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Impact of Multidimensional Poverty on Immunization: Evidence from Pakistan

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ABSTRACT

The association between health and poverty is well well-known concept, but poverty extends beyond income and encompasses multiple dimensions. Good health is not always attributed to wealth, but many other factors contribute to maintaining good health and life expectancy. **Objective:** To investigate the association between multidimensional poverty and immunization. **Methods:** Using the data of the Pakistan Demographic Health Survey (2017-18), the study focuses on three dimensions of poverty (income, education, and living standard) and adopts immunization as a health variable. The study examines, with the help of descriptive statistics and multivariable logistic regression that how the health variable is associated with multidimensional poverty measures. The effective curves are used to identify which dimensions of poverty are more effective in predicting the association of poverty with poor health. Additionally, the study applies the dual cut-off method to identify the proportion of population in poverty. **Results:** The results of the study demonstrate that composite measures of multiple poverty dimensions are more effective predictors to identify individuals in poor health than a unidimensional poverty measure such as income. Individuals experiencing multiple dimensions of poverty face more health issues as compared to those who are poor in just a single dimension. **Conclusions:** The study confirms the importance and relevance of multidimensional poverty for health and suggests focusing on multiple aspects of poverty rather than considering a single dimension. Encouraging collaboration among health, education and social welfare departments can be helpful to address poverty and improve health holistically.

INTRODUCTION

The idea of multidimensional poverty is derived from Sen's Capabilities theory [1]. Sen's theory highlights inequalities arising from individual preferences and capabilities. These inequalities are formed if primary capacities and goods are uniformly distributed among the people, and then they reveal their preferences. Capabilities are seen as the freedom or opportunity a person has to choose among different combinations of functionings that they have reason to value. The notion of capability and the theory of multidimensional poverty are helpful to explore key features of human life and overall well-being. These frameworks explore how various dimensions of poverty can be hurdles to a person's ability to achieve the functioning they have reason to value. This also allows us to find the association between health and multidimensional poverty [2]. The existence of poverty is one of the acknowledged restricting factors to achieve the objective of sustainable growth. Poverty has been discussed in different forms, including the monetary poverty in its single dimension; however, the inclusion of Sen's capability approach converted the debate from a single dimension to multiple dimensions of poverty, including the different social and economic aspects of social disadvantages. Some socio-economic attributes were considered as the key attributes of this capability approach, like education, health and housing facilities. Though researchers preceded their thinking to some other distinct aspects of multidimensional poverty like child poverty, energy poverty and health poverty, however, the last one achieved unprecedented attention of researchers because its

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impact on the performance of the economies was not ignorable [3]. Health has been analyzed in the research in various aspects, including the association of health with poverty [4, 5]. After the idea of multidimensional poverty, it has been included in the multidimensional analysis as a dimension of poverty [6]. Some studies analyzed the deprivations of individuals in different aspects of health [7-9]. Most of the studies conducted on multidimensional poverty and health adopted health as a poverty aspect or analyzed the multidimensional health poverty, taking different aspects of health and identifying deprivation of individuals in these aspects. Some studies investigated how different types of poverty (unidimensional and multidimensional) affected health and used effective curves to identify which type of poverty was a better predictor of poor health [10]. The association between health, poverty and multidimensional poverty had been analyzed in different ways in Pakistan. The majority of the studies have examined how poverty affected health [11-14]. Different studies examined the impact of health facilities on poverty in rural Punjab and analyzed the relationship between health poverty and climate variability in provinces of Pakistan [15, 16]. Some studies analyzed how poverty affected the health of children and mothers [17, 18]. In multidimensional poverty analysis, most of the studies included health as a dimension of poverty [19-21]. However, one study used different dimensions of health poverty and estimated the multidimensional poverty health index (MPHI) [22]. These studies give a clear understanding regarding the poor health, the cause of relationship between health and poverty and, multi-dimensional features of health poverty. An important limitation of these studies is the lack of analysis that how multidimensional poverty affects the health. This gap has been attempted to be filled in the current study, and the current study has examined the effect of multidimensional poverty on health considering immunization as a dependent variable and unidimensional and multidimensional poverty as explanatory variable. The research examined the relationship between health and multidimensional poverty and gave some guidelines to the stakeholders that what aspects of multidimensional or unidimensional poverty could be addressed. The study focused upon three dimensions of poverty: wealth, education and living standard. Preceding studies had proved that these three dimensions of poverty were independently related to health even after controlling the income [23].

