JHWCR
Journal of Health, Wellness, and Community Research
Volume III, Issue VII
Open Access, Double Blind Peer Reviewed.
Web: https://jhwcr.com, **ISSN**: 3007-0570
https://doi.org/10.61919/7yj5x858

Article

How Multidimensional Poverty Contributes to Child Mortality: Evidence from Pakistan

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Cite this Article

Received 2025-05-11
Revised 2025-06-16
Accepted 2025-06-17
Published 2025-06-19

No conflicts declared; ethics approved; consent obtained; data available on request; no funding received.

Authors' Contributions
Concept: AUH; Design: MSA; Data Collection: SA; Analysis: AUH; Drafting: AUH

ABSTRACT

Background: Child mortality remains a significant public health concern in low- and middle-income countries, particularly in Pakistan, where multifaceted deprivation persists. Existing literature often isolates income poverty without fully accounting for the overlapping effects of social and infrastructural deprivations. This study addresses the gap by examining how multidimensional poverty, encompassing education, living standards, and wealth, influences child mortality. **Objective**: To assess the impact of multidimensional poverty on under-five child mortality in Pakistan, identifying which dimensions or combinations thereof are most predictive of mortality risk. **Methods**: This cross-sectional analytical study used data from the Pakistan Demographic and Health Survey (PDHS) 2017–18, including 50,495 households after excluding incomplete entries. Households reporting at least one live birth were included. Multidimensional poverty was calculated using a dual-cutoff approach across three dimensions: education, wealth, and living standard. Logistic regression models were applied to estimate odds ratios (OR) with 95% confidence intervals (CI), controlling for age, gender, and marital status. Statistical analysis was conducted using Stata 15. Ethical approval was granted by the National Bioethics Committee of Pakistan, adhering to the Helsinki Declaration. **Results**: Households deprived in education ($D(2)=1$) exhibited the highest association with child mortality (OR=1.49, 95% CI: 1.44–1.77, $p<0.001$), followed by combined wealth and living standard deprivation ($D(1,3)\geq 1$; OR=1.48, 95% CI: 1.37–1.59, $p<0.001$). Full multidimensional poverty ($D(1,2,3)\geq 1$) affected 93% of households, with a moderate yet significant OR of 1.15 (95% CI: 1.05–1.26, $p<0.001$). **Conclusion**: Multidimensional poverty, particularly when involving education and housing-related deprivations, is a stronger predictor of child mortality than income-based poverty alone. These findings underscore the need for integrated health and social interventions targeting education, infrastructure, and household welfare to effectively reduce child mortality in Pakistan.

Keywords: Child Mortality, Multidimensional Poverty, Health Inequality, Pakistan Demographic and Health Survey, Logistic Regression, Education Deprivation, Living Standards

INTRODUCTION

Child mortality remains one of the most critical public health challenges globally, with low- and middle-income countries bearing a disproportionate burden despite notable improvements in child survival rates in recent decades. Defined as the death of a child before reaching five years of age, this issue persists due to a combination of medical, socioeconomic, and structural factors. Among these, poverty plays a central role in undermining children's access to adequate nutrition, clean water, sanitation, and healthcare. While conventional research has primarily emphasized monetary poverty as a determinant of child health outcomes, growing evidence suggests that the multidimensional nature of deprivation—extending beyond income—may offer a more comprehensive understanding of the root causes of child mortality (1). In Pakistan, Arif et al. highlighted that monetary deprivation significantly hindered access to nutrition for children, a critical factor in early survival (2). However, other studies have challenged the primacy of income, suggesting that the relationship between household earnings and child health is neither linear nor sufficiently explanatory when isolated from other social indicators (3). Wang's work reinforces the idea that earlier studies may have overestimated the link between income and health outcomes by failing to account for broader contextual variables (4). These include maternal education, household living conditions, and access to basic amenities, all of which can independently and synergistically

