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Inter-district Socioeconomic Disparity and Child Health Care in Pakistan: A Cross-Sectional Study

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Abstract

The study assesses the impact of socioeconomic disparities on child health care in Pakistan using cross-section data of 106 districts for the year 2015. The data has been taken from Bureau Statistics of all provinces and PSLM (2014-15). The study utilizes two determinants of child health i.e. child immunization under 12-23 months and treatment of diarrhea under five. The wealth-based disparity index, health infrastructure index, pre-natal care, mother's education, housing sanitation and source of safe drinking water are taken as determining factors of the child's health. The results indicate that socioeconomic disparities harm both measures of child health care. It implies that an increase in socioeconomic disparity decreases child immunization and treatment of diarrhea in Pakistan. The health infrastructure, pre-natal care consultation, education of mother, housing sanitation, availability of clean drinking water has a significant impact on both measures of child health. The study, therefore, recommends the strategies and means aims at enhancing health care services and improving socio-economic disparities in the country.

Keywords: **C**hild Health Care, Socioeconomic Disparity, Health Infrastructure, Mother's Education, Housing Sanitation, Source of Drinking Water
JEL Classification: O47, C01

1. Introduction

Children's health is a fundamental global issue, especially in developing countries and Pakistan is no exception. It is a dominant issue of the whole country and requires special attention. Although, the worldwide infant mortality rate has decreased by 58%, from an

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estimated rate of 93 deaths per 1000 live births in 1990 to 39 deaths per 1000 live births in 2017 (WHO, 2017). According to United Nations International Children's Emergency Fund (2018), in Pakistan deaths per 1000 live births is 42 in 2017-18. This indicates the alarming state of child health in the country. It is worse than the neighboring countries: India, Sri Lanka, Bangladesh, and Iran. The literature on child health indicates that socioeconomic disparities, low adult literacy rates, lack of availability of safe drinking water, housing sanitation, prenatal care facility and inadequate health infrastructure are leading reasons for low-level children's health.

According to Harahap (2019) and Desmennu et al. (2017), child health can be seen through two dimensions: immunization and treatment of diarrhea. UNICEF (2018), indicates that the ratio of fully immunized children is 66 percent in Pakistan. Similarly, the treatment of diarrhea through oral rehydration salts to children is 37 percent, prenatal care within two days of birth is 62 percent of women aged 15-49, 39% of the population of Pakistan is without access to safe drinking water.

In this backdrop, the current study aims to examine the impact of socioeconomic disparity on full immunization of children less than 12-23 months as well as examine the relationship between socioeconomic disparity and treatment of diarrhea under five. Moreover, the study also examines the effect of socio-economic factors such as maternal education, health infrastructure, housing sanitation, safe drinking water and prenatal care on both dimensions of child health in Pakistan.

Previous studies such as George et al. (2014), Kumi-Kyereme and Amo-Adjei (2015), Lakew et al. (2015) and Abdulmalek (2017) have examined the effect of socioeconomic determinants on child health in Pakistan. However, these studies are confined to specific regions of the country as some studies are conducted only for some districts, and others are conducted for some regions. The studies are scant that examined this relationship for the whole country. The current study contributes to the literature by examining the effect of socioeconomic disparities on child health care in all districts of Pakistan.

The rest of the study is organized as follows: Section 2 deals with the literature review of prior studies. Section 3 is about the formulation of the model, source of the data and estimation technique.

Section 4 explains the results and discussion. Finally, section 5 concludes the study and offers meaningful policy recommendations.

2. Review of Literature

The serious issue of child health has been investigated over the years in different parts of the world. The research studies have concluded many socio-economic factors responsible for poor child health care in developing countries. The research on the link between socioeconomic disparity and child health care is still in the infancy state. One of the pioneer studies on the issue is of Raouafi, Achiche, and Raison (2018) because they identified the associations between socioeconomic disparities and child health care with their household socioeconomic status (SES) and their frequency of visits to a healthcare provider in Canada. Data was collected from the 2006 Participation and Activity Limitation Survey on children aged 5-14 years. Through logistic regression, analysis study indicates that socioeconomic disparities in household health status such as after-tax low income, family assistance, out-of-pocket expenses, needing but not receiving health services from a social worker, condition of the dwelling, and residential location were highly associated with the child health care and harm child health care.

Desai and Alva (1998) investigated the effect of maternal education on child health for 22 developing countries. Results indicated that the children whose mothers were educated were less likely to die than the children whose mothers were uneducated.