The study aims to concentrate upon the evidence achieved from PDHS which indicated that the wealth poor individuals were 53.88% and multidimensional poor individuals were 96%. Considering the importance of the multidimensional poverty, it is of great interest to analyze to what extent MP effects the health of the individuals and implies to policies of health care in Pakistan.

METHODS

The microdata attained by the Pakistan Demographic and Health Survey 2017-18 were utilized in the study. The DHS project is funded through USAID (an American agency of international development) that supports the processes of implementation of health and population surveys in all over the world. The National Institute of Population Studies (NIPS) under the aegis of the Ministry of Health in Pakistan implemented it. The sampling frame used for the survey is the same as it was created by the Pakistan Population and Hosing Census 2017 and that was complete list of Enumeration Block (EBs). The estimates of the survey cover all the provinces of Pakistan (Punjab, Khyber Pakhtunkhwa, Sindh, and Baluchistan), Gilgit Baltistan, Islamabad Capital Territory, FATA and AJK. Samples were chosen independently through a two-stage selection process in every stratum. This study selected the Household Questionnaire from the total six questionnaires used for the DHS survey, which reflects the health issues of the population of Pakistan. After removing missing values, 50,495 households were included in the analysis. The current study adopted the dual-cutoff approach to construct the measures of multinational poverty. This measure can be divided into two unique steps: (1) the identification step, which helps to distinguish the poor from non-poor (2) the aggregate step, which brings the poor into an overall indicator of poverty. Following these two steps, the study initially defines deprivation as a shortfall from a definite cutoff point. Secondly, poverty is defined as a shortfall of the total of deprivations from a definite cutoff point. Each dimension is given equal weight as it is narrated by Atkinson [24]. The current study considered three poverty dimensions: living standard, education, and wealth, with equal weight to all dimensions. The study considered immunization as a proxy of health variable and analyzed it with unidimensional and multidimensional poverty separately. Some studies analyzed the contribution of immunization to the improvement of health and survival of life [25]. Currently, the three most popular ways of identification exist: unidimensional, union and intersection. Under the unidimensional approach, all the indicators of welfare are combined in a single aggregate variable, and the cutoff point is defined based on this aggregate variable. An individual is taken as a poor when his or her achievements become below this cutoff level. This approach of identification is useful in situations when all dimensions of deprivation affect the aggregate indicator. The union approach is taken into account when an individual is deprived of any single dimension of poverty. This is commonly used, but it may be overly exclusive and may lead to overestimation when the number of dimensions' increases. The intersection method is applied when someone is deprived in all dimensions to be recognized as

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poor. This method often leads to an underestimation of poverty. For example, in our data using this method, only 0.1% of the respondents are identified in the poverty. Union method covers more individuals in poverty, but it possibly reduces the odds of recognizing individuals in poor health. In the alternative, the intersection approach can raise the probability of finding the people who are in bad health, but it may reduces the numbers of a actual individual in group of poor people. [26]. To curb the above-explained problem, based on three dimensions (1. wealth, 2. education and 3. standard of living), the study formulated some types of poverty. Writing format, various forms of poverty can be laid out, such as D = (1, 2, 3) $\geq$ 2, being individuals who are lacking in a minimum of two of the three aspects of poverty. And also D (1, 3) tells us about individuals who are deprived in 1 and 3 measures of poverty. Unidimensional poverty like D (1) =1, D (2) =2 and D (3) =3 are not left out in this classification. Putting aside three dimensions of poverty, there will be varieties of multidimensional poverty. Analogues of poverty in 3 dimensions to D = (1, 2, 3) $\geq$ k, where K=1, 2 and 3 or D(1, 2, 3)= 3. D =(1,2,3)$\geq$ 1 reveals that a group of people will be assumed to be poor in one of the 3 dimensions that are included. D(1, 2, 3)= 3 indicates that the individuals are poor by all three aspects of poverty.The study first concentrated on three one-dimensional types of poverty measures (D (1)=1, D (2)=2, and D (3)=3) followed by multi-dimensional measures of poverty (D= (1, 2)=1, D= (1, 3) =1, D= (2, 3)=1 and D= (1, 2, 3)=3) and compared each form of poverty and rate of immunization (in indicator poor health) with each form of poverty. It used a logistic model for regression analysis after controlling the other factors (gender, age and marital status). In health research, the ordered logit model is commonly used when the dependent variable possesses more than two ordered categories, like low, medium and high. The logistic model is an appropriate selection when the dependent variable has two categories. In this way total of seven equations are estimated. The first three equations are based on unidimensional poverty, taking a single indicator of each dimension.