influence child wellbeing. In this regard, multidimensional poverty—comprising deprivations in education, living standards, and economic status—better captures the intersecting disadvantages that families face. Children born into households lacking adequate housing, sanitation, and educational attainment are significantly more vulnerable to preventable diseases, malnutrition, and limited healthcare utilization, thus elevating their risk of mortality (5). Murtaza et al. reported that illiteracy, lack of awareness, and household poverty were major contributors to disparities in child health in Pakistan (5), while Iqbal and Nawaz introduced a health poverty index that illuminated widespread deprivation in critical services such as postnatal care and child immunization. Their findings underscored the influence of regional disparities and educational attainment in shaping health outcomes (6).

Moreover, the inequitable distribution of healthcare services exacerbates the vulnerability of disadvantaged populations. Wuneh et al. documented that in Ethiopia, maternal and child health services were predominantly utilized by wealthier women, indicating a persistent access gap detrimental to child survival in poorer households (7). Aizawa's cross-national analysis in South Asia further demonstrated that socio-demographic disparities, particularly parental literacy and household living conditions, accounted for substantial variation in infant mortality rates (8). Complementary findings by Di Novi and Thakar in Bangladesh echoed this pattern, identifying maternal education, household wealth, and geographic region as key predictors of inequality in access to maternal and newborn care (9).

Despite the growing body of research exploring socioeconomic determinants of child health, limited attention has been directed toward systematically analyzing the effect of multidimensional poverty on child mortality using robust, population-based datasets in the Pakistani context. Most studies remain focused on single dimensions or aggregate poverty measures, thereby missing the nuanced interrelationships among various deprivations. The present study seeks to fill this gap by evaluating the association between multidimensional poverty and child mortality using data from the Pakistan Demographic and Health Survey (PDHS) 2017–18. Employing a dual-cutoff method, the study constructs multiple types of poverty based on deprivations in wealth, education, and living standards, and subsequently applies logistic regression to identify which dimensions, individually or in combination, are most predictive of under-five child mortality.

MATERIALS AND METHODS

The present study employed a cross-sectional observational design to examine the association between multidimensional poverty and child mortality in Pakistan. Data were drawn from the Pakistan Demographic and Health Survey (PDHS) 2017–18, a nationally representative dataset conducted under the technical supervision of USAID and implemented across all four provinces and administrative regions. The survey was conducted between November 2017 and April 2018 and included multiple instruments, among which the Household Questionnaire was selected for this study due to its detailed coverage of socioeconomic and demographic indicators relevant to household-level deprivation and child health outcomes. The study population comprised households with complete responses in the PDHS dataset. A total of 50,495 households were included after excluding those with missing values in key variables of interest, such as child mortality, wealth indicators, educational attainment, and living standards. Households were eligible if they reported at least one live birth and responded to all relevant modules of the survey. The sampling strategy followed a two-stage stratified cluster design, where enumeration blocks were selected at the first stage and households at the second. All survey participants provided informed consent, and PDHS protocols adhered to ethical guidelines approved by the National Bioethics Committee of Pakistan. Anonymized data were obtained through public access upon registration with DHS.

Child mortality was operationalized as the death of any child under the age of five reported within the household. The primary exposure variable, multidimensional poverty, was constructed using a dual-cutoff methodology. Deprivation in three dimensions—household wealth, parental education, and living standard—was identified using pre-established thresholds consistent with global development goals. Wealth deprivation was defined based on asset ownership and housing characteristics derived through principal component analysis. Education deprivation was coded for households where no adult had completed primary education. Living standard was measured using indicators such as type of sanitation facility, drinking water source, and type of cooking fuel. Each dimension was assigned equal weight, and individuals were categorized into various poverty groups: unidimensional (D(1), D(2), D(3)), dual-dimensional (D(1,2), D(1,3), D(2,3)), and full-dimensional poverty (D(1,2,3)). To assess the association between poverty type and child mortality, logistic regression models were estimated for each poverty group. The dependent variable was binary, indicating the presence or absence of child mortality. Independent variables included the respective poverty categories, with covariates such as age of household head, gender, and marital status included to control for confounding. Seven equations were estimated, corresponding to the following models:

$$(1)\ \log(y_1) = \alpha_0 + \alpha_1 x_1 + \mu$$
$$(2)\ \log(y_1) = \alpha_0 + \alpha_2 x_2 + \mu$$
$$(3)\ \log(y_1) = \alpha_0 + \alpha_3 x_3 + \mu$$
$$(4)\ \log(y_1) = \alpha_0 + \alpha_4 (x_1 + x_2) + \mu$$
$$(5)\ \log(y_1) = \alpha_0 + \alpha_5 (x_1 + x_3) + \mu$$
$$(6)\ \log(y_1) = \alpha_0 + \alpha_6 (x_2 + x_3) + \mu$$
$$(7)\ \log(y_1) = \alpha_0 + \alpha_7 (x_1 + x_2 + x_3) + \mu$$

Where y_1 represents the probability of child mortality, x_1 to x_3 represent wealth, education, and living standard deprivations respectively, and μ is the error term. All models were analyzed using Stata software (version 15), and multicollinearity was assessed through variance inflation factor (VIF) diagnostics to ensure model stability. Missing data were handled through case-wise deletion after preliminary analysis confirmed the randomness of missingness. Sample size sufficiency was assured due to the large volume of observations in the PDHS dataset, which exceeded the minimum number required for logistic regression with multiple predictors. The model's fit was evaluated using log-likelihood values, and the effectiveness of each poverty type as a predictor was gauged by comparing odds ratios (ORs) and 95% confidence intervals. All procedures ensured transparency and reproducibility, with variable coding, data cleaning, and analysis workflows documented and stored in version-controlled files. Data confidentiality and ethical standards were upheld throughout the study, with no identifying information retained during analysis.

RESULTS

Table 1 presents a descriptive breakdown of various types of poverty and their respective association with child mortality. The sample consisted of 50,495 households. Among these, 93% experienced deprivation in at least one of the three dimensions—wealth, education, or living standard. Notably, 93.5% of these households also reported child mortality. Unidimensional poverty indicators such as D(2)=1 (education) were associated with particularly high child mortality (70%), followed by D(1,3)≥1 (72.56%). In contrast, D(1)=1 (wealth deprivation only) had a relatively lower child mortality prevalence at 44.8%. Full intersection poverty, D(1,2,3)=3, accounted for only 1.8% of the sample and had a very low mortality proportion (0.07%), likely due to smaller subgroup size rather than reduced risk.

Table 1. Descriptive Distribution of Poverty Types and Associated Child Mortality

Dimension of Poverty	Definition	N	% of Total Sample	Child Mortality (% CM)
Wealth only	D(1)=1	27,209	53.88%	44.8%
Education only	D(2)=1	19,798	60.8%	70.0%
Living Standard only	D(3)=1	3,949	10.3%	11.0%
Wealth or Education	D(1,2)≥1	46,895	92.0%	92.5%
Wealth or Living Std.	D(1,3)≥1	32,128	63.6%	72.56%
Education or Living Std.	D(2,3)≥1	30,548	60.4%	52.46%
Any of 3 Dimensions	D(1,2,3)>1	47,393	93.0%	93.5%
All 3 Dimensions	D(1,2,3)=3	929	1.8%	0.07%
Total Sample	—	50,495	100%	—

Logistic regression was conducted to evaluate the strength of association between different poverty types and child mortality. Table 2 displays the odds ratios (OR), 95% confidence intervals (CI), and p-values for each unidimensional and multidimensional poverty category. Education deprivation (D(2)=1) exhibited the strongest unidimensional association (OR = 1.486, $p < 0.001$), indicating nearly 1.5 times higher odds of child mortality compared to non-deprived households. Among multidimensional categories, D(1,3)≥1 yielded an OR of 1.479 ($p < 0.001$), suggesting the combination of wealth and living standard deprivation is significantly linked to increased child mortality. The full multidimensional deprivation (D(1,2,3)>1) remained a significant predictor as well (OR = 1.150, $p < 0.001$).

