000 ***
Higher education	.891 (.229)	.0135 (.002)	0.000 ***
Birth Place (Home as Reference)			
Govt. hospital	.748 (.190)	.011 (.002)	0.000 ***
Private hospital	.571 (.154)	.009 (.002)	0.000 ***
Others	-.908 (-.907)	-.027 (.026)	0.143
Mother age	.031 (.008)	.0005 (.0001)	0.000 ***
Distance from the Health Facility (0-14 minutes as Reference)			
15-29 min	.011 (.160)	.0001 (.001)	0.943
30-44 min	-.393 (.175)	-.005 (.002)	0.025 **
45-59 min	-.804 (.213)	-.014 (.004)	0.000 ***

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60+ min	-1.405 (.164)	-.034 (.004)	0.000 ***
Province (Baluchistan as Reference)			
Punjab	1.054 (.152)	.0217 (.003)	0.000 ***
Sindh	1.025 (.145)	.0214 (.003)	0.000 ***
KPK	1.024 (.156)	.0214 (.003)	0.000 ***
Land Ownership (Yes as Reference)			
No ownership of land	-0251 (.112)	-.004 (.001)	0.025 **

Note: ***, ** and * represents the significance level at 1%, 5% and 10% respectively. Values in parenthesis are the standard deviations.

The gender of the child is an important variable in the study to observe its effect on childhood immunization. The results show that male children are preferred to female children in childhood immunization. According to marginal analysis, the effect of child gender on child immunization is explained as the probability of being a female child is less as compared to a male child as shown by the negative sign of coefficient as well as marginal effect. Male children have more probability to be immunized than female children (Subhani, 2015). The odd ratio results show that male child has more chances to be immunized (Barreto & Rodrigues, 1992). Pande (2003) had analyzed the sex of child differences in immunization in rural India. The results of this study show that there is a bias of the children with specific sex and for boys and girls differentially operating birth-order combinations. Moreover, the boys born after two or three daughters have more chances to be immunized. Prusty and Kumar (2014) also support the view that there exist gender disparity in childhood immunization.

The positive sign of coefficients shows that as mother education improves, there is more probability of the child being immunized. Mother education has no significant impact on child immunization as described by *P*-value in the study. Bondy (2009) has estimated the determinants of childhood immunization in the Philippines. This study stated that less educated and those mothers who have not attended the minimally-recommended four antenatal visits are less likely to immunize their children completely. It was suggested that the transfer of knowledge to mothers should be increased to increase immunization coverage in the Philippines. Awadh *et al.* (2014) discussed the importance of parental education to childhood immunization. Parental knowledge helps to improve the awareness of parents about childhood immunization. The results of the study have shown a positive and significant relationship of parental knowledge with childhood immunization. Bondy (2009) found mother's education was a significant factor in childhood immunization. Education of the mothers is important to improve the awareness of mothers to become conscious about childhood immunization (Subhani *et al.,* 2015).

Mother employment status shows whether job holder mothers are more conscious about their children being immunized. The result of this study shows that mothers having "No employment"

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are less focused on childhood immunization. The children whose mothers have no employment have 1% less probability to be immunized as compared to the children whose mothers have employment in any organization or anywhere else. The results are significant even at a 1% level of significance. This is all because working status produces more sense of responsibility in mothers, so they become more conscious about children's immunization. There is a significant and positive impact of the mother working status on childhood immunization (Hu *et al,* 2013). Diddy (2012) examined the relationship between multiple dimensions of gender inequalities and full child immunization in Nigeria. Results show that the children of women whose husbands did not participate in family income had a higher level of full immunization while others have a lower level of full immunization. Findings suggested that there should be the intervention of government to reduce gender inequalities and to promote women's employment opportunities. Rehman & Obaida (2004) support the view that mother occupation is important and positively related to childhood immunization. They also found the importance of antennal care and visits are positively related to childhood immunization. The positive sign of coefficients of Household income shows that as income increases in percentage, there is more probability of the child to be immunized. Household income has no significant impact on child immunization as described by the *P*-value in the study based on data of PSLM (214-15). Lauridsen (2011) analyzed that per capita domestic product is positively related to childhood immunization.