$$\log(y_1) = \alpha_0 + \alpha_1 x_1 + \mu \quad (1)$$

$$\log(y_1) = \alpha_0 + \alpha_2 x_2 + \mu \quad (2)$$

$$\log(y_1) = \alpha_0 + \alpha_3 x_3 + \mu \quad (3)$$

$$\log(y_1) = \alpha_0 + \alpha_4 (x_1 + x_2) + \mu \quad (4)$$

$$\log(y_1) = \alpha_0 + \alpha_5 (x_1 + x_3) + \mu \quad (5)$$

$$\log(y_1) = \alpha_0 + \alpha_6 (x_2 + x_3) + \mu \quad (6)$$

$$\log(y_1) = \alpha_0 + \alpha_6 (x_1 + x_2 + x_3) + \mu \quad (7)$$

The effectiveness is measured in two terms, first by asking about poverty type as an effective definition of poor health, without identifying a different kind, giving a broader coverage to the poor and with a higher OR of poor health. Second, the paper compared the probability of the model that indicates the poor health with every kind of poverty. However, this method may constitute a trade-off between the coverage of the population in the deprivation group and the probability of occurrence of individuals in the group of poor health individuals. The results suggest that increasing the cutoff points, i.e., targeting more intersections of dimensions of poverty (as it reduces the coverage of individuals in poverty dimension).

RESULTS

Regression analysis demonstrates the estimated outcomes obtained from the output of estimated logistic regression models applied separately to each type of poverty dimension. In the following tables of output, the first column shows different types of poverty dimensions. The second columns talk about the coverage of population in poverty, while the third and fourth column indicates the odds ratios (OR) of poor health concerning each dimension and their confidence intervals (95% CI), respectively. The fifth column presents p (z), which indicates that the variable is likely to be a significant predictor of outcome. The study determined a 95% confidence interval to check the association between poor health and poverty. The results indicated that this association in terms of OR was significant at the 5% level for the maximum types of poverty. In the logistic regression model, the value of log-likelihood indicates how well the estimated model explains the observed data. Particularly, it uses the logarithm of the likelihood function that measures the probability of observation of a given set of outcomes (dependent variable) given the parameters of the model. It is maximized during the estimation as the larger the log-likelihood, the better the model fits the dataset. Results indicate the logistic model regression output explaining the impact of different types of poverty on immunization. In unidimensional poverty, D (1) =1 and D (2) =1 (the impact of wealth and education on health) is positive, as well as all types of multidimensional poverty are predicting their positive relation with immunization, except D (3) =1. Higher OR values indicate greater odds of poor immunization. Unidimensional poverty shows significant associations with wealth (OR=1.389) and education (OR=1.224). Multidimensional poverty, combining multiple deprivations, shows even higher odds, with the highest OR (1.531) when at least one deprivation is present in wealth or education (Table 1).

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Table 1: The Estimated Analysis Between Different Types of Poverty and Immunization

Type of Poverty	Poverty	OR	95% CI	Log likelihood	p>(z)
Uni -Dimensional Type of Poverty and Immunization					
D (1) =1	53.8%	1.389228	1.334453-1.446251	-33593.287	0.000
D (2) =1	60.4%	1.223697	1.177972-1.271197	- 33667.783	0.000
D (3) =1	10.3%	.7694182	0.7263929-0.8149919	-34283.67	0.061
Multidimensional Type of Poverty and Immunization					
D (1, 2) ≥1	92%	1.530311	1.428026-1.639922	-33648.987	0.000
D (1, 3,) ≥1	63.6%	1.137378	1.094279-1.182174	-33700.486	0.000
D (2,3) ≥1	60.4%	1.300974	1.25003-1.353995	-33638.498	0.000
D (1, 2, 3) >1	93%	1.431219	1.329102-1.541181	-33676.755	0.000
D (1, 2, 3) =3	1.8%	1.431219	1.329102-1.541181	-33676.755	0.000

Note: The OR shows the estimated odds ratio of poor health, obtained from the logistic regression models to predict poor health by poverty. D denotes the number of deprivations in the dimensions in the subsequent parenthesis, where 1 = household wealth, 2 = education, 3 = housing conditions.

Figure 1 shows the combination of effective types of poverty and the proportion of individuals in poverty. The effectiveness is assessed with the highest proportion of poverty and a high odds ratio. Moving from left to right the curve shows that multidimensional poverty (D (1, 2) >1 and D (1, 2, 3) >1 cover more individuals in poverty with higher odd ratio, while unidimensional poverty (D (1) =1) has lowest coverage of population as well as lowest OR. This confirms the validity of multidimensional poverty in the effectiveness of identifying the poor status of health. In unidimensional poverty, education is the most relevant correlate to immunization (Figure 1).