Table 2. Logistic Regression of Poverty Types Predicting Child Mortality

Type of Poverty	% in Poverty	Odds Ratio (OR)	95% Confidence Interval (CI)	Log-Likelihood	p-value
Unidimensional Poverty					
D(1)=1 (Wealth)	53.8%	0.718	0.666 – 0.773	-13494.601	<0.001
D(2)=1 (Education)	60.4%	1.486	1.441 – 1.770	-13476.218	<0.001
D(3)=1 (Living Std.)	10.3%	1.046	0.941 – 1.163	-13532.820	0.003
Multidimensional Poverty					
D(1,2)≥1	92.0%	0.999	0.881 – 1.134	-13533.159	0.930
D(1,3)≥1	63.6%	1.479	1.371 – 1.596	-13479.908	<0.001
D(2,3)≥1	60.4%	0.754	0.533 – 0.652	-13504.043	<0.001
D(1,2,3)>1	93.0%	1.150	1.047 – 1.264	-8193.974	<0.001

These findings affirm that multidimensional poverty, particularly when it includes educational deprivation, is more strongly associated with child mortality than income or wealth-based poverty alone. The policy implication is clear: interventions aimed solely at increasing income or wealth may not suffice; instead, targeted programs addressing multiple facets of deprivation—especially education—are essential to reducing under-five mortality in Pakistan.

Figure 1 illustrates the relationship between different types of poverty and child mortality in terms of both the proportion of the population in poverty and the associated odds ratios (OR). The maroon-shaded area represents the proportion of the population experiencing each poverty type, while the dark line with diamond markers shows the corresponding OR for child mortality. The highest odds ratios are observed in multidimensional deprivation types such as D(1,3)≥1 and D(2)=1, indicating that households deprived in education and combinations of wealth and living standards face significantly elevated risks. Although D(1,2,3)≥1 encompasses the largest share of the population (93%), it shows a moderate OR (1.15), suggesting that the intensity and combination of deprivations,

rather than prevalence alone, are critical in influencing child mortality. The visual emphasizes the importance of addressing education and living standard deprivations in tandem with income-based poverty to reduce child mortality risks effectively.

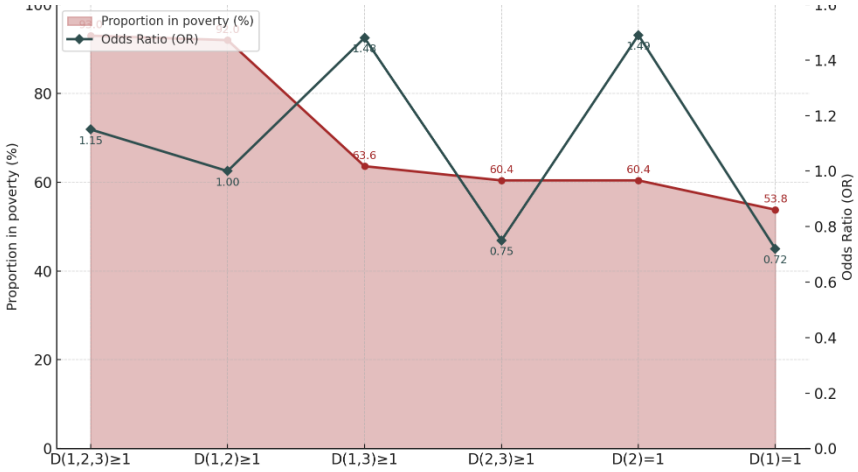

Figure 1 Association of Poverty Type with Child Mortality (Proportion in Poverty and Odds Ratio)