Harahap (2019) had analyzed the effect of availability to safe drinking water on child health growth and found that the households who were living in the larger villages and the villages with a high school, with paved roads, bus stops, telephone services, bank, and a market were more liable to contain tap water and have a low incidence of diarrhea occurrence between the households.

Karim et al. (2001) examined the risk factors for the highest occurrence of persistent diarrhea episodes that occurs in children under 1 year of age in Karachi. The results of this study indicated that risk factors for persistent diarrhea include a lack of safe water supply and housing sanitation at home and income from family members. Therefore, it can be concluded that the provision of safe tap drinking water and housing sanitation is significant to prevent persistent diarrhea.

Grant and O'Hara (2010) examined the availability of clean drinking water, housing sanitation and health of children evidence from the 172 Demographic Health Surveys (2010). The study found that access to the availability of clean drinking water, housing sanitation facilities decreased the probability of suffering from diarrhea among children fewer than five. The study also explored the significant and comparable decline in the under 5 mortality threat.

Plenty of studies such as A. Freeman et al. (1992), Mahmood and Kiani (1994), R. Pebley et al. (1996), Biswas, Darda, and Alam (2001), Arif (2004), Adil et al. (2009), Ahmed (2011), Bugvi et al. (2014), Lakew et al. (2015), Abdulmalek (2017), Cao et al. (2018), and Harahap (2019) took child immunization as the measure of child health and examined the impact of different socio-economic factors: family wealth, mother education, prenatal care, health infrastructure, housing sanitation, drinking water sources and other demographic variables on child immunization. The results of these studies indicate mixed findings. Family wealth has negative while other factors such as maternal education, prenatal care, health infrastructure, housing sanitation, safe drinking water have a positive impact on child health care.

Besides, the studies such as Quadri et al. (2013), George et al. (2014), Kumi-Kyereme and Amo-Adjei (2015) and Desmennu et al. (2017) take treatment of diarrhea as the measure of child health care by using OLS, fixed effect, and logistic regression techniques and methods. These studies focus on the measurements of child health and discuss family wealth, mother education, prenatal care; health infrastructure, housing health, drinking water sources and other demographic variables that affect the treatment of diarrhea. The results of these studies indicate mixed findings. Family wealth has negative while other factors such as maternal education, health infrastructure, housing sanitation, safe drinking water have a positive impact on the treatment of diarrhea.

Although all these studies make help in many ways there is a noticeable flaw that is common in all these studies. That is, the implementation of all these studies is done in only specific areas and regions in Pakistan which cannot give whole results. Not a single study covers the whole population in a good way. Limited samples are taken from a specific population. Backward and the areas difficult to reach did not take into consideration. Due to this, the whole previous calculations do not give proper results. Therefore, these studies cannot

be considered to achieve accurate results. As it lacks authentic data therefore, the results of all districts cannot be expectable or applicable. Each district and region of Pakistan have different kind of environment and socioeconomic disparities.

3. Model, Data and Methodology

The current study establishes a framework to assess the impact of socioeconomic disparities on child health care in the context of Pakistan. Following the Quadri et al. (2013), George et al. (2014), and Desmennu et al. (2017) immunization and treatment of diarrhea under-five have been taken as a dimension of child health. The study, therefore, employs two different models for each dimension of the childcare. The model-1 is employed to assess the impact of socio-economic disparity, mother's education, prenatal care, health infrastructure, housing sanitation, availability of safe drinking water on child immunization. While, model-2 has been employed to assess the impact of socio-economic disparity, mother's education, health infrastructure, housing sanitation, availability of safe drinking water on the treatment of diarrhea. Prenatal care has not been included in model-2 because of no direct relation between them.

Model-1

$$Imf=\beta_o+\beta_1\ Dis+\beta_2\ Med+\beta_3\ Hi+\beta_4\ Dw+\beta_5\ Hs+\beta_6\ Prn+Ɛi$$

In model-1 Imf stands for child immunization, Dis for the inter-district socio-economic disparity, Med for mother's education, Hi for health infrastructure, Dw for the source of drinking water, Hs for housing sanitation and Prn represents prenatal care consultation. While Ɛ use for error term and i use for the number of observations.