Father education is a very important variable that emerged in this study and has a positive relation with childhood immunization and also has a significant result. The results of marginal effect show that the children whose fathers got primary education have 36% more probability as compared to the children whose fathers are illiterate. As the education level of the father increases the probability of being immunized also increases as compared to the children whose father is illiterate. The results are strongly significant Fathers as head of the house and being educated have their influence on the decision of childhood immunization. Father education is another significant variable of childhood immunization. As father education improves, there is more probability for the child to be immunized, marginal analysis tell that the effect of father education on child immunization. As the education improves as compared to illiterate fathers, the probability of the child being immunized increases. Khan & Aslam (2017) analyzed the effect of father education on childhood immunization and found a positive and significant relationship.

The place of birth of the child also contributes to childhood immunization. As the result are significant, the probability of a child to be immunized is more in Govt. /Private Hospitals as compared to the delivery at home. The results show the children born in govt. hospitals have 74.8% more probability to be immunized as compared to the children born at home. The same result is for the children born in private hospitals. Children born in govt. /private hospitals have more probability to be immunized (Hu *et al.,* 2013). The results have shown that male children and children born in hospitals are more likely to be immunized (Khan & Aslam, 2017). Results of this study revealed that educated mothers were more focused on childhood immunization. Children born after three or four children have less probability to be immunized. Children born in health centres like govt. or private hospitals have more probability of immunization than children born in a home or other places (Mukungwa, 2015)

Mother age is also a significant variable of childhood immunization. As mother age increases by 1 year, the probability of a child being immunized increases by 3%. Barreto and Rodrigues

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(1992) reported that with the increase in mother age she becomes more conscious and mature towards child immunization. Mother age is also one of the significant factors of childhood immunization. It is suggested that early age marriages should be banned because it is dangerous for the maternal life as well as the life of the child.

Distance of home from health facility is another significant variable of childhood immunization. As the distance of home from a health facility in minute increases, there is less probability of the child being immunized. Parents feel cumbersome to go far away from their homes for vaccination to their children. It is suggested that vaccination centres should be established in every village and towns.

In Baluchistan province, which is relatively underdeveloped, the accessibility and proximity of health care facilities are the lowest as compared to Punjab, Sindh and KPK. Results also show the fact that, in comparison to the other provinces, the marginal effect tells the immunization for children in the other three provinces increased. Punjab, being more developed, has shown the highest magnitude of coefficients of childhood immunization The Sindh follows the province of Punjab in predicting. The effect is also significant. Khan & Aslam (2017) also found that children living in Punjab province are likely to be more immunized as compared to the other three provinces. The children living in Sindh and Baluchistan are least likely to have complete immunization as compared to those living in Punjab.

Results show that land ownership is a significant variable and has a positive role in child immunization parents has land ownership. The results show that the children whose parents have no land in their ownership have 2.5% less probability to be immunized as compared to the children whose parents have land ownership. Arif and Arif (2012) had examined the socioeconomic determinants of child health in Pakistan Logistic regression model was used to analyze this relationship. Findings of this study indicate that there is a positive role of economic factors such as land and livestock according to child health. Furthermore, in rural areas, both the ownership of land and livestock are means of livelihood. Overall results of this study are significant despite the reality that some insignificant result is also in the study. Egondi *et al.* (2015) discussed the inequality of childhood immunization and found that children related to poor families have less probability to be immunized.