DISCUSSION

The present study demonstrates that multidimensional poverty, particularly when encompassing educational and living standard deprivations, is more strongly associated with child mortality than unidimensional or income-based poverty alone. These findings align with the growing body of evidence suggesting that poverty is a multifaceted phenomenon whose health impacts extend beyond mere financial deprivation. The high odds ratio observed for education-related poverty (D(2)=1) underscores the critical role of parental—especially maternal—education in influencing child health outcomes. This association is consistent with earlier studies conducted in South Asia and Sub-Saharan Africa, where maternal education has been repeatedly identified as a determinant of health-seeking behavior, immunization coverage, and nutrition (14,15). The finding that households deprived in both wealth and living standards (D(1,3)≥1) also had significantly elevated odds of child mortality supports previous research from Ethiopia and Bangladesh, which highlighted that inadequate access to clean water, poor sanitation, and lack of essential household infrastructure are core contributors to poor child health (7,9).

Interestingly, the present results echo Mohanty's findings in India, which emphasized the importance of evaluating composite poverty indicators over unidimensional indices when studying health inequalities (17). However, the relatively modest OR for full multidimensional poverty (D(1,2,3)≥1), despite covering a large segment of the population, may appear counterintuitive at first. This paradox likely reflects heterogeneity within this group, where overlapping deprivations dilute the individual effect sizes due to interaction complexities. Moreover, the regression analysis reveals that while D(1)=1 (wealth only) was prevalent, it had the weakest association with child mortality. This supports the argument posited by Wang and Anand that income alone may not sufficiently capture health vulnerabilities, especially in settings where public services and social determinants disproportionately shape outcomes (3,4).

These results have significant theoretical implications for understanding poverty through a capability-based lens, as proposed by Sen, where health is both a component and outcome of broader deprivation in freedoms and choices. The present study expands on this perspective by offering empirical evidence from a nationally representative dataset, reinforcing the notion that integrated socio-economic interventions are needed to mitigate child mortality risks. Clinically, the findings suggest that health programs focusing exclusively on service delivery may underperform unless paired with social interventions such as parental literacy, housing upgrades, and sanitation improvements. This holds particular importance in resource-constrained settings like Pakistan, where healthcare access alone does not guarantee utilization or effectiveness due to surrounding socio-cultural and infrastructural limitations.

Despite its strengths, including the use of a large, representative sample and a rigorously applied multidimensional framework, the study is not without limitations. The cross-sectional design precludes causal inference and may be influenced by recall bias, especially in reporting child mortality. Additionally, the use of secondary data limits control over variable definitions and measurement precision. While the dual-cutoff method used to classify multidimensional poverty is well-supported in literature, it may oversimplify complex household realities by treating all dimensions as equally weighted. Furthermore, generalizability may be constrained by contextual differences across provinces and rural–urban divides that were not explicitly disaggregated in the present analysis.

Future research should explore longitudinal data to assess causality and temporal patterns, potentially incorporating spatial analysis to capture geographic health inequalities. Studies that integrate qualitative assessments with quantitative models could enrich our understanding of household decision-making processes regarding child health. Moreover, refining the multidimensional poverty index to account for cultural norms, gender-based access disparities, and environmental exposures could further enhance policy

relevance. Overall, this study contributes to a growing consensus that tackling child mortality requires multidimensional strategies that go beyond health services and encompass the broader ecosystem of deprivation in which vulnerable households are embedded.

CONCLUSION

This study confirms that multidimensional poverty—comprising deprivations in wealth, education, and living standards—is a stronger predictor of child mortality than income-based poverty alone, with educational deprivation emerging as the most critical factor. Aligned with the study's objective and title, these findings underscore that addressing child mortality in Pakistan requires an integrated approach that targets multiple facets of household deprivation rather than isolated financial metrics. Clinically, the results highlight the necessity of incorporating social determinants such as parental education and household infrastructure into public health strategies to enhance child survival outcomes. From a research perspective, the study provides empirical justification for adopting multidimensional frameworks in health policy analysis and calls for future longitudinal and intervention-based studies to further elucidate the causal pathways linking compound poverty to preventable child deaths.

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