Model-2

$$Diar=\beta_o+\beta_1\ Dis+\beta_2\ Med+\beta_3\ Hi+\beta_4\ Dw+\beta_5\ Hs+Ɛi$$

In model-2, Diar represents under-five diarrhea in children, Dis represents inter-district socio-economic disparity, Med represents mother's education, Hi represents health infrastructure, Dw represents the source of drinking water and Hs represents housing sanitation. While Ɛ use for error term and i use for the number of observations.

The district wealth disparity index has been constructed using four variables, own houses, perceived economic situation, livestock

and number of vehicles while other variables measure as mother's education (female adult literacy rate), health infrastructure index (number of hospitals, number of dispensaries, number of rural health care centers RHCs, number of basic health units BHUs), availability of safe drinking water (tap water and motor pump), housing sanitation (flush), pre-natal consultation, immunization of child, and under-five child diarrhea treatment. To construct the regional wealth difference index difference formula is used. The district wealth difference index is equal to the maximum value of the regional wealth index - the relative value of the regional wealth index / the maximum value of the regional wealth index. The regional wealth difference index constructs from PSLM 2014-15 through Principal component analysis (PCA) which is a tool for classifying different answers to the same set of questions caused by different errors. When we have a larger number of values in data sets with multiple proportions, we can't simply manipulate the answers to these questions. Though, PCA helps to handle such large data sets by selecting and retaining important answers and dumping answers that only interfere with the data.

The data has been taken from Pakistan Social and Living Standards Measurement Survey (2014-15), Punjab Bureau-Statistics (2014-15), Sindh Bureau-statistics (2014-15), Khyber Pakhtunkhwa Bureau-Statistics (2017) and Baluchistan Bureau-Statistics.

As all variables in model-1 and model-2 are continuous variables, therefore, there is no need to employ binary logistic models. The current study, therefore, employs Ordinary Least Squares (OLS) for the estimation of the coefficients of both models. The OLS is a method of estimating unidentified parameters in a linear regression model. The method minimizes the sum of the squares of the vertical distances among the response observed in the data set and the response of the linear approximation prediction. The consequential estimator can be expressed in a simple formula, especially in the case of a single repressor on the right side.

4. Results and Discussions

The empirical analysis includes descriptive and correlation statistics, regression results and diagnostic tests. Two regressions analyses are carried out to estimate the coefficients of model-1 and model -2. The model-1 explains the connection between childhood immunizations that is the first dimension of childcare and socio-economic determinants of child health. While model-2 explains the impact of socio-economic determinants on under-five diarrhea

treatment of children that is the second dimension of childcare and socio-economic determinants of child health. As empirical analysis is carried out for cross-section data of 106 districts of Pakistan therefore, diagnostic tests for heteroscedasticity and normality of the data are also having been employed.

The analysis starts with descriptive statistics given in Table 1. The high values of a standard deviation relative to mean indicate that variables have substantial variation. Similarly, the high range (the difference between maximum and minimum value) also indicate the same for the data of 106 districts of Pakistan. Finally, the Jarque- Bera (JB) statistics, a test of normality, does not reject the null hypothesis (H_0: The variable is normally distributed) because the-values in all cases are above then 10% significant level. It implies that underlying variables are normally distributed.

Table 1
Descriptive Statistics

Variables	IMM	DIA	DISP	HS	DW	PRN	MED	HI
Observation	106	106	106	106	106	106	106	106
Mean	51.019	90.868	0.132	56.764	26.005	63.981	30.328	20.630
Std. Dev.	24.029	12.404	0.054	27.319	10.695	16.656	17.952	15.873
Min.	0	0	0	0	4	21	2	3.5
Max.	93	100	0.266	99	47	96	74	107
JB (I)	2.879	**JB (I)**	0.934					

The correlation statistics are given in Table 2 and Table 3. The correlation statistics indicate that independent variables of both models are not highly correlated. It implies that regression models do not have the problem of multicollinearity.