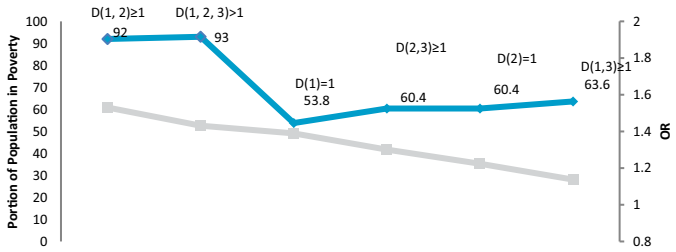

Figure 1: The Effective Poverty Curve for Poor Immunization

The curve shows the combination of the population in poverty (X-axis) and the odds ratio (Y-axis) of poor immunization for every effective type of poverty.

DISCUSSION

The study analyzed and compared the impact of unidimensional and multidimensional poverty on health by taking immunization as a proxy of health variable and regressing them separately with different dimensions of poverty. When using immunization as a health variable, the study found that in unidimensional poverty, wealth and education had a significant impact on health, with high OR and covering a prominent proportion of the population with the least immunization. In the analysis of multidimensional poverty, two-dimensional poverty (combining education and wealth (D= (1, 2≥1)) gives more significant results, predicting that less educated and poor people have more risk of being less immunized. The results are strengthened from the literature as some studies found a strong relationship between income, education and least immunization [27]. Some studies narrated that in Pakistan, low levels of education and low economic status remained the main hurdles in immunization of children, as well as women's empowerment, which was a significant factor in low immunization [28, 29]. Ahmed and Ahmed analyzed the impact of poverty and social status on immunization in Pakistan and determined that poverty was a big obstacle to immunization in Pakistan [28]. The OR ratio of D (1, 2) ≥ 1 is highest among the results, which indicates that wealth and education, as combined, are the most prominent factors contributing to immunization, following D (1, 2, 3) ≥ 1, which is the combination of all three types of poverty. Concluding the analysis, the two types of poverty, D (1, 2) ≥1 and D (1, 2, 3) ≥1, are the most significant predictors of poor immunization, as these possess high OR; additionally, these cover a significant portion of the population in poverty. In unidimensional poverty, D (2) =1 covers the highest proportion of the poor population, meaning that the less educated people have the least tendency to the immunization. The results of the estimation are significant, all odd ratios lie in the range of the confidence interval, and the probability of z is in the range of 95% confidence interval. This finding is consistent with the results of many preceding studies, which mentioned a close association between education and immunization [30]. The results achieve strengthen from literature as some studies found a strong relationship between income, education and least immunization [31]. Khan *et al.*, considered that education and low economic status remained the main hurdles in immunization of children, as well as women's empowerment, which was a significant factor in low immunization [32, 33]. The study recommended that emphasizing the multidimensional poverty, the health status of the people could be improved. So, the policymakers might address MP more seriously rather than focusing on unidimensional poverty. Addressing a single aspect of poverty, education, particularly female literacy, can be a catalyst to increase the motivation for immunization.Some other key points can be helpful for policy formation.

- In short run program of addressing multidimensional poverty, educational programs on immunization, hygiene and preventive health care can be launched with conditional cash payments, which can be linked to

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maternal and child health care visits. In long run, education on immunization and health care knowledge can be included in syllabus while to reduce financial burden health insurance can be introduced.

- Government might formulate policies to enhance awareness about diseases and the importance of immunization to escape the ill health.
- A media campaign can play a vital role in creating awareness among the people about immunization.
- Energy subsidies might be given to low-income people to ensure their access to electricity and clean fuel.
- The government might formulate a mechanism for collaboration among health, education and social welfare departments to eradicate poverty and improve health holistically.
- A well-coordinated strategy can improve the health disparities and overall well-being of the people. sectors.

CONCLUSIONS

It was concluded that the study confirms the importance and relevance of multidimensional poverty for health and suggests focusing on multiple aspects of poverty rather than considering a single dimension. Encouraging collaboration among health, education and social welfare departments can be helpful to address poverty and improve health holistically.

Authors Contribution

Conceptualization: AUH
Methodology: AUH
Formal analysis: AUH, SA, UA
Writing review and editing: AUH, MSA

All authors have read and agreed to the published version of the manuscript.

Conflicts of Interest

The authors declare no conflict of interest.

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