5. Conclusions and Policy Recommendations

Children are the future of any country. Child health is the foremost objective of every parent in any society. Health is a social factor that is the responsibility of every government. Childhood immunization is a very important process to save children from dangerous diseases. Despite the reality that the death rate is falling in Pakistan which is a good sign for the improvement of the health sector but still Pakistan is lacking behind in childhood immunization especially in polio. As compared to the other countries in the world, Pakistan is not considering a safe country for its health sector. The neglect of childhood immunization is one of the causes of this issue related to the health sector. This study aims at exploring socio-economic determinants of childhood immunization. Pakistan is lacking behind in child immunization, so there is a need to discuss various causes of child immunization. This study discusses the impact of some important socio-economic variables on childhood immunization.

The health of the child is important for the foundation of any society. Health contributes to economic development as one of the indicators of economic development. Health plays

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important role in economic development by direct way to become the more productive and indirect way by improving knowledge and hence increase earnings. Childhood immunization is one part of child health that is the preventive side of health. After the birth, till to age of 1-2 years, children are injected called vaccination to reduce the chances of the victim of dangerous six diseases. This vaccination process is called immunization of `children.

Even though the death rate at early ages in Pakistan reduces significantly, but still, there is a need for improvement in the preventive healthcare sector especially in childhood immunization because Pakistan is lacking behind the targets defined by SDG. There is a huge need to invest in health care especially in childhood immunization. Staff to conduct the vaccination process should be well trained and well equipped. So that we become able to control the situation of childhood immunization.

Childhood immunization depends on many factors. Some of the important variables explain childhood immunization in this study. Some of the important factors of childhood immunization in the study are child gender, mother education, mother working status, household income, land ownership, father education, mother age, birthplace, the distance of home from health facility and regional disparity (provinces). The objective of the study is to explore the socio-economic determinants of childhood immunization in Pakistan. The significance of this study is to examine the social factor like parental education, gender inequality of childhood immunization and economic factors like mother working status, household income and land ownership.

The data source for this purpose is the Pakistan social and living measure (PSLM) of 2014-15. Childhood immunization is the dependent variable in the study. Socio-economic determinants like child gender, education of the mother, employment status of the mother, household income and agricultural land ownership by household are the independent variables of the study. Childhood immunization is a binary variable in nature (child is immunized or not immunized) therefore we are not able to apply simple OLS regression. The binary logistic technique is applied for data analysis in this study.

It is the primary duty of the government of Pakistan to provide all type of health facilities to society. Children are the most important to avail the health facility because their immunity power is very low as compare to the adults. This study suggests some important policy implications:

- There is still a need to spread awareness to the parents as well as to the society that daughters are as much important as sons in every sphere of life especially in the case of childhood immunization.
- It is also suggested that government may protect and ensure a good and smooth working environment in govt. and private organizations for women so that they feel better at the workplace and hence become able to learn how to become responsible and disciplined and apply this learning on this issue.
- Pakistan is a developing country therefore males become engaged in livelihood at an early age of their life. Father education is a very important and significant variable found in this study for childhood immunization. So, it is suggested that facilities of education for males and females should improve. There should be at least a higher secondary school in a big village for girls and boys separately.
- This study found a significant and positive relationship between land ownership by household and childhood immunization. Land ownership improves the chances of better

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livelihood which force the owner of land to take care of their children health. It is suggested that there should be Land Reforms in the country and also protect the farmers' right, especially small farmers.

6. Limitations and Future research suggestions

This study tries to tackle the issue of childhood immunization concerning socio-economic determinants like child gender, education of the mother, employment status of the mother, household income and agricultural land ownership by household in Pakistan. Much has been found from the results but still, this study is lacking a cross country comparison to clear the issue of childhood immunization more broadly due to shortage of time. Inter-regional comparison of childhood immunization may not be tackled in this study because of the shortage of time.

The study suggests future research on childhood immunization. The study may be expanded to explore the socio-economic determinants of childhood immunization on a regional basis (rural and urban) in Pakistan. The researcher may also be suggested to expand the study area by making a cross country comparison on the socio-economic determinants of childhood immunization to understand the issue more broadly.

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