Table 2
Correlation for Model I

Correlation	IMM	DISP	DW	MED	HI	HS	PRN
IMM	1	-0.189	0.551	0.764	0.405	0.767	0.707
DISP	-0.189	1	-0.085	-0.128	-0.133	-0.163	0.036
DW	0.551	-0.085	1	0.568	0.266	0.527	0.374
MED	0.764	-0.128	0.568	1	0.604	0.756	0.735
HI	0.405	-0.133	0.266	0.604	1	0.479	0.514
HS	0.767	-0.163	0.527	0.756	0.479	1	0.669
PRN	0.707	0.036	0.374	0.735	0.514	0.669	1

Table 3
Correlation for Model II

Correlation	DIA	DISP	DW	MED	HI	HS
DIA	1	-0.231	0.539	0.716	0.418	0.713
DISP	-0.231	1	-0.085	-0.140	-0.128	-0.163
DW	0.539	-0.085	1	0.570	0.237	0.527
MED	0.716	-0.140	0.570	1	0.535	0.761
HI	0.418	-0.128	0.237	0.535	1	0.422
HS	0.713	-0.163	0.527	0.761	0.422	1

The regression results for model-1 are given in Table 4. In model-1 child immunization (Imf) has been taken as a dimension of child health while socioeconomic disparity (Dis), housing sanitation(Hs), source of safe drinking water (Dw), pre-natal consultation(PRN), education of mothers (Med) and health infrastructure(Hi) is as a determining factor of the immunization in the children.

According to the results, the socioeconomic disparity has a significant inverse relation with child immunization. These results reflect that for every unit increase in socioeconomic disparity the immunization will decrease by 43.23961 percent. These results are in line with Denburg & Daneman (2010) explained that access to hospitals, dispensaries and basic health units and cost of treatment is the main factor for households in districts with low wealth. However, poor families cannot provide better health facilities to their children.

The availability of safe drinking water is found to have a significant positive impact on child immunization. These results indicate that for every unit increase in availability to safe drinking water increases the immunization by 0.302318 percent. These results are in line with (Esrey, Feachem, & Hughes, 1985) who concluded that a 17 percent decrease in diseases in the absence of vaccination is associated with a better supply of drinking water. Fiscella & Williams (2004) also concluded similarly that access to improved water decreases the illness by 25 %. However, some studies also concluded that the source of safe drinking water is insignificant for child health because there are more chances that the child may not suffer from that diseases which affects child health without vaccination or immunization for short time period (Sattar, 2014).

Health infrastructure also has a positive significant impact on child immunization. According to the results, every unit increase in health infrastructure increases the immunization by 0.212816 percent.

These results are in line with WHO (2013) which implies that health infrastructure: transportation, hospitals, access to basic health units and rural health centers facilities increases the child immunization.

Housing sanitation also has a significant positive impact on child immunization. These results reflect that for every unit increase in housing sanitation lead immunization increase by 0.289497. These results are in line with WSP (2012) housing sanitation who claims that housing sanitation affects not only the families and individuals, but it places complexity on the available health care systems and that is a greater risk for the child's health.

A mother's education also has a positive significant relation with child immunization. The results indicate that for every unit increase in mother's education improves immunization in a child by 0.381769. These findings are similar to the findings of Biswas et al. (2001) who claimed that educated mothers are three times more likely to immunize their children than uneducated mothers.

Lastly, prenatal care also has a positive significant impact on child immunization. According to the results, one unit increase in prenatal improves the immunization by 0.456759. These findings are in line with Noonan, Corman, Schwartz-Soicher, & Reichman (2013) who claimed that advanced and scarce prenatal care was associated with subsequent short birth spacing, which was linked with poor prenatal outcomes; suggesting that early or enough prenatal care could indeed be for the next child.

Table 4
Regression results for model-1

Variables	**Coefficient**	**Std. Err.**	**P-value**
DISP	-43.23961	24.77186	0.0840
DW	0.302318	0.141252	0.0348
HI	0.212816	0.102873	0.0412
HS	0.289497	0.074342	0.0002
MED	0.381769	0.125312	0.0030
PRN	0.456759	0.116945	0.0002
No. of Districts	106	R Square	0.72627
No. of Observations	106	Adjusted R Square	0.70968
F-Test	43.7792		

*p<0.10, **p<0.05, ***p<0.01

The diagnostic tests for model-1 are given in Figure 1 and Table 5. According to the results, Jarque- Bera (JB) statistics do not reject the null hypothesis (H_0): Residuals of the model are normally distributed, are not rejected. It implies that residuals of the model-I and model-II are normally distributed.

Figure 1
Histogram Normality-test

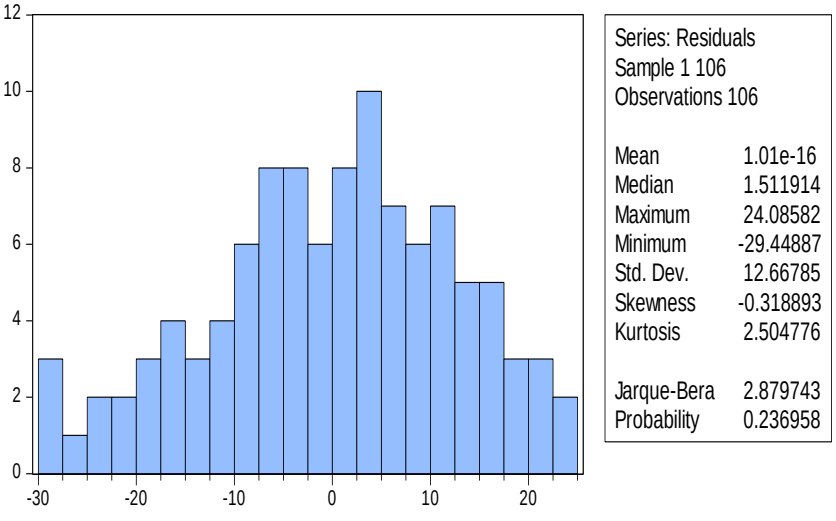

Table 5
Heteroskedasticity Test: Breusch-Pagan-Godfrey

F-statistic	1.648674	Prob. F (6,99)	0.1418
Obs*R-squared	9.629324	Prob. Chi-Square (6)	0.1412

The regression results for model-2 are given in Table 6. In the model-2 treatment of diarrhea (diar) has been taken as a dimension of child health while socioeconomic disparity (Dis), housing sanitation (Hs), source of safe drinking water (Dw), education of mothers (Med) and health infrastructure (Hi) used as independent variables.

The socioeconomic disparity is highly significant and has an inverse relation with the treatment of diarrhea. These results reflect that for every unit increase in socioeconomic disparity diarrhea cases during the past 30 days to decrease by 60.15153 percent. These findings are similar to the findings of Gertler & Gruber (2002) who claimed that socioeconomic disparity affects the treatment of diarrhea in districts with low wealth.

Availability to safe drinking water is highly significant and has a direct relation with the treatment of diarrhea. These results reflect that for every unit increase in availability to safe drinking water treatment of diarrhea to increase by 0.363721. These results are in line with Feachem (1984), Esrey et al., (1985) and Arif & Ibrahim (1998) who stated that availability of safe drinking water may lead to a greater decline in transmission of many, if not all, agents of diarrheal disease. Health infrastructure is highly significant and has a direct relation to the treatment of diarrhea. These results reflect that for every unit increase in health infrastructure treatment of diarrhea to increase by 0.235458. These findings are similar to the findings of WHO (2013) who claimed that the absence of health infrastructure facilities decreases the child treatment of diarrhea ratio.

Housing sanitation is highly significant and has a direct relation with the treatment of diarrhea. These results reflect that for every unit increase in housing sanitation treatment of diarrhea to increase by 0.340562. Sanitation amenities seem to be more essential than the supply of drinking water to control the occurrence of diarrhea among children under five (Arif & Ibrahim, 1998). Feachem (1984) also stated that the safe disposal of human excreta may lead to a major reduction in the transmission of many, if not all agents of diarrheal disease.

A mother's education is highly significant and has a direct relation to the treatment of diarrhea. The results indicate that for every unit increase in mother's education increases the treatment of diarrhea by 0.470439. These results are in line with Arif & Ibrahim (1998) who stated that an educated mother is well-known with the simply prepared treatment about diarrhea treatment like the use of Nimkol (ORT) and know about personal hygiene.

Table 6
Regression results for model-2

Variables	Coefficient	Std. Err.	P-value
DISP	-60.15153	31.33060	0.0577
DW	0.363721	0.189733	0.0581
HI	0.235458	0.377314	0.5340
HS	0.340562	0.096347	0.0006
MED	0.470439	0.157757	0.0036
No. of Districts	106	R Square	0.610164
No. of Observations	106	Adjusted R Square	0.590672
F-Test	31.30364		

*p<0.10, **p<0.05, ***p<0.01

The diagnostic tests are given in Figure 2 and Table 7. Jarque-Bera statistics 0.933603 and P-value 0.627005 indicate that the null hypothesis: residuals are normally distributed in data are not rejected. Similarly, Harvey tests statistics from table 7 indicates that the null hypothesis: Heteroskedasticity does not exist in data, is not rejected.

Figure 2
Histogram Normality-test

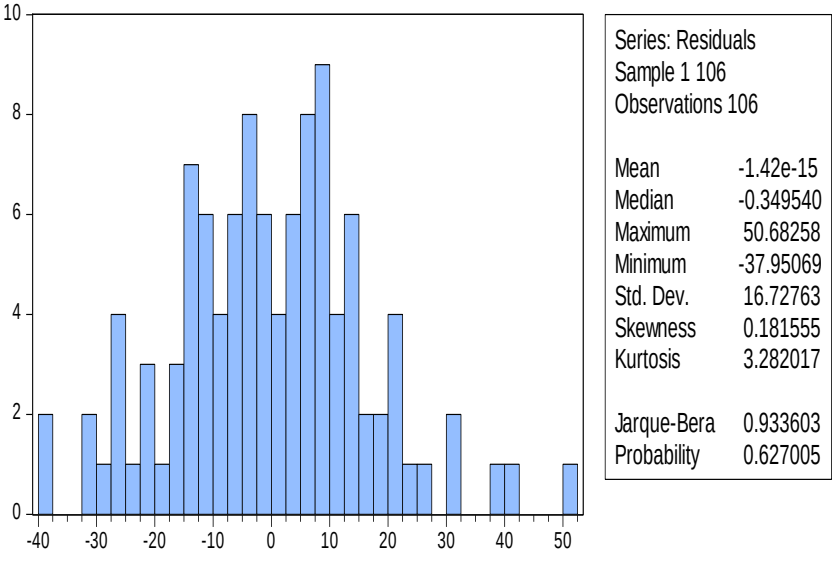

Table 7
Heteroskedasticity Test: Harvey

F-statistic	0.976243	Prob. F (5,100)	0.4361
Obs*R-squared	4.933284	Prob. Chi-Square (5)	0.4241

5. Conclusion and Policy Recommendations

The major objective of the study is to find out the effect of socioeconomic disparities on child health in all districts of Pakistan. The study uses the cross-section data of 106 districts of Pakistan taken from Pakistan Standards of Living and Measurements (PSLM-2015). Two indicators of child health i.e. child immunization under 12-23 months and treatment of diarrhea under five have been taken as dependent variables. While, wealth-based disparity index, health infrastructure index, pre-natal care, mother's education, housing sanitation and source of safe drinking water as independent variables.

In the first model, child health is measured by child immunization under 12-23 months and determines the socioeconomic disparity harms child immunization while, health infrastructure, pre-natal care consultation, education of mother, housing sanitation, a supply of clean drinking water has a positive consequence on health of children. In the second model, child health is considered as a treatment of diarrhea under five and evaluates that socioeconomic disparity has an inverse effect on child diarrhea under five while, health infrastructure, education of mother, housing sanitation, the supply of clean drinking water has a positive consequence on health of children.

The underlying study concludes an important role of socio-economic factors for child health in Pakistan. Therefore, the government should maintain and implement such type of policies which are beneficial for child health and wellbeing.

1. Lack of facilities decreases the treatment of diarrhea under five in children. First, the Government should expand the health infrastructure by increasing the number of hospitals, the number of dispensaries,
2. RHC and BHU's and provide facilities like clean drinking water, improved sanitation, and different health centers should be maintained for improving the lives of children.
3. Second, especially in deprived areas, the number of hospitals and the number of dispensaries should be increased and medicines and treatment for the different diseases in children should be free. As well as a different type of program should be established in which the awareness about child health should be given to backward areas people.
4. Third, health education for mothers should be enhanced through home-based health programs and courses should be financial like LHV and lady health workers should be provided even to fewer wealthy areas and long routed areas. Finally, subsidies should be given not only on medicines but also on food from avoiding malnutrition.
5. Facilities like clean drinking water, improved sanitation, and different health centers should be maintained for improving the lives of children.
6. Multi-sectoral development activities such as women's micro-credit, life-skill training, and non-formal education should be established to decrease the wealth-based disparities in districts of Pakistan.

7. The quality of health facilities needs to be improved in rural and urban areas to enhance child health in Pakistan.

This study makes sure to implement proper policies and to make these policies more significant and help to give a proper manner. It may also add more relevant appropriate and best suggestions that help the policymakers to concerned and choose better options in the process of policymaking for child health care. It will also improve socioeconomic disparities in Pakistan at the district and regional level in a proper hierarchy. By improving the health infrastructure, the ratio of treatment of diarrhea and child immunization will increase in all districts of Pakistan